

## Protocol of new ULO1 Generation for 3mm Receiver using a Valon 5009 Dual Frequency Synthesizer

### I. Valon 5009 Dual Frequency Synthesizer and components in the box

In ULO1x6 box the Frequency multiplier and driver unit has not been worked properly. And therefore it is difficult to repair or buy a new module to replace the defected module. Because of this reason we need to develop an equivalent system that works with Valon 5009 dual frequency synthesizer. The new system's Schematic diagram is shown on Figure 1. This new system has equivalent power out just like that of the old ULO1x6 box power output. The output power level from each of three channels (Port A, B and C) has been adjusted to have around 12 or 13 dBm.

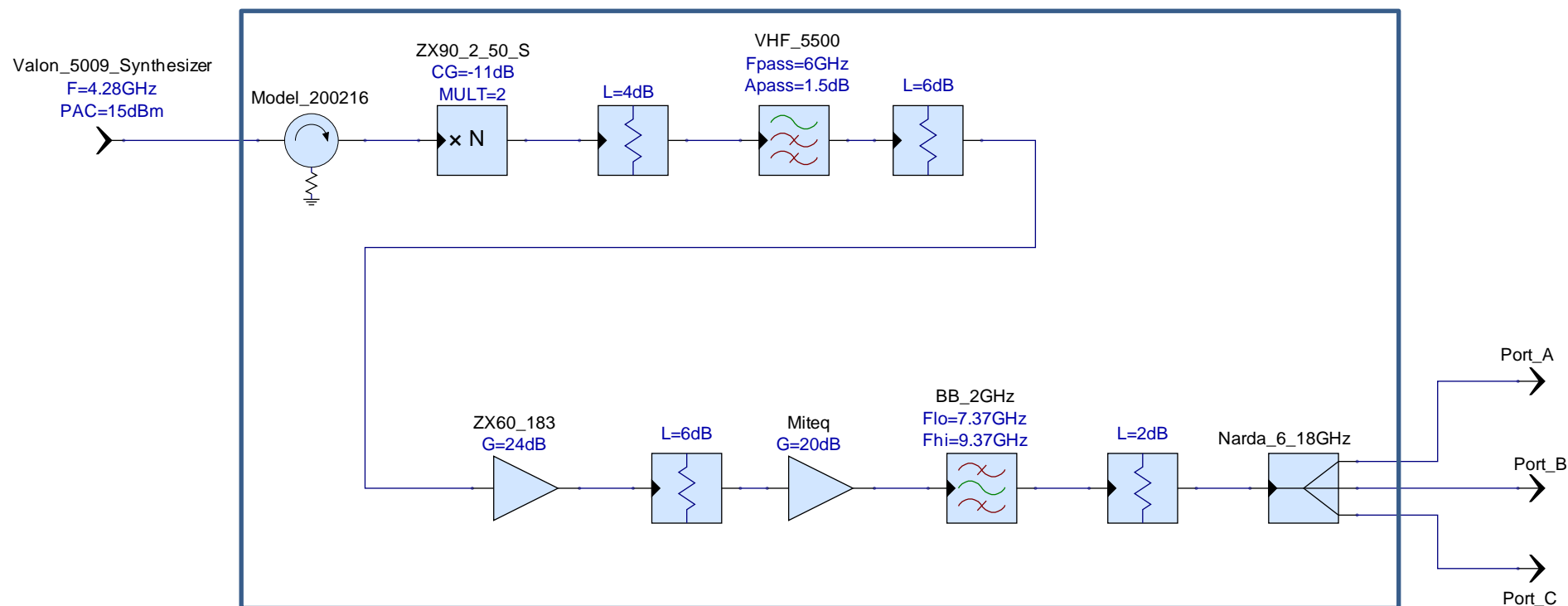


Figure 1: Synthesizer's power flow Schematic diagram



Since the old box is too big for the new components, I preferred to develop a new smaller box to win enough place for external connection. Therefore the new components Isolator, Multiplier, Amplifier, Filter & Power Splitter (MAFS) block position in the box is shown in Figure 2. Unfortunately for the time being there is no material to develop a new box. And hence we placed the new components in the old box. In the future it is better to develop a new box to save place and reduce the weights of the box.

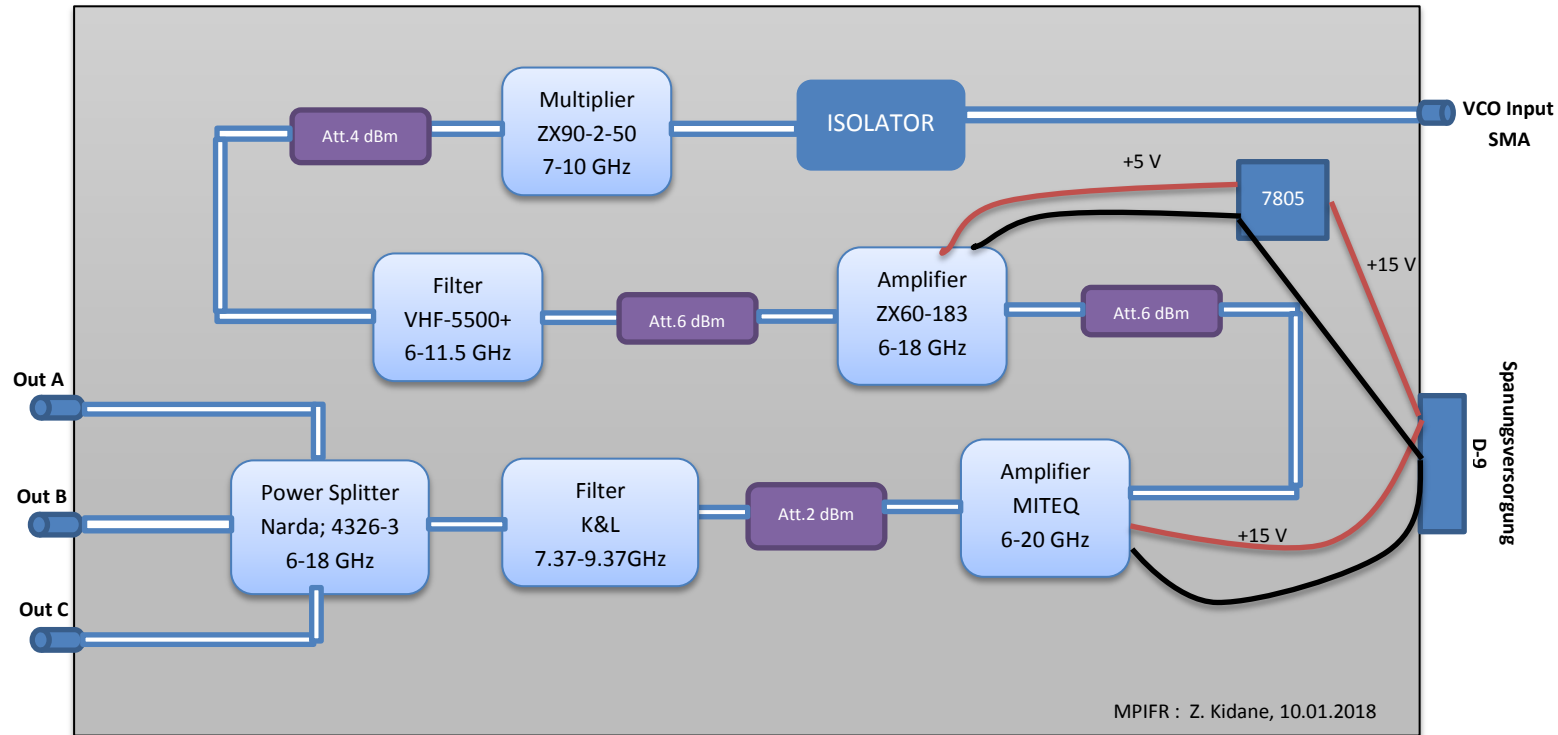
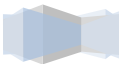


Figure 2: Frequency Synthesizer's Multiplier, Amplifier, Filter & Power Splitter Components block Position in the box.



## II. Test measurement on Valon 5009 dual Frequency Synthesizer

<b>Valon 5009 Dual Synthesizer1 output power level measurement using Spectrum Analyzer ( HP 8593A 9-26.5 GHz)</b>				
<b>Valon 5009 Dual Synthesizer test for 3mm Receiver ( 3.97 GHz- 4.67 GHz) with 20MHz Reference</b>				
<b>Synthesizer Internal attenuation= 0 dBm</b>				
<b>Synthesizer output for VCO frequency 3,97 GHz</b>				
	Frequency (GHz)	Power level (dBm)	RF Amplifier Power	Synthesizer Power
Fundamental Signal	3.98	14.68	On	On
Second Harmonic Signal	7.99	-14.52	On	On
Third Harmonic Signal	11.95	-24.89	On	On
Fourth Harmonic Signal	15.99	-48.49	On	On
<b>Fundamental Signal</b>				
Fundamental Signal	3.98 GHz	-16.48	Off	On
Second Harmonic Signal	7.99	-41.80	Off	On
Third Harmonic Signal	11.95	-49.78	Off	On
<b>Synthesizer output for VCO frequency 4,28 GHz</b>				
	Frequency (GHz)	Power level (dBm)	RF Amplifier Power	Synthesizer Power
Fundamental Signal	4.28	14.79	On	On
Second Harmonic Signal	8.58	-13.90	On	On
Third Harmonic Signal	12.87	-32.20	On	On
Fourth Harmonic Signal	17.17	-47.20	On	On
<b>Fundamental Signal</b>				
Fundamental Signal	4.28	-15,29	Off	On
Second Harmonic Signal	8.58	-39.70	Off	On
Third Harmonic Signal	-	-	Off	On
<b>Synthesizer output for VCO frequency 4,67 GHz</b>				
	Frequency (GHz)	Power level (dBm)	RF Amplifier Power	Synthesizer Power
Fundamental Signal	4.66	14.74	On	On
Second Harmonic Signal	9.38	-13.31	On	On
Third Harmonic Signal	14.10	-42.80	On	On
Fourth Harmonic Signal	18.81	-45.40	On	ON
<b>Fundamental Signal</b>				
Fundamental Signal	4.67	-14.15	Off	On
Second Harmonic Signal	9.37	-41.28	Off	On
Third Harmonic Signal	-	-	Off	On



Valon 5009 Synthesizer1 output power level measurement using Power meter ( HP 436A Power meter)	
Valon Internal RF amplifier Power= On Synthesizer Internal attenuation= 0 dBm <b>Power Level =16.70 dBm</b>	Valon Internal RF amplifier Power= On Synthesizer Internal attenuation= 15 dBm <b>Power Level =2.28 dBm</b>
Valon Internal RF amplifier Power= Off Synthesizer Internal attenuation= 0 dBm <b>Power Level =-10.76 dBm</b>	Valon Internal RF amplifier Power= Off Synthesizer Internal attenuation= 15 dBm <b>Power Level =very low</b>

The Valon 5009 Dual Synthesizer for a frequency range from 3.97 GHz to 4.67 GHz of VCO has been tested with 20 MHz reference internal frequency. As shown on the above table the synthesizer output has a second, third and fourth harmonic distortion with a considerable output power level. These harmonic frequencies have effects on the receiver multipliers and other systems. To avoid the synthesizer's harmonic frequencies it is necessary to develop suitable Isolator and Filters on the required position of the system. It has been also observed the effects of the output power level when the internal Synthesizer RF power amplifier is switched off. An Isolator direct to the output of the Synthesizer and a band pass filter that passes a signal frequency range from 7.37 to 9.37 GHz have been developed on the required place. They are clearly indicated on Figure 1.

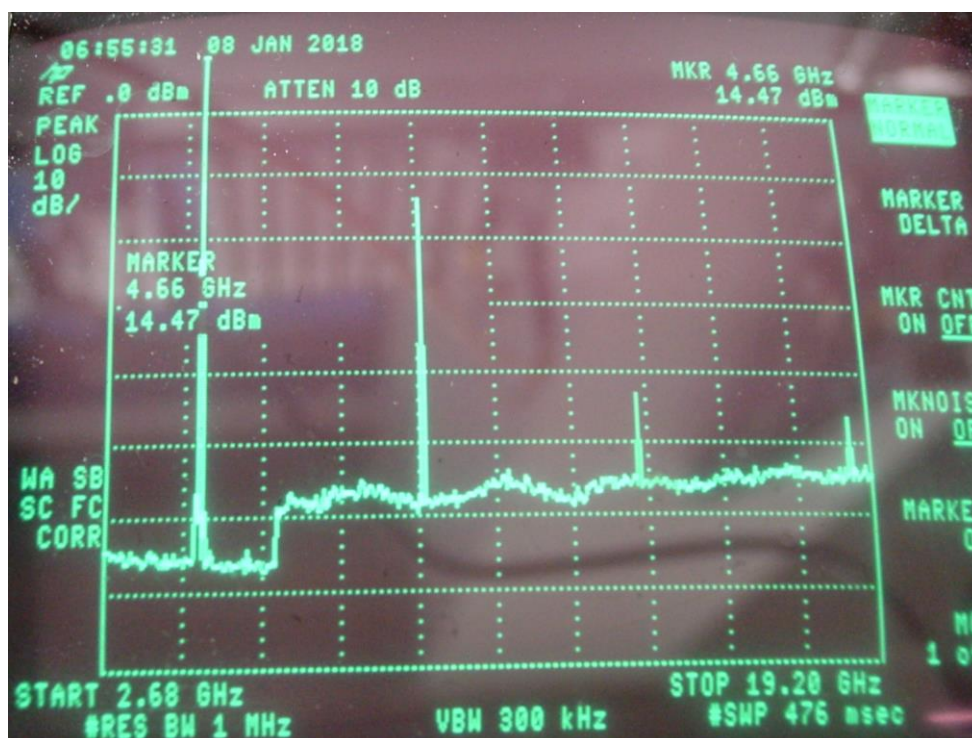


Figure 3: Valon 5009 dual Synthesizer output for VCO 4.67 GHz of frequency setting



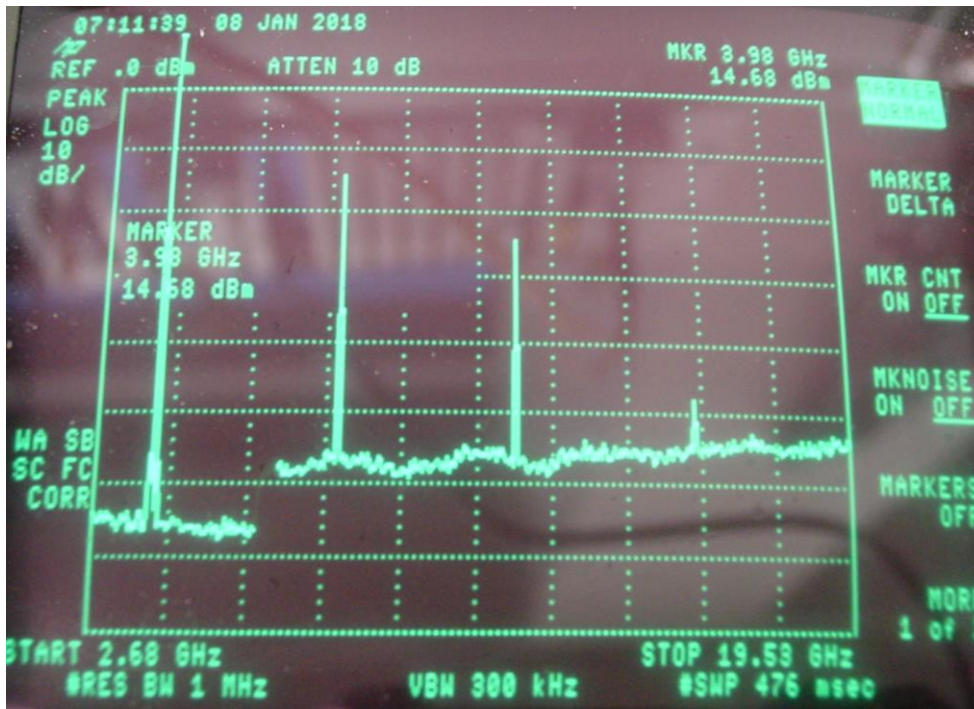


Figure 4: Valon 5009 dual Frequency Synthesizer output for VCO 3.97 GHz

The measurement has also been conducted for 4.28 GHz Synthesizer. The input power level which comes from Valon 5009 dual Frequency Synthesizer and the output power level from Frequency Synthesizer's MAFS box have been shown on the below Figures. From the test measurement the result shows that the expected signal power level is available for the next blocks of the receiver. This shows that the required local oscillator for the first 3mm receiver mixer can be generated using this new system.

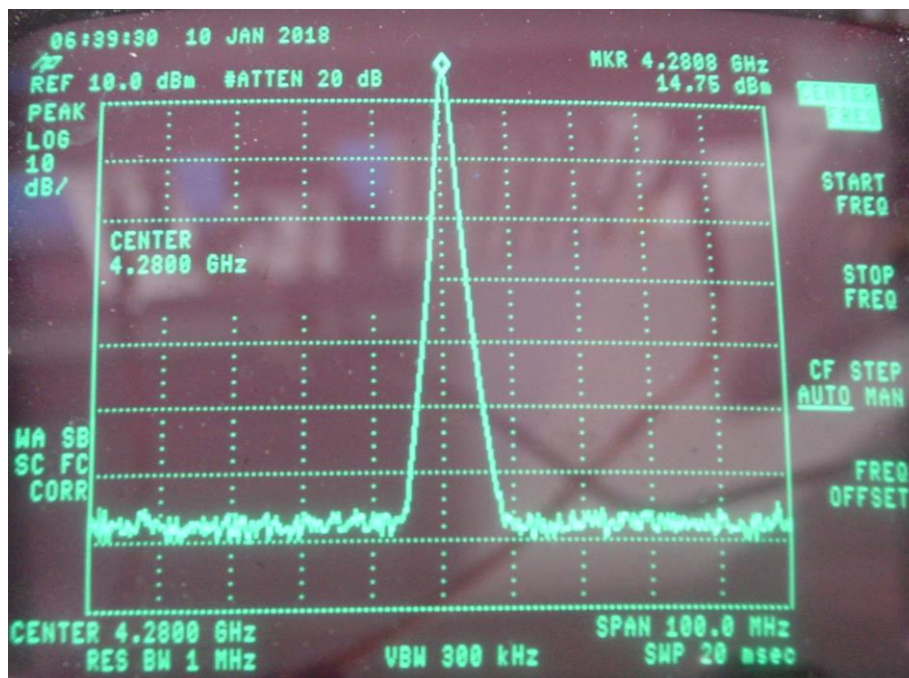


Figure 4. Valon 5009 dual Frequency Synthesizer spanned output for 4.28 GHz



From Figure 4 we observe that the Valon 5009 dual frequency synthesizer output power level is 14.75 dBm. This power level is the required power level for the next blocks MAFS box.

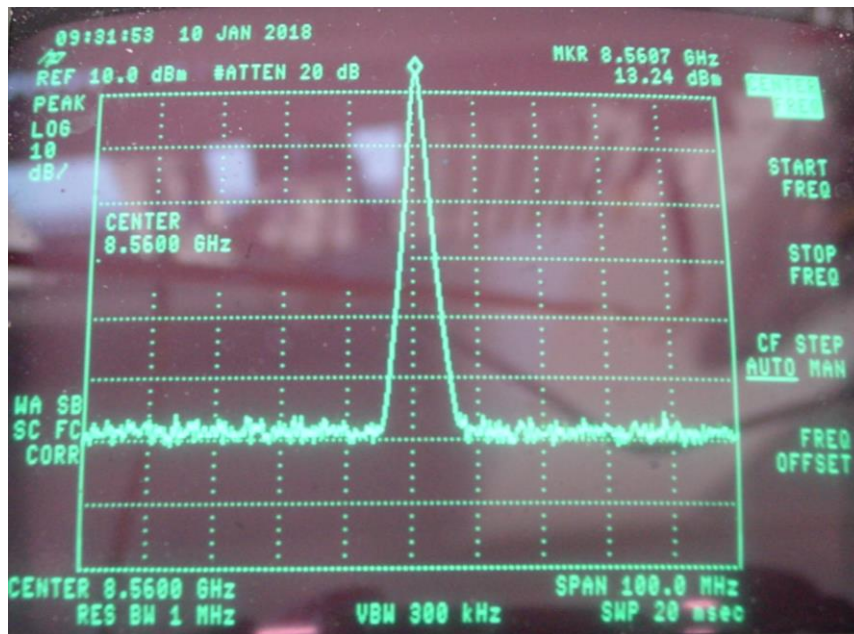


Figure 5. Multiplier, Amplifier, Filter & Splitter (MAFS) box power out

From Figure 5 we can see that the MAFS box output power level is 13.75 dBm. This power level is one of three channel of the required power level for the next blocks of the system.

### III. Valon 5009 dual Frequency Synthesizer Configuration using USB Interface

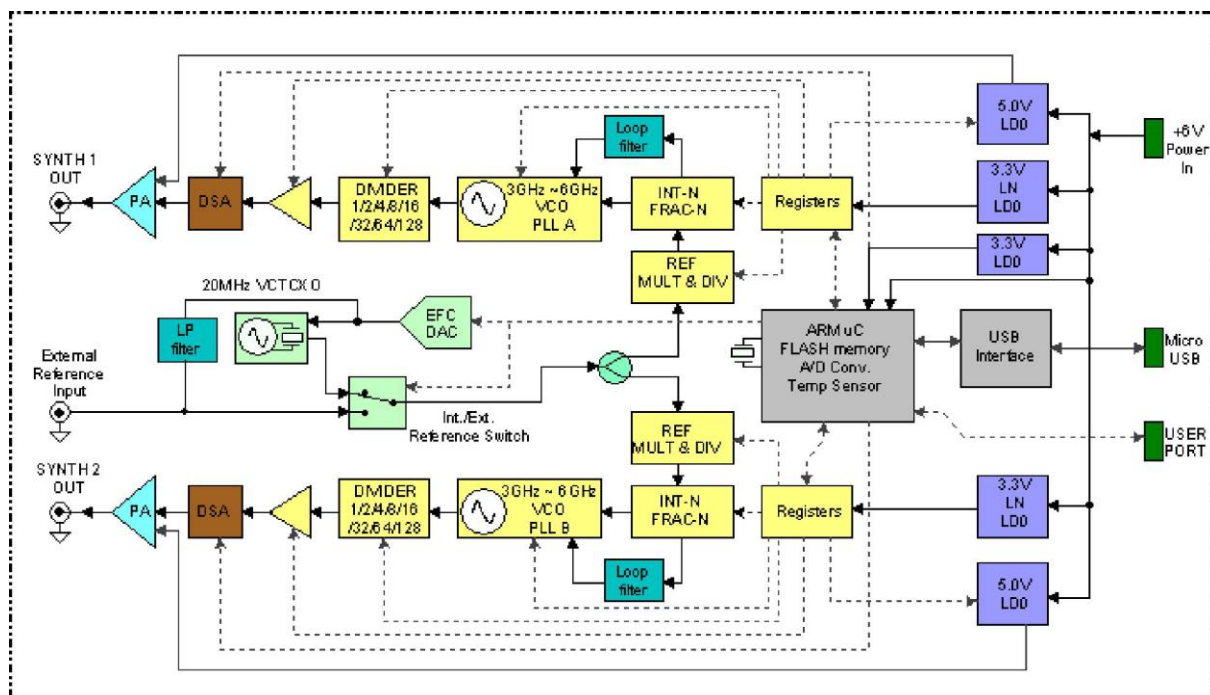


Figure 6: Block diagram of valon 5009 dual frequency synthesizer

The Valon Technology 5009 Dual Frequency Synthesizer Module is dual channel, PLL-synthesized RF signal source programmable from 23.5MHz to 6GHz , with output level control from approximately +15dBm to -15 dBm in 0.5dB steps. Both sources are locked to a common internal TCXO reference or to an external frequency reference. The synthesizers are fully shielded by machined aluminum, RF-tight, housing and use low noise circuit techniques to ensure high signal purity.

The 5009 can be controlled using simple, human-readable, commands either through the micro-USB port or the direct TTL-User port. Alternatively, the 5009 can be configured using the V5009CM.exe downloadable MS-Windows based graphical user interface. The 5009 settings can all be saved to non-volatile flash memory for automatic recall on power up. For more detail please refer the Valon synthesizer operation manual.

The simplest way to set frequencies and configure the 5009 synthesizer module is to use the **USB port** with the Valon Technology downloadable **V5009CM.exe** Configuration Manager (GUI). The Configuration Manager is a MS Windows compatible graphic user interface. No programming knowledge is required. The V5009CM will automatically detect a connected 5009 synthesizer and configure the USB port. Please refer the operation manual for detail explanation.

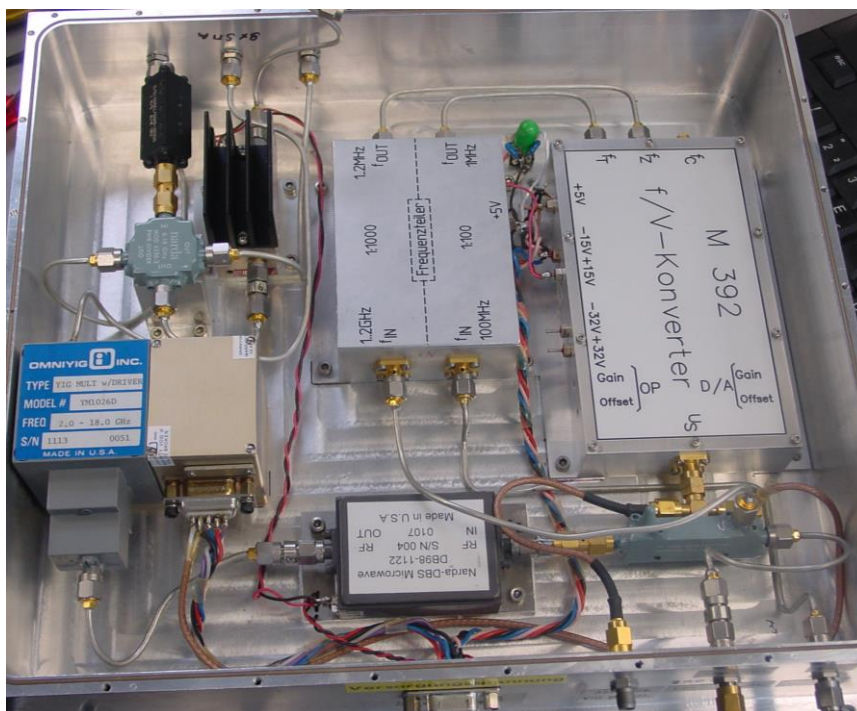


Figure 7: Old System Components in the box



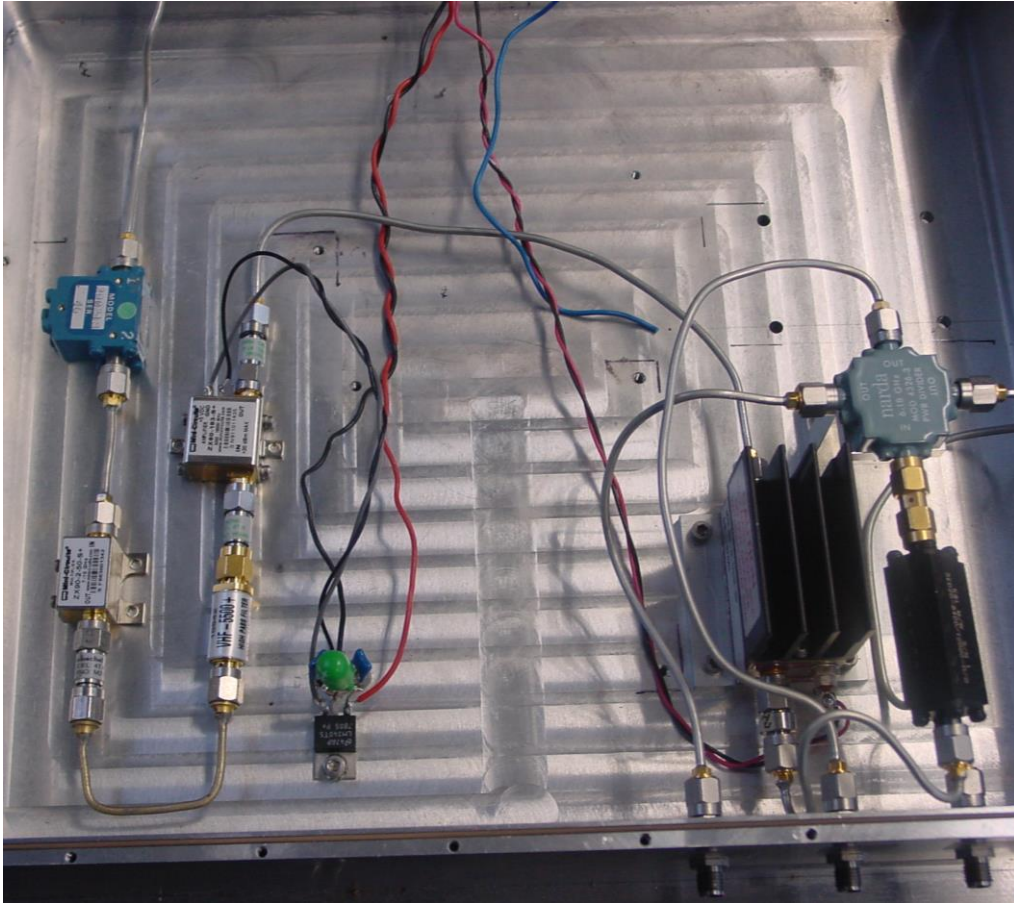


Figure 8: New System Components in the box

