How to be sure your electric, gas or water meter does not transmit wirelessly

How to measure a smart meter

We describe how to verify that a smart utility meter doesn't transmit and how to measure how strongly it radiates.

Keywords: smart meter, wireless meter, how to measure, EMF, verify, opt out

In some areas, utilities allow people to opt out of having a wireless meter on their home, whether it is for electricity, water or gas. It can be useful to measure the radiation to decide whether to ask for an opt out, or to verify that the meter really doesn't transmit if the utility makes that claim.

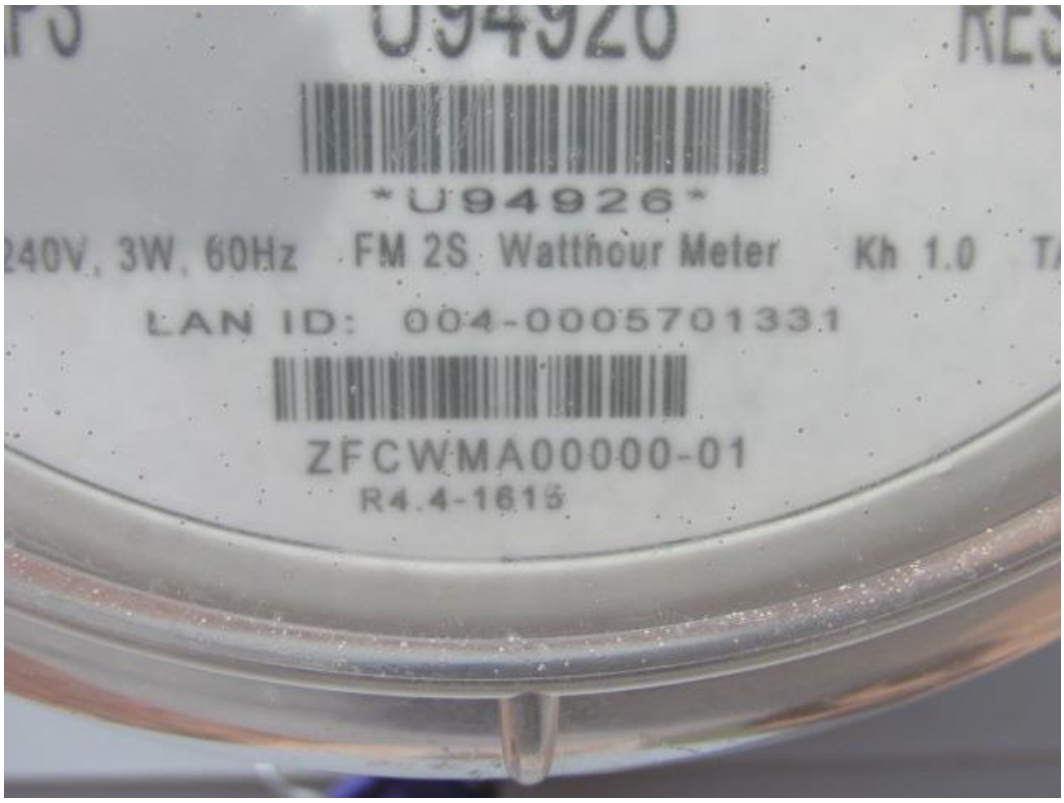
We have not heard any stories where there was a mistake so the opt-out meter did actually transmit anyway, but mistakes can happen. There was a case in Vermont where the smart electrical meters had a secondary transmitter (HAN) which was activated in every meter, even though it was not supposed to (Tell, 2013, p.10).

Look at the labels

In the United States, every device that transmits wirelessly must have a label with its FCC ID number. This is a registration number for this type of device. All copies of the same design will have the same FCC ID number.

Look at the bottom, sides and front of the meter for such a label.

Labels stating the device complies with FCC regulations does *not* mean there is a transmitter inside.



Look for anything that says "LAN" or "FCC ID."

Also look for other labels such as any that mentions a LAN (Local Area Network).

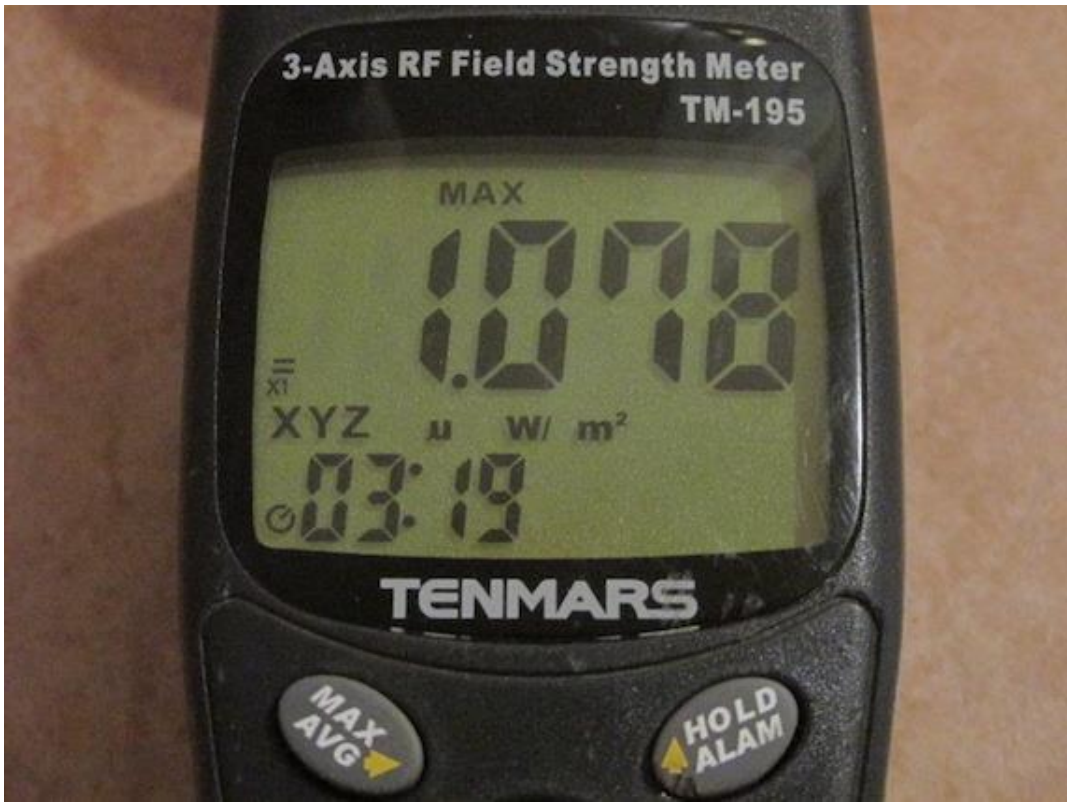
However, labels could be misleading. It could be the utility refurbished an older meter and the label no longer matches what is inside. Or it could be that the meter does have a transmitter inside, but it is disabled. And if the transmitter is disabled, how to be sure no mistake happened so it is actually on?

How to measure

The following procedure is the most surefire method we could come up with. You'll need two things:

- RF meter that can record Max/Peak
- Tripod

This will not work correctly if there are other sources of microwaves close by, such as other electrical meters or wireless networks (Wi-Fi).



An RF meter with a MAX (Peak) function is needed.

Also, the measurements must all be done with the RF meter in the shade. The heat of the sun will make consumer-grade RF meters show too high a reading.

1. Turn off all electronics in the house. Use the circuit breakers to be sure.
2. Mount RF meter on tripod, at same height as the utility meter
3. Place tripod 3 ft (1 meter) directly in front of the utility meter
4. Turn on the RF meter and set it to record the MAX or PEAK reading

5. Measure for at least 5 minutes
6. Move tripod to be 10 ft (3 meters) and still directly in front of the utility meter.
7. Reset RF meter, then do another 5 minute MAX/PEAK measurement.
8. Move tripod further away, and NOT directly in front of the utility meter.
9. Reset RF meter and do a third 5 minute MAX/PEAK measurement. This is the ambient reading.

It won't work if you try to cut corners, such as just holding an RF meter up against the utility meter. If you want to know why that fails, and why we chose this more cumbersome method, please look in the technical notes further down.

Looking at your readings

Here are the data from two such measurements, both on meters that do radiate. You should now have something similar.

Meter model	3 ft/1 m	10 ft/3 m	Ambient
Itron C1SR	7.5	0.70	0.06
Focus AXR	191	34	0.6

Measurements of two wireless electrical meters. All numbers in mW/m^2

Note how the readings for both electrical meters are dramatically lower at 10 ft distance compared with at 3 ft, and that both are higher than the ambient reading. This is the signature of a wireless meter.

If the utility meters were not wireless, the three readings should be roughly the same.

If the three readings are not roughly the same, and do not neatly drop off from the meter, then there may be another transmitter close by. Try to redo the three measurements, perhaps at a different time of day, such as early morning or late at night.

If the 10 ft and the ambient reading are about the same, it may be because the ambient levels are high. This can easily happen in densely populated areas.

If the utility meter is part of a bank of other meters that are wireless, this method cannot determine whether yours transmits or not.

There are several other possible reasons the readings do not make sense. A common one is human error. Consider hiring a specialist, though there is no way to ensure such a person is truly competent unless you shell out for a professional engineer (P.E. in America). Such a person should arrive with sophisticated equipment that can determine the issue directly in one single measurement.

Technical notes

All wireless utility meters transmit in pulses that each last a fraction of a second. The typical duration is between 30 and 100 milliseconds (Tell, 2013, p. 24).

Consumer grade RF meters typically have trouble picking up brief pulses. One instrument we are familiar with, the TENMARS TM-195, only samples three times a second according to the manual.

The wireless electric meters can transmit as frequently as multiple times a second (PG&E, 2011), or every 30 seconds (UniSource, 2011), perhaps even slower. One test of a wireless gas meter showed it transmitted every 14 seconds (Tell, 2013, p. 85).

To ensure that at least one of the brief samples of a budget RF meter coincides with one of the brief and possibly infrequent transmission bursts, we decided on recording the peak value over 5 minutes. (The Itron C1SR meter we list in the table transmits every 30 seconds, according to UniSource, 2011).

Simply holding an RF meter near a pulsing microwave source, such as a wireless smart meter, will likely provide a much too low reading.

Most consumer grade meters are not able to measure RF in the near field, i.e. within about three wavelengths. This requires a special antenna. The manual for the TM-195 lists this limitation. At 900 MHz, the wavelength is about 0.33 meters, i.e. why we specify a distance of at least one meter (3 ft).

Our own testing has shown that the antennas on smart meters tend to be directional, with the strongest signal straight out front, and dropping off when at an angle. It is therefore essential that the two measurements both are directly in front of the utility meter.

Our testing of the TM-195 has shown the sensor to be very sensitive to heat, especially radiant heat from the sun. It can then show too high a reading. This appears to be a common problem for consumer grade RF meters.

For a detailed example of how to measure smart meters with professional equipment see Tell (2013).

More information

For more information about smart meters, go to www.eiwellspring.org/smartmeter.html.

For more about how to measure EMF, go to www.eiwellspring.org/measureemfmenu.html.

References

PG&E, Pacific Gas and Electric Company's response to administrative law judge's October 18, 2011 ruling directing it to clarifying radio frequency information, Cal PUC application 11-03-014, November 1, 2011

Tell, R and C. Tell, An evaluation of radio frequency fields produced by smart meters deployed in Vermont, January 14, 2013. (Prepared for the Department of Public Service, Vermont).

UniSource, oral testimony at Arizona Corporation Commission hearing about smart meters, Docket E-00000C-11-0328, www.azcc.gov. September 8, 2011.

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