Before the
Federal Communications Commission
Washington, D.C. 20554

In the Matter of	)	
	)	
Allocation and Service Rules for the 1675–1680 MHz Band	)	WT Docket No. 19-116
	)	

COMMENTS OF ACCUWEATHER

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AccuWeather, Inc. ("AccuWeather"),hereby files it comments on the Commission's Notice of Proposed Rulemaking ("NPRM") in the above-captioned matter.[1] In 2012 and, again, in 2016, the Commission solicited comments on a Petition for Rulemaking in the 1675-1680 MHz band filed by LightSquared Subsidiary LLC, and supported by its successor Ligado Networks LLC ("Ligado").[2] Many concerns have been raised in the record by members of the weather community[3] and government officials[4] about a reduction in fast and reliable access to critical, life-saving weather satellite data that would result from the rule changes Ligado sought with its Petition. AccuWeather

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1 In the Matter of Allocation and Service Rules for the 1675-1680 MHz Band, WT Docket No. 19-116, Notice of Proposed Rulemaking and Order, FCC 19-43 (rel. May 13, 2019) ("NPRM").

2 *See generally* Petition of LightSquared Subsidiary LLC for Rulemaking (filed Nov. 2, 2012) (LightSquared Petition); see Petition for Rulemaking Filed, RM No. 11681, Public Notice, Report No. 2967 (CGB Nov. 9, 2012); Public Notice, Comment Sought to Update the Record on Ligado's Request That the Commission Initiate a Rulemaking to Allocate the 1675-1680 MHz Band For Terrestrial Mobile Use Shared With Federal Use, RM-11681, DA 16-443 (rel. April 22, 2016).

3 *See, e.g.,* "Re: Oral Exparte presentation in GN 19-116 "In the Matter of Allocation and Service Rules for the 1675-1680 MHz Band"; RM-11681 "Petition [by Ligado Networks] for Rulemaking to Allocate the 1675-1680 MHz Band for Terrestrial Mobile Use," May 2, 2019.

4 *See* David Grimes, "Re: FCC Notice of Proposed Rulemaking and Order in the Matter of Allocation and Service Rules for the 1675-1680 MHz Band (WT Docket No. 19-116), dated April 18, 2019," May 1, 2019.

expresses grave concern regarding the NPRM, which, while not granting the Petition, technically speaking, raises many of the same concerns.

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I. SUMMARY

AccuWeather and other members of America's Weather Industry actively disseminate important forecasts and warnings each day which depend upon the timely and reliable receipt of meteorological data from U.S. government meteorological satellites, such as GOES-16 and GOES-17. Those satellites deliver this critical data to Federal and non-Federal earth stations through GOES Rebroadcast ("GRB") downlinks immediately adjacent to the 1675-1680 MHz band. GRB is the direct feed of real-time atmospheric data that federal and non-federal users obtain that serves as a key input when monitoring severe thunderstorms, blizzards, forest fires, hurricanes, and other weather hazards and issuing up to the minute forecasts and time-sensitive warnings. The GOES Data Collection System ("DCS") uses 1679.9 MHz as a downlink frequency to support dissemination of additional time-sensitive information captured by other sensors, such as wind monitors, that inform forecasts and warnings to the public.

The potential introduction of terrestrial mobile and fixed services in the 1675-1680 MHz spectrum band, as considered by the NPRM, raises grave concerns about harmful interference to the continued reliable downlinking of GRB and DCS data. Interference to the GOES-R downlinks can delay receipt and processing of these data, and therefore postpone dissemination of vital information to the public to aid and protect life, property, businesses, and government operations. The loss of seconds can mean the difference between safety and grave risk to life and property.

Non-federal earth station operations that enable direct downlink of this data should be protected to the same extent as federal government earth stations. While protection zones should be the principal method used to avoid harmful interference to downlinks at earth

station sites, additional mitigation methods might be possible – dynamic protection zones based on monitoring or earth station shielding – but these should be considered and implemented only at the expense of the terrestrial mobile and fixed licensee(s).

The Commission seeks comment about whether use of a content delivery network based on the Internet would be an adequate substitute for non-Federal users to direct satellite downlinks. While there may be some purposes that do not rely on the low-latency access to the meteorological data that the satellite downlink supports, for AccuWeather and other members of the American Weather Enterprise, the lower latency and greater reliability of satellite downlinks is essential. As the new generation of GOES-R satellites were about to be launched, AccuWeather examined the possibility of accessing the meteorological data it relies upon in other ways, for example, utilizing the data made available through Amazon's Web Services. Other options were deemed inadequate to meet AccuWeather's requirements, and further significant investment was made in earth station equipment, hardware, and software in anticipation of the GOES-R satellites. AccuWeather understands that many other organizations made a similar calculation. A content delivery network, as evidenced by the trials that Ligado engaged in with two academic institutions, would increase latency materially. Moreover, a terrestrial content delivery network would be prone to outages and disruptions that would prevent the availability requirements that AccuWeather relies on from being satisfied. The prospect of a content delivery network also raises a host of other concerns and questions, such as whether terrestrial licensees would pay for it and for how long.

Finally, many of the questions posed by the NPRM are being extensively studied by the National Oceanic and Atmospheric Administration ("NOAA"), an effort that will not be complete

for another year. Any decision by the Commission should wait until these studies have been made available to the public for comment and thoroughly reviewed. Moreover, the Commission should create an ability for non-federal users who operate one or more earth stations to register to create a record of usage of the GOES-R downlink in or near the 1675-1680 MHz band, so as to ensure that a more complete picture of where the satellite downlinks are being utilized by non-Federal users.

II. BACKGROUND

Over 1.5 billion people rely on AccuWeather each day for actionable weather forecasts and information used to make important decisions. Recognized and documented as the most accurate source of weather forecasts and warnings, AccuWeather's mission is to save lives, protect property, and help people prosper. AccuWeather delivers critical weather information via its website, mobile applications, smart devices, radio, television, newspapers and other media outlets to reach consumers while providing tailored products and services to more than half of the Fortune 500 and thousands of other businesses.

As a leading member America's Weather Industry, AccuWeather actively partners with the U.S. National Weather Service to assist in the rapid dissemination of official government severe weather warnings to the public through mobile technology, putting potentially life-saving information generated by the government into the hands of users within seconds. Mobile applications such as AccuWeather's, connected TVs, and other smart devices are increasingly the primary method used by the public to receive official government weather alerts.

Since 1980, 246 weather and climate disasters have occurred in the United States that have caused over $1 billion in damage and considerable loss of life. In total, the cost of these events exceeds $1.6 trillion.[5] The significant impact of weather has a tangible effect on GDP with 3-6% of its variability attributed to weather.[6] Although high-impact weather events will continue to occur, the ability to predict such events has significantly advanced in the last decades. Weather forecasts, accessed over 300 billion times per year in the United States, improve due to a variety of factors such as timely access to more meteorological data, increased computing capability, revolutionary advances in atmospheric observing technology, and research on Earth's atmospheric processes. The benefits of these improved forecasts are enhanced by the ability to better reach people with critical information during times of adverse weather.[7]

One of the most important technological advances in the last decade for weather forecasting is the new generation geostationary weather satellites in the GOES-R series, GOES-16 and GOES-17, launched by NOAA in 2016 and 2018, respectively. (Two more GOES satellites in the GOES-R series are scheduled for launch in the next few years.) These satellites transmit time-sensitive, life-saving data to users in the United States, the Americas, and globally. Unimpeded, real-time, and highly reliable access to this data is critical for members of the American Weather Enterprise to meet its mission

[5] "Billion-Dollar Weather and Climate Disasters: Overview," NCEI, NOAA, https://www.ncdc.noaa.gov/billions/.

[6] "National Weather Service Enterprise Analysis Report", NOAA, June 8, 2017: 2. https://www.weather.gov/media/about/Final_NWS%20Enterprise%20Analysis%20Report_June%202017.pdf

[7] Richard B. Alley, Kerry A. Emanuel, Fuqing Zhang, "Advances in weather prediction", *Science* Vol. 363, Issue 6425 (2019): 342-344.

of saving lives, keeping people out of harm's way, protecting property and mitigating economic disruption.

The American Weather Enterprise consists of organizations from three sectors: America's Weather Industry, academia, and government. Working together, the collective Enterprise leverages the expertise of each sector to generate weather forecasts and information that benefit citizens, business and society. The partnerships are critical in terms of keeping people safe, reducing injuries and fatalities, and helping people and companies avoid financial loss.

Within the Enterprise, America's Weather Industry, of which AccuWeather is a leading member, utilizes foundational weather data generated by government organizations to build value-added products. These products and services, spurred by public, private, and academic collaboration, enable the Enterprise to have an accelerated and positive impact on citizens, businesses and society by protecting property and minimizing the economic impacts of weather.

The weather data received from satellites and other sources is only useful to people if transformed into actionable information and provided in a timely manner. AccuWeather, the largest provider of weather forecasts, warnings, news and information in the US and globally, along with many other members of the Weather Industry, actively disseminates important forecasts and warnings each day dependent upon the receipt of timely weather data from government meteorological satellites, such as GOES-16 and GOES-17. Specifically, at AccuWeather, we utilize our extensive digital media partnerships and services to provide relevant and timely weather information to more than 1.5 billion people. In each case, whether

it be a Fortune 500 company, a school district, or a member of the public, America's Weather Industry is a critical part of the value chain of data distribution from the National Oceanic and Atmospheric Administration ("NOAA").

The 1675-1680 MHz band, which is the focus of the NPRM, is utilized for or adjacent to the spectrum which is used by organizations within the American Weather Enterprise to collect essential data and make important decisions each day about weather's impact on life, property and the economy. The effectiveness of the GOES-R series spacecraft would be adversely impacted by the introduction of terrestrial mobile service in the band. The GOES Rebroadcast ("GRB") downlink, accessed by many federal and non-federal users, including AccuWeather, for the highest reliability and lowest latency data transmits at 1686.6 MHz. The GOES Data Collection System ("DCS") uses 1679.9 MHz as a center frequency of transmissions to support weather data downlink to many users. [8]

GRB is the direct feed of real-time atmospheric data that federal and non-federal users obtain as a key input when diagnosing severe thunderstorms, blizzards, forest fires, hurricanes, and other weather hazards to issue forecasts and time-sensitive warnings. AccuWeather and, to AccuWeather's knowledge, many other organizations recently installed new earth stations along with other hardware and software designed to reliably receive, process, and incorporate GRB via a downlink. Data collection directly from the GOES satellites has been repeatedly stated by federal government officials

[8] Department of Commerce, National Oceanic and Atmospheric Administration, *GOES Rebroadcast (GRB) Downlink Specifications for Users*, 2012.

within NOAA as the most reliable way to receive this mission-critical data, as specified in the GRB design and outlined in the GOES-R Product User's Guide.[9] Given this governmental guidance, in combination with operational needs, the American Weather Enterprise has significantly invested in technology to ensure the lowest latency and highest reliability of data through direct downlinks from the satellites in and just above the 1675-1680 GHz Band.

Latency, the time it takes for data from a scan of Earth to reach an end user, is of utmost importance to members of America's Weather Industry who maintain weather forecasting operations. This environment requires the lowest possible latency in order to rapidly integrate new data into computer forecast systems and provide to meteorologists for analysis. For instance, some of the highest resolution data from the GOES-R series of satellites is captured and transmitted to Earth every minute. This data can indicate the start of a wildfire, the growth of a storm capable of producing a tornado, or a volcanic eruption that could quickly impact aviation due to an ash cloud. In each situation, each second matters: accurate [near] real-time information must be provided to citizens and businesses to allow them to make decisions in a timely fashion.

When AccuWeather evaluated the processing of GOES-R series satellite data, a variety of options were reviewed considering cost, maintenance, reliability, data latency, and performance in times of natural disasters or national emergencies. The decision to install two new earth stations for GRB (and three others many years ago for GOES VARiable - GVAR)

[9] Department of Commerce, National Oceanic and Atmospheric Administration, *GOES-R Series Product Definition and Users' Guide (PUG).* Revision 2.0, 2018.

resulted in millions of dollars of investment, which was necessary to leverage this essential satellite data in a way that most reliably meets our operation's needs.

III. THE INTRODUCTION OF TERRESTRIAL SYSTEMS WILL POSE A SERIOUS INTERFERENCE THREAT TO INSTITUTIONS THAT RELY UPON GRB DATA COLLECTION, REQUIRING THE PROTECTION OF EARTH STATIONS AT THE EXPENSE OF ANY NEW ENTRANTS

The NPRM seeks comment on "the number and location of such non-federal earth stations, the likelihood of interference at such locations, and ways to mitigate the risk of interference or otherwise ensure that they continue to have access to the data were we to allow non-federal fixed and mobile operations."[10] Earth stations at hundreds of organizations, including AccuWeather, will face significant adjacent band interference from terrestrial wireless operations within 1675-1680 MHz spectrum, which may render GRB downlink functionality useless or at least severely disrupted. This cannot occur. In times of severe weather, such as tornadoes, forest fires, and flooding, missing just one scan of satellite data can result in several minutes of reduced lead time for weather forecasters to issue life-saving warnings. This means the data will not be available when it is needed most, with potential severe consequences for life, property, governmental functions, and businesses.

For example, the proposed sharing of 1675-1680 MHz with non-federal wireless operators raises serious concerns about the viability of DCS downlink (centered at 1679.9 MHz) as a data transmission option due to power considerations. The downlink power is far weaker than what would be utilized by a wireless network and could be

[10] NPRM ¶ 19.

completely overwhelmed, leaving entities who rely on data transmitted via DCS without critical, life-saving information. The NPRM recognizes the need to ensure this data remains available to AccuWeather and these hundreds of other organizations.[11] The NPRM recognizes that the primary way to protect Federal earth stations operating in or hear the 1675-1680 MHz band is through protection zones.[12] Similarly, the best way to protect non-Federal earth station operations is through protection zones. The burden of implementing protections, weather protection zones alone, or protection zones combined with monitoring or shielding, should be borne solely by the new entrants that seek to share this band.

IV. AN INTERNET CONTENT DELIVERY NETWORK FOR DISSEMINATION OF GRB AND DCS DATA IS AN INADEQUATE SUBSTITUTE FOR PROTECTING NON-FEDERAL EARTH STATION OPERATIONS

The Commission asks whether an Internet-based content delivery network ("CDN") could be used in place of GRB for non-federal users, allowing them to access the same data with the same level of timeliness.[13] This is an inadequate substitute and should be rejected. Here's why:

First, GRB was designed to an uptime specification of 99.988% over a 30-day time period, leaving room for only 5 minutes of downtime per month.[14] Although many enterprise-grade internet service providers offer highly reliable access to the internet, the infrastructure,

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[11] *Id.*

[12] *Id.* ¶¶ 17-18.

[13] *Id.* ¶ 20.

[14] NOAA, "GOES-R Series Ground Segment (GS) Project Functional and Performance Specifications (F&PS) Attachment 2: 28," https://www.goes-r.gov/resources/docs/GOES-R_GS_FPS.pdf

where available, may not consistently and reliability function to provide that service, especially in times of natural disasters. After Hurricane Michael struck the Gulf Coast in 2018, numerous fiber lines were cut and major carriers had to deploy mobile towers to support internet functionality during this "unprecedented" outage.[15] It is exactly at these times where satellite data is needed most and GRB requires little infrastructure, only relying on the cable connecting the satellite dish to the data center. Even if there was a private internet network or direct fiber used by the CDN, it could be rendered unusable in the event of a natural disaster such as Michael.[16]

Second, latency is increased with a CDN. As part of an effort to prove the effectiveness of such a solution, Ligado Networks partnered with George Mason University to ingest GOES-R data for research purposes.[17] The latency of data through the study period is posted online.[18] In a review of this data in comparison to AccuWeather's own GRB latency as well as that of other partners who receive data via GRB, it is clear that the latency falls well short of what is required by users such as AccuWeather but which is currently satisfied by GRB.

George Mason's system monitoring indicates satellite radiance data (data used to make images) received via the CDN examined in that case has a latency of 20 to 80

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[15] Jon Brodkin, "Verizon fiber suffered 'unprecedented' damage from Hurricane Michael", *Ars Technica,* October, 15 2018, https://arstechnica.com/information-technology/2018/10/verizon-fiber-suffered-unprecedented-damage-from-hurricane-michael/

[16] *See,* "Reply Comments of Ligado Networks LLC", pp: 25, August 11, 2016

[17] *See,* "Re: Written ex parte presentation, WT Docket No. 19-116," Attachment A, Ligado Networks, June 13, 2019.

[18] "GTPAS", George Mason University, Ligado Networks, http://aoes-ligado.gmu.edu/tmp/system.shtml.

seconds.[19] Conversely, a review of data received via GRB indicates a much lower latency, 2 to 15 seconds. Even if referencing the maximum GRB latency specified by NOAA (55 seconds for Full Disk and CONUS data), the CDN is inadequate.[20] Further, it is important to note the George Mason statistics reflect daily *mean* latency which smooths times of poor latency. In addition, the statistics omit outliers from the calculation, further massaging the latency data. We find it interesting the Ligado study was completed in partnership with two research universities and did not engage with any member of America's Weather Industry whose use case and requirements for GOES data is significantly different and more demanding, for reasons explained above.

Exacerbating the differences above, the Ligado experiment does not account for times of highly congested terrestrial networks that caused latency to increase further. AccuWeather requires the most timely data, and it must be consistent and reliable. A GRB downlink guarantees consistent, low latency and high reliability. Seconds, let alone minutes, lost during high impact weather events is simply unacceptable and poses serious public danger.

The type of inconsistent latency inherent in terrestrial networks is experienced regularly by many in the American Weather Enterprise. For example, most computer weather model data is disseminated via the public internet and sometimes dedicated fiber. While this works adequately most of the time for many purposes, it does not always provide low latency. There are a handful of times each year where latency drastically increases or dissemination reliability breaks down. This causes significant challenges and results in delayed receipt of mission-critical

[19] *Id.*

[20] Department of Commerce, National Oceanic and Atmospheric Administration, *GOES-R Series Product Definition and Users' Guide (PUG).* Revision 2.0, 2018.

meteorological data relative to satellite delivery which cannot be tolerated where timeliness matters.

Third, one of the ways that NOAA receives significant return on investment from the GOES-R series of satellites is through American Weather Enterprise users who access the highest resolution data as quickly as possible through satellite downlinks and incorporate the data into value-added products and services. In total, the GOES-R program budget is $10.8 billion.[21] Given the troublesome latency statistics of the trial CDN, there should be significant concern that a large part of this investment risks being squandered should organizations lose access to data via GRB.

Fourth, GRB contains a significant amount of data and all of it would need to be disseminated through a CDN. Throughput of high volumes of data, feeding constantly, requires a large bandwidth and high cost, while a GRB earth station is essentially a fixed cost.

Fifth, there is a recommendation that the winner of this spectrum auction build and support a CDN.[22] This raises critical questions. What type of support would be provided and for how long? What type of latency and reliability of the CDN would be guaranteed? As noted above, availability and performance would have to be 24/7/365 with an uptime the same or better than the GRB SLA of 99.988%. Who will maintain the CDN over many years?

[21] "GOES-R Series Frequency Asked Questions (FAQs)", GOES-R, NOAA, NASA, https://www.goes-r.gov/resources/faqs.html.

[22] *See,* "Reply Comments of Ligado Networks LLC," August 11, 2016: 24.

Sixth, the potential for benefits of expanding the access of satellite meteorological data by using a CDN is questionable. Amazon Web Services already employs its own method of access to GOES-R and S data which is used by a variety of entities from academia, industry, and government, albeit those which do not have as demanding a requirement for real-time access as, say, AccuWeather. A CDN as proposed in the NPRM is not revolutionary but already exists. In fact, AccuWeather examined the possibility of utilizing Amazon's data when exploring GOES-R options, and decided it was only useful as backup given our time-sensitive operations.

It should be clear that a CDN, while perhaps acceptable for certain use cases such as academic research, forensic weather analysis, and education, it is not a viable solution for operations who rely on the most consistent, reliable and lowest latency data such as members of America's Weather Industry. Any suggestion that it would be sufficient for NOAA earth stations to enjoy protection zones while similar protections not be provided to entities like AccuWeather, or other public, non-federal users, reflects a fundamental misunderstanding of how weather information is created and disseminated in the United States. The timely and direct distribution of data to members of the entire American Weather Enterprise is what makes our country's weather community unique. AccuWeather and other companies in America's Weather Industry are directly involved in the support of federal, state, and local emergency managers and the direct support of land, air and sea transportation operations. In each of these applications, the satellite data transmitted in or near the 1675-1680 MHz band play a vital role in the provision of tailored weather information services, which enable decisions that affect the safety of large numbers of the public and the country's economic vitality.

A reduction in data quality and latency could also be detrimental to university research. Many atmospheric science programs rely on GRB downlink to receive data in the most efficient and reliable way possible. This data is used to develop new methods of incorporating satellite data into the weather forecast process and uncovering new ways to more rapidly identify adverse weather events. Federal government weather forecasters along with meteorologists throughout the Weather Enterprise benefit from this research, improving forecasts and warnings that are directly provided to the American public. A detrimental impact to satellite data availability has a wide ripple effect.

Not to be missed in this discussion is the Data Collection System ("DCS"). This very different but important function on the GOES-R spacecraft, which downlink operates centered at 1679.9 MHz, is used by entities across the western hemisphere to ensure reliable and cost-effective transmission of data not captured by the GOES-R spacecraft. For example, the Florida Department of Transportation ("FDOT") sends data from bridge wind sensors through DCS instead of the public internet. This has reduced costs and provides consistent transmission during the times when the data is most needed, such as during and after tropical cyclones, which can cut public internet access.[23] While uplink of DCS will not be impacted by this proposal, downlink would be as it operates directly in the 1675-1680 MHz band. Once again, a CDN has been proposed to mitigate any interference. As enumerated above, a CDN is not a viable alternative.

[23] Florida Department of Transportation, *Best Practices for Road Weather Management*, https://ops.fhwa.dot.gov/publications/fhwahop12046/rwm09_florida1.htm

V. PROPOSED NEXT STEPS BEFORE THE COMMISSION MAKES A DECISION

The items raised here that address many of the questions posed by the NPRM are being extensively studied by NOAA with a completion date in 2020. Given the important and complex issues being discussed, it is prudent and necessary to wait until such spectrum studies are finalized in order to understand the full consequences of sharing the 1675-1680 MHz band. Any decision by the Commission should wait until these studies have been thoroughly reviewed.

In this time window, non-federal users who currently operate an earth station should be asked to register with the Commission to create a record of the wide variety of organizations who make use of GRB. Like AccuWeather, these are incumbent users who made significant investments in earth station and related equipment which would be rendered unusable without protection zones. Why should these incumbent users not also qualify for similar protection zones as federal users would when many organizations perform actions similar to that of federal users for the protection of life and property? Since America's Weather Industry is considered a core part of the value chain used to disseminate life-saving information to citizens and businesses, any adverse impact that occurs from sharing 1675-1680 MHz renders these significant investments useless.

VI. CONCLUSION

In conclusion, AccuWeather is in favor of continued U.S. leadership in mobile enhancement and its deployment through innovation and sensible management of spectrum for public benefit. This deployment, though, cannot and should not jeopardize the use of 1675-1680 MHz, which is of high importance to the protection of life and property, not only by

federal users but by numerous non-federal ones. We continue to feel strongly that no sharing of 1675-1680 MHz should occur due to the lack of other viable data access options. This portion of spectrum and the infrastructure used to receive data should be considered critical and its interference minimized. Without a viable data dissemination alternative that matches GRB and DCS in reliability and latency that is thoroughly proven and documented to do so, accurate, life-saving weather forecasts and warnings will be compromised, resulting in a genuine risk to life and property, thereby causing a direct, negative, and grave impact on the American public.

Respectfully Submitted,

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