# Reducing radio-frequency radiation from a solar electric system

Modern solar systems radiate radio-frequencies that can affect human health and interfere with radio reception. A radio amateur modified a solar system to greatly reduce the radiation, but it was a large and costly project**.**

*Keywords:* *solar power, solar electricity, inverter, optimizer, Maximum Power Point Tracking, dirty electricity, RFI, conducted emissions, health, electrical sensitivity, radio, interference, EMF, EMC, shielding, filtering*

## The problem with solar systems

Modern solar systems use inverters to take the electricity from solar cells and make it into regular AC electricity that can power a home and be sold to a utility company. Inverters work by rapidly switching the flow of electricity. This generates radio-frequency radiation from the inverter itself and also from the wiring and solar panels connected to it, as transients travel on them (called “dirty electricity”). This is a problem with every type of inverter, including sinewave, squarewave and microinverters.

Most solar systems also use optimizers (also called Maximum Power Point Tracking), which work similarly and cause the same problems.

These technologies can interfere with radio amateur (ham) operators and reception of short wave radio. They can also cause symptoms in people who are extremely electrically sensitive (see "more information" below).

## The radio amateur’s solar project

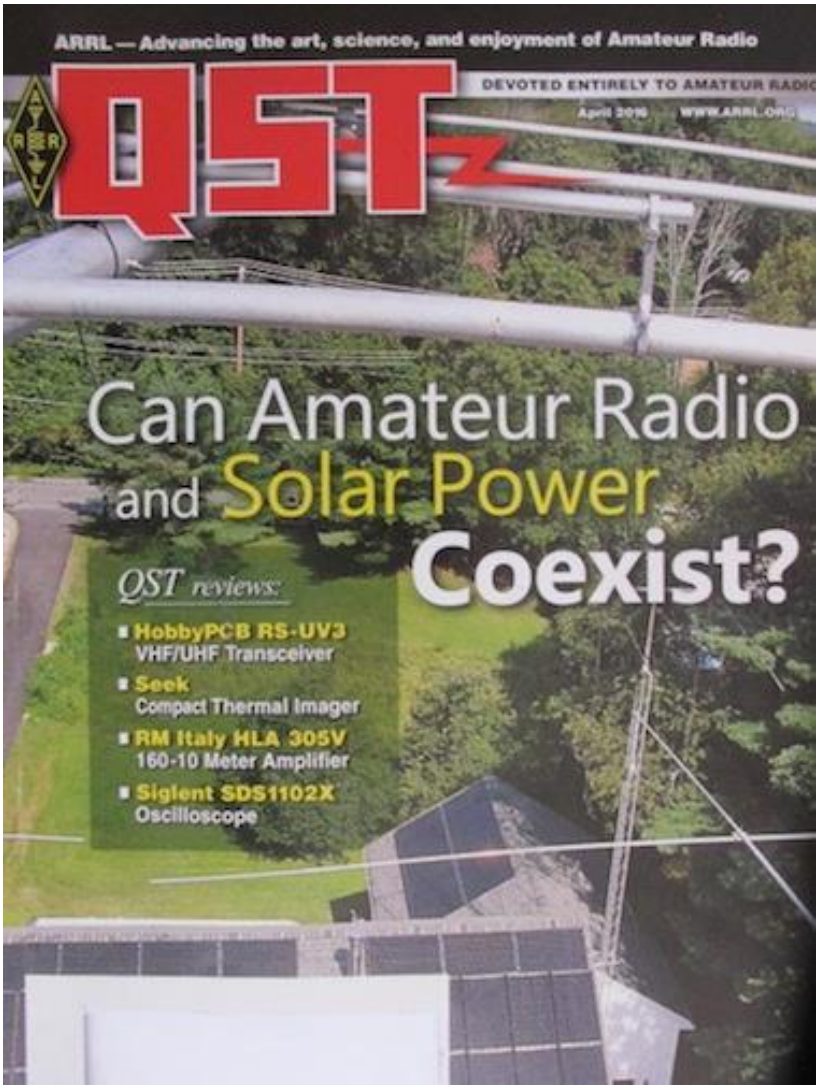
Tony Brock-Fisher is a retired engineer who also has a degree in physics. He wanted to install a large 10 KW solar system on the roof of his house without interfering with his hobby as a radio amateur. His antennas were mounted on poles well above the house, so there was some distance to the solar equipment.

He modified a standard solar system in various ways including:

- avoiding microinverters
- avoiding wire loops

- shielded wires
- line filtering (filters and ferrites)

He was able to reduce the radiation about a hundredfold (20 dB). This added about 10% to the total cost of the solar system.




*Front page of the QST magazine, with Brock-Fisher's antennas and solar system. The issue is available from ARRL.*

## Commentary

As a commenter to the article pointed out (Andrea, 2016), eliminating the optimizers entirely should further reduce the emissions. They are not essential.

For people with electrical sensitivities, all these measures may not be sufficient. The fundamental frequency of an inverter is in the tens of kilohertz (SEI, 2006), the optimizers are presumably also in that area.

The strongest emissions are at the fundamental frequency, with the energy tapering off with increasing harmonics. The radio amateurs are seldomly interested in frequency bands below 2 megahertz (Brock-Fisher tested from 14 MHz and up), which is around the hundredth harmonic, i.e. much less energy to dampen than at the fundamental frequency.

The articles (Andrea, 2016; Brock-Fisher, 2016) correctly recommend using ferrites, but they are ineffective for frequencies in the lower kilohertz band.

Very few solar installers and electricians will understand the methods described in the article. If the problem is with a neighbor's solar system, it will likely be difficult to get them to modify the system, even if you pay them.

It is possible to avoid all these problems by using a DC-only solar system, such as a 12 volt system. These systems were common in the 1990s, but have various limitations.

## More information

For additional articles about dirty electricity, their possible health effects and solar power, see: www.eiwellspring.org/demenu.html.

## References

Andrea, Steve S. Simpler solar, SDR receiver upgrades, and MFJ tuner feedback (Technical correspondence), *QST,* September 2016

Brock-Fisher, Tony. Can home solar power and ham radio coexist?, *QST,* April 2016

SEI. Photovoltaics design and installation manual, Solar Energy International, New Society, 2006 (chapter 8).

Back issues of *QST* magazine are available from American Radio Relay League, www.arrl.org.

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