Before the
NATIONAL TELECOMMUNICATIONS AND INFORMATION ADMINISTRATION,
U.S. DEPARTMENT OF COMMERCE

In the Matter of	)	
	)	
The Benefits, Challenges, and	)	
Potential Roles for the Government in	)	Docket No. 160331306–6306–01
Fostering the Advancement of the	)	
Internet of Things	)	
	)	
	)	

COMMENTS OF DEERE & COMPANY

Deere & Company (NYSE: DE) ("Deere"), by its undersigned attorneys, submits these comments in response to the National Telecommunications and Information Administration ("NTIA") Notice and Request for Comment ("NOI") in the above-referenced docket.[1] Deere is a world leader in the manufacture of agricultural, construction, and forestry machinery, diesel engines, and other machinery equipment. It provides advanced agricultural and other equipment and services to customers that cultivate, harvest, transform, enrich and build upon the land to meet the world's dramatically increasing need for food. Deere has delivered innovative equipment since 1837, and today, is pioneering state-of-the-art data and information solutions designed to greatly enhance productivity and environmental sustainability.

Deere applauds the NTIA's recognition of the growing importance of technologies that comprise the evolving Internet of Things ("IoT") and its decision to seek public input on the potential benefits and challenges of the IoT and specifically, what, if any, the U.S. Government's role should be in the development and deployment of IoT technology. Deere welcomes this

[1] *National Telecommunications and Information Administration Notice and Request for Comment,* 81 Fed. Reg. 19956 (Apr. 6, 2016) ("NOI").

opportunity to provide its experience and perspective on the current and future technological and policy landscape of IoT in the United States, and specifically in rural and agricultural areas. As an active innovator and stakeholder in IoT technology deployment in agricultural areas, Deere offers its specific suggestions on steps the U.S. Government should take to foster, and remove barriers to, the development of IoT technologies.[2]

I. Deere's Innovations in Internet of Things Technology

Deere is a pioneer in IoT advancement in agricultural equipment, giving farmers access to tools that make crop preparation, planting, feeding, watering, maintenance, and harvesting significantly more efficient with lower costs and higher per-acre yields. Deere recognized early on the potential productivity gains that could be achieved by tapping into the digital and information revolution, and beginning ten years ago in 2006, Deere started furnishing construction and forestry equipment with telemetrically enabled mobile systems. Since January 2011, all of Deere's large self-propelled agriculture equipment models (except skid steer loaders) incorporate JDLink™ telematic modems. Modems, along with IoT sensors, third-party and cloud applications, GPS-enabled precision steering systems, and powerful in-cab and farmhouse analytic and mapping programs comprise a highly specialized system that is transforming modern farming techniques in order to meet the expanding worldwide demand for food in an increasingly challenging economic environment.

While these information and communication technology-integrated systems started on large machines (tractors, combines, etc.), they rapidly spread to the entire agricultural production chain. Machine-to-machine ("M2M") communication and machine-to-farmhouse ("M2F")

[2] Deere's recommended specific government actions are identified in Section VII of these comments.

communication have become current practice. John Deere's Machine Sync™,[3] Remote Display Access ("RDA"),[4] Service Advisor Remote ("SAR"),[5] and JDLink™[6] are components of the in-field IoT network. Deere's FarmSight™ gives farmers access to detailed agronomic information in the field essential for improved decision making with respect to managing costs and resources. Real Time Kinematics ("RTK")[7] systems leverage cellular connections to access dealer, vendor, and market applications.

Today, the cabin of a contemporary Deere tractor, bearing little resemblance to a traditional piece of farm equipment, is filled with state-of-the art technology supporting precision guidance systems and designed for intense data gathering and processing.[8] Deere's StarFire™ system enables in-motion equipment to navigate with accuracy of a few centimeters, Deere tractors and implements are equipped with a full suite of complementary information and

[3] John Deere Machine Sync™ allows coverage map sharing and guidance line sharing to improve planting, seeding, spraying and nutrient application. This increases efficiency in the field, because two machines can work simultaneously with each operator having immediate access to coverage maps and guidance lines to ensure complete field coverage. Machine Sync also makes harvesting easier with automated communication and logistics for combines and grain carts, by allowing the combine operator to automatically control the location of the tractor and grain cart while unloading on-the-go.

[4] Remote Display Access enables farm managers and dealers to remotely assist operators with machine setup, setting adjustments and operation. RAD allows farmers to establish a live connection to the GreenStar 2630 display in the cab of a machine.

[5] Service Advisor Remote allows a Deere dealer to remotely access machine's diagnostics systems so they can make sure it's running at peak performance, like having an infield technician. SAR reduces diagnostic call-outs, increases machine uptime, and identifies potential issues early.

[6] JDLink™ allows farmers to manage operations in real-time without being in the cab. JDLink™ is John Deere's telematics system connecting all make/model machines in the field with the office and mobile devices. The technology bases on a modular telematics gateway (MTG) controller that collects and transmits data via cellular network, selective data points even in near real-time. The solution enables customers to keep track of their fleet, monitor work progress, manage logistics, access important machine information, analyze and optimize machine performance, receive alert SMS or eMail messages, perform remote operator support and automate data exchange.

[7] RTK supplements GPS signals to achieve up to one-inch location accuracy. It is not a stand-alone localization system such as GPS.

[8] As John Reid points out in his article in *The Bridge*, "a modern, high-end agricultural machine system is effectively a mobile, geospatial data-collection platform with the capacity to receive, use, sense, store, and transmit data as an integral part of its operational performance." John F. Reid, "The Impact of Mechanization on Agriculture," The Bridge 41, no. 3 (Fall 2011): 14 – 21.

technology ("IT") applications.[9] The IT applications and state-of-the-art equipment used by today's farmers generate and consume tremendous amounts of data, and future IT applications will be even more real-time data driven and bandwidth intensive.

II. What are the most significant new opportunities and/or benefits created by IoT, be they technological, policy, or economic? (NOI Question 1(c))

The emergence of IoT technologies is of central importance to the economic vitality of the nation's rural communities, generally, and to the agricultural sector, in particular. In fact, the rapid adoption of information technologies and services across the agricultural economy today is no less significant than was the introduction of mechanization to farming almost 100 years ago. Today's worldwide demand for food requires innovation that can increase yields from the same amount of land and lower costs, conserve water, and limit fertilizer and pesticides. The challenging economics of farming and the need to meet long-term demand have transformed agriculture in the U.S. and many other countries into a technology-driven sector increasingly dependent on IoT technologies.

Gone are the days when a producer's crop yield can be improved simply by using more and bigger agricultural machines. Instead of bigger, stronger and faster, it is easier, smarter, and more efficient. IoT in America includes not only smart meters and smart appliances, but also smart tractors, combines, and production systems. With the use of smart farming technologies incorporated into moving machinery and in the field, precision agriculture harnesses information technology to achieve material boosts in productivity.[10] Best practices for fields are identified in any given location. Modern agricultural machines equipped with state-of-the-art IoT

[9] Examples

[10] For example, informed decisions about irrigation, fertilization and harvesting can increase corn form profitability by $5 to $100 per acre. Precision Agriculture Eats Data, CPU Cycles: It's a Perfect Fit for Cloud Services, K. Marko, 8/25/15, at www.forber.com/sites/kurtmarko/2015/08/25/precision-ag-cloud.

technologies share data between and among machines, the farmhouse, and third-party vendors and dealers, 24 hours a day, capturing the full benefit of favorable weather conditions and peak growing seasons, and eliminating equipment downtime for repairs, reloading, refueling, etc. In addition to the economic benefits of smart farming with IoT, it also reduces the use of pesticides and conserves water.[11]

As the world population continues to grow, farmers will more and more be compelled to look to innovative techniques to sustain unprecedented high levels of productivity and manage costs on an increasingly granular level. World population is projected to climb from approximately 7 billion today to approximately 9.7 billion by 2050.[12] This means that every hour, there are an additional 9,000 new mouths to feed globally, which equates to roughly enough new people to fill Washington Nationals Park more than five times each and every day. As incomes around the world rise, animal protein becomes a larger component of average diets. This, in turn, generates greater demand for grains. In most of the world there is a rising trend in farm sizes, scale and specialization as economies develop. Looking into the future, IoT agricultural technologies will be a primary solution to squeeze more out of finite land resources.

It is worth noting that the stakes for the future of the Ag sector are high. Agriculture and agriculture-related industries contributed $835 billion to the U.S. gross domestic product (GDP) in 2014, a 4.8-percent share.[13] The agricultural economy extends to a wide range of other sectors

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[11] Precision irrigation systems using weather data integrated from automated weather stations and meteorological soil-monitoring data found water reductions ranging from 11-50%. A combination of precision irrigation technologies, including wireless soil sensors, could reduce agricultural water consumption by 17% per year in California. *See* Pacific Institute, 2009.

[12] United Nations Department of Economic and Social Affairs, World Population Projected to Reach 9.7 billion by 2050, available at: http://www.un.org/en/development/desa/news/population/2015-report.html.

[13] *See* USDA, Ag and Food Sectors and the Economy, available at: http://www.ers.usda.gov/data-products/ag-and-food-statistics-charting-the-essentials/ag-and-food-sectors-and-the-economy.aspx.

that contribute added value to the economy. In 2014, 17.3 million full- and part-time jobs were related to agriculture—about 9.3 percent of total U.S. employment.[14] Direct on-farm employment provided over 2.6 million of these jobs.[15] Employment in related industries supported another 14.7 million jobs.[16]

III. With respect to current or planned laws, regulations, and/or policies that apply to IoT: Are there examples that, in your view, unnecessarily inhibit IoT development and deployment? (NOI Question 3(b))

Deere encourages the U.S. Government to announce a policy that commits to streamline government processes to approve and foster innovative IoT technologies where possible. Current and future laws and procedures should be reexamined with this priority in mind. For example, the FCC recently granted Deere a rule waiver to enable the use of unlicensed, low power fixed white space devices in motion on agricultural equipment for broadband machine-to-machine data communications to support agricultural applications.[17] In its Order, the FCC acknowledged the public interest benefits of Deere's proposed services: "there is a stronger public interest benefit in granting these waivers than in strictly applying the rule. Granting these waivers will support broadband M2M communications among farm equipment and a broad variety of agricultural applications aimed at increasing the efficiency of commercial agricultural producers' operations, materially increasing crop yields and reducing food production costs, thereby benefiting consumers and the economy."[18]

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14 *See id.*
15 *See id.*
16 *See id.*
17 *See In the Matter of Deere & Company Request for Limited Waiver of Part 15 Rules for Fixed White Spaces Devices*, Order, ET Docket No. 15-184 (2016).
18 *See id.*

The grant of this rule was a positive step in the development of innovative IoT technologies to serve rural agricultural needs. Deere commends the FCC's action here and supports further flexibility and streamlining of regulatory licensing and equipment requirements and procedures where possible to encourage further IoT development and innovation. In that regard, Deere encourages further examination of whether and to what extent municipal zoning and permitting laws are inhibiting infrastructure deployments of IoT devices and transmitters. Inflexible regulatory requirements and prolonged approval procedures present an administrative and timing burden that inhibits development and deployment of innovative IoT technology.

Furthermore, conduit installed with the support of federal funds (i.e., through the Federal Communications Commission's ("FCC's") Connect America Fund ("CAF") or "Dig Once" programs) should be made available to third parties on reasonable rates, terms and conditions to support the goals of universal service and competition.

IV. What factors should the Department of Commerce and, more generally, the federal government consider when prioritizing their technical activities with regard to IoT and its applications, and why? (NOI Question 7)

Given that agricultural operations are an important – and often the most important – economic driver in many rural areas, Deere urges the U.S. Government to consider the interests of rural economies and populations by eliminating technological barriers to the development of rural IoT technologies. In this regard, government priorities should focus on (1) protecting navigation through GPS and other GNSS systems; (2) funding broadband deployment, specifically for rural agricultural operations on croplands; and (3) bolstering infrastructure to ensure that agricultural producers have flexibility to pick the appropriate technology for their needs. Deere expands on these areas of interest below while answering other critical questions asked in the NOI.

V. With respect to current or planned laws, regulations, and/or policies that apply to IoT: Are there examples that, in your view, unnecessarily inhibit IoT development and deployment? (NOI Question 3(b))

A. What technological issues may hinder the development of IoT, if any? (NOI Question 6) What can the government do, if anything, to help mitigate these technical issues? (Question 6(b))

1. Government Policies Must Protect Navigation through GPS

In keeping with other broad trends in commercial applications, precision agriculture relies on location and navigation services provide by the United States Global Positioning System ("GPS") and other ("GNSS") systems such as GLONASS, Galileo and Compass. Deere's high precision agricultural equipment (and other similar precision agriculture equipment) augments its navigation signals with data obtained from a receive-only vehicle mounted mobile earth station that receives satellite signals covering the United States. This correctional data stream greatly enhances the information the on-board equipment receives simultaneously from GPS enabling the operators of agricultural equipment to pinpoint their locations to within 10 centimeters.

The augmented navigation systems that are integral to precision farming rely on robust and interference-free GPS signals, 24 hours a day, 365 days a year. As just one of many IoT systems that rely on unimpaired location services, it is imperative to precision agriculture that government policies continue to protect GPS as a national resource. To that end, Deere urges the NTIA to explicitly state in the report emerging from this proceeding that continued widespread access to interference-free GPS and GNSS signals are critical to existing IoT systems and to recap the future benefit of further IoT innovation. In particular, initiatives to permit uses in adjacent spectrum must be examined to ensure that the proposed use does not interfere with GPS and high precision navigation services.

2. Availability of Network Infrastructure: Government Broadband Subsidies for Rural Areas Should Focus on Agriculture, Specifically Croplands

Existing government efforts to promote broadband deployment in rural areas have historically assessed broadband availability or unavailability based on the state of broadband coverage in population centers, namely residential areas, along with "anchor institutions" identified as schools and hospitals. While this approach identifies needs of people at their homes, it often can mask a severe lack of broadband access in business and commercial locations in rural areas thus overlooking the need for broadband access to the very locations that are the economic lifeblood sustaining the rural community. Deere respectfully suggests that U.S. government agencies, including the FCC, with broadband deployment mandates update the way they assess the need for broadband in rural communities. In particular, Deere recommends that agencies with deployment mandates view availability through an additional lens – one that incorporates geographic and functional usage that captures the importance of promoting broadband access to economic centers.

An important example of this is the need to assess broadband availability in areas of agricultural operations – specifically, croplands and the farm institutions that manage the farming operations. Broadband infrastructure and services are sorely needed to support the growing demand in the agricultural sector for machine-to-machine services to optimize efficiencies in operations, provide real time access to market data and transactions, and manage vendor and materials resources. Together, croplands and farm institutions represent the economic drivers to most rural communities in the United States. As such, farm institutions or crop operations should be considered an "anchor institution" in those programs that provide support to specific functions. Similarly, Deere recommends examining "cropland" coverage as a

key indicator of where broadband deployment gaps exist in the United States.[19] By supporting increased broadband deployment to those areas where most farming operations occur (*i.e.*, in the fields), IoT technology will be able to increase economic efficiency, improve environmental stewardship, and enhance food safety.

Deere strongly supports using the Connect America Fund ("CAF") to provide affordable broadband access to rural areas, including cropland areas, to ensure that agricultural producers have the communications capacity to use IoT technology. The FCC's *2011 Connect America Fund Order* redirected the universal service system from supporting voice to supporting broadband.[20] Government agencies, specifically the FCC, should continue to ensure that CAF funding – whether for wireline or wireless service; whether allocated for price-cap carriers or small rural telephone companies – is properly focused on bringing broadband to the unserved and underserved rural areas where support is most needed, including agricultural farm and cropland.

Deere is concerned that the current rural broadband support programs administered by the FCC do not place sufficient priority on providing access to the full suite of technology options. Fiber, including fiber in the middle mile that supports last mile fiber and last mile wireless, is important to broadband coverage but it must not be the exclusive technology choice. In some circumstances, wireless access may be the best or even the only feasible solution.

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[19] *See* Comments of Deere & Company, GN Docket No. 15-191 (filed Sept. 15, 2015).

[20] *See Connect America Fund*, Report and Order and Further Notice of Proposed Rulemaking, 26 FCC Rcd 17663 (2011).

B. How will IoT place demands on existing infrastructure architectures, business models, or stability? (NOI Question 8) What role might the government play in bolstering and protecting the availability and resiliency of these infrastructures to support IoT? (NOI Question 10) What effects, if any, will Internet access have on IoT, and what effects, if any, will IoT have on Internet access?(NOI Question 18(c)) What role, if any, should the government play in ensuring that the positive impacts of IoT reach all Americans and keep the negatives from disproportionately impacting disadvantaged communities or groups? (NOI Question 18(d))

1. Government Rules and Funding Should Promote Rural Access for the Full Suite of Technologies to Support IoT

As the U.S. agricultural economy becomes increasingly data dependent, insufficient access to broadband has hindered the full potential of IoT technology. Much of the future of enhanced farming efficiency and productivity turns on the grower's ability to gather, process, and transmit data using advanced information and communications technologies. Technology-equipped machine solutions enable agronomic data collection, analysis and required reliable widespread access to broadband connections.

For this purpose, government rural broadband funding initiatives should promote the deployment of the full range of infrastructure necessary to support innovative IoT solutions in rural areas, including areas where construction, forestry, agriculture, and mining machines operate. To enable real-time sharing of data and communications, precision agriculture technology requires access to reliable mobile, fixed wireless, and wireline broadband services. While fixed broadband has penetrated the residential and business areas of many rural communities, the cropland areas (and similarly, ranchlands) where farming is done lags behind in adequate fixed and mobile broadband access.

Enabling farmers to utilize M2M data fully requires significant improved communications capacity and access to high speed mobile broadband. Today, many of Deere's

customers are challenged with a lack of adequate cellular coverage in the fields where agricultural equipment operates. Deere's JDLink™ data service, for example, currently relies on the cellular telephone network to transmit telemetric machine operation data. The lack of coverage needed for these solutions to transmit telemetric data from the machines is already a concern, but the shortfall in coverage will only become more problematic as data volumes increase.

Due to significant gaps in cell coverage in rural areas where farm machines operate, today JDLink™ data transmissions have only a 70% successful call completion rate. Absent significant improvements in cell coverage in cropland areas, Deere expects that this figure will drop to about 50% in two to three years as agricultural demand for broadband services increases. These data communication services depend on stable, reliable high speed connections to equipment operating in remote locations. This is not a problem that can be resolved by relying on satellite services or even more spectrum. In addition to fiber-to-farm buildings, rural areas need more wireless antenna towers, all of which must be connected by fiber backhaul to the broadband network provider. Towers provide the wireless coverage – the problem is there are simply not enough towers in the cropland areas where significant productivity enhancements could be gained. Government agencies should examine ways to remove regulatory barriers to the deployment of tower and backhaul infrastructure in rural areas, and seek to stimulate business funding for this critical national infrastructure. For these reasons, Deere supports the retention and expansion of the CAF, the Mobility Fund, USDA's Rural Utility Service, and other funding sources, as well as infrastructure policies and rules aimed at supporting expansion of rural mobile services.

Deere recommends that the FCC avoid preferences for fiber over wireless in the distribution of CAF support. The method by which CAF funds are distributed will determine whether rural families and businesses in agriculture will have the flexibility they require to apply the technology solution – whether fixed or wireless or some combination of both – that best meets their particular needs. If a wireless service is a superior option for particular areas based on the cost and other efficiencies that apply to the equipment, terrain, distance and other specific attributes of a locale to be served, then wireless providers should not be precluded from competing on an equal basis for available funds.

2. The Mobility Fund II Should be Retained and Expanded

Mobile broadband services are essential to broadband deployment in rural areas where infrastructure, land acquisition, and right-of-way cost to serve large areas can be high, and the potential subscriber population can be small relative to urban and suburban areas. To enable real time sharing of data and communications, including M2M and M2F interactions, precision agriculture requires access to both reliable wireless and wireline broadband services. However, today's reality is that access to mobile and fixed broadband coverage in the fields where agriculture equipment operates falls short of what is needed now, and what will be needed in the future.

Despite the growing demand for and importance of mobile services in rural areas, the FCC's current commitment to the Mobility Fund is in real question and it has even suggested that it may not continue the fund. Deere has long supported the creation and use of the Mobility Fund as a means of targeting deployment of broadband coverage to rural and cropland areas. The FCC's early plans contemplated a Mobility Fund Phase II but today, more than 5 years later, that fund is yet to become a reality. The Commission has since revised the program to retarget

funds to support 4G LTE mobile broadband and voice service and in 2014, the FCC asked for further input on how best to distribute Mobility Fund Phase II support. Now, two and a half years later, the FCC has yet to adopt rules to implement Mobility Fund Phase II and the effort appears to be stalled. The FCC should confirm that expanded broadband in rural areas is a current priority by issuing a decision that preserves and even expands the Mobility Fund Phase II. Although there is a need to update these support programs to better ensure coverage of agricultural areas, the FCC can and should act promptly to confirm the status of the Mobility Fund Phase II while considering further updates. In addition, as government agencies develop this and other funding mechanisms in the future, the FCC and other funding agencies should promote wireless coverage of areas of intense agricultural use by recognizing a specific category of "cropland" for determining mobile broadband coverage.

VI. What impact will the proliferation of IoT have on industrial practices, for example, advanced manufacturing, supply chains, or agriculture? (NOI Question 13) In what ways could IoT affect and be affected by questions of economic equity? In what ways could IoT potentially help disadvantaged communities or groups? Rural communities? (NOI Question 19)

Today, agriculture producers are able to farm to within a few centimeters of accuracy thanks to innovative GPS-enabled positioning systems that are now standard on virtually all modern farming equipment, as supplemented with data available from satellite signals. Using these high precision techniques, advanced agricultural equipment and services now include technology that provides real-time agronomic data that can be analyzed to optimize the precise amount of seed, fertilizer and pesticides needed, reduce costs for fuel, labor, water, and identify best practices for fields in a given location. Where possible, producers using these precision agriculture techniques communicate via high-speed wireless broadband with customers and

vendors, follow commodity markets, obtain real-time information on field conditions, weather and other environmental factors, and manage fleets and regulatory compliance.

For example, when the farmer leaves his field in the fall, he is able to share harvest yields directly and immediately with trusted agronomist advisors. This helps the advisor to prescribe the appropriate amount of nutrients to be added back to the soil, based only on what the farmer took off at harvest, and ensure those nutrients are added and incorporated before winter. The farmer can also make decisions on which seeds to buy for next year, taking advantage of early order price discounts. By reducing inputs, improving resource management, minimizing land impacts and lowering costs, these technologies are delivering the promise of sustainability on the farm.

In a recent hearing before the Senate's Subcommittee on Communications, Technology, Innovation, and the Internet, Darrington Seward from Seward & Son Planting Company, a family farming business, shared real examples of how innovative technologies and broadband is helping to realize the economic and commercial potential of precision agriculture.[21] According to Mr. Seward, precision agriculture is essential to running their farms in several forms:

- **Soil management and health.** Precision agriculture uses a variable-rate application of nutrients to ensure that every area of soil receives exactly the proper amount of nutrients needed, without wasting or inefficiently applying nutrients.

- **Planting.** Seward uses hydraulic drives and rate controllers that govern the amount and spacing of planting seeds in a field, which has increased planting speed. This allows more seed to be planted underneath a pivot circle where irrigation can maximize yield. High speed broadband allows real-time monitoring of each individual row being planted, which is imperative for quality control.

[21] Statement of Darrington Seward of Seward & Son Planting Company (2016), available at https://www.commerce.senate.gov/public/_cache/files/86a9b24c-e124-4b4b-a701-f0fe165be074/F3297DD6CC57D51B9EA2A54F209F07E3.darrington-seward-testimony.pdf.

- **Crop Harvesting.** Monitoring applications allow agriculture producers to check a combine's performance in real time and make critical decisions about the speed and temperature at which to operate machinery, optimize storage capacity, calculate relative moisture needed to maintain freshness or dehydrate as needed, and get a real time look at crop yields.

- **Machine Communications.** Continuous monitoring of machine performance is extremely important, as improperly set machines experience technical issues could result in any number of costly operational problems, including improperly planted crops, improperly applied fertilizers, herbicides, or pesticides, lost efficiencies, or even yield loss. Machine communications reduce machine downtime and avoid costly delays in field activity.

- **Irrigation.** Irrigation systems can report its position and the amount of water being applied in real time, and irrigation wells can record the exact amounts of water being applied. The capabilities of smart irrigation systems allow farmers to efficiently manage large acreages with fewer men, increasing productivity.[22]

[22] *See id.*

VII. Conclusion and Action Points

Deere appreciates NTIA's efforts to examine the role of the U.S. Government in the advancement of IoT technologies, and encourages consideration of the steps described in these comments. In particular:

- the U.S. Government should announce a policy that commits to streamline government processes to approve and foster innovative IoT technologies where possible.
    - Deere encourages further examination of whether and to what extent municipal zoning and permitting laws are inhibiting infrastructure deployments of IoT devices and transmitters.
    - Further, conduit installed with the support of federal funds (i.e., through the FCC's Connect America Fund or "Dig Once" programs) should be made available to third parties on reasonable rates, terms and conditions to support the goals of universal service and competition.

- the U.S. Government should consider the interests of rural economies and populations by eliminating technological barriers to the development of rural IoT technologies.

- the NTIA should explicitly state in the report emerging from this proceeding that continued widespread access to interference-free GPS and GNSS signals are critical to existing IoT systems and to reap the future benefit of further IoT innovation.
    - U.S. government agencies, including the FCC, with broadband deployment mandates should update the way they assess the need for broadband in rural communities. In particular, Deere recommends that agencies with deployment mandates view availability through an additional lens – one that incorporates geographic and functional usage that captures the importance of promoting broadband access to economic centers.
    - Deere recommends examining "cropland" coverage as a key indicator of where broadband deployment gaps exist in the United States.

- the Connect America Fund should be used to provide affordable broadband access to rural areas, including cropland areas, to ensure that agricultural producers have the communications capacity to use IoT technology.

- the FCC (and other federal agencies) should avoid preferences for fiber over wireless in the distribution of funding support.

- the FCC should preserve and in fact expand the Mobility Fund II as a means of targeting deployment of broadband coverage to rural and cropland areas.

Respectfully submitted,

DEERE & COMPANY

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Mark Lewellen
Manager of Spectrum Advocacy
Intelligent Solutions Group (ISG)
Deere & Co.
801 17th Street, N.W.
Washington DC 20006

Catherine Wang
Stephany Fan
Morgan, Lewis & Bockius LLP
2020 K Street, N.W.
Washington, DC 20006

Counsel for Deere & Company

Dated: June 2, 2016