SES-STA-20150213-00081 IB2015000281
Universal Space Network, Inc.

Approved by OMB
3060–0678

APPLICATION FOR EARTH STATION SPECIAL TEMPORARY AUTHORITY

APPLICANT INFORMATIONEnter a description of this application to identify it on the main menu:
Galileo FOC3 & FOC4

1. Applicant

Name:	Universal Space Network, Inc.	**Phone Number:**	215–328–9130
DBA Name:		**Fax Number:**	215–328–9132
Street:	417 Caredean Drive Suite A	**E–Mail:**	jgreet@uspacenet.com
City:	Horsham	**State:**	PA
Country:	USA	**Zipcode:**	19044 –
Attention:	Joanne Greet		

GRANTED
International Bureau
File # SES-STA-20150213-00081
Call Sign None Grant Date 3-27-15
(or other identifier)
Term Dates
From 3-27-15 To 5-26-15
Approved

2. Contact

Name:	Universal Space Network, Inc.	**Phone Number:**	215–328–9130
Company:		**Fax Number:**	215–328–9132
Street:	417 Caredean Drive	E–Mail:	jgreet@uspacenet.com
	Suite A		
City:	Horsham	**State:**	PA
Country:	USA	**Zipcode:**	19044 –
Attention:		**Relationship:**	Legal Counsel

(If your application is related to an application filed with the Commission, enter either the file number or the IB Submission ID of the related application. Please enter only one.)
3. Reference File Number or Submission ID

4a. Is a fee submitted with this application?
◉ If Yes, complete and attach FCC Form 159. If No, indicate reason for fee exemption (see 47 C.F.R.Section 1.1114).
○ Governmental Entity ○ Noncommercial educational licensee
○ Other(please explain):

4b. Fee Classification CGX – Fixed Satellite Transmit/Receive Earth Station

5. Type Request

◉ Use Prior to Grant ○ Change Station Location ○ Other

6. Requested Use Prior Date 03/20/2015	
7. CityNaalehu	8. Latitude (dd mm ss.s h) 19 0 50.3 N

9. State HI	10. Longitude (dd mm ss.s h) 155 39 46.6 W

11. Please supply any need attachments.

Attachment 1: FCC 312 Galileo F3&4 Attachment 2: Waiver Attachment 3: Galileo Analysis

12. Description. (If the complete description does not appear in this box, please go to the end of the form to view it in its entirety.)

Launch support of the Galileo FOC3 & FOC4 spacecrafts currently scheduled for launch on March 27, 2015. Support requested for 60 days for the LEOP and IOT phase. USN shall provide the Comsearch coordination study separately.

13. By checking Yes, the undersigned certifies that neither applicant nor any other party to the application is subject to a denial of Federal benefits that includes FCC benefits pursuant to Section 5301 of the Anti–Drug Act of 1988, 21 U.S.C. Section 862, because of a conviction for possession or distribution of a controlled substance. See 47 CFR 1.2002(b) for the meaning of "party to the application" for these purposes. (●) Yes ( ) No

14. Name of Person Signing Joanne Greet	15. Title of Person Signing Manager, Compliance

WILLFUL FALSE STATEMENTS MADE ON THIS FORM ARE PUNISHABLE BY FINE AND / OR IMPRISONMENT (U.S. Code, Title 18, Section 1001), AND/OR REVOCATION OF ANY STATION AUTHORIZATION (U.S. Code, Title 47, Section 312(a)(1)), AND/OR FORFEITURE (U.S. Code, Title 47, Section 503).

FCC NOTICE REQUIRED BY THE PAPERWORK REDUCTION ACT

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THE FOREGOING NOTICE IS REQUIRED BY THE PAPERWORK REDUCTION ACT OF 1995, PUBLIC LAW 104–13, OCTOBER 1, 1995, 44 U.S.C. SECTION 3507.

Conditions
Applicant: Universal Space Network, Inc. (USN)
File No.: SES-STA-20150213-00081
Call Sign:

USN is granted special temporary authority to operate its fixed earth station in Naalehu, HI, to support of the launch and initial operation test phase of the Galileo FOC3 & FOC4 on March 27, 2015, for 60 days under the following conditions.

1. Operations a limited to the following parameters:

Frequencies MHZ	T/R	Pol.	Em. Desg.	Max Carrier EIRP	Max EIRP Density per 4 kHz	Mod & Service
2228.094	R	L,R	510KG2D			20 kbps data is PSK modulated into a 255 kHz subcarrier with 100 kHz tone
2234.232	R	L,R	510KG2D			20 kbps data is PSK modulated into a 255 kHz subcarrier with 100 kHz tone
2225.025	R	L,R	510KG2D			20 kbps data is PSK modulated into a 255 kHz subcarrier with 100 kHz tone (EMERGENCY USE ONLY)
2051.703	T	L,R	200KG2D	68	51	2 kbps data PSK modulated onto an 8 kHz subcarrier with 100 kHz major ranging tones
2057.355	T	L,R	200KG2D	68	51	2 kbps data PSK modulated onto an 8 kHz subcarrier with 100 kHz major ranging tones
2048.887	T	L,R	200KG2D	68	51	2 kbps data PSK modulated onto an 8 kHz subcarrier with 100 kHz major ranging tones (EMERGENCY USE ONLY)

Minimum Elevation for Transmission: 5 degrees

2. Operations under this STA shall not cause harmful interference to, and shall not claim protection from, interference caused to it by any other lawfully operating station and it shall cease transmission(s) immediately upon notice of such interference.

3. The USN must maintain a manned 24x7 Point of Contact (POC) during operations at 215-394-0155 and confirm this "STOP BUZZER"

4. The power flux-density at the Earth's surface from such non-Federal stations shall not exceed -144 to -154 dBW/m²/4 kHz, depending on angle of arrival, in accordance with ITU Radio Regulation 21.16

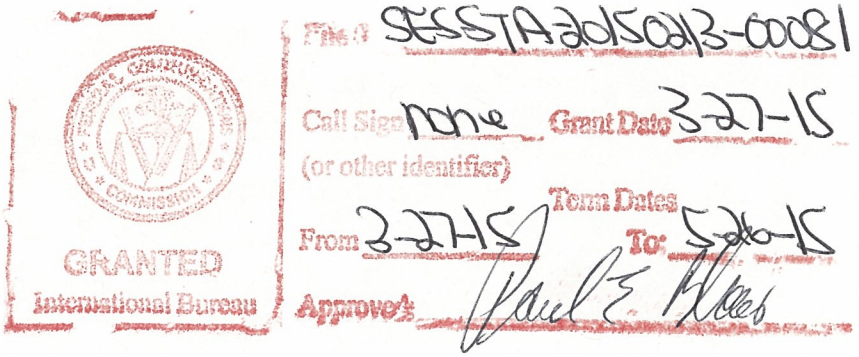
5. This STA will expire as soon as the launch and initial operational test phase is completed. Any future launches will need to submit applications to the FCC to be re-coordinated with NTIA.

6. Grant of this authorization is without prejudice to any determination that the Commission may make regarding pending applications or future requests for special temporary authority.

7. Grant of this authorization does not constitute U.S. market access approval for any of the Galileo FOC3 & FOC4 navigation or other services.

8. Any action taken or expense incurred as a result of operations pursuant to this STA is solely at Universal Space Network, Inc.'s risk.

9. This action is issued pursuant to Section 0.261 of the Commission's rules on delegated authority, 47 C.F.R. § 0.261, and is effective immediately. Petitions for reconsideration under Section 1.106 or applications for review under Sections 1.115 of the Commission's rules, 47 C.F.R. §§ 1.106, 1.115, may be filed within thirty days of the date of the public notice indicating that this action was taken.



FCC 312
Schedule B

FEDERAL COMMUNICATIONS COMMISSION
APPLICATION FOR SATELLITE SPACE AND EARTH STATION AUTHORIZATIONS
Technical and Operational Description)

(Place an "X" in one of the blocks below)

☐ License of New Station ☐ Registration of new Domestic Receive-Only Station ☐ Amendment to a Pending Application ☐ Modification of License/Registration ☐ Notification of Minor Modification

B1. Location of Earth Station Site. If temporary-fixed, mobile, or VSAT remote facility, specify area of operation and point of contact. If VSAT hub station, give its location For VSAT networks attach individual Schedule B, Page 1 sheets for each hub station and each remote station. Individually provide the Location, Points of Communications, and Destination Points for each hub and remote station.

B1a. Station Call Sign	B1b. Site identifier (HUB, REMOTE1, etc.)	B1c. Telephone Number	B1j. Geographic Coordinates N/S, Deg. - Min. - Sec. - E/W	B1k. Lat./Lon. Coordinates are:
	USHI01	(808) 929-8069	Lat. 19° 00' 50.3" N Lon. 155° 39' 46.6" W	☐ NAD-27 ☒ NAD-83
B1d. Mailing Street Address of Station or Area of Operation		B1e. Name of Contact Person		
93-1704 South Point Road		Joanne Greet		

B1f. City	B1g. County	B1h. State	B1i. Zip Code	B1l. Site Elevation (AMSL)
Naalehu	Ka'u	HI	96772-0842	378.0 meters

B2. Points of Communications: List the names and orbit locations of all satellites with which this earth station will communicate. The entry "ALSAT" is sufficient to identify the names and locations of all satellite facilities licensed by the U.S. All non-U.S. licensed satellites must be listed individually.

Satellite Name and Orbit Location	Satellite Name and Orbit Location	Satellite Name and Orbit Location
Galileo Constellation (GFOC3 & GFOC4) MEO Orbits		

B3. Destination points for communications using non-U.S. licensed satellites. For each non-U.S. licensed satellite facility identified in section B2 above, specify the destination point(s) (countries) where the services will be provided by this earth station via each non-U.S. license satellite system. Use additional sheets as needed.

Satellite Name	List of Destination Points
Galileo – GFOC3 (MSATNAV-2)	ESA (Non US Spacecraft)
Galileo – GFOC4 (MSATNAV-2)	ESA (Non US Spacecraft)

FEDERAL COMMUNICATIONS COMMISSION
APPLICATION FOR SATELLITE SPACE AND EARTH STATION AUTHORIZATIONS
FCC Form 312 - Schedule B: (Technical and Operational Description)

B4. Earth Station Antenna Facilities: Use additional pages as needed.

(a) Site ID*	(b) Antenna ID**	(c) Quantity	(d) Manufacturer	(e) Model	(f) Antenna Size (meters)	(g) Antenna Gain Transmit and/or Receive (____dBi at____GHz)
USHI01	HI-13M	1	Datron	1453	13.0	46.9 dBi at 2.245 GHz
						45.9 dBi at 2.067 GHz

B5. Antenna Heights and Maximum Power Limits: (The corresponding Antenna ID in tables B4 and B5 applies to the same antenna)

(a) Antenna ID**	(b) Antenna Structure Registration No.	Maximum Antenna Height (c) Above Ground Level (meters)	Maximum Antenna Height (d) Above Mean Sea Level (meters)	(e) Building Height Above Ground Level (meters)***	(f) Maximum Antenna Height Above Rooftop (meters)***	(g) Total Input Power at antenna flange (Watts)	(h) Total EIRP for all carriers (dBW)
HI-13M		20.0	398.0			200.0	68.9

Notes: * If this is an application for a VSAT network, identify the site (Item B1b, Schedule B, Page 1) where each antenna is located. Also include this Site-ID on Schedule B, Page 5.
** Identify each antenna in VSAT network or multi-antenna station with a unique identifier, such as HUB, REMOTE1, A1, A2, 10M, 12M, 7M, etc. Use this same antenna ID throughout tables B4, B5, B6, and B7 when referring to the same antenna.
*** Attach sketch of site or exemption, See 47 CFR Part 17.

APPLICATION FOR SATELLITE SPACE AND EARTH STATION AUTHORIZATIONS
FCC Form 312 - Schedule B: (Technical and Operational Description)

B6. Frequency Coordination Limits: Use additional pages as needed.

(a) Antenna ID*	(b) Frequency Limits (MHz)	(c) Range of Satellite Arc Eastern Limit**	(d) Range of Satellite Arc Western Limit**	(e) Antenna Elevation Angle Eastern Limit	(f) Antenna Elevation Angle Western Limit	(g) Earth Station Azimuth Angle Eastern Limit	(h) Earth Station Azimuth Angle Western Limit	(i) Maximum EIRP Density toward the Horizon (dBW/4kHz)
HI-13M	2228.094	0.0° W.L.	360.0° W.L.	5.0°	5.0°			
HI-13M	2234.232	0.0° W.L.	360.0° W.L.	5.0°	5.0°			
HI-13M	2225.025	0.0° W.L.	360.0° W.L.	5.0°	5.0°			
HI-13M	2051.703	0.0° W.L.	360.0° W.L.	5.0°	5.0°			9.6
HI-13M	2057.355	0.0° W.L.	360.0° W.L.	5.0°	5.0°			9.6
HI-13M	2048.887	0.0° W.L.	360.0° W.L.	5.0°	5.0°			9.6

Notes: * Provide the ANTENNA-ID from table B4 to identify the antenna to which each frequency band and orbital arc range is associated.
** If operating with geostationary satellites, give the orbital arc limits and the associated elevation and azimuth angles. If operating with non-geostationary satellites, give the notation "NON-GEO" for the satellite arc and give the minimum operational elevation angle and the maximum azimuth angle range.

FEDERAL COMMUNICATIONS COMMISSION
APPLICATION FOR SATELLITE SPACE AND EARTH STATION AUTHORIZATIONS
FCC Form 312 - Schedule B: (Technical and Operational Description)

B7. Particulars of Operation (Full particulars are required for each r.f. carrier): Use additional pages as needed.

(a) Antenna ID*	(b) Frequency Limits (MHz)	(c) T/R Mode **	(d) Antenna Polarization (H,V,L,R)	(e) Emission Designator	(f) Maximum EIRP per Carrier (dBW)	(g) Maximum EIRP Density per Carrier (dBW/4kHz)	(h) Description of Modulation and Services
HI-13M	2228.094	R	L, R	510KG2D			20 kbps data is PSK modulated into a 255 kHz subcarrier with 100 kHz tone
HI-13M	2234.232	R	L, R	510KG2D			20 kbps data is PSK modulated into a 255 kHz subcarrier with 100 kHz tone
HI-13M	2225.025	R	L, R	510KG2D			20 kbps data is PSK modulated into a 255 kHz subcarrier with 100 kHz tone (EMERGENCY USE ONLY)
HI-13M	2051.703	T	L, R	200KG2D	68.0	51.0	2 kbps data PSK modulated onto an 8 kHz subcarrier with 100 kHz major ranging tones
HI-13M	2057.355	T	L, R	200KG2D	68.0	51.0	2 kbps data PSK modulated onto an 8 kHz subcarrier with 100 kHz major ranging tones
HI-13M	2048.887	T	L, R	200KG2D	68.0	51.0	2 kbps data PSK modulated onto an 8 kHz subcarrier with 100 kHz major ranging tones (EMERGENCY USE ONLY)

Notes: * Provide the ANTENNA-ID from table B4 to identify the antenna to which each frequency band and emission is associated. For VSAT networks, include frequencies and emissions for all HUB and REMOTE units.

** Indicate whether the earth station transmits or receives in each frequency band.

FEDERAL COMMUNICATIONS COMMISSION
APPLICATION FOR SATELLITE SPACE AND EARTH STATION AUTHORIZATIONS
FCC Form 312 - Schedule B: (Technical and Operational Description)

If VSAT Network, provide the SITE-ID (Item B1b) of the station that B8-B13 are in response to (HUB, REMOTE1, etc.): _____

B8. If the proposed antenna(s) operate in the Fixed Satellite Service (FSS) with **geostationary** satellites, do(es) the proposed antenna(s) comply with the antenna gain patterns specified in Section 25.209(a) and (b) as demonstrated by the manufacturer's qualification measurements? If NO, provide as an exhibit, a technical analysis showing compliance with two-degree spacing policy.	☐ YES	☐ NO	N/A
B9. If the proposed antenna(s) do not operate in the Fixed Satellite Service (FSS), or if they operate in the Fixed Satellite Service (FSS) with **non-geostationary** satellites, do(es) the proposed antenna(s) comply with the antenna gain patterns specified in Section 25.209(a2) and (b) as demonstrated by the manufacturer's qualification measurement?	☒ YES	☐ NO	
B10. Is the facility operated by remote control? If YES, provide the location and telephone number of the control point.	☒ YES	☐ NO	

Remote Control Point Location:

B10a. Street Address: 417 Caredean Drive Suite A			
B10b. City: Horsham	B10c. County: Montgomery	B10.d. State/Country: PA	B10e. Zip Code: 19044
B10f. Telephone Number: 215-328-9130	B10g. Call Sign of Control Station (if appropriate):		

B11. Is frequency coordination required? If YES, attach a frequency coordination report as an exhibit.	☒ YES	☐ NO
B12. Is coordination with another country required? If YES, attach the name of the country(ies) and plot of coordination contours as an exhibit.	☐ YES	☒ NO
B13. FAA Notification - (See 47 CFT Part 17and 47 CFT Part 25.113(c)) **Where FAA notification is required, have you attached a copy of a completed FCC Form 854 and/or the FAA's study regarding the potential hazard of the structure to aviation?** **FAILURE TO COMPLY WITH 47 CFT PARTS 17 AND 25 WILL RESULT IN THE RETURN OF THIS APPLICATION**	☐ YES	☒ NO

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 (FOC3 and FOC4), third and forth 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 launch and early orbit support ("LEOP") of the GALILEO (FOC3 and FOC4) spacecraft from launch to 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 (FOC3 and FOC4). 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 (FOC3 and FOC4) satellites, nor is USN in contractual privity with that operator. Rather, USN has contracted with Swedish Space Corporation, Solona Sweden (SSC) to support the Launch and Early Orbit (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 GALILEO (FOC3 and FOC4) 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.

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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 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 it's 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 14 days of LEOP support of the GALILEO (FOC3 and FOC4) satellite.

It is USN's understanding that GALILEO (FOC3 and FOC4) is licensed by ESA (European Space Agency). GALILEO (FOC3 and FOC4) are the third and forth 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 (FOC3 and FOC4) satellite using its U.S. earth station for a period of 14 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 14 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 LEOP of the GALILEO (FOC3 and FOC4) satellites. 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.

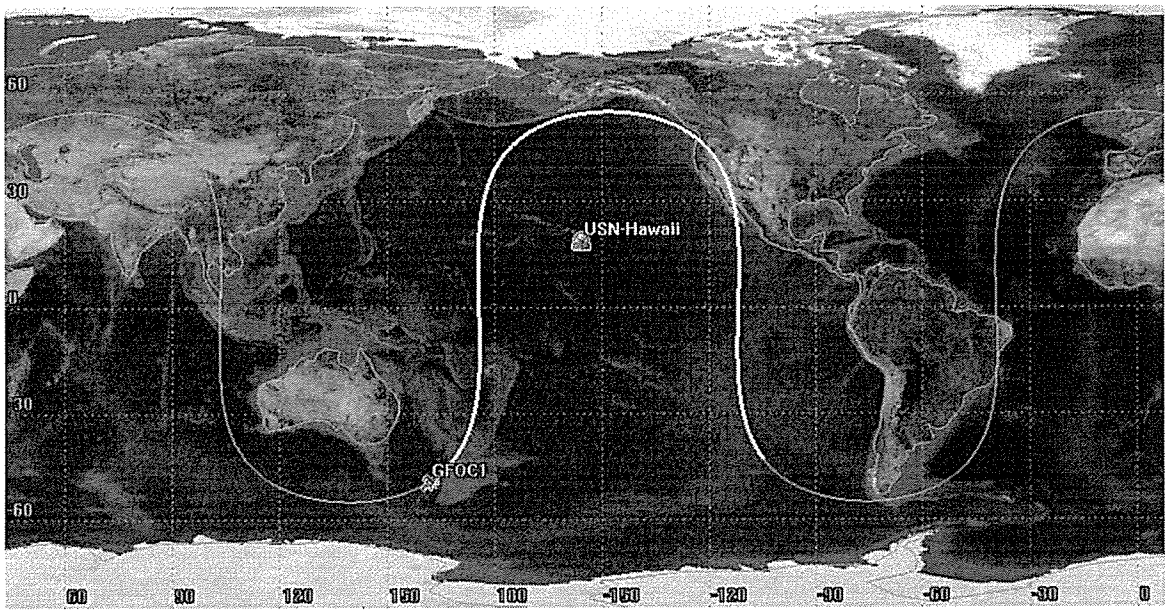
[6] 47 C.F.R. §2.106

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

LEOP support of Galileo Constellation (FOC3 and FOC4) from USN's Hawaii ground station

Galileo FOC3 and FOC4 are the third and fourth spacecraft of the "Full Operational Capability" of the Galileo navigation constellation for the EU. The launch consists of 2 spacecraft (FOC3 and FOC4) that will be launched from French Guiana on a Soyuz vehicle on March 27th, 2015 at 21:46:18 UTC. USN has been contracted to support the Galileo spacecraft LEOP(s) for a period of up to 14 days.

The spacecraft(s) are a Medium Earth Orbiting (MEO) spacecraft in a high mid-latitude orbit (55 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.



FOC3 and FOC4 nominal orbit and Hawaii coverage

The spacecrafts will be supported from injection and three subsequent orbital maneuvers for spacing of FOC3 and FOC4. The below analysis covers all possible visibilities from USN Hawaii, but not all visibilities will be supported.

FOC3 and FOC4 injection and coverage of pass #1-5

Both spacecraft are still in same antenna beamwidth after injection for the first several passes and then begin to drift apart. For the first several passes FOC3 and FOC4 are supported by selecting different RF frequencies. Subsequent to the first several hours the spacecraft(s) are supported separately. Post maneuver TLE's and maximum visibilities are shown below for each event and each spacecraft.

	Downlink	Uplink
FOC3	2228.094 MHz	2051.703 MHz
FOC4	2234.232 MHz	2057.355 MHz

GFOC3-injection
1 99935 14999A 15087.06545139 +.00000000 +00000-9 +73172-3 2 00008
2 99935 055.0630 094.9122 0004840 254.6556 347.3149 01.67807181000002

GFOC4-injection
1 99790 14999B 15087.06545139 +.00000000 +00000-9 +73174-3 2 00009
2 99790 055.0629 094.9122 0003715 045.1545 196.8159 01.68014372000001

FOC3

Access	Start Time (UTCG)	Stop Time (UTCG)
1	27 Mar 2015 01:33:00	27 Mar 2015 05:33:21
2	28 Mar 2015 03:53:04	28 Mar 2015 15:21:38
3	29 Mar 2015 13:32:20	29 Mar 2015 21:09:36
4	29 Mar 2015 22:44:28	30 Mar 2015 04:54:51
5	31 Mar 2015 03:17:34	31 Mar 2015 06:43:00*

* Note that spacecraft stays in view of Hawaii during TLE update V1 below, therefore visibility continues into pass #6.

FOC4

1	27 Mar 2015 01:33:00	27 Mar 2015 05:35:20
2	28 Mar 2015 03:53:07	28 Mar 2015 15:20:00
3	29 Mar 2015 13:27:52	29 Mar 2015 21:06:36
4	29 Mar 2015 22:44:50	30 Mar 2015 04:48:51
5	31 Mar 2015 03:10:35	31 Mar 2015 06:43:00*

* Note that spacecraft stays in view of Hawaii during TLE update V1 below, therefore visibility continues into pass #6.

FOC3 Maneuvers and possible support times pass # 6 - 17

GFOC3-V1
1 99935 14999A 15091.28150463 +.00000000 +00000-9 +73196-3 2 00005
2 99935 055.0659 094.8004 0008735 262.0833 006.9010 01.67709650000006

Access	Start Time (UTCG)	Stop Time (UTCG)
6	31 Mar 2015 06:43:00	31 Mar 2015 14:41:40
7	1 Apr 2015 12:50:09	1 Apr 2015 16:33:00*

*Note that spacecraft stays in view of Hawaii during TLE update V2 below, therefore visibility continues into pass #8.

GFOC3-V2
1 99935 14999A 15092.69589120 +.00000000 +00000-9 +73220-3 2 00005
2 99935 055.0671 094.7623 0006062 286.6487 116.3026 01.67610303000003

Access	Start Time (UTCG)	Stop Time (UTCG)
8	1 Apr 2015 16:33:00	1 Apr 2015 20:40:10
9	1 Apr 2015 22:34:54	2 Apr 2015 04:16:45

GFOC3-V3
1 99935 14999A 15093.87583333 +.00000000 +00000-9 +73222-3 2 00008
2 99935 055.0680 094.7304 0005993 288.0570 106.8867 01.67605180000004

Access	Start Time (UTCG)	Stop Time (UTCG)
10	3 Apr 2015 02:44:58	3 Apr 2015 14:06:22
11	4 Apr 2015 12:13:09	4 Apr 2015 20:14:53
12	4 Apr 2015 22:25:46	5 Apr 2015 03:45:53
13	6 Apr 2015 02:16:56	6 Apr 2015 13:33:06
14	7 Apr 2015 11:36:33	7 Apr 2015 19:49:10
15	7 Apr 2015 22:17:25	8 Apr 2015 03:14:59
16	9 Apr 2015 01:49:08	9 Apr 2015 12:58:36
17	10 Apr 2015 10:57:39	10 Apr 2015 19:23:07

FOC4 Maneuvers and possible support times pass # 6 - 19

GFOC4-V1
1 99790 14999B 15090.70934028 +.00000000 +00000-9 +73295-3 2 00007
2 99790 055.0645 094.8164 0021704 097.1699 188.8742 01.68513690000005

Access	Start Time (UTCG)	Stop Time (UTCG)
6	31 Mar 2015 06:43:00	31 Mar 2015 14:32:02
7	1 Apr 2015 12:29:52	1 Apr 2015 16:33:00*

*Note that spacecraft stays in view of Hawaii during TLE update V2 below, therefore visibility continues into pass #8.

GFOC4-V2
1 99790 14999B 15092.17795139 +.00000000 +00000-9 +73430-3 2 00009
2 99790 055.0653 094.7762 0000151 292.1454 164.8527 01.69070070000002

Access	Start Time (UTCG)	Stop Time (UTCG)
8	1 Apr 2015 16:33:00	1 Apr 2015 20:27:11
9	1 Apr 2015 22:38:34	2 Apr 2015 03:52:53

GFOC4-V3
1 99790 14999B 15093.29023148 +.00000000 +00000-9 +73437-3 2 00004
2 99790 055.0662 094.7459 0001208 235.9601 178.0499 01.69098115000003

Access	Start Time (UTCG)	Stop Time (UTCG)
10	3 Apr 2015 02:10:11	3 Apr 2015 13:05:36
11	4 Apr 2015 10:31:19	4 Apr 2015 19:18:04
12	4 Apr 2015 22:46:53	5 Apr 2015 02:21:19
13	5 Apr 2015 18:15:17	5 Apr 2015 20:21:44
14	6 Apr 2015 00:55:31	6 Apr 2015 10:47:48
15	7 Apr 2015 07:43:08	7 Apr 2015 18:05:06
16	7 Apr 2015 23:34:23	8 Apr 2015 00:13:48
17	8 Apr 2015 16:32:02	8 Apr 2015 20:44:02
18	8 Apr 2015 23:43:37	9 Apr 2015 08:05:57
19	10 Apr 2015 05:43:34	10 Apr 2015 16:49:31

Flux Density impinging on the ground in Hawaii from Galileo FOC3 and FOC4

The Flux density is calculated as:

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

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 FOC 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:

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

Flux density = 1.127 x 10^{-16} Watts/meter^2
Or
Flux density = 1.127 x 10^{-17} mW/cm^2