BER PERFORMANCE COMPARISON IN DEMODULATED SCHEMES BASED ON BACKSCATTER ANALYSIS OF PIGGYBACK MODULATION FOR PASSIVE UHF RFID TAGS

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Abstract- Inspired by state of the Backscatter modulation piggyback modulation, basics of the backscatter from a passive tag 16-QAM demodulation is proposed to reduce the interferences between two independent data streams and improve the bit error rate are addressed. We present the same symbol error rate, 16-QAM modulation requires lesser signal to noise ratio, when compared with 16PSK modulation. The bit error rate (BER) performance would be improved if the demodulation is performed by taking both amplitude and phase into account. Comparison of experimental and theoretical result, demodulation analysis for the ASK, PSK and 16-QAM are presented. Conformed bit error probability for QPSK modulation in Gaussian Environment is offered.

Keywords- Piggyback Modulation, Backscatter Modulation Uhf Rfid, Sensor, Backscattering, Vector Signal Analysis, ASK,PSK, 16-QAM, QPSK.

I. INTRODUCTION

Radio-Frequency Identification (RFID) systems have begun to find abundant use in automatic identification applications. RFID systems consist of Radio Frequency (RF) tags, or transponders, and RF tag readers, or transceivers. The transponders themselves constraint of integrated circuits connected to an antenna. The aim of this paper is to study precisely the characteristics of RF signals involved during a RFID communication. Recently it’s become popular in many application and used for many services such as manufacturing, security, supply chain, military surveillance and tracking make it as most promising and emerging technology.

A typical RFID system comprises few interrogators (readers) and many tags also called labels. Interrogator is similar to radar, but as far as tag is consider it’s the part of RFID’s. RFID can work in short as well as long distances (e.g. it has replaced the present bar code system).

In this paper the BER performance is improved. Comparison of experimental and theoretical results of PSK and QPSK.

II. PIGGYBACK MODULATION

In a passive tag, ASIC (application specific integrated circuit) of the tag switches its input impedance between two states to modulate the RCS (radar cross section) of the tag antenna. This technique uses the same principle, the voltage controlled sensor coupling module manipulates the RCS by varying the effective input impedance of the tag antenna.
III. VECTOR BACKSCATTERED SIGNAL

To describe the backscattered signals in both amplitude and phase the vector backscattered signal is used. In the passive tags, either the ASK or the phase shift keying (PSK) is selected to modulate the backscattered wave, as the Gen2 standard readers are regulated by the EPCglobal UHF Class-1 Generation-2 air interface protocol to perform demodulation for both of these two formats.

To thoroughly demodulate signals backscattered from tags that adopt PSK or ASK modulation, only the amplitude or phase is detected, while the other one is discarded. The bit error rate (BER) performance would be improved if the demodulation is performed, but we have to consider both amplitude and phase into account. On this basis a quadrature amplitude modulation (QAM) backscatter method is proposed to reduce the BER, transmit more bits per symbol, and use the bandwidth more effectively.

Compared with the conventional ASK demodulation scheme for signal detection, employing 16-QAM demodulation for the vector backscattered signal reduces the interferences between two independent data streams and improves the BER (bit error rate). For 16-PSK we have the Vector backscattered signal with piggyback modulation in states at a receiving reader.

![Figure 3. Distance between constellation points](image)

We have to derive the symbol error rate, for this we need to find the probability that the phase of the received symbol lies within this boundary defined by the magenta lines i.e. from $-\pi/M$ to $+\pi/M$.

We make the following assumptions:
(a) The signal to noise ratio is high: The real part of the received symbol is not affected by noise for high SNR.
(b) The value of $M$ is probably high: This result the constellation point to be closely spread.

Given the above two assumptions, it can be observed that the symbol $s_0$ will be decoded incorrectly.

The symbol will be in error, if at least one of the symbols gets decoded incorrectly.

IV. MEASUREMENT SETUP AND ANALYSIS

To confront all different vectors, the tag ASIC needs to be awakened by receiving a Gen2 standard forward link signal, as these constraint the request commands. In the earlier setup, a reader is used to awake and communicate with a tag attached with the sensor.

In the earlier setup, a reader is used to awake and communicate with a tag attached with the sensor. Which is also coupled to module and an antenna of the vector signal analyzer we call it as (VSA) system, it main work comprises is to receives both of the forward link and return link signals.

![Figure 4. Schematic diagram of the measurement setup](image)

The measurement setup is thus shown is modified and the schematic diagram is indicated in Fig.4. The key improvements are listed below:
(a) Forward link signal is generated by a vector signal generator to awake the tags.
(b) The carrier frequency is controllable and fixed to a 915 MHz.
(c) The isolation between the VSA and the RFID readerSystem is something near to 25 dB which is taken by the reflection coefficient of the antenna.

V. DEMODULATION SCHEME ANALYSIS

We present three demodulation schemes: the split two-level ASK demodulation, the four-level ASK demodulation, and the 16-QAM demodulation. The signal detection will be comes in individually for the ASIC and the sensor data stream. On performing the ASIC signal demodulation the sensor signal is treated as noise as the threshold is set to distinguish “high” and “low”. Thus the Bit Error Rate of the ASIC data stream is dramatically deteriorated when increasing frequency or amplitude of the piggybacking signal shown in [4], besides, a low pass filter is needed to recovery the waveform of the sensor signal, which normally has lower bit rate, before the demodulation.
Consider a general M-PSK modulation, where the alphabets are defined as:
\[ \text{Alpha}_{16PSK} = \sqrt{E_s} \{ e^{j2\pi/M}, e^{j4\pi/M}, \ldots, e^{j2\pi(M-1)/M} \} \]
Symbol on the real axis
\[ S = \sqrt{E_s} \]
The received symbol
\[ Y = \sqrt{E_s} + n \]
The total probability of error is given when \( S0 \) was transmitted as
\[ P[e/S0] = \text{erfc}\left( \sqrt{E_s/N_0 \sin(\pi/M)} \right) \]
The symbol will be in error, if at least one of the symbol gets decoded incorrectly. Hence the total symbol error rate from M-PSK modulation is
\[ P_e,MPSK = \text{erfc}\left( \sqrt{E_s/N_0 \sin(\pi/M)} \right) \]
As can be seen from the figure above, the transmitted symbol gets spreaded on the addition of noise. Although, if the received symbol is present within the boundary shown the magenta lines, then the symbol will be demodulated correctly.

The constellation plot shows that, for a 16PSK modulation.
Typical digital modulation schemes, like 16-QAM, have all the symbols located around the origin of the constellation diagram while the backscattering modulation pulls the symbols far from the origin reason as because its nature makes the strength of the return link signal diminutive compared with the leakage forward link signal. Therefore, the backscattering modulation requires much higher SNR than other digital modulation schemes to acquire the same BER performance.

We got many result of Symbol error probability curve as the decrease of the BER and SER on increase of SNR in PSK and QPSK for theoretical and practical values.

**CONCLUSION**

16-QAM demodulation is proposed to reduce the interferences between two independent data streams and improve the bit error rate are addressed. Symbol error probability curve for PSK, QPSK in accordance with theory and simulation is addressed. We presented that the same symbol error rate, 16-QAM modulation requires lesser signal to noise ratio, when compared with 16PSK modulation. As shown the bit error rate (BER) performance would be improved if the demodulation is performed by taking both amplitude and phase into account.

**REFERENCES**


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