



March 29, 2018

*Ex Parte*

Marlene H. Dortch, Secretary  
Federal Communications Commission  
445 12<sup>th</sup> Street SW  
Washington, DC 20554

*Re: Expanding Flexible Use in Mid-Band Spectrum Between 3.7 and 24 GHz*, GN Docket No. 17-183

Dear Ms. Dortch:

Ericsson is a vocal proponent of making spectrum in the 3.7-4.2 GHz band available for licensed mobile broadband use. We ask that the Commission take the next step in this proceeding and initiate a Notice of Proposed Rulemaking (“NPRM”) quickly. This band is of vital importance in fulfilling the goal of ensuring that adequate low-, mid-, and high-band spectrum is available for licensed, mobile terrestrial uses with a focus on 5G. An extensive record that began with the publication of the Notice of Inquiry<sup>1</sup> continues to develop, demonstrating interest in this band. In order to provide the incentive the private sector requires to develop products and services in the band and address the need for mid-band spectrum in a timely way, regulatory certainty is needed.

Because the issues have coalesced around a few central themes, Ericsson urges the Commission to move forward with an NPRM to seek more granular comment on critical matters. We ask that the upcoming NPRM state anticipated clearing targets in order to provide some certainty and also guide the discussion on the various approaches to making the spectrum available.

One particular theme driving a great deal of conversation around the band is the idea that market-based approaches should be considered as the only option for clearing and repurposing this spectrum for terrestrial mobile broadband. Proponents of this option cite the fact that a market-based approach will provide sufficient spectrum to support 5G and do so in a manner fast enough to keep the U.S. globally competitive in this band.<sup>2</sup>

While Ericsson agrees that market-based approaches can, and will, play an important role in repurposing this valuable spectrum, we request that any market-based approach be backed by a firm proposal from the Commission to ensure sufficient spectrum would be cleared and made

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<sup>1</sup> See *Expanding Flexible Use in Mid-Band Spectrum Between 3.7 and 24 GHz*, Notice of Inquiry, GN Docket No. 17-183, FCC 17-104, 32 FCC Rcd 6373 (rel. Aug. 3, 2017).

<sup>2</sup> See Joint Comments of Intelsat License LLC and Intel Corporation, *Expanding Flexible Use in Mid-Band Spectrum Between 3.7 and 24 GHz*, GN 17-183, at 3 (filed Oct. 2, 2017).



available for licensed terrestrial mobile service. In our view, at least 100 MHz is needed on a per carrier basis to fulfill mobile broadband use cases. An investment climate conducive to the deployment of 5G services requires assurance that enough spectrum will be cleared by a certain time. Leaving critical decisions *solely* up to existing incumbents may not provide the certainty that the investment community requires for funding networks in these bands.

As a first step to determining how much spectrum can be repurposed for commercial mobile broadband, we ask the Commission to survey the band. We note that others have advocated updating federal databases with accurate information.<sup>3</sup> Some registered earth stations have moved or even no longer exist. The current Commission database may incorrectly identify the number of earth stations that theoretically require protection. This process is essentially the low-hanging fruit of this proceeding – a reasonably quick survey of the landscape could provide meaningful near-term opportunities for mobile broadband.

Following the survey, the next step we recommend is to delve deeper into what is, and is not, actually being used to provide services over the C-band. That is, what frequencies are actually being used to determine the requirement for “full-band, full-arc” use of the band. It appears from some of the data that not all devices have the capabilities for full-band, full-arc reception.

For example, data from Lyngsat, a public domain site that tracks content distribution, shows that only 37% of the C-band satellites have any significant transponder usage (10 or more, i.e., 7 out of 19 satellites). In many cases, the transponders are spread across the spectrum band, even though many of the blocks may be unused. This suggests there is an opportunity to better optimize spectrum use for 63% of C-band satellites.

In addition, the findings of Northern Sky Research outlined in the attached presentation offer further support for repurposing as much of the 3.7-4.2 GHz band as possible for terrestrial broadband use. C-band transponder demand, and revenue generated from use of satellites using C-Band spectrum, is declining. Transponder equivalent (TPE) demand is expected to decline by 26% over the 10-year period from 2017 through 2026. One reason for this is the increased penetration of fiber in urban areas. Additional factors, such as the increased demand for 4K TV signals, are also expected to speed up the migration from C-band to fiber.

Another finding of the Northern Sky report is that the annual C-band satellite projected revenue for the North American market is estimated to decline from \$547M in 2017 to \$358M in 2026. Contrast this with the value this spectrum would receive at auction, even using conservative \$/MHz/PoP values, and it is clear that this spectrum is not achieving its potential. Auctions taking place in this frequency range would likely dwarf the current C-Band revenues.

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<sup>3</sup> See Ex Parte Letter from Alex Starr, AT&T, to Marlene Dortch, FCC (filed March 12, 2018), Reply Comments of CTIA, at 8-9 (filed Nov. 15, 2017), Reply Comments of T-Mobile, at 5-8 (filed Nov. 15, 2017), Reply Comments of Verizon, at 5 (filed Nov. 15, 2017), GN Docket No. 17-183.



Roughly 50% of satellites have under-utilized transponder capacity (less than 70% utilization) and TPE demand is declining as is revenue from satellite use of the C-band. The record supports using some combination of band-clearing approaches, including relocating incumbents or using alternative transmission means (such as fiber or Ku-band satellites).

Clearing as much of the band as possible for mobile use is critical to extracting the maximum value of the band and ensuring that a sufficient amount of spectrum is available for innovation and development in support of 5G. Proposals that only call for a total of 100 MHz of cleared spectrum simply leave too much potential untapped and could hardly be considered for mobile broadband use cases for truly high-speed (greater than 1 Gigabit per second) broadband for multiple operators. In the long term, Ericsson would like to see the entire C-Band cleared for licensed mobile broadband use; however, we recognize that band segmentation may be necessary to ensure near-term access to the band. A primary goal for the Commission should be to ensure that multiple blocks of 100 MHz are available to support multiple operators' use of the band.

For the U.S. to retain and expand its global leadership in wireless, C-band spectrum must be brought to market quickly and with a robust bandplan. As we noted in our comments to the Mid-Band Notice of Inquiry, mid-band spectrum is critical to enable a robust 5G ecosystem.<sup>4</sup> Other countries are pushing aggressively to make more mid-band spectrum available and as Chairman Pai recently observed, "I want the United States to be the best country for innovating and investing in 5G networks." A strong mid-band spectrum platform for wireless broadband is imperative for U.S. leadership in 5G.

Respectfully submitted,

/s/ Mark Racek

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<sup>4</sup> See Comments of Ericsson, *Expanding Flexible Use in Mid-Band Spectrum Between 3.7 and 24 GHz*, GN 17-183, at 2 (filed Oct. 2, 2017).

# C-band NR requirement vs. satellite spectrum usage



Ericsson

Public Affairs and Regulations

# NR TDD in 3.7-4.2 GHz

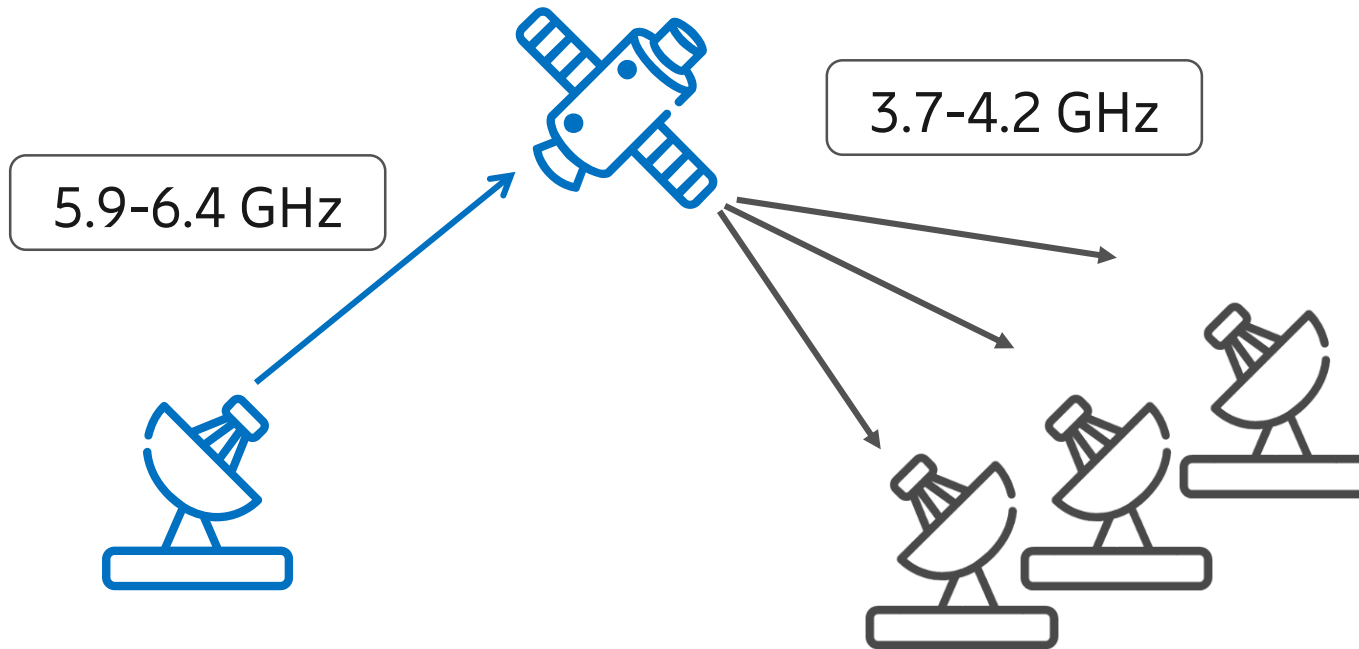


- 100 MHz TDD Channel key to providing an expected peak rate of 1.8 Gbps, delivering a true 5G experience.
- Results based on Ericsson simulations of expected early deployments

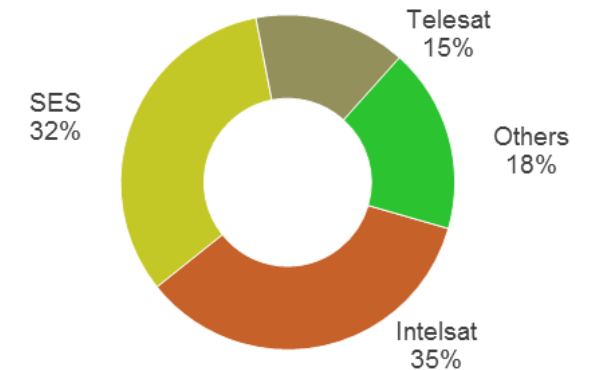
Carrier Bandwidth	100 MHz
MIMO	4X4
Sub Carrier Spacing (SCS – KHz)	30
Spectrum utilization	98%
DL:UL Ratio	77:23
Peak rate DL [Mbps]	1 791
Peak spectral eff. [b/s/Hz]	23.2

# C-band satellite systems

frequency bands



North American Market Share of Leased C-, Ku- and Ka-Band TPEs, 2016



Source: ©2017 Northern Sky Research

- Satellites deployed Full Band (500 MHz) and Full Arc
- Up to 12 Transponders / satellite @ 36 MHz and 2 polarizations per Transponder
  - 18 MHz in V-pol and 18 MHz in H-pol
- 85% of satellites deployed by 3 players

# C-band satellite TPE distribution



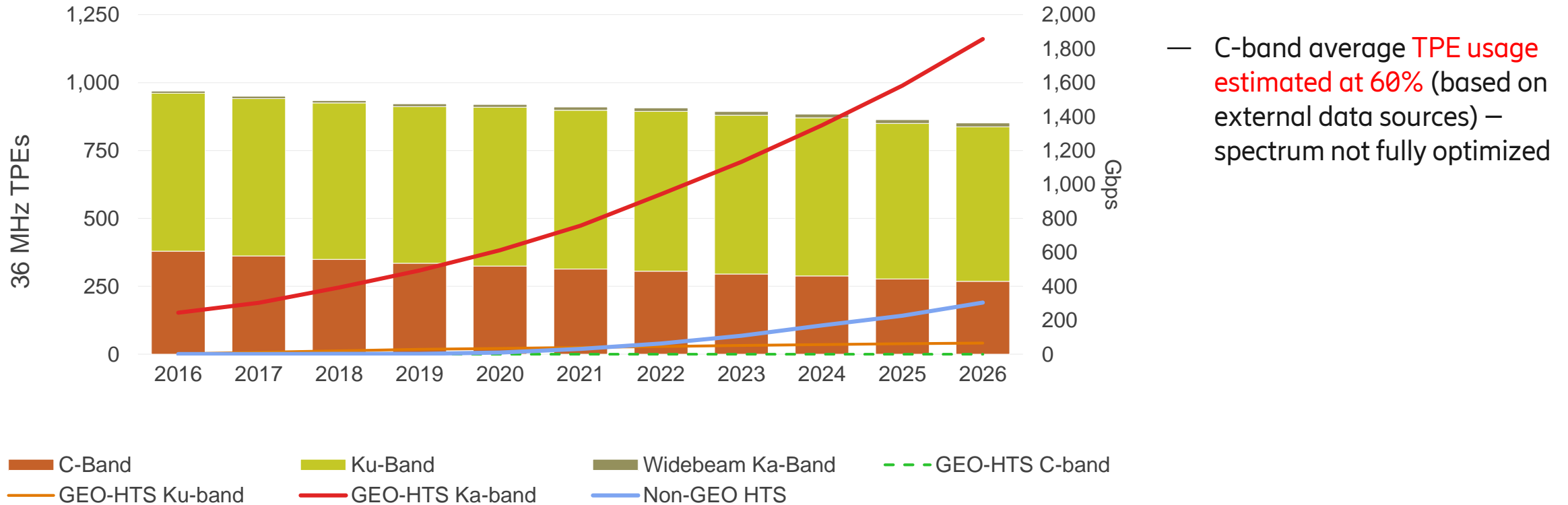
S. No	Location	Satellite Name	Band	SERVICE	# VERTICAL TPs	#HORIZONTAL TPs	FREQUENCY - START	FREQUENCY -END	LOCATION
1	87.1°W	SES 2	CKu		5	4	3743	4188	USA
2	89.0°W	Galaxy 28	CKu		5	5	3840	4185	USA
3	91.0°W	Galaxy 17	CKu		12	12	3715	4180	USA
4	93.1°W	Galaxy 25	CKu		1	1	4036	4180	USA
5	95.0°W	Galaxy 3C	CKu		8	8	3785	4173	USA
6	97.0°W	Galaxy 19	CKu		12	12	3706	4167	Mexico/USA
7	99.2°W	Galaxy 16	CKu		12	12	3735	4193	USA
8		SES 1	CKu		6	6	3716	4180	USA
9		SES 3	CKu		10	10	3720	4140	USA
10		AMC 18	C	AMC	8	8	3740	4160	USA
11	114.9°W	Eutelsat 115 West B	C				3780	3780	USA
12	119.0°W	Anik F3	CKu	Dish	1		3934	3934	USA
13	121.0°W	EchoStar 9/Galaxy 23	CKu	Dish+Others	8	8	3721	4192	USA
14	123.0°W	Galaxy 18	CKu		2	4	4020	4176	USA
15		Galaxy 14	C		11	11	3720	4180	USA
16	127.0°W	Galaxy 13/Horizons 1	CKu		10	10	3760	4160	USA
17	131.0°W	AMC 11	C	TV Channels	11	7	3720	4160	USA
18	133.0°W	Galaxy 15	C		10	10	3720	4180	USA
19	135.0°W	AMC 10	C	AMC	7	5	3720	4180	USA
20	139.0°W	AMC 8	C	AMC TV	3	1	3756	4111	USA
		<b>Total Transponders (TPEs)</b>			<b>142</b>	<b>134</b>	<b>276</b>		
		<b>Average TPE / Satellite</b>			<b>7.1</b>	<b>6.7</b>			

# C-band satellite transponder demand declining



**CAGR: -3.1%**

North American Total TPE & Bandwidth Demand



Source: ©2017 Northern Sky Research

30% demand decline for C-band Satellite TPEs by 2026, potentially driven by move to fiber and to higher bands



# C-band application demand

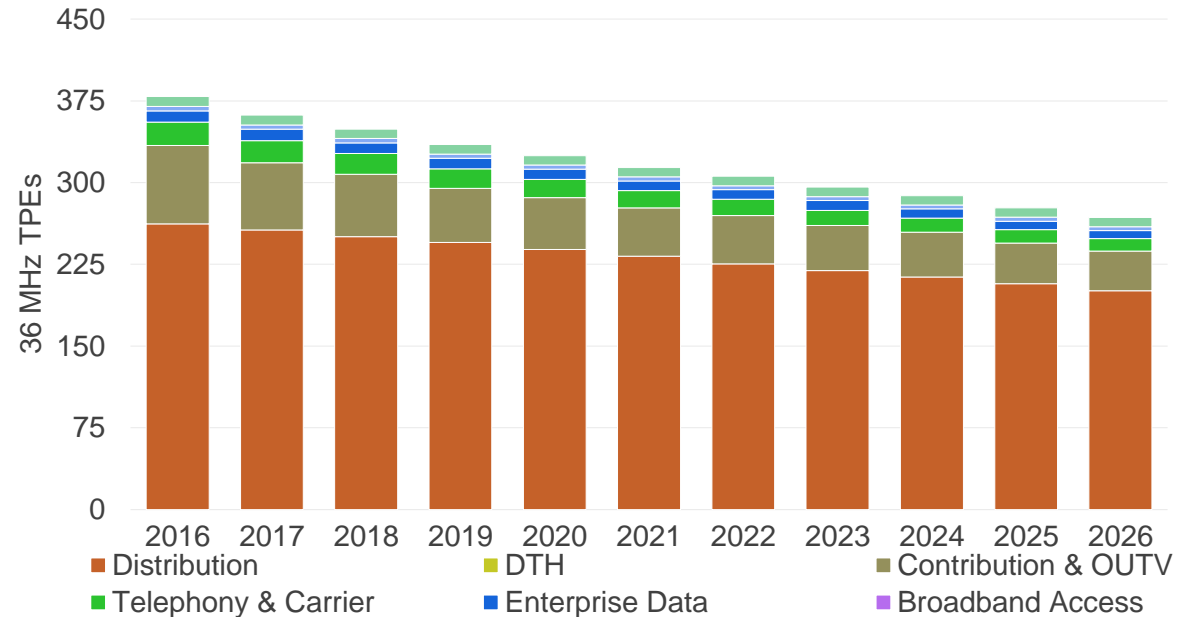


North America Demand by Application (2017 Estimate)

	C-Band	Total FSS	% C-Band
<b>Distribution</b>	256.5	294.2	87%
<b>DTH</b>	0.0	140.9	0%
<b>Contribution &amp; OUTV</b>	61.9	157.7	39%
<b>Telephony &amp; Carrier</b>	20.2	21.3	95%
<b>Enterprise Data</b>	10.4	156.9	7%
<b>Broadband Access</b>	0.0	2.9	0%
<b>Commercial Mobility</b>	4.1	53.7	8%
<b>Gov/Mil</b>	8.9	122.1	7%
<b>Total Demand</b>	<b>361.9</b>	<b>949.7</b>	<b>38%</b>

Source: ©2017 Northern Sky Research

C-Band TPE Demand by Application Projection



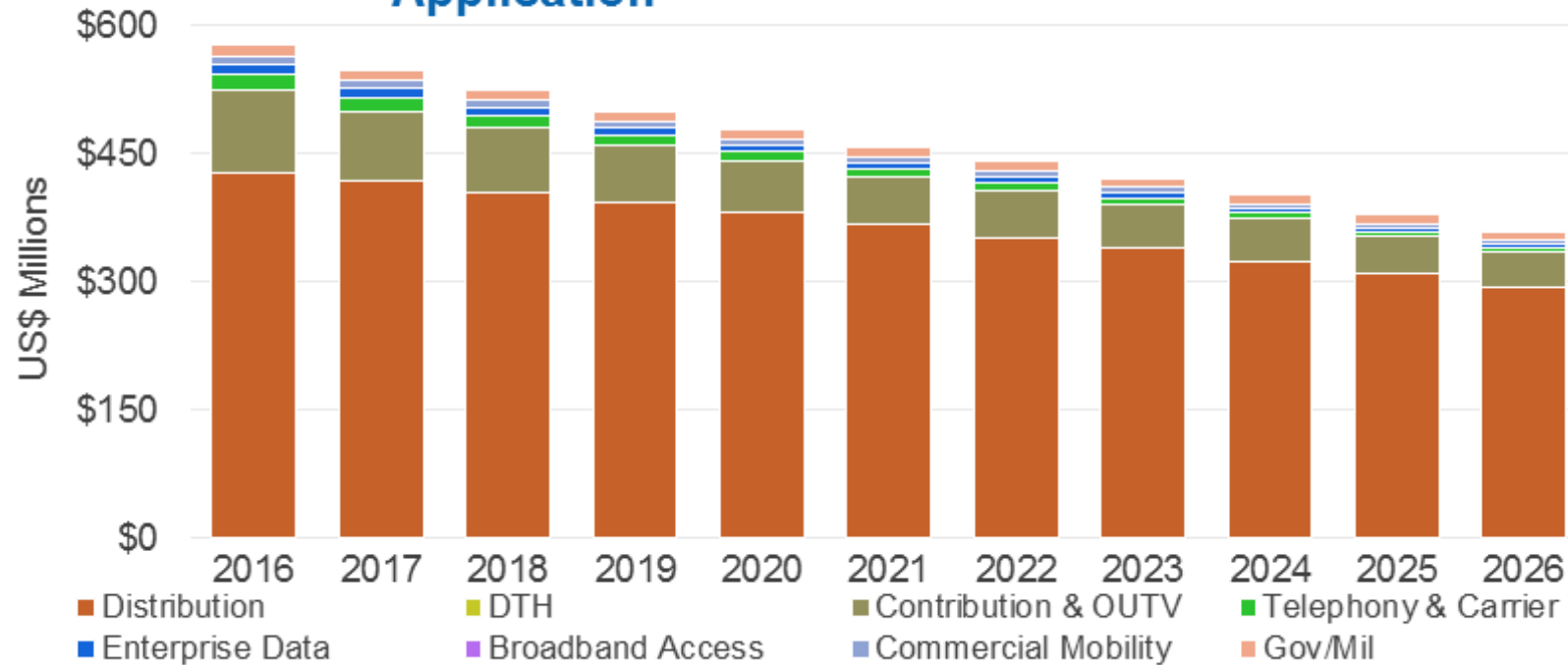
Source: ©2017 Northern Sky Research

- C-Band Dominant with Distribution Networks
- C-Band made sense for distribution networks in the past, but increasing reliability and bandwidth from fiber is a better alternative
- Declining demand & revenue due to increased competition from terrestrial fiber networks

# C-band North America revenue forecast



## NAM Revenues for Leased C-Band TPEs by Application



**CAGR: -4.6%**

Source: ©2017 Northern Sky Research

Annual C-band satellite projected revenue decline from \$523M in 2018 to \$358M in 2026

