20160001590

#16-44

FISH.
FISH & RICHARDSON

Fish & Richardson P.C.
1425 K Street, N.W.
11th Floor
Washington, DC 20005

202 783 5070 main
202 783 2331 fax

January 21, 2016

Marlene H. Dortch, Secretary
Federal Communications Commission
Office of the Secretary
445 12th Street S.W.
Washington, D.C. 20002

Re: In the Matter of Petition for Waiver of Part 15 of the Commission's Rules Applicable to Ultra-Wideband Devices

Dear Ms. Dortch,

Enclosed please find a Petition for Waiver filed on behalf of Headsight Inc. If there are any questions regarding this filing, please contact the undersigned.

Very truly yours,

Terry G. Malo

Counsel for Headsight Inc.

Enclosures

Cc: Julius Knapp, Chief, OET
Bruce A. Romano, Associate Chief (Legal), OET
Mark Settle, Chief, Policy and Rules Division, OET
Edward Drocella, NTIA

Before the

Federal Communications Commission
Washington, D.C. 20554

In the Matter of	)	
	)	
Headsight Inc.	)	
Waiver of Part 15 of the Commission's Rules	)	
Applicable to Ultra-Wideband Devices	)	

PETITION FOR WAIVER

Terry G. Mahn
Jay S. Newman
Fish and Richardson P.C.
1245 K Street N.W.
Suite 1100
Washington D.C. 20005

Counsel for Headsight Inc.

January 21, 2016

TABLE OF CONTENTS

Before the

Federal Communications Commission
Washington, D.C. 20554

In the Matter of	)
	)
Headsight Inc.	)
Waiver of Part 15 of the Commission's Rules	)
Applicable to Ultra-Wideband Devices	)

PETITION FOR WAIVER

Background

The agricultural industry is in a constant battle with Mother Nature. To improve their odds of winning, farmers must increasingly rely on the latest in farming technology. They also require timely and accurate data on climate, soil, and crop conditions and the corresponding analytics that tell them when and where to plant, tend, and harvest their fields. To make certain their farming infrastructure functions efficiently and at capacity, farmers must also rely on diagnostic data to anticipate equipment repair, schedule maintenance and prevent costly downtime. This growing demand for real-time data and the use of local area networks to manage the information flow has been revolutionizing farming across North America. Farmers today, have a myriad of opportunities to convert conventional farming operations into what is called "precision agriculture" ("PA"), where intelligent infrastructure gathers real-time data and communicates it to centralized hubs where it can be stored and processed to increase farming efficiency, lower operating costs, and increase yield potential.[1]

A key factor in the evolution of PA is the adaptation and introduction of various data "sensors" and wireless technologies commonly found in other industries. For example, GPS receivers, a staple feature in cell phones and automobiles, are now being used to control driver-less farm equipment and to generate precise "yield mapping" data on farms and other agricultural areas. So too, wireless diagnostic devices coupled to cellular modems are being

[1] *Deere & Company Request for Limited Waiver of Part 15 of the Commission's Rules for Fixed Television Band Devices*, ET Docket No. 15-184 (July 13, 2015). *See also On the Farm: A Bountiful Harvest of Data*, Wall Street Journal (September 1, 2015), which discusses startups like Farmobile LLC, Granular Inc., and GISC that are developing sensor-driven computer programs that enable farmers to capture data streaming from tractors and combines, store it in digital silos and market it to agricultural companies or futures traders. *See* Attachment 1.

used to track and monitor farm equipment and to remotely manage product levels in storage tanks and silos.

Recently, Headsight Inc. ("Headsight"), the Petitioner of this waiver request, adapted a novel wireless technology used primarily in the construction and mining industries for agricultural operations. Headsight's new device, the Terrahawk, uses ultra-wideband ("UWB") imaging technology to detect the ground surface conditions that are obscured by crops during harvest operations. The Terrahawk allows for the precise positioning of the combine cutting head (i.e. "header height"), which leads to faster harvesting operations, reduced operator fatigue, less machine wear and tear and increased crop yields. In addition, the introduction of UWB imaging in agriculture will facilitate accurate and efficient soil mapping, a process that currently requires labor-intensive drilling and sampling operations.

The Commission's Part 15 Subpart F Rules, however, pose a potential barrier to UWB imaging in farming operations. More specifically, the Subpart F Rules do not expressly authorize UWB ground imaging devices for agricultural use, though many ground penetrating radar ("GPR") manufacturers appear to be marketing devices for such purposes. In addition, the Subpart F rules are also unclear as to how the one (1) meter of "above ground" operating limit should be applied when imaging ground surface conditions beneath crops. Headsight, therefore, seeks a waiver and/or clarification of the Part 15 Subpart F Rules to permit the use of UWB imaging devices in farming operations.

A. The Terrahawk is a UWB Imaging Device Designed for Agricultural use

Headsight is a leading manufacturer of mechanical sensors that are installed and used on harvesting equipment to provide operators with important information about crop and ground

surface conditions. As explained in greater detail below, safe and efficient crop harvesting requires that equipment operators know as much as possible about what is going on beneath the cutting "head." A significant improvement over mechanical sensors that "feel" their way along the ground is impulse radar, which has the capability of providing detailed below-crop imaging without having to come in contact with the ground. Using conventional UWB/GPR technology, Headsight developed the Terrahawk device to control the header height on combines. In time, however, this technology will also be used to provide imaging information on surface and subsurface ground conditions that are important to farming.

The Terrahawk is a sealed circuit board assembly containing a UWB impulse radar chip, designed by Novelda AS, that operates between 1 and 6 GHz. *See* Attachment 2. The assembly contains two modified bowtie antennas with a boresight gain of 4-6 dBi and a 4-pin connector for power, ground, and CAN communication. Headsight has contracted with a third party to build the circuit board and assemble the device. Multiple devices can be mounted along the combine header along with a base controller to communicate via WiFi to a small transceiver located in the operator's cab and connected to the combine's touch screen display. Attachment 3 contains several illustrations on how the Terrahawk can be typically installed on harvesting equipment.

The Terrahawk is designed to comply fully with the Part 15 Subpart F emission standards for UWB ground imaging devices. No waiver of any Part 15 technical standard or emission limit is being requested; however, the Terrahawk is intended for agricultural use which is not one of the authorized uses for ground imaging devices set forth in Section 15.509(b). In addition, although the Terrahawk will operate within one meter of the ground surface under most conditions of use (as per Section 15.503(f)), for certain crops it will need to operate above

crop levels, although never more than one meter above crop height. Importantly, the Terrahawk's transmit antennas will always be pointed toward the ground during harvest operations and thus, the emissions will attenuate much like conventional GPR devices used in the construction and mining industries.

1. Ground Imaging is Important to Farming

Mapping subsurface ground conditions such as moisture content and soil compaction can be of great benefit to the farmer. For example, moisture content data will tell the farmer when and where crop watering will be most productive; and compaction data will help farmers avoid yield reductions – that can range as high as 60% from compacted soil – and provide guidance on how to improve field traffic control and related issues such as tire pressure and tillage practices. Currently, these types of subsurface conditions are detectable only through time-consuming and labor-intensive drilling and soil sampling. With ground imaging technology, however, these functions can be streamlined and automated. Subsurface mapping can also assist the farmer in improving general practices such as timing to "work the ground" and crop spraying both of which will increase the yield potential as well as quality of the crops produced.

Ground imaging technology can benefit the farmer in other ways as well. Hard to detect surface conditions such as uneven terrain, voids and field stones can interfere with farming operations and present safety concerns for both workers and equipment. With ground imaging, adverse surface conditions that are often hidden by crops can be detected and addressed before they are unexpectedly encountered during farming operations.

2. The Terrahawk can Control the Header Height on Harvesting Machines[2]

An important feature of the Terrahawk technology is the ability to harvest crops precisely and efficiently by controlling the header height on combines. Header height control has been growing in acceptance and demand in the agricultural industry over the last twenty years and has reached the point where original equipment manufacturer and aftermarket header height control systems are available for nearly every new grain head on the market.

The demand for height control is driven by several factors including increased yield, decreased operator fatigue, enhanced machine protection, and improved harvesting efficiency. Two of the major limitations with the current industry standard sensor, which is a mechanical arm that drags along the ground to "measure" header height, are sensor failure and crop debris. The Terrahawk overcomes both of these barriers.

The environment beneath a harvesting machine is extremely harsh. A sensing device like the Terrahawk, which can measure the distance to the ground without having to physically contact it, means there is far less potential for damage to the sensor or the equipment itself and harvesting can occur at higher speeds. Breakdowns of mechanical arm sensors are often very costly to the farmer. The harvest window when the crop conditions are ideal and the weather permissible is normally short. A sensor or machine breakdown will not only result in added

[2] As discussed throughout this petition, UWB ground imaging technology can serve multiple purposes in farming. It can be used in a conventional manner to image underground structures/conditions as well as surface conditions hidden by crops. In addition, the technology can be used to control the header height (above ground) on harvesting machinery. Although Section 15.515 permits UWB for proximity sensing, the standards set forth in this rule are crafted for "vehicle radars" (i.e. automobiles) where transmissions are in or above the horizontal plane and in "free space." Even if a Section 15.515 device was capable of controlling the header height on farm equipment, which it is not, it should be clear that no purpose would be served by not allowing the information obtained from a ground imaging device to be used for this purpose.

expense of repair, but may also limit the quantity and the quality of the grain the farmer is able to harvest.

The second challenge to mechanical sensors is crop debris. When stalks are broken or blown flat from a wind storm, the sensor arm will ride up over the crop and automatically raise the header. The result is crops left in the field. The Terrahawk can penetrate the fallen crop, measure the distance to the ground beneath, and provide protection to the header while allowing it to pick up much of the crop that would otherwise be lost.

There are three types of combine headers for which the Terrahawk would be most applicable: corn heads, platform heads, and stripper heads. Corn heads are used specifically for harvesting corn. Platform heads can harvest a large variety of grains such as wheat, lentils, soybeans, rice, barley, flax, milo, peas, oats and mustard. Stripper heads can be used for many of the same standing grains as a platform heads, but are used in situations where it is desirable to leave the stalk standing and strip the grain from it.

For all corn headers, the Terrahawk would be mounted under the "snout" near the tip and would measure the distance to the soil. The snout should always engage the stalk below the height of the ear so the Terrahawk would generally float less than one meter above the soil while harvesting. On platform headers, the Terrahawk would most commonly be mounted under the head or just in front of the crop divider to measure the distance to the soil. On these headers, the device would normally be near the height of the grain kernels being harvested. For the majority of crops, this would be below one meter, but it could be slightly above that limit for a few crops such as milo.

The common mount for stripper heads, which could also be used on platform heads in some crop conditions, would be a raised mount. Here, the Terrahawk would be suspended just above the crop to measure the distance to the top of the crop canopy. This is desirable for certain standing grains where only the grain head is cut or stripped from the stalk. In certain areas of the country this type of harvesting is particularly advantageous to help with soil erosion, water conservation, and harvesting efficiency.

Importantly, field mapping and header height control via ground imaging technology go hand-in-hand. If surface and subsurface data can be collected during harvest operations, the farmer can avoid having to make multiple passes with heavy equipment over the same fields. This avoids the added expense of additional operations, unnecessary ground compaction and damage to certain (*e.g.*, stripped) crops that are left standing after harvesting. Additionally, real-time data on ground conditions at time of harvest will be important to the farmer for the next planting season.

B. The Part 15 Subpart F Rules Should be Waived to Accommodate Agricultural use

In many respects, agriculture is similar to construction. Like the construction engineer, the farmer needs accurate data on surface and sub-surface conditions before a work site or field can be commercialized. Both are also concerned with worker and machine safety, and both benefit economically if such information can be obtained at a low cost, for example, by electronic imaging rather than labor-intensive drilling and soil sampling. For these reasons, UWB ground imaging devices have become standard tools throughout much of the construction industry and, but for the Commission rules, they could be important tools for today's farmers.

1. Section 15.509(b) Should be Waived to Permit the use of Ground Imaging Devices on Farms

The administrative history of the UWB rules indicates that they were developed largely in response to the specific applications that were then undergoing experimentation and development. Three companies petitioned the FCC in 1998 for Part 15 Rule waivers to allow the use of UWB technology for commercial ground and wall imaging devices[3] for use by safety personnel for communications and location determination using "imaging radar."[4] Shortly thereafter, the Commission issued a Notice of Inquiry ("NOI") requesting public comment on the "types of devices" that were likely to be developed using this emerging wideband technology.[5] Significantly, the NOI did not seek public comment on the "types of businesses" or industries that might benefit from UWB applications. In a Notice of Proposed Rule Making ("NPRM") spawned by the NOI, the Commission proposed a new category of Part 15 ground and wall imaging devices for which there were no restrictions on eligibility; however, the NPRM asked for comment on whether through-wall imaging devices should be limited to "parties eligible for licensing under the Public Safety pool in the Part 90 Rules."[6]

A First Report and Order ("FRO") was issued by the Commission in April 2002, adopting a first set of UWB rules and technical standards that were, in the Commission's words, "extremely conservative," "over protective" and likely to "unnecessarily constrain the

---

[3] *U.S. Radar Inc. Request for a Waiver of Part 15 of the Commission's Rules for Ground Penetrating Radar*, DA-221 (January 28, 1998); *Zircon Corporation Request for a Waiver of Part 15 of the Commission's Rules for an Ultra-Wideband System*, DA 98-924 (April 14, 1998).
[4] *Time Domain Corporation Request for a Waiver of Part 15 of the Commission's Rules for an Ultra-Wideband Time Modulating Technology*, DA 98-222 (February 2, 1998).
[5] *Notice of Inquiry ("NOI")* at 9, ET Docket No. 98-153, 63 Fed. Reg. 50184 (September 21, 1998).
[6] *Notice of Proposed Rule Making ("NPRM")* at ¶ 5, ET Docket No. 98-153, 65 Fed. Reg. 37332, (June 14, 2000).

development of UWB technology."[7] So concerned was the Commission that it might be stunting the growth of this new and useful technology that it said it would issue a further rulemaking within the year "to explore more flexible technical standards and to address the operation of additional types of UWB operations."[8] In the interim, the Commission restricted UWB imaging and GPR devices to locations where there would be low proliferation and usage would be infrequent.[9] Thus, the rules adopted in 2002 restricted ground and wall imaging device usage to law enforcement, fire and emergency rescue organizations, scientific research institutes, commercial mining companies, and construction companies, as those entities were defined by the Section 90.20 eligibility requirements.[10]

The FRO did not explain the basis for these use restrictions other than to note that these were the focus of the 1998 waiver requests and, thus, the focus of most of the comments submitted in response to the NOI. Agricultural use was never raised or discussed. Nonetheless, the use of ground imaging technology in agriculture would have met the Commission's essential requirements of low device proliferation and infrequent use. Moreover, ground imaging in agriculture – an exclusively rural use -- would not raise any cumulative interference issues (as discussed more fully below) which were a primary concern of certain spectrum licensees. Like the GPRs used in construction and mining, agricultural devices would also "direct their emissions into the ground or horizontally, away from airborne or satellite receivers" and thus, operation at ground level would "ensure that the emissions attenuate more rapidly with

[7] *First Report and Order ("FRO")* at ¶¶ 1-2, ET Docket No. 98-153, 17 FCC Rcd 7435 (April 22, 2002).
[8] *Id.*
[9] *Id.* at ¶ 185.
[10] *Id.*

distance and have a higher probability of obstructions between the UWB transmitter and the victim receiver."[11]

In February 2003, the Commission issued a Memorandum Opinion and Order and Further Notice of Proposed Rule Making[12] which, among other things, relaxed the rules on GPR operation by third-party contractors and opened up additional bands for GPR operation. There was no discussion in that proceeding of expanding the use of ground imaging technology to other industry sectors. In December 2004, the Commission issued a Second Report and Order and Second Memorandum Opinion & Order[13] and in August 2010, it issued a Third Memorandum Opinion & Order[14] bringing the UWB rulemaking to a close. None of these orders discussed user eligibility issues.

Today, after more than a dozen years of UWB operations under the Part 15 Rules, an inspection of Commission enforcement records reveals that there has never been a report of harmful interference from a UWB device. The ultra-conservative rules and overly cautious approach followed by the Commission since it first began regulating UWB devices in 1998 have proven to be successful. And because there was never any reason to restrict ground imaging from agricultural use in the first place where, like mining and construction, device proliferation would be low and use infrequent, there can be no reason for maintaining this restriction today, especially given the fact that UWB ground imaging devices are routinely

---

[11] Id. at ¶ 234.
[12] *Memorandum Opinion and Order and Further Notice of Proposed Rule Making ("MO&O" and "FNPRM")*, ET Docket No. 98-153, 18 FCC Rcd 3857 (February 13, 2003).
[13] *Second Report and Order and Second Memorandum Opinion and Order*, ET Docket No. 98-153, 19 FCC Rcd 24558 (December 15, 2004).
[14] *Third Memorandum and Order and Memorandum Opinion and Order*, ET Docket No. 98-153 (August 10, 2010).

marketed by various manufactures for agricultural use.[15] Clearly, the Terrahawk can provide an important imaging tool for farmers, and the Part 15 Rules should be waived to permit its use.

2. Waiving Section 15.509(b) for Agricultural use will not Threaten Harmful Interference to GPS

For the earliest UWB proceeding, the question of possible harmful interference to GPS was raised and extensively debated by government and industry. NTIA conducted a study in 2001 that showed an extremely low probability of harmful interference to GPS from UWB devices[16] and various industry groups filed comments with the Commission that demonstrated GPS interference concerns to be a non-issue. It was noted, for example, that many GPR devices are co-located with GPS receivers and nearly all GPRs incorporate hardware and software specifically designed to accommodate GPS input because location accuracy is critical for GPR mapping applications.[17] And despite the exaggerated claims of interference by GPS proponents, actual testing has repeatedly shown that GPS receivers function perfectly when located only a few centimeters from the transmit antenna of a GPR. Indeed, after

[15] Geophysical Survey Systems Inc. ("GSSI"), which bills itself as the world's leading manufacturer of GPR systems, advertises on its web site the many uses for GPR, including "agriculture and forestry." *See* http://www.geophysical.com/. GSSI promotes GPR use for measuring ground conductivity for the remediation of contaminated soils, for "precision agriculture" applications and for determining how best to apply fertilizer to farmlands and vineyards. GPR use is also promoted as an invaluable tool for golf course superintendents to delineate areas of excess water "on greens" and to measure tree trunk characteristics to identify potential insect and fungal infestation that can affect a tree's health. GPR Systems, another manufacturer of imaging devices promotes on its web site, a recent survey of an eight-acre cranberry bog using GPR to determine the depth of the "top layer of moss/organic matter." *See* http://www.gp-radar.com/about-us.html. Sensors & Software advertises GPR applications in "agriculture and forestry" as well as for high value "crop management" such as vineyards and also states that a "common application" of GPR involves examining the condition of utility poles. *See* http://www.sensoft.ca/. In short, GPR manufacturers appear to have found their way into the agricultural sector whether the Part 15 Rules allow it or not because the demand for ground imaging data exists.

[16] *Assessment of Compatibility Between Ultrawideband (UWB) Systems and Global Positioning System (CPS) Receivers,* NTIA Special Publication 01-45 at xiv, 4-4, 4-12, 4-27 (February 2001).

[17] *Ground Penetrating Radar Industry Coalition Petition for Partial Reconsideration,* ET Docket No. 98-153 (June 17, 2002).

reviewing industry comments and test data provided in the UWB rulemakings, the Commission recited the fact that "[GPR] devices have been used for many years with attached GPS receivers without a single incidence of reported harmful interference."[18]

Headsight is abundantly familiar with the importance of GPS in the agricultural sector and is well aware of interference concerns. Headsight's customer base will be active GPS users who will depend on the compatibility between GPS and the Terrahawk. Indeed, if the Terrahawk is to provide accurate field mapping information on ground and crop conditions for farmers it is essential that it operate compatibly with GPS. To this end, Headsight has tested the Terrahawk device operating in close proximity to a standard GPS system marketed with farm equipment and found no evidence whatsoever of interference to GPS operations. *See* Attachment 4.

3. The One Meter Above Ground Limit in Section 15.503(f) Should Either be Waived or Interpreted to Include "Ground Structures" such as Crops

Section 15.503(f) defines GPR as "a field disturbance sensor that is designed to operate only when in contact with, or within one meter of, the ground for purposes of detecting or obtaining the images of buried objects or determining the physical properties within the ground."[19] Headsight requests an interpretation of the term "ground" to mean "ground structure." In the alternative, Headsight requests a waiver of the rule to include farm crops within the one meter limitation. The administrative history of this rule provision indicates that there is nothing "sacred" about the one meter limit.

---

[18] *MO&O and FNPRM at ¶ 28.*
[19] 47 C.F.R. Section 15.503(f).

In the NOI, the Commission asked for comment on "the expected or desired operating distances for UWB."[20] In the NPRM that followed, the Commission proposed that GPRs be operated in "close proximity" to the ground which, without any explanation, was defined by the Commission to be one meter.[21] One party voiced an objection to the proposed one meter limit as being too lax, but the Commission dismissed those concerns as unfounded.[22] Accordingly, the one meter limit became the standard without any substantive discussion or technical justification other than the apparent belief that the GPR devices that were then under development could successfully operate within that limit.

What makes the one meter limit difficult to apply is the fact that the term "ground" is nowhere defined in the Part 15 Rules. Logically, the concept of "ground" can vary considerably depending on what is being imaged. For example, in any particular location or at any particular time the "ground" could include loose impediments, debris, landfills, water, snow or vegetation, as well as exhibit a variety of structural features such as uneven terrain, ditches, overhangs and voids, to name a few. In the NPRM, the Commission contemplated GPRs being used to image bridges and suspended roadways thus, apparently bringing these elevated structures within the definition of "ground."[23] Because there is nothing scientific about the term, the one meter limit should logically apply to "ground structures" as long as what is being imaged is under the structure and imaging emissions are directed toward the ground. In fact, this is exactly how GPR devices are being used today.

---

[20] *NOI* at ¶ 9.
[21] *NPRM* at ¶ 25.
[22] *FRO* at ¶ 43.
[23] *NPRM* at ¶ 10.

In the construction industry for reasons of safety GPRs are often used to image sites containing demolished structures or have been backfilled. They are also commonly used to measure ice thickness on lakes and rivers and snow covering on mountains. It can make no sense to ignore these "ground structures" when applying the one meter above ground limit as to do so would defeat the purpose of using GPR in all of these applications. The same logic applies to ground imaging devices used in agriculture. Crops should not have to be disturbed or cleared to investigate what lies beneath them. Again, the key to applying the one meter limit should be whether the imaging radar's emissions are being directed into the ground structures that are being imaged.

Finally, it should be noted that Industry Canada has adopted UWB regulations that are almost identical to the Commission's Part 15 Subpart F Rules with one notable difference. In the case of the one meter limit for GPR, the Canadian regulations define the term "ground" to include "any lossy dielectric materials."[24] Quite plainly, this language was intended to make clear that ground imaging devices can be used to image ice, snow, crops and other ground-based structures.

C. Headsight's Waiver Request Satisfies the Commission's General Standard for Granting Waivers and is Consistent with Other Recent Waivers Granted for UWB Devices

The Commission can waive its rules if it determines that the public interest will be served and the waiver will not undermine the policy of the rule to be waived.[25] The public interest

[24] *Industry Canada, Ground Penetrating Radar (GPR) and In-wall Radar Imaging Devices*, RSS-220 - Devices Using Ultra-Wideband (UWB) Technology § 6.2 (2009).

[25] *WAIT Radio v. FCC*, 418 F 2d 1153 (D.C. Cir 1969). The Commission is authorized to grant a waiver under §1.3 of the Commission rules if the petitioner demonstrates good cause. 47 C.F.R. §1.3. Good cause may exist "where particular facts would make strict compliance inconsistent with the public interest." *Northeast Cellular Telephone Co. v. FCC*, 897 F.2d 1164, 1166 (D.C. Cir. 1990). There must

arguments for a waiver of the Part 15 Subpart F Rules are set forth herein and present a compelling case for allowing the use of the Terrahawk, an UWB ground imaging device, in agriculture. In addition, the Commission's policy underlying its UWB rules will not be undermined by this waiver request because the Terrahawk will operate in conformance with the technical standards that apply to GPR devices generally. On numerous occasions, the Commission has granted UWB waivers involving similar devices and/or rules for which Headsight is seeking relief.

The Commission has shown a willingness to waive definitional restrictions (similar to the definitional restrictions raised herein with respect to Rule 15.509(h)) when a UWB device presents little threat of harmful interference and a waiver would further public interest goals. For example, in 2010, Robert Bosch GmbH requested a waiver of Section 15.503(h) to permit the approval of professional "wall scanners" under the same technical and operating conditions as "wall imaging systems" regulated under Section 15.509.[26] Bosch noted that Section 15.509 did not permit wall scanners (*e.g.*, stud finders) because these devices did not meet the definition of a "wall imaging system" which the rules defined as a "field disturbance sensor that is designed to detect the location of objects … or to determine the physical properties within the 'wall' [which is a] physical structure that is dense enough and thick enough to absorb the majority of the signal transmitted by the imaging system."[27]

After public notice and comment, the Commission determined that Bosch's waiver request was in the public interest because it would allow deployment of a product with beneficial

---

be a strong public interest benefit in granting the waiver, and the waiver may not undermine the purposes of the rule. *Robert Bosch, GMBH Request for Waiver of Part 15 Rules Ultra Wideband Rules for a Wall Imaging Device*, ET Docket No. 10-253, Order, 26 FCC Rcd 07572 (2011) ("Robert Bosch Waiver").

[26] Robert Bosch Waiver.

[27] *Id.* at ¶ 3.

applications in building construction, as well as inspection and maintenance of buildings in the United States.[28] The Commission said that because the Bosch wall scanner would not increase the potential for harmful interference and, hence, would not undermine the purpose of the rules, a waiver was justified.[29] "A denial would prevent the availability of devices which can help building and construction professionals improve safety of infrastructure and would not undermine the policy of the rule because the technical and operational provisions of Section 15.509 that are in place to limit harmful interference to other spectrum users are not being waived."[30] The Commission further noted that because the Bosch device was not a consumer product, it would not undermine the Commission's goal of limiting the interference potential of UWB imaging devices by limiting their proliferation and use to coordinated and controlled applications.[31]

Like the situation in Bosch, the waiver requested by Headsight will not undermine the Commission's UWB policies because the technical and operational provisions in Section 15.509 "that limit harmful interference to other spectrum users" are not being waived. And because the Terrahawk will only be used for commercial activities, a grant of Headsight's waiver request will not impair the Commission's goal of limiting the proliferation of UWB imaging devices to "coordinated and controlled applications in order to limit interference potential from the device."[32] Finally, because the Terrahawk will deploy a technology that will be of enormous benefit to the farmers without increasing the risk of interference, Headsight's waiver request will serve the public interest and thus, should be granted.

---

[28] *Id.* at ¶1.
[29] *Id.* at ¶ 7.
[30] *Id.* at ¶¶ 7-8.
[31] *Id.* at ¶ 8 citing to First Report and Order in ET Docket 98-153, 17 FCC Rcd 7435, at ¶ 49 (2002).
[32] *Id.*

The Commission has also shown a willingness to waive technical restrictions when a UWB device presents little threat of harmful interference and a waiver would further public interest goals. In 2008, for example, the Commission granted a waiver to UltraVision Security Systems for a UWB surveillance system, operating between 80 and 600 MHz, designed to warn of intruders on sites of strategic or commercial interest (even though the then current rules did not permit UWB surveillance systems below 1.99 GHz).[33] UltraVision argued for a waiver to operate in the lower bands on the basis that the UWB rules adopted in 2002 authorized the use of certain bands based on the technologies known to the Commission at the time of the rulemaking,[34] and because UltraVision's technology did not exist at that time, the operational needs could not have been factored into the Commission's decision making. Subsequently, the Commission determined that the public benefits of an innovative surveillance system outweighed the potential risk of harmful interference in the requested bands (which could be managed through operational and technical restrictions[35]) and granted the requested waiver.

Like UltraVision, Headsight faces a regulatory restriction that limits its ability to introduce a new technology that would significantly benefit the public. And like UltraVision, Headsight is proposing a use of technology that did not exist at the time of the Commission's rulemaking (*i.e.*, agriculture) and, thus, was never factored into the UWB rules that were adopted.

The Commission has also shown a willingness to grant waiver requests involving other UWB rules. For example, the Commission granted a waiver in 2017 to Curtiss-Wright Controls,

[33] *UltraVision Security Systems, Inc. Request for Interpretation and Waiver of Section 15.511(a) & (b) of the Commission's Rules for Ultra-Wideband Devices*, ET Docket No. 06-195, Order, 23 FCC Rcd 17632 (2008) ("*UltraVision Waiver*").
[34] *UltraVision Waiver* at ¶ 6.
[35] *Id.* at ¶ 13.

Inc. ("CWCI") regarding the specific minimum operational bandwidth of a UWB transmitter and the UWB measurement procedure outlined in Sections 15.503(d) and 15.521(d), respectively.[36] CWCI requested the waiver for its GPR system known as the 3d-Radar system, which was designed to increase efficiency in subsurface imaging. In granting the waiver, the Commission recognized that the device benefitted the public interest through lowering the costs of infrastructure repair and improving safety conditions for both infrastructure workers and the general public.[37] Like the 3d-Radar device, the Terrahawk is designed to increase efficiency in subsurface imaging and will benefit the public by improving farming operations and crop yields.

In sum, the public interest will clearly be served if the Commission waives the specific rules which are discussed herein.

D. A Waiver of the UWB Rules is Consistent with Previous Commission Statements Concerning the Evolution of UWB Technology

The Commission always intended to revisit its initial conservative approach taken to the regulation of UWB. Granting this waiver request to allow the Terrahawk to operate as described herein would be consistent with those intentions. As noted above, the Commission adopted "extremely conservative" UWB standards based on the information and technology that was known to the Commission in 2002.[38] The Commission reasoned that "[t]hese systems are relatively new products, and we therefore believe that their operation should be limited until more experience has been obtained."[39] The Commission was reluctant to add flexibility or consider changes to the technical parameters "until it [had] more experience with

[36] *3d-Radar Waiver* at ¶ 24.
[37] *Id.* at ¶ 8.
[38] *FRO* at ¶ 2.
[39] *Id.* at ¶ 21.

UWB devices," as any changes to the rules at an early stage "would be disruptive to current industry product development efforts."[40] But because "initial restrictions on applications, operating frequencies and emission levels may limit some UWB applications," the Commission was open to reevaluating these standards "in the future as [it] continue[s] to collect data regarding UWB operations."[41]

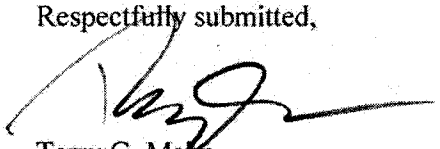
Farmers today, would clearly benefit from the use of UWB ground imaging applications. Thus, the time has come for the Commission to relax the "extremely conservative" UWB rules to allow them to keep pace with the advances in ground imaging technology that are benefiting other important American industries.

[40] *MO&O and FNPRM* at ¶¶ 1 and 153.
[41] *FRO* at ¶¶ 2 and 21.

Conclusion

In this Waiver Petition, Headsight is asking the Commission to do exactly what it always intended; and that is to periodically review and reconsider its ultra-conservative UWB rules whenever it becomes clear that new and useful applications are being developed that will benefit the public, without risking harmful interference to other spectrum users. Headsight has shown that to be the case with its Terrahawk ground imaging device, a UWB application that will be exclusively rural in nature. For the reasons provided above, therefore, Headsight requests that the Commission waive and/or interpret Sections 15.503(f) and 15.509(b) so that a UWB imaging device like the Terrahawk can be used in modern farming.

Respectfully submitted,



Terry G. Mahn
Jay S. Newman
Fish and Richardson P.C.
1425 K Street N.W.
Suite 1100
Washington D.C. 20005

Counsel for Headsight Inc.

ATTACHMENT 1

THE WALL STREET JOURNAL September 1, 2015

On the Farm: A Bountiful Harvest of Data

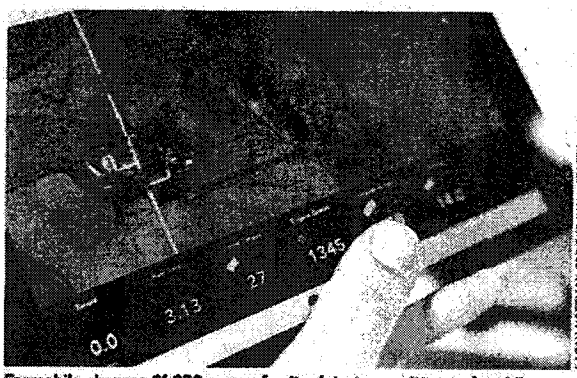
Iowa farmer Jason Rouse adjusts the Farmobile data-collection device in his combine. Information gathered in real time allows farmers to monitor operations and fine tune decisions.

By Jacob Bunge

Farmers and entrepreneurs are starting to compete with agribusiness giants over the newest commodity being harvested on U.S. farms—one measured in bytes, not bushels.

Startups including **Farmobile LLC**, **Granular Inc.** and **Grower Information Services Cooperative** are developing computer systems that will enable farmers to capture data streaming from their tractors and combines, store it in digital silos and market it to agriculture companies or futures traders. Such platforms could allow farmers to reap larger profits from a technology revolution sweeping the U.S. Farm Belt and give them more control over the information generated on their fields.

The efforts in some cases would challenge a wave of data-analysis tools from big agricultural companies such as Monsanto Co., DuPont Co., Deere & Co. and Cargill Inc. Those systems harness modern planters, combines and other machinery outfitted with sensors to track planting, spraying and harvesting, then crunch that data to provide farm-management guidance that these firms say can help farmers curb costs and grow larger crops.



SARAH HOFFMAN FOR THE WALL STREET JOURNAL (2)

Farmobile charges $1,250 a year for its data transmitter and mobile app.

The companies say farmers own their data, and it won't be sold to third parties.

Some farmers and entrepreneurs say crop producers can get the most from their data by compiling and analyzing it themselves—for instance, to determine the best time to apply fertilizer to their soil and how much. Then, farmers could profit further by selling data to seed, pesticide and equipment makers seeking a glimpse into how and when farmers use machinery and crop supplies.

The new ventures come as farmers weigh the potential benefits of sharing their data with large agricultural companies against privacy concerns and fears that agribusinesses could leverage farm-level information to charge higher rates for seeds, pesticides and other supplies.

"We need to get farmers involved in this because it's their information," said Dewey Hukill, board president of Grower Information Services Cooperative, or GISC, a farmer-owned cooperative that is building a platform to collect its members' data.

The cooperative has signed up about 1,500 members across 37 states.

Members of the Lubbock, Texas, co-op eventually will be able to choose to have their data scrubbed of identifying details, combined with other farmers' information and sold to prospective buyers. Farmers who participate would share in the proceeds. "If there is any monetary value, we think it needs to go back to the grower," Mr. Hukill said.

Advancements in wireless technology, inexpensive sensors to monitor seeding rates and data-crunching techniques honed

Please see FARM page B2

SARAH HOFFMAN FOR THE WALL STREET JOURNAL

Farmer Jason Rouse, who uses crop data monitoring tools, checks on his corn fields in Massena, Iowa.

FARM

Continued from the prior page

in Silicon Valley have helped agricultural companies build systems to help farmers examine which seeds to use in different soils or whether they are underutilizing farm equipment.

Monsanto, the world's largest seed maker by sales, has spent more than $1 billion on acquisitions over the past three years on farming hardware and data analysis capabilities. DuPont, which has teamed up with Deere and other groups as it develops its own service, anticipates generating as much as $500 million a year in revenue from computerized farming services.

Startups including Farmobile and Granular say farmers should have greater control over how their information is used.

Farmobile's transmitters, about the size of a paperback book, download information from the diagnostic systems of tractors and other machinery and beam it to a remote server, allowing farm managers to monitor operations and make quick adjustments. Farmobile charges farmers $1,250 a year for its data transmitter and mobile application, which allows farmers to track their tractors and combines in real-time, monitoring performance and chemical use.

Next year Farmobile, which is based in a suburb of Kansas City, Mo., plans to open an electronic marketplace where pesticide companies, tractor makers or commodity traders could search for data on farmers' harvests and quote prices to individual farmers to see detailed information. If a farmer sells, proceeds would be split evenly between the farmer and Farmobile.

"We're monetizing something [farmers] hadn't monetized before," said Jason Tatge, cofounder and chief executive of Farmobile, which is funded by its founders and has about 140 farmers using its transmitters this year.

Granular, which sells farm-management software, also envisions a platform that would allow farmers to store and potentially market their data, said CEO Sid Gorham, who previously ran the mobile division of market-research firm Nielsen NV. Granular has raised $25 million in venture capital from firms including Google Ventures and Andreessen Horowitz.

The San Francisco company is working to aggregate data from large-scale farms to allow its farmer users to compare prices and performance of farm supplies like seeds to see if they are getting the best deal. Allowing farmers to market their data could become possible late next year, Mr. Gorham said. "We'd give our farmers the first crack [at using the data] before selling it."

Granular charges about $3 per acre a year for its farm management platform, which automates some budgeting and inventory functions and projects profits.

Companies developing markets for farm data say it's not their intention to displace big seed and machinery suppliers but to give farmers a platform that would enable them to manage their own information. Storing and selling their own data wouldn't necessarily bar a farmer from sharing information with a seed company to get a planting recommendation, they say.

Meanwhile, companies developing the data silos expect it will take several years to set up comprehensive databases spanning significant swaths of big crop-producing states. Farmers, many of whom struggle with the idea of big companies or traders gaining an intimate view of their farms, will also have to be won over to make the concept work.

Some farmers, however, see the potential for a new revenue stream from their crop information. "At this point, I'm pretty comfortable with allowing my data to be aggregated into other [data sets]," said Zachary Hunnicutt, a Nebraska farmer who has been testing Farmobile's system. "It's [potentially] another income flow and a way to help people make better decisions around agriculture."

Field-level information on crops, collected in near real-time, would find ready purchasers among traders of agricultural futures such as corn and wheat, said Jon Marcus, principal of Chicago-based brokerage firm Lakefront Futures & Options LLC. "It's invaluable if it's done correctly," he said.

Big grain companies, too, could be buyers. "It'll be a source of input that we would eventually put a price on," said Soren Schroder, chief executive of Bunge Ltd., among the world's biggest purchasers of agricultural commodities.

Date:	January 21, 2016
Subject:	Request for Confidentiality
Re:	In the Matter of Petition for Waiver of Part 15 of the Commission's Rules Applicable to Ultra-Wideband Devices

To Whom It May Concern:

On behalf of our client Headsight Inc. ("Headsight") and pursuant to 5 U.S.C. § 552 and Sections 0.457 and 0.459 of the Commission's Rules, 47 C.F.R. §§ 0.457, 0.459, we hereby request that certain information complementary to the above-referenced Petition for Waiver be treated as confidential and not subject to public inspection. The designated information constitutes confidential and proprietary information that, if subject to public disclosure, would cause significant commercial, economic, and competitive harm. As described below, Headsight's request satisfies the standards for grant of such requests set forth in Sections 0.457 and 0.459 of the Commission's Rules.

In accordance with Section 0.459(b) and in support of this request, Headsight provides the following information:

1. **Identification of the information for which confidential treatment is sought:**

   Headsight's request for confidential treatment is limited to the preliminary datasheet for the Headsight impulse radar transceiver system.

2. **Identification of the Commission proceeding in which the information was submitted or a description of the circumstances giving rise to the submission:**

   The above-referenced document was submitted on January 21, 2016 to the Commission in support of the Petition for Waiver.

3. **Explanation of the degree to which the information is commercial or financial or contains a trade secret or is privileged:**

   The information requested to be kept confidential has significant commercial value and includes confidential business information provided to Headsight by the GPR transceiver manufacturer. Headsight does not have the manufacturer's permission to publicly disseminate this information.

4. **Explanation of the degree to which the information concerns a service that is competitive:**

   The services and technologies that are the subject of this Experimental Application have not yet been fully developed, but are expected to be competitive with existing services that use older technology to serve a similar purpose.

5. **Explanation of how disclosure of the information could result in substantial competitive harm:**

The technology under development is sensitive and confidential in nature. The release of such information would provide valuable insight into Headsight's technology innovations and potential business plans and strategies.

6. **Identification of any measures taken by the requesting party to prevent unauthorized disclosure:**

Headsight has taken steps to keep confidential the information set forth in the confidential attachment by limiting the number of people involved in the development of the technology.

7. **Identification of whether the information is available to the public and the extent of any previous disclosures of the information to any third parties:**

The document which we seek confidential treatment is not available to the public, and has only been disclosed to limited third parties involved in the preparation of the Petition for Waiver. Headsight voluntarily provides the information to the Commission at this time with the expectation that it will be treated confidentially in accordance with the Commission's rules.

8. **Justification of the requested period of confidentiality:**

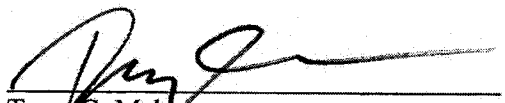
Headsight expects that confidential treatment will be necessary for the duration of the rule-making and thereafter in order to protect Headsight's evolving business and technology strategies.

9. **Any other information that would be useful in assessing whether this request should be submitted:**

The information subject to this request for confidentiality should not be made available for public disclosure at any time. There is nothing material that public review of this information would add to the Commission's analysis of Headsight's petition for waiver.

Consistent with 47 C.F.R. § 0.459(d)(1), Headsight requests notification if release of the information subject to this request is requested pursuant to the FOIA or otherwise, so that Headsight may have an opportunity to oppose grant of any such request.

Sincerely yours,



Terry G. Mahn
Counsel for Headsight Inc.