BEFORE THE

ORIGINAL

Federal Communications Commission

WASHINGTON, D.C. 20554

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FEDERAL COMMUNICATIONS COMMISSION
OFFICE OF THE SECRETARY

In the Matter of	)	
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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-9118

To: The Commission

COMMENTS OF TRW INC.

TRW Inc. ("TRW"), by counsel and pursuant to Sections 1.415 and 1.419 of the Commission's Rules, hereby comments on the above-captioned notice of proposed rulemaking ("NPRM").[1/] In the *NPRM*, the Commission has proposed to redesignate previously allocated spectrum in the 17.7-20.2 GHz band in a way that separates terrestrial fixed service operations from the Geostationary ("GSO") and Non-Geostationary ("NGSO") Fixed-Satellite Service ("FSS") over substantial portions of this spectrum. The Commission has also proposed a blanket licensing procedure that would apply to GSO and NGSO FSS satellite Earth stations in certain Ka-band frequencies.

TRW has long had an interest in the equitable and efficient allocation of Ka-band spectrum. Currently, it is an applicant for authority to utilize spectrum in the bands 17.7-20.2 GHz (space-to-Earth), 28.6-29.1 GHz (Earth-to-space), and 29.25-30.0 (Earth-to-space) as part of its proposed Global EHF Satellite Network ("GESN"), which would also utilize spectrum in

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1/ *Notice of Proposed Rulemaking*, FCC 98-235, (released September 18, 1998).

the bands above 36 GHz.[2] TRW will operate GESN using both GSO and NGSO satellites on a co-frequency basis. This approach is unique among existing licensees and second round applicants for the Ka-band, and gives TRW a fresh perspective from which to assess and comment upon the *NPRM*.

I. The Commission Should Revise Its 18 GHz Band Redesignation Proposal To Strike A More Equitable Balance Between The Needs of the Fixed Service and the Fixed-Satellite Service.

Under the original band plan for the spectrum at 17.7-20.2 GHz, the Commission proposed co-primary sharing of spectrum throughout the 17.7-19.7 GHz portion of the band between the terrestrial fixed service and the several satellite services designated to use specific blocks of frequencies within this range (GSO FSS, NGSO FSS, as well as mobile-satellite service ("MSS") feeder links). As a general approach, TRW believes that this manner of handling interservice sharing is optimal, in that it encourages users to coordinate spectrum use and maximizes the access of different technologies to the broadest possible range of frequencies.

Unfortunately, as the Commission implicitly recognizes in the *NPRM*, in bands where particular services are very far along in development, accommodating newer, advanced services becomes more problematic. Patterns of use in both satellite and terrestrial services are already well-established and a substantial equipment base has already been deployed that cannot

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2/ *See* FCC File Nos. 112-SAT-P/LA-97(15); 60-SAT-AMEND-98; and 61-SAT-AMEND-98(4). Consistent with the Commission's established practice in satellite application proceedings, TRW will modify its proposal to comply with the requirements ultimately adopted for the Ka-band in this and related proceedings. *See NPRM*, FCC 98-235, slip op. at ¶ 10 ("Any licenses granted to second round Ka-band applicants will be conditioned upon conformance with the final band plan adopted in this proceeding and any service rules that are adopted in the licensing proceeding.")

be easily re-engineered to account for coordination trade-offs.[3/] This situation clearly exists in the 18 GHz band, and provides the basis for TRW's reluctant agreement with the Commission that some segmentation of the 18 GHz band is appropriate.

The Commission states that it has developed its redesignation proposal after taking into account the spectrum requirements of all services authorized in the band and attempting to "strike a balance between the requirements of these different services and the public interest." *NPRM,* FCC 98-235, slip op. at ¶ 24. The current band plan, and the Commission's redesignation proposal are reproduced below:

Current Band Plan

GSO/FSS and FS ngso/fss 1100 MHz	NGSO/FSS and FS gso/fss 500 MHz	MSS/FL and FS gso/fss 400 MHz	GSO/FSS ngso/fss 500 MHz

17.7 18.8 19.3 19.7 20.2
GHz

FCC Proposed Band Plan (*NPRM*)

FS gso/fss and ngso/fss 600 MHz	GSO/FSS fs and ngso/fss 250 MHz	GSO/FSS and FS ngso/fss 250 MHz	NGSO/FSS fs and gso/fss 500 MHz	MSS/FL and FS gso/fss 400 MHz	GSO/FSS ngso/fss 500 MHz

17.7 18.3 18.55 18.8 19.3 19.7 20.2
GHz

3/ It is for this reason that the Commission "tentatively concluded, in light of the current state of technological development, that the public interest is best served by separating terrestrial fixed service operations from the operations of non-government ubiquitously deployed FSS earth stations into dedicated sub-bands." *NPRM,* FCC 98-235, slip op. at ¶ 1.

Under the current Ka-band plan, GSO/FSS is allotted 750 MHz on an exclusive basis in the uplink spectrum at 28 GHz, but only 500 MHz in on an exclusive basis in the 18 GHz downlink bands. The ratio of downlink spectrum to uplink spectrum is thus .667:1.

One of the tentative bases upon which the new proposal is premised is the Commission's observation that "[s]atellite systems have typically been allocated equal blocks of uplink and downlink spectrum." *NPRM,* FCC 98-235, slip op. at ¶ 25. Drawing on this historical pattern of symmetric spectrum allocation for FSS uplinks and downlinks, the Commission tentatively concludes that it should remove the need to consider sharing and coordination issues between terrestrial fixed service and GSO/FSS over much of the 17.7-18.8 GHz band, and allocate 250 MHz for GSO/FSS exclusively, which would be coupled with 500 MHz at 19.7-20.2 GHz to match equally the 750 MHz of exclusive uplink GSO/FSS bandwidth. *See NPRM,* FCC 98-235, slip op. at ¶ 25. Another 250 MHz at 18.55-18.8 GHz would be allocated to GSO/FSS and the fixed service on a co-primary shared basis, matching the 29.25-29.5 GHz uplink band where GSO/FSS is also co-primary.

While it is correct that FSS systems operating in the C-band and the Ku-band have been allocated equal blocks of uplink and downlink spectrum, this has been the case because these systems are used primarily for bent-pipe, point-to-point services. The systems designed for the Ka-band, however, herald a new generation of point-to-multipoint satellite services to be offered, in many cases, directly to end-user consumers. These satellites will use on-board processing to increase their efficiency. For the following reasons, the use of on-board processing leads in turn to a requirement for a downlink spectrum to uplink spectrum ratio that is greater than one-to-one:

- On-board processing allows the use of higher coding gain on the downlink for efficient use of limited spacecraft power and reduces susceptibility to interference from adjacent GSO systems.

- Growth in Internet access-type service has resulted in greater use of asymmetric point-to-multipoint Internet protocol multicasting. This use inherently requires greater downlink bandwidth as the information is repeated across many beams.

- To serve such a large base of multipoint users, on-board processing also allows the use of spectrum-efficient higher order uplink modulation from user terminals, while using power efficient QPSK modulation on the downlink. Again, to deliver the large amounts of data transmitted from user terminals, greater downlink bandwidth is required.

There is, in short, no question that on-board processing provides the most efficient use of satellite and spectrum resources. In TRW's view, the Commission should adjust its band plan to provide more fully and appropriately for GSO FSS downlink requirements. To match the exclusive 750 MHz uplink spectrum allocation for GSO/FSS at 28 GHz, there should be a correspondingly larger 1000 MHz exclusive allocation on the downlink side to meet the system needs described above. Requiring GSO/FSS to share a portion of the 1 GHz downlink with the fixed service would cause a substantial spectrum shortfall, despite the appearance of equity.

To establish an acceptable ratio of downlink spectrum to uplink spectrum in the subject bands, TRW proposes the following alternative to the band plan contained in the NPRM:

TRW's Band Plan Proposal

FS	GSO/FSS	NGSO/FSS	MSS/FL and FS	GSO/FSS
gso/fss and ngso/fss	fs and ngso/fss	fs and gso/fss	gso/fss	ngso/fss
600 MHz	500 MHz	500 MHz	400 MHz	500 MHz

17.7 18.3 18.8 19.3 19.7 20.2
GHz

The only change requested by TRW from the plan proposed by the Commission is a change in the designation of the fixed service allocation at 18.55-18.8 GHz from primary to secondary, giving GSO/FSS access on a primary basis to the full band 18.3-18.8 GHz. While the

Commission suggests in the *NPRM* that the upper portion of this band could be used by FSS on a shared basis with the fixed service "for a limited number of large antenna diameter, high-data-rate terminals" (*see NPRM*, FCC 98-235, slip op. at ¶ 32), this technical approach is inconsistent with the actual service proposals that have been made for this spectrum by the vast majority of Ka-band satellite operators. Again, these entities intend to use this band for ubiquitously deployed VSAT type services, which the *NPRM* itself acknowledges cannot realistically share with the terrestrial fixed service.[4] For the same reasons, the Commission must reject the notion of designating an additional 100 MHz at 18.3-18.4 GHz to be shared between GSO/FSS and the fixed service.[5]

II. The Commission Should Make Certain Modest Adjustments To It's PFD Limit Proposals To Conform The Levels With Recent Developments.

In it's NPRM, the Commission queries whether GSO/FSS would be feasible in the 18.55-18.8 GHz band given the strict PFD limit that is imposed at 18.6-18.8 GHz to protect the passive sensings of the Earth-Exploration Satellite ("EES") and Space Research ("SR") services that take place in these bands. *See NPRM*, FCC 98-235, slip op. ¶ 34.[6] TRW believes that such sharing is workable, but should be accomplished at the slightly relaxed PFD levels that the United States has indicated internationally would afford EES and SR stations the required protection.

4/ The type of GSO FSS use the Commission envisioned for the 18.55-18.8 GHz band will continue to be feasible under the alternative TRW is proposing for this segment.

5/ *See NPRM*, FCC 98-235, slip op. at ¶ 35.

6/ Under Footnote US255 to the Table of Allocations, FSS is limited in the 18.6-18.8 GHz band to a PFD at the earth's surface of -101 dBW/m^2 in a 200 MHz band for all angles of arrival. *See NPRM*, FCC 98-235, slip op. at n.59; 47 C.F.R. § 2.106, fn. US255.

Specifically, at the most recent meeting of ITU Working Party 4A, the U.S. formally proposed a PFD limit of -95 dBW/m^2/200 MHz for this band.[7] This standard should be adopted in this proceeding. Such an approach will provide the requisite protection to the scientific services while also permitting commercial GSO/FSS providers to achieve adequate link margin to employ small earth terminals.

III. The Commission Must Establish Technical Requirements for Intra-Service Sharing That Equitably Apportion The Burdens Of Spectrum Sharing And Do Not Provide Undue Technical Advantages For One Type of Satellite Technology Over Another.

In the *NPRM*, the Commission also advances technical standards to permit the blanket licensing of FSS earth stations in the Ka-band. TRW endorses this approach, and believes it is important to the success of Ka-band FSS systems employing widely deployable earth stations.

A. GSO/FSS

1. Uplink Off-Axis EIRP Density: With respect to off-axis equivalent isotropically radiated power ("EIRP") density in the uplink band, the Commission has determined to establish a single value rather than adopt separate standards for antenna sidelobe performance and maximum antenna input power densities. The limitations are expressed through a composite curve relating the EIRP density to the off-axis angle. TRW supports this standard, so long as some spectrum not subject to this limit is specifically designated for order wire channels and on-orbit telecommand. Most systems use a global beam for the order wire. Due to the low gain of the satellite global beam receiver, a high transmit power EIRP will be required to close the link.

7/ *See* U.S. Contribution to October 1998 meeting of Working Party 4A, Document 4A/167. Other participants, including INTELSAT, proposed less stringent limits. The options are contained in an output paper from the recent WP 4A meetings in Geneva, where it is noted that the one administration (*i.e.*, the U.S.) that currently applies a -101 dBW/m^2/200 MHz limit for 18.6-18.8 MHz now accepts -95 dBW/m^2/200 MHz, and that all other expressions are less stringent still. *See* Document WP 4A/TEMP/55.

This EIRP density will be up to 20 dB higher than the Commission's proposed limit. TRW suggests that a minimum of 15 MHz be identified for order wire and uplink telecommand at the band edge in either the 28.35-28.6 GHz band or the 29.5-30.0 GHz band.[8/]

2. **Downlink Power Flux Density**: The Commission proposes a maximum downlink PFD threshold for GSO/FSS of -120 dBW/m^2/MHz averaged over any contiguous 40 MHz,[9/] and queries whether this value would allow sufficient power for operators to implement a viable service. *See NPRM,* FCC 98-235, slip op. at ¶ 59. TRW does not believe that the proposed value is appropriate, as it would not permit adequate service to be provided in regions that typically experience heavy rains. As noted above, even in the particularly sensitive 18.6-18.8 GHz band that would be shared with the EES and SR passive sensing services, the U.S. has proposed a PFD level that translates to -118 dBW/m^2/40 MHz (the equivalent of -95 dBW/m^2/200 MHz). This level is more appropriate than the level proposed in the *NPRM.* While TRW acknowledges that the Commission's PFD can only be applied domestically, most of the Ka-band systems are inherently global. If forced to design these systems to comply with the stringent PFD level advanced by the Commission, the U.S. GSO/FSS systems would have great difficulty competing with systems licensed by other administrations due to disadvantages with respect to link availability, earth terminal size, and maximum data rate.

Accordingly, as discussed in the preceding section, TRW proposes a hard PFD limit of -118 dBW/m^2/MHz averaged over any contiguous 40 MHz only for the band 18.6-18.8 GHz (with additional exclusion zone protection for EES and SR services). In the bands 18.3-18.6

8/ Indeed, the Commission's rules specifically require telecommand functions to be located in-band, at the band edge. *See* 47 C.F.R. § 25.202(g) (1997).

9/ The Commission also proposes a level of -118 dBW/m^2/MHz in any 1 MHz segment, provided that the -120 dBW/m^2/MHz is also met over a 40 MHz bandwidth. *See NPRM,* FCC 98-235, slip op. at ¶ 59 & n.91.

GHz and 19.7-20.2 GHz, this same PFD level would apply, but would serve as a coordination threshold, not an absolute limit. Thus, for systems that meet the -118 dBW/m^2/MHz over 40 MHz level outside of 18.6-18.8 GHz, no coordination with other systems would be required. Coordination with other affected satellite networks would be required if the -118 dBW level were exceeded. For the 18.3-18.6 GHz and 19.7-20.2 GHz bands, a hard PFD limit ranging from -105 dBW/m^2/MHz to -115 dBW/m^2/MHz, depending on elevation angle, would apply.[10/]

B. NGSO/FSS

The Commission also requests comment on the appropriate downlink PFD and uplink off-axis EIRP values to be applied to NGSO/FSS systems in the Ka-band, but does not suggest what values it might consider appropriate. *See NPRM,* FCC 98-235, slip op. at ¶ 69. In TRW's view, where GSO/FSS and NGSO/FSS are either co-primary or co-secondary, both services should be subject to the same PFD and off-axis EIRP density limits. Unless equivalent standards are applied to both types of FSS systems, an NGSO/FSS operator will be able to provide a higher data rate and greater link availability than GSO/FSS systems, while also being able to serve smaller user terminals. This circumstance would cause a competitive disparity that could handicap the development of these bands for next generation GSO/FSS.

Even more significantly, even in the 18.8-19.3 GHz NGSO/FSS-only band and its companion band of 28.6-29.1 GHz, limitations equivalent to those to be applied to GSO/FSS will be necessary to ensure that more than one NGSO system is afforded the opportunity to operate. The initial NGSO system licensed in these bands will need to bear its equal share of the burden

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10/ The -115/-105 dBW/m^2/MHz level is the ITU PFD limit in the band 17.7-19.7 GHz.

with subsequent systems in order to accommodate the later entrants. The Commission recognized this obligation in its Ka-band FSS service rules proceeding just last year.[11/]

III. Conclusion

For the foregoing reasons, TRW strongly urges the Commission to modify its spectrum redesignation plan as proposed herein. It also requests that the Commission adopt standards for uplink off-axis EIRP density and downlink PFD that will permit equitable and efficient co-frequency operation of GSO/FSS and NGSO/FSS.

Respectfully submitted,

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11/ *See Rulemaking to Amend Parts 1, 2, 21, and 25 of the Commission's Rules to Redesignate the 27.5-29.5 GHz Frequency Band, to Reallocate the 29.5-30.0 GHz Frequency Band, to Establish Rules and Policies for Local Multipoint Distribution Service and for Fixed Satellite Services*, FCC 97-378, slip op. at 16 (¶ 38) (released October 15, 1997) (" we expect all NGSO FSS licensees to bear some portion of the technical and operational constraints necessary to accommodate multiple 'non-homogeneous' NGSO FSS systems").

TECHNICAL CERTIFICATE

The undersigned hereby certifies under penalty of perjury that I am the technically qualified person responsible for the preparation of the technical material in the foregoing Comments of TRW Inc., and that such material is complete and accurate to the best of my knowledge and belief.

Hau H. Ho
TRW Inc.

Dated: November 19, 1998