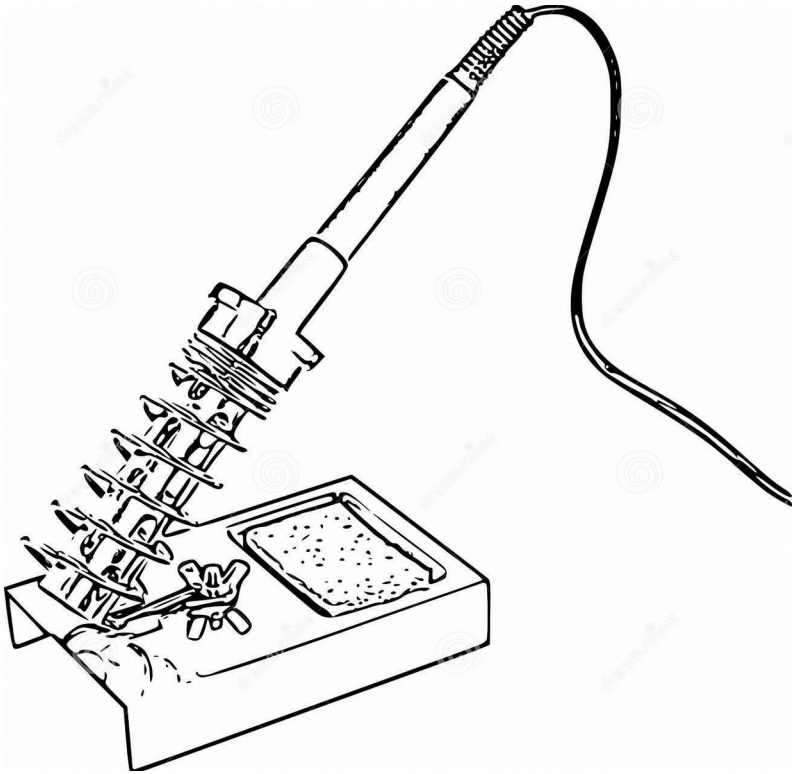
Kit Building Committee Report



Rich “FluxMan” Mitchell, N3III

Steve “FlipBits” Beckman, N3SB

October 12, 2018

UBITX Harmonics and Spurs

Reports seen on the BITX20 Group indicate that the uBITX is not meeting FCC Requirements for attenuation of spurious and harmonics (43 dB down from carrier.)

47 CFR Part 97 Section 97.307 (d) states:
For transmitters installed after January 1, 2003, the mean power of any spurious emission from a station transmitter or external RF power amplifier transmitting on a frequency below 30 MHz must be at least 43 dB below the mean power of the fundamental emission.

Update

- Modifications have been implemented on the uBITX to reduce harmonics and spurs:
  - A Daughter Board (designed by Gordon Gibby) has been added to the Low Pass Filter circuit, that switches filter inputs and outputs through separate relays, reducing harmonic leakage.
  - A 45 MHz filter and small impedance transformer (mod designed by Warren WA8TOD) have been added to the input of the last mixer to reduce overload from the high power amplifier, reducing spurs.

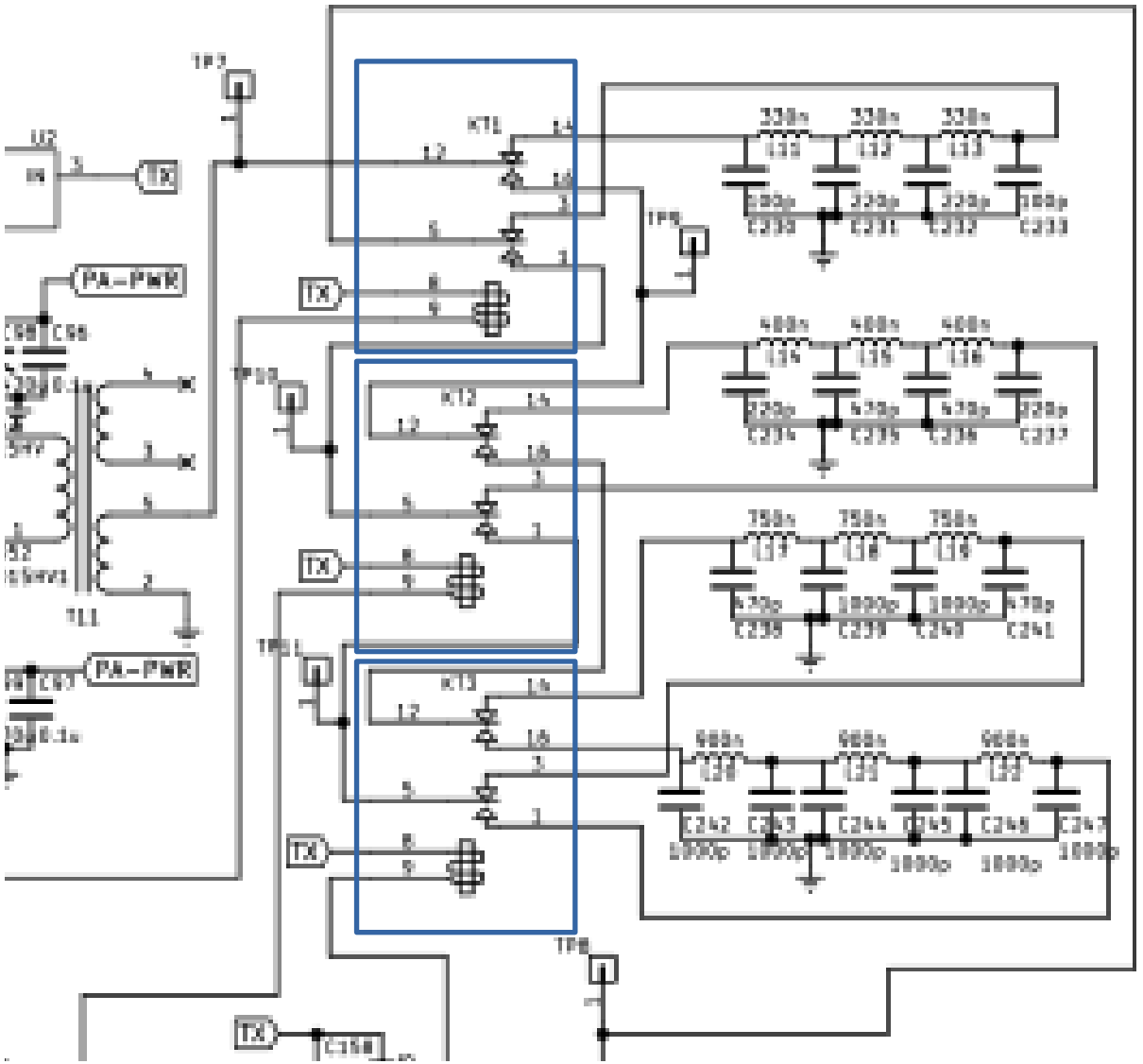
Test Result Summary - Stock

Band	SSB	CW
80	Good	Out of Spec Harmonics
40	Good	Out of Spec Harmonics
30	Out of Spec Harmonics & Spurs	Out of Spec Harmonics
20	Out of Spec Spurs	Good
17	Out of Spec Spurs	Out of Spec Harmonics
15	Out of Spec Spurs	Good
12	Out of Spec Spurs	Good
10	Good	Good

Test Result Summary - Modified

Band	SSB	CW
80	Good	Good
40	Good	Good
30	Good	Good
20	Good	Good
17	Good	Good
15	Good	Good
12	Good	Good
10	Good	Good

uBITX Low Pass Filters

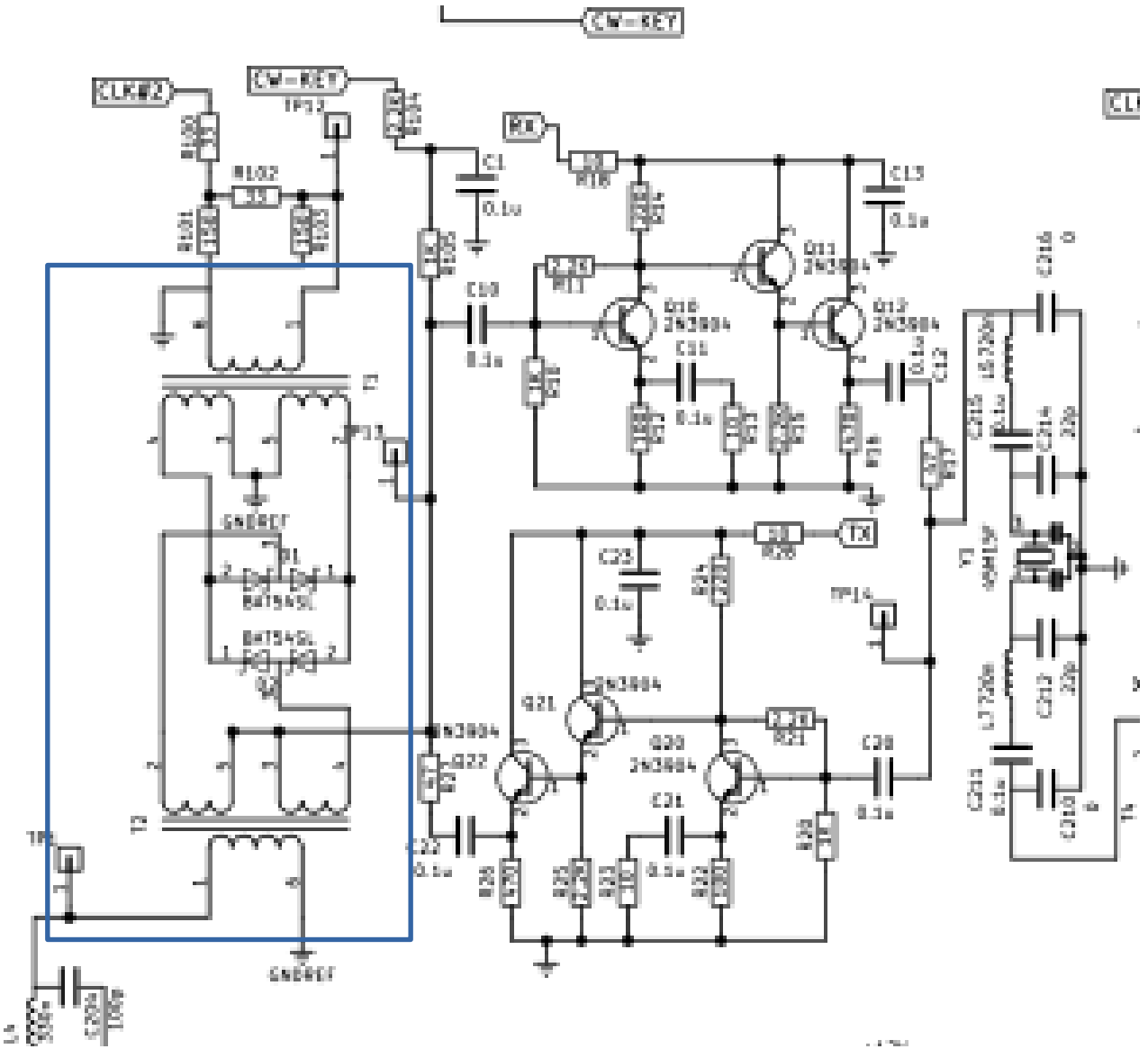


The stock low Pass Filter inputs and outputs for each frequency range are routed through the same, small relay. Capacitive coupling between the relay structures is limiting the effectiveness of the filters.

Adding a daughter board with three more relays to allow for switching of filter inputs and outputs using separate relays has been shown to fix the harmonic problem by eliminating this leakage path.

Note: The board tested was wired in using unshielded wire. Further improvements are expected when shielded coax is used to connect this daughter board to the uBITX.

uBITX Transmit Mixer



The stock 45 MHz Transmit Mixer is picking up RF energy from the transmitter final amplifier, and is being overloaded, resulting in spurs.

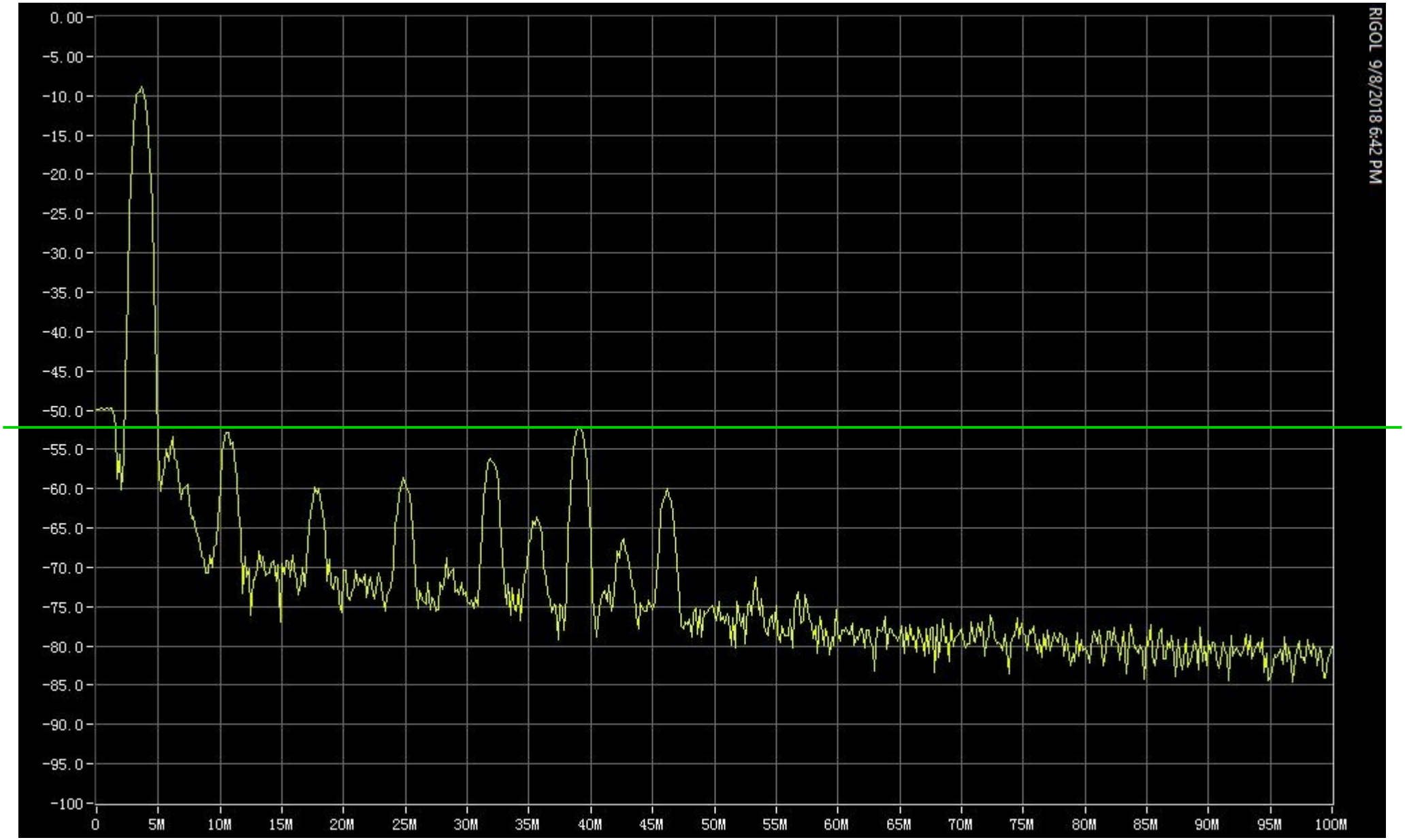
Adding a 45 MHz filter has been shown to reduce the spurs.

Note: An alternative solution, replacing L5 and L7 – currently toroids – with chip inductors, has recently been proposed. Parts have been ordered, but this solution has not yet been tested.

Recap
uBITX measurements
prior to modifications

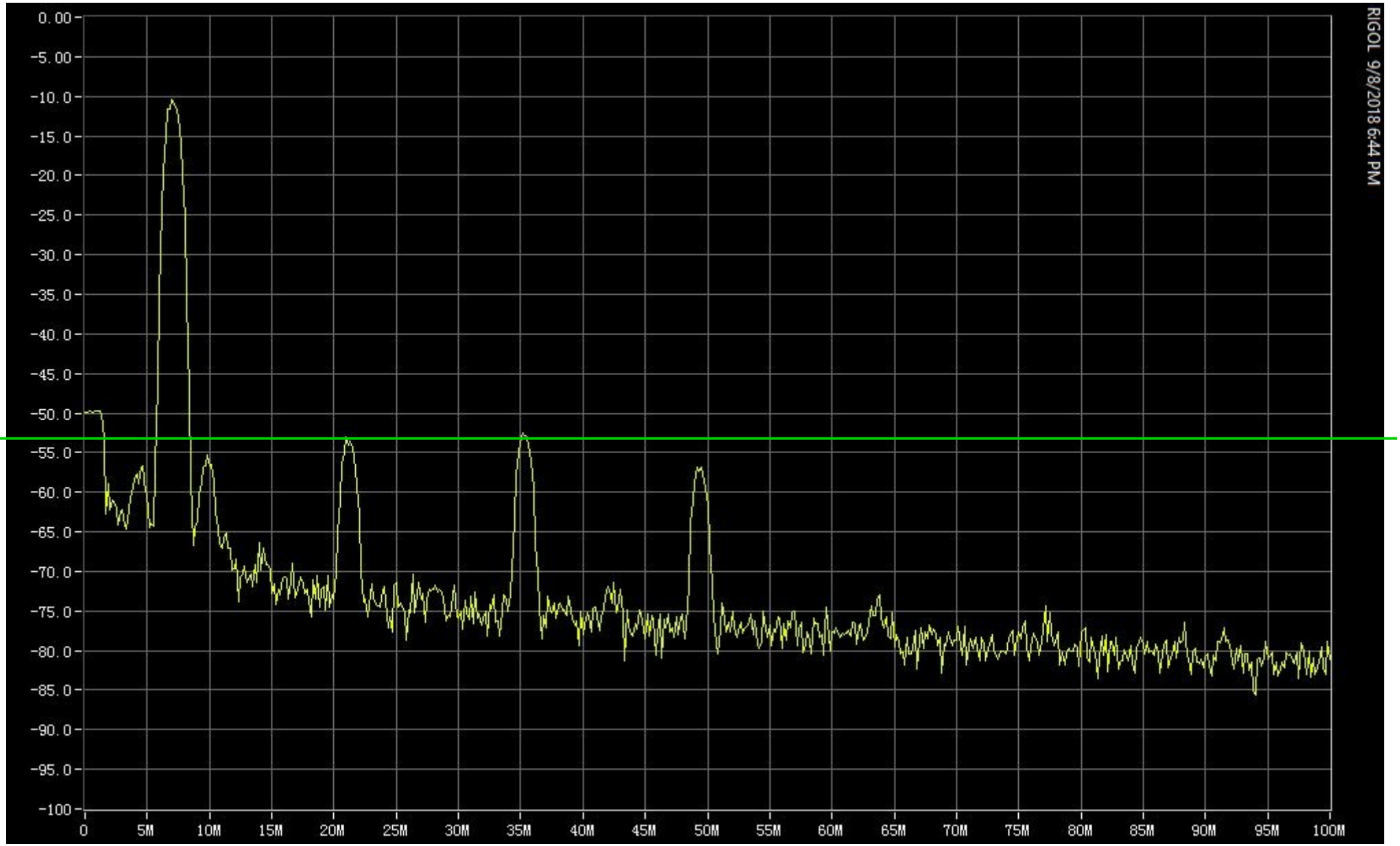
OK

80M SSB Stock



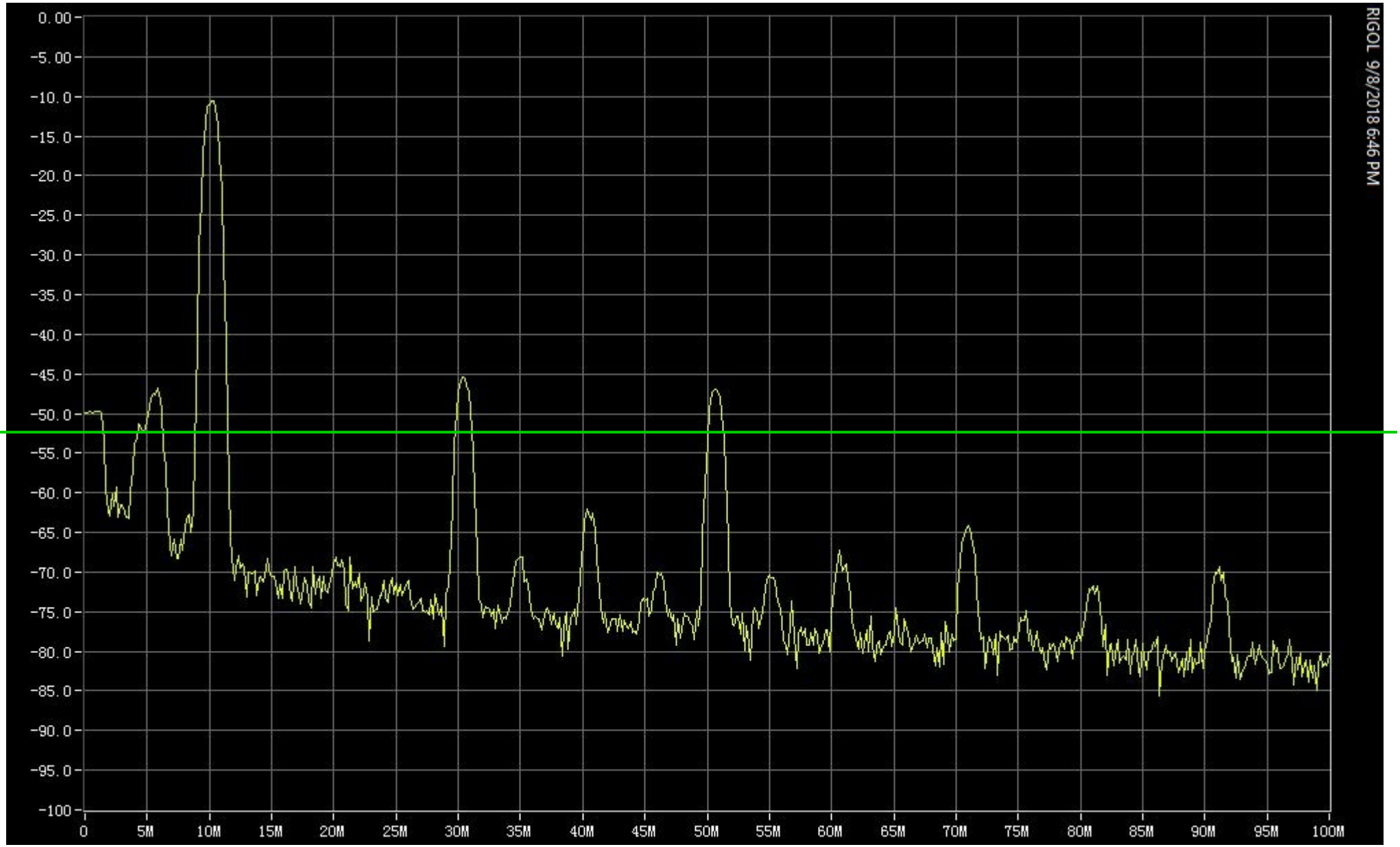
OK

40M SSB Stock



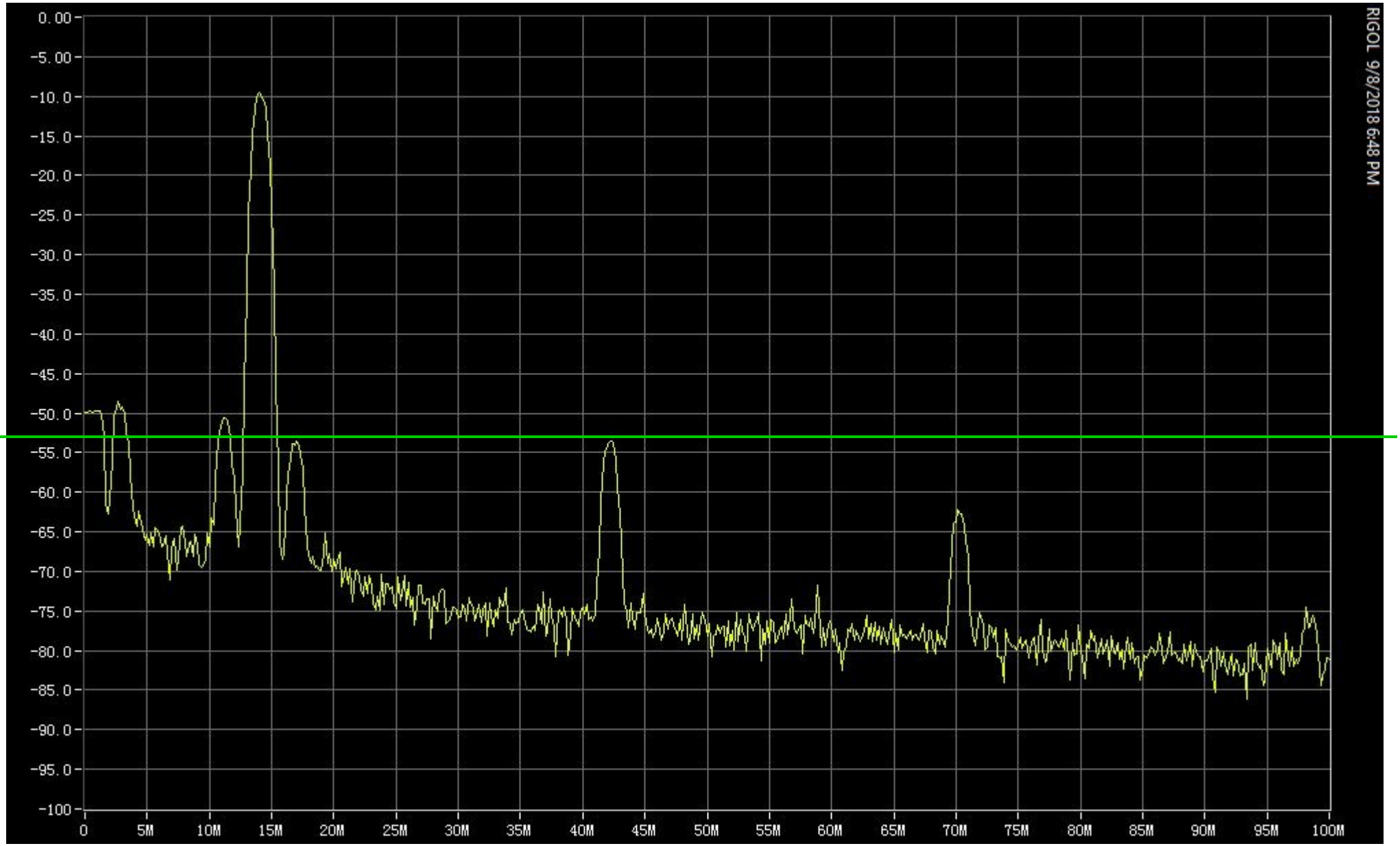
Out of Spec

30M SSB Stock



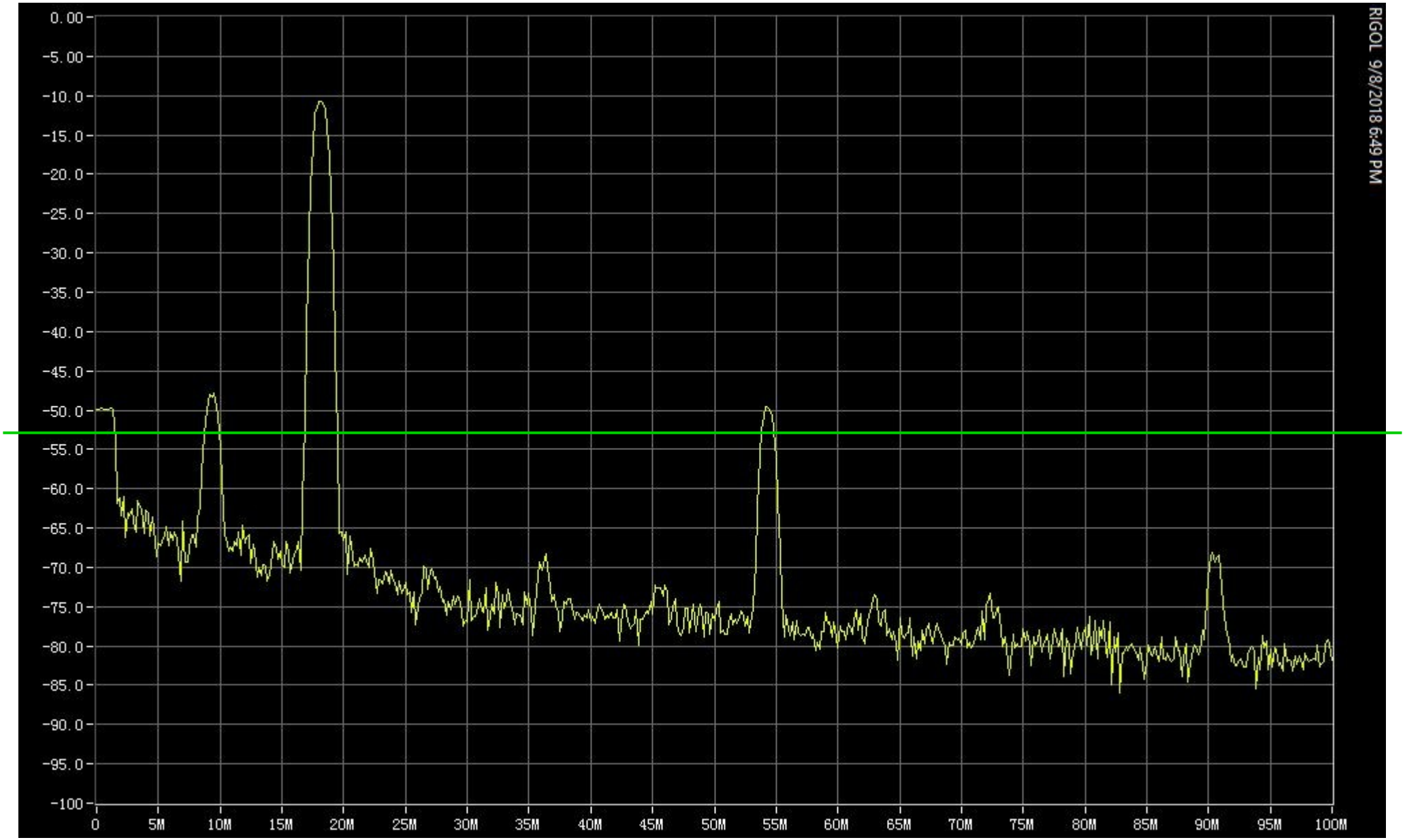
Out of Spec

20M SSB Stock



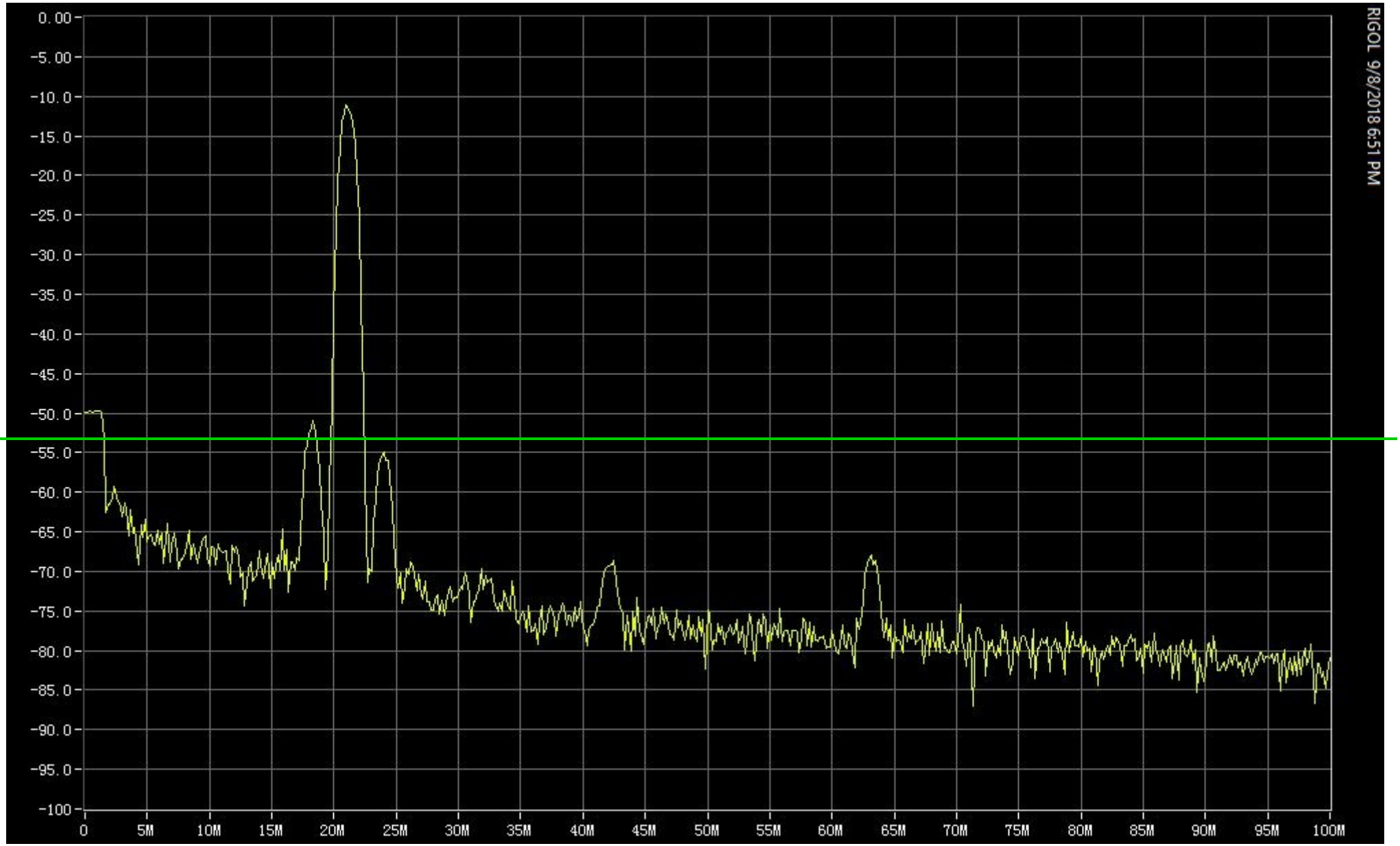
Out of Spec

17M SSB Stock



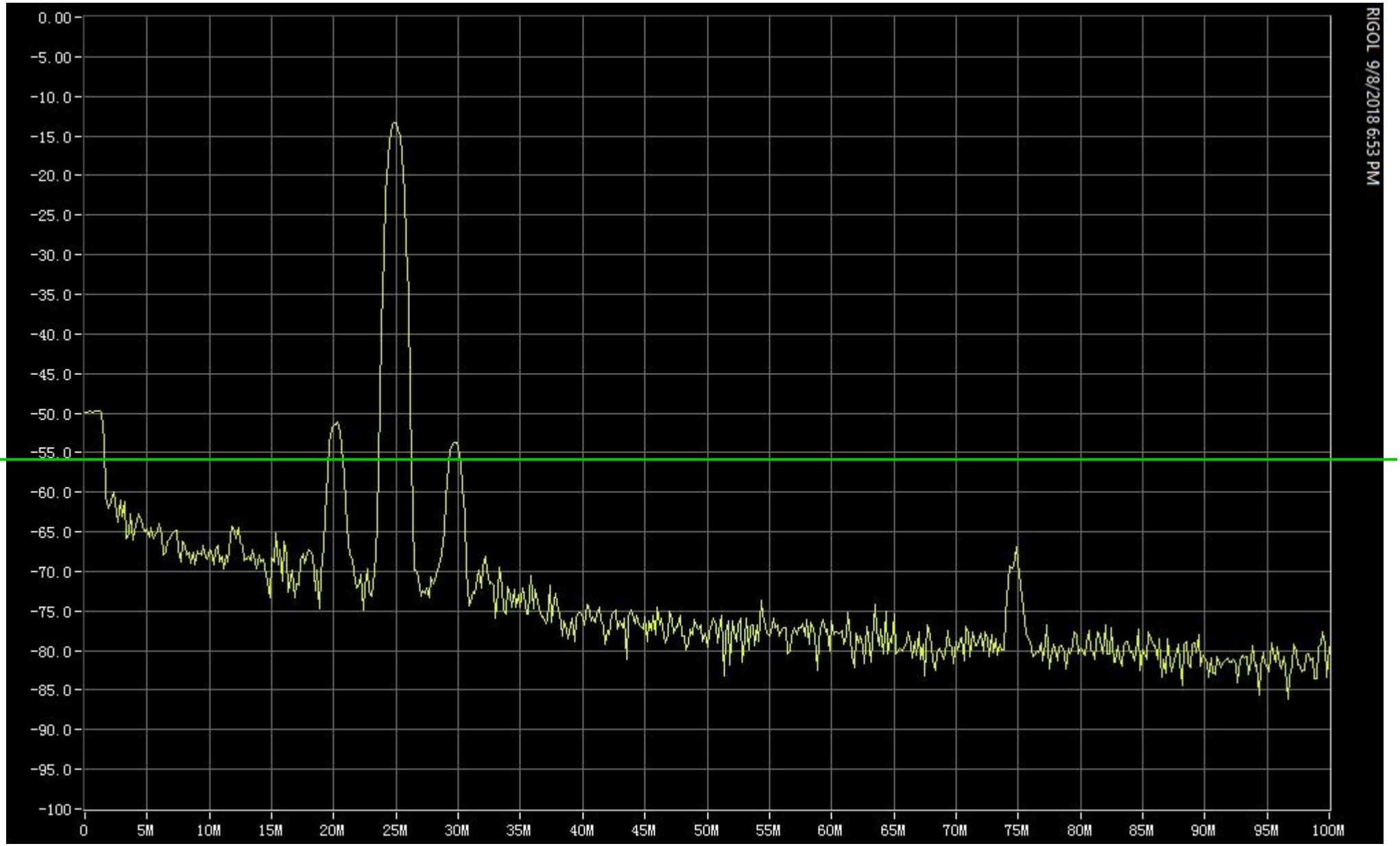
Out of Spec

15M SSB Stock



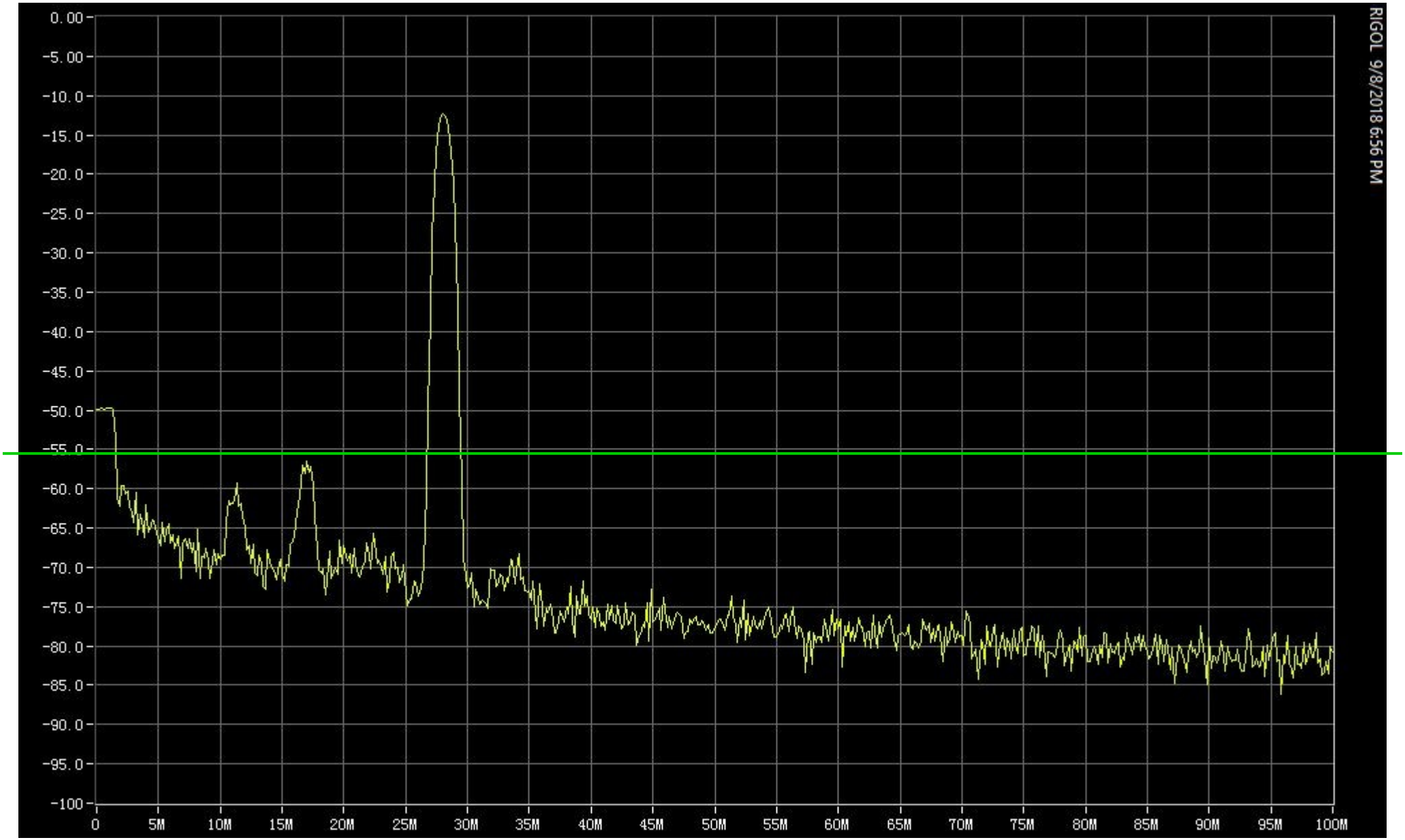
Out of Spec

12M SSB Stock



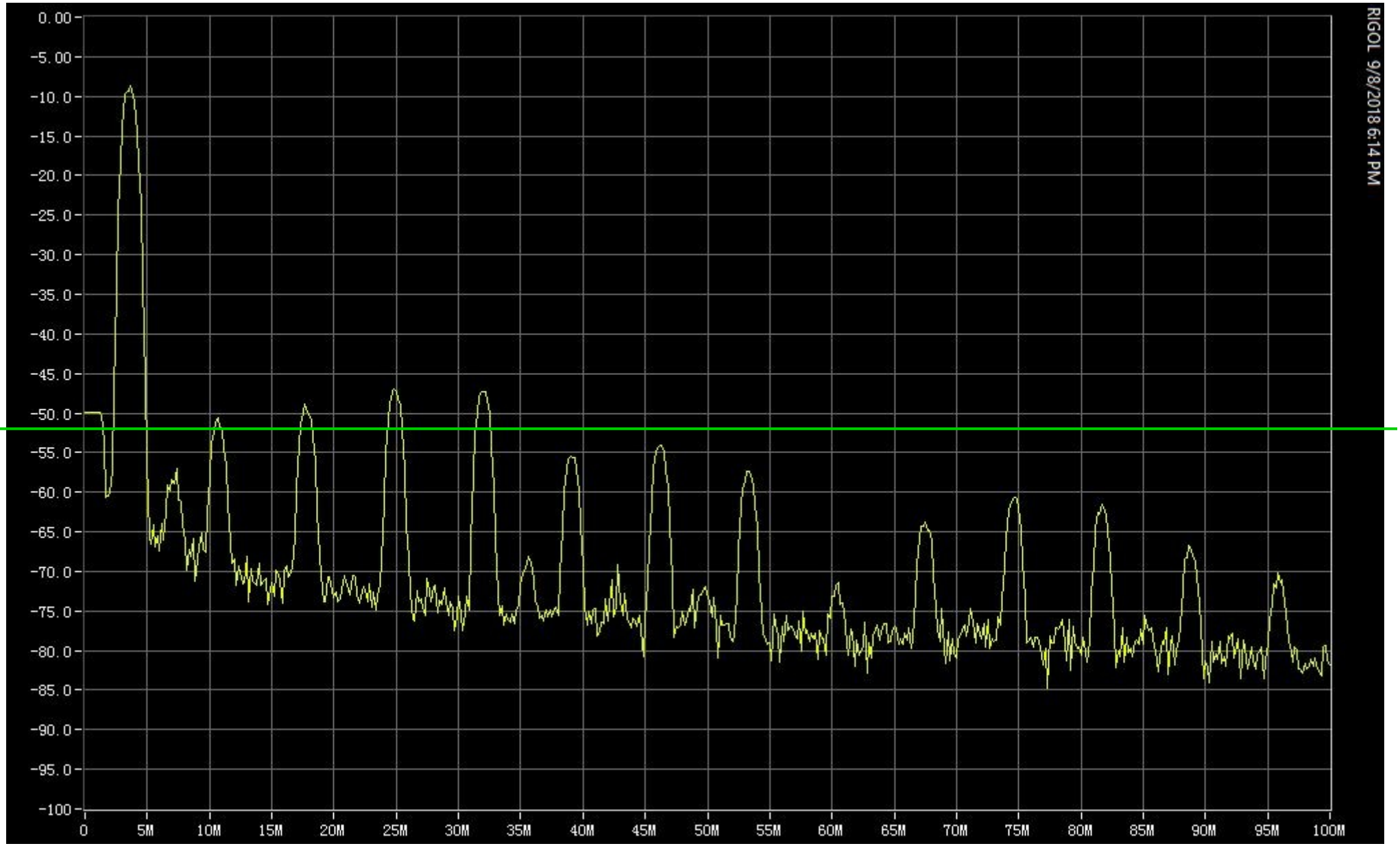
OK

10M SSB Stock



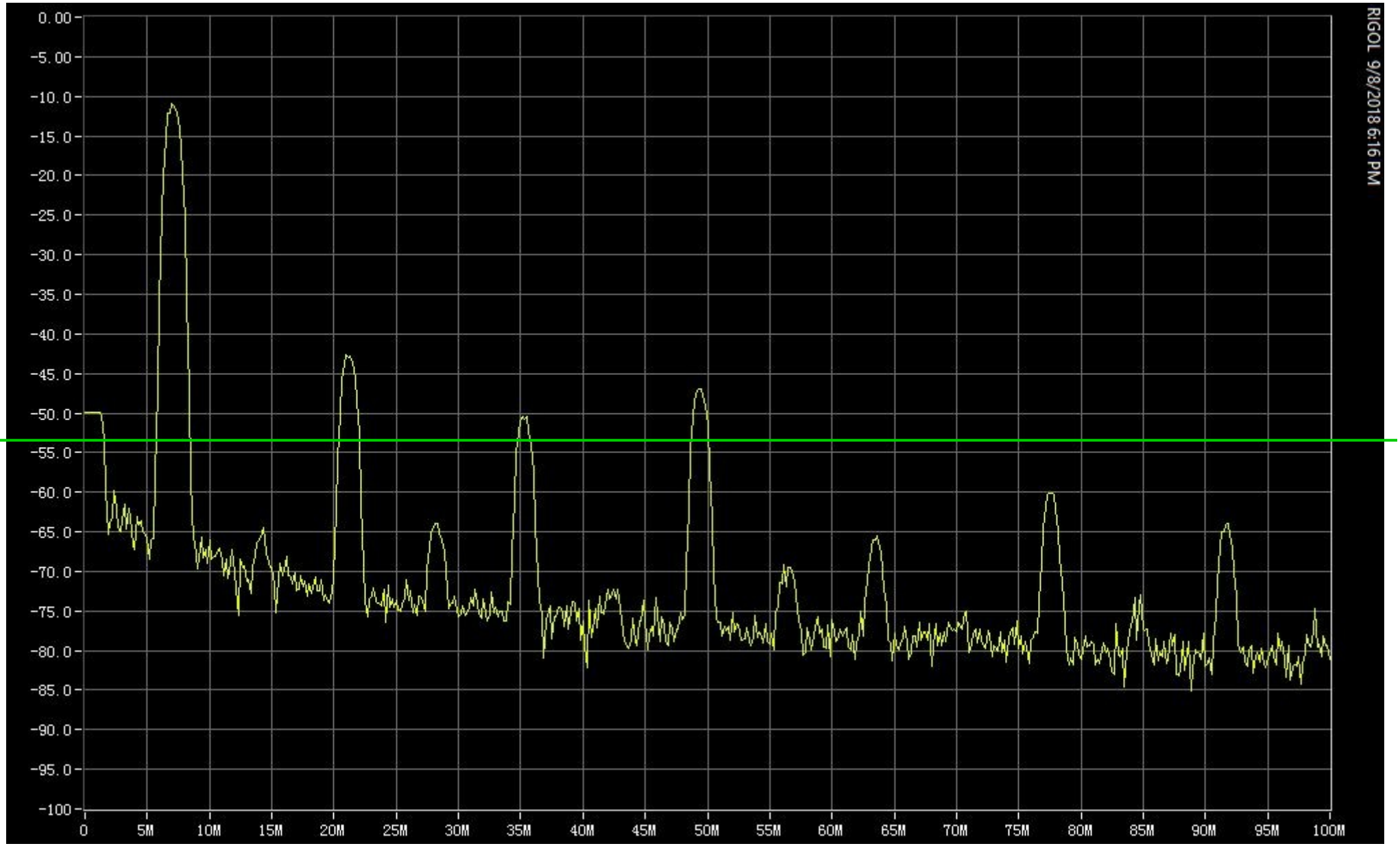
Out of Spec

80M CW Stock



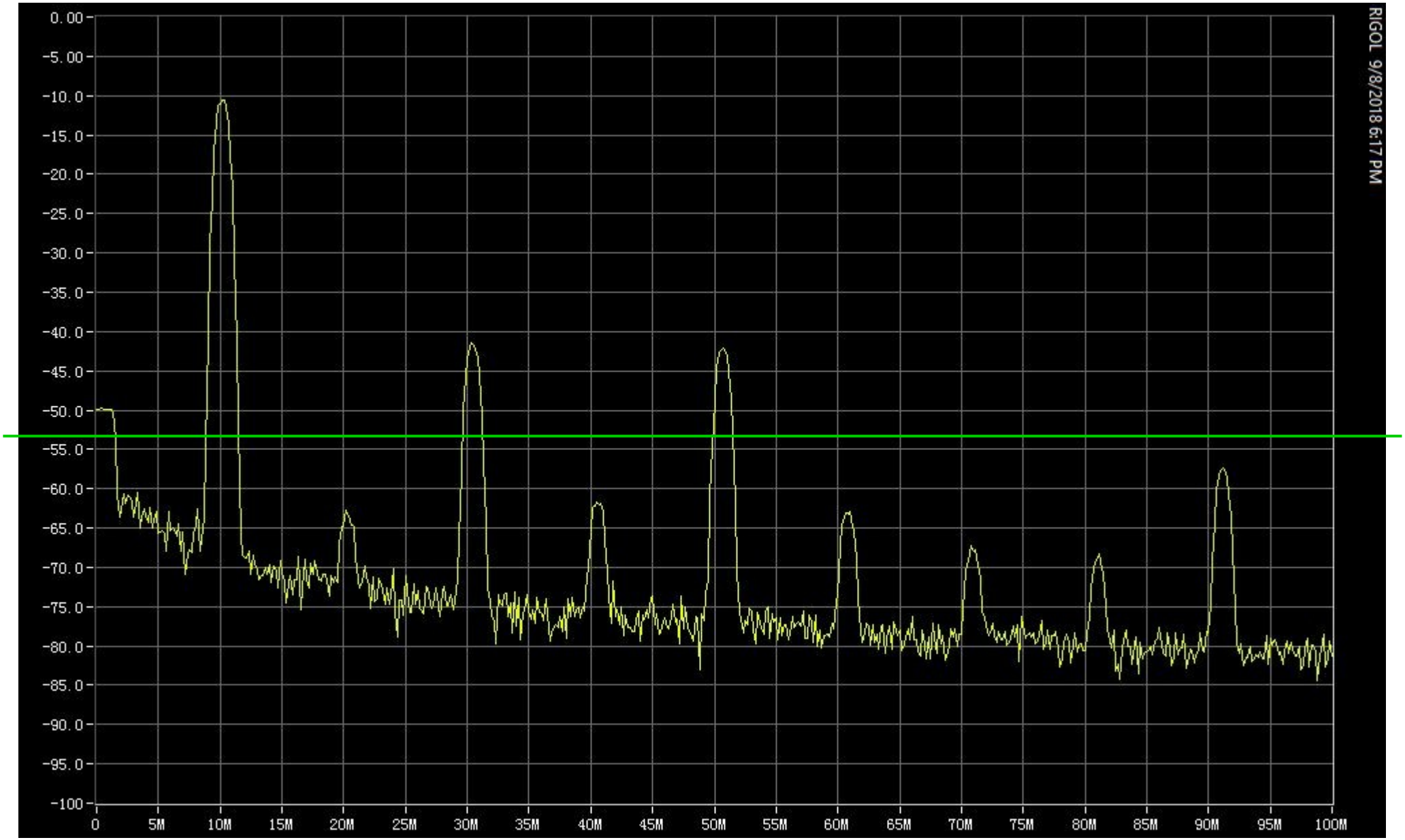
Out of Spec

40M CW Stock



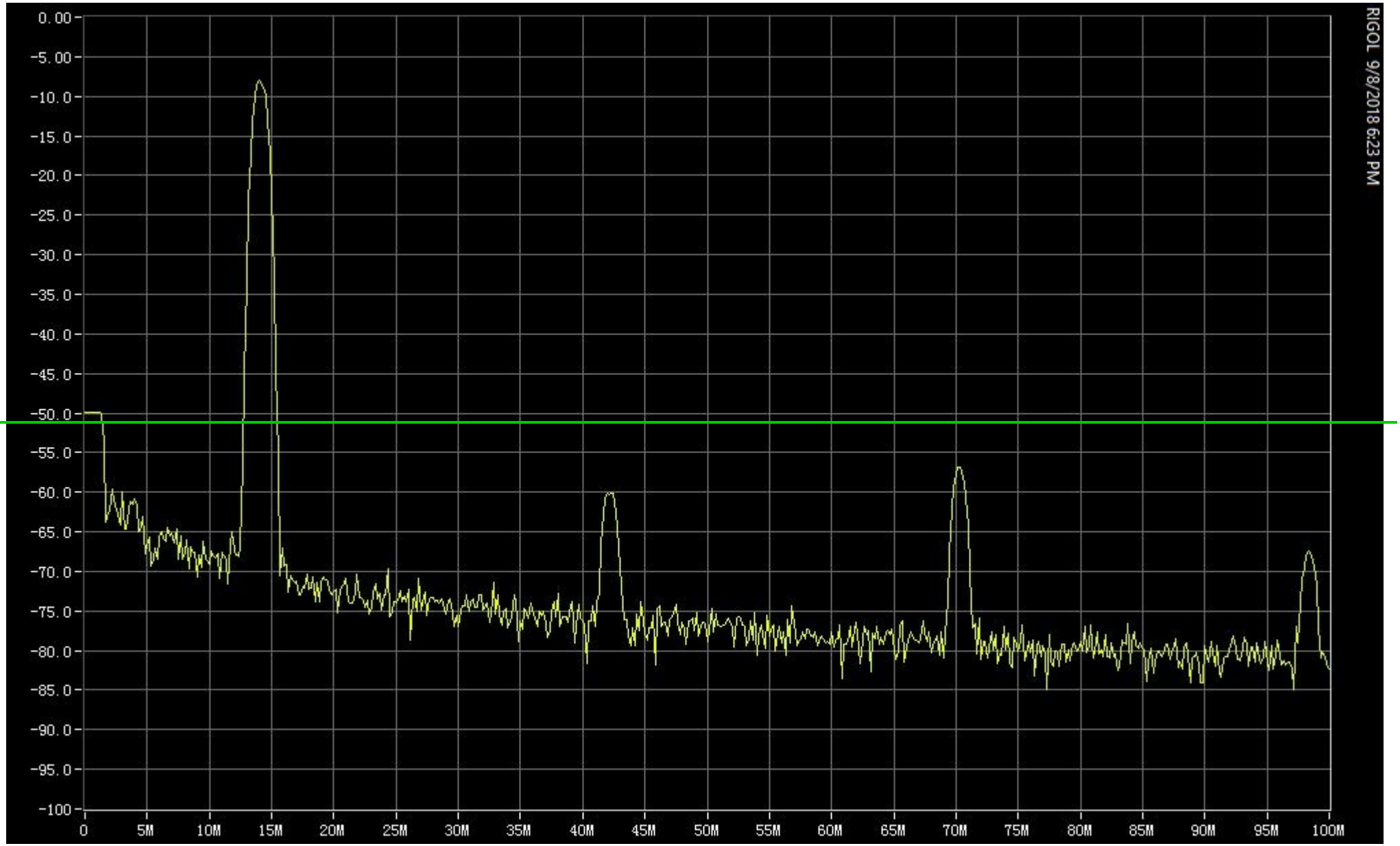
Out of Spec

30M CW Stock



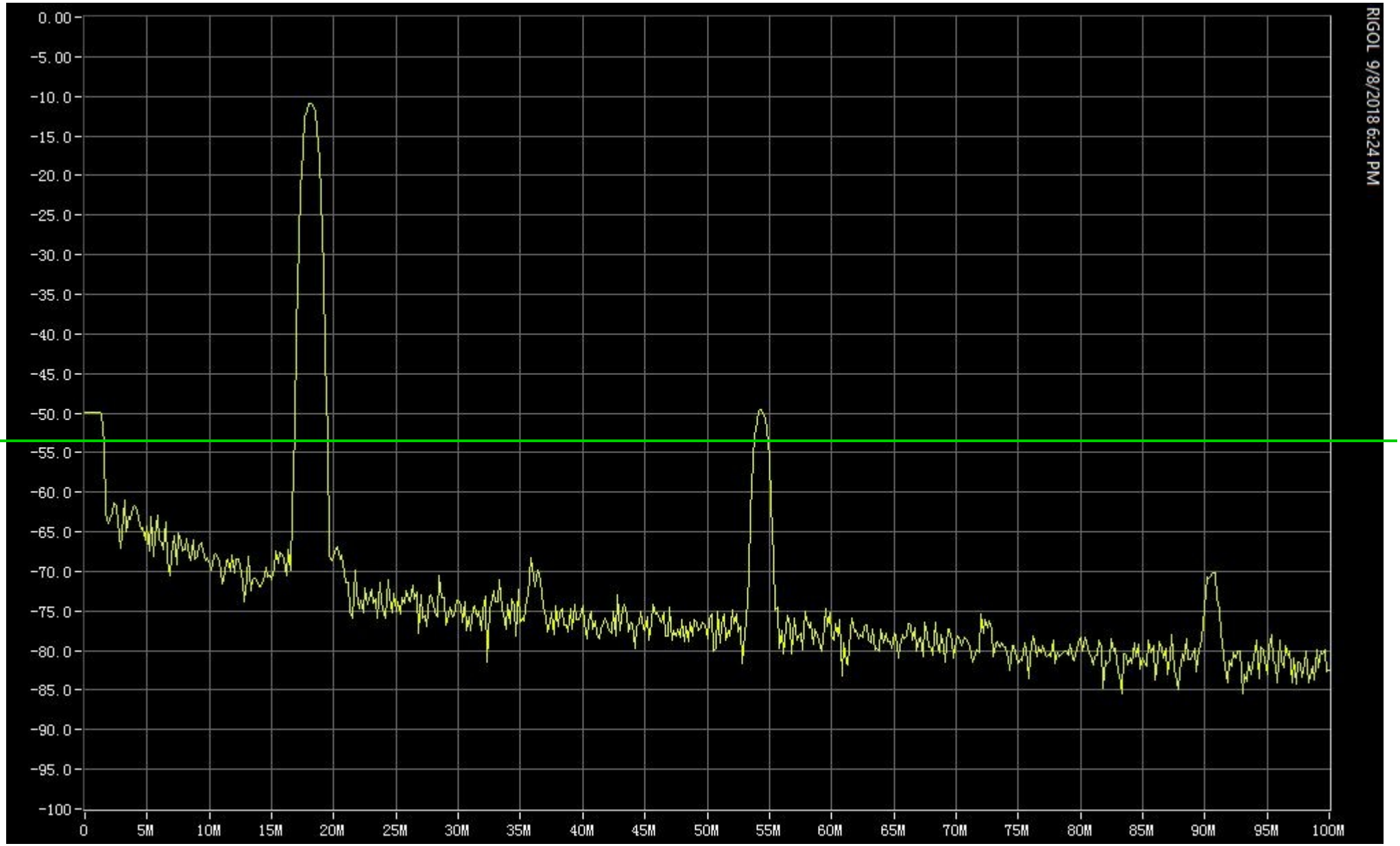
OK

20M CW Stock



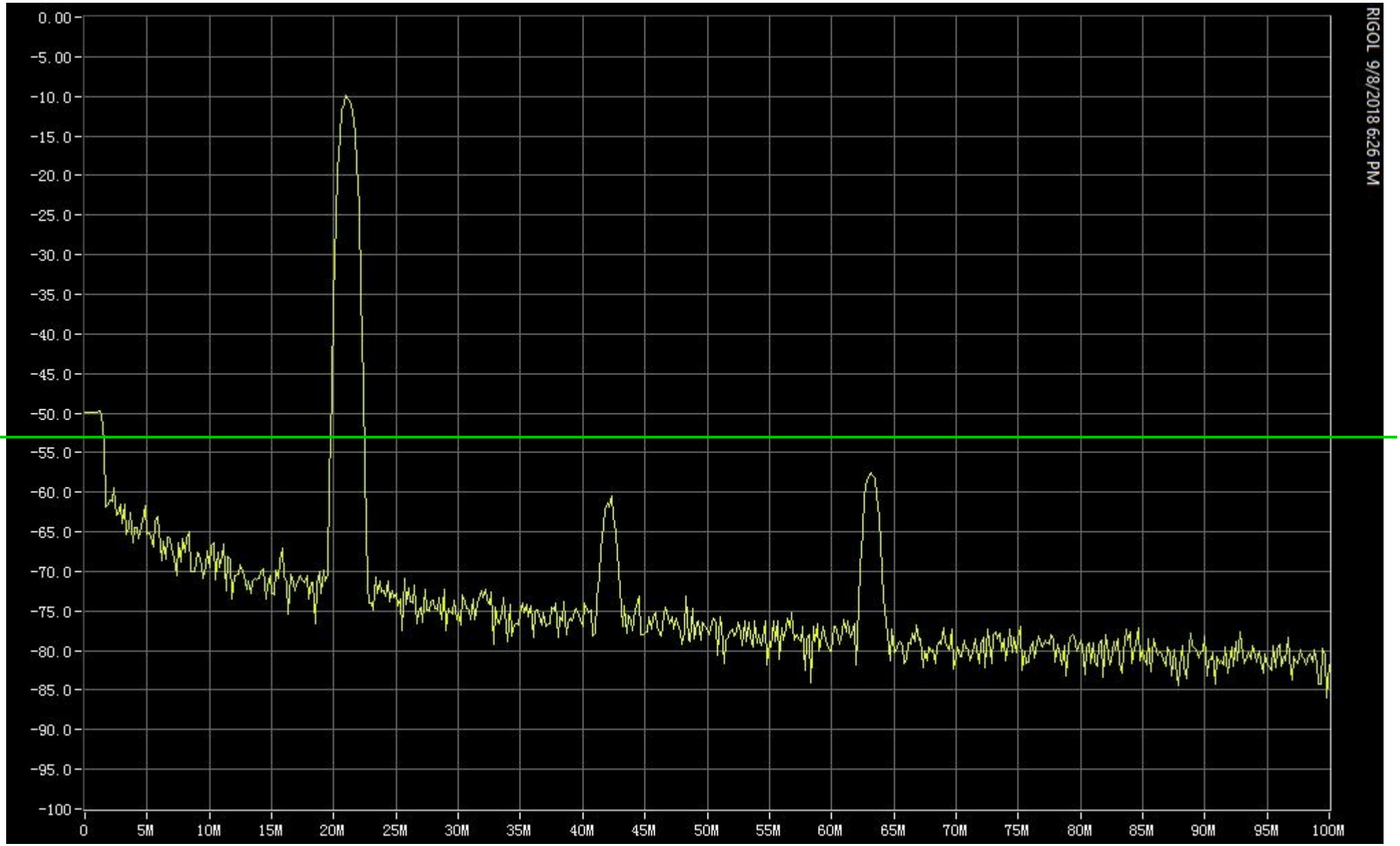
Out of Spec

17M CW Stock



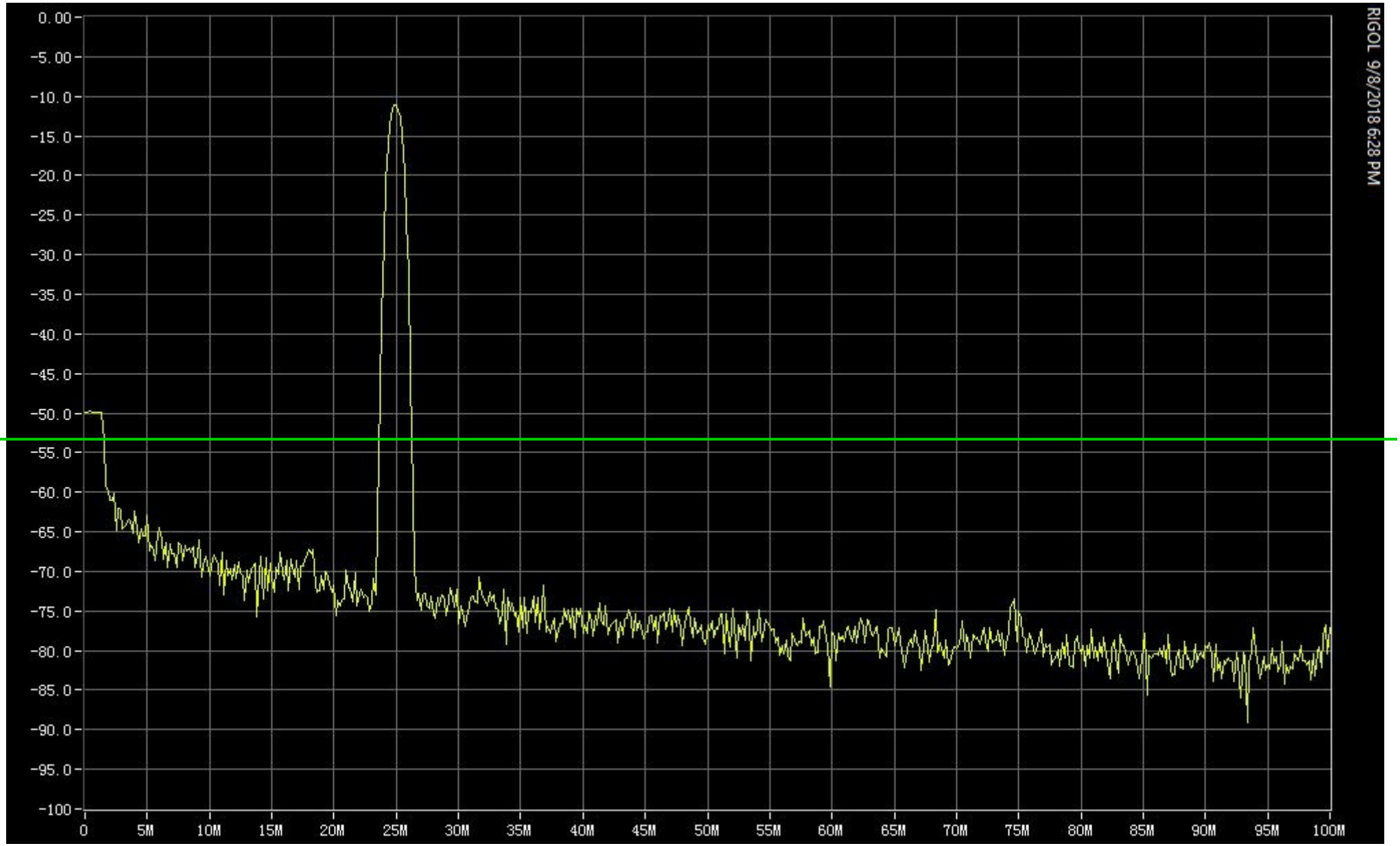
OK

15M CW Stock



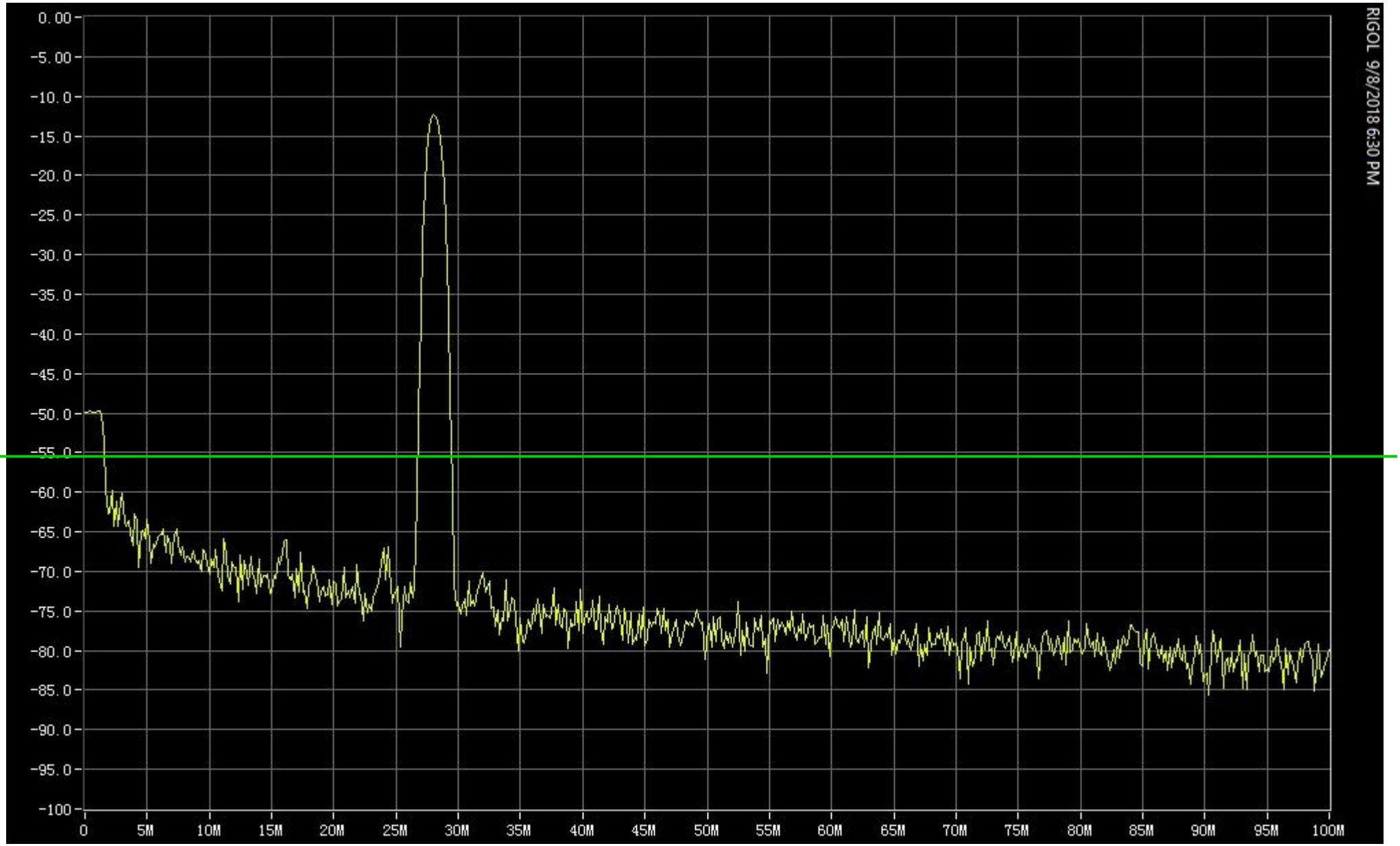
OK

12M CW Stock



OK

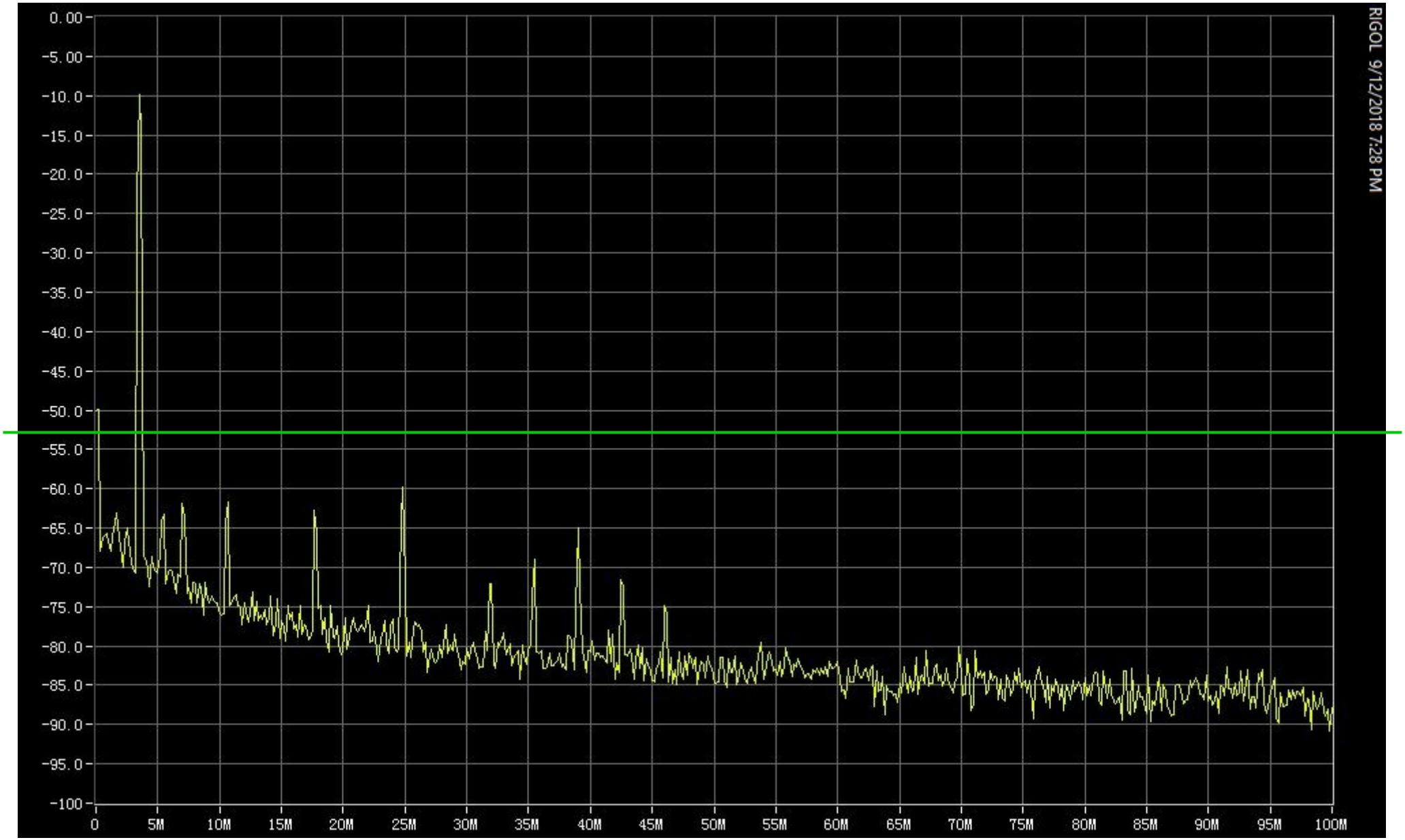
10M CW Stock



uBITX measurements after modifications

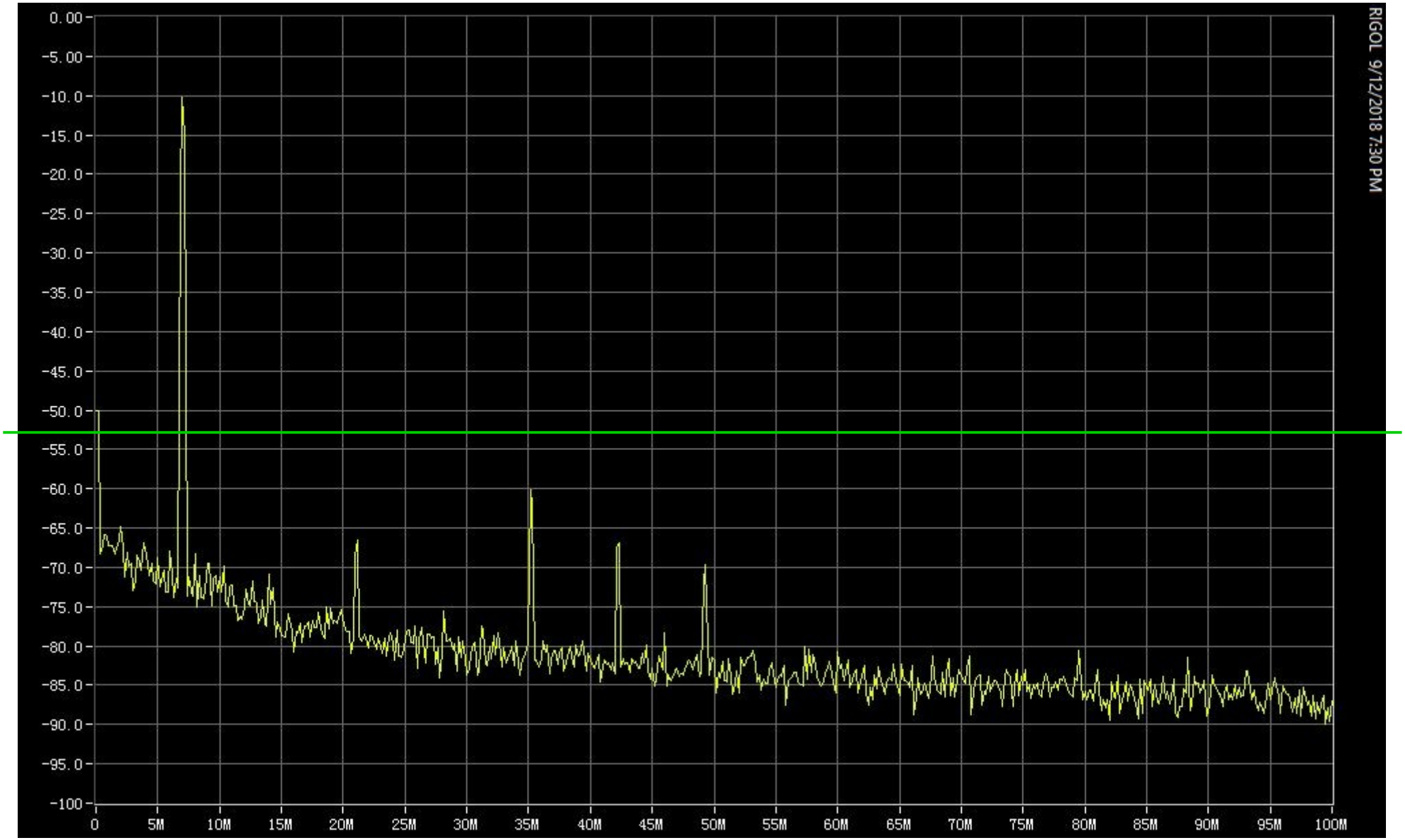
OK

80M SSB Modified



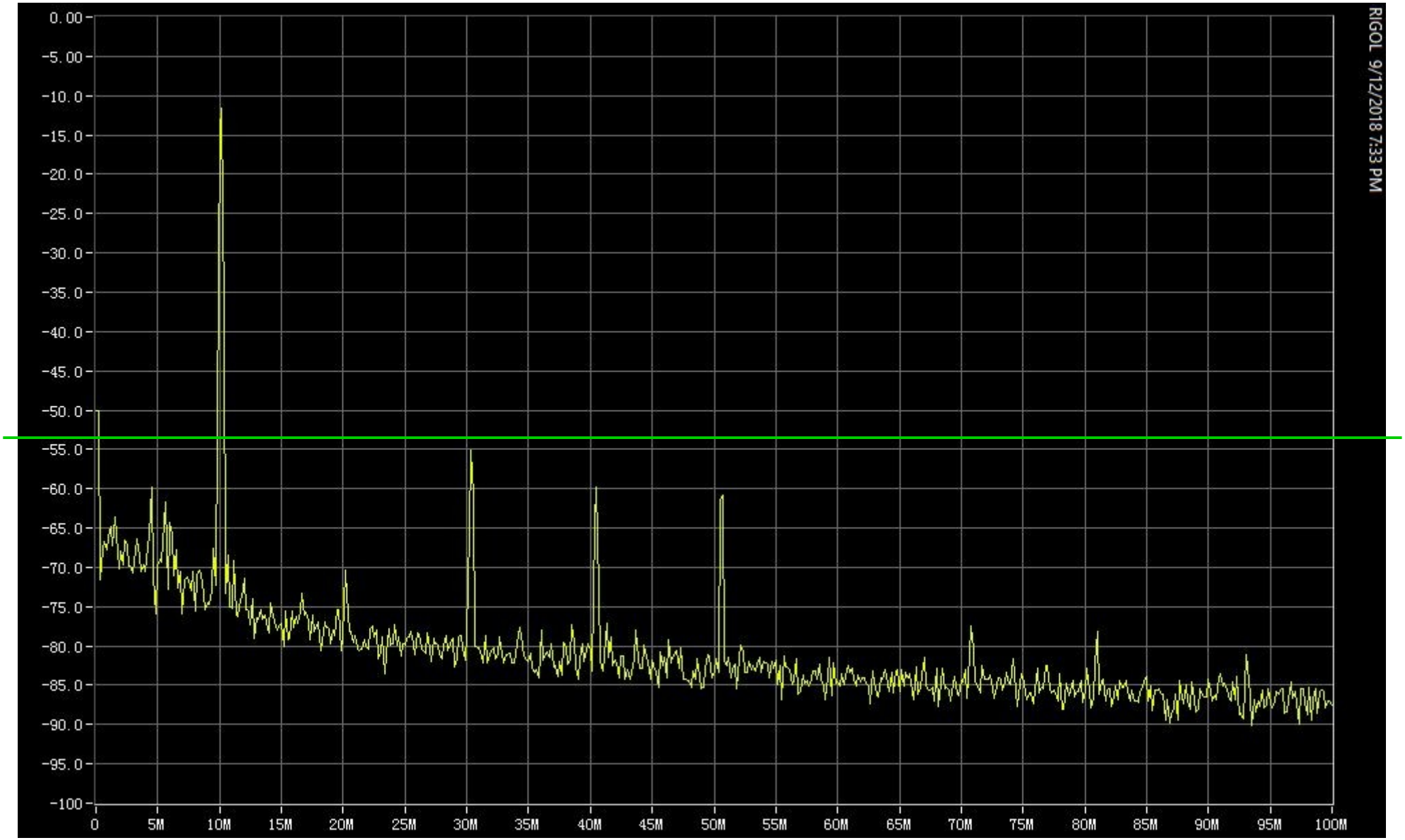
OK

40M SSB Modified



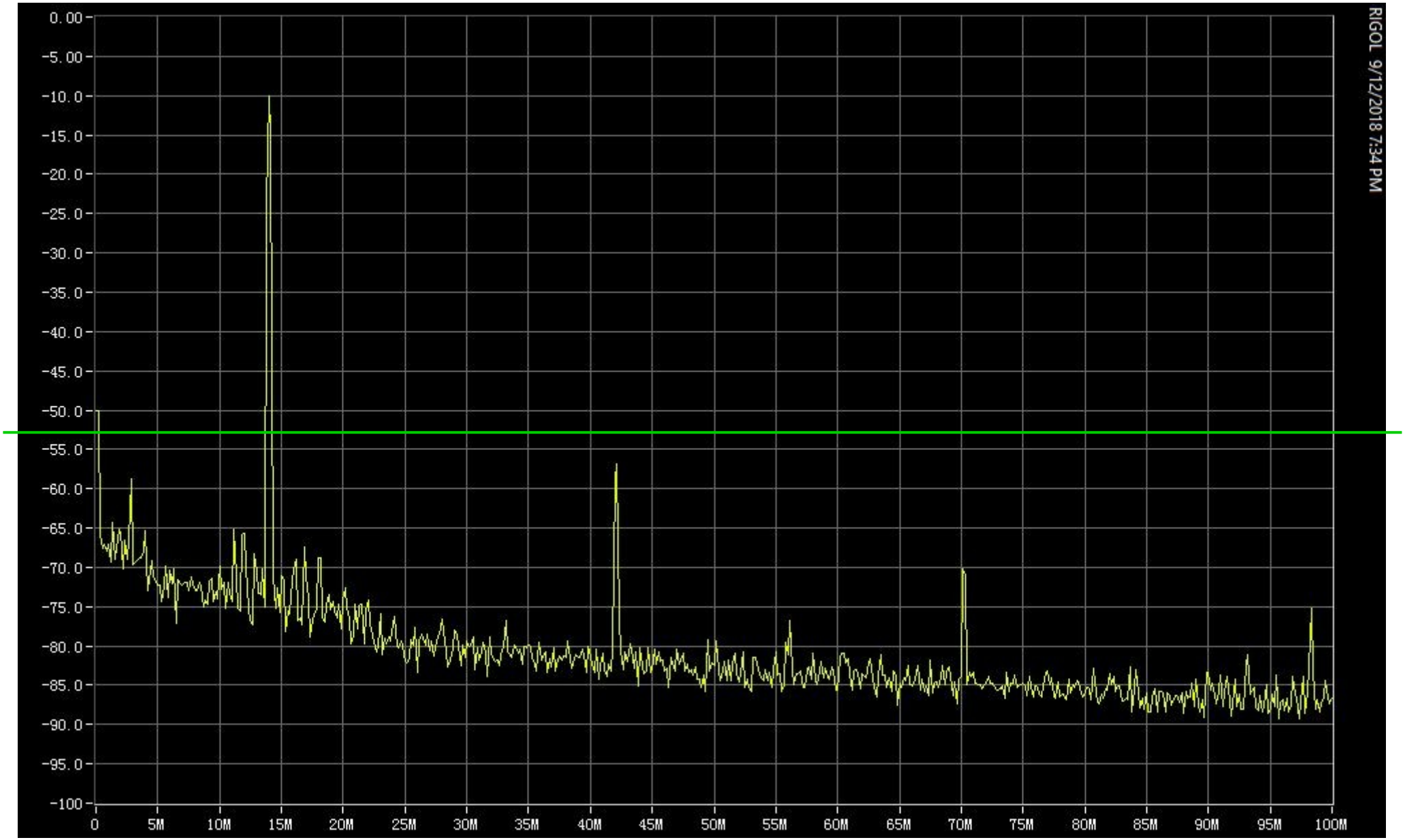
OK

30M SSB Modified



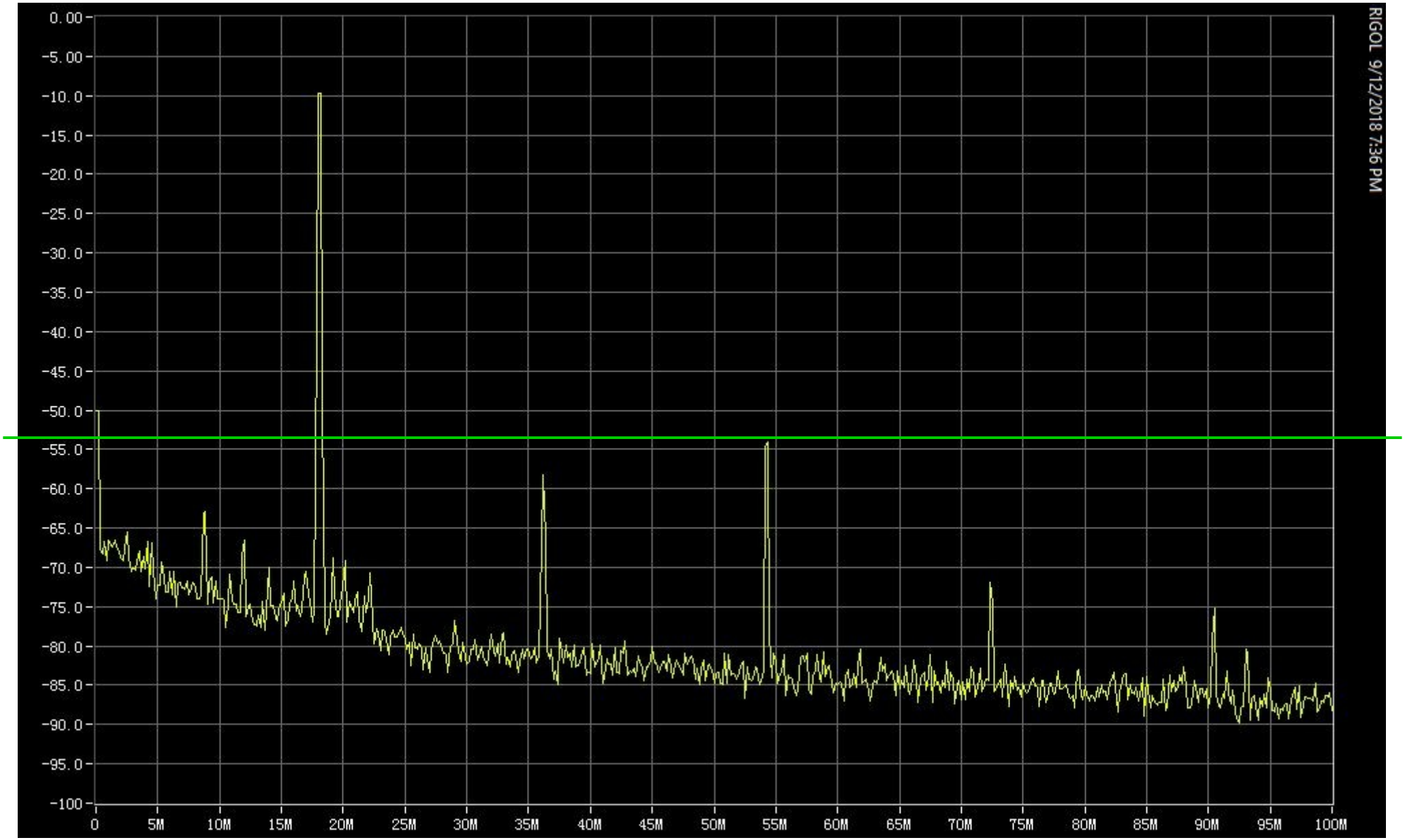
OK

20M SSB Modified



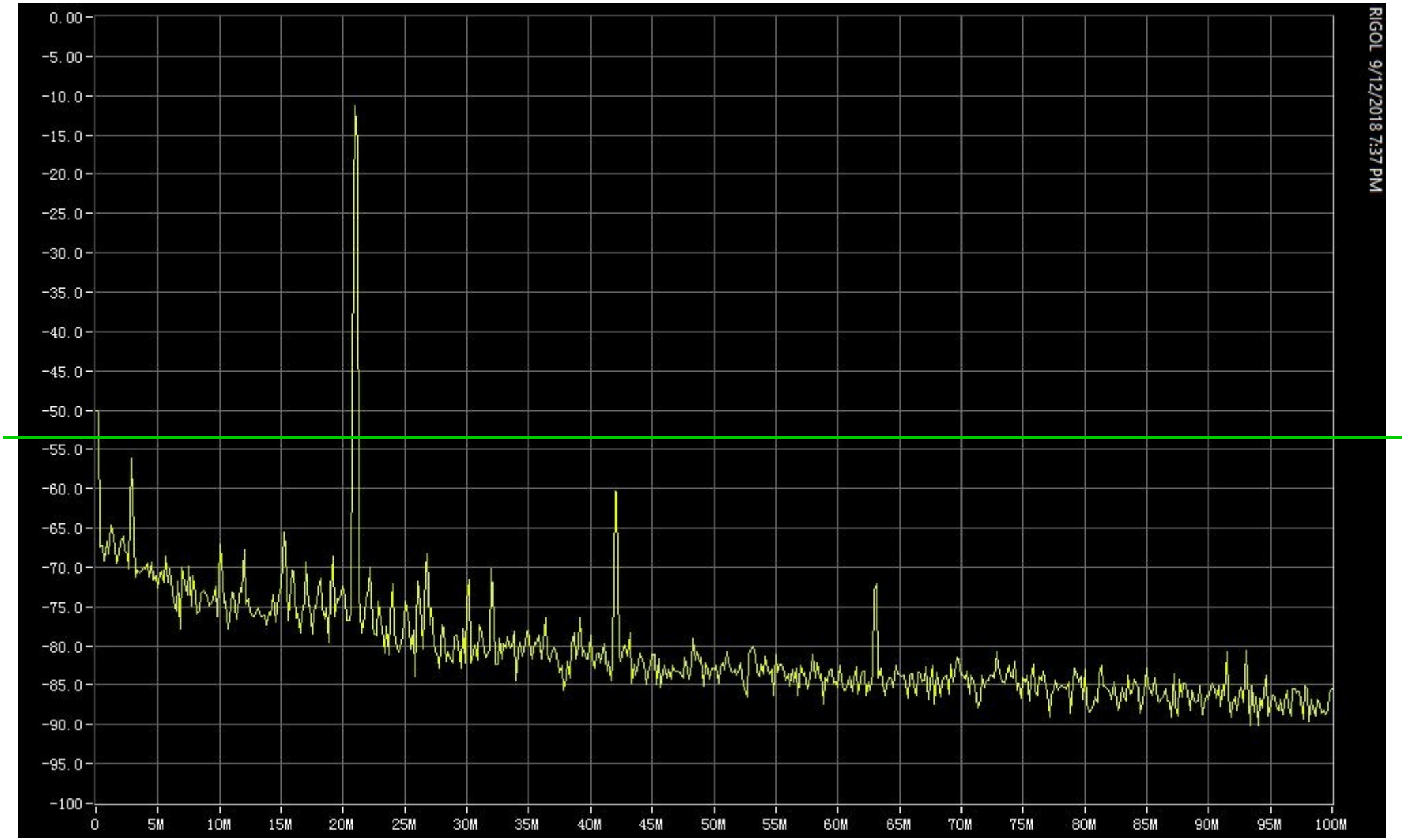
OK

17M SSB Modified



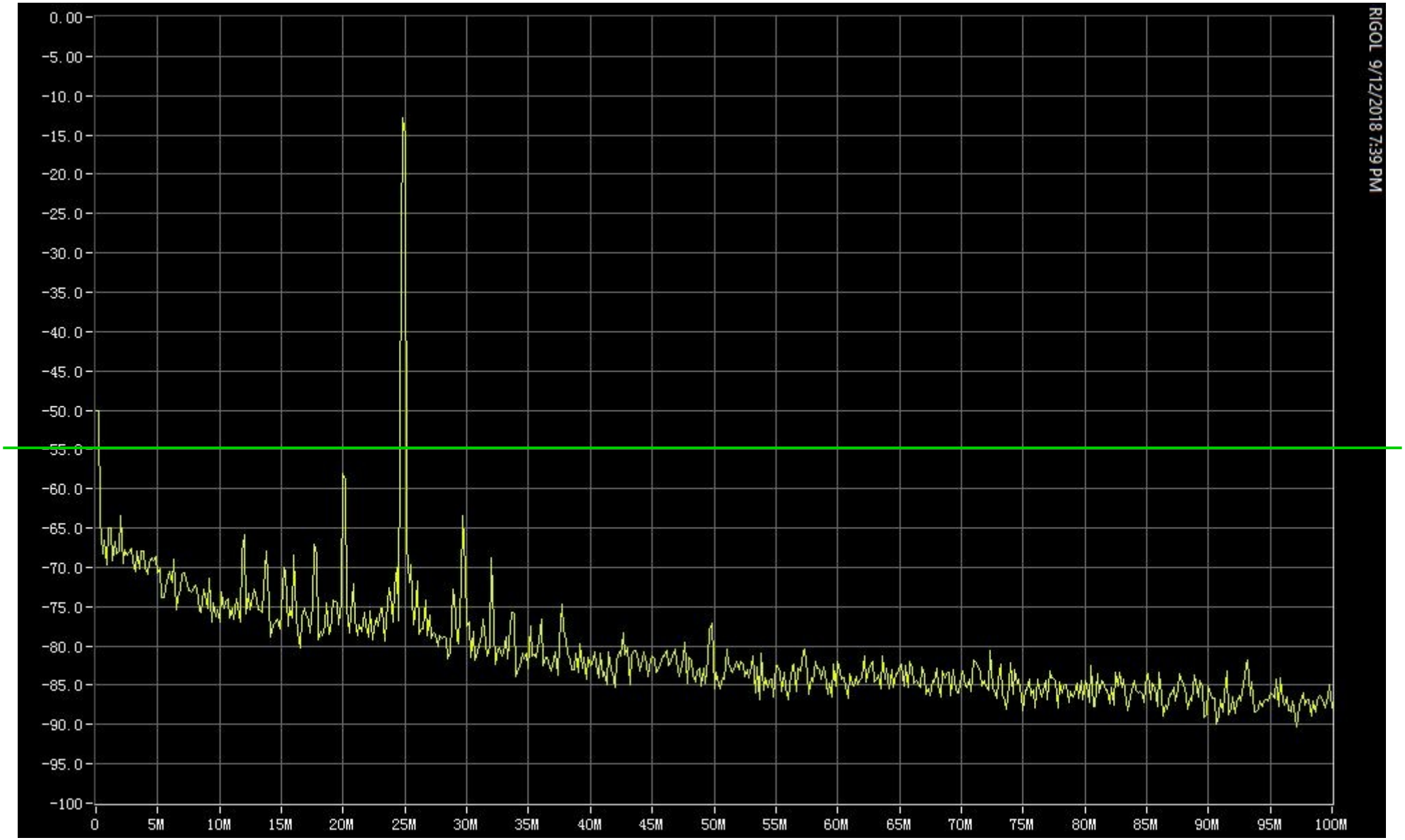
OK

15M SSB Modified



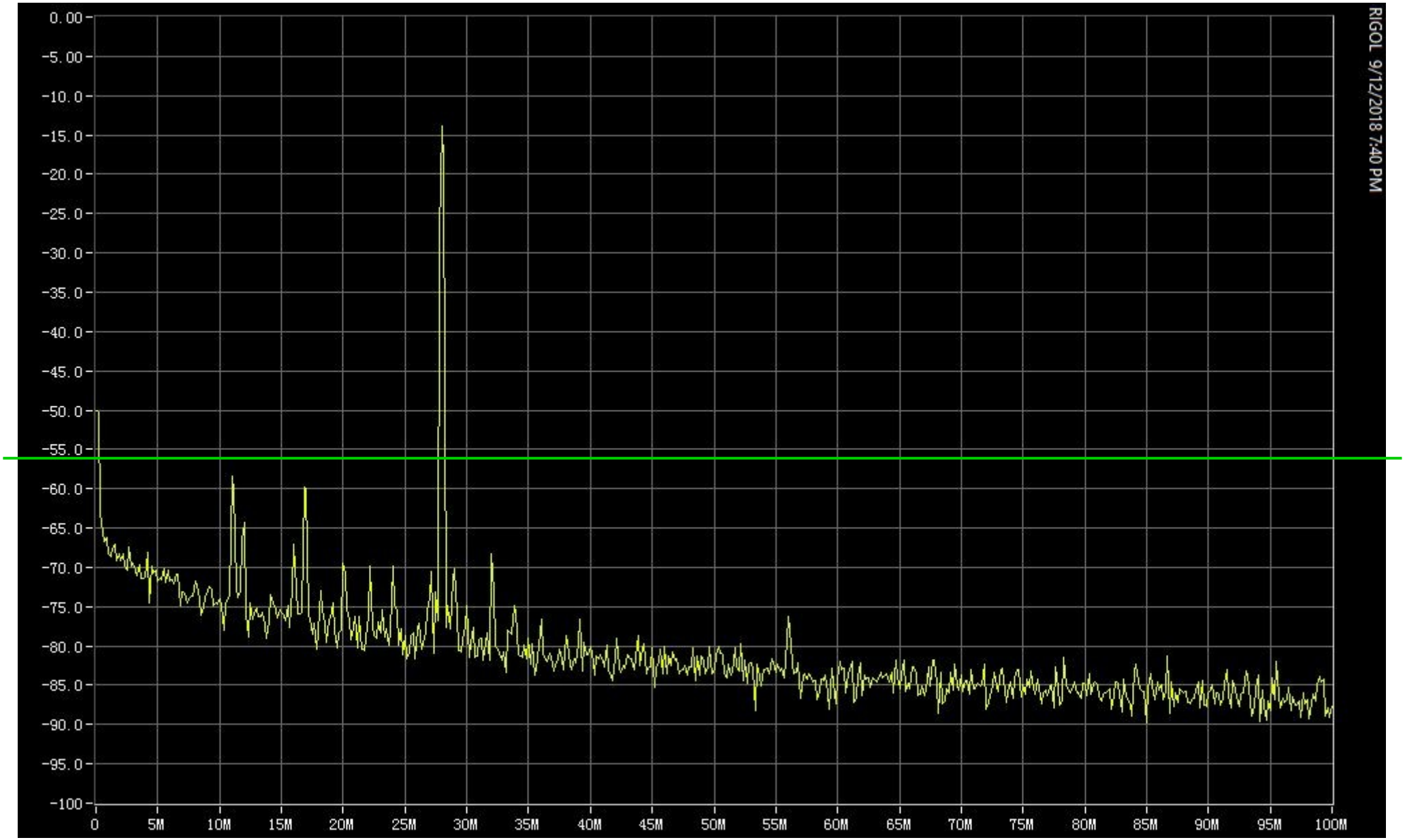
OK

12M SSB Modified



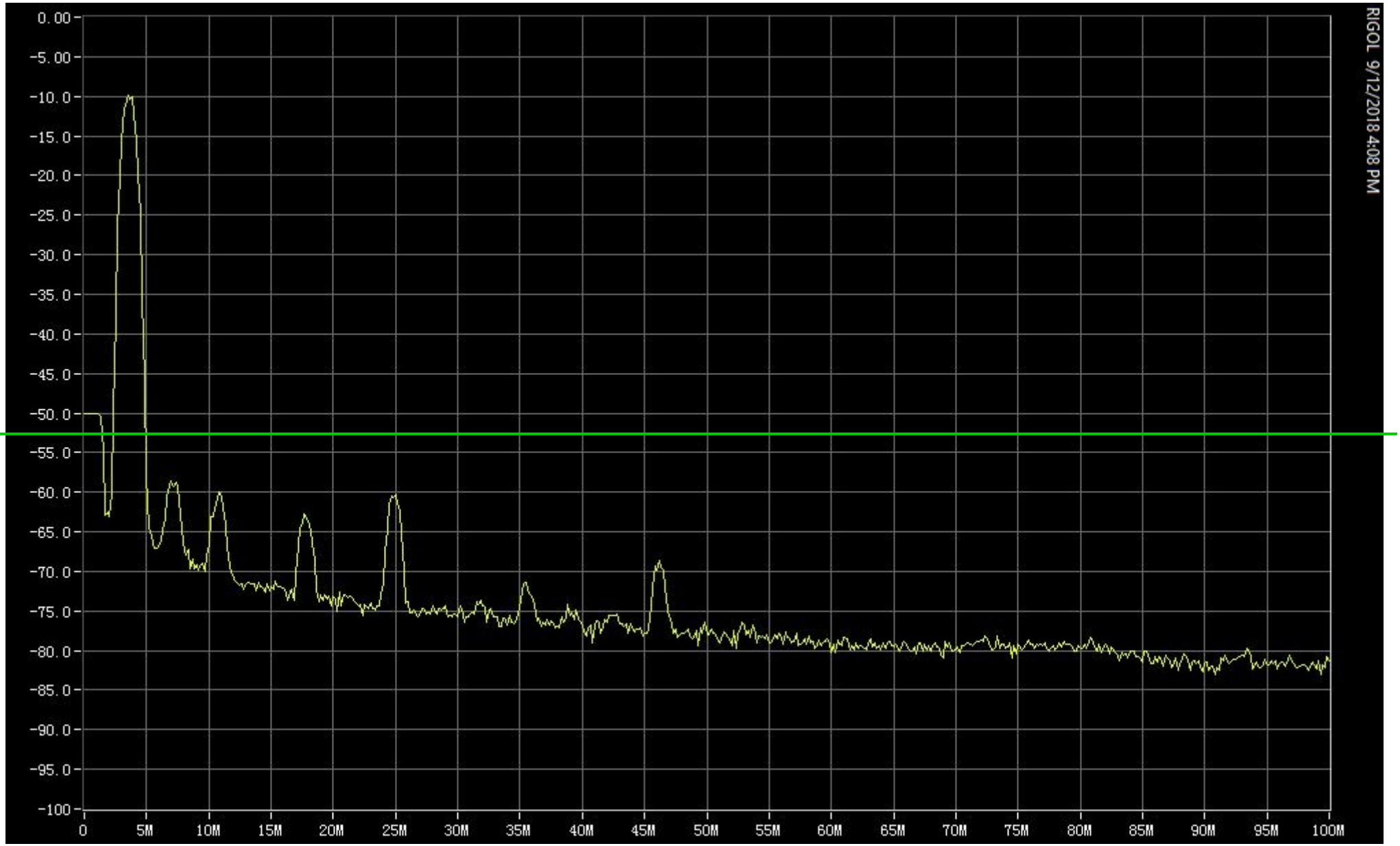
OK

10M SSB Modified



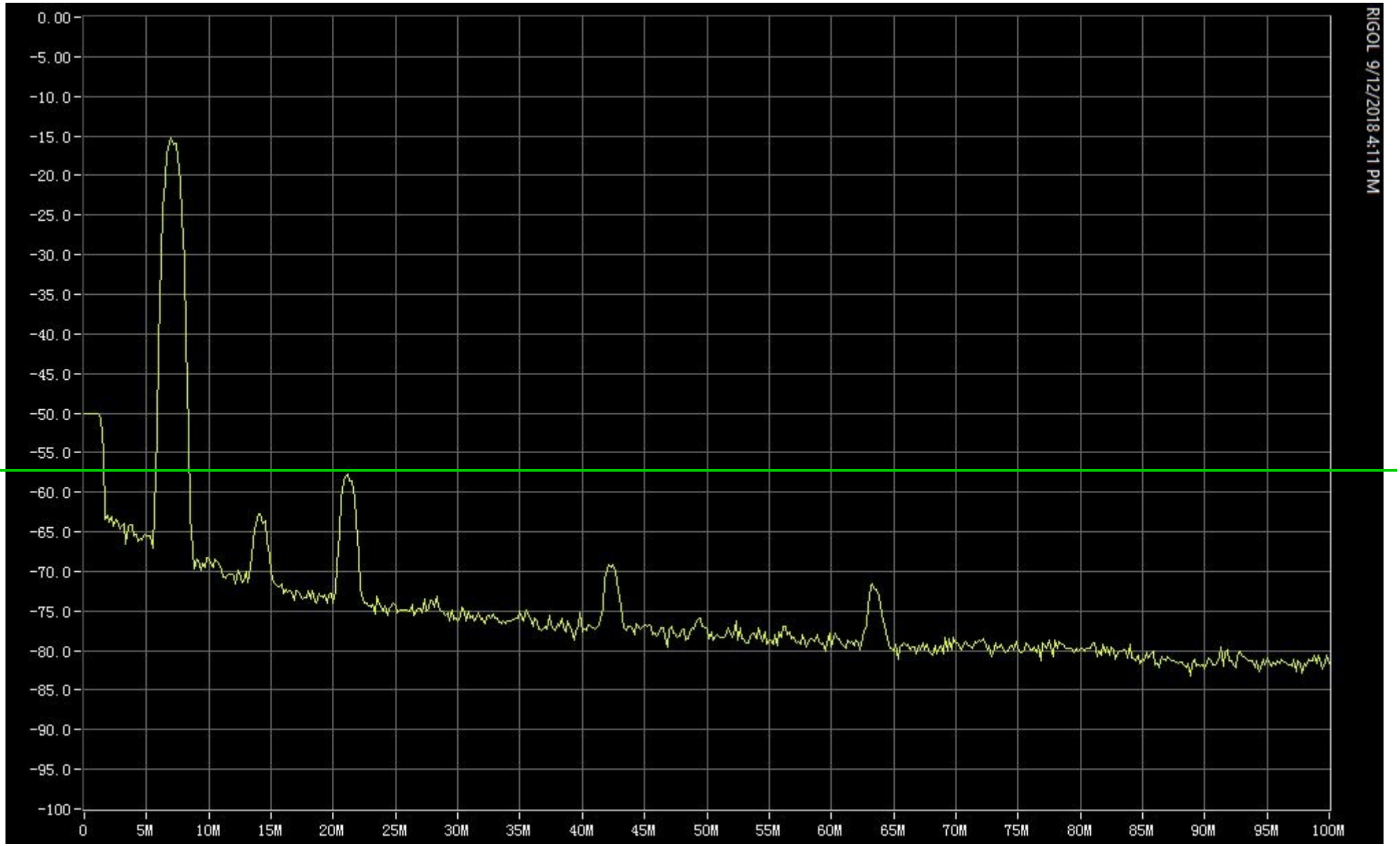
OK

80M CW Modified



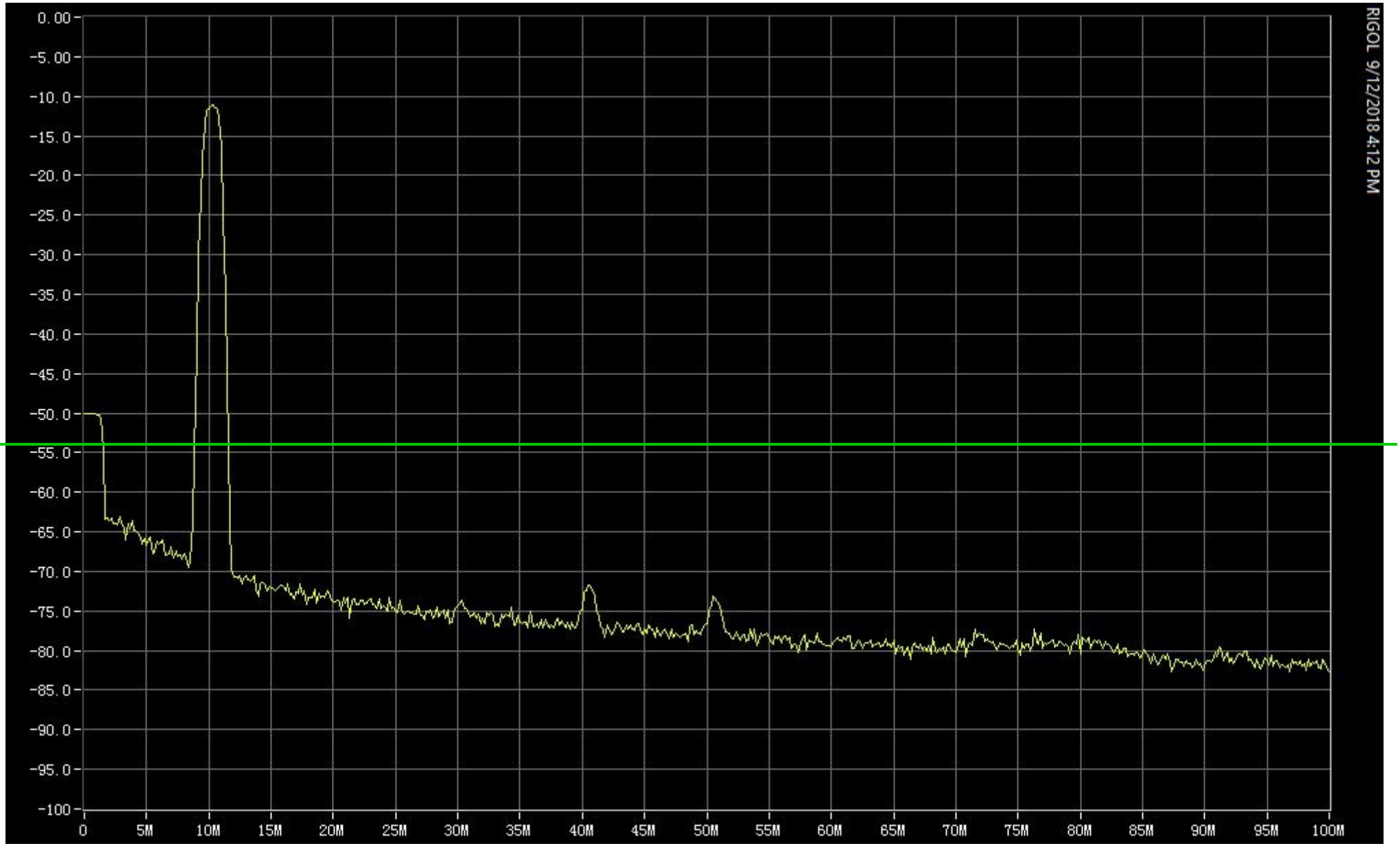
OK

40M CW Modified



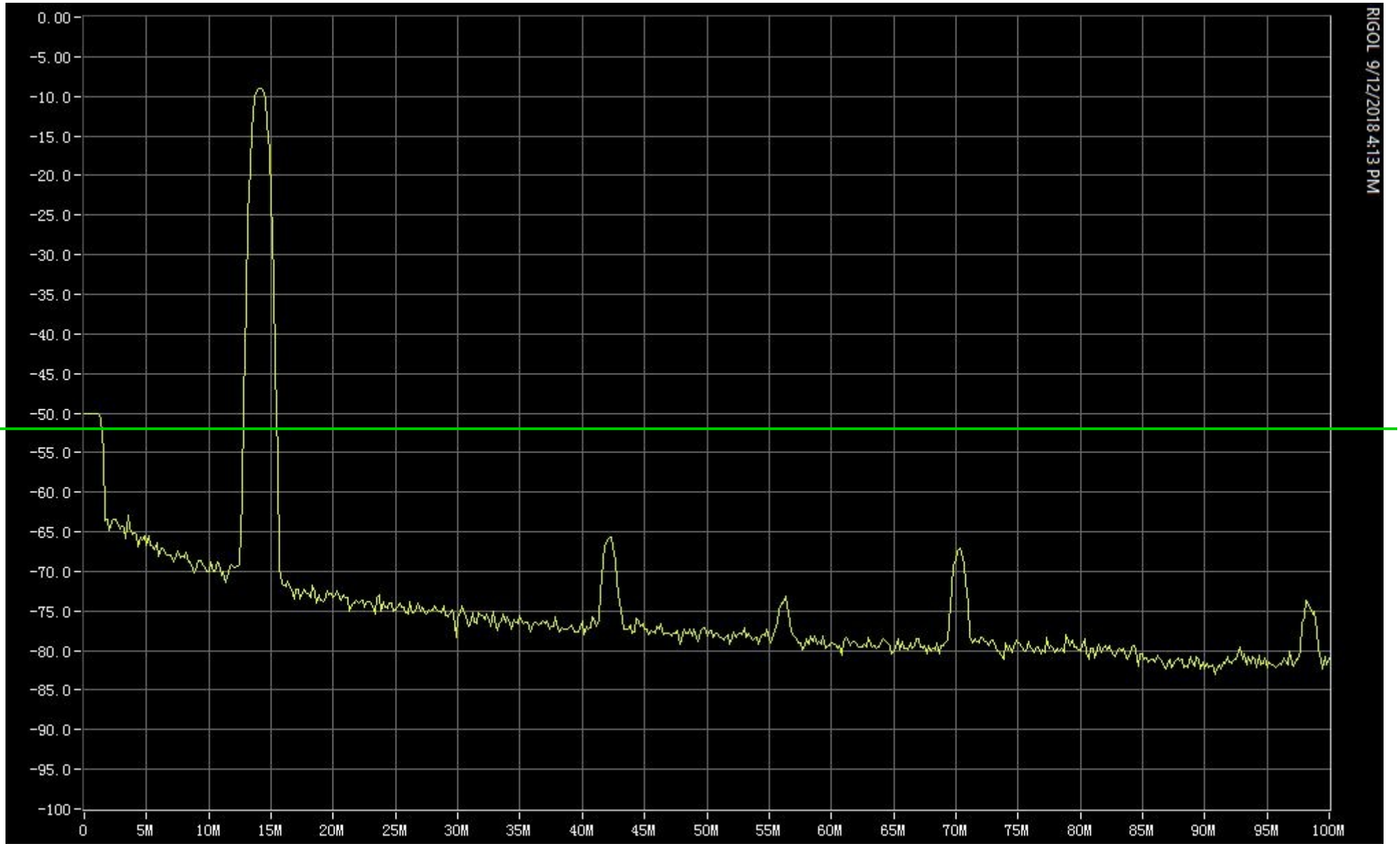
OK

30M CW Modified



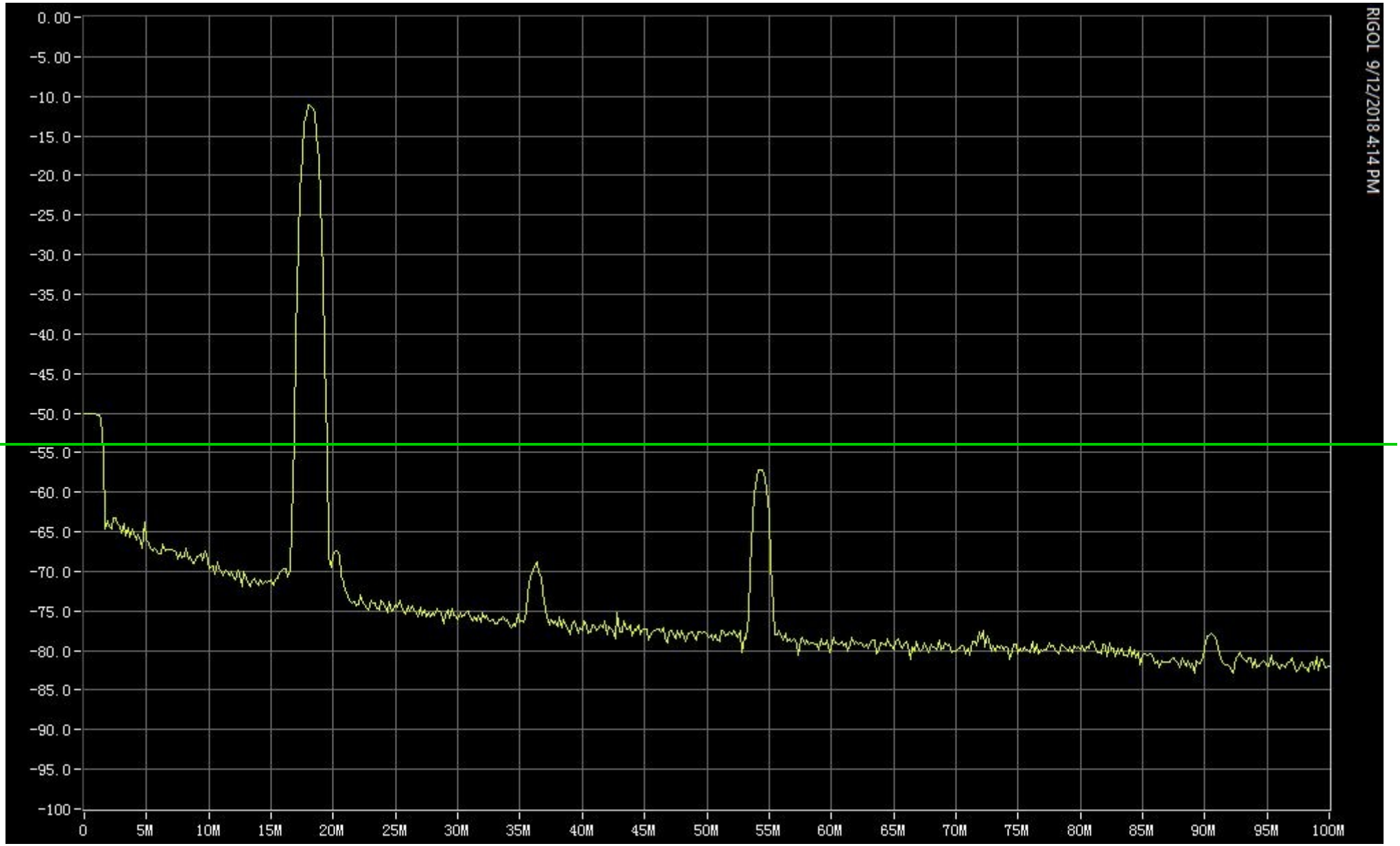
OK

20M CW Modified



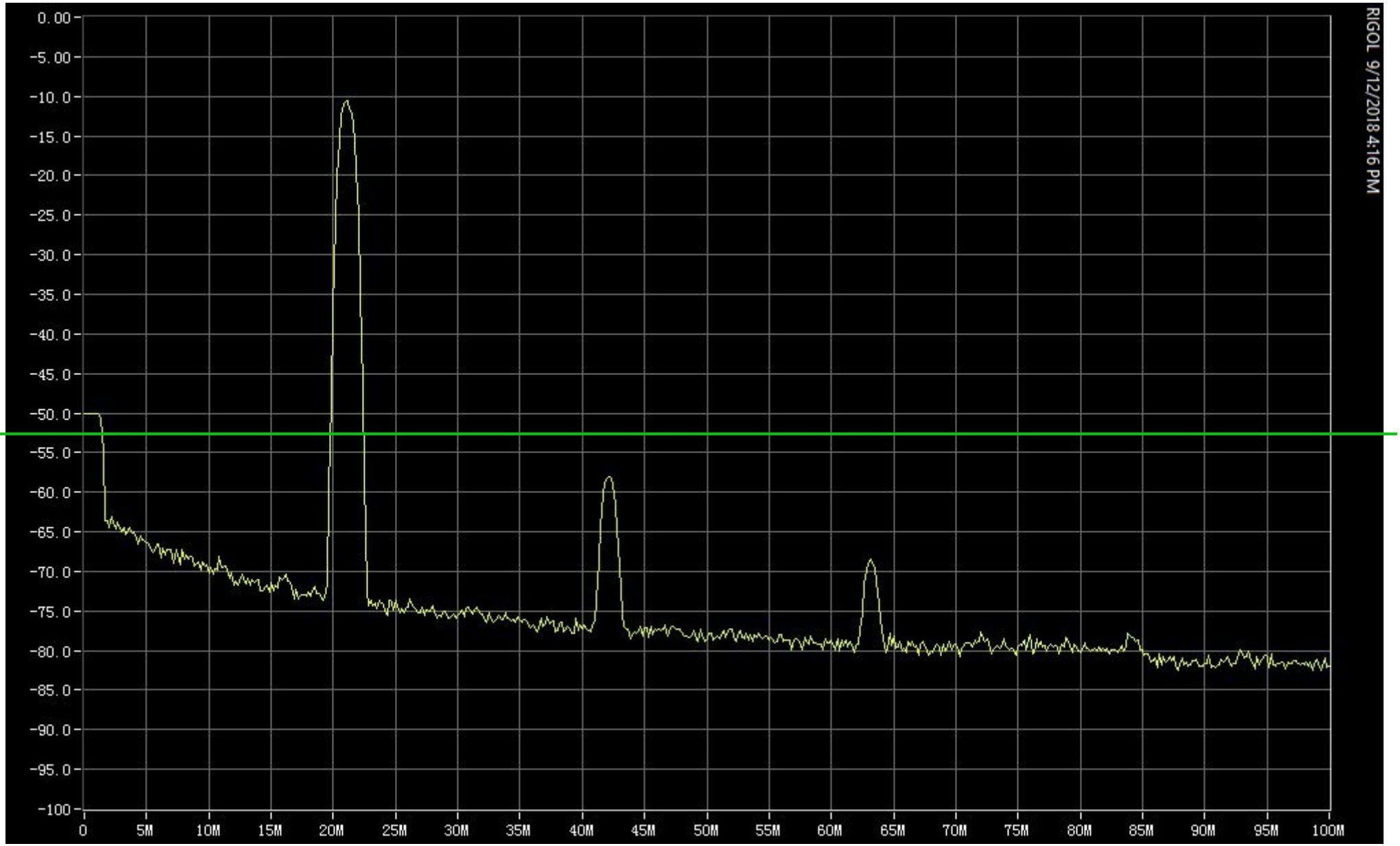
OK

17M CW Modified



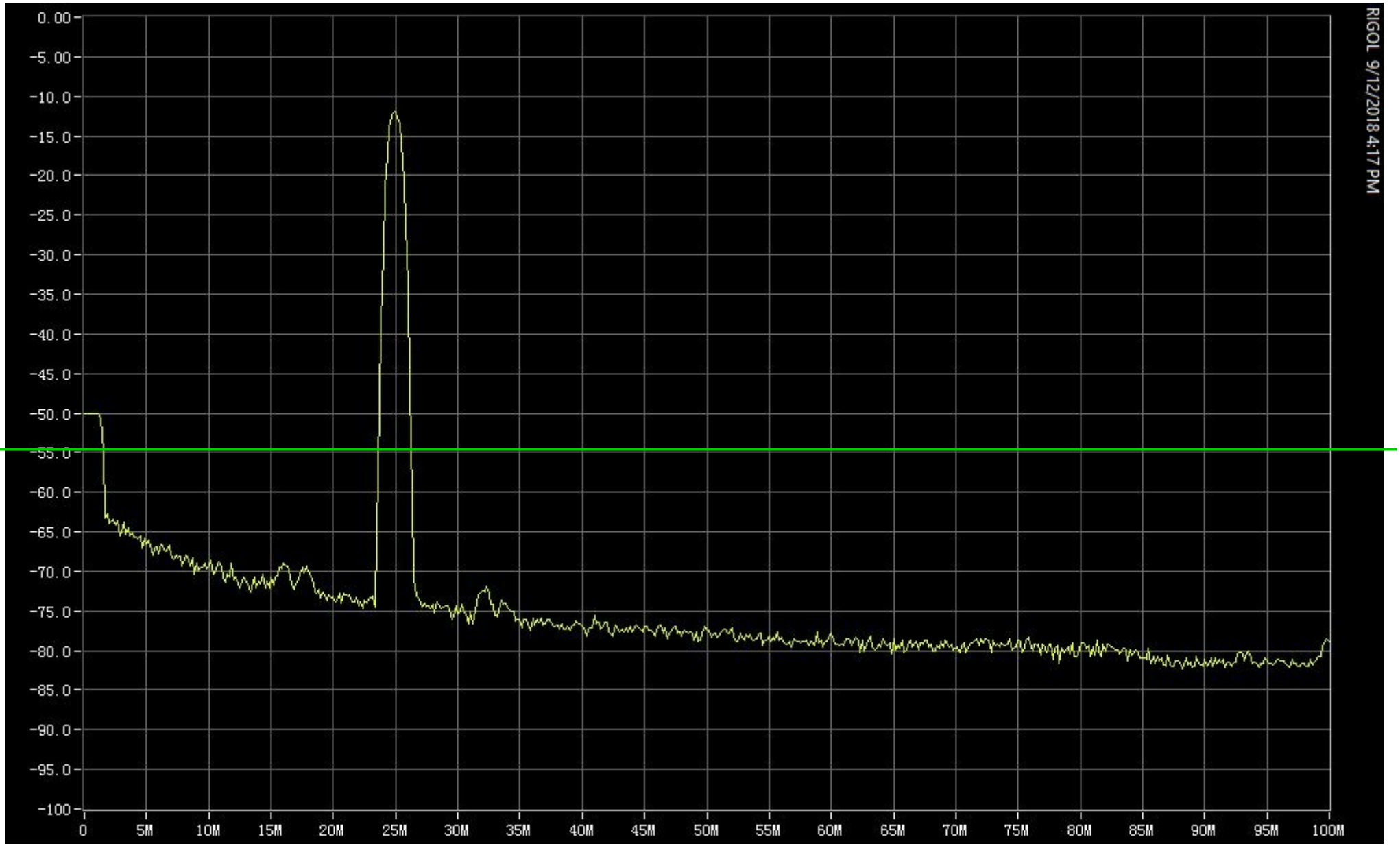
OK

15M CW Modified



OK

12M CW Modified



OK

10M CW Modified