

CSMAC Bi-Directional Sharing Working Group Draft Report

Introduction: The Bi-Direction Subcommittee is providing responses to the questions raised by NTIA at the August 28, 2013 CSMAC meeting. NTIA had provided the following framework for the subcommittee's work: "Federal agencies and particularly the Department of Defense need significant amounts of spectrum for large training exercises; however, the United States cannot afford to obligate so much spectrum all the time for such exercises. What approaches to authorization, coordination would facilitate access to spectrum for training? Should DOD expect to pay license holders for that access? Should DOD expect to pay for access even where the license holder does not provide coverage?" This framework is reflected in the 4 questions set forth below.

The working group is co-chaired by Jennifer Warren and Janice Obuchowski and includes participation by CSMAC Members Tom Sugrue, Bryan Tramont, Michael Calabrese, and Carl Povelites, supported by Steve Sharkey, Adam Krinsky, and Mary Greczyn. The group initially met on Sept. 24, 2013 and has met at least seven times since that inaugural teleconference, and worked electronically.

One consideration that emerged across several of the questions was the viability and utility of using database functionality as a means to advance spectrum sharing in different scenarios. This continues to require additional consideration, and the applicability of it toward a solution may vary by scenarios.

Specific NTIA Questions:

Question 1: What methods can be used to allow federal agency access of non-federal bands, particularly for large, intermittent exercises and emergency use?

Question 2: Would federal users be expected to pay for temporary spectrum access?

Question 3: Would such access only be available if the nonfederal licensee does not have an immediate, short-term or long-term need to operate in the spectrum and location in question?

Question 4: What band and location combinations can support large federal exercises or emergency use?

- I. **Question 1: What methods can be used to allow federal agency access to non-federal bands, particularly for large intermittent exercises and emergency use?**

Potential Methods:

1. Federal Agency access to non-federal communications network. A Federal Agency enters into a commercial services agreement for access to the commercial network utilizing the underlying commercial services of the licensee. May use devices available to the public but may also attach proprietary federal devices to the network as part of the commercial services agreement. There is no transfer of rights to the federal user. In addition, there may be different methods for different wireless and satellite services.

2. Secondary Easements by Federal Agency for use of “unused commercially licensed spectrum”¹. No interference protection from primary users and must not cause interference to primary users. The term “Unused spectrum” would need to be defined and may be defined differently for different commercial services. Generally, unused spectrum can be defined as where the licensee has not yet built facilities to utilize specific frequencies, is not providing service, and signal level is below a certain quality of service threshold.
 - a. As a secondary market agreement² with the incumbent whereby the licensee leases specific frequencies, in a specific area, over a specific period of time where the licensee is not currently using the spectrum. Sec. 2.103 allows direct leasing of 700 MHz public safety spectrum for Federal use, but we recommend that the NTIA review its own Manual to determine whether changes are required to enable federal users to participate in secondary market access to commercial spectrum, and to work with the FCC to determine how best to revise its FCC regulations to expand eligible bands for secondary market uses, to include federal users.
 - b. As a license condition on spectrum assigned by license. For an example, this may include geographic build-out requirements that exclude certain federal properties. This would be known to the commercial licensee prior to obtaining the spectrum.
 - c. As a regulatory allocation and rule change. For an example, the federal agency gains secondary access to the spectrum on a non-interfering basis in areas where the spectrum is unused. In addition, database query functionality could potentially be used in this case.
 - d. While distinct from a licensed situation, a federal unlicensed user into unlicensed “common bands”. Annex K of the NTIA Manual sets out technical standards for Federal non-licensed devices, which agencies can generally operate without an NTIA frequency assignment under Sec. 7.9 of the Manual.

3. License rights by Federal Agency of spectrum by incumbent – protected from interference
 - a. Voluntary by incumbents
 - i. Lease/Short Term Access -- Federal Agency negotiates use with license holder via secondary market rules for discrete access – time frame, location, what spectrum – in the desired block in the desired area. This agreement could include a range of rights and may be service specific. Negotiations for access area not limited to monetary compensation, but could include a wide variety of arrangements, such as access to facilities, service agreements or other arrangements that the parties find mutually agreeable.
 - ii. Long Term Access – Federal Agency negotiates with license holder via secondary markets for long term access in the desired block in the desired area. Negotiations for access area not limited to monetary compensation, but could include a wide variety of arrangements, such as access to facilities, service agreements or other arrangements that the parties find mutually agreeable.
If there are any prohibitions or constraints on federal users obtaining use rights co-extensive with the licensees (e.g., use for period of license), , then we would recommend that the NTIA and FCC explore regulatory or legislative options to facilitate such capabilities. Currently, Sec. 7.12 of the NTIA Manual addresses use of frequencies authorized to non-Federal stations under Part 90 but it seems to cast

¹ May provide an incentive for the federal agency to deny placement of facilities on federal property, ensuring its availability for federal use.

² Commercial licensees may lack incentives to take this route.

this in relatively narrow terms and does not anticipate leased access that doesn't involve intercommunication with non-federal users.

- b. Involuntary by incumbents
 - i. Eminent Domain -- Federal Agency identifies unused, or underutilized³ commercial spectrum and notifies license holder of need for discrete access – time frame, location, what spectrum – in the desired block in the desired area. Prior to using any such commercial spectrum, a regulatory process would need to be established to address the question of whether spectrum is in fact unused. Functionality could potentially be used whereby discrete use for a limited period of time is added to a database and the database is queried to determine if the spectrum is in use by the incumbent and the licensee is notified when the federal agency is using the spectrum. Processes may be needed in order for the incumbent to challenge any underutilized determinations by the federal agency.

Considerations:

As we set about addressing this question, we realized the need for a standard taxonomy to ensure common understanding of scenarios and recommendations. Below are several important considerations that impact the recommendation regarding federal government access to non-federal spectrum, including:

- 1) Time period: Below are representative time periods, which are not reflective of the length of planning cycles for federal acquisition and do not match the STA process. At the same time, these time periods are reflective of time periods that commercial incumbents would take into consideration for any sharing of their spectrum
 - a. Short term - a day or less
 - b. Mid-term - a day to one week
 - c. Long-term – more than a week
- 2) Size of area
 - a. Small localized within and close proximity to government facilities
 - b. Outside of government facilities
 - c. Regional
 - d. Nationwide
 - e. Distance off the coast
- 3) Demographics of area
 - a. Sparse population
 - b. Dense population
- 4) How much spectrum is needed
 - a. Small contiguous block
 - b. Large contiguous block
 - c. Unpaired/paired
- 5) What is the best spectrum band for the intended purpose
- 6) Nature of federal access
 - a. Needed to deploy federal networked solution
 - b. Needed for federal end-user devices that can operate with commercial networked services
- 7) Nature of use

³ Ideally, this would only happen where the spectrum is deemed to be underutilized. It is unclear how the federal agency would be able to identify such underutilized spectrum. Also see footnote 1.

- a. Pre-planned, intermittent
- b. Emergency basis
- c. Constant

Given the above, certain assumptions need to be made to respond to the question. Without further, more specific instruction from NTIA, following assumptions that should be made:

- Time period: short to mid-term, not more than a week but generally less
- Size of area: localized within or near government facilities
- Demographics: fairly sparse
- Spectrum required: small contiguous block – unpaired
- Nature of use: federal networked solution, pre-planned

II. Question 2. Would federal users be expected to pay for temporary spectrum access?

The answer is not a yes or no, but depends upon the nature of commercial spectrum, presence of incumbent operations, impact upon incumbent operations, and period of time (temporary or perhaps permanent). Below is an outline of an approach, based on the above.

1. Access to Exclusive Licensed Spectrum

- a. Temporary, where there are no planned or existing incumbent operations and/or agreed that there would be no constraint or impact on incumbent operations or use of secondary markets(perhaps due to nature of temporary use or location/terrain, such as White Sands or the National Training Center location)
 - i. We recommend that no financial payments are necessary and no rights (NIB basis- STA Model) accrue.
- b. Temporary, having potential impact on timing of build out, use of secondary markets, or on incumbent operations.

We recommend consideration of the following options, but recognize that there may be others that we have not yet considered as viable for this list.

- i. Secondary Markets Scheme — perhaps if desire to negotiate constraints, temporary operational changes to provide incentives for incumbent to agree to use or temporary constraint.
- ii. Regulatory Framework, rather than Negotiated Secondary Markets
- iii. Other options to still explore.
- c. Permanent Options?

2. Access to Shared Licensed Spectrum/Existing Shared Spectrum.

- a. Temporary, where there is no impact on sharing regime (FSS/FS) or incumbent operations
 - i. We recommend that no financial payments are necessary and that a Special Temporary Authority (STA) model would be appropriate
- b. Temporary, where there could be impact on secondary market opportunities
 - i. Engage in a Secondary Market Scheme – but challenges in the valuation for federal access.
- c. Permanent Options?

3. Access to “Unlicensed” Bands

- a. Temporary Basis – Consistent with Technical Rules for Band
 - i. We recommend that no financial payments be required—and that there are no rights for any user to expect to operate without interference.
- b. Permanent Options?

III. Question 3. Would such access only be available if the non-federal licensee does not have an immediate, short-term or long-term need to operate on the spectrum and location in question?

Sharing arrangements should be constructed in a way that meets the needs of both the incumbent and the new entrant. New entrant operations should not negatively impact the ability of the incumbent to meet its requirements. Likewise, sharing arrangements that do not provide meaningful access for the new entrant are of little value. Based on this, federal operations that conflict with the service needs of the incumbent non-federal licensee should generally not be permitted.

However, there are a number of considerations and approaches that should be evaluated in determining whether a conflict exists or whether options are available that could lead to mutually beneficial sharing/use arrangements, including the type and location of the competing spectrum uses and the potential for commercial agreements between the parties.

Geographically restricted operations – In many cases the federal use may be restricted to geographically remote locations, such as certain military bases. These are areas where the desire for non-federal use may be significantly lower than in areas with a greater population density, and, in some cases, where non-federal licenses remain unused. This can present opportunities for federal agencies to access this spectrum without negatively impacting the ability of non-federal entities to meet coverage/capacity requirements. In such cases the proposed federal use needs to be carefully evaluated to determine whether it would interfere with the non-federal use – existing or planned. This is particularly true in instances where the proposed federal operations are relatively close to more populated areas or where the federal operations may present an interference risk at significant distances from the federal location, as is generally true with airborne operations.

Temporal sharing – There may be instances where temporal sharing arrangements are feasible. In cases where either the federal operations or the non-federal operations are limited by time, it may be feasible for the entities to coordinate for shared use via, for example, scheduling, use of an interactive database, or sensing capabilities.. Such arrangements may present challenges in ensuring that the spectrum is available to a user when it is needed. Developing equipment that can operate in multiple bands can help ease such concerns by allowing a variety of options for scheduling around various competing uses. Federal agencies are already sharing many bands with other Federal users through coordination methods that include scheduling, so there are likely “lessons learned” from these scenarios that could be applied to temporal sharing with commercial users. Scheduling is, however, a relatively static approach that may not be the most efficient mechanism since actual use may be less than scheduled use. Mechanisms that allow identification of when spectrum is actual being used will allow the most

efficient temporal sharing. In addition, a Section of the NTIA Manual (7.17) addresses military communications at test ranges in certain non-federal bands and this may also lay down some markers for reference in terms of the conditions of use.

Secondary Market Mechanisms – FCC rules include provisions for secondary market transactions where a license or a portion of a license (divided by either spectrum or geography) can be transferred or leased to another entity. Secondary markets can provide financial or other incentives to non-federal entities to make spectrum available for federal use and will allow a greater range of sharing agreements and arrangements that are protected by contract agreements. Such an approach may be preferable in many instances than rigid regulatory approaches because they allow the nonfederal entity to more accurately determine what spectrum resources can be made available based on actual needs. Changes may be necessary to FCC and NTIA regulations to allow secondary market transactions between federal and non-federal entities.

Service Provider Relationships – As federal agencies look to modernize systems they are, in some cases, considering the same LTE technology that is being deployed by commercial service providers. In certain cases there may be opportunities for federal users to contract for service from a commercial provider. Such an approach could be attractive for services like video surveillance that may be necessary in more densely populated areas. In more rural areas, federal use could provide a base of users that facilitates the economic deployment of services in areas that would otherwise not be economically viable and would have the dual benefit of meeting federal needs while extending broadband to underserved areas. LTE and IP-based network deployments have a variety of features that could address security, control and priority concerns and allow a market driven approach to implementing customized solutions.

- IV. **Question 4. What band and location combinations can support large federal exercises or emergency use?** Based on discussions with NTIA, we are not responding to this question, as there need be too many uninformed assumptions at this point regarding both federal and non-federal operations to contribute.

Conclusion: In response to the NTIA questions, the Subcommittee has outlined sharing scenarios to potentially enable Federal use of non-Federal spectrum, including options for determining whether a conflict exists or whether alternatives are available (i.e., geographically restricted operations, temporal sharing, secondary market mechanisms and service provider relationships.)

The following are three baskets of regulatory issues to be addressed in considering the options and recommendations contained in this report.

- (1) NTIA & FCC Joint Statement of Principles to Encourage Sharing between Federal and non-Federal Users;**
- (2) Modifications to Existing NTIA or FCC Rules to Facilitate Sharing;**
- (3) Implementation of Sharing Principles in Open Proceedings**

Each of the approaches to the three issues above may not have full consensus among Subcommittee members when applied to specific bands and situations. However, it is necessary to assess these challenging regulatory issues to allow bi-directional sharing to occur. In particular, these approaches to addressing the three issues identify opportunities in spectrum transitioning from Federal to non-Federal uses, as well as related paired bands, to build such considerations into service rules in a way that is minimally disruptive to commercial users but provides Federal users access in certain areas when needed.

Current status: NTIA has pointed out that the NTIA Manual of Regulations and Procedures for Federal Radio Frequency Management already authorizes access to a wide range of non-federal bands for military tactical and training operations, including the 2155-2180 MHz band.⁴

NTIA Manual: The NTIA Manual outlines circumstances in which military services may “employ frequencies in certain non-Federal bands above 25 MHz,” after coordination between FCC field personnel and military field personnel for tactical and training operations in the U.S. and Possessions under the arrangement between the FCC and the Military entitled “Field Coordination of Military Tactical and Training Assignments 25-2400 MHz.”⁵

According to the NTIA Manual, the agreement stipulates, “military field representatives will first establish that proposed assignments have a good chance of being compatible with non-Federal assignments.” The Manual states, “Tactical and training assignments shall be temporary for a period of no longer than one year and the military representatives shall recoordinate if continued use is desired.”

FCC Rules/Emergency Use: Section 2.103 of the FCC’s rules covers Federal use of non-Federal frequencies, primarily geared toward public safety applications. This section states that Federal stations may be authorized to use non-Federal frequencies above 25 MHz (except the 763-775 MHz and 793-805 MHz public safety bands) if the FCC “finds that such use is necessary for coordination of Federal and non-Federal activities.” Caveats contained in this section include that Federal operation on non-Federal frequencies conforms with the conditions agreed upon by the Commission and NTIA; operations are in accordance with FCC rules governing the service to which the frequencies involved are allocated and shall not cause harmful interference to non-Federal stations “and, should harmful interference result, that the interfering Federal operation shall immediately terminate.” This section also stipulates that a Federal operation has been certified as necessary by the non-Federal licensees and this certification has been furnished, in writing, to the Federal agency with which communication is required.

In addition, Federal stations can be authorized to use channels in the 769-775 MHz, 799-805 MHz and 4940-4990 MHz public safety bands with non-Federal entities “if the Commission finds such use necessary,” where the stations are used for interoperability or part of a Federal/non-Federal shared or joint-use system; the Federal entity obtains the approval of the non-Federal (State/local government) licensee(s) or applicant(s) involved; the Federal operation is in accordance with Commission's Rules governing operation of this band and conforms with any conditions agreed upon by the Commission and NTIA; and interoperability, shared or joint-use systems are the subject of a mutual agreement between the Federal and non-Federal entities. This language was updated in 2007 to allow Federal entities to share the 700 MHz public safety bands with non-Federal entities under certain conditions (i.e., the Federal entity obtains the prior approval of the Public Safety Broadband Licensee.)

⁴ See Letter to OET Chief Julius Knapp from NTIA Associate Administrator Karl Nebbia, Nov. 25, 2013, fn 13.

⁵ See, e.g., *NT/A Manual* at § 7.15.3.5.d.

At the same time, the 2013 Presidential Memorandum on sharing includes goals for facilitating sharing of non-Federal spectrum by Federal operations.⁶ As a result, the challenge is how to update current rules and regulations, or remove regulatory obstacles, that discourage or prevent broader forms of sharing that are now under consideration from occurring.

Summary of Options/Pro:

(1) NTIA & FCC Joint statement of principles to encourage sharing between Federal and non-Federal users;

- a. A policy statement that contains affirmative language that it is the policy of the FCC and NTIA to encourage sharing of non-Federal spectrum by Federal operations, particularly in cases that match relatively light commercial use with projected heavy use by Federal operations on an intermittent, supplemental basis.
- b. The policy statement would include guiding principles and key factors needed to facilitate sharing arrangements (i.e., compatibility with non-Federal assignments; for temporary periods of not longer than one year; for tactical and training operations, subject to coordination between the non-Federal incumbent and the applicable Federal entity.)

(2) Modifications to existing NTIA or FCC Rules to Facilitate Sharing;

- a. Possible modifications to Sec. 2.103 rules to apply more broadly beyond public safety scenarios.
- b. Potential updates to FCC secondary leasing regulations to broaden eligibility to Federal entities.

(3) Implementation of Sharing Principles in Open Proceedings.

- a. Review existing proceedings to determine which ones may benefit from consideration of the joint sharing principles
- b. Incorporation into future service rules the joint spectrum sharing principles. For example, future service rules should encourage licensees to engage in coordination of Federal use in certain geographic areas where commercial build-out is less likely.
- c. Encouraging voluntary coordination via collaborative agreements, when possible, between new Federal rules in (a) with new wireless facility siting efforts aimed at facilitating the siting and construction of commercial wireless facilities on Federal lands. j

⁶ See Presidential Memorandum, "Expanding America's Leadership in Wireless Innovation," June 14, 2013. Sec. 7, (b) "identifying spectrum allocated for nonfederal uses that can be made available to agencies, on a shared or exclusive basis, particularly where necessary to accommodate agencies seeking to relocate systems out of bands that could be made available for licensed services or unlicensed devices."

[Appendix still under discussion]

1. Exclusive-Use Spectrum Scenarios

Option	Commercial Arrangement or Regulatory?	Property Rights?	Time Period?	Regulatory changes?	Spectrum in use?	Paid	Interference protected
Federal agency access to non-Federal network ⁷	(a) Commercial services agreement for network access; (b) Secondary market agreement with incumbent through spectrum lease in desired area	Held by license-holder				Yes	No
Secondary easements by agency for unused spectrum ⁸	(a) Secondary market agreement; (b) License condition; (c) License modification	Held by license-holder			No		No
Property-like license rights by agency ⁹	(a) Voluntary by incumbents (lease or sale via secondary markets); (b) Involuntary by incumbents (lease of underutilized spectrum or eminent domain).	Held by license-holder but may be negotiated (or ceded in case of eminent domain) to Federal agency.	Time period for lease would be negotiated; sale would be for long-term access.		May involve under-utilized spectrum.		Yes
Access to exclusive licensed spectrum ¹⁰ (Option 1 a)	No constraint or impact on incumbent operations.	Non-federal license holder	Temporary		No incumbent operations	No	No
Access to exclusive licensed	Potential impact on incumbent operations or	Non-federal license	Temporary	Regulatory framework involved			

⁷ Draft inputs to Question 1- What methods can be used to allow Federal agency access to non-Federal bands, particularly for large intermittent exercises and emergency use?

⁸ Id.

⁹ Id.

¹⁰ Draft inputs to Question 2- Would federal users be expected to pay for temporary access?

Option	Commercial Arrangement or Regulatory?	Property Rights?	Time Period?	Regulatory changes?	Spectrum in use?	Paid	Interference protected
spectrum (Option 1b) ¹¹	involving areas where incumbent operations (i) Secondary markets scheme (e.g., negotiated constraints) or (ii) Regulatory framework.	holder					
Access to exclusive licensed spectrum (Option 1c)	To be discussed		Permanent				
Access to shared licensed spectrum/existing shared spectrum (Option 2a)	No impact on sharing regime or incumbent operations	Shared spectrum	Temporary		Likely	No	
Access to shared licensed spectrum/existing shared spectrum (Option 2b)	Potential impact to sharing regime or incumbent operations – secondary market scheme?	Shared spectrum	Temporary		Yes (because there could be impact)	?	
Geographically restricted operations ¹²					Possibly not		Interference risk would have to be addressed
Temporal sharing ¹³	Entities can coordinate when Federal or non-Federal operations are limited by time				Yes (but not at all times)		
Secondary market mechanisms	FCC rules cover secondary market transactions when a license or part thereof can be			Changes may be necessary to FCC and NTIA regulations to allow		Yes	

¹¹ Id.

¹² Question 3 inputs – Would such access only be available if the nonfederal licensee does not have an immediate, short-term or long-term need to operate on the spectrum in question?

¹³ Id.

Option	Commercial Arrangement or Regulatory?	Property Rights?	Time Period?	Regulatory changes?	Spectrum in use?	Paid	Interference protected
	transferred or leased.			secondary market transaction between federal and nonfederal entities.			
Service Provider Relationships	Commercial (e.g., LTE)	License-holder			Yes	Yes	

2. Unlicensed Spectrum Scenarios

Option	Commercial or regulatory?	Property Rights?	Time?	Regulatory Changes	Spectrum in use?	Paid?	NIB?
Secondary easements by agency for unused spectrum (Option 2d) ¹⁴	Unlicensed user into unlicensed common bands	No			No	No	No
Access to unlicensed bands ¹⁵ (Option 3a)			Temporary	Consistent with technical rules for band		No	No

Appendix

Overview: Spectrum Access Scenarios

Option	Access Arrangement/ Scenario	Rights	Time Period?	Terms/ Conditions	Spectrum already in use?	Interference protected
Q. 1: Potential Methods for Access						
Federal agency access to non-Federal communication network	Commercial services agreement for network access using underlying commercial services	No transfer of rights to Federal user		May be different methods for satellite and wireless.	Yes	No
Secondary easements by agency for	Secondary market agreement;	Held by license-holder and		Unused spectrum would need	No	No interference protection

¹⁴ Input to Question 1

¹⁵ Input to Question 2

Option	Access Arrangement/ Scenario	Rights	Time Period?	Terms/ Conditions	Spectrum already in use?	Interference protected
unused commercially licensed spectrum	License condition on spectrum assigned by license; license modification on existing licenses or Federal access to unlicensed bands (which is currently permitted).	subject to leasing agreement		to be defined; modifications would need to be made to current non-Federal secondary markets rules		from primary users and must not cause interference to primary.
License rights by agency of incumbent spectrum	Voluntary by incumbents (lease/short-term access); long-term access – both based on secondary markets rules). Involuntary by incumbents (eminent domain based on agency identifying unused or underused spectrum).	Rights negotiated with license-holder based on secondary market rules for discrete access for voluntary methods.	Time period for lease would be negotiated; sale would be for long-term access.		May involve under-utilized spectrum.	Yes
Q. 2: Potential Approaches for Payments						
Access to exclusive licensed spectrum	Temporary, where no planned or existing incumbent operations or use of secondary markets Temporary, with potential impact on timing of buildout, use of secondary markets or on incumbent operations.	No financial payments are necessary and no rights accrue (i.e., NIB) Several options recommended for consideration, including secondary markets scheme,	Temporary		No planned or existing incumbent operations	NIB

Option	Access Arrangement/ Scenario	Rights	Time Period?	Terms/ Conditions	Spectrum already in use?	Interference protected
	Permanent options?	regulatory framework or other options.				
Access to shared licensed spectrum/ existing shared spectrum	Temporary (no impact on sharing regime or incumbent operations) Temporary (where could be impact on secondary market opportunities) Permanent options?	No financial payments (e.g., STA model) Secondary market scheme	Temporary	Regulatory framework involved		
Access to unlicensed bands	Consistent with technical rules for band; no financial payments required	Shared spectrum				No rights to protection from interference
Q. 3: Is access only available if non-Federal licensee does not need to operate on location, or in the spectrum, in question?						
Geographically restricted operations	Federal use may be restricted to remote locations and desire for non-Federal use may be lower than in areas with greater population density or in some cases, licenses may remain unused.				Possibly not	Interference risk would have to be addressed regarding existing or planned non-Federal operations.
Temporal Sharing	May be feasible for Federal and non-Federal operations to coordinate			Developing equipment that can operate in multiple	Yes (but not at all times)	

Option	Access Arrangement/ Scenario	Rights	Time Period?	Terms/ Conditions	Spectrum already in use?	Interference protected
	shared use when operations are limited by time (i.e., scheduling, database, sensing capabilities)			bands may ease concerns about ensuring that spectrum is available to a user when needed. Tools that identify when spectrum is actually being used would also be helpful.		
Secondary market mechanisms	FCC rules cover secondary market transactions for when a license or part thereof can be transferred or leased.			Changes may be necessary to FCC and NTIA regulations to allow secondary market transaction between federal and nonfederal entities.		
Service Provider Relationships	May be opportunities for a Federal user to contract for service from a commercial provider or to use commercial technology (e.g., LTE)	License-holder		In rural areas, could provide a base of users that provides better economic basis to justify deployment . LTE has features to address security, control and priority concerns.	Yes	

