Measurements Corp. - Crystal Calibrator Model 111-B

I had this crystal calibrator for a while and did nothing with it until now. It is 1950's vintage and has 4 or 5 tubes depending on the version. There are 3 switch positions for the frequency output, 10 MHz, 1 MHz and either 0.250 MHz or 0.1 MHz and are rich in harmonics. This one has 5 tubes and is the 0.1 MHz version. I could not find much information on line about this calibrator. This kind of inspired me to do this wright up just to get more information out there in case anyone was interested. I don't know how many were made or if they were extensively used at the time.

There is an operating manual available that includes the alignment procedure. The manual seem complete as indicated by the page numbering but some paragraphs are truncated. The manual appears to be for the 0.25 MHz version with some instructions for the 0.1 MHz version. Anyway, there are issues with the manual. It appears it was not proof read properly. The manual is dated 1950.

The manual provides a basic description on how the crystal calibrator works. There are 3 oscillators, a 10, 1 and in this case a 0.1 MHz. The 10 MHz oscillator is crystal controlled and the other 2 are free running but synchronized to the 10 MHz oscillator by the fact they are harmonically related. This actually works quite well. A problem is they didn’t provide enough buffering (isolation) between the crystal controlled 10 MHz reference oscillator and the other two. If you calibrate the 10 MHz reference oscillator to be on 10 MHz and then switch to the 1 MHz position it will pull the 10 MHz oscillator off frequency slightly. The same applies to the 0.1 MHz oscillator. In reality this probably doesn’t matter much considering the accuracy, I would assume, was expected at the time.

My calibrating experience with this crystal calibrator was not all that good. I followed the procedure described in the manual but did not always get the outcome I was expecting. For example, it asked you to measure the frequency of a tuned circuit in the cathode circuit of the 10 MHz crystal oscillator. It specified a frequency to look for of about 7.5 MHz. I did not get these results. I even have the piece of test equipment they recommended to use for the test, a Measurement Model 59 GDO although any GDO would probably work. The frequency measured was at 2.8 MHz on the Model 59 and the calculated frequency was about 3.1 MHz. I am not sure why they even asked to do

this or what to do if you didn't get the results expected. There were other cases where the expected results were not obtained.

Overall it works but the output is lower than expected. I did not trouble shoot it in detail other than taking a few voltage readings. The tubes were tested by substitution. It is also difficult to troubleshoot due the way it was constructed. They crammed a lot of components into a small space and are very difficult to get at many of them.
The output can be modulated and has a modulating frequency about 1300 Hz. This could be useful in finding the generator output frequency on an AM receiver that does not have a BFO.

The calibrator has a mixer circuit built in. It allows it to produce other frequencies by connecting an external frequency generator to the input. It gives the example of using a sweep generator to do an IF alignment by mixing the signal from a sweep generator with a frequency generated by the crystal calibrator. This may work (somewhat) but you may not have a lot of flexibility in the levels produced etc. It's just a crude way of doing an IF alignment but maybe that was common at the time.

The manual provides some specifications but are not in-depth. For example, they specify the frequency accuracy at 0.002% at 117 AC Volts. A temperature range was given along with usable frequencies and that's about it. The usable frequencies specified depended on the frequency selected on the Megacycle switch with the 10 MHz position up to 1000 MHz, 1 MHz up to 600 MHz and the 0.1 MHz position was not given. (BTW: The frequencies are given in megacycles not megahertz which would be standard at the time).

I was interested to see how much the frequency would change with line voltage. With a line voltage changed between 105 and 120 VAC at the 10 MHz position and measuring the frequency at the fundamental, it was about 10 Hz.

The manual gives the procedure for checking the frequency accuracy of signal generators. I have a couple of old RF signal generators made for Motorola by Edison Electronics, a subsidiary of Measurements Corp. and was interested in trying the procedure out. Not sure of the vintage of these generators but guess they were made in the 1960's. The procedure calls for the use of headphones to listen for a zero beat by tuning the signal generator to a harmonic generated by the crystal calibrator. The calibrator has a headphone jack to do this. I used a computer speaker in place of the headphones. The headphones I had are low impedance and the output audio was too low. It was not specified to use high impedance headphones. I heard the 1 MHz and 10 MHz markers up to 960 MHz, the high frequency limit of the generator. I can't imagine what it would be like working with this stuff in the 1950's and 1960's trying to get close to the frequency you want

especially at 900 MHz. It would be time consuming and challenging. This may have more to do with this RF generator than the crystal calibrator.

I can't think of much use for this calibrator today. It can give you a 10 MHz source but it's not all that accurate or stable. It may have been good enough in the 1950's. The crystal used is in a HC6/u holder and out in the open, certainly nothing you would see with a precision frequency standard. It could be useful as a crystal calibrator if you have some old tube type shortwave radios that do not have their own crystal calibrator. To be fair, this crystal calibrator works but may not work as expected. Due to its age there could (likely?) be components out of tolerance. As it is now, it's just not very impressive.

Here is the list of test equipment used:

- SDR PLAY RSP 1A Receiver
- Motorola signal generator S-1381A-1
- Measurements Corp. Model 59 Grid Dip Oscillator
- ZOYI ZT-MD1 LCR Meter
- AADE LC Meter II
- Fluke 7220 Frequency Counter
- Triplett Model 630A Multimeter
- Krohn-Hite function generator (used for mixer check)
- Variac

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