BRYAN TEXAS UTILITIES

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Some Answers About AMI

April 10, 2012

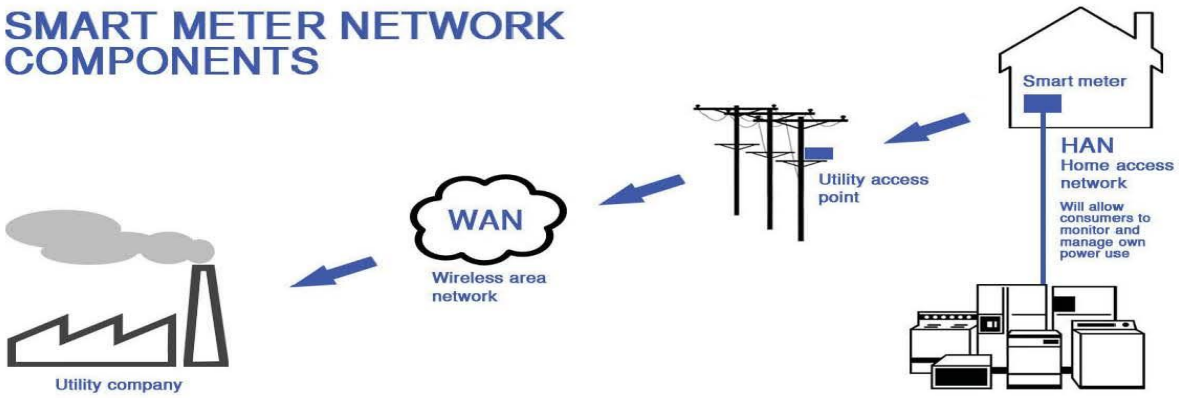


Figure 3. Simplified depiction of Smart Meter system network. Arrows show the use of radiofrequency (RF) signals for automated meter reading, communications among electric power meters, relays, access points, the company's enterprise management systems. The future home access network will operate within the house.

Smart meters have evolved from automatic meter reading (AMR; i.e., replacing meter readers) to a real time monitoring of power as delivered to the consumer by the utility company. CCST obtained from PG&E the Richard Tell Associates report, which describes the operation of the smart meter from the 2008 perspective of AMR, not a fully deployed real time smart grid. The Richard Tell Associates reports describe the use of the smart meter radios being deployed by PG&E as licensed by the FCC for a maximum power output of 1 W (watt) and within the 902-928 MHz (mega-hertz) frequency band. In its initial deployment, PG&E reports that it will configure the radios to transmit data from the meter to the access point once every four hours, for about 50 milliseconds at a time.[3] Accounting for this, the current duty cycles of the smart meter transmitter (that is, the percent of time that the meter operates) would then typically be 1 percent, or in some cases where the meter is frequently used as a relay, as much as 2-4 percent. *This means that the typical smart meter in this initial (AMR) use would not transmit any RF signal at least 96-98 percent of the time.*

It is important to note that any one smart meter is part of a broader "mesh" network and may act as a relay among other smart meters and utility access points. In addition, when the smart grid is fully functional the smart meters would be expected to be transmitting much more than once every four hours, providing data in near real-time, which will result in a much higher duty

[3] Tell, R. (2008) "Supplemental Report on An Analysis of Radiofrequency Fields Associated with Operation of the PG&E Smart Meter Program Upgrade System," Prepared for Pacific Gas & Electric Company, Richard Tell Associates, Inc., October 27. http://www.pge.com/includes/docs/pdfs/shared/edusafety/systemworks/rfsafety/rf_fields_supplemental_report_2008.pdf)

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AMI System Selection Process

- 3 of the top 5 AMI system providers bid
  - Elster - radio frequency (RF) mesh
  - Itron -RF mesh for electric, star for water
  - Sensus - RF tower
- 400+ technical requirements evaluated
- Elster and Sensus - on-site demo
- Utility references - solid technology


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Powering the Future by:
• Offering advanced technology
• Providing reliable service
• Offering customer options
• Supplying renewable energy
• Maintaining low rates
• Caring about our Community
• Valuing our customer
BTU Utility Payments Accepted Here
Services Include:
• Electric
• Water
• Waste Water
• Solid Waste
• Drainage and Transportation
Treasure Shop

The Federal Communications Commission established limits for exposure to radio-frequency electromagnetic fields, which are published in FCC OET Bulletin 65 (August 1997), and codified in the Code of Federal Regulations (47 CFR § 1.1310). The FCC rule was adopted from two previous guidelines, one published by the National Council on Radiation Protection and Measurements (NCRP Report No. 86) in 1986, and the other by the Institute for Electrical and Electronic Engineers (IEEE C95.1 1991) in 1991. Both had extensively reviewed the biological and health literature, concluding that the only established effects were associated with tissue heating and no confirmed effects below heating thresholds were identified. The effects associated with heating, so-called 'thermal effects", concerned diminished response rates in food-motivated behavioral experiments in laboratory animal subjects (rhesus monkeys and rats) and were accompanied by a rise in body core temperature of about 1° C. The exposure limits specified by the FCC afford the public a margin of safety 50-fold lower than the adverse effect threshold identified in the behavioral studies. Since the FCC rule was promulgated, other organizations concerned with RF health and safety have developed exposure guidelines very similar to the FCC's. These include the International Commission on Non-Ionizing Radiation Protection (ICNIRP) guideline (Health Physics 74: 494, 1998) and IEEE Std C95.1™ published in 2005. These have again been based on thorough reviews of the literature, concluding that in the absence of heating, there have been no consistently demonstrated "non-thermal" mechanisms that could lead to adverse biological or health effects. A 2009 review of the radio-frequency health literature conducted by ICNIRP concluded:

> *The mechanisms by which RF exposure heats biological tissue are well understood and the most marked and consistent effect of RF exposure is that of heating, resulting in a number of heat-related physiological and pathological responses in human subjects and laboratory animals... Whilst it is in principle impossible to disprove the possible existence of non-thermal interactions, the plausibility of various non-thermal mechanisms that have been proposed is very low... the recent in vitro and animal genotoxicity and carcinogenicity studies are rather consistent overall and indicate that such effects are unlikely at specific absorption rate levels up to 4 W kg^{-1} [the level associated with behavioral disruption in animal experiments].*

EPRI Perspective

The use of RF-based smart meter technology for the residential sector has raised questions from the public as to potential health and safety risks that may be related to the meters' RF emissions. The Electric Power Research Institute's (EPRI's) EMF Health Assessment and RF Safety program initiated its research in response to these concerns with a preliminary commentary, A Perspective on Radio-Frequency Exposure Associated With Residential Automatic Meter Reading Technology (1020798), which described how wireless smart meters communicate, and provided insights into what kind of exposure levels may result. The EPRI research program has followed up with two ongoing research activities. One is an analysis of the amount of RF energy deposited in persons exposed to smart meter emissions. This study uses computer simulations of anatomically correct models of children and adults exposed under a range of conditions in very close proximity to a smart meter.

A second activity, the main subject of this paper, concerns a measurement study of RF emissions from one type of smart meter, taken under controlled conditions at the manufacturer's facility (as described in the Introduction). The purpose of the study was to take a first step in collecting empirical smart meter emission data. (*An Investigation of Radiofrequency Fields Associated with the Itron Smart Meter*. EPRI Technical Report 1021126, December 2010, www.epri.com). These data could potentially provide insight into the range of exposure levels produced by other wireless smart meter systems. Key results of the study described below were that (1) exposure levels from an individual meter fall off rapidly with distance as one moves away; (2) based on empirical data from two electric utility service territories in California, the meters transmit only a small fraction of the time, and (3) exposure levels—even when one is close to a meter that is continuously transmitting—remain below the FCC exposure limits.

Smart Meter Measurement Study

When deployed across neighborhoods, meters of the type studied operate as part of a "mesh" network. The meters distributed across the mesh network are referred to as "end-point" meters and are the most common. Data from the end-point meters at individual residences are routed to "cell relays" (referred to by some as "col-

FCC Standards

- FCC standards based on the thermal effects of RF radiation.
- Thermal effects refers to the observable heating of biological tissue due to exposure to high levels of RF radiation.
- Known for many years that exposure to high levels of RF radiation can be harmful due to the ability of RF energy to heat biological tissue rapidly as evidenced by microwave ovens.

FCC Standards (cont.)

- FCC standards for RF exposure were established in 1996, but reviewed in May 2010.
- Reviewed the findings of the World Health Organization Interphone Study that investigated health effects of RF radiation from cell phones
- Study found that "[o]verall, no increase in risk of either glioma or meningiomas was observed in association with use of mobile phones."

FCC Standards and Electric Meters

- The California Council on Science and Technology in its report dated April 2011 had the following findings:
  - Wireless meters result in much smaller levels of RF exposure than many existing common household electronic devices. (e.g. cell phones, microwave ovens)
  - The current FCC standard provides an adequate factor of safety against known thermally induced health impacts of existing common household electronic devices and smart meters.
  - Scientific studies have not identified or confirmed negative health effects from potential non-thermal impacts of RF emissions.
  - Not enough is currently known about potential non-thermal impacts of radio frequency emissions to identify or recommend additional standards for such impacts.

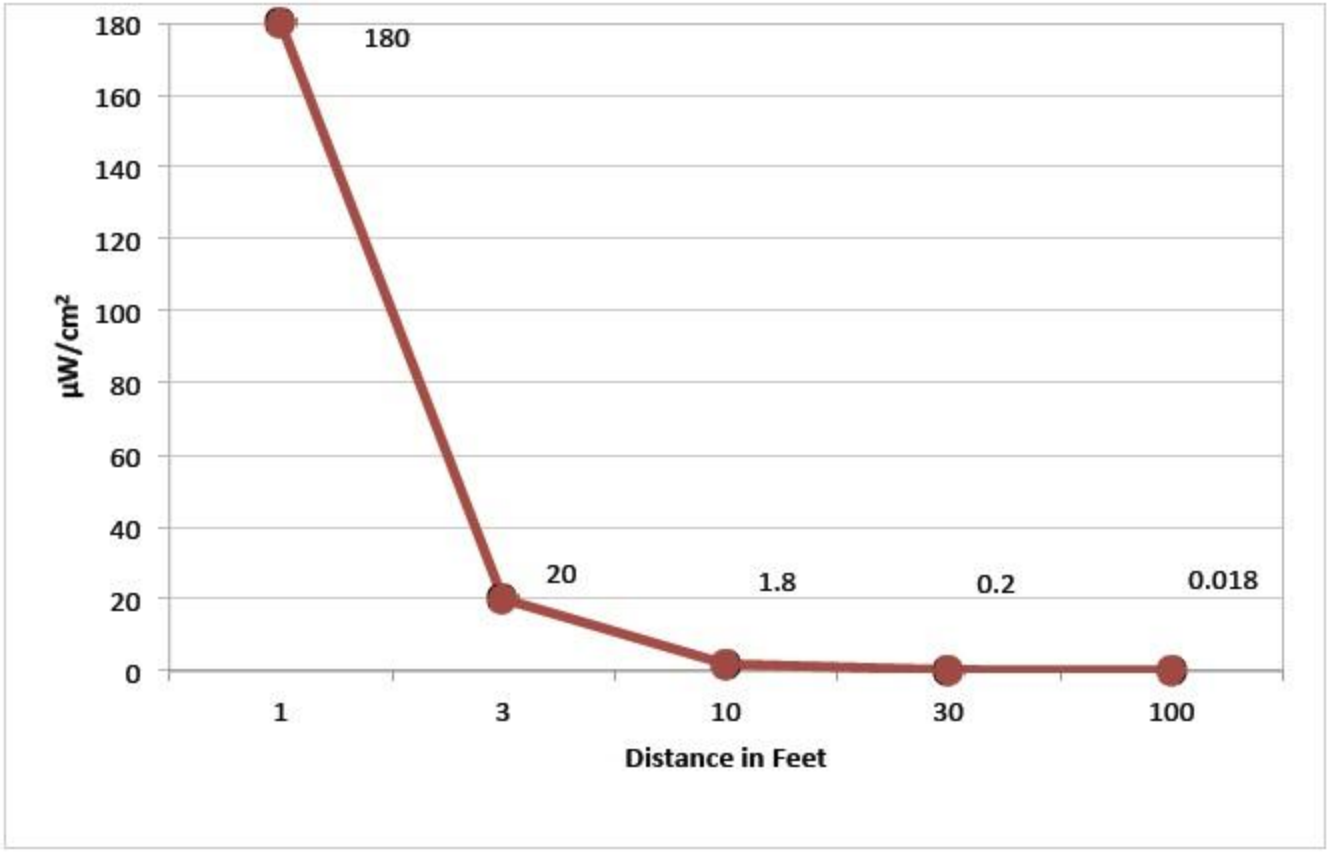


Figure 6. Power density from a sample smart meter versus distance;[29] 1-Watt emitter at 50% duty cycle. Typical smart meter AMR transmitter power density declines rapidly with distance. The rapid drop of power density with distance (inverse-square law) is similar for various duty cycles and different sets of source data.

TABLE 1 – RADIO-FREQUENCY LEVELS FROM VARIOUS SOURCES

Source	Frequency	Exposure Level (mW/cm2)	Distance	Time	Spatial Characteristic
Cell Phone (1)	900 MHz, 1800 MHz	1–5	At ear	During call	Highly localized
Cell phone base station(2)	900 MHz, 1800 MHz	0.000005–0.002	10s to a few thousand feet	Constant	Relatively uniform
Microwave oven(3)	2450 MHz	~5 0.05-0.2	2 inches 2 feet	During use	Localized, non-uniform
Local area networks(4)	2.4–5 GHz	0.0002–0.001a 0.000005–0.0002 b	3 feet	Constant when nearby	Localized, non-uniform
Radio/TV broadcast(5)	Wide spectrum	0.001 (highest 1% of population) 0.000005 (50% of population)	Far from source (in most cases)	Constant	Relatively uniform
Smart meter(6)	900 MHz, 2400 MHz	0.0001 (250 mW, 1% duty cycle) 0.002 (1 W, 5% duty cycle) 0.000009 (250 mW, 1% duty cycle)0.0002 (1 W, 5% duty cycle)	3 feet10 feet	When in proximity during transmission	Localized, non-uniform

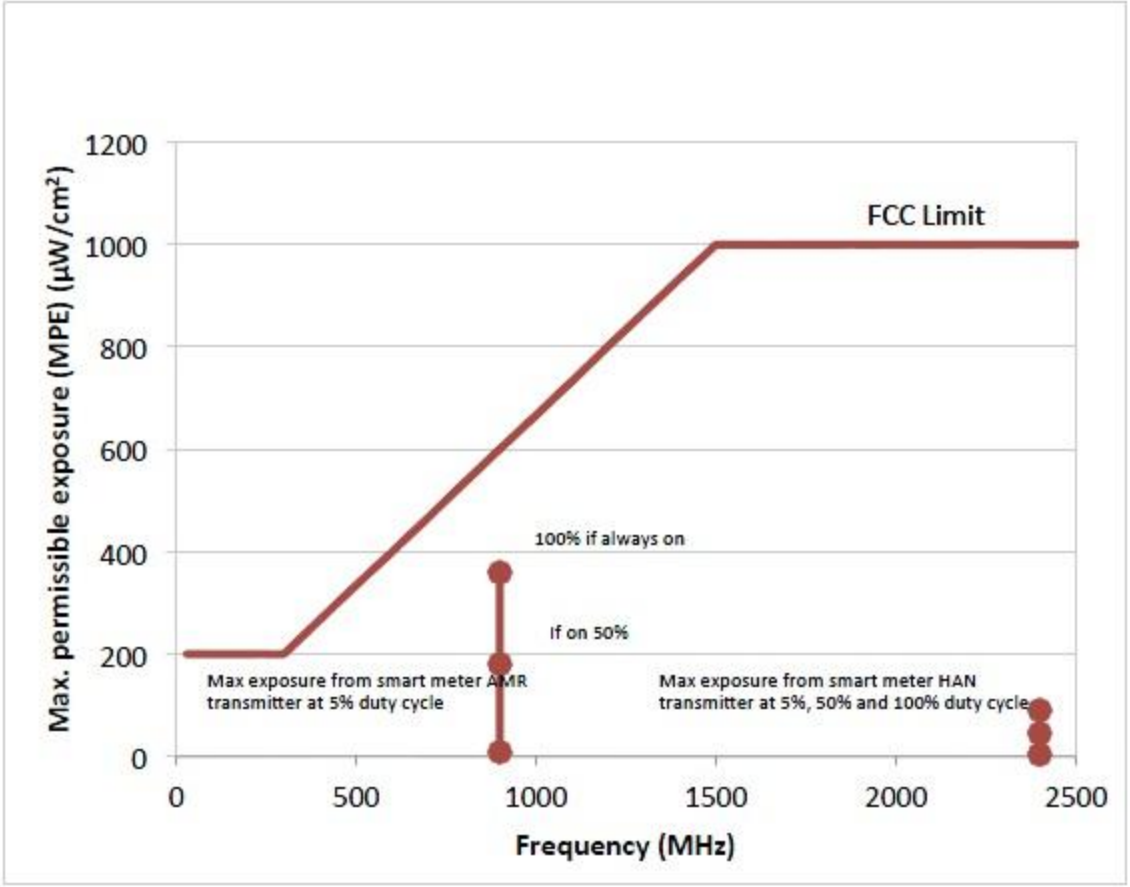


Figure 5. FCC maximum permissible exposure limits on power density rise with frequency because the human body can safely absorb more energy at higher frequencies. The estimated maximum exposure from a 1-Watt AMR transmitter at 5% duty cycle (i.e., 72 minutes/day) and one-foot distance is 18 µW/cm^2, or 3% of the FCC limit. Even if a meter malfunctioned and was stuck in the always-on transmit mode (i.e., 100% duty cycle), exposure levels would be 60% of the FCC limit for an AMR transmitter. For a 250mW HAN transmitter at a 5% duty cycle, the level would be .45% of the FCC limit and 9% of the FCC limit if the transmitter were on 100%. Exposure figures derived from November 2010 Electric Power Research Institute (EPRI) field measurement study entitled "Radio Frequency Exposure Levels from Smart Meters".[28]

Emergencies and AMI

- Provisions to implement rolling outages to electric customers during emergency conditions to protect the reliability of electric service in Texas.
- Provisions in place for greater than 20 years and predates AMI
- Implementation of the new meters will potentially allow BTU to implement these emergency provisions in a more efficient and equitable manner.

AMI Nationwide

- Pacific Gas & Electric in northern California and the Los Angeles Department of Water and Power have advances metering infrastructure (AMI) projects underway.
  - Marin and Santa Cruz counties have called moratorium on smart meters.
- the Maine PUC has implemented an opt-out program where the old electromechanical meter may be kept at an initial cost of $40 with a monthly fee of $12.
- An effort in court to stop AMI in New Hampshire failed.

Impacts of AMI over 20 Year Meter Life

	Life of Asset	YR1	YR2	YR3	YR4	YR5	YR6	YR7	YR8	YR9	YR10
AMI Debt Service (City & Ru	13,350,000	1,335,000	1,335,000	1,335,000	1,335,000	1,335,000	1,335,000	1,335,000	1,335,000	1,335,000	1,335,000
	13,350,000	1,335,000	1,335,000	1,335,000	1,335,000	1,335,000	1,335,000	1,335,000	1,335,000	1,335,000	1,335,000
Cost Reductions											
CS FY13 \ 20 Positions		(1,100,000)	(1,122,000)	(1,122,000)	(1,122,000)	(1,122,000)	(1,122,000)	(1,122,000)	(1,122,000)	(1,122,000)	(1,122,000)
CS Capital Cost (vehicles)		(15,000)	(15,300)	(15,300)	(15,300)	(15,300)	(15,300)	(15,300)	(15,300)	(15,300)	(15,300)
2 Managers		(292,500)	(298,350)	(298,350)	(298,350)	(298,350)	(298,350)	(298,350)	(298,350)	(298,350)	(298,350)
Not Quantified											
Fewer Meter Techs											
Lower Bad Debt on Prepaid is offset by 2% Discount											
Addition IT Support not in CS Budget											
	(28,684,850)	(1,407,500)	(1,435,650)	(1,435,650)	(1,435,650)	(1,435,650)	(1,435,650)	(1,435,650)	(1,435,650)	(1,435,650)	(1,435,650)
Total Savings	(15,334,850)	(72,500)	(100,650)	(100,650)	(100,650)	(100,650)	(100,650)	(100,650)	(100,650)	(100,650)	(100,650)
NPV	$ (9,943,696)										

AMI and Information Security

- The AMI project is wholly contained within the BTU private network.
- The AMI system provides for all communication traffic to the meters to be encrypted according to industry standards.