



DVB-S2X Modulator IP Core  
Specification

## Release Information

Name	DVB-S2X Modulator IP Core
Version	3.0
Build date	2022.09
Ordering code	ip-dvb-s2x-modulator
Specification revision	r1908

## Features

The IP core is a digital DVB-S2/DVB-S2X modulator and is fully compatible with this standard:

- ETSI EN 302 307-2 (v1.1.1)

## License

License:

- Netlist for One FPGA Family or Full Source Code (Verilog, SDC/XDC)
- Perpetual
- Without Quantitative Restrictions
- Worldwide
- Royalty-free
- Free Remote Technical Support for 1 Year

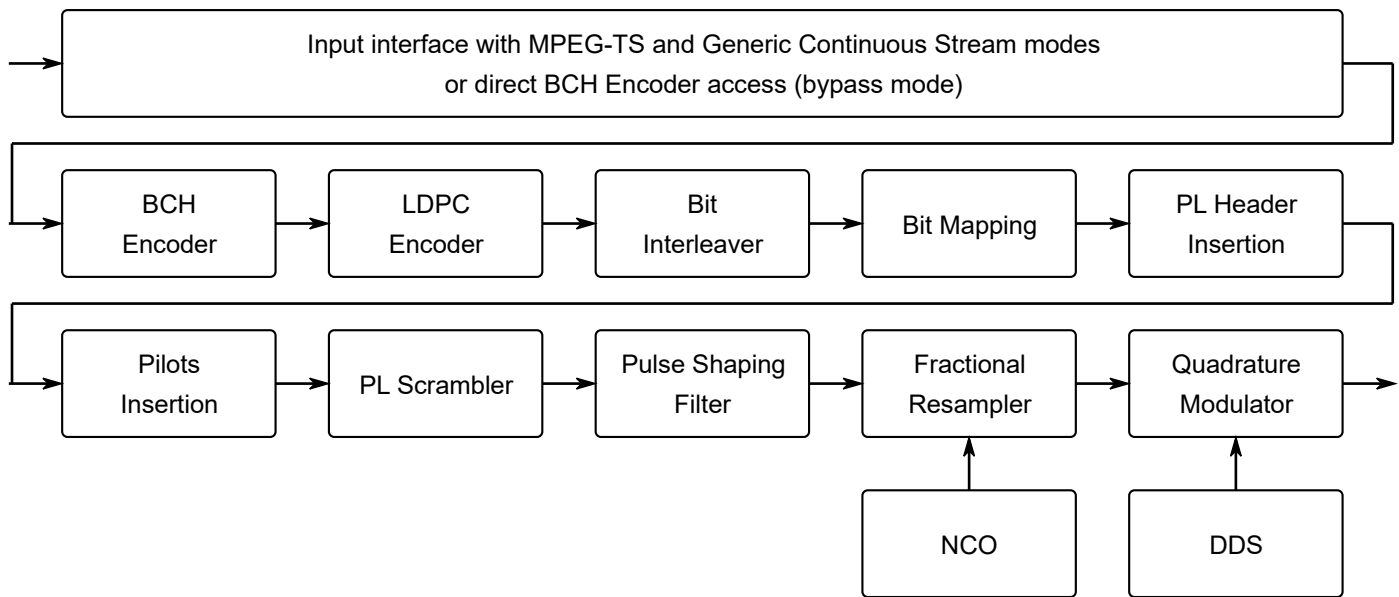
## Deliverables

The DVB-S2X Modulator IP Core includes:

- EDIF/NGC/QXP/VQM netlist for Xilinx Vivado/ISE, Intel (Altera) Quartus, Lattice Diamond or Microsemi (Actel) Libero SoC
- IP Core testbench scripts
- Design examples for Xilinx, Intel (Altera), Lattice, and Microsemi (Actel) evaluation boards

## IP Core Structure

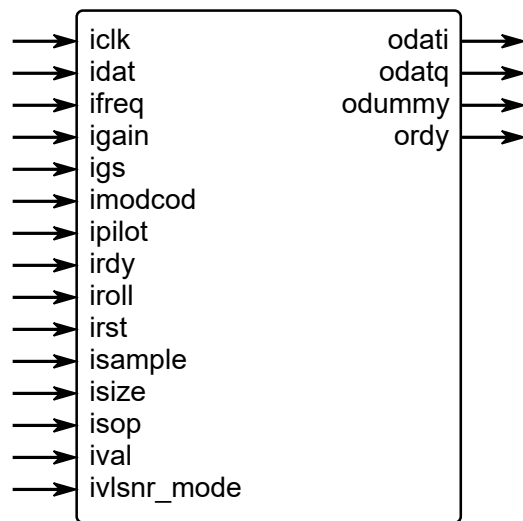
Figure 1 shows the DVB-S2X Modulator IP Core block diagram.



**Figure 1. The DVB-S2X Modulator IP Core block diagram**

## Port Map

Figure 2 shows a graphic symbol, and Table 1 describes the ports of the DVB-S2X Modulator IP Core.



**Figure 2. The DVB-S2X Modulator port map**

Table 1. The DVB-S2X Modulator port map description		
Port	Width	Description
iclk	1	The main system clock. The IP Core operates on the rising edge of iclk.
idat	8	input (information) data
ifreq	32	output intermediate frequency
igain	16	output gain control
igs	2	input interface mode: 0 - MPEG-TS 1 - Generic Continuous Stream 2 - Direct access to BCH Encoder (bypass BBFramer)
imodcod	8	MODCOD value. See Annex A for values.
ipilot	1	pilot mode: 0 - without pilot 1 - with pilot
irdy	1	Modulator output data request.
iroll	3	RRC filter roll-off factor: 0 - alpha=0.35 1 - alpha=0.25 2 - alpha=0.2 3 - alpha=0.15 4 - alpha=0.10 5 - alpha=0.05
irst	1	The IP Core synchronously reset when irst is asserted high.
isample	32	bandwidth control (symbol rate): 0.01% to 50% of iclk
isize	1	LDPC frame size (only for DVB-S2): 0 - Normal FECFrame (Nldpc = 64800 bits) 1 - Short FECFrame (Nldpc = 16200 bits)
isop	1	input sync-word byte marker (0x47 TS)
ival	1	input data valid
ivlsnr_mode	3	VL-SNR type. See Annex A for values.
odati	W_DAC	modulator output at baseband (I channel) or at an intermediate frequency
odatq	W_DAC	modulator output at baseband (Q channel)
odummy	8	counter of inserted DUMMY Frames

ordy	1	ready to accept input data
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## IP Core Parameters

Table 2 describes the DVB-S2X Modulator IP Core parameters, which must be set before synthesis.

Table 2. The DVB-S2X Modulator IP Core parameters description	
Parameter	Description
W_DAC	Width of output DAC symbols ( <b>odati/odatq</b> ) Increasing the width of odati/odatq, increases the quality of waveform but also increases FPGA required resource

Performance and Resource Utilization

The values were obtained by automated characterization, using standard tool flow options and the floorplanning script delivered with the IP Core. The IP Core fully supports all Xilinx and Altera FPGA families, including Spartan, Zynq, Artix, Kintex, Virtex, Cyclone, Arria, MAX, Stratix. Table 3 summarizes the DVB-S2X Modulator IP Core measurement results.

Table 3. The DVB-S2X Modulator performance				
IP Core parameters	FPGA type			
	Resource	Speed grade, maximal system frequency		
W_DAC=16	Altera Cyclone V 5CEFA7			
	7503 ALMs (14%) 114 M10K RAM blocks (17%) 15 DSP (18x18) (10%)	-8, Fmax	-7, Fmax	-6, Fmax
		96.0 MHz 48.0 Msymb/s	111.0 MHz 55.5 Msymb/s	132.0 MHz 66.0 Msymb/s
W_DAC=16	Xilinx Virtex-7 XC7VX330T			
	6126 Slices (12%) 58 18K RAM blocks (4%) 14 DSP (18x18) (2%)	-1, Fmax	-2, Fmax	-3, Fmax
		145.0 MHz 72.5 Msymb/s	176.0 MHz 88.0 Msymb/s	196.0 MHz 98.0 Msymb/s

IP Core Interface Description

IP core has two ways of forming the output spectrum:

- Baseband (using **odati** and **odatq**), **ifreq** equal 0
- Intermediate frequency (using **odati**), **ifreq** not equal 0

Digital-to-analog converters must operate synchronously with the DVB-S2X Modulator IP core. Figure 3 shows the DAC connection diagram for baseband mode and Figure 4 shows the timing diagram for this mode.

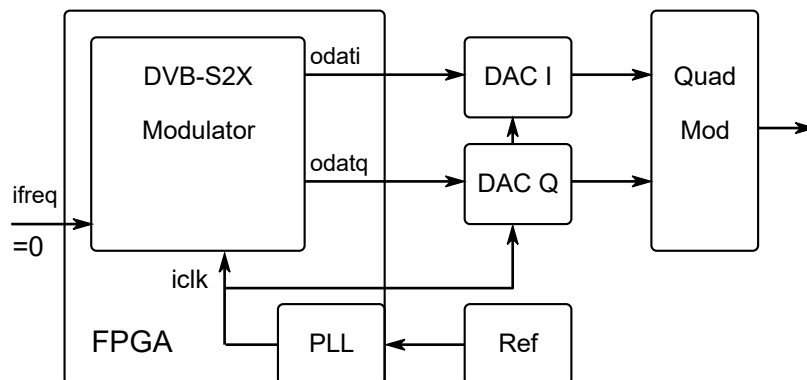
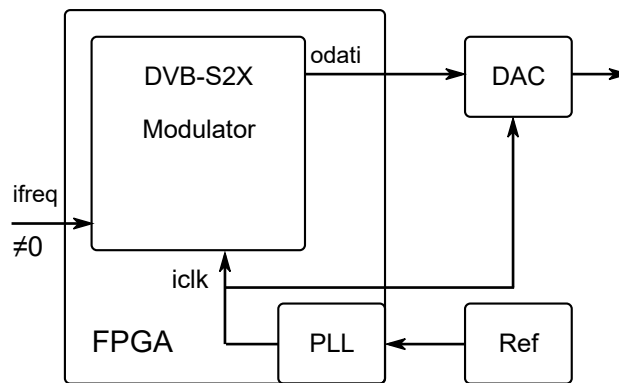


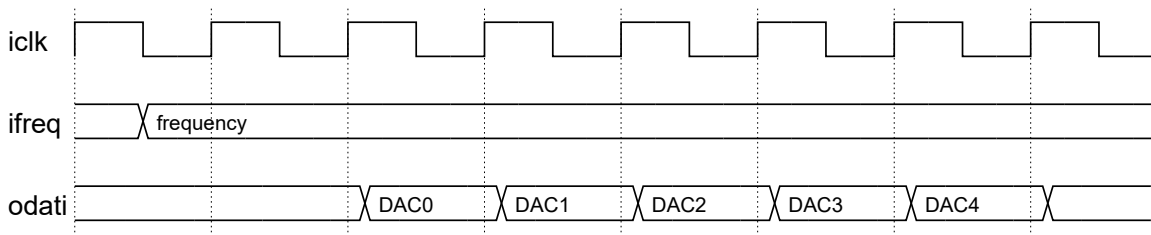
Figure 3. The DAC connection diagram for baseband mode.

**Figure 4. The timing diagram for baseband mode.**

Figure 5 shows the DAC connection diagram for IF mode and Figure 6 shows the timing diagram for this mode. The output intermediate frequency port **ifreq** sets the central frequency for **odati** modulator output port.

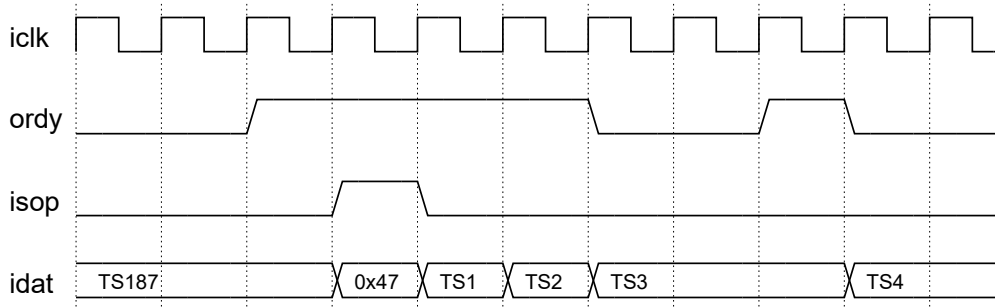


**Figure 5. The DAC connection diagram for IF mode.**



**Figure 6. The timing diagram for IF mode.**

Figure 7 shows an example of the waveform of the input interface. Handshake port **ordy** controls input dataflow. Input data is read from the input **idat** only when **ordy** is equal to logical one ("1").



**Figure 7. The timing diagram of the IP Core input interface.**

## Upgrade and Technical Support

Free remote technical support is provided for 1 year and includes consultation via phone, E-mail and Skype. The maximum time for processing a request for technical support is 1 business day.

For up-to-date information on the IP Core visit this web page

<https://www.iprium.com/ipcores/id/dvb-s2x-modulator/>

## Feedback

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## Revision history

Version	Date	Changes
3.0	2022.09.20	Added input interface with MPEG-TS, Generic Continuous Stream and bypass modes
2.0	2017.11.14	Added support for AD9361, AD9363, AD9364, AD9371, AD9375 and AD9789
1.0	2015.06.16	Official release



**MODCOD setup**

Table A.1 shows the correct settings for **imodcod**, **isize**, **ipilot**, and **ivlsnr\_mode** ports.

Table A.1. The DVB-S2/DVB-S2X Modulator settings

DVB-S2 Modes, ipilot controls Pilot Mode Off and On

MODCOD	Mode	Code Type and Pilot	
imodcod = 1	QPSK 1/4	<b>isize:</b> 0 - Normal FEC block (64800 bits) 1 - Short FEC block (16200 bits) <b>ipilot:</b> 0 - Pilot Off 1 - Pilot On	
imodcod = 2	QPSK 1/3		
imodcod = 3	QPSK 2/5		
imodcod = 4	QPSK 1/2		
imodcod = 5	QPSK 3/5		
imodcod = 6	QPSK 2/3		
imodcod = 7	QPSK 3/4		
imodcod = 8	QPSK 4/5		
imodcod = 9	QPSK 5/6		
imodcod = 10	QPSK 8/9		
imodcod = 11	QPSK 9/10		
imodcod = 12	8PSK 3/5		
imodcod = 13	8PSK 2/3		
imodcod = 14	8PSK 3/4		
imodcod = 15	8PSK 5/6		
imodcod = 16	8PSK 8/9		
imodcod = 17	8PSK 9/10		
imodcod = 18	16APSK 2/3		
imodcod = 19	16APSK 3/4		
imodcod = 20	16APSK 4/5		
imodcod = 21	16APSK 5/6		
imodcod = 22	16APSK 8/9		
imodcod = 23	16APSK 9/10		
imodcod = 24	32APSK 3/4		
imodcod = 25	32APSK 4/5		

imodcod = 26	32APSK 5/6		
imodcod = 27	32APSK 8/9		
imodcod = 28	32APSK 9/10		
<b>DVB-S2X VL-SNR set1 Modes, ipilot does not work in this mode</b>			
<b>MODCOD</b>	<b>Canonical MODCOD name</b>	<b>Implementation MODCOD name</b>	<b>Code Type</b>
imodcod = 129 ivlsnr_mode = 0	QPSK 2/9	QPSK 2/9	Normal
imodcod = 129 ivlsnr_mode = 1	BPSK 1/5	p/2 BPSK 1/5	Medium
imodcod = 129 ivlsnr_mode = 2	BPSK 11/45	p/2 BPSK 11/45	Medium
imodcod = 129 ivlsnr_mode = 3	BPSK 1/3	p/2 BPSK 1/3	Medium
imodcod = 129 ivlsnr_mode = 4	BPSK-S 1/5	p/2 BPSK 1/5 SF 2	Short
imodcod = 129 ivlsnr_mode = 5	BPSK-S 11/45	p/2 BPSK 11/45 SF 2	Short
<b>DVB-S2X VL-SNR set2 Modes, ipilot does not work in this mode</b>			
<b>MODCOD</b>	<b>Canonical MODCOD name</b>	<b>Implementation MODCOD name</b>	<b>Code Type</b>
imodcod = 131 ivlsnr_mode = 0	BPSK 1/5	p/2 BPSK 1/5	Short
imodcod = 131 ivlsnr_mode = 1	BPSK 4/15	p/2 BPSK 4/15	Short
imodcod = 131 ivlsnr_mode = 2	BPSK 1/3	p/2 BPSK 1/3	Short
<b>DVB-S2X Modes, ipilot controls Pilot Mode Off and On</b>			
<b>MODCOD</b>	<b>Canonical MODCOD name</b>	<b>Implementation MODCOD name</b>	<b>Code Type</b>
imodcod = 132	QPSK 13/45	QPSK 13/45	Normal
imodcod = 134	QPSK 9/20	QPSK 9/20	Normal
imodcod = 136	QPSK 11/20	QPSK 11/20	Normal
imodcod = 138	8APSK 5/9-L	2+4+2APSK 100/180	Normal

imodcod = 140	8APSK 26/45-L	2+4+2APSK 104/180	Normal
imodcod = 142	8PSK 23/36	8PSK 23/36	Normal
imodcod = 144	8PSK 25/36	8PSK 25/36	Normal
imodcod = 146	8PSK 13/18	8PSK 13/18	Normal
imodcod = 148	16APSK 1/2-L	8+8APSK 90/180	Normal
imodcod = 150	16APSK 8/15-L	8+8APSK 96/180	Normal
imodcod = 152	16APSK 5/9-L	8+8APSK 100/180	Normal
imodcod = 154	16APSK 26/45	4+12APSK 26/45	Normal
imodcod = 156	16APSK 3/5	4+12APSK 3/5	Normal
imodcod = 158	16APSK 3/5-L	8+8APSK 18/30	Normal
imodcod = 160	16APSK 28/45	4+12APSK 28/45	Normal
imodcod = 162	16APSK 23/36	4+12APSK 23/36	Normal
imodcod = 164	16APSK 2/3-L	8+8APSK 20/30	Normal
imodcod = 166	16APSK 25/36	4+12APSK 25/36	Normal
imodcod = 168	16APSK 13/18	4+12APSK 13/18	Normal
imodcod = 170	16APSK 7/9	4+12APSK 140/180	Normal
imodcod = 172	16APSK 77/90	4+12APSK 154/180	Normal
imodcod = 174	32APSK 2/3-L	4+12+16rbAPSK 2/3	Normal
imodcod = 178	32APSK 32/45	4+8+4+16APSK 128/180	Normal
imodcod = 180	32APSK 11/15	4+8+4+16APSK 132/180	Normal
imodcod = 182	32APSK 7/9	4+8+4+16APSK 140/180	Normal
imodcod = 184	64APSK 32/45-L	16+16+16+16APSK 128/180	Normal
imodcod = 186	64APSK 11/15	4+12+20+28APSK 132/180	Normal
imodcod = 190	64APSK 7/9	8+16+20+20APSK 7/9	Normal
imodcod = 194	64APSK 4/5	8+16+20+20APSK 4/5	Normal
imodcod = 198	64APSK 5/6	8+16+20+20APSK 5/6	Normal
imodcod = 200	128APSK 3/4	128APSK 135/180	Normal
imodcod = 202	128APSK 7/9	128APSK 140/180	Normal

imodcod = 204	256APSK 29/45-L	256APSK 116/180	Normal
imodcod = 206	256APSK 2/3-L	256APSK 20/30	Normal
imodcod = 208	256APSK 31/45-L	256APSK 124/180	Normal
imodcod = 210	256APSK 32/45	256APSK 128/180	Normal
imodcod = 212	256APSK 11/15-L	256APSK 22/30	Normal
imodcod = 214	256APSK 3/4	256APSK 135/180	Normal
imodcod = 216	QPSK 11/45	QPSK 11/45	Short
imodcod = 218	QPSK 4/15	QPSK 4/15	Short
imodcod = 220	QPSK 14/45	QPSK 14/45	Short
imodcod = 222	QPSK 7/15	QPSK 7/15	Short
imodcod = 224	QPSK 8/15	QPSK 8/15	Short
imodcod = 226	QPSK 32/45	QPSK 32/45	Short
imodcod = 228	8PSK 7/15	8PSK 7/15	Short
imodcod = 230	8PSK 8/15	8PSK 8/15	Short
imodcod = 232	8PSK 26/45	8PSK 26/45	Short
imodcod = 234	8PSK 32/45	8PSK 32/45	Short
imodcod = 236	16APSK 7/15	4+12APSK 7/15	Short
imodcod = 238	16APSK 8/15	4+12APSK 8/15	Short
imodcod = 240	16APSK 26/45	4+12APSK 26/45	Short
imodcod = 242	16APSK 3/5	4+12APSK 3/5	Short
imodcod = 244	16APSK 32/45	4+12APSK 32/45	Short
imodcod = 246	32APSK 2/3	4+12+16rbAPSK 2/3	Short
imodcod = 248	32APSK 32/45	4+12+16rbAPSK 32/45	Short