

## Pluto\_MSK\_Modem address map

- Absolute Address: 0x0
- Base Offset: 0x0
- Size: 0x43C00050

Offset	Identifier	Name
0x43C00000	pluto_msk_regs	Pluto MSK Registers

## pluto\_msk\_regs address map

- Absolute Address: 0x43C00000
- Base Offset: 0x43C00000
- Size: 0x50

### MSK Modem Configuration and Status Registers

Offset	Identifier	Name
0x00	Hash_ID_Low	Pluto MSK FPGA Hash ID - Lower 32-bits
0x04	Hash_ID_High	Pluto MSK FPGA Hash ID - Upper 32-bits
0x08	MSK_Init	MSK Modem Control 0
0x0C	MSK_Control	MSK Modem Control 1
0x10	MSK_Status	MSK Modem Status 1
0x14	Tx_Bit_Count	MSK Modem Status 2
0x18	Tx_Enable_Count	MSK Modem Status 3
0x1C	Fb_FreqWord	Bitrate NCO Frequency Control Word
0x20	F1_FreqWord	FSK f1 NCO Frequency Control Word
0x24	F2_FreqWord	FSK f2 NCO Frequency Control Word
0x28	LPF_Config_0	PI Controller Configuration and Low-pass Filter Configuration
0x2C	LPF_Config_1	PI Controller Configuration and Low-pass Filter Configuration
0x30	Tx_Data_Width	Modem Tx Input Data Width
0x34	Rx_Data_Width	Modem Rx Output Data Width
0x38	PRBS_Control	PRBS Control 0
0x3C	PRBS_Initial_State	PRBS Control 1
0x40	PRBS_Polynomial	PRBS Control 2
0x44	PRBS_Error_Mask	PRBS Control 3
0x48	PRBS_Bit_Count	PRBS Status 0
0x4C	PRBS_Error_Count	PRBS Status 1

### Hash\_ID\_Low register

- Absolute Address: 0x43C00000
- Base Offset: 0x0

- Size: 0x4

Bits	Identifier	Access	Reset	Name
31:0	hash_id_lo	r	0xAAAA5555	Hash ID Lower 32-bits

**hash\_id\_lo field** Lower 32-bits of Pluto MSK FPGA Hash ID

#### Hash\_ID\_High register

- Absolute Address: 0x43C00004
- Base Offset: 0x4
- Size: 0x4

Bits	Identifier	Access	Reset	Name
31:0	hash_id_hi	r	0x5555AAAA	Hash ID Upper 32-bits

**hash\_id\_hi field** Upper 32-bits of Pluto MSK FPGA Hash ID

#### MSK\_Init register

- Absolute Address: 0x43C00008
- Base Offset: 0x8
- Size: 0x4

Synchronous initialization of MSK Modem functions, does not affect configuration registers.

Bits	Identifier	Access	Reset	Name
0	init	rw	0x1	Init Enable

**init field** 0 -> Normal modem operation 1 -> Initialize modem

#### MSK\_Control register

- Absolute Address: 0x43C0000C
- Base Offset: 0xC
- Size: 0x4

MSK Modem Configuration and Control

Bits	Identifier	Access	Reset	Name
0	ptt	rw	0x0	Push-to-Talk Enable

Bits	Identifier	Access	Reset	Name
1	loopback_ena	rw	0x0	Modem Loopback Enable
2	rx_invert	rw	0x0	Rx Data Invert Enable
3	clear_counts	rw	0x0	Clear Status Counters

**ptt field** 0 -> PTT Disabled 1 -> PTT Enabled

**loopback\_ena field** 0 -> Modem loopback disabled 1 -> Modem loopback enabled

**rx\_invert field** 0 -> Rx data normal 1 -> Rx data inverted

**clear\_counts field** Clear Tx Bit Counter and Tx Enable Counter

#### **MSK\_Status register**

- Absolute Address: 0x43C00010
- Base Offset: 0x10
- Size: 0x4

Modem status bits

Bits	Identifier	Access	Reset	Name
0	demod_sync_lock	r	0x0	Demodulator Sync Status
1	tx_enable	r	0x0	AD9363 DAC Interface Tx Enable Input Active
2	rx_enable	r	0x0	AD9363 ADC Interface Rx Enable Input Active

**demod\_sync\_lock field** Demodulator Sync Status - not currently implemented

**tx\_enable field** 1 -> Data to DAC Enabled 0 -> Data to DAC Disabled

**rx\_enable field** 1 -> Data from ADC Enabled 0 -> Data from ADC Disabled

#### **Tx\_Bit\_Count register**

- Absolute Address: 0x43C00014
- Base Offset: 0x14
- Size: 0x4

Modem status data

Bits	Identifier	Access	Reset	Name
31:0	data_req_count	rw	0x0	Tx Bit Count

**data\_req\_count field** Count of data requests made by modem

**Tx\_Enable\_Count register**

- Absolute Address: 0x43C00018
- Base Offset: 0x18
- Size: 0x4

Modem status data

Bits	Identifier	Access	Reset	Name
31:0	data_req_count	rw	0x0	Tx Enable Count

**data\_req\_count field** Number of clocks on which Tx Enable is active

**Fb\_FreqWord register**

- Absolute Address: 0x43C0001C
- Base Offset: 0x1C
- Size: 0x4

Set Modem Data Rate

Bits	Identifier	Access	Reset	Name
31:0	config_data	rw	0x0	Frequency Control Word

**config\_data field** Sets the center frequency of the NCO as  $FW = F_n * 2^{32}/F_s$ , where  $F_n$  is the desired NCO frequency, and  $F_s$  is the NCO sample rate

**F1\_FreqWord register**

- Absolute Address: 0x43C00020
- Base Offset: 0x20
- Size: 0x4

Set Modem Data Rate

Bits	Identifier	Access	Reset	Name
31:0	config_data	rw	0x0	Frequency Control Word

**config\_data field** Sets the center frequency of the NCO as  $FW = F_n * 2^{32}/F_s$ , where  $F_n$  is the desired NCO frequency, and  $F_s$  is the NCO sample rate

#### F2\_FreqWord register

- Absolute Address: 0x43C00024
- Base Offset: 0x24
- Size: 0x4

Set Modem Data Rate

Bits	Identifier	Access	Reset	Name
31:0	config_data	rw	0x0	Frequency Control Word

**config\_data field** Sets the center frequency of the NCO as  $FW = F_n * 2^{32}/F_s$ , where  $F_n$  is the desired NCO frequency, and  $F_s$  is the NCO sample rate

#### LPF\_Config\_0 register

- Absolute Address: 0x43C00028
- Base Offset: 0x28
- Size: 0x4

Configure PI controller and low-pass filter

Bits	Identifier	Access	Reset	Name
0	lpf_freeze	rw	0x0	Freeze the accumulator's current value
1	lpf_zero	rw	0x0	Hold the PI Accumulator at zero
31:16	lpf_alpha	rw	0x0	Lowpass IIR filter alpha

**lpf\_freeze field** 0 -> Normal operation 1 -> Freeze current value

**lpf\_zero field** 0 -> Normal operation 1 -> Zero and hold accumulator

**lpf\_alpha field** Value controls the filter rolloff

### LPF\_Config\_1 register

- Absolute Address: 0x43C0002C
- Base Offset: 0x2C
- Size: 0x4

Configure PI controller and low-pass filter

Bits	Identifier	Access	Reset	Name
15:0	i_gain	rw	0x0	Sets the integral gain of the PI controller integrator
31:16	p_gain	rw	0x0	Sets the proportional gain of the PI controller integrator

**i\_gain field** Integral gain value

**p\_gain field** Proportional gain value

### Tx\_Data\_Width register

- Absolute Address: 0x43C00030
- Base Offset: 0x30
- Size: 0x4

Set the parallel data width of the parallel-to-serial converter

Bits	Identifier	Access	Reset	Name
7:0	data_width	rw	0x8	Modem input/output data width

**data\_width field** Set the data width of the modem input/output

### Rx\_Data\_Width register

- Absolute Address: 0x43C00034
- Base Offset: 0x34
- Size: 0x4

Set the parallel data width of the serial-to-parallel converter

Bits	Identifier	Access	Reset	Name
7:0	data_width	rw	0x8	Modem input/output data width

**data\_width field** Set the data width of the modem input/output

### PRBS\_Control register

- Absolute Address: 0x43C00038
- Base Offset: 0x38
- Size: 0x4

Configures operation of the PRBS Generator and Monitor

Bits	Identifier	Access	Reset	Name
0	prbs_sel	rw	0x0	PRBS Data Select
1	prbs_error_insert	w	0x0	PRBS Error Insert
2	prbs_clear	w	0x0	Reserved
3	prbs_sync	w	0x0	PRBS Sync

**prbs\_sel field** 0 -> Select Normal Tx Data 1 -> Select PRBS Tx Data

**prbs\_error\_insert field** 0 -> No error insertion 1 -> Insert bit error in Tx data (both Normal and PRBS)

**prbs\_clear field** Reserved

**prbs\_sync field** 0 -> Normal Operation 1 -> Synchronize PRBS monitor

### PRBS\_Initial\_State register

- Absolute Address: 0x43C0003C
- Base Offset: 0x3C
- Size: 0x4

PRBS Initial State

Bits	Identifier	Access	Reset	Name
31:0	config_data	rw	0x0	PRBS Seed

**config\_data field** Sets the starting value of the PRBS generator

### PRBS\_Polynomial register

- Absolute Address: 0x43C00040
- Base Offset: 0x40
- Size: 0x4

PRBS Polynomial

Bits	Identifier	Access	Reset	Name
31:0	config_data	rw	0x0	PRBS Polynomial

**config\_data field** Bit positions set to ‘1’ indicate polynomial feedback positions

#### PRBS\_Error\_Mask register

- Absolute Address: 0x43C00044
- Base Offset: 0x44
- Size: 0x4

PRBS Error Mask

Bits	Identifier	Access	Reset	Name
31:0	config_data	rw	0x0	PRBS Error Mask

**config\_data field** Bit positions set to ‘1’ indicate bits that are inverted when a bit error is inserted

#### PRBS\_Bit\_Count register

- Absolute Address: 0x43C00048
- Base Offset: 0x48
- Size: 0x4

PRBS Bits Received

Bits	Identifier	Access	Reset	Name
31:0	status_data	r	—	PRBS Bits Received

**status\_data field** Number of bits received by the PRBS monitor since last BER can be calculated as the ratio of received bits to errored-bits

#### PRBS\_Error\_Count register

- Absolute Address: 0x43C0004C
- Base Offset: 0x4C
- Size: 0x4

PRBS Bit Errors



Bits	Identifier	Access	Reset	Name
31:0	status_data	r	—	PRBS Bit Errors

**status\_data field** Number of errored-bits received by the PRBS monitor since last sync BER can be calculated as the ratio of received bits to errored-bits