IEEE P802.11
Wireless LANs

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| FCC 13-49 Comment Framework |
| Date: 2013-03-20 |
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Abstract

A framework for drafting Comments on FCC 13-49 Revision of Part 15 of the Commissions Rules to Permit Unlicensed National Information Infrastructure (U-NII) Devices in the 5 GHz Band.

 **Version 3 – Industry Discussion draft**

**TAXONOMY**

**U-NII-1 = 5150-5250**

**U-NII-2A = 5250-5350**

**U-NII-2B = 5350-5470 NEW**

**U-NII-2C = 5470-5725**

**U-NII-3 = 5725-5825 (NEW Proposal to extend to 5850)**

**U-NII-4 = 5850-5925 (NEW)**

**PROPOSED OUTLINE – FCC 5 GHZ RULEMAKING**

**DOCKET 13-49**

1. INTRODUCTION
	1. Who is filing; thanking the FCC for opening the proceeding; summary of comment
2. POLICY IMPERATIVE
	1. Goal – open more spectrum to support next generation Wi-Fi and to address exploding demand
	2. Per Part 15, unlicensed use cannot cause interference to licensed or incumbent users & must ensure that for new spectrum identified, and existing spectrum, rules are designed so that FCC and other stakeholders have confidence that interference will not occur
		1. Highlight sentence from ¶70: We believe that responsible operation of U-NII devices is a joint responsibility of both manufacturers and users. We agree.
		2. Consider summarizing the enforcement cases to date, noting high incidence of user misbehavior. Mftr error on country code selection so far has been identified with frame-based radios, and has been corrected by a significant tightening of the certification guidance from the FCC. Industry welcomes strong FCC role here to ensure all mftrs are on equal footing.
	3. Facts, statistics or other data that provides a reason why it is so important to have access to contiguous spectrum at 5 GHz
		1. 802.11 ac as the technology imperative – wide channels; efficiency gains from contiguous spectrum; provide picture of channel plan, etc.
		2. Wi-Fi as the demand imperative (chipsets to be shipped, or other facts)
3. SEQUENCING OF DECISIONS IS IMPORTANT
	1. Waiting until all issues raised in NPRM can be decided is a mistake – better to sequence what can be decided now and decide it, take longer to resolve issues that require an additional record development
	2. And of those issues requiring an additional record, then sequence according to what can be decided first, second, etc.
	3. A series of partial decisions allows benefits to flow immediately; provide a few examples of benefits
	4. Suggest the following groupings, which could be resolved in “modular” way (some modules could be decided/released at the same time):
		1. Unifying U-NII -2C and U-NII-3, including the TDWR interference issues. Significant record already developed on TDWR issues. Consequence of resolving – eliminates 50 MHz “notch” and provides certainty for TDWR operations; good for all parties
		2. “Low hanging” fruit from specific proposed 5 GHz changes (e.g., extending the U-NII 3 rules to the 25 MHz between 5825 and 5850 MHz)
		3. Remaining rule changes to 5 GHz (e.g., proposed changes to U-NII-1)
		4. Potential operations in the U-NII 4 band (5850-5925) where there are some new and novel issues, but dominant technology there (802.11p) is part of same technology family as 802.11ac; may take longer than i or ii, above
		5. Potential operations in the U-NII 2B band (5350-5470) where there are new and novel issues for sharing involving radio systems that 802.11 devices have not shared with before
	5. State an industry expectation for time frame for final decision.
4. ALIGNMENT OF U-NII-2C & -3 RULES (INCLUDING PROTECTION OF TDWR) (*note that FCC proposal is to apply one rule throughout U-NII-2C and U-NII-3 bands, with some possible exceptions for lower power devices*)
	1. Summarize FCC proposal from ¶51-52: Apply a consistent set of rules across U-NII-2C and U-NII-3 bands for easier/better compliance, using modified 15.407; require implementation of security features to ensure users cannot modify software. FCC asks - Is this proposal sufficient to protect against interference or should we resort to other mitigation techniques? ANSWER: Yes, the proposal, as discussed and modified below, is sufficient. The FCC does not need to resort to geolocational database, frequency separation rules or adjacent channel sensing requirements. Applying the modified 15.407 across U-NII-2C and U-NII-3 is a significant change in operating parameters and directly addresses the enforcement cases where interference has been identified.
	2. ¶51-52 SUPPORT MODIFIED proposal that mftrs implement security features in any digitally modulated MASTER device[[1]](#footnote-1) so that 3rd parties cannot operate it outside of parameters in FCC rules (FCC proposal essentially requires the security required for SDRs on all master devices) Agree with SDR showing for master devices, and no showing for slaves. Support different requirements and showing that apply to Wi-Fi Direct- in the form of attestation letter…
		1. Summarize state of SDR security showing - The FCC published a comprehensive guide in 2011 (KDB 442812) that lists the security showings needed for the Form 731 when certifying a master device as an SDR. Key consideration – no user control or ability to manipulate software. The showing requires the applicant to respond to six questions:
			1. Describe the procedure that ensures 3rd parties can't operate US sold devices on non-US frequencies or in violation of any rule.
			2. Explain if any 3rd parties have the ability described in (1) to change & operate a device to non-US
			3. Describe how the software updates are distributed for all regulatory domains and what procedures ensure that a product sold in the US can only operate under US rules
			4. If you assert that product can only be operated per US rules, explain how this is achieved.
			5. What stops 3rd parties from loading non-US versions of software on to the device?
			6. Can 3rd parties make factory level changes to reload non-US domain codes, etc.
		2. The same guide also asks about unauthorized changes to software (i.e., “hacking”), and how your code would defeat or mitigate against a hack.
		3. There are also labeling and general software description (block diagram) requirements for inclusion in the showing.
		4. For traditional fixed access points, and especially those installed outdoors in the U-NII-2C and U-NII-3 bands, industry agrees that the SDR approach is more robust because it requires software designs that can prevent 3rd party reconfiguration of the radio outside of approved parameters. Significant number of enforcement cases seen to date involve post-manufacture “re-tuning” of U-NII-3 radios into the DFS bands, resulting in operation of the radio in a DFS band, but without DFS. Post-manufacture manipulation of the radio could have been prevented if manufacturers had taken steps to make their software less hospitable to manipulation – as the SDR security requirements do (cite and explain cases) Had an “SDR security” showing been in effect for access points, it would have eliminated most interference cases, based on the record of cases resolved to date.
			1. FCC and industry has some experience here with SDR rules, since SDR certifications have been available for [ x ] years. These provisions appear to work well.  Should be confidence on the part of stakeholders that expanding SDR security to a broader class of master devices will yield the positive results the FCC seeks.  Benefits outweigh costs. [[2]](#footnote-2)
		5. [For [Wi-Fi Direct] [any other class of devices?], none of these devices has been identified as a source of interference or has had software manipulated after manufacture. For this class, industry recommends … Using this different approach for Wi-Fi Direct helps ensure that the benefits outweigh the costs of implementation.
	3. ¶51 FCC asks if it should require that manufacturers ensure that modifying or reconfiguring firmware or software will make a device interoperable in certain bands? Answer: Yes, if software/firmware is modified/reconfigured by someone other than the authorized mftr, code should be written to cause device to disable or block out or notch the DFS bands. Benefits outweigh costs.
	4. ¶51 FCC seeks comment on whether it should require U-NII devices to transmit identifying information so that, in the event interference to authorizes users occurs, the FCC can identify the source of the interference and its location. What type of information should be transmitted and in what format?  Answer: Unlike TVWS, where geolocation is required as a condition of certifying equipment to the TV band, there is no geolocational data available today, and therefore there is no way to transmit geolocational data. Nor has there been a requirement for “call signs” as there is no mechanism to record whose call sign is whose. SSIDs are usually broadcast by Masters, but do not have to be, and often don’t provide sufficient identifying information. Therefore, the only way to transmit identifying info is to require a geolocation database and equipment that interacts with that database, as TVWS devices do. We believe the complexities and costs associated with setting up a geolocational database in a band that has significant embedded base are quite high (as discussed below), and we believe that implementing stronger protections for security as outlined above (along with applying 15.407 to U-NII-3) should be more than sufficient to prevent harmful interference to government systems. Cost outweighs benefits
	5.
	6. SUPPORT FCC proposals to unify certification of all digitally modified devices in 5.725 to 5.850 GHz under 15.407 (as modified by ¶28-35)] Important to ensure that devices operating using broad channelization do not increase the risk of interference to government systems. New rule also targets the issues that have been shown in the enforcement cases to be one of prime causes of interference to TDWR – very high gain antennas.
		* 1. ¶28 SUPPORT FCC proposal to consolidate equipment authorization for U-NII devices under 15.407, and no longer have the option to certify under 15.247. Specifics discussed below. Benefits outweigh costs.
			2. ¶29 SUPPORT addition of 5.725-5.85 GHz to U-NII band. For 802.11ac, helps ensure access to a broad swath of spectrum available under a clear and consistent set of equipment authorization rules.
			3. ¶30 SUPPORT FCC proposal to remove the variable power limit by removing the bandwidth dependent term (17 + log B). Power limit would be 1W. Agree this does not contribute to interference environment because currently 15.247 allows certification of up to 1W.
	7. ¶30 SUPPORT (OR MODIFY) FCC plan to modify 15.407 Power Spectral Density rules in U-NII 3. Summarize what para proposes to do: Relative to Section 15.407, Section 15.247 today allows a higher PSD when the device emission bandwidth is between 0.5 to 20 megahertz.  Above 20 megahertz emission bandwidth, the 1 Watt power limit becomes the limiting parameter, and PSD is the same for both Sections 15.247 and 15.407.  We propose to modify Section 15.407 to require the PSD limit used in Section 15.247 (*i.e.,* (33 dBm/MHz)), so that digitally modulated devices designed to meet this limit will continue to  comply with the new PSD requirement in Section 15.407.  This will ease the transition of all digitally modulated devices in the 5.725-5.85 GHz band to authorization and compliance under Section 15.407.  The only change for digitally modulated devices will occur when emission bandwidth is between 500 kilohertz and 20 megahertz.  High-bandwidth devices like those typically used in U-NII applications will still be limited by 1 Watt total power, and thus the proposed change in PSD limits would not increase the risk of any potential interference.  However, we do realize that limiting the PSD to (33dBm/MHz) would result in a PSD that is higher than the total power limit of 1 watt (30dBm).
		* + 1. Industry should say: SUPPORT. The FCC’s proposal of moving to 33 dBm/MHz in the UNII band will give us a couple of dB back in the 20MHz TX bandwidth. [. We propose 33 dBm/1MHz in para 31 to reduce measurement time.]
			1. [¶31 We support the FCC proposal to increase the measurement bandwidth to 1 megahertz to reduce complexity & amount of time it takes to do measurement tests. FCC recognizes that requiring devices that employ wider bandwidths to utilize a measurement bandwidth of 3 kHz may unnecessarily increase the time that it takes to complete measurement tests.  Notes that changing the measurement bandwidth would promote consistency within the U-NII rules.
			2. ¶32 SUPPORT FCC PROPOSAL ON 15.407 Emission bandwidth. Because FCC is proposing to eliminate bandwidth-dependent limit on total power (above), it proposes here to eliminate in 15.407 the 26-dB bandwidth requirement and to add the minimum 6-dB bandwidth requirement from Section 15.247.
			3. ¶32 SUPPORT FCC proposal to retain the 15.407 Antenna Gain requirements. The only difference between 15.247 & 15.407 is that 407 is more restrictive for antenna gain above 23 dBi (provision requires a 1 dB reduction in power for every 1 dB that gain exceeds 23 dBi) Agree that using the more restrictive antenna gain will help ensure that there is no increase in interference potential from unlicensed devices operating under the combined rule parts.
			4. ¶34 SUPPORT THE FCC proposal to apply the more restrictive unwanted emissions requirements from 15.407 to the unified rule, as compared to the unwanted emission requirements in 15.247. Section 15.407 requires unwanted emissions to be below -17 dBm/MHz within 10 MHz of the band edge, and below -27 dBm/MHz beyond 10 megahertz of the band edge. (testing guidelines given in KD 789033)
			5. ¶35 SUPPORT THE FCC proposal to apply the 15.407 peak to average ratio of no more than 13 dB across any 1 MHz band. Note that 15.247 had no such provision. Agree that applying the 15.407 rule will help guard against interference.
	8. ¶53-56 ALTERNATIVE TO SUPPLEMENT OR REPLACE THE ABOVE PROPOSAL - PROTECTION OF TDWR ONLY. OPPOSE imposition of geolocational database on 802.11 systems. Rule changes above will address the interference problem. Note that unlike a “greenfield” band, 5 GHz has been in use to varying degrees for 15 years and imposing an interactive database is problematic. Implementing a database requires numerous issues to be solved - issues about who pays for it, the cost of implementing software in the master devices to talk to the database, who is responsible for ensuring the system works, whether should apply to higher power systems only, etc;
		1. If FCC finds its SDR security proposal (as modified above) plus the application of 15.407 across the 2C & 3 band insufficient, then database should apply to outdoor point-to-point systems only; enforcement data shows that these systems are the problems
	9. ¶57- 61 ALTERNATIVE TO SUPPLEMENT OR REPLACE THE ABOVE PROPOSAL - PROTECTION OF TDWR ONLY OPPOSE implementation of tougher unwanted emissions limits on U-NII-2A and U-NII-2C. Note FCC wrongly accepts NTIA view on need for this, and restates NTIA finding that the maximum allowable co-channel interference power that can be received in the TDWR without exceeding the I/N level of -8 dB is shown to be -119 dBm/MHz . There is no enforcement case illustrating the problem. Analysis done by ITS lab is a paper analysis and does not reflect how 802.11 equipment is used and operates in the real world. Given how critical 802.11 equipment is for deploying broadband, FCC should not impose new regulation unless there is clear evidence that the cost outweighs the benefit. No evidence here.
		1. FCC also asks if it could impose a tougher limit on outdoor devices, and then how to define indoor/outdoor.
	10. [¶62-65 ALTERNATIVE, ETC. PROTECTION OF TDWR ONLY. FCC says that if it decides that U-NII devices must be more than 30 MHz from TDWR, then what should adjacent channel sensing requirements look like? Answer: You don’t need them because improved security + improved 15.407 are enough.
		1. Text notes at ¶63 that it is possible for the U-NII device to transmit on the same frequency as the radar with the radar signal falls within the 20 percent of occupied bandwidth that does not require sensing. Asks if should require sensing over 100% of bandwidth. Because of improved security and 15.407, do not change sensing requirement.
5. RULE CHANGES THAT THE FCC SHOULD ADOPT IMMEDIATELY
	1. ¶68 SUPPORT MODIFIED FCC PROPOSAL : Mftrs must design so that users cannot disable DFS (codifying KDB 594280) in U-NII-2A and 2C and when transmitting in these bands, must be operated with DFS on. Proposal works for fixed access points.
		1. ¶69 FCC proposes that any device that has the capability of initating a network must have DFS and be subject to the rule, above. ¶70 Asks whether this rule would have limited applications that could have been deployed in 2A & 2C, particularly in circumstances where wider bands are in use.
	2. ¶71-72 Sensing Threshold for Co-channel Operation. SUPPORT FCC PROPOSAL. For devices seeking to certify under relaxed sensing detection threshold of -62 dBm, then FCC to require EIRP of less than 200 mW (23 dBm) and EIRP spectral density of less than 10 dBm/MHz (10 mW/MHz), consistent with ETSI (adds spectral density to the existing rule). Devices that do not meet the proposed EIRP and EIRP spectral density requirements must use the -64 dBm sensing threshold
		1. AGREE that these proposed changes will further enhance protection for radars from co-channel interference by reducing both the range and the in-band spectral density emissions of the U-NII device. Believe benefits outweigh costs. Proposal is consistent with ETSI requirements that industry complies with today.
		2. [¶72 asks if costs to comply should be borne by manufacturers, operators or 3rd parties.
	3. ¶73 SUPPORT FCC ADOPTION of the negotiated and revised Bin 1. Industry is concerned that the original Bin 1 did not reflect the full dimensions of the FAA weather radar systems. The revised Bin 1 does so, and the new test will address interference cases to TDWR. Agree that future adjustments to measurement procedures should not require a rulemaking, and could be updated by the OET itself.
	4. ¶74 SUPPORT FCC PROPOSAL to eliminate uniform channel spreading rule. Original purpose of rule was to prevent large number of devices from starting up on one channel. But with shifts in technology and introduction of 40, 80, and eventually 160 MHz channels, the rule no longer serves a meaningful purpose.
		1. ¶74 SUPPORT - PERMIT DEVICES TO FORMULATE LIST OF AVAILABLE CHANNELS – Fixed access points already have to identify a clear channel to move to as requires. Provides increased flexibility to manufacturers to ensure that device has clear channel available to it.
		2. ¶74 SUPPORT FCC PROPOSAL to replace existing MPEG test file (streams 30 frames/sec) for channel loading. Test has been outmoded by the development of 802.11 technologies.  Recommend that MPEG file transfer based traffic generation be replaced with a test which consist of packet transmissions that together exceed the transmitter minimum activity ratio of 30 % measured over an interval of 100 ms. The required traffic loading can be generated either via audio/video streaming, datafile transfer or using network testing tools that can generate data streams (e.g. iperf, Chariot etc.). We note that this change would make the testing method consistent with recent European Telecommunications Standards Institute (ETSI) rules (EN 301 893).
	5. ¶113 Miscellaneous rule clean up.
		1. 15.403 definitions replaces “Peak Power Spectral Density” with “Maximum Power Spectrum Density; SUPPORT. Also suggest modification to 403(s) to include the 5.825-5.850 MHz spectrum in the definition of U-NII spectrum to help ensure that spectrum will be used by broadband technologies[[3]](#footnote-3)
		2. 15.407 – delete second sentence, replace “peak” with “maximum”, all peak excursion measurements are to the highest average in each corresponding 1 MHz band;
		3. 15.215 – clarify that the 20 dB bandwidth limitation for ultrawideband devices does not apply to 15.407 devices; fix a typo in 15.247]
	6. ¶114 SUPPORT proposed transition period. FCC proposes a 12 month period for manufacturers to produce compliant equipment after adoption of a rule change; a 2-year period from date of rule change to cessation of manufacturing/importing non-compliant equipment (after 2 years, no more permissive changes) ; grandfathers existing equipment] However, note that the FCC should allow an exception to the 2 year stop date for permissive changes in one case – when the permissive change is being filed to upgrade the existing device to the new Bin 1. Reason – government policy should support transitioning embedded base to the new rules.
	7. ¶29 SUPPORT inclusion of 25 MHz from 5.825-5.850 GHz in the U-NII 3 band. Reason- good to have a consistent set of rules across the band. Also make conforming edits to the definition of U-NII at 15.403(s). Conforming 15.403(s) ensures that only U-NII devices will be certified for the band and greatly mitigates the sharing concerns.
6. REMAINING RULES THAT MAY NEED ADDITIONAL CONSIDERATION BASED ON THE RECORD
	1. ¶68-70 FCC asks for comment on the existing state of its DFS requirement which applies to master devices – those that can initiate a network. Requirements apply to U-NII-2A and U-NII-2C. Industry supports applications of rules as to fixed access points.
	2. ¶36-41 U-NII-1 proposed changes. Incumbents are global NGSO/MSS feeder links & NTIA is proposing to move certain federal systems from 1755 MHz to this band (see footnote 45 – aeronautical mobile telemetry). FCC proposal is to harmonize U-NII-1 with U-NII-2A; eliminate outdoor restriction; alternatively, FCC asks – harmonize with U-NII-3?. Proposed response – if aeronautical mobile telemetry, may need to consider at same time as U-NII-2B because sharing problems are the same, but why wouldn’t this use be put in U-NII-2B to begin with instead of U-NII-1? If could be grouped there, then U-NII-1 could harmonize with U-NII-2A or U-NII-3]

This section continues to require significant work and analysis

* + 1. **use case enablement examples**
			1. We believe the indoor designation should be eliminated.
1. U-NII-4 BAND RULES SHOULD BE CONSIDERED AHEAD OF U-NII-2B
	1. Summarize and repeat the need for contiguous spectrum from II, above; federal radar can be protected with DFS and in this case, should begin examination with hypothesis that existing or modified DFS could work; DSRC protection is the new problem to be resolved
	2. Note that because both are 802.11 technologies, many companies have a footprint in both & want both to succeed (not either/or)
	3. ¶101 How to protect DSRC. Impossible to know at the time these comments are filed whether U-NII devices can successfully operate in the band without producing harmful interference to DSRC.
	4. [¶97 Accept the FCC proposal to apply the same U-NII-3 rules (as modified here) to U-NII-4: max output power is lesser of 1 Watt and 17 dBm+10Log (B) where B is 26 dB emission bandwidth; antenna gain requirements is 6 dBi for non point to point and 23 dBi for point to point (power and power spectral density reduction is applied if antenna gain exceeds these values). Max power spectral density should not exceed 17 dBm in any 1 megahertz band and OOBE from band edge to 10 megahertz above or below the band edge should not exceed an eIRP limit of – 17 dBm/MHz and for frequencies 10 MHz or greater, emissions should not exceed EIRP of – 27 dBm/MHz]97 use cases supporting 1W

##### 5 GHz contiguous spectrum from 5150-5925 MHz is essential to robust implementation of next generation Wi-Fi technology, i.e. IEEE 802.11ac effectively utilizing the capabilities the technology to the fullest. Opening the U-NII-4 band in conjunction with the U-UNII-2B band would greatly help in achieving this objective.

##### We support the proposal to extend U-NII-3 rules to the 25 MHz situated between the present U-NII-3 and the proposed U-NII-4 bands, i.e. 5825-5850 MHz, which effectively expands the U-NII-3 band by 25 MHz and provides 125 MHz contiguous spectrum under the new proposal.

##### We further support the proposal to uniformly apply the framework and technical requirements in Section 15.407 (A) (2) and Section 15.407 (B) (3) across the 5725-5925 MHz spectrum.

* 1. [¶98 – DFS modifications and whether devices can detect less than 1 microsecond pulses] (there are federal radars in the band – not just ITS)[¶100– DFS detection of radars designed not to be detected]
	2. )[¶101– UNII-4 band
		+ 1. 5 GHz contiguous spectrum from 5150-5925 MHz is essential to robust implementation of next generation Wi-Fi technology, i.e. IEEE 802.11ac effectively utilizing the capabilities the technology to the fullest. Opening the U-NII-4 band in conjunction with the U-UNII-2B band would greatly help in achieving this objective. Recognizing the fact that Wi-Fi must share spectrum with the primary users of the band while protecting non-radar systems such as the DSRC system for automotive, we firmly believe that working with the ITS community we can jointly develop acceptable sharing mechanisms for co-existence.
			2. There are companies in the Wi-Fi community including the silicon vendors who would like both technologies to succeed, and have interest in offering solutions for the implementation of DSRC in the automotive market.
			3. Wi-Fi technology is based on the IEEE specification IEEE 802.11 and subsequent amendments such as 802.11a, 802.11g, 802.11n, etc. DSRC technology is based on an amendment to the base IEEE 802.11 specification, and is called IEEE 802.11p. It is important to note that both use the same base specification, which means that both Wi-Fi and DSRC have a common base.
			4. Since both are IEEE 802.11 based technologies, we believe that there is a way forward to address the concerns of the ITS community about potential interference to their system from Wi-Fi devices.
			5. We recommend that stakeholder from both sides hold a series of meetings to (1) Exchange information on respective requirements, (2) Discuss possible mitigation solutions prepared by the technical experts from the 802.11 community, and (3) Come to an agreement on a mutually acceptable solution for testing/implementation.
			6. The follow-on step may involve DSRC to develop and test prototypes of the system comprehending the above solution to ensure it works in lab and real life, and that it is acceptable for full implementation.
			7. The two 802.11 standards groups should work together to jointly develop a co-existence mechanism between the two technologies.
			8. Important to emphasize that all key stakeholders are represented in this process. We encourage that the above outlined process be initiated at the earliest possible time.

1. U-NII-2B RULES WILL REQUIRE NOVEL APPROACHES TO PROTECT INCUMBENT SYSTEMS. THIS EXPANSION OF U-NII BANDS IS LIKELY TO TAKE LONGER BECAUSE IT REQUIRES NEW SOLUTIONS TO SHARING AS A TECHNOLOGY AND POLICY MATTER
	1. ¶80. Comment should summarize briefly benefits of contiguous spectrum – what it means for band plan & channelization; why more efficient
	2. [¶81 Asks how ITU WRC 2015 prep & sharing studies should inform FCC decision-making.
	3. ¶83-86. Note that there are new sharing problems presented by the incumbents in the U-NII-2B band. From NTIA report, summarize incumbent users of U-NII-2B: ground-based, air, and ship-borne radar (DoD, Coast Guard, NASA, NOAA, DoE); Spaceborne Altimeter Radar Systems (NASA/CNES – ocean surface height); EESS – USG is consumer of Canadian data); UAS (drones) by DoD, DHS, NASA downlinks. Non-Federal systems in ¶87.
	4. Agree with NTIA report that additional study is needed (¶103) Agree with NTIA characterization of mitigation techniques known today (¶106-108)
	5. [¶109-112. NPRM asks for views on NTIA risk analysis. Proposed response: Too early to tell if NTIA has correctly catalogued the risks.
2. Conclusion

**References:**

1. Rather than refer to “master device” could use the terminology “fixed access point” instead. [↑](#footnote-ref-1)
2. FCC may consider further guidance providing additional specificity as to the detail of the showing or perhaps an illustrative example. That would help industry present a more uniform set of materials in support of its applications. [↑](#footnote-ref-2)
3. This rule change and proposed change following align with ANSI C 63.10 Rev 2 [↑](#footnote-ref-3)