BEFORE THE

Federal Communications Commission

WASHINGTON, D.C. 20554

In the Application of	)	
	)	
L/Q LICENSEE, INC.	)	File Nos. 90-SAT-ML-96
	)	19-DSS-P-91(48)
For Authority to Construct, Launch and	)	and CSS-91-014
Operate Globalstar, a Low-Earth Orbiting	)	
Satellite System, to Provide Mobile-Satellite	)	
Services in the 1.6/2.4 GHz Bands.	)	

REPLY OF TRW INC. TO CONSOLIDATED RESPONSE

TRW Inc. ("TRW"), by counsel and pursuant to Section 25.154(d) of the Commission's Rules (47 C.F.R. § 25.154(d) (1995)), submits these reply comments concerning the "Consolidated Response" filed by L/Q Licensee, Inc. ("LQL") on May 2, 1996 with respect to its above-captioned application. TRW did not oppose the modification of LQL's license, but filed comments to highlight the inherent susceptibility of LQL's Globalstar system to interference in the downlink — and the consequent difficulty of shielding Globalstar from adverse impact. This signal power deficiency would have been greatly exacerbated by the substantial reduction in the Globalstar average payload power from 660 to 346 Watts that appeared in its modification application. This severe power shortfall provided an obvious motive for LQL's request, in the context of TRW's recent modification application for Odyssey™, that the

Commission impose arbitrary conditions on Odyssey™ operations in the S-band[1/] — i.e., as a means of providing extra protection to Globalstar's weaker downlink signals.

In its response, LQL offers nothing to refute the fundamental accuracy of TRW's showing. LQL has renounced the modification application's average payload power value of 346 Watts, and corrected it to 550 Watts.[2/] Thus, it appears that a portion of the initially-calculated reduction in available power for the service downlink is simply attributable to LQL's inattention to critical details.[3/]

LQL's "correction," however, does not otherwise alter TRW's conclusion that the modification application will reduce the power available for Globalstar service downlinks. If, in fact, the average payload power has been reduced from 660 to 550, then the power available for the transmission from satellite to users would be reduced from 420 Watts to 310 Watts, which still represents a 26% reduction in the power transmitted

---

1/ See LQL Comments, File Nos. 33-SAT-AMEND-96, et al., at 7-8 (filed February 23, 1996).

2/ See LQL Consolidated Response at 3.

3/ LQL does not offer any explanation as to how such a significant error could occur in its technical statement. Given the disparity in the numbers involved — all three digits of the figures for both the average payload power and the total system average power were modified — its seems evident that this was not simply a typographical error.

to the ground.[4/] LQL's hyperbolic attacks on TRW's methods[5/] are a mere smokescreen obviously intended to obscure the essential accuracy of TRW's showing that Globalstar's available downlink power will indeed be reduced, and that this loss of available power poses problems for its operation.

The foundation of LQL's response is that TRW improperly subtracted the peak power required to operate Globalstar's feeder links from the average power provided to their payload in order to obtain a measure of the power available for the service links.[6/] However, LQL is incorrect in its assertion that TRW simply chose arbitrarily to use the peak power figure for its calculations. TRW's calculations were based on the Mitsubishi paper, cited by both TRW and LQL. Table 1 of this paper shows (at line 5) that the DC to RF Efficiency is 19% at a power output of 25 Watts, yielding a peak power of 132 Watts[7/] — higher than the value ultimately used by TRW. TRW's calculation actually used a reduced load based on examination of Figure 8 in the Mitsubishi paper, which

---

4/ As to LQL's claim that the efficiency of its power system has been enhanced (see LQL Consolidated Response at 4), it is curious that such a design improvement would prompt a reduction in power rather than an increase in system capacity or improvement in the link margins to the user.

5/ See LQL Consolidated Response at 3.

6/ See LQL Consolidated Response at 4.

7/ See Ono, *et al.*, "Linearized C-Band SSPA Incorporating Dynamic Bias Operation for Globalstar," 16th International Communications Satellite Systems Conference, February 25-29, 1996, Washington, D.C.

suggests that 120 Watts is the power level required to achieve linearity of performance,[8/] i.e., the 2 dB output backoff level at which the system must necessarily operate in a multi-carrier environment in order to reduce signal distortion to an acceptable level.

LQL asserts that, because the "amplifier operates linearly, to minimize average power drawn . . . the average power will be substantially less than the peak power."[9/] For LQL's argument to be valid the power drawn by the Globalstar feeder link Solid State Power Amplifiers ("SSPAs") must fall off significantly during periods of low demand with reduced throughput capacity. The Mitsubishi article shows that the SSPA power does fall off with reduced drive power. However, detected and retransmitted noise ("noise power robbing") will offset the reduced signal drive level and force the SSPAs to draw almost as much power from the satellite power subsystem. As a result, the actual operating power of the SSPAs remains very close to the 120 Watt figure calculated by TRW — the value appropriate to multiple carrier operation. The difference between peak and average SSPA power, in percentage terms, will thus be small, and subtracting

---

8/ The Mitsubishi paper observes:

> In [the] GLOBALSTAR application, the high power FET (Field Effect Transistor) will be operated with around 2 dB output back-off to get the required linearity performance. Therefore the efficiency at that back-off point is very important. Also, in this application, the SSPA (Solid State Power Amplifier) will be operated under multi-carrier conditions. The design of the FET matching circuit was optimized at this operating point.

9/ See LQL Consolidated Response at 6.

the peak power from the average payload power yields a reasonably accurate approximation to the power available for the service links.[10/]

Significantly, LQL does not actually support its claim that the TRW analysis is incorrect, it simply asserts that, on the average, Globalstar satellite feeder link SSPAs use less power. LQL has not been forthcoming in supplying appropriate figures or power tables to back up its argument that TRW has misinterpreted the Globalstar data.[11/] One would expect that, if TRW's calculations were as greatly in error as LQL implies, it would have seized the opportunity to quantify the disparity. One is left to wonder how much feeder link power is typical in LQL's estimation, and what is the peak and "average" power available for S-band transmission to subscribers. In the absence of hard data from Globalstar, the only recourse is to use the publicly published papers and statements of LQL and its suppliers, as described above.

Of course, the underlying issue is that, from the outset, Globalstar has proposed a system with much less satellite-to-user power per subscriber than Odyssey™ or the other Big LEO MSS systems. Globalstar is therefore more susceptible to interference than Odyssey™ or these other systems. Even without the recently disclosed power reduction, Globalstar's vulnerability is certain in an absolute sense without precise

---

10/ LQL's criticism is akin to attacking the calculation of a circle's area because the value of pi used was only calculated to the fourth decimal place instead of the tenth.

11/ The Commission would benefit from a full and consistent description of the "physical characteristics of the space station including . . . power (beginning and end of life) budgets" as required by the Commission's rules. See 47 C.F.R. §25.114(14)(1995).

quantification of the actual reduction. Link budgets have been provided to the FCC by Globalstar and Odyssey™. An examination clearly shows that the Globalstar signals are 11.8 dB (a factor of 15.5) weaker than Odyssey™ signals.[12/]

The Globalstar system of combining signals from two or three satellites does not overcome the power deficiency because the total available energy in the system is split among multiple satellites. The power combining technique does not increase the total available power; the whole is the sum of the parts. The signal from an individual Globalstar satellite is extremely faint. Although the transmitted signal is subdivided between several satellites and recombined in the user terminals, the total energy is critical to a secure communications link. For the second and third satellites the elevation angles are extremely low and the probability of blockage is high (especially if the user is near a tree or building). Furthermore, the satellites are moving rapidly through the sky (typically 10° per minute) and one can move into a blocked location without warning. Most significantly, the Globalstar ground station will not be able to determine

---

12/ The Globalstar application shows that the outer user beam Rx Signal Strength/user/satellite = -169.1 dBW. See Application for Modification to Order and Authorization for Globalstar, 19-DSS-P-91(48) and CSS-91-014, at Table 3 (filed February 29, 1996). The TRW Odyssey™ application shows that the User Rx Signal Power C at an elevation of 20° is -157.2 dBW. See Application for Modification of License of TRW Inc. in the Mobile Satellite Service Above 1 GHz, Odyssey™, at Table B-1 (filed September 29, 1995). The difference in signal strength is evident throughout the tables in the Globalstar application.

immediately that one of the satellites is obstructed in order to adjust. In many cases, a single satellite signal will be too weak to close the link.[13/]

The Commission should not be swayed by LQL's repeated and disingenuous assertion that TRW's comments are part of an attempt to avoid coordination.[14/] Given that LQL has attempted to use the license modification process to solicit Commission intervention in the coordination between the systems — and to impose conditions on any modified license granted for Odyssey™ — it was only logical that TRW would highlight for the Commission the reasons that Globalstar might feel the need for special (and unjustified) interference protection.

LQL knows very well that TRW has been in frequent dialogue with its representatives and continues to pursue coordination between Globalstar and Odyssey™ in good faith.[15/] It is true that there has been a lull in negotiations due to the deliberations on S-band standards before the European Technical Standards Institute, but this was a mutual decision between the parties. Discussions, however, are set to resume in mid-May, a meeting that was scheduled before Globalstar asked the Commission to impose arbitrary conditions on TRW's modified license.

13/ Globalstar could make its signals more robust and reduce the effect of the interference simply by reducing the number of circuits it provides (by about a factor of ten).

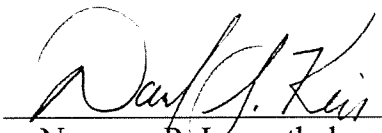
14/ See LQL Consolidated Response at 2 & 3.

15/ TRW has been working to minimize the potential interference to Globalstar. For example, TRW has already agreed to modify the Odyssey™ L-band service link polarization from LHCP to RHCP to protect Globalstar. By doing so, TRW faces more difficult coordination with Iridium and other adjacent services.

TRW believes that the Commission was correct to place the burden of pursuing sharing solutions on the applicants themselves.[16/] If this method is to be successful, however, system operators cannot expect to receive extra protection from other spectrum users as a means of ameliorating deficiencies in their own system designs. Such measures would be spectrum inefficient, and therefore contrary to the public interest.

Respectfully submitted,

TRW INC.

By: 

Norman P. Leventhal
Stephen D. Baruch
David S. Keir

Leventhal, Senter & Lerman
2000 K Street, N.W.
Suite 600

Washington, D.C. 20006
(202) 429-8970

May 9, 1996

Its Attorneys

16/ Indeed, even LQL acknowledges this Commission instruction. See LQL Consolidated Response at 2, citing Amendment of the Commission's Rules to Establish Rules and Policies Pertaining to a Mobile-Satellite Service in the 1610-1626.5 MHz and 2483.5-2500 MHz Frequency Bands, 9 FCC Rcd 5936, 5962-63 (1994).

TECHNICAL CERTIFICATE

I, Roger J. Rusch, hereby certify, under penalty of perjury, that I am the technically qualified person responsible for the preparation of the technical information contained in the foregoing "Reply of TRW Inc. to Consolidated Response," and that this information is true and correct to the best of my knowledge and belief.

Dated: May 9, 1996

By: _____

Roger J. Rusch
Deputy Managing Director
TRW Odyssey Services Organization
Vice President, System Engineering
Odyssey Telecommunications
International, Inc.

CERTIFICATE OF SERVICE

I, Vera L. Pulley, hereby certify that a true and correct copy of the foregoing "Reply of TRW Inc. to Consolidated Response" was mailed, first-class postage prepaid, this 9th day of May, 1996 to each of the following:

* Scott Harris, Chief
International Bureau
Federal Communications Commission
2000 M Street, NW, Room 800
Washington, DC 20554

* Tom Tycz, Chief
Satellite and Radiocommunication Division
International Bureau
Federal Communications Commission
2000 M Street, NW, Room 811
Washington, DC 20554

* Cecily C. Holiday
Deputy Chief
Satellite and Radiocommunication Division
Federal Communications Commission
2000 M Street, NW, Room 800
Washington, DC 20554

* Karl A. Kensinger
International Bureau
Satellite Radio Branch
Federal Communications Commission
2000 M Street, NW, Room 800
Washington, DC 20554

* By Hand Delivery

* Kathleen Campbell
International Bureau
Satellite Policy Branch
Federal Communications Commission
2000 M Street, NW, Room 800
Washington, DC 20554

* Fern Jarmulnek, Chief
Satellite Policy Branch
Federal Communications Commission
2000 M Street, NW, Room 518
Washington, DC 20554

* Harry Ng
Satellite Engineering Branch
Federal Communications Commission
2000 M Street, NW, Fifth Floor
Washington, DC 20554

* Michael J. Marcus
Office of Engineering and Technology
Federal Communications Commission
2000 M Street, NW, Room 480
Washington, DC 20554

* Bruce Franca
Office of Engineering and Technology
Federal Communications Commission
2000 M Street, NW, Room 480
Washington, DC 20554

* Fred Thomas
Office of Engineering and Technology
Federal Communications Commission
2000 M Street, NW, Room 480
Washington, DC 20554

* Charles Iseman
Federal Communications Commission
1919 M Street, NW, Room 322
Washington, DC 20554

* By Hand Delivery

* Donald H. Gips
Office of Plans and Policy
Federal Communications Commission
1919 M Street, NW, Room 822
Washington, DC 20554

Jill Abeshouse Stern
Shaw, Pittman, Potts & Trowbridge
2300 N Street, NW
Washington, DC 20036

Robert A. Mazer
Albert Shuldiner
Vinson & Elkins L.L.P.
1455 Pennsylvania Avenue, NW, Suite 700
Washington, DC 20004

Lon C. Levin
American Mobile Satellite Corporation
10802 Parkridge Boulevard
Reston, VA 22091

Bruce D. Jacobs
Glenn S. Richards
Fisher, Wayland, Cooper, Leader
& Zaragoza
2001 Pennsylvania Avenue, NW, Suite 400
Washington, DC 20006

Philip L. Malet, Esq.
Alfred M. Mamlet
Steptoe & Johnson
1330 Connecticut Avenue, N.W.
Washington, D.C. 20036
Counsel for Motorola, Inc.

William D. Wallace, Esq.
Crowell & Moring
1001 Pennsylvania Avenue, N.W.
Washington, D.C. 20004-2595
Counsel for L/Q Licensee, Inc.

* By Hand Delivery

Leslie Taylor
Leslie Taylor Associates
6800 Carlynn Court
Bethesda, MD 20817
Counsel for L/Q Licensee, Inc.

Vera L. Pulley

77900/050996/01:48

* By Hand Delivery