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May 28, 2021

Michael Coe
Director, Energy Resilience Division of the Office of Electricity
U.S. Department of Energy
Mailstop OE-20, Room 8H-033
1000 Independence Avenue SW
Washington, DC 20585

Dear Mr. Coe:

Xperi Holding Corporation ("Xperi") submits these comments in response to the Request for Information from the Department of Energy (the "Department" or "DOE"), Office of Electricity, regarding recommendations to strengthen requirements for supply chain risk management practices by the Nation's electric utilities.[1]

As the DOE considers ways to secure the nation's energy supply, it is essential to adopt a holistic approach that recognizes that critical infrastructure is only as secure as its weakest link. In that vein, merely ensuring that grid equipment is provided by domestic suppliers is hardly enough. Rather, the Department's consideration of procurement practices and requirements must begin with an evaluation of the design of our nation's energy grid, with a focus on the areas that create potential vulnerabilities. The DOE should pay particular attention to the communications capabilities incorporated into the grid. While advanced communications capabilities provide significant benefits for the nation's energy supply, each point of interconnection also constitutes a potential point of failure. It is, therefore, imperative that any integrated communications capabilities are built upon a foundation of security, resiliency, and redundancy.

Xperi's HD Radio® technology offers a secure and resilient communications platform that should play a central role in the DOE's efforts to address the security of the nation's critical electric infrastructure. HD Radio broadcasting is already widely deployed and has the capability to deliver advanced data services for the energy sector that are reliable and can avoid many of the security risks associated with public communications networks.

The Department should identify the use of HD Radio technology as an important part of the Department's efforts to combat threats to critical infrastructure. Specifically, the DOE should establish an expectation of redundancy and reliability for communication and messaging services

[1] *See Notice of Request for Information (RFI) on Ensuring the Continued Security of the United States Critical Electric Infrastructure*, Request for Information, 86 FR 21309 (Dept. of Energy, Office of Electricity Apr. 22, 2021) (the "RFI").

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supporting the grid, which should include the use of FM spectrum and digital radio broadcast technology. In furtherance of these efforts:

1. DOE should consider funding and support of local or regional testing of various communication services, including broadcast digital FM radio.

2. DOE should issue one or more reports outlining the various communications technologies involved in current and future energy distribution efforts, with analysis of the benefits and drawbacks of each.

Xperi looks forward to coordinating with DOE on technical considerations related to these recommendations and participating in future DOE discussions and investigations on this topic.

I. BACKGROUND

A. About HD Radio Technology

The HD Radio system was first authorized by the Federal Communications Commission ("FCC") in 2002 to facilitate digital radio transmissions in existing AM and FM bands.[2] HD Radio broadcasting is available in two waveforms for both AM and FM stations – hybrid and all-digital. Hybrid transmissions involve a combination of analog and digital signals, allowing broadcasters to transmit a digital signal without sacrificing existing analog capabilities. With all-digital transmissions, the spectral region previously used for analog is populated with digital carriers moved to the center frequency, resulting in a more robust signal. Although FM stations are currently only permitted to operate in the hybrid mode, the FCC recently authorized AM stations to voluntarily transition their facilities to all-digital operations.[3]

An important aspect of the in-band-on-channel digital radio technology at the core of the HD Radio system is the use of digital modulation techniques to expand beyond traditional audio content and provide a wide array of content, including audio, text, images, traffic alerts, weather updates, and other general data applications. The increased power of HD Radio broadcasts, meanwhile, provides increased population coverage as compared to traditional analog radio.

[2] *In re Digital Audio Broadcasting Systems and Their Impact on the Terrestrial Radio Broadcast Service*, First Report and Order, FCC 02-286 (rel. Oct. 11, 2002).

[3] *In re All-Digital AM Broadcasting; Revitalization of the AM Radio Service*, Report and Order, FCC 20-154, MB Docket Nos. 19-311, 13-249.

As a result of these improved features, interest in HD Radio technology is growing – as of April 1, 2021, over 2,300 radio stations in the United States had converted to digital broadcasting.[4] These 2,300 stations represent all of the top Nielsen metro areas and cover almost 93% of the U.S. population.

B. Delivering the Internet of Things Using HD Radio Broadcasting

Broadcast to Infrastructure Control, or B2Ic, is a radio-based data broadcasting system that facilitates mass distribution of short messages to infrastructure components including utility, transportation, educational, and recreational infrastructure. Xperi is bringing together several critical components to position digital radio as an ideal platform for connecting the Internet of Things ("IoT"). The first is a content distribution system. With this system, service providers will have the ability to connect to local radio stations or subscribers in each market to provide data content on unused or available bandwidth. Radio stations will register to allow part of their digital data capacity to be used for services or applications. When an application provider (e.g., utility provider) requests a data transmission, a secure, cloud-based manager will identify spectrum availability based on the urgency of the message and the priority of the user and deliver the message to the host controller. The system will allow both scheduled and real-time messages and provide logs of message transmissions.

To facilitate the integration of HD Radio data services into utility systems, Xperi is working with its partners on low-cost HD Radio receiver components for public utility demand response systems.

The result of these efforts is an integrated system that offers secure uni-directional transactions with end-to-end encryption.

II. USE OF HD RADIO TECHNOLOGY CAN STRENGTHEN THE SECURITY AND RELIABILTY OF THE ENERGY GRID

With communications becoming an increasingly integral part of the nation's energy infrastructure, HD Radio technology can serve an important role delivering secure and reliable information to the energy system. More than 10 years ago, the DOE recognized that the Smart Grid would "revolutionize electricity generation, delivery, and use in this nation."[5] But while the

[4] Source: Xperi Holding Corporation.

[5] *See* Department of Energy, *Communications Requirements of Smart Grid Technologies* (Oct. 5, 2010), *available at* https://www.energy.gov/sites/default/files/gcprod/documents/Smart_Grid_Communications_Requirements_Report_10-05-2010.pdf.

report identified a number of communications technologies that could be used to support Smart Grid applications, including traditional twisted-copper phone lines, cable lines, fiber optic cable, cellular, satellite, microwave, WiMAX, power line carrier, broadband over power line, WiFi and ZigBeeToday, broadcast was notably absent.[6] In the decade since the DOE issued this report, digital radio has grown exponentially. Not only do HD Radio stations provide service to more areas than most of the aforementioned technologies, but HD Radio technology has a number of built-in advantages, such as multi-factor authentication and least privilege access to services, which provide the security, reliability, and redundancy that is critical to the success and stability of the nation's energy infrastructure.

A. HD Radio Technology Provides Enhanced Security for Communicating with the Grid

Data services provided using HD Radio technology feature a security first design that makes digital radio a preferred mechanism for delivering communications to the electric grid. The security of the nation's energy infrastructure is a paramount concern. The recent ransomware attack on a major U.S. fuel pipeline demonstrates the ease with which malicious actors can utilize the interconnected nature of the energy grid to cause substantial harm. And while the Colonial Pipeline attack primarily resulted in minor disruptions to energy supply, the next attack could prove much worse. As a uni-directional service, HD Radio broadcasting is inherently more secure than interactive communications systems. Moreover, messages delivered using HD Radio technology are subject to strict verification mechanisms that prevent spoofing, hijacking, and other forms of malfeasance.

An interconnected communications system like the energy grid is only as secure as the communications networks to which it is connected. Most IoT devices currently allow bi-directional communication, meaning the devices can both send and receive information. While this interactivity may be beneficial for some functions, it also creates additional vulnerabilities. For device applications that do not require interactivity (or where delivery and return paths can be separated), the uni-directional approach along with least privilege access to services utilized by HD Radio technology provides a more secure alternative, preventing access to critical or confidential data. The DOE should adopt a policy that prioritizes one-way (uni-directional) communications, where possible, and identify applications that would benefit from such communications. HD Radio technology is well-positioned to serve as a vehicle for delivering secure, one-way communications to the nation's energy infrastructure.

[6] *Id.* at 3.

Another way to improve the security of communications with the energy grid is through message authentication, which is also a component of the HD Radio system. A 2016 report by the Mission Support Center at Idaho National Laboratory recognized that "[c]ommon and long-established ICS protocols such as Modbus and DNP3 used throughout the power system have little or no security measures: lacking authentication capabilities, messages may be intercepted, spoofed, or altered, potentially causing a dangerous event in an operations environment."[7] Messages delivered using HD Radio technology can be secured with multi-factor authentication, providing a greater degree of reliability than messages transmitted over public networks. This approach uses industry-standard cryptographic techniques to generate and transmit an authentication message embedded in the HD Radio broadcast transmission. HD Radio receivers can locally and independently generate the same message and compare it to the received message, authenticating the signal if they match. As a result, energy providers can have a high degree of confidence that communications delivered to the grid using HD Radio technology are genuine, significantly improving the security of the energy communications ecosystem.

B. HD Radio Technology Provides Redundancy and Reliability

Another primary benefit of using HD Radio technology to serve the communications needs of critical infrastructure is its redundancy and reliability. Because HD Radio broadcasting is built upon existing radio infrastructure, it is ubiquitous and extremely reliable.

While there is great excitement in the communications industry about 5G networks – and rightfully so – 5G is not a one-size-fits-all solution for the energy industry. As an initial matter, 5G technology remains in its infancy. The networks and infrastructure needed to support 5G services still need to be fully deployed. And while the economics may support an expeditious buildout of 5G facilities in high population density and urban locations, the infrastructure costs in suburban and rural areas may limit service rollout in those locations.

Furthermore, not all 5G is created equal. Carriers in the United States have delivered 5G in three flavors: low-, mid-, and high-band. Low- and mid-band 5G networks provide more desirable propagation, but at the expense of capacity and throughput. While each of the major carriers is planning to incorporate low- and mid-band 5G into its networks to increase coverage, services delivered over these frequencies cannot deliver the exemplary speed and capacity that is often associated with 5G. Those characteristics are unique to high-band, or millimeter wave networks, which are extremely limited today. As a result of distance and line-of-sight challenges, each cell

[7] *See* Mission Support Center, Idaho National Laboratory, *Cyber Threat and Vulnerability Analysis of the U.S. Electric Sector* at 13 (Aug. 2016), *available at* https://www.energy.gov/sites/prod/files/2017/01/f34/Cyber%20Threat%20and%20Vulnerability%20Analysis%20of%20the%20U.S.%20Electric%20Sector.pdf.

using millimeter wave covers only around 1km – 2km. And the signal propagation at those transmission frequencies can be significantly attenuated by foliage and atmospheric moisture. To increase robustness and quality of service, operators will need to reduce capacity to improve signal reliability. And given the number of sites required to provide millimeter wave service, each site may lack important features of a network supporting critical communications, such as extended backup capabilities and hardening that are common among radio facilities.

Because there is no perfect technology for data transmission that fulfills all of the energy industry's needs, a robust network for energy communications will incorporate a number of different technologies, including HD Radio broadcasting. Broadcast radio offers a number of benefits for delivery of critical communications including its ubiquity and its scalability. The Department should consider digital radio broadcasting both in a primary capacity and as a reliable backup configuration and control service.

Not only is HD Radio technology widely available, with more than 2,300 radio stations in the United States covering almost 93% of the U.S. population, but it is also easily scalable. Radio enables a one-to-many transmission service with no point-to-point links or connections. As a result, a broadcast from a radio station can deliver the same content to a single device or a million individual devices with no delay, no additional bandwidth, no additional infrastructure costs, and without reducing service quality. This makes HD Radio broadcasting an ideal platform for delivering real time data to different points on the grid.

Even in circumstances where another form of communications may be more appropriate in the first instance, digital radio provides an effective backup service. HD Radio services are available in most places where energy facilities are located – whether urban or rural, densely or sparsely populated. And stations using HD Radio technology are extremely robust and not susceptible to conditions that can disrupt other forms of communication, including most weather events, power outages, and line cutting. Digital radio data services can also provide a back-haul service to offload some of the cellular capacity to distribute content to energy distribution sites.

Given the robustness and ubiquity of digital radio broadcasting, it should be an integral part of any system for communications with and among the energy grid.

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III. RECOMMENDATIONS

In developing its strategy to address the security of the U.S. energy sector, it is imperative that the Department conduct a comprehensive analysis of communications issues and potential vulnerabilities. As part of that analysis:

1. The Department Should Consider Redundancy and Reliability in Communications and Messaging Services. HD Radio technology provides a solution for delivering messages to the nation's energy grid that is widely available, secure, and robust. As a result, digital broadcasting is well-suited to serve as a primary and/or backup method of communications for the energy industry.

2. The Department Should Consider Funding and Support for Local or Regional Testing of Various Communications Services, Including Broadcast Digital FM Radio. Given the increasing importance of communications services to the nation's energy infrastructure, the Federal government should actively support efforts to evaluate different communications services and assess their suitability for various applications. The DOE's efforts should include testing HD Radio technology as a method for delivering secure messages to energy facilities.

3. The Department Should Issue Reports on Various Communications Technologies for the Energy Grid. Xperi supports DOE activities to draft reports outlining the landscape of various technologies with analysis of benefits and drawbacks. The Department's guidance will help influence purchasing decisions by electric utilities and, in particular, provide valuable information about the effectiveness of different communications technologies for different applications and the design of a resilient communications network with adequate redundancies.

4. The Department Should Continue to Engage with Stakeholders, Including Xperi. Xperi stands ready to offer technical support to the DOE and to participate in future Department discussions and investigations on the security of the communications networks supporting the nation's electric grid.

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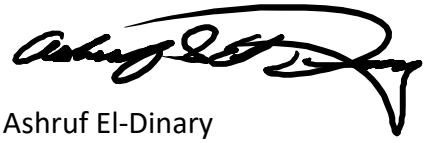
Xperi appreciates the opportunity to contribute to the Department's inquiry and to inform the DOE about the role digital radio broadcasting can play in securing nation's energy supply. Xperi views this as the beginning of a dialogue and looks forward to participating in future discussions and efforts with the department and related stakeholders.

Sincerely,



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