

*a) The complete program of research and experimentation proposed including description of equipment and theory of operation.*

The research program is to study the feasibility of and user interaction with a passive non-volatile memory chip, in the context of entertainment and gaming. The chip has a high rate wireless interface operating in the 2.4GHz frequency band and derives its power during a communication session from a reader/writer unit. The range of operation is expected to be up to 2mm with a maximum RF power level of 0.5W.

The reader/writer unit will be custom hardware, comprising a digital circuit with a processor to run a communications protocol and an RF circuit with a modem to provide the power and data transfer. The RF circuit is also connected to a simple antenna, for example a loop printed on a substrate of FR4. Data transmission to the chip will use low modulation index AM (~15%); reading data from the chip will use a variable matching technique, such that some of the RF signal that provides the chip with power is reflected with a phase that is dependent on the data that the chip is sending. This reflected signal can be separated from the transmitted signal by using a directional coupler, then downconverted and demodulated to recover the data. It is intended that a complete communication session with the chip will only last for a maximum of a few seconds, so the RF signal will not always be on.

Experiments will be conducted to evaluate how well or easily a user can read or write to the memory in a test chip under a range of different usage scenarios related to entertainment and gaming. The results of these experiments will be used to make improvements to the underlying communications system (for example, including error correction coding) and will also inform the user interface design (for example, include sound effects to convey to a user exactly what is happening).

*b) The specific objectives sought to be accomplished.*

The specific objectives of the program of experimentation are:

1. To see how a high speed, high capacity wireless memory chip can find applications in the entertainment and gaming industry.
2. To evaluate the reliability of the data link and develop a suitable communications protocol.
3. To gather observations of how the memory chip reader/writer unit is used and develop its user interface for clear, unambiguous operation.

*c) How the program of experimentation has a reasonable promise of contribution to the development, extension, expansion or utilization of the radio art, or is along a line not already investigated.*

The outcome of the program of research and experimentation will be an extension of the RFID concept (a passive chip that receives power from the reader-writer unit whilst communicating) to encompass much higher data rates and possibly enhanced functionality. It will also push the RFID concept from a mainly business and industry focus into the consumer domain.