

From: Laura Stefani

To: Nimesh Sangani

Date: May 19, 2021

Subject: Additional Information Request

Message:

Response to April 19, 2021 Inquiry

1) The attached copy of the Papua New Guinea ("PNG") license only showed the grant for the 617-960 MHz and 1710-2200 MHz bands. Please provide an updated PNG license to include the proposed frequency bands 400.15-401 MHz, 437-438 MHz, 47.2-50.2 GHz and 50.4-51.4 GHz had been granted, and to include BW3 satellite that will orbit between 500 km and 600 km above the earth.

RESPONSE: AST has submitted an updated license from PNG to ensure clarity. However, the previous license indicated "other LTE bands as needed," and the ITU filings cover all frequencies requested for the BW3.

2) Please provide the ITU link and the name of PNG ITU filing that registered the uplink and downlink frequency bands (400.15-401 MHz, 437-438 MHz, 788-798 MHz, 845-846.5 MHz, 846.5-849 MHz, 47.2-50.2 GHz and 50.4-51.4 GHz) for the BW3 satellite.

RESPONSE: As noted on pg. 10 of the exhibit titled "Technical Annex," the BW3 is under the ITU filing name "MICRONSAT."

The link to all MICRONSAT filings is:

https://www.itu.int/net/ITU-R/space/snl/bresult/radvance.asp?q_sns_id=&sel_satname=MICRONSAT&ftexte=&sel_esname=none&ktexte=&sel_adm=all&sel_org=all&sel_ific=&sel_year=&sel_date_from=&sel_date_to=&sel_rcpt_from=&sel_rcpt_to=&sel_gso=gso&sel_gso=ngso&sel_orbit_from=&sel_orbit_to=

The link to the Notified filing with the Q/V bands is:

https://www.itu.int/online/sns/nongeo.sh?sat_type=N&ie=y&ntc_id=119500299&categ=N

3) Please provide an updated agreement from AT&T to include the proposed frequency bands 788-798 MHz and 845-849 MHz bands.

RESPONSE: The frequency band 788-798 MHz is held by FirstNet, not AT&T, and therefore FirstNet must provide permission for its use. It is AST's understanding that FirstNet has providing the Commission with an affirmation of its agreement for AST to test on this band, via email.

The attachment "Frequency Use Agreement" provides AT&T's agreement to use relevant frequencies in the 845-849 MHz bands. (See footnote 1 of that document, indicating by license call sign the frequencies for AST's use.)

4) Please provide the number of 2.4m antennas located at Midland, TX and Kapolei, HI. Please provide the number of handsets to be used for the tests.

RESPONSE: As noted in AST's application Form 442, under "Manufacture," AST seeks authority to use two 2.4 m antennas and up to 20 handsets. AST will use one 2.4m antenna at each requested fixed location (Midland and Kapolei). AST may use up to 20 handsets at each requested mobile, though most likely will use only 3-4 handsets at each mobile location.

5) Please note in RESOLUTION 122 (REV.WRC-19), ITU stated that FSS satellite networks with earth

station antenna diameters of 2.5 meters or larger operating as a gateway-type station are capable of sharing with HAPS ground stations. Please address the proposed 2.4m antenna is capable to share with HAPS ground stations or consider to change the size of 2.4m antenna

RESPONSE: AST is confused by this query, as:

- a) The mention of a 2.5 m gateway antenna in Resolution 122 (WRC-19) occurs in a recognizing manner and is not a mandatory requirement, as the WRC-19 agenda item that led to the identification of the 47.2-47.5 GHz and 47.9-48.2 GHz frequency ranges for use by HAPS did not call for protection of HAPS from the FSS;
 - b) There is no US requirement, either in the US Table of Frequency allocations or in the Part 25 rules, to protect HAPS from FSS transmissions in the 47.2-47.5 GHz and 47.9-48.2 GHz frequency ranges;
 - c) Interference potential is not a function of antenna diameter alone, but of a combination of power density delivered to the antenna, antenna gain and sidelobe pattern. A mere reference to antenna diameter does not define the level of protection that could be afforded to HAPS;
 - d) There were no technical studies carried out during the study cycle prior to WRC-19 involving protection of HAPS from the FSS in the 47.2-47.5 GHz and 47.9-48.2 GHz frequency ranges, and therefore there are no technical characteristics of HAPS available for the determination of the required protection or reference to compare with; and
 - e) Notwithstanding the above, the difference in power density levels to operate with a 2.5 m gateway antenna verses a 2.4 m gateway antenna is at most 0.4 dB, which is negligible.
- 6) Please provide the antenna patterns/performance and/or manufacture specification/certification of the 2.4m antenna operating in the 400.15-401 MHz, 437-438 MHz, 788-798 MHz, 845-846.5 MHz, 846.5-849 MHz, 47.2-50.2 GHz and 50.4-51.4 GHz bands.

RESPONSE: As explained in AST's Legal Narrative, AST will only operate the 2.4 m antennas in the requested V bands (47.2-50.2 GHz and 50.4-51.4 GHz). Additionally, AST will operate a second antenna from the Midland, TX location in 437-438 MHz. AST will not need to use the 400.15-401 MHz frequency, and has removed that from the Form 442.

As indicated in AST's Form 442, under "Manufacturer," the V band antennas are manufactured by Comtech and the model number is "2.4 X/Y." The 437-438 MHz antenna is manufactured by Sirio and the model number is WY 400-10N.

Antenna patterns for both fixed antennas are provide in the exhibit titled "Antenna Patterns (fixed stations)."

- 7) Please provide the maximum height of antenna (in meter) above the ground (AGL) and AMSL.

RESPONSE: Both the V band (Comtech) and 400 MHz (Sirio) antenna types will be operated from ground level. The AMSL/ground elevation above sea level is provided on p. 2 of the Legal Narrative (2857.4' at Midland and 52.49' at Kapolei).

- 8) Please provide a radiation hazard analysis of the gateway 2.4m antenna.

RESPONSE: AST has filed an exhibit with this analysis.

- 9) Please provide the name and number of handsets for operations in the 788-798 MHz, 845-846.5 MHz, 846.5-849 MHz. Please confirm that the handsets already approved by the FCC and the SAR level transmitted from the handsets was reviewed and approved by the FCC. If the handsets had not been approved by FCC, please provide a radiation hazard analyses for of the handsets.

RESPONSE: As noted in Form 422, and in the attachment titled "Legal Narrative," AST will use up to 20 off-the-shelf GSM handsets for its testing, which means that the handsets will not be experimental but will be already tested and approved by the FCC. Therefore, a radiation hazard analysis

for the handsets is not necessary.

10) Do all the users equipment route through the terrestrial networks before they transmit directly to BW3 satellite? Or do all the users equipment route through the terrestrial networks before they transmit to BW3 satellite via gateway station? If so, please address and provide an updated Figure 2.

RESPONSE: The user equipment will communicate directly to the BW3 satellite, which will relay to the gateway stations. The BW3 is a phased array with enough gain to receive from standard handsets, which is how the handsets can transmit directly to the satellite. The gateway station will be connected to an MNO's network for data and voice calls. Figure 2 correctly shows the configuration.

11) Please amend the power 28.2W (ERP) to 1.22W (ERP) /3 dBW EIRP (2W & 0dBi from Schedule S) for emission 30K0FXD in the 400.15-401 MHz and 437-438 MHz bands.

RESPONSE: The 28.2W ERP power level is correct, as it reflects the transmissions from the ground station to the satellite for emission 30K0FXD in the 400 MHz bands. The 2W & 0 dBi is from the satellite to the fixed earth station for emission 30K0FXD in the 400 MHz band for TT&C. The satellite antenna for 400 MHz transmissions is omnidirectional; hence, it has a gain of 0 dBi.

12) Please amend the power 0.12W (ERP) to 485.2W (ERP) /29.01 dBW EIRP (0.2W & 36dBi from Schedule S) for emission 180KDxD in the 788-798 MHz and 845-849 MHz bands. Please consider to choose a different handset with much lower antenna gain and power or change to different frequency bands.

RESPONSE: There's a confusion here between the satellite power and the handset power. We clarified in the Legal Narrative (pg. 4) that the power from a handset to the satellite in one beam will be 0.12 W. We also noted that, while the total downlink power (maximum aggregated EIRP) from the satellite is 130572.6 W, that does not represent the downlink power level that will be used during testing to one handset. Also, as noted, AST will test with off-the-shelf handsets already authorized by the FCC. Therefore, the handset power levels are allowable under the FCC's rules and should not be of concern. The stated 36 dBi gain is correct, as the satellite has a phased array antenna with 7.7m x 9m aperture size, and so can achieve such an unusually high gain in the 788-798 MHz and 845-849 MHz bands.

13) Please amend the power 97.7kW (ERP) to 64863W (ERP) /50.27 dBW EIRP (3W & 45.5 dBi Schedule S) for emission 10M0DxD in the 47.2-50.2 GHz and 50.4-51.4 GHz.

RESPONSE: The requested power for this emission in these bands is correct, as it is the power from the earth station. For downlink from the satellite, the 45.1 dBi (as stated in Schedule S) is the satellite gateway beam antenna gain. As explained in the Legal Narrative (pg. 3), the Schedule S information represents the total maximum capacity of the satellite, supporting multiple channels, which is different from the power levels requested in the application to support one channel.

14) Please address the allocation and co-share bands (47.2-50.2 GHz and 50.4-51.4 GHz.) in the US Table of Section 2.106 of Commission's rules. Please provide interference analyses on how the proposed NGSO operations (EIRP and EIRP density of emissions for both an individual and aggregate) transmitting from 2.4m antenna(s) on ground to NGSO BW3 satellite would not cause harmful interference into GSO FSS & BSS operating in the 47.2-50.2 GHz and 50.4-51.4 GHz.

RESPONSE: AST has attached an exhibit that provides the requested interference analysis.