Data Logging
With
Modern Multimeters
for
Microwavers

By

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Digital Multimeters have changed a great deal in recent years. Due to increased integration of IC and computing functions into smaller and smaller chips, they will continue to add functions and better interfaces and displays as time goes on. One key change has been datalogging. Previously this type of data gathering was proprietary and difficult to interface. All of the meters can be linked to display computers or phones by either standard USB interfaces or through Bluetooth or LAN connections.

Meters are easily able to measure dBm referenced to impedance. The meters can also update their firmware and communicate easily via USB Or LAN connections

Displays are also improving and moving beyond fluorescent or LCD displays to color TFT displays and displays that include graphing and data presentation such as averaging. This talk will feature a few outstanding meters from cheap to expensive that include the latter features

Some measurement examples are-

Using the sun as a source, one can measure antenna beamwidth.

You can measure cold sky to sun or grsound.

You can use the DC recorder jacks on a number of analogue meters and do data logging of the readings.

Frequency drift over time, and you can do dBm or dBV ;measurements over time referenced to an impedance.

The focus of the talk is on seven different meters-

Siglent SDM3045x 4.5 digit meter with 60k counts

Agilent 34410A 6.5 digit

Uni-T UT181A handheld, 4.5digit with 60k counts

Uni-T UT61E+ handheld 4.5digit with 22k counts

Uni-T UT60BT Handheld with 9.9k counts

AN9002 Handheld with 6k counts

Meet Pencil Dmm

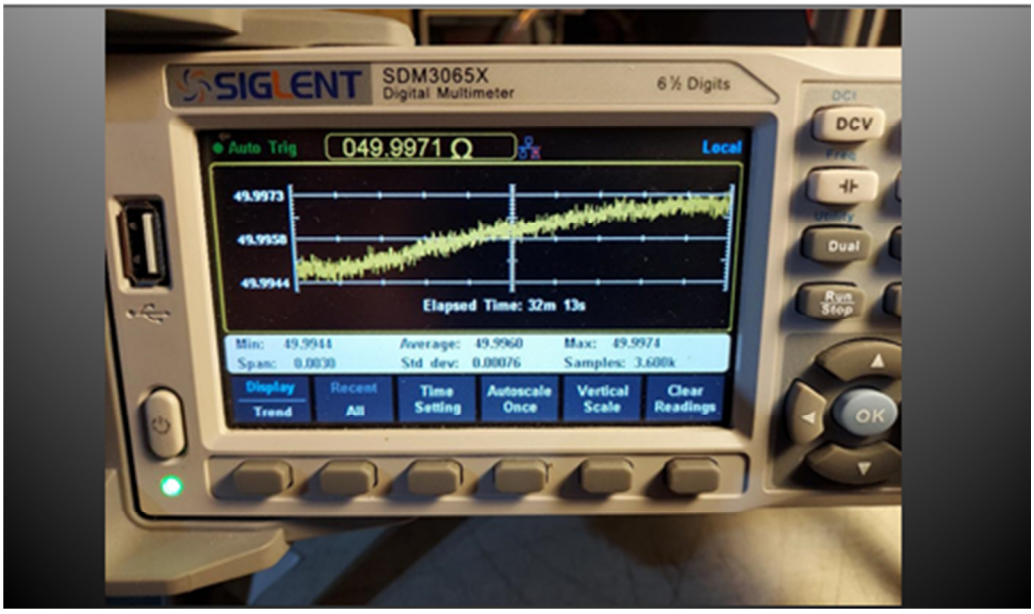
Most of the meters can be linked to external apps or programs via USB or LAN connections. All of these meters connected well and the programs were easy to use. One could also put a router to connect to a remote computer and increase the range between the meter and computer. All the units that used Bluetooth were version 4.0.

Siglent
SDM3045,55,65

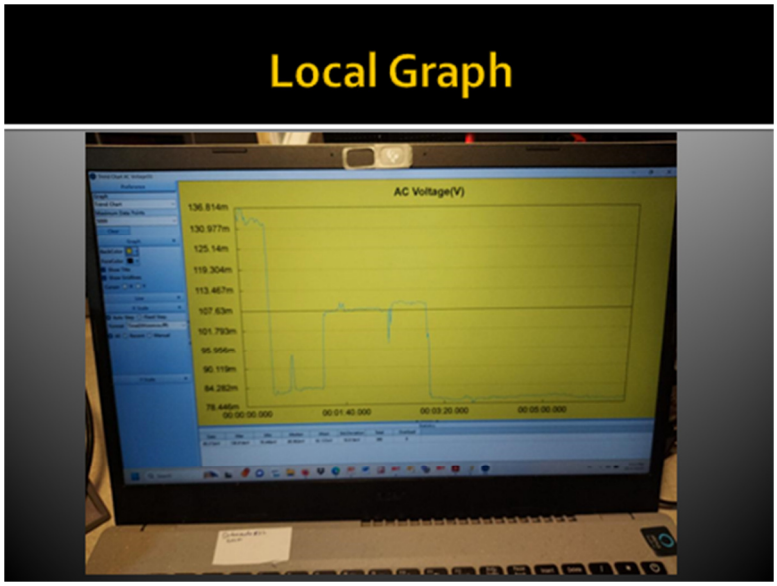
- Very similar to an Agilent 34461A ($1,300+)
- Does data logging and trend analysis live. 1Gb of memory and thumb drive
- Does dBm at Z or dBV
- Simple Recalibration
- 1GB of memory +USB

  - 4 ½ digit $250
  - 5 ½ digit $350
  - 6 ½ digit $600

Trend Display
Data Logging



Notice the graph has been autoscaled to give better resolution.



Agilent Pathwave DMM Program

It automatically finds your meter via USB or LAN

It can average an extra digit

Fully expandable and auto scaling

BenchVue DMM Paid App and 34410A

Both the meter and the program do averaging.

Agilent 34401a Notes

- 34401a
  - Uses a Null Modem-DB9 connection.
  - Startech.com FTDI to null modem DB9 adapter cable should work. $45
  - Keysight serial cable instructions-
- Keysight Serial cable Instructions
  - Meter will measure dBm.
  - Excellent meter but 1993 vintage

UNI-T 181A

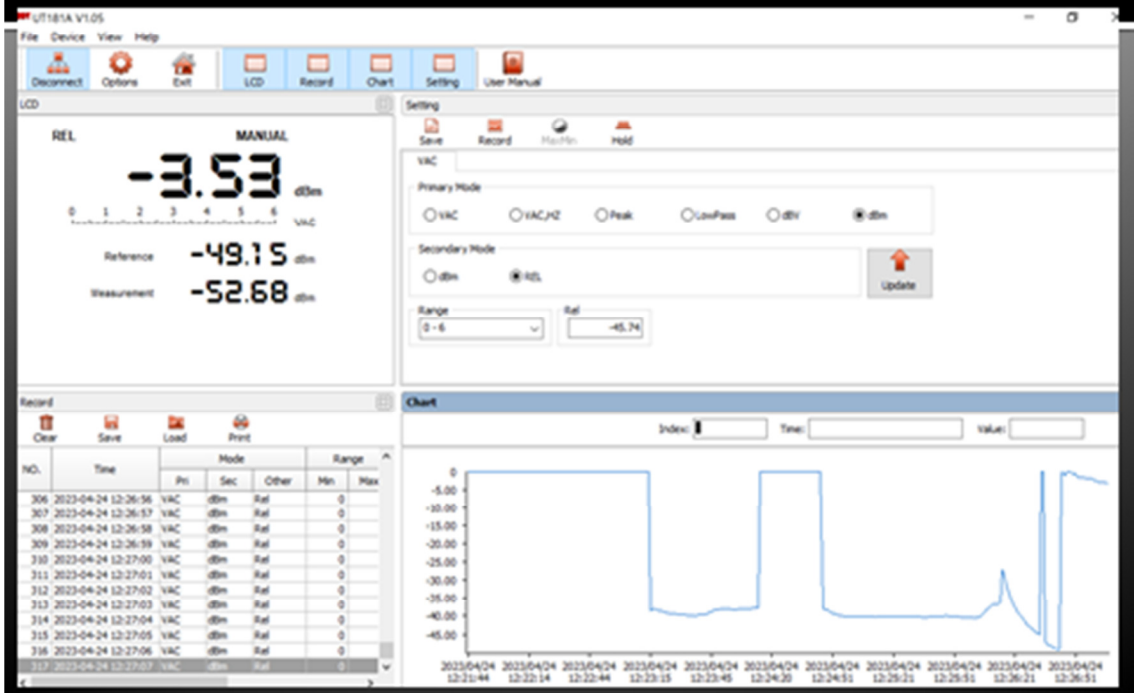
- Hand held
- Bigger than average.
- Excellent sharp display
- Extensive data recording
- Accurate and very fast
- External USB/Bluetooth
- Firmware upgradable
- Recording and graphing are internal and External.

- **About $280**

UT181A

Data Logging
Use either
Internal data display or
External program via USB
Or via ***Bluetooth to Android***
Easy set up! Live graphing.
Record data then get graph.
Use up and down to scale graph.
dBV or dBm
20,000 data point memory.

Software for UT181A



Bluetooth Adapter

Works well with UNI-T and *Android or Apple* Data program BT 4.0

Adapter $30

UT 181A via Android

You don't have
To be at the
Meter to read it!!

Recording live
in dBm
Try- the meter
at the radio
and
The Android
at the antenna
Data saved on
Phone and DMM

UNI-T 61E+

- UNI-T 61E+ $85
  - Very accurate excellent Meter.
  - Has Relative measurement
    - Relative AC V measurement
    - No dBm measurement
    - No internal data logging
  - Has same Bluetooth adapter
  - and excellent program.
  - 22,000 counts
  - $250 cheaper than UT 181

Android display Via Bluetooth

For dBV readings

1. Zero with relative button in AC volts position.
2. Observe peak hold on chart.
3. Calculate dBm from AC voltage difference.

Comes with calibration cert.

4. Order one that comes with a case.

Uni-t UT60BT

- Very cheap at $40
- Internal Bluetooth
- More limited
- Same program
- 9.9k counts

AN9002

- Cheap at $28
- Excellent ext. Program
- Internal Bluetooth
- Slippery case.
- Cheap leads
- Display Lens not protected
- Good display, though.
- 6k counts

Pencil DMM with Bluetooth= DMM with

No test probes!

MEET- Pencil DMM

- Relative and hold
- Bluetooth for external analog type meter.
- " DMM
- without test leads"
- Data logging,
- and graphing
- Takes pictures of the setup.

$35 Amazon

"MSBDTP1A"

Meter and Phone

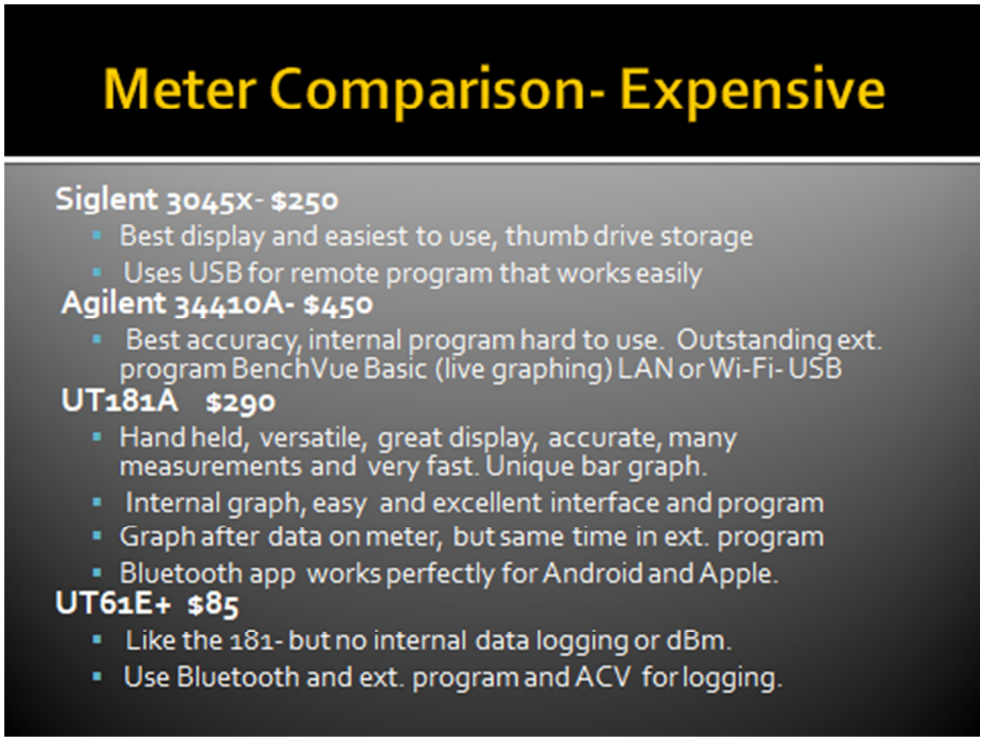
Turn the phone clockwise for this display

Turn it anticlockwise and get the graphing display.

You can take pictures of the measurements.

No test lead wires!

Did I say $35 from Amazon?



Conclusions

Having used each of the meters, I have some suggestions.

The Siglent meters get the best all-around grade with easy calibration, easy to use interface and an excellent program. Front panel USB access is excellent for storage

A great combination would be to get a Siglent meter and the UT61E+.

I really like Uni-T 181A for its all-around usefulness and good price. If you just got one meter that might be the best choice.

The Agilent meters are in a class by themselves. I would say that with current prices, and lacking a great deal, a 34461A would be an excellent meter, but since it is so close to a Siglent and much harder to calibrate, it is a tough choice.

On the other hand, the Pencil DMM is a no-brainer. It is remarkable how not having test leads frees one up when doing measurements.

Results-

Here are some of the worthwhile changes I have noticed.

Data logging and graphing have finally come to a mature level where they are easy to use and do what they should

USB and LAN connections are smooth and easy.

Bluetooth connections to the phone are excellent and are stable and very useful with their apps.

Next steps?

I'd like to see more phone apps

The use of Bluetooth 5.3 would improve the range to nearly Wi-Fi distances.

In the last year and a half of developing this talk, I have seen considerable change and not a few improvements in both data logging and connections. I am sure there will be more in the future. However, from having used the featured meters myself I think I can recommend them with confidence that they will not be quickly outdated.

I hope this talk has been helpful in any decision you make on a new DMM.
Doug K6JEY