From: Dietz, Sidney
Sent: Wednesday, June 22, 2011 2:20 PM
To: 'cek@cpuc.ca.gov'
Cc: Cuaresma, Sally
Subject: Information on SmartMeter RF

Attachments: CCST report on SM RF.doc; Ms. Cindy Sage.pdf

Colette --

Please find attached some basic information on SmartMeter radios, mostly from the CCST report. Also, I have included a letter from the FCC to Cindy Sage.

yours,

sid

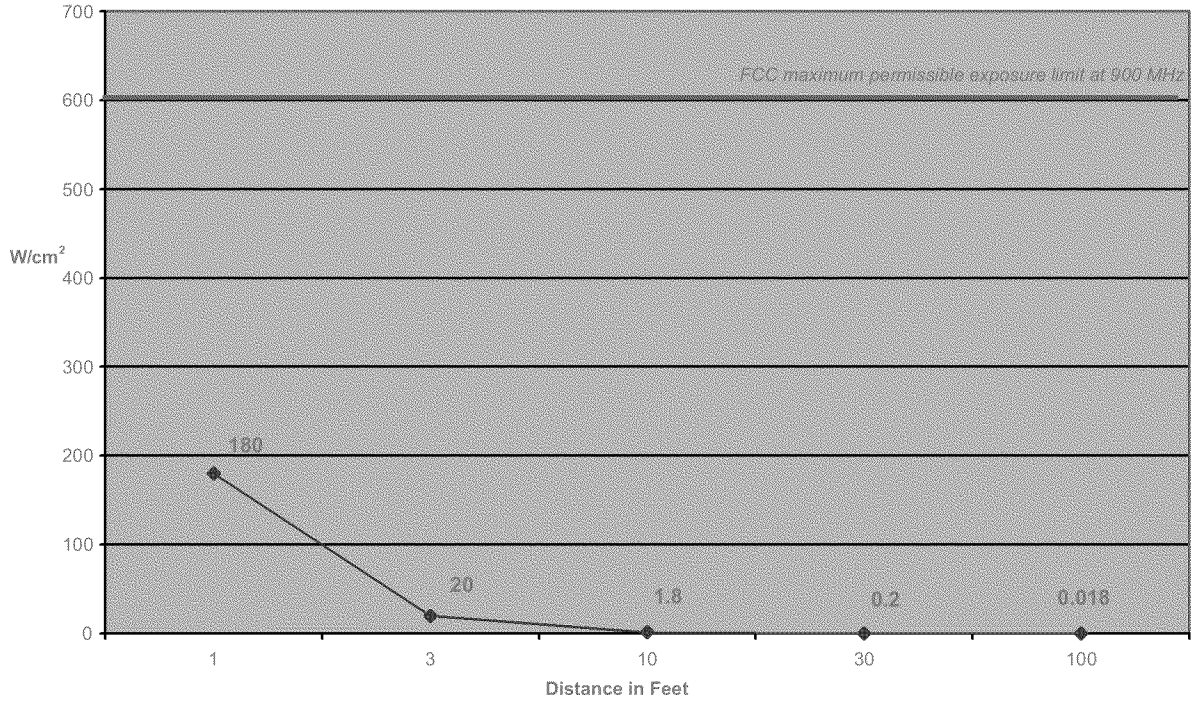
CCST report on SM RF.doc (271 ..

Ms. Cindy Sage.pdf (205 KB

Question 1: What did the California Council on Science and Technology (CCST) say about the relationship between RF and distance in its "Health Impacts of Radio Frequency Exposure from Smart Meters" (Report)?

Answer 1: The CCST Report contains a section entitled "Power Density (and Exposure Level) Declines Rapidly with Distance, in which CCST concluded as follows: "The power density from smart meters, or other devices that emit RF, falls off dramatically with distance. Figure 6[1] illustrates this affect for an example smart meter. While the estimated maximum exposure level at 1 foot from the meter with a duty cycle of 50% is 180 W/cm2 (far below the FCC guidelines), at a distance of about 10 feet, the power density exposure approaches zero." (Report at p.19.)

Figure 6R: Power Density from a Sample Smart Meter Versus Distance



Power density from a sample smart meter versus distance; 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.

"The FCC guidelines measure exposure to RF emissions in two ways. Specific absorption rate (SAR) measures the rate of energy absorption and is measured in units of watts-per-kilogram of body weight (W/kg). . . . Limits on SAR provide the basis for another measurement of exposure, maximum permissible exposure (MPE). MPE limits average exposure over a given time period (usually 30 minutes for general exposure) from a device and is often used for exposure to stationary devices and where human exposure is likely to occur at a distance of more than 20 cm. It is measured in micro (10^6) watts-per-square-centimeter (W/cm^2), and accounts for the fact that the human body absorbs energy more efficiently at some radiofrequencies than others. . . . In the frequency bands where smart meters operate, including PG&E's, namely the 902-928 MHZ band and 2.4 GHz range, the human body absorbs energy less efficiently, and the MPE limits are less restrictive. . . . At 902 MHz, appropriate for operation of the AMR transmitter of the smart meter, the FCC limit is 601 W/cm^2." (Report at pp.17-18.)

[1] Figure 6R combines information from CCST Report Figures 5 and 6.

Question 2: What did the CCST Report say about exposure levels from a bank of meters and from behind the wall of a single meter?

Answer 2: The CCST Report contains a section entitled "What About Exposure Levels from a Bank of Meters and from Just Behind the Wall of a Single Meter?" (Report at p.24.) It answered these questions by citing the Electric Power Research Institute's (EPRI) February 2011 assessment of the Itron smart meters in use in Southern California Edison's and San Diego Gas & Electric Company's service territories:

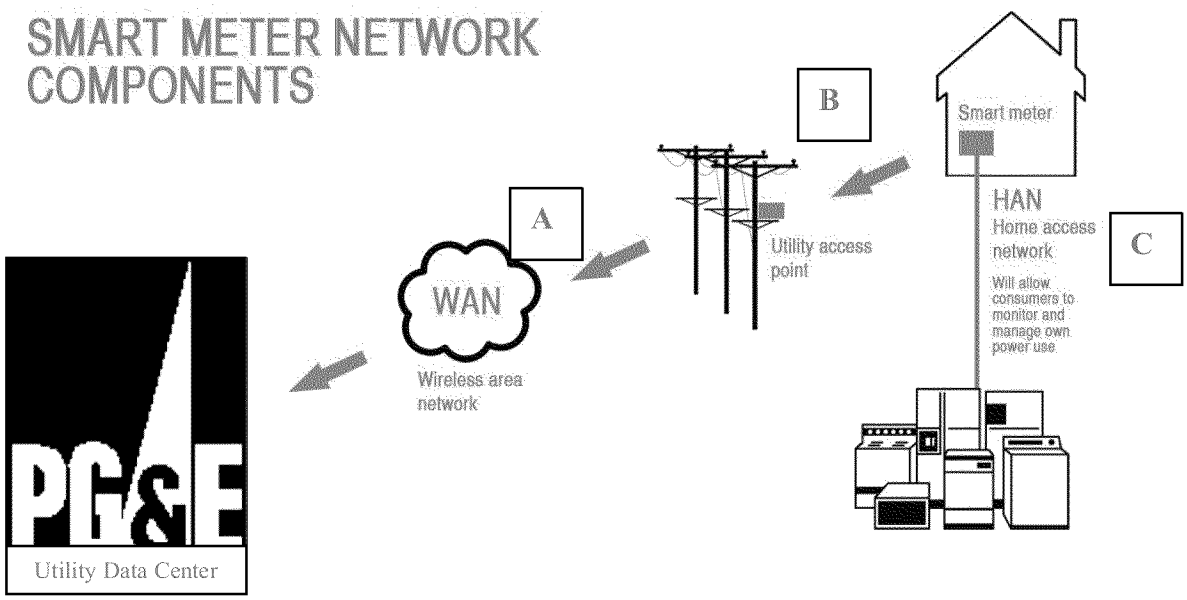
"[EPRI] field tested exposure levels from a bank of 10 meters of 250 mW [i.e., milliwatts] power level at one foot distance in order to simulate a bank of smart meters located at a multifamily building, such as an apartment house. The exposure level was equivalent to 8% of the FCC standard. [¶] In the same study EPRI measured exposure of one meter from eight inches *behind* the meter panel box in order to simulate proximity on the opposite site of the meter wall. At 5% duty cycle it yielded an exposure of only 0.03% of the FCC standard. Even at 100% duty cycle (i.e., always transmitting), exposure at eight inches behind the meter was 0.6% of the FCC limit." (Report at p.24)[2]

[2] There are two noteworthy differences between the types of meters to which CCST referred in responding to Questions 1 and 2 above. In its answer to Question 1, CCST referenced a 1-Watt power source with a 50% duty cycle (defined as the percentage of time that an RF device is in operation [Report at p.46].). In contrast, the meter that CCST referenced in its answer to Question 2 has a ¼-Watt emitter operating with a 5% duty cycle (i.e., it operates at a quarter of the power for just one-tenth of the time).

Question 3: What system architecture does PG&E utilize for its electric SmartMeter™ technology?

Answer 3: CCST describes PG&E's electric system architecture in a section entitled "What are Smart Meters?" (Report at p.10.) It states as follows:

"The smart meters used by PG&E are made by General Electric and Landis + Gyr and use a wireless communications technology from Silver Spring Networks. Each of these PG&E meters has two transmitters to provide two different communications of data from these meters. The first provides for the "automatic meter reading" (AMR) function of the meter . . . and sends this data to an access point, where it is collected along with data from many other customers and transmitted to PG&E using a wireless area network (WAN) (similar to the way cell phone communication works)." (Report at pp.10-11.)



Source: This diagram derives a similar diagram at page 11 of CCST's Report.

PG&E utilizes different radio network frequencies to convey the different amounts of data that it collects (e.g., a single home's data compared to a full neighborhood's data) the various distances that the data must travel (e.g., from a measure of feet at the HAN-level to a measure of miles at the WAN-level). These are reflected by letters A, B, and C above, as follows:

A. Public Service Telephone Network cellular wireless packet data service provided by Verizon and AT&T.

B. PG&E SmartMeter™ electric mesh network (operating in the 902 – 928 MHz band).

C. PG&E SmartMeter™ electric home area network (will operate in the 2.4 GHz band once in operation).

Federal Communications Commission
Washington, D.C. 20554

August 6, 2010

Ms. Cindy Sage
Sage Associates Environmental Consultants
1396 Danielson Road
Montecito, CA 93108-2857

Dear Ms. Sage:

Thank you for your letter of March 15, 2010, in which you request that we review compliance with FCC radiofrequency (RF) exposure limits for the "Smart Meter" technology being implemented by utilities across the country. In particular, you expressed concern about multiple adjacent Smart Meter installations used to service multiple dwellings such as condominiums, and the effect of increased data traffic on exposure from collector or controller units.

The FCC Equipment Authorization (EA) program in the Office of Engineering and Technology has taken a very conservative approach to RF exposure compliance for low-power network devices such as Wi-Fi base stations and Smart Meter transceivers. For such devices that are not expected to be used close to the body, it is generally unnecessary to perform routine specific absorption rate (SAR) evaluations as field strength or power density is a sufficient and appropriate measure of exposure. The maximum field strength at a distance can be derived from the effective radiated power (ERP). Also, FCC field strength limits, like the SAR limits, are time-averaged. Accordingly, for devices that will not be used within 20 centimeters of the body, we rely on the "source-based" time-averaged ERP and require that it be less than our specified values of 1.5 or 3 watts, depending on frequency,[1] in order to ensure compliance with our exposure limits. This does not imply that FCC exposure limits will be exceeded at distances less than 20 cm, but only that detailed evaluation of the SAR is not required if the 20 cm separation distance can be maintained.

It is useful in considering this issue to recognize that the power level specified on the Grants of Equipment Authorization issued by the EA program is the peak power as this is the power relevant to interference concerns. For exposure evaluations, however, the average power is relevant, which is determined by taking into account how often these devices will transmit. Since the purpose of these devices is to provide very infrequent information they transmit in occasional bursts. Thus, for exposure purposes the relevant power is maximum time-averaged power that takes into account the burst nature of transmission, and based on the typical maximum time-averaged transmitter power for many of these devices, they would generally be compliant with the local SAR limit even if held directly against the body.

With respect to multiple adjacent Smart Meter installations, since the antennas for each device are mounted individually on each utility meter, the separation distance from people for most of the transmitting antennas is relatively large compared to 20 cm and the

[1] See Section 2.1091(c) of the FCC rules.

meters' contributions to the total potential exposure at any location are small, as only the nearest few transmitters can add meaningfully to the total. Further, as a practical design matter, when several of these meters are placed in a cluster, they have to communicate with a single controller. In order to ensure that the controller receives the information properly, only one transmitter can communicate with the controller at a time, eliminating the potential for exposure to multiple signals at the same time.

The general issue of cumulative exposure from an arbitrary group of transmitter installations or from all transmitters distributed in the environment can appear to be complex, but as discussed, the need for orderly communications requires that a few sources normally dominate. In addition, the exponential decrease in signal strength over distance and additional signal losses due to non line-of-sight conditions for distant sources ensures that only the contributions of nearby transmitters are significant.

In summary, compliance for Smart Meters is determined according to the operating and installation requirements of each type of meter during equipment certification, and is based on the maximum transmission duty cycle for the device, including relay functions. Necessary installation requirements to maintain compliance for each meter are specified in the Grant. Irrespective of duty cycle, based on the practical separation distance and the need for orderly communications among several devices, even multiple units or "banks" of meters in the same location will be compliant with the public exposure limits. These conditions for compliance are required to be met before a Grant can be issued from the EA program and auditing and review of Grants is a routine function of the FCC laboratory.

With respect to interference to medical devices, which you also raise in your letter, Smart Meters typically operate under Part 15 of the FCC Rules. Those rules specify power limitations to avoid interference. The Smart Meter wireless technologies used today are not significantly different from Wi-Fi devices, cell phones and other typical consumer products. Certain medical devices may need specific precautions in many other environments; these are generally considered during FDA approval of the individual medical device.

I hope that this information will be helpful. In addition, some technical information on the subject has been developed by the Electric Power Research Institute (EPRI) and we have enclosed that information for reference.

Please know that the FCC is continually monitoring the issue of RF exposure and related health and safety concerns, both in the general terms of the continuing propriety of its regulations, and in individual cases where substantive concerns are raised.

Sincerely,

Julius P. Knapp

Julius P. Knapp
Chief
Office of Engineering and Technology