



Trinity Power Incorporated (TPI)
205 Cowal Drive South
Spicewood, TX 78669
512.852.8110 (office)
512.992.8657 (cell)
310.943.2123 (fax)
robert@rf-consultant.com
www.rf-consultant.com

TPI Synthesizer Operation Manual

Prepared for	Freddy
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1. Introduction

Robert Yarbrough of Trinity Power Incorporated (TPI) has made a decision to try and market a USB Frequency Synthesizer to compete with similar Synthesizers available on EBay. TPI developed a significantly better design to include an Aluminum housing and a superior reference oscillator and is looking to take existing software and to change it significantly. These changes will add capability and improved functionality.

2. LabView Files

LabView files are used to create the operating software. TPI does not own LabView and has limited knowledge regarding LabView. In the past TPI included the Native LabView files on the CD. At this time TPI is not including those files for free for two reasons. The first reason is regarding the significant cost associated with the software development. The second reason has to do with giving away my competitive edge to competitors. TPI will be glad to discuss selling the software for a reasonable price if a non-compete document is entered into between all involved.

3. TPI Synthesizer Startup and Features

Insert the CD into your CD drive. Open the CD drive in Windows Explorer. Run "Setup.exe" and follow instructions. You will most likely need to "restart" your computer.

Once your software is loaded you should have a TPI Synth icon on your desktop.

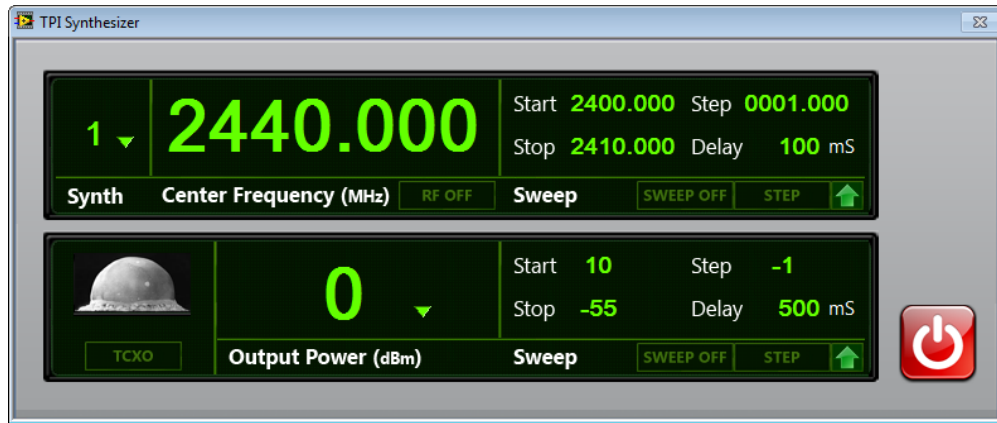
Do not start the software program at this time. If you do you will get an error message: "There are no TPI synthesizers connected to the computer". Hit "Abort" and the program will close automatically.

Plug in the TPI synthesizer into a USB 2.0 Port (Most ports support 2.0) using the supplied USB interface cable provided. Always plug in the unit before starting the software.

The USB drivers required should automatically install. There is an audible sound that indicates that the device is plugged in. You should see a pop up box that tells you drivers are being installed and inform you when the device is ready to use.

- A. This could take 3 or 4 minutes
- B. I have never seen it not install on Win7, XP or Vista
- C. If for some reason the driver does not install then look at the CD. Go to the Documents folder and click on CDM20814_Setup. This will properly install your driver.

Once your drivers are installed, you may double click on the TPI Synth icon located on your desktop. **Note it is important to always “Plug” the unit into the USB port before invoking the software. When you click on the TPI Icon the software loads a critical “Cal Table” so do not start the software and then plug in the unit.**



Starting from top right hand corner the first box is labeled “Synth” and should have the number 1 in that box.

SYNTH

1. In the past the software would control more than one Synthesizer. We are still looking to have that feature soon but for now the software only controls 1 TPI Synthesizer. So at this time disregard that box. I will send you updates.

CENTER FREQUENCY

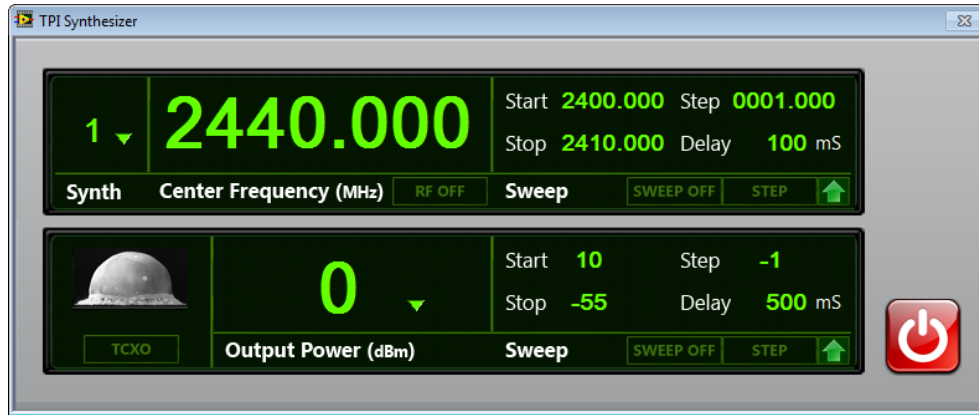
The next window is “Center Frequency in MHz” and the default center frequency is 2440MHz. You can change that frequency from your keyboard by placing the cursor into that window and typing in the frequency you desire.

NOTE:

If the RF is “On” you can change the frequency but you must toggle the RF On to Off and then back to On in order to go to the new frequency.

Within the “Center Frequency” box bottom left you will see “RF Off”. Simply hit that button to turn the RF “On” and the button will say “RF On”. The TPI Synthesizer has a visual indication (RED LED Front Panel) that informs you the RF is on and “Locked” on frequency.

Frequency Resolution is 1KHz.



SWEEP (Frequency)

The next box is the “Sweep” box. When you hit the sweep button you will see the RF output move in frequency according to the parameters of the “Sweep” box. In the sweep box you have a start and stop value that you can change from the keyboard. If your center frequency is set to 250MHz and your sweep box parameters are set to 2400 to 2500MHz (as an example) you will sweep from 2400 to 2500MHz and it will loop over and over until you stop the sweep at which time it will go back to your Center Frequency setting.

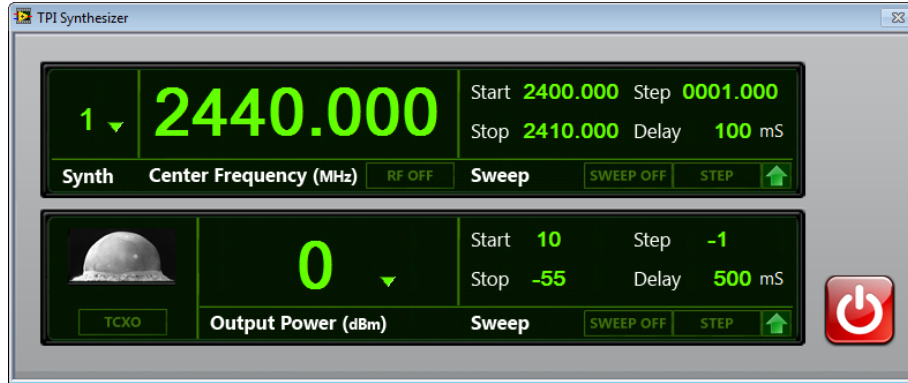
1. You cannot change the sweep values while the unit is sweeping
2. The Phase Lock Loop Integrated Circuit employs 7 different VCO's
3. You may not pick values outside of a single VCO at this time
 - a) In other words there are 7 sweep bands and you cannot sweep between bands. We are looking at that for future upgrades.
4. You can control the step size down to 1KHz resolution via the keyboard
5. You can control the time per step anywhere between 100msec to 5 seconds

Sweep Frequency Bands

Band 1: 35MHz to 68.749MHz
Band 2: 68.75MHz to 137.499MHz
Band 3: 137.5MHz to 274.999MHz
Band 4: 275MHz to 549.999MHz
Band 5: 550MHz to 1099.999MHz
Band 6: 1100MHz to 2199.999MHz
Band 7: 2200MHz to 4400MHz

Sweep Frequency Single Step

Of course you can “Single Step” up or down as directed by the Arrow next to the “Step” button. When you hit the step button the synthesizer will step per the information in the Sweep Box. You can single step across VCO bands.



TCXO/External 10MHz Reference

The next button is located under the TPI Logo. FYI the logo is a picture of the Trinity Nuclear Blast at 25msec into the blast. I am one of the fastest engineers you will ever work with. I don't mess around and get it done! So that is my Logo.

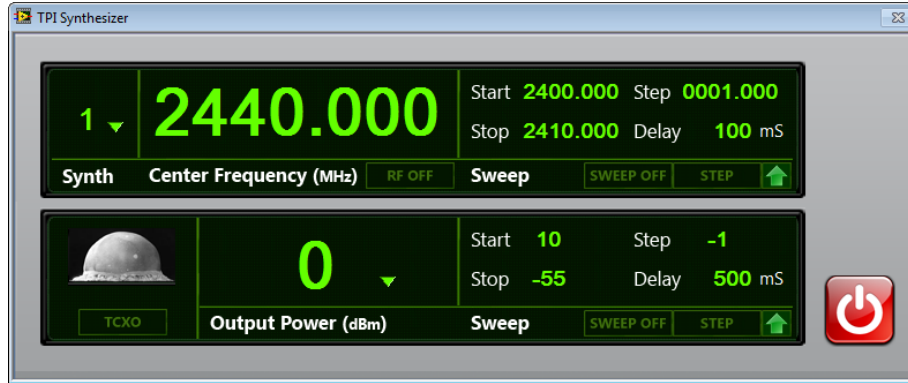
If you would like to operate the TPI Synthesizer from an external 10MHz Reference simply hit that "TCXO" button and it will switch the PLL reference input to the BNC on the back panel. The button will indicate "EXT REF".

Output Power (dBm)

This is the actual RF output power available at the RF Output SMA (standard SMA) connector. You may choose the RF power to be anywhere between +10dBm to -55dBm.

When you first turn on the unit you will notice that the calibration program loads the calibration table. Each Synthesizer is calibrated and tested before shipping. For over 90% of the frequencies the calibration is less than +/- 1dB for frequencies between 35MHz and 3.5GHz. For frequencies above 3.5GHz a new cal table is being developed and once developed all users will receive an updated cal table file.

Each of the internal VCOs has slightly different output power and so I added 62dB of attenuation to the design. I set the Power amplifier to output +13dBm. Then I added the calibration table to set the appropriate amount of digital attenuation to get +10dBm at any frequency. For example at 35MHz the VCO only gets me +10dBm with 0dB of attenuation. At 2.4GHz I have to add 4dB of attenuation to get +10dBm.



Output Power (dBm) SWEEP Box

The Sweep Box located next to RF Power box controls the digital attenuators. These attenuators allow you to sweep the RF Power from any value within +10dBm and -55dBm. You can set the parameters inside the sweep box. If you pick a value outside of +10dBm to -55dBm you will see a dialogue box open suggesting that you look at your values again.

The step size must be whole numbers. Now if you ask to step -10dB and you set start at -30dBm and stop to -55dBm you will get a dialogue box open asking you to check your numbers because you can't step into -55dBm with 10dB steps.

Play with it and you will easily understand it.

You can set the step delay from 100 msec to 5 seconds.

You may also "Single Step" the attenuators and they will step up or down according to the associated Arrow.

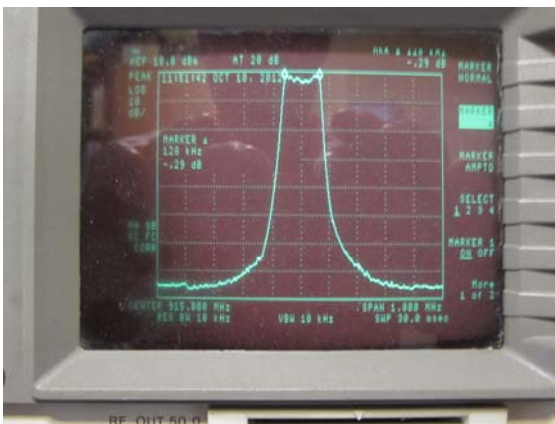
The RF Power box will reflect all changes made in the attenuator sweep box.

FM Input Port

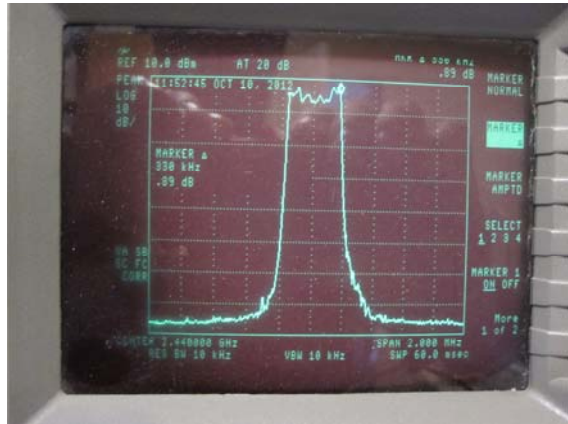
The FM input port is a BNC input. You must have a function generator or some source of AC between 1 to 5vp/p. For example at 2.44GHz a 2vp/p sinewave will deviate the CW signal +/-150KHz (300KHz deviation). It will deviate 425KHz with 3Vp/p input.

You will notice that the lower you go in Frequency the harder it gets to deviate the CW signal. This is because the modulation signal is fed into PLL Loop filter and that filter is designed to roll off at the lower frequencies.

AC Input with 0V reference DC coupled. 1KHz modulation Frequency					
315 MHz		915 MHz		2.44 GHz	
Vp/p	P/P Deviation (KHz)	Vp/p	P/P Deviation (KHz)	Vp/p	P/P Deviation (KHz)
1	20	1	50	1	150
2	35	2	120	2	330
3	60	3	170	3	425
4	85	4	240	4	600
5	100	5	280	5	700



915MHz 2vp/p 1KHz
120KHz Deviation



2440MHz 2vp/p 1KHz
330KHz Deviation

4. Disclaimers (PLEASE READ)

When I say that the unit is “Calibrated” what I am saying is that it is calibrated to my spectrum analyzer (SA). I calibrate the interface cable first on my Network analyzer. The interface cable between the Unit and the SA is a 6 inch piece of Semi-Rigid Coax with less than 0.7dB loss at 2GHz. So when the Unit reports “0dBm” I see a signal on my SA at 0dBm (+/- 1.5dB) (but within less than 1dB for 90% of my measurements).

Anyway what I am NOT saying is that this unit is NIST certified. It is an inexpensive source that is good enough for 95% of all measurements you will take.