TADIRAN Microwave Networks

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Redesignation of the 17.7-19.7 GHz Frequency Band, Blanket Licensing of Satellite Earth Stations in the 17.7-20.2 GHz and 27.5-30.0 GHz Frequency Bands, and the Allocation of Additional Spectrum in the 17.3-17.8 GHz and 24.75-25.25 GHz Frequency Bands for Broadcast Satellite-Service Use	)	IB Docket No. 98-172 RM-9005 RM-9818

TADIRAN MICROWAVE NETWORKS

Introduction and Summary

Tadiran Microwave Networks designs, manufactures, installs, and services long and short-haul, point-to-point microwave systems for cellular, PCS and private communications systems. With an extensive product portfolio from 2 to 38 GHz, TMN is able to provide quick response to customer needs and provide the best in telecommunications products and services. For over 20 years, TMN has offered a variety of 18 GHz radio products.

Tadiran Microwave Networks has carefully studied the Commission's band segmentation and sharing proposals in the NPRM in this matter, and while TMN appreciates the Commissions desire to provide specific allocations to the satellite services in the 18 GHz band, the Commission's specific proposals raise serious concerns and would produce numerous instances of unacceptable interference into fixed service (FS) systems if the proposals are implemented.

As more fully described below, adoption of the NPRM proposals would result in widespread intolerable interference to the fixed services and to satellite earth stations, costly dislocations of thousands of existing systems and would seriously restrict the ability of the fixed services to continue to serve the many communications requirements of existing and emerging communications providers. In addition, TMN is very concerned that reallocation proposals articulated in the NPRM continue a sequence of FCC policies that are causing unacceptable erosion of spectrum available to the FS. At the same time, competitive local market demands and other reallocation actions are necessitating that the fixed service have access to a significant amount of additional spectrum.

It is clearly in the best interests of all categories of services to be able to meet their respective needs in terms of spectrum requirements, however as we have learned from past experience, sharing the same spectrum becomes increasingly difficult, and in many cases this ultimately results in one of the sharing services having to vacate the band. This generally has resulted in the relocated service having to move to a less desirable frequency allocation. As we are now approaching frequency gridlock, there are no new suitable alternative frequency allocations, other than those that would require sharing with other services. We therefore believe that, as a principal, where a new service is proposed it is more reasonable for that new service to share with similar services in the same category. In the instance of this reallocation proceeding, the new FSS services should be required to share spectrum with other FSS services.

As an alternative to the Commission's proposed band segmentation plan, TMN proposes the FCC adopt a modified version of its plan which would minimally accommodate FS needs and, at the same time, provide significant allocations for GSO/FSS, NGSO/FSS and MSS/FL proposed systems.

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FCC Reallocation Decisions are Threatening Fixed Service Viability

Of particular concern to Tadiran Microwave Networks is an emerging sequence of apparently independent policy decisions and unrealistic FCC expectations that are effectively precluding access by FS operators to spectrum required for their continued viability. These reallocation policies, which when taken together, are producing a constriction in necessary spectrum:
Reallocation of FS frequencies to other services, without making available new spectrum for FS use. [cite 90-314, 92-9]
Expectation by the FCC that incumbents displaced by reallocation proceedings should move to "other bands." [cite 90-314, 92-9]
Reallocation of these "other bands" to services incompatible with FS operations and, at the same time, disenfranchising additional incumbents. [cite 98-172, others]
Lack of recognition by the Commission that spectrum is needed to accommodate growth of existing licensed systems. [cite 98-172, PCN volume report]
Lack of recognition by the Commission that spectrum is needed to accommodate new FS systems. [cite 98-172, PCN volume report]

Proposed 18 GHz Band Plan

As an alternative to the FCC's proposed band segmentation plan, Tadiran Microwave Networks endorses the TIA Fixed Section's modification of the Commission's proposal as well as the FWCC's proposal. These plans would:
Preserve the existing 17.7-18.14 and 19.26-19.76 GHz paired FS primary allocations.
Preserve the existing 18.14-18.58 GHz primary CARS allocation.
Grandfather incumbent licensees as primary in the paired 18.58-18.82 and 18.92-19.16 GHz FS allocation.
Allocate the 18.58-18.8 GHz band as primary for GSO/FSS gateways and ubiquitous blanket licensed satellite receivers.
Allocate the 18.8-19.26 GHz band as primary for NGSO/FSS ubiquitous blanket licensed receivers.
Rechannelize the 17.7-18.14 and 19.26-19.7 GHz paired FS primary allocation to (a) accommodate growth from the narrow band grandfathered systems in the paired 18.58-18.82 and 18.92-19.16 GHz FS band and (b) accommodate the demand for new systems in this band.

As discussed below, Tadiran Microwave Networks believes this plan, which represents a loss of 35% of FS spectrum in this band, will provide the minimum necessary spectrum for continued viability of 18 GHz band FS and CARS services while providing significant allocations to the proposed satellite services. In summary, the modified FCC band segmentation plan provides 880 MHz for FS needs, 440 MHz for CARS/PCO licensees and 1120 MHz for proposed satellite systems.

Concerns with the FCC Band Plan

In this Notice, the Commission proposes to reduce spectrum available to the FS by 53.3%. Further, in the 46.7% of the spectrum remaining, FS point-to-point services would be required to share with FS point-to-multi-point one-way VIDEO distribution services, something that is not required today. This effectively FURTHER reduces the FS point-to-point and point-to multi-point available frequencies because sharing is virtually impossible due to the coordination difficulties between these services in the metropolitan areas where these services both reside. This point is clearly acknowledged by the Commission in paragraph 27 of the NPRM; "Due to the difficulties of coordinating these point-to-multipoint operations with typical point-to-point terrestrial fixed service operations, these services have generally been licensed in separate portions of the 17.7-19.7 GHz band". Finally, whereas the VIDEO distribution services only require one-way frequencies, the frequencies paired with the one-way frequencies would be lost to the point-to-point FS services. The total impact of this could be a loss of an additional 560 MHz of FS point-to-point

frequencies in areas where video distribution services reside. The ultimate impact of this action would be either the loss of 84% of FS point-to-point frequencies where full video distribution services are deployed, or the loss of 53% of FS point-to-point frequencies and the loss of 100% of the VIDEO distribution services.

The 18 GHz band represents a critical and important band for the Fixed Services (FS).

This is a short-haul band used heavily by the FS for local service customer links, campus links, cell-site interconnects, backbone point-to-point, and video distribution. The FCC states in the NPRM (Appendix B, Paragraph C 8), "At present, there are 22,015 Common Carrier licensees, approximately 61,670 Private Operational Fixed Licensees and Broadcast Auxiliary radio licensees in the microwave services" and, with the exception of broadcast auxiliary licensees, these are all small businesses. It is important to note that each licensee may have multiple licenses, likewise each of these licensees usually provides the authorization for multiple hops.

Part 101 FS users (18.58-18.82 GHz, 18.92-19.16 GHz and 17.7-18.14 GHz, 19.26-19.7 GHz) deploy digital radios with high spectral efficiencies of at least 1 b/s/Hz. These radios currently have traffic capacities ranging from 4-DS1's (6 Mb/s) to 1-DS3 (45 Mb/s). New highly spectrally efficient radios (OC3/155 Mb/s) are planned for introduction when the 18 GHz allocations become stable. Video distribution radios (18.14-18.58 GHz) are analog AM radios which transmit the block-upconverted cable video channels to multiple locations using multiple point-to-point systems frequently configured in a hub-to-spoke topology.

The 18 GHz band has been, and will continue to be, an important 2.1 GHz re-location and growth band for cellular and private users when path lengths are appropriate to the rain region. ET Docket 92-9 (x) made growth in the 2.1 GHz band by common carrier and private users impossible by relegating new systems to secondary status. The current primary users at 2.1 GHz will eventually need to be moved as the 2.1 GHz mobile satellite service is implemented. Part 101 licensees currently use, and must use in the future, the popular, and already heavily congested, 6- and 11-GHz bands for longer path lengths because rain attenuation is minimal at these frequencies. Utilization of the 6- or 11-GHz bands for short paths more appropriate for 18 GHz is spectrally inefficient and would accelerate congestion in the lower bands.

The private cable video distribution operators are able to use only 18 GHz band spectrum to deliver their services (fn.: Throughout the NPRM, the Commission has used the term "CARS", Cable TV Relay Service, to refer to both franchised and private CATV providers. However, it is important to note that the private cable operators only have access to the 18.14-18.58 GHz band, and are precluded from using the 12.7-13.2 GHz band). These private cable operators provide competitive video alternatives to the franchised CATV providers, distribute educational video signals In addition, franchised CATV companies use these frequencies for back-bone connections into areas where fiber or cable is not available or impractical. This is a significantly different service than the point-to-point service since the minimum bandwidth required for the video distribution service is the entire 440 MHz of contiguous spectrum.

This NPRM SIGNIFICANTLY reduces the frequencies available to the FS, continuing the trend of erosion of FS spectrum by the Commission over the last several years.

The FS currently has 440 MHz paired go/return (880 MHz total) spectrum (17.7-18.14 GHz, 19.26-19.7 GHz), and 240 MHz paired go/return (480 MHz total) spectrum (18.58-18.82 GHz, 18.92-19.16 GHz) for a total of 680 MHz paired (1360 MHz total) spectrum for two-way communications. Additionally, there is 440 MHz of spectrum (18.14-18.58 GHz) available for one-way video distribution.

The NPRM has made the 18.92-19.16 GHz FS spectrum secondary since the Commission has correctly surmised that FS sharing with ubiquitous satellite earth stations is impossible (a fact made known to the FS community through its inability to coordinate new FS links in the 3.7-4.2 GHz band). While the Commission has left the FS co-primary from 18.55-18.8, this is of no use to the FS since this is half of a go/return frequency band and reallocation of the upper part to secondary status results in elimination of pairing capability and consequent loss of the lower part as well. This one proposed action would result in an immediate loss of 35% of the available FS go/return frequencies currently available to the FS in the 18 GHz band.

The NPRM would place the FS into a secondary status in the 19.26-19.3 GHz frequency range. This effectively eliminates use of the 17.7-17.74 GHz band since this is also a PAIRED band. This is another 5% loss of frequencies to the FS.

The NPRM would also eliminate 280 MHz, or 64% of the one-way video distribution band. This service cannot operate competitively with a reduced bandwidth since this band is used in its entirety on each link to upconvert the full 72 channel CATV video for distribution in metropolitan areas. It is not possible to reduce the necessary bandwidth without much more complex equipment with its attendant higher cost, thereby making the independent cable operator non-competitive. As discussed in Paragraph 2 above, sharing between point-to-point and full band point-to-multi-point services has been shown to be virtually impossible.. Therefore, adoption of this one element of the reallocation proposal would eliminate one of these services in a given geographical area. This represents another 16% loss of the currently available FS frequencies at 18 GHz.

Finally, the NPRM proposes to allocate 17.7-17.8 GHz to the BSS in 2007 on a co-primary basis with the FS. Ubiquitously deployed BSS earth stations CANNOT share with the FS, as the Commission acknowledges in Paragraph 19 of this NPRM. The allocation of 17.7-17.8 GHz would require FS stations to be relocated, and would also freeze future FS growth in this band. Additionally, allocation of this frequency range would also effectively eliminate use of the PAIRED frequencies from 19.3-19.36 GHz. This would represent another 7% loss of FS 18 GHz frequencies.

NPRM docket 98-172 proposes to grandfather existing FS systems. It is shown below that for both analog and digital systems, grandfathered FS systems can be harmfully interfered with by the proposed satellite systems. GSO/FSS systems will cause continuous interference for certain antenna alignments, and the NGSO/FSS systems will unacceptably degrade FS performance periodically. Thus, even under the current FCC pfd limits, grandfathered digital and analog FS systems will suffer serious performance degradation in the presence of the proposed satellite systems.

The proposed pfd allowed to illuminate the earth by the satellites is –118 dBW/m2/mhz. This level of interference causes a significant degradation of the threshold of a digital receiver, and makes an AM video distribution receiver unworkable. This is illustrated by the following example:

FS digital receiver example: A 12-DS1 receiver with a 10 MHz bandwidth is assumed. This receiver has a thermal Noise floor of –1020 dBm, and a corresponding threshold of –890 dBm. A 4-foot diameter antenna is used in these calculations.

First, convert –118 dbw/m2/mhz to an interference noise floor of the digital receiver.

-118 dBw/m2/MHz = -118 + 10 dB(BW) + 30 dB (dBw-to-dBm) –2 dB (4-ft antenna) = -80 dBm

The new receiver threshold is –80 dBm + 1320 dB C/N = -670 dBm. The FS digital receiver has lost 220 dB of threshold due to the interference. In addition to this, computer simulations have shown that interference levels 20 dB above the thermal noise floor will occur approximately every 40 minutes (fn: ITU-R Document 4-9S/44-E, submitted to the September 1998 international meetings of ITU-R WP4-9S. It should be noted that the antennas used in this simulation 6-foot antennas; whereas antennas commonly

used by the digital FS service in the US normally use 2- and 4-foot antennas, WHICH WILL MAKE THE INTERFERENCE WORSE due to the larger look angles of these smaller antennas.). This results in momentary interference thresholds of –470 dBm which is very similar to ABOVE the normal receive signal level of typical FS digital receivers in this band.

Thus, FS receivers are likely to LOSE SYNCHRONIZATION more than once per hour due to the peak interference power of the satellite constellations!

Additionally, if the interference lasts more than two seconds, then channel bank and switch Carrier Group Alarms (CGA) are generated which terminates system traffic for a minimum of 20 seconds. However, it is not unusual for a cell-site switch to take from 10-30 minutes to recover from a 2-second CGA!

Thus, interference expected from satellite systems into grandfathered digital systems can cause not only per-hop outages, but also total system outages.

Next consider the analog AM video receiver example: A per-channel (6 MHz) video distribution receiver has a 4 MHz noise bandwidth resulting in a typical thermal noise floor of –108 dBm. With a noise floor of –108 dBm, the video receiver is operating at approximately a 52 dB C/N. This is 6 dB above where "graininess" is observed in the picture, and 17 dB above a complete system outage (35 dB C/N). Currently, the FCC mandates a subscriber terminal C/N of no worse than 43 dB (fn: 47CFR Section 76.605(a)(7). As of January 1999, there is a FCC proposal to change this to 46 dB C/N).

Assuming that the video distribution service providers are willing to accept a 1-dB degradation of C/N (putting them only 5 dB from "graininess"), the maximum permissible interference power into the receiver would be –114 dBm.

The Interference noise floor of –114 dBm will determine the effective aperture of the antenna as follows::

-118 dBw/m2/MHz + 6 dB (BW) + Effective aperture (dB) + 30 dB (dBw-to-dBm) -3 dB (circular polarization).= -114 dBm

Rearranging, the Effective Aperture (dB) required = -31 dB.

Therefore, any antenna look angles that give an effective aperture gain of less than 31 dB will cause unacceptable interference to the video distribution providers.

Simulations by satellite interests purporting to show minimal interference into FS receivers have not taken into account terrain scatter. In particular, metallized glass buildings have been shown to be efficient reflectors of RF energy. Energy from satellites at any elevation can be reflected directly into the boresite of an FS antenna due to terrain scatter. This effect is discussed by Dr. Joseph Shapira ("Interference from Mobile Satellite Systems Through Terrain Scattering", International Journal of Wireless Information Networks, Vol. 3, No. 3, 1996) where the conclusion is drawn that "This type of interference has a potential to exceed the directly coupled interference by far, not to be strongly angle dependant, and only mildly dependant on small uptilt of the antenna".

Simulations by satellite interests purporting to show minimal interference into FS receivers also have not taken into account the frequent 6 dB upfades that occur due to multipath conditions for in-phase reflections. This is a high occurrence phenomenon well known by the FS, and also noted by the FSS in Document ITU-R 4-9S/38 (liaison statement from Working Party 3Mof ITU-R Study Group 3, submitted to the September '98 meetings of ITU-R WP4-9S as information to be taken into consideration in the development of the PFD limits).

It is very important to note that any type of interference, and especially intermittent interference, is EXTREMELY difficult to identify, locate, and resolve. An interfering signal 14-30 dB (depending on modulation complexity and error-correct coding employed) BELOW a digital radio spectrum can cause complete loss of synchronization of the radio. This interference is not visible with a spectrum analyzer since it is completely covered up by the desired digital radio received spectrum. Most of the many thousands of 18 GHz FS users are unaware of the satellite interference potential. This is known primarily by the frequency coordination houses. In general, cases of intermittent interference usually result in users spending many weeks or months changing out suspected defective radio modules. Finally, in frustration, the user calls the equipment manufacturer who dedicates field service engineers for extended periods of time to the problem. These field service engineers first must check out the radio (again) before looking for interference, since finding interference normally entails taking the hop off the air for an extended period of time thereby disrupting the customer's traffic.

The proposed ubiquitous satellite receivers from 18.3-18.55 GHz, and from 18.92-19.16 GHz will be unable to co-exist with the "grandfathered" FS in these frequency ranges.

FS transmitters operate with very high effective EIRPs (up to +55 dBw), whereas satellite receivers are characterized by very sensitive receivers operating very close to threshold. The band segmentation proposal of this NPRM is a result of the inability of the sensitive ubiquitous satellite receivers to operate with the high EIRP FS transmitters. This incompatibility between the FS transmitters and satellite receivers is well known to the FS and has been demonstrated by the inability of the FS to coordinate new FS transmitters in the 3.7-4.2 GHz FS/Satellite "shared" band, due to the effective ubiquitous nature of the LICENSED satellite receivers. At 18 GHz, both normal high EIRP point-to-point FS transmitters occur in large numbers, as well as high EIRP point-to-multipoint video distribution transmitters. The effect of these high power FS transmitters will cause large "exclusion zones" where the satellite receivers will be unable to operate. This is exactly the problem experienced by the FS at 3.7-4.2 GHz; however the satellite receivers are already in place at 4 GHz thereby preventing new FS transmitters from being installed. Obviously, this is not acceptable to either the FS or satellite industries.

Tadiran Microwave Networks supports the Commission in its effort to provide frequencies for new emerging services. The FS recognizes that many new wireless technologies are competing for the finite spectrum available. However, no new spectrum is being created and so more efficient use of the spectrum is required. The FS has been a technology leader in its efficient use of the diminishing spectrum available to it. FS radio manufacturers have implemented modulation technologies which permit up to 9 bits/sec/Hz of spectrum efficiency in the bands below 12 GHz. The technology to implement spectral efficiency greater than 1 b/s/Hz (currently required by the Commission for Part 101 digital radios above 12 GHz) is just now becoming available at reasonable cost for radios operating above 12 GHz. Additionally, through the Telecommunications Industry Association (TIA) and the National Spectrum Managers Association (NSMA), the FS has developed comprehensive and effective coordination methodologies and recommendations which permit the ability of the FS to efficiently coordinate FS routes with maximum frequency re-use. The FS believes that the satellite interests must be held to minimum spectral efficiency standards and efficient coordination methods as well.

In this submission, and in recognition of the necessity for some compromise to accommodate new and emerging satellite services, Tadiran Microwave Networks proposes a modification of the Commission's proposal that will permit future growth of the FS, and will also allow the different satellite services to be implemented at 18 GHz.

Tadiran Microwave Networks proposes that FS be given primary status from 17.7-18.58 GHz, and co-primary status with MSS/FL from 19.26-19.7 GHz.

This permits paired (go/return) FS operation with 17.7-18.14 GHz paired with 19.26-19.7 GHz. These bands will have to accommodate (1) the growth of existing wideband systems, (2) new wideband systems, (3) growth of the grandfathered narrowband systems, and (4) new narrowband systems. In addition, Tadiran Microwave Networks believes that the satellite services will find that interference into their systems from grandfathered narrow band FS transmitters is unacceptable, and will opt to sponsor relocation of these grandfathered narrowband FS systems.

18.14-18.58 remains for the video distribution services . Point-to-point bi-directional FS cannot share with point-to-multi-point one-way video distribution services due to the inability to coordinate these services against each other in a given geographic area. Therefore these two types of FS services must have their own separate frequency ranges.

FS spectrum loss from 19.26-19.3 GHz is NOT AN OPTION because this would also cause the paired loss of FS spectrum from 17.7-17.74 (80 MHz total additional FS loss). Similarly, the loss of FS spectrum below 17.8 GHz causes a loss of spectrum in the paired band below 19.36 GHz resulting in loss of an additional 120 MHz to the FS.

Tadiran Microwave Networks proposes to give up 18.58-18.82 GHz, and 18.92-19.16 GHz for FUTURE FS use.

Tadiran Microwave Networks agrees with the Commission that sharing between FS and the NGSO/FSS ubiquitous terminals is not possible. Accordingly, since the 18.92-19.16 GHz band is paired with the 18.58-18.82 GHz band, the 18.58-18.82 GHz band is of no future use to the FS once the 18.92-19.16 GHz band becomes unavailable.

EXISTING FS between 18.58-18.82 GHz and 18.92-19.16 GHz must, however, be grandfathered as a co-primary service. Relocation of these existing links would be at the expense of the satellite services.

TMN proposes that the 18.3-18.55 GHz allocation proposed by the NPRM for GSO/FSS ubiquitous satellite terminals be moved to the 18.58-18.8 GHz range.

This places GSO/FSS ubiquitous terminals in a "sharing" scenario with the GSO/FSS coordinated gateways

There would no longer be co-primary usage of the FS in this band, other than the grandfathered existing FS links. This should make this a more palatable region for the GSO/FSS ubiquitous and gateway terminals.

Tadiran Microwave Networks proposes that the 17.7-18.14 GHz and 19.26-19.7 GHz frequency ranges be re-channelized in 2.5, 5, 10, 20, and 40 MHz channels, and permit concatenation.

With the current spectral efficiency rules under Part 101, radio capacities of less than 8-DS1s would be spectrally inefficient in the existing 10 MHz channel bandwidths. These low capacity radios have been used effectively in the 18.58-18.82 GHz and 18.92-19.16 GHz range where 5 MHz channels have been efficiently used.

Additionally, Tadiran Microwave Networks believes that higher spectral efficiency radios will be required as demands for spectrum continue to increase, and therefore a 2.5 MHz channeling plan is required.

In order for the FS to ensure operation and growth in the significantly reduced spectrum at 18 GHz, the FS requires that the MSS/FL co-primary users from 19.26-19.7 GHz use the available spectrum, so as to not hinder future growth of the co-primary Fixed Service. Therefore, the FCC must require that:

MSS/FL sites be located in remote areas. This will minimize the "exclusion zone" problem experienced by the FS at 4 GHz, which effectively eliminated the FS from the 4 GHz band.

MSS/FL sites must include 360 degree integral shielding of at least 25 dB for protection from FS transmitters.

MSS/FL sites must only coordinate the frequencies and arcs necessary. Full-band, full-arc coordination is nothing short of spectrum warehousing and cannot be tolerated when spectrum is at such a premium. While the satellite interests may argue that they need full band coordination for growth, the FS can only coordinate frequencies that they can justify loading to 50% within two years. Yet, the FS has been able to successfully grow in bands where they do not share with satellite services.

Conclusion

Notwithstanding the desirability to provide spectrum for emerging satellite services, and to harmonize domestic US spectrum allocations for these different services, the Commission must consider the impact of any rulemakings on all services affected. The FS is making a significant concession of its existing frequencies at 18 GHz in these comments in the interests of spectrum efficiency and future services by giving up 1/3 of the currently available FS frequencies available at 18 GHz.

It is further recommended that the Commission should require the proponents of new services, which propose the use of spectrum currently fully utilized by existing service providers, to develop and use technologies which will permit the proposed new services to operate in an interference environment by the use of interference cancellation techniques.

Tadiran Microwave Networks respectfully submits the foregoing Comments and requests that the Commission act in a manner fully consistent with these views.

Respectfully submitted,

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