Itron

The Facts on RF Exposure from Meter Banks

Multiple meters in a group does not significantly increase RF exposure

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INTRODUCTION

Some consumers concerned about Radio Frequency (RF) emissions from smart meters have also raised concerns about meter banks and their safety. Meter banks are multiple-meter installations on a wall or in a closet and are typically located at apartment complexes or strip malls.

Intuition might suggest that if one smart meter that utilizes wireless communications to send consumption data back to the utility represents "X amount" of RF exposure, 10 or 20 meters located in closer proximity to each other in a meter bank must represent 10 times or 20 times the RF exposure of a single meter.

That's simply not the case. The total RF exposure from multiple meters in meter banks is effectively no greater than that of a single meter, as we'll explain in this document.

SMART METERS AND RF

Before we explain how meters in a meter bank function and their RF profile, first it's important to emphasize that Itron meters are thoroughly tested and meet or exceed all applicable performance and safety standards for RF devices established by such regulatory bodies as ANSI, The Federal Communications Commission (FCC), Industry Canada, and the Institute of Electrical and Electronic Engineers (IEEE).

> "The total RF exposure from multiple meters in meter banks is effectively no greater than that of a single meter"

Furthermore, because of the low-power of the smart meter transmissions, the very short "duty cycle" or transmission time (typically just a minute per day total) and the fact that the meter banks are usually located at some distance away from people, the RF exposure from Itron meters amounts to a small fraction of the RF that people expose themselves to every day with other devices such as cell phones, microwave ovens and Wi-Fi routers.

In addition, RF exposure from these meters amounts to a very small percentage of what the FCC refers to as the "Maximum Permissible Exposure" (MPE) for people, and those MPE limits have a 50X safety cushion built into them below what can cause actual harm to the human body.

In fact, independent testing of Itron meters conducted in 2010 by the Electric Power Research Institute in both the lab and in the field in southern California, revealed that 900 MHz RF emissions at about 8 inches away (20 cm) from a bank of meters, which were also specially programmed to transmit continuously (100 percent duty cycle vs. the typical 0.06 percent duty cycle of normal operation), showed peak transmissions that were only 2 to 7 percent of the MPE standard. Again, these measurements were taken from about 8 inches away from the meter and the meter was set to transmit continuously.

METER BANKS

Anyone who has lived in an apartment building or a high-rise condo, or has driven behind a strip mall, may have noticed that the electric meters tend to be located in groups in a closet or on a wall inside or outside a building. These meter banks, as they're called, have always been a convenient and cost-effective approach to wiring and metering electricity usage for the separate dwellings or areas in the facility. Typically, these meter banks house anywhere from 10 to 30 electricity meters.

With the advent of smart meters, the utility can now collect consumption data from those meters remotely via wireless RF communications. This has raised the question of whether this many meters located close together substantially increases the amount of RF exposure compared to a single meter on a single house.

The answer to that question is no. The RF exposure is effectively the same as that of a single meter during normal network operations. This is still only a small fraction of what the safety standards allow. Why is this the case?

METERS DON'T COMMUNICATE SIMULTANEOUSLY

Itron smart meters communicate via a "mesh network" architecture. This means that individual meters communicate with and through other nearby meters before the data reaches a collector unit, which aggregates the incoming data from hundreds of meters and forwards that data to the utility.

This mesh architecture enables the network to be self-healing, so that when something changes in the network conditions, individual meters can automatically find alternative routes in the mesh network to route consumption data, or a power outage alert message, back to the collector and ensure reliability of the network. The meter transmissions are very lower power (roughly 1 watt or less) and occur for very short durations – fractions of a second.

Itron's mesh network is designed so that the meters in a network cell communicate at different times when they're receiving or sending data. Hence, the amount of RF exposure from a meter bank at any given time is effectively the same as a single meter on a single family home.

Therefore, there is no increase in RF exposure from a meter bank relative to the MPE standards during normal operation of the network. And while it is possible for two meters in a bank to communicate at same time (Note: This results in a failed communication), the frequency or incidence of simultaneous communications is so low that any addition to overall RF exposure would be inconsequential relative to MPE thresholds.

DISTANCE DIMINISHES SIGNAL STRENGTH SIGNIFICANTLY

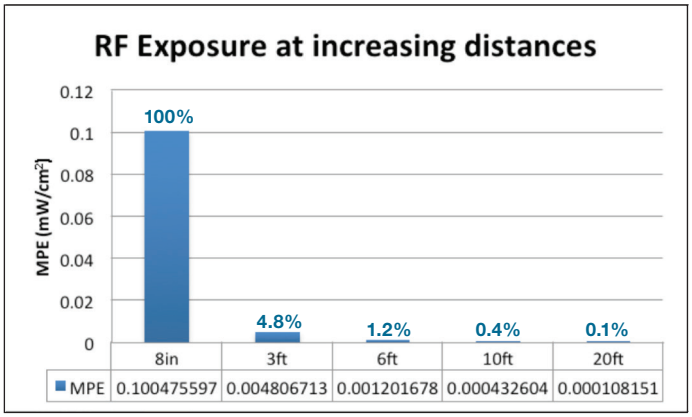
Secondly, as distance increases from that meter, the RF exposure level drops off very quickly due to the physics of RF propagation. More precisely, to calculate the RF exposure at any given distance, the transmitted power is divided by "4 x pi x the distance squared." To illustrate this, let's look at a transmitted power level of 504.8 milliWatts (mW) and calculate the MPE (power density) at two distances from the transmitter: 8 inches (20 cm) and 3 feet (91.4 cm):

$$\text{MPE at 8 inches} = \frac{504.8\ mW}{4 \times pi \times 20 \times 20} = 0.1005\ mW/cm2$$

$$\text{MPE at 3 feet} = \frac{504.8\ mW}{4 \times pi \times 91.4 \times 91.4} = 0.0048\ mW/cm2$$

This shows that the RF exposure level (MPE) from this transmitter is more than 20 times less at 3 feet when compare to at 8 inches from the transmitter (less than 5%). The graph below shows how this level falls off very quickly as the distance increases.

Notes: 1. 504.8 mW is the maximum transmitted power from an Itron HW3.0 smart meter.
2. pi (π) = 22/7 ≈ 3.14



As you can see, the RF exposure from a smart meter falls off sharply only a small distance from the meter and meter banks are usually located at a considerable distance from people. Both the absence and infrequency of simultaneous meter communications coupled with the degradation of RF signal strength at any distance, means that the density of RF exposure from meter banks is extremely low relative to the applicable safety standards and other sources of RF in our everyday lives.

WHAT THE DATA SAYS

The data from the independent testing done by EPRI on Itron meters in the field supports this conclusion. For instance, field measurements done by EPRI on a rack or "bank" of 10 Itron OpenWay® meters pre-programmed to transmit continuously at 900 MHz (a scenario that will never happen in the reality), revealed RF exposure at just over 8 percent of MPE safety levels at only ~1 foot (30 cm) away from the meter bank. More importantly, as distance increased from the meter bank, the strength of those RF signals decreased quickly. At seven feet from the meter bank, RF density and exposure levels from 10 meters quickly dropped off to less than 1 percent of Maximum Permissible Exposure. At 20 feet, it's approximately 0.2 percent of MPE. Again, in normal operations, these meters typically transmit a total of about 1 minute per day.

BEHIND THE METER BANK

Another question raised about smart meters is the strength of the RF emissions behind a meter or meter bank containing multiple meters. For instance, if a bedroom where someone sleeps is located on the other side of a wall from where a meter or meter bank is located, how much additional RF exposure will that person be subjected to? Two factors significantly reduce the amount of RF exposure from behind the meter so that the levels are comparable, or even lower, than other locations relative to the meter or meters.

First, the radio transmitter and antenna in the smart meter are designed to primarily direct transmissions outward through the front and sides of the meter and less through the back and meter box. In fact, the RF field density behind a transmitting Itron meter is only about 3 percent of the field density of that found in front of the meter. Secondly, there are typically a variety of materials separating the transmitter in the meter from the space situated behind the meter on the other side of a wall, or in an adjacent room.

> "Hence, the amount of RF exposure from a meter bank at any given time is effectively the same as a single meter on a single family home."

These materials typically include wood, stucco, brick, sheet rock, insulation, etc. All of these materials behind the meter will further degrade or reduce the field density and RF exposure behind the meter. In fact, these materials have been shown to decrease the signal strength behind the meter by as much as 90 percent compared to the signal strength in front of the meter. Sample measurements, with these two factors accounted for, show that the RF exposure on the inside of a stucco wall (with a meter mounted directly on the other side of the wall) are only one half of one percent (0.5%) of the levels directly in front of the meter.

CONCLUSION

For a variety of reasons highlighted in this report, RF exposure does not increase significantly when groups of smart meters are located together in a meter bank. Because Itron smart meters transmit at different times and have very low duty cycles, coupled with the fact that RF signal strength decreases substantially as distance from the meters increase, RF exposure from meter banks (as measured by field density relative to MPE safety standards) does not effectively increase based on the number of meters in a group. Rather, RF exposure from a bank of meters is effectively the same as that of single meter. These levels of meter and meter bank emissions are just a small fraction of the RF exposure people incur from other common everyday devices, and they are an even smaller fraction relative to RF safety thresholds established by the FCC and other regulatory bodies.

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