ECHOSTAR
COMMUNICATIONS PRODUCT DIVISION
A PART OF THE ECHOSTAR GROUP OF COMPANIES

To: Doug Young

April 14, 1998

Steptoe and Johnson, LLP
1330 Connecticut Avenue, N.W.
Washington, D.C. 20036-1796

Attn: Mike Nilsson

RE: **Comments on DCE's Northpoint Experimental License Renewal to the FCC**

Diversified Communication Engineering, Inc. [DCE] has obtained an experimental FCC license to broadcast on the 12.2 GHz to 12.7 GHz frequency band from terrestrial sources. This is the same frequency that EchoStar uses for DBS transmissions from multiple satellite locations. DCE claims their system will not cause interference to current DBS customers. These tests were conducted in Kingsville, Texas in October 1997. An engineering report was completed and submitted to the FCC. Northpoint has now submitted a petition for rule making to allow terrestrial broadcast of DBS frequencies. Northpoint has also petitioned to extend their experimental license in order to begin testing in Austin, Texas.

Summary

The DCE Northpoint system will generate interference to existing DBS services. The tests demonstrated that interference can and do result in loss of signal for a DBS customer. This was reported in the Comsearch report for sites #3 and #8. The calculations and test results raise issues that indicate there will be problems with deployment of a terrestrial DBS broadcast system.

The test conditions for the experiments conducted last October 1997 are not representative of a fully deployed system. The test signals consisted of a singular narrow band interferer. The interferers were set to different frequencies for DirecTV and EchoStar receivers. This also indicates that the receivers were tuned to different polarities of the downlink signal thereby adding another variable to the tests. The antenna measurements used test conditions and adjustments that missed sidelobes and null points in the antenna gain patterns. The measurements were also conducted on a limited range of elevation adjustments. The antenna used was a DirecTV antenna and LNBF. The tests were not made with an EchoStar antenna and LNBF.

The determination of interference was subjective. The interferer was adjusted until the video just stopped 'breaking up'. If this level of C/(N+I) were maintained in an actual environment, there are several issues. First is the issue that the DBS receiver now has no margin to amplitude variations. The DBS system is designed as a noise limited system rather than an interference limited system. Multipath was not tested due to testing in a flat rural environment. The receiver depends upon the signal margins to compensate for signal degradation due to rain fade. Although DCE suggest that automatic power control may be used to compensate for rain fade, no link budgets were included in the reports to show a true analysis of system performance.

Analysis was performed only for satellite locations at 119W, 61.5W, and 101W. No calculations

A DIVISION OF ECHOSTAR COMMUNICATIONS CORPORATION
90 INVERNESS CIRCLE EAST · ENGLEWOOD, CO 80112
TEL: (303) 790-4445 · FAX: (303) 799-6406

were included for satellite locations at 110W or 148W. These sites also require consideration.

Comments on Engineering Report by Delawder Communications, Inc, Exhibit EE, 3/19/1998:

- Assumption that 49 dBW is the minimum EIRP levels.

A large number of EchoStar systems are customer installed. Pointing error can result in approximately one dB lower power given that the 3 dB beamwidth is approximately 3.5 degrees.

- Assumption that 6.0 dB C/I levels are acceptable degradation levels.

No specific details and/or calculations were furnished resulting in the 6.0 dB levels. This level will result in Bit Error Rates exceeding that required by DVB. Our set top box is DVB compliant to the ETS 300 421 specification.

- Section V. Conclusion states "... should not experience significant interference from the proposed experimental test facility at Austin."

This does not state that DCE will guarantee that no interference will be present. In addition, the term 'significant interference' is unclear as to what constitutes 'significant'.

- Figure 1: Horizontal Gain Pattern of Antenna

This table only calculates gain at a forty-degree elevation. The elevation requirement for EchoStar across the USA varies from nearly 65 degrees in Miami Florida to a low of 10 degrees for Seattle Washington.

- Calculations for Various Satellite Locations

Interference calculations were presented for 119W EchoStar, 101W DirecTV, and 61.5W EchoStar. They were not calculated for 148W EchoStar. Furthermore, an additional satellite location at 110W was also not used in the calculations.

Comments on DCE's Progress Report to FCC dated January 8, 1998:

- FCC moved the testing location from Austin, Texas to Kingsville, Texas.

This site "was chosen to address FCC concerns that the test not interfere with existing DBS customers." Thus, the FCC already expressed a concern about deployment of the Northpoint system.

- "No interference calls were received during these tests."

It is unclear from the report how many DBS subscribers were actually within the affected areas that can experience interference.

- The report cites a DirecTV real world interference example where a terrestrial link passes the DirecTV headquarters at a 48 dBW EIRP. The DirecTV location is "12 degrees off center line to the beam peak" and "does not cause measurable degradation to the overall DBS link C/(N+I)."

It is unclear what the beamwidth of the terrestrial transmit antenna was for this case. In addition, the DirecTV antenna size was not stated. If the DirecTV antenna were a 46 cm and the interferer were 12 degrees off the 46cm main beam, the received signal would have been more than 20 dB lower than the satellite receive level. This scenario does not indicate whether the actual C/(N+I) is good or bad.

- The test method consisted of adjusting the interfering EIRP levels "until the DBS receiver was able to achieve a demodulation lock and a good, no freeze frame, video/audio signal." "... it was determined that the actual C/(N+I) required for demodulation lock and no visually noticeable degradation of the DBS signal was actually just under 5 dB."

The DBS data stream consists of multiple digital video streams. They are interleaved depending upon the encoding rate for each video source. Thus, equal encoding rates will create a composite stream of all channels with equal interleaving on average. On EchoStar, the encoding rates vary for each channel depending upon program content and other factors. Therefore, monitoring for interference on a particular channel will result in C/(N+I) levels different from another channel on the same data stream due to differences in the encoding rates.

- Test conditions were a "very rural environment with almost flat terrain."

The test sites lacking buildings and other structures does not present the added problem of multipath issues. DCE does state that this needs to be tested "in a more urban environment to test for multi-pathing due to reflections." DBS set top box receivers do not typically include amplitude and phase equalizers in the demodulators. In comparison to an MMDS system, the MMDS receivers do include equalizers to compensate for multipathing problems. A DBS receiver is not expected to have multipath problems given the location of the transmitter. Therefore, DBS receivers will have difficulty in maintaining demodulator lock and good audio/video in a multipath environment. In addition, there are much more difficult problems such as 'foliage flutter' as the signal passes through leaves in a tree as it moves due to wind resulting in rapid amplitude fluctuations. Thus, line of sight is a requirement for each receiver location.

- The interfering test signals used with DirecTV and EchoStar were different in frequency.

The downlink frequencies for any DBS provider are defined and publicly available. There is no reason to test different receivers with different frequencies. The test placed an interferer at 12470 MHz for DirecTV and 12460 for EchoStar. These were "near mid-transponder". Given these frequencies it appears they were testing DirecTV set to receive a Left Hand Circular Polarized downlink which is actually centered at 12471.86 MHz. In comparison, the EchoStar receiver was set to receive a Right Hand Circular Polarized downlink, which is actually centered at 12457.28 MHz. Thus, the receivers were tested with differing polarities adding another variable in the comparison of interference levels.

- "Since the DBS modulation is TDMA, an interfering signal in any portion of the transponder will affect all channels on that transponder equally. Thus, if one channel experiences interference, all channels are similarly affected."

This is not true. See explanation above regarding interference and channel encoding rates.

- The terrestrial transmitter used by DCE was set to 8 MHz occupied bandwidth.

The EchoStar system downlinks each signal in a 24 MHz band. Assuming that DCE will maximize usage of the DBS band, why was only one 8 MHz signal used for testing. A more likely scenario is that two or three 8 MHz signals will be in the same bandwidth as the satellite 24 MHz downlink signal. This effectively raises the total interferer power level and therefore reduces the actual C/(N+I) level. For that matter, DCE does not offer a system plan for spectrum usage.

- "This first stage of testing demonstrated that as long as a Carrier-to-Interference ratio of at least 4.8 dB was maintained between the satellite signal and the terrestrial signal ... there would be no perceptible interference into the DirecTV or EchoStar DBS systems."

The test conditions used are not likely to be present should a full system be deployed. In a fully defined system, it is not likely that the terrestrial signals are going to consist of a singular 8 MHz signal. The

terrestrial signals will experience multipath and flutter problems. Finally, the tests did not take into account different encoding rates for different video channels. Refer to ETS 300 421 specification for link budget requirements.

- "Weather is obviously and justifiably a major concern to DBS operators ... one solution is to use an automatic power level control that monitors the RSL of the weakest usable DBS satellite and dynamically adjusts the terrestrial transmitter's output power accordingly."

There are no link budget calculations demonstrating that the terrestrial system will work under all weather conditions. Furthermore, there are no link calculations demonstrating that when the power level is lowered that the link can be maintained.

Comments on the Comsearch DBS Measurement Report dated October 28, 1997:

- The RCA antenna and LNBF was used for all tests.

Although DirecTV and EchoStar antenna and LNBF are similar products, there may exist fine differences that can affect this study. First is the antenna gain pattern and sidelobe performance may be slightly different leading to inconsistencies. The second issue is the F/D ratio of the antenna and the LNBF feedhorn pattern. These also have particular gain patterns and sidelobe performance that can affect the results of the measurements.

- DBS Antenna Pattern Tests.

The RCA antenna was setup at two locations. At site #1, the antenna was fixed at 32 degrees elevation and rotated through 360 degrees of azimuth in 15-degree increments. At site #2, the RCA antenna was adjusted in elevation from 30 to 70 degrees in 5-degree increments.

The increments at each measurement are too large. The beam patterns on a 46-cm antenna has the 3-dB beamwidth at approximately 3.5 degrees. The 10-dB beamwidth is at approximately 5.9 degrees. The first null is approximately 3.7 degrees. Therefore, the pattern tests conducted miss the sidelobes and null points that will make significant difference. For example, the first sidelobe is as high as 17 dB from maximum gain and is approximately 5 degrees off center beam. As stated previously, the elevation of antennas across the USA can vary from 10 to 65 degrees. The tests were not conducted for the lower elevation angles between 10 and 30 degrees.

- At Site #3 and Site #8, interference was reported on the EchoStar system.

This is only noted that interference was observed and is a problem for DBS satellite receivers for DBS terrestrially broadcast signals.

Sincerely,

Paul A. Langer
Manager of RF Engineering

Cc: Mike Dugan, President of EchoStar Technologies Corp.
David Moskowitz, Senior Vice President and General Counsel of EchoStar Communications Corp.
Ed Allwein, Vice President of Engineering of EchoStar Technologies Corp.