Clean Sweep Implementation

Implementation Guide: Clean Sweep on PPCL700

The Pure Photonics products provide a very low frequency noise, making them very suitable for sensing applications. In that low-noise mode, the Pure Photonics firmware adds frequency flexibility, so that the laser can be swept over a short frequency range at a controlled speed.

Typical frequency range is 50GHz at speeds up to 20GHz/sec (for larger ranges, lower speeds can be supported and for shorter ranges, higher speeds), where the laser moves up and down this frequency range in a controlled manner.

This implementation guide describes how to operate the Clean Sweep on the PPCL7xx product families (micro-ITLA). This will also work on PPCL5xx enclosures with micro ITLA (serial number starting with ‘PP7’).

1. Graphical User Interface

The GUI is implemented (currently) only for the ITLA formfactor tunable laser. We will update this section once a micro-ITLA implementation is included.

2. RS-232 interface

The RS-232 interface follows the conventions, as outlined in the OIF-MSA (http://www.oiforum.com/wp-content/uploads/OIF-ITLA-MSA-01.3.pdf). Several registers have been added to enable the Clean Sweep functionality.

Operating the Clean Sweep

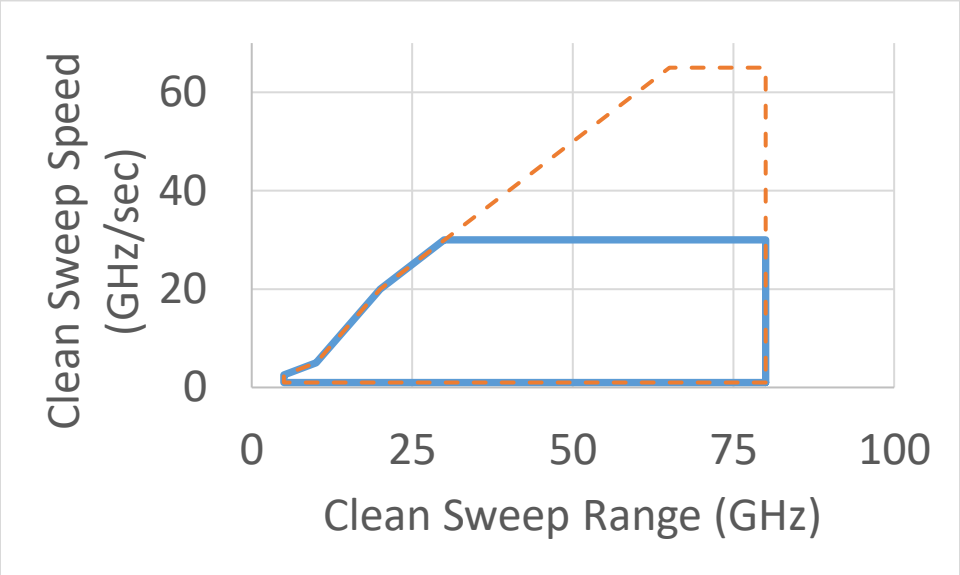
To operate the Clean Sweep the laser must have been activated at the center-point of the sweep. The laser must be in the whispermode (mode 2). The whispermode is activated by writing a value of 2 to register 0x90, after the laser has stabilized (NOP flags have dropped).

The sweep range for the Clean Sweep is loaded through **register 0xe4**, in units of GHz.

The sweep speed for the Clean Sweep is loaded through **register 0xe7**, in units of MHz/sec (i.e. 10000 for 10GHz/sec). For backwards compatibility register 0xf1 is aliased to this register and hence writing to register 0xf1 will have the same effect.

Note that the unit does only check if the Clean Sweep Range does not exceed the device capabilities. It does not check if the combination of sweep range and sweep speed will give acceptable results.

The below graph indicates acceptable combination of cleansweep range and cleansweep speed. The device can operate outside of this range, but performance may not be as desired. Note that the solid line indicates the range that we test to and that is guaranteed. The dotted line represents a range that the device would be expected to have good performance also.



Sweep pattern

The sweep pattern will have the frequency offset move between -range/2 to +range/2, with the sweep starting at 0. In the center portion of the sweep the sweep will be linear at

the target sweep rate. Before the end of the sweep, the sweep rate will be linearly decreased and then increased linearly in the other direction. The default change rate is 1.5GHz/sec per second, with the condition that the change in direction will take less than 25% of the sweep range.

To change the sweeprate from max speed to 0 will take 0.5*sweepspeed*sweepspeed/1.5. In the below table the change rate is indicated for different conditions. Obviously, the larger the change rate, the more difficult for the module.

		Sweep range (GHz)					
		1	5	10	20	40	60
sweeprate (GHz/sec)	1	2.0	1.5	1.5	1.5	1.5	1.5
	5	50.0	10.0	5.0	2.5	1.5	1.5
	10	200.0	40.0	20.0	10.0	5.0	3.3
	20	800.0	160.0	80.0	40.0	20.0	13.3
	30	1800.0	360.0	180.0	90.0	45.0	30.0
	40	3200.0	640.0	320.0	160.0	80.0	53.3
	60	7200.0	1440.0	720.0	360.0	180.0	120.0

The overall sweep will look like:

Trigger output

During the sweep the unit can generate a trigger signal on the SRQ port of the device. This trigger signal is either a short (5ms) positive pulse, or it can be a high signal as long as the laser is within the sweep range (i.e. +- sweeprange / 2).The signal is triggered when the laser frequency passes the begin and end of the sweep (at center+- sweeprange/2).

The trigger behavior is set through **register 0xe8**. Bit 0 – 3 are set to indicate which trigger signal is active:

Bit 0: trigger at end of the linear part of the sweep towards higher frequency

Bit 1: trigger at begin of the linear part of the sweep towards lower frequency

Bit 2: trigger at the end of the linear part of the sweep towards lower frequency

Bit 3: trigger at the begin of the linear part of the sweep towards higher frequency

Bit 4 is used to indicate the trigger type. If 1, pulses will be generated. If 0, the SRQ line will be high within the sweep range. Note that for value 0, the bit 0 and bit 2 are ignored.

The Clean sweep is started by writing 1 to **register 0xe5** and stopped by writing 0 to register 0xe5.

The sweep error is read through **register 0xe6** in units of 0.1GHz. The return is a signed integer.