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October 31, 2019

VIA ELECTRONIC FILING

Ms. Marlene H. Dortch, Secretary
Federal Communications Commission
Office of the Secretary
445 12th Street, SW
Washington, DC 20554

Re: *Notice of Ex Parte Submission*, GN Docket No. 18-122

Dear Ms. Dortch:

The C-Band Alliance (“CBA”) has committed to clear 300 MHz of C-band spectrum, inclusive of a 20 MHz guard band, with 100 MHz of spectrum in 46 of the top 50 PEAs available within 18 months of an FCC Order (“Tranche 1”) and the remainder of the spectrum throughout CONUS available within 36 months from a CBA-led auction.¹ At the request of FCC staff, the attached analysis provides additional explanation of how the CBA identified the earth station locations outside of the 46 PEAs for Tranche 1 that will need to be filtered to ensure that they do not receive harmful interference from 5G terrestrial operations in the cleared PEAs.

The underlying earth station location data in the analysis is based on registrations in the FCC’s IBFS database, including registration applications that remain pending. To ensure that the CBA’s implementation plans include all potentially affected FSS earth stations, the analysis conservatively estimates potential interference levels at earth stations from 5G operations in the 46 PEAs and is not indicative of actual interference levels that will occur when terrestrial operations begin. The methodology used in the attached analysis is intended solely to estimate 5G rejection filter requirements for earth station antennas and should not be used for 5G network planning purposes vis-à-vis protecting C-band earth stations. The CBA has proposed specific rules for 5G terrestrial operations, and each operator will need to conduct its own interference assessment to comply with the rules adopted by the Commission.

¹ See Letter from Bill Tolpegin, C-Band Alliance to Marlene H. Dortch, Secretary, FCC, GN Docket No. 18-122 (filed Oct. 28, 2019); see also Joint Letter from Hank Hultquist, AT&T Services, Inc., Peter Pitsch, C-Band Alliance, et al to Marlene H. Dortch, Secretary, FCC, GN Docket No. 18-122 (filed Oct. 29, 2019).

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Please contact the undersigned with any questions regarding this letter.

Respectfully submitted,

A handwritten signature in black ink, appearing to read "Henry Gola". The signature is written in a cursive style with a large, sweeping "H" and a distinct "G".

Henry Gola
Counsel for the C-Band Alliance

Attachment

Tranche 1 Satellite Earth Station Analysis

31 October 2019



Methodology

Each C-band earth station location in the IBFS database and within CONUS is assessed for potential interference from 5G base stations within 46 of the top 50 PEAs.¹

- Within each PEA, hypothetical base stations are located within a grid with 2 km spacing.
- Using the Irregular Terrain Model (“ITM”) propagation model with parameters as shown on slide 6, the propagation loss from each base station to each earth station location is calculated.
- For every base station, the power level is set at 65 dBm/MHz and the base station antenna pattern is assumed to be directly incident on the earth station location; this likely results in an over-estimation of the number of filters to deploy, thereby ensuring that all potentially vulnerable earth station locations receive 5G rejection filters in Tranche 1.
- For every earth station location, the aggregate in-band and out-of-band interference is determined and compared to the CBA-proposed levels utilizing the CBA-proposed earth station antenna and filter mask² for every earth station antenna pointing position in the CONUS arc.³

The results conservatively estimate the number of earth station antennas that will require filters in the CBA Tranche 1 clearing. This conservative approach ensures that the CBA plans for the maximum amount of filters that may be needed; it is not necessarily indicative of the interference that earth station antennas may be exposed to.

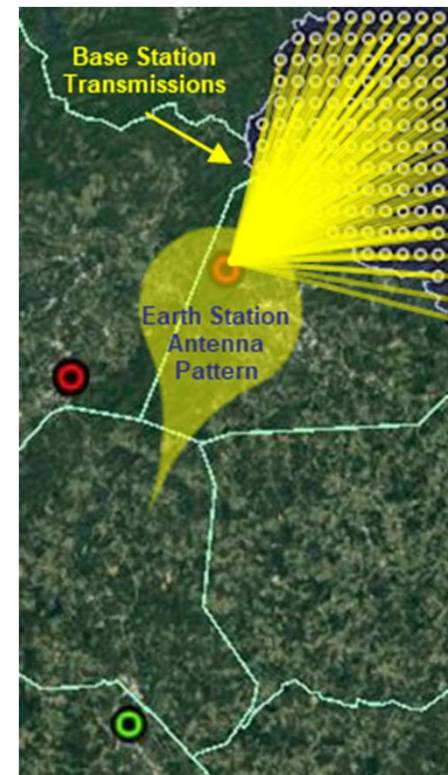
¹The following 4 PEAs are not considered for clearing within Tranche 1: Atlanta, Baltimore-Washington, Denver and Honolulu (which is outside of scope as it is not within CONUS)

²See Comments of the C-Band Alliance, GN Docket No. 18-122, RM-11791, RM-11778 (filed Aug. 7, 2019).

³See *id.*

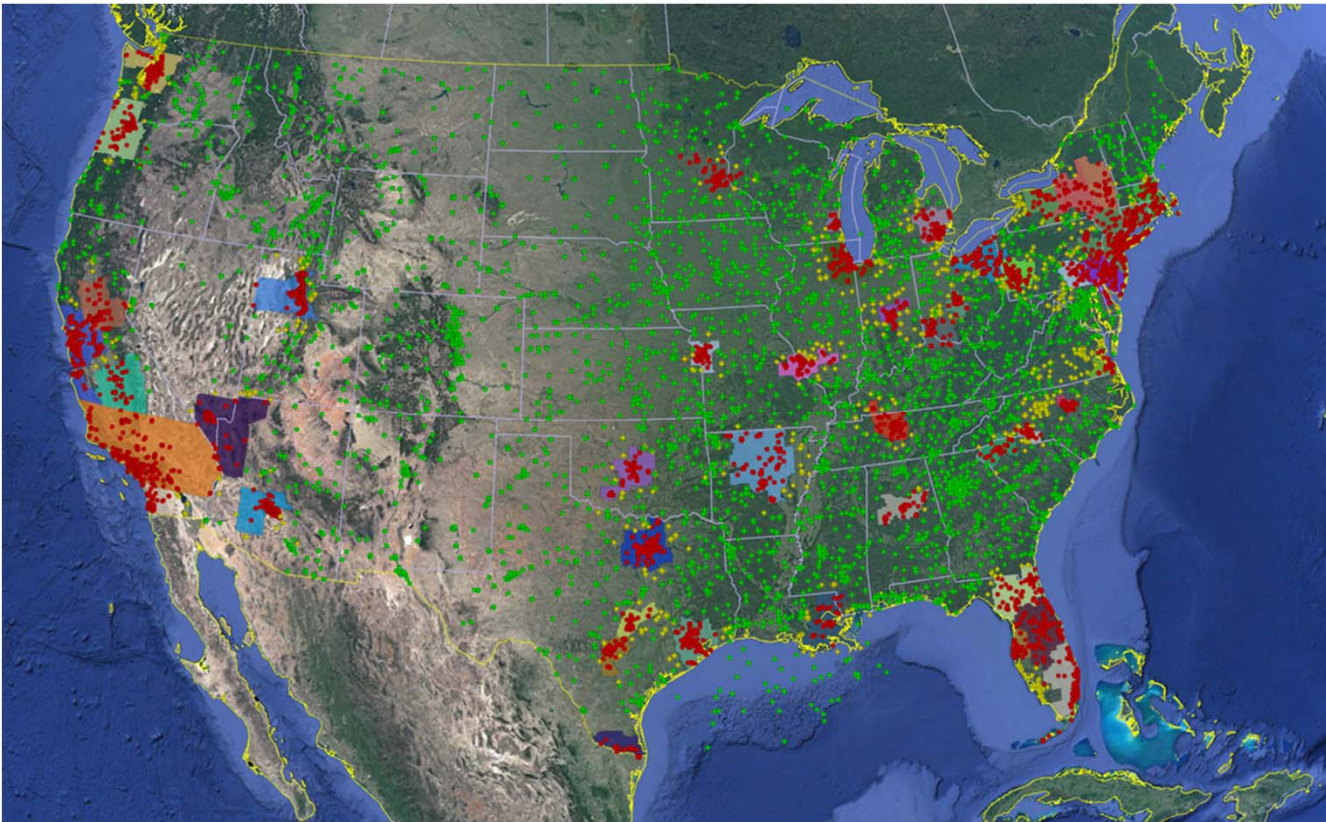
Example: Greenville, SC (PEA 50)

- Base stations are arranged in a grid configuration inside the PEA (white icons).
- The aggregate IBE and OOB E from every base station is determined at every earth station location for each earth station antenna pointing angle to the CONUS arc¹ (27 az/el positions for each earth station location).
- The worst-case earth station antenna az/el position aggregate in-band emissions (IBE) is then used in determining if the earth station antenna will require a Tranche 1 filter.
- Earth station locations affected by IBE outside of the PEA will require filters (red icons).
- The green icons represent earth station locations outside of the PEA that will not require filters.
- This analysis uses the ITM propagation model and therefore distance is not the only factor considered; base station and earth station locations and terrain are also factored in.



¹See Errata for Comments of the C-Band Alliance filed August 7, 2019, Filed as Letter from Jennifer Hindin to Marlene H. Dortch, Secretary, FCC, GN Docket No. 18-122 (filed August 29, 2019).

Results



- Red icons indicate earth station locations within the 46 PEAs; All require filters.
- Yellow icons indicate earth station locations outside of the 46 PEAs requiring filters.
- Green icons indicate earth station locations outside of the 46 PEAs that do not require filters in the first tranche of spectrum clearing.

Results

- Determination of the registered earth station locations outside of the 46 PEAs that may be subject to interference from base stations within the 46 PEAs required approximately 75 million link budget calculations performed over approximately 70 hours of computational time.
- Note that more than 1 antenna may be present at each earth station location and each antenna may require up to 2 filters (one for each polarization); as an example, a cable head-end earth station location with 11 antennas accessing satellites carrying cable TV programming may require 22 filters at that location

Category	Number of Registered Earth Station Locations ¹	Number of First Tranche Filters
Inside 46 of the top 50 PEAs ⁴	4,000 ^{2,5}	27,000 ²
Outside of the 46 PEAs that require filters	1,000 ^{3,6}	7,000 ²

¹Approximate, from IBFS data. Does not include expired, closed or duplicate filings.

²Estimated, based on analysis of IBFS data

³Estimated, based on BS / ES link budget analysis

⁴Does not include PEAs 5, 11, 20 and 42

⁵Antennas at these earth station locations require filters as they are within the first tranche PEAs

⁶Antennas at these earth station locations require filters due to their potential for interference from base stations within the first tranche PEAS

ITM Propagation Model Parameters

ITM Parameter	Value
Base station height	10 m
Earth station height	3 m
Reliability (time variability tolerance)	1%
Confidence (situation variability tolerance)	50%
Antenna polarization	Horizontal ¹
Ground conductivity	.005 (average ground)
Ground permittivity	15 (average ground)
Atmospheric refractivity	301 (average atmospheric)
Climate	5 (continental temperate)
Frequency	3800 MHz
Transmitter power	65 dBm / MHz ²

The NTIA-developed Irregular Terrain Model (“ITM”) implemented in point-to-point mode was incorporated into the CBA aggregate interference modeling tool to determine the overall impact from multiple base stations impacting a given earth station.

¹Antenna polarization in the ITM model is used for impedance calculations and does not represent polarization discrimination in link analysis. In general, horizontal polarization selection results in lower path loss than vertical polarization (within 1dB).

²65 dBm/MHz is used in all calculations (urban and rural) in order to conservatively over-estimate the number of required filters in Tranche 1.