November 13, 2013

The Honorable Fred Upton
Chairman
United States House of Representatives
Committee on Energy and Commerce
Washington, DC 20515

The Honorable Henry Waxman
Ranking Member
United States House of Representatives
Committee on Energy and Commerce
Washington, DC 20515

The Honorable Greg Walden
Chairman
United States House of Representative
Committee on Energy and Commerce
Subcommittee on Communications and Technology
Washington, DC 20515

The Honorable Anna Eshoo
Ranking Member
United State House of Representatives
Committee on Energy and Commerce
Subcommittee on Communications and Technology
Washington, DC 20515

Dear Chairman Upton, Ranking Member Waxman, Chairman Walden and Ranking Member Eshoo:

As you prepare for the Subcommittee on Communications and Technology's upcoming hearing, "Challenges and Opportunities in the 5 GHz Spectrum Band," Intelsat Corporation ("Intelsat") and SES Americom, Inc. ("SES") would like to bring to your attention our interests and concerns with the FCC's proposal to introduce ubiquitously-deployed U-NII (Unlicensed National Information Infrastructure) devices in the 5850-5925 GHz ("5.9 GHz") band.

International fixed-satellite service ("FSS") is allocated on a co-primary basis in the 5.9 GHz band. The satellite industry has been using this uplink (Earth-to-space) band to provide a wide range of international services to commercial and government customers for many decades. Intelsat and SES alone have a dozen satellites in orbit, representing billions of dollars in investments that serve the United States using this band.

While we understand the desire to identify new spectrum to satisfy the increasing demand in wireless uses and applications, we have significant concerns about what impact the introduction of U-NII devices changes could have on our long-standing operations in the 5.9 GHz band. SES and Intelsat have commissioned a study (see enclosed) to evaluate whether U-NII devices could be introduced in the 5.9 GHz band without causing unacceptable interference into licensed FSS uplinks. Specifically, we were concerned about aggregate interference from U-NII devices into the 5.9 GHz satellite receiver in orbit, which would "see" the cumulative interference from all devices within the satellite's footprint. Because 5.9 GHz is an international FSS band, the satellite footprints in this band are typically very large, covering one or more continents.

Our analysis demonstrates that even small numbers of simultaneously-operating U-NII devices would result in aggregate interference to FSS receivers that exceed the internationally recognized levels set through the ITU and thus could degrade the satellite transmission. Even if the widest bandwidth for U-NII operations is used, only 5,200 outdoor U-NII devices would by themselves create a 1% rise in the satellite receive system interference noise temperature – an increase that would consume the entire allowance established by the ITU for all non-primary services in the spectrum band. Because there are other non-primary operations in the band, however, U-NII devices would need to be held to a fraction of that allowance.

In contrast, U-NII proponents have indicated a desire to deploy hundreds of millions of devices capable of operating in the 5.9 GHz band. The Wi-Fi Alliance has issued a press release that estimates that more than 1.5 billion dual-band U-NII chipsets utilizing 802.11n and 802.11ac protocols will ship by the end of next year. Clearly, there is a disconnect between the U-NII industry's desire to ubiquitously deploy U-NII devices capable of operating in the 5.9 GHz band and the technical reality that a relatively small number of such devices would cause impermissible interference into licensed primary satellite operations.

It is important to point out that satellite industry is not the exclusive user of the 5.9 GHz band. Over the years, we have engaged with the U.S. government and then with the intelligent transportation industry to find ways to co-exist in the 5.9 GHz band on a co-primary basis. In the case of the FCC's U-NII proposal, however, there has been no engagement on sharing for these unlicensed devices. In fact, the FCC seemed to assume in its proposal that the operating parameters applicable in the adjacent U-NII-3 band could be applied to the 5.9 GHz band without alteration, even though neither FSS nor DSRC systems are in the U-NII-3 band. The satellite industry is willing to consider proposals for protecting FSS operations in the 5.9 GHz band, but such proposals have to be practical, realistic, and enforceable.

Finally, we note that Congress required the FCC to introduce some unlicensed use of spectrum in the 5.4 GHz band as part of the Middle Class Tax Relief and Job Creation Act of 2012, but removed a similar requirement for the 5.9 GHz band from the final legislation. Instead, Congress called for an NTIA study of that band and did not direct the Commission to modify its regulations. The Committees obviously understood the additional complexity of sharing in the 5.9 GHz band, given the presence of the co-primary FSS and intelligent transport systems. While we do not reject the notion of more sharing in the 5.9 GHz band, we do think the evidence presented should give the FCC reason to consider more carefully the sharing dynamics before allowing ubiquitously deployed unlicensed devices to operate in this band.

Intelsat and SES have serious concerns with the impact of U-NII devices operating in the 5.9 GHz band, and we stand ready to work with the Subcommittee and all interested parties to explore practical, realistic, and enforceable solutions.

Sincerely,

Patricia A. Casey
Senior Vice President & Deputy General Counsel
Intelsat Corporation

Gerald E. Oberst
President and CEO
SES Americom, Inc.

Enclosure

Technical Annex

Analysis of Uplink Interference from Proposed U-NII Devices in the 5.9 GHz Band into the Fixed-Satellite Service

A.1 Introduction

This technical annex presents an analysis of interference that would occur from the proposed U-NII (Unlicensed National Information Infrastructure) devices in the 5.85-5.925 GHz band, described in the FCC's NPRM,[1] into existing geostationary FSS (Fixed-Satellite Service) satellites that are already operating uplinks from US territories in this same band. Both the NPRM and commenters anticipate that U-NII devices using the Wi-Fi IEEE 802.11 family of standards would be deployed in this band.

A.2 Existing FSS operations in the 5.85-5.925 GHz band

Currently, there are at least 12 geostationary satellites operated by SES and Intelsat that provide service in the US with uplinks operating in the 5.85-5.925 GHz band. These are listed in Table A2-1 below. This table also provides the uplink sensitivity of these satellites in their beams operating in this band that provide coverage of US territory – expressed in terms of the beam peak and "average" G/T performance.[2]

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1 See FCC Notice of Proposed Rulemaking in the matter of "Revision of Part 15 of the Commission's Rules to Permit Unlicensed National Information Infrastructure (U-NII) Devices in the 5 GHz Band", ET Docket No. 13-49, 20 February 2013.

2 The "average" G/T is intended to represent the average G/T performance across the footprint of that beam, which in many cases covers a large portion of CONUS where U-NII devices would potentially operate. The average is conservatively estimated to be 2 dB below the beam peak G/T value, which allows for the roll-off of the beam towards the edge of the beam.

Table A.2-1: Existing operational satellites of Intelsat and SES providing service to the US in the 5.85-5.925 GHz band, showing G/T performance levels

Satellite Operator	Satellite Name	Beam Name	Beam Peak G/T (dB/K)	Average G/T over Beam (dB/K)
Intelsat	IS-10-02 @ 1W	West Hemi	2.66	0.66
		East Hemi	-1.53	-3.53
		NE Zone	3.75	1.75
		SE Zone	0.93	-1.07
	IS-901 @ 18W	West Hemi	-3.3	-5.3
		East Hemi	-3.6	-5.6
		NW Zone	2.6	0.6
		SW Zone	-3	-5
		NE Zone	2.3	2
		SE Zone	3.2	1.2
	IS-905 @ 24.5W	West Hemi	-4.3	-6.3
		East Hemi	-4.4	-6.4
		NW Zone	2.5	0.5
		SW Zone	-3.7	-5.7
		NE Zone	1.9	-0.1
		SE Zone	-2.1	-4.1
	IS-907 @ 27.5W	West Hemi	-4.3	-6.3
		East Hemi	-4.4	-6.4
		NW Zone	2.5	0.5
		SW Zone	-3.7	-5.7
		NE Zone	1.9	-0.1
		SE Zone	-2.1	-4.1
	IS-903 @ 34.5W	West Hemi	-4.3	-6.3
		East Hemi	-4.4	-6.4
		NW Zone	2.5	0.5
		SW Zone	-3.7	-5.7
		NE Zone	1.9	-0.1
		SE Zone	-2.1	-4.1
		CA Zone	0.1	-1.9
	IS-801 @ 29.5W	WHUL	-0.5	-2.5
		EHUL	-3	-5
		NWUL	5	3
		NEUL	1.5	-0.5
		SWUL	2	0
		SEUL	2.5	0.5
	IS-805 @ 55.5W	Hemi A	-3.5	-5.5
		Hemi B	-4.0	-6.0

Satellite Operator	Satellite Name	Beam Name	Beam Peak G/T (dB/K)	Average G/T over Beam (dB/K)
SES	NSS-7 @ 20W	West Hemi	-2.3	-4.3
		East Hemi	-2.1	-4.1
		NE Zone	3.8	1.8
		SE Zone	1.7	-0.3
	SES-4 @ 22W	West Hemi	1.4	-0.6
		East Hemi	0.4	-1.6
	NSS-806 @ 40.5W	Hemi A/B	-3.1	-5.1
	SES-6 @ 40.5W	Hemi	-2	-4
	NSS-9 @ 177W	East Hemi	-0.9	-2.9
		West Hemi	-1.6	-3.6

Note that the average G/T performance (right hand column in Table A.2-1) ranges from +3.0 dB/K to -6.4 dB/K. The simple arithmetic average (in dB) of the average G/T values (right hand column of Table A.2-1) is -2.62 dB/K. In the interference analysis below we have conservatively assumed an average satellite G/T performance of -3 dB/K. This is 0.38 dB below the average of the average G/T values set forth above, 6.0 dB lower than the highest average G/T value, and 3.4 dB higher than the lowest average G/T value. It is thus a conservative assumption to make to simplify the uplink interference analysis.

A.3 Description of the interference analysis

The interference analysis is given in Table A.3-1 below. This analysis computes the impact of the uplink interference in terms of increased satellite receive system noise temperature, the so-called $\Delta T/T$ method.

The starting point of this analysis is the transmit power and antenna gain of the U-NII devices. The FCC's NPRM proposes that the maximum power of the proposed U-NII devices that would operate in the 5.85-5.925 GHz band would be 1 Watt per device (i.e., 0 dBW or 30 dBm). The antenna gain of these devices is a variable but, according to the NPRM, would be typically +6 dBi but with provision for higher gain for point-to-point devices. For this interference analysis, it is not the peak gain that is important but the gain in the direction of the geostationary orbit ("GSO"). There is nothing in the existing or proposed FCC rules relating to U-NII that addresses the performance of the U-NII devices in this respect. Therefore we must make certain assumptions for the purposes of this analysis, which are described below.

U-NII devices with a peak gain of +6 dBi are presumably intended to radiate over a wide range of horizontal azimuth directions, but not intentionally in vertical directions, either downwards or upwards. However, such antennas would be low-cost and therefore would likely provide very little gain discrimination in the upwards direction towards the GSO. We have therefore tentatively assumed an average of 6 dB gain discrimination for the universe of such devices towards the GSO. Coupled with the maximum transmit power of 0 dBW, this would give an average radiated EIRP towards the GSO of 0 dBW (i.e., 0 dBW power + 6 dBi peak gain – 6 dB gain discrimination).

For U-NII devices with higher antenna gain, such as those for point-to-point applications, we tentatively assume that these devices also radiate the same EIRP towards the GSO, which may well be a very optimistic assumption. Such devices are unlikely to be the most popular compared to the near-omnidirectional ones, but they will almost certainly be installed outdoors. This assumption is unlikely to significantly impact the overall interference analysis.

In the analysis that follows, a direct line of sight is assumed between the interfering U-NII devices and the victim satellites, which implies that the U-NII devices are operating outdoors. It is recognized that not all U-NII devices will in fact be operated outdoors, so the results below should be interpreted only in relation to the outdoor U-NII devices. Indoor U-NII devices would produce a correspondingly lower level of interference to the GSO satellites, depending on the building blockage effects.

The interference analysis below, which computes the $\Delta T/T$ impact on the satellite uplink, is based on a spectral density approach. Therefore, we need to make certain assumptions concerning the occupied bandwidth of the power radiated by the U-NII devices. This is variable over a very wide range, based on the discussion in the NPRM, with a minimum value of 500 kHz and ranging up to 160 MHz. Therefore we have kept this as a variable parameter in the analysis below, showing the results for each of the following U-NII operating bandwidths: 500 kHz, 20 MHz, 40 MHz, 80 MHz and 160 MHz.

The analysis shown in Table A.3-1 computes the number of co-frequency U-NII devices that would cause various levels of ΔT/T degradation to the satellite link. The ΔT/T degradation levels considered are 0.33%, 0.5% and 1.0%. ITU-R Recommendation S.1432 budgets 1% of an FSS satellite system noise for all non-primary allocated services and other emissions that operate on a non-interference basis.[3] However, there are already non-primary allocations and emitters allowed in 5850-5925 MHz.[4] This suggests that unlicensed U-NII devices should contribute only a portion (say one-third or one-half) of the allotted 1%, and the analysis below therefore considers the reduced ΔT/T thresholds of 0.33% and 0.5%.

The results of the interference analysis show the following:

a. For U-NII devices operating in the minimum bandwidth (500 KHz) even a very small number of such devices (ranging from five to 16), operating outdoors anywhere in the US that falls within the beam footprint of the GSO satellites, would cause interference that exceeds the threshold levels.
b. Even for U-NII devices operating at the wider bandwidths contemplated by the IEEE 802.11ac standard (20 MHz to 160 MHz), the number of such outdoor devices that will cause interference exceeding the threshold levels is still very low compared to the numbers of devices foreseen by the U-NII proponents. The numbers range from only 215 for the 20 MHz operating bandwidth (for the ΔT/T level of 0.33%) to only 5,200 for the 160 MHz operating bandwidth (for the ΔT/T of 1.0%). By comparison, the Commission has suggested that there could be hundreds of millions of such U-NII devices across the US in the near future,[5] and the Wi-Fi Alliance has cited projections that global shipments

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[3] *See* ITU-R Recommendation S.1432, *recommends* 4 and Annex 1, Section 4.

[4] *See* 47 C.F.R. § 2.106, Part 18 (ISM equipment) and Part 97 (Amateur Radio).

[5] In his statement in support of the NPRM, Commissioner McDowell cited estimates that "775 million wirelessly-connected devices will be used by Americans in 2017." *See* Notice at 53, Statement of Commissioner Robert M. McDowell (footnote omitted).

of dual-band Wi-Fi chipsets – including both 802.11n and 80.211ac – will exceed 1.5 billion by the end of 2014.[6]

A.4 Conclusions

In conclusion, this interference analysis shows that only a very modest number of U-NII devices operating in the 5.85-5.925 GHz band will cause unacceptable interference into the existing operational GSO FSS satellites that currently provide service to the US. If past and predicted Wi-Fi deployments are any guide, the deployment of U-NII devices in this band (if authorized) can be expected to very quickly exceed the thresholds for unacceptable interference. If the numbers of actual U-NII devices were to approach the current predictions for Wi-Fi deployments, the interference levels into the GSO FSS satellites would be many orders of magnitude higher than the threshold levels discussed here, and the satellite service would be completely incapable of operating.

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6 *See* WiFi Alliance, Press Release, *Wi-Fi CERTIFIED™ ac takes Wi-Fi® performance to new heights*, http://www.wi-fi.org/media/press-releases/wi-fi-certified%E2%84%A2-ac-takes-wi-fi%C2%AE-performance-new-heights (last visited July 22, 2013).

Table A.3-1: Analysis of uplink interference from proposed U-NII devices operating in the 5.85-5.925 GHz band into existing co-frequency FSS satellites serving the USA

		Operating Bandwidth of U-NII Devices														
		500 kHz			20 MHz			40 MHz			80 MHz			160 MHz		
Frequency	GHz	5.900			5.900			5.900			5.900			5.900		
EIRP (max) for a single U-NII device	dBW	6.0			6.0			6.0			6.0			6.0		
U-NII device operating bandwidth	MHz	0.5			20.0			40.0			80.0			160.0		
Assumed gain discrimination of U-NII Tx antenna towards the GSO	dB	-6.0			-6.0			-6.0			-6.0			-6.0		
EIRP for a single U-NII device towards GSO	dBW	0.0			0.0			0.0			0.0			0.0		
# of U-NII devices simultaneously operating in same spectrum across operating bandwidth within satellite beam	#	5	8	16	215	325	650	430	650	1300	860	1300	2600	1720	2600	5200
Aggregate EIRP of multiple U-NII devices towards GSO	dBW	7.24	9.08	12.10	23.32	25.12	28.13	26.33	28.13	31.14	29.34	31.14	34.15	32.36	34.15	37.16
Aggregate EIRP density of multiple U-NII devices towards GSO	dBW/Hz	-49.75	-47.90	-44.89	-49.69	-47.89	-44.88	-49.69	-47.89	-44.88	-49.69	-47.89	-44.88	-49.69	-47.89	-44.88
Space loss to GSO orbit at 37,000 km	dB	199.2			199.2			199.2			199.2			199.2		
Polarization mismatch factor	dB	-1.5			-1.5			-1.5			-1.5			-1.5		
Typical GSO satellite receive G/T (averaged over satellite beam footprint)	dB/K	-3.0			-3.0			-3.0			-3.0			-3.0		
Resulting ΔT/T at GSO satellite Rx	%	0.33%	0.50%	1.00%	0.33%	0.50%	1.00%	0.33%	0.50%	1.00%	0.33%	0.50%	1.00%	0.33%	0.50%	1.00%

CERTIFICATION OF PERSON RESPONSIBLE FOR PREPARING ENGINEERING INFORMATION

I hereby certify that I am the technically qualified person responsible for preparation of the engineering information contained in this supplement, that I am familiar with the Commission's rules, that I have either prepared or reviewed the engineering information submitted in this supplement and that it is complete and accurate to the best of my knowledge and belief.

/s/

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