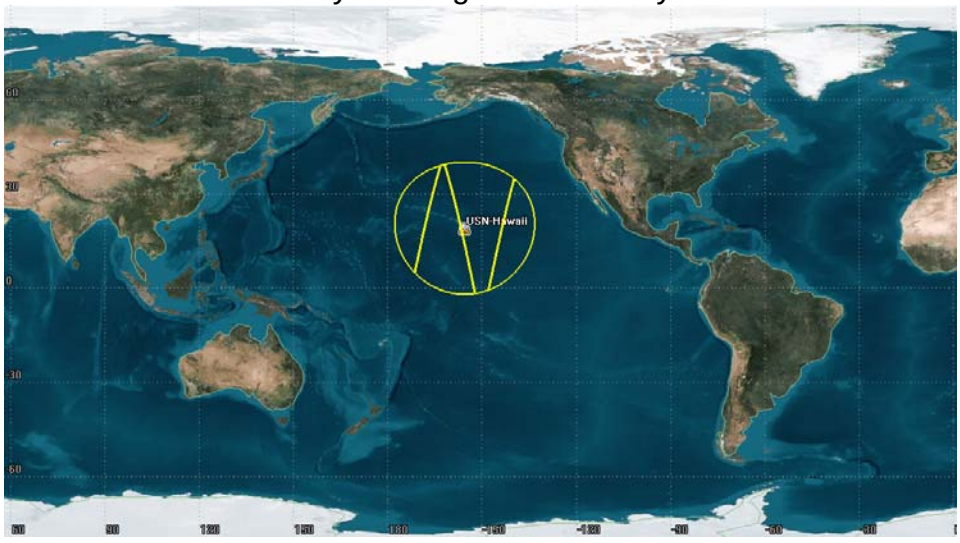
Test qualification support for the KARI GK-2A LEOP using the KARI KOMPSAT-2 spacecraft from USN's Hawaii ground station

KARI (Korean Aerospace Research Institute) in South Korea will launch 2 geosynchronous spacecraft (GK-2A and GK-2B) in late 2018 and early 2019 for communications and meteorology support. USN will support both launches in the LEOP phase to final orbit parking. KARI desires some tracking qualification testing before the missions launch. KARI has requested that USN conduct a tracking and telemetry campaign using their on orbit KOMPSAT-2 (aka Arirang-2) spacecraft. This test will consist of a maximum of 7 days spread out in the month of September 2018.

The KOMPSAT-2 spacecraft is an NGSO with inclination of 98.1 degrees. USN will conduct receive only tracking and telemetry on 2209.68 MHz.



KOMPSAT-2 view from Hawaii

The spacecraft orbits the earth approximately 14 times each day and is visible for a nominal 10 minute pass in Hawaii 3 times per day. The first day of September is shown below, which is typical of the nominal pass times for the month.

KOMPSAT-2
1 29268U 06031A 18186.29406449 .00000044 00000-0 17896-4 0 9992
2 29268 98.0661 82.3364 0016633 240.2998 119.6539 14.62363471636981

Access	Start Time (UTCG)	Stop Time (UTCG)
1	1 Sep 2018 08:15:47	1 Sep 2018 08:25:34
2	1 Sep 2018 09:53:09	1 Sep 2018 10:02:35
3	1 Sep 2018 20:44:04	1 Sep 2018 20:55:16

Flux Density impinging on the ground in Hawaii from KOMPSAT-2

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 Kompsat-2 spacecraft is -2.2 dBW. Being a low earth orbit satellite in a circular orbit with altitude of 692 Km, its closest point to the USN Hawaii earth station is = 692 Km.

Converting -2.2 dBW to scalar watts = 0.602 watts transmitted at 2209.68 MHz

Therefor:

$$\boldsymbol{Flux\ density = 0.602 \div (4\pi * 692{,}000\ meters^2)}$$

Flux density = 1.001 x 10^{-13} Watts/meter^2
Or
Flux density = 1.001 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 (USN) is provided limited legal and technical information for the KARI KOMPSAT-2 spacecraft.[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 this pre-LEOP Telemetry and Tracking for test qualification in preparation for upcoming launches of the KARI GK-2A and GK-2B spacecraft LEOP supports, 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 pre-LEOP 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 pre-LEOP test support using KARI KOMPSAT-2. Thus, any information sought by Section 25.114 that is not relevant to the pre-LEOP – 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 KOMPSAT-2 satellite, nor is USN in contractual privity with that operator. Rather, USN has contracted with Swedish Space Corporation, Solona Sweden (SSC) to support the testing (pre-LEOP) portion in S-Band of the satellite prior to launch of follow on satellites.

No uplink transmission will be conducted from Hawaii to KOMPSAT-2 and as such no Comsearch report will be provided. Moreover, as with any STA, USN will conduct the pre-LEOP 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 pre-LEOP 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 Telemetry and Tracking to qualify for the future launches. 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 7 days of pre-LEOP testing with the KOMPSAT-2 satellite.

It is USN's understanding that KOMPSAT-2 is licensed by the Republic of South Korea (Korean Aerospace Research Institute). KOMPSAT-2 is a communication and meteorological spacecraft. The spacecraft is primarily meant to serve the South Korean peninsula. 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 KOMPSAT-2 satellite using its U.S. earth station for a period of two (2) 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 7 days (spread out during the month of September 2018) 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 pre-LEOP testing of the KOMPSAT-2 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.

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[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