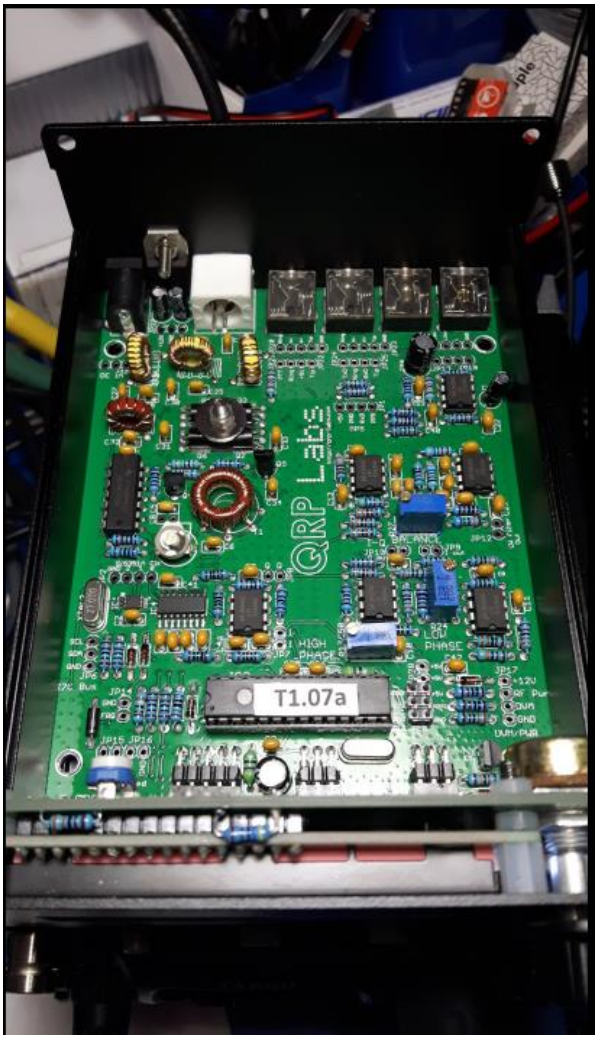
QCX+ RF measurement report by YO3FFF



1. General

U_RX = 13.8V

I_RX_no signal_R48 original 270ohm= 110mA

I_RX_no signal_R48 replaced with 4k7 = 95mA

TX current consumption vs Ualim and Pout/50ohm with L2 = 2uH; L4 = 0.8uH:

U = 11V; I_TX = 0.51mA; Pout/50ohm = 3.76W

U = 12V; I_TX = 0.55mA; Pout/50ohm = 4.5W

U = 13.8V; I_TX = 0.62mA; Pout/50ohm = 5.88W

U = 14.5V; I_TX = 0.65mA; Pout/50ohm = 6.48W

2. Receiver

MDS (Minimum Discernable Signal) Fig 1.

For S/N 10dB = -133dBm

For S/N 6dB = -137dBm

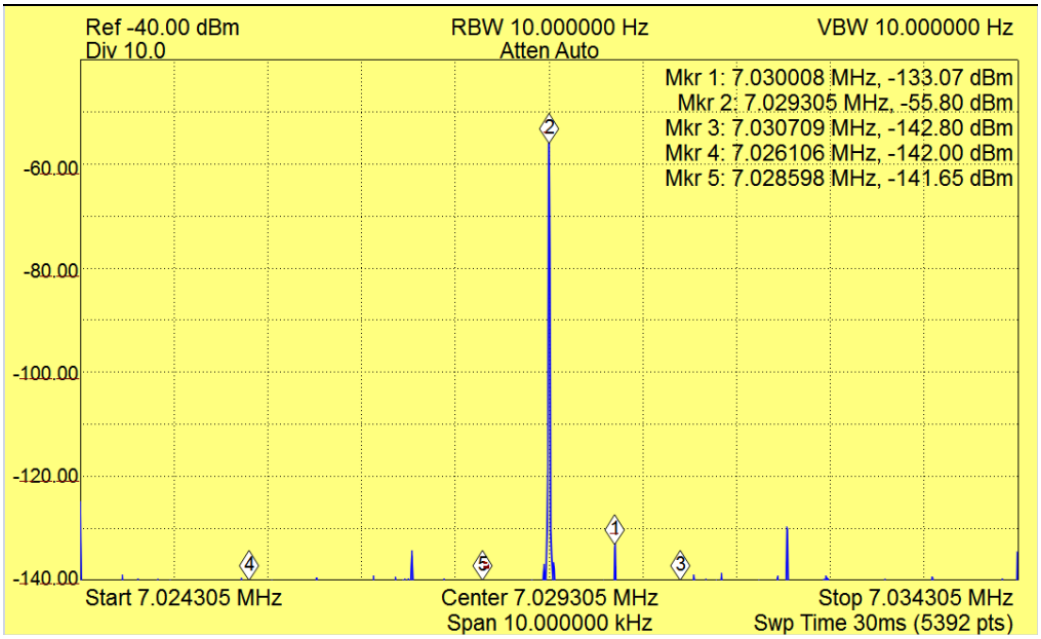


Fig 1. MDS; Marker 1 = MDS signal, 2 = LO; 3-4-5 noise.

Conducted RX spurious emission on antenna port:

Local oscillator (LO) can be found strong and stable at -51.5dBm. It is always with 700Hz below the received frequency (if CW-R is ON will be above the received frequency) Fig 2. Disconnecting R43 proved this signal is coupled with the antenna through the mixer.

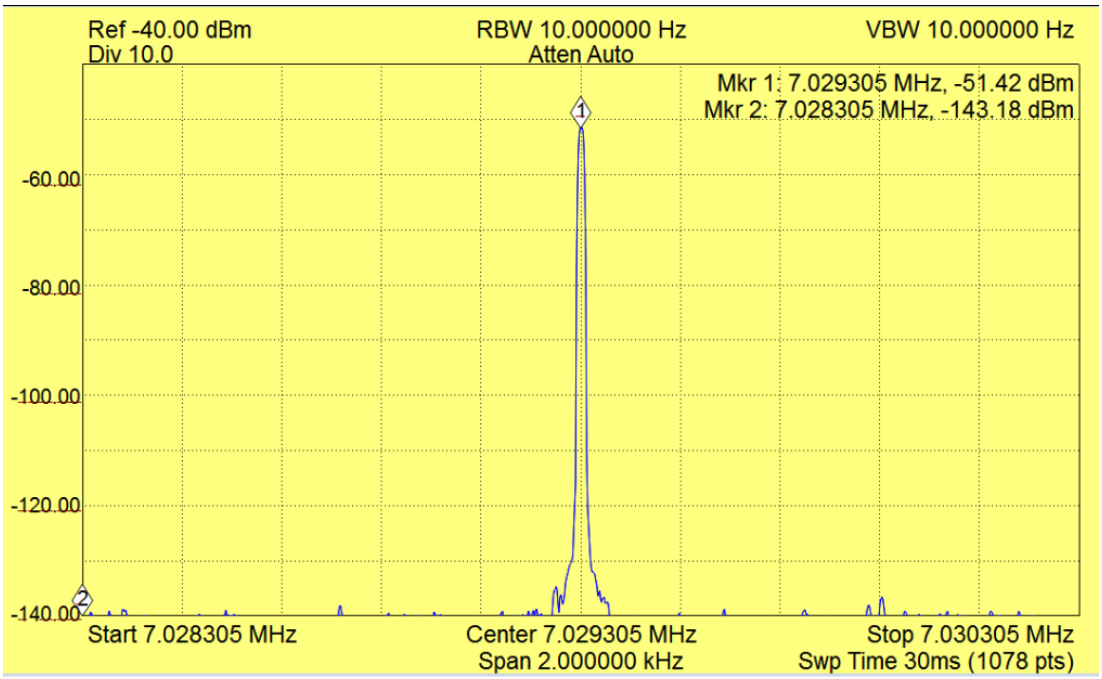


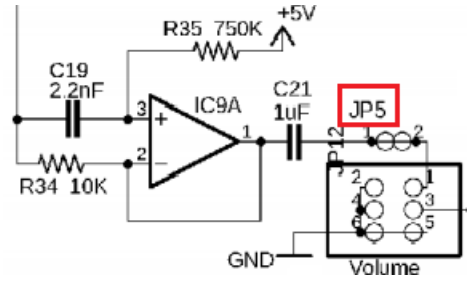
Fig 2. LO conducted emission on antenna port.

IMD DR (Intermodulation Dynamic Range):

Maximum antenna signal for best IMD DR was – 46.6dB (S9+26dB) Fig 3. IMD DR was 93dB, IMD3 product -140dBm.

At -23dBm (S9+50) input antenna signal IMD DR was measured to 30dB Fig 4.

Distortion up to the audio volume potentiometer (JP5) for strong antenna input signal:



- Input antenna signal -53dBm (S9+20dB); the maximum signal for distortion free; IMD DR = 87dB, IMD3 product at -140dBm.
- Input antenna signal -33dB (S9+40dB); the maximum signal for acceptable audio distortion; IMD DR = 75dB, IMD3 product at -108dBm
- Input antenna signal -23dB (S9+50dB); signal is very distorted also on the audio path; IMD DR = 30dB, IMD3 product at -53dBm

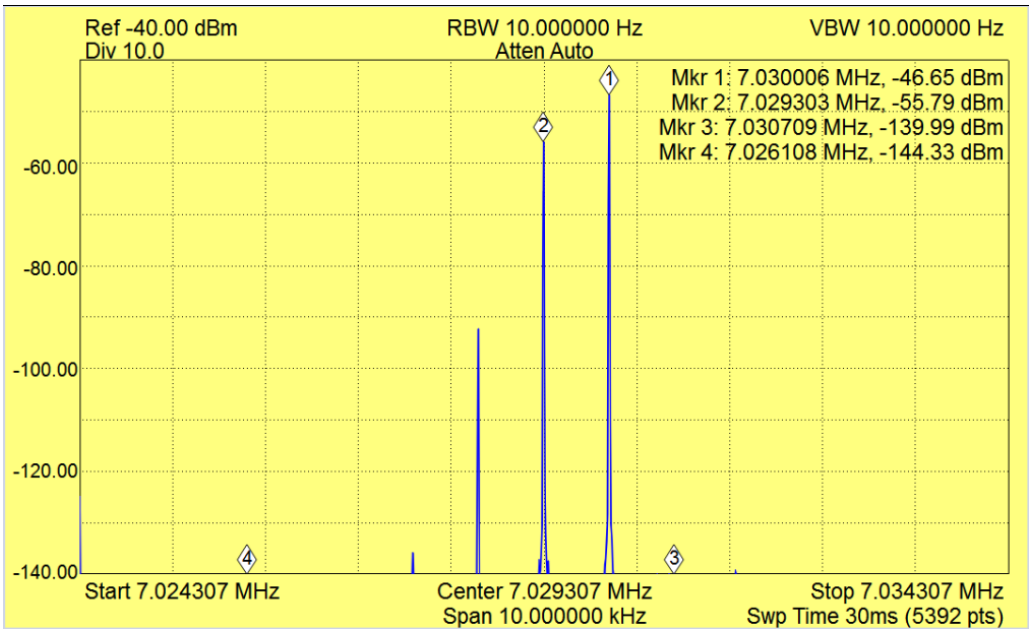


Fig 3. Max antenna input for best IMD DR -46.6dBm (S9+26dB); IMD DR 90dB. Marker 1 is the input antenna signal, 2 LO (is attenuated by 3dB due to Spectrum analyzer insertion on the circuit), 3 is the IMD3 product, 4 noise level.

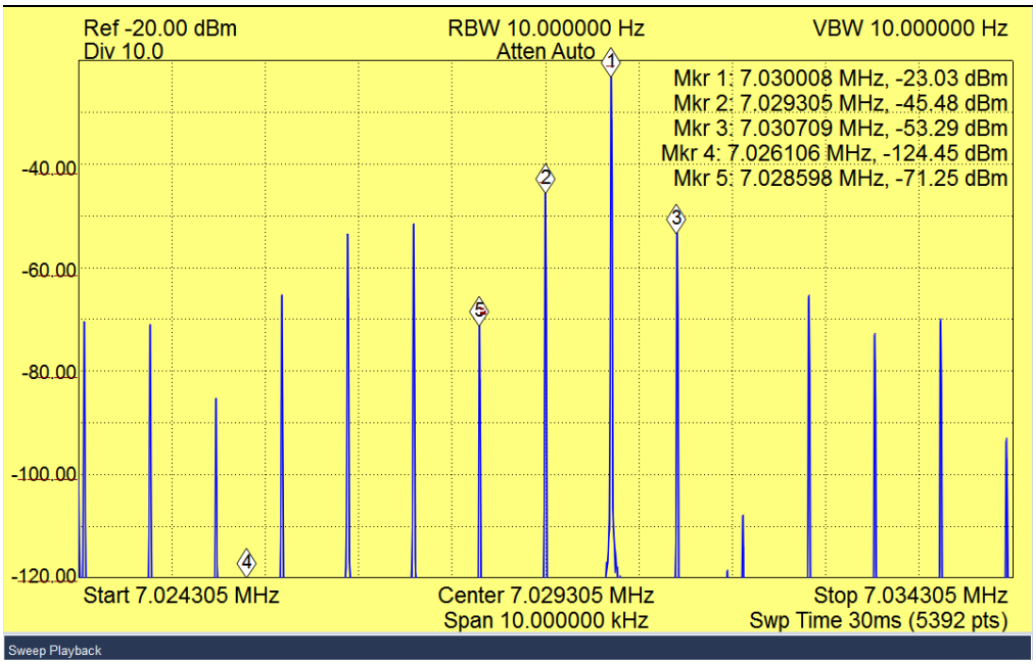
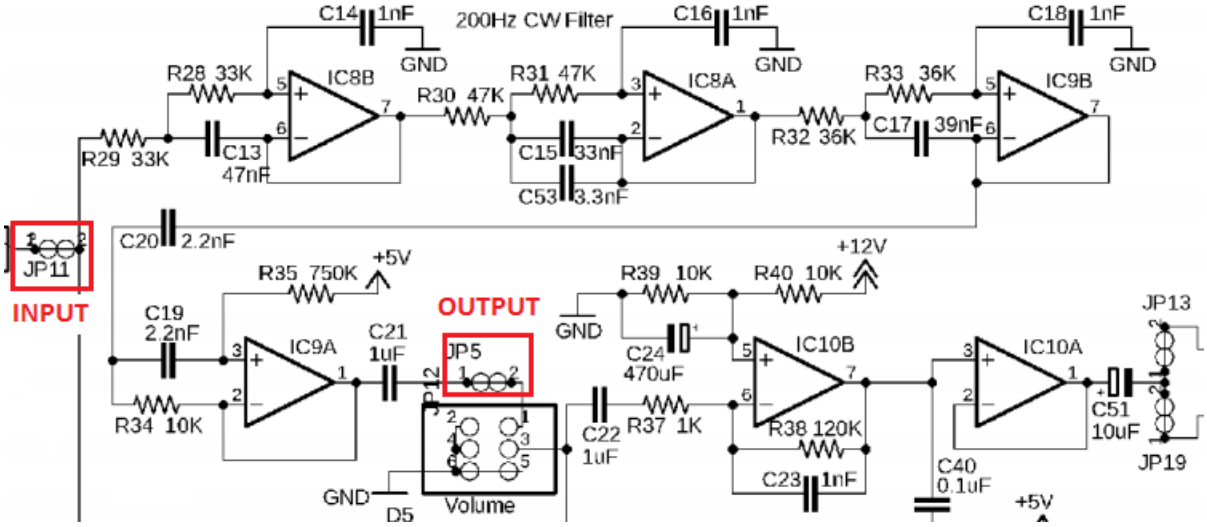


Fig 4. IMD DR for -23dB (S9+50dB) input signal. IMD DR was a poor 30dB. Marker 1 input signal, 2 LO, 3 IMD3 product, 4 noise level.

Audio frequency chain amplification:

- CW 200Hz filter plus preamplifier between JP11 and JP5 (before the audio volume potentiometer)



Antenna input signal -53dBm (S9+20dB);
INPUT JP11 voltage = 0.15Vpp
OUTPUT JP5 = 3.78Vpp
Ugain = 28dB

- PA audio amplifier between C22 and JP13
  Antenna input signal -53dBm (S9+20dB);
  INPUT C22 voltage = 0.06Vpp
  OUTPUT JP13 = 2.24Vpp (U max for distortion free!)
  Ugain = 31dB

3. Transmitter

TX output power/50ohm vs Ualim with L2 = 2uH; L4 = 0.8uH:

U = 11V; Pout/50ohm = 3.76W

U = 12V; Pout/50ohm = 4.5W

U = 13.8V; Pout/50ohm = 5.88W

U = 14.5V; Pout/50ohm = 6.48W

Fig 5. TX PA wave shape for 5.88W output. Trace 1 (yellow) 3xBS170 Drain voltage, Trace 2 (blue) 3xBS170 gate voltage.

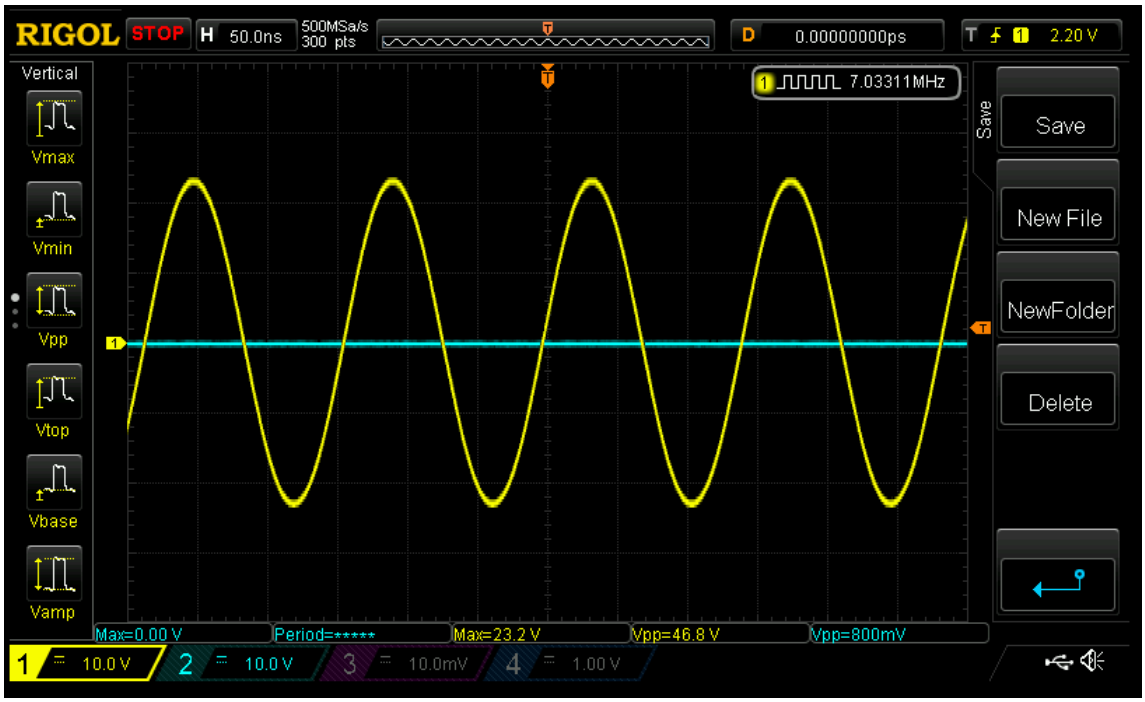


Fig 6. TX PA output at the antenna port for 5.88W output.

TX Spectral emission:

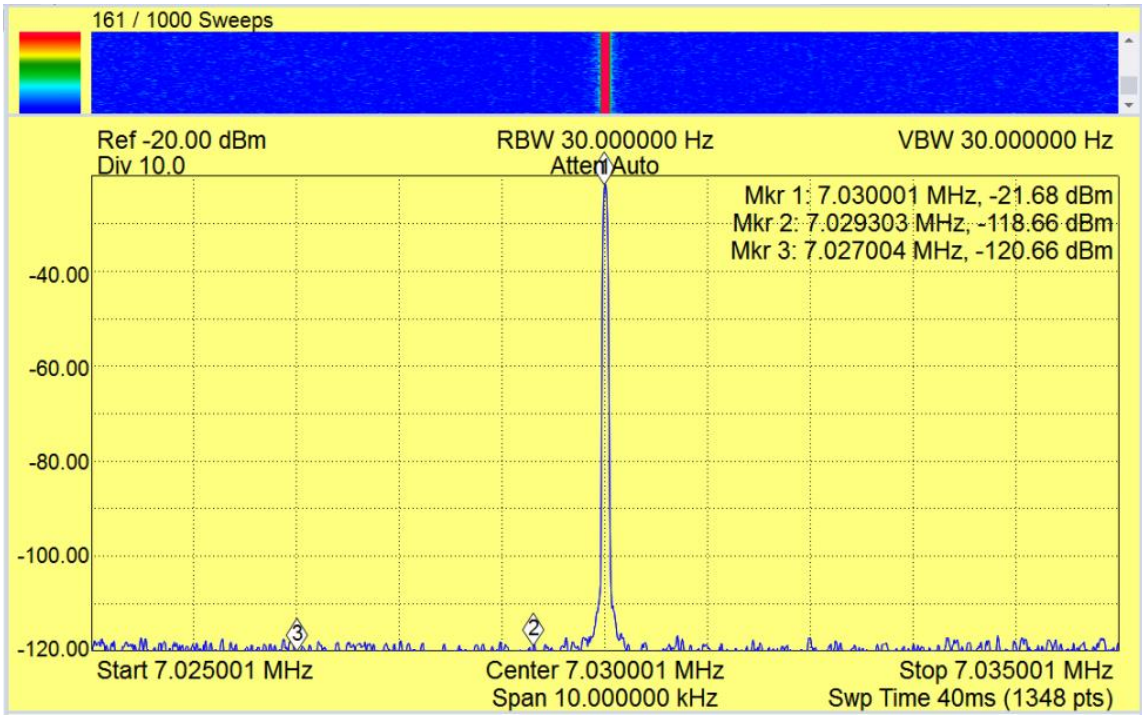


Fig 7. CW on 7.03MHz with -59.2dB ATT in front of the SA44B Spectrum Analyzer.

IMD DR at 700Hz = 97dB

IMD DR at 3kHz = 99dB

Harmonics:

Fig 8.

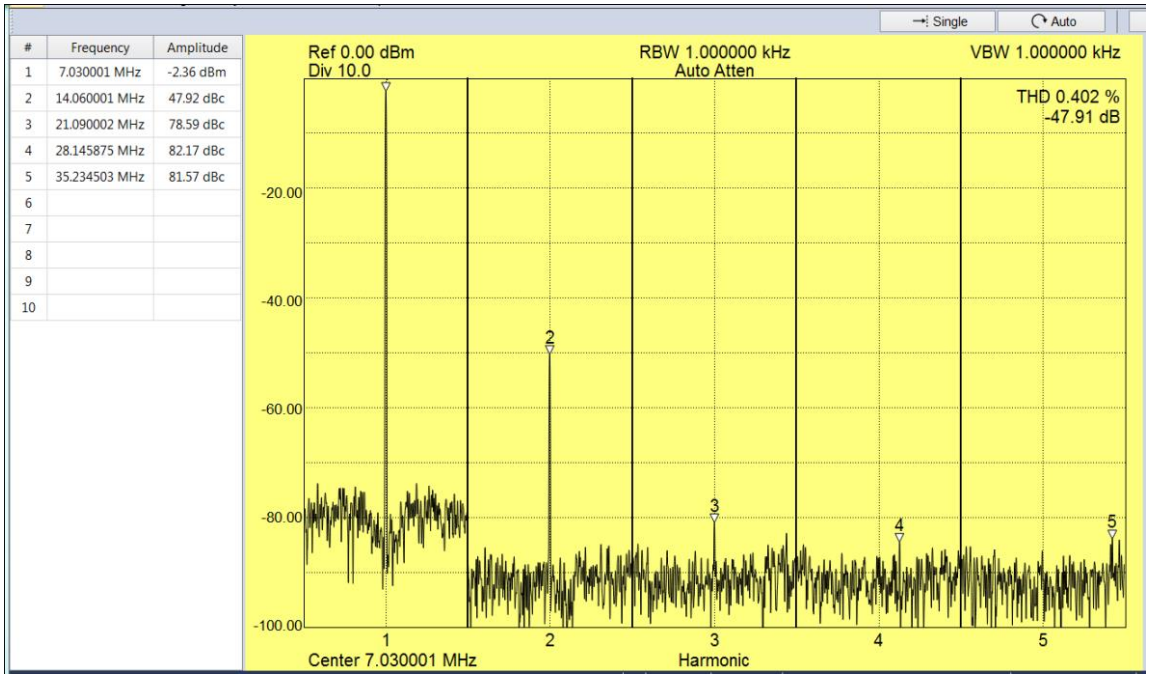
2nd harmonic = -47.9dBc

3rd harmonic = -78.6dBc

4th harmonic = -82.2dBc

5th harmonic = -81.6dBc

Meet FCC emission requirement with some margin.



#	Frequency	Amplitude
1	7.030001 MHz	-2.36 dBm
2	14.060001 MHz	47.92 dBc
3	21.090002 MHz	78.59 dBc
4	28.145875 MHz	82.17 dBc
5	35.234503 MHz	81.57 dBc
6		
7		
8		
9		
10		

Fig 8. First 5th harmonics for 5.88W power output (ATT in front of the SA44B Spectrum Analyzer).

TX PA Thermal measurement:

TX output power/50ohm load 5.88W.

After 15min key down the temperature stabilized on 3xBS170 transistors to 40C. L4 heated to 42C.

Feedback welcome by e-mail: cyo3fff@yahoo.com

Thank you for reading it.

73 de YO3FFF

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