6 May 2010

The Honorable Julius Genachowski
Federal Communications Commission
445 12th St., SW
Washington DC 20554

The Honorable Lawrence Strickling
National Telecommunications and Information Administration
U.S. Department of Commerce
1401 Constitution Ave., NW
Washington, DC 20230

Dear Chairman Genachowski and Assistant Secretary Strickling:

Spectrum policy decision making by the Federal Communications Commission (FCC) and the National Telecommunications and Information Administration (NTIA) is critical to many sectors of the U.S. economy and specifically to the industries in which many of the 210,000 members of the Institute of Electrical and Electronics Engineers-United States of America (IEEE-USA) work. The intent of this letter is to offer suggestions to both agencies to improve the transparency and speed of spectrum allocation decisions. These suggestions focus on how the two agencies can develop a more transparent framework for making "harmful interference" determinations.

Harmful interference will be a key issue using spectrum to stimulate economic growth. For example, there is no controversy that the AWS-3 band (2155-2175 MHz) is vacant, yet commercial access to this band has been blocked for several years because of harmful interference and the lack of definitive findings on the issue: various sides have offered different criteria for defining harmful interference. The AWS-3 deadlock may be replicated many times in the follow-on to a spectrum inventory, unless both the FCC and NTIA improve their approaches to making harmful interference findings. Such deadlocks could have a severe negative impact on the U.S. economy, technical innovation and the growth of services to the public.

The Communications Act of 1934, as amended, uses the phrase "harmful interference" without defining it in multiple sections[1] as a key determinant in whether spectrum reallocations or other regulatory changes are permitted.

The ITU Radio regulations, the FCC Rules, and the NTIA Manual of Regulations and Procedures for Federal Radio Frequency Management (Redbook) all define "harmful interference" in the same precise way:

> "Interference which endangers the functioning of a radionavigation service or of other safety services or seriously degrades, obstructs, or repeatedly interrupts a radiocommunication service operating in accordance with [the ITU] Radio Regulations."

The Institute of Electrical and Electronics Engineers, Inc. - United States of America
2001 L Street, N.W., Suite 700, Washington, D.C. 20036-5104 USA
Office: +1 202 530-8331 ■ Fax: +1 202 785 0835 ■ E-mail: ieeeusa@ieee.org ■ Web: http://www.ieeeusa.org

[1] 47 U.S.C. §§301(a)(1), 303(g), 309(j)(16)(C), 337, 922

FCC has pointed out in its recent Innovation Notice of Inquiry (Docket 09-157 NOI at paragraph 34-35) the significance of harmful interference:

> Spectrum allocations and access often hinge on controlling interference between new services and incumbent services, as do licensing and service rules to some extent. The resolution of disputes about potential or actual interference in rulemakings can pose a major impediment to the introduction of new services, devices and technologies, either as a result of long delays in the establishment of service rules or the imposition of onerous and perhaps unachievable technical standards….The trend of more radio services and devices seeking to use extremely weak signals and mobility bringing products in closer proximity to each other is making the risk of interference a more acute problem. A challenge for the Commission is that application of these criteria often devolves to a case-by-case interpretation of conflicting data….The viability of spectrum access for new radio services often centers on whether the new service may cause harmful interference to incumbent services. This can lead to delays through protracted rule making proceedings that can create uncertainty and discourage investment.

Uncertainties like this discourage capital formation for new radio technologies. Such uncertainties also affect capital formation for incumbents in determining how much protection they are entitled to from later entrants.

While Docket 09-157 was an attempt by the Commission to explore this issue, responsibility for clarifying harmful interference remains with **both** agencies. For any spectrum inventory result showing potential vacant spectrum, availability is still dependent on the findings of no harmful interference to incumbent users. Note that this issue is independent of actual inventory results, and clarification can be addressed in parallel with any inventory activity.

Determinations of harmful interference involve four basic sub-problems:

1) desired to undesired (D/U) power ratio at the victim receiver,
2) transformation of desired and undesired field strength (fs) or power flux density (pfd) into D/U at the receiver,
3) calculating desired and undesired fs or pfd at the victim receiver location, and
4) determination of the statistical significance of the interference for classification as “harmful.”

When the current definition was adopted decades ago, only the first sub-problem was important. Low gain antennas, limited system mobility, and low frequencies made the latter factors unimportant. However, with today’s systems *all four sub-problems are important.*

With digital modulations, the issue of desired to undesired (D/U) comparison is much simpler than in the analog world. Generally D/U ratios of 6 to 10 dB are adequate for protection but the precise number depends on the systems involved. Safety and radionavigation services as well as analog systems, such as NTSC television (which is being phased out) may require higher protection ratios on a case by case basis.

The issue of predicting D/U based on fs or pfd is more complicated since it depends on antenna and receiver design. The ITU Radiocommunication Sector systematically engages in developing interference protection criteria for band sharing among different radiocommunication services, and has adopted a number of specific recommendations, most of which were initiated by U.S. representatives and developed with their active participation. Incorporating these criteria for domestic spectrum deliberations should be examined. ITU-R

Recommendation ITU-R M.1635, "General methodology for assessing the potential for interference between IMT-2000 or systems beyond IMT-2000 and other services," may be a good basis for dealing with this issue in the case of non-safety or radionavigation services, even though it was originally intended only for the 3G case.

The third sub-problem is by far the most contentious. When the current definition was adopted, the propagation issues of time variability due to effects of precipitation and location variability due to multipath propagation were probably unknown. Furthermore personal communication devices were unknown and mobile use was rare. For many radio frequency bands, the statistical nature of the geometry of desired and undesired transmitters has a large impact on both co-channel and adjacent channel interference. Mobile radio systems are not statically deployed and result in rapidly changing geometries of desired and undesired stations.

ITU-R M.1635 states that "Parts of the assessment procedures need to be based on a statistical methodology, well known as the Monte Carlo technique." The UK's national spectrum manager, Ofcom, has also advocated and frequently used statistical technique in spectrum policy decisions.[2] Statistical techniques have been used by both FCC and NTIA in authorizing point-to-point fixed links where weather-related propagation losses are time variable[3], and by FCC in authorizing broadcast stations because the Grade B contours include a statistical factor.[4]

FCC and NTIA do not have a general policy on the use of statistical techniques in interference prediction even though many of the most contentious issues in recent years have focused on such issues. But no general guidance exists on how to extrapolate to cases involving other propagation phenomenon or mobile stations. Your agencies are in a position to begin to create such guidance.

In adopting statistical approaches the agencies should try to use widely accepted propagation models that include confidence limits for path losses. Such approaches should also use location information that is based on actual databases as well as data available from direct spectrum measurements or monitoring wherever possible, recognizing that in some cases infrequent peak public safety spectrum traffic must be considered even though it is not observed during limited monitoring periods.

The Nuclear Regulatory Commission (NRC) has for several years been using Probabilistic Risk Analysis and Risk-Informed Decision Making in conjunction with regulatory decisions on the safety of nuclear power plants.[5] The Department of Veterans Affairs also uses probabilistic analyses for setting patient safety goals for hospitals. [6] We believe that FCC and NTIA should make a general policy concerning the use of probabilistic models in harmful interference determinations, such as what type of propagation models should be used and

---

[2] *See* http://www.ofcom.org.uk/consult/condocs/bb_application/statement/bbstatement.pdf ; http://www.ofcom.org.uk/consult/condocs/1781/lowpower/concurrent.pdf

[3] Telecommunications Industry Association Standard TSB-10-F, Interference Criteria for Microwave Systems

[4] 47 C.F.R. 73.683,4

[5] *See* NRC, Issues and Recommendations for Advancement of PRA Technology In Risk-Informed Decision Making (NUREG/CR-6813) (http://www.nrc.gov/reading-rm/doc-collections/nuregs/contract/cr6813/); NRC, Fact Sheet on Nuclear Reactor Risk, (http://www.nrc.gov/reading-rm/doc-collections/fact-sheets/reactor-risk.html)

[6] http://www.patientsafety.gov/SafetyTopics.html

how mobile users should be modeled, and should consider setting confidence limits on interference goals, just as NASA and FAA use probabilistic safety goals in their activities.[7]

Should your two agencies explore similar risk analysis techniques as a means to create a Harmful Interference metric, deriving a receiver-side interference metric—that is, an assumption of receiver immunity to interference may also be required. While NTIA currently approves receiver standards as part of system approvals, FCC does not, except in rare cases as required by treaties. Mandatory receiver standards are not required to clarify harmful interference, but at least some assumption of reasonable receiver immunity is necessary for bands being studied.

The current ITU/FCC/NTIA Harmful Interference definition is bifurcated and treats "radionavigation service or of other safety services" differently than other "radiocommunication service". In clarifying the meaning of harmful interference we urge FCC and NTIA to keep this bifurcation with a higher level of protection for services that impact safety. In doing so, the agencies should also clarify which services should be entitled to the higher protection level. The current definition of safety service used by ITU, FCC and NTIA is

> Any radiocommunication service used permanently or temporarily for the safeguarding of human life and property.

NTIA and FCC should clarify that this includes public safety communications as well as medical uses of the spectrum where interference would adversely affect health. A more difficult question that should be considered is whether *every* Federal Government frequency assignment is a safety service."

In ITU fora, the United States has generally opposed the use of probabilistic models in determining sharing with radionavigation and safety services. This highlights the complexity of determining the contexts where probabilistic models can be used and should be a factor in the clarification of harmful interference.

IEEE-USA stands ready to work with the Commission, NTIA and with industry groups to develop more specific plans to implement these suggestions.

IEEE-USA advances the public good and promotes the careers and public policy interests of more than 210,000 engineers, scientists and allied professionals who are U.S. members of the IEEE. IEEE-USA is part of the IEEE, the world's largest technical professional society with over 395,000 members in over 160 countries. For more information, please contact Deborah Rudolph at (202) 530-8333, or at d.rudolph@ieee.org.

Sincerely,

Evelyn Hirt
President, IEEE-USA

EHH/dr:bc

---

[7] NASA, Agency Risk Management Procedural Requirements, NPR 8000.4A (http://nodis3.gsfc.nasa.gov/npg_img/N_PR_8000_004A_/N_PR_8000_004A_.doc); NASA, Probabilistic Risk Assessment Probabilistic Risk Assessment Procedures Guide for Procedures Guide for NASA Managers and Practitioners, (http://www.hq.nasa.gov/office/codeq/doctree/praguide.pdf); FAA, System Safety Handbook, (http://www.faa.gov/library/manuals/aviation/risk_management/ss_handbook/)