

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

In the Matter of)
)
CREATION OF A SPECTRUM SHARING) **ET Docket No. 06-89**
INNOVATION TEST BED)

To: The Commission

**COMMENTS OF ARRL, THE NATIONAL ASSOCIATION
FOR AMATEUR RADIO**

ARRL, the National Association for Amateur Radio, also known as the American Radio Relay League, Incorporated (ARRL), by counsel, and pursuant to the *Public Notice*, FCC 06-77, released June 8, 2006 (the Notice), hereby respectfully submits its comments in response to the Commission's proposal to establish a spectrum test-bed. The concept would encourage experimentation with "innovative" methods for spectrum sharing among disparate users to enable more intensive, but presumably compatible, use of the radio spectrum. According to the Notice, the Commission proposes to set up a "test-bed" (a segment or segments of spectrum) where both Federal and non-Federal users could undertake studies and experiments to test concepts and ideas to increase the efficient use of the spectrum. The Commission's Notice, and a companion *Notice of Inquiry*¹ released contemporaneously by the National Telecommunications and Information Administration (NTIA) each seek comment² on a variety of very generalized

¹ See, the *Notice of Inquiry*, Docket No. 060602142-6142-01, released June 7, 2006, and published in the Federal Register on June 8, 2006.

² ARRL is submitting comments in both the instant Commission proceeding and the NTIA proceeding, inasmuch as the questions asked about a spectrum test-bed in each of the two proceedings are similar, but not identical.

questions about the creation of such a test-bed, which will be called the Spectrum Sharing Innovation Test-Bed (“Test Bed”). In response to those questions, and to assist in the conceptualization of a Test Bed, ARRL states as follows:

1. ARRL, in general, supports the concept of a spectrum Test Bed. The Commission’s interest in spectrum overlays in recent years is understandable, given the pressure on the radio spectrum from competing, typically commercial, proposed uses. The establishment of a Test Bed is consistent with the Commission’s obligation under Section 303(g) of the Communications Act of 1934, as amended, which obligates the Commission to “[s]tudy new uses for radio, provide for experimental uses of frequencies, and generally encourage the larger and more effective use of radio in the public interest.” Indeed, since well prior to the time the Commission was established in 1934, the Amateur Service has effectively and in an encouraging manner served as a test bed for new, experimental and developing radio technologies, and continues to do so. The Commission’s present Experimental Radio Service, regulated minimally under Part 5 of the Commission’s rules, has also provided an effective and flexible method of encouraging and developing concepts and ideas to increase the efficient use of the spectrum. In the Experimental Radio Service, the Commission routinely permits testing, development and refinement of new and advanced concepts and technologies in frequency bands allocated to different radio services.³ Some experimental authorizations are conducted specifically to determine compatibility with incumbent services and unlicensed devices and systems already deployed. The Experimental Radio Service therefore already serves as a very flexible mechanism for encouraging spectrum sharing

³ ARRL congratulates the Commission’s Office of Engineering and Technology on the efficient and responsive Experimental Licensing Division. It is well-staffed and well-run.

and examining methods of optimizing the use of the United States' spectrum assets for Federal and non-Federal users.

2. While the mechanisms are in place already to experiment with spectrum overlays and to accomplish the goals set in the *Presidential Memorandum on Spectrum Policy for the 21st Century* (69 Fed. Reg. 1568, January 6, 2004), the Commission could set aside some spectrum for a Test Bed which might add some incentive to private sector entities to conduct and evaluate spectrum overlay experiments. In ARRL's experience, there is no present shortage of such incentive. However, the difference between the Test Bed concept proposed by the Commission and the present Part 5 Experimental Radio Service is that the Test Bed concept is intended to explore expanded Federal and non-Federal sharing of spectrum. The participation of NTIA in the process, and the anticipated addition of non-Federal to Federal uses adds a dimension to the proposal that could in certain circumstances lead to increased efficiency in the use of already deployed spectrum. The Amateur Service has successfully shared spectrum with Federal agencies for more than sixty years. In ARRL's view, which is shared by NTIA, this sharing works well.⁴

3. ARRL has, recently in the past few years, expressed criticism of the Commission's non-technical approach to domestic spectrum allocations planning and the means by which new, or overlay technologies have been evaluated and authorized by the Commission. Proposed spectrum uses have been advanced by the Commission and in some cases implemented without what ARRL would term a sufficient technical basis. The creation of a spectrum Test Bed offers the opportunity to objectively test and

⁴ See, the *Spectrum Reallocation Final Report*, in response to Title VI, Omnibus Budget Reconciliation Act of 1993, NTIA Special Publication 95-32, released February, 1995 at Appendix B, Page B-2.

evaluate the compatibility of various incumbent and proposed overlay (or underlay) uses of spectrum prior to actually authorizing them. This prevents spectrum allocation decisionmaking based on no more than the relative success of private sector marketing of a technology by its own advocates. To this extent, ARRL supports the concept, as a means of properly refocusing the Commission's spectrum planning effort toward technical compatibility determinations based on actual testing.

4. The Commission's Notice first asks what the goals of the Test Bed should be. In ARRL's view, the overarching goal of the Test Bed should be to create a means of conducting both theoretical testing of technologies, and practical testing, prior to authorizing the systems and devices under test. The Commission's intention should be to obtain hard, reliable data concerning the compatibility of incumbent and proposed additional uses, (regardless of whether the overlay technology is to be licensed or unlicensed), prior to authorizing their deployment. Another important goal is to use the test bed to evaluate aggregate effects of new technologies. The Commission does not now have the ability, other than through computer modeling, to determine what the cumulative effect of RF devices is in a subject band. The Test Bed provides an opportunity, albeit somewhat limited, to evaluate cumulative effects on the noise floor, and on ambient noise levels, of multiple devices and systems. Such would contribute to preventing the "tragedy of the commons" effect in authorizing unlicensed devices which has occurred in, for example, the band 2400-2483.5 MHz.

5. The Commission next asks whether there should be specific technologies or areas of interest that should be tested. ARRL suggests that the Test Bed permits a valuable forum for testing cognitive radio designs, listen-before-transmit protocols, and

the functionality and sufficiency of other interference avoidance mechanisms. Often, the Commission suggests that certain technologies may be compatible with incumbents, merely assuming the success of interference avoidance mechanisms. Those assumptions, however, are in many cases no more than hopeful speculation. The Test Bed offers an objective means of evaluating the sufficiency of these mechanisms. Since more intensive uses of spectrum are the Commission's end goal, the evaluation of interference avoidance mechanisms in ascertaining compatibility should be the focus of the Test Bed experiments.

6. The Notice asks what challenges exist that the Test Bed can be used to resolve. The Commission has used two different models in spectrum planning in recent years. The "chaos model" as ARRL would term it, is essentially an unmanaged spectrum plan: the high power Part 15 bands are a good example of this model. The "technical spectrum management model" on the other hand involves a more managed approach, premised on licensing and channel assignments. The Commission has lately favored the "chaos" model, but the challenge to that model is the point at which the capacity of a band is exceeded, and the "tragedy of the commons" is reached. For that reason, aggregate interference testing is a critical component of the Test Bed and a challenge to the spectrum planning model that the Commission favors now.

7. The Notice asks whether multiple experiments should be conducted at once or whether individual experiments can be conducted separately. This is merely a matter of management. The experiments should be separated, so that the outcomes are not corrupted by other ongoing experimentation at the same time. There is going to be

required a management entity, independent of the experiment sponsors, that should provide oversight to insure the integrity of each experiment.

8. As to logistics, ARRL urges that the criteria to be used in identifying candidate bands for the Test Bed should be non-interference to incumbents. There should be sufficient spectrum dedicated to the project to conduct experiments. The Commission envisions a situation in which 10 MHz is identified by the Commission for the Test Bed and another 10 MHz is identified by NTIA for the same purpose, for a total of 20 MHz. In ARRL's view, 10 MHz of shared government and non-government spectrum is ample for the Test Bed. It is unclear whether more than 10 MHz in the aggregate is necessary.

9. Which portions of the spectrum should be identified is not clear at the moment. Higher microwave spectrum is preferable for several reasons, though that portion of the spectrum suffers atmospheric attenuation. The advantages of that segment are that it promotes frequency re-use based on geographic separation. The determination of a specific band requires further study, however, and should be the subject of specific further rulemaking. The limitations applicable to the candidate bands should include dynamic frequency selection (i.e. listen-before-transmit protocols); limitations on power spectral density, antenna beamwidth limitations (i.e. encouraging antenna directivity) and geographic separations between and among incompatible experiments. The power limitations should be modeled after the current Part 15 rules, which, though liberal by comparison to those of certain other administrations, provide a base line for Test Bed experiments. The spectrum identified should be Federal and non-Federal shared spectrum, or Federal exclusive spectrum. The Test Bed concept is premised on increased, more efficient shared use of Federal and non-Federal spectrum, and use of non-Federal

exclusive spectrum does not contribute to the goals of the Test Bed. If there are two bands to be selected, one by NTIA and one by the Commission, they should be contiguous.

10. As to protections for incumbent users in the Test Bed, the Commission should use the limitations applicable in Part 5: all operation should be on a non-interference basis, and all experiments should be specifically authorized by the Test Bed administrator/manager. Experiments should be terminated immediately in the event of a complaint of interference from an incumbent and should not recommence unless and until the experimenter and the incumbent licensee coordinate interference elimination. Both parties should be required to cooperate in interference resolution, but the burden of modifying operations to eliminate interference should be on the experimenter.

11. The regulation of the Test Bed experiments should be based on the Commission's Part 5 rules. The process should involve Federal government-funded simulation studies, including aggregate interference predictions using computer modeling. Then, based on the results of those developed models, and predicted sharing compatibility results, the field testing should be conducted in the Test Bed over a period of time sufficient to yield reliable results. Information provided should be, at minimum, that provided in a Part 5 experimental license application. Included as an exhibit to the application should be the assumed or ascertained technical parameters of incumbent operations in the Test Bed band in the geographic area in which the testing will occur. A copy of the computer modeling results should be appended to the application, and at the conclusion of the Test Bed operations, the results should be compared to the modeling results in a report filed with the Commission.

12. The Notice asks whether large or small geographical areas should be used for Test Bed implementation. Clearly, larger geographical areas are necessary. A variety of RF environments must be tested, lest the results be inapplicable to other RF environments. ARRL suggests that, as a minimum, specific urban, suburban, exurban and rural areas should be studied for each overlay technology under study. If a technology is determined to be compatible with incumbents in a rural RF environment but not in an urban environment, that information is critical to determining the outcome of any later rulemaking with respect to that particular overlay technology.

13. In ARRL's view, multiple candidates should be selected. If there are competing proposals, they should be permitted to conduct experiments in separate geographical areas. The method that candidates would use to coordinate with each other would be through a publicly accessible database maintained by a Test Bed Manager. In order to conduct Federal and non-Federal operations, the test plans submitted by the potential experimenter should have all necessary information for NTIA's review in the application. The preparation and submission of the test plan should be reviewed by both Commission and NTIA. However, the role of the Commission and NTIA should be a reduced role. At least one person from either NTIA or the Commission should be designated for oversight when needed, and to review applications and test plans, and to coordinate them with NTIA. An administrator in the private sector which is not conducting experiments in the Test Bed should be appointed as a Test Bed Manager, to handle administrative functions.

14. The simulations that ARRL suggests as a precondition to use of the Test Bed should be Federally funded so as to insure feasibility of the experiment prior to its being

conducted in the Test Bed. Access to spectrum is an ample and sufficient incentive to promote participation. In addition, however, access to the Test Bed, and funding of the computer modeling contributes to the proof of concept of a technology. Those incentives are strong incentives to participate. Proprietary technologies should not be permitted in the Test Bed. The benchmark of the concept should be that all experiments are conducted openly and based on a publicly available database. The test plan, the database, the application, and the computer modeling should all be public information. The test plan should be prepared and submitted by the parties involved. It should be evaluated in terms of interference potential to incumbent services. The experiment should be terminated if it results in interference to incumbent licensed or Federal government services in the Test Bed more than 1 percent of the time. The extent to which the noise floor at an incumbent's receiver is increased should be measured and determined. The test plan should specify who is responsible for analyzing and evaluating the data from the experiment. Status report should be provided every six months, as is currently required for experimental authorizations issued by the Commission under Part 5.

15. If the experiment meets the performance metrics, it should not automatically be permitted to remain in the Test Bed or expanded to other frequency bands. Each test should be complete and separate from others, and should be evaluated on its merits thereafter. At the conclusion of the Test Bed operation, the experimenter should be required to submit a public report, stating the goals, assumptions, methodology, and results of the experiment and any conclusions drawn. There should be no prejudgment of the service at the conclusion of the test, except as conducted through normal allocations processes such as notice and comment rulemaking. However, success in the Test Bed

would be a significant factor in evaluating any separate, later rulemaking or application process needed to implement the technology after the conclusion of the experiment.

16. In short, ARRL supports the Test Bed concept. The extent to which there are compatible means of intensifying the use of existing shared Federal and non-Federal spectrum obviously requires study. The Test Bed concept, in ARRL's view, makes the process of determining compatibility in this process objective, rather than predictive. The Amateur Service has long shared successfully with Federal government users. It is far more challenging to add commercial uses to bands used by Federal government agencies, often intensively. Sharing in bands already occupied by Federal and Amateur operations is especially problematic where the overlay technology is commercial; uses a relatively high transmitter power; has a high aggregate number of transmitters or intentional emitters in heavily populated areas, and/or has a high duty cycle. But ascertainment of increased sharing opportunities is best done through a combination of computer modeling and real-world measurements over a wide geographic area. The Test Bed concept is a welcome, objective addition to a domestic spectrum allocation process that has, more often than not in recent years, been premised on policy or political expediencies, rather than on hard technical fact. The Commission and NTIA are to be congratulated for this initiative. It is overdue.

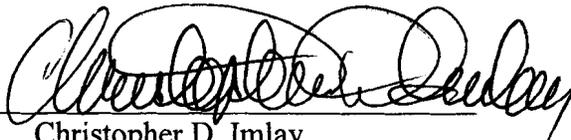
Therefore, the foregoing considered, ARRL respectfully requests that the

Commission implement the spectrum Test Bed in accordance with the foregoing comments.

Respectfully submitted,

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