ON THE AIR
FREQUENCY MEASUREMENT SET-UP at VE2AZX

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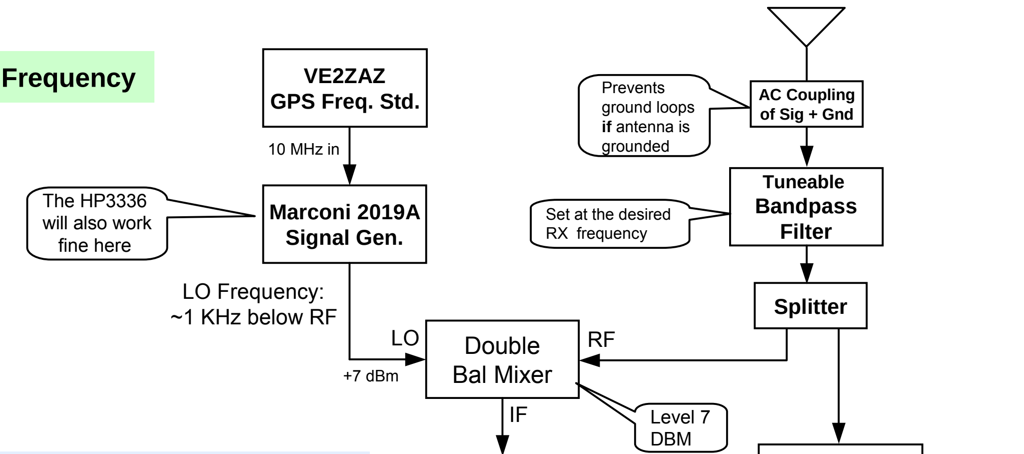
Measuring a single Frequency

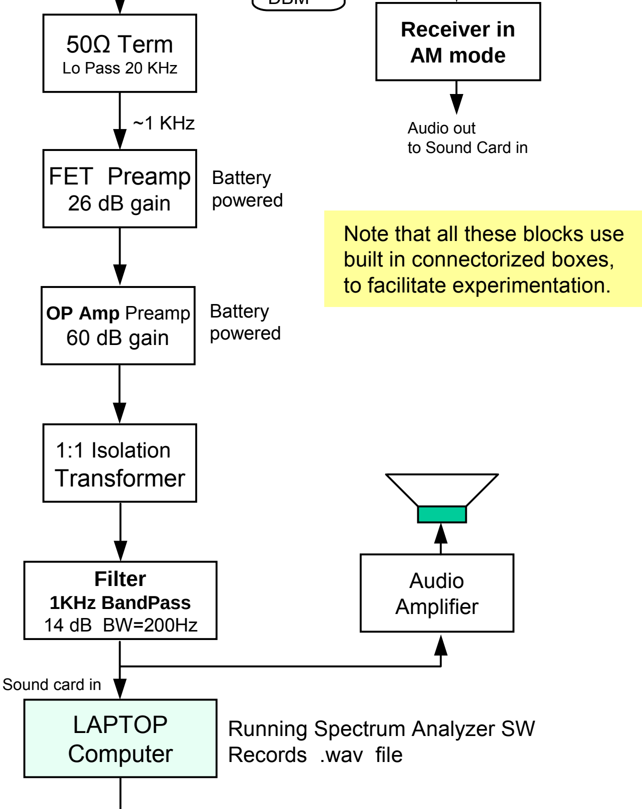


Measurement technique

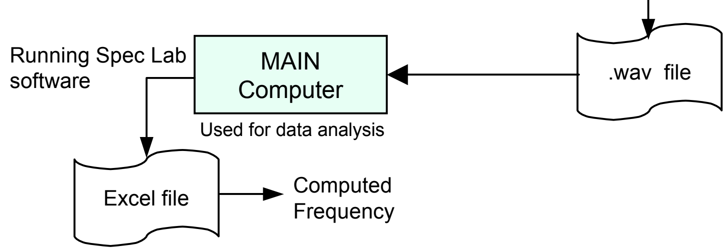
- Signals from the antenna are sent to the RF port of a double balanced mixer. The synthesized signal genrator supplies the local oscillator. Its frequency is set ~ 1 KHz below the RF signal freq. The mixer output is terminated into 50 ohms and low pass filtered at 20 KHz.
  Two battery powered audio amplifiers are used to boast the audio signal, as well as a 1 Khz bandpass filter, with a bandwidth of 200 Hz which rejects signals well away from 1 KHz.
- In operation the LO frequency is adjusted to receive the desired signal by listening to it and looking at the spectrum analyzer display on the laptop to set the received tone at ~ 1 KHz.
- The laptop is used to record a .wav file of the tone.
- Analysis of the .wav file is done on my main computer, using the Spec Lab software to determine the tone frequency.
  Note that Spec Lab has been calibrated with precise audio tones.

  The RF signal frequency is the sum of the LO freq. + tone freq.
  Since the LO is synchronized to the GPS, its displayed frequency is assumed to be correct.

NOTE: This «receiver» has a gain of 100 dB – 8 dB = 92 dB.
The 8 dB losses are the mixer and tuneable filter losses.
Then a 1 µV signal at the antenna will give 40 mV at the soundcard mic. input.



Note that all these blocks use built in connectorized boxes, to facilitate experimentation.



Jacques Audet
VE2AZX

Example of simultaneous measurement of two tones spaced by 25 KHz.

Note that the previous set-up has 20 KHz audio bandwidth, (provided that the 1 KHz bandpass filter is removed – see page 1).

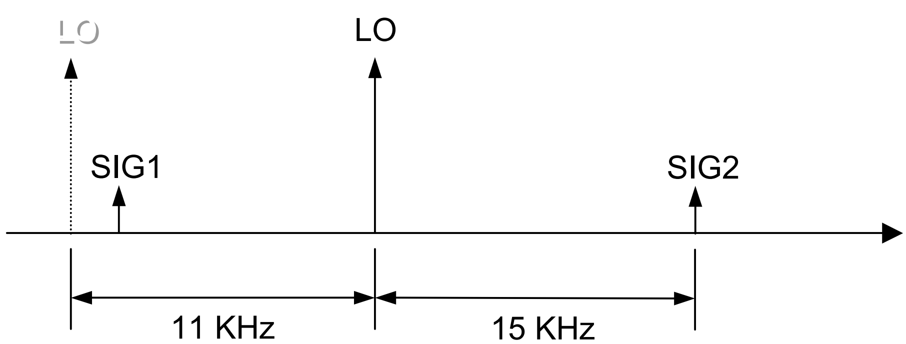
Set the LO frequency to receive the SIG1 with ~1 KHz beat note.

The audio output will be a single tone at 1 KHz

Move the LO up by 11 KHz, when the two tones are transmitted.

The audio output will now give TWO tones at 10 and 15 KHz respectively.

Record these in a .wav file for processing with SL, using a sampling rate above 30 KHz.



The LO should be moved from 30 to 40% of the expected span.

F_{SIG1} = LO – 10 KHz (the lower freq is substracted from the LO)

F_{SIG2} = LO + 15 KHz (the higher freq is added to the LO)

The frequency of each tone (10 and 15 KHz here) is measured separately with SL.

A perhaps simpler method would be to change the LO frequency (when the two tones are transmitted) until both audio tones are at the same frequency.

The LO frequency is then midway between SIG1 and SIG2. Then decrease the LO by say 100 Hz. Record the .wav file and measure the frequency of each tone using SL.

Note that this technique works since the set-up of page 1 has its RF/IF bandwidth larger than the 20 KHz audio bandwidth. Both SIG1 and SIG2 must fit inside the RF/IF bandwidth.

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FREQUENCY MEASUREMENT SET-UP at VE2AZX

Measuring a Received Audio Frequency Tone in AM mode

This simple technique allows measuring the frequency difference between two tones, provided that their frequencies fit inside the receiver IF passband, and that the frequency difference (beat) is within the audio passband of the RX. (Typically 5 KHz in AM)