



August 18, 2023

VIA ELECTRONIC FILING

Ms. Marlene H. Dortch, Secretary
Federal Communications Commission
45 L Street NE
Washington, DC 20554

Re: Notice of *Ex Parte* Presentation, GN Docket No. 23-135; ICFS File No. SAT-MOD-20230207-00021

Dear Ms. Dortch:

On August 17, 2023, representatives of Omnispace, LLC¹ met with Commission staff² to discuss the above-referenced proceedings. The purpose of the Omnispace meeting with the FCC was to address issues raised by SpaceX during meetings held with FCC staff on July 24, 2023, and reported in an *ex parte* letter on July 26, 2023. During the August 17 meeting, Omnispace provided a presentation (attached) to address SpaceX allegations that analysis undertaken by Omnispace was unrealistic or incorrect, when in fact Omnispace's analysis used best case parameter assumptions rather than worst case and still showed that there will be harmful interference from the aggregate power of SpaceX satellites in view of Omnispace's receive antenna system.

SpaceX has yet to provide any technical analysis addressing Omnispace's detailed concerns that the SpaceX/T-Mobile request to provide SCS in the PCS G-block of 1910-1915 MHz/1990-1995 MHz will cause space-to-space interference to duly authorized and operational mobile-satellite service (MSS) systems like those of Omnispace because the U.S. terrestrial uplink-downlink assignment conflicts with the global ITU MSS uplink-downlink allocation. As Omnispace explained in its comments and reply comments in the above-referenced proceedings, while idiosyncratic uplink and downlink allocations do not necessarily create problems for terrestrial infrastructure, these conflicts generate acute problems for satellite infrastructure where even a single distant transmitter operating at comparatively low power can cause system-disabling interference for sensitive satellite receivers since the vacuum of space provides the least-possible path loss. In addition, SpaceX claims this is a transient problem by assuming only one

¹ Attending for Omnispace were Mindel De La Torre (Chief Regulatory and International Strategy Officer), Ron Olexa (Vice President for Terminal and RF Engineering) and John Zukoski (Vice President for Satellite Engineering).

² Attending for the FCC were Jennifer Gilsenan, Jeanine Poltronieri, Whitney Lohmeyer, Stephanie Neville, Clay DeCell, Jameyanne Fuller, and Gregory Boren of the Space Bureau; Kari Hicks, Jon Markman, Melissa Conway, Alice Koethe, Kamran Etemad, and Hallie Peacher of the Wireless Telecommunications Bureau.



Omnispace, LLC

8255 Greensboro Drive, Suite 101, McLean, VA 22102

+1 (202) 930-7922 omnispace.com info@omnispace.com

Omnispace satellite out of a constellation is impacted. However, because there are two constellations of satellites (Omnispace and SpaceX) moving constantly in relation to each other, the interference issues are not a transient problem but a continual one. During the meeting, Omnispace pointed out that, in its July 24 presentation, SpaceX incorrectly set the thermal noise level, so SpaceX significantly underestimated the interference to Omnispace.

While not a direct concern to our MSS operations, Omnispace also noted that there are additional terrestrial interference considerations that should be taken into account by the FCC with regard to cross-market and cross-border claims made by SpaceX.

Please direct any questions regarding this matter to the undersigned.

Respectfully Submitted,

/s/ Mindel De La Torre

Mindel De La Torre
Chief Regulatory and International Strategy Officer
Omnispace, LLC

Attachment



Omnispace, LLC

8255 Greensboro Drive, Suite 101, McLean, VA 22102

+1 (202) 930-7922 omnispace.com info@omnispace.com



Omnispace Response to SpaceX *Ex Parte* of 26 July 2023

GN Docket No. 23-135

ICFS File No. Sat-MOD-20230207-00021

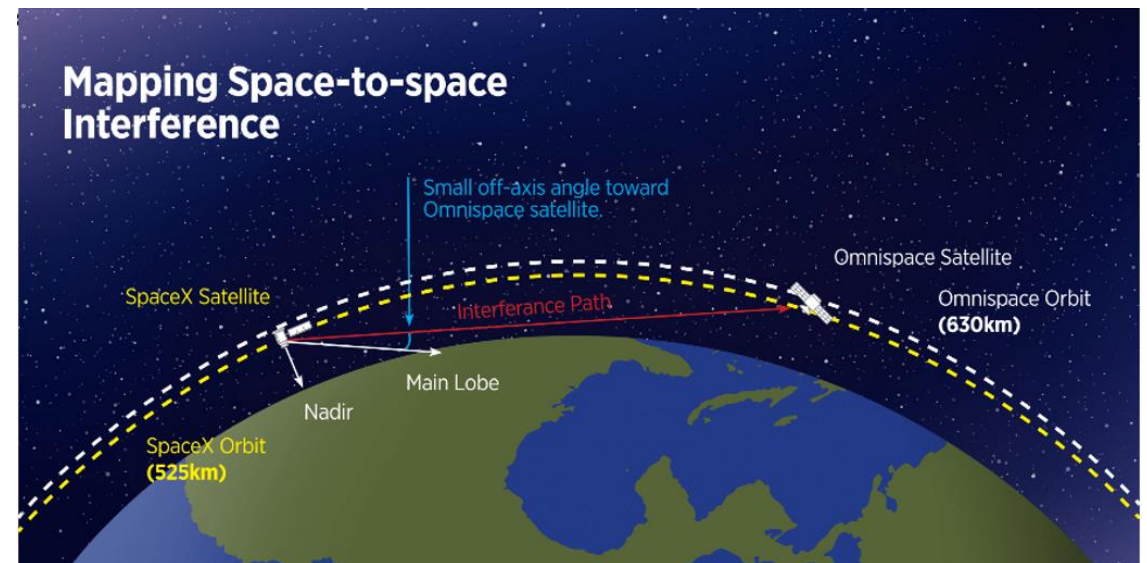


Omnispace's interference concerns have not yet been addressed

- Omnispace has raised interference concerns at various comment and reply comment stages of the FCC's NPRM on *the Single Network Future: Supplemental Coverage from Space* and SpaceX/T-Mobile's *Application for Modification of Authorization for the SpaceX Gen2 NGSO Satellite System to Add a Direct-to-Cellular System*
 - Omnispace's interference concerns have been supported by extensive technical analyses (see pages 8-16, *Omnispace Reply Comments To Responses*, 5 June 2023)
- SpaceX's most recent *ex parte* of July 26 contends that additional information provided by SpaceX to the FCC demonstrates that the "proposed operations will not cause harmful interference to in-band, out-of-band, and cross-border users"
- In its latest *ex parte*, SpaceX continues to ignore the analyses provided by Omnispace in the record and erroneously accuses Omnispace of unrealistic and incorrect assumptions. Additionally, SpaceX has made an elementary error in calculating the aggregate interference of SpaceX SCS downlink into Omnispace's satellite uplink
 - This mistake results in the erroneous conclusion that the aggregate interference will be significantly below internal noise power

SpaceX claims Omnispace uses unrealistic antenna performance

- Omnispace's first analysis used performance parameters expected of the direct radiating arrays (DRAs) required to provide a service such as that proposed by SpaceX
 - Each satellite must produce many spotbeams at many angles to create a coverage field of view
 - 30 dB side lobe attenuation was used in Omnispace's original analysis
- SpaceX challenged this, so Omnispace's *Reply Comments* used the best case expectation of Rec. ITU-R S.1528 and raised the sidelobe attenuation to 38 dB
- Also, instead of assuming single satellite to single satellite interference, Omnispace's revised analysis used **100** SpaceX satellites in the field of view based upon a review of SpaceX's ITU filings
 - This analysis still showed significant interference developed towards Omnispace's satellite



Omnispace's Reply Comments addressed SpaceX allegations utilizing SpaceX asserted gain values and best-case assumptions for the Omnispace sidelobe performance for off-axis beams

Table 1: Aggressor Downlink Power Calculation

Parameter	Value	Units	Notes
Satellite EIRP	88	dBm	Max EIRP specified in SpaceX Tech Narrative and Schedule S
Bandwidth	1.08	MHz	Calculated on next tab
Antenna Gain	38	dBi	Max gain from SpaceX Tech Narrative and Schedule S
Transmit Power per Hz	-10.3	dBm/Hz	
SpaceX Off-axis Gain in direction of Omnispace satellite	0	dBi	Assume side lobes are fully attenuated
EIRP toward Omnispace satellite	-10.3	dBm/Hz	
Required I/N	-12.2	dB	Noise rise 0.25 dB
Required Ix Power at Rx	-174.7	dBm/Hz	
Omnispace Off-axis Gain in direction of SpaceX satellite	0	dBi	Assume sidelobes are fully attenuated
Power at Omnispace Rx (no separation)	-10.3	dBm/Hz	
Required Isolation	184.4	dB	
Number of satellites in view	100		
Power increase due to number of satellites	20	dB	
Required Separation Distance	19827	km	
Altitude of Aggressor Satellites	535	km	
Maximum distance above the horizon	5570.6	km	

- These results use SpaceX asserted gain values and **best-case** assumptions – not worst-case
- The results indicate that there will be **harmful interference** from the aggregate power from the 100 SpaceX satellites that are in view of the Omnispace receive antenna system
- In fact, if the same 100 SpaceX satellites were in view, the satellites would need to be more than **19,000 km away** before the interference would be acceptable
- Source: Pages 12-13, Omnispace *Reply Comments To Responses*, 5 June 2023

Omnispace's Reply Comments calculated the severity of actual noise floor rise of the impact of the multiple satellites within view of a single Omnispace satellite serving Colombia

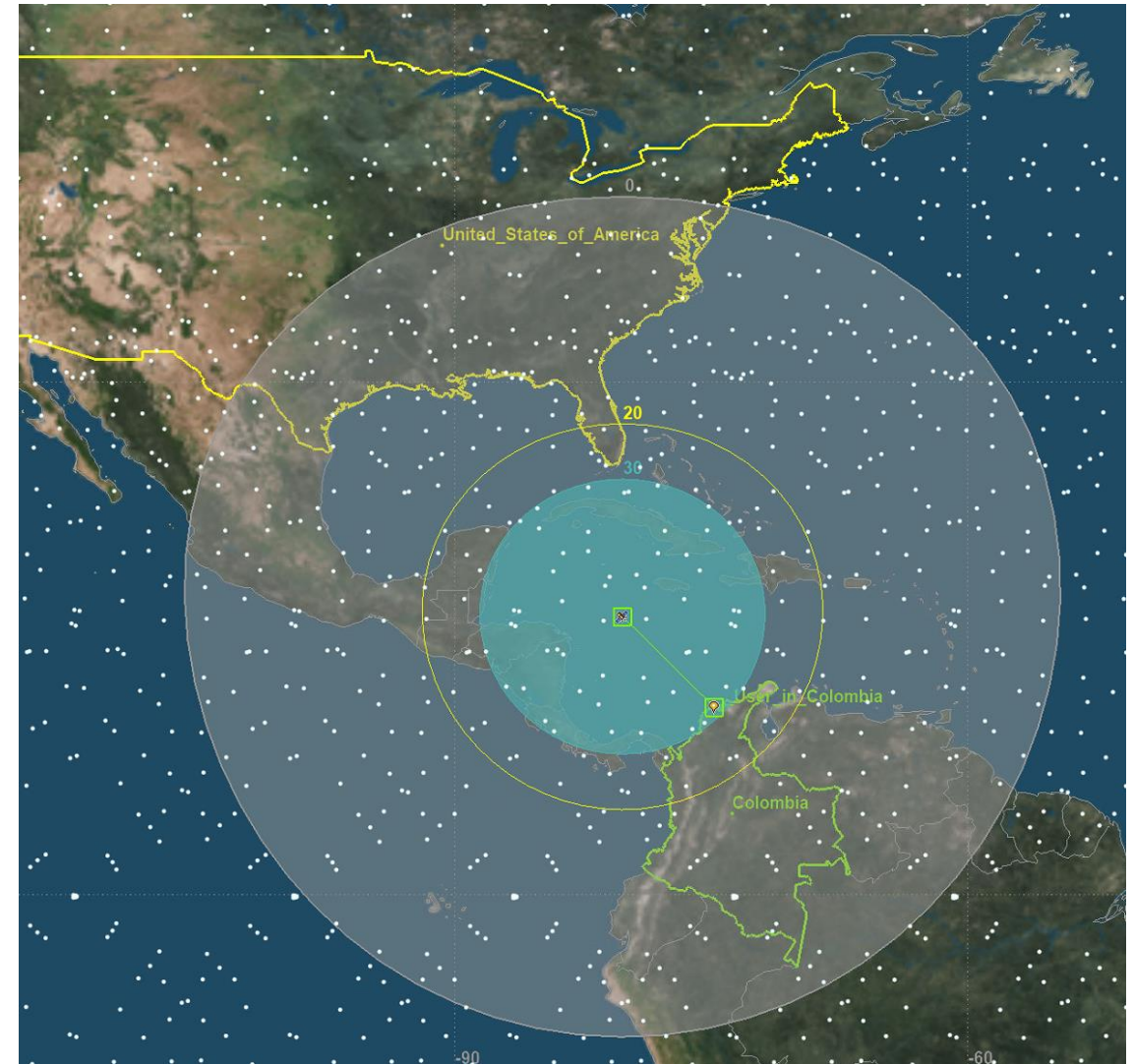
Parameter	Value	Units	Notes
Satellite EIRP	88	dBm	Max EIRP specified in SpaceX Tech Narrative and Schedule S
Bandwidth	1.08	MHz	Calculated on next tab
Antenna Gain	38	dBi	Max gain from SpaceX Tech Narrative and Schedule S
Transmit Power per Hz	-10.3	dBm/Hz	
SpaceX Off-axis Gain in direction of Omnispace satellite	0	dBi	Assume side lobes are fully attenuated
EIRP toward Omnispace Sat	-10.3	dBm/Hz	
Required I/N	0	dB	Noise rise 3 dB
Required Ix Power at Rx	-162.5	dBm/Hz	
Omnispace Off-axis Gain in direction of SpaceX satellite	0	dBi	Assume sidelobes are fully attenuated
Power at Omnispace Rx (no separation)	-10.3	dBm/Hz	
Required Isolation	172.2	dB	
Number of satellites in view	100		SpaceX satellites in view serving U.S.
Power increase due to number of satellites	20	dB	Cumulative energy increase due to multiple spacecraft
Required Separation Distance	4867	km	

- Demonstrates that the many SpaceX satellites operating serving the US will contribute similar power as will be seen by the Omnispace satellite from its own users in Colombia
- 0 dB I/N means that the interferer will arrive with power equaling the desired signal -- this is the equivalent of raising the noise floor by 3 dB which will result in a best-case **reduction of 50% of the capacity** of the Omnispace system – the desired signal modulation and coding will need to be reduced in order to compensate for the noise floor rise
- This is clearly **harmful interference** as Omnispace's satellite capacity is reduced by 50% or greater
- Source: Pages 13-16, *Omnispace Reply Comments To Responses*, 5 June 2023

Single Omnispace satellite providing coverage to Colombia

Overlay of field of view with 7,500 satellite SpaceX constellation

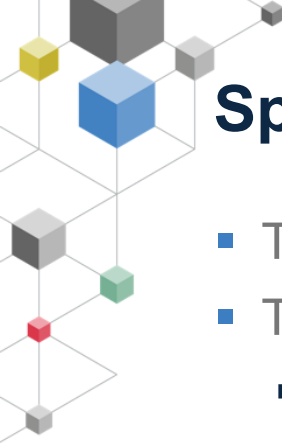
- SpaceX considers only the impact of a single satellite
- Omnispace showed that there would be on the order of 100 SpaceX satellites serving the US in view of a single Omnispace satellite serving Colombia
 - SpaceX noted it should be 188 not 100 satellites so this graphic vastly undercounts the SpaceX planned system
- SpaceX's latest calculations consider the aggregate power of the interfering signals from the 180 satellites in view of a single Omnispace satellite serving nearby Colombia, but incorrectly set the thermal noise level and significantly underestimate the interference
- Source: Page 11, Omnispace *Reply Comments To Responses*, 5 June 2023





Omnispace used lower number of satellite interference sources than actual higher SpaceX number

- As mentioned previously, SpaceX now notes **188 Starlink satellites** in view of the Omnispace satellite instead of the **100** used in Omnispace's analysis
- The result nearly **doubles** the number of interference sources and makes the interference problem 2.7 dB worse or 1.9 times more interference than what Omnispace originally calculated
- SpaceX claims this is a transient problem by assuming only one Omnispace satellite out of a constellation as being impacted
 - **Not a transient problem** because there are two constellations of satellites (Omnispace and SpaceX) moving constantly in relation to each other
- Without presenting any evidence, SpaceX still claims that its antenna array will exhibit a side lobe power attenuation much greater than what Omnispace believes is possible based on current DRA technology
- Using SpaceX's own claimed antenna performance, SpaceX then declares that no interference is generated, however, there is a **significant error** in its interference analysis as SpaceX uses an **incorrect** thermal noise floor of **-132.5 dBW/MHz**



SpaceX representation of noise floor is incorrect by 11.4 dB

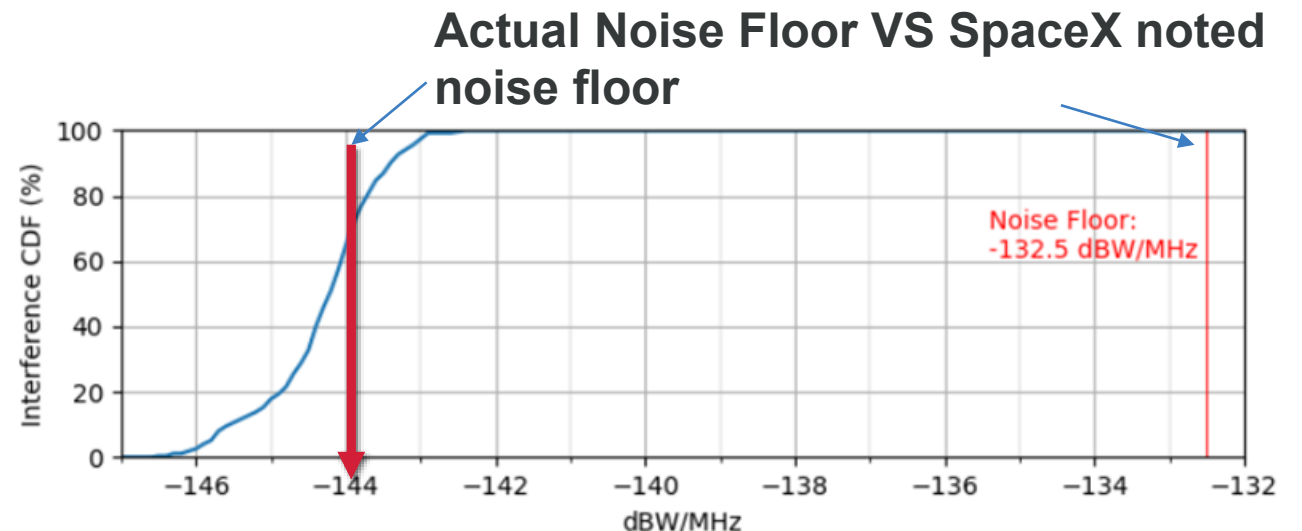
- Thermal noise in one MHz is an established fact, yet SpaceX misrepresents this in its analysis
- The total thermal noise power $N = (kTB)$ is a function of three entities:
 - Boltzmann's constant "k" in Joules/°K
 - Temperature T in degrees °Kelvin
 - Bandwidth of the channel B in Hz.

Noise power $N = 10 \times \log_{10}(k \times T \times B)$ in dBW/Hz

For B = 1 MHz $N = 10 \times \log_{10}(1.38 \times 10^{-23} \times 290^\circ \times 1,000,000) = -144$ dBW/MHz

- SpaceX claims this level is -132.5 dBW/MHz

- Using SpaceX's own questionable antenna performance numbers, and by its own admission, SpaceX interference will be equal to or greater than the noise floor based upon the real noise floor and number of satellites in view





Impact of SpaceX interference on Omnispace

Adding interference equal to thermal noise will raise the $C/I+N$ seen by Omnispace 3 dB over thermal noise alone

ITU-R Recommendation S.2131 notes the maximum acceptable signal to noise degradation is 1 dB, which results in a 10% reduction in spectral efficiency

A 3 dB rise in the noise floor ($C/I+N$) seen by the Omnispace satellite will cause a 50% reduction in capacity due to the fact that there is not 3 dB of additional power available at the user equipment to compensate for the additional interference

Omnispace considers this to be harmful interference



Additional terrestrial interference considerations

- Beyond Omnispace's satellite to satellite interference concerns, SpaceX's claims regarding cross-market or cross-border interference are specious
- SpaceX uses terrestrial border power coordination levels to determine its cross-border interference is acceptable
- However, these limits (47 dBuV/M) were made for terrestrial to terrestrial systems with the expectation that terrestrial signals decay at rates of 30 to 40 dB/Decade due to terrain, morphology and Earth bulge
- Satellite signals will have no decay other than roll off of the beam gain because there is no terrain and morphology adding losses to the free space loss derived signal from space
- From an altitude of 550 km, the ground illumination in the satellite beam achieving 47 dBuV/M power flux will be -95 dBm, which can be equivalent to cell edge coverage of the terrestrial system and will raise the noise floor significantly due to added interference
- This will impact the capacity and coverage of all terrestrial cells operating within and beyond the spotbeam from the SpaceX satellite



Conclusions

- SpaceX continues to make assertions without any supporting analysis
- Using SpaceX's own calculations and assumptions, the Starlink system will cause harmful interference to Omnispace
- The interference from the 188 SpaceX satellites in view will equal or exceed the thermal noise floor
 - Satellite systems are designed to operate at very low carrier-to-noise (C/N) levels
 - If interference is added, then the impacted system can no longer provide the service that is achievable in an interference free environment
 - The new base for system performance will be based on C/I+N
- Since satellite systems operate with very small margins, any added interference will reduce the capacity of the Omnispace satellite
 - This level of interference will interrupt communications entirely in marginal signal areas
- Omnispace believes SpaceX's antenna performance assumptions are unachievable and therefore the actual interference levels will be far greater than SpaceX portrays



Thank you