Kinéis

Technical Annex to Application for Blanket Mobile Earth Station License

March 2022

Kinéis SAS au capital de 15 687 654 euros
11, rue Hermès, Parc Technologique du canal, 31 520 Ramonville-Saint-Agne France
RCS Toulouse – SIREN 841 489 123

Table of Contents

1 Introduction

Pursuant to Sections 25.115, 25.135 and 25.142(b) of the Commission's rules, Kinéis SAS ("Kinéis") is pleased to submit its application for a blanket Earth station authorization ("Application").

Additional documents include the Form 312, Main form and Schedule B, and radiation hazard report as required by the Commission's rules.[1]

The Application reflects Kinéis plans to operate up to one million terminals deployed across the United States of America territory (continental United States, Alaska, Hawaii, Puerto Rico, Guam, American Samoa, the U.S. Virgin Islands, the North Mariana Islands, all other U.S. territories and possessions, and all U.S. territorial waters).

Depending on the end-user application, the Kinéis/ARGOS enabled devices will operate on the following frequencies from and to the authorized non-voice, non-geostationary system[2].

- Uplink (Earth to space)
  - 399.9-400.05 MHz (Mobile Satellite Service allocation)
  - 401-403 MHz (Earth Exploration Satellite Service allocation), sub-bands in compliance with the Recommendation ITU-R SA.2045[3]
- Downlink (space to Earth)
  - 400.15-401 MHz (Mobile Satellite Service allocation)

The analysis developed in this Application demonstrates that Kinéis enabled terminals and ARGOS data collection platforms comply with the Commission's technical and operational requirements and that grant of the Application would serve the public interest, consistent with the Commission's statutory mandate to "*make available, so far as possible, to all the people of the United States, […], a rapid, efficient, Nation-wide, and world-wide […] radio communication service with adequate facilities at reasonable charges, […] for the purpose of promoting safety of life and property through the use of […] radio communications, […]*"[4].

---

[1] See 47 C.F.R. § 25.115(d)

[2] Kinéis, Petition for Declaratory Ruling Requesting Access to the U.S. Market for a Non-Voice, Non-Geostationary Satellite Network, IBFS File No. SAT-PDR-20191011-00113

[3] 401-403 MHz is allocated to Earth Exploration Satellite Services to accommodate environmental applications and has been identified worldwide for the long-term ARGOS use by the ITU with the Recommendation ITU-R SA.2045 in the three following sub-bands: 401-401.2 MHz, 401.3-401.7 MHz and 402.85-403 MHz, called "401-403 MHz" in the Application to ease the reading.

[4] 47 U.S. Code § 151

Kinéis is committing to deploy a new generation constellation of 25 nanosatellites in 2023[5] that will ensure the continuity and a substantial incremental improvement of the ARGOS data collection services, operational since the 80's, and will bring new MSS connectivity to the space Internet of Things (space "IoT") market in the U.S. and for U.S. users requiring global communications.

[5] See Kinéis Press Release, "Rocket Lab Lands Deal to Launch Entire IoT Satellite Constellation for Kinéis," cited September 7, 2021, *available at* https://www.kineis.com/en/rocket-lab-lands-deal-to-launch-entire-iot-satellite-constellation-for-kineis/

2 General presentation

Kinéis's constellation will operate in sun synchronous orbits at an altitude of approximately 650 kilometers, on five orbital planes, each containing five satellites operating at an inclination of 98 degrees[6]. A network of 19 ground stations will control and monitor the service offered by the constellation, and their locations have been selected to provide low latency service to most areas in the world.

The Kinéis system has been built upon and is compatible with the Argos data collection system (DCS), an existing system utilizing satellites in polar orbits at altitudes around 850 kilometers[7]. Any existing Argos data collection platforms able to connect to the existing ARGOS satellites will benefit from Kinéis retrocompatible services (modulations, frequencies, etc.). On top of this guaranteed service continuity the ARGOS community will enjoy the significant performance increase brought by the Kinéis constellation (near real time experience, new capacity and services, two-way terminal capability, a larger manufacturer ecosystem, etc.).

ARGOS-Kinéis enabled platforms and terminals (called "ARGOS-Kinéis terminals" in this application) integrate radio modules coupled with antennas fitting the application requirement (indoor/outdoor, high throughput, size-constraints, etc.) and could either rely on batteries/solar panel or wired electricity depending on the end-user set-up and autonomy needs.

[6] Two satellites per plane will have maritime capabilities, i.e., will be able to receive signals in the 156.7625-162.0375 MHz band, but only one satellite per plane will actively monitor maritime signals. The transmitting terminals in these frequency bands are not operated by Kinéis, hence not subjected to the request of the Application.

[7] "How Argos Works", available at: https://www.argos-system.org/argos/how-argos-works

3 Technical information

3.1.1 Frequencies and Emission Characteristics

The ARGOS-Kineis terminals will transmit in the 399.9-400.05 MHz (MSS - Earth to space) or 401-403 MHz[8] (EESS – Earth to space) frequency bands, depending on the nature of the application, and receive within the 400.15-401 MHz (space to Earth) frequency band as per the market access granted by the FCC[9] on the 18th November 2021.

Lower Frequency (MHz)	Upper Frequency (MHz)	Mode (receive/transmit)	Nature of service
399.9	400.05	Transmit	NVNG MSS
400.15	401	Receive	NVNG MSS
401	401.2	Transmit	EESS (ARGOS)
401.3	401.7	Transmit	EESS (ARGOS)
402.85	403	Transmit	EESS (ARGOS)

Table 1 : Frequencies (reception/transmission) for ARGOS-Kinéis terminals

End-users have different radio transmission needs directly linked to the application requirements: lower/higher power/throughput, energy consumption, indoor/outdoor, mobile/fixe environment, etc. All those parameters play a pivotal role on the emission characteristics to be used. Kinéis offers different emissions to fit the user need to provide the best cost-efficient solution. Each terminal will then be assigned a channel for their uplink communications and will be able to receive in a pre-defined downlink frequency band.

The following table displays the ARGOS-Kinéis emission types and their characteristics available to ARGOS-Kinéis terminals.

[8] See footnote 3, *supra*.

[9] See footnote 2, *supra*.

Emission Designator	Necessary Bandwidth (kHz)	Typical Power level (W)	Max EIRP (dBW)	Max EIRP Density (dBW/4kHz)	Comments
1K60G7D--	1.6	0.25-1	5 in MSS 7 in EESS (see note (1))	5 in MSS 7 in EESS	This emission is appropriate for polyvalent applications as data could be sent at an optimize cost (power, battery, data volume).
0K80G7D--	0.8	<0.2			This emission is suitable for low power applications (wildlife monitoring for example) that require long battery life for a prolonged use time and robustness.
14K0G7D--	14	2-3		-0.4 in MSS 1.6 in EESS	This emission is suitable for high data rate applications.

Table 2 : ARGOS-Kinéis emission characteristics

Those emissions all comply with the power limitations set by regulations:

- 5 dBW EIRP in 399.9-400.05 MHz, RR footnote No. 5.260A;
- 7 dBW EIRP in 401-403 MHz (RR footnote No. 5.264A).

Note (1) In the EESS band, additional limits have been set (-3dBW EIRP in 401.1-401.2 MHz and 401.3-401.4 MHz) in the note (2) of the Rec. ITU-R SA.2045-0.

Finally, these emissions in the 401-403 MHz satisfy the protection criteria of the Department of Commerce/National Oceanic and Atmospheric Administration radiosondes operations in the United States as previous compliance will apply to ARGOS data collection platforms communicating with Kinéis constellation.

3.1.2 Out-of-Band Emissions

The ARGOS-Kinéis spectrum mask for the terminals uplink transmission complies with the limits defined in Section 25.202(f) of the Commission's rules, as demonstrated below for channels with a necessary bandwidth of 14 kHz, the highest ARGOS-Kinéis bandwidth, in each frequency bands. Transmissions using alternative emission designators by nature will also comply with the emission mask requirements for each frequency bands.

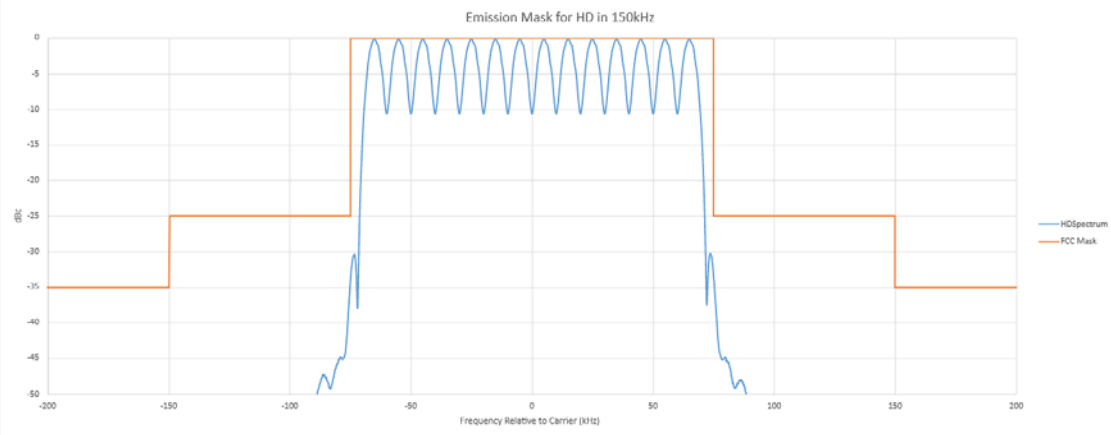

Figure 1: Emission mask for 399.9-400.05 MHz

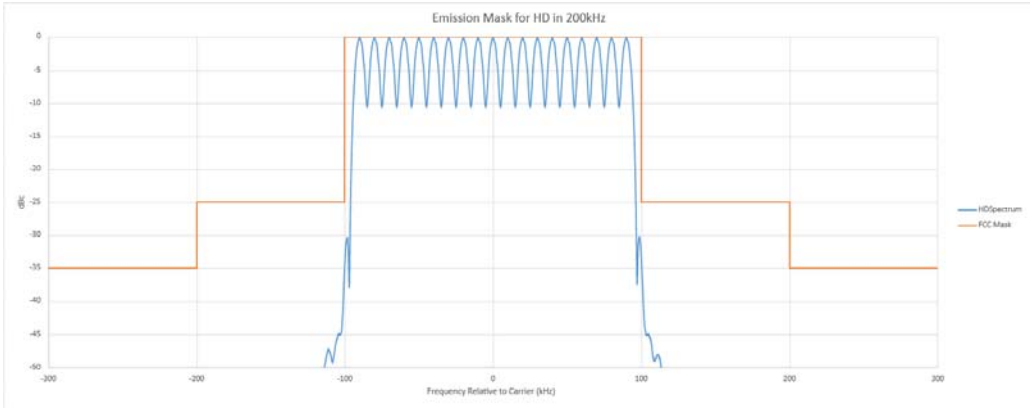

Figure 2: Emission mask for 401-401.2 MHz

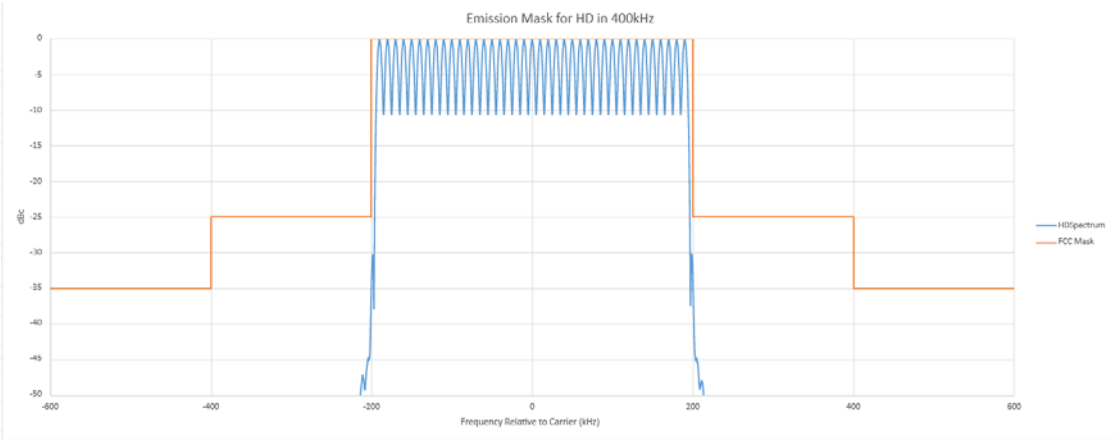

Figure 3: Emission mask for 401.3-401.7 MHz

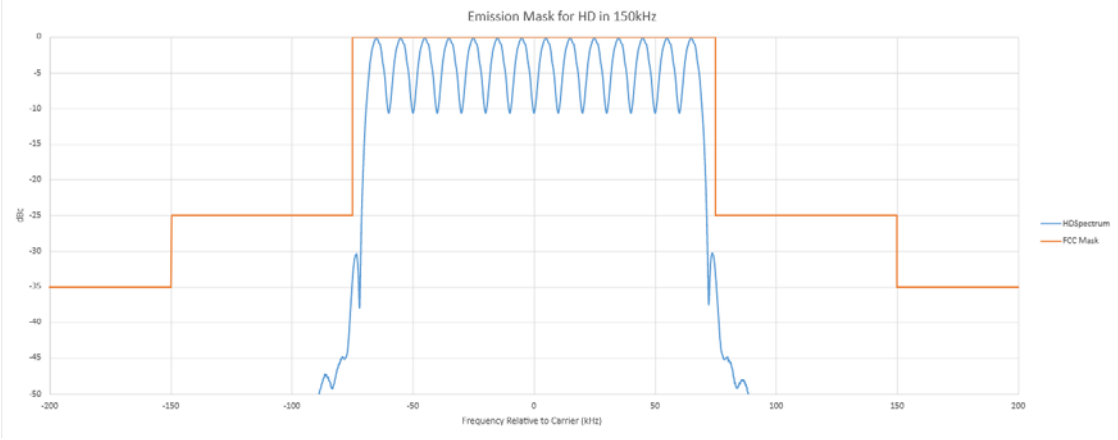

Figure 4: Emission mask for 402.85-403 MHz

Kinéis has taken into account Doppler shift for its frequency plan with a 10kHz guard bands at the edge of each of the operational sub-bands. For example, in the MSS band, the terminals will be assigned an emission frequency within 399.91-400.04 MHz, rendering the satellite reception compliant with the MSS allocation (399.9-400.05 MHz), independently of any resulting Doppler shift.

3.1.3 Frequency Tolerance

The ARGOS-Kinéis terminals comply with the requirements of Section 25.202(d), as their carrier frequency will be maintained within 0.001 percent of the reference frequency.

3.1.4 Additional Technical Parameters, Operating Conditions, and Demonstration of Non-Interference (47CFR25.135)

This section describes the technical parameters of the ARGOS-Kinéis terminals that ameliorate the risk of harmful interference to radiocommunication services in the requested frequency bands.

- **E.I.R.P. Limits**: ARGOS-Kinéis terminals will be operated to comply with the 5 dBW and 7 dBW e.i.r.p limits in the 399.9-400.05 MHz and 401-403 MHz frequency bands, respectively; and with the limits provided for in the note (2) of the Rec. ITU-R SA.2045-0 (-3dBW EIRP in 401.1-401.2 MHz and 401.3-401.4 MHz). The integrators may choose various antennas providing different antenna gain parameters. The application describes the antenna type used by the majority of the ARGOS-Kinéis ecosystem. The maximum level of 5 or 7 dBW will not be exceeded by any ARGOS-Kinéis terminals, as in effect, the terminal power level will be below 5 dBW most of the time, and typically in the range -9 dBW to 0 dBW to maximize power consumption efficiency and reduce cost of device manufacturing.
- **Duty Cycle and transmission limitations**: ARGOS-Kinéis terminals will transmit at low duty cycle (typically 0.01%) signal burst of about 1 second, presenting a very low spectrum and time occupation of the radio channel and thereby facilitating sharing with other ARGOS-Kinéis terminals and other users of the bands.
- **Frequency selection**: Each ARGOS-Kinéis terminal will be allocated randomly a frequency within the authorized sub-band depending on the end-user applications, which may require different throughput depending on the use cases.

This section addresses the operating conditions and limitations.

- **Voice service limitation**. By design the ARGOS-Kinéis service does not offer voice services, complying with 47 C.F.R. § 25.142(b)(1).
- **Coordination with federal users**. ARGOS-Kinéis terminals will comply with any technical parameters defined to protect federal users from the NVNG MSS operated by Kinéis per its commitment and requirement to coordinate its operation. Kinéis is engaging with the FCC and NTIA to reach appropriate coordination agreements.

- **Coordination with other NVNG MSS users**. Kinéis is engaging with authorized NVNG MSS operators and target to reach an agreement for harmonious operations.