

Date: 26 August 2019

To: Nimesh Sangani
Office of Engineering and Technology
Federal Communications Commission
445 Twelfth Street, S.W.
Washington, D.C. 20554

Re: ELS File No. 0330-EX-CN-2019
ITU SNL Database Search and Supplement to EMC Analysis

Nimesh,

In response to your email requests dated August 8, 2019 and July 26, 2019 in the above-referenced proceeding, Astro Digital US, Inc. ("Astro Digital") has performed an International Telecommunication Union ("ITU") Space Network List ("SNL") database search associated with the space-to-Earth and Earth-to-space frequency bands being proposed for use in the above-referenced Part 5 experimental license application and further supplements its electromagnetic compatibility ("EMC") analysis. We note that there are three categories of space systems that apply in our circumstances:

- 1) Those systems with which there is no potential for interference;
- 2) Those systems with which there is some potential for interference; and
- 3) Those systems which have applied to the process as an Advanced Publication Information ("API") filing and which request the entire frequency band. It is not possible to assess these Category 3 systems at this time because they have not quantified their actual intended operating frequencies. NOTE: We place these systems in a different category as they will not likely be launched or operated during the limited term of our experimental (Part 5) license.

We focus in this letter on those systems in Category 2. These systems are the only systems that would seem to be capable of any conflict in terms of potential interference.

400.15 to 401.00 MHz Band Systems; NGSO; space-to-Earth - POTENTIAL CONFLICT:

The following systems were identified in the SNL database in our Category 2:

SNL List for F=400-401 MHz; NGSO; space-to-Earth Direction - POTENTIAL CONFLICT				
No.:	Country:	System Name at ITU:	NOTIF.REASON:	Reason for Potential Conflict:
1	CAN	M3MSAT	C & N	Overlapping Assignment
2	HOL	HOL-MG-A006	C	Overlapping Assignment
3	S	KIRUNA ROCKET	N	Overlapping Assignment
4	USA	LEOTELCOM-3	U	Slight Frequency Overlap
5	USA	BLOCK-5D-3	N	Slight Conflict on TEM&WWP Beams
Total:			5	

Of the 85 systems reported in this frequency band, these systems have overlapping spectrum and are in a category higher than A (API filing only). Of these systems, the U.S. systems are only

overlapping by a fraction of our emission bandwidth (20 kHz). The systems from Holland and Singapore do not appear to have earth stations that will operate near our stations in Santa Clara, CA and Littleton, CO. At this time, we are not certain about the operations of the Canadian system M2MSAT.

402 to 403 MHz Band Systems; NGSO; Earth-to-space - POTENTIAL CONFLICT:

Of the 47 systems reported in this frequency band, these systems have overlapping spectrum. All of these systems have submitted APIs only. The two Chinese systems likely communicate with earth stations that operate outside the coverage area of our operations; hence, there would be no potential conflict between systems. The two French systems appear to be a portion of the NOAA/CNES Tiros Data Collection System. Our understanding is that this system will not be implemented until sometime after the end of 2020 (at the earliest), and our operations should be completed by that time.

SNL List for F=402-403 MHz; NGSO; Earth-space Direction - Potential Conflict			
No.:	Country:	System Name at ITU:	Reason for Potential Conflict:
1	CHN	HT-1	Overlapping Assignment
2	CHN	QS-1	Overlapping Assignment
3	F(France)	ARGOS-4A	Overlapping Assignment
4	F(France)	A4NG	Overlapping Assignment

EMC Analysis and Further Coordination:

With regard to the systems that are or may operate in the 402-403 MHz band that could be caused interference by our Part 5 space station, we believe that the Chinese systems will cooperate while there is mutual visibility between systems. For the ARGOS systems, we believe these systems will not be in operation during the performance period of this license. If this is not the case, we will agree to cease operations of our uplink commanding earth station(s) during the time that the NOAA/CNES Tiros system is in line-of-sight to those stations.

With regard to the systems that are or may operate in the 400.48-400.52 MHz channel, Astro Digital agrees to coordinate with the operators of all the systems we have listed here in order to determine if any mitigation is necessary.

For completeness, we have provided a complete breakdown of our ITU SNL database search as Attachment A to this letter. We will perform further analysis regarding systems that could operate co-channel to our own once we have discussed the details of these systems with the appropriate operators.

The above results also serve as further support for our prior EMC analysis sent via email to you on July 25, 2019. Attached as Attachment B is a copy of that email for inclusion in the record.

Best regards,

/s/ Jan A. King

Jan A. King
CTO
Astro Digital US, Inc.

ATTACHMENT A: Space Network List Data Base Search for:

- 400.15 – 401.00 MHz; NGSO; space-to-Earth; All Latitudes; All Submission Reasons
- 402.00 – 403.00 MHz; NGSO; Earth-to-space; All Latitudes; All Submission Reasons

SNL List for F=400-401 MHz; NGSO; space-to-Earth Direction - ALL ENTRIES

<u>ADM/ORG</u>	<u>SATELLITE NAME</u>	<u>NOTIF. REASON</u>	<u>BR IFIC</u>	<u>FREQUENCIES</u>
AFS	ZACUBE-2	A	2875	view
ARG	LATINSAT	U	2487	view
ARG	LATINSAT	N	2742	view
ARS	SAUDISAT-1C	U	2625	view
ARS	SAUDISAT-1C	N	2667	view
AUS	MNSAT	C	2895	view
B	VCUB1	A	2898	view
BEL	MLMS	U	2412	view
BEL	PICASSO-BEL	A	2892	view
BEL	SIMBA	C	2895	view
CAN	CASSIOPE-1A	N	2770	view
CAN	ADS	U	2791	view
CAN	ADS	C	2807	view
CAN	M3MSAT	U	2834	view
CAN	EV9	U	2839	view
CAN	ADS	N	2872	view
CAN	MULTUS	A	2874	view
CAN	M3MSAT	C	2879	view
CAN	KELYPsis	A	2884	view
CAN	KELYPsis	C	2888	view
CAN	M3MSAT	N	2892	view
CHN	MCSCS	C	2832	view
CHN	KS-2	A	2872	view
CHN	CMARS-1	A	2878	view
CHN	JUVENILE-OFO	C	2891	view
CHN	JUVENILE-5C	C	2892	view
D	ICARUS	A	2761	view
D	CUBEL	A	2893	view
DNK	ULLORIAQ	C	2860	view
E	AISTECH	C	2888	view
E	AISTECH	A	2896	view
E	NANOSAT-1	U		view
F	EB-SAT-LEO-1	C	2888	view

ADM/ORG	SATELLITE NAME	NOTIF. REASON	BR IFIC	FREQUENCIES
F	EB-SAT-LEO-1B	C	2888	view
F	F-SAT-NG-7	A	2889	view
F	F-SAT-NG-8	A	2898	view
F	A4NG	A	2900	view
G	CATAPULT-IOD	A	2898	view
HOL	IPS	A	2821	view
HOL	HOL-MG-ANS-001	A	2842	view
HOL	IPS	N	2857	view
HOL	HOL-MG-ANS-002	A	2862	view
HOL	HOL-MG-A006	C	2864	view
HOL	HOL-MG-ANS-002	N	2884	view
J	SPATIUM	C	2891	view
J	SPATIUM	A	2893	view
LUX	LXS-AIS	U	2716	view
LUX	LXS-AIS	N	2870	view
MEX	THUMBSAT-1	C	2891	view
NOR	HYPISO	A	2902	view
PNG	MICRONSAT	C	2895	view
RUS	TSYKADA	N	2804	view
S	KIRUNA ROCKET	N	2577	view
S	PRISMA	N	2680	view
S	BEYOND-ATLAS-1	A	2896	view
SLM	SI-SAT-KURUKURU	C	2886	view
SLM	SI-SAT-KURUKURU	U	2897	view
SLM	SI-SAT-BILIKIKI	C	2899	view
SUI	S4P	A	2819	view
SUI	S4P	N	2896	view
USA	LEOTELCOM-3	U	2424	view
USA	BLOCK 5D-3	N	2590	view
USA	LEOTELCOM-1	N	2593	view
USA	LEOTELCOM-3	N	2593	view
USA	MSL	N	2750	view
USA	UST4WP	C	2752	view
USA	INSIGHT	A	2764	view
USA	MARS 2020	A	2831	view
USA	CICERO	A	2853	view
USA	NANOACE	A	2853	view
USA	CUCU	A	2865	view
USA	COSMIC-2	C	2870	view
USA	INSIGHT	N	2873	view

ADM/ORG	SATELLITE NAME	NOTIF. REASON	BR IFIC	FREQUENCIES
USA	RAINCUBE	A	2875	view
USA	LUNAR ICECUBE	A	2882	view
USA	ISS-CUCU	N	2884	view
USA	CUCU	N	2892	view
USA	MOMENTUS	A	2895	view
USA	THEA	A	2896	view
USA	BRIO	A	2897	view
USA	SEAHAWK	A	2898	view
USA	USASAT-30H-LM	A	2900	view
USA	CUPID	A	2902	view
USA	LEOTELCOM-1	U		view
USA	LEOTELCOM-5	U		view
TOTAL:		85		

SNL List for F=400-401 MHz; NGSO; space-to-Earth Direction - NO CONFLICT				
No.:	Country:	System Name at ITU:	NOTIF. REASON:	Reason There is No Conflict:
1	ARG	LATINSAT	U & N	No Common Channel
2	AUS	MNSAT	C	No Common Channel
3	B	VCUB1	A	No Common Channel
4	BEL	PICASSO-BEL	A	No Common Channel
5	CAN	CASSIOPE-1A	N	No Common Channel
6	CAN	ADS	A & N	No Common Channel
7	CAN	EV9	U	Mars Mission
8	CAN	CMARS-1	N	No Common Channel
9	CHN	JUVENILE-OFO	C	No Common Channel
10	CHN	JUVENILE-5C	C	No Common Channel
11	D	ICARUS	A	No Common Channel
12	DNK	ULLORIAQ	C	No Common Channel
13	E	AISTECH	E	No Common Channel
14	E	NANO-1	E	No Common Channel
15, 16	HOL	IPS	A & N	No Common Channel
17	MEX	THUMBSAT-1	C	No Common Channel

18,19	LUX	LUX-AIS	U & N	No Common Channel
20	RUS	TSYKADA	N	No Common Channel
21	S	Beyond-Atlas-1	A	No Common Channel
22, 23	SUI	S4P	A & N	No Common Channel
24	USA	LEOTELCOM-1	N & U	No Common Channel
25	USA	UST4WP	C	No Common Channel
26, 27	USA	INSIGHT	A & N	Mars Mission
28	USA	MARS2020	A	Mars Mission
29	USA	CICERO	A	Stops @ 400.5MHz
30	USA	NANOACE	A	No Common Channel
31	USA	COSMIC-2	C	No Common Channel
32	USA	RAINCUBE	A	No Common Channel
33	USA	LUNARICECUBE	A	Starts@400.5 MHz
34	USA	MOMENTUS	A	Coordinated
35	USA	THEA	A	Starts@400.5 MHz
36	USA	BRIO	A	Starts@400.5 MHz
37	USA	SEAHAWK	A	No Common Channel
38	USA	USASAT-30H-LM	A	Coordinated
39	USA	ISS-CUCU	N	Expected to be coordinated with NASA consistent with prior agreements
40	USA	CUCU	N	Expected to be coordinated with NASA consistent with prior agreements
Total:			40	

SNL List for F=400-401 MHz; NGSO; Space-to-Earth Direction - POTENTIAL CONFLICT				
No.:	Country:	System Name/ITU:	NOTIF.REASON:	Reason for Potential Conflict:
1	CAN	M3MSAT	C&N	Overlapping Assignment
2	HOL	HOL-MG-A006	C	Overlapping Assignment
3	S	KIRUNA ROCKET	N	Overlapping Assignment
4	USA	LEOTELCOM-3	U	Slight Frequency Overlap
5	USA	BLOCK-5D-3	N	Slight Conflict on TEM&WWP Beams
Total:		5		

SNL List for F=402-403 MHz; NGSO; Earth-space Direction - ALL ENTRIES				
ADM/ORG:	Satellite Name:	Notification/Reason:	BR IFIC:	Frequency:
AFS	ZACUBE-2	A	2875	view
ARS	SAUDISAT-2	N	2697	view
B	ITASAT-1	A	2897	view
CAN	JC2SAT	A	2640	view
CAN	GHGSAT-D	A	2773	view
CAN	GHGSAT-D	N	2898	view
CHN	SPACEKEY-2	A	2845	view
CHN	HT-1	A	2862	view
CHN	AOBO	A	2865	view
CHN	DES-LEO	A	2867	view
CHN	SPACEKEY-2	N	2871	view
CHN	CMARS-1	A	2878	view
CHN	QS1	A	2880	view
CHN	AOBO	N	2886	view
CHN	SKYWALKER	A	2892	view
D	ICARUS	A	2761	view
D	ICARUS	N	2896	view
E	OPTOS	N	2764	view
E	AISTECH	A	2896	view
F	ARGOS-4A	A	2805	view
F	BRONET	A	2891	view
F	A4NG	A	2900	view
G	JUKEBOX	A	2902	view
G	CDCSAT-1	A	2902	view
J	SPATIUM	A	2893	view
LUX	MINAS	A	2880	view
NOR	TYVAK-0082	A	2890	view
NOR	HYPISO	A	2902	view
POL	SWIATOWID 2	A	2896	view
RUS	METEOR-3M	N	2652	view

RUS	ARCTICA-M	A	2800	view
RUS	AURIGA	A	2866	view
RUS	ARCTICA-M	N	2871	view
SNG	COLUGO	A	2862	view
SVN	NEMO-HD	A	2780	view
SVN	NEMO-HD	N	2832	view
USA	MRO	N	2584	view
USA	OSTM	A	2682	view
USA	MARCO	A	2823	view
USA	NPOESS	A	2831	view
USA	USASAT-30A	A	2842	view
USA	LEMUR-2	A	2854	view
USA	LEMUR-2-3	A	2867	view
USA	LEMUR-2	N	2879	view
USA	MOMENTUS	A	2895	view
USA	CAPSAT	A	2897	view
USA	USASAT-30H-LM	A	2900	view
TOTAL:			47	

SNL List for F=402-403 MHz; NGSO; Earth-space Direction - No Conflict			
No.:	Country:	System Name at ITU:	Reason:
1	CAN	GHGSAT-D	No Common Channel
2	CHN	AOBO	No Common Channel
3	CHN	DES-LEO	No Common Channel
4	CHN	SKYWALKER	No Common Channel
5	E(Spain)	OPTOS	No Common Channel
6	RUS	METEOR-3M	No Common Channel
7	RUS	AURIGA	Coordinated
8	SVN	NEMO-HD	No Common Channel
9	USA	MRO	Mars Mission
10	USA	OSTP	No Common Channel
11	USA	MARCO	Mars Mission (over)
12	USA	USASAT-30A	No Common Channel
13	USA	LEMUR-2	No Common Channel
14	USA	Momentus	Coordinated

15	USA	CAPSAT	No Common Channel
16	USA	USASAT-30H-LM	Coordinated

SNL List for F=402-403 MHz; NGSO; Earth-space Direction - Potential Conflict			
<i>No.:</i>	<i>Country:</i>	<i>System Name at ITU:</i>	<i>Reason for Potential Conflict:</i>
1	CHN	HT-1	Overlapping Assignment
2	CHN	QS-1	Overlapping Assignment
3	F(France)	ARGOS-4A	Overlapping Assignment
4	F(France)	A4NG	Overlapping Assignment

ATTACHMENT B: Email from Jan King, Astro Digital, to Nimesh Sangani, FCC

Lin, Tony

From: Jan King <jan@astrodigital.com>
Sent: Thursday, July 25, 2019 10:26 PM
To: Nimesh Sangani
Cc: Chris Bidy; Patrick Shannon; Lin, Tony
Subject: File No. 0330-EX-CN-2019; Correspondence Ref: 49304

To: Nimesh Sangani,

From: Applicant: Astro Digital US, Inc; Jan A. King, Chief Technical Officer

File No. 0330-EX-CN-2019

Correspondence Ref. No.: 49304

Date of Original Email: 07/03/2019

Response:

Nimesh,

Thank you for your email.

By separate email, I am sending you a revised ITU filing, which checks the box regarding Article 4.4 being applicable to this space-Earth emission.

With respect to the requested EMC analysis, this is a command uplink emission, and we have been able to successfully coordinate the same PFD level and bandwidth with other authorized operators (particularly as it applies to our use w.r.t. to our Part 25 license grant (see SAT-LOA-20170508-00071) and other approved Part 5 authorizations. Use of this frequency for command purposes will be relatively infrequent at each of two earth stations (Santa Clara, CA and Littleton, CO). We will command the proposed spacecraft for approximately 4 or less passes per day from each site, and the pass durations are less than or equal to 10 minutes per pass. Additionally, the mission duration is expected to be less than one year.

For our other authorized operations in this band, we have not had any reported instances of harmful interference either to US Federal Government users or to any other user of the frequency band. We understand that NOAA is a primary user of this band, and we expect to be able to coordinate our use with NOAA. This link is situated well away from the NOAA Data Collection System (DCS) uplink frequency band, and no changes to their system performances are anticipated during the period of our proposed operations.

Jan A. King
Chief Technical Officer
Astro Digital - US
jan@astrodigital.com