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DVB-S2 A Predominant Technology Towards Radar

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ABSTRACT: As in today's generation, Digital Video Broadcasting Second generation (DVB-S2) is one of the most emergent and successful satellite communication technology. With the use of long PLS code as a spreading code followed by a scrambling code, the performance of the DVB-S2 technology is excellent under the noisy channel condition. It is developed by the Digital Video Broadcasting (DVB) in the year 2003 and needs to be seen in conjunction with the world famous DVB-S which was finalized in the year 1993. It benefits the more recent development in channel coding (LDPC codes) combined with a variety of modulation formats (QPSK, 8PSK, 16APSK, 32APSK). DVB-S2 standard is the new emerging technology which enables much more efficient transmission of Digital video in current satellite Transponders. The new technology dramatically improves the utilization of the available satellite bandwidth which will enable increased programming capacity, increased geographical coverage of the satellite Footprint (more customers) and accommodate future requirement for High definition TV.

KEYWORDS: DVB S2, LDPC, PLS, MXG N5182A.

I. INTRODUCTION

Digital Video Broadcasting – Satellite second Generation is a digital television broadcast standard that has been designed as a successor for the popular DVB-S system. DVB-S2 is envisaged for broadcast services including Standard and HDTV, interactive services including internet access, and (professional) data content Distribution. The development of DVB-S2 coincide with the introduction of HDTV and H.264 (MPEG-4 AVC) video codes. A powerful coding scheme based on modern LDPC codes. LDPC codes are helpful in low encoding complexity. DVB-S2 achieves a significantly better performance than its predecessors mainly allowing for an increase in the Bit rate over the same satellite Transponder Bandwidth. When a contribution of improvements in video compression is added, an MPEG-4 AVC HDTV service can now be delivered in the same Bandwidth as earlier.

II. PROBLEM DEFINATION

Today's existing Radar waveforms are not involved sufficiently excellent in comparison to the High Definition TV signals used in DVB-S2 Technology. So the performance of the Radar in terms of Target Detection, Target Imaging could be improved by selecting the proper waveform and redesigning the Radar. Commercially DVB-S2 is excellent technology.

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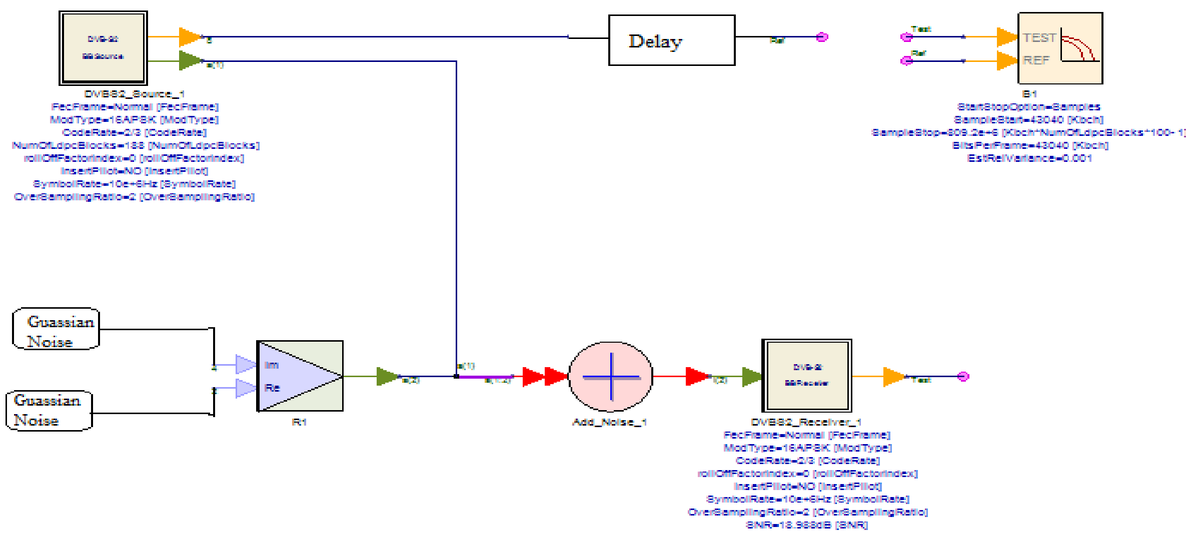

Fig.-1: Basic Block Diagram

A.DVB S2 waveform, Generation to hardware realization:

PL Framer is the tool where, the spreading operation is done on the baseband PN Sequence. This spreading code is a Reed-Muller Code. The PL Framer block is used to implement the Physical Layer framer process, according to the figure below.

The PL Framing sub-system shall generate a physical layer frame (named PLFRAME) by performing the following processes:

1. XFECFRAME slicing into an integer number S of constant length SLOTs (length: M = 90 symbols each); S shall be according to the table below.

S=Number of slots (M=90 Symbols) per XFECFRAME

Table:01

	n_{ldpc} = 64 800 (normal frame)		n_{ldpc} = 16 200 (short frame)	
η_{MOD} (bit/s/Hz)	S	η % no-pilot	S	η % no-pilot
2	360	99,72	90	98,90
3	240	99,59	60	98,36
4	180	99,45	45	97,83
5	144	99,31	36	97,30

2. PLHEADER generation and insertion before the XFECFRAME for receiver configuration.

PLHEADER shall occupy exactly one SLOT (length: M = 90 Symbols).

3. Pilot Block insertion (for modes requiring pilots) every 16 SLOTS, to help receiver synchronization. The Pilot Block shall be composed of P=36pilot symbol.

4. The Physical Layer (PL) HEADER is intended for receiver synchronization and physical layer signaling.

After decoding the PLHEADER, the receiver knows the PLFRAME duration and structure, the modulation and coding scheme of the XFECFRAME, the presence or absence of pilot symbols.[2] The PLHEADER (one SLOT of 90 symbols)

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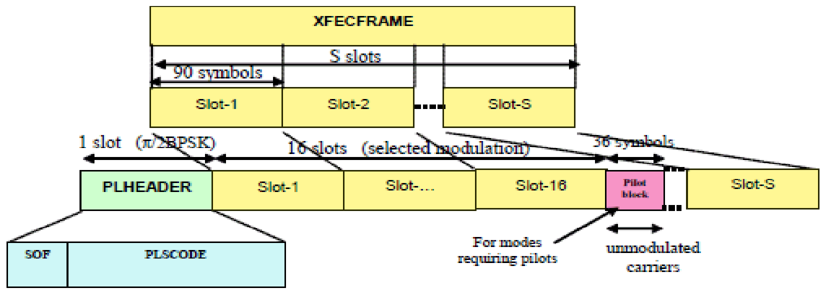

Fig.-2: The PLHEADER framing using Reed-Muller Code as the 'PLSCODE'

shall be composed of the following fields:
** SOF (26 symbols), identifying the start of Frame.
** PLS code (64 symbol): PLS (Physical Layer Signaling) code shall be a non-systematic binary code which is nothing but a Reed-Muller code. The formulation is shown below.
1 = (1111111111111111)
v4 = (0000000011111111)
v3 = (0000111100001111)
v2 = (0011001100110011)
v1 = (0101010101010101)
v3v4 = (0000000000001111)
v2v4 = (0000000000110011)
v1v4 = (0000000001010101)
v2v3 = (0000001100000011)
v1v3 = (0000010100000101)
v1v2 = (0001000100010001)
This is a (16; 11) Reed-Muller code, with min. distance 4. In general for an R(r; m) code, we have

$$k = 1 + \binom{m}{1} + \binom{m}{2} + \cdots + \binom{m}{r}$$

We can recursively construct an R(r + 1; m + 1) code --
twice the length -- from an R(r; m) and R(r + 1; m) code. The binary Reed-Muller code R(r; m) of order 'r' and length 2^m consists of all linear combinations of vectors 'k' associated with Boolean functions. that are monomials of degree $\leq r$ in 'm' variables.

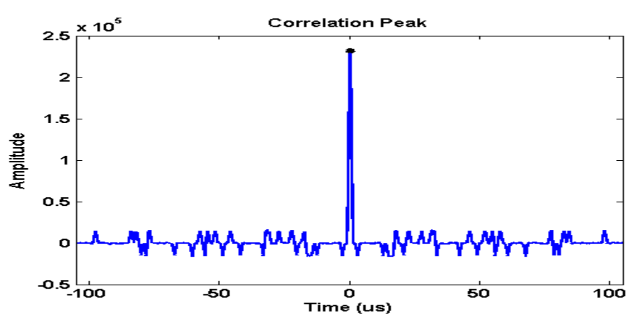

Fig.-3: Simulated result for the Autocorrelation Nature of the Reed-Muller Code.

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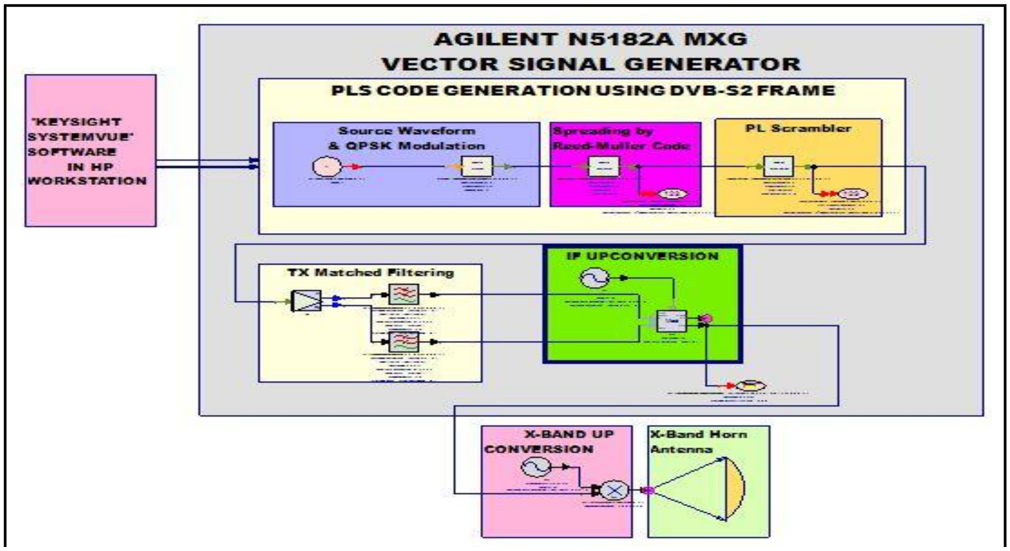

Fig.-4: Modified Block Diagram of the DVBS2 Transmitter

III. BLOCK DESCRIPTION

Keysight is focused Electronic Design Automation (EDA) environment for Electronic System Level (ESL). It enables system architecture and algorithm developers to innovate the physical layer of wireless and aerospace/defence. SystemVue 'speaks RF' cuts physical development and verification time in half and connects to your mainstream EDA flow. The source here is the 'Constant' which supports the value i.e., 0,1,2,3. As we are using QPSK modulation technique. Constant is used to trigger the PL Frame after passing through the Mapper. Mapper is used for modulation purpose. It maps the bits into constellation. input of the Mapper is the complex value and the output is XFECFRAME (Complex FECFRAME). It generates Inphase and Qudrature (I, Q) sequence. The input of the Physical Layer Framing in XFECFRAME (Complex FECFRAME). If there is no XFECFRAME ready to be processed or transmit than PL Frame act as the Dummy PL Frame which generates the signal.

The next Block is PL Scramble this block consist of scrambling code sequences which shall be constructed by combining two real m-sequences (generated by means of two generator polynomials of degree 18) into a complex sequence. The output signal of the PL Scrambler is complex signal and it is converted into Rectangular signal using ' CxToRect' block, the signals will be in the form of Real and Imaginary. The signals are fed to the Low Pass Filter (LPF).Then there will be IF up conversion followed by X-Band up conversion. The Signal is dumped into the N5182A (MXG) Vector Signal Generator and using X-Band horn Antenna signal is transmitted from the transmitter. The same signal is received at the receiver using receiver horn Antenna.

IV. RADAR SPECIFICATIONS

Radar Parameters

- Radar Principle: Pulsed Coded Radar with DVB-S2 64-bit length PLS code
- Frequency: 11.5 GHz
- Tx Power: <17dBm EIRP
- Bandwidth: 40MHz @ 3 dB points
- Pulse width: 3 us
- Pulse Repetition Time (PRT): 0.813 ms

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• Tx Antenna Characteristic: Band- X Band, Gain-17 dbi, 3dB Beamwidth- 22^0
• Rx Antenna Characteristic: Type- Dish with prime focus horn, Band- X Band, Gain-41.85 dbi, 3dB Beamwidth- 0.49^0

Object Parameters
• Number of Objects: 1
• Parameters Types: Range

Range Parameters
• Detection Range:
• Range (Object) Resolution: 3.75 meter

V. DVB-S2 RADAR SET-UP:

Fig-5a: Tx Horn Antenna

The above Fig 5a shows the Transmitter section which consist of the Horn Antenna, PC System and the Mix Signal Generator (MXG) N5182A.

Fig-5b: Receiver Horn

The Above Fig 5b shows the Receiver Horn antenna and the TV where we are able to see the Signal level and the Signal Quality.

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B.Types of Target

Fig.-5c: Test-Bed DVB-S2 RADAR

Fig.-5d**:** 0.7mx0.7mFlatPlate

***C.*Result Obtained**

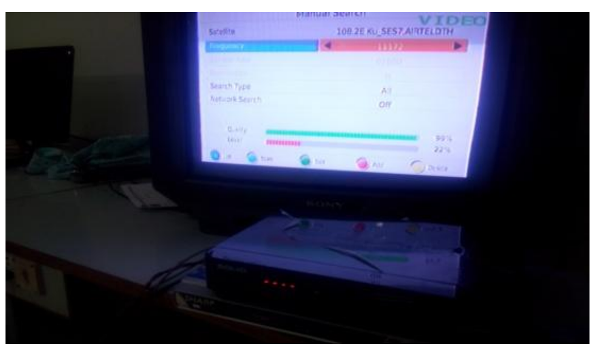

Fig.-5e**:** Detection of the Flat Plate used for standard Target

In the above set-up, the 0.7m x 0.7m flat plate is illuminated by the DVB-S2 RADAR using the PLS coded pulsed waveform. The target detection is measured in terms of Signal Quality and Signal Strength parameter display in the television screen. The commercially available DTH set-top box has been used as the receiver. Here the presence or absence of the target has been detected successfully.

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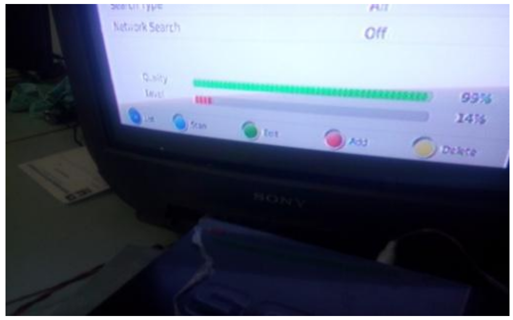

Fig.-5d: Detection of Toy Vehicle

After replacing the flat plate, a toy vehicle has been mounted on the rotating stand of a rotor motor as shown in Fig. The vehicle is illuminated by the SSDBF RADAR. Here the presence or absence of the toy vehicle has been detected successfully in the radar receiver using the DTH SET-TOP box and displaying the detection results in terms of Signal quality and Signal strength.

Table 02

TYPE OF TARGET	TARGET DETECTION USING DVB-S2 RADAR		REMARKS
	SIGNAL LEVEL	SIGNAL QUALITY	
1.FLAT PLATE (0.7m x 0.7m)	21%	99%	Detection is done as per fig no 5e.
2.TOY VEHICLE	14%	99%	Detection is done as per fig no 5d

VI. CONCLUSION

An excellent radar performance exploiting DVB S2 waveform realized in a MXG N518A and the quality of the Target detected and observed in the TV using the Horn Antenna at the Transmitter and the Receiver side..

REFERENCES

[1] ETSI EN 302 307-1 V1.4.1, "*Digital Video Broadcasting Second Generation (DVB-S2),*" [Online]. Nov.2014, Pg no. 14-36.
[2] S.Jung and D.G.Oh, "*Frequency Estimation for Non-pilot Mode of DVB-S2 System*," Proceeding of the World Congress on Engineering and Computer Science, Vol. I, Oct. 24, 2012.
[3] ISO/IEC 13818-1,"Information technology — Generic Coding of Moving Pictures and associated Audio Information: Systems," Second edition, Dec.01, 2000, Page-75-83.
[4] A. Morello and V. Mignone, "*DVB-S2: The Second Generation Standard for Satellite Broad-band Services,*" proceedings of the IEEE, vol. 94, Jan. 2006.
[5]. www.etsi.org