

Operating the prototype iSPA641 synthesizer/RF amplifier using iHHS-Software Tool

1. Install Software.

Download the latest *HHS Tool* software from <http://www.isomet.com/software.html>

Run the setup.exe from the iHHS Tool directory.

Select and run Isomet iHHS Tool from the Start Menu, All Programs.

Connect the USB and apply DC power (+24V minimum, +28V maximum)

The title bar will show *Connected* when USB communication is established.

The Isomet GUI features tooltip hints. Place the cursor near a wiper or check box to display the corresponding Tooltip.

The driver will only respond to data changes after the *Write* button at the foot of each page is pressed.

Slider controls are the exception. Selected data is auto-written once the respective slider button is released.

The Write button can also be used to confirm new slider values.

The slider controls snap to the nearest 0.5 unit. Fine control is achieved using the navigation keys.

Keys	FREQ slider
+ / -	1 MHz
PgUp / PgDn	0.1 MHz
↑ / ↓ arrows	0.01 MHz
← / → arrows	0.001 MHz

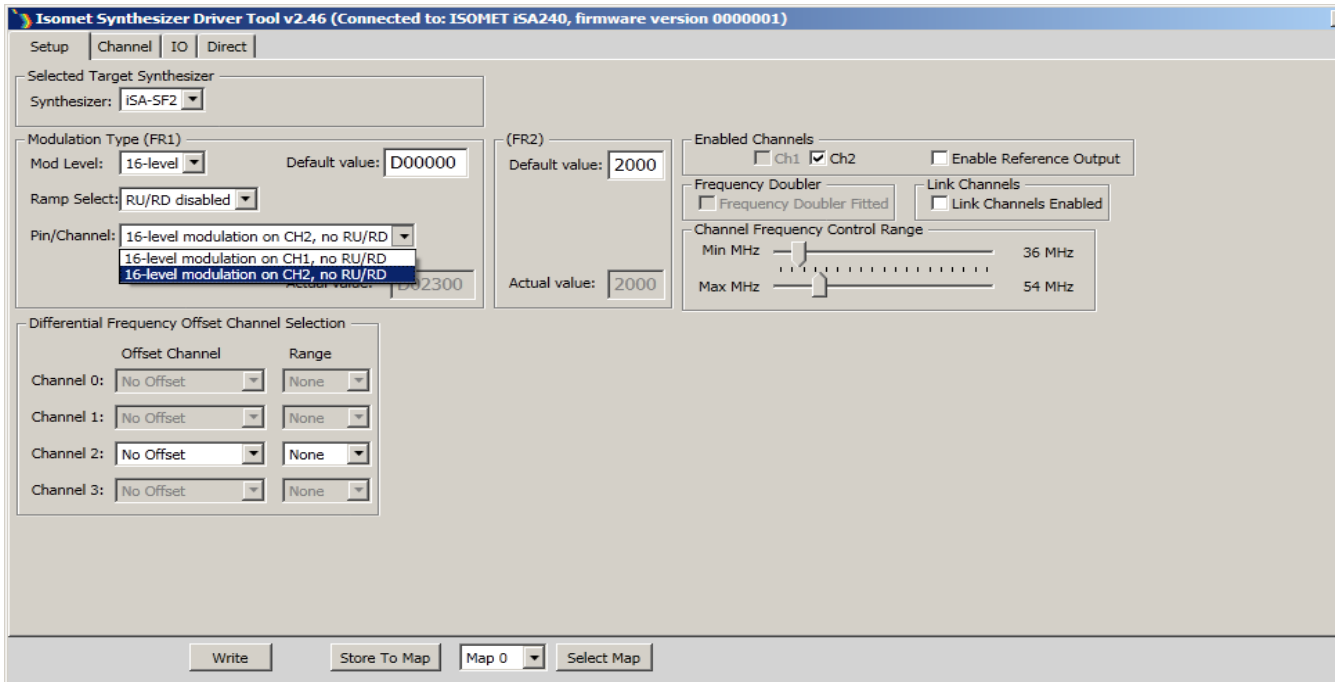
The opening window will display four menu tabs. **Setup, Channel, IO** and **Direct**.

The Direct tab displays internal register values and is a low level diagnostic tool.

(Please refer to the Analog Devices AD9959 data sheet for detailed explanation)

Most user controls are found under the Setup, Channel and IO tabs.

2. Select the Setup Tab



Selected Target Synthesizer Window

Set *Synthesizer* pull down options to: **iSPA-SF2**

Modulation Type (FR1)

Set *Mod Level* to: **16-Level** (or 8-level, 4-Level, 2-Level as desired)

Set *Pin/Channels* pull down options to: **16-level modulation on Ch2, no RU/RD**

Enabled Channel

Check **Ch2**

Channel Frequency Control Range

Set:

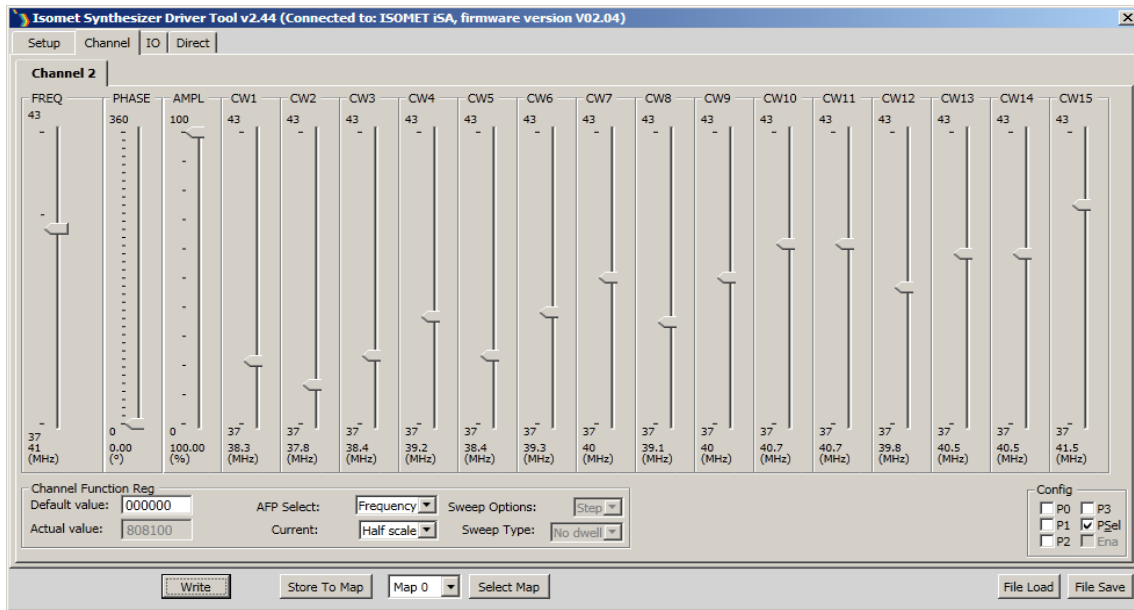
Min MHz = 36MHz

Max MHz = 54MHz

This sets the upper and lower limits for the sliders in the Channel Tab
Change later, if required.

[Don't forget, press **Write** to load new values]

3. Select Channel Tab



[Don't forget, press **Write** to load new values]

A total of 18 sliders will be available

See the **Channel Function Reg'** frame at bottom of window

Set:

AFP Selects = Frequency

Current = Half Scale [THIS IS IMPORTANT. AVOIDS AMPLIFIER SATURATION]

The slider functions are:

FREQ = Frequency 0 value (=CW0)

PHASE = no function in this mode

AMPL = no function in the mode

CW1 = Frequency 1 value

CW2 = Frequency 2 value

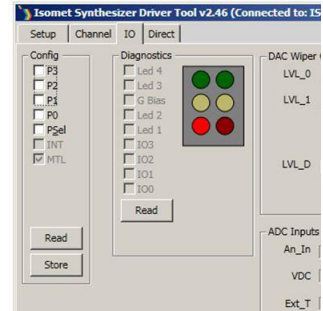
.....

CW15 = Frequency 15 value

Set sliders FREQ(CW0) CW1....CW15 to the desired frequencies.

Output Frequency Selection

First step, open **IO tab** and make sure all **Config** boxes are unchecked. Enter **STORE**



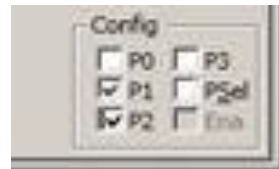
Return to the **Channel Tab**

See the **Config** panel in the bottom right hand corner of the window

If **Psel** , then the output frequency is selected using the external inputs to the D-type connector, inputs P0,P1, P2, P3. (see section 5). This is the high speed dynamic mode.

If **Psel** , then the output frequency is selected using the check boxes P0,P1, P2, P3 in the **Config** panel . This method is used for alignment.

Each time a P? check box is changed, press **Write** to update.



Condensed truth table

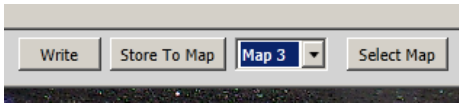
Control	P0	P1	P2	P3
Active Slider				
CW8	1	0	0	0
CW4	0	1	0	0
CW2	0	0	1	0
CW1	0	0	0	1
FREQ(CW0)	0	0	0	0

Logic "1" = external input on P0,1,2,or 3 with 3.3V maximum

Logic "1" = tick in the P0,1,2,or 3 check box

Storing Values using MAPS feature

MAP Store:



Set-up data can be stored in non-volatile Flash memory .

The user can select up to 8 different “Maps” to store 8 unique sets of channel registers and DDS configuration data values.

User Pull down to feature to select MAP 0 , MAP1....as required.

MAP0 is a special case. MAP0 values are loaded at power up or after RESET

Press **Store To Map** to save values

Note: the RF power level is set using digital pots (See section 4). These have separate Flash storage and the respective DAC wipers values are not stored in the MAP FLASH area.

MAP Recall:

Data stored in MAP0 is always loaded on power-up or after a RESET is applied.

Use pull down menu to select the MAP for recall e.g. Map 3

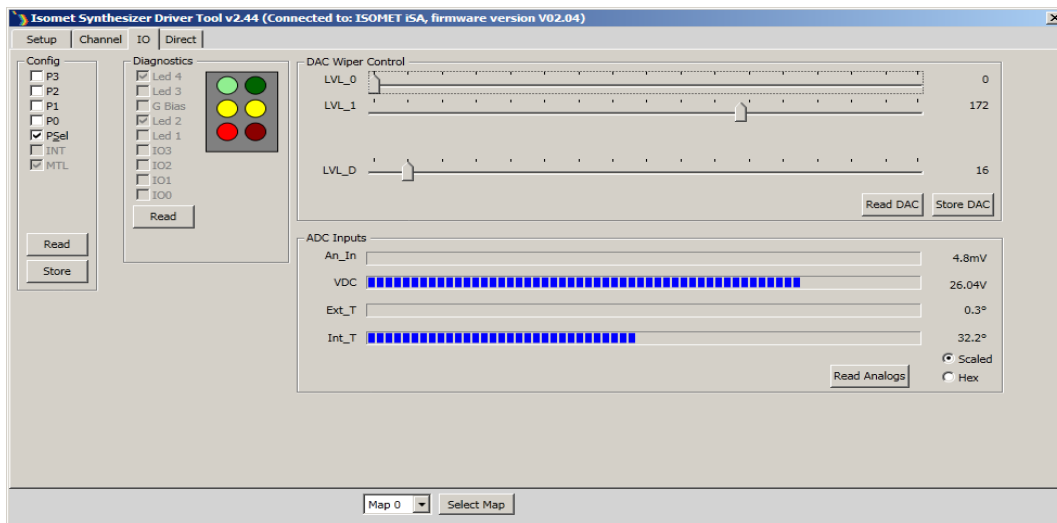
Press **Select Map**

DDS registers will be updated and output will change to reflect the selected MAP3 data. The registers values can be viewed under the Direct tab (see section 6).

The GUI sliders do not change when the DDS registers are updated using MAP recall.

4. Select IO Tab

DAC Wiper Control Window



Slider LVL_0 has no function

Slider LVL-1

Slider LVL_L sets the maximum modulation level.

Its function is similar to the RF PWR ADJ potentiometer on a classical RF driver.

This slider is only active if the D-type input signal –OHL is High (see section 5)

0 = Lowest output power when modulation input is On

255 = **Maximum** output power when modulation input is On

If -OHL is Low (see section 5) then the RF power level is controlled from the D-type connector, input MOD_A. In this case, slider LVL-1 is not active.

Slider LVL-D

LVL_D sets the overall RF attenuation factor.

0 = Max Power output

255 = Min Power output

This value is factory set and should not be changed UNLESS insufficient range is possible using the MOD-A or LVL-1 RF power controls.

Wiper values can be stored and are non-volatile

Press **Store DAC** to save values

The RF driver test data sheet will give typical values of RF power vs. LVL-D , LVL-1 and MOD_A

ADC Inputs Window

Diagnostic values are shown in this pane

VDC: Indicates supply voltage at the RF driver (+/- 5%)

Int_T : Indicates temperature of RF driver heatsink

5. Connections and Operation

PRECAUTIONS

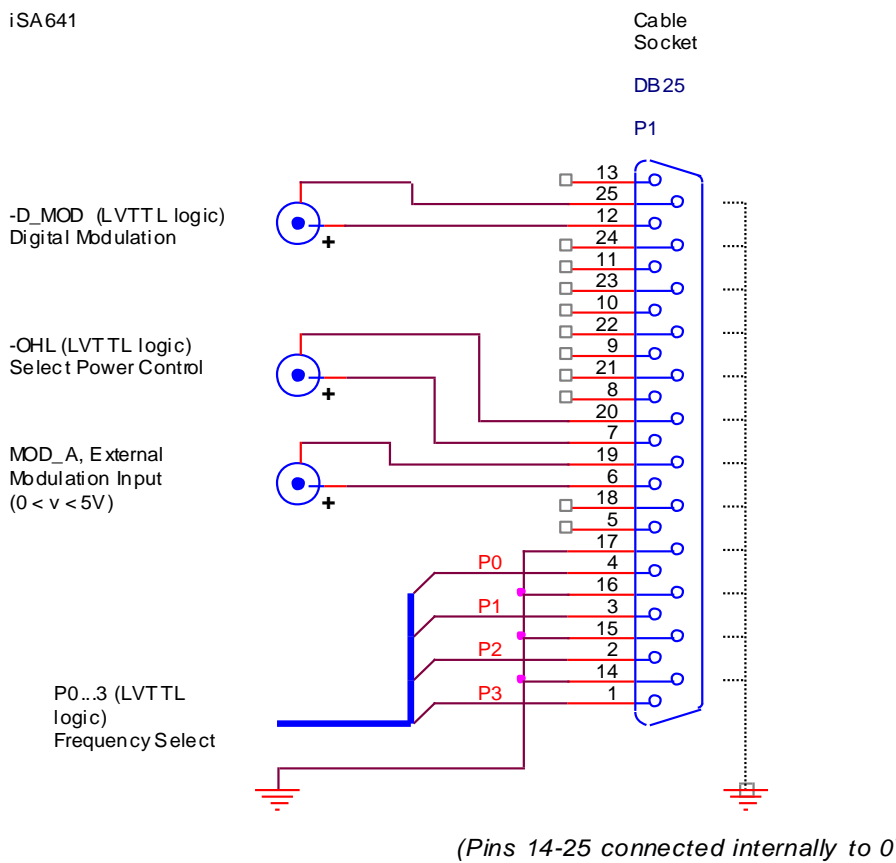
Digital input levels are LVTTTL and must not exceed 3.3 volts

Analog input levels must not exceed 12 volts

DAMAGE TO THE AMPLIFIER MAY RESULT IF THE TEMPERATURE EXCEEDS 70°C.

SERIOUS DAMAGE TO THE AMPLIFIER MAY ALSO RESULT IF THE MAIN RF OUTPUT(S) IS OPERATED OPEN-CIRCUITED OR SHORT-CIRCUITED. (Reference outputs may be left un-terminated)

Minimum connections:



Signal Description

Signal	Pin	Rtn	Description	Internal termination
-D_Mod	12	25	High speed On:Off modulation Low = RF on High = RF Off	Pull-up to 3V3 via 10KΩ
-OHL	7	20	Selects Power Level Control Low = External control, MOD_A High = Software control Digital pot, wiper LVL-1	Pull-up to 3V3 via 10KΩ
MOD_A	6	19	Analog Modulation Input or RF level control 0 < V < 5V(max)	Approximately 600Ω
P0	4	17	Register (Freq) Select Input	Pull-down via 1KΩ
P1	3	16	Register (Freq) Select Input	Pull-down via 1KΩ
P2	2	15	Register (Freq) Select Input	Pull-down via 1KΩ
P3	1	12	Register (Freq) Select Input (MSB)	Pull-down via 1KΩ

All digital inputs are LVTTTL. DO NOT exceed 3V3 as logic high input level.

Selection table

P0	P1	P2	P3	Frequency Selected
0	0	0	0	FREQ (CW0)
0	0	0	1	CW1
0	0	1	0	CW2
0	0	1	1	CW3
0	1	0	0	CW4
0	1	0	1	CW5
0	1	1	0	CW6
0	1	1	1	CW7
1	0	0	0	CW8
1	0	0	1	CW9
1	0	1	0	CW10
1	0	1	1	CW11
1	1	0	0	CW12
1	1	0	1	CW13
1	1	1	0	CW14
1	1	1	1	CW15

6. Signal Timing

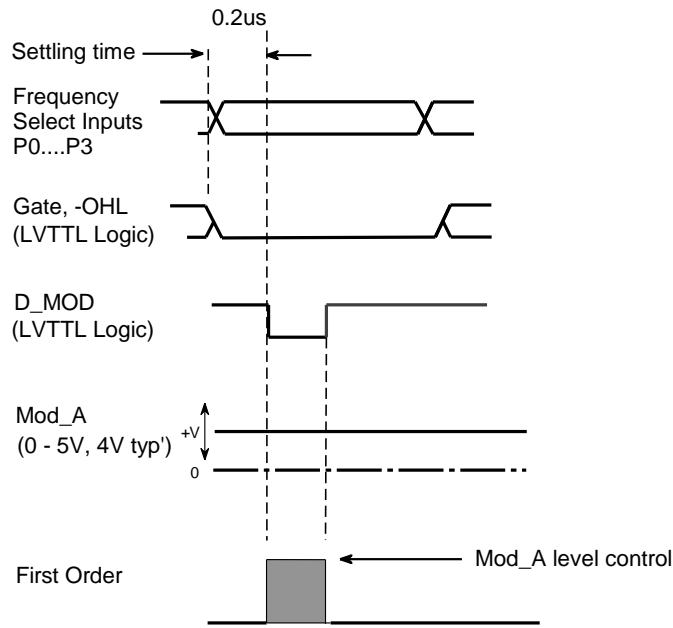


Diagram shows modulation waveforms and power control using MOD_A input

7. Alignment

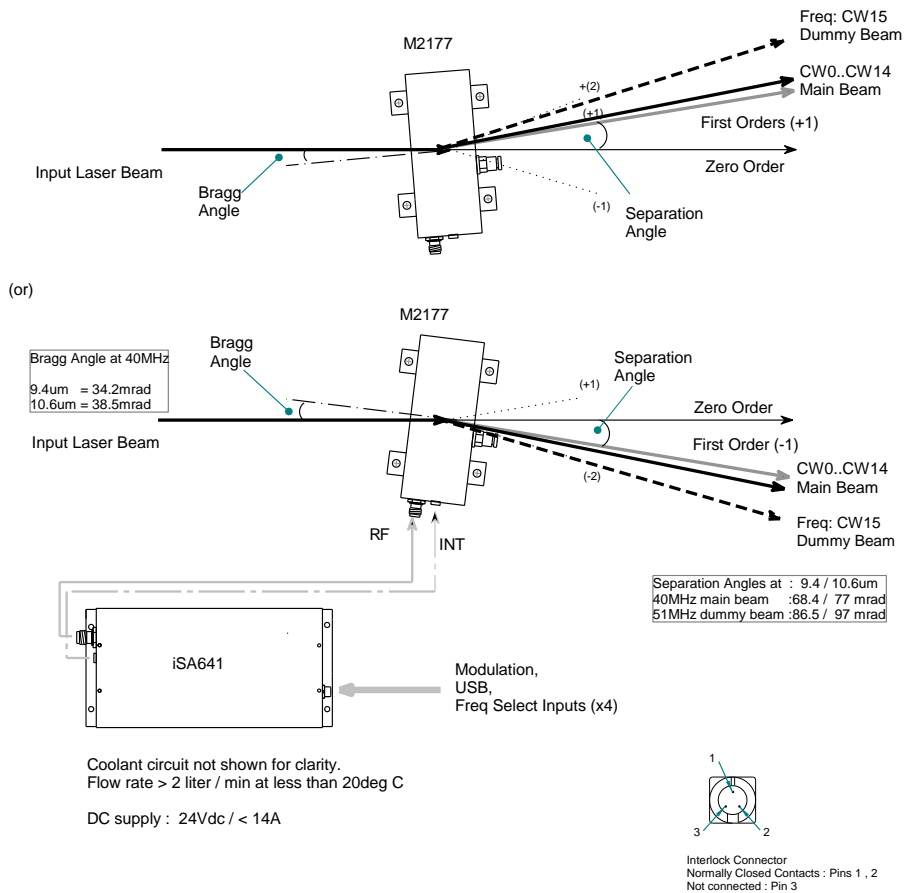
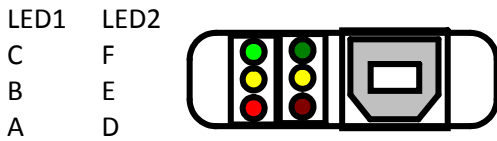


Diagram shows typical beam alignment. Laser can be input either side of AOM.

8. LED Indicator and Monitor outputs

The two front panel tri-colour LED sets indicate the operating state



RED - A: Normal condition is ON
The bottom left LED will illuminate RED when DC power is applied.

YELLOW – B: Normal condition is ON
The middle left LED will illuminate YELLOW when the Power amplifier stages are enabled.

GREEN – C: Normal condition is ON
The top left LED: reserved for future use.

RED – D: Normal condition is OFF
The bottom right LED will illuminate RED when there is a fault condition.
This signal is also available on pin 8 of the 25way D-type connector. See STATUS MONITOR below
Fault conditions:
- DC power is below 15Vdc or above 28Vdc
- Over temperature fault

YELLOW – E: Normal condition is ON
The middle right LED will illuminate YELLOW when the DC supply voltage is within limits
Limits: $28V > v > 15V$.

GREEN – F: Normal condition is OFF, not blinking
The top right LED will blink GREEN when driver temperature is outside recommended limits
Limits: $50^{\circ}\text{C} > T > 7^{\circ}\text{C}$.

RESETTING

Once the fault condition is corrected, it will be necessary to reset the driver.

- 1) Turn the DC power OFF and ON
or
- 2) RESET the driver by momentary connecting pin 13 of the D-type to pin 25

Status Monitor Output

The status of the RED-D LED is replicated at the D-type connector

“FAULT” = logic low between pins 8 and 21 = LED on

“OK” = logic high between pins 8 and 21 = LED off

Signal is LVTTTL compatible. Sink / Source 4mA

9. Checking

Select **Direct Tab**.

Specific register values can be viewed in this window.

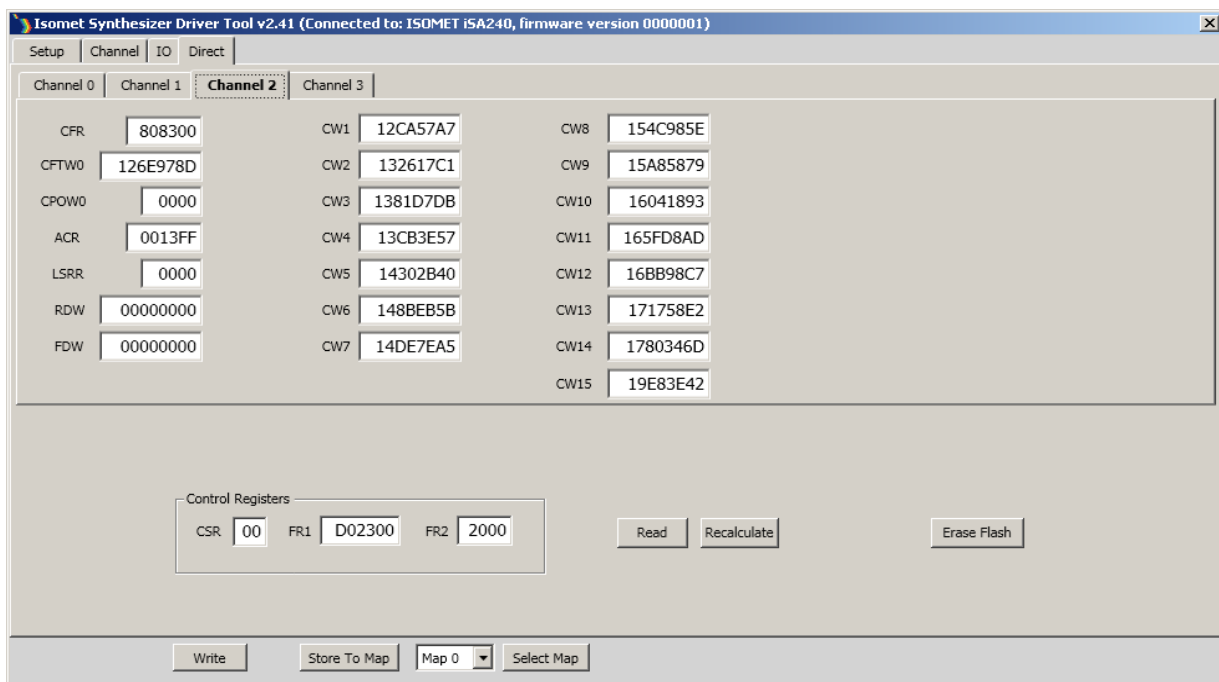
Use this option to check configuration. Refer to the Analog devices AD9959 data sheet for further explanation.

Data on Channel 2 should look something like the screen grab below.

CFTW0 = FREQ = Frequency 0

CPOW0 = PHASE = no function in this mode

ACR = AMPL = no function in the mode



10. INSTALLATION and ADJUSTMENT

- Connect cooling water to the iSPA641 and AOM at a flow rate greater than 2.0 litres/minute and coolant temperature less than < 20 deg.C. Corrosion inhibitor is strongly advised.
- Due to the high RF power dissipated in the AO modulator, it is paramount that the device is operated only when water cooling is circulating.
- With no DC power applied, connect the + 24V DC live to the center terminal of the feed-thru terminal.
- Connect the TNC output connector to the TNC RF input of the AOM (or a 50Ω RF load, if it is desired to measure the RF output power).
- Connect the Interlock of the acousto-optic modulator (mini 3-pin snap connector) to the RF driver "INT" input (mini snap connector).
- If the temperature of the modulator exceeds 32°C or the internal driver temperature exceeds 50°C then the interlock connection becomes open circuit, disabling the RF output. An LED indicator illuminates when the Interlocks are closed and the RF is enabled.
- Adjustment of the RF output power is best done with amplifier connected to the acousto-optic modulator. When shipped, the iSPA641 output power is set to give 60W maximum using LVL-1 software control *.
- The optimum RF power level required for the modulator to produce maximum first order intensity will be differ depending in the laser wavelength. Applying RF power in excess of this optimum level will cause a decrease in first order intensity (a false indication of insufficient RF power and makes accurate Bragg alignment difficult. It is therefore recommended that initial alignment be performed at a low RF power level.

* The RF power level is adjusted using the Mod_A voltage input level or the software controlled LVL-1 digital pot wiper depending on the -OHL signal level.

The set up procedure below assumes MOD-A is used to control the power level.

The initial alignment is made at half RF power (MOD_A = 2.5V approximately)

- Apply DC to the amplifier (14A continuous capability)
- To select RF power level control using the MOD-A input, apply a constant LVTTTL low signal to the -OHL input.
- Apply constant LVTTTL signals to the P0, P1, P2, P3 frequency select inputs. Set the specific P0....P3 logic levels to select your mid-frequency point e.g. 40MHz
- Apply a constant input of 2.5V to the MOD_A analog modulation input.
- Apply a constant LVTTTL Low signal to the -D-MOD digital modulation input. This will modulate the RF power continuously ON

Input the laser beam toward the centre of either aperture of the AOM. Ensure the polarization is horizontal with respect to the base and the beam height does not exceed the active aperture height of the AOM. Start with the laser beam normal to the input optical face of the AOM.

- Observe the diffracted first-order output from the acousto-optic modulator and the undeflected zeroth order beam. Adjust the input angle (rotate the modulator) very slightly to maximise the first order beam intensity.

- After the input angle has been optimized, slowly increase the RF power by increasing MOD_A until maximum intensity is obtained in the first orders. Peak efficiency value should occur between 4V to 5V.