

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

**In the Matter of** )  
**Amendment of the Commission's Rules with** ) **GN Docket No. 12-354**  
**Regard to Commercial Operations in the** )  
**3550-3650 MHz Band**

**To: The Commission**

**REPLY COMMENTS OF SHARED SPECTRUM COMPANY**

Shared Spectrum Company (SSC) hereby submits its Reply Comments in the above referenced proceeding in response to the Notice of Proposed Rule Making, FCC 12-148, released December 12, 2012 (NPRM).

***I. SENSING TECHNOLOGY IS NECESSARY TO REDUCE THE SIZE OF EXCLUSION ZONES AND HELP TO MITIGATE POSSIBLE INTERFERENCE.***

In its comments in this proceeding, SSC advocated a two-phase approach. In the near-term, SSC supports the adoption of a hybrid regulatory structure that utilizes database and sensing techniques to minimize the size of exclusion zones. Over the longer term, SSC believes that exclusion zones can be eliminated entirely, through the integration of Dynamic Spectrum Access (DSA) or similar sensing

technologies into all end-user devices operating in the 3.5 GHz band.<sup>1</sup>

Others espoused similar views in their comments. The Software Defined Radio Forum/Wireless Innovation Forum stated that sensing technologies should be used to augment databases.<sup>2</sup> Spectrum Bridge noted that a geo-location database, coupled with evolving sensing technologies, can offer better interference mitigation.<sup>3</sup> It concluded that “sensing and database techniques can be used to promote co-existence and mitigate interference.”<sup>4</sup>

Like SSC, Allied Communications promoted a hybrid architecture, using both a database and sensing.<sup>5</sup> Allied noted that the current TV Whitespace (TVWS) database minimizes – rather than maximizes – spectrum sharing due to that database’s inability to “directly leverage spectrum sensing.”<sup>6</sup> Instead, that database assumes the worst case scenario regarding incumbent propagation: i.e., that TV broadcast stations are always in operation.<sup>7</sup> SSC concurs with Allied’s observations regarding this shortcoming inherent in the TVWS database.

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<sup>1</sup> SSC pointed out that this sensing-only approach is the best method for sharing with military incumbents, who typically are unwilling (or, at the very least, highly reluctant) to divulge either the location of their facilities, or the extent of their communications, to a database operator. *See* Comments of Shared Spectrum Company at 6 (“SSC Comments”).

<sup>2</sup> Comments of The Software Defined Radio Forum Inc dba The Wireless Innovation Forum at 3.

<sup>3</sup> Comments of Spectrum Bridge at 19 (“Spectrum Bridge Comments”). As noted below, SSC disagrees with Spectrum Bridge’s assertion that sensing alone has limited utility, since these technologies have been deployed successfully in other bands.

<sup>4</sup> *Id.* at 18.

<sup>5</sup> Comments of Allied Communications at 3 (“Allied Comments”).

<sup>6</sup> *Id.* at 5.

<sup>7</sup> *Id.* at 5-6.

The Wi-Fi Alliance advocated creating a regulatory framework for use of cognitive devices.<sup>8</sup> Similarly, the IEEE 802 group noted that spectrum can be shared in frequency, time, and space, supporting a framework for opportunistic use of cognitive devices, noting that some advanced approaches, including sensing techniques, could be deployed in the 3.5 GHz band.<sup>9</sup> SSC supports all these comments, because we believe that a database is always improved by the addition of real-world, real-time sensing information.

Interestingly, Allied Communications suggests aggregating sensing reports from licensed secondary users, who would act as a de facto network of distributed RF sensors.<sup>10</sup> SSC concurs with this approach, since, at a most basic level, this is how its DSA technology functions.

The White Space Alliance favored using sensing technologies and cognitive radios with databases.<sup>11</sup> Representatives of the utility industry, UTC/NRECA, also support the use of sensing technologies.<sup>12</sup>

In addition, Vanu stated that dynamic device management is more effective when sensing data is used in the device management algorithms,<sup>13</sup> and agreed that combining sensing technology, such as that used in cell systems today, with a

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<sup>8</sup> Comments of Wi-Fi Alliance at 2.

<sup>9</sup> Comments of IEEE 802 at 2-3.

<sup>10</sup> Allied Comments at 7.

<sup>11</sup> Comments of Whitespace Alliance at 2, 4-5 (“Whitespace Comments”).

<sup>12</sup> Comments of Utilities Telecom Council, Edison Electric Institute and National Rural Electric at 10 nn. 23-24.

<sup>13</sup> Comments of Vanu, Inc. at 5 (“Vanu Comments”).

database, would be more effective than just a database alone.<sup>14</sup> T-Mobile also noted that spectrum sensing techniques, similar to those used by unlicensed devices in the 5250-5350 MHz and 5470-5725 MHz bands, may provide an effective method for avoiding conflicts with DoD radars.<sup>15</sup>

In short, the proper deployment of state-of-the-art sensing technologies – particularly in combination with a database – has essentially universal support. SSC pointed out in its comments that once standards are developed for a sensing-only approach, and the technology is integrated into consumer devices, sensing alone will be the best approach to maximizing use of the spectrum without threatening incumbent users.

In concert with this view, the Commission should act to promote competition among database operators by favoring those who develop intelligent database approaches that integrate sensing technologies, by permitting these database operators to allow users to access spectrum within the exclusion zones based on actual usage. Database operators without such a hybrid sensing approach would not be permitted to allow its users/subscribers to operate in the exclusion zones.

While some parties (Vanu and SpectrumBridge) questioned the viability of sensing alone,<sup>16</sup> they apparently overlook the fact that sensing solutions have been

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<sup>14</sup> *Id.*

<sup>15</sup> Comments of T-Mobile USA, Inc. at 7.

<sup>16</sup> Vanu Comments at 5; Spectrum Bridge Comments at 19.

deployed worldwide in a variety of wireless systems. One obvious example is Wi-Fi. With this technology so widely deployed – and its use of sensing so widely known – it is clear that sensing-based spectrum sharing works well. A further example involving sensing technology deployed in a diverse users environment is Dynamic Frequency Selection (DFS). Companies that have long relied on such technologies, such as Cisco, would be surprised to learn that their systems are, in Spectrum Bridge’s words, “marginally feasible.”<sup>17</sup>

Comments about the viability of sensing in the TVWS bands are similarly misplaced. SSC has developed sensing technology for TVWS operations,<sup>18</sup> and has integrated it into a femtocell platform that accesses the TVWS.<sup>19</sup> Moreover, the 3.5 GHz band presents a much easier interference-avoidance environment compared to the TVWS band. The challenge for TVWS sensing is man-made noise creating too many false alarms. Man-made noise is minimal in the 3.5 GHz band.<sup>20</sup>

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<sup>17</sup> Spectrum Bridges Comments at 19. For a discussion of DFS capabilities, see “Dynamic Frequency Selection and IEEE 802.11h Transmit Power Control,” available at [http://www.cisco.com/en/US/docs/ios/12\\_4t/12\\_4t11/ht\\_DFS.html](http://www.cisco.com/en/US/docs/ios/12_4t/12_4t11/ht_DFS.html).

<sup>18</sup> “Spectrum Sensing Toolbox,” available at <http://www.sharedspectrum.com/wp-content/uploads/Spectrum-Sensing-Toolbox-a-data-sheet-050212.pdf>.

<sup>19</sup> “Shared Spectrum Company receives American Technology Award,” available at <http://www.interdigital.com/bwm/technology-partner-shared-spectrum-company-receives-american-technology-award-for-telecommunications-innovation>.

<sup>20</sup> It is true that, if the entrant system used exactly the same waveform as TV broadcast (8 – VSB and with the same pilot tone frequency), then sensing would not be able to distinguish the two waveforms. However, we are not aware of any TVWS device in production that uses 8-VSB modulation nor any other data product that uses 8-VSB modulation. The 8-VSB waveform was not designed for multi-user data systems. We believe that using 8-VSB modulation in the TVWS is a very unlikely situation. A similar problem (the entrant and incumbent using the same waveform) in the 3.5 GHz band also is extremely unlikely, because radar waveforms have very poor data efficiency compared to communications waveforms.

## II. *THE PROPOSED EXCLUSION ZONES ARE TOO LARGE.*

Most commenters believe that the size of the proposed exclusion zones could be greatly reduced.<sup>21</sup> SSC supports this view, noting in particular that small cell technology, rather than deployment of WiMax technology, should facilitate this development.

As noted above, deployment of sensing technology in tandem with databases should enable even further reduction of exclusion zones. The Commission's rules should promote such hybrid database approaches in order to maximize use of spectrum in and around areas of incumbent operations.

## III. *THE RULES SHOULD BE SIMPLE TO PROMOTE INNOVATION AND INVESTMENT.*

The final rules should promote innovation and investment. Limiting the size of the market or the practical use of spectrum by rules which impose overly broad exclusion zones, overly restrictive device power limits, or similar constraints, will only hinder the development and deployment of advanced technologies, such as DSA, cognitive radio, and software defined radios.

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<sup>21</sup> Comments of IEEE Dynamic Spectrum Access Networks Standards Committee at 6; Comments of XChange Telecom, Inc at 2; Comments of Telecommunications Industry Association at 2-3; Comments of Interdigital at 3-4 (make zones time dependent and managed by database); Comments of Motorola Solutions at 7 (shrink exclusion zones and have database with frequent device registration); Comments of Google Inc. at 11, 13-15 ("Google Comments").

Google noted that the FCC should ensure the widest market possible for new products and services by adopting reasonable technical rules, noting that devices should be able to switch to other authorized spectrum if necessary.<sup>22</sup> Microsoft favors the non-exclusive use of the 3.5 GHz band and believes it will be good for consumers.<sup>23</sup> Allied Communications notes it is difficult to attract entrepreneurs and manufacturers to the band if large exclusion zones cut off access to emerging, competitive technologies for tens of millions of American consumers.<sup>24</sup>

As SSC pointed out in its comments, spectrum sensing technologies are largely available off-the-shelf; there are no great barriers in terms of technical or cost considerations. SSC has been offering these types of solutions for years.<sup>25</sup> The technology is commercially available and rules need to be adopted which are simple and promote deployment of innovative services and technologies, including DSA.

## CONCLUSION

In this proceeding, the Commission should encourage database operators to adopt sensing techniques in order to gain access to incumbent user information. The Commission can, and should, greatly reduce, and ultimately eliminate, exclusion

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<sup>22</sup> Google Comments at 12.

<sup>23</sup> Comments of Microsoft Corporation at 5.

<sup>24</sup> Allied Comments at 19.

<sup>25</sup> SSC Comments at 16.

zones except in the most extraordinary circumstances. The FCC rules should be clear and simple for manufacturers and investors to understand and rely upon as they develop new paradigms for frequency sharing.

Respectfully submitted,

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## Certificate of Service

I, William Lewis, counsel for Shared Spectrum Company, hereby certify that on April 5, 2013, I caused copies of the foregoing Reply Comment of Shared Spectrum Company to be delivered to the following parties via electronic mail.

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