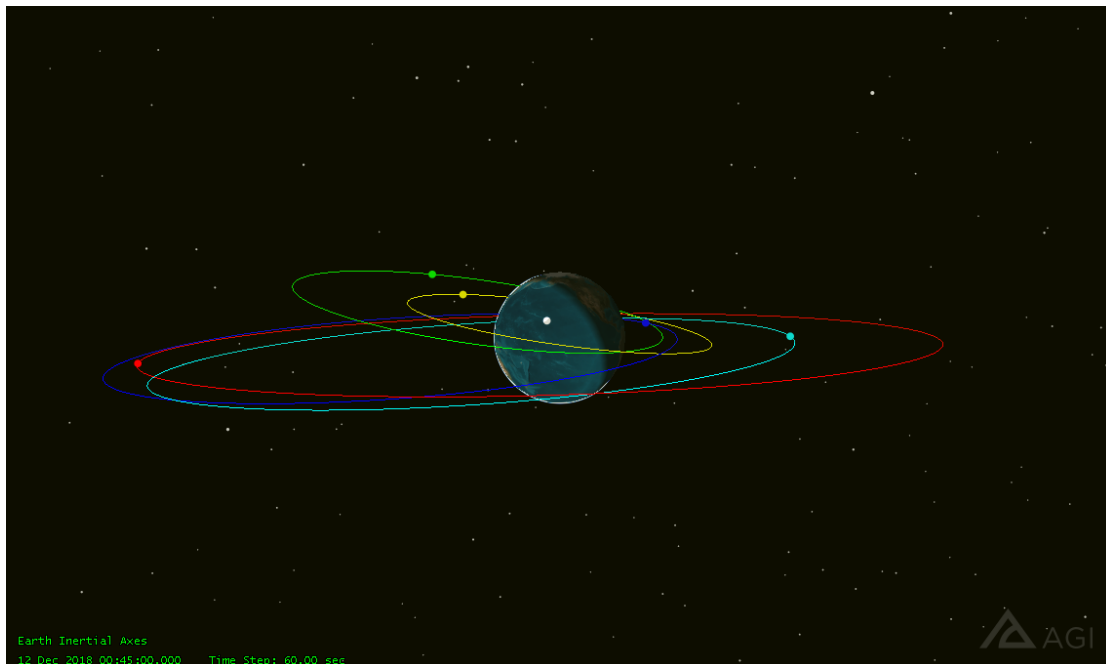


Launch and Early Orbit (LEOP) support for the KARI Geo-Kompsat-2B spacecraft from USN's Hawaiian ground station

KARI (Korean Aerospace Research Institute) in South Korea will launch the second in a series of 2 geosynchronous spacecraft Geo-Kompsat 2A and 2B (aka GK-2A and GK-2B). GK-2A was successfully launched in 2018 for communications and meteorology support. USN will support the second launch as it did the first in the LEOP phase to final orbit parking over South Korea. GK-2B is scheduled to launch on February 18th at 22:14:00 GMT on an Ariane launch vehicle from Kourou in French Guiana. The LEOP support from Hawaii will be conducted for a maximum period of 5 days.



GK-2B showing 5 orbital maneuver burns

The spacecraft is directly injected into a near circular inclined orbit then raised using highly elliptical orbits with apogee near GEO altitude with visible passes from 45 minutes to 8 hours long. In the following 5 days five orbital maneuvers are conducted to circularize the orbit and park the spacecraft over South Korea. Maneuver #5 and post burn satellite position are no longer visible from Hawaii. All possible visibilities are shown for each maneuver below, but note that all visibilities will not be supported.

Initial injection orbit

GEO-KOMPSAT-2B-inj

1 99919U 19777A 20049.95486111 .00000000 00000-0 00000-0 0 00001
2 99919 006.0313 305.0441 7274338 178.0835 017.0751 02.27768859000011

Access	Start Time (UTCG)	Stop Time (UTCG)
1	19 Feb 2020 20:16:40	20 Feb 2020 01:10:00*

*Note that the spacecraft is visible from Hawaii during the maneuver #1 burn and continues into pass #2

Post Maneuver #1 orbit

GEO-KOMPSAT-2B-post1

1 99919U 19777A 20051.04861111 .00000000 00000-0 00000-0 0 00001
2 99919 005.4184 304.6388 6990791 178.7950 194.7869 02.22556952000047

Access	Start Time (UTCG)	Stop Time (UTCG)
2	20 Feb 2020 01:10:00	20 Feb 2020 02:57:08
3	20 Feb 2020 05:11:26	20 Feb 2020 06:03:20
4	20 Feb 2020 17:20:58	20 Feb 2020 22:50:00*

*Note that the spacecraft is visible from Hawaii during the maneuver #2 burn and continues into pass #5

Post Maneuver #2 orbit

GEO-KOMPSAT-2B-post2

1 99919U 19777A 20051.95138889 .00000000 00000-0 00000-0 0 00000
2 99919 003.6748 304.1946 5875791 179.4394 196.1468 02.01063417000068

Access	Start Time (UTCG)	Stop Time (UTCG)
5	20 Feb 2020 22:50:00	21 Feb 2020 04:08:16
6	21 Feb 2020 16:46:57	21 Feb 2020 22:45:00*

*Note that the spacecraft is visible from Hawaii during the maneuver #3 burn and continues into pass #7

Post Maneuver #3 orbit

GEO-KOMPSAT-2B-post3

1 99919U 19777A 20052.94791667 .00000000 00000-0 00000-0 0 00009
2 99919 002.0396 303.6680 4141614 180.0420 194.5492 01.69058357000087

Access	Start Time (UTCG)	Stop Time (UTCG)
7	21 Feb 2020 22:45:00	22 Feb 2020 05:32:22
8	23 Feb 2020 08:34:54	23 Feb 2020 17:20:00*

*Note that the spacecraft is visible from Hawaii during the maneuver #4 burn and continues into pass #9

Post Maneuver #4 orbit

GEO-KOMPSAT-2B-post4

1 99919U 19777A 20054.72222222 .00000000 00000-0 00000-0 0 00003
2 99919 000.6515 301.9679 1618764 181.7931 190.6820 01.25880604000116

Access	Start Time (UTCG)	Stop Time (UTCG)
1	23 Feb 2020 17:20:00	24 Feb 2020 00:33:45

End of mission and visibility from Hawaii

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

The Flux density is calculated as:

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

Where ***Rse*** is the distance from spacecraft to the ground?

Where ***EIRP*** is the Effective Isotropic Radiated Power of the spacecraft?

Data from the spacecraft vendor indicates that the nominal EIRP of GK-2B spacecraft is -4.0 dBW. Due to the highly elliptical orbit the spacecraft will pass near Hawaii at an altitude of 400 Km during the perigee of pass #3 shown above and thus the maximum flux density will be received during that pass. The smallest slant range to USN Hawaii is = 450 Km.

Converting -4.0 dBW to scalar watts = 0.398 watts transmitted at 2283.2 MHz

Therefore:

$$\text{Flux density} = 0.398 \div (4 \pi * 450,000 \text{ meters}^2)$$

Flux density = 1.564×10^{-13} Watts/meter²

Or

Flux density = 1.564×10^{-14} mW/cm²

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 Geo-Kompsat-2B (GK-2B), meteorological and communications Satellite.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 the LEOP orbit raising support of the Geo-Kompsat-2B (GK-2B) spacecraft from launch to geosynchronous parking 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 LEOP orbit raising 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 LEOP orbit raising support for Geo-Kompsat-2B (GK-2B). Thus, any information sought by Section 25.114 that is not relevant to the 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 Geo-Kompsat-2B (GK-2B) satellites, nor is USN in contractual privity with that operator. Rather, USN has contracted with Swedish Space Corporation, Solona Sweden (SSC) to support the orbit raising LEOP portion in S-Band of the satellite prior to its operation.

As evidenced by the Comsearch report attached to this request, USN has coordinated the LEOP of the Geo-Kompsat-2B (GK-2B) satellites with potentially affected terrestrial operators. Moreover, as with any STA, USN will conduct the LEOP on an unprotected, non-interference basis to government operations.

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 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 TT&C while the satellite is on the way to its operational orbit. 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 5 days of LEOP support of the Geo-Kompsat-2B (GK-2B) satellites.

It is USN’s understanding that Geo-Kompsat-2B (GK-2B) is licensed by KARI (Korean Aerospace Research Institute). Geo-Kompsat-2B (GK-2B) is the first of two meteorological and communications spacecraft series to support South Korea. 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 Geo-Kompsat-2B (GK-2B) satellite using its U.S. earth station for a period of 5 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 5 days would pose undue hardship without serving underlying policy objectives. Given these particular facts, the waiver sought herein is appropriate.

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 LEOP of the Geo-Kompsat-2B (GK-2B) satellites. In considering request for case-by-case spectrum uses, the Commission has indicated that it 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