FCC Form 442
File No. 1059-EX-CN-2020
AST&Science LLC

Supplemental Interference Analysis

This analysis is provided in response to the FCC request for the provision of AST's proposed strategy to adequately protect the GSO from unacceptable interference caused by the Blue Walker 3 ("BW3") gateway stations.

The BW3 satellite is equipped with a payload which can operate in the 47.2-50.2 GHz and 50.4-51.4 GHz frequency bands. These bands are allocated to the FSS, including, in the 47.2-49.2 GHz portion, feeder links for the BSS in the 40.5-42.5 GHz frequency band. However, there are currently no satellite networks in the GSO notified or in the process of notification for provision of BSS in the 40.5-42.5 GHz frequency band.

Transmissions from the BW3 satellite gateway stations need to ensure protection of GSO satellite networks in accordance with RR 22.2.

AST will conduct testing of the V band gateway feeder links, and engage in nominal TT&C operations, from two fixed earth stations:

1) AST's facility at Midland International Air and Space Port in Midland, TX; and
2) Hawaii Pacific Teleport in Kapolei, HI

at the following locations:

- Midland – 2901 Enterprise Lane, Midland, TX 79706
  Lat: 31°55'49.2033'' North
  Long: 102°12'31.7398'' West
  Ground elevation: 2857.4'

- Kapolei – 91-340 Farrington, Kapolei, HI 96707
  Lat: 21°20'11.418'' North
  Long: 158°5'18.7152'' West
  Ground elevation: 52.49'

For the protection of the V band geostationary orbit FSS satellites, the characteristics of the Jupiter 3 satellite (also called Echostar XXIV) were used for the interference analysis. In accordance with the Schedule S characteristics of Echostar XXIV, the receive peak antenna gain of the 47.2-50.2 GHz and 50.4-51.4 GHz receive beams is 61 dBi, and the peak G/T is 28.8 dB/K, which yields a receive noise temperature of 1660 K. The noise floor of the satellite is therefore -196.4 dB(W/Hz), assumed to be protected if the BW3 gateway transmissions do not increase it by more than 6% (I/N = -12.2 dB).

The maximum power spectral density delivered to the BW3 2.4 m gateway station antennas is -65.2 dB(W/Hz), the peak antenna gain is 59 dBi, and the sidelobe pattern conforms to Rec. ITU-R 580-6.

The worst-case geometry occurs for the non-GSO satellite, the GSO satellite, and the gateway station all at the same longitude (minimum path loss).

a) Analysis for Midland Location

For the Midland gateway (Lat: 31°55'49.2033'' North), the in-line event for the same longitude occurs when BW3 is at 27.54° N, with a path loss to the GSO satellite of 217.8 dB, calculated at 50 GHz.

The in-line interference received by a GSO satellite with the same characteristics of Jupiter 3 at the same longitude would then be equal to:

-65.2 dB(W/Hz) + 59 dBi – 217.8 dB + 61 dBi = -163 dB(W/Hz)

for an I/N of 33.4 dB.

For BW3 at the lower latitude of 26.87°N, however, the Midland gateway off-axis angle toward the GSO is 4.24°, and the off-axis gain is 13.3 dBi. As a result, the interference received by the GSO satellite will be equal to:

-65.2 dB(W/Hz) + 13.3 dBi – 217.8 dB + 61 dBi = -208.7 dB(W/Hz)

For an I/N of -12.3 dB.

On the other hand, if BW3 at the higher latitude of 28.15°N, the Midland gateway off-axis angle toward the GSO is 4.22°, and the off-axis gain is 13.4 dBi. As a result, the interference received by the GSO satellite will be equal to:

-65.2 dB(W/Hz) + 13.4 dBi – 217.8 dB + 61 dBi = -208.6 dB(W/Hz)

For an I/N of -12.2 dB.

The gateway antenna pointing accuracy is better than 0.025 degrees RMS (Auto track Option), but in order to allow for some margin, the Midland gateway will cease transmissions to BW3 whenever the satellite is within the 26.85°N to 28.17°N latitude range (0.1° margin applied to the gateway elevation angle toward BW3).

b) Analysis for Kapolei Location

For the Kapolei gateway (21°20'11.418'' North), the in-line event for same longitude occurs when BW3 is at 18.59° N, with a path loss to the GSO satellite of 217.6 dB, calculated at 50 GHz.

The interference received by a GSO satellite with the same characteristics of Jupiter 3 at the same longitude would then be equal to:

-65.2 dB(W/Hz) + 59 dBi – 217.6 dB + 61 dBi = -162.8 dB(W/Hz)

for an I/N of 33.6 dB.

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For BW3 at the lower latitude of 18.05°N, however, the Kapolei gateway off-axis angle toward the GSO is 4.27°, and the off-axis gain is 13.2 dBi. As a result, the interference received by the GSO satellite will be equal to:

-65.2 dB(W/Hz) + 13.2 dBi – 217.6 dB + 61 dBi = -208.6 dB(W/Hz)

For an I/N of -12.2 dB.

On the other hand, if BW3 at the higher latitude of 19.10°N, the Kapolei gateway off-axis angle toward the GSO is 4.27°, and the off-axis gain is 13.2 dBi. As a result, the interference received by the GSO satellite will be equal to:

-65.2 dB(W/Hz) + 13.2 dBi – 217.6 dB + 61 dBi = -208.6 dB(W/Hz)

For a I/N of -12.2 dB.

The gateway antenna pointing accuracy is better than 0.025 degrees RMS (Auto track Option), but in order to allow for some margin, the Kapolei gateway will cease transmissions to BW3 whenever the satellite is within the 18.03°N to 19.12°N latitude range (0.1° margin applied to the gateway elevation angle toward BW3).

In conclusion, AST's V-band gateway stations in Midland and Kapolei will protect the V band geostationary orbit FSS satellites by ceasing transmissions to BW3 whenever BW3 is within the latitude range as shown in the above analysis respectively.

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I HEREBY CERTIFY THAT I AM THE TECHNICALLY QUALIFIED PERSON RESPONSIBLE FOR THE PREPARATION OF THIS SUPPLEMENTAL INTERFERENCE ANALYSIS, AND THAT IT IS COMPLETE AND CORRECT TO THE BEST OF MY KNOWLEDGE AND BELIEF.

BY:____________________

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