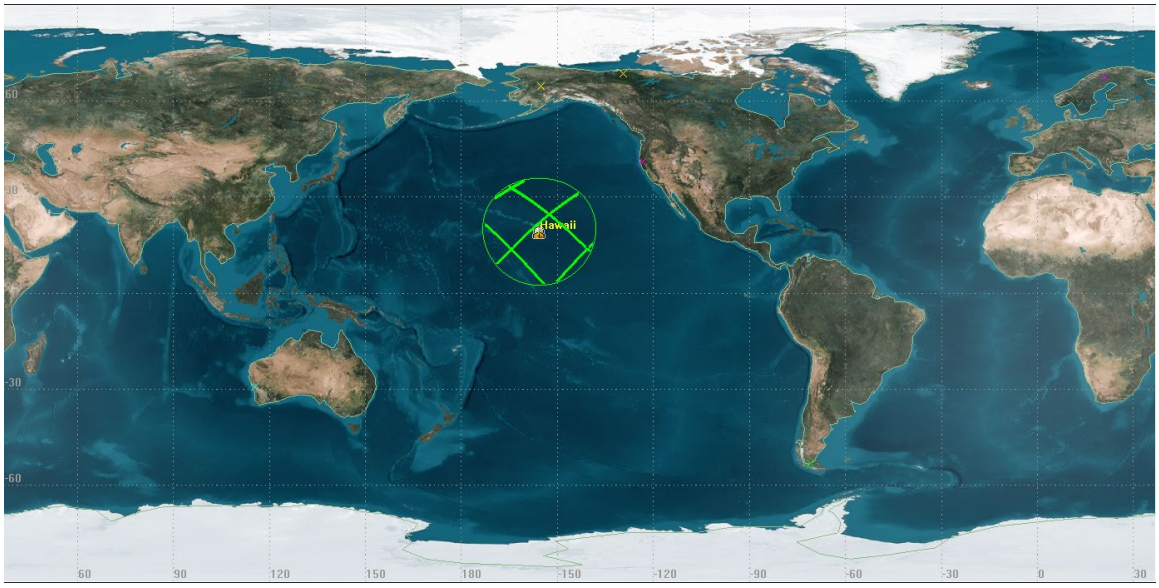
Test support of Rocketlab Pathstone pre-Lunar mission bus validation from USN's Hawaii ground station

Pathstone is a satellite bus to be validated before the Lunar Capstone mission to be launched in Q3-2021. The Rocket Lab vehicle containing Pathstone launched 6 satellites one of which was a US Army test spacecraft. Pathstone is the upperstage of the RocketLab vehicle that contains the bus to be tested and validated. The vehicle was launched from the Mahia, New Zealand launch facility on March 22nd, 2021 at 22:57:00 UTC. USN will support this LEO test mission starting on May 1st for the pre-Lunar mission validation. USN is requesting a 60 day STA for this validation.

The spacecraft may be contacted once each day over Hawaii several times each week during the STA period. This orbit allows a nominal 4+ visibilities over the USN Hawaii station every day. The passes for May 1, 2021 are shown below for example.



Pathstone nominal coverage for a typical day at USN Hawaii

	Downlink	Uplink
Pathstone	2272.500 MHz	2092.593 MHz

Pathstone
1 99999U 18123A 21082.03761418 .00040058 00000-0 10524-2 0 00002
2 99999 045.0100 109.3123 0006385 265.1812 045.3282 15.37402629000017

Pathstone potential passes for May 1, 2021

Access	Start Time (UTCG)	Stop Time (UTCG)
1	1 May 2021 12:16:23	1 May 2021 12:20:47
2	1 May 2021 13:51:44	1 May 2021 14:00:34
3	1 May 2021 15:33:11	1 May 2021 15:35:47
4	1 May 2021 22:08:50	1 May 2021 22:17:05
5	1 May 2021 23:47:09	1 May 2021 23:54:11

Flux Density impinging on the ground in Hawaii from Pathstone

The Flux density is calculated as:

$$\boldsymbol{Flux\ density = EIRP \div (4\,\pi\, Rse^2)}$$

Where $\boldsymbol{Rse}$ is the distance from spacecraft to the ground?
Where $\boldsymbol{EIRP}$ is the Effective Isotropic Radiated Power of the spacecraft?

Data from the spacecraft vendor indicates that the nominal EIRP of the Pathstone spacecraft is -2.10 dBW. Being a near circular orbit, the altitude (and thus the closest distance to earth during an overhead pass) is = 550 Km.

Converting -2.10 dBW to scalar watts = 0.616 watts transmitted at 2272.7 MHz

Therefor:

$$\boldsymbol{Flux\ density = 0.616 \div (4\,\pi * 450{,}000\ meters^2)}$$

Flux density = 1.620 x 10^{-13} Watts/meter^2
Or
Flux density = 1.620 x 10^{-14} mW/cm^2

Exhibit C
PETITION FOR WAIVER OF SECTION 25.137 AND 25.114 AND OF THE U.S. TABLE OF FREQUENCY ALLOCATIONS

I. TO THE EXTENT THEY APPLY, GOOD CAUSE EXISTS FOR A WAIVER OF CERTAIN PORTIONS OF SECTIONS 25.137 AND 25.114

Universal Space Network, Inc. (USN) is provided limited legal and technical information for the PATHSTONE satellite bus.[1] Pursuant to Section 25.137 of the Federal Communications Commission's ("Commission" or "FCC") rules, the same technical information required by Section 25.114 for U.S.-licensed space station, and certain legal information, must be submitted by earth station applicants "requesting authority to operate with a non-U.S. licensed space station to serve the United States…"[2] USN seeks authority to support the needed Telemetry, Tracking, and Control ("TT&C") during testing and validation of the PATHSTONE spacecraft bus in LEO orbit , not commercial service to the United States, and thus believes that Section 25.137 does not apply.

To the extent the Commission determines, however, that USN's request for authority to provide testing on a special temporary basis is a request to serve the United States with a non-U.S-licensed satellite, USN respectfully requests a waiver of Sections 25.137 and 25.114 of the Commission's rules, to the extent that USN has not herein provided the information required by these rules. [3] The Commission may grant a waiver for good cause shown.[4] A waiver is therefore appropriate if special circumstances warrant a deviation from the general rule, and such a deviation will serve the public interest.

In this case, good cause for a waiver of portions of Section 25.114 exists. USN seeks authority only to conduct testing support for PATHSTONE. Thus, any information sought by Section 25.114 that is not relevant to the testing – e.g., antenna patterns, energy and propulsion and orbital debris - USN does not have. In addition, USN would not easily be able to obtain such information because USN is not the operator of the PATHSTONE satellite, nor is USN in contractual privity with that operator. Rather, USN has contracted with Swedish Space Corporation, Solona Sweden (SSC) to support the bus testing portion in S-Band of the satellite prior to its validation for future lunar missions.

As evidenced by the Comsearch report attached to this request, USN has coordinated the testing of the PATHSTONE satellites with potentially affected terrestrial operators. Moreover, as with any STA, USN will conduct the testing on an unprotected, non-interference basis to government operations.

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[1] FCC Form 312 Section B

[2] 47 C.F.R. § 25.137(a)

[3] 47 C.F.R. §§25.137 and 25.114

[4] 47 C.F.R. §1.3

Because it is not relevant to the service for which USN seeks authorization, and because obtaining the information would be a hardship, USN seeks a waiver of all the technical and legal information required by Section 25.114, to the extent it is not provided herein. As noted above, USN has provided the required information to the extent that it is relevant to the testing service for which USN seeks authorization.

Good cause also exists to waive portions of Section 25.137, to the extent the information required is not herein provided. Section 25.137 is designed to ensure that "U.S.-licensed satellite systems have effective competitive opportunities to provide analogous services" in other countries. Here, there is no service being provided by the satellite; USN is providing TT&C bus testing validation. Thus, the purpose of the information required by Section 25.137 is not implicated here. For example, Section 25.137(d) requires earth station applicants requesting authority to operate with a non-U.S.-licensed space station that is not in orbit and operating to post a bond. [5] The underlying purpose in having to post a bond – i.e., to prevent warehousing of orbital locations by operators seeking to serve the United States – would not be served by requiring USN to post a bond in order to conduct 60 days of bus testing support of the PATHSTONE satellite.

It is USN's understanding that PATHSTONE is licensed by New Zealand. PATHSTONE is a test mission for future lunar missions. Thus, the purpose of Section 25.137 – to ensure that U.S. satellite operators enjoy "effective competitive opportunities" to serve foreign markets and to prevent warehousing of orbital locations service the United States – will not be undermined by grant of this waiver request.

Finally, USN notes that it expects to communicate with the PATHSTONE satellite using its U.S. earth station for a period of 60 days. Requiring USN to obtain technical and legal information from an unrelated party, where there is no risk of interference and the operation will cease within 60 days would pose undue hardship without serving underlying policy objectives. Given these particular facts, the waiver sought herein is appropriate.

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[5] 47 C.F.R. §25.137(d)(4)

II. GOOD CAUSE EXISTS FOR A WAIVER OF THE UNITED STATES TABLE OF FREQUENCY ALLOCATIONS

USN further requests a waiver of the United States Table of Frequency Allocations ("U.S. Table") as described in section 2.106 of the rules for the frequency bands 2025 – 2110 MHz (Earth-to-Space) and 2200 – 2290 MHz (Space-to-Earth).[6] Section footnotes allow for non-federal Government use of these bands in the United States on a case-by-case non-interference basis. Such use by USN necessitates a waiver of the U.S. Table.

Good cause exists to grant USN a limited waiver of the U.S. Table to allow testing of the PATHSTONE satellite. In considering request for case-by-case spectrum uses, the Commission has indicated that is would generally grant such waivers "where there is little potential for interference into any service authorized under the Table of Frequency Allocations and when the case-by-case operator accepts any interference from authorized services." [7] USN will coordinate with other parties operating communication systems in compliance with the Table of Frequency Allocations to ensure that no harmful interference is caused. USN seeks to operate only pursuant to special temporary authorization and thus agrees to accept any interference from authorized services. In summary, USN's operation on a non-interference, non-protected basis support waiver of the U.S. Table.

[6] 47 C.F.R. §2.106

[7] Previously approved STA's for Universal Space Network SES-STA-20020725-01174; SES-STA-20021112-02008; SES-STA-20040315-00475