Before the

FEDERAL COMMUNICATIONS COMMISSION

Washington, D.C. 20554

In the Matter of	)	
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INQUIRY REGARDING CARRIER CURRENT SYSTEMS, INCLUDING BROADBAND OVER POWER LINE SYSTEMS	))))	ET Docket No. 03-104

To: The Commission

COMMENTS OF QUANTUM MAGNETICS, AN INVISION TECHOLOGIES COMPANY

Quantum Magnetics (QM), a company engaged in the research and development of explosive detection technologies using Nuclear Quadrupole Resonance (NQR) applicable to aviation security and land mine detection, hereby respectfully submits its comments in response to the *Notice of Inquiry* (the Notice), FCC 03-100, released April 28, 2003, 68 Fed. Reg. 28182; *corrected* 68 Fed. Reg. 32720. The Notice requests information on the current state of Broadband Power Line (BPL) technology. These comments are timely filed. For its comments, QM states as follows.

I. Introduction

1. QM's interest in this proceeding is related only to the interference potential of BPL to QM's NQR detection systems for aviation security and landmine detection. This is a matter of concern for national security, as NQR offers capabilities that are not matched by other explosives detection technologies. The following comments do not address the utility of BPL as a competitive broadband delivery mechanism.

2. NQR makes use of the transitions between the energy levels defined by the interaction between the quadrupole moment of certain nuclei and the electric field

gradients present in the crystalline lattice containing quadrupolar nuclei. Nitrogen-14 (^{14}N) is an example of a quadrupolar nucleus and is present in most explosives. In the case of ^{14}N, the frequencies associated with the transitions typically fall between 400 kHz and 6 MHz (frequencies most commonly used at QM are 742, 842, 890 and 3,410 kHz). The signals associated with these transitions are extremely weak and considerable effort is put into the design and construction of the NQR apparatus to minimize unwanted noise, one source of which is noise received by the detection coil. The frequencies used are a function of the compounds of interest *and it is not possible* to shift the operating frequency to avoid intereference.

3. The NQR systems intended for screening baggage make use of extensive shielding to reduce external noise pickup, although the shielding is not totally effective due to the need of being able to rapidly transfer baggage in and out of the sensitive volume. An equivalent to improved shielding effectiveness can be achieved by using the interference reduction technique described in the next chapter.

4. It is not possible to use an external shield on the NQR systems intended for landmine detection and it was necessary to develop a Radio Frequency Interference Mitigation (RFIM) subsystem. The RFIM consists of a receiver array that is independent of the main detection coil and works by subtracting the signals detected in the separate receive channel from the signal as received by the detection channel. The system is *very* effective in mitigating signals from medium wave broadcast stations, mainly due to the sources being few in number and relatively coherent. QM personnel estimate that the RFIM technology can tolerate a distributed and incoherent noise source about 10 dB

higher than ambient noise levels produced by atmospheric, ionospheric and galactic noise sources for the 3.41 MHz frequency.

5. QM is concerned that the wide scale adoption of BPL will create a distributed and incoherent interference that cannot be mitigated by any RFIM technology. We do not expect that US armed forces will looking for live landmines on US soil, however we do expect that the armed forces will need training in the use of the landmine detection equipment and the presence of BPL interference will lessen the effectiveness of that training. QM is also concerned about the effects of BPL interference on the performance of the NQR systems used for aviation security.

II. Discussion

6. In the paper[1] submitted to the Commission by Ed Hare of the ARRL, the calculated received signal level (RSL) at a 30 meter distance from a power line carrying BPL signals was 43 dB relative to ambient at 3.5 MHz which is close to the 3.41 MHz line used at QM. This translates into an interference level of 10 dB above ambient at a distance of 1.4 km from the power line in question. The BPL signals will need to be regenerated at intervals of 500 to 600 meters and the multiple sources will have the potential of either further raising the received noise or conversely increasing the distance at which the noise falls to tolerable levels.

6. QM has several projects involving the use of Nuclear Magnetic Resonance (NMR) for non-destructive evaluation (NDE). Unlike NQR, NMR allows considerably more flexibility in the choice of operating frequency to avoid interference (e.g. avoiding operating in a broadcast band or amateur radio band). Unfortunately, the wide band used

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[1] Hare, Ed "Calculated Levels from Broadband Over Power Line Systems and their Impact on Amateur Radio Communication Circuits" ARRL, submitted to the Commission on July 7, 2003.

by the proposed BPL systems will make it difficult if not impossible to choose a frequency not subject to interference.

III. Conclusion

7. QM considers the widespread adoption of BPL, in particular Access BPL, with the existing Part 15 limits on interference, to be detrimental in the application of NQR technologies for the furtherance of national security.

Respectfully submitted,

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