ICO

June 13, 2002

Mr. Donald Abelson, Chief
International Bureau
Federal Communications Commission
445 12th Street, S.W.
Washington, D.C. 20554

Mr. Thomas J. Sugrue, Chief
Wireless Telecommunications Bureau
Federal Communications Commission
445 12th Street, S.W.
Washington, D.C. 20554

Mr. Edmond J. Thomas, Chief
Office of Engineering and Technology
Federal Communications Commission
445 12th Street, S.W.
Washington, D.C. 20554

***Re:*** ***Ex Parte* Response to AT&T Wireless, Cingular Wireless and Sprint**
*Mobile Satellite Systems – Terrestrial Services*
*IB Docket No. 01-185; ET Docket No. 95-18*

Dear Messrs. Abelson, Sugrue and Thomas:

ICO Global Communications (Holdings) Ltd. ("ICO")[1] would like to submit the attached engineering analysis for the Commission's consideration in connection with this proceeding. The analysis was prepared by Radio Dynamics Corporation, an independent consultant hired by ICO to assess the feasibility of the type of integrated, ancillary terrestrial components ("ATCs") that ICO and other mobile-satellite service ("MSS") licensees have proposed. The Radio Dynamics analysis also evaluates the eleventh-hour studies conducted by Comsearch and Telcordia, and relied upon by AT&T Wireless Services, Inc. ("AWS"),[2] Cingular Wireless, and Sprint, respectively.

The Radio Dynamics analysis demonstrates that the analyses provided by AWS and Cingular/Sprint in fact support ICO's longstanding and well-documented position that satellite and terrestrial services cannot be independently operated in the same spectrum at the same time. Furthermore, to the extent that AWS and Cingular/Sprint manipulate their technical reports to conclude that ATCs cannot be successfully integrated into MSS networks, the Radio Dynamics

[1] ICO, a Delaware corporation, indirectly owns a 100 percent interest in ICO Satellite Services G.P., which holds a letter of intent authorization to provide 2 GHz mobile satellite services ("MSS") in the United States.

[2] *See* Letter from Brian Fontes, Cingular, and Luisa L. Lancetti, Sprint, to Donald Abelson *et al.*, FCC (May 13, 2002) ("Cingular/Sprint Letter"); Letter from D Brandon, AWS, to William F. Caton, FCC Acting Secretary (Apr. 1, 2002) ("AWS Letter").

1730 Rhode Island Ave., NW
Suite 1000
Washington, DC 20036

202 721 0960 tel
202 296 8953 fax
web: www.ico.com

analysis points out that Telcordia and Comsearch consciously disregarded many of the factors that make integrated use of ATCs feasible. Put simply, the Comsearch and Telcordia studies do not say what AWS and Cingular/Sprint claim they do.

One can only conclude that these extremely late pleadings are intended more for delay than for illumination. Since the very beginning of this proceeding, the major terrestrial wireless carriers have made a concerted effort not just to oppose ATC flexibility for MSS licensees, but *to indefinitely delay the Commission from deciding this matter either way.* Pleadings from AWS, Cingular/Sprint, Verizon, and CTIA routinely argue not just that flexibility should not be granted, but that the whole question should be ducked for what may be months or years. They evidently hope this strategy will enable them to kill off the MSS industry slowly and indirectly, without having to explain how rural Americans will be served without a vibrant MSS sector, and without having to confront the obvious public interest benefits that flow from spectrum flexibility. Unfortunately, the strategy is in danger of working. The Commission must realize that the AWS and Cingular/Sprint filings, proffered in the final hours of this proceeding,[3] are only part of a larger program of delay and denial.

Despite the egregious manipulation of the Commission's processes that these submissions represent, the Commission must not overlook the fact that both the Comsearch analysis prepared for AWS and the Telcordia analysis prepared for Cingular and Sprint clearly prove what ICO has been saying all along: that an independent, severed terrestrial system can not co-exist with MSS in the 2 GHz MSS frequencies. Indeed, with the exception of a few incorrect key parameters, the analyses performed by Comsearch and Telcordia rely on the same data ICO filed almost a year ago. Despite a few questionable assumptions – such as the assumption that the Earth is flat,[4] the Comsearch and Telcordia analyses basically get this point right.

The new studies go astray, however, in their discussion of the feasibility of *fully integrated* ATCs, as proposed by MSS licensees. Telcordia and Comsearch largely ignore the very different goals and network architectures that the MSS licensees have adopted. Instead, at a number of crucial junctures, the consultants blithely *assumed* that the ATC portion of an MSS network would be just like any existing terrestrial network – optimized for stand-alone performance, regardless of the effect on the satellite network. Since all parties agree that independent terrestrial and satellite networks cannot share the same spectrum, it is not surprising that an "ATC" model that is assumed by the consultants to be just like an independent terrestrial

[3] There is no excuse for the terrestrial incumbents' delays in submitting this information. Since the filing of ICO's request for ATC authority more than a year ago, these carriers have had abundant opportunity to retain outside consultants and prepare any relevant technical analysis. In fact, they have actively participated in this proceeding, individually and through the Cellular Telecommunications & Internet Association ("CTIA"), since at least June 2001. *See* Letter from Dustun Ashton, CTIA, to Magalie Roman Salas, Secretary, FCC, IB Docket No. 99-81 (June 11, 2001); Letter from Douglas Brandon, AT&T Wireless *et al.*, to Michael K. Powell, Chairman, FCC, IB Docket No. 99-81 (June 13, 2001). Despite this active participation, they have chosen to wait almost a year into this proceeding to provide information that should have been submitted in the formal pleading cycle or, at the latest, in the additional filing period for supplemental technical comments, both of which have long closed.

[4] Comsearch interference measurements do not take into consideration fundamental physics including the curvature of the Earth.

network also cannot share. Thus, at the most basic level, the problem with the Comsearch and Telcordia analyses of integrated MSS-ATC networks is that critical analyses were never performed.

Even the "headline" from Telcordia's analysis – that "at most 18 ATC handsets could be operating outdoors and transmitting at full power (100 milliwatts) per CDMA carrier pair within one of its satellite beams" suffers from this basic failure to understand how an MSS network operates. If the terrestrial and satellite networks in question are independently owned and operated, then 18 handsets is not far from what ICO itself used as its starting point for the calculation over a year ago. However, by utilizing dynamic resource management, multiple satellite beams, and other mitigation measures like voice activation and power control, and factoring in the number of users operating indoors or in areas with blocked views of the sky, the relevant number is the approximately 1,600,000 additional subscribers that ICO will be able to provide ATC service on a co-frequency basis to in the U.S.

While this number of potential ATC subscribers – 1.6 million – is significantly smaller than the number of users of larger stand-alone terrestrial providers, the benefits that will accrue from bringing advanced wireless service to all parts of the world that otherwise would likely never get it make ATC an extremely efficient use of spectrum. Cingular, Sprint and AT&T, on the other hand, seem myopically focused on bringing additional services only to urban consumers, while leaving America's rural and public safety needs unserved. In the regulatory arena, they seem to be satisfied to continue the wireless industry's schizophrenic fight for spectrum, crying for more spectrum while not fully utilizing what they have, and fighting all attempts to make more available. Everyone agrees that independent operators technically cannot provide terrestrial service in the MSS spectrum on an independent basis, no matter where it is delivered. But incumbents are going to extremes, even relying on bad research, to ensure that no new terrestrial providers are allowed into the highly valued urban markets even on an ancillary basis.

As discussed in the attached further comments, the attached Radio Dynamics Review reaffirms the validity of the technical analyses previously submitted by ICO and specifically refutes the erroneous assumptions and conclusions made by both the Telcordia and Comsearch Analyses.

Respectively,

/s/ Lawrence H. Williams

Lawrence H. Williams
Senior Vice President
Business Development

**Before the**
**FEDERAL COMMUNICATIONS COMMISSION**
**Washington, D.C. 20554**

| | | |
|---|---|---|
| In the Matter of | ) | |
| | ) | |
| Flexibility for Delivery of Communications by Mobile Satellite Service Providers in the 2 GHz Band, the L-Band, and the 1.6/2.4 GHz Band | ) | IB Docket No. 01-185 |
| | ) | |
| Amendment of Section 2.106 of the Commission's Rules to Allocate Spectrum at 2 GHz for Use by the Mobile-Satellite Service | ) | ET Docket No. 95-18 |

To: The Commission

**FURTHER COMMENTS OF ICO GLOBAL COMMUNICATIONS**

ICO Global Communications (Holdings) Ltd. ("ICO")[1] submits these further comments and the attached engineering review prepared by Radio Dynamics Corporation (the "Radio Dynamics Review"), in response to the late-filed comments and technical submissions by Cingular Wireless LLC ("Cingular"), Sprint Corporation ("Sprint"), and AT&T Wireless Services, Inc. ("AWS").[2] The Radio Dynamics Review refutes the erroneous assumptions and conclusions set forth in the technical analysis prepared by Telcordia Technologies on behalf of Cingular and Sprint (the "Telcordia Analysis") and the technical analysis prepared by Comsearch on behalf of AWS (the "Comsearch Analysis"), both of which purport to demonstrate that co-frequency sharing between the integrated ancillary terrestrial component ("ATC") and satellite component ("SC") of MSS is infeasible. Instead, the Radio Dynamics Review reaffirms the

---

[1] ICO, a Delaware corporation, indirectly owns a 100 percent interest in ICO Satellite Services G.P., which holds a letter of intent authorization to provide 2 GHz mobile satellite services ("MSS") in the United States.

[2] *See* Letter from Brian Fontes, Cingular, and Luisa L. Lancetti, Sprint, to Donald Abelson *et al.*, FCC (May 13, 2002) ("Cingular/Sprint Letter"); Letter from Douglas I. Brandon, AWS, to William F. Caton, Acting Secretary, FCC (Apr. 1, 2002) ("AWS Letter"). All filings in IB Docket No. 01-185 and ET Docket No. 95-18 will hereinafter be short cited.

validity of the technical analyses previously submitted by ICO that demonstrate that an integrated satellite and terrestrial operation can efficiently share frequencies through an architecture that relies upon dynamic frequency allocation and intelligent, real-time, integrated control of operational parameters.

## I. Terrestrial Wireless Carriers Concede That Co-Frequency Sharing Between MSS and Severed Terrestrial Systems Is Infeasible

The extreme tardiness of the Cingular/Sprint and AWS filings notwithstanding, these filings are notable because the parties readily concede that co-frequency sharing between MSS and severed terrestrial systems is infeasible or impractical.[3] The Telcordia and Comsearch Analyses merely bolster the undisputed fact that MSS and severed terrestrial systems cannot practically share the same frequencies. In view of this consensus, the Commission must remove from consideration any proposal to permit co-frequency sharing between MSS and severed terrestrial systems.

Cingular, Sprint, and AWS further concede that, as a practical matter, severing terrestrial from satellite operations can be accomplished only through band segmentation.[4] As ICO has demonstrated in prior filings, band segmentation is not an adequate substitute for integrated ATC

[3] *See* Cingular/Sprint Letter at 15 ("The sharing of the MSS band between satellite and terrestrial operations, while technically feasible, is not practically viable."); AWS Letter at 3 ("ATC and the Satellite Component…cannot operate co-frequency in the same cell regardless of whether MSS and terrestrial wireless service are provided by a single or different providers."). Other terrestrial wireless carriers participating in this proceeding also share this view. *See* Further Technical Comments of CTIA at 2 (Mar. 22, 2002) ("the 2 GHz band can clearly be segmented into separate frequency bands for terrestrial satellite services, and indeed *must* be segmented….") (emphasis in original); Letter from John T. Scott III *et al.*, Verizon Wireless, to William F. Caton, Acting Secretary, FCC, 3 (Mar. 22, 2002) ("Without band segmentation, these technical difficulties exist regardless of whether there is an integrated MSS/terrestrial network or separate operators, with one operator providing terrestrial service and another providing satellite services in the same MSS band.").

[4] *See* Cingular/Sprint Letter at 15 ("As a practical matter, the only way that the construction of an ATC network could be cost-justified would be to separate the MSS band into two different segments--one segment for ATC use and the other segment for MSS use."); AWS Letter at 7-8 ("Regardless of whether MSS providers implement their ATC proposals or other providers are permitted to use a segment of MSS spectrum for terrestrial wireless service…terrestrial service would be offered on a segmented portion of the MSS band.").

systems.[5] More important, any proposal to segment and reallocate MSS spectrum is beyond the scope of this proceeding and must be properly considered in the separate 3G proceeding.[6]

The only real dispute that remains between ICO and the terrestrial commercial mobile radio service ("CMRS") providers is not whether severed terrestrial systems can feasibly share spectrum with MSS systems (they cannot), but whether spectrum sharing between integrated ATC and SC is feasible as well as spectrally efficient. As discussed below, the Telcordia and Comsearch Analyses are fundamentally flawed and, as a result, fail to refute the feasibility or public interest benefits of an integrated ATC and SC system. The Commission therefore cannot accord either the Comsearch Analysis or the Telcordia Analysis serious consideration.

## II. Telcordia Grossly Distorts Sharing Capability Between SC and ATC

By relying upon unrealistic assumptions about the technical parameters applicable to SC and ATC, the Telcordia Analysis grossly distorts the actual sharing capability between those two operations. In doing so, the Telcordia Analysis reaches a number of patently erroneous conclusions, the most egregious of which are:

(1) separate MSS and terrestrial operators are equally capable of managing interference issues as a single integrated MSS operator managing both ATC and SC;

(2) interference from ATC-mode handsets to ICO satellites would severely reduce capacity on either or both ATC and SC;

(3) interference from SC-mode handsets to an ATC base station cannot be mitigated to a larger extent than interference from SC-mode handsets to a severed terrestrial base station; and

(4) interference from an ATC base station to SC-mode handsets cannot be mitigated to a larger extent than interference from a severed terrestrial base station to SC-mode handsets.

---

[5] *See* Letter from Cheryl A. Tritt, Counsel to ICO, to William F. Caton, Acting Secretary, FCC, Exh. B, at 14 (Mar. 8, 2002); Reply Comments of ICO at 6-7 (Nov. 13, 2001); Comments of ICO at 37 n.65 (Oct. 22, 2001).

[6] *See Amendment of Part of the Commission's Rules to Allocate Spectrum Below 3 GHz for Mobile and Fixed Services to Support the Introduction of New Advanced Wireless Services, Including Third Generation Wireless Systems*, Memorandum Opinion and Order and Further Notice of Proposed Rulemaking, 16 FCC Rcd 16043 (2001).

As the Radio Dynamics Review confirms, however, interference between satellite and terrestrial operations can be mitigated effectively only by a single, integrated operator. Specifically, using more realistic assumptions about ATC operations, the Radio Dynamics Review supports the conclusion that MSS ATC can accommodate a significantly larger number of handsets than a severed terrestrial system.[7]

The Radio Dynamics Review further confirms that severed terrestrial base stations actually generate much larger exclusion zones (within which SC-mode handsets cannot operate without causing or receiving harmful interference to or from the base stations) than assumed by the Telcordia Analysis.[8] Unlike independent MSS and terrestrial operators, an integrated MSS operator can mitigate interference within these exclusion zones by assigning non-overlapping frequencies by virtue of its knowledge of both ATC and SC operations (e.g., locations of ATC base stations and SC-mode handsets, and emission and receive characteristics of ATC base stations and SC-mode handsets). Although this frequency coordination and harmonization is readily achievable by an integrated MSS operator, it becomes an operational nightmare when two separate operators are involved. Such coordination would require unrealistic sharing of extensive information between both operators, as well as mutual agreement as to the proper allocation of frequencies between the two systems and the proper scope of MSS and terrestrial deployment. Tellingly, no CMRS participant in this proceeding has proposed to implement any severed terrestrial system requiring that degree of coordination between CMRS and MSS operators.

### A. Interference from ATC-mode Handsets to ICO Satellites

In focusing on ICO's estimate of 18 outdoor, severed terrestrial handsets that can be accommodated within a given satellite spot beam, the Telcordia Analysis quotes this estimate completely out of context and misleadingly equates this estimate with the number of *ATC-mode*

---

[7] *See* Radio Dynamics Review at 5-6.

[8] *Id.* at 6-8.

handsets that can be accommodated. By itself, ICO's estimate of 18 outdoor, severed terrestrial handsets is strictly limited to the severed terrestrial context.[9] Moreover, ICO used that estimate as merely an intermediate point in the larger series of calculations yielding the number of ATC subscribers within the United States that can be accommodated by an integrated MSS system. The Telcordia Analysis ignores or selectively discounts a number of other critical factors, which if properly taken into account, would yield a conservative estimate of 1.6 million ATC subscribers in the United States than can be supported by an integrated MSS system.[10]

In particular, an integrated MSS operator can operate under more aggressive assumptions about operational parameters, such as carrier-to-interference ratios, voice activation, and power control levels, because it has full knowledge of and tight control over both SC and ATC operations. The integrated MSS operator therefore can react or respond in real time to variations in the aggregate level of interference to the satellite by adjusting the appropriate operational parameters. Two separate operators, on the other hand, will be required to operate under much more conservative parameters because little or no real-time coordination and exchange of information between both systems is practical. Thus, the use of more aggressive operational parameters by an integrated MSS operator will produce a corresponding increase in the overall capacity of ATC and SC.[11]

ICO repeatedly has emphasized that an integrated MSS operator can mitigate interference by establishing an admission control criteria for ATC users based on monitored interference data from the SC operations.[12] Under these criteria, when the maximum interference threshold for proper SC operations is reached, additional requests for frequency assignments for ATC will be either denied or accommodated through the assignment of available, non-overlapping

---

[9] *See* Comments of ICO, App. A, at A-1.

[10] *Id.*, App. A at A-7.

[11] *Id.*, App. A. at A-2 through A-7.

[12] *See* Supplemental Comments of ICO at 9 (Mar. 22, 2002); Comments of ICO, App. B, at B-6.

frequencies. A severed terrestrial operator, on the other hand, has no ability to limit terrestrial use in such a manner because it lacks real-time knowledge of the interference parameters for the independently operating MSS system. This inability to limit terrestrial use would require the severed terrestrial operator to operate under much conservative operational parameters so as to avoid harmful interference to a co-frequency MSS system, thus limiting the available capacity on the terrestrial system.

Moreover, the Telcordia Analysis conveniently fails to consider that an integrated MSS operator will deploy ATC only in urban areas where the satellite signal is attenuated. Severed terrestrial operators, on the other hand, will have little incentive to limit deployment to those areas. Because a larger number of power-limited ATC microcells and picocells are generally required to cover urban areas (as opposed to rural areas) to allow for greater capacity, the corresponding ATC handsets necessarily will operate at lower power, thus increasing capacity on the ATC and SC networks. As the Radio Dynamics Review points out, Telcordia's own data shows that a reduction alone in the handset power level associated with these smaller ATC cells would result in a substantial increase in SC capacity.[13]

Similarly, the Telcordia Analysis wrongly assumes that all ATC-mode handsets will be visible to the satellite. In view of the urban nature of ATC deployment and the likelihood that ATC-mode handsets will be subject to signal blockage by buildings and other structures, Telcordia should have assumed a greater reduction in the power of ATC-mode handsets due to signal blockage. Thus, as the Radio Dynamics Review demonstrates, accounting for more realistic ATC operating conditions would result in a substantial increase in overall ATC and SC capacity.[14]

---

[13] *See* Radio Dynamics Review at 5.

[14] *Id.* at 5-6.

### B. Interference from SC-mode Handsets to Terrestrial Base Stations

The Telcordia Analysis concludes that interference from SC-mode handsets to terrestrial base stations (ATC or severed) is manageable, but fails to account for critical differences between an integrated MSS system and independent MSS and terrestrial systems. As the Radio Dynamics Review observes, Telcordia assumes a transmit power level of 400 mW for an SC-mode handset.[15] In practice, the transmit power level for the SC-mode handset is on the order of 5 watts, which is 11 dB higher than Telcordia's assumption. This error means that the exclusion zones calculated by Telcordia are substantially smaller than the exclusion zones that actually will be required for a severed terrestrial system.

If the Telcordia Analysis had used proper parameters for SC-mode handsets, such as a higher emission power level, it would have yielded exclusion zones around terrestrial base stations that extend to several thousand square kilometers (equivalent to approximately 32 kilometers in radius), rather than the few tens of square kilometers that it predicted. Within these exclusion zones, two separate operators cannot simply manage interference from SC-mode handsets to the severed terrestrial base station "using fairly straightforward engineering practices,"[16] as Telcordia suggests. Rather, only an integrated MSS operator can effectively mitigate this interference through the assignment of non-overlapping frequencies.

Independent MSS and terrestrial operators cannot effectively mitigate interference through the assignment of non-overlapping frequencies because it would require both operators to share knowledge of: (1) the locations of the terrestrial base stations and SC-mode handsets; (2) the emission characteristics of the SC-mode handsets; and (3) the receive characteristics of the terrestrial base stations. It also would require both operators to agree on an acceptable allocation of non-overlapping frequencies for each geographic area where both satellite and terrestrial services are intended to be deployed. Such extensive coordination is simply

---

[15] *Id.* at _6.

[16] Cingular/Sprint Letter, Att. A, at 1.

uneconomic, impractical, and unrealistic, particularly if each operator views the other as a competitive threat.

### C. Interference from Terrestrial Base Stations to SC-mode Handsets

The Telcordia Analysis also underestimates the size of the exclusion zones around terrestrial base stations (ATC or severed) for purposes of analyzing interference from those base stations to SC-mode handsets. Specifically, it assumes a thermal noise floor of –111 dBm for SC-mode handsets when, in practice, ICO handsets operating in the SC mode will typically have a thermal noise floor of approximately –130 dBm. Thus, if properly calculated, the operational parameters for SC-mode handsets would yield exclusion zones around terrestrial base stations that extend to several thousand square kilometers (equivalent to approximately 32 kilometers in radius), rather than the few tens of square kilometers predicted by the Telcordia Analysis. Within these exclusion zones, only an integrated MSS operator can effectively mitigate interference from terrestrial base stations to SC-mode handsets through the assignment of non-overlapping frequencies. As noted above, nothing in the record suggests that two independent MSS and terrestrial operators would have any incentive or ability to achieve the level of coordination required to mitigate interference through the assignment of non-overlapping frequencies.

## III. The Comsearch Analysis Assumes the Earth Is Flat

In concluding that co-frequency sharing between ATC and SC is not technically possible, the Comsearch Analysis purports to demonstrate unacceptable interference between ATC base stations and SC-mode handsets. This analysis, however, is premised on the ridiculous assumption that the Earth is flat. As the attached Radio Dynamics Review points out, Comsearch's estimated exclusion zone radius of almost 14,000 kilometers is longer than the diameter of the Earth itself (which is 12,756 kilometers) and suggests that an ATC base station in New York would cause harmful interference to an SC-mode handset located halfway around the world in China. Any analysis that is based on such a fundamental error cannot be seriously entertained.[17]

Because exclusion zones around ATC base stations are in fact much smaller than estimated by Comsearch (i.e., approximately 32 kilometers in radius), the assignment of non-overlapping frequencies to ATC and SC within these exclusion zones would not result in any band segmentation for two reasons. First, the same 2 GHz MSS frequencies assigned to ATC within the exclusion zones may be efficiently re-used by SC-mode handsets outside the exclusion zones. Second, dynamic frequency allocation permits an integrated MSS operator to use the same 2 GHz MSS frequencies for both SC and ATC operations within the same area, albeit at different times.

Although the Comsearch Analysis concludes that ATC and SC cannot share frequencies within the same area, it entirely disregards the fact that the dynamic frequency allocation performed by an integrated MSS operator permits precisely such sharing. It concedes that "there may be some benefits to dynamically allocating spectrum between satellite and terrestrial users in terms of spectral efficiency."[18] It blithely claims, however, that these benefits could be achieved through MSS/terrestrial partnerships without any consideration of the remote probability or disadvantages of these partnerships.[19] As the Radio Dynamics Review observes, the interference analysis performed by Comsearch offers absolutely no justification for several of the parameters used and relies on assumptions that simply do not apply to integrated MSS systems. The obvious lack of technical rigor with which the Comsearch Analysis was conducted suggests that the conclusions were result-oriented and not the product of any thoughtful analysis.

---

[17] The Radio Dynamics Review also points out that the Comsearch Analysis used a simplistic free space loss model that grossly underestimates terrestrial signal attenuation by failing to account for any terrain blockage. *See* Radio Dynamics Review at 3-4.

[18] *See* AWS Letter, Att. A, at 3.

[19] *See* Comments of Globalstar and L/Q Licensee at 14-15; Comments of Globalstar Bondholders at 34-35; Comments of Celsat America at 8.

## IV. Conclusion

The Commission's stated objective for this proceeding is to consider proposals "to bring flexibility to the delivery of communications by [MSS] providers."[20] Cingular, Sprint, and AWS make much ado about the infeasibility of ATC/SC sharing, but significantly fail to offer any proposal of their own to achieve similar spectral efficiencies through severed terrestrial systems. The sole interference issues that they raise regarding ATC deployment concern interference between co-frequency ATC and SC operations conducted by an integrated MSS operator, i.e., MSS self-interference. As the record amply demonstrates, integrated MSS operators have every incentive and the full ability to mitigate this interference. Any possible remaining concerns that ATC deployment would occur at the expense of satellite deployment could be easily addressed by strict enforcement of construction milestones requiring timely satellite deployment and additional gating requirements ensuring that ATC remains truly ancillary.[21]

The eleventh-hour filings by Cingular, Sprint, and AWS are nothing more than a desperate attempt to delay innovative spectrum use and thwart what they perceive as a competitive threat to their market dominance in urban areas. They have used bad science to support untenable conclusions that have no basis in scientific fact. The Commission accordingly must not reward their transparent efforts to muddy the record with irrelevant and inaccurate data.

Denying 2 GHz MSS operators the flexibility to provide ATC to urban and indoor areas would jeopardize the viability of 2 GHz MSS and render it unavailable even to rural customers. 2 GHz MSS operators would continue to be restricted to rural markets and remain unable to achieve scale economies necessary to sustain commercial viability. As a result, the limited MSS offerings would deter capital investment and reduce demand for MSS even in rural markets.

---

[20] *ATC NPRM* ¶ 1.

[21] *Id.* ¶ 32 (proposing ATC conditions to ensure ancillary operations); Comments of ICO at 43-47 (supporting specific ATC gating requirements).

Further delay will jeopardize ICO's roll-out of Internet and high-speed services. Until the Commission offers clear guidance that will stimulate necessary capital investment, ICO's planned upgrade of its satellite system and ground network is on hold. Moreover, the failure to resolve the ATC issue before the first milestone deadline in July 2002 will limit 2 GHz MSS operators' ability to enter into favorable contracts for satellite construction and system upgrades, as well as to proceed expeditiously with their construction plans. ICO therefore urges prompt adoption of the ATC proposal.

Respectfully submitted,

/s/ Lawrence H. Williams

Lawrence H. Williams
Suzanne Hutchings
ICO GLOBAL COMMUNICATIONS (HOLDINGS) LTD.
1730 Rhode Island Avenue, N.W.
Suite 1000
Washington, D.C. 20036

June 13, 2002

Radio Dynamics

# Technical Review of MSS Spectrum Sharing Commentary

Radio Dynamics Corporation
June 13, 2002

6903 Rockledge Drive, Suite 220 • Bethesda, Maryland 20817 • 301 493 5171 Fax 301 493 5162 • www.radyn.com



*An Employee-Owned Company*

# I Introduction

Mobile Satellite System (MSS) providers have proposed adding an Ancillary Terrestrial Component (ATC) to their deployments in order to provide service in urban areas. Sprint Corporation/Cingular Wireless and AT&T Wireless submitted Ex Parte filings to the FCC,[1] one containing an appendix by Comsearch and another with an appendix by Telcordia, which purport to show that the ATC deployment could be severed from the MSS with no loss of spectral efficiency. This paper analyzes the technical appendices of these filings. Both filings claim that co-channel frequency reuse between the Satellite Component (SC) and ATC deployments is not feasible and that, therefore, band segregation must be used to isolate the ATC from the SC. In fact, while frequency reuse may be impossible in severed systems, it can be utilized in the proposed integrated system with both an ATC and SC.

The appendix produced by Comsearch consists primarily of a series of spreadsheets containing four interference scenarios assuming two different technologies. Several factors call into question the results set forth in the spreadsheets. Indeed, the results are not even relevant for the proposed MSS systems.

Because some of the underlying assumptions of the Telcordia appendix are flawed, the results are likewise not applicable to the proposed MSS with integrated ATC systems. In particular, the results do show that co-channel frequency reuse is, indeed, not feasible for a severed system. However, the results are not applicable to an integrated system with both ATC and SC. The main difference is that, in an integrated system, it is possible to jointly optimize the ATC and SC. This is not possible in a severed system.

Both the Telcordia and Comsearch reports examine all the four interference scenarios discussed in ICO's original ex-parte filing. They are 1) MSS handsets in SC mode into ATC base, 2) ATC base into MSS handsets in SC mode, 3) satellite transmitter into MSS handsets in ATC mode, and 4) MSS handsets in ATC mode into satellite receiver. But neither of these papers demonstrates that a spectrally efficient co-channel frequency reuse strategy between the SC and ATC deployments is not feasible in an integrated system as proposed by the MSS providers. Also, neither paper provides any substantial consideration of the gains associated with dynamic frequency allocation strategy proposed by the MSS providers as a means of increasing SC capacity by eliminating harmful ATC interference.

# II Comsearch appendix

The spreadsheets attached to the Comsearch document intend to provide justification for spectrum severing between mobile satellite service and terrestrial service. Comsearch considers the four interference scenarios described above under two technologies. The conclusions in these

[1] See *Written Ex Parte Communication* submitted by Sprint Corporation & Cingular Wireless LLC, dated May 13 2002, IB Docket No.01-185; ET Docket No. 95-18. See also *Ex Parte Presentation* submitted by AT&T Wireless dated April 1 2002, IB Docket No.01-185; ET Docket No. 95-18.

spreadsheets are of dubious value for several reasons, but in particular because of two highly questionable assumptions that are crucial to the calculations.

First, throughout the spreadsheets the systems are modeled independently, with no justification for several of the parameters. Based on this model, the attachment concludes that spectrum sharing is possible only if the band is split between the terrestrial and satellite systems. While it is true that if different operators are responsible for the terrestrial and satellite operation, the band may need to be segregated, the same result does not hold for an integrated system. In fact, it is likely that a more realistic integrated satellite and terrestrial system would have a similar implementation (and requirements) to the terrestrial systems alone. For example, in a combined system, the SC and ATC would make use of careful power control. This may not be possible with a severed system, but it is possible, and indeed necessary, in an integrated satellite and terrestrial network. Intelligent power control can substantially reduce harmful interference in the combined system.

Second, Comsearch consistently bases distance estimates on free space loss estimates for the received signal levels. While the free space model provides good clear sky estimates for satellite coverage, it is well known in the industry that it will grossly overestimate terrestrial interference. In particular, a 100-foot-tall base station (reasonable for an urban scenario) cannot be seen by any handset 23 km away because of the earth bulge. Additional mitigation will also result from terrain blockage. Beyond 23 km, a model that takes terrain and the earth's curvature into account must be used. Further, shortly beyond this distance, the dominant propagation mode will often be isotropic scattering, which is substantially weaker than the modes usually associated with line of sight propagation. Finally, additional interference mitigation will result from buildings and other man-made structures that will certainly be significant, given that the terrestrial deployments will be in urban areas.

The most salient issues with the Comsearch report are discussed below.

## 1) Required loss values

The "OH (Over the Horizon) loss required values" in scenarios (1), (2), and (4) appear to be based on several assumptions. First, the handset must be directly on boresight of the victim receive antenna to create or experience the computed interference. Second, both the satellite system and the terrestrial system are not assumed to be utilizing any form of power control. As stated above, while this may be true in a "severed" system, it is not clear from this analysis that, for example, a working system containing a mixture of satellites and terrestrial base stations would be bound by this restriction. This is a crucial omission: without power control, current terrestrial CDMA cellular systems would not operate.

## 2) Use of free space loss

The "distance to clear" values reported in scenarios (1), (2), and (4) of the Comsearch report are all based on a free space loss estimate which is clearly inappropriate in this instance. As discussed above, realistic estimates for Comsearch's Scenario (1) are more than two orders of magnitude lower. The values reported for Scenarios (2) and (4) are considerably worse. In the CDMA case, the distance to clear is reported as greater than 14000 km. Since the earth is only 12756 km in diameter and straight-line distances are being used, this is clearly not realistic. According to this computation, a terrestrial CDMA base station in New York would create unacceptable interference to an SC-mode handset in China.

## III Telcordia appendix

The document prepared by Telcordia contains several pages of detailed calculations that analyze SC-ATC spectrum sharing. Although the technical details rely on well-known sources in the literature,[2] the underlying assumptions about the nature of the ATC deployment are not consistent with an MSS-ATC integrated system. Consequently, the application of the results in the main body of the filing is seriously flawed.[3]

As noted above, both the Telcordia and Comsearch reports examine all the four interference scenarios discussed in ICO's original ex-parte filing. They are 1) MSS handsets in SC mode into ATC base, 2) ATC base into MSS handsets in SC mode, 3) Satellite transmitter into ATC mode handsets, and 4) ATC mode handsets into satellite receiver. However, the Telcordia paper suggests that the first three of the interference scenarios decribed above are not technically challenging. In fact, the Telcordia report states that "The other three are confined to areas near MSS-ATC coverage boundaries and appear to be manageable using fairly straightforward engineering practices...."[4] But the Telcordia analysis erroneously suggests that a severed terrestrial operator is equally capable of managing three of the four interference scenarios (i.e., SC-mode handset to ATC base, ATC base to SC-mode handset, and ATC-mode handset to satellite) as an ATC-integrated MSS operator. As shown below, a severed terrestrial operator in fact is incapable of managing interference in those cases.

The fourth interference case addresses interference from ATC-mode handsets into the satellite receiver. Telcordia has made several implicit assumptions concerning the nature of the ATC deployment that, in fact, are not appropriate for an integrated MSS-ATC deployment. They are applicable to a severed MSS and terrestrial system, however, and point out some inherent spectral inefficiency in a severed approach.

### 1) Interference from ATC mode handsets to Satellite

### 1.1) Power levels

[2] See *Written Ex Parte Communication* submitted by Sprint Corporation & Cingular Wireless LLC, dated May 13 2002, IB Docket No.01-185; ET Docket No. 95-18, Attachment A at 90, especially [11] & [12].

[3] *Written Ex Parte Communication* submitted by Sprint Corporation & Cingular Wireless LLC, dated May 13 2002, IB Docket No.01-185; ET Docket No. 95-18 at 14 states that "... the CDMA system it describes would require 30 MHz of spectrum – not 15 MHz." This statement is in contradiction to the Telcordia's understanding that 30 MHz of spectrum would be required, 15 MHz in each direction. See Attachment A at 72.

[4] See *Written Ex Parte Communication* submitted by Sprint Corporation & Cingular Wireless LLC, dated May 13 2002, IB Docket No.01-185; ET Docket No. 95-18, Attachment A at 1.

The report makes the important point that all ATC-mode handsets within the satellite spot beam will contribute to the interference level and that, therefore, an aggregate power level must be computed. However, to compute aggregate power, the report makes the assumption that the ATC system has been designed for optimal stand-alone performance. This will certainly be the case if the operator of the ATC system is not the same as the operator of the MSS deployment. However, in an integrated system there is no reason to assume that the ATC system will be optimized at the expense of the SC performance.

For example, consider a large urban area (e.g. New York City). The Telcordia paper assumes that all base stations will allow ATC mode handsets out to the boundaries of available coverage. This assumption is unrealistic for two reasons. First, the primary purpose of integrating ATC is to provide coverage in areas inaccessible to satellite coverage. A large number of these cells will be microcells and picocells, some located indoors or in urban canyons, where, because of power control, it is unlikely that substantial amounts of ATC mode handset radiation will reach the satellite. Secondly, as is known from standard terrestrial deployments, it is always necessary to use a larger number of power limited cells to cover urban markets to allow for greater capacity.

The net effect of the lower power cells and corresponding ATC-mode handsets at lower operating powers is to alter the paper's computed estimates of total power from the ATC-mode handsets. In particular, if the cell radius is scaled back to 1/2 or less of the optimal value, this reduction translates into a power reduction of 10 dB or more. This assumes, as the paper does, that the path loss exponent is between 3 and 4 (see, e.g., discussion on page 18 of the Telcordia paper, above equation 20). It should be noted that, according to the paper, this change alone, i.e. a reduction in cell radius, would improve the computed capacity of the MSS uplink substantially. In fact, using Figure 3, (page 9 of the Telcordia paper), a 10 dB power change corresponds to the difference between a completely unusable MSS uplink (i.e. 0 MSS handsets permitted) and one that is operating at 92% of capacity.

## 1.2) ATC and SC parameters

There is a large discrepancy between the parameters released by ICO and those that are applied in the Telcordia paper. When more realistic parameters are applied, the results predict far less degradation in performance for a MSS SC integrated with ATC than the main body of the Telcordia filing suggests.

Consider the MSS SC uplink capacity reduction predicted by Figure 11 (page 26 of the Telcordia paper). These curves show the reduction in MSS capacity based on the number of functioning ATC base stations in the spot beam. The key parameter, $L_{EX}$, represents the reduction in power due to blockage of the ATC-mode handsets. It is obvious from the results that most allowances for blockage and power reduction were omitted.

Considering the urban nature of the ATC deployment, and the comparatively large number of ATC base stations that will experience man-made blockage (e.g. indoor or urban canyon sites), a more realistic value of $L_{EX}$ = 10 dB or $L_{EX}$ = 15 dB should be used. In addition, several other mitigating factors such as voice activation allowances, multibeam distribution, etc., would further substantially reduce the effective power.

According to Figure 11 and the preceding equations when the above-mentioned allowances are made, the numbers of handsets can be increased by several orders of magnitude. An additional order of magnitude is gained when the proper ATC system design for an integrated MSS system is used as discussed in the preceding section. The result is a quite feasible MSS-ATC co-channel deployment.

## 2) Interference from SC mode handsets to ATC Base Station

The analysis submitted in this section is based on papers and filings made by ICO. Indeed, MSS providers have previously submitted much of this information,[5] as noted in the text. It is restated here in response to specific erroneous assumptions made by Telcordia.

Telcordia's analysis assumes a transmit EIRP of 400 mW for the SC mode user terminal. The actual transmit EIRP for an ICO SC-mode handset is on the order of 5 watts (11 dB higher than the Telcordia assumption). As a result, the exclusion distances calculated by Telcordia are not sufficient: much wider exclusion zones are created around severed terrestrial base stations within which SC-mode handsets could not operate without harmful interference to the severed terrestrial base station.

Telcordia also concludes that this type of interference is a low probability event[6] by assuming a uniform planar distribution of MSS handsets.[7] This assumption is flawed due to the fact that any real population of MSS handsets is not uniformly distributed. This significantly increases the likelihood of interference from MSS handsets to a severed terrestrial base station, contrary to Telcordia's conclusion. Thus, using proper ICO SC-mode handset parameters, the coverage gaps caused by severed operations will extend to several thousands of square kilometers[8] (effectively limited by the radio horizon) rather than the few tens of square kilometers predicted by Telcordia. Within this exclusion zone, interference from SC-mode handsets to the terrestrial base station cannot be managed "using fairly straightforward engineering practices," as Telcordia suggests. On the other hand, an ATC-integrated MSS operator can effectively manage this interference by allocating non-overlapping frequencies for SC-mode handsets operating within the exclusion zone of an ATC base station.

[5] See Letter to Chairman Powell re ATC, dated March 8, 2001; Appendix B at 15.
[6] See Sprint Corporation Cingular Wireless Ex Parte dated May 13, 2002; Attachment A at 36.
[7] Ibid. at 32.
[8] See Letter to Chairman Powell re ATC dated March 8, 2001; Appendix B at 15.

Under the proposed ICO ATC system, the allocation of frequencies is performed by means of complex resource management algorithms installed in the Dynamic Resource Allocator. This approach can work only if some basic information is known:

(a) Locations and frequencies used by the ATC base stations and MSS handsets in SC-mode;

(b) Real-time Emission characteristics of the ATC base stations and MSS handset in SC-mode; and

(c) Receive characteristics of the ATC base station and MSS handset in SC-mode.

An MSS operator operating the ATC can easily accommodate these planning requirements into its system. An independent operator who wishes to do this will encounter significant signaling overload (as opposed to "fairly small blocks of data" as predicted by Telcordia[9]) and must use additional system hardware. This would not be financially or spectrally efficient. ICO's moving satellite constellation, 12 satellite access nodes and 2 network management centers spread across the globe has already incorporated this type of complex resource management techniques into its system.

A more thorough discussion of the exclusion zones associated with ATC operation can be found in the Supplemental Comments of ICO filed in March 2002. Though relevant, it is not reproduced here (see Figure 1 on page 4 and the associated discussion for details).

## 3) Interference from ATC Base Station to SC mode handsets

The analysis submitted in this section is based on papers and filings made by ICO. Indeed, MSS providers have previously submitted much of this as noted in the text. It is restated here in response to specific erroneous assumptions made by Telcordia.

Telcordia analysis is based on a thermal noise floor of –111 dBm[10] for an SC-mode handset. ICO SC-mode handsets typically have a thermal noise floor of around –130 dBm. This difference is fairly large and thus, once more, the exclusion zones predicted by Telcordia, in the order of a few square kilometers, are no longer applicable. The exclusion zone, in this case, is limited by the radio horizon as originally shown in the ICO Ex Parte dated March 8th 2001.[11]

The mitigation associated with this type of interference is similar to that employed for the MSS handsets in SC mode to ATC base interference. Thus a single operator, with knowledge of the technical parameters, and the availability of real-time information (locations, frequencies used, etc.) from both components of the system, can avoid any coverage gap. On the contrary, independent operators will end up with large coverage holes extending to many kilometers in radius.

---

[9] See See Sprint Corporation Cingular Wireless Ex Parte dated May 13, 2002; Attachment A at 78.

[10] See Sprint Corporation Cingular Wireless Ex Parte dated May 13, 2002; Attachment A at 48.

[11] See Letter to Chairman Powell re ATC dated March 8, 2001; Appendix B at 18.

Telcordia proposed that they can mitigate coverage gaps by extending the coverage for the cells at the edge by transmitting 10% more pilot power[12] from the base stations. This approach assumes that the exclusion zone is fairly small. The ATC coverage for the cells at the edge cannot be extended as indicated by Telcordia due to the large exclusion distance. In the end the technique is self-defeating because any increase in transmit power from the base station would result in increased exclusion.

# IV Conclusion.

The Comsearch and Telcordia technical appendices do not support the claim that a combined MSS and ATC system would require band splitting or would be as spectrally inefficient as severing.

The Comsearch paper, in addition to having several technical issues, is not relevant to the proposed MSS architectures. No allowance is made for parameters such as power control that would seriously affect the results. Further the propagation models used are in most cases inappropriate for the environment.

The Telcordia paper uses assumptions that make sense only if the ATC system is severed from the MSS deployment. The assumptions are flawed for a combined MSS-ATC system as proposed by the MSS providers. In the case of ATC-mode handset interference into a satellite receiver, no allowance is made for power control or other parameters that can be optimized in a combined system. In both cases of interference between the ATC base station and SC-mode handsets discussed in Sections 2) and 3) above, Telcordia did not use the parameters submitted by MSS providers.

Finally, neither of these papers considers the benefits of the joint optimization of the MSS and ATC system as proposed by the MSS providers. Also, neither paper provides adequate analysis of the dynamic frequency allocation strategy.

[12] See Sprint Corporation Cingular Wireless Ex Parte dated May 13, 2002; Attachment A at 58.

## CERTIFICATE OF SERVICE

I, Gwendolynne M. Chen, do hereby certify that I have on this 13th day of June 2002, had copies of the foregoing **FURTHER COMMENTS OF ICO GLOBAL COMMUNICATIONS** delivered to the following via electronic mail:

Peter A. Tenhula, Senior Legal Advisor
Office of Chairman Powell
Federal Communications Commission
445 12th Street, S.W., 8th Floor
Washington, D.C. 20554

Paul Margie, Spectrum & Int'l Legal Advisor
Office of Commissioner Copps
Federal Communications Commission
445 12th Street, S.W., 8th Floor
Washington, D.C. 20554

Bryan N. Tramont, Senior Legal Advisor
Office of Commissioner Abernathy
Federal Communications Commission
445 12th Street, S.W., 8th Floor
Washington, D.C. 20554

James D. Schlichting, Deputy Chief
Wireless Telecommunications Bureau
Federal Communications Commission
445 12th Street, S.W., 3rd Floor
Washington, D.C. 20554

Sam Feder, Spectrum & Int'l Legal Advisor
Office of Commissioner Martin
Federal Communications Commission
445 12th Street, S.W., 8th Floor
Washington, D.C. 20554

Thomas J. Sugrue, Chief
Wireless Telecommunications Bureau
Federal Communications Commission
445 12th Street, S.W., Room 3-C252
Washington, D.C. 20554

Charles Rush
Wireless Telecommunications Bureau
Federal Communications Commission
445 12th Street, S.W., 4th Floor
Washington, D.C. 20554

Thomas Tycz, Chief
Satellite Division
Federal Communications Commission
445 12th Street, S.W., 6th Floor
Washington, D.C. 20554

Kathleen Ham, Deputy Chief
Wireless Telecommunications Bureau
Federal Communications Commission
445 12th Street, SW, Room 3-C255
Washington, D.C. 20554

Trey Hanbury
Policy Division
International Bureau
Federal Communications Commission
445 12th Street, S.W., Room 5-C313
Washington, D.C. 20554

Linda Haller
Associate Bureau Chief for Policy
International Bureau
445 12th Street, S.W., 6th Floor
Washington, D.C. 20554

Richard B. Engelman, Chief Engineer
International Bureau
Federal Communications Commission
445 12th Street, S.W., Room 7-A760
Washington, D.C. 20554

Donald Abelson, Bureau Chief
International Bureau
Federal Communications Commission
445 12th Street, S.W., 6th Floor
Washington, D.C. 20554

Cassandra Thomas, Deputy Chief
Satellite Division
International Bureau
Federal Communications Commission
445 12th Street, S.W., 6th Floor
Washington, D.C. 20554

Breck Blalock, Deputy Chief
Policy Division
International Bureau
Federal Communications Commission
445 12th Street, S.W., 6th Floor
Washington, D.C. 20554

Geraldine Matise, Deputy Chief
Policy & Rules Division
Office of Engineering and Technology
Federal Communications Commission
445 12th Street, S.W., Room 7-A123
Washington, D.C. 20554

Tom Stanley, Chief Engineer
Wireless Telecommunications Bureau
Federal Communications Commission
445 12th Street, S.W., 4th Floor
Washington, D.C. 20554

Barry Ohlson, Chief
Policy Division
Wireless Telecommunications Bureau
Federal Communications Commission
445 12th Street, S.W., 4th Floor
Washington, D.C. 20554

Jane Mago, General Counsel
Federal Communications Commission
445 12th Street, S.W.
Room 8-C755
Washington, D.C. 20554

Julius Knapp, Deputy Chief
Office of Engineering and Technology
Federal Communications Commission
445 12th Street, S.W., Room 7-A123
Washington, D.C. 20554

Edmond J. Thomas, Chief
Office of Engineering and Technology
Federal Communications Commission
445 12th Street, S.W., 7th Floor
Washington, D.C. 20554

Bruce Franca, Deputy Chief
Office of Engineering and Technology
Federal Communications Commission
445 12th Street, S.W., Room 7-A123
Washington, D.C. 20554

Karl Kensinger, Special Advisor
Satellite Division
Federal Communications Commission
445 12th Street, S.W., 6th Floor
Washington, D.C. 20554

David Furth, Senior Legal Advisor
Wireless Telecommunications Bureau
Federal Communications Commission
445 12th Street, S.W., 4th Floor
Washington, D.C. 20554

Scott Delacourt, Legal Advisor
Wireless Telecommunications Bureau
Federal Communications Commission
445 12th Street, S.W., 4th Floor
Washington, D.C. 20554

Michele Ellison, Deputy General Counsel
Federal Communications Commission
445 12th Street, S.W.
Room 8-C757
Washington, D.C. 20554

Judy Herman, Assistant Division Chief
Industry Analysis Division
Media Bureau
Federal Communications Commission
445 12th Street, S.W.
Room 1-C804
Washington, D.C. 20554

/s/ Gwendolynne M. Chen
Gwendolynne M. Chen