

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

In the Matter of )  
 )  
Inquiry Regarding Software Defined Radios ) ET Docket No. 00-47  
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**To: The Commission**

**REPLY COMMENTS OF BELLSOUTH**

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Dated: July 14, 2000

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**REPLY COMMENTS OF BELLSOUTH  
ON SOFTWARE DEFINED RADIOS**

BellSouth Corporation (“BellSouth”) files these Reply Comments in response to comments in the Commission’s Notice of Inquiry regarding the current state of software defined radio (“SDR”) technology and whether changes in applicable Commission rules are required to encourage implementation of this technology.<sup>1</sup> BellSouth will focus its comments on a few major points raised in the documents filed by other parties.

**BellSouth General Comments on Responses to the NOI**

All of the major manufacturers and carriers that submitted responses to the NOI suggested that no changes or few, if any, changes to the Commission's rules are needed at this time.<sup>2</sup> In large part, it appears that responses that differ from those of the major

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<sup>1</sup> *Inquiry Regarding Software Defined Radios*, ET Docket No. 00-47, *Notice of Inquiry*, FCC 00-103 (rel. Mar. 21, 2000) (“NOI”).

<sup>2</sup> Lucent, pp. 3 & 5; Motorola, p. 32; Nokia, p. 10; Nortel, p. 11; BellSouth, p. 2. SBC Wireless (p. 18) states that rules changes may be necessary if software changes can have an impact on RF performance.

commercial wireless manufacturers and carriers reflect differences in the definitions of several key terms including software defined radio, software radio, software based radio, and wideband radio. In addition, the questions on spectrum efficiency appear to have been given widely different interpretations. The Commission must carefully consider the context in which the term "spectral efficiency" is being used when evaluating NOI responses that state that SDR deployment in the near-term will promote either spectral efficiency or spectrum efficiency.

In the near-term, the major commercial manufacturers and service providers view software defined radio and software radio as simply being an implementation technique or enabling technology in which some radio functionality is implemented in software rather than hardware.<sup>3</sup> By way of contrast, Dandin equates wideband wireless communications with SDR<sup>4</sup>, while SBC Wireless<sup>5</sup> more correctly differentiates between wide bandwidth of spectrum and radio functionality that is implemented in software on a digital platform.

The distinction between spectral efficiency and spectrum efficiency made by SBC Wireless and BellSouth is crucial to analyzing the impact of SDR on spectrum issues.<sup>6</sup> Also important is the comment by SBC Wireless that many of the capabilities described in the NOI may require very wideband RF front ends, which are not yet technically feasible.<sup>7</sup>

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<sup>3</sup> See, e.g., Ericsson, p. 1; Motorola, p. i; SBC Wireless, p. ii; BellSouth, p. 2; Nokia, p. 8.

<sup>4</sup> Dandin, p. 6.

<sup>5</sup> SBC Wireless, p. 2.

<sup>6</sup> *Id.*, pp. 14-16; BellSouth, Appendix B, p. 12.

<sup>7</sup> *Id.*, p. 7.

BellSouth agrees with NTIA's comment that the Commission should adopt a definition for software defined radio.<sup>8</sup> As noted by NTIA<sup>9</sup>, the ITU-R Study Group 8 has a new Question on SDR that includes establishing an internationally agreed definition for SDR. BellSouth supports NTIA's recommendation that the U.S. Government actively participate with industry representatives within the Software Defined Radio Forum to complete the studies called for in the ITU-R Question on SDR including an internationally agreed definition for SDR. Furthermore, to ensure a common understanding of the issues, the FCC should not begin consideration of rule changes relating to SDR technology prior to the completion of the baseline work in the SDR Forum and ITU-R Study Group 8 to define the technology and set standards.

In addition, other work within the ITU-R resulting from the recently completed World Radiocommunication Conference may impact the future course of action of the FCC on SDR (this ITU-R work includes spectrum sharing studies). As Nortel points out: "The Commission historically has allowed a technology to crystallize, and private industry to adopt appropriate standards, before the Commission codifies rules to address the new technology. [T]he Commission should follow a similar process for software defined radios."<sup>10</sup>

**BellSouth Comments on Responses to NOI Questions on Spectral Efficiency and Spectrum Efficiency**

There is widespread agreement among the major commercial wireless manufacturers and service providers (including BellSouth) on spectral efficiency and

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<sup>8</sup> NTIA, p. 31.

<sup>9</sup> *Id.*, p. 10.

<sup>10</sup> Nortel, pp. i-ii.

spectrum efficiency issues. The following excerpts support BellSouth's view that SDR will not have an impact on the need for additional spectrum for 10 years or more.<sup>11</sup>

Ericsson:

- SDR implementation technology does not in and of itself increase or decrease the need for more spectrum for communication services nor does SDR technology make the use of spectrum inherently more efficient.<sup>12</sup>

Motorola:

- [SDR] is not a quick and simple solution for complex spectrum management problems.<sup>13</sup>
- Spectral efficiency is determined by the air interface and system deployment standards.<sup>14</sup>
- SDR technology does not implicitly affect spectral efficiency [b/s/Hz].<sup>15</sup>

Nokia:

- SDR technology will not be able to replace the need for additional spectrum for new and existing wireless systems. Spectral efficiency depends largely on system specific characteristics that are determined by system standards and specifications, not by enabling technologies such as SDR.<sup>16</sup>

Nortel:

- [I]n determining allocations for third generation ("3G") wireless services ... the Commission cannot simply rely on SDR technology ... for satisfying the ... need for additional 3G spectrum.<sup>17</sup>
- [T]he Commission [should not] assume prematurely that SDR technology will solve interference and other spectrum management issues. Such premature assumptions would not serve the public interest.<sup>18</sup>
- [T]he Commission should use caution before it relies on this new technology to solve the difficult spectrum shortage problems confronting

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<sup>11</sup>"BellSouth does not believe that software based radio can be expected to lead to major enhancements in adaptive spectrum sharing, flexible spectrum management, or interruptible spectrum usage for ten years or more." BellSouth, p. 5.

<sup>12</sup> Ericsson, p. 3.

<sup>13</sup> Motorola, p. v.

<sup>14</sup> *Id.*, p. 27.

<sup>15</sup> *Id.*, p. 28.

<sup>16</sup> Nokia, p. 7.

<sup>17</sup> Nortel, p. ii.

<sup>18</sup> *Id.*, p. 4.

users, manufacturers, and service providers today and in the near future.<sup>19</sup>

SBC Wireless:

- Software defined radio technology is an implementation technique. It is not a spectral efficiency improvement technology. However, SDR makes it easier and more cost-effective to implement techniques that can improve the spectral efficiency [b/s per Hz] of a wireless system.<sup>20</sup>

By way of contrast, the responses to the NOI from AirNet, NTIA, Red Bat, Shared Spectrum, and the Technological Advisory Council appear to encourage the Commission to consider SDR technology as a presently available means for solving the “spectrum crunch”, spectral efficiency and spectrum efficiency issues such as those identified in Paragraphs 15-17 of the NOI. It appears that responses that imply the near-term practicality of the concept of dynamic, interruptible spectrum sharing across wide bandwidths for commercial wireless services have not fully considered all of the practical ramifications of this concept including the following:

1. Impact on the existing network infrastructure and resulting need to fully deploy a new infrastructure.
2. For SDR technology, there are major differences in complexity and cost between (i) finding and using an unoccupied sliver of frequency within a limited band, and (ii) dynamically finding and using such slivers with a wide band that may be occupied and used by other high-powered services.<sup>21</sup>
3. Business case issues for both service providers and manufacturers which ultimately impact the cost, which is of paramount importance to the consumer.

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<sup>19</sup> *Id.*, p. 12.

<sup>20</sup> SBC Wireless, p. 14.

<sup>21</sup> Nortel, p. i.

4. Coordination issues between service providers, including coordination potentially between providers of totally different classes of services.
5. Issues related to software control of the radio frequency, power, and other characteristics of the transmitted signal.
6. Need for international standards.
7. Interoperability between signalling protocols.
8. Need for full deployment of software based radio concepts (including software control) in all handsets, base stations, and network infrastructure in which interruptible, adaptive spectrum sharing will be used.
9. Time to implement a fully deployed software based radio network having the adaptive spectrum sharing capabilities.
10. The significant differences between dynamic channel assignment for a specific narrowband service such as PCS<sup>22</sup> and spectrum sharing across multiple bands.
11. The need for service providers to provide uniform coverage across any specified geographical area.
12. The fact that the two ends of a communications link see different electromagnetic environments - this leads to complex network control issues.
13. The ability of SDRs to distinguish between currently unused channels, and mere gaps in conversation or data bursts.<sup>23</sup>
14. For some services, there will be geographic differences in approved RF transmission limits.

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<sup>22</sup> SBC Wireless, p. 10.

<sup>23</sup> APCO, p. 3.

## **BellSouth Recommendations**

For the reasons stated above, the Commission should:

1. Consistent with the comments of the major commercial wireless manufacturers and carriers, move cautiously in adopting rule changes and new policies in response to SDR technology.
2. Await the completion of the baseline work in the SDR Forum and ITU-R Study Group 8 to define the technology and set standards before adopting any rule changes resulting from SDR technology.
3. Support NTIA's recommendation that the U.S. Government actively participate with industry representatives within the Software Defined Radio Forum to complete the studies called for in the ITU-R Question on SDR including an internationally agreed-upon definition for SDR. Established fora, such as the SDR Forum and ITU-R Study Group 8, are already addressing specific SDR issues. Therefore, a separate industry/FCC SDR working group is not needed.

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4. Not rely on SDR as a panacea for solving difficult spectrum requirements and spectrum management issues.

Respectfully submitted,

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July 14, 2000

## CERTIFICATE OF SERVICE

I hereby certify that I have this 14<sup>th</sup> day of July, 2000, served the following parties to this action with a copy of the foregoing ***REPLY COMMENTS OF BELLSOUTH CORPORATION*** by electronic filing (\*\*) or United States mail, postage prepaid to the addresses shown below:

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