SNA Extended N-port and

Full-N-port Calibration Steps

SNA is connected with SSM switch matrix to expand into N-port network analyzer. For example, vector network analyzer SNA5032A is expanded to 16 ports by using switch matrix SSM5124A, and perform full 16 ports calibration. The expansion process involves the following steps:

 Connect SNA5302A and SSM5124A through USB cable. Select System > External Ports > Ext Port Enabled. After VNA and SSM establish physical connection, contact Switch Matrix... menu to enter the interface of "Switch Matrix RF Connections" dialog box, with the configuration shown below.

Sv	vitch Ma	trix RF C	onnection	IS								ŏ ×		
					VNA	A 1A	B 1B							
S	Switch Matrix 1 SSM5124A (SSM5AAAX7R0003)													
									1B					
		14						20				24		
	13	14			17			20	21	22	23	24		
												12		
	Rese	et	Renumbe	r Al	Unused									
	Reset		Renumber					Ok		Cancel		Help		

- 2. Use ECal for full 16-port calibration and SEM5014 is adopted here.
 - 1) Set SNA Start Frequency =1GHz, Stop Frequency = 6GHz
 - Connect SEM5014 and SNA5302A through USB cable. After SNA5302A prompts to identify SEM5014, press Cal > ECal > ECal... to enter the ECal Configuration interface. Select Port1 to Port16 ports. Perform Unknown Thru SOLR calibration as shown below.

SIGLENT 🔊	~ 🗛 🖬 🖼	🛦 📆 🛱 🚔	0				Local
Tr 1 S11 LogM 50.00	10 dB/ 0 dB		Calibration ~				
		Ports	Type O OSL (Open, Short, I	Load)		ECal	
30.00		 ✓ Port 2 ✓ Port 3 ✓ Port 4 	SOLR			Confidence Check	
20.00		 ✓ Port 5 ✓ Port 6 				Orientation Auto Manual	
0.000		✓ Port 7 ✓ Port 8 ✓ Port 9				Characterization Factory	Adapter Removal
-10.00		 ✓ Port 10 ✓ Port 11 					ECal
-20.00		Port 12	🗹 Unknown Thru 🗌	Auto Orientation			
-30.00				Start Ca	ncel		
-40.00							
-50.00) dBm		Stop 6.000		
Tr 1 Ch 1 IntTrig	Continuous BW=10 k	No Cor SrcCal RF On I	intRef Update On	no messages			

3) **P1-P4 Calibration**: Connect Ports 1, 2, 3 and 4 of matrix switch to Ports A, B, C and D of SEM5014 through SMA cables. Click OK and then click any calibration standard option of P1

(like Open/Short/Load) to start P1-P4 calibration as shown below.



4) P5-P8 Calibration: Connect Ports 5, 6, 7 and 8 of matrix switch to Ports A, B, C and D of SEM5014 through SMA cables. Click OK and then click any calibration standard option of P5 (like Open/Short/Load) to start P5-P8 calibration as shown below.



5) P9-P12 Calibration: Connect Ports 9, 10, 11 and 12 of matrix switch to Ports A, B, C and D of SEM5014 through SMA cables. Click OK and then click any calibration standard option of P9 (like Open/Short/Load) to start P9-P12 calibration as shown below.

SIGL	ENT	I D (21	1 🕼 🖬 🛙	🗟 🛦 📆 🛛	H 🚖 🛛	0						-45	윪 🛛 🖪	Local
	Tr 2 S88 Tr 4 S87	8 LogM 10 dB 7 LogM 10 dB /b7.8 LogM 10	V 0 dB V 0 dB 0 dB/ 0 dB		Tr 3 Tr 5 Tr 7	S78 Log S77 Log a8/b8.7	M 10 dB/ 0 M 10 dB/ 0 LogM 10 dI	Calibration	Calibration ~					
50.00 40.00 30.00					ECal Select Po	rt						ECal		
20.00					ECal SEM50144	A-TEST2						Confidence	Check	
0.000		~~~			VNA Port 9		ECal					1		Port Extension
-20.00	Ŵ	and the		Provident and the second se	Port 10		Port P		Ŵ	V/A		Orienta Auto	ition Manual	
-40.00 -50.00 2 Max	>Ch2: Sta	nt 1.0000000	0 GHz		Port 11		Port C			Sto	p 6.00000000 GHz	Characteri	zation	Adapter
ECal M	leasurem	hent			POILTI						Ō] Facto		
P8		Open	🗸 Short	🗸 Load	Port 12		Port D							ECal
P9		Open	Short	Load				Auto						
P10		Open	Short	Load				Adto						
P11		Open	Short	Load	ОК	Ca	ncel	Help						
P12		Open	Short	Load	P1 ↔ P6			Unknown Th	ru					
Calibrati	on is 21	% Done												
								Ba	ck		Cancel			
Tr 7		IntTrig Co			RF On IntRef	Upda	ate On							

6) P13-P16 Calibration: Connect Ports 13, 14, 15 and 16 of matrix switch to Ports A, B, C and D of SEM5014 through SMA cables. Click OK and then click any calibration standard option of P13 (like Open/Short/Load) to start P13-P16 calibration as shown below.

SIGLE	ENT S	- 🔒 🗔	🕞 🛦 🐔	H) 🚔 🖸]					Local
	Tr 2 S1212 LogM Tr 4 S1211 LogM	10 dB/ 0 dB 10 dB/ 0 dB ogM 10 dB/ 0 dB		Tr 3 S Tr 5 S	1112 LogM 10 dE	V 0 dB V 0 dB			Calibration ~	
50.00 40.00 30.00				ECal Select Port	12/012,11 LogM	© ×			ECal	
20.00 10.00				ECal SEM5014A-T	EST2				Confidence Check	
-10.00		ATA		Port 13	 Port A 				Orientation	Port Extension
-30.00 -40.00		₩	v m	Port 14	✓ Port B		ADAM	1-9-Y		
-50.00 2 Max ECal M	>Ch2: Start 1.00000	0000 GHz		Port 15	∽ Port C		Stop 6.00	0000000 GHz	Characterization	Adapter Removal
 Р12	V Open	✓ Short	✓ Load	Port 16	✓ Port D					ECal
P13	Open	Short	Load			Auto				
P14	Open	Short	Load	ок	Cancel	Help				
P15 P16	Open	Short	Load	P1 ↔ P10		Unknown Thru				
Calibratio	on is 32% Done									
						Back		Cancel		
Tr 7				RF On IntRef	Update On					

- 7) After reflection calibration of P1-P4, P5-P8, P9-P12 and P13-P16 is completed, perform through calibration between each two groups. Select the five through items P1-P5, P1-P9, P1-P13, P5-P13, and P9-P13.
- **P1-P5 Calibration**: Connect Ports 1 and 5 of matrix switch to Ports A and D of SEM5014 through SMA cables. Click the P1-P5 Unknown thru tab on UI and set Port 1 corresponding to Port A of Ecal, Port 2 corresponding to None of Ecal, Port 3 corresponding to None of Ecal, and Port 5 corresponding to Port D of Ecal. Click OK to perform through calibration of P1-P5, as shown below.



 P1-P9 Calibration: Connect Ports 1 and 9 of matrix switch to Ports A and D of SEM5014 through SMA cables. Click the P1-P9 Unknown thru tab on UI and set Port 1 corresponding to Port A of Ecal, Port 2 corresponding to None of Ecal, Port 3 corresponding to None of Ecal, and Port 9 corresponding to Port D of Ecal. Click OK to perform through calibration of P1-P9, as shown below.

Tr Tr Tr	2 S55 LogM 10 4 S51 LogM 10 6 a1/b1,5 LogM	B/ 0 dB B/ 0 dB 10 dB/ 0 d	iB		Tr3 S Tr5 S Tr7 a	15 Log 11 Log 5/b5,1		Calibration ~				
					ECal Select Port						ECal	
					ECal SEM5014A-1	TEST2						
					VNA		ECal				Confidence Check	
7	A Marin	XX	XPA.		Port 1		Port A		AVERANC	Ţ	Orientation	Exter
))				V	Port 2		None		W W			
	h2: Start 1.000000	000 GHz			2.4.2				Stop 6.00000000	GHz	Characterization	Adap
/lea	surement				Port 3		None					
	Open		Short	Load	Port 9		Port D					ECal
	Open		Short	Load				Auto				
	Open		Short	Load	ок	Ca	incel	Help				
	Open		Short	Load	P1 ↔ P9			Unknown Thru				
	Open		Short	Load	P1 ↔ P10			Unknown Thru				
ion i	s 43% Done											
								Back	Finish Cance			

• **P1-P13 Calibration**: Connect Ports 1 and 13 of matrix switch to Ports A and D of SEM5014 through SMA cables. Click the P1-P13 Unknown thru tab on UI and set Port 1 corresponding to Port A of Ecal, Port 2 corresponding to None of Ecal, Port 3 corresponding to None of Ecal, and Port 13 corresponding to Port D of Ecal. Click OK to perform through calibration of P1-P13, as shown below.

SIGU	ENT	1	C ^a ;	A 🗄		_ ≜	Ē.	H) 🚖 🖸	3							80	dh I	ocal
	Tr 2 Tr 4	S99 LogM S91 LogM	10 dB/ 0 d	B B				Tr 3 S	519 Log	gM 10 dB/ 0 gM 10 dB/ 0	dB dB				Calibratio	on ~		
50.00 40.00 30.00		81101,5 20	-5 m 10 00					ECal Select Port				×			EC	al		
20.00								ECal SEM5014A-	TEST2	FCal					Confidenc	e Check	Powei	
0.000 -10.00 -20.00		74-	X To		- de	<i>f</i> ee		Port 1		Port A				APS.	Orien	tation	Port Exten	
-30.00 -40.00 -50.00			14	Y		J		Port 2		None		W		Y-				
2 Max ECal N	>Ch2: leasur	Start 1.0000	000000 GH					Port 3		None			Stop 6.000	000000 GHz	Characte	rization tory	Adapt Remo	
P12		Open		✓ Sho	ort		Load	Port 13		Port D							ECal	
P13		Open		🗸 Sho	ort		Load				Auto							
P14		Open		🖌 Sho	ort		Load	ок	Ca	ancel	Help							
P15		Open		Sho	ort		Load	P1 ↔ P13			Unknown Thr							
Calibrat	ion is	44% Done					12000											
											Bac	k Fir		Cancel				
Tr 7		IntTrig		ous BV		No Cor		RF On IntRef	Upd	ate On								

 P5-P13 Calibration: Connect Ports 5 and 13 of matrix switch to Ports C and D of SEM5014 through SMA cables. Click the P5-P13 Unknown thru tab on UI and set Port 5 corresponding to Port C of Ecal, Port 6 corresponding to None of Ecal, Port 7 corresponding to None of Ecal, and Port 13 corresponding to Port D of Ecal. Click OK to perform through calibration of P5-P13, as shown below.



 P9-P13 Calibration: Connect Ports 9 and 13 of matrix switch to Ports C and D of SEM5014 through SMA cables. Click the P9-P13 Unknown thru tab on UI and set Port 9 corresponding to Port C of Ecal, Port 10 corresponding to None of Ecal, Port 11 corresponding to None of Ecal, and Port 13 corresponding to Port D of Ecal. Click OK to perform through calibration of P9-P13, as shown below.



8) After completing the P9-P13 calibration, Finish will be highlighted on the UI. And then you can click Finish to end the full 16 ports calibration, as shown in the following figure.



9) After calibration, you can add several traces and set S-parameter, such as S22, S88, S1616, to check the calibration effect, as shown in the following figure.

