A Microwave Analyser for the Laboratory F. Thompson

A recent article [1] has show how a low cost single board analyser was used in measuring the electrical permittivity of selected material. The LTDZ_35 – 4400 MHz Spectrum Analyser, shown in Fig 1 is extremely versatile as it can detect microwave radiation up to the GHz region but the board also contains a tracking generator and therefore can be used as a scalar network analyser.

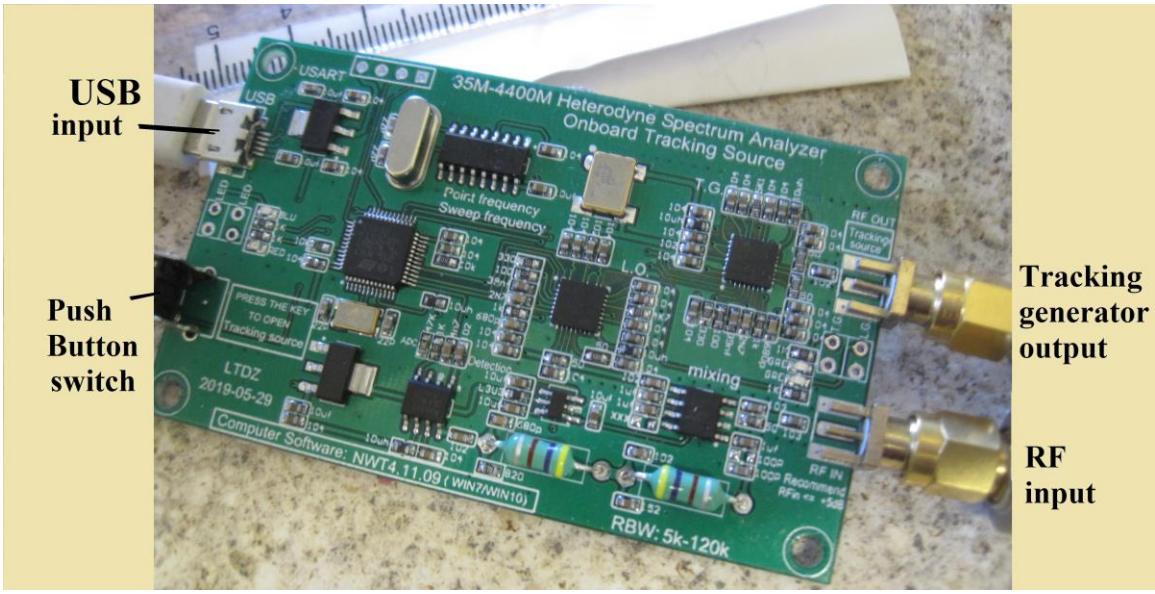

Fig 1 LTDZ_ 35 – 4400 MHz Analyser board. (supplied by www.banggood.com)

The unit is powered from the USB port and two SMA terminals provide connections to any microwave circuit. Software, Win NWT4 , can be downloaded from the Banggood site and this allows a PC with Win 7/10 to control the board. A User Manual is available as a .pdf file.

NWT4000-2 RF DIGITAL
SWEEPER & ANALYZER

USER MANUAL

Manufacturer:

WUTONG ELECTRONIC

site：http://bg7tbl.taobao.com
TEL: +86134 2795 9750
Q Q: 1630 2767
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version: V2.0
date: 2014-10-20

Before embarking on measurements it is recommended that the user consults one of the many YouTube presentations, for example, Mark from Radio Shack describes both the hardware and software https://www.youtube.com/watch?v=Kp_T2c5hl6Y. Another presentation compares this single board unit with a traditional Spectrum Analyser https://www.youtube.com/watch?v=PRsaGEk-EsQ .

When used as a Spectrum Analyser the set-up is very simple; a signal source is attached to the input port (RF input) and Fig 2 shows the display

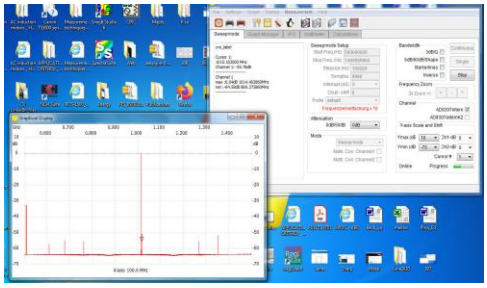

Fig 2 Display for microwave signal of frequency 1.015 GHz connected to input port

A large signal at about 1 GHz is visible and smaller lines may well result from spurious radiation. Placing the cursor on the peak proved to be rather difficult but the additional information is provided on the main control page under the Cursor 1 list.

When the unit is used as a Network Analyser the inbuilt tracking generator has to be activated. The small push-button switch is pressed and a blue LED is illuminated showing that a microwave signal is coming from the output port. If a cable is then connected between this port and the RF input port a sweep display of + 2/3 dB is recorded. If a 1GHz low pass filter is now connected between the ports then the display is shown in Fig 3

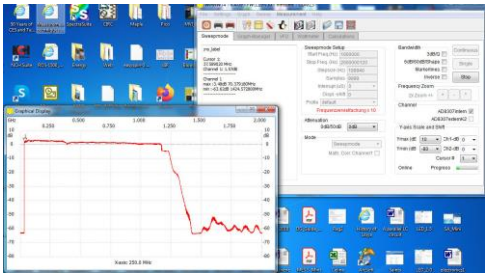

Figure 3 Transmission through a low pass filter showing a cut-off at 1.2GHz.

The curve shows that close to 100% transmission occurs below a frequency of 1 GHz whereas this falls by more than 60 dB (1 million times) at frequencies above 1 GHz.

As reference [1] shows the Analyser was connected to a resonant cavity allowing permittivity measurements to be made. In addition, the two ports could be connected to

antennas and then a whole list of experiments demonstrating wave propagation in free space could be made [2].
In summary, it is felt that the Spectrum/Network Analyser board would be a worthwhile investment for any college/ schools as a variety of laboratory experiments would then be possible.

References
[1] F. Thompson “A resonant cavity method for measuring the electrical permittivity in the GHz region” Physics Education (2020), 55(3), 035027.

[2] F. Thompson and H. Tsui “Transmission of normally incident microwave radiation through parallel plates of material (1986), 54(7), 712.

Please note - the cost below is for the analyser board encased in a metallic box.