

## Implementation of ISDB-Tb LDM Broadcast system on SDR Platform

Rangel Arthur, Rafael H. Ignácio\*

## Abstract

This work aims to apply Layered Division Multiplexing (LDM) by Software Defined Radio (SDR) in the Brazilian Digital TV System (ISDB-Tb) for its evolution to the next generation Digital TV (DTV). For the results obtained, first demonstrate the operation of the proposed system, and finally the advent of capacity increase, performance and efficiency.

## Key words:

ISDB-Tb, LDM, SDR.

## Introduction

The LDM is a Physical Layer (PHY) technology that uses a spectral overlay to transmit information divided by layers, using the same bandwidth. [1]

This work objective is to present a simplified and modified version of the ISDB-Tb system that uses LDM technology for two layers. The proposed system, which demonstrates the use of LDM, was simulated using MATLAB software and later implemented in SDR. And another objective of this work is to demonstrate the operation of the system, and the advent of increased capacity, performance and efficiency.

## Results and Discussion

Image 1 shows the block diagram of the LDM transmitter. The main parts of the transmission modules are shared by both layers. [1]

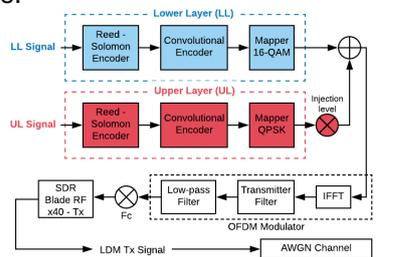


Image 1. ISDB-Tb LDM Transmitter.

At the two-layer LDM receiver, the signal acquisition process is the same for both layers. [1]

Image 2 shows the block diagram of the LDM receiver.

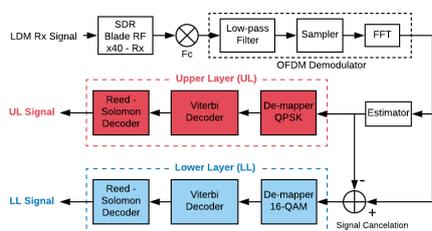


Image 2. ISDB-Tb LDM Receiver.

Image 3 shows the LDM constellation for UL using QPSK, with code rate of 2/3, and LL using 16-QAM, with code rate of 2/3 as well. Image 4 shows the estimated Power Spectral Density (PSD) of the LDM signal at the transmitter output and the performance measurements.

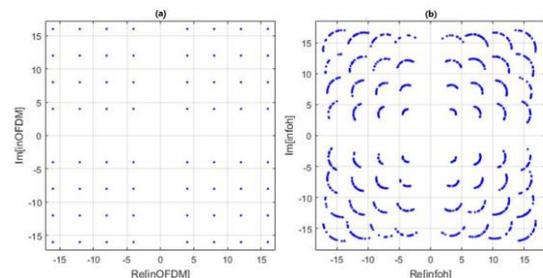


Image 3. Simulated LDM Constellation (a) post modulator (b) post demodulator.

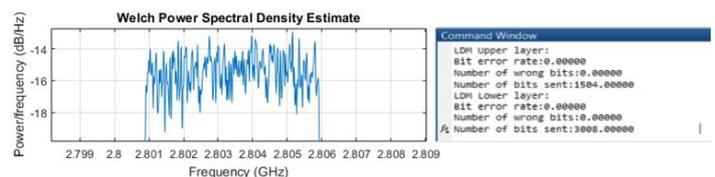


Image 4. (a) Estimated PSD and (b) Performance measurements.



Image 5. Measured PSD (a) with antenna (b) with cable.

As can be seen in Figure 3 (b), the LDM constellation presented phase and amplitude noise, but there were no transmission errors.

## Conclusions

The simulation of the ISDB-Tb system with LDM showed that this technique is perfectly applicable to Brazilian standards, and that the use of two layers opens new possibilities, as signal in UHDTV quality.

## Acknowledgement

The authors of this paper would like to thank FAPESP (São Paulo State's Research Funding Agency) for financial support and their colleagues at UNICAMP.

[1] L. Zhang, W. Li, Y. Wu, X. Wang, S.-I. Park, H. M. Kim, J.-Y. Lee, P. Angueira, and J. Montalban, "Layered-Division-Multiplexing: Theory and Practice," *IEEE Trans. Broadcast.*, vol. 62, no. 1, pp. 216–231, Mar. 2016.