Before the
Federal Communications Commission
Washington, D.C. 20554

In the Matter of	)	
	)	
Reassessment of Federal Communications Commission Radiofrequency Exposure Limits and Policies	)))	ET Docket No. 13-84
	)	
Proposed Changes in the Commission's Rules Regarding Human Exposure to Radiofrequency Electromagnetic Fields	)))	ET Docket No. 03-137
	)	

COMMENTS OF RICHARD A. TELL
Submitted August 27, 2013

Richard A. Tell, President of the firm of Richard Tell Associates, Inc. submits these Comments in response to the publication of FCC 13-39, First Report and Order, Further Notice of Proposed Rule Making and Notice of Inquiry (ET Docket No. 13-84 and ET Docket No. 03-137) released March 29, 2013 by the FCC. Richard Tell has 46 years of experience directly related to matters of radiofrequency (RF) safety, with 20 of those years in service to the U.S. Environmental Protection Agency (EPA) and the last 26 years in private consulting practice of RF hazard identification, assessment and resolution. He has been a participant in the Institute of Electrical and Electronic Engineers (IEEE) since the late 1960's and serves as Chairman of Subcommittee 2 (Subcommittee on Terminology, Units of Measurement, and Hazard Communications) of the IEEE's International Committee on Electromagnetic Safety (ICES). He is also Chairman of the IEEE Committee on Man and Radiation (COMAR). Mr. Tell has provided RF safety support over the years to various large scale broadcast sites including the former World Trade Center, the Empire State Building, 4Times Square, Hancock Center, Tucson Mountain and high power international broadcast sites, etc., as well as to wireless telecommunications operators throughout the United States. Mr. Tell holds a B.S. degree in physics and an M.S. degree in radiation sciences. He is a Life Fellow of the IEEE. His experience and background are known to the Commission through several contracts to the Office of Engineering and Technology on RF safety related projects. These comments are those of Richard A. Tell, personally, and not as a representative of the IEEE or any of its committees.

These comments are presented in the order of the various paragraphs of the subject documents with the paragraph number at the beginning of each comment.

25: The statement that "…where the compliance of a devise or transmitter installation is based on MPE assessment and is later found to be noncompliant with the MPE requirement, *post factum* SAR evaluation showing compliance with the SAR guidelines will not be allowed as a response to enforcement action." is inconsistent with the fundamental basis of using SAR as the basic restriction underlying the MPE rules and should be deleted. Both the ICNIRP guidelines and the IEEE standard state the following:

ICNIRP
Purpose and Scope: "In any particular exposure situation, measured or calculated values of any of these quantities can be compared with the appropriate reference level. Compliance with the reference level will

ensure compliance with the relevant basic restriction. If the measured or calculated value exceeds the reference level, it does not necessarily follow that the basic restriction will be exceeded."

IEEE

Clause 3.1.39: "If an exposure is proven to be below the basic restrictions, the MPE can be exceeded. MPEs are sometimes called *reference levels*, *derived limits*, or *investigation levels*."
Clause 4.4: "If the BRs given above are not exceeded, the MPEs in Table 8 and Table 9 can be exceeded."
Clause 4.7: "In cases where the measured exposure parameters approach or exceed the MPE, the more complex evaluation of SAR may be used to make a further determination of compliance with the standard."

Should a transmitter site be subsequently found to exhibit RF fields in excess of the MPE, it is only reasonable that the relevant "non-compliant" party be permitted to conduct whatever kind of evaluation they deem technically appropriate, including an assessment of SAR, to further assess compliance at the site. If this were not allowed, then sites that are actually in compliance could be deemed non-compliant with subsequent inappropriate penalties. Any party designated as "non-compliant" should always be permitted the opportunity to use the more involved, complex and expensive approach of using SAR in the assessment of compliance.

183: The FCC proposes to allow transient exposures of the general public where the general population limit is exceeded (but not the occupational limit) so long as adequate controls are in place and the 30-minute averaging time is used and the person is escorted by a person qualified to be in the controlled environment. There is no reason why the peak exposure shouldn't be allowed to exceed the occupational limit so long as the time averaged value does not exceed the public MPE. If the presence of the transient individual is to be supervised to insure that the time-averaged public MPE is not exceeded, then there is no logical reason that the same person should not be qualified to insure that the time-averaged exposure is in compliance regardless of the momentary magnitude of the exposure level.

195: A detailed definition of the term "training" is needed. For example, training could simply include RF safety information provided in the form of an informational sheet…not formal classroom training. In most instances, based on personal experience, formalized classroom type training often misses the purpose of insuring that workers know what to do and what not to do at an active antenna site. In most cases, very limited but specific instruction on behavior at an active antenna site is entirely sufficient to achieve compliance with the RF exposure limits adopted by the FCC. The abbreviated approach to "training" described here is also highly cost effective, resulting in much lower cost to antenna or site operators.

196. For Category Two – NOTICE (Exceeds General Population Exposure Limit but Less Than the Occupational Exposure Limit), the text is not clear. This section begins by stating that signs and positive access control is proposed to be required surrounding areas in which the general population exposure limit is exceeded. However, it then proposes that under certain "controlled" conditions, positive access control is apparently not required if a label or small sign is affixed to the surface of an antenna that specifies a minimum approach distance with the assumption that the label can be read from the required separation distance. An example is provided of a "controlled" condition as being a rooftop with limited access such as a locked door with appropriate signage. Physically restricting access to an area to those authorized to enter the site does not necessarily imply that those that are authorized to enter the site are fully aware of the potential to be exposed above the general public MPE. Hence, in general, most persons entering such a site are classified as members of the general public and subject to the lower tier of exposure limits. Examples include electricians, telephone repair personnel, roof repair workers, window washing crews, pest control technicians, etc. If the assumption is made that all individuals on the site can read the applicable label on an antenna and will abide by the indicated exclusion distance, without positive access control to the area in which the RF fields exceed the public limit, then it should follow that signage is sufficient at any transmitter site, without a requirement for positive access control.

It should be noted that the IEEE lower tier (in IEEE Std. C95.1-2005) is an "action level" to do something; it is not reflective of a biological limit, per se! Hence, there is no need for FCC to treat it as a legal exposure limit. It is, however, a level above which the FCC should require action to be taken to insure that exposure of individuals does not exceed the upper tier. Through such a requirement, an RF safety program would be instituted whereby any individuals within the area affected by the program would, through their awareness of the possibility of exposure, and consistent with other requirements of the FCC, would be subject to the occupational exposure limits. In fact, necessarily, and importantly, there is NO biological difference between individuals in the general population and those in occupational positions in regard to any underlying differential sensitivity to RF exposure. The only distinction between the two classes of individuals is awareness of potential exposure exceeding the lower tier of limits.

196 bottom: This section needs to be more precisely explained. Specifically, under what condition is lockout/tagout required if exposure exceeds ten times the occupational limit? Is a ten-fold value in terms of the momentary peak value or time averaged value of field?

212: The specification that the MPE limits apply to the environmental level of RF field strength without the body present is an excellent point. Body interaction with the field being measured can result in significant errors relative to assessing compliance and can go both ways; in some cases the presence of the observer can lead to erroneously high values of fields while in other instances, lower values of fields. When reporting measurements for compliance purposes, it is recommended that data illustrating the effect of the observer making the measurements be provided as part of the overall evaluation.

221. The text addressing "averaging area" is also discussed at the bottom of page 197 where it is stated that at locations close to antennas where spatial averaging may not be appropriate (because the localized SAR limit may be exceeded), "the spatial peak field should be used to determine compliance". This requirement will have impact on compliance evaluations in that the region around transmit antennas that will be determined to be noncompliant with the FCC limits will, generally, increase. It is important to note that in general, there is no convenient way to know when the local RF field may cause local SAR to exceed the SAR limit. This will, hence, lead to the use of the more conservative application of the spatial peak field in lieu of the spatially averaged field for compliance determinations. The FCC should consider providing guidance on what values of local RF fields can result in exceeding of the local SAR limit. With greater areas surrounding transmitting antennas that may result in exceeding the local SAR limit, more extensive barriers will be required at an additional expense. In many cases, these more expansive barriers will not be necessary.

223: In the case of smart meters, the transmit activity of any given meter typically varies over time but is always a small percentage. In several studies related to smart meters, duty cycles have been examined from two different perspectives, direct measurement and statistical evaluation based on interrogation of the meter management software used by electric utilities. In both cases, the maximum duty cycles have been found to range upward to a few percent for a very small number of meters with much lower values for the vast majority of meters.

Figure 1 provides the results of a study of smart meter duty cycles where the sample interval varied from 1 to 126 minutes (just over two hours) for a sample of 88,296 smart meters deployed by Pacific Gas and Electric

(PG&E). The figure shows the maximum, minimum, average and standard deviation of the duty cycles. The results show that the average duty cycle is relatively small, typically being less than 0.1%. During short momentary periods, the maximum duty cycle can range up to slightly greater than 10%.

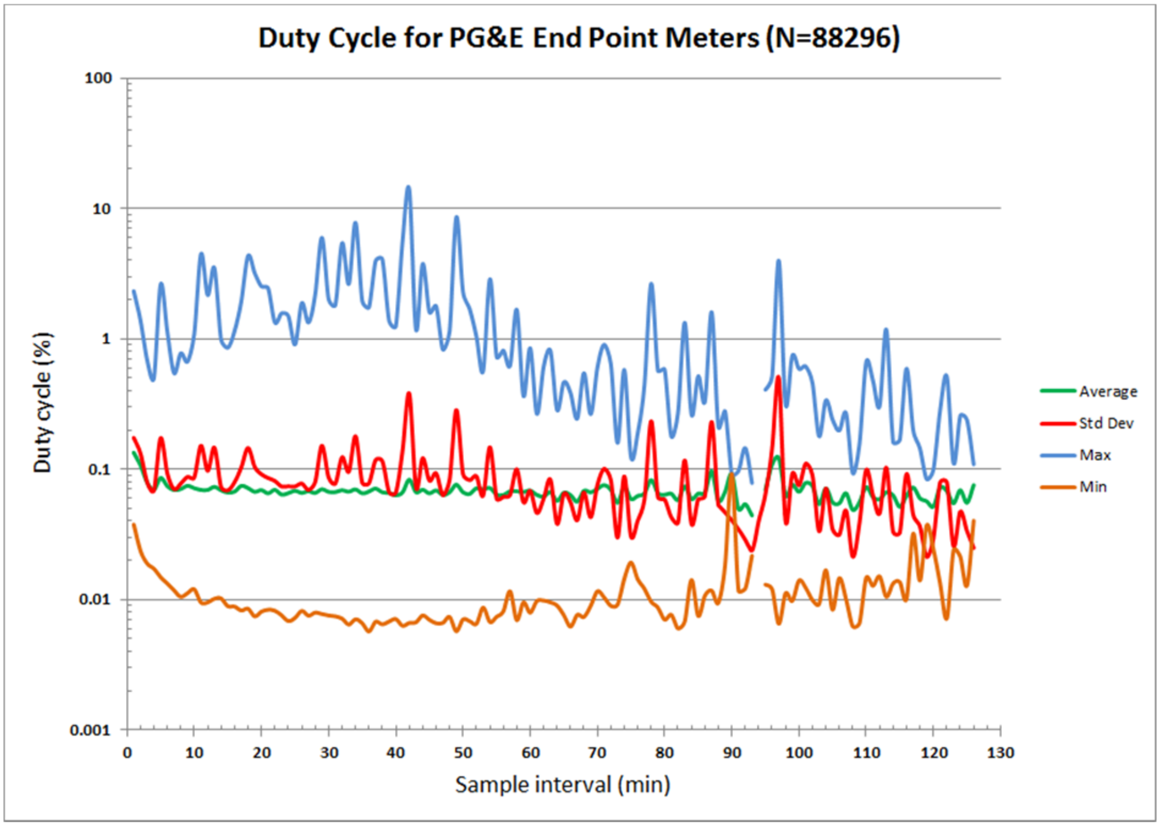

Figure 1. Duty cycle based on a study of 88,296 Pacific Gas and Electric Company (PG&E) end point smart meters in which a range of sample intervals (averaging times) was used ranging from 1 to 126 min. Figure 5 from Tell, R.A., R. Kavet and G. Mezei (2012). Characterization of radiofrequency field emissions from smart meters. *Journal of Exposure Science and Environmental Epidemiology* (2012), 1-5.

These data can be viewed differently in Figure 2 where the cumulative percentile of smart meter exhibiting various duty cycles over the sampling periods of 1 to 126 minutes is displayed.

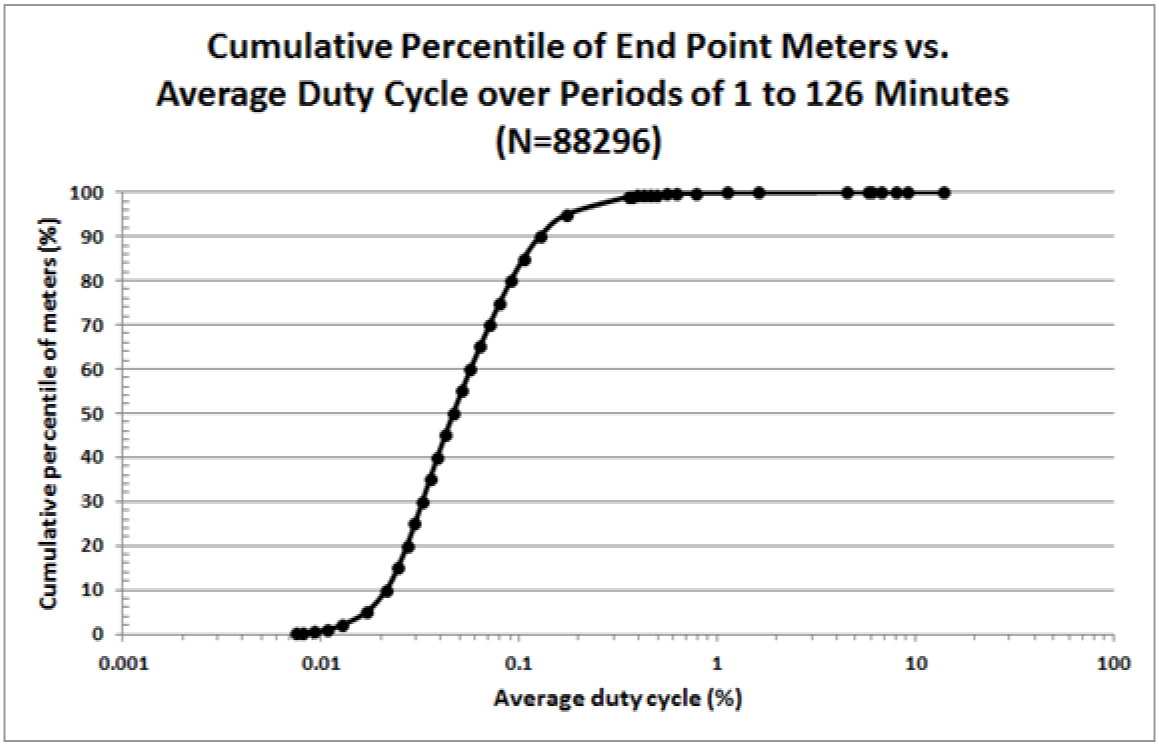

Figure 2. Percentile analysis of duty cycles from 88,296 end point smart meters with sampling periods from 1 to 126 min. Figure 6 from Tell, R.A., R. Kavet and G. Mezei (2012). Characterization of radiofrequency field emissions from smart meters. *Journal of Exposure Science and Environmental Epidemiology* (2012), 1-5.

The data demonstrate that for all meters combined, regardless of the sampling interval, half exhibited duty cycles <0.0465%; 99% had duty cycles of no more than 0.355%; 99.9% had duty cycles <1.12%; and 99.99% of meters had duty cycles <4.54%.

In another study of smart meter duty cycles deployed by Southern California Edison (SCE), with a sample size of 47,000 meters monitored over an 89 day period, similarly small values were found (see Figure 3). In this study, end point smart meters as well as those meters that act as data collectors (in this case referred to as cell relays) were studied. The maximum duty cycle for the SCE RF LAN transmitters was 4.74%, which occurred in the highest 1/10th percentile of values, dropping to a 99th percentile duty cycle of only 0.11%. From the 10th to 99th percentile, the duty cycles ranged from ~0.001 to 0.1%.

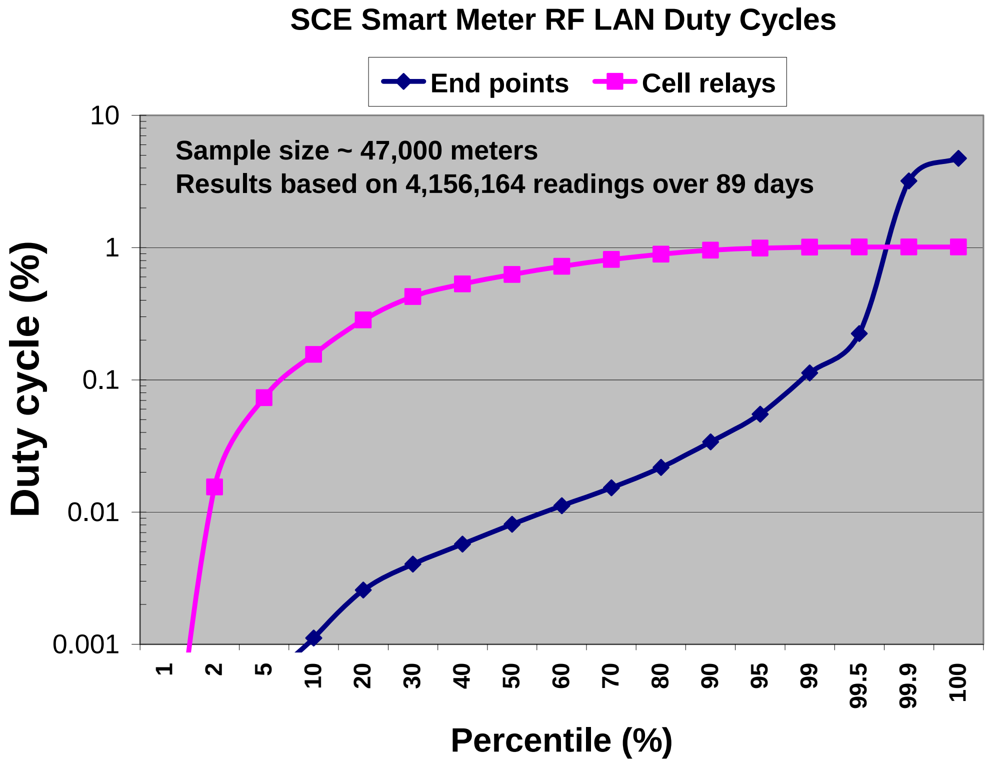

Figure 3. Analysis of Southern California Edison (SCE) daily average RF LAN duty cycle distribution for different percentiles based on 4,156,164 readings of transmitter activity from an average of 46,696 Itron smart meters over a period of 89 consecutive days. Analysis based on estimated transmitter activity during a day. Figure 13 from Tell, R.A., G.G. Sias, A. Vazquez, J. Sahl, J.P. Turman, R. I. Kavet and G. Mezei (2012). Radiofrequency fields associated with the Itron smart meter. *Radiation Protection Dosimetry Advance Access* published January 10, 2012, pp. 1-13.

Yet another study of smart meters used by San Diego Gas and Electric (SDG&E) was based on an assessment of 6,865 meters observed over a one day period. In the SDG&E sample, the smart meters with the highest activity had lower duty cycles than the SCE smart meters with the highest activity, but overall the duty cycles were in equivalent ranges. Figure 4 shows the results. For instance, half of the SDG&E meters exhibited duty cycles of 0.06% or more. The 50th percentile of duty cycles in the SCE data was 0.01% for SCE; SDG&E's 95th percentile value was 0.08% compared with SCE's 0.06%.

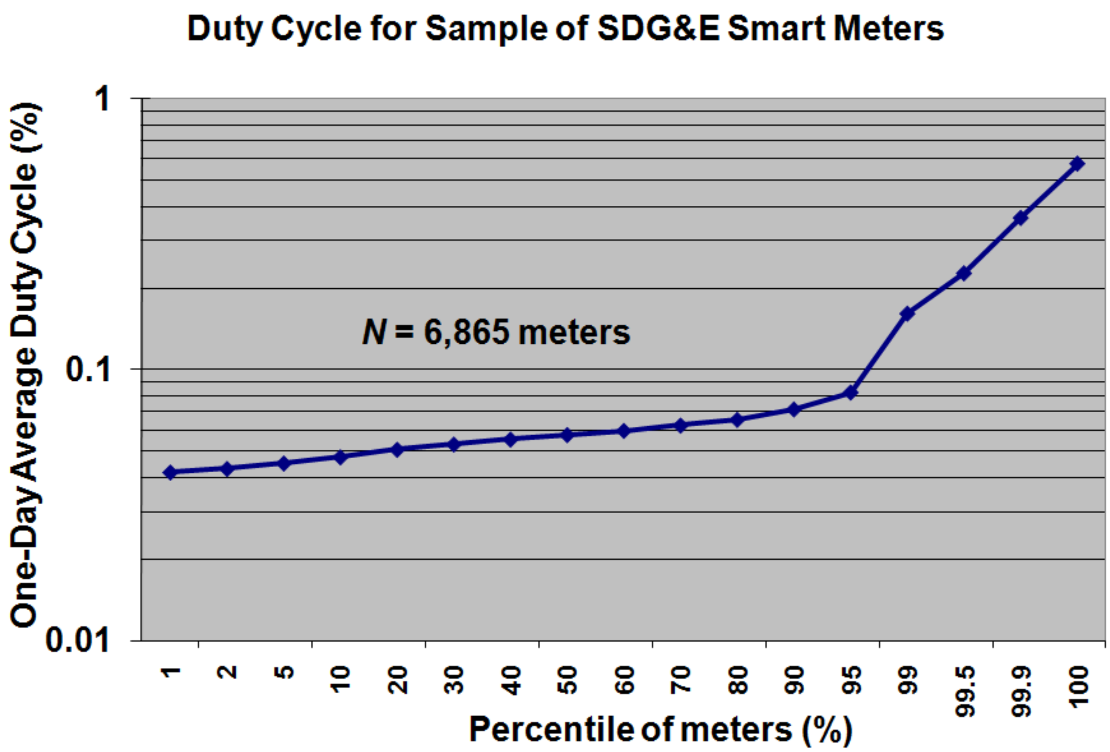

Figure 4. Results of an analysis of duty cycles for a sample of 6865 Itron smart meters deployed by San Diego Gas and Electric (SDG&E) based on transmit duration during a single day of observation. Figure 14 from Tell, R.A., G.G. Sias, A. Vazquez, J. Sahl, J.P. Turman, R. I. Kavet and G. Mezei (2012). Radiofrequency fields associated with the Itron smart meter. *Radiation Protection Dosimetry Advance Access* published January 10, 2012, pp. 1-13.

A study of smart meter emissions in the state of Vermont included direct measurements of meter emission duty cycle from a single meter that had been strategically selected because of its hierarchical location within the smart meter wireless mesh network. The meter in question relayed data from 554 other end point meters within the network. Measurements of the RF emissions were made over a 30-minute period timed to coincide with the reporting time for the meter. The maximum duty cycle observed was 3.55%. Figure 5 illustrates the result of the measurement over a 30-minute window.

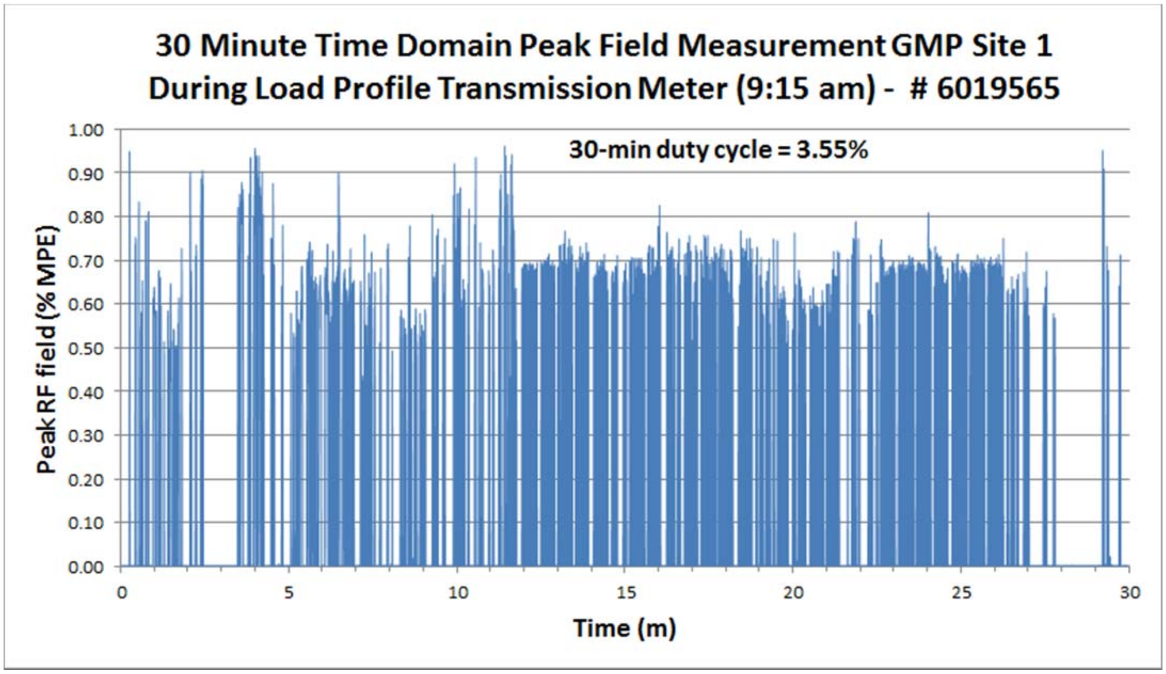

Figure 5. Result of 30-minute time domain measurement of peak RF fields at Green Mountain Power site 1 during period of maximum expected transmit activity. The 30-minute duty cycle was measured to be 3.55% during this period of maximum transmitter activity when the meter was relaying data from 554 other end point meters. Figure 31 from technical report: An Evaluation of Radio Frequency Fields Produced by Smart Meters Deployed in Vermont. Prepared for the Vermont Department of Public Service by R.A. and C.A. Tell, Richard Tell Associates, Inc., January 14, 2013, 137 p.

224: Presently available data on biological effects indicates that the average value of the plane wave equivalent power density is the exposure parameter most closely related to potential adverse biological effects. It would be outside the framework of current mainstream science for the FCC to adopt limits on the peak value of pulsed RF fields.

225: It is true that higher frequencies do not result in greater induced currents, and associated voltages, in long conductive structures. Figure 6, illustrates the magnitude of contact current that would be expected when an individual would touch a vertical conductor immersed in RF electric fields of 1, 10 and 100 MHz. The figure shows that as frequency is increased, the length of the conductor that results in a maximum contact current is shorter; for a given frequency, there is a maximum length beyond which greater contact current does not occur. Because sufficiently great RF currents can lead to burns on the skin, the FCC should include limits on contact currents, something that it has not done since its Report and Order issued in 1996 in ET Docket 93-62. Instrumentation has been available for many years and is routinely used for measurements of compliance with the IEEE standard. Besides the direct hazard of tissue burning from contact currents, the FCC should also include a limit on open circuit RF voltage, as included in IEEE Standard C95.1-2005, to eliminate the hazard of arcing between a person and RF energized objects. Please see response to paragraph 227.

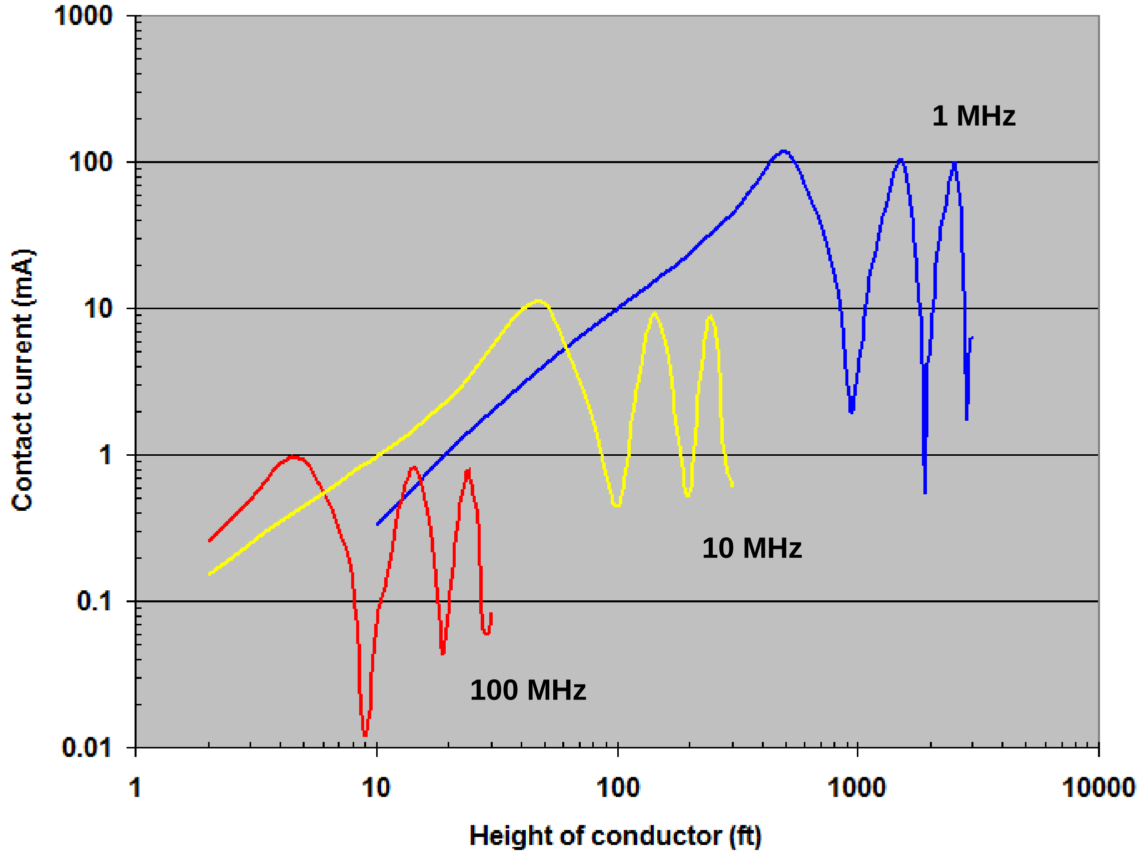

Figure 6. Calculated contact current vs. height of conductor exposed to an electric field strength of 1 V/m for frequencies of 1, 10, and 100 MHz. Note the similar behavior of the oscillation in contact currents but, importantly, the diminished value of the peak currents at higher frequencies. Adapted from Figure 6 from Olsen, R.G., J. Schneider and R. A. Tell (2011). Radiofrequency burns in the power system workplace. *IEEE Transactions on Power Delivery*, Vol. 26, Issue 1, pp. 352-359.

226: RF fields of even modest magnitudes can energize conductive structures such as guy wires, electric power transmission poles, electrical cables, tall cranes and house wiring such that these structures can become potent sources of contact current and/or open circuit RF voltage. This phenomenon is largely, but not completely, related to AM radio broadcasting antennas. Because contact with such structures can lead to excessive contact current and RF burns, it would be beneficial for the FCC to provide publicly available maps showing areas where electric fields produced by AM broadcast stations exceed a specific criterion. This approach has been accomplished in a project sponsored by the Electric Power Research Institute (EPRI) in the form of a software tool that combines mapping of AM broadcast stations in the U.S. and Canada with radiation pattern data that illustrates regions in which RF fields have the potential of exceeding an electric field strength of 2 V/m, this value being deemed sufficient to result in high open circuit voltages on large conductive structures sufficient to result in arcing to ground. See EPRI Technical Brief: Use of a Geographic Mapping Tool in Power Line Routing for RF Hazard Identification: A Feasibility Evaluation. EPRI product ID 1023107, November 16, 2011. Prepared for EPRI by Richard Tell Associates, Inc. Figure 7 provides an illustration of how such mapping can be prepared.

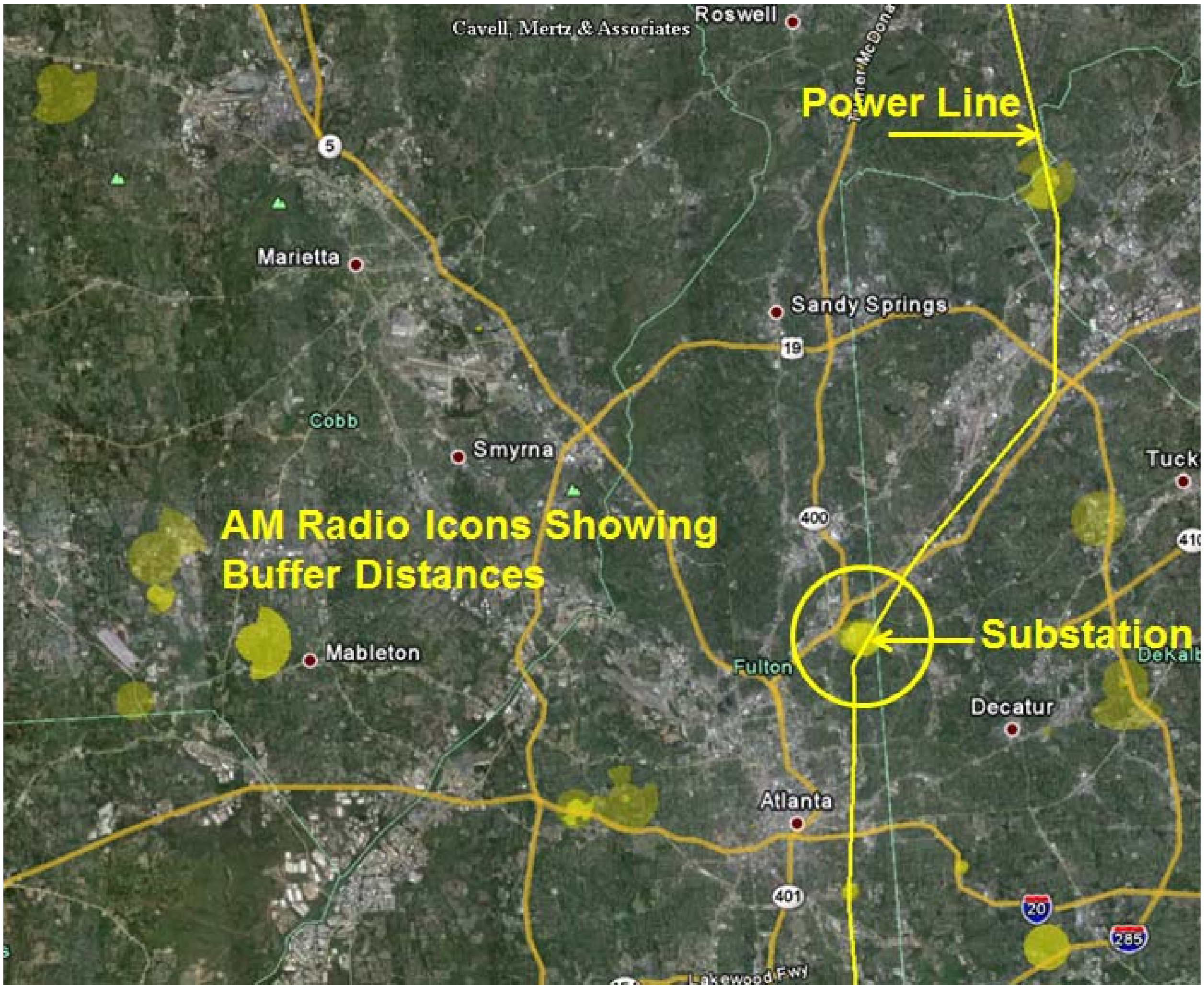

Figure 7. Illustration of a mapping of electric field strengths of 2 V/m in the vicinity of AM radio broadcast stations in a portion of the Atlanta, GA area. Non-circular icons are used in the case of directional stations showing the 2 V/m contour. This example was used to illustrate the extent of RF fields in the region of an electric power substation that was located immediately adjacent to several AM radio stations (note the yellow dot that represents the area in which RF fields are projected to exceed 2 V/m that covers the area of the substation).

227. In a practical sense, the only real hazard of RF exposure is the production of RF burns. This is particularly true when considering RF fields with magnitudes in the range of the present FCC MPE values. Because ambient RF fields that are a small fraction of the FCC MPE can lead to open circuit voltages that can easily arc to a person attempting contact with an energized object, the RF burn hazard is commonly ignored during typical RF field compliance evaluations. Figure 8 provides measurement data showing the relationship between incident RF electric field strength and the open circuit voltage measured at the bottom end of two different crane cables. These data show that for the conditions under which the measurements were made, an incident electric field equivalent to the FCC MPE across the AM radio broadcast band of 614 V/m for occupational exposure and for frequencies up to 1340 kHz for general population/uncontrolled exposure could result in an open circuit voltage of approximately 56 kV. Voltages of this magnitude will result in substantial arcing. Because of this, it is especially relevant that the FCC take steps to eliminate the most hazardous effect of RF exposure.

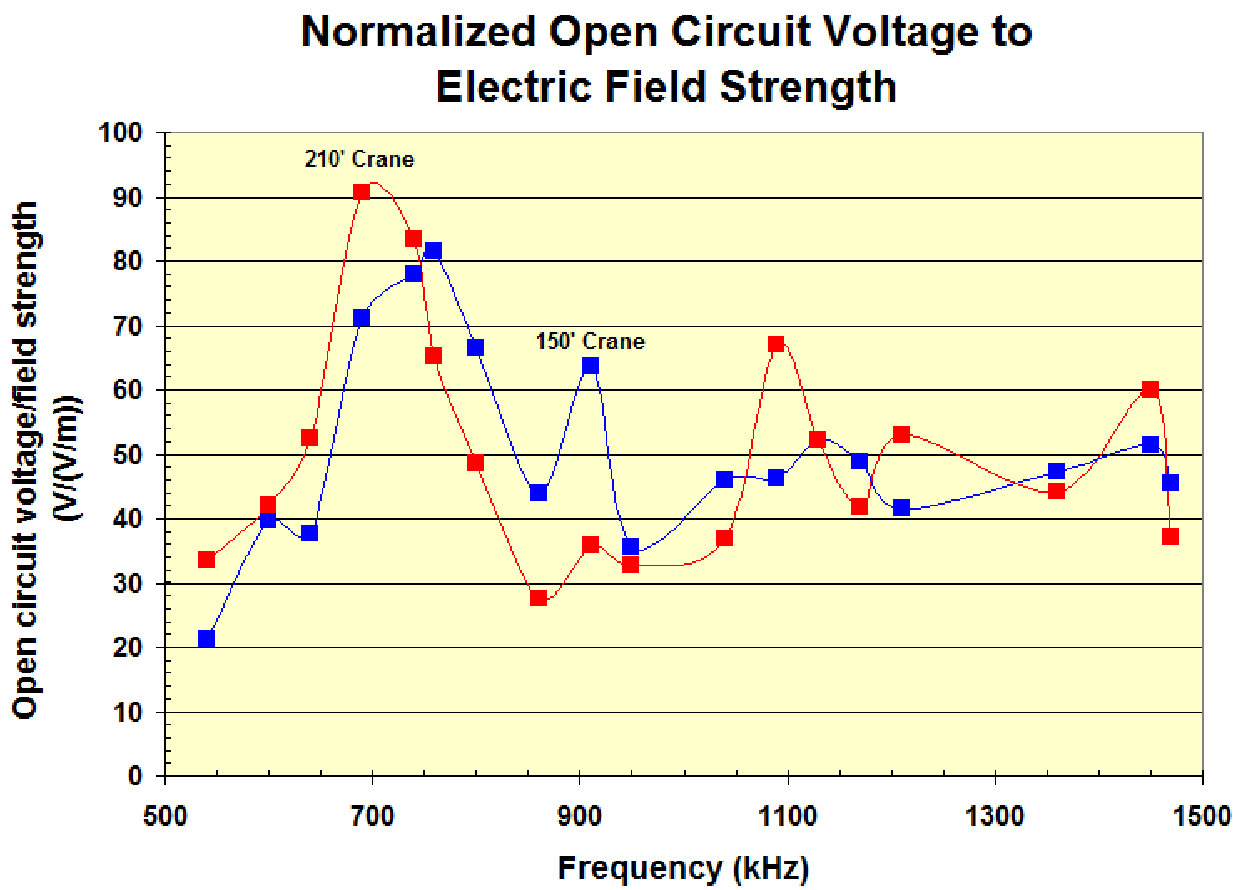

Figure 8. Ratio of measured open circuit RF voltage to measured electric field strength as a function of frequency across the AM radio broadcast band for two different cranes (cranes were not aligned relative to the various AM radio stations in the same way).

This can be accomplished by adopting limits on open circuit voltages and contact currents. When this issue arises, the determination of responsibility should be driven by whether the station or affected party was first present at the site. If the affected party is the result of development activities near an existing AM station, responsibility should fall on the affected party. Alternatively, if a station establishes operation within an area with existing development, the responsibility should fall to the station.

228: Because RF burns are the only known and demonstrated hazard related to RF exposure that are associated with field strengths equivalent to the present FCC MPEs, the FCC should certainly address this deficiency in the present rules by adopting relevant limits for contact currents and open circuit voltages. While it is true that interactions between RF fields and various structures in the environment can be complicated, such complexity associated with the relevant hazard evaluation should not be used as a rationale for continuing to ignore the potential seriousness of the RF burn hazard. The FCC should adopt relevant numerical values for both contact currents and open circuit voltages that can lead to arcing, perhaps the most hazardous of all RF exposure scenarios. Instrumentation has existed for years that allows for quantifying these exposure parameters. Any additional burden associated with the inclusion of such limits in compliance evaluations is clearly offset by the benefit of RF burn hazard reduction.

240: The suggestion by some of applying extremely stringent, precautionary limits would have the severe consequence of impacting broadcasting and telecommunications as they are currently known and appreciated in the U.S. For example, a recent proposal to apply an RF power density limit of 0.3 nW/cm^2 is, simply, not practical. This conclusion is exemplified by Figure 9, in which population exposure to VHF and UHF broadcast fields was estimated from detailed measurements in 15 metropolitan areas of the U.S. The data show that virtually the entire population of the cities studied was exposed to RF fields exceeding the recommended, precautionary limit of 0.3 nW/cm^2. While the data are from the 1978-1980 era, no follow-up work of this magnitude has been accomplished since and it is anticipated that since the time of this study, the introduction of wireless communications (cellular telephone) base stations has likely not reduced population exposure levels. Hence, the implementation of precautionary exposure measures similar to this would certainly impact on the ability to provide domestic broadcasting service and wireless communications as currently available.

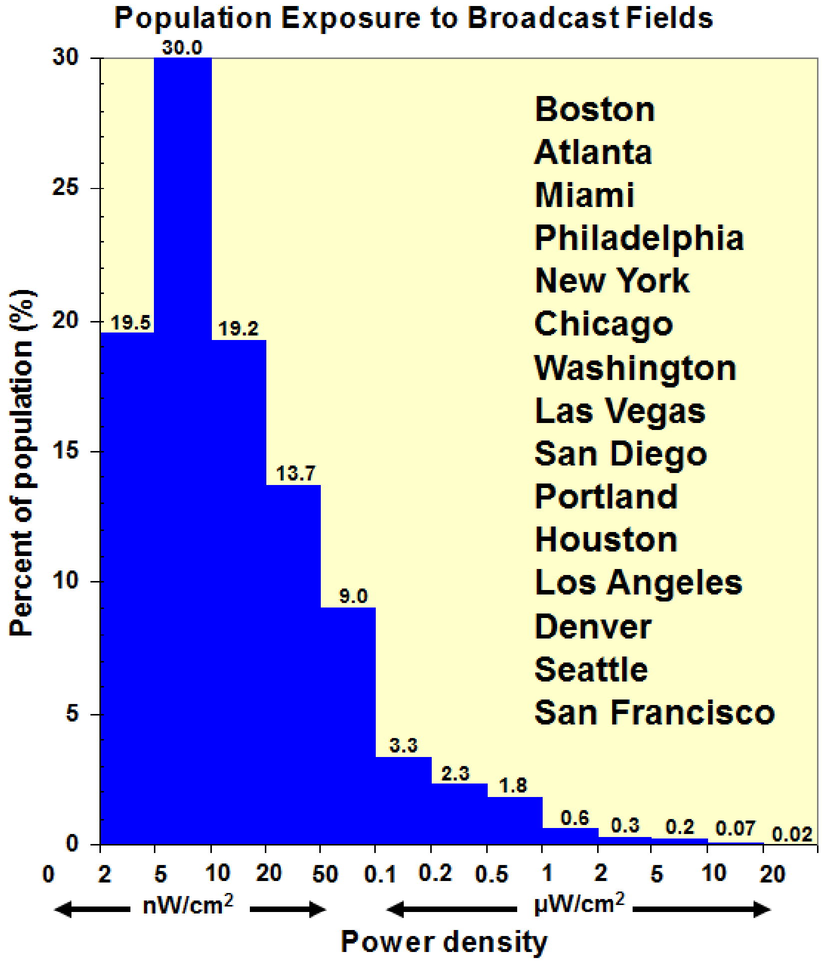

Figure 9. Population exposure to VHF and UHF broadcast RF fields in the U.S. Adapted from Figure 7 in Tell, R.A. and E.D. Mantiply (1980), Population exposure to VHF and UHF broadcast radiation in the United States, *Proceedings of the IEEE*, Vol. 68, No. 1, January, pp. 6-12.

243: There is no need to recommend minimizing exposure below present SAR based limits. The safety factor of 50 associated with the present SAR based lower tier exposure values, for the general public, are already so far below the threshold of established adverse biological effects as to represent a practical zero probability of harmful effect.

250: If the FCC recommends that a manual, for a portable communications device, provide instructions and advisory statements so the user is aware of body-worn requirements for RF exposure compliance, how does this relate to the requirement that barriers be erected to avoid exposure above public limits at wireless transmitter sites? This appears inconsistent since in one case only advisory statements be used while in another, engineering controls are required to insure compliance. Note that exposure to a cell phone likely results in a greater local SAR within the body than does typical whole body exposure at a wireless or broadcast site.

251: It is stated that exposures "exceeding the SAR limits should not necessarily create an unsafe condition" and "should not be viewed with significantly greater concern than compliant use" since the exposure limits were set with a large safety factor to be well below a threshold for unacceptable rises in tissue temperature! This perspective would argue against such aggressive compliance measures found in other parts of the document as the requirement to install positive access control (barriers) to inhibit members of the general public from accessing areas within which RF fields could exceed the general public limit. The statement that "a use that possibly results in non-compliance with the SAR limit should not be viewed with significantly greater concern than compliant use" is inconsistent with other parts of the document where absolute control is required to avoid exceeding public exposure limits.

P. 99: The terminology "appropriate training" needs clarification since the "training" might be able to be accomplished via simple written information, such as on a sign or the provision of an RF safety information sheet to be given to those entering the site.

2.1093(d)(1)(ii), page 101: "visual advisories on portable devices designed only for occupational use can be used as part of an applicant's evidence of the device user's awareness of occupational/controlled exposure limits." Because there is no inherent biological difference between members of the general public and those that are occupationally exposed to RF, the use of visual advisories supports the concept that appropriate signage should be sufficient at transmitter sites to provide the awareness necessary for individuals to occupy areas in which the RF fields exceed the FCC's general population exposure limit.

1.1307(b)(2)(ii), page 106: It is unclear whether positive access control is required for the example rooftop with limited access where a sign on the antenna is stated as sufficient "mitigation". Further, the terminology "…rooftop with limited access…" needs definition. What is meant by "limited" access? The use of signage is stated as representing "sufficient mitigation" of potential RF exposure exceeding the general population exposure limit. The terminology "under certain controlled conditions" must be defined. The language, once again, implies that signage could be sufficient for compliance with the general population MPE without positive access control as required elsewhere in the document.

1.1307(b)(2)(ii), page 107: The text "…to ensure compliance with the time-averaged general population exposure limit" should be clarified to be consistent with earlier requirements relative to the instantaneous peak value of exposure (see paragraph 183, and comment).

1.1307(b)(2)(iii), page 107: It seems that positive access control is not being called for and that signage can be sufficient. If members of the general public have access, in a transient manner at the site, would positive access control be required? Again, the time-averaged value of exposure should not have any limitation on the instantaneous peak value of RF field.

1.1307(b)(2)(iv), page 107: It appears that the use of lockout/tagout procedures are only required for Category 4 exposure scenarios. The same should apply to Category 3 if power reduction is not feasible such that exposure category reduction is not feasible.

1.1307(b)(2)(v)(B), page 107: It should be noted that the triangle used to surround the RF energy advisory symbol is not used on the NOTICE sign since there is no expectation that exposure less than the upper tier can cause adverse biological effects. See C95.2-1999, section 5.7, second paragraph.

1.1307(b)(2)(i), page 108: An outline of the content requirements of an EA needs to be provided.

2.1093(d)(4), page 115: If visual advisories, on a device for occupational use, are sufficient evidence of the device user's awareness of occupational/controlled exposure limits, signs at a site should also be sufficient to indicate awareness of any individual to occupational/controlled exposure limits.

Page 197: The FCC states that the spatial peak field should be used at locations close to antennas where spatial averaging of fields may not be appropriate because the local SAR limit may be exceeded. This new requirement will have substantial impact on compliance assessments at transmitter sites such a broadcast and wireless base stations where, heretofore, spatial averaging has typically been the only metric used in the determination of compliance. While, undoubtedly, a simpler measurement method, this recommendation will be very challenging and potentially result in erroneous compliance assessments. In general, there is currently no fixed distance from a source or defined exposure geometry for which it can be assumed that local SAR will always comply with the local SAR limit. As a consequence, in the interest of conservatism, many compliance measurements will be made entirely on the basis of spatial peak values of field. This practice will result in larger regions in the vicinity of transmitting antennas wherein it will be assumed that RF fields may exceed either the FCC general population or occupational exposure limits in terms of local SAR. This, in turn, will likely mean that more extensive barriers, signage and training (or providing of RF safety information) will be required at additional cost to transmitter operators. Such overly conservative, and unnecessary, measures will result unless specific guidance can be provided that relates the local RF field strength (or plane wave equivalent power density) to maximum possible local SAR within the body. The FCC should specify a dosimetry based limit in terms of peak RF field strength or plane wave equivalent power density. This will allow compliance assessments to be performed with minimal impact over the current approach of measuring the spatially averaged field. The spatially averaged field remains the primary criterion for compliance unless the local peak field exceeds an FCC specified value.