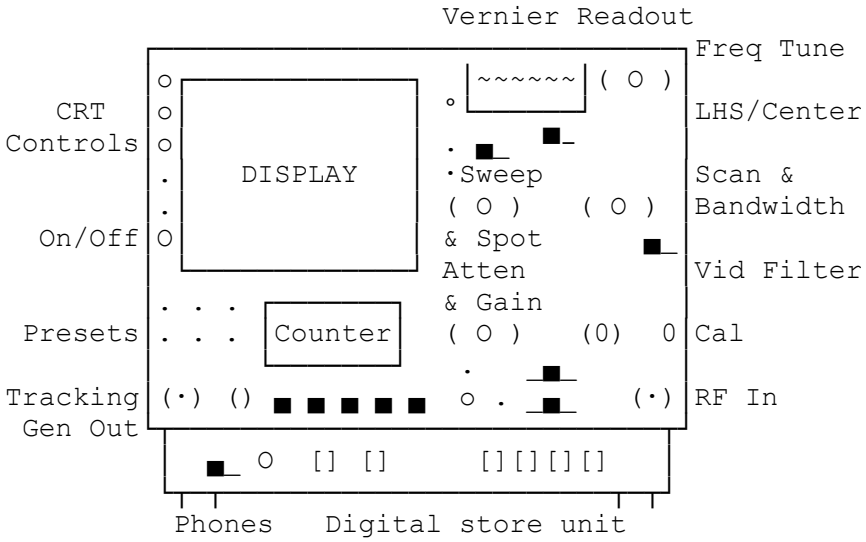
Analyser Takeda Riken TR4122B

By G8MNY (Updated Oct 17)
(8 Bit ASCII graphics use code page 437 or 850, Terminal Font)
Being a sucker for test gear, I bought this rather large & very heavy vintage Japanese Spectrum Analyser, also badged as Adventest, for a "song" at a club junk sale. It has a tracking generator & Digital Store. It was not known how well it worked, but I had seen it switched on at a club's test evening so I knew it was not quite all OK.



It came with no information or front cover, but here is my spec for it so far..

FEATURES
Freq : 100kHz-1500MHz (Display & Mechanical Vernier counter to 1750MHz)
Input : 50Û N, +20dBm (100mW) Max, 0-50dB atten, in 10dB steps
IF Gain: 0 to +50dB, in 10dB steps (Gain/loss scale) & a Calibrated +12dB Pot
IF B/W : 3MHz, 1MHz, 100kHz, 10kHz, 1kHz, & 500Hz, all sweep friendly shape
Video : Video filter, 1/30 of IF BW. For noise averaging, sweep speed adjusts
Cal out: 50Û BNC with 200MHz @ -30dBm, harmonics check to 1400MHz sweep cal.
Sweep : 2kHz-100MHz/Div (B/W linkable). Sweep stop for envelope & Phones use
Phones : AM 3.5mm jack, and AM/FM switched 6mm jack on memory unit
Marker : Movable spot stops sweep momentarily for 8 digit Freq Counter readout
Modes : Trace (U sweep marker spot) / Manual select sweep time / Auto (best)
Display: Linear / 2dB/Div / 10dB/Div. 10 x 10 Div etched tube graticule
Gen out: Tracking Generator, optional filters. 0 to -50dBm in 10dBs, 50Û N
Store : 2 Digital memories, one can be subtracted to normalise display
Outputs: IF @ 10.7MHz, X, Y, & Z, for a 2nd display. Data/printer socket out
Power : 122VA selectable AC Volts internal / External DC (unknown Volt/Batt)
Weight : 24kg!

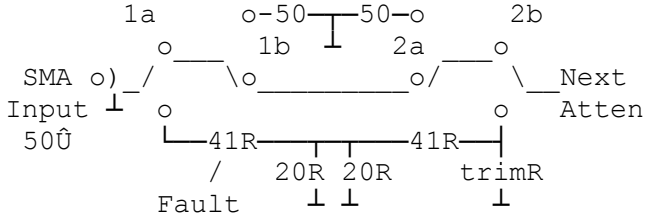
TESTING IT
Well it was very cheap, so I expected the odd problem, I soon saw one. The precision input attenuator was broken. The first 10 20 & 30dB worked, but 40 & 50dB fell off the screen. It has a DC isolator to the N socket, so I had to open it up & unbolt bits to get further.

REPAIR
I located the attenuator, to find it was a SMA connected relay controlled remote module after the N input. On testing I found all the relay control lines went on & off OK, so it was not a control switch or relay drive logic fault. Removed attenuator, took off the RF cover. Inside I saw 6x 6mm dia tiny uWave relays & 3 RF attenuators & silver track line on the RF substrate. It was fairly symmetrical, & I was able to identify an open circuit metal deposited R

only 2mm square, on the input side of the offending 20dB attenuator section. So it had been "burnt out", luckily only this attenuator & not the RF input!

Searching Jessop G6JP's RADIO DATA book, I found the theoretical value for the series arm of a 20dB T atten should be 41R. I initially solder tinned the silver strip lines either side of the faulty R, & tried a small wired resistor of 47R, that proved OK, so this realy was the fault!

THE 1st 20dB RELAY ATTENUATOR



2 double change over relays 1 & 2 are used, this ensures high isolation with 4 contacts bypassing the through path when attenuating.

The unused paths are terminated.

The fixed trimR used in calibration?

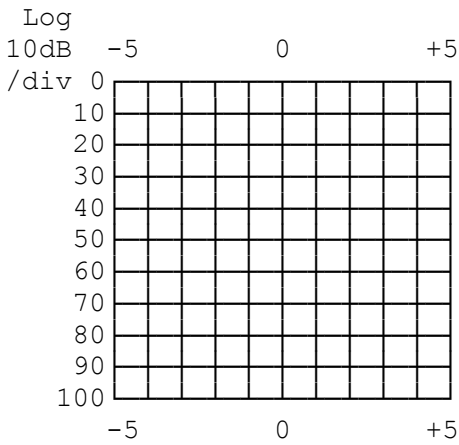
So for a proper job, the 41R had to be accurate, small & non inductive, if it was to work well to 1500MHz. After consulting an old Basic Hamhelp Program for multiple Rs, I used 3 surface mount Rs in parallel 2x100R & a 220R to give the 41R. Once stacked up & soldering together the SM Rs were not too difficult to solder to the pre-tinned stripline, although it looked a bit messy in the end.

Success, re-assemble & tested, display now showed nice even steps of the 40 & 50dB atten & all exactly 10.0dB & quite flat to 1.5GHz.

2nd REPAIR

Later after many days of use & taking it to club fixit nights, it packed up! The fault was a humming transformer & -15V being shorted out! Disconnecting the PSU load wire brought the volts back. The wire went to the motherboard, so I pulled out the 5 cards & short went on my meter. The Log detector PCB had the short, no high power components, just 10 x 10dB gain amps/detectors. With the -rail the track was easily identified with its electrolytic caps +ve to earth. I removed 3 of them, but they were not faulty, eventually I came to the end of the double sided weaving track, to see a mechanical 3mm long soldered lead bent over & shorting to adjacent earth. Fixed OK.

CRT DISPLAY



The Long persistent White/Blue P7 Phosphor is viewed through a clear thick blue glass gives a clear display.

Usual Brill, Focus, & a bottom blanking controls, Astig & Geom are presets.

10 x 10 div graticule with 0.2div marks, are etched inside the tube for accurate no parallax readings.

The Tune Freq calibration can be switched to LHS or Display centre.

CALIBRATION (After 1 hour warm up)

Using the internal 200MHz -30dBm Calibrator & its harmonics with a patch lead, will test:- Input & IF Attenuators, Frequency & Sweep controls, can easily be done, & you can check & set front panel CRT Preset Geometry Shifts & Gains,

ONCE WARMED UP:-

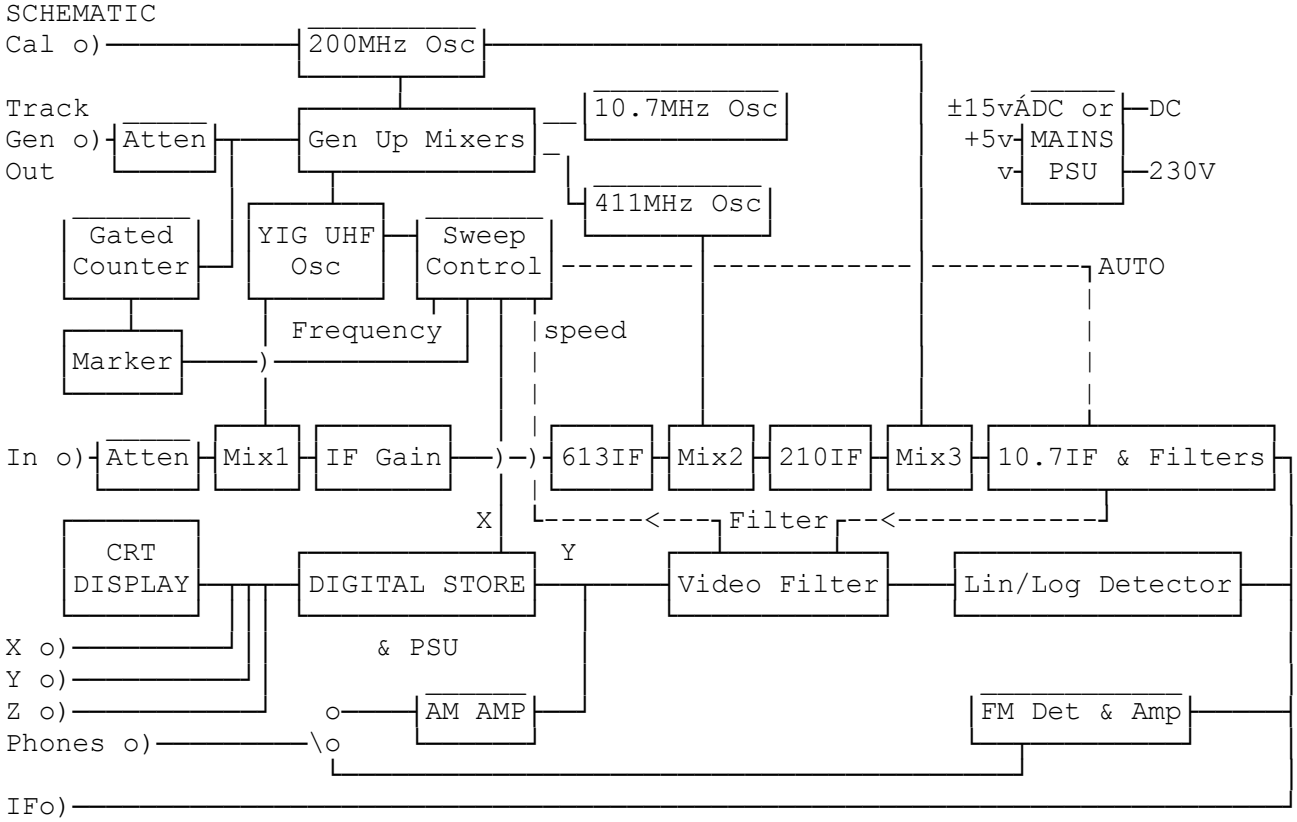
X: With centre freq mode, Zooming in with sweep range & on a signal (Zero Line) in the middle & then zooming out, sets the X screen position middle. Frequency cal lines (& harmonics) set the X Gain to get scale right.

Y: Linear scale mode, no signal defines the lower Y graticule. Y Gain is set in 10dB/Div mode, over 90dB of atten/IF gain, to get the scale right.

Memory: Repeat for the 4 preset Shift & Gains on the side of the memory unit, so there is no difference with memory on/off. N.B. Position & Gains interact & repeat adjustments are needed.

Inside are lots more presets for PSU. Linear & 2dB/Div scales, Filter gain equalisers, 12dB Log pot, Verneer freq pot ends, centre-side offset, as well as RF tweaks on the underside S.A. Rx & Gen module. The RF modules are well sign written, hence I was able to work out much of a schematic for it...

SCHEMATIC

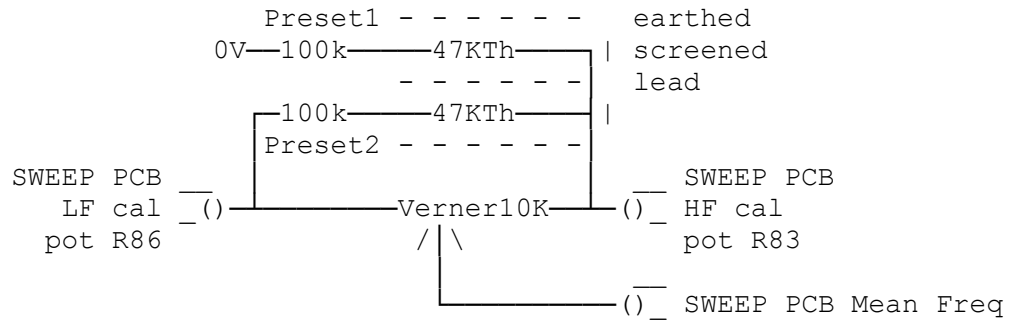


Understanding the internals does help you use gear better.

YIG UHF OSCILLATOR

This is the heart of this Spectrum Analyser; it uses a free running, UHF osc with a temperature controlled high Q "Yttrium Iron Gamete" bead, like a ferrite core, in the centre of the UHF osc coil. It's magnetic inductance is changed with external magnetic field at right angles to the UHF coil, & this linearly sweeps the oscillator between 613-2113MHz. YIGs are very stable (when temperature controlled) & like Xtal oscillators have very low noise sidebands, & unlike PLL & DDS sources, have NO sprogies/spurs, but they do drift!

WARM UP DRIFT COMPESNATION
On close in work I have found the YIG osc drifts at different rates @ 613MHz (0Hz) drift was -ve & @ 2.2GHz (1.5GHz) +ve. At first this seems too complex to compensate for, but I decided to put in 2x 47k NTC thermisters, insulated in heat shink, then taped to top of the hot YIG Osc Box with polystirine cover, 10cm below the main geared vernier Pot, & fed with triple core screened lead (made up with some braid) to reduce any hum pickup.



A thermistor & 100K Preset1 go to ground (Cal pot earth point) to the vernier tuning 10 turn pot most +ve lead (~5V), & 2nd thermistor with 100K Preset2 to the -ve of the 10 turn pot Vernier (~2V).

Minimising drift..
1/ Set FRONT PANEL CAL & FINE TUNE to their mid positions.
2/ When warmed for only 5 mins, & repeatedly adjust R83 & R86 to give the correct vernier calibration @ 200MHz & 7th harmonic at 1400MHz of the Cal Ref. to agree with centre marker spot counter frequency.
3/ When warmed up >1hr set vernier 1400 & adjust Preset2 for 1400MHz counter.
4/ When warmed up >1hr set vernier 200 & adjust Preset1 for 200MHz on counter.
5/ Let it cool down for an hour or so, & go around the loop from /2 again & again, until hot & cold frequencies do not need adjusting (<±1MHz out).

N.B. This will not stop all display drift when zoomed right in & @ 500Hz B/W, but it will make a big difference.

IN USE
Compared to home made & simper commercial Spectrum Analyser I have used, this "Proper one" is not as sensitive & takes some getting use to. With the multiple bandwidths available from 3MHz for fast sweeps right down to 500Hz close in work. The inter-lockable Sweep & Bandwidth control & the Auto sweep speed, stops you getting a faulty spectrum display. But as this is not a modern PLL system, slow drift of the swept YIG UHF oscillator is noticeable on close in work. but it does reduce after 1 hr warm up or so. One shot sweeps with memory solves most of this drawback though.

The Zero Hz line can be seen when the YIG Osc is on the 1st IF freq, as well as about 300MHz of the spectrum mirror image.

With slow sweep, narrow bandwidth, video filter in & the storage memory, the noise floor can be seen as low as 98dB down on a near overloading input.

Harmonics & images are well down, if the signals are >5MHz apart so they are not in the 1st IF together.

The tacking generator with sweep stopped can be used as an RF generator, it is also very useful on filters & pre-amps etc. But the first thing you notice is all your bad cables & connectors! Of course it can also be used just a sweep gen too, triggering a scope from Z out etc.

Best accuracy for adjustments is in Linear mode or the expanded 2dB/Div.

The 2 memories can be used in subtraction mode, so a change in display can be seen, or an un-flat response of test leads normalised before measurement. And the Peak store mode lets you capture a rouge signal too.

FURTHER INFORMATION
I have only found 3 pages of the user manual on line so far, without buying the full price set of 5 manuals, so I wonder if any readers have used this S.A. or have any information on it?

Also see my Tech buls on "Spectrum Harmonic Demo circuit", "A Versatile Pulse Tester", "Clip on QRM Probe". " Spectrum Analyser mods 88-89", "Power Line Telecomm QRM", "SSB Demo circuit" & "Marconi 2019A Sig Gen"

Why don't U send an interesting bul?

73 de John G8MNY @ GB7CIP