# Radio Local Area Network ("RLAN") and Microwave Fixed Service ("FS") Sharing in 6 GHz

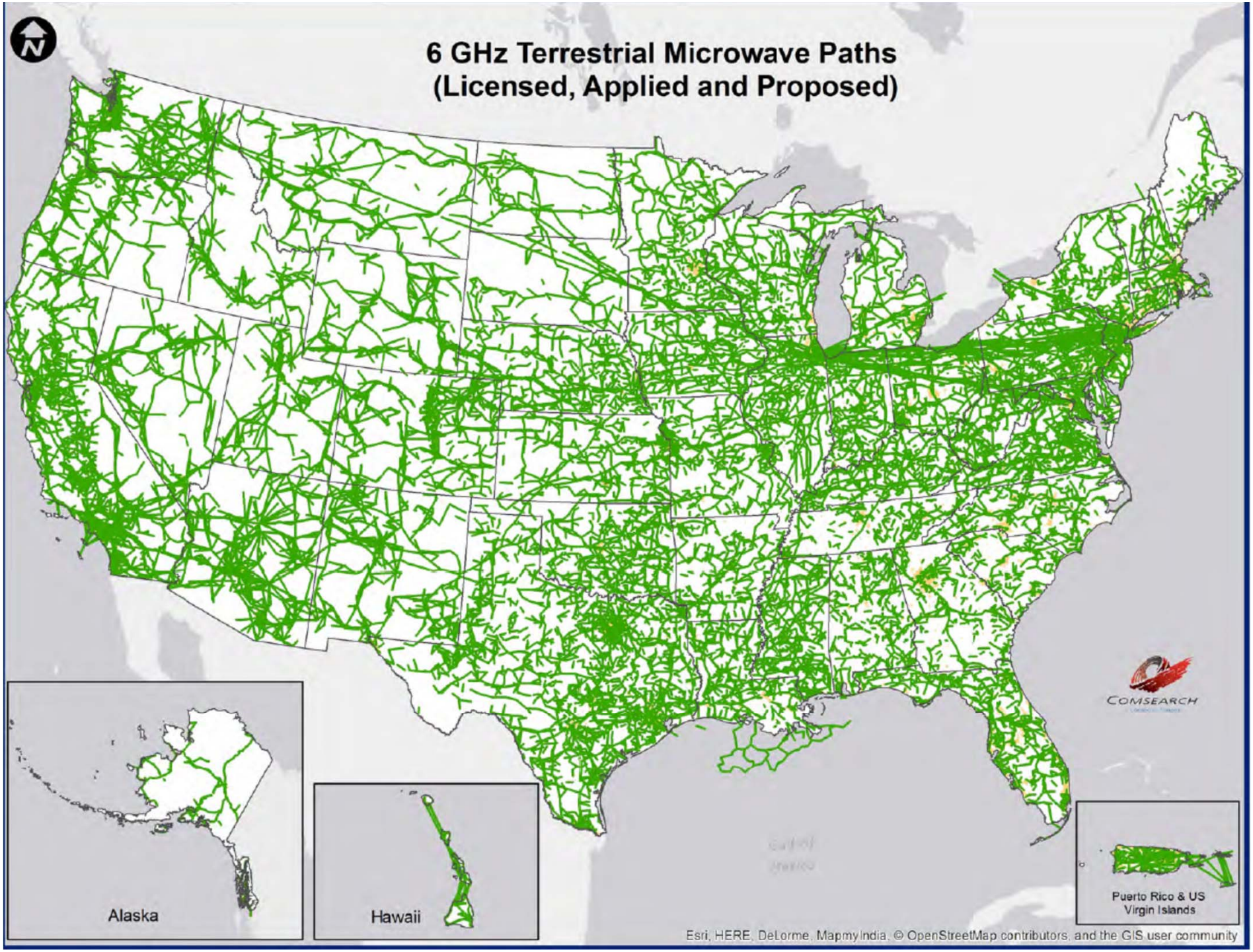
*March 16, 2018*

AT&T Services, Inc.

# The 6 GHz FS Bands Serve Key Needs

- The 6 GHz FS Bands are Densely Populated
  - There are presently 27,000 licenses issued for the 5.925-6.425 GHz band (Lower 6 GHz) and 22,900 licenses issued for the 6.425-7.125 GHz band (Upper 6 GHz)—collectively, these support approximately 100,000 links
  - AT&T holds 8,138 licenses in the 6 GHz FS bands supporting backhaul for its mobile networks, as well as telecommunications links for its landline assets
  - Microwave links in this band are usually engineered with "five nines" of availability—uptimes that are 99.999%, or outages on the order of approximately 30 seconds per month.
  - Most typically 99.9999% equates to 30 seconds outage per year or 99.999% is equal to 5 minutes outage per year
  - AT&T will be relying on a significant number of existing and newly deployed 6 GHz fixed links in support of FirstNet, where AT&T is contractually committed to provide high levels of reliability.

- The 6 GHz FS Bands also Support Other Key Aspects of the Nation's Telecommunications Infrastructure
  - ~25% of the links in the 6 GHz band support Public Safety and Critical Infrastructure Industry licensees
  - ~27% of the links in the 6 GHz band support utilities, so the Upper and Lower 6 GHz bands also are key bands supporting infrastructure crucial to the Nation


6 GHz Terrestrial Microwave Paths
(Licensed, Applied and Proposed)
N
Alaska
Hawaii
Puerto Rico & US
Virgin Islands
COMSEARCH
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# The 6 GHz Band Supports Unique Needs

- The 6 GHz FS Bands Offer Long Haul Options and Reliability that Are Not Available In Other Bands
  - The 6 GHz FS band is the only band suitable for long distance transmission, routinely supporting paths between 10-50 miles and, in cases, even longer distances. Higher frequency bands above 10 GHz are simply not suitable for these types of links due to rain and atmospheric attenuation and cannot be engineered with sufficient reliability
  - The average path length for 6 GHz links is 30 km—twice that of an 11 GHz link
  - Even if cost was not a factor, splitting links may not be an option—the 6 GHz band may have been used because intermediate hops were not feasible
  - 6 GHz FS systems are not limited to rural deployments
  - A map of FS links in the 6 GHz band readily shows that microwave paths can be in rural areas, urban areas, or link urban to rural areas
- Maintaining adequate long haul and high reliability microwave will be critical for 5G and other advanced services
  - The introduction of unlicensed users will increase the cumulative amount of interference in the band nationwide, elevating the noise floor, degrading the performance of existing systems, and making it more and more difficult for network operators to implement new microwave routes or expand the capacity of existing paths

# The RKF Study Does Not Support Sharing

- The RKF Study Was Intended to Demonstrate RLAN/FS & FSS Sharing Potential
  - Sponsors are seeking to introduce RLAN deployments into Upper and Lower 6 GHz bands at powers levels equivalent to 4W
  - The study states that it concludes that RLANs could be deployed in a manner complementary to FS and FSS systems "and will not cause harmful interference"
- Recent filings have identified a number of flaws in the RKF Study that call into question the feasibility of unrestrained sharing in the 6 GHz band between unlicensed services and existing users.
  - On February 23, 2018, Intelsat and SES Americom filed an ex parte raising a number of flaws with the RKF analysis, especially with respect to its modeling of RLAN devices
  - More recently, the Fixed Wireless Communications Coalition, Inc. filed an extensive analysis, concluding that:
    - Every microwave receiver in its 8 city study would see several cases of interference
    - At least 70% of each city's microwave receivers would have fade margins degraded by 10 dB or more
    - One in 33 microwave receivers will experience 40 dB or more of interference
- The RKF gives the overly optimistic and misguided impression that unlicensed services can successfully coexist with the primary services present in the 6 GHz

# Burden of Proof

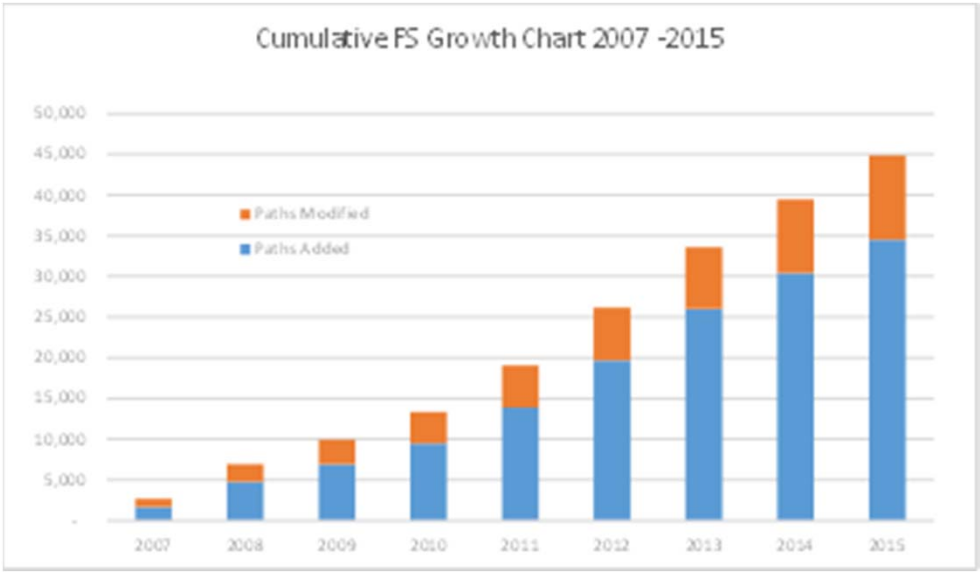
- Incumbent systems, including licensed microwave systems are entitled to interference protection from RLAN devices in the band
- The RKF proposal to introduce unconstrained relatively high power RLAN – up to 4W – in a band heavily used for critical communication is a departure from past policy and precedent
- With the development and standardization of ecosystem for UNII bands, RLAN type of operations will be prevalent in outdoor commercial installations operating under FCC's max allowable power limits in the band
    - AT&T's real world use of RLANs for LAA in 5 GHz band shows virtually all are operating at highest allowable power and most operating at heights of 30'
    - AT&T also believes RKF underestimates growth in outdoor RLANs—AT&T has 200 RLAN LAA sites today, but will add 4,000 more in 2018 and 2019
- The erroneous results and conclusions from the RKF study mean that it is not a reliable predictor of co-existence potential between RLANs and FS in the 6 GHz Band
- As a final matter, RKF and the RLAN proponents fail to address one of the key issues with RLAN deployment in FS bands—the problem with identification and mitigation of interference.
    - FS systems are not built to detect interference of this nature and the FS links will be unable to distinguish RLAN interference from fade caused by atmospheric or other naturally occurring conditions.

# RKF Study Assumptions

- The probabilistic model used by RKF is inherently inappropriate because it appears to rely on a significant amount of averaging that may smooth out variations that may be most likely to create actual interference
    - Statistical distribution of RLAN source power (EIRP)
    - Statistical Distribution of RLAN heights
    - Statistical Distribution of number of Active RLANs
- RKF's study purports to study "worst case" scenarios, but the cases identified by RKF are randomly drawn, not worst case.
    - Study fails to consider line of sight conditions between RLAN and microwave receivers including scenarios where RLAN and microwave receiver line up along a street or microwave receiver is on a mountain top overlooking the city or individual RANs situated on high floors near a window at close range to the receiver
- RKF's supplemental study of its self-defined "worst case" scenarios appears to incorrectly vary parameters in order to conclude that no significant interference will result
    - The study says it involves 910,000 RLAN-to-FS "morphologies and time instances," but that is really just evaluating the base of 91,000 FS facilities of record against 10 random national RLAN deployments. RKF report is ambiguous in its reporting on how simulation parameters were randomized in each of the runs making it difficult to reverse engineer and to gain confidence in its results

# RKF Study Assumptions

- RKF's study contains a number of assumptions that are incorrect including
  - RKF uses its study to discount entirely the potential for RLANs on high floors interfering with FS receivers, which cannot be the case—there are clearly RLANs deployed on high floors of dense urbanized areas like Manhattan where the immediate rooftops also have FS receivers
  - RKF study appears to make incorrect assumptions regarding outdoor RLAN deployments, including that 60% of outdoor APs will be "low power" and 95% will be at heights of 1.5 m or less
  - With the advent of 5G, RKG assumes zero growth in FS deployments by 2025
  - Data from FCC ULS shows an average growth of 4K/yr over the last 10 in 5925 to 6425 MHz band



# RKF Study Erroneous Assumptions

- On Propagation in Urban environments
  - RKF calculates nearfield (>1 km) propagation losses using the WINNER II Model C2 for Urban Macro (UMa) environments, but that model overstates losses by as much as 10 dB as compared to the 3GPP 3D UMa model
- On Antenna side lobe performance of FS systems
  - RKF models side lobe suppression for FS systems using F.1245, which overestimates discrimination, and therefore underestimates interference. RKF's study should have assumed only the discrimination required by FCC mask
- On availability of fade margins for FS link
  - Fixed microwave systems often carry time-critical information engineered to extremely high levels of reliability for only few minutes' of outage per year requiring high fade margin.
  - Operators incur cost to design the network with margins for reliability—not to accommodate unlicensed devices
  - Margins are added in link budgets to combat multipath fading and to allow for transmission at higher modes of modulations
  - While the systems are engineered to specifications accommodating such natural fading conditions, added RLAN interference will manifest itself through a performance decrease that is noticeable only as a statistical trend over time.

# RKF's Study Fails To Address Key Issues

- Beyond Technical Flaws, RKF's Analysis Also Fails To Address Certain Key Co-Existence Issues
- The Interference Detection Problem
  - FS systems are not designed to identify interference, and interferers will simply resemble naturally-occurring fades
  - Interference will only be detected as a statistical matter over long periods of time
- The Interference Identification Problem
  - Even if an FS system could establish the existence of an interferer, the FS system has no way to identify where the interferer is located
  - The interferer may have moved or temporarily ceased transmitting
- The Interference Mitigation Problem
  - Even if an FS operator could identify that interference is occurring and the approximate location of the interferer, the operator has no way to identify the party controlling the device to rectify the interference
- Impact of aggregate interference from multiple RLAN emitters