

**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 SPACEIL Lunar surface landing mission satellite.<sup>1</sup> 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..."<sup>2</sup> USN seeks authority to support the needed Telemetry, Tracking, and Control ("TT&C") during launch and early orbit support ("LEOP") and Lunar support of the SPACEIL spacecraft from launch to Lunar surface landing, 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.<sup>3</sup> The Commission may grant a waiver for good cause shown.<sup>4</sup> 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 and Lunar support for SPACEIL. 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 SPACEIL satellite, 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) and Lunar support in S-Band during the mission.

As evidenced by the Comsearch report attached to this request, USN has coordinated the LEOP of the SPACEIL satellite 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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<sup>1</sup> FCC Form 312 Section B

<sup>2</sup> 47 C.F.R. § 25.137(a)

<sup>3</sup> 47 C.F.R. §§25.137 and 25.114

<sup>4</sup> 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 Lunar landing. 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.<sup>5</sup> 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 63 days of support of the SPACEIL satellite.

It is USN’s understanding that SPACEIL is licensed by the state of Israel. SPACEIL is a mission inspired by the Google Lunar XPRIZE and is sponsored for educational purposes of Science, Technology, Engineering, and Mathematics (STEM). 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 SPACEIL satellite using its U.S. earth station for a period of 63 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 63 days would pose undue hardship without serving underlying policy objectives. Given these particular facts, the waiver sought herein is appropriate.

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<sup>5</sup> 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).<sup>6</sup> 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 SPACEIL satellite. 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."<sup>7</sup> 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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<sup>6</sup> 47 C.F.R. §2.106

<sup>7</sup> Previously approved STA's for Universal Space Network SES-STA-20020725-01174; SES-STA-20021112-02008; SES-STA-20040315-00475

# LEOP support of SpacEL lunar mission from USN's Hawaiian ground station

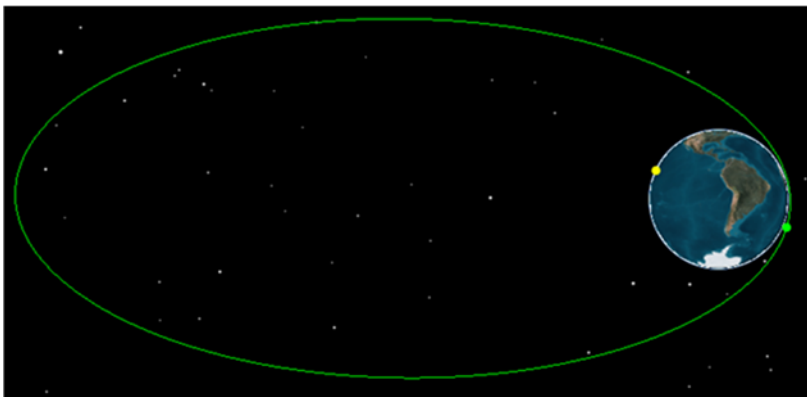
Originally inspired by the Google Lunar XPRIZE, SpacEL will softly land a spacecraft on the lunar surface for a period of time and relay high resolution photos to Earth. SpacEL is a non-profit organization founded in Israel to inspire young people to pursue Science, Technology, Engineering, and Math (STEM). The mission will launch on a SpaceX Falcon-9 from Florida on December 18<sup>th</sup>, 2018 at 16:30 UTC as a secondary payload. USN has been contracted to support the mission from USN's Hawaiian ground station from orbital injection thru visibility of spacecraft on the lunar surface for a total nominal mission time of about 63 days.

The mission phases consist of initial Earth orbit for a period of 30 days, followed by a lunar transfer maneuver lasting 6.5 days, followed by Lunar orbit for approximately 20 days mapping the magnetic field, then a Lunar landing in February 2019 for a period of up to 6 days. USN will support the spacecraft during all phases for a period of approximately 63 days depending mission successful operations. The spacecraft operates on the following S-band frequencies.

	Downlink	Uplink
SpacEL	2280.000 MHz	2099.500 MHz

## Spacecraft injection

The Falcon-9 will initially inject the spacecraft into a highly elliptical orbit for a nominal 30 day period. This orbit will have a super-geosync apogee of about 55,000 Km. Hawaii will conduct pass supports for a nominal 30 minute duration every 4 hours of available visibility. Visibility from Hawaii ranges from 4 hours to 14 hour each day during this phase of the mission. The initial orbit is defined below and the potential USN Hawaii supports.



Initial Orbit Phase

Initial Orbit has been defined with the following state vector:

**Epoch Time: 18 Dec 2018 17:52:48 UTC**

**X: 6189.65 Km**

**Y: 2913.71 Km**

**Z: -1651.60 Km**

**X Velocity: -2.55056 Km/sec**

**Y Velocity: 8.70091 Km/sec**

**Z Velocity: -4.49232 Km/sec**

## Spacell Injection Visibility from USN-Hawaii

Access	Start Time (UTCG)	Stop Time (UTCG)
1	19 Dec 2018 13:43:57	19 Dec 2018 21:12:03
2	20 Dec 2018 08:51:38	20 Dec 2018 22:30:55
3	21 Dec 2018 10:30:00	21 Dec 2018 23:07:19
4	22 Dec 2018 11:17:21	22 Dec 2018 18:13:17
5	23 Dec 2018 14:47:12	23 Dec 2018 20:31:52
6	24 Dec 2018 09:44:31	24 Dec 2018 21:52:44
7	25 Dec 2018 10:00:46	26 Dec 2018 00:02:35
8	26 Dec 2018 10:47:28	26 Dec 2018 19:11:44
9	27 Dec 2018 15:59:40	27 Dec 2018 19:42:04
10	28 Dec 2018 10:40:18	28 Dec 2018 21:17:01
11	29 Dec 2018 09:28:37	30 Dec 2018 00:57:32
12	30 Dec 2018 10:19:04	30 Dec 2018 20:08:44
13	31 Dec 2018 11:23:56	31 Dec 2018 14:57:24
14	1 Jan 2019 11:37:41	1 Jan 2019 20:41:44
15	2 Jan 2019 08:47:48	2 Jan 2019 22:09:25
16	3 Jan 2019 09:51:13	3 Jan 2019 21:04:54
17	4 Jan 2019 10:43:30	4 Jan 2019 16:05:18
18	5 Jan 2019 12:37:10	5 Jan 2019 20:05:12
19	6 Jan 2019 07:44:51	6 Jan 2019 21:24:03
20	7 Jan 2019 09:23:09	7 Jan 2019 22:00:32
21	8 Jan 2019 10:10:30	8 Jan 2019 17:06:30
22	9 Jan 2019 13:40:25	9 Jan 2019 19:25:01
23	10 Jan 2019 08:37:43	10 Jan 2019 20:45:52
24	11 Jan 2019 08:53:55	11 Jan 2019 22:55:47
25	12 Jan 2019 09:40:37	12 Jan 2019 18:04:57
26	13 Jan 2019 14:52:53	13 Jan 2019 18:35:12
27	14 Jan 2019 09:33:31	14 Jan 2019 20:10:10
28	15 Jan 2019 08:21:46	15 Jan 2019 23:50:44
29	16 Jan 2019 09:12:13	16 Jan 2019 19:01:57
30	17 Jan 2019 10:17:05	17 Jan 2019 13:50:37
31	18 Jan 2019 10:30:54	18 Jan 2019 19:34:53*

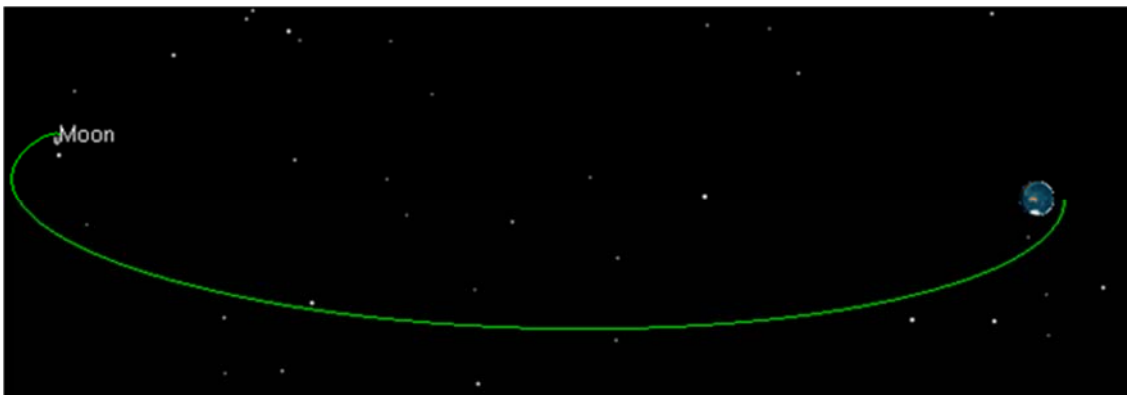
\*Note that the Lunar transfer orbit burn occurs during this pass and completes at 17:33:25

## Lunar Transfer Orbit

The SpacEL lander contains its own booster propulsion system as this is required to softly land on the Moon, as such this booster will also be used to conduct an orbital maneuver burn to place the spacecraft into a heliocentric Lunar transfer orbit. This burn is scheduled to complete at 18 Jan 2019 17:33:25 UTC. The spacecraft traverses towards the Moon for approximately 6.5 days and will then conduct a Lunar orbit injection burn and enter Lunar orbit at 25 Jan 2019 00:13:25 UTC.

The transfer orbit is defined by the STK state vector file:

**SIL-00-LunarTransferOrbit.e**



Lunar Transfer Orbit

Hawaii will conduct pass supports for a nominal 30 minute duration every 4 hours of available visibility. Visibility from Hawaii ranges from 10 to 11 hours each day during this phase of the mission. The potential USN Hawaii supports are shown below.

Access	Start Time (UTCG)	Stop Time (UTCG)
1	20 Jan 2019 07:42:14	20 Jan 2019 18:38:57
2	21 Jan 2019 08:03:49	21 Jan 2019 19:07:37
3	22 Jan 2019 08:12:07	22 Jan 2019 19:22:04
4	23 Jan 2019 08:17:02	23 Jan 2019 19:31:55
5	24 Jan 2019 08:20:29	24 Jan 2019 19:39:46
6	25 Jan 2019 08:22:46	25 Jan 2019 19:45:33

## Lunar Surface Support

USN-Hawaii will support the spacecraft when in view of the Lunar landing location for the duration of the mission as scheduled for periods of 40 minutes duration. Lunar surface support is expect to not exceed 6 days.

## Flux Density impinging on the ground in Hawaii from Spacell

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?

The spacecraft has two mission antennas, Low Gain omni (LGTA), and High Gain directional (HGTA). The LGTA will be used exclusively in Earth orbit and has an EIRP of 2.1 dBW. The HGTA has an EIRP of 12.66 dBW and will be deployed at a time the spacecraft is about one third of the way to the moon during the lunar orbit transfer. For worst case analysis the LGTA will have a minimum altitude over Hawaii of 500 Km, and the HGTA will have a minimum altitude of 150,000 Km.

### Earth Orbit LGTA:

Converting 2.1 dBW to scalar watts = 1.622 watts transmitted at 2280.0 MHz

Therefore:

$$\text{Flux density} = 1.622 \div (4 \pi * 500,000 \text{ meters}^2)$$

$$\text{Flux density} = 5.163 \times 10^{-13} \text{ Watts/meter}^2$$

Or

$$\text{Flux density} = 5.136 \times 10^{-14} \text{ mW/cm}^2$$

### Lunar Transfer, Lunar Orbit, and Lunar Surface HGTA:

Converting 12.66 dBW to scalar watts = 18.450 watts transmitted at 2280.0 MHz

Therefore:

$$\text{Flux density} = 18.45 \div (4 \pi * 150,000,000 \text{ meters}^2)$$

$$\text{Flux density} = 6.525 \times 10^{-17} \text{ Watts/meter}^2$$

Or

$$\text{Flux density} = 6.525 \times 10^{-18} \text{ mW/cm}^2$$