LimeSDR-USB TX output power and harmonics

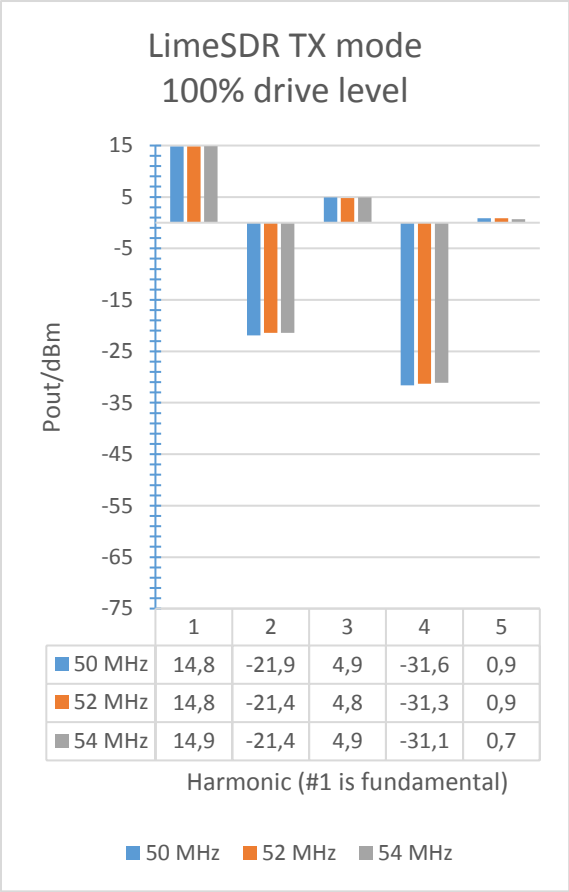
Matthias, DD1US, April 8th 2019

Some time ago, I measured the output characteristics of my LimeSDR-USB board as a function of frequency and drive level.

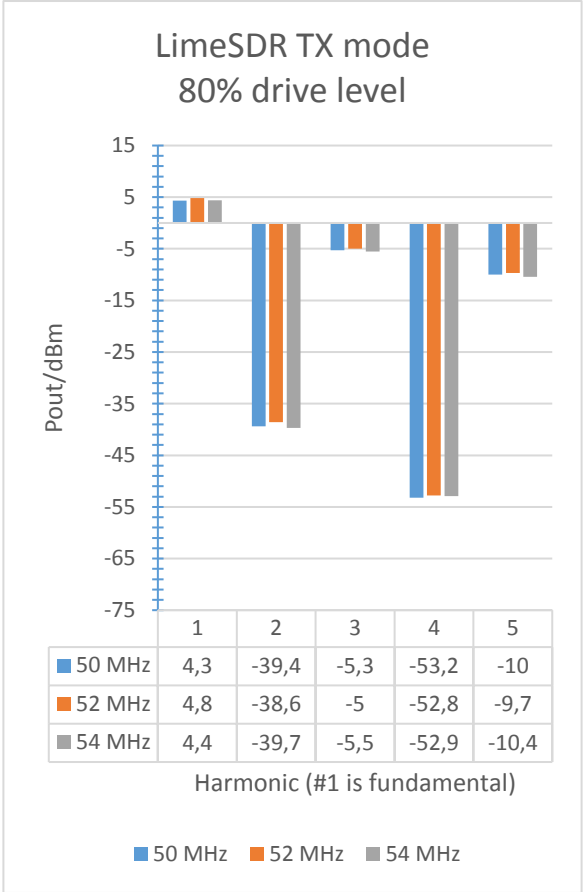
Below you will find my measurement results. Please note that I measured only one unit, thus the characteristics will most likely vary between different units.

The measurements were performed with a HP70000A spectrum analyzer with the HP70612A&HP70904A units installed. The measurement range of this setup is 100Hz-2900 MHz, thus no harmonic measurements were possible in the 2400 MHz band. The respective missing values are set to 0. The measurements were done in max hold mode with a resolution bandwidth (RBW) of 3 MHz. The measurement of the harmonics was also limited by the noise floor of the analyser which was around -65dBm.

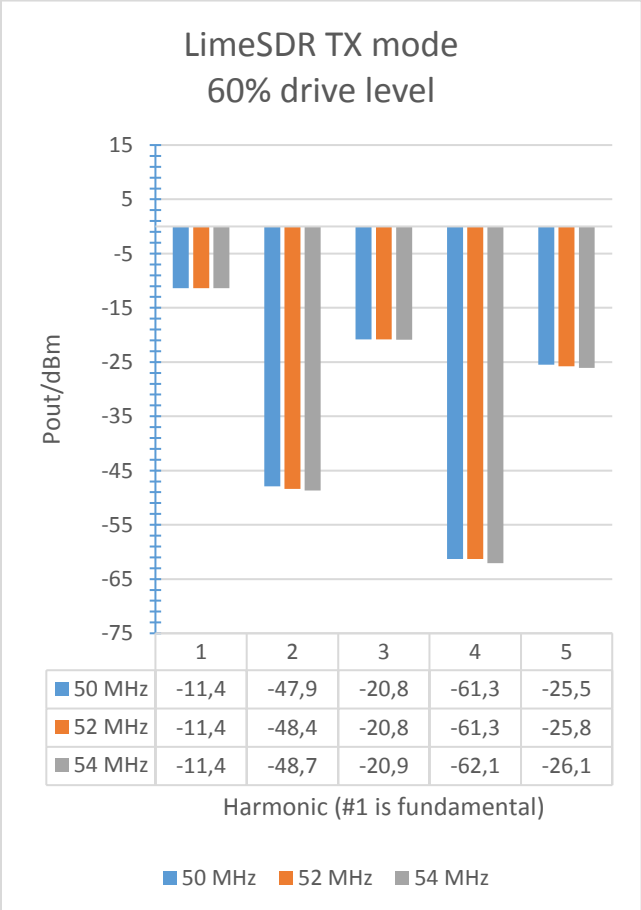
I used SDR-Radio to control the LimeSDR. All measurements were done in AM mode with 100% carrier, 100% Gain, Mic boost 20dB. The drive level was varied. On all bands TX1 L port was used except for 13cm where both, TX1L and TX1H were measured for comparison.



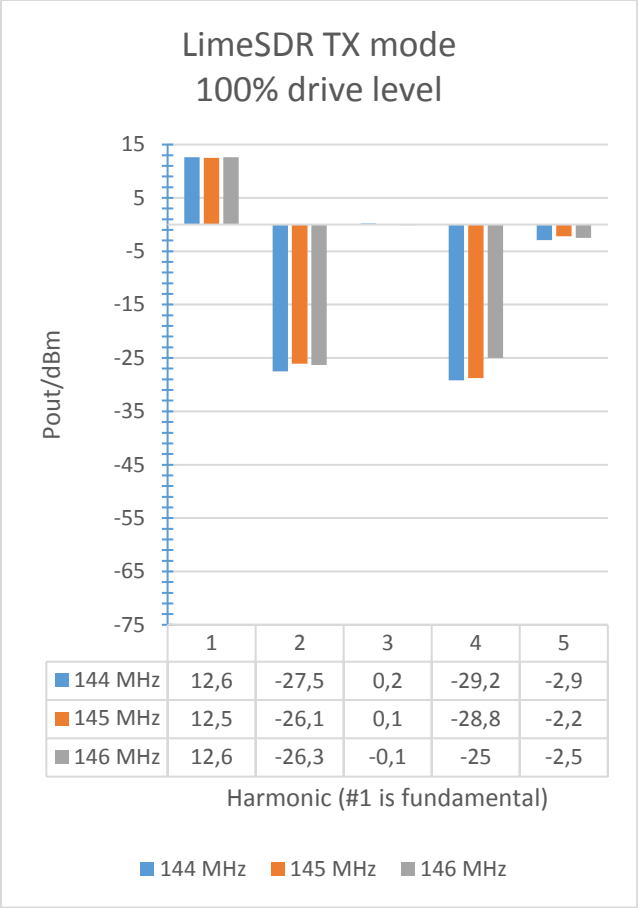
	1	2	3	4	5
50 MHz	14,8	-21,9	4,9	-31,6	0,9
52 MHz	14,8	-21,4	4,8	-31,3	0,9
54 MHz	14,9	-21,4	4,9	-31,1	0,7



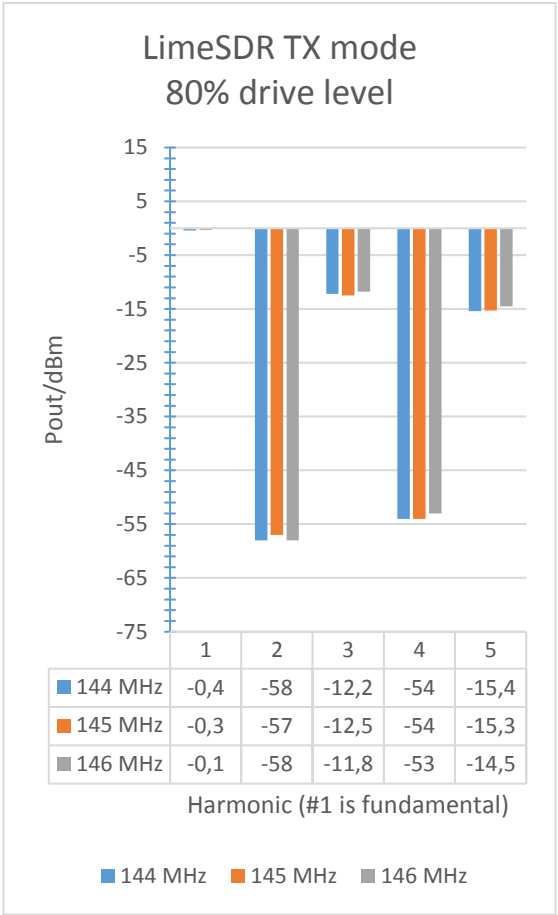
	1	2	3	4	5
50 MHz	4,3	-39,4	-5,3	-53,2	-10
52 MHz	4,8	-38,6	-5	-52,8	-9,7
54 MHz	4,4	-39,7	-5,5	-52,9	-10,4



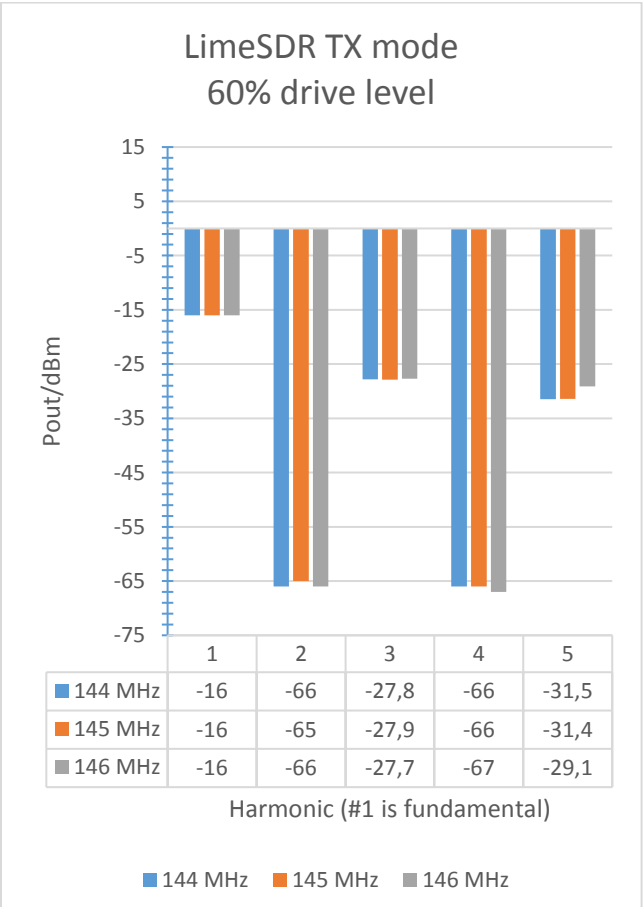
	1	2	3	4	5
50 MHz	-11,4	-47,9	-20,8	-61,3	-25,5
52 MHz	-11,4	-48,4	-20,8	-61,3	-25,8
54 MHz	-11,4	-48,7	-20,9	-62,1	-26,1



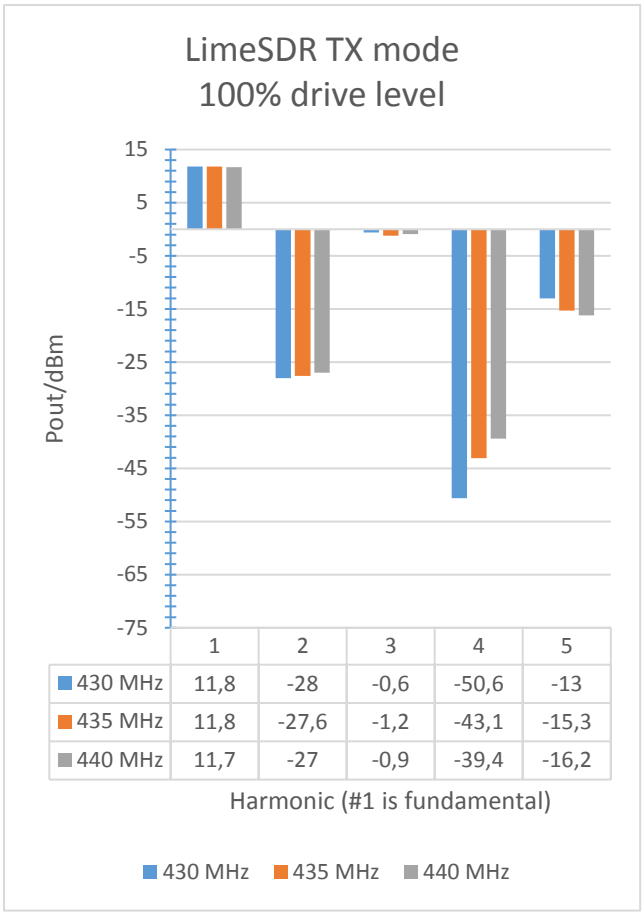
	1	2	3	4	5
144 MHz	12,6	-27,5	0,2	-29,2	-2,9
145 MHz	12,5	-26,1	0,1	-28,8	-2,2
146 MHz	12,6	-26,3	-0,1	-25	-2,5



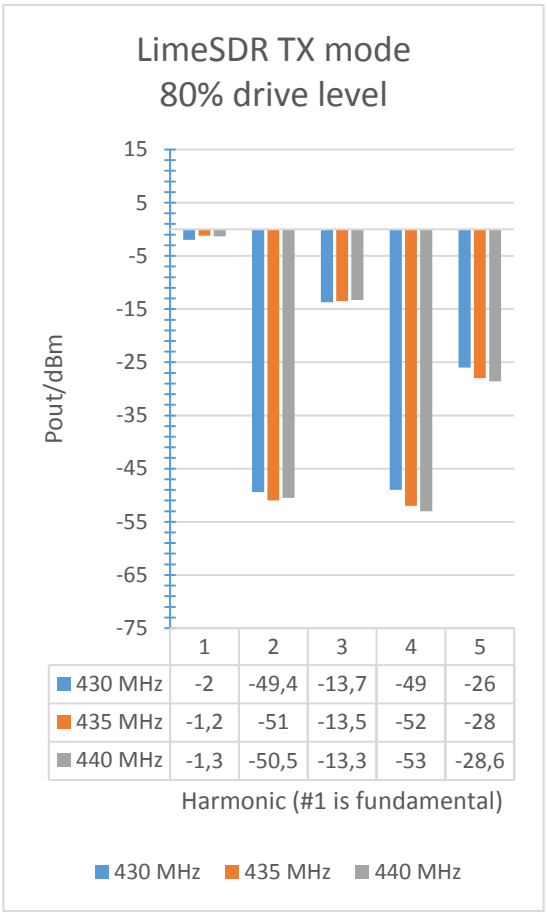
	1	2	3	4	5
144 MHz	-0,4	-58	-12,2	-54	-15,4
145 MHz	-0,3	-57	-12,5	-54	-15,3
146 MHz	-0,1	-58	-11,8	-53	-14,5



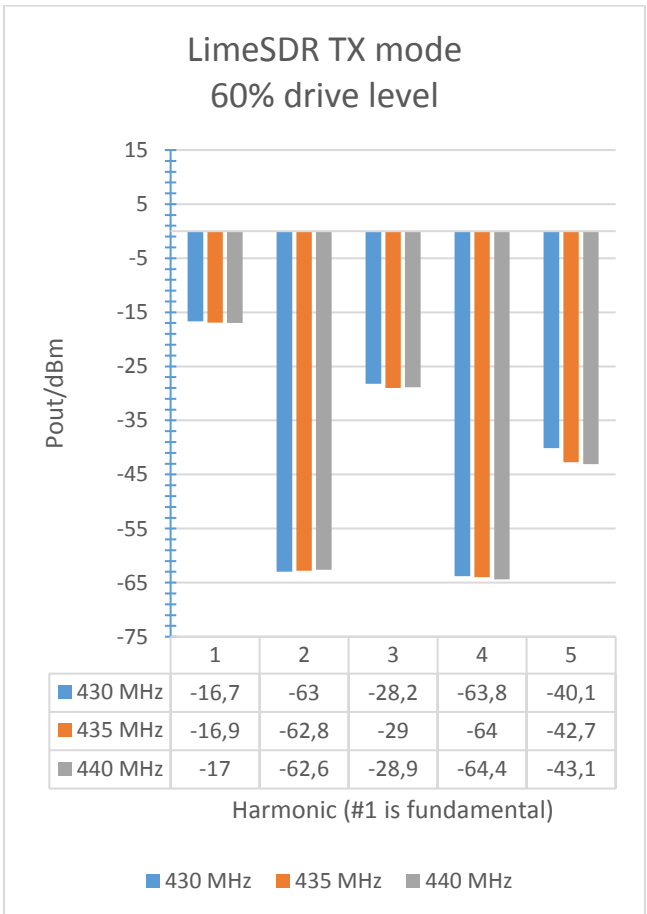
	1	2	3	4	5
144 MHz	-16	-66	-27,8	-66	-31,5
145 MHz	-16	-65	-27,9	-66	-31,4
146 MHz	-16	-66	-27,7	-67	-29,1



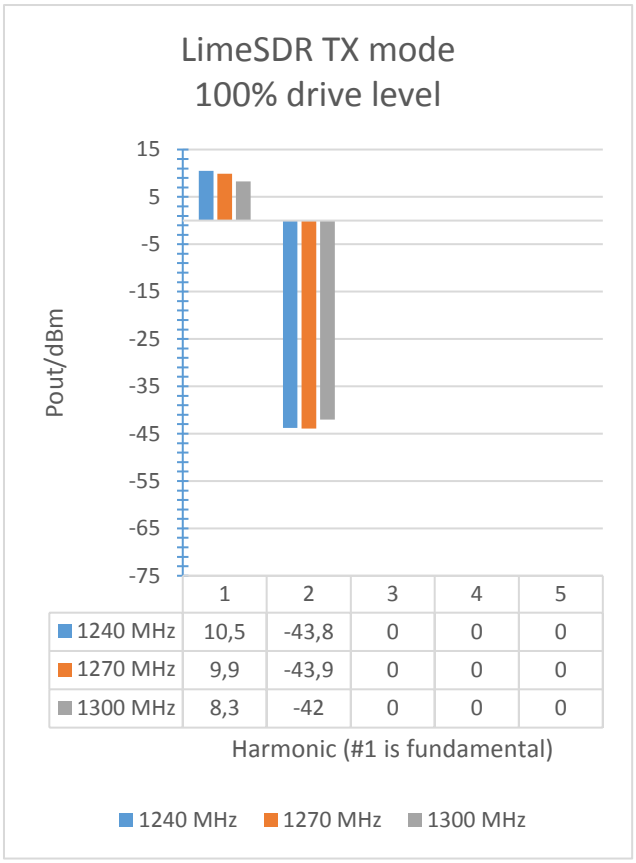
	1	2	3	4	5
430 MHz	11,8	-28	-0,6	-50,6	-13
435 MHz	11,8	-27,6	-1,2	-43,1	-15,3
440 MHz	11,7	-27	-0,9	-39,4	-16,2



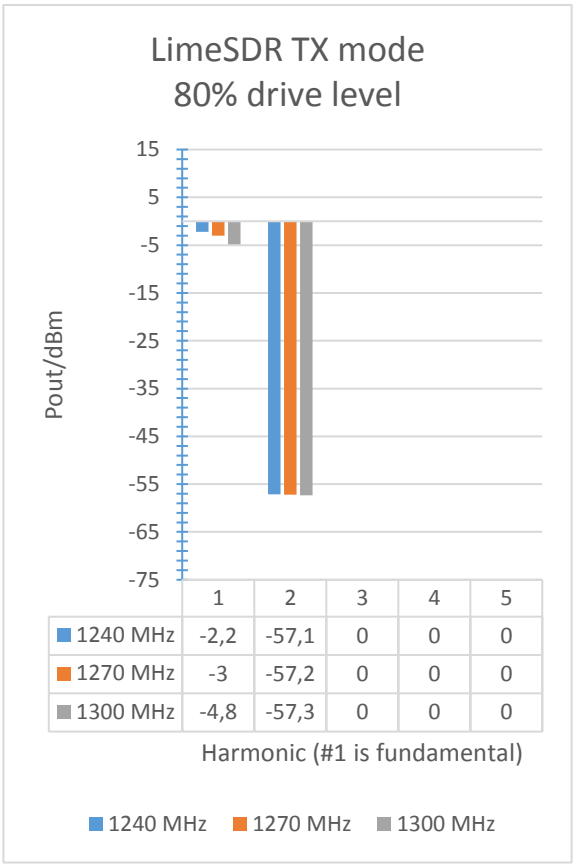
	1	2	3	4	5
430 MHz	-2	-49,4	-13,7	-49	-26
435 MHz	-1,2	-51	-13,5	-52	-28
440 MHz	-1,3	-50,5	-13,3	-53	-28,6



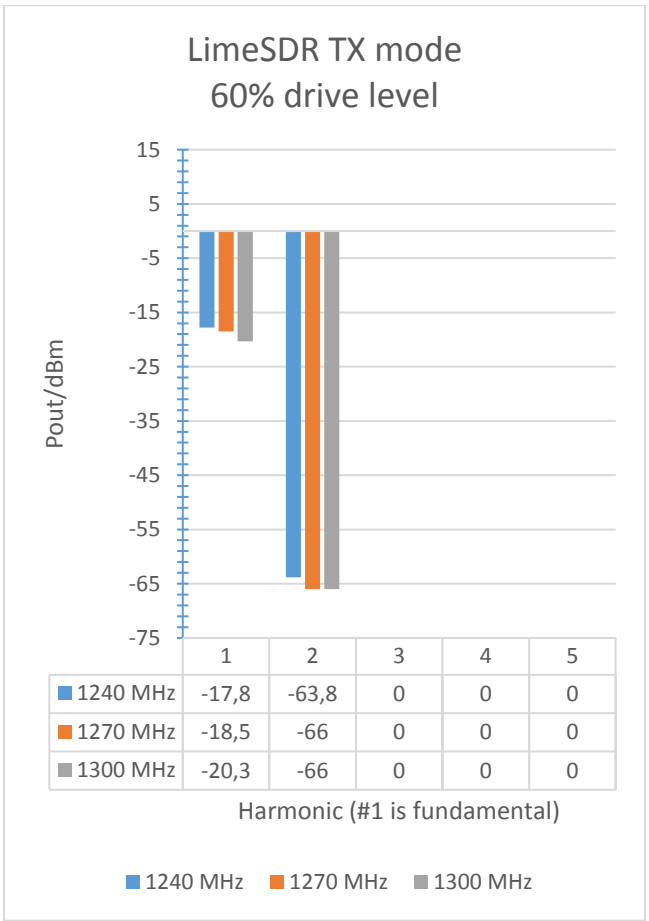
	1	2	3	4	5
430 MHz	-16,7	-63	-28,2	-63,8	-40,1
435 MHz	-16,9	-62,8	-29	-64	-42,7
440 MHz	-17	-62,6	-28,9	-64,4	-43,1



	1	2	3	4	5
1240 MHz	10,5	-43,8	0	0	0
1270 MHz	9,9	-43,9	0	0	0
1300 MHz	8,3	-42	0	0	0



	1	2	3	4	5
1240 MHz	-2,2	-57,1	0	0	0
1270 MHz	-3	-57,2	0	0	0
1300 MHz	-4,8	-57,3	0	0	0



	1	2	3	4	5
1240 MHz	-17,8	-63,8	0	0	0
1270 MHz	-18,5	-66	0	0	0
1300 MHz	-20,3	-66	0	0	0

As described before, with the setup which I was using, no harmonics could be measured of the 2400 MHz signal. Thus, I prepared two simple tables.

Here is the measurement at port TX1L (drive level 100%):

Frequency /MHz	Pout/dBm
2320	-6,1
2360	-7,6
2400	-10,6
2440	-7
2480	-19,1

Here is the measurement at port TX1H with different drive levels (100%, 80%, 60%):

Frequency f/MHz	Pout/dBm @100% Drive Level	Pout/dBm @80% Drive Level	Pout/dBm @60% Drive Level
2320	-2,6	-15,6	-30,8
2360	-3	-15,9	-31
2400	-6	-18,6	-33,9
2440	-3,3	-16,2	-31,7
2480	-15,5	-27,7	-40,1

In addition, I made a frequency sweep in the 13cm band.

Please ignore the peaks, which are marked with red crosses. They are spurious emissions resulting from an imperfect control of the LimeSDR by the SDR-Radio software. This was corrected in a later version of the SDR-Radio software.

As can be seen, my unit has a dip of about 3dB in the output power centred right at 2.4 GHz, which is the uplink frequency for QO-100.

I appreciate any feedback and comments. In addition, if you have any questions I will be happy to answer them by Email.

Best regards

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