MIMO Based Advanced Transmission in DVB-T2

K. Aparna[1], R. Divya Bharathi[2]

[1]Assistant Professor ECE Department, JNTUACEP, Pulivendula, Kadapa, Andhra Pradesh, India

[2]PG Scholar, ECE Department, JNTUACEP, Pulivendula, Kadapa, Andhra Pradesh, India

Abstract: *In this paper, to estimate a Carrier Frequency Offsets in DVB-T2 a special preamble symbol named the P1 symbol was defined, which is kept at the beginning if every T2-frame. Thus, in order to obtain the estimates of multiple CFOs in DVB-T2, two transmitters should send P1 symbols (preambles) alternately in presence of two time slots. In other words it can be expressed as, transmitter one sends a symbol p1 and estimates its own carrier frequency offsets during the decoding process, while the other one is set as zero i.e.p1 symbol as null. However this decreases the levels of data rates and is also practically infeasible for application of current running systems. So, the demand and customer interest to combat multiple CFOs MIMO modes for DVB-T2 application. The proposed method is MIMO based DVB-T2 in which the comparison of MSE performance of joint ML estimator, where the P1 symbol is exploited as a pilot symbol with MISO system is considered.*

Key words: DVB-T2, MISO, Carrier frequency offsets, MIMO.

1. Introduction

DVB-T2, is the next generation digital broadcasting system, it is advanced generation of the DVB proposal for digital terrestrial TV, has been recently proposed by DVB project [1] as an evolution of DVB-T when the shutdown of analog television process will be finished. In order to give a newer technical response to the necessity of the digital dividend, that is the process by which some free frequencies at UHF used by analog TV will be assigned to different services (3G/4G), DVB-T2 will improve frequency efficiency to provide multicast in HD with the same 8 MHz channel. As DVB-T, DVB-T2 expects to be received in plugged TV terminals, in mobile environment or with unplugged terminals in indoor or in low speed (pedestrian) environments, so a MISO scheme has been included, transmitting with a distributed Almouti block code. However, in order to go further a full MIMO scheme is proposed in this paper, which may be similar to the one that will be included in NGH (second generation of DVB-H) in the next future, obtaining a very efficient performance in high Doppler environments for terminals (unplugged or not) operating in high speed vehicles.

Increasing the demand in MIMO (Multiple-Input-Multiple-output) systems has given to raise a prolific research activity in this topic in Recent years. Several aspects have been studied, including both theoretical and Practical issues. So far much effort has been put in the study and design of coding schemes for MIMO systems, taking into account different considerations such as some knowledge (full, partial or none) of Channel information at the transmitter or the type of scenario. Another point of view is the design of the antenna array and its configuration, since the MIMO systems performances depend on three aspects: antenna array, channel characteristics and coding. The pioneer works [2], [3] show an increase in the data bit rate and an enhancement of quality of signal at the receiver. Many works can be found in the literature for the channel propagation characteristics and signal processing in MIMO [4]-[7]. On the other hand, DVB-T2 is expected to provide higher efficiencies in frequency than the nowadays DVB standard DVB-T.

DVB-T2 proposal considers the inclusion of MISO technology but not MIMO. MIMO will be considered in future revisions and it could provide a further increment of frequency efficiency mainly in harsh scenarios such as strong multipath environments or highly Doppler radio channels. Nowadays, few works employing multiple antennas at each side of the radio link for either DVB-T or DVB-T2 can be found in the literature. There are barely some research works carried out by BBC [8]—[10], as pioneer researchers using MIMO with DVB-T. In order to evaluate the performances of a DVB-T2 system in realistic scenarios, the use of a real platform is of great interest, since it enables to include several aspects that are not usually addressed in theoretical studies or simulations, such as the effect of different antennas or scenarios [11]. In this contribution, a novel 2x2 MIMO tested for DVB-T2 has been designed and implemented in order to test the enhancements obtained by the using many antennas at transmitter and receiver side for UHF band, particularly at frequency of 594 MHz Moreover, MIMO measurements have been carried out by employing polarization diversity, since there are few works in the literature related to the use of polarization diversity for UHF and DVB-T [12]-[14]. Apart from that, for the future use of MIMO with DVB-T2, a new scheme for channel estimation has been proposed in this paper, which has been tested by the corresponding simulations and finally, with measurements.

2. MIMO

Advanced diversity techniques called as MIMO systems and techniques. There are many researches had been made on MIMO-OFDM WLAN products based on IEEE 802.11n standard are available already. The wireless MAN standard IEEE 802.16 is called as Mobile also includes MIMO features. Fixed Mobile services are being offered by hole worldwide. Mobile networks based on 802.16 are also being deployed while 802.16m is in under development [15] IEEE 802.20 mobile broadband wireless access (MBWA) standard is also being contrived which will provide the complete support for mobility including the high speed mobile user's egg: on train users. For the other like applications are

cellular mobile communications which supports both data traffic and voice, MIMO systems are yet to be distributed. However, the 3GPP's long term evolution (LTE) is directly below and adopts MIMO OFDM, orthogonal frequency division multiplexing access (OFDMA) and single-carrier frequency-division multiple access (SC-FDMA) transmission schemes. The forward sections explain a more detailed discussion of the various technical aspects of these standards and technologies.

3. System Design Model For DVB-T2 MIMO

In MIMO based DVB-T2 we use the input as an Almouti OFDM symbols.The diagram shown below represents the model of a T2 system. The given input to the preprocessor is indicated by TS or GS, these are standards for one or more MPEG-2 Transport streams and also generic streams. From the fig1 we can represent that the Input Preprocessor is not a part of T2 system, but it have the service splitters or de-multiplexers for separating services of the transport streams into input system for the T3.All these are passed into a PLP layer (Physical Layer Pipes).the total data capacity of one input T2 frame over its should not exceed the available data capacity of T2.
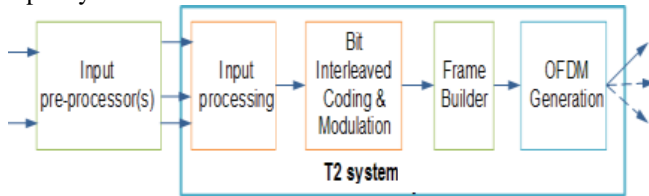

Figure 1: DVB-T2 Architecture block diagram

The main function of the Almouti sub-block here is to encode the analog signal with respect to Almouti space time block code. This work will do on the OFDM cells. Since the block sends the output of two we can say that the data output should be twice the data input size. In the first time slot, transmitter0 (TX0) sends output s0 and the transmitter1 (TX1) sends the output s1.in the time slot 2 TX0 sends output as - s1* and TX1 s0*. Here, * denotes the conjugate complex. The Almouti scheme is a full date rate transmission as one unique symbol in each slot.
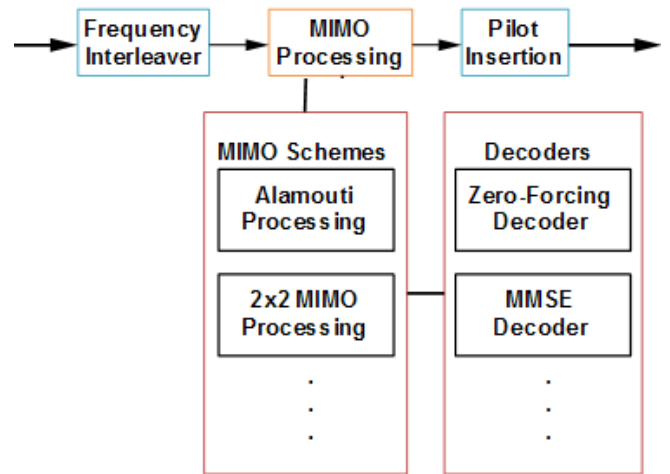

Figure 2: Block of MIMO Processing Unit

The signals are travelling through the h0 and h1 channel without to the receiver. The signals two must have the correlation less than 0.7 and roughly equal to the transmit power in order to provide diversity gain.

The functioning of MIMO receiver is separates the signals received from the transmitting antennas using signatures of the spatial signal [16]. The receiving antenna always receive the signals in combined form, both signals sent from the transmitted section should be de-correlated in determined to get the archetype signal. Here, we are mentioned to see the unlike types of receiver-models and their characteristics. They are called as zero forcing receivers, V-BLAST receiver and maximum likelihood receivers.

A. Zero Forcing Receivers
These receivers are also called as a linear de-corrector. Here the architecture of the receiver is simple and it gains the knowledge from the channel matrix, using this we can estimate the received signal.

B. Minimum Mean-Square Error

Receiver
Minimum mean square error also helps in dividing the co-channel.it does the impact created by co-channel interference and noise introduced in the received signal.

C. V-Blast Receivers
V-BLAST is abbreviated as Vertical Bell lab space time architecture. It works by enhancing the computational complexity of the receiver comparatively to the minimum mean square receiver and zero forcing receivers. But at the similar it provides a signal separation and capability of tolerance towards noise. It works by separating the signals repeatedly by order strength and finally all are have been detected and separated it reconstructs the signals.
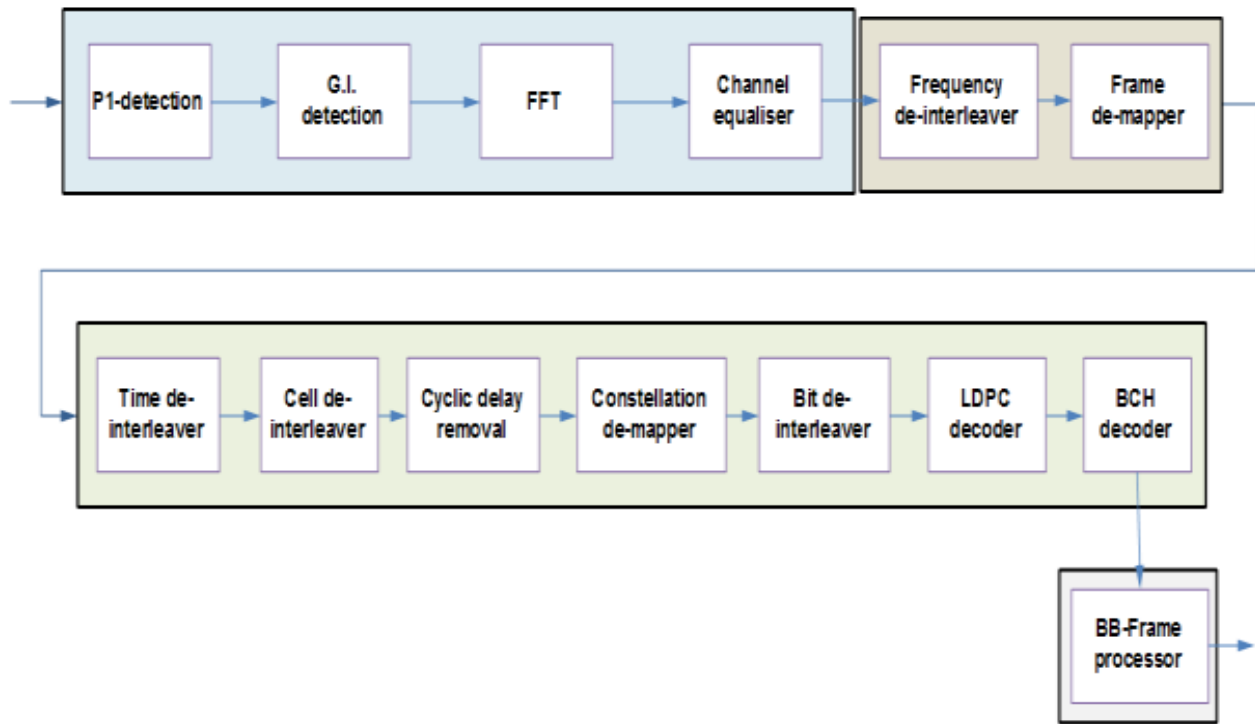
Figure 3: DVB-T2 Demodulator

It is mainly about the consumer or user receivers whose main function is to decode and produce an output which combines the Transport stream carried by PLP and its common interface. Certain parts belonging to the receiver gibes directly to the any blocks or boasts in the quondam modulator and other part such as synchronization does not play any counterpart with the receiver.

4. Simulation Results

We now present numerical results to illustrate the effectiveness of the proposed iterative receiver for DVB-T2 systems with multiple CFOs. The performance is evaluated via a full DVB-T2 simulator with the parameters that are summarized in Table I. the parameters basically fallow the DVB-T2 standard and modulation of 16-QAM is adopted to evaluate the trends of the BER performance according to the various multiple CFOs. For the channel model, the MISO channel described in the implementation guidelines [2, p.196] adopted, which are generally used to describe portable indoor and outdoor reception conditions. We assume that the fading channel is a semi-static fading channel, i.e., the channel taps not change during one T2-frame, and vary independently from one T2-frame to another. To achieve better estimation performance, the soft estimates of the first P2 symbol, which is modulated by QPSK, are employed for the joint ML estimation.
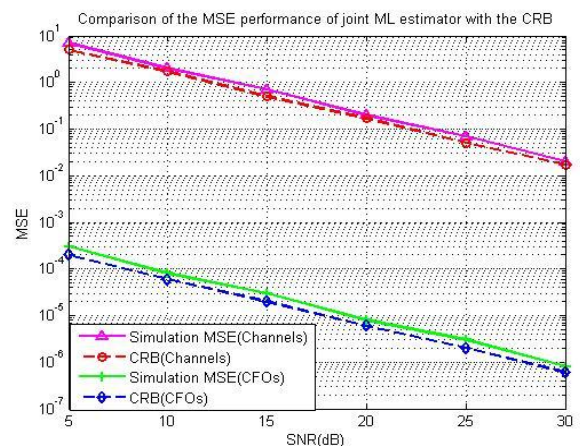

Figure 3.1: Comparison of the MSE performance of joint ML estimator with the CRB.

Fig. 3.1 shows the MSE performance of joint ML estimator, where the P1 symbol is exploited as a pilot symbol.

Figure 3.2 BER performance of the proposed iterative receiver in the presence of multiple CFOs.

In Fig. 3.2, The BER performance of the proposed iterative receiver with different numbers of iterations is given in case of

Paper ID: SUB152018

493
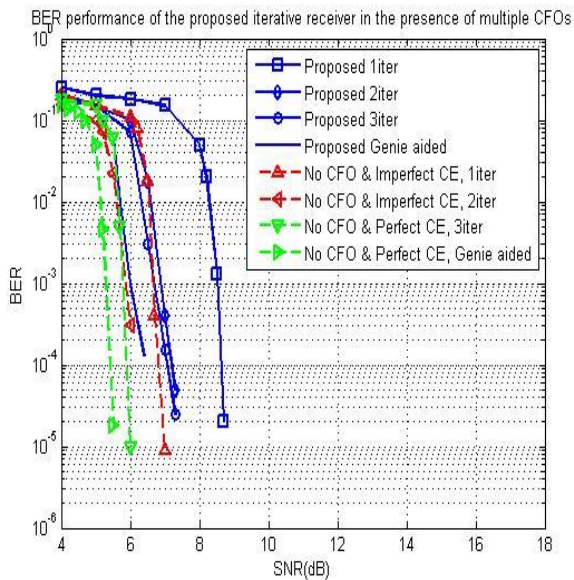
Multiple CFOs $f(1)f = −0.1$ and $f(2)f = 0.1$. For reference, the performance in the ideal case of CFOs-free under perfect and imperfect channel estimation (CE) is plotted by using the first and genie-aided iterations.
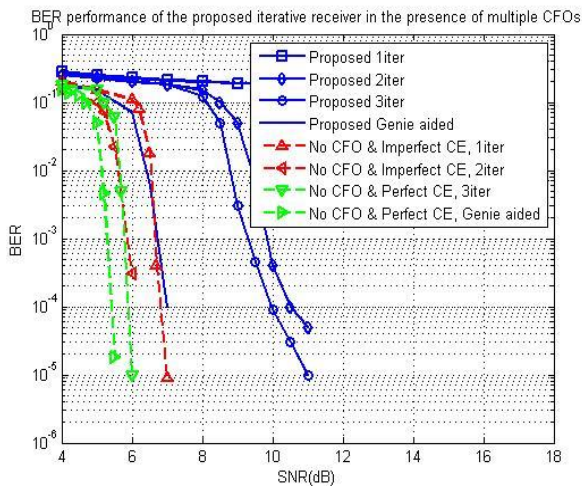

Figure 3.3: shows the BER performance of the appraised proposed iterative receiver in the presence of multiple CFOs.

In Fig. 3.3, shows the BER performance of the appraised receivers in the case of multiple CFOs $f(1)f = −0.2$ and $f(2)$ $f = 0.2$, which has relatively larger multiple CFOs than the previous case. It is observed that the proposed iterative receiver provides very poor performance at the first iteration. Even with three iterations, the performance on BER is still bad. This can be described as the fact that the increased ICI due to the large multiple CFOs cause irrecoverable loss during both the initial channel estimation and the data detection.
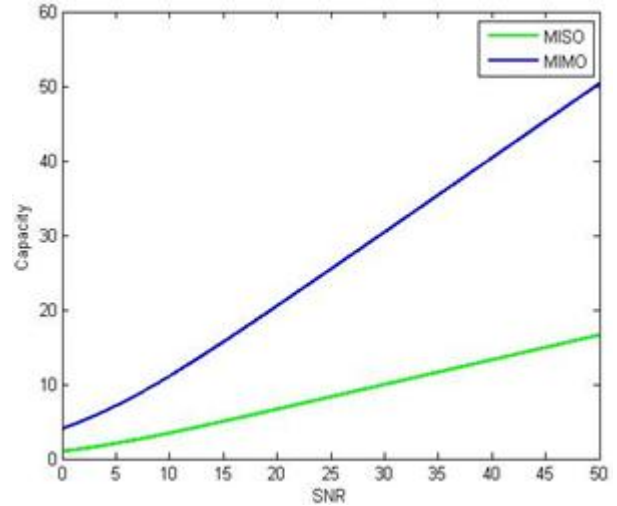

Figure 3.4: Comparison of MISO and MIMO with respective to capacity and SNR.

In Fig. 3.4 Shows the comparison between the MIMO system and MISO system based DVB-T2 in terms of capacity
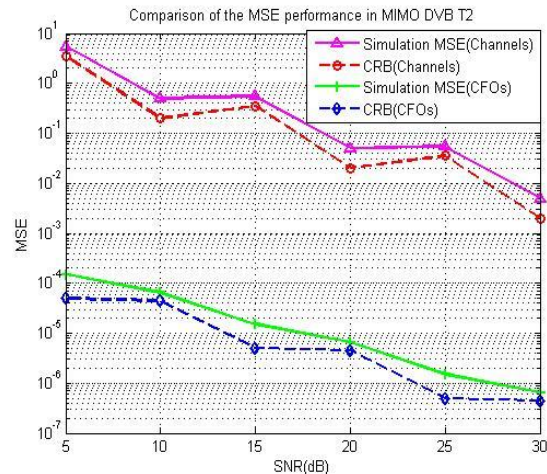

Figure 3.5: Comparison of the MSE performance in MIMO DVB-T2.

The results in Fig. 3.5 Shows the comparison between the MIMO system and MISO system based DVB-T2 in terms of mean square error MSE.

5. Conclusion

Number of researches on primary and secondary had been made. During this research period I have been learned a lot about the DVB-T2 System and MIMO-OFDM technology. After making the screen background required for the maturation, I have dug into the MATLAB and acquired dissimilar coding technique grades, logics and make for principle of MATLAB. During the development of the DVB2 simulator, I learned how the wireless communication simulation can be achieved using MATLAB before implementing in the current world. Since the OFMD is extremely flexible as it supports different modulation techniques. During this implementation the transmission of random binary stream using the 16-QAM the constellation received from the transmitter is precise which demonstrates that the transmission method acting is going on the useful way. It resolves that the MIMO technology will provides

better solution for prominent ameliorate number of users using HDTV. The triumphed MSE vs. SNR graph shows the exactitude of the system after the execution.

References

[1] ETSI, "Digital Video Broadcasting (DVB): framing structure, channel coding and modulation for a second generation digital terrestrial television broadcasting system (DVB-T2)", vol.1.1, 2009.

[2] ETSI, "implementation guidelines for a second generation digital Terrestrial television broadcasting system (DVB-T2)", Nov 2009.

[3] S.Almouti, "A simple transmit diversity techniques for a wireless communication", vol.16, Oct 1998.

[4] T.Jiang, Y.Yi, "channel modulating and inter carrier interference analysis for a vehicle to vehicle communication system in frequency dispersive channels", vol.15, Feb 2010.

[5] Eun-sung-jeon, Janghoon yang, "Iterative joint detection and ICI cancellation and Estimation of multiple CFOs, Channels in MISO transmission mode", vol.16, March 2014.

[6] Jang Soo Seo, "Improved CIR based receiver design for DVB-T2 system in large delay spread channels: synchronization and equalization", vol.57, March 2011.

[7] H.-C. Wu, "Joint phase/amplitude estimation and symbol detection for a wireless ICI self cancellation coded OFDM system", vol.50, March 2004.

[8] X.Liu, "Novel asterisk 16-QAM constellations for COFDEM", vol.14, July 2010.

[9] X .Huang, "Robust and efficient ICI mitigation for OFDM system in time varying fading channels", vol.56, Sep 2007.

[10] Hala M Mahmud, "journal of networks", vol.5.

[11] Jokela T, Tupala M, "Analysis of physical layer signaling in DVB-T2 systems", vol.56.2010.

[12] Mousa, Rashid Salem, "Channel Estimation Based in Comb-Type Pilot Arrangement for OFDM System over time varying Channels", vol.56.

[13] Lukasz Kondrad, Vinod Kumar, "Cross-Layer Optimization of DVB-T2 System for Mobile Services", 2010.

[14] Robert J. Besant, "Peak to Average Power Ration Reduction for Digital Video Broadcast T2", 2011.

[15] A.J. Paul raj, "Multi-Input Multi- Output (MIMO) wireless system", CRC press, Second edition 2002.

[16] Yoke Leen Sit, "MIMO-OFDM Radar with communication and interferences cancellation features", 2014.