Improving the quality of MIMO technologies of perspective communication channels when using polarized orthogonal data

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Abstract. *In this article was derived method of finding the field components of the antenna signal and background noise, or processing in antenna with full polarization receiver. This will result to increase of bit rate of MIMO system on the basis of the use of polarization properties of signals, in the case of a real product. MIMO technology with orthogonal polarizing channels additional provides increase signal to noise ratio and therefore increase in bit rate in wireless net*

Keywords: *Wi-Fi, MIMO, mixed polarization, orthogonal data coding.*

I. INTRODUCTION

MIMO technology with orthogonal polarizing channels additional provides increase signal to noise ratio and therefore increase in bit rate in wireless [1].

MIMO is an important part of modern wireless communication standards such as IEEE 802.11n, ac (Wi-Fi), 4G, 3GPP Long Term Evolution, WiMAX.

II. PROBLEM SOLUTION AND RESULTS

The signal on the receiving party is recorded as follows:

$$X = H \cdot S + Z\,, \tag{1}$$

where S – matrix of transmitted signals; Z – matrix of a self-noise of the receiving elements of the antenna; X – matrix of the received signals; H – transformer matrix of the signals.

Most the simple and widespread matrix H is the Allamouti matrix.

Real antennae in MIMO technology can be represent like two input (top) and one output (bottom) antennae and this antennae can use at orthogonal polarization for better signal to noise ratio (SNR).

Its explain result of analysis differences of signal and noise polarizing parameters. Polarization is spatial - temporal characteristics of electromagnetic waves, it notes the spatial pattern of targeting vector voltage electric or magnetic field over the rotor vibration.

For homogeneous plane wave vector voltage electric and magnetic fields lie in the plane perpendicular to the direction of wave motion. Depending on whether parameters change (angle of orientation - β and angle of ellipse α) with the influence of polarization diagrams at time or remain constant, electromagnetic waves are divided into three groups: 1- completely polarized (polarization factor m=1); 2 - partially polarized (0<m<1); 3 – neutral or chaotic (m=0).

Consider the wave of elliptical polarization in the free linear basis and Ex, Ey orthogonal projection of the electric field vector E in the complex form. Represent wave in matrix form.

$$\vec{E_w}(t) = \begin{pmatrix} E_x(t) & E_y(t) \end{pmatrix}' \tag{2}$$

Polarization ellipse is defined by its shape (α), orientation axis (β) relative coordinate system selected and direction of rotation vector of the ellipse. The total form of wave is next

$$\vec{E_W}(t) = \begin{pmatrix} cos(\beta) & sin(\beta) \\ -sin(\beta) & cos(\beta) \end{pmatrix} \cdot \begin{pmatrix} cos(\alpha) & -j\,sin(\alpha) \\ -j\,sin(\alpha) & cos(\alpha) \end{pmatrix} \cdot \begin{pmatrix} E_0 \\ 0 \end{pmatrix} \cdot exp\{j(\omega \cdot t + \varphi_0)\} \tag{3}$$

Difference of polarization parameters between antennae and real signal described by loss of energy fact

$$P_{loss} = \cos^{-1}\left(\vec{E_S}, \quad \vec{E}\,in \right). \tag{4}$$

The dependence of throughput on SNR and given polarization losses for real conditions was calculated on the basis of the Shannon formula.

The results of the comparison of the real experiment of Alamouti / MRC algorithms with 2x2 multiplexing without antennas of orthogonal polarization indicate the following. We find that BER is close to 0.01 with a SNR of 10 dB for spatial multiplexing - QPSK and ML receiver (maximum likelihood).

Actual transmitted signal characterized by the parameters of the polarization ellipse - the angle of ellipticity and orientation angle of semi-major axis of the ellipse. Then, omitting the factors - angular frequency, attenuation and range, the vector of the electric field near a transmitting antenna can represented in the form of the polarization vector of the emitted signal

III. CONCLUSIONS

The result of the experiment means that the BR is better without loss of energy when the antennas are fully polarized. If BR is 11 MB / s with 10 dB SNR in real time and energy loss at 6 dB, then BR is 20 MB / s with 10 dB SNR and without energy loss due to polarization.

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