

The 5009a Dual Frequency Synthesizer module provides two independent RF frequency synthesizers covering the frequency range 23.5MHz to 6 GHz. Each synthesizer is phase locked to the same internal TCXO reference or can be locked to a high stability external reference. Programming the non-volatile settings can be accomplished using 5009 Configuration Manager or any terminal emulation program including the Valon 5000term.exe through the micro-USB interface. List Mode and Sweep Step mode is also provided as well as serial TTL control through the User Port.



## **Electrical Specifications**

Note: The 5009a is **NOT** USB powered. You may purchase a Valon **PS6V-1** power supply kit.

DC Input	
Input Voltage Range	
Absolute Max	+16V to -16V (reverse protected)
Operational Max	+8v
Operational Min	+6V Recommended Operation Voltage
Reduced performance	+4.8 to 5.8V (output power reduced)
Min non-operational	+3.5V (synthesizer remains locked and serial port ok)
	>10V for >10sec resets the synthesizer to factory default settings
Input Current	
Source 1 and Source 2 on	560mA Output Enabled
	330mA Output disabled
Source 1 or Source 2 on	190mA Output disabled
	270mA Output enable
Source and Source 2 off	30mA both disabled
DC Input Connector	Hirose DF3A-2P-2DS
	Mates with Hirose DF3-2S-2C plug and pre-crimped wire H2BXT-10112-R4
	(red) and H2BXT-10112-B4 (black). Custom 20" dc cables supplied with
	synthesizer, additional cables available.

Full performance is obtained when the dc input voltage is in the operational range. If the input voltage is increased above the operational range, the output will be disabled and the synthesizer will be in standby mode. The synthesizer may be operated with reduced RF output power in the reduced performance voltage range. If the dc voltage is in the Min non-operational range, the output will be disabled but all user settings will be retained. Input voltages below the minimum non-operational range will cause a reset condition.

## Valon Technology 5009a Version 1.5 ValonRF.com



# 5009a Dual Frequency Synthesizer Specifications

RF Synthesizer Specifications (Unless otherwise noted, all specifications apply equally to both synthesizers.)

Max	6000MH	łz						
Min	23.5MH	Z						
		201411-				2014		
Frequency increment (Fractional-		ZUIVIHZ	referenc	ce		20101	Hz reference	
Frequency Range (MHz)		Reference	Double	r ON		Referen	ice Doubler (	)FF
3000~6000	10 kHz				5 kHz			
1500~3000	10 KΠ2 5 kHz				2.5 kHz			
750~1500		2.5	5 kHz			1.25 kHz		
375~750		1.2	5 kHz			1 kHz		
187.5~375		1	kHz			500 Hz		
93.75~187.5		50	00 Hz			250 Hz		
46.875~93.75		25	50 Hz				100 Hz	
23.4375~46.875		10	00 Hz			50 Hz		
		(minimur	n step si	ize)		(minin	num step size	e)
Frequency Lock Time	<100uS	· • •					c	
	LOCK tim	ie is from t	he time '	the frequen	cy commar	nd is sent,	or a frequen	icy step in
Frequency Increment (Integer-N	Sweepi	20MHz	referen				Hz reference	
Mode)		20101112	referen			20101		
Frequency Range (MHz)		Reference	Double	r ON		Referen	ice Doubler (	DFF
3000~6000		40	MHz	-			20 MHz	
1500~3000		20	MHz				10 MHz	
750~1500		10	MHz			5 MHz		
375~750		5	MHz				2.5 MHz	
187.5~375		2.5	MHz			1.25 MHz		
93.75~187.5		1.2	5 MHz				625 kHz	
46.875~93.75	625 kHz			3	312.5 kHz			
23.4375~46.875		312	.5 kHz			1	56.25kHz	
Sweep rate	0.1ms to	o 1sec in 0.	1ms step	os				
Sweep rate Phase Noise	0.1ms to Typical I	o 1sec in 0. ohase noise r	1ms ster e as mea	os sured with E	Berkeley Nu	ucleonics	7300 Signal S	Source
Sweep rate Phase Noise	0.1ms to Typical I Analyze <b>10Hz</b>	o 1sec in 0. ohase noise r <b>100Hz</b>	1ms step e as mea <b>1kHz</b>	os sured with E <b>10kHz</b>	Berkeley Nu 100kHz	ucleonics 1MHz	7300 Signal S	Source
Sweep rate Phase Noise 6GHz	0.1ms to Typical p Analyze <b>10Hz</b> -54	o 1sec in 0. ohase noise r <b>100Hz</b> -59	1ms step e as mea <b>1kHz</b> -85	os sured with E 10kHz -90	Berkeley Nu 100kHz -94	1MHz	7300 Signal S <b>10MHz</b> -147	ource dBc/Hz
Sweep rate Phase Noise 6GHz 5GHz	0.1ms to Typical p Analyze <b>10Hz</b> -54	o 1sec in 0. ohase noise r 100Hz -59	1ms step e as mea 1kHz -85	os sured with E 10kHz -90	3erkeley Ni 100kHz -94	-127	7300 Signal S <b>10MHz</b> -147 -149	dBc/Hz
Sweep rate Phase Noise 6GHz 5GHz 4GHz	0.1ms to Typical p Analyze <b>10Hz</b> -54 -57 -76	2 1sec in 0. bhase noise r 100Hz -59 -61 -82	1ms step e as mea 1kHz -85 -86 -89	205 sured with F 10kHz -90 -93 -98	Berkeley No <b>100kHz</b> -94 -94 -95	-126 -127 -129	7300 Signal S 10MHz -147 -149 -150	dBc/Hz dBc/Hz dBc/Hz
Sweep rate Phase Noise 6GHz 5GHz 4GHz 3GHz	0.1ms to Typical p Analyze 10Hz -54 -57 -76 -60	2 1sec in 0. 2 1sec in 0. 2 1sec noise 7 100Hz -59 -61 -82 -65	1ms step e as mea 1kHz -85 -86 -89 -93	DS sured with F -90 -93 -98 -101	Berkeley Nu <b>100kHz</b> -94 -94 -95 -100	<b>1MHz</b> -126 -127 -129 -134	7300 Signal S <b>10MHz</b> -147 -149 -150 -150	dBc/Hz dBc/Hz dBc/Hz dBc/Hz dBc/Hz
Sweep rate Phase Noise 6GHz 5GHz 4GHz 3GHz 2GHz	0.1ms to Typical p Analyze <b>10Hz</b> -54 -57 -76 -60 -64	2 1sec in 0. bhase noise r 100Hz -59 -61 -82 -65 -69	1ms step e as mea 1kHz -85 -86 -89 -93 -96	DS sured with F -90 -93 -98 -101 -104	3erkeley Nu 100kHz -94 -94 -95 -100 -100	-126 -127 -129 -134 -130	7300 Signal S 10MHz -147 -149 -150 -150 -152	dBc/Hz dBc/Hz dBc/Hz dBc/Hz dBc/Hz dBc/Hz
Sweep rate Phase Noise 6GHz 5GHz 4GHz 3GHz 2GHz 1GHz	0.1ms to Typical p Analyze 10Hz -54 -57 -76 -60 -64 -70	2 1sec in 0. phase noise r 100Hz -59 -61 -82 -65 -69 -99	1ms step e as mea -85 -86 -89 -93 -96 -99	JOKHz       -90       -93       -98       -101       -104       -107	Berkeley Nu <b>100kHz</b> -94 -94 -95 -100 -100 -106	-126 -127 -129 -134 -130 -140	7300 Signal S 10MHz -147 -149 -150 -150 -152 -152 -152	dBc/Hz dBc/Hz dBc/Hz dBc/Hz dBc/Hz dBc/Hz dBc/Hz
Sweep rate Phase Noise 6GHz 5GHz 4GHz 3GHz 2GHz 1GHz 500MHz	0.1ms to Typical p Analyze 10Hz -54 -57 -76 -60 -64 -70 -76	1sec in 0.         ohase noise         100Hz         -59         -61         -82         -65         -69         -99         -81	1ms step e as mea 1kHz -85 -86 -89 -93 -96 -99 -105	Jos         sured with B         -90         -93         -98         -101         -104         -107         -113	3erkeley Nu -94 -94 -95 -100 -100 -106 -112	-126 -127 -129 -134 -130 -140 -124	7300 Signal S 10MHz -147 -149 -150 -150 -152 -152 -152	dBc/Hz dBc/Hz dBc/Hz dBc/Hz dBc/Hz dBc/Hz dBc/Hz dBc/Hz
Sweep rate Phase Noise 6GHz 5GHz 4GHz 3GHz 2GHz 1GHz 500MHz 200MHz	0.1ms to Typical p Analyze 10Hz -54 -57 -76 -60 -64 -70 -76 -83	1 sec in 0.         obase noise         r         100Hz         -59         -61         -82         -65         -69         -99         -81         -89	1ms step e as mea -85 -86 -93 -93 -96 -99 -105 -113	JOKHZ         -90         -93         -98         -101         -104         -107         -113         -121	3erkeley Nu -94 -94 -95 -100 -100 -106 -112 -124	<b>1MHz</b> -126 -127 -129 -134 -130 -140 -124 -152	7300 Signal S 10MHz -147 -149 -150 -150 -152 -152 -152 -152 -155	dBc/Hz dBc/Hz dBc/Hz dBc/Hz dBc/Hz dBc/Hz dBc/Hz dBc/Hz dBc/Hz
Sweep rate Phase Noise 6GHz 5GHz 4GHz 3GHz 2GHz 1GHz 500MHz 200MHz 40MHz	0.1ms to Typical 1 Analyze 10Hz -54 -57 -76 -60 -64 -70 -76 -83 -90	1sec in 0.         ohase noise         100Hz         -59         -61         -82         -65         -69         -99         -81         -89         -104	1ms step e as mea -85 -86 -89 -93 -96 -99 -105 -113 -126	Jok         sured with B         -90         -93         -98         -101         -104         -107         -113         -121         -132	3erkeley Nu -94 -94 -95 -100 -100 -106 -112 -124 -135	IMHz           -126           -127           -129           -134           -130           -140           -124           -152           -156	7300 Signal S 10MHz -147 -149 -150 -150 -152 -152 -152 -152 -155 -157	dBc/Hz dBc/Hz dBc/Hz dBc/Hz dBc/Hz dBc/Hz dBc/Hz dBc/Hz dBc/Hz dBc/Hz
Sweep rate Phase Noise 6GHz 5GHz 4GHz 3GHz 2GHz 1GHz 500MHz 200MHz 40MHz Harmonics	0.1ms to Typical p Analyze 10Hz -54 -57 -76 -60 -64 -70 -76 -83 -90 The 500	b       1sec in 0.         obase noise       100Hz         -59       -61         -82       -65         -69       -99         -81       -89         -104       9a outout y	1ms step e as mea -85 -86 -93 -96 -99 -105 -113 -126 wavefor	Jok         sured with B         -90         -93         -98         -101         -104         -107         -113         -121         -132         m is a clippe	3erkeley Nu -94 -94 -95 -100 -100 -106 -112 -124 -135 d sine way	IMHz           -126           -127           -129           -134           -130           -140           -152           -156           e. Harmon	7300 Signal S 10MHz -147 -149 -150 -150 -152 -152 -152 -152 -155 -157 -nics are typic	dBc/Hz dBc/Hz dBc/Hz dBc/Hz dBc/Hz dBc/Hz dBc/Hz dBc/Hz dBc/Hz aBc/Hz
Sweep rate Phase Noise 6GHz 5GHz 4GHz 3GHz 2GHz 1GHz 500MHz 200MHz 40MHz Harmonics	0.1ms to Typical p Analyze 10Hz -54 -57 -76 -60 -64 -70 -76 -83 -90 The 500 12dBc. 0	D 1sec in 0.           phase noise           100Hz           -59           -61           -82           -65           -69           -99           -81           -89           -104           9a output woodd harmo	1ms step e as mea -85 -86 -93 -93 -96 -99 -105 -113 -126 waveform nics are	JOKHZ           sured with B           -90           -93           -98           -101           -104           -107           -113           -121           -132           m is a clippe           most promi	3erkeley Nu -94 -94 -95 -100 -106 -112 -124 -135 d sine wav nent.	IMHz           -126           -127           -129           -134           -130           -140           -152           -156           e. Harmon	7300 Signal S 10MHz -147 -149 -150 -150 -152 -152 -152 -152 -155 -157 onics are typic	dBc/Hz dBc/Hz dBc/Hz dBc/Hz dBc/Hz dBc/Hz dBc/Hz dBc/Hz dBc/Hz dBc/Hz cally
Sweep rate Phase Noise 6GHz 5GHz 4GHz 3GHz 2GHz 1GHz 200MHz 40MHz Harmonics Spurious	0.1ms to Typical p Analyze 10Hz -54 -57 -76 -60 -64 -70 -76 -83 -90 The 500 12dBc. 0 Non-Hai	D 1sec in 0.           phase noise           100Hz           -59           -61           -82           -65           -69           -99           -81           -89           -104           9a output to Odd harmo           cronnic <-66	1ms step e as mea -85 -86 -93 -93 -96 -99 -105 -113 -126 waveform nics are 0dBc exc	Jos           sured with B           -90           -93           -98           -101           -104           -107           -113           -121           -132           m is a clippe           most promitizept bounda	3erkeley Nu -94 -94 -95 -100 -100 -106 -112 -124 -135 d sine wav nent. ry spurs	IMHz           -126           -127           -129           -134           -130           -140           -152           -156           e. Harmo	7300 Signal S 10MHz -147 -149 -150 -150 -152 -152 -152 -155 -155 -157 onics are typic	dBc/Hz dBc/Hz dBc/Hz dBc/Hz dBc/Hz dBc/Hz dBc/Hz dBc/Hz dBc/Hz cally
Sweep rate Phase Noise 6GHz 5GHz 4GHz 3GHz 2GHz 1GHz 200MHz 200MHz 40MHz Harmonics Spurious Output Return loss	0.1ms to Typical p Analyze 10Hz -54 -57 -76 -60 -64 -70 -76 -83 -90 The 500 12dBc. 0 Non-Hat	D 1sec in 0.           phase noise           100Hz           -59           -61           -82           -65           -69           -99           -81           -89           -104           9a output to Odd harmo rmonic <-60           Min.(dB)	1ms step e as mea -85 -86 -93 -96 -99 -105 -113 -126 waveforn nics are 0dBc exc	DS         IOkHz         -90         -93         -98         -101         -104         -107         -113         -121         -132         m is a clippe most promitizept bounda         Typi	3erkeley Nu -94 -94 -95 -100 -100 -106 -112 -124 -135 d sine wav nent. ry spurs cal(dB)	ucleonics         1MHz         -126         -127         -129         -134         -130         -140         -124         -152         -156         e. Harmo	7300 Signal S 10MHz -147 -149 -150 -150 -152 -152 -152 -155 -157 onics are typic	dBc/Hz dBc/Hz dBc/Hz dBc/Hz dBc/Hz dBc/Hz dBc/Hz dBc/Hz dBc/Hz cally
Sweep rate Phase Noise 6GHz 5GHz 4GHz 3GHz 2GHz 1GHz 200MHz 200MHz 40MHz Harmonics Spurious Output Return loss 25~ 100MHz	0.1ms to Typical p Analyze 10Hz -54 -57 -76 -60 -64 -70 -76 -83 -90 The 500 12dBc. 0 Non-Har	D 1sec in 0.           obhase noise           100Hz           -59           -61           -82           -65           -69           -99           -81           -89           -104           9a output to Odd harmo           Odd harmo           -monic <-60           Min.(dB)           >5	1ms step e as mea -85 -86 -93 -96 -99 -105 -113 -126 waveform nics are OdBc exc	Jos         sured with B         10kHz         -90         -93         -98         -101         -104         -107         -113         -121         -132         m is a clippe         most promit         cept bounda         Typi         8	3erkeley Nu         -94         -94         -95         -100         -106         -112         -124         -135         d sine wav         ry spurs         cal(dB)         cdB	ucleonics         1MHz         -126         -127         -129         -134         -130         -140         -124         -152         -156         e. Harmoder	7300 Signal S 10MHz -147 -149 -150 -150 -152 -152 -152 -155 -155 -157 onics are typic	dBc/Hz dBc/Hz dBc/Hz dBc/Hz dBc/Hz dBc/Hz dBc/Hz dBc/Hz dBc/Hz cally
Sweep rate Phase Noise 6GHz 5GHz 4GHz 3GHz 2GHz 1GHz 200MHz 40MHz Harmonics Spurious Output Return loss 25~ 100MHz 100 ~ 1000MHz	0.1ms to Typical p Analyze 10Hz -54 -57 -76 -60 -64 -70 -76 -83 -90 The 500 12dBc. 0 Non-Hai	D 1sec in 0.           obhase noise           100Hz           -59           -61           -82           -65           -69           -99           -81           -89           -104           9a output v           Odd harmo           rmonic <-60           Min.(dB)           >5           >9	1ms step e as mea -85 -86 -89 -93 -96 -99 -105 -113 -126 waveform nics are OdBc exc	JOKHz         sured with B         -90         -93         -98         -101         -104         -107         -113         -121         -132         m is a clippe         most promitizept bounda         Typi         8	3erkeley Nu -94 -94 -95 -100 -100 -106 -112 -124 -135 d sine wav nent. ry spurs cal(dB) 8dB 15	1MHz -126 -127 -129 -134 -130 -140 -124 -152 -156 e. Harmo	7300 Signal S 10MHz -147 -149 -150 -150 -152 -152 -152 -155 -155 -157 -nics are typic	dBc/Hz dBc/Hz dBc/Hz dBc/Hz dBc/Hz dBc/Hz dBc/Hz dBc/Hz dBc/Hz cBc/Hz
Sweep rate           Phase Noise           6GHz           5GHz           4GHz           3GHz           2GHz           1GHz           500MHz           200MHz           40MHz           Harmonics           Spurious           0utput Return loss           25~ 100MHz           100 ~ 1000MHz           1000 ~ 2000MHz	0.1ms to Typical p Analyze 10Hz -54 -57 -76 -60 -64 -70 -76 -83 -90 The 500 12dBc. ( Non-Han	D 1sec in 0.           phase noise           r           100Hz           -59           -61           -82           -65           -69           -99           -81           -89           -104           9a output to Ddd harmo           Ormonic <-60           Min.(dB)           >5           >9           >8	1ms step e as mea -85 -86 -93 -93 -96 -99 -105 -113 -126 waveforn nics are 0dBc exc	IOkHz         -90         -93         -98         -101         -104         -107         -113         -121         -132         m is a clippe         most promine         cept bounda         Typi         8	3erkeley Nu -94 -94 -95 -100 -100 -106 -112 -124 -135 d sine wav nent. ry spurs cal(dB) 3dB 15 10	1MHz -126 -127 -129 -134 -130 -140 -140 -124 -152 -156 e. Harmo	7300 Signal S 10MHz -147 -149 -150 -150 -152 -152 -152 -155 -155 -157 mics are typic	dBc/Hz dBc/Hz dBc/Hz dBc/Hz dBc/Hz dBc/Hz dBc/Hz dBc/Hz dBc/Hz cally
Sweep rate           Phase Noise           6GHz           5GHz           4GHz           3GHz           2GHz           1GHz           500MHz           200MHz           40MHz           Harmonics           Spurious           Output Return loss           25~ 100MHz           100~ 2000MHz           100~ 2000MHz           2000~ 4000MHz           2000~ 2000MHz	0.1ms to Typical p Analyze 10Hz -54 -57 -76 -60 -64 -70 -76 -83 -90 The 500 12dBc. ( Non-Hai	D 1sec in 0.           phase noise           r           100Hz           -59           -61           -82           -65           -69           -99           -81           -89           -104           9a output woodd harmo           rmonic <-60           Min. (dB)           >5           >8           >6           >7	1ms step e as mea -85 -86 -93 -93 -96 -99 -105 -113 -126 waveforn nics are 0dBc exco	DS Sured with F -90 -93 -98 -101 -104 -107 -113 -121 -132 m is a clippe most promit cept bounda Typi 8	<b>100kHz</b> -94         -94         -95         -100         -106         -112         -124         -135         d sine wavnent.         ry spurs         cal(dB)         8dB         15         10         8	1MHz -126 -127 -129 -134 -130 -140 -140 -124 -152 -156 e. Harmo	7300 Signal S 10MHz -147 -149 -150 -150 -152 -152 -152 -155 -155 -157 mics are typic	dBc/Hz dBc/Hz dBc/Hz dBc/Hz dBc/Hz dBc/Hz dBc/Hz dBc/Hz dBc/Hz cally



**RF** Connectors

SMA Female

Unless otherwise noted, all specifications apply equally to both synthesizers.

AM Modulation	0.5dB to 31.5dB
AM Frequency	
Range	0.5Hz to 10kHz
Accuracy	±0.5Hz
AM Waveform	50% duty cycle square wave

Maximum Output	Amplitude			
(PLEV=4, ATT=0)	Freq. Range	Min dBm	Typ. dBm	Max. dBm
(MHz)				
	25~100	>14	17	<17.5
	100~3000	>15	16	<17
	3000~6000	>13	15	<16
	See power plots below			
Attenuator				
Relat	tive Attenuation Range		0dB to 31.5dB	
	Attenuation Step Size		0.5dB	
RF output On/OFF		When off power is	s reduced by ~30dB	

#### **Typical RF Output Power Plots**



## Reference Frequency

Internal Reference	
Frequency	20.000MHz
Initial Accuracy	± 2ppm (23°C)
Temperature Stability	±0.5ppm -20°C to +70°C (case temp)
Reference Trim Range	± 10ppm
Reference Trim Resolution	10-bit (8-bit before 2016)
Internal Phase Frequency Detector	Max 140MHz, 125MHz Fractional mode
(PFD)	Min 1 MHz
External Reference	50Ω nominal impedance
Frequency Range	10MHz to 210MHz



5009a Dual Frequency Synthesizer Specifications

	(max PFD 140MHz integer mode, 125MHz fractional mode)
Input power range	-10dBm min.
	+13dBm max.
	(note, external reference as low as -50dBm with reduced phase noise
	performance)
External Reference Connector	SMA Female 50 $\Omega$ nominal impedance
	Note: Ext input is ac coupled to synthesizer but dc coupled to internal
	VCTCXO control circuit. External reference should be disconnected
	when using internal reference.
External Reference Return Loss	10dB typical 50Ω nominal impedance
10MHz	>24dB
20MHz	>20dB
50MHz	>14dB
100MHz	>6dB
200MHz	>5dB
EFC	Pulling range >±10ppm
Electronic frequency Control at	Voltage ±3V
external reference input	Input resistance 20kΩ
	Frequency response 0Hz~>5kHz

#### Interface

USB	Micro-B socket
	FTDI virtual com port
	9600, 8, N,1,N default- Automatically shift to 115200 with GUI
	See FTDI for drivers for your computer. Note: The Configuration Manager GUI will automatically
	configure the USB port and switch to 115200 baud rate.
USER PORT	3.3V TTL TXD & RXD
	(see section 5)
	115200,8,N,1,N default
	Hirose DF11-8DP-2DS
	Mates with Hirose DF11-8DS-2C plug and pre-crimped
	wireH3BXT-10112-** (DigiKey)
	LSW-1 LIST Mode switch and cable accessory is also available.
	External Trigger Input: 3.3V TTL Hi-Z input
Selectable Baud	Fither port: 0600, 10200, 28400, 57600, 115200, 220400, 460800, 021600
Rates	Litilei port. 5000, 15200, 58400, 57000,115200, 250400, 400800, 921000

#### Environmental

Operational full specifications:	-20°C~+70°C (case temperature)
No damage functional:	-40°C~+85°C (case temperature)
Humidity:	5%~95% minimal condensation allowed
IP rating:	50 No water protection.



## **Mechanical Dimensions**

3.625"W x 2.685"L x 0.50"H

Weight: 0.2lbs, 91g

Material: AL-6061-T6 Finish: Clear Alodine (conductive)



**Dimensions are Inches**