IC-7000 Audio Measurements taken 12-24-05 - KB6MUZ

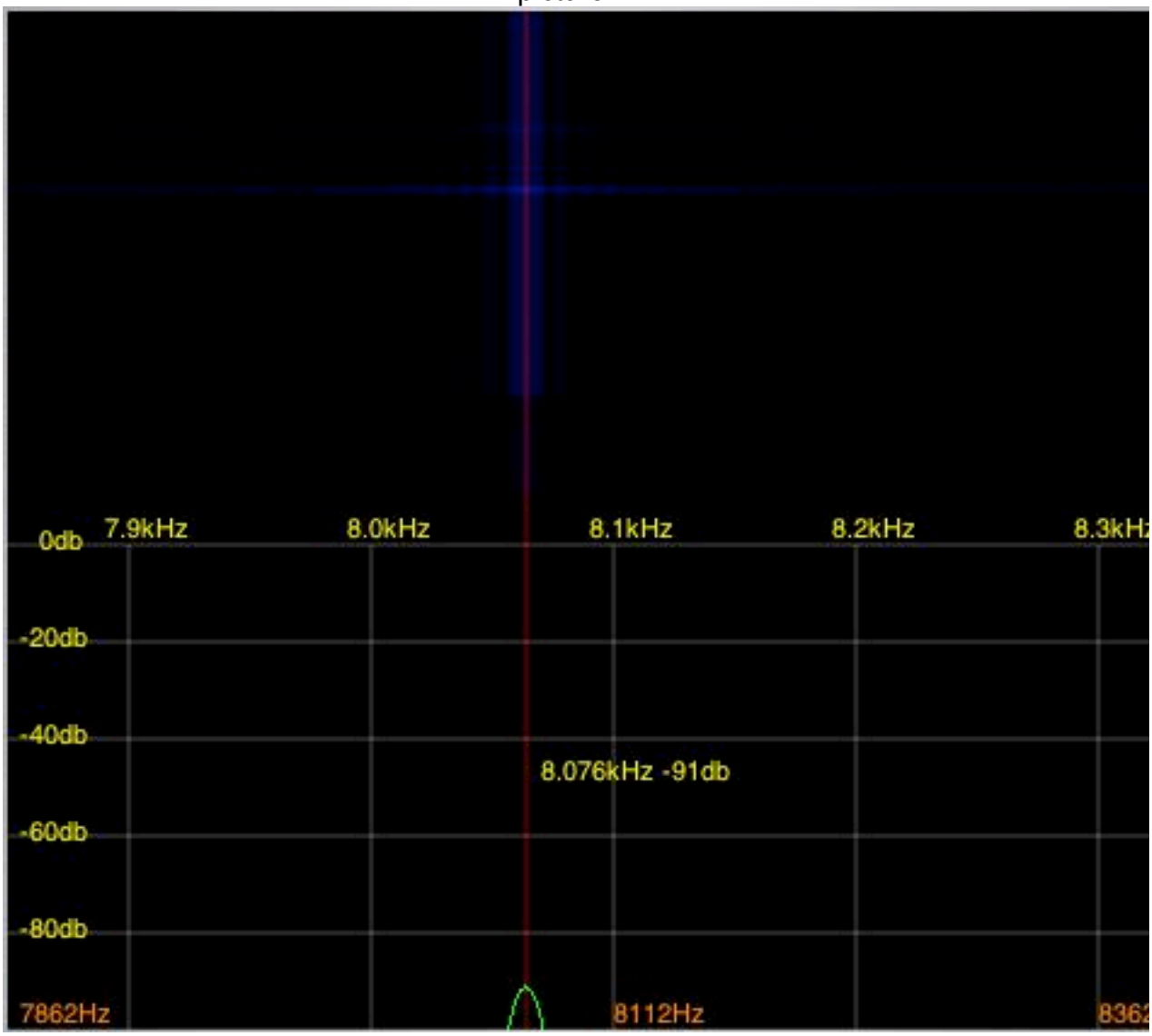
Equipment used:
Macintosh G4 1.67GHz laptop OSX 10.3.7 with iSpectrtum V 0.3 audio software
Honglin E239426 6 foot 1/8 inch stereo audio patchcord
Icom IC-7000 Transceiver SN:050103x with HM-151 mic
Astron RS-20M

Test Configuration:
For all tests laptop is on battery power with no connections other than audio to the IC-7000.
Radio - laptop connection is via 6' stereo 1/8" shielded cable, RFI suppression at each end.
Radio's 1/8" output jack on the faceplate was used for these tests.
Laptop's sound input is via Audio Line-in port. Apple's Input level control set to 3 (default value).
iSpectrum settings: gain 0.00dB, 6 second average, bandwidth is 0.5 kHz (with the exception of pictures 8 and 9 which have a 10 kHz bandwidth).
IC-7000 is only connected to its HM-151 hand mic, power supply and the laptop computer.
IC-7000 is powered by an Astron RS-20M at 13.64 volts.
IC-7000 Ant 1 connector terminated with dummy load (tested at 48Ω).
IC-7000 tuned to 14.200 MHz Pre Amp Off, AGC Slow (2.0 seconds), AM filter width 10kHz, SSB filter width 3.6 kHz.
IC-7000 headphones / speaker impedance switch (back of face plate) set to Phones.

Test Results:
The frequency of the high frequency tone in question appears to be roughly 8.076 kHz

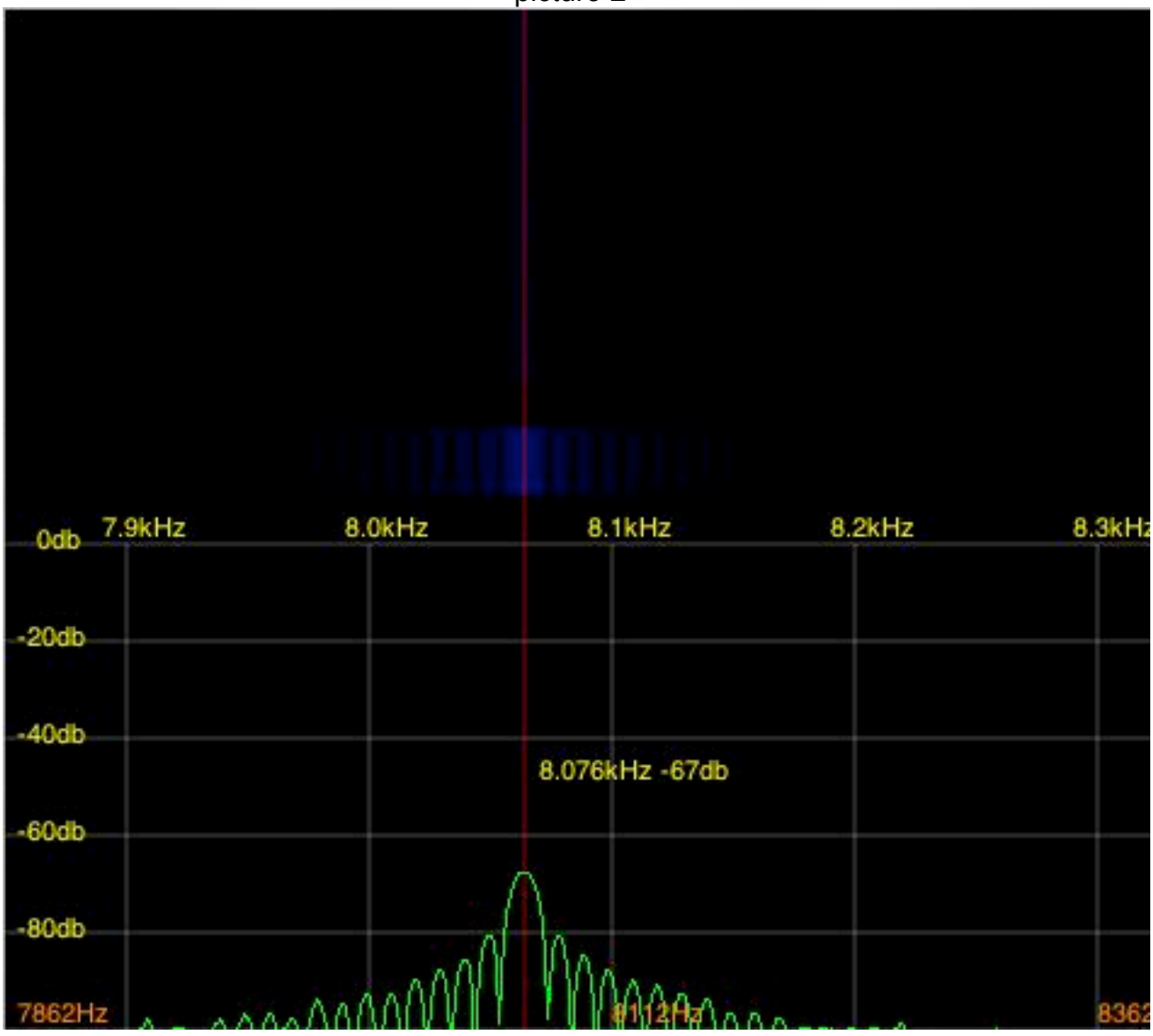
In AM mode with IF bandwidth set to 10 kHz, AF gain fully counter clockwise (minimum, or off), Squelch open, I show the high frequency tone at roughly -91 dB

- picture 1-



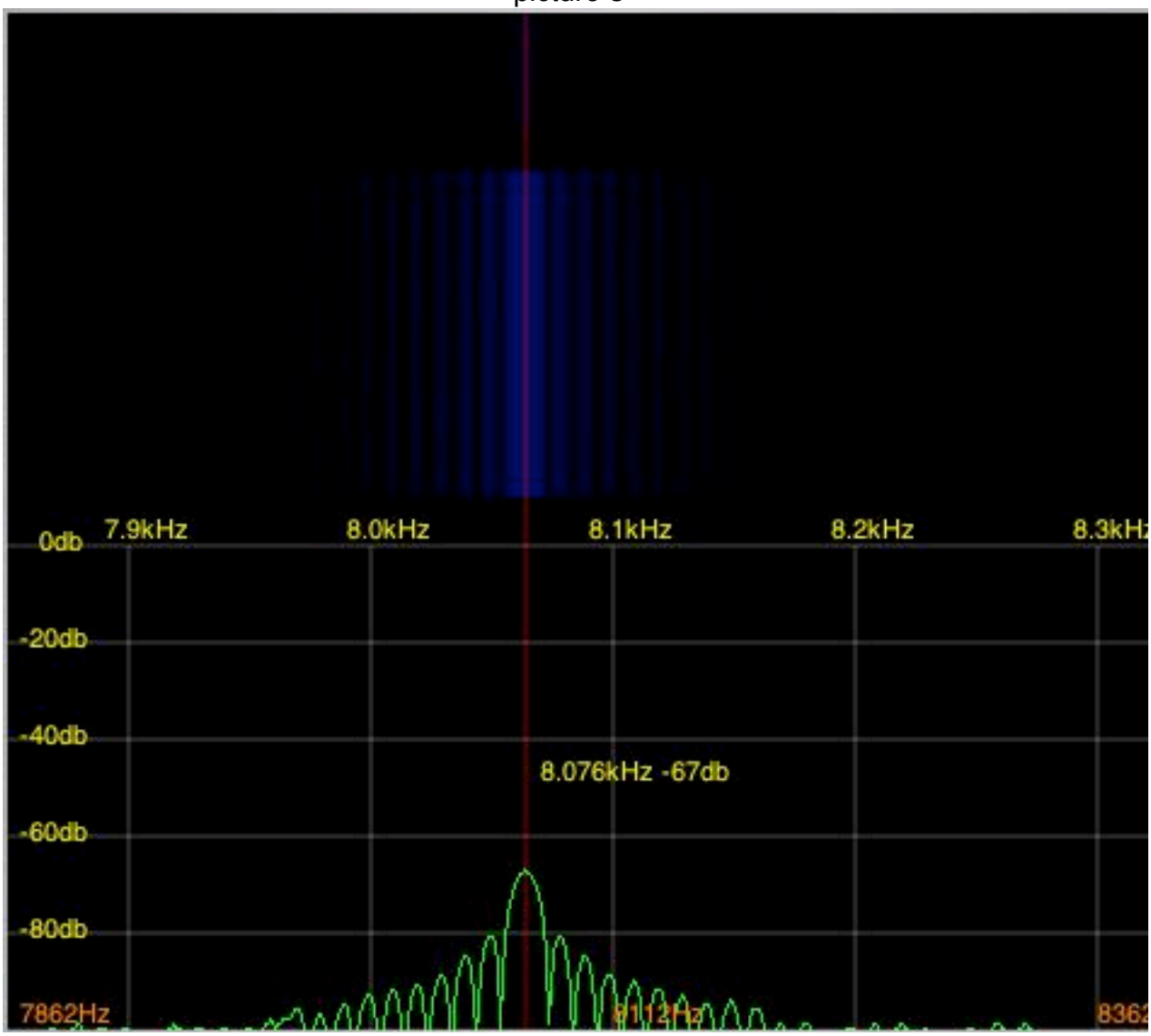
In AM mode with IF bandwidth set to 10 kHz, AF gain at minimum, (or just passing audio), Squelch open, the tone appears at roughly -67 dB

- picture 2 -



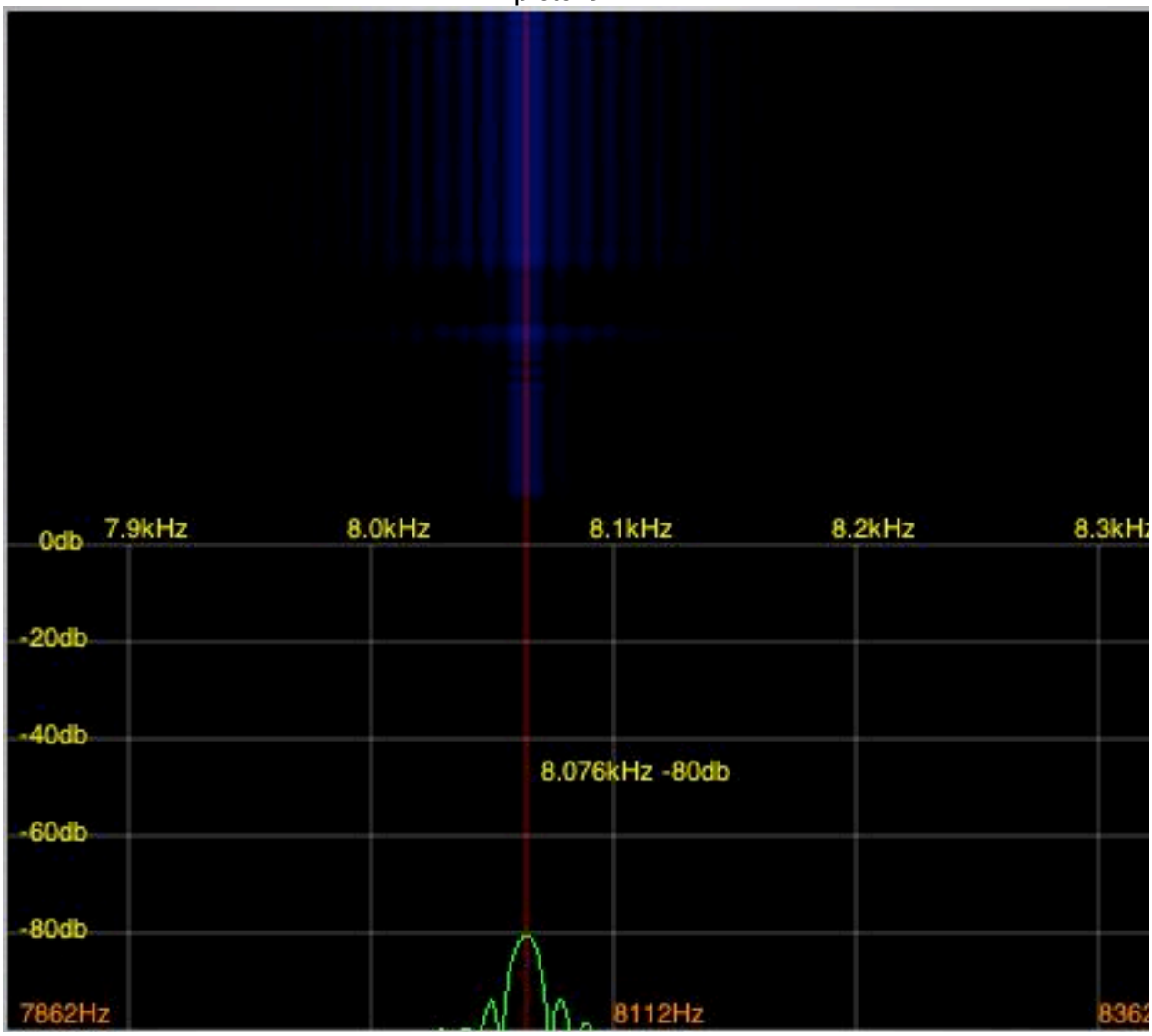
In AM mode with IF bandwidth set to 10 kHz, AF gain at minimum, (or just passing audio), Squelch maximum, tone is roughly -67 dB

- picture 3 -



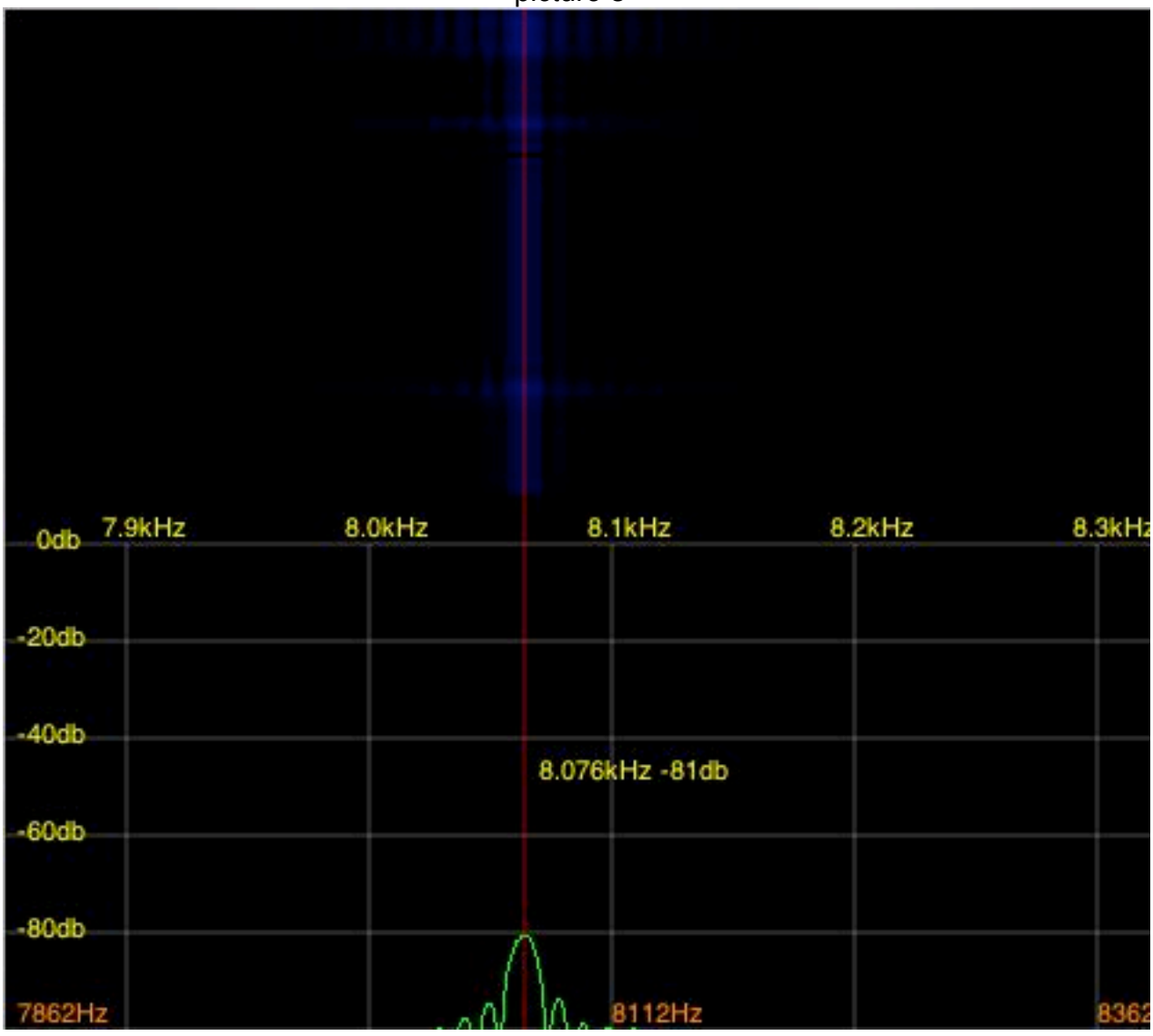
In USB mode with IF bandwidth set to 3.6 kHz, AF gain at minimum, (or just passing audio), Squelch open, I show it at roughly -80 dB

- picture 4 -



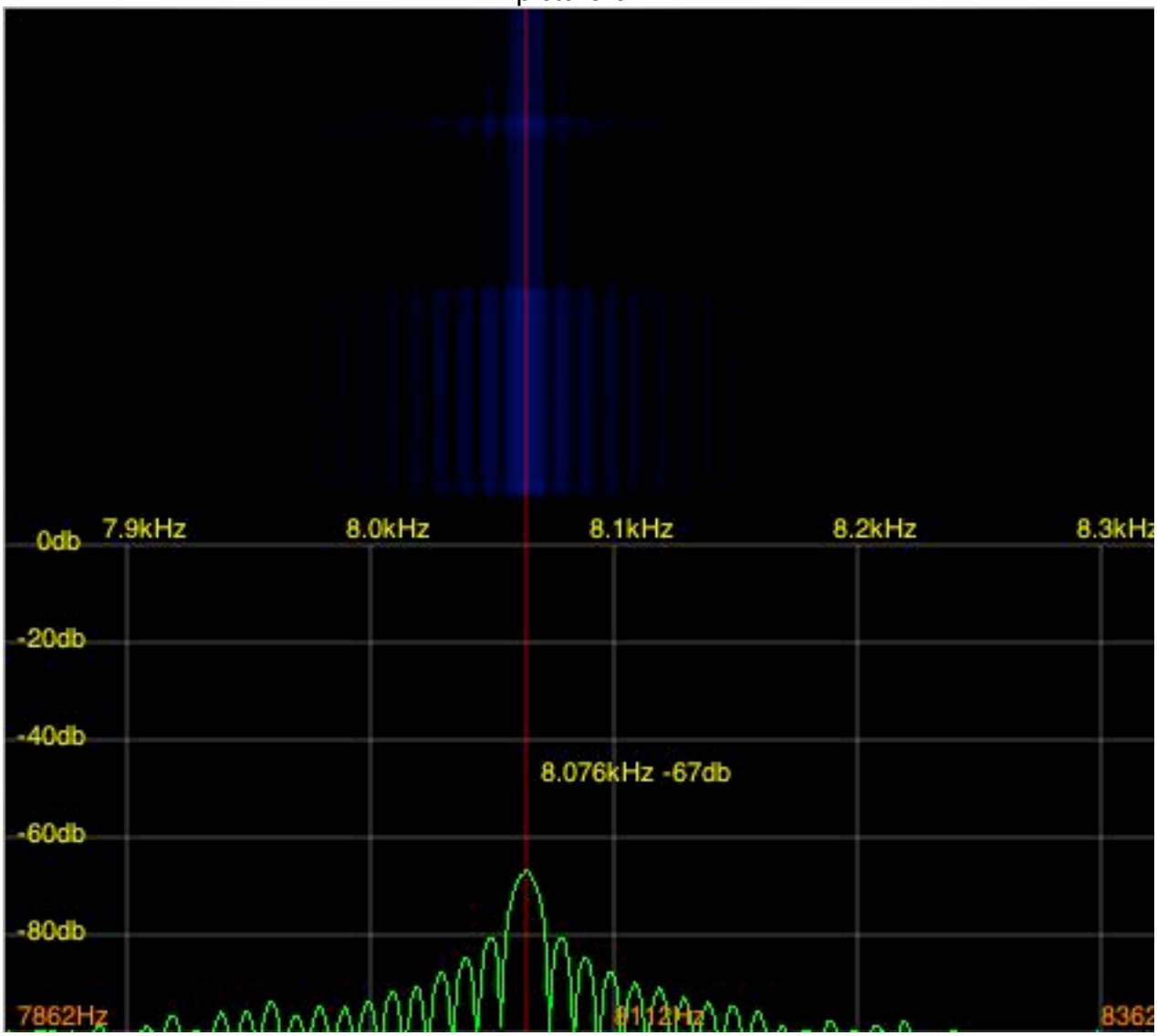
In FM mode with IF bandwidth set to 15 kHz, AF gain at minimum, (or just passing audio), Squelch open, I show roughly -81 dB

- picture 5 -



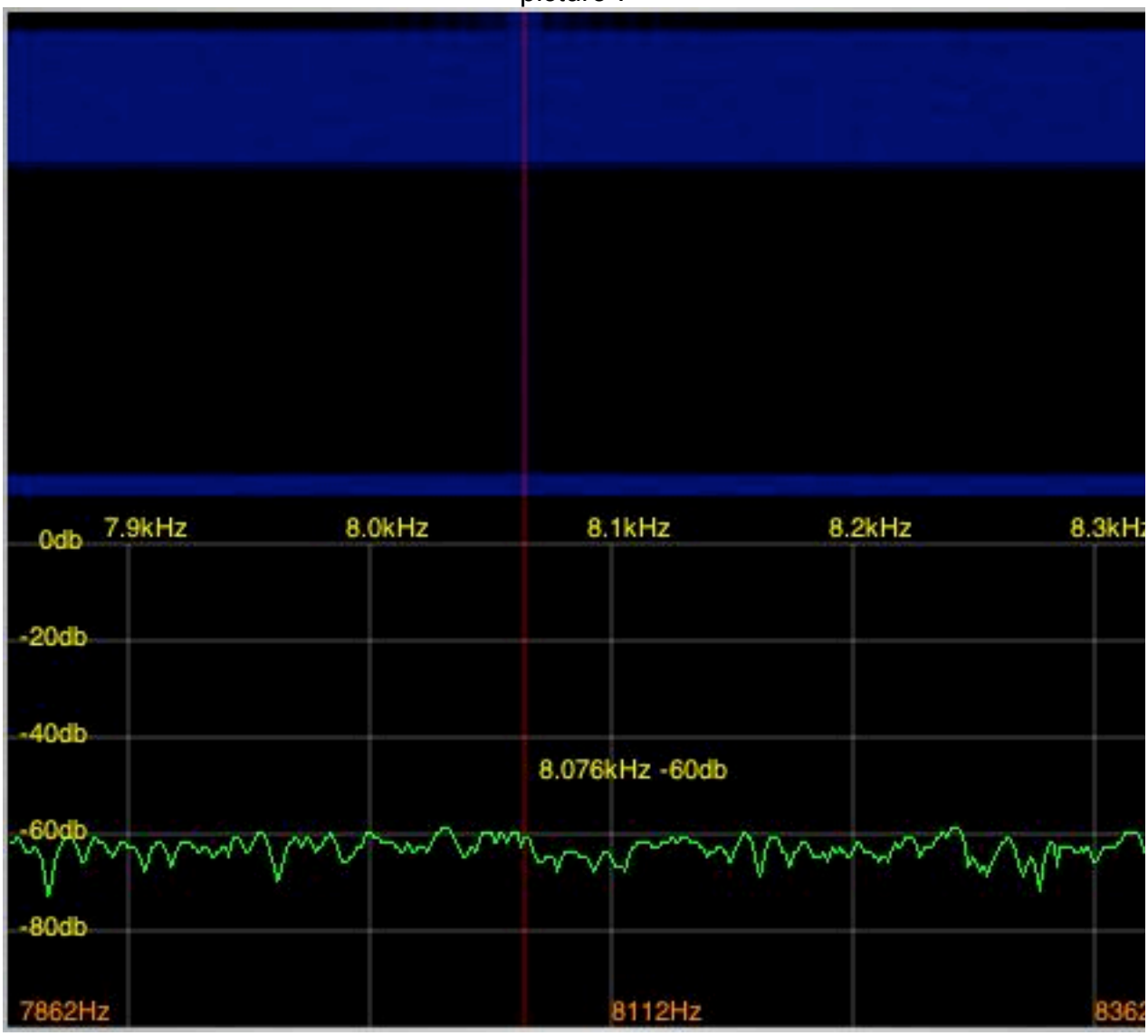
In WFM mode with IF bandwidth set to 280 kHz, (AGC-F*), AF gain at minimum, (or just passing audio), Squelch open, the tone is at -67 dB

- picture 6 -



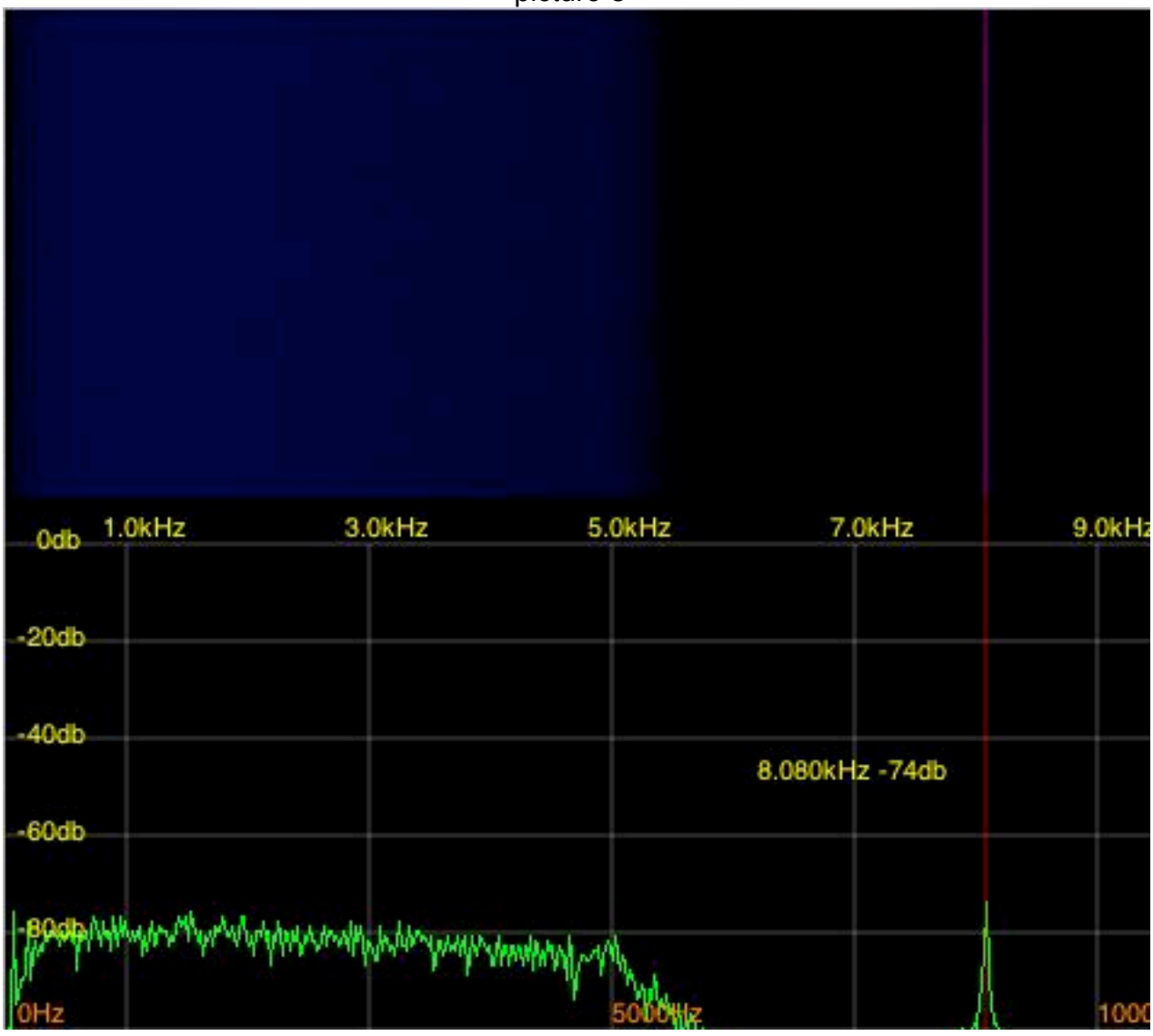
In AM mode with IF bandwidth set to 10 kHz, AF gain at maximum, (or fully clockwise), Squelch open, I show roughly -60 dB at the frequency in question**

- picture 7-



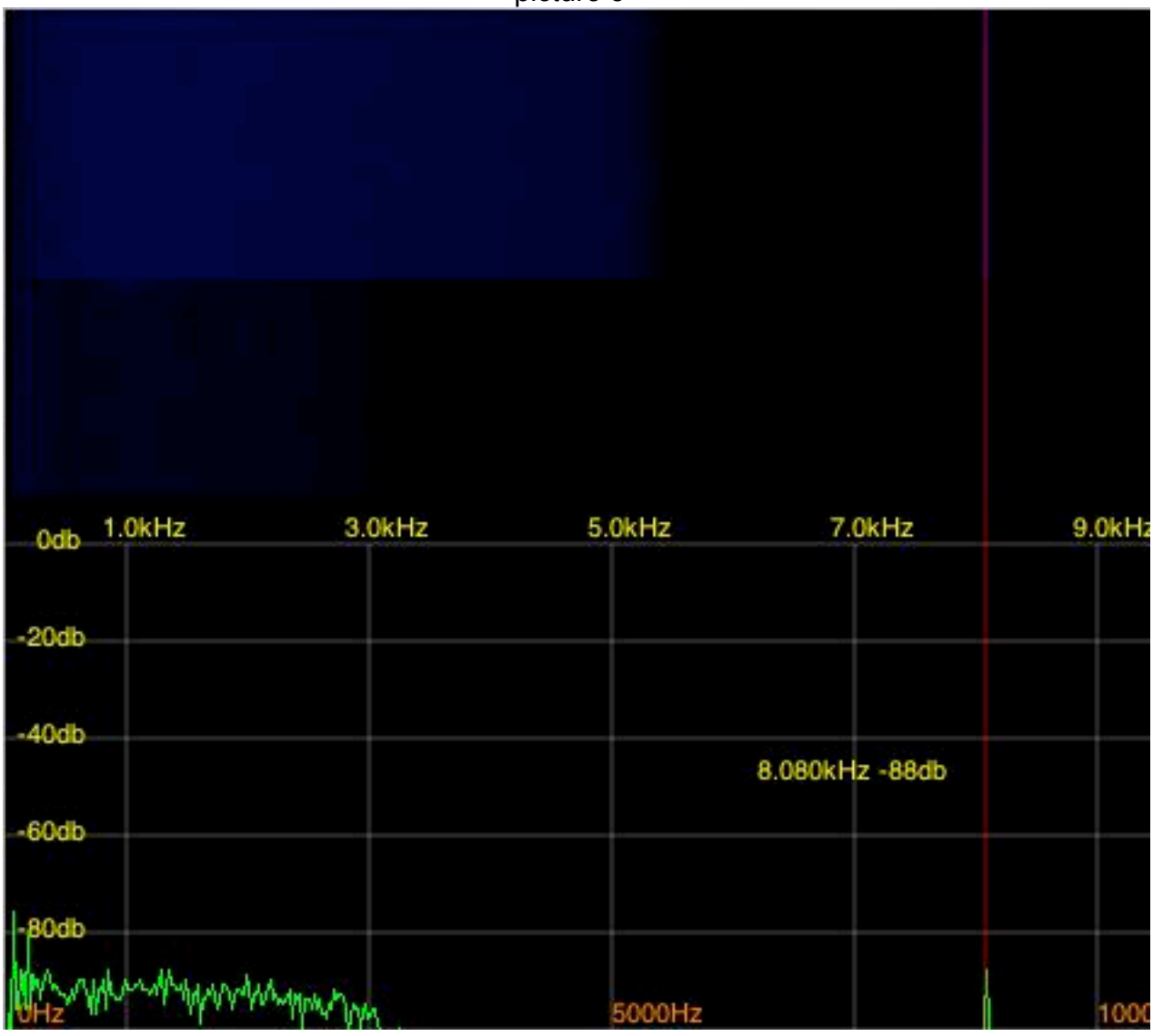
In AM mode with IF bandwidth set to 10 kHz, AF gain at typical listening volume, (or 9 o'clock), Squelch open, I show the tone at -74 dB***

- picture 8 -



In USB mode with IF bandwidth set to 3.6 kHz, AF gain at typical listening volume, (or 9 o'clock), Squelch open, I show roughly -88 dB***

- picture 9 -



Conclusions:
My initial estimate of 15 kHz was way off. As far as I can tell the frequency I'm hearing corresponds with the 8.076 kHz spike visible in many of the spectrum pictures above. The behavior follows what I'm hearing, and though I typically only notice the noise on AM and WFM, it is obviously present in all modes though at a reduced amplitude. Interestingly, it is even present when the volume is at zero (fully counter clockwise). According to these results there is a 14 to 15 dB difference in level between the modes where it is audible and those where it is not (or based on these results I should say where it is much less audible).

An additional factor to keep in mind is the tone is not affected by changes in the volume setting (other than the initial gain step where audio begins to be passed), so turning up the volume actually increases the received audio but does not change the amplitude of the high frequency tone. This can be observed in picture 7, where the AF gain is at maximum and the tone is obscured by the broadband noise.

Though these readings are relative, it is interesting to see that in several instances the tone appears to be only 7 dB down from the maximum output volume.

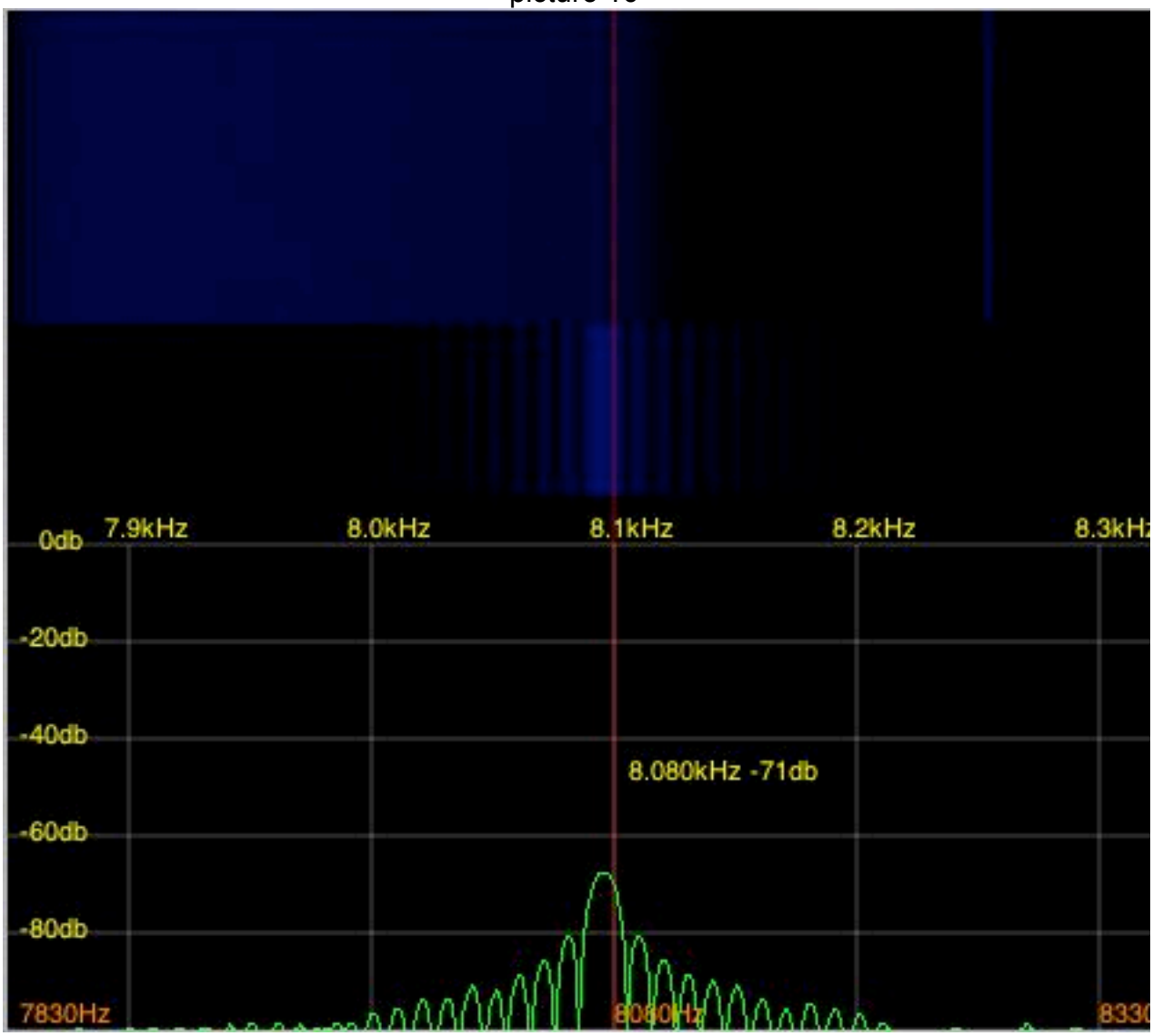
Suggestions for future analysis:
One of the problems with my test setup is an impedance mismatch between the speaker output and the line input of the computer. In retrospect I should have placed a proper terminating load in line with the speaker / headphone output. Another problem with this test was the lack of calibration of iSpectrum to an external, known, fixed reference value, such as 0.775 volts being 0 dBm (1mW) across 600Ω, etc. or preferably a lab quality Spectrum Analyzer should be used. Additionally, I did not test for any differences in tone output at the rear speaker jack, or the AF output from the ACC connector. Also, I did not test the effects (if any) of Mars/CAP and TVRO modification. I"m not sure how informative such testing would be, however it should probably be performed for the sake of completeness.

Notes:
* Apparently there is no way to set the AGC for WFM mode, it appears to be fixed at AGC-F. I'm not sure what the Fast value is in this case.

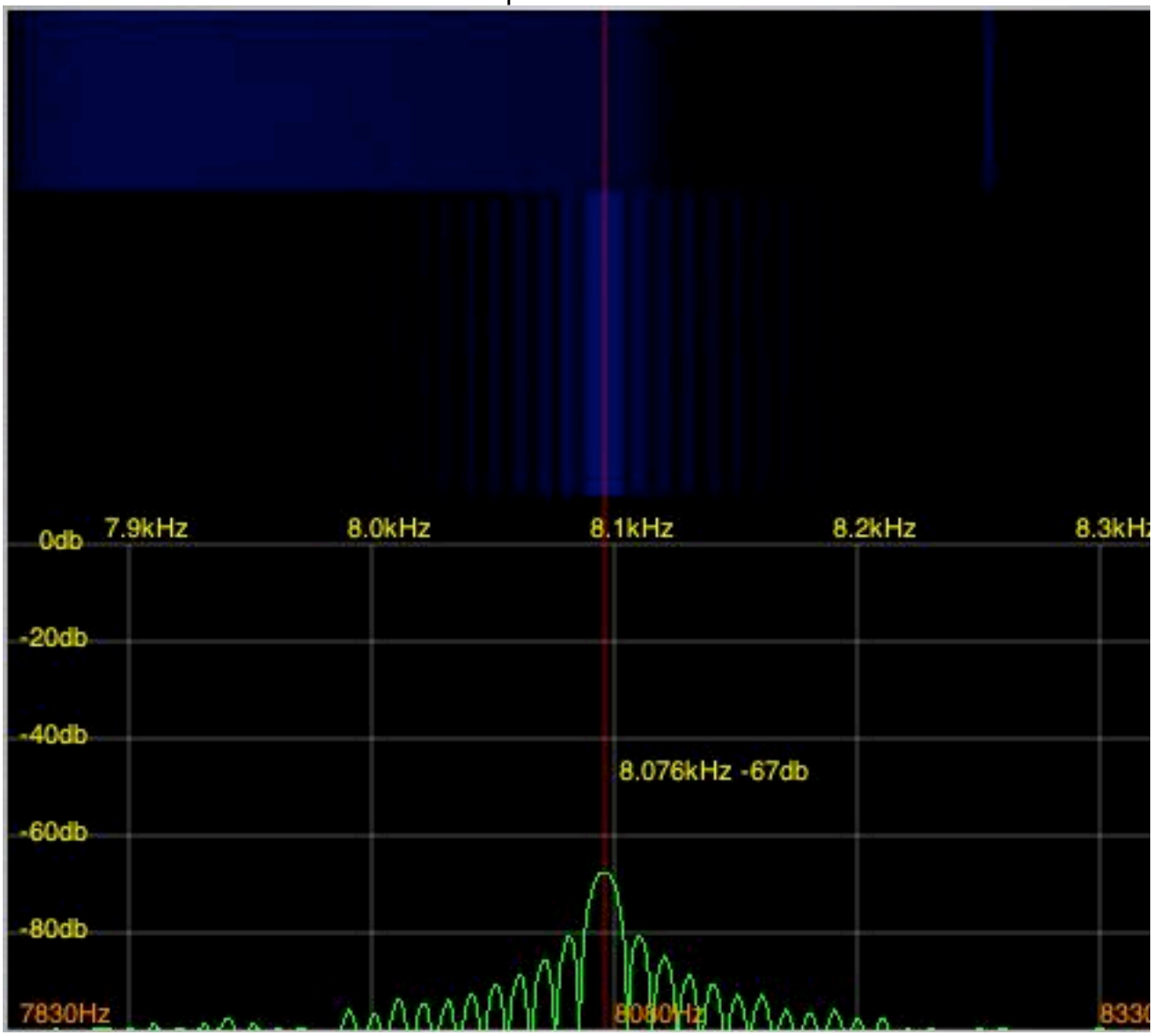
** The 8.076 kHz signal is obscured by the broadband noise from the AF gain set to maximum.

*** Due to a limitation in iSpectrum, at this scale I could not set the marker exactly to the previously used frequency of 8.076 kHz, thus the reading of -74 dB is likely due to the selected frequency (8.080 kHz) being slightly off the peak value. Picture 10 shows this in greater detail. In picture 11 I have moved the marker to the previously used frequency of 8.076 kHz, confirming my supposition.

- picture 10-


7.9kHz
8.0kHz
8.1kHz
8.2kHz
0db
-20db
-40db
-60db
-80db
8.080kHz -71db
7830Hz

- picture 11 -


7.9kHz
8.0kHz
8.1kHz
8.2kHz
0db
-20db
-40db
-60db
-80db
8.076kHz -67db
7830Hz