

NTIA Evaluation of CSMAC Recommendations Regarding

Interference and Dynamic Access Subcommittee

November 10, 2010

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Recommendation	Report Page	NTIA Response
1. Recommendations concerning guardbands		
To provide greater certainty with respect to spectrum use rights, and thereby stimulate investment in incumbent communications services, NTIA or any government entity employing guardbands in spectrum policy should be guided by the following principles:		
Where appropriate, guardbands should continue to be used as a tool to reduce the effects of out-of-band emissions (OOBE) and adjacent channel interference. They are not necessarily useful in reducing the effects of intermodulation or interference for small, low cost devices and have only a modest impact in reducing the effects of receiver-generated intermodulation.	6	NTIA agrees that given the practical limitations on transmitter and receiver filter technology, the use of guardbands to protect adjacent band receivers will continue for the foreseeable future. However, spectrum managers and system implementers should seek to minimize the amount of spectrum used in guardbands. OOBE limits can be an effective method of protecting adjacent band receivers. Establishing OOBE limits for a transmitter is difficult. OOBE limits that are too stringent can place unnecessary cost and operational constraints on a transmitter, while limits that are too relaxed will not adequately protect adjacent band receivers. The OOBE level will depend on the operational scenario(s) under consideration for the transmitter and receiver (e.g., fixed-to fixed, fixed-to-mobile, mobile-to-mobile) which dictates technical factors such as minimum separation distance, propagation modeling, antenna coupling, and the receiver interference protection criteria. The computed OOBE levels can be used to establish the regulatory limits that determine the amount of transmitter filtering needed to protect an adjacent band receiver (typically assumed to be operating at the edge of its allocated band). In some cases, however, general limits may not be required. Instead solutions can be limited to specific locations to protect known receivers.

		NTIA also agrees that limits on OOB E alone will not reduce the impact of other frequency related interference effects such as transmitter and receiver generated intermodulation.
<input type="checkbox"/> <input type="checkbox"/> For new services, the spectrum used for such a guardband should come from a new service commencing operations and not an incumbent service.	6	NTIA agrees in principal that a guardband should be the responsibility of the new entrant. However, this approach could be difficult to implement, especially in situations where the new entrant expects access to the boundary of the licensed spectrum, for example when they obtain spectrum through an auction process. NTIA believes other approaches should be considered before relying on guardbands which essentially mean vacant spectrum. For example, interference may be avoided by filtering some locations or changing locations. Furthermore, it seems reasonable to ask the new entrant to bear the responsibility only if adjacent band receivers meet minimum performance requirements. The FCC has used a similar approach in their Part 90 rules for the 800 MHz band (Section 90.672, Section 90.673, and Section 90.674). Without such minimum performance standards it is difficult to see how the new entrant can fully bear the responsibility.
<input type="checkbox"/> <input type="checkbox"/> If an incumbent service makes changes to its system's architecture or modulation technique that result in new interference, then the spectrum to be used to establish any guardband protections should be provided by the service making such changes, if that would be in the public interest.	6	NTIA agrees that the spectrum user making the change bears the responsibility of establishing the guardband. Federal and non-federal spectrum users must have the flexibility to make changes to their systems. However, if those changes impact operations to or from their new systems, then they bear responsibility. As noted above, only receivers following the minimum performance requirements should be able claim protection against interference from an adjacent band transmitter. The FCC has used a similar approach in their Part 90 rules for the 800 MHz band (Section 90.672, Section 90.673, and Section 90.674).
<input type="checkbox"/> <input type="checkbox"/> When allocating spectrum for new services, guardbands should not simply reflect current OOB E rules. A realistic assessment of the potential for OOB E interference should be analyzed to ensure the size of the guardband is appropriate. This assessment should consider filter performance that is commercially	6	NTIA agrees that a realistic assessment of the potential interference is necessary when establishing a guardband between adjacent band transmitters and receivers. However, spectrum managers often do not know many of the technical and operational parameters necessary to accurately determine the OOB E level for a transmitter operating as part of a new service. In the absence of these parameters, spectrum managers typically use worst case assumptions, increasing the amount of spectrum needed for the guardband.

<p>available and performance that can be reasonably expected in the near term.</p>		<p>NTIA also agrees that better technical characteristics for the filters, such as the amount of attenuation (for transmitters), the amount of rejection (receivers), and the roll-off, would help to ensure that the size of the guardband is as small as possible. The FCC generally specifies a 43+10logP requirement for unwanted emissions (OOBE and spurious). However, most equipment can do and does better. This 43+10logP may be inadequate in dealing with broadband systems that naturally produce spurious emissions at high levels far outside their operating band.</p>
<p><input type="checkbox"/> <input type="checkbox"/> Where appropriate, “virtual guardbands” using dynamic spectrum access techniques may be considered as an alternative to physical guardbands on a case-by-case basis.</p>	<p>6</p>	<p>This recommendation does not provide enough information for NTIA to assess how “virtual guardbands” can be used in addressing adjacent band interference. NTIA requests that the CSMAC provide radio service specific examples of how “virtual guardbands” can be used in managing adjacent band interference to and from federal systems.</p>
<p><input type="checkbox"/> <input type="checkbox"/> Consistent with the recommendations contained herein, when employing physical guardband techniques, government policy makers may consider whether the equipment to be protected from harmful interference is dated technology that can reasonably be upgraded to mitigate adjacent band interference.</p>	<p>6</p>	<p>It is extremely difficult for NTIA to determine what constitutes “dated technology”. In performing their missions the agencies use a number of different radiocommunication systems, many of which have been in use for decades. The federal budget process does not necessarily include funding for equipment upgrades or replacement to address interference. Upgrading equipment to address interference could include modifications to both the hardware and software. In cases where the transmitter OOBE levels fall within the passband of an adjacent band receiver upgrading the receiver may not resolve the interference problem.</p>
<p>2. Frequency Coordination Recommendations</p>		
<p>In addition to the techniques previously employed, we suggest that the NTIA, the FCC and other government agencies responsible for spectrum management should:</p>		
<p><input type="checkbox"/> <input type="checkbox"/> Move forward with a complete spectrum inventory to assist all future spectrum coordination efforts.</p>	<p>7</p>	<p>NTIA agrees. However, NTIA is not free to release the records of the Government Master File. Therefore, efforts by NTIA at producing an inventory have focused on producing readable descriptions of agency operations by band, similar to presentations in Spectrum Resource Assessment previously prepared by NTIA. Still NTIA will need to seek the support of the agencies to release information about their operations.</p>
<p><input type="checkbox"/> <input type="checkbox"/> Recognize that frequency coordination</p>	<p>7</p>	<p>NTIA agrees that situations involving these systems are complex. However,</p>

becomes more complex when sharing spectrum with unlicensed devices or devices approved as part of a “blanket licensing” regime, and coordination may be impossible if such devices are “untethered” or not connected to an accurate spectrum database or other management control system.		no frequency coordination occurs with them.
<input type="checkbox"/> <input type="checkbox"/> Understand that the NTIA, the FCC and other government entities managing spectrum may have to play a greater role in frequency coordination, especially where commercial and government entities will share spectrum and also where different commercial services are sharing spectrum.	7	NTIA agrees. NTIA sees its role to facilitate this coordination, but may in most cases, as in the early-entry during relocation, most of the coordination will occur between the users of the spectrum. Furthermore, the Administration supported Congress passed legislation changing the CSEA to cover costs related to transition coordination and sharing during any repurposing of spectrum. This approach aims to better equip agencies to participate in coordination discussions.
<input type="checkbox"/> <input type="checkbox"/> Utilize private market mechanisms, such as negotiated interference solutions, to facilitate frequency coordination.	7	NTIA understands this to mean coordination arrangements made between users and therefore agrees. However, due to federal budget processes, not all approaches that two commercial entities might consider between them are applicable to discussions between commercial entities and government agencies. Federal agencies cannot buy and sell access to spectrum.
3. Dynamic Spectrum Access Recommendations		
Cognitive Radio and Spectrum Sensing Technology		
Cognitive radio and spectrum sensing technologies may become an important tool in spectrum sharing policies in the future. NTIA, the FCC and other government entities responsible for spectrum management should:		
<input type="checkbox"/> <input type="checkbox"/> Establish procedures that examine the efficacy of spectrum sensing devices to protect services that employ different system architectures and modulation systems.	8	NTIA need CSMAC clarification regarding where these procedures should be established and what the nature of them should be. NTIA does not see a single set of procedures proving the efficacy of sensing devices. The process of proving such techniques must be pursued band by band and deal with specific combinations of equipment.
<input type="checkbox"/> <input type="checkbox"/> Ensure that such technologies, like any new or existing radiofrequency (RF) device, comply with existing transmitter and/or receiver regulations applicable to the various services that may occupy those frequencies.	8	NTIA agrees.

<p>Nonetheless, the adaptive capabilities of these technologies may create challenges to mitigating interference and will need to be examined as they become available.</p>		
<p><input type="checkbox"/><input type="checkbox"/> Examine the application of this technology as a sharing and interference avoidance tool on a case-by-case basis for each radio service as DSA technology becomes available, because cognitive radio and spectrum sensing technologies may create unique interference challenges to different system architectures. Examples include certain safety-of-life bands (e.g., GPS and public safety) and services (e.g., passive radio astronomy and broadcasting).</p>	8	<p>NTIA agrees but technology development has progressed slowly. Furthermore, NTIA has limited resources for testing. The NITRD WSRD is considering approaches to expand test capabilities and opportunities.</p>
<p><input type="checkbox"/><input type="checkbox"/> While additional research is always important, government efforts should focus on testing and evaluation to ensure that such technology will develop properly and not lead to interference. Further field and laboratory testing is necessary in the following areas:</p> <p>The efficacy of spectrum sensing devices to protect other fixed, mobile and portable devices from all types of interference.</p> <p>The potential for interference due to a DSA device's potential inability to sense an occupied channel due to a "hidden node."</p> <p>The ability of the DSA device to sense signals at low enough levels to protect other spectrum users without producing substantial "false</p>	8	<p>NTIA agrees and has followed these approaches in its Spectrum Sharing Innovation Test-Bed Pilot Program. On a limited scale such testing progresses slowly. Furthermore, technology developers need to design equipment in such a way as to enable test measurements that track equipment dynamic response.</p> <p>NTIA's program includes lab characterization and testing and field testing.</p>

<p>alarms” to render the devices useless.</p> <p>The ability of the entire DSA system to effectively prevent interference. For example, the effect of antennas on the ability of a device to adequately receive/sense a signal from an existing spectrum user should be examined.</p> <p>Examinations should include how an actual DSA device will operate in its environment as part of the communications ecosystem.</p>		
<p><input type="checkbox"/><input type="checkbox"/>The NTIA, the FCC and any other government entities responsible for spectrum management should increase significantly the resources directed to provide further testing, evaluation and development consistent with the above recommendations. Several sources of funding should be explored including an increase in Congressional appropriations, auction revenues or appropriate spectrum fees that are consistent with the cost of regulation.</p>	8	Funding for additional testing, evaluation and development is not included in NTIA FY12 funding and was not included in the President’s FY13 budget submitted to Congress.
<p><input type="checkbox"/><input type="checkbox"/>The NTIA and the FCC should also explore cooperative real time spectrum sharing arrangements in which the primary user actively signals the sharing party about both real time spectrum availability and near term projections.</p>	8	NTIA will consider in consultation with the federal agencies. However, federal agencies often do not want to signal their presence.
Database and Geolocation Approaches		
<p><input type="checkbox"/><input type="checkbox"/>Consistent with the goal of spectrum inventory legislation, the NTIA, the FCC and other government spectrum managers should examine actual usage of spectrum assigned to government and commercial entities.</p>	9	NTIA agrees yet recognizes the significant challenges that agencies would have in collecting such data.

<p>As part of the government's efforts to conduct an overall spectrum inventory, government entities managing spectrum should complete a comprehensive spectrum inventory for the frequencies on which sharing is proposed, to ensure that a database system effectively mitigates interference.</p> <p><input type="checkbox"/> <input type="checkbox"/> When developing a comprehensive database to facilitate spectrum sharing, the NTIA, the FCC, government agencies and other entities managing spectrum on behalf of the government should:</p>		
<p><input type="checkbox"/> <input type="checkbox"/> Construct the database so it can provide accurate information regarding spectrum use in real time, where feasible. In creating this database, government spectrum managers must develop specific metrics, which define spectrum use. Such an examination should involve determining what constitutes a usable signal. For example, this could be arrived at by specific signal measurements or use of predictive models that define protected service areas. Use may also be defined not only in terms of geographic areas, but also in terms of time and duration.</p>	9	<p>NTIA agrees in principle. However, real-time monitoring data would require significant changes to the federal user and spectrum manager infrastructure and would require significant funding to support it. Therefore, NTIA declines to endorse this concept but will continue to study new spectrum management and use architectures.</p>
<p><input type="checkbox"/> <input type="checkbox"/> Maintain administrative control over the database or distribution of the database where government spectrum is involved or in cases where government spectrum will be shared.</p>	9	<p>NTIA controls the federal database.</p>
<p><input type="checkbox"/> <input type="checkbox"/> To the extent a government agency delegates the creation and maintenance of a database to any private entity, the government should enact policies to maintain direct oversight over all aspects of the database management including, information distribution to database administrators, spectrum managers and devices relying on database information.</p>	9	<p>NTIA agrees.</p>
<p><input type="checkbox"/> <input type="checkbox"/> Where appropriate, database information</p>	9	<p>NTIA makes GMF data for non-classified and non-FOIA exempt records.</p>

<p>should be made available to the public to provide transparency and proper oversight. Such access must be consistent with concerns regarding national security. From an operational standpoint, however, government spectrum managers may find it appropriate to limit real time access to database information to those devices that have been certified or approved to use the database by the NTIA, the FCC or an appropriate government entity. In the interest of transparency, provisions may be made to allow for non-real time access by other parties interested in improving spectrum utilization. If the data contains sensitive details about national security, the non-real time access might contain aggregated data that protects sensitive details.</p>		<p>However, approximately 85% of the records are not releasable.</p>
<p><input type="checkbox"/> <input type="checkbox"/> All DSA devices relying on or using the database must receive an appropriate authorization code to the database or database administrator before transmitting on any frequency. Where feasible, such authorization shall be updated continuously. Should a device fail to receive an authorization code or signal, it will cease operation on the frequencies assigned by the database.</p>	<p>10</p>	<p>This recommendation assumes the accessibility of the database. As NTIA cannot make the database available, NTIA cannot support this recommendation.</p>
<p><input type="checkbox"/> <input type="checkbox"/> Adopt specific end-to-end security to ensure that only authorized DSA devices are able to access database information and prevent the database from being “hacked.”</p>	<p>10</p>	<p>This recommendation assumes the accessibility of the database. As NTIA cannot make the database available, NTIA cannot support this recommendation.</p>
<p><input type="checkbox"/> <input type="checkbox"/> Ensure the technical security of the database and all devices using the database. A database approach may not be appropriate for sharing spectrum with DSA devices that are classified.</p>	<p>10</p>	<p>This recommendation assumes the accessibility of the database. As NTIA cannot make the database available, NTIA cannot support this recommendation.</p>

<p><input type="checkbox"/> <input type="checkbox"/> DSA devices relying on a database to avoid interference should be capable of being turned off remotely in a timely manner, if they are causing interference. Interfering devices shall cease operation on those frequencies causing interference while resolving bona fide interference complaints. Complaints should be resolved within 30 days.</p>	<p>10</p>	<p>This recommendation assumes the accessibility of the database. As NTIA cannot make the database available, NTIA cannot support this recommendation.</p>
<p><input type="checkbox"/> <input type="checkbox"/> Provide for equal participation by incumbent users and new users in the establishment and maintenance of any databases and where appropriate, participation by third parties.</p>		<p>This recommendation assumes the accessibility of the database. As NTIA cannot make the database available, NTIA cannot support this recommendation.</p>
<p><input type="checkbox"/> <input type="checkbox"/> Place primary emphasis on protecting existing services from additional harmful interference.</p>	<p>10</p>	<p>NTIA agrees.</p>
<p><input type="checkbox"/> <input type="checkbox"/> Consider the types of DSA system architectures and devices that will rely on the database. While in some cases a database can be used for both fixed and mobile devices, there may be scenarios (or bands) where a database is not appropriate for mobile and portable systems.</p>	<p>10</p>	<p>This recommendation assumes the accessibility of the database. As NTIA cannot make the database available, NTIA cannot support this recommendation. NTIA agrees that mobile systems create significant challenges for database approaches.</p>
<p><input type="checkbox"/> <input type="checkbox"/> Sound spectrum policy may benefit from the use of both cognitive radio and database systems. In addition, data gleaned from cognitive radio/sensing technology may become an important component in ensuring the accuracy of a database system.</p>	<p>10</p>	<p>Not a recommendation.</p>
<p><input type="checkbox"/> <input type="checkbox"/> Resources should be devoted to additional research regarding the use of databases to provide additional sharing opportunities. For example, future database approaches may include not only geographic coverage</p>	<p>10</p>	<p>Research on use of databases is not included in NTIA FY12 funding and was not included in the President's FY13 budget submitted to Congress.</p>

information, but other factors such as the time of day spectrum is being used.		
4. Harmonized Spectrum to Facilitate Grouping Services Recommendations		
<p><input type="checkbox"/> <input type="checkbox"/> In the search to find additional spectrum and optimize spectrum allocations, policymakers must remain vigilant in realizing the benefits of promoting regional and/or globally harmonized spectrum allocations wherever possible. These benefits include:</p> <ul style="list-style-type: none"> <input type="checkbox"/> <input type="checkbox"/> Significant economies of scale in the development and deployment of both infrastructure and devices; <input type="checkbox"/> <input type="checkbox"/> Major enhancements to roaming across international borders; <input type="checkbox"/> <input type="checkbox"/> Enhanced interoperability among various services, devices and platforms. <p>While recognizing these benefits, policy makers should also consider the potential impact of such harmonization on the development of new, innovative uses of spectrum and wireless technologies.</p>	10	<p>NTIA agrees. At the same time, the United States, in encouraging innovation, often steps out in front of the rest of world in making spectrum decisions. Other countries often decide that they prefer another approach. This may result from technical reasons, but can just as easily result from market strategies. Other countries, grouped in large numbers, can hinder a U.S. innovation advantage by selecting and advocating for a competing technology or band plan.</p>
5. Allocation Decisions: Sharing Like Services/Mixing Disparate Services		
<p>Policymakers must also strive to cluster like services when allocating spectrum wherever possible. Such clustering of like services is important because:</p> <ul style="list-style-type: none"> <input type="checkbox"/> <input type="checkbox"/> Clustering of like services is frequently a beneficial by-product of harmonized spectrum allocations. <input type="checkbox"/> <input type="checkbox"/> There is widespread consensus on the mechanisms and dangers of creating 	10	<p>NTIA agrees in principle. However, the availability of spectrum to the various federal missions and applications do not generally allow for such clustering. For example, the 1755-1850 MHz band has satellite uplinks, airborne transmitters, local short range surveillance systems, and tactical military radio among others. If the federal agencies have to relocate, they have few choices that permit clustering.</p>

<p>interference when licensing services that employ different duplexing technologies in adjacent spectrum. Careful attention is needed in such “boundary conditions” to avoid harmful interference.</p> <p>Some have noted that an example of the problems associated with mixing disparate services is illustrated in the plans to permit TDD operations in AWS-3 spectrum, without adequate allowances to protect adjacent AWS-1 FDD operations.</p>		
6. Equipment Standards Recommendations		
<p><input type="checkbox"/> <input type="checkbox"/> The NTIA, the FCC, and other government spectrum managers should devote substantial resources to establish a wide-ranging evaluation process for new devices that use spectrum to transmit or receive signals. Increased demand for spectrum and the possibility of expanded sharing opportunities requires policymakers to focus on the importance of future receivers and transmitters as tools in achieving greater spectrum efficiency.</p>	11	<p>Resources for such a wide-ranging evaluation are not included in NTIA FY12 funding and was not included in the President’s FY13 budget submitted to Congress.</p>
<p>Government spectrum managers should consider incentives, rules and policies to:</p> <p><input type="checkbox"/> <input type="checkbox"/> Improve the capability of receiving devices to reject adjacent channel interference.</p> <p><input type="checkbox"/> <input type="checkbox"/> Improve devices to reduce the out-of-band emissions (OOBE) and adjacent channel interference from transmitting devices. Review existing OOBE regulations, including the 43+ 10logP attenuation requirement as well as the Part 15 Section 209 Emission Limits, to ensure</p>	12	<p>NTIA agrees.</p>

<p>they provide sufficient protection when applied to new and varied services.</p> <p><input type="checkbox"/> <input type="checkbox"/> Improve and reduce unintentional emissions from all electronic devices.</p>		
<p><input type="checkbox"/> <input type="checkbox"/> Investment in commercial and government communications services requires certainty that the equipment provided will not be subject to interference from new services sharing spectrum. Future spectrum planning must give consideration to the investment in existing legacy devices. Investment in equipment should not be stranded unnecessarily due to new services or devices that cause interference.</p>	12	NTIA agrees.
<p><input type="checkbox"/> <input type="checkbox"/> New services acquiring or accessing spectrum should be made aware of the interference characteristics of receiving and transmitting equipment operating on frequencies that will be shared or used in adjacent bands.</p>	12	NTIA agrees.
<p><input type="checkbox"/> <input type="checkbox"/> The NTIA, the FCC or government entities responsible for managing spectrum should establish a clearinghouse to make such information available to those seeking to obtain spectrum access. Such information will give new services necessary visibility about the potential for interference for such equipment, before the new services access or bid for spectrum.</p>	12	Resources for such a clearinghouse are not included in NTIA FY12 funding and was not included in the President's FY13 budget submitted to Congress.
<p><input type="checkbox"/> <input type="checkbox"/> We recommend that the government fund research to accelerate development of monolithic radiofrequency (RF) filters (e.g., FBAR, MEMS) to improve selectivity, linearity</p>	12	Resources to fund such research are not included in NTIA FY12 funding and was not included in the President's FY13 budget submitted to Congress.

<p>and dynamic range of portable transceivers (e.g., LMR portables and cellular phones) without affecting size or power consumption. The ability to tune high-selectivity filters and produce components in low volumes cost effectively should also be an objective of the funding. Thus a better dialog between the filter community and spectrum managers is essential as filter performance has a large impact on spectrum efficiency.</p>		
<p><input type="checkbox"/><input type="checkbox"/>The NTIA, through the Institute for Telecommunication Sciences Laboratory (ITS), should characterize the unwanted emission levels of commercially available wireless devices and compare them to existing FCC standards to facilitate sharing with government users and to determine if changes should be made to the standards.</p>	12	<p>Resources to conduct such characterization are not included in NTIA FY12 funding and was not included in the President's FY13 budget submitted to Congress. However, NTIA has found in many cases that current technology far surpasses unwanted emission standards and those standards do not serve well as the basis for interference analysis. However, as long as they are the rules and technology developers may fall back to those levels, incumbents will insist on using the unwanted emission standard values in interference analysis.</p>
<p><input type="checkbox"/><input type="checkbox"/>Technical improvements to transmitting and receiving equipment will permit greater spectrum sharing over time, as new generations of equipment come on line. When developing future spectrum sharing policies, spectrum managers should take into account changes and improvements in legacy equipment that will occur in the marketplace. While recognizing potential improvements in transmitting and receiving equipment, NTIA government spectrum managers should also consider the replacement rate of existing transmitting and receiving equipment, to avoid the potential for unnecessary stranded investment in this equipment. In doing so it should try to balance</p>	12	<p>NTIA agrees.</p>

the cost of stranded investment with the public benefits of more spectrum access to both federal government and other users.		
7. Enforcement Recommendations		
<p>The NTIA, the FCC and government entities with spectrum management responsibilities need to shift from interference prevention only approach to both prevention and rapid resolution of problems that occur. Enforcement will become an important aspect of making more spectrum available to meet growing demands and introduce new spectrum-dependant applications as sharing opportunities increase. But new spectrum applications may also uncover limitations on existing regulations that were unanticipated. Both need timely resolution to limit the resulting harmful interference. These spectrum managers should:</p>		
<input type="checkbox"/> <input type="checkbox"/> Put in place streamlined interference reporting tools to complement “spot monitoring” of new operations.	12	NTIA needs CSMAC clarification regarding the specifics of the interference reporting tools.
<input type="checkbox"/> <input type="checkbox"/> Increase penalties for violations. There should be a tiered series of penalties for violations of existing spectrum management rules that cause interference, with increased penalties, especially for incidents that put safety-of-life systems at risk.	13	NTIA cannot apply such penalties to federal users.
<input type="checkbox"/> <input type="checkbox"/> Increase budgetary resources for monitoring and enforcement. Budgetary funding should be increased to facilitate increased laboratory testing and field monitoring by the FCC and NTIA after new rules are implemented for advanced wireless technologies. Several sources of funding should be explored including an increase in Congressional appropriations, auction revenues or appropriate spectrum fees that are consistent with the cost of regulation.	13	Additional resources for monitoring are not included in NTIA FY12 funding and was not included in the President’s FY13 budget submitted to Congress.
<input type="checkbox"/> <input type="checkbox"/> Per the FCC’s FY11 budget proposal language to resolve “100% of non-emergency interference complaints” in one month, the NTIA should encourage the Commission to expand this to a broader “shot clock” approach	13	It is unclear how the approach of a “shot clock” would work to address interference complaints. Identifying, characterizing and developing solutions to resolve interference can be a difficult and time consuming process. This is especially true if the interference is intermittent in nature. Based on NTIA’s experience establishing a specific timeframe for interference resolution would

<p>to responding to interference complaints so that licensees and operators of unlicensed devices will have certainty as to the timetable for concerns to be addressed.</p>		<p>be difficult and may lead to less than optimal solutions.</p>
<p><input type="checkbox"/><input type="checkbox"/> Develop tools for Temporary Restraint of Interference (TRI). Government entities responsible for spectrum management should establish a process, similar to a temporary restraining order, to address egregious interference complaints immediately. Upon a bona fide showing of interference from a specific device, class of devices or service, an entity receiving such interference should be able to file a complaint with the appropriate government agency. Upon an appropriate showing, the device or entity causing the interference shall cease such harmful transmissions, while the case is being examined by the appropriate government agency. This recommendation is not intended to alter the various spectrum priorities of existing law. For example, a device or service that is secondary in a band would lack standing to restrain an interfering device that has been given primary status.</p>	<p>13</p>	<p>NTIA needs CSMAC clarification regarding the specifics of the tools for TRI.</p> <p>It is essential that parties can obtain efficient redress of their grievances about harm to their operations, both current and foreseen. While like-to-like co-channel conflicts seem to be handled well, and are often resolved without FCC involvement, cross-allocation conflicts appear to be more time-consuming and contentious. Enforcement is also important because it influences private negotiations.</p> <p>The CSMAC needs to clarify:</p> <p>How does one prove harmful interference? What are the elements of a claim for harmful interference? What are the defenses to those elements?</p>
<p><input type="checkbox"/><input type="checkbox"/> Develop and explore the use of remote shut-off technologies for resolving interference problems. In cases where interference occurs, government spectrum managers, or government authorized frequency coordinators, should, upon a proper showing, and good faith attempt to notify, have the ability to remotely turn off transmitting equipment that is causing actual</p>	<p>14</p>	<p>On the surface having ability to remotely turn off devices that are causing interference is very appealing. NTIA needs CSMAC clarification regarding the specifics of how these procedures should be established before it can evaluate this recommendation.</p>

interference to other services.		
<input type="checkbox"/> <input type="checkbox"/> Increase assessments/Test-Bed approach.	14	The existing NTIA Test-Bed is a pilot program. When the pilot program is completed NTIA may be in a better position to use the lessons learned to determine if this is the best approach for assessing future spectrum sharing techniques.
<input type="checkbox"/> <input type="checkbox"/> The ability of cognitive radio (software defined radio) technology to sense the surrounding RF spectrum environment can be harnessed to assist in reporting cases of “bad actors” in which nearby RF emitters are operating outside of their permissible parameters and causing interference.	14	NTIA agrees there is an opportunity to use smart devices to contribute to identifying potential sources of interference. These devices allow measurement of the radio environment in a way that was not previously possible. Such devices could make diagnosing interference problems easier. Also, devices could be required to report on their locations. A database of device locations and waveforms could keep track of their operation, and turn them off if they are not behaving properly. Using devices in this way is not without problems, for example if devices that were constantly measuring the radio frequency environment would be measuring just in their own bands or in adjacent bands as well. It will also be necessary to ensure that the device is detecting a signal and not noise as waveforms become more noise-like. A spectrum monitoring system is likely to encounter three main problems: too much information, bad data, and false alarms. Another problem is in bands that are only intermittently used, no single measurement would be a good reflection of the use of the band.
<input type="checkbox"/> <input type="checkbox"/> Equipment authorization will be an important tool in facilitating spectrally efficient equipment. It may be appropriate for the FCC and NTIA to review equipment authorization practices, such as spot checking, to ensure there are adequate and correct incentives to manufacture and distribute spectrally efficient equipment consistent with the FCC and NTIA rules.	14	After the FCC adopted service rules for Unlicensed National Information Infrastructure devices NTIA through its laboratory at the Institute for Telecommunication Sciences performed spot checks to ensure that the Dynamic Frequency Selection spectrum sharing techniques was properly implemented.
<input type="checkbox"/> <input type="checkbox"/> Establish a streamlined process for the maintenance and retention of interference reporting and enforcement data. Such data should include documentation of interference	14	NTIA agrees that information documenting interference problems should be retained. NTIA typically publishes reports documenting major interference problems when federal systems are involved. Because the FCC field enforcement agents are generally focused on resolving an interference

<p>that may be caused by legally authorized operations. Analyzing these data will provide an ongoing assessment of FCC and NTIA spectrum management and enforcement policies.</p>		<p>problem rather than assigning blame, sanctions are rare and cases are not published. Because problems are resolved on a case-by-case basis, other operators with similar problems have no access to the resolution of an individual case, and important knowledge may be lost.</p>
<p><input type="checkbox"/><input type="checkbox"/> Explore through legislation, regulations or industry/government agreements, the ability of the federal government to expand its enforcement of spectrum interference rules, especially as it may relate to public safety and law enforcement.</p>	<p>14</p>	<p>NTIA needs CSMAC clarification regarding the definition of spectrum interference rules before it can evaluate this recommendation</p>