IQ Modulator Programming Guide

Covers the following products:
RFMD2080 and RFMD2081

RFMD Multi-Market Products Group

REVISION HISTORY

Version	Date	Description of change(s)	Author(s)
1.0	04-Sep-12	Corrected instructions. Added and corrected hyperlinks.	Barbara Cox
0.1	02-May-11	Prep for Publication	Eric Schonthal
0.0	13-Apr-11	Initial Draft	Chris Shepherd

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1. INTRODUCTION

The RFMD208x series of parts are IQ modulators taking baseband quadrature signals in and directly modulating the local oscillator.

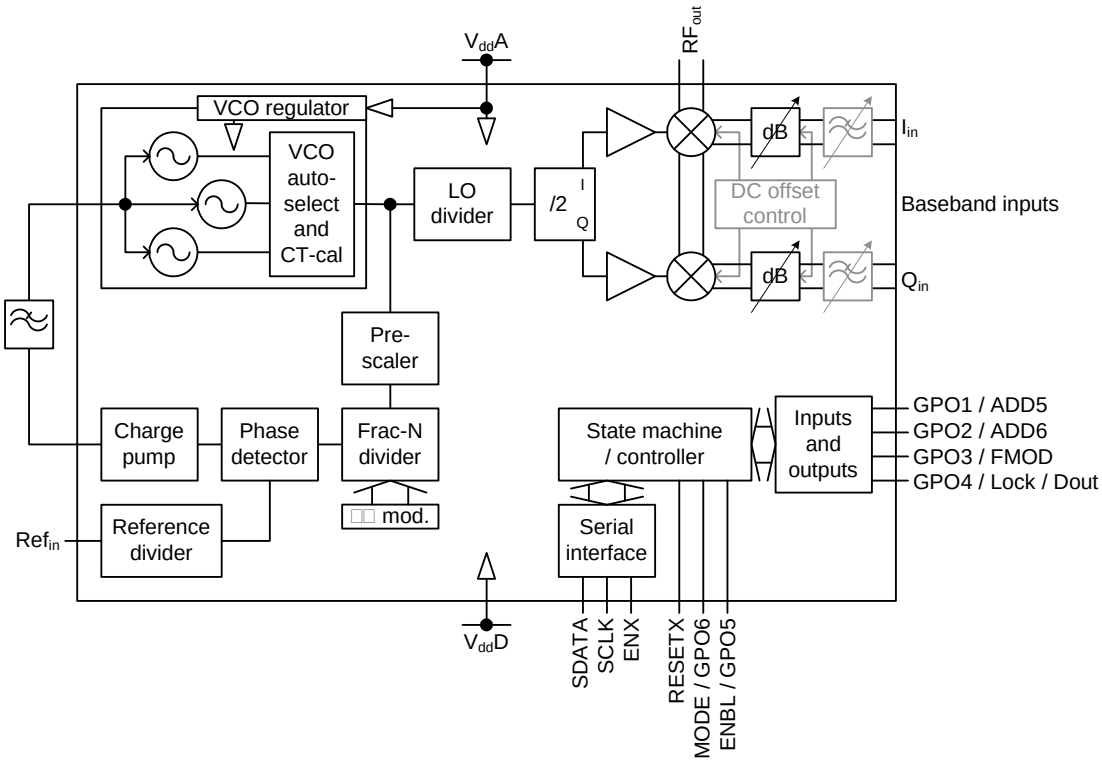

Figure 1. Modulator block diagram, showing the additional features of the RFMF2080 part

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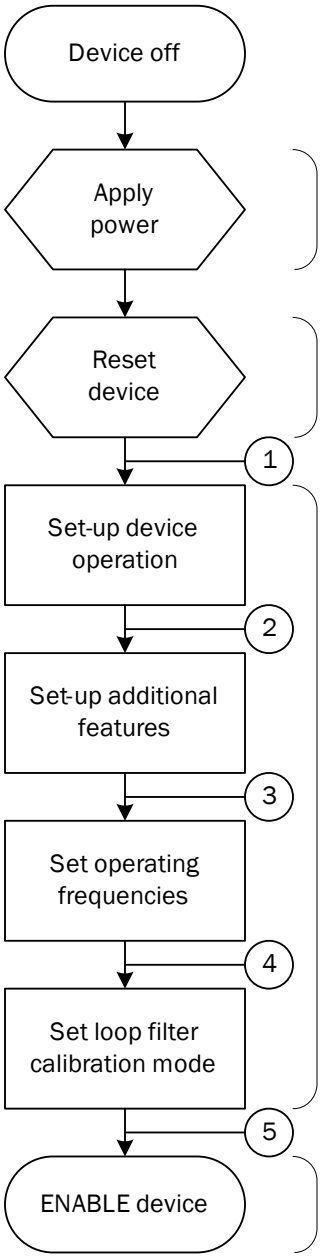
2. PROGRAMMING THE DEVICE



Apply power to the device.

Ensure the device is set into a known and correct state. The device does include a power on reset circuit which means this operation may be omitted if the power supply is well behaved.

To use the device it will be necessary to program the registers with the desired contents to achieve the required operating characteristics.

See following sections for details.

When programming is complete the device can be enabled.

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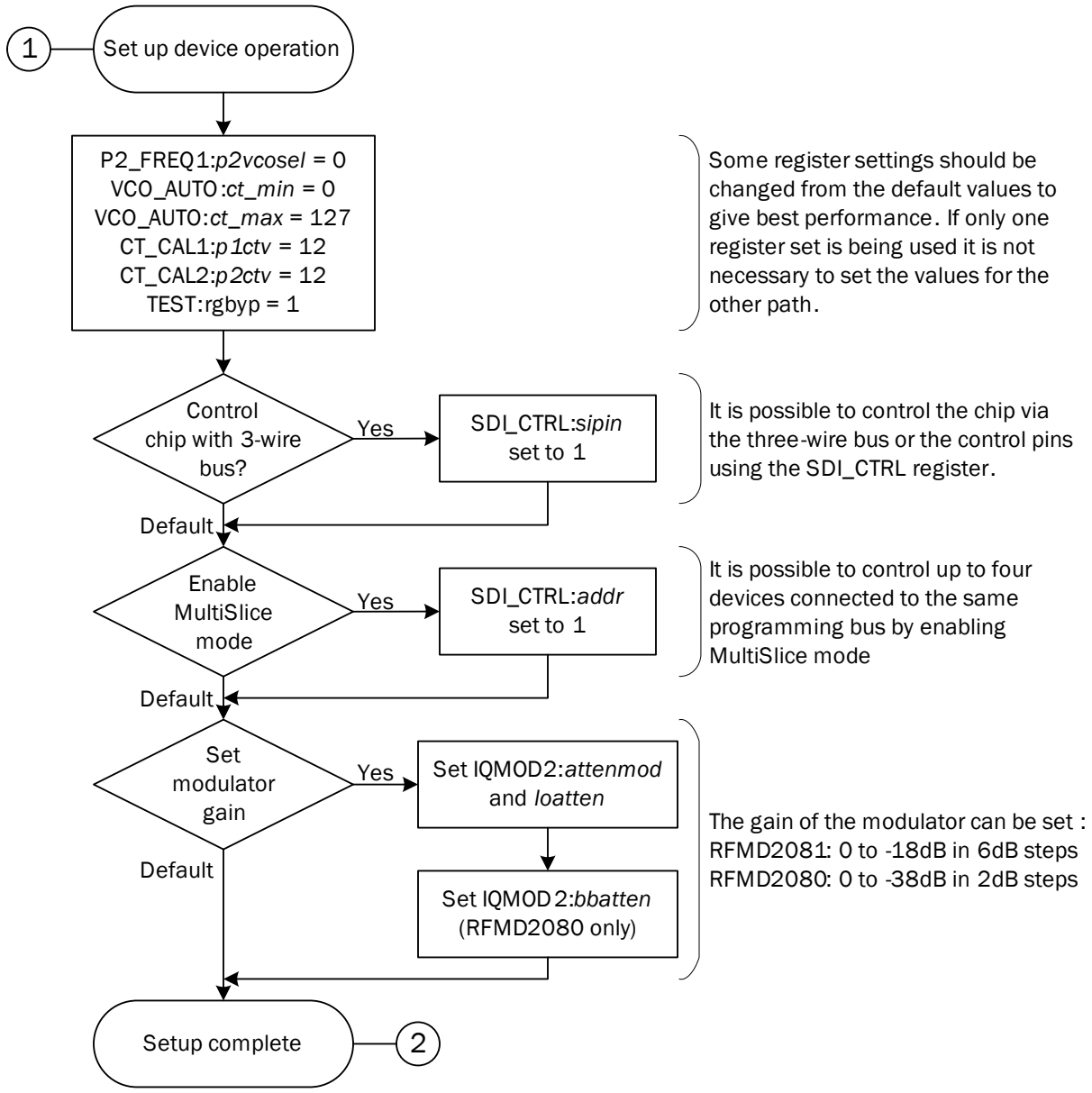
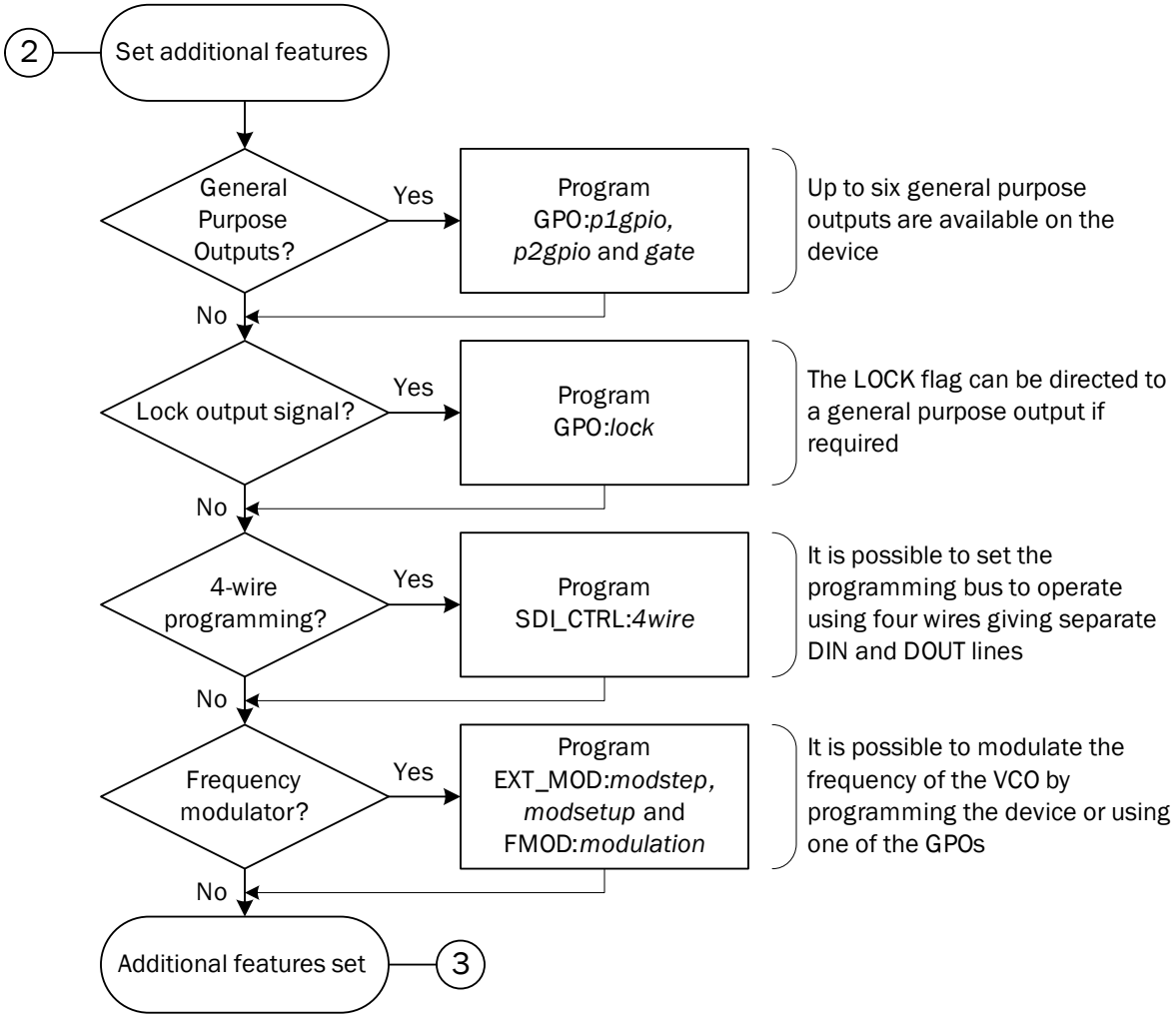
2.1 SET UP DEVICE OPERATION



2.2 SET ADDITIONAL FEATURES



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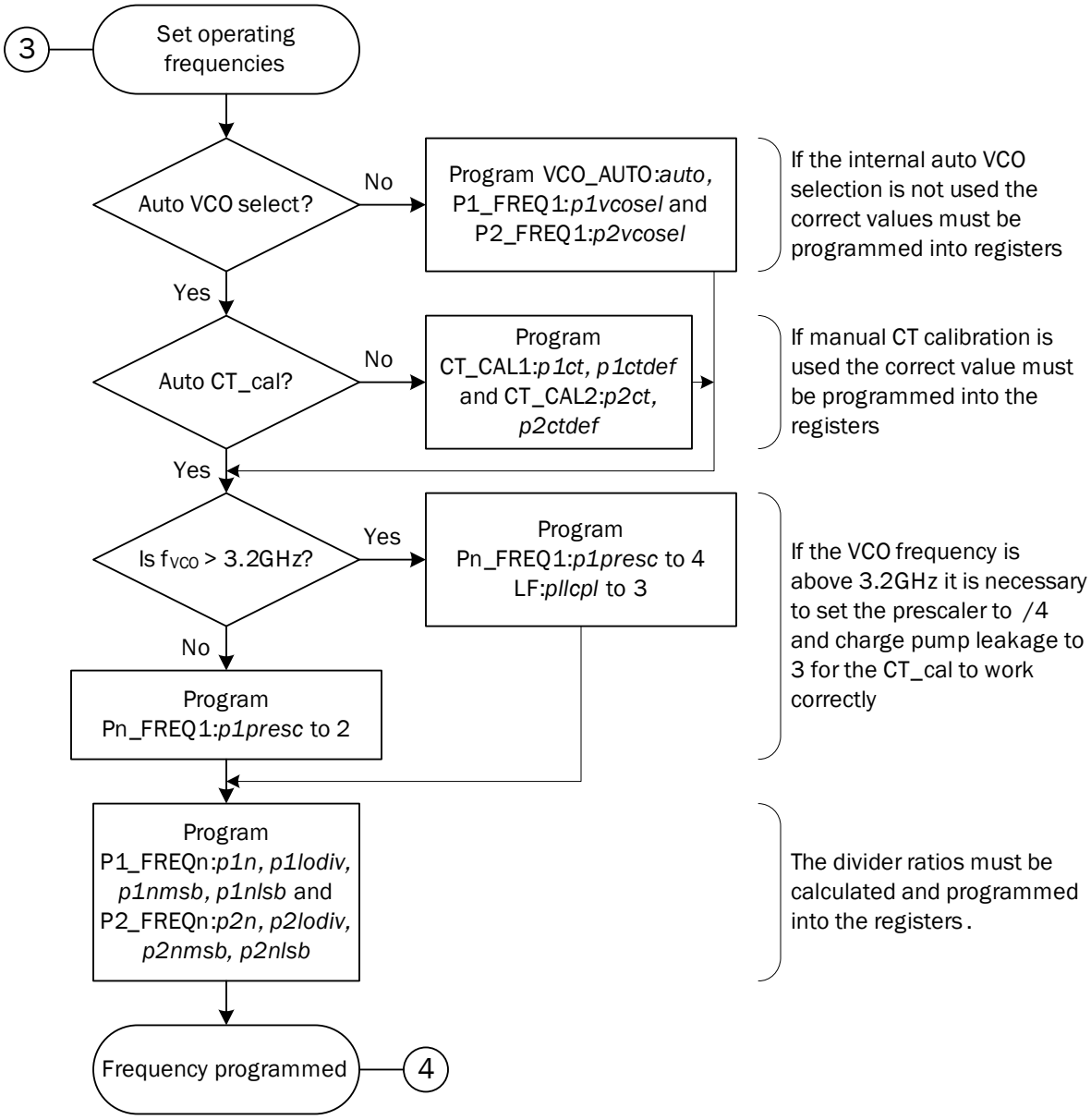
2.3 SET OPERATING FREQUENCIES



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2.3.1 Calculating Divider Values

There are four dividers on the chip controlling the local oscillator frequency: the LO divider, the modulator divider (IQ generator), the N-divider and its associated prescaler. The prescaler is required to restrict the input frequency to the N-divider to a maximum frequency of 1.6GHz. This is illustrated in the simplified block diagram of the synthesizer shown below.

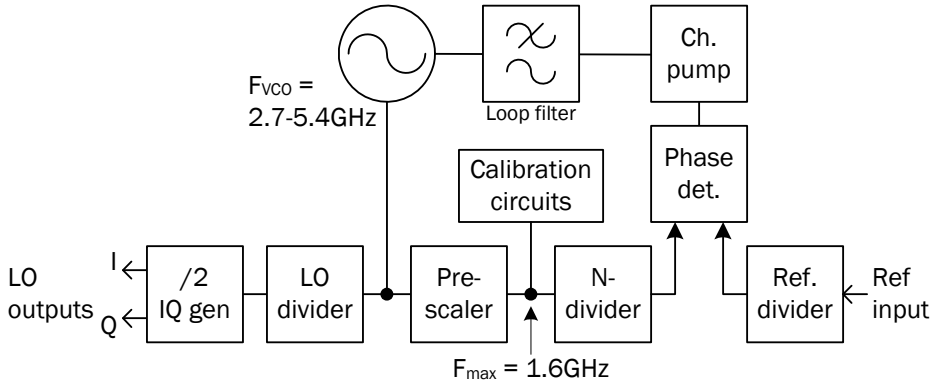

Figure 2. Simplified block diagram of the frequency synthesizer

The divider values should be calculated in the following order:

1. The LO divider (*lo_div*)
2. The N-divider (*n*, *nummsb*, *numlsb*)

$n\_lo = INT(\log_2(f_{VCOmax} / (2.f_{LO})))$

lodiv $= 2^{n\_lo}$

$f_{VCO} = 2 * lo\_div * f_{LO}$

fbkdiv $= 2\ (f_{VCO} < 3.2GHz)$

$= 4\ (f_{VCO} > 3.2GHz)$

$n\_div = f_{VCO} / fbkdiv / f_{PD}$

n $= INT(n\_div)$

nummsb $= INT(2^{16} * (n\_div - n))$

numlsb $= INT(2^8 * (2^{16}*(n\_div - n) - nummsb))$

For example an LO of 314.159265MHz with a 26MHz reference frequency would be calculated as follows:

$n\_lo = INT(\log_2(5600 / (2 * 314.159265))) = INT(\log_2(8.9126768234)) = 3$

lodiv $= 2^{n\_lo} = 8$

$f_{VCO} = 2 * lo\_div * f_{LO} = 5026.548240MHz$

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fbkdiv = 4

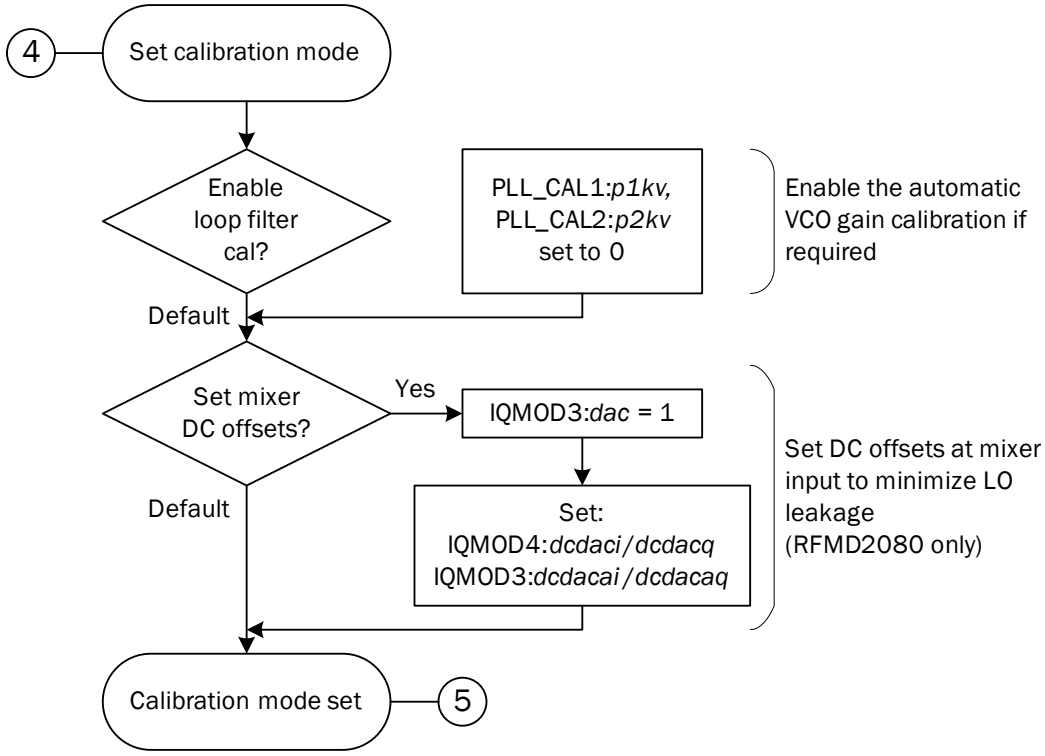
n_div = f_{VCO} / 4 / f_{PD} = 5026.54824 / 4 / 26 = 48.3321946154

n = INT(n_div) = 48 (0x030)

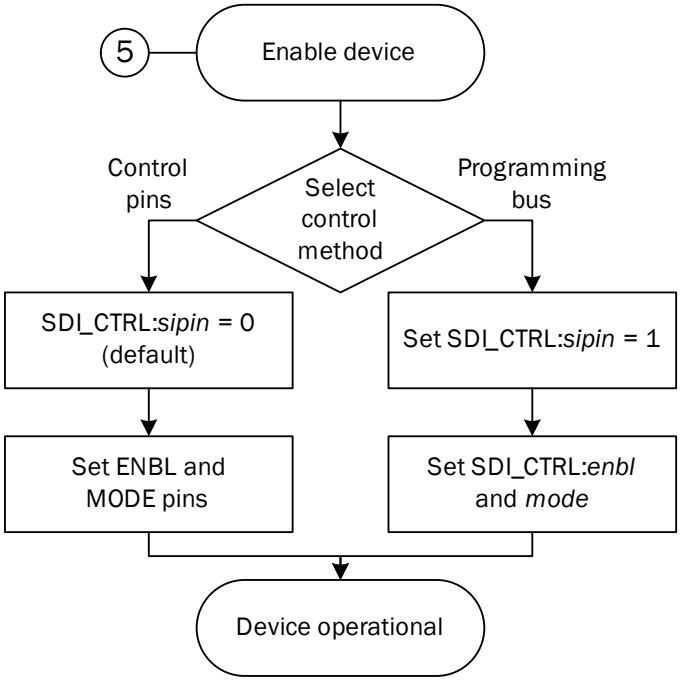
nummsb = INT(2^{16} * (n_div – n)) = 21770 (0x550A)

numlsb = INT(2^{8} * **(**2^{16}*(n_div – n) - nummsb**)**) = 181 (0x85)

2.4 SET LOOP FILTER CALIBRATION MODE



2.5 ENABLE DEVICE



2.5.1 Optimizing Phase Noise

For optimum VCO phase noise the prescaler divider should be set to divide by 2. If the VCO frequency is greater than 3.2GHz it is necessary to set the ratio to 4 to allow the CT cal algorithm to work. After the device is enabled the divider values can be reprogrammed with the prescaler divider ratio of 2 and the new n, nummsb and numlsb values. Taking the previous example of an LO of 314.159265MHz:

fbkdiv = 2

n_div = f_{VCO} / 2 / f_{PD} = 5026.54824 / 2 / 26 = 96.66438923

n = INT(n_div) = 96 (0x060)

nummsb = INT(2^{16} * (n_div – n)) = 43541 (0xAA15)

numlsb = INT(2^{8} * **(**2^{16}*(n_div – n) - nummsb**)**) = 106 (0x6A)

These new values would be programmed into the device since the VCO frequency is unaffected the CT_cal value will be correct.

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3. REFERENCES

- RFMD web site (http://www.rfmd.com)
- IQ Modulator web site (http://www.rfmd.com/products/IntSynthModulator/)
- IQ Modulator Evaluation Board and GUI User Guide (http://www.rfmd.com/CS/Documents/IntegratedSyntMixerEvalBoardandGUIUserGuide.pdf)
- IQ Modulator Register Map and Programming Guide (http://www.rfmd.com/CS/Documents/IntegratedSynthMixerRegMapProgrammingGuide.pdf)

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