

# Graph drawing method of CSV data by Scilab (AntScope-2 & AA-55ZOOM)

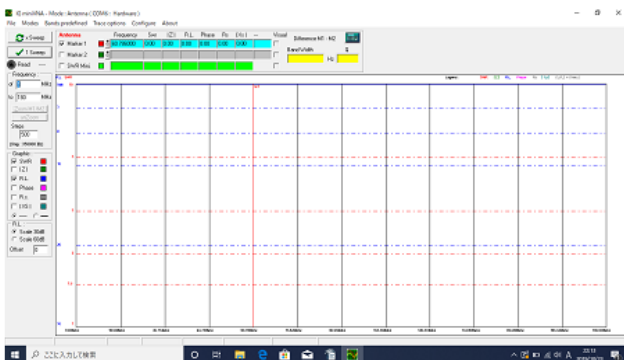
## 1. Introduction

Most VNAs (Vector Network Analyzers) such as MFJ-225, AA-55ZOOM, and SARK-110 can be controlled from a PC using a dedicated S / W, and data is sent from the VNA main unit to the PC to be sent to the PC. Data can be displayed above.

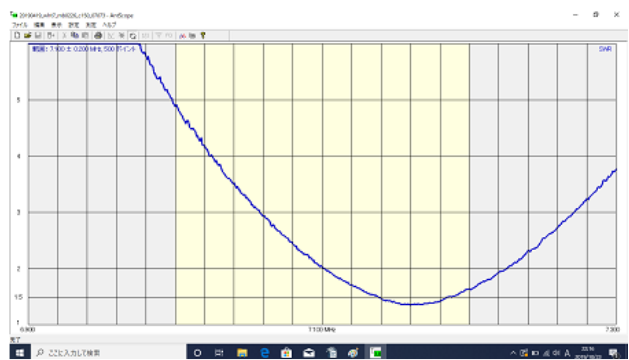
For example, MFJ-225 can be controlled from IG\_miniVNA, AA-55ZOOM can be controlled from AntScope2, and SARK-110 can be controlled from Sark plots, and data can be displayed on a PC. In addition, these can output data in CSV format. Here, we will show how to display data using Scilab from CSV data output from AA-5ZOOM / AntScope2. (The procedure is almost the same for other S / Ws. However, the data content of IG\_miniVNA is different.) As mentioned above, data can be displayed with each dedicated S / W, but data can be displayed uniformly using Scilab. If you do, you have the following advantages:

1. Data can be displayed in a unified format regardless of the model, making comparison and examination easy.
2. It is possible to display in the desired format (for example, 2x2 4 graph display on one page)
3. Arbitrary comments, memorandums, etc. can be displayed in the graph
4. A series of operations is possible only by starting and executing the display program.

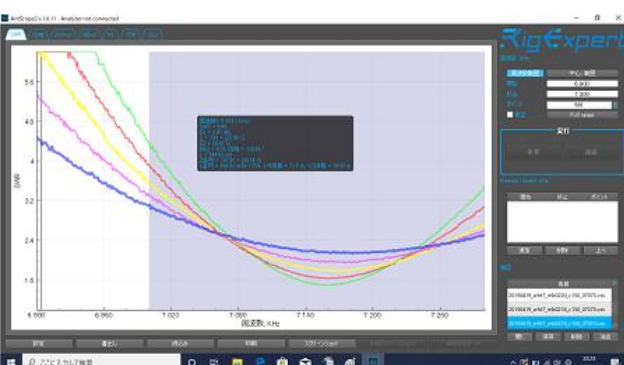
### IG\_miniVNA



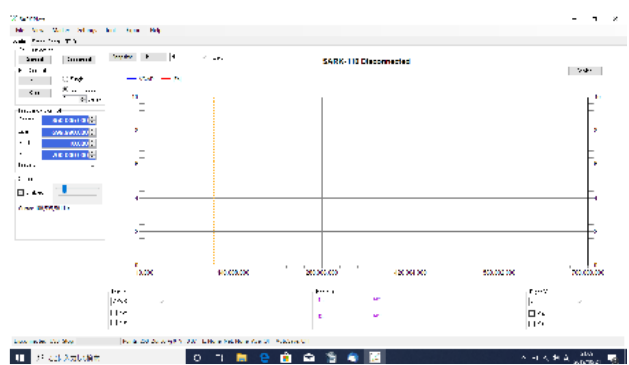
### AntScope



### AntScope2



### SARK Plots



## 2. Save CSV data

- (1) Connect AA-55 to a PC, draw a graph using AntScope2, and check the data.
- (2) Click "Export" at the bottom of the screen
- (3) Click "CSV" on the "Export" pop-up screen (see the figure below).
- (4) Enter the "File name", set the save format to "CSV", and click "Save" to save.
- (5) Confirm that the CSV file is created

## 3. Delete the header of the CSV file

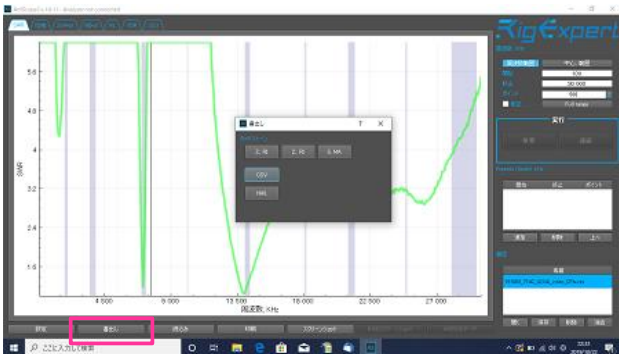
- (1) Double-click the CSV file to open the file
- (2) Delete the first line (Frequency (MHz), R, X)
- (3) Overwrite with a CSV file or save with a different file name

## 4. Set of Scilab file for drawing and CSV data

- (1) Set the Scilab file (.sce file) for drawing and the CSV data to be read in the same folder.

## 5. Launch Scilab file

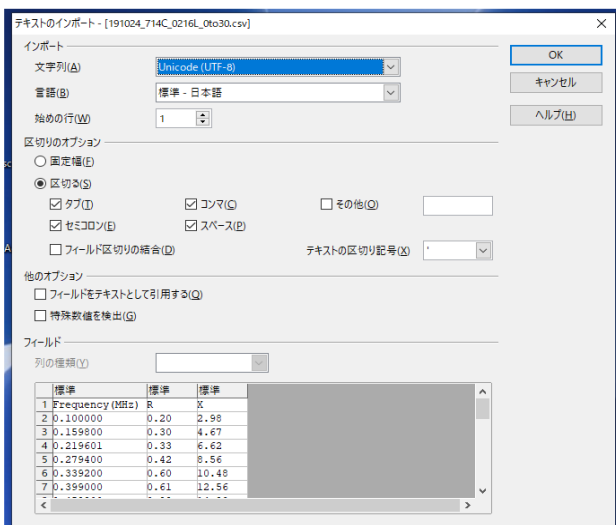
- (1) Exit if Scilab has already been started
- (2) Double-click the Scilab file for drawing, start Scilab, and open the drawing file.



	A	B	C	D
1	Frequency(MHz)	R	X	
2	0.1	0.2	2.98	
3	0.1598	0.3	4.67	
4	0.219601	0.33	6.62	
5	0.2794	0.42	8.56	
6	0.3392	0.6	10.48	
7	0.399	0.61	12.56	
8	0.4588	0.89	14.83	
9	0.5186	1.07	17.41	
10	0.5784	1.44	20.14	
11	0.6382	1.88	23.16	
12	0.698	2.47	26.6	

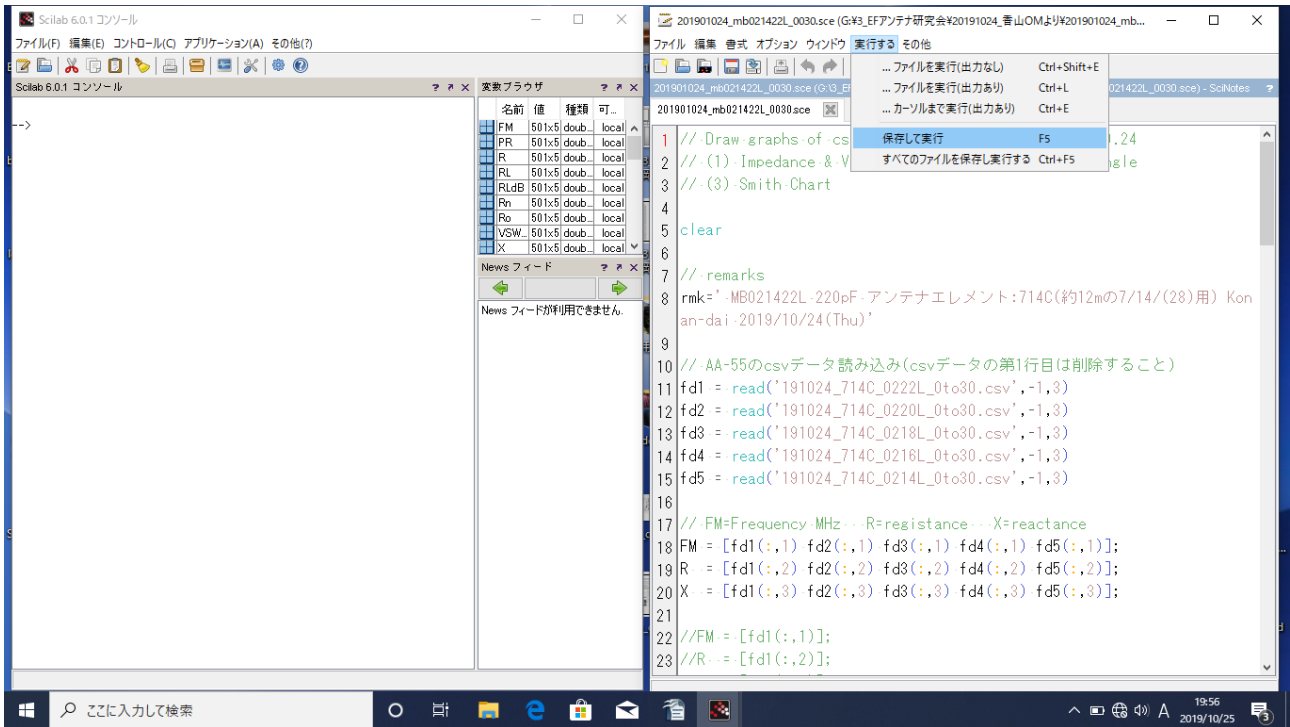


	A	B	C	D
1	0.1	0.2	2.98	
2	0.1598	0.3	4.67	
3	0.219601	0.33	6.62	
4	0.2794	0.42	8.56	
5	0.3392	0.6	10.48	
6	0.399	0.61	12.56	
7	0.4588	0.89	14.83	
8	0.5186	1.07	17.41	
9	0.5784	1.44	20.14	
10	0.6382	1.88	23.16	
11	0.698	2.47	26.6	
12	0.7578	3.53	30.78	

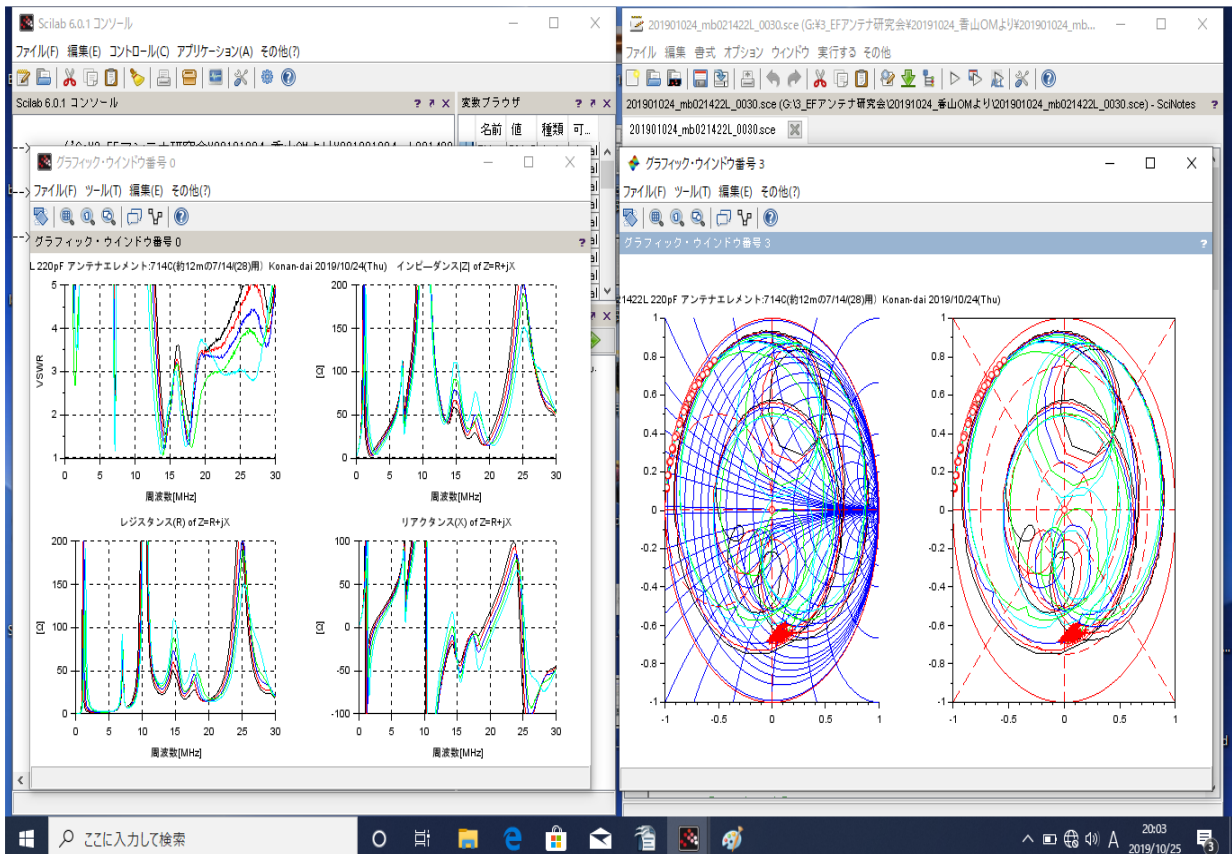


## 6. Execute graph drawing file with Scilab

(1) "Execute" → "Save and execute" (directly rewrite the input file and execute)



(2) For example, the following four graphs will appear, so you can use them by pasting them from "File" to the clipboard, or export them to PNG files and JPEG files.



## 7. How to modify the drawing Scilab file and the meaning of each command

- // indicates a comment line. Modify the file description as appropriate
- Clear all variables first (initialize)

```
0001 // Draw graphs of csv-data from AA-55    2019.10.24
0002 // (1) Impedance & VSWR (2) Return Loss & Phase Angle
0003 // (3) Smith Chart
0004
0005 clear
0006
```

- 8<sup>th</sup> Line: Enter the character string to be displayed at the top of the graph in rmk.

```
0007 // remarks
0008 rmk=' MB021422L 220pF アンテナエレメント:714C(約 12m の 7/14/(28)用) Konan-dai
2019/10/24(Thu)'
09
```

- From the 11th line onward, read the CSV data and write the drawing data (\*. Csv) to fd \*. (Here, 5 data are read and overwritten)
- The data to be read is assumed to be in the current folder (specify the path if necessary).

```
0010 // AA-55 の csv データ読み込み(csv データの第 1 行目は削除すること)
0011 fd1 = read('191024_714C_0222L_0to30.csv',-1,3)
0012 fd2 = read('191024_714C_0220L_0to30.csv',-1,3)
0013 fd3 = read('191024_714C_0218L_0to30.csv',-1,3)
0014 fd4 = read('191024_714C_0216L_0to30.csv',-1,3)
15  fd5 = read('191024_714C_0214L_0to30.csv',-1,3)
16
```

- Sort the read data into frequency [FM (MHz)], resistance [R], and reactance [X].

```
0017 // FM=Frequency MHz  R=resistance  X=reactance
0018 FM = [fd1(:,1) fd2(:,1) fd3(:,1) fd4(:,1) fd5(:,1)];
0019 R  = [fd1(:,2) fd2(:,2) fd3(:,2) fd4(:,2) fd5(:,2)];
0020 X  = [fd1(:,3) fd2(:,3) fd3(:,3) fd4(:,3) fd5(:,3)];
0021
0022 //FM = [fd1(:,1)];
0023 //R  = [fd1(:,2)];
0024 //X  = [fd1(:,3)];
0025
```

- Calculate reflection coefficient, VSWR [VSWR], return loss [Ro], etc.
- “.\*”, “.^”, And “./” specify the operation for each element of the sequence (without “.”, It becomes a vector operation!)

```

0026 // Z=impidance(R+jX) Ro= 反射係数
0027 // RL=Return Loss PR= Phase Radian
0028 Z = R+%i*X;
0029 Ro = (R+%i*X-50)./(R+%i*X+50);
0030 VSWR=(1+abs(Ro))./(1-abs(Ro)); // VSWR
0031
0032 PR= atan(X,R);
0033 RLdB= 20*log10((VSWR+1)./(VSWR-1)); // リターン・ロス dB
0034 RL= 10.^(-RLdB/20); // リターン・ロス 真数
0035
0036 sizeFM=size(FM); // データサイズ
0037 Xmin=FM(1,1); Xmax=FM(sizeFM(1,1),1);
0038 if Xmin<3 then Xmin=0 end
0039

```

- Start graph drawing
- Scf (): Screen specification, clf (): Screen erase (initialization)
- Subplot (221): Divide the screen into 2x2 and specify the first (upper left)
- Style is a color specification. 1: Black, 5: Red, 2: Blue, 3: Green, 4: Cyan, 6: Yellow

```

0040 scf(0),clf()
0041
0042 subplot(221),plot2d(FM,VSWR,rect=[Xmin 1 Xmax 5],style=[1 5 2 3 4 6]),xgrid()
0043 xtitle('VSWR'+rmk,'周波数[MHz]','VSWR')
0044
0045 subplot(222),plot2d(FM,abs(Z),rect=[Xmin 0 Xmax 200],style=[1 5 2 3 4 6]),xgrid()
0046 xtitle('インピーダンス|Z| of Z=R+jX','周波数[MHz]','[Ω]')
0047
0048 subplot(223),plot2d(FM,R,rect=[Xmin 0 Xmax 200],style=[1 5 2 3 4 6]),xgrid()
0049 xtitle('レジスタンス(R) of Z=R+jX','周波数[MHz]','[Ω]')
0050
0051 subplot(224),plot2d(FM,X,rect=[Xmin -100 Xmax 100],style=[1 5 2 3 4 6]),xgrid()
0052 xtitle('リアクタンス(X) of Z=R+jX','周波数[MHz]','[Ω]')
0053
0054 scf(1),clf()
0055 subplot(111),plot2d(FM,VSWR,rect=[Xmin 1 Xmax 5],style=[1 5 2 3 4 6]),xgrid()
0056 xtitle('VSWR'+rmk,'周波数[MHz]','VSWR')
0057
0058 scf(2),clf()
0059 subplot(111),plot2d(FM,RLdB,rect=[Xmin 0 Xmax 60],style=[1 5 2 3 4 6]),xgrid()

```

```
0060 xtitle('Return Loss[dB]+rmk','周波数[MHz]','R.L.[dB]')
0061
```

- Smith chart drawing

```
0062 // Draw frame of Smith Chart
0063 th=-3.1416:01:3.141593;
0064 rr=[0.01 0.1 0.15 0.2 0.25 0.3 0.4 0.5 0.7 1.0 1.5 2 3 5 7 10 15 20 50 70 100];
0065 oth=ones(1,size(th,2));
0066 for i=1:size(rr,2), crr(i,:)=oth.*rr(i);
0067     x(i,:)=1.0./(crr(i,:)+1).*cos(th)+crr(i,:)./(crr(i,:)+1);
0068     y(i,:)=1.0./(crr(i,:)+1).*sin(th);
0069     u(i,:)=1.0./crr(i,:).*cos(th)+1;
0070     v(i,:)=1.0./crr(i,:).*sin(th)+1.0./crr(i,:);
0071     vm(i,:)=1.0./crr(i,:).*sin(th)-1.0./crr(i,:); end
0072
0073 scf(3),clf()
0074 subplot(121)
0075 cl=2 // 1=black 2=blue 3=green 4=cyan 5=red 6=violet
0076 plot2d([x' u' u'],[y' v' vm'],style=ones(1,size(x,1)*3)*cl)
0077 zoom_rect([-1 -1 1 1])
0078
0079 // (x-R/(R+1))^2+y^2=(1/(R+1))^2 (x-1)^2+(y-1/X)^2=(1/X)^2
0080 // (x-a)^2+y^2=b^2 (x-1)^2+(y-c)^2=c^2
0081 Rn=R/50; Xn=X/50;
0082 a=Rn./(Rn+1); b=1.0./(Rn+1); c=1.0./Xn;
0083 al=(a-1)./c; be=(-a.^2+b.^2+1.0)./(2*c);
0084 x=((a-al.*be) - sqrt((al.*be-a).^2 -(al.^2+1.0).*(a.^2-b.^2+be.^2)))./(al.^2+1.0);
0085 y=al.*x+be;
0086
0087 plot([-1 1],[0 0],'r--',[0 0],[1 -1],'r--',cos(th),sin(th),'r-',0,0,'ro')
0088 plot(0.5*cos(th)-0.5,0.5*sin(th),'r--')
0089
0090 plot2d(x,y,style=[1 5 2 3 4 6])
0091 plot(x(1:10,:),y(1:10:),'ro')
0092 plot(x(sizeFM(1)-10:sizeFM(1):),y(sizeFM(1)-10:sizeFM(1):),'r+')
0093 xtitle('Smith Chart'+rmk,' ','')
0094
```

- Reflection coefficient (polar coordinates) drawing

```
0095 subplot(122)
0096 //plot(RL.*cos(PR),RL.*sin(PR)),zoom_rect([-1 -1 1 1]),plot(x(1),y(1),'g*')
```

```
0097 plot([-1 1],[0 0],'r--',[0 0],[1 -1],'r--',[-1 1],[1 -1],'r--',[-1 1],[-1 1],'r--')
0098 plot(cos(th),sin(th),'r-',0,0,'ro')
0099 plot(0.75*cos(th),0.75*sin(th),'r--')
0100 plot(0.5*cos(th),0.5*sin(th),'r--')
0101 plot(0.25*cos(th),0.25*sin(th),'r--')
0102
0103 plot2d(x,y,style=[1 5 2 3 4 6])
0104 plot(x(1:10,:),y(1:10:),'ro')
0105 plot(x(sizeFM(1)-10:sizeFM(1),:),y(sizeFM(1)-10:sizeFM(1),:),'r+')
```