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ATTORNEYS AT LAW

January 17, 2014

BY ELECTRONIC FILING

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

Re: 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

Dear Ms. Dortch:

On January 15, 2013, Terri Natoli of Time Warner Cable Inc., David Don of Comcast Corporation, Rob Alderfer of CableLabs (via telephone), Dirk Grunwald and Ken Baker of the University of Colorado (via telephone), Rick Chessen (via telephone), and I met with Geraldine Matise, Mark Settle, Ira Keltz, Karen Rackley, Aole Wilkins, Navid Golshahi, and Bryant Wellman of the Office of Engineering and Technology regarding the above-referenced proceeding. During this meeting, we reiterated the cable industry's support for permitting higher power operations and outdoor use in U-NII-1 and discussed the contents of the attached slides.

Pursuant to the Commission's rules, a copy of this notice is being filed electronically in the above-referenced docket. If you require any additional information, please contact the undersigned.

Respectfully submitted,

Paul Margie
Counsel for the National Cable & Telecommunications Association

cc: meeting participants

5 GHz UNII-1 Sharing Analysis

January 2014

cable

Technical Background

- *May 2013*: Globalstar says that a commercial Wi-Fi deployment would interfere with duplex system
  - Analysis based on inappropriate interference metric and many assumption errors
- *July 2013*: CableLabs, CU demonstrate Wi-Fi can successfully co-exist with Globalstar
  - Analysis based on holistic interference modeling method, critiques May GSAT analysis
- *November 2013*: Globalstar submits second paper to justify opposition to Wi-Fi

↳ *We now explore this latest (redacted) analysis…*

Newfound Agreement on “Whole System” Analysis

- Narrow “single link” definition of interference used in May study is no longer relevant
- Key dependency is impact to sat phone users, as noted in July
- Demonstrates the outdated basis of satellite interference protections
- But: latest Globalstar paper continues uses incorrect assumptions to obtain an unrealistic result, rendering it unreliable

Two-Pronged Approach to New CL/CU Analysis

1. Basic critique of Roberson Report
   - Categorical analysis of assumptions:
     a) Density
     b) Duty cycles
     c) Channelization
     d) Elevation angle / signal losses

2. Dynamic Simulation to Confirm Results
   - Accounts for real-world interaction of satellite system and Wi-Fi deployment

Part 1: The Basic Critique

1. Density

Relevance: Foundation of interference calculations

Observations:

- Globalstar bases analysis on Google Mountain View Wi-Fi deployment, extrapolates to all “urban” areas
- But: Google uses 2.4 GHz for Wi-Fi access, not 5 GHz
- No accounting for indoor / outdoor breakdown

2. Duty Cycles

Relevance: Used to determine peak-period Wi-Fi noise

Observations:

- 100% duty cycle used - not technically possible
- Observed peak duty cycles are much lower, vary by time of day
  - Empirical measurements indicate 10% duty high end

3. Channelization

Relevance: Determines concentration of Wi-Fi noise in satellite system

Observations:

- Analysis concentrates all Wi-Fi in UNII-1, ignoring all other channels
  - Wi-Fi spectrum available today is 3X more than used in GSAT analysis

4. Elevation Angle / Signal Losses

Relevance: Determines Wi-Fi signal strength seen at satellite

Observations:

- Globalstar assumes uniform angle, height, clutter, omni APs, clear line of sight to satellite
- These dimensions are not possible in the real world

Quantifying the Basic Critique

Using Table 7 of Roberson Report…

Table 7. Calculation of Relative Capacity as a Function of Number of Access Points

Number of Access Points U-NII-2 Rules Outdoor (6 dB antenna elevation loss) in 20 MHz BW	Uplink Degradation (dB)	Uplink Eb/(No+Io+Ia) (dB)	Required Downlink Eb/(No+Io,red) (dB)	Overall Eb/No+Io) (dB) Required [Eb/(No+Io)min]	Incr = Increase in downlink (Eb/No+Io) needed to maintain Eb/(No+Io)MIN, ovr (db)	Io, downlink dBW/Hz	Reducs in Downlink Io (dB) Required	Relative Capacity
.-	0	19.9	1.063	1.01	0	-209.60	0.00	1
32,000	1	18.9	1.077	1.01	0.0145	-209.67	0.07	0.985
72,000	2	17.9	1.095	1.01	0.0325	-209.75	0.16	0.965
185,000	4	15.9	1.150	1.01	0.0875	-210.03	0.43	0.906
365,000	6	13.9	1.235	1.01	0.1725	-210.48	0.88	0.816
650,000	8	11.9	1.375	1.01	0.3125	-211.32	1.72	0.673
1,100,000	10	9.9	1.610	1.01	0.5475	-213.15	3.55	0.442
1,820,000	12	7.9	2.000	1.01	0.9375	-220.32	10.72	0.085

Impact estimated by Globalstar: 1.1 million access points in each 20 MHz UNII-1 channel will lead to ~56% diminution of duplex system capacity

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Quantifying the Basic Critique

We can develop a simple formula…

$$1{,}100{,}000_{APs} * 0.5_{outdoor} * 0.1_{duty\ cycle} * 0.33_{channels} = 18{,}150_{AP\ equivalents}$$

Quantifying the Basic Critique

And anchor it back to Roberson Report:

Table 7. Calculation of Relative Capacity as a Function of Number of Access Points

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Adjustment for Globalstar's errors of assumption: duplex system capacity impact likely less than 1.5%.

Part 2: Dynamic Simulation

Method Overview

Goal is to enable real-time noise estimation by:

- Tracking the GSAT constellation, and
- Using Wi-Fi deployment and signal characteristics to simulate the interaction as satellites orbit and Wi-Fi is used

GSAT Constellation

Intake real-time constellation information

GLOBALSTAR M097		
LOCAL TIME:	12:06:28	
UTC:	19:06:28	
LATITUDE:	-29.41	
LONGITUDE:	-80.82	
ALTITUDE [km]:	1422.66	
ALTITUDE [mi]:	884	
SPEED [km/s]:	6.82	
SPEED [mi/s]:	4.24	
AZIMUTH:	157.8	SSE
ELEVATION:	-28.7	
RIGHT ASCENSION:	23h 6m 25s	
DECLINATION:	-69° 40' 50"	
Local Sidereal Time:	18h 47m 46s	

Wi-Fi Deployment

Use conservative geographic AP distribution

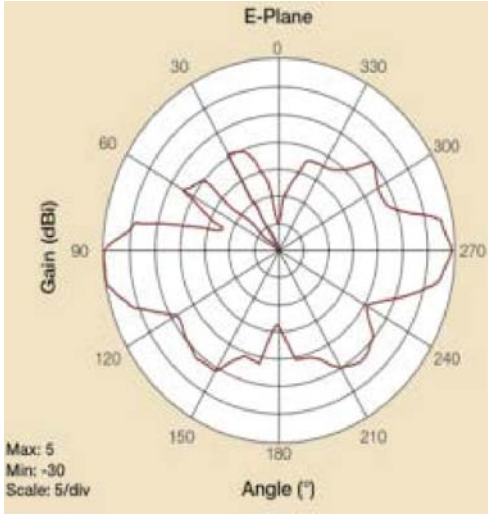
- GSAT-assumed density is basis, simulated over more granular geography
  - 33,000 US “ZCTAs” used, classified by urban / suburban / rural

Wi-Fi Signal

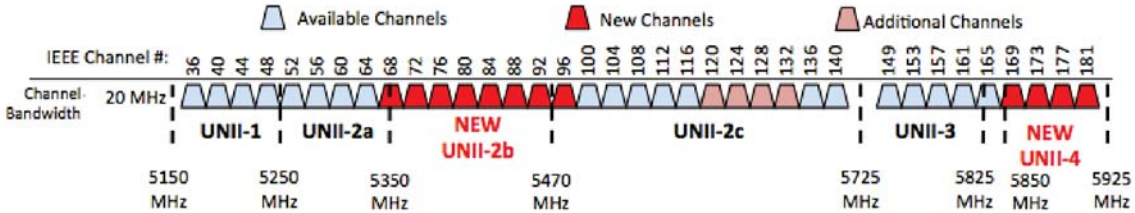
Incorporate maximum signal data

- 1 Watt Tx for all APs w/ actual antenna pattern and high duty cycle
- Use a range of bandwidth (12 to 39 ch.)

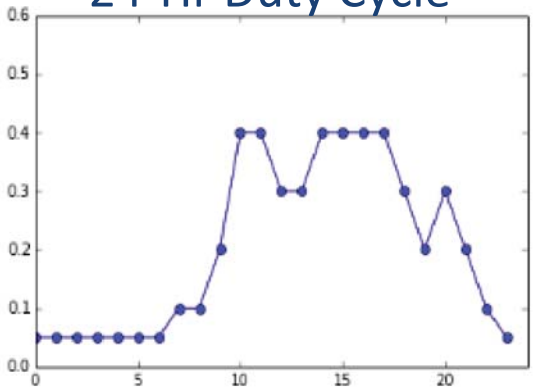
Ruckus Antenna



5 GHz Wi-Fi Band Plan



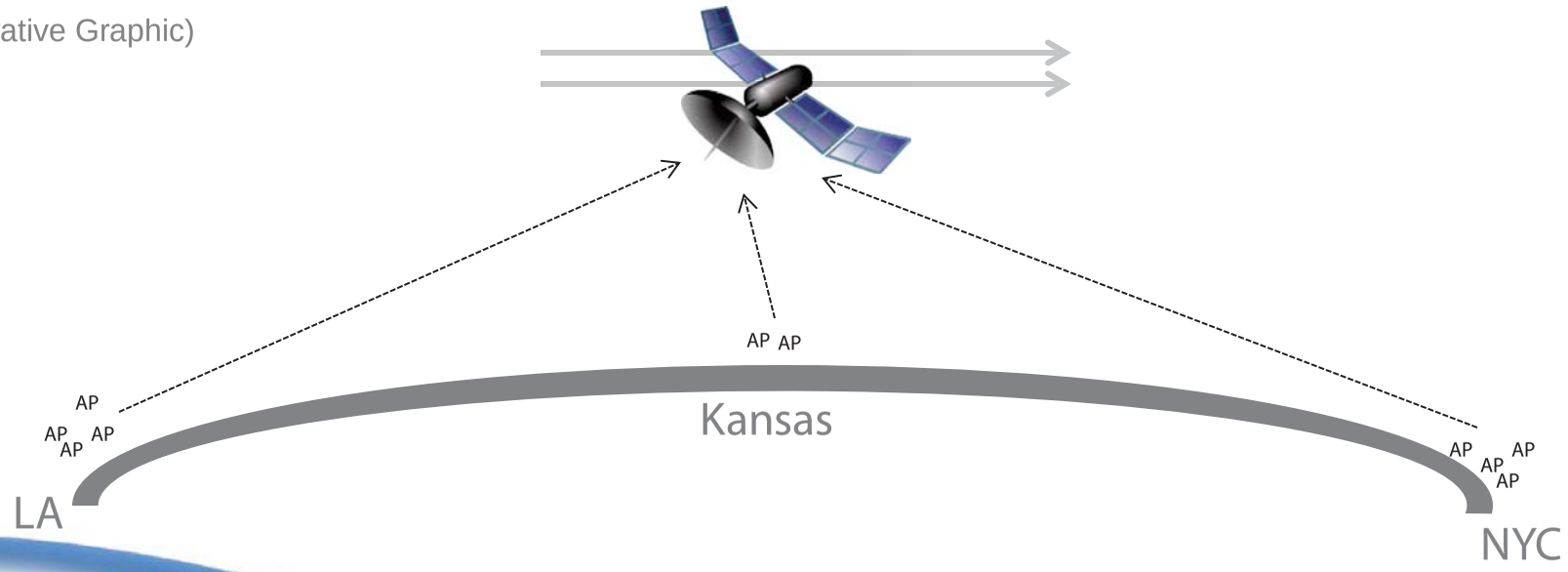
24-Hr Duty Cycle



Building the Simulation

Determine angle, distance, APs seen by a satellite

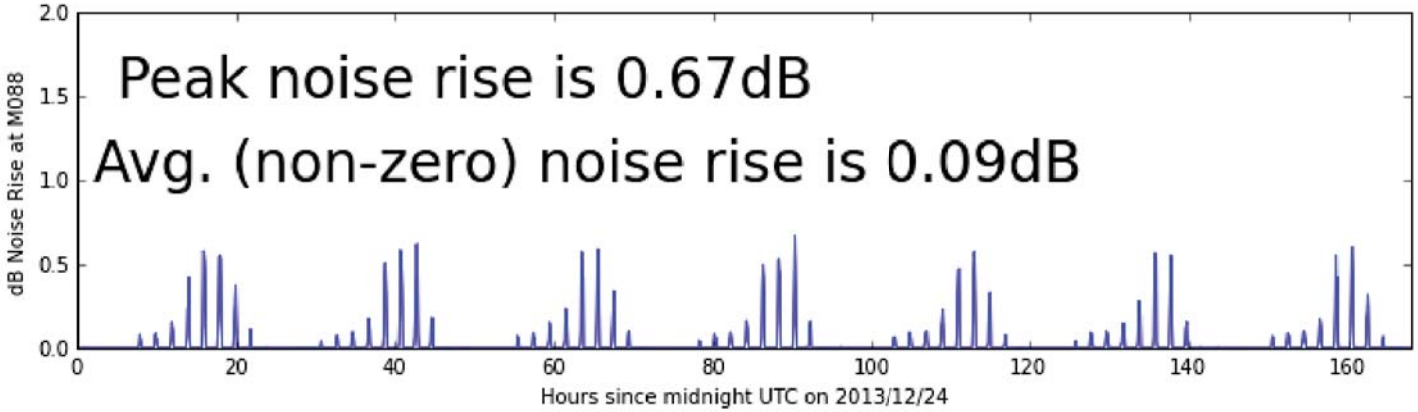
(Illustrative Graphic)



Building the Simulation

Translate to "noise" using Wi-Fi signal data

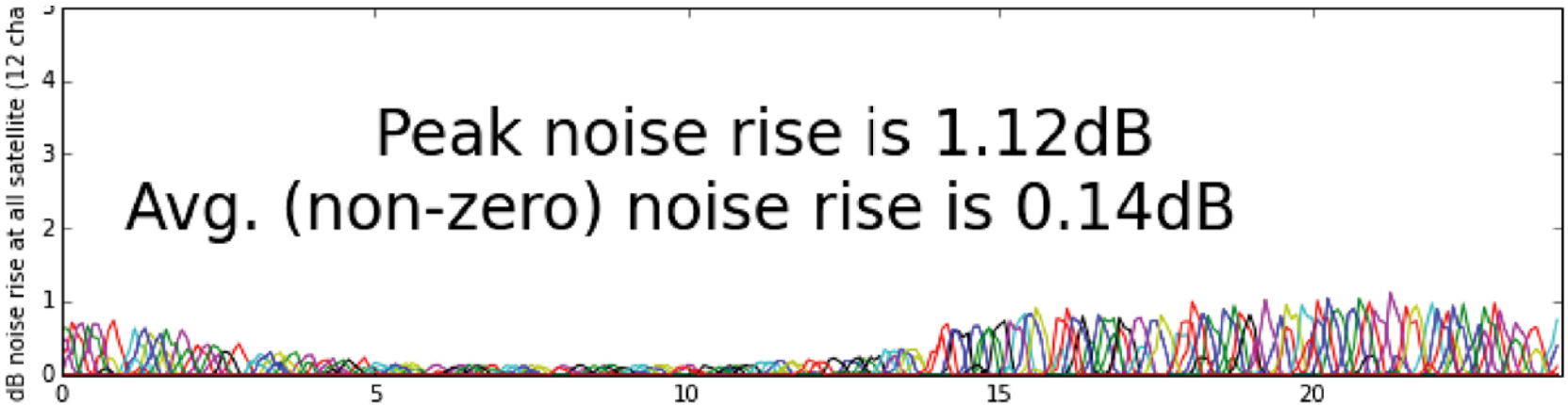
Noise Seen by One Satellite Over 1-Week Period



Building the Simulation

Then repeat for all satellites

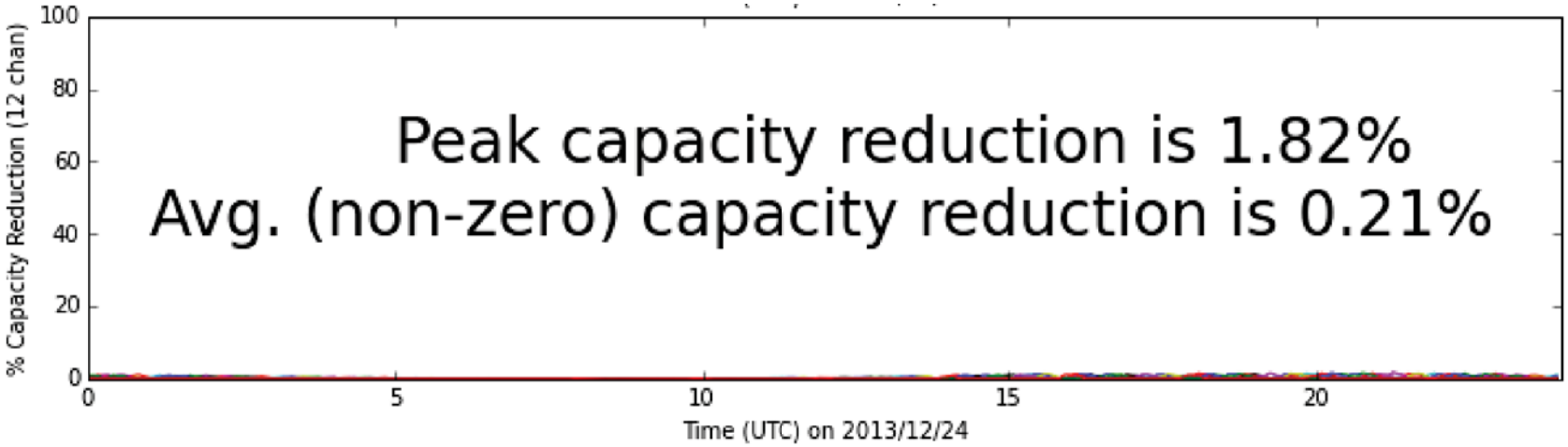
Noise Seen by All Satellites Over 24-Hr Period



Translate to “Capacity Impairment”

Use GSAT link budget

24-Hour “Capacity Impairment” for GSAT Constellation



Conclusions

- Dynamic simulation shows *de minimus* risk of even peak harmful interference to GSAT, using conservative parameters
  - Uniform 1W Tx, high duty cycles, outdoor AP density all calibrated to upper-bound levels

- Confirms our July findings