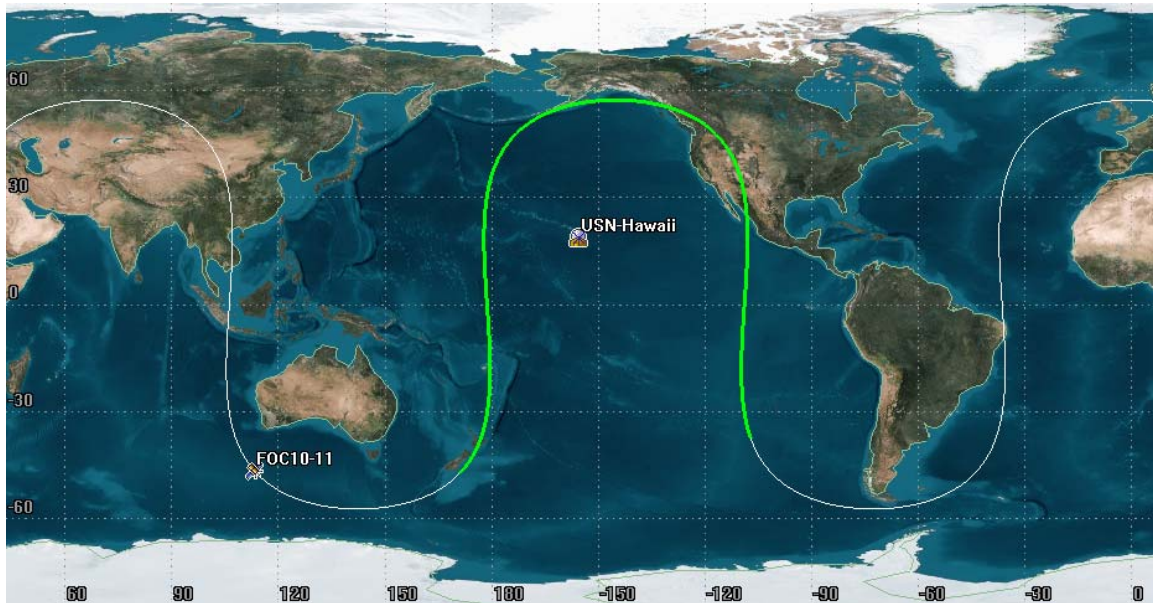


Orbit Raising support of Galileo Constellation Launch Flight #10 (GSAT219, GSAT220, GSAT221, and GSAT222 vehicles) from USN's Hawaii ground station

Galileo Flight #10 will place the 20th to 23rd spacecraft of the "Full Operational Capability" in their operational orbit of the Galileo navigation constellation for the EU. The launch consisted of 4 spacecraft occurred on July 25th, 2018 from French Guiana on an Ariane 5 ES vehicle. USN has been contracted to support the Galileo spacecraft orbital maneuvering and spacing campaign for a period of 27 days.

The spacecraft(s) are a Medium Earth Orbiting (MEO) spacecraft in a high mid-latitude orbit (56 degrees) with a near circular orbit of altitude of 23400 Km. This orbit allows a nominal 1 visibility over the USN Hawaii station every day. Each spacecraft contact is on the order of 1 to 16 hours.



GSAT219, GSAT220, GSAT221, and GSAT222 nominal orbit and Hawaii coverage

The spacecraft's will be supported approximately 9 weeks after launch to maneuver them into their proper operational orbital spacing. GSAT219 and GSAT220 will be maneuvered from Sept 23rd – Oct 1st, 2018 and GSAT221 and GSAT222 will be maneuvered from Oct 11th – Oct 19th, 2018. USN is not scheduled to support any of these spacecraft's from August 13th – Sept 22nd, 2018, but could be called to support for anomalies and schedule conflicts with other ground station resources. The below analysis covers all possible visibilities from USN Hawaii, but not all visibilities will be supported.

Spacecraft on orbit

At the beginning of the orbit raising campaign the spacecraft's have all been sitting in a preliminary orbit for about 6 weeks. This campaign is required to raise and space each spacecraft to its operational position. Three maneuvers will be conducted on each of the four spacecraft. Post maneuver TLE's and maximum visibilities are shown below for each event and each spacecraft.

	Downlink	Uplink
GSAT219	2215.818 MHz	2040.399 MHz
GSAT220	2234.232 MHz	2057.355 MHz
GSAT221	2228.094 MHz	2051.703 MHz
GSAT222	2221.956 MHz	2046.051 MHz

GSAT219-initial orbit

1 98986 18999A 18212.96480324 +.00000000 +00000-9 +75466-3 2 00001
2 98986 056.3292 059.9608 0001945 266.0683 274.0436 01.70316318000002

GSAT220-initial orbit

1 98987 18999B 18213.52946759 +.00000000 +00000-9 +75212-3 2 00003
2 98987 056.3291 059.9409 0005096 224.1404 315.9874 01.71380135000008

GSAT221-initial orbit

1 98988 18999C 18217.50067130 +.00000000 +00000-9 +74945-3 2 00005
2 98988 056.3298 059.8284 0004604 344.2200 163.0335 01.72627025000005

GSAT222-initial orbit

1 98989 18999D 18216.92939815 +.00000000 +00000-9 +75065-3 2 00003
2 98989 056.3401 059.8469 0003734 306.1072 201.1709 01.72122446000000

GSAT219 Initial Orbit Checkout pass

Access	Start Time (UTCG)	Stop Time (UTCG)
-----	-----	-----
1	23 Sep 2018 20:00:00	24 Sep 2018 01:36:07

GSAT219 Maneuvers and possible support times pass # 2 - 8

GSAT219-V1

1 98986 18999A 18267.11799769 +.00000000 +00000-9 +75502-3 2 00005
2 98986 056.3714 058.4498 0001494 151.7961 112.2417 01.70394132000002

Access	Start Time (UTCG)	Stop Time (UTCG)
-----	-----	-----
2	24 Sep 2018 23:20:46	25 Sep 2018 06:37:27
3	25 Sep 2018 08:41:48	25 Sep 2018 14:19:53

GSAT219-V2

1 98986 18999A 18269.20300926 +.00000000 +00000-9 +75521-3 2 00001
2 98986 056.3731 058.3925 0002433 251.2634 211.7835 01.70472801000001

Access	Start Time (UTCG)	Stop Time (UTCG)
-----	-----	-----
4	26 Sep 2018 12:21:12	26 Sep 2018 23:10:26

GSAT219-V3

1 98986 18999A 18270.68836806 +.00000000 +00000-9 +75522-3 2 00007
2 98986 056.3741 058.3517 0002158 250.6433 043.9857 01.70477322000005

Access	Start Time (UTCG)	Stop Time (UTCG)
-----	-----	-----
5	27 Sep 2018 20:12:15	28 Sep 2018 04:57:16
6	28 Sep 2018 08:54:48	28 Sep 2018 11:56:22
7	29 Sep 2018 03:25:44	29 Sep 2018 06:37:58
8	29 Sep 2018 10:27:29	29 Sep 2018 19:04:03

GSAT220 Initial Orbit Checkout

Access	Start Time (UTCG)	Stop Time (UTCG)
-----	-----	-----
1	24 Sep 2018 09:11:57	24 Sep 2018 16:09:19*

* Note that spacecraft stays in view of Hawaii during TLE update V1 below, therefore visibility continues into pass #2.

GSAT220 Maneuvers and possible support times pass # 2 - 9

GSAT220-V1

1 98987 18999B 18267.67313657 +.00000000 +00000-9 +75322-3 2 00005
2 98987 056.3705 058.4357 0015977 127.9071 337.6931 01.70936107000003

Access	Start Time (UTCG)	Stop Time (UTCG)
-----	-----	-----
2	24 Sep 2018 16:09:19	24 Sep 2018 16:12:26
3	25 Sep 2018 13:54:21	26 Sep 2018 01:03:36

GSAT220-V2

1 98987 18999B 18269.75060185 +.00000000 +00000-9 +75431-3 2 00002
2 98987 056.3721 058.3784 0001575 266.3685 037.6708 01.70498251000004

Access	Start Time (UTCG)	Stop Time (UTCG)
-----	-----	-----
4	26 Sep 2018 22:38:24	27 Sep 2018 06:10:11
5	27 Sep 2018 08:35:52	27 Sep 2018 13:41:00

GSAT220-V3

1 98987 18999B 18271.39035880 +.00000000 +00000-9 +75436-3 2 00004
2 98987 056.3735 058.3333 0002347 249.3397 341.1920 01.70477108000005

Access	Start Time (UTCG)	Stop Time (UTCG)
-----	-----	-----
6	28 Sep 2018 11:46:42	28 Sep 2018 22:18:01
7	29 Sep 2018 18:52:54	30 Sep 2018 04:24:16
8	30 Sep 2018 09:03:42	30 Sep 2018 11:06:57
9	1 Oct 2018 02:42:29	1 Oct 2018 06:39:51

GSAT221 Initial Orbit Checkout

Access	Start Time (UTCG)	Stop Time (UTCG)
-----	-----	-----
1	11 Oct 2018 12:22:07	11 Oct 2018 15:11:29

GSAT221 Maneuvers and possible support times pass # 2 - 10

GSAT221-V1

1 98988 18999C 18285.47331019 +.00000000 +00000-9 +75214-3 2 00006
2 98988 056.3837 057.9415 0042740 273.4916 356.5321 01.71576623000009

Access	Start Time (UTCG)	Stop Time (UTCG)
-----	-----	-----
2	12 Oct 2018 12:36:24	12 Oct 2018 23:43:01
3	13 Oct 2018 21:02:05	14 Oct 2018 04:43:20
4	14 Oct 2018 07:32:08	14 Oct 2018 12:01:31

GSAT221-V2

1 98988 18999C 18287.51837963 +.00000000 +00000-9 +75472-3 2 00008
2 98988 056.3851 057.8845 0002274 281.1989 172.0212 01.70532458000002

Access	Start Time (UTCG)	Stop Time (UTCG)
-----	-----	-----
5	15 Oct 2018 03:58:18	15 Oct 2018 04:44:43
6	15 Oct 2018 10:13:06	15 Oct 2018 20:16:35

GSAT221-V3

1 98988 18999C 18288.88175926 +.00000000 +00000-9 +75486-3 2 00008
2 98988 056.3861 057.8471 0003623 244.1476 326.0841 01.70475310000009

Access	Start Time (UTCG)	Stop Time (UTCG)
-----	-----	-----
7	16 Oct 2018 16:40:14	17 Oct 2018 02:50:42
8	18 Oct 2018 01:01:30	18 Oct 2018 05:37:44
9	18 Oct 2018 08:24:24	18 Oct 2018 16:10:00
10	19 Oct 2018 13:42:45	19 Oct 2018 21:09:44

GSAT222 Initial Orbit Checkout

Access	Start Time (UTCG)	Stop Time (UTCG)
-----	-----	-----
1	11 Oct 2018 14:11:26	11 Oct 2018 20:20:39*

* Note that spacecraft stays in view of Hawaii during TLE update V1 below, therefore visibility continues into pass #2.

GSAT222 Maneuvers and possible support times pass # 2 - 9

GSAT222-V1

1 98989 18999D 18284.84767361 +.00000000 +00000-9 +75269-3 2 00000
2 98989 056.3845 057.9574 0027130 115.4594 357.5447 01.71322206000004

Access	Start Time (UTCG)	Stop Time (UTCG)
-----	-----	-----
2	11 Oct 2018 20:20:39	12 Oct 2018 01:13:15
3	12 Oct 2018 22:55:24	13 Oct 2018 05:44:48
4	13 Oct 2018 07:31:46	13 Oct 2018 13:43:25

GSAT222-V2

1 98989 18999D 18286.88458333 +.00000000 +00000-9 +75467-3 2 00002
2 98989 056.3860 057.9008 0004920 253.3578 035.9383 01.70520435000008

Access	Start Time (UTCG)	Stop Time (UTCG)
-----	-----	-----
5	14 Oct 2018 11:35:57	14 Oct 2018 22:36:37

GSAT222-V3

1 98989 18999D 18288.31849537 +.00000000 +00000-9 +75478-3 2 00004
2 98989 056.3870 057.8614 0003577 248.2285 201.3146 01.70477311000006

Access	Start Time (UTCG)	Stop Time (UTCG)
-----	-----	-----
6	15 Oct 2018 19:56:57	16 Oct 2018 04:08:35
7	16 Oct 2018 07:31:19	16 Oct 2018 11:19:31
8	17 Oct 2018 02:52:35	17 Oct 2018 05:10:04
9	17 Oct 2018 09:39:32	17 Oct 2018 19:00:36

Flux Density impinging on the ground in Hawaii from Galileo GSAT219, GSAT220, GSAT221, and GSAT222

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 each GSAT spacecraft is -1.10 dBW. Being a near circular orbit, the altitude (and thus the closest distance to earth during an overhead pass) is = 23,400 Km.

Converting -1.10 dBW to scalar watts = 0.776 watts transmitted at 2221.9 MHz

Therefor:

$$\text{Flux density} = 0.776 \div (4 \pi * 23,400,000 \text{ meters}^2)$$

Flux density = 1.127×10^{-16} Watts/meter²

Or

Flux density = 1.127×10^{-17} 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 GALILEO (GSAT219, GSAT220, GSAT221, and GSAT222), twentieth thru twenty-third spacecraft of the “Full Operational Capability” series) Satellites.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 Post-LEOP orbit raising of the GALILEO (GSAT219, GSAT220, GSAT221, and GSAT222) spacecraft from initial earth orbit to operational medium earth 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 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 support for GALILEO (GSAT219, GSAT220, GSAT221, and GSAT222). 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 GALILEO (GSAT219, GSAT220, GSAT221, and GSAT222) satellites, nor is USN in contractual privity with that operator. Rather, USN has contracted with Swedish Space Corporation, Solna Sweden (SSC) to support the Post-LEOP orbit raising 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 GALILEO (GSAT219, GSAT220, GSAT221, and GSAT222) satellites with potentially affected terrestrial operators. Moreover, as with any STA, USN will conduct the Post-LEOP orbit raising 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 Post-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 medium earth 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 27 days of Orbit Raising (Post-LEOP) support of the GALILEO (GSAT219, GSAT220, GSAT221, and GSAT222) satellites.

It is USN’s understanding that GALILEO (GSAT219, GSAT220, GSAT221, and GSAT222) is licensed by ESA (European Space Agency). GALILEO (GSAT219, GSAT220, GSAT221, and GSAT222) are the twentieth thru twenty-third spacecraft of the European navigation constellation. The spacecraft family is primarily meant to serve the EU. 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 GALILEO (GSAT219, GSAT220, GSAT221, and GSAT222) satellite using its U.S. earth station for a period of 27 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 27 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 GALILEO (GSAT219, GSAT220, GSAT221, and GSAT222) 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