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Temporary document 05

23 September 1997

page **1**

Summary of the WINForum U-NII Reconsideration Petition, SRDC/09.15.97.06

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Title: SUMMARY OF THE WINFORUM U-NII RECONSIDERATION PETITION

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Document for:

Decision	
Discussion	
Information	

Decision/action requested

For information and comment

References

SUMMARY OF THE WINFORUM U-NII RECONSIDERATION PETITION**Purpose**

The purpose of this document is to summarize the WINForum reconsideration petition of the U-NII Report and Order which was filed March 3, 1997 and to report on the status of the reconsideration items. The title of the petition is Wireless Information Networks Forum Petition for Reconsideration and Clarification in FCC ET Docket No. 96-102. This will henceforth be referred to as the reconsideration petition. The SRDC considers that favorable resolution of the points brought out in the reconsideration petition is necessary to achieve full utility of the band and that the changes would not alter the interference potential.

Most of the reconsideration points affect government operations within or close to the U-NII band. The NTIA submitted comments on the petition on April 18, 1997. These will be subsequently referenced as the NTIA comments. The SRDC is now working closely with the NTIA to resolve many of the issues. While it is not possible to predict the eventual resolution, a subjective prognosis is given on most and some of the issues of concern to the NTIA are described.

This is a supplement to the paper U-NII Band Channelization and the WINForum SRDC, prepared by the WINForum Sharing Rules Development Committee dated August 27, 1997. This will subsequently be referenced as the first SRDC paper for brevity. References 4 and 5 of the SRDC paper are the technical attachments to the reconsideration petition.

Summary Points of the Petition

In the following the lower band is from 5.15 to 5.25 GHz, the middle band is from 5.25 to 5.35 GHz and the upper band is from 5.725 - 5.825 GHz when the R&O issued. The upper band frequency range may be subsequently lowered.

The abbreviation PSD is used throughout for power spectral density.

The following lists the reconsideration points and the subsequent sections discuss each point individually.

1. Devices should be permitted to operate across the lower-middle band boundary.
2. The out-of-band emissions limitations with regard to the restricted band limits should be clarified.
3. The frequency stability requirements should be eliminated.
4. The output power and power spectral density limits should be revised to avoid disadvantaging broadband systems.
5. The out-of-band emission limits should be stated relative to the in-band limits, rather than as relative to actual transmitted power.
6. The total power output should be specified in a manner that accurately represents the interference potential of U-NII devices.
7. The definition and measurement of power spectral density should be clarified.
8. Special rules should be implemented to control wideband impulse transmission techniques.
9. The U-NII device definition should be modified to require U-NII devices to utilize digital modulation techniques.

Points 6 and 7 are very important. If these points are denied, the total power permitted in wide bandwidth systems will be 6 to 10 dB lower than the limits specified and, in addition, some efficient modulation techniques will effectively be denied. Other important points relative to effective use of the U-NII band are numbers 2, 4 and 5. Point 9 addresses an important concern which the NTIA has experienced with similar systems. The other points are important clarifications.

Point 1: Devices should be permitted to operate across the lower-middle band boundary.

There is a subtle conundrum in Section 15.407 (b).

Consider an example device with 25 MHz bandwidth that occupies spectrum in both middle and lower bands. Does it operate in the lower or the middle band?

If it operates in the middle band then it must obey the 15.407 (b) out-of-band limits at and below the lower-middle band boundary, even though this boundary is within the U-NII band. If it operates in the lower band then it must follow the lower band rules on indoor operation only and power level, but need not follow the out-of-band limits at and above the boundary.

WINForum understands that the lower band interpretation is intended and asks for this clarification in the reconsideration petition; that is, the example device should be considered to operate in the lower band if it occupies spectrum in both bands. This would require it to operate with the indoor only restriction and at the lower band maximum power level.

It is anticipated that this point will be accepted.

Point 2: The out-of-band emissions limitations with regard to the restricted band limits should be clarified.

Section 15.407 (b) appears to cover the out-of-band emission limits. However, Section 15.407 (b) (5) requires compliance with Section 15.209 which specifies another set of emission limits. Section 15.209 establishes the bands immediately above the 5.25-5.35 GHz middle band and immediately below the 5.15-5.25 GHz lower band as restricted bands subject to special restricted band rules. These rules put severe limitations on the out-of-band emissions. The SRDC interpretation of the restricted band rules, as they apply to out-of-band U-NII emissions, are described in the first SRDC paper.

WINForum asks for relaxation of the restricted band rules for a 20 MHz wide band immediately above the middle band and immediately below the lower band. The 15.407 (b) out-of-band emissions specifications would apply in these 20 MHz bands.

The NTIA opposed this request in their comments on the reconsideration petition and the point probably will not be allowed. The SRDC paper presumes that the restricted band rules (Section 15.209) will apply .

The SRDC is now seeking further interpretation of the restricted band rules as regards out-of-band measurements. This activity is described in the first SRDC paper.

Point 3: The frequency stability requirements should be eliminated.

The frequency stability requirements of Section 15.407 (g) appear to be superfluous or at least premature since the rules do not specify actual frequencies.

This point will probably be accepted and the frequency stability requirement will be dropped from the rules.

Point 4: The output power and power spectral density limits should be revised to avoid disadvantaging broadband systems.

The 1 MHz measurement bandwidth for power permits the power spectral density of devices with a bandwidth less than 1 MHz to be higher than those above 1 MHz. That is, the actual power is permitted to be the same in systems with a bandwidth less than 1 MHz as is permitted in systems with a bandwidth of 1 MHz or more. This is a severe disadvantage for wide bandwidth devices operating in the same physical region as the narrow bandwidth devices. To help alleviate this disadvantage for wide bandwidth devices, WINForum requests that 1) the power be specified in a form $X^{*1} \text{ dBm} + 10 \text{ Log } B$ where B is the 26 dB bandwidth and that 2) a 3 dB tolerance in power spectral density (PSD) be permitted to allow for systems that do not have a flat in-band spectrum.

1 X is 4 dBm for the 5.150 to 5.250 MHz band, and 11 dBm for the 5.250 to 5.350 MHz band, and 17 dBm for the 5.725 to 5.825 MHz band

ETSI EP BRAN #4
London,
September 9-12, 1997

Temporary document 05

23 September 1997

page **4**

Summary of the WINForum U-NII Reconsideration Petition, SRDC/09.15.97.06

Point 1 will likely be accepted. Point 2 may be accepted for the middle and upper bands but will not likely be accepted for the lower band.

Point 5: The out-of-band emission limits should be stated relative to the in-band limits, rather than relative to actual transmitted power.

15.407 (b) specifies out-of-band limits relative to the actual in-band power spectral density (PSD). Devices which do not meet the limits at full power cannot meet the limits just by lowering the power of the overall spectrum mask. The reconsideration petition requests that the limits be stated relative to the allowed in-band PSD. This would allow devices to meet the specifications by lowering their output power.

The FCC concern was that specifying the out-of-band limits relative to allowable in-band power would permit high in-band EIRP when high gain antennas are used. Thus, WINForum requested that the rules make clear that the "maximum allowed" in-band PSD include the reduction required for high gain antennas.

This point will probably be accepted.

Point 6: The total power output should be specified in a manner that accurately represents the interference potential of U-NII devices.

This is a very important point. If it is not allowed, some very efficient modulation techniques will be severely penalized.

15.407 (a) specifies limits on the "peak transmit power". The peak envelope power of modulation techniques such as OFDM and other spectrum efficient methods exceeds the average power by significant amounts. Thus, setting the limits on the peak rather than the average will create a large disadvantage to these efficient modulation techniques. On the other hand, these variable envelope emissions create no more interference in potential victim receivers than does constant envelope emissions.

WINForum, in the petition, urges the Commission to specify the power output of U-NII transmitters in a manner that is independent of symbol-to-symbol envelope variations and which neither understates nor overstates the actual power of the device from the perspective of its interference potential. The ANSI C63.17 testing rules for unlicensed PCS devices are cited as an example of a means of specifying power levels that achieve this objective and a technical analysis on the subject is presented in an attachment (reference 5, Annex C, of the first SRDC paper).

The NTIA, in their comments, agreed with the general concept of specifying power in a manner that accurately reflects the interference potential without disadvantaging particular systems, but raised a number of concerns on the subject. One example concern is the impulse transmitter question of point 9.

The SRDC is now working with NTIA representatives on this point. It is expected that the general concept will be accepted and that power will be specified in a manner that does not unduly penalize emissions with symbol-to-symbol power deviations. This is an important continuing item.

Point 7: The definition and measurement of power spectral density should be clarified.

This too is a very important point that could severely reduce the permissible power level.

Section 15.407 (a) (5) and 15.407 (b) set controls on the peak power spectral density or the peak levels of emissions as measured in a 1 MHz filter. The levels specified would require that the full band power be 6 to 10 dB lower than otherwise specified in 15.407 (a). If the peak envelope power out of a spectrum analyzer resolution filter is taken as the PSD, the measured PSD will exceed the true PSD by the peak-to-average ratio of the filter output, which can be in the range of approximately 6 to 10 dB. The effect will be to penalize the device under test by that amount.

The following is from the reconsideration petition and defines the problem:

“The use of peak detection for measuring PSD has two other undesirable effects. First, it favors devices with emission bandwidths on the order of 1 MHz, if a 1-MHz resolution filter is used. Since all of the power of the 1-MHz device will fall within the bandwidth of the resolution filter, the peak-to-average ratio of the filter output for the 1-MHz device will be limited to the actual peak-to-average ratio of the modulation, which typically is much lower than for the noise-like filter output that results from a wideband input to the filter. Second, for a wideband (e.g., 20 MHz bandwidth) emission, it may be necessary to compute the total power output by integrating the power measured with a resolution bandwidth that is much less than the emission bandwidth of the device, since the maximum resolution bandwidth of most commercial spectrum analyzers is 2 to 3 MHz. If peak detection is used, the total computed power output would be 6 to 10 dB greater than the actual power output. Again, the effect would be to penalize the U-NII device by this amount. As an example, a 10-dB penalty would in effect reduce the limits on total power output to 5 mW in the 5150-5250 MHz band, 25 mW in the 5250-5350 MHz band, and 100 mW in the 5725-5825 MHz band. The result would be to reduce the service area, under free-space conditions, by 90 percent.”

The SRDC also did an extensive analysis on the question of specifying and measuring PSD. This too was covered in the technical attachments to the reconsideration petition (references 4 and 5 of the first SRDC paper).

The NTIA, in their comments, also agreed with the general concerns of WINForum on this question, but questioned whether a specification on PSD, as defined in the reconsideration petition, was sufficient to control interference. They cited the possibility of unknown types of systems that might behave in unanticipated ways.

The SRDC is continuing to work with NTIA representatives on this point. It is expected that the general concept will be accepted. This is an important continuing item.

Point 8: Special rules should be implemented to control wideband impulse transmission techniques.

Some types of devices transmit signals of very short duration (10 ns and less) with very high power. Such devices tend to be highly disruptive because of their very wide emission bandwidth and the difficulty of detecting and measuring their presence. WINForum states in the petition that special considerations for measurement techniques for these impulse transmission systems are needed.

WINForum has been consulting with the NTIA on this question before the reconsideration petition was filed and continues to do. This appears to be one of the prime concerns that prompts the regulatory agencies to set limits on peak power and PSD. The SRDC is attempting to develop a specification and measurement method for such systems that will permit the PSD and power level concerns to be resolved properly for legitimate systems while being comprehensive enough to prevent disruptive uses of the U-NII band.

It is expected that these rules, when developed, will be added to the rules governing the U-NII band.

Point 9: The U-NII device definition should be modified to require U-NII devices to utilize digital modulation techniques.

WINForum requested a change in the definition of U-NII devices to make it clearer that digital modulation is required.

Section 15.403(a) defines U-NII devices as “Intentional radiators operating in the frequency bands 5.15-5.35 GHz and 5.725-5.825 GHz that provide a wide array of wideband, high data rate, digital, mobile and fixed communications for individuals, businesses, and institutions.”

The proposed definition is:

15. 403 (a) U-NII devices [Unlicensed]. Intentional radiators operating in the frequency bands 5.15-5.35 GHz and 5.725-5.825 GHz that use wideband digital modulation techniques and provide a wide array of high data rate mobile and fixed communications for individuals, businesses, and institutions.

WINForum expects this definition to be accepted.

September 1997

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ETSI EP BRAN #4
London,
September 9-12, 1997

Temporary document 05

23 September 1997

page **6**

Summary of the WINForum U-NII Reconsideration Petition, SRDC/09.15.97.06
