cingular WIRELESS

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July 2, 2003

Mr. Robert Lucky, Chairman
Technological Advisory Council
Federal Communications Commission
445 12th Street SW.
Room 7-A325
Washington, DC 20554

Re: Public Notice DA 03-1991: Technological Advisory Council's July 7, 2003 Spectrum Interference Measurement and Management Meeting

Dear Mr. Lucky:

On June 17, 2003 the Federal Communications Commission (FCC) released a Public Notice, DA 03-1991, inviting written comments to the FCC's Technological Advisory Council (TAC) regarding their July 7, 2003, meeting on Spectrum Interference Measurement and Management. Cingular Wireless LLC (Cingular) hereby submits the following comment for consideration by the TAC.

The FCC is currently in the process of reviewing various regulations and moving towards spectrum management principles that allow greater access to spectrum, and, concomitantly, greater sharing of spectrum. As the Commission's Spectrum Policy Task Force has noted, there are cases where spectrum sharing concepts, such as secondary markets, make good business, and technical, sense. Furthermore, secondary market opportunities can be accomplished with minimal risk of interference to primary licensees. In some cases, Cingular[1] and other licensed service providers continue to have concerns over the Commission's eagerness to adopt new spectrum-sharing regulations without the benefit of the scientific and engineering inquiry and knowledge required to understand all of the potential interference implications of such sharing on licensed services. Thus, while the growth in the use of unlicensed spectrum may warrant a move to allow increased flexibility in certain bands, the FCC must demonstrate that sharing will <u>not</u> cause interference to licensed services.

As noted by the FCC's TAC in its Wireless Device Bill of Rights, the move towards increased spectrum sharing, through the use of advanced technologies, such as cognitive radios, places an even greater regulatory burden on the FCC than the current spectrum management model, particularly if the FCC is to avoid the chaos associated with the early days of radio services. As such, the FCC must develop a more complete understanding of the advanced technologies and systems it hopes to successfully regulate. The Commission should heed the statement given by Commissioner Martin:

[1] *See Commission Seeks Public Comment on Spectrum Policy Task Force Report*, ET Docket No. 02-135, Comments of Cingular Wireless LLC, filed Jan. 27, 2003, a copy of which is attached as Attachment A.

> I am concerned with the manner in which the Commission analyzes harmful interference. The Commission has not developed a consistent methodology for such analysis, instead using a case-by-case, ad hoc approach. Not only does this approach cause a great deal of uncertainty for spectrum users and markets alike, it also creates another problem: the appearance of results oriented decision making.[2]

The FCC created the TAC in 1998 to "provide scientifically supportable information in those emerging technologies that could fundamentally impact the work of the FCC."[3] Spectrum management and interference measurement are at the foundation upon which the FCC was founded – to rein in the free-for-all that was taking place in the radio spectrum in the 1920's and 1930's. The TAC recognized from the outset that the FCC cannot engage in effective spectrum management until it "develop[s] a more complete understanding of the current state of the radio noise environment."[4] According to TAC:

- There "could be a very serious emerging problem caused by the explosive growth of both intentional and unintentional radio sources. The future could be very different from what we might expect from past experience. The key to getting our hands around this issue will be a good set of models for both intentional and unintentional radiators which can then be used to predict the evolution of the noise background."[5]
- "We could potentially be entering a period of rapid degradation of the noise environment. Such degradation would reduce our ability to meet the communications needs of the country. The principle impacts are likely to be reductions in the performance or reliability of wireless systems or increases in their costs."[6]
- "Data on the level and the changes of the noise environment is sorely lacking, however, as neither the FCC nor industry has tracked recent noise growth nor modeled how it will increase in the future."[7]

Based on these concerns, the TAC urged the FCC to immediately undertake a multi-part study of the noise floor issue including a detailed analysis of available noise floor literature, the creation of detailed noise floor models and performance of simulations; and verification of the simulations.[8] This recommendation was accepted by the FCC.[9]

'he first step of the study has been completed and demonstrates that

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[2] *See AirCell, Inc., Petition, Pursuant to Section 7 of the Act, for a Waiver of the Airborne Cellular Rule, or, in the Alternative, for a Declaratory Ruling, Order on Remand*, FCC 02-324 rel. Feb. 10, 2003, Separate Statement of Commissioner Kevin J. Martin, Concurring.
[3] TAC Second Meeting Report, at 1 (Oct. 28, 1999) (All references in footnotes herein to TAC and TAC II documents can be found at <http://www.fcc.gov/oet/tac>.
[4] TAC Second Meeting Report, at 1, 9.
[5] TAC Third Meeting Report, at 1.
[6] TAC Fourth Meeting Report, at 23 (Annex 4).
[7] *Id.*
[8] TAC Third Meeting Report, at 9.
[9] *See* TAC Fourth Meeting Report, at 7; TAC Fifth Meeting Report, at 14.

- [O]nly minimal information is available from U.S. sources;[10]
- Different methods of analyzing noise have unfortunately yielded different results through the years;[11]
- "Until [noise floor] information is organized and analyzed, the FCC will not have a firm basis for deciding whether current noise standards are too tight, too loose, or maybe just right;"[12]

  "As we enter the new millennium, new noise sources are being developed (e.g., ultrawideband devices), and other electronic devices continue to proliferate as fast as other individual sources of 'noise' may meet the current Federal Communications Commission (FCC) rules, but in great numbers they may negatively affect the overall electromagnetic noise environment;"[13]

  "We find multiple kinds of users in the unlicensed bands that appear to be incompatible. We cannot find any useful U.S. studies that examine the situation;"[14]
- "Unlicensed radio seems to be an enormous success, but with the proliferation of more and more systems, we are in effect participating in an unplanned experiment in real time and are not sure how to predict the outcome."[15]

To move forward with the second and third steps, the American Radio Relay League (ARRL) was selected to compile detailed noise floor information in the 2402-2417 MHz band.[16] This band is a shared allocation between Part 97 (amateur radio), Part 15 (unlicensed devices) and Part 18 (ISM). The TAC concluded that a "three-year observation interval is probably the minimum required for real world measurements to provide meaningful data trend."[17] Current preliminary information compiled from the ARRL and others demonstrates that the rising noise floor is creating numerous problems.[18] Indeed, one report from the ARRL indicated that "[t]he noise floor is so high [in the 2.4 GHz band] as to [make the band] unusable."[19] The TAC recognized that new unlicensed operations should not be permitted until the noise floor study was complete[20] and that experiments would be necessary to validate theories and claims before new unlicensed operations such as Ultra-Wide Band (UWB) should be permitted.[21] Despite these words of advice from the TAC, the Commission is now permitting the use of UWB devices. In fact, the FCC is encouraging, indeed with a very stark trend line, this unplanned experiment in real time through a variety of recent decisions.

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[10] Literature Search and Review of Radio Noise and its Impact on Wireless Communications, Signal Enhancement Laboratory, Department of Electrical and Computer Engineering, Naval Postgraduate School, Monterey, California, Section 5 ("Literature Search-Radio Noise") at <http://www.fcc.gov/oet/tac/june12-02-docs/NoiseStudy_Final_1.docs>.

[11] TAC Sixth Meeting Report, at 9 (discussing Abstract presented by George H. Hagn).

[12] *Id.*

[13] *Id.*

[14] Literature Search-Radio Noise, *supra*, n.10.

[15] FCC Technological Advisory Council II ("TAC II"), First Meeting Report, at 9 (Aug. 26, 2001).

[16] TAC II Second Report, at 1.

[17] TAC II Second Report, at 10.

[18] *Id.*

[19] ARRL ARIA Update (June 2002) at <http://www.fcc.gov/oet/tac>.

[20] TAC Fourth Meeting Report, at 9-10.

[21] TAC Second Meeting Report, at 7; TAC Third Meeting Report, at 1, 15; TAC Fourth Meeting Report, at 9.

Regarding the measurement and management of interference, the TAC and the Spectrum Policy Task Force have urged the Commission to engage in studies and measurement programs to evaluate the radio noise and interference environment before adopting changes to existing regulations. At this date, however, only a single report examining one particular set of frequency bands has been produced by the Commission.[22] In its comments on this report, Cingular noted that the measurement program was only a snapshot of the interference environment at a few locations and was not a comprehensive study of the noise and interference environment. The Commission agreed with this description.[23]

Over the past several months, Cingular has been working with other cellular carriers and engineering consultants to study the noise and interference levels in cellular networks. The first phase of this effort, the AMPS Noise Floor Study[24], has been submitted to the Commission in Docket WT 02-86. The results show that in many rural, suburban, and urban environments the noise and interference levels at cellular base station receivers are quite low, while in dense-urban environments the levels may be slightly higher (approx. 5 dB). Cingular's view of the results is simple. The results show that an increase in the noise and interference levels would significantly impact service levels and coverage areas.

The Spectrum Policy Task Force also recommended a renewed focus on radio receivers and introduced the concept of "interference temperature". While the newly created term "interference temperature" has not been clearly defined, it already seems to have been widely adopted by policy makers. It must be noted, however, that once a reference measurement bandwidth has been chosen (*e.g.*, 1 MHz), the difference between RF power and absolute temperature is nothing more than a change in the unit of measurement (*i.e.*, $Power \propto Temperature$). The conversion to any other measure of power also would be valid (*e.g.*, horsepower, kilowatts, Joules/second). Note also that there is really no new physics being introduced. The well established physical principles of transmitted power, antenna patterns and polarization, RF propagation loss, and received power still apply and there are still significant differences between the concept of antenna temperature (fundamentally caused by black-body radiation) and discrete sources of RF interference. Without a more detailed definition of "interference temperature," it is unclear how technically-based regulations on radio interference can be successfully developed.

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[22] FCC Staff Releases Report "Measured Emissions Data for Use in Evaluating the Ultra-Wideband (UWB) Emissions Limits in the Frequency Bands Used by the Global Positioning System (GPS)," (ET Docket No. 98-153), Public Notice DA 02-2786, rel. Oct. 22, 2002.

[23] *See Revision of Part 15 of the Commission's Rules Regarding Ultra-Wideband Transmission Systems*, ET Docket No. 98-153, *Memorandum Opinion and Order and Further Notice of Proposed Rulemaking*, FCC 03-33, rel. Mar. 12, 2003.

[24] *See AirCell, Inc., Petition for Extension of Waiver.*, WT Docket 02-86, Comments in Opposition to Petition for Extension of Waiver, AT&T Wireless Services, Inc., Cingular Wireless LLC, CellCo Partnership d/b/a Verizon Wireless, Exhibit II, App. B, Engineering Report of the AirCell Compatibility Test (AMPS Noise Floor Study), filed Apr. 10, 2003.

Particularly troubling in the case of noise and interference measurements is that in some cases the Commission needs to take into account the underlying radio engineering principles that are necessary to perform the correct analysis. For example, in comments filed on the FCC's report on emissions in the Global Position Satellite bands (Docket ET 98-153), an analysis of the noise characteristics in the receiving system was provided using a software tool developed by Agilent Technologies and freely distributed via the Internet. In its reply, the FCC dismissed this analysis based on the premise that the source code for the computer model was not provided. It is unclear why the Commission did not evaluate the software itself or simply perform the calculations with some other computer program or with a calculator. Furthermore, when discussing the comments, the Commission explained that "...noise figure values of 1 dB and 10 dB are shown as inputs to represent the band-pass filter and the in-line attenuator, respectively. These are passive components in the TRB measurement system and, thus, have no associated noise figure." This statement is incorrect. It is common practice in radio engineering to assign a noise figure value to a passive device equal to the amount of loss in the device.[25] It is vitally important that the TAC assist the Commission in the development of a complete understanding, examination, and measurement program of the radio noise and interference environment.

In another recent case, the Commission has seemingly redefined the concept of interference. Within the FCC's Order on Remand (WT Docket 02-86), the industry accepted standard for acceptable call quality for AMPS service (*i.e.*, carrier to interference ration, C/I = 17 dB) has been recast. In the Commission's view, a C/I of 17 dB may be desirable, but a determination of harmful interference will be made only if the C/I has been degraded to 10 dB or below. In its explanation, the FCC has defined this decrease of as much as 6 dB in the C/I (*i.e.*, C/I = 11 dB) to be "objectionable" but not harmful. Obviously, this is of significant concern to Cingular and other licensed service providers who must attempt to explain to their customers why the cellular call quality is sometimes "objectionable".

As a related issue, the Commission has recently released a Notice of Inquiry on interference immunity standards for radio receivers. The wireless industry has defined the requirements for acceptable receiver standards now for 20 years. It is unclear, however, how the Commission hopes to have the industry continue to adopt performance specifications for radio systems (*e.g.*, the acceptable quality for AMPS is defined as C/I = 17 dB) while at the same time issuing rulings that are in direct conflict with the industry accepted standard values.

The FCC must continue to examine the technical details, as well as the legal aspects, of its regulations. In a recent workshop on cognitive radios hosted by the FCC, a participant asked how the Commission will regulate these "smart" radio systems and how will anyone be able to determine the presence of interference when the systems are allowed to automatically reconfigure themselves. The response was that they will only know if interference occurs when someone complains about it. As such, it is unclear if the Commission will be actively involved in developing rigorous technical regulations for

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Reference Data for Radio Engineers, Sixth Edition (Howard W Sams Co., Inc., 1982).

future cognitive systems. As technical advisors to the Commission, the TAC should help to ensure that the technical considerations are benefiting rather than harming the development of new telecommunications regulations, and the deployment of services to consumers.

I realize the points raised in this letter challenge the current processes to develop new regulations regarding the technical aspects of radio communications. Nonetheless, it is import to recognize that we must all work constructively to assure regulations will benefit the American public and facilitate the deployment of new and existing services.

Sincerely,

Brian F. Fontes/drp

Brian F. Fontes