Analog Devices, Inc. (ADI) has been closely following the Ofcom process regarding the release of the 870-876/915-921MHz band, and we are pleased to have the opportunity to respond to this latest consultation. ADI provided a response to the March 2013 questionnaire, and we support Ofcom's efforts. We have, additionally, been following the CEPT process and note the recent positive news that the WGFM has approved the designation of 870-876 MHz and 915-921 MHz for Short Range Devices (SRD)s and RFID on the basis of the ECC Report 200 (spectrum compatibility study) and ECC Report 189 (spectrum management solution). Analog Devices applauds this announcement and supports CEPT's efforts, as well.

This proposed spectrum release is a vital proposal that should extend metering networks and help manifest key application spaces in Europe, especially the Internet of Things (IoT) and Machine-to-Machine communications (M2M) receiving critical attention in several publicly announced company business plans and standards organizations (like ETSI, IEEE, and TIA). The IoT and M2M appear poised to be economically and socially instrumental over the next several years, with the Smart Grid representing an important interdependent element in their ecosystems.

License-free spectrum, which provides for higher transmit power and faster data rates, has seen considerable success in other areas of the world, for example the US, Australia, and Japan. It is a strong and viable schema that, with open standards specifications, like 802.15.4, ANSI/TIA-4957, and TS 102 887, will allow multi-millions of IoT and M2M devices to interoperate. Utilities, specifically, have chosen subGHz wireless mesh as their primary communications options for the Smart Grid, as long range is a critical requirement for Smart Grid applications. In addition, this new spectrum could, indeed, be the motivating force behind bringing IP-enabled, secure standards to Europe for gas, water, and heat metering systems.

If analogous to the highly successful 902-928MHz license free spectrum in the US, the value of this new band would be substantial, especially for metering applications where range and coverage are vital. The 868MHz band, while offering some spectra at 500mW, is simply challenged, offering fragmented bandwidth and insufficient system-level duty cycle allowance for effective interference management. Thus, many European gas, water, and heat metering companies are clamoring to solve range and coverage issues by moving from the 868MHz and also from the popular, but range-challenged, 2.4GHz band to subGHz frequencies like 169MHz and 433MHz. These spectra, though, bring other implementation issues that are increasing the cost and limiting the capabilities of these systems. As an example, 169MHz receivers must, in relatively narrow bandwidth, resolve the issue of a higher noise floor accumulated from such elements as FM radio harmonics and, additionally, use higher transmit power to compensate for the antenna loss attributed to lower frequency, form-factor-restricted designs. Both of these constraints force a need for higher, and, hence, more costly battery capacity. In contrast, the proposed spectrum provides the bandwidth and transmit powers required to secure a very good balance between the benefits and weaknesses of the 2.4GHz (i.e. high bandwidth, low transmit power, and short range) and 169MHz (i.e. low bandwidth, large antenna, high range) bands.

The 870-876/915-921MHz band is a technically valid and balanced solution that can be successfully deployed to address the challenges faced by many applications; addressing link margin from the transmit

side and providing the receiver with sufficient and contiguous bandwidth to use interference avoidance techniques, many which can be placed in the higher layers of the protocol.

Furthermore, semiconductor manufacturers have greatly improved short range device (SRD) radio parameters. Receiver sensitivity has continuously improved with new processes and architectures. Also, blocking performance has improved, preambles can be shortened, and clear channel assessment (CCA) has been specified as an option for this new spectrum. These improvements and methods will inherently improve spectral efficiency and clarity. Additionally, features like Gaussian filtering, higher performance voltage controlled oscillators (VCO)s, and automatic power control (APC) can provide cleaner and more efficient transmitters.

Successful M2M and IoT deployments will rely on low density Network Relay Point (NRP)s placed with purpose in the network ecosystem. These AC-powered relay points can fortuitously accept the burden of higher duty cycles to provide freedom, value, and critical power savings options to their higher density, and likely battery-operated, associated endpoints. In addition, while APC, where the protocol is inclusive, at these battery-operated endpoints typically supports a primary objective of power dissipation management, the 20dB APC recommendation for the NRP is a contrasting, but consistent, analogous scheme which will provide a strong mechanism for system-level interference mitigation.

The recommendation for individual license requirements in Annex 6, A6.6 of the "Consultation on 870 to 876 MHz and 915 to 921 MHz Technical Proposals" dated December 18, 2013 provides the necessary allowance for NRPs to transmit up to 500mW with duty cycles up to 10%. Analog Devices strongly condones this recommendation. The listed 10% duty cycle will provide a strong framework to support the higher volume networks that the data-driven, and often form-factor-limited, M2M and IoT will mandate. These markets will be presented with coverage and connectivity challenges that can only be addressed with technical innovation like coding and error correction schemes. With data rates constrained to inhabit relatively narrow bands, for a multitude of reasons, maintenance of acceptable levels of future-proofing within ever expanding security requirements will force solutions to inevitably require longer packet lengths. This, in high volume aggregate, will challenge any stringent duty cycle limitations at a Network Relay Point.

In conclusion, Analog Devices supports Ofcom's proposal to release the license-exempt 870-876/915-921MHz spectrum per CEPT access guidelines. The new spectrum should best ensure strong economic benefits which result when customer application needs, here, those of metering systems, are satisfactorily addressed: long range and coverage while balancing cost-associated design constraints such as antenna size, bandwidth, and transmit power. Analog Devices favors system-level innovation, and duty cycle is a critical transmission parameter that can be effectively managed at the system level to ensure maximum effectiveness for next-generation high volume applications, like the IoT and M2M. Therefore, ADI recommends that Ofcom provide a means for light licensing of select NRPs with provision up to 10% duty cycle. We believe that addressing difficult challenges faced by network ecosystems in this newly released spectrum via technical creativity and methods, like APC and CCA, is a consistent approach to those advanced by existing successful deployments.