12 VDC to 120 VAC Inverter Comparative Amateur Band Emissions

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Summary
All the 12 VDC to120 VAC inverters tested create incidental RF signals in the 160 meter to 6 meter bands. Only some inverter brands and models list RFI/EMC as part of their specifications, and some comply with FCC Part 15(B), Class B for limiting potential interference. My measurements indicate that:
1. higher cost or superiority in other inverter specifications is not a guide to the inverter interference potential;
2. inverters with FCC Part 15(B), Class B compliance are likely to be better to operate in close proximity to amateur radio HF gear;
3. Manufacturer claims of lower interference potential for certain brands or models, vs complete avoidance of any statements concerning RFI/EMC potential for another manufacturer's inverters should be considered when products are evaluated;
4. Inverter incidental signals in amateur bands can be 10-20 dB lower using one inverter compared with another inverter, under the same load conditions.

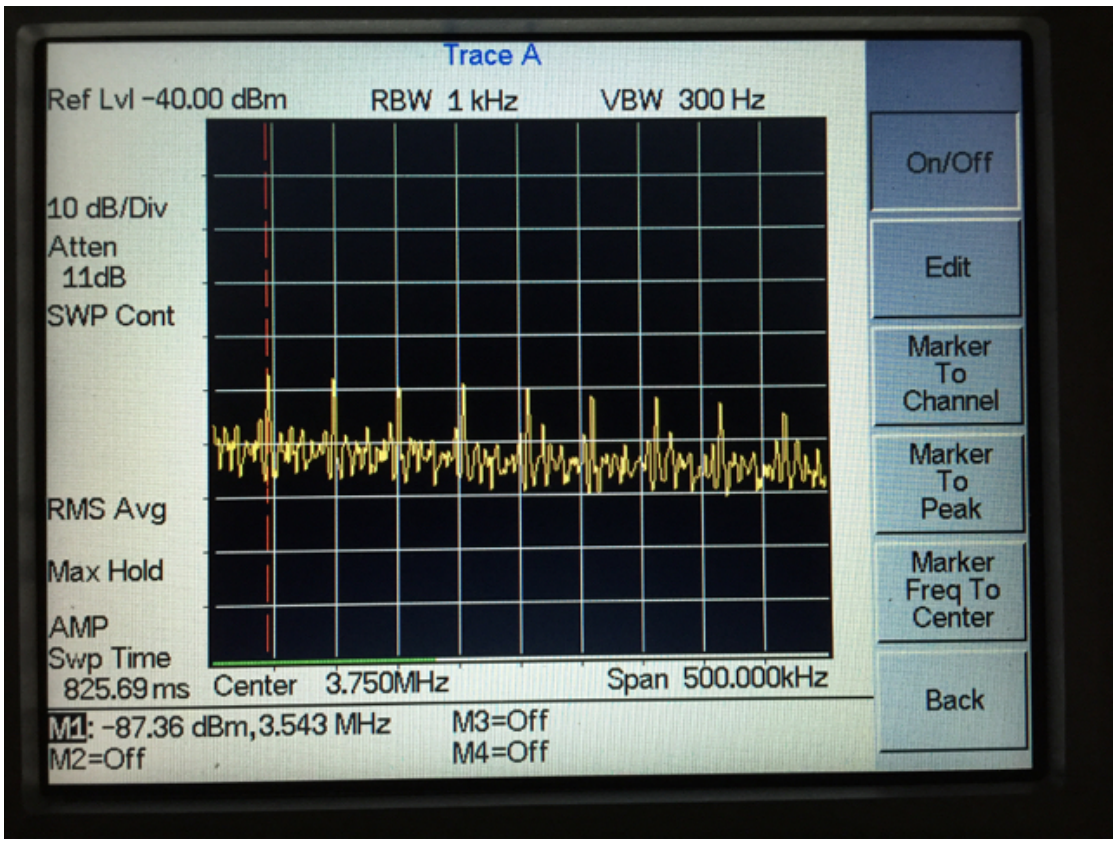
Background
I was using a sine-wave inverter to power some equipment and noticed what seemed to be a higher level of interfering signals from the inverter on HF bands than I had expected. Later research turned up a product review from QST covering this issue (April, 2009, p44-50). I learned that some manufacturers of inverters don't mention RFI/EMC in their product specifications, while others list compliance with various EMC standards including FCC Part 15(B), Class B. I then called technical support at one manufacturer who did not list RFI/EMC in their documentation to be sure I wasn't overlooking information or suggestions for interference reduction, and was told they had no information on the subject.

While I don't have the background or facilities for formal EMC standards testing, by taking comparative measurements of several inverters I hope to pick those less likely to cause HF interference. I am also now paying attention to EMC compliance listed in inverter specifications.

There are times when it is useful to operate a 120 volt AC inverter while operating HF amateur radio equipment nearby, and it is easier with some inverters than others.

Measurement conditions for inverters

I used a Beehive Electronics 100C loop EMC probe and Anritsu MS2711D spectrum analyzer to measure the strongest signal within each HF amateur band. Measurements were with the probe immediately adjacent to the DC input cable 1 foot from the DC input terminals of the inverter. Each cable was a side-by-side wire pair. Both AC loads used for testing were fans. The load for all inverters except the Enercell was 144 W. The load for the Enercell was 28 W.



Comparison Table
Table values are in dBm. The top figure in each table cell is with no AC load on the inverter, and if there is a bottom figure, it is with the load specified in the 1.8-2.0 MHz row. A weaker signal is more negative than a stronger signal. -90 is a weaker signal than -72, and less likely to cause annoying interference to nearby amateur receivers.

Freqencies measured MHz	Samlex PST-30S-12A	Samlex PST-300-12	ExelTech XP250	Xantrex Xpower 400	Enercell 75 W
1.8-2.0	-90 -78 144 W	-89 Not meas. 144W	-72 -68 144 W	-88 Not meas. 144W	-96 -85 28 W
3.5-4.0	-96 -85	-87 -77	-79 -75	-95	-98 -81
7.0-7.3	-108 -94	-93 -88	-88 -84	-95	-99 -88
10.1-10.15	-113 -115	-97	-97 -91	-102	-97 -93
14.0-14.350	-116 -100	-94	-99 -92		-101 -97
18.068-18.168	-119 -104	-114	-106 -92		-114 -100
21.0-21.450	-105 -88	-113	-100 -87		-114 -101
24.890-24.990	-123 -100	-129	-108 -111		-130 -114
28.0-30.0	-114 -100	-116	-88 -111		-116 -96
50.0-54.0	-102 -94	-105	-109 -105		-116 -104

Quick fixes that didn't work
I made 10 turns of an inverter DC cable through a 2" ferrite toroid as close as possible to the inverter. Amateur band signals measured along the DC cable in at least one band were higher than without the toroid. (Note added in 2017 - When I reviewed the ferrite mix for the toroid later, I discovered that it was Mix 43, and not useful for common mode noise reduction in the 1.8 MHz to 21 MHz frequency range.)

I made a tightly twisted pair of the DC input cable on an inverter and compared it with the side-by-side configuration of the same cable. Amateur band signals measured along the twisted pair were at least as strong as side-by-side. This cable was approximately 3 feet long.

Another possible aid for interfering inverter emissions

There are commercial EMI filters for the DC input cable and the AC output cable. I haven't tested the effect of placing filters on the power input and power output lines as of now.