WT 10-4

Before the
FEDERAL COMMUNICATIONS COMMISSION
Washington, D.C. 20554

In the Matter of	)	
	)	
Request by Kathrein Automotive GmbH & Co. KG	)	
For Waiver of Section 20.21	)	File No. _____
of the Commission's Rules	)	

To: Division Chief, Mobility Division, Wireless Telecommunications Bureau

REQUEST FOR WAIVER

Kathrein Automotive GmbH & Co. KG ("Kathrein"), pursuant to Sections 1.3 and 1.925 of the Federal Communications Commission's ("FCC" or "Commission") rules,[1] hereby requests a partial waiver of the Section 20.21 anti-oscillation and labeling requirements[2] to obtain equipment certification for and market a "compensator:" a device for the amplification of mobile phone signals in vehicles. Grant of this request is consistent with the intent of the rule, as the Kathrein compensator is inherently oscillation-proof. The waiver will fulfill the Commission's objectives of promoting technological innovation and competition in the signal booster industry and ensuring the widespread availability of mobile voice and broadband services to consumers, including access to emergency services, while protecting wireless networks from harm.

In the alternative, in lieu of a waiver of the anti-oscillation rule, Kathrein requests that the Wireless Telecommunications Bureau ("Bureau") determine that Kathrein has demonstrated compliance with the Network Protection Standard through equivalent protections pursuant to Section 20.21(e)(10).

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[1] 47 C.F.R. § 1.3 and § 1.925.
[2] 47 C.F.R. § 20.21(e)(5) and § 20.21(f)(1)(3) and (4).

BACKGROUND

Kathrein, located in Hildesheim, Germany, is a world leader in innovation and technology. Kathrein's parent company designs products for mobile, satellite and broadband communications, while Kathrine has partnered with the automotive industry for decades to develop infrastructure for technology within vehicles as well as communication between vehicles.

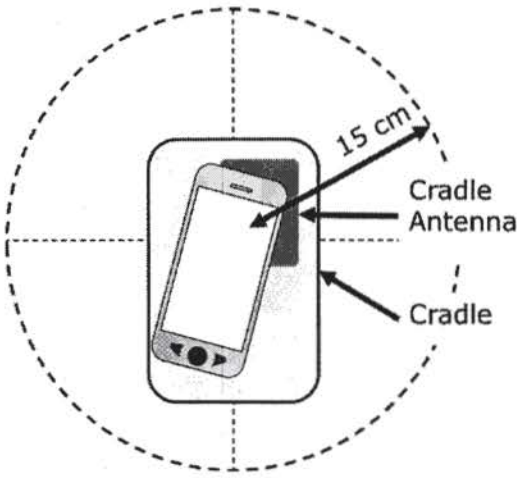
Kathrein has developed a compensator, which is a device that functions similarly to a signal booster in that it amplifies cell phone signals to improve reception within a vehicle. The compensator is needed because vehicles increasingly are manufactured with windows made from newer types of glass, with coatings used to reflect UV and infrared light. These coatings attenuate cell phone signals, reducing the ability to place and receive phone calls from within a vehicle. The compensator is a solution to this problem.

The compensator will comply with all FCC rules except those related to oscillation recognition and mitigation and labeling requirements. The compensator will support up to five frequency bands.[3] Due to its "one mode" uplink design, and because it compensates only up to the amount of loss occurring within a vehicle, the compensator appears to cellular networks as one mobile phone without vehicle shielding. As discussed further below, the compensator will function only when keyed (non-standard) connectors are recognized, and when the external antenna is recognized as correctly installed. Unlike conventional consumer signal boosters, the compensator and accessories will be professionally installed in fixed locations in the vehicle during the automobile manufacturing process. Only the cradle will be accessible by the consumer (for this reason, labeling on the compensator cannot be viewed by the consumer). Due

[3] Attachment A lists the specific bands and air interfaces that it will support.

to limited amplification, the "range" within the car will be approximately 15 cm, as demonstrated in the diagram below:

Diagram A



Free Space "range" for 15/19 dB gain

These features will ensure that consumers cannot access or modify the system to create oscillation or cause other problems to the networks. There is no risk that consumers will engage in "self-help, unauthorized, or uncoordinated use" – concerns expressed by the wireless industry prior to enactment of the current signal booster rules.[4]

The compensator does not fit neatly within the FCC's regulatory regime. The Commission contemplated that consumer signal boosters would be "designed to be used 'out of the box'" by individuals, while industrial signal boosters would be used "by licensees or qualified installers."[5] Consumer signal boosters would "not need fine tuning or other technical adjustments" and would be installed "without third party or professional assistance,"[6] but they

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[4] *See* Petition for Declaratory Ruling of CTIA – The Wireless Association Regarding the Unlawful Sale and Use of Cellular Jammers and Wireless Boosters and Repeaters, at pgs. 2, 6 and 12, WT Docket No. 10-4 (filed Nov. 2, 2007).

[5] *Amendment of Parts 1, 2, 22, 24, 27, 90 and 95 of the Commission's Rules to Improve Wireless Coverage Through the Use of Signal Boosters*, Report and Order, 28 FCC Rcd 1663 at ¶ ¶ 4-5 (2013) ("2013 Signal Booster Order").

[6] 2013 Signal Booster Order at ¶ 13.

would require clear labeling to inform consumers about the device.[7] For this reason, the Commission concluded that it must "require tight regulatory controls to mitigate their potential for interference."[8] Industrial signal boosters, in contrast, are designed to be installed in a fixed location and have much higher output power and gain to serve multiple users over a much larger coverage area, and an FCC license is required.

The Kathrein compensator suits neither of these two schemes. On one hand, it is similar to a wideband consumer signal booster as it: 1) contains a bi-directional amplifier; 2) is for use by consumers, who would not obtain FCC licenses; 3) is used in private vehicles (*i.e.* is for mobile use); and 4) is designed to access all network providers. On the other hand, the compensator: 1) will be sold directly to the automotive industry, not to the consumer; 2) will be professionally installed during the automobile manufacturing process; and 3) cannot be set up, modified, or even accessed by the consumer.

More specifically, the compensator and related accessories (cradle, RF cabling, and external antenna) will be installed by the automobile manufacturer in fixed vehicle locations that are inaccessible to the consumer; only the cradle will be accessible to the consumer as a place to set or "cradle" one's smartphone.[9] The external antenna, RF connectors, and power supply will be "keyed," meaning that the device will function only when properly installed and receiving the intended control check signals. If a consumer attempts to modify any portion of this system, such as changing the external antenna, the compensator will cease to function. The compensator contains an active antenna recognition system for the external antenna that assesses the DC

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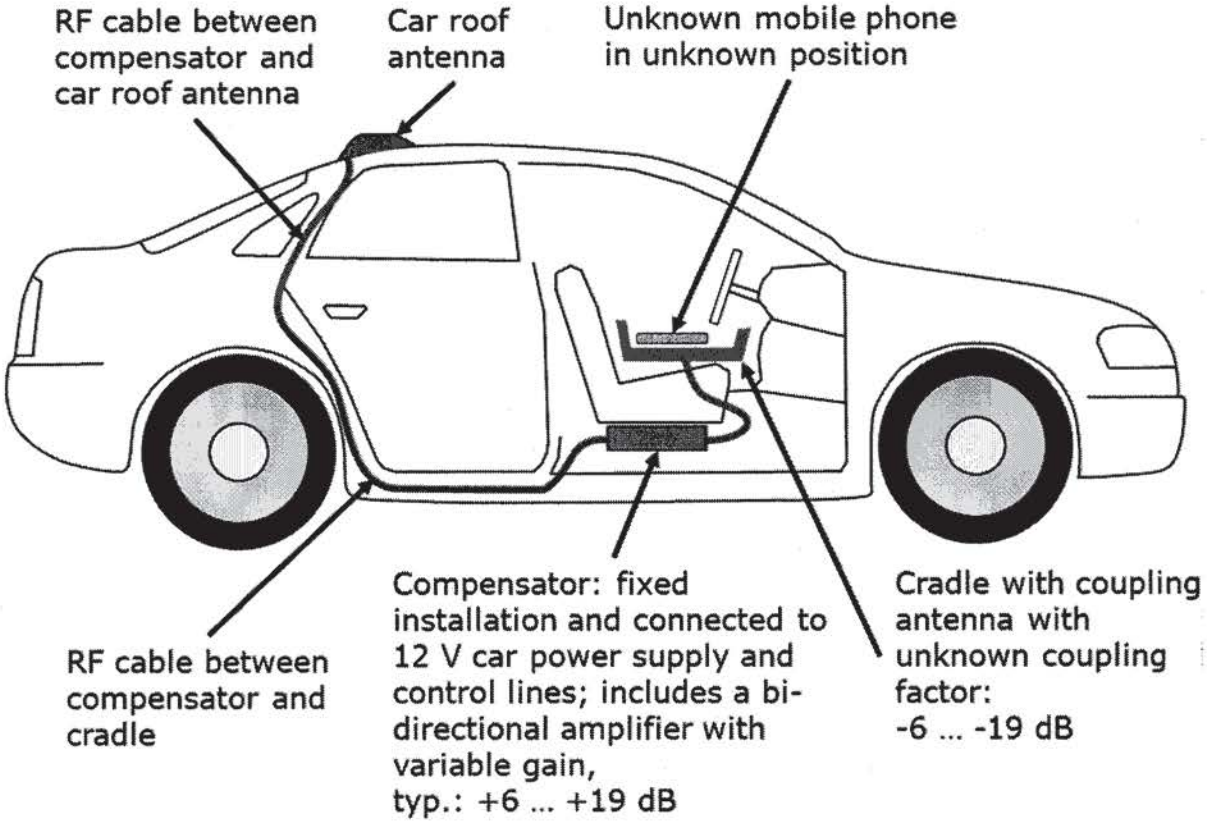
[7] 47 C.F.R. § 20.21(f).
[8] *Id.*
[9] The cradle will be large enough to hold the largest smartphone on the market today, and only will hold one phone at a time. It will be too small to hold a tablet.

resistance and will shut down if it determines that the antenna type is not properly-installed and recognized. Should a consumer attempt to reuse the Kathrein device in another car, it will not operate because "keyed connectors" plus certain signals from the original car are required in order for it to function.

The following diagram shows the installation of the compensator and related accessories (antenna, cradle, cables).

Diagram B



In contrast, a conventional consumer signal booster typically contains the booster electronics directly within the cradle, and employs standard RF connectors and power supply connectors. Consumers are free to position the cradle, external antenna, and RF cabling however they

choose. It is for this reason that the Commission required anti-oscillation control for consumer signal boosters, as detailed below. A conventional booster also will have a label affixed to the device that can be seen by the consumer and, because it is purchased by the consumer, the consumer will have access to the device and outside packaging, both of which are required to contain a consumer advisory.[10]

The Kathrein device provides for needed amplification of cellular service within vehicles, yet ensures through professional fixed installation that consumers cannot alter the function of the device in any way that would disable its oscillation-proof design.

DISCUSSION

The Kathrein compensator will be able to operate in compliance with all FCC rules except that it does not meet the anti-oscillation and certain labeling requirements of Section 20.21. Kathrein seeks a waiver of these requirements because the underlying purpose would not be served by application of the rules and because grant of the waiver is in the public interest.

I. Request for Waiver

A. Waiver of the Anti-Oscillation Rule.

Section 20.21(e)(5) requires that all consumer signal boosters "must be able to detect and mitigate any unintended oscillations in uplink and downlink bands (such as may result from insufficient isolation between the antennas)."[11] Section 20.21(e)(8)(ii)(A) specifies that

[10] 47 C.F.R. § 20.21(f).
[11] 47 C.F.R. § 20.21(e)(5).

Wideband Consumer Signal Boosters will meet the Network Protection Standard if they contain specific interference safeguards, including anti-oscillation features.[12]

Though Section 20.21 requires that signal boosters must be able to "detect and mitigate any unintended oscillations in uplink and downlink bands," the compensator is consistent with the intent of the rule because it is designed to be oscillation-proof. The underlying purpose of the anti-oscillation requirement is to prevent harm to the networks. When the Commission adopted this technical requirement, it explained that the purpose of the rule was to prevent "oscillation in the uplink and downlink bands (such as may result from insufficient isolation between the device's antennas)," *i.e.*, as a result of improperly installed devices.[13] The Commission noted:

> This safeguard is particularly important for a consumer-targeted device where **installation will be undertaken by individuals without the technical expertise to identify and correct faulty installation**.[14]

The Kathrein compensator will be installed by individuals with technical expertise, and will not (and cannot) cause oscillation. As the Commission explained, "oscillation occurs when the signal from the internal antenna of a signal booster reaches the external antenna of the device and generates uncontrollable high level signals."[15] This can be prevented either by attenuating, or creating sufficient spacing, between antennas,[16] or by limiting the system gain. Here, the

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[12] 47 C.F.R. § 20.21(e)(8)(ii)(A) ("Oscillation detection and mitigation must occur automatically within 0.3 seconds in the uplink band and within 1 second in the downlink band. In cases where oscillation is detected, the booster must continue mitigation for at least one minute before restarting. After five such restarts, the booster must not resume operation until manually reset.").
[13] 2013 Signal Booster Order at ¶ ¶ 61-62.
[14] *Id.* (emphasis added).
[15] *Amendment of Parts 1, 2, 22, 24, 27, 90 and 95 of the Commission's Rules to Improve Wireless Coverage Through the Use of Signal Boosters*, Notice of Proposed Rulemaking, 26 FCC Rcd 5490 at ¶ 16 (2011) ("Signal Booster NPRM").
[16] *Id.*

Kathrein device is designed to be professionally installed so that the compensator is placed in a location of the vehicle near the cradle, but the antenna is installed on the exterior of the car well away from the cradle (*see* Diagram B above), thereby ensuring sufficient isolation.

Oscillation in a booster is closely analogous to the noisy "feedback" sometimes heard in an improperly installed public address system. That occurs when the microphone picks up and re-amplifies sound from the loudspeakers. Similarly, oscillation occurs in a booster when the receive antenna picks up and re-amplifies signal from the transmit antenna. It can happen only when the system gain (amplifier gain + cradle gain + external antenna gain) exceeds the coupling loss between the two antennas. In the case of the compensator—unlike a conventional booster—the manufacturer has full control over each of these factors, and thus can reliably eliminate oscillation at the design stage. (*See* Attachment B for a detailed link budget.) The compensator thus has no need for anti-oscillation mechanisms.

Moreover, these anti-oscillation protections of the networks cannot be defeated. Consumers will be unable to disable or deactivate the system's safeguards. Should harm to the networks nonetheless be detected—an exceedingly unlikely event—a subscriber may be notified of an interference event by a wireless provider and must shut down the device immediately or as soon as practical; carriers may shut off service for customers who fail to do so.[17]

The Kathrein compensator is similar in many respects to a direct connection signal booster, for which the Office of Engineering and Technology ("OET") has determined that oscillation testing is not necessary. OET's signal booster testing guidance provides that: "Consumer boosters certified as direct connection mobile boosters having less than or equal to

[17] 47 C.F.R. § 20.21(d); 2013 Signal Booster Order at ¶ 29. Should a consumer receive such a notice with regard to use of the Kathrein device, they would be able to bring their automobile to the dealership to shut down the device.

15 dB are exempt from compliance to testing procedures in sections 7.11.2 and 7.11.3," *i.e.*, the two anti-oscillation testing procedures required for FCC certification.[18] The reason for this is that a direct coupler has a "mechanical" means of preventing oscillation, *via* the direct cabled RF link. In the same way, the Kathrein compensator has a "mechanically" ensured method of preventing oscillation: controlled and fixed professional installation that deliberately maintains a sufficient separation between the transmit and receive antennas. Because the compensator controls for oscillation in the same way as a direct connection signal booster, it should be treated similarly and not be required to test for oscillation.

B. Waiver of the Labeling Rule.

Section 20.21 requires that a specific consumer advisory be provided to consumers in four ways: 1) in on-line, point of sale marketing materials; 2) on print or on-line owner's manuals or installation instructions; 3) on the device packaging; and 4) on the device label.[19] Because the Kathrein compensator will be sold only to resellers (automobile manufacturers) rather than directly to consumers, and because the compensator is installed in locations not accessible to consumers, Kathrein seeks waiver of this rule.

Kathrein proposes that it provide an advisory notice to the automobile manufacturers, who would then ensure that the language is placed in all on-line, point of sale marketing

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[18] Federal Communications Commission, Office of Engineering and Technology Laboratory Division, *Wideband Consumer Signal Booster Compliance Measurement Guidance*, Section 7.11.1 at p.18, Knowledge Database Publication 935210 D03 (June 5, 2015). This is consistent with the Institute of Electrical and Electronics Engineers, Inc. ("IEEE") recommended compliance testing standards for consumer signal boosters. *See* C63.26/D15 Draft American National Standard for Compliance Testing of Transmitters Used in Licensed Radio Services, Line 4297 (June 2015) (providing "NOTE—Consumer boosters certified as direct connection boosters having a gain in both the uplink and downlink of less than or equal to 15 dB are exempt from compliance to the testing procedures described in 7.3.13.3 and 7.3.13.4.").

[19] 47 C.FR. ¶ 20.21(f).

materials and on print or on-line owner's manuals.[20] As a condition of the waiver, Kathrein will bind automobile manufacturers by contract to ensure that their dealers provide this notice to the consumer. A sample consumer notice is attached.[21]

Kathrein requests a waiver of the requirements to place the advisory on the device packaging and on the device itself, as neither of these requirements would be beneficial to the public interest because consumers do not have access to the packaging or device.

C. Grant of the Waivers is in the Public Interest.

When Congress constituted the Commission in 1934, it did so in part "for the purpose of promoting safety of life and property through the use of wire and radio communications."[22] The Kathrein device directly serves this purpose. The Commission recognizes the public interest benefits of signal boosters, including those that serve many Americans "on the road," as a means of enhancing wireless coverage for consumers.[23] In deciding to broaden the availability of signal boosters to consumers in a 2013 proceeding, the Commission relied on the fact that "[m]obile voice and mobile broadband services are increasingly important to consumers and to our nation's economy."[24] As it explained, the regulatory framework was one of "a set of initiatives designed to promote deployment of mobile voice and broadband services in the United States."[25] Specifically,

> Coverage gaps that exist within and at the edge of service areas can lead to dropped calls, reduced data speeds, or complete loss of service. Robust signal

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[20] Because consumers will not install the compensator, no installation instructions would be provided.
[21] *See* Attachment C.
[22] 47 U.S.C. § 151.
[23] 2013 Signal Booster Order, 28 FCC Rcd 1663 at ¶ 1.
[24] *Id.*
[25] *Id.*

> boosters can bridge these gaps and extend coverage at the fringe of service areas.[26]

The Kathrein compensator addresses the need to provide wireless coverage in one difficult to serve area – a car's interior. Grant of this waiver will further the Commission's policy of promoting mobile voice and broadband deployment.

The Commission also explained that its new rules were designed to be "sufficiently flexible to encourage further technological advances and a robust, competitive market for booster technology."[27] Grant of the waiver will facilitate a more robust and competitive signal booster market by providing a means for amplifying cell signals within vehicles.

Finally, grant of the waiver will accomplish these policy objectives while ensuring protection of the wireless networks, as the compensator is installed with numerous safeguards to ensure network protection. Only one frequency band is supported at any given time, and no uplink RF signal is generated unless a phone is placed in the cradle and the phone is active. The system does not engage in signal processing, just amplification, and the amplification is balanced, meaning the uplink and downlink gain is always equal. The network will see the system as one cellular phone. The compensator measures RF power and limits RF radiation at the antenna.

Oscillation will not occur because the system will be designed for and installed by the car manufacturer in a way that ensures sufficient isolation between the cradle and car roof antenna, as discussed above. The system employs Adaptive Gain Control ("AGC"), and gain is limited (by chips in the device) to approximately 20 dB; it is not capable of creating a higher gain. The

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[26] *Id.*
[27] *Id.* at ¶ 2.

actual maximum gain will be measured and will meet the FCC's 23 dB limit for signal boosters. The AGC reduces the gain below this level as needed, *e.g.*, in case of a nearby base station.

For all of these reasons, there is negligible risk of harmful interference to wireless networks (or other users) and network protection in ensured. Kathrein will commit as a condition of its waiver to market and sell the compensator only to the automobile industry and not directly to consumers. And Kathrein agrees as a condition of the waiver to provide the attached Consumer Advisory to the automobile manufacturers and to bind those automobile manufacturers by contract so that the compensator may only be operated under the terms of this waiver if the consumer advisory is provided on a separate sheet and at the time of delivery.

C. Legal Basis.

The Commission may waive any provision of its rules if good cause is shown.[28] The Commission assesses waiver requests according to the standards set out in *WAIT Radio v. FCC*.[29] In that case, as here, the applicant sought authority in contravention of the rules while explaining how it would nonetheless accomplish the purpose of the rules.[30] *WAIT Radio v. FCC* made clear that the Commission must consider that:

> [A] general rule, deemed valid because its overall objectives are in the public interest, may not be in the "public interest" if extended to an applicant who proposes a new service that will not undermine the policy, served by the rule, that has been adjudged in the public interest.[31]

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[28] 47 C.F.R. § 1.3.

[29] 418 F.2d 1153 (D.C. Cir. 1969). *See also 2002 Biennial Regulatory Review*, 18 FCC Rcd 13620 at para. 85 n.130 (2003) (citing *WAIT Radio* as "setting out criteria for waivers of Commission rules.")

[30] WAIT Radio operated an AM broadcast station. It was limited to daylight hours so as to afford protection to "white areas" that had no local service, and that relied on nighttime skywave propagation from another station. WAIT Radio proposed to transmit at night using a directional antenna that would limit its signal in the white areas. *WAIT Radio v. FCC*, 418 F.2d at 1154-55.

[31] *Id.* at 1157.

The meaning is clear: Waiver is appropriate where the applicant furthers the public interest inherent in the underlying rules.

The waiver requested here meets the *WAIT Radio* standard: it proposes a device that will advance the policy served by the rules, promoting mobile voice and broadband development while ensuring protection of the wireless networks. The requested waiver fits easily into the boundaries drawn by *WAIT Radio*.

The Court of Appeals emphasized the importance of waiver procedures as part of the regulatory scheme:

> The agency's discretion to proceed in difficult areas through general rules is intimately linked to the existence of a safety valve procedure for consideration of an application for exemption based on special circumstances.[32]

Thus, it said, "allegations such as those made by petitioners, stated with clarity and accompanied by supporting data ... must be given a 'hard look."[33] Here, too, the request fully qualifies. The "safety valve" of the waiver procedure is needed to make available a device not otherwise available. The requested waiver is in the public interest, not only in terms of benefits to the public, but also in the absence of any downside. The request is entitled not only to the "hard look" mandated in *WAIT Radio,* but to a grant of the waiver.

Finally, precedent exists for waiver of the labeling requirements. The Bureau granted the same partial waiver of Section 20.21(f) to Audi AG ("Audi") for the Audi Phone Box with regard to that rule's requirements for providing advisories on the outside packaging and on a label affixed to the device. The Audi Phone Box, like the Kathrein device, is installed within a

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[32] *Id.*

[33] *Id.* (citation footnote omitted).

vehicle during the manufacturing process and is not viewable or accessible by consumers.[34] The Bureau concluded that, "[b]ecause consumers would lack access to the actual Phone Box device or packaging, we find that [an alternative approach] better meets the Commission's public interest goals in enacting Section 20.21(f)(1)."[35] Audi's alternative approach, like the one proposed here, provides that Audi dealers give the advisory notice to consumers on a separate page at the time of delivery, and make the advisory available on all relevant on-line and point-of-sale marketing materials, as well as in the section of the owner's manual providing operating instructions.

II. Network Protection Standard Equivalency Request.

In the alternative to a waiver of the anti-oscillation rule, Kathrein requests that the Bureau determine, pursuant to Section 20.21(e)(10), that the compensator meets the Network Protection Standard under an equivalent protection analysis.

As discussed above, the compensator addresses the risk of oscillation though its fixed installation along with methods to prevent consumer misuse or modification of the device. These methods include: 1) sale only to the automobile industry, not to consumers; 2) professional installation; 3) fixed vehicle installation of the compensatory and accessories; 4) limited accessibility of the compensator and RF connectors, which are designed into the vehicle; 5) specially engineered "keyed" RF and signal and power connectors; 6) a specific signal at one of the lines of the power supply and a control line that is required for the device to function; 7)

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[34] Letter to Jeffrey Olsen, Counsel to Audi AG, from Roger Noel, Chief, Mobility Division, Wireless Telecommunications Bureau, Re: Request for Partial Waiver of Section 20.21(f) of the Rules (Feb. 20, 2014).

[35] *Id.* at 2.

an active antenna recognition system; and 8) limited system gain maintained at levels below FCC requirements.

These factors combine to ensure that the networks will be protected from interference caused by oscillations.

CONCLUSION

For the foregoing reasons, Kathrein respectfully requests that the Bureau grant waiver of the anti-oscillation and labeling rules so that Kathrein may obtain equipment certification of its compensator.

Respectfully submitted,

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July 15, 2015

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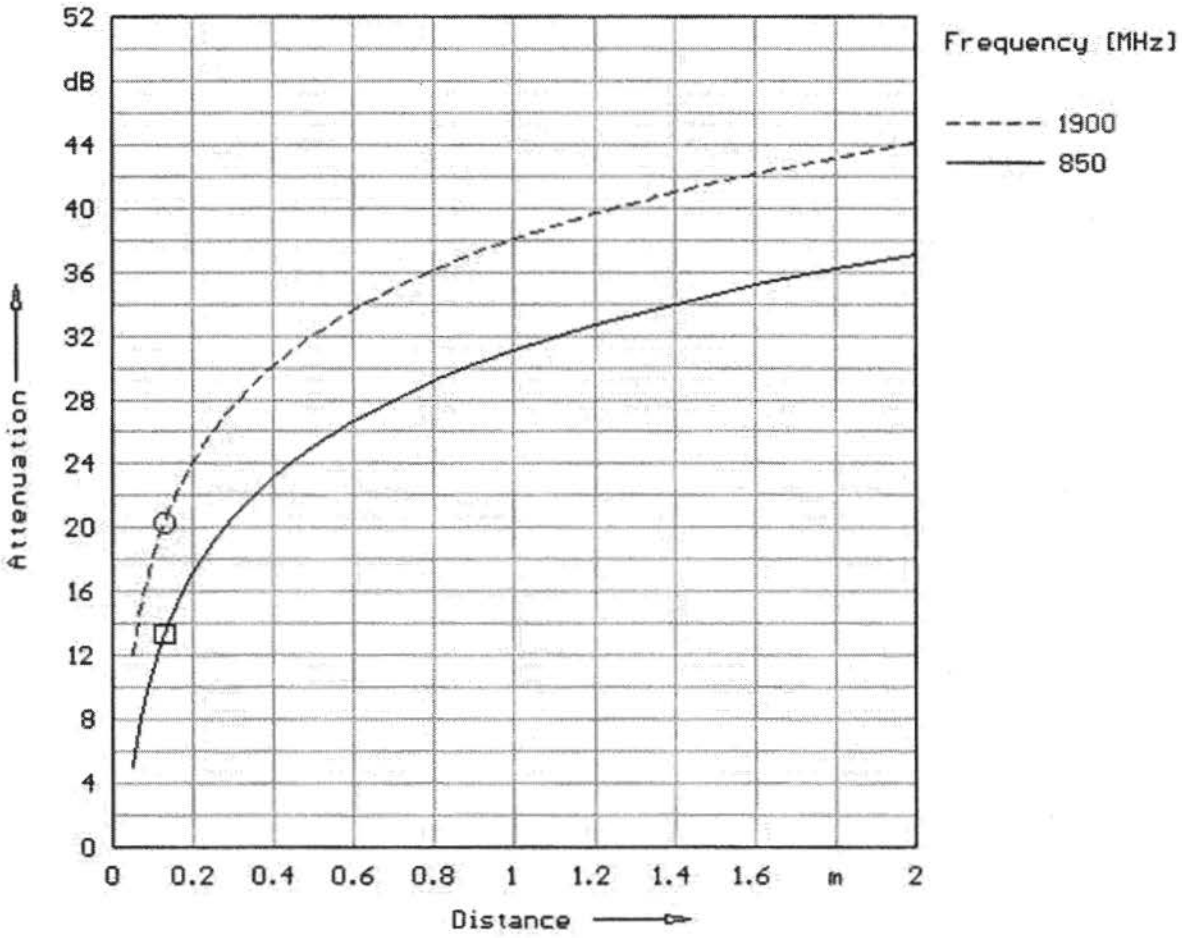
Attachment A – Frequency Bands and Interfaces Supported and Related Technical Information

Band	Mode	Uplink Frequency Range	Maximum Gain	Maximum RF Output Power
12/17	LTE	699-716 MHz	15 dB	23 dBm
13	LTE	777-787	15 dB	23 dBm
5	GSM	824-849 MHz	15 dB	30 dBm
5	UMTS / LTE / CDMA 2000		15 dB	24 / 23 / 23 dBm
2	GSM	1850-1910 MHz	18 dB	30 dBm
2	UMTS / LTE / CDMA2000		18 dB	24 / 23 / 23 dBm
4	UMTS / LTE	1710-1755 MHz	19 dB	24 / 23 dBm



Attachment B – Link Budget

Maximum gain of the compensator:	23 dB (Measurement)
Maximum assumed (lambda/4 Monopole) external antenna gain:	5 dBi (Textbook)
Maximum assumed (lambda/2 dipole) cradle gain:	2 dBi (Textbook)
Impact of best case cradle coupling:	-7 dB (FCC fig. D3: MSCL)
System gain:	23 dB.

Measured typical isolation between external antenna and cradle within the car: 70 dB

Non oscillation when 70 dB > 23 dB.

(70 dB – 23 dB = 47 dB, hence the above relation (">") is fulfilled by a Factor 50 000).

Attachment C - Consumer Advisory

FCC Consumer Advisory

This vehicle is equipped with signal booster that is a CONSUMER device.

BEFORE USE, you MUST REGISTER THIS DEVICE with your wireless provider and have your provider's consent. Most wireless providers consent to the use of signal boosters. Some providers may not consent to the use of this device on their networks. If you are unsure, contact your provider.

You MUST operate this device with approved antennas and cables as specified by the manufacturer. Antennas MUST be installed at least 20 cm (8 inches) from any person.

You MUST cease operating this device immediately if requested by the FCC or a licensed wireless service provider.

WARNING: E911 location information may not be provided or may be inaccurate for calls served by using this device.