SAN2PC Rev 2.00 User's Guide
(R.CORDESSES Updated January 29, 2010)

Foreword.

- It is assumed that the PCB is properly wired and you have checked the power supply voltages (+5V, +6,6V and -6,6V) before inserting the 3 ICs in their sockets.
- Moreover, check that the level and polarity of the Pen Lift and Vertical outputs are in accordance with the expected values before connecting them to the interface.
- It is assumed that your Spectrum Analyzer is working properly : in particular, the horizontal position and gain must be adjusted so the display scan width is well centered and spreads slightly over the 10 horizontal divisions.

Note 1 : This new revision succeeds the 1.12 version : now each S.A digitized spectrum has 3000 horizontal samples points instead of 1000 and you can use analyzer settings until **K =< 3000**, where **K = TotalScanWidth/Bandwidth**. When K becomes larger than 3000, the probability of sampling outside the spectrum peaks increases, thus leading to amplitude errors and underestimation of the peaks.
Note 2 : In order to store these 3000 points in the PIC RAM, spectrum amplitudes are recorded as 8 bits data instead of 10 bits : the ***resolution*** is thus not as good as before, but still better than the ***accuracy*** of most spectrum analyzers of the kind we are talking about. The present power resolution is 0.4 dBm, a very respectable value.
Note 3 : In order to accomodate the 3000 points, you must use a **ScanTime/div >= 10 ms/div** when digitizing a spectrum.
Note 4 : The maximum analyzer sweep time handled by rev. 2.00 is still 100 seconds full scale.

1. First steps.

- Connect the Pen Lift and Vertical Input lines to the corresponding Spectrum Analyzer connectors.
- Select the RS232 speed (9600 or 115200 Bauds) with the SAN2PC Speed switch and link the unit to your PC through the RS232 line.
- Run a terminal program : I use RealTerm but I suppose other programs work (Terminal by Bray, Hyperterminal ...) and select the RS232 settings as : 8 bits, No parity, 1 stop bit, no handshaking and speed in accordance with the SAN2PC switch).

2. Calibration.

==> Upon **first power-up**, the user **MUST** perform the calibration procedure, as there are **NO** default calibration values in the PIC EEPROM. There are two procedures, one related to amplitude and the other to frequency.
- Before entering the calibration, you need to connect your Spectrum Analyzer to an RF source. It can be any reasonably stable signal generator or, merely, the Calibrator Output found on most analyzers.
- Set the Normal/Calibrate switch to « **Calibrate** » and push the **Start** button.
- You are asked "Amplitude (A) or Frequency (F) : "
- Upon first power-up, it is better to perform the Frequency calibration first, thus select "F" and hit Enter.

2.1 Frequency calibration.

- You are asked to put the displayed "peak" (using the analyzer or the signal generator frequency control) on the first left graticule, then to press Enter.
- The software answers " Left maximum found : **v i**", where **v** is the amplitude of the peak (in A/D points) and **i** is the index of the peak.
- Typical value for **i** is between 1 and 100, according to your analyzer, and **v** can be anything

between 10 and 250 if the Amplitude calibration has not been performed.
Note : If the displayed **i** is around 3000, the analyzer scan width is probably not well centered and /or smallest than the 10 horizontal divisions. Fix this problem before performing a new calibration.
- You are then asked to put the peak on the right graticule, then to press Enter, and will be answered by "Right maximum found : **w j**", with **w** about the same as **v** and **j** between 2900 and 3030 .
- If everything is OK, answer "Yes" to the following question : "Write value to EEPROM (Y/N) :"
- The Frequency calibration is now complete.

2.2 Amplitude calibration.
- With the same RF source connected to the analyzer, set the Scan Control of your analyzer on "Zero", ie, noscan and adjust the RF level and/or the analyzer input attenuator to put the horizontal trace just on the upper graticule.
- In order to improve calibration accuracy and to mitigate the effects of noise, select a narrow Video Filter setting (1000 Hz or 100 Hz) on your S.A, .
- Push the **Start** button again, select "A" then hit Enter.
- SAN2PC answers by following lines scrolling on the screen " **n** Press any key when displayed number # 200", where **n** is the amplitude corresponding to the Ref Level (upper graticule).
- Adjust R5 (U4A gain) until this number **n** is around 200 then hit Enter.

This completes the amplitude calibration.

3. Operation.
- Set the Normal/Calibrate switch to **Normal** and push the **Start** button.
- You are asked to enter the Reference level (dBm), Center frequency, Scan Width/div, Filter Bandwidth and Video Filter Bandwidth. An example of this dialog is shown below (the values you enter are in bold):

Enter Reference Level (dBm): **10**
Enter Center Freq (M or G) : **30M**
Enter Scan Width/Div (k or M or G) : **2M**
Enter BW (Hz) : **100k**
Enter Video Filter (Hz) : **10k**

- If you want to capture the spectrum data in a file, you must select the capture option in your terminal program before you hit the last **Enter**, ie, just after entering the Video Bandwidth value (10k in the above example).
- Then, after you hit **Enter**, the RF power (in A/D points) information will scroll on your PC screen until the last value, followed by « * Reset for another run » . Unselect the capture option and you are ready to use the stored spectrum file with your favorite spreadsheet program or with the **drawsan.py** Python program.
- If you want to start a new measurement ***with the same Spectrum Analyzer settings***, just type « **y** » after the « Reset for another run » message.

Remarks.
- This software is designed for Spectrum Analyzers with a 80 dB vertical scale.
- For best results, the Scan Time per Div setting must be equal or greater than 10 ms/div.
- Switch off the Tracking Generator (if any) before using SAN2PC.
- The SAN2PC amplitude and frequency ***resolutions*** are better than the ***accuracy*** of most spectrum analyzers of the kind we are talking about. Keep that in mind when interpreting data files or pictures.
For example, the HP141T Operating Manual says : « frequency error between two points on the display is less than +-3% of the indicated frequency separation between the two points ». So, if we

select a 5 MHz/div Span Width, the *frequency error* between the center frequency and the left graticule can be as large as 750 kHz, while the SAN2PC *resolution* is better than 20 kHz.