Southern Company

Southern Company Services, Inc.
600 North 18th Street
Birmingham, AL 35203

June 23, 2021

VIA ECFS

Marlene H. Dortch, Secretary
Federal Communications Commission
45 L Street NE
Washington, DC 20554

Re: Unlicensed Use of the 6 GHz Band, ET Docket No. 18-295; Expanding Flexible Use in Mid-Band Spectrum Between 3.7 and 24 GHz, GN Docket No. 17-183: Notice of *Ex Parte* Presentation

Dear Ms. Dortch:

Southern Company Services, Inc., on behalf of itself and its affiliates (collectively "Southern") respectfully submits the attached report on the results of field testing conducted by Southern, Lockard & White ("L&W"), and the Electric Power Research Institute ("EPRI") measuring the impact of commercially available, FCC-certified unlicensed low power indoor ("LPI") devices on an actual licensed 6 GHz Fixed Service microwave link.[1] As detailed in the attached report, this testing confirmed that FCC-certified LPI devices operating in the 6 GHz band will cause harmful interference to licensed fixed microwave systems, including those – such as Southern's licensed microwave systems – which are critical to ensuring the reliability and resilience of our Nation's energy infrastructure.

Significantly, the field test found that just the beacon transmitted by a *single* LPI device – without *any* data traffic – resulted in interference that exceeded the FCC's threshold in five of the thirteen different configurations tested. Moreover, a device's beacon transmits continuously, resulting in actual duty cycles for LPI devices that exceed by orders of magnitude the assumed duty cycles that the Commission cited in its decision to authorize unlicensed LPI operations. However, at no point during this multi-year process did any proponent of unlicensed operations describe or model the effect of continuously-transmitting beacon signals, and this interference case has therefore never been considered or vetted by the Commission or any other affected incumbent licensee.

The field test further found that the interference to the microwave link increased dramatically once the LPI device began transmitting actual data. As detailed in the report, the transmission of low speed data (*i.e.*, 100 Mbps or less) resulted in interference that exceeded the FCC's threshold in eleven of the thirteen configurations tested, including at a site more than 4.5 kilometers from the microwave receiver, while higher data rates (*i.e.*, 750

[1] *See* Attachment A, "Test Report on the Effects of 6 GHz Unlicensed RLAN units on Fortson to Columbus Microwave Link," June 21, 2021 ("Joint Test Report").

Mbps or higher) presented even more harmful interference and was measurable more than 9 kilometers from the microwave system.

Overall, the field test shows that interference from a *single*, FCC-certified LPI device would result in outage times measured in the tens of hours per year, rather than the required design level for critical infrastructure and public safety systems of approximately 5 minutes per year. This substantial decrease in operational reliability would effectively render the licensed fixed microwave system inoperable.

The results of this testing confirm Southern's concern that unlicensed LPI operations will cause harmful interference to incumbent 6 GHz systems, including those which support critical public safety and utility operations. Southern therefore supports the call for the Commission to pause any further certification of equipment intended for LPI operations in the 6 GHz band until automated frequency coordination ("AFC") or another sufficient form of mitigation has been implemented.[2]

Overview of the Test Program

In April 2021, Southern, L&W, and EPRI conducted real-world testing of commercially available, FCC-certified unlicensed LPI devices near Southern's existing licensed 6 GHz fixed microwave link between Fortson and Columbus, Georgia.[3] Southern previously discussed the outline of the plan for this testing with the Office of Engineering and Technology ("OET") and stated that representatives of the Commission and other interested stakeholders were welcome to observe and/or participate in this testing.[4]

The testing was conducted using off-the-shelf, FCC-certified 6 GHz access points and mobile client devices acquired on the open market; specifically, the ASUS GT-AXE-11000 and Netgear Nighthawk Tri-Band Wi-Fi 6E routers, Intel AX210 Wi-Fi 6E equipped laptops, and a Samsung Galaxy S21 Ultra smartphone.[5] Testing was conducted at seven locations ranging from 285 meters to up to 9.4 kilometers from the fixed microwave receiver.[6] Several of the locations had existing Wi-Fi access points operating, therefore where possible Southern placed the 6 GHz LPI access points directly next to or near the existing Wi-Fi access point to replicate the configuration used by the public.[7]

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[2] *See* Letter from Utilities Technology Council, et al., to Marlene H. Dortch, Secretary, Federal Communications Commission, ET Docket No. 18-295, GN Docket No. 17-183 (filed Jan. 26, 2021); Letter from Jennifer L. Oberhausen, CTIA to Marlene H. Dortch, Secretary, Federal Communications Commission, ET Docket No. 18-295, GN Docket No. 17-183 (filed March 5, 2021).
[3] *See* Joint Test Report at 6.
[4] *See* Letter from Larry F. Butts, Southern Company Services, Inc. to Marlene H. Dortch, Secretary, Federal Communications Commission, ET Docket No. 18-295, GN Docket No. 17-183 (filed March 26, 2021) (with attached test plan outline).
[5] *See* Joint Test Report at 9.
[6] *Id*. at 8.
[7] *Id*. at 7.

In addition, Southern performed a non-exhaustive drive test to develop a preliminary census of existing Wi-Fi routers already in commercial operation along the microwave path being tested.[8] This drive test was necessarily understated because: (1) the speed of the measuring vehicle did not allow capture of all access point SSIDs along the route; (2) only easily accessible roads were driven; and (3) only 60 percent of the path length was driven. Despite these limitations, the drive test nevertheless found just over 3,000 Wi-Fi access points in the main beam of the Columbus antenna.[9] This confirmed that the test locations were representative of the actual deployment of Wi-Fi devices used by the public. Given that unlicensed proponents anticipate 100 percent penetration of 6 GHz-capable access points within the next few years, this also strongly indicates that there will soon be numerous unlicensed 6 GHz LPI devices in operation directly in the main beam of the Columbus-to-Fortson microwave path.

For each test configuration, multiple test runs were performed: (1) access point beacons alone; (2) low speed data (10 to 100 megabytes per second average); and (3) high speed data (approaching 1 gigabyte per second).[10] The impact to the licensed microwave path was measured for each iteration in dB of fade margin reduction, which was used to calculate I/N ratios that were compared to the FCC-reportable interference level of -6 dB I/N.[11] The majority of the test results are for a single Wi-Fi access point – multiple Wi-Fi access points operating simultaneously were also tested and the impact was found to be additive, creating large gains in the final I/N dB ratio measured.[12] All testing was performed while the link was stable from an atmospheric fade perspective, and the fade margin was measured before and after each set of test runs to ensure the link remained stable.[13]

Overview of the Test Results

Overall, the results of this test confirm the theoretical concerns that Southern and many other incumbents and industry organizations have been expressing on the record for the past 18 months: FCC-certified LPI devices operating without AFC or other interference mitigation techniques will harmfully interfere with licensed incumbent 6 GHz microwave networks.

As detailed in the attached report, 6 GHz LPI access points in beacon-only mode (without any data traffic) resulted in interference greater than the FCC threshold in five of the thirteen different configurations tested.[14] This is significant as every Wi-Fi 6E compatible access point will transmit these beacons continuously at least every 104 milliseconds.[15]

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[8] *Id*.
[9] *Id*. at 54.
[10] *Id*. at 9.
[11] *Id*.
[12] *Id*. at 52.
[13] *Id*.
[14] *Id*. at 10.
[15] *Id*.

Interference from beacon operations would therefore be continuous for any microwave receiver that is affected in this manner.

The report further explains that the addition of low speed data resulted in reportable interference in eleven of the thirteen different configurations tested, with the most distant sites more than 4.5 kilometers from the microwave receiver, while higher data rates resulted in interference measurable more than 9 kilometers from the microwave receiver.[16] Moreover, as detailed in the report, the test results show that at five of the thirteen locations the 30 dB fade margin of the licensed microwave link was reduced by 14 to nearly 26 dB, rendering the microwave path too unreliable to be used.[17] In fact, the results show that if testing had occurred during the measured fades during fog, the microwave link in some cases would have been taken off the air entirely.[18]

Perhaps the most significant result of this testing, however, was the discovery of the actual operating parameters and impact of the LPI devices' beacon signals. During this test, Southern, L&W, and EPRI learned that every Wi-Fi access point sends a beacon signal at full AP power in a 20 MHz bandwidth channel using low speed modulation for backwards compatibility. Under the 802.11 standard, these beacons would typically transmit continuously every 104 milliseconds, but during testing it was found that the certified LPI devices being tested actually transmitted their beacons continuously every 20 milliseconds regardless of the beacon timing parameter set in their configurations.[19] Either way, the continuous transmission of these beacons substantially affects both the expected and observed duty cycles of these unlicensed LPI devices.

Throughout the rulemaking process for unlicensed use of the 6 GHz band, a key argument relied on by both proponents and the Commission has been the limited duty cycle of RLAN networks. In the *2020 6 GHz Order*, the Commission based its determination to allow unlicensed LPI operations in the 6 GHz band in large part on the representation of a duty cycle of 0.4%,[20] and unlicensed proponents used 0.00022% for 90% of units deployed and 0.11% to 0.44% for the remaining 10% of units deployed.[21] However, these assumed duty cycles do not account for the continuous transmission of beacon signals.

As mentioned above, and as discussed in the report, both of the certified LPI devices that were tested transmitted beacon signals every 20 milliseconds, resulting in a real-world *beacon-only* duty cycle of 2.2% and a measured duty cycle with low speed data streams (100

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[16] *Id*. at 11.
[17] *Id*.
[18] *Id*.
[19] *Id*.
[20] *See, e.g., Unlicensed Use of the 6 GHz Band; Expanding Flexible Use in Mid-Band Spectrum Between 3.7 and 24 GHz*, ET Docket No. 18-295, GN Docket No. 17-183, Report and Order and Further Notice of Proposed Rulemaking, FCC 20-51 (rel. Apr. 24, 2020)("*2020 6 GHz Order*") at ¶¶ 120-121 and 131.
[21] *See Ex Parte* Presentation of Apple, Inc., *et al*, GN Docket No. 17-183, RKF Study Table 3-1 (filed Jan. 26, 2018).

Mbps or less) of over 50%.[22] At no point during the multi-year rulemaking process did any proponent of unlicensed operations describe or model the effect of continuous beacon signals or address them in the analyses presented on the record to the Commission. This interference case has therefore never been considered or vetted by the Commission or any other affected incumbent licensee and reveals substantial flaws in the simulations and analyses relied on by the Commission in its decision to authorize unlicensed LPI operations.

In summary, this real-world field test of commercial, off-the-shelf, FCC-certified LPI devices demonstrated that a single unlicensed LPI device will cause harmful interference to incumbent 6 GHz systems which support critical public safety and utility operations.

Respectfully submitted,

/s/ Larry Butts

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Encl.

[22] *See* Joint Test Report at 12.