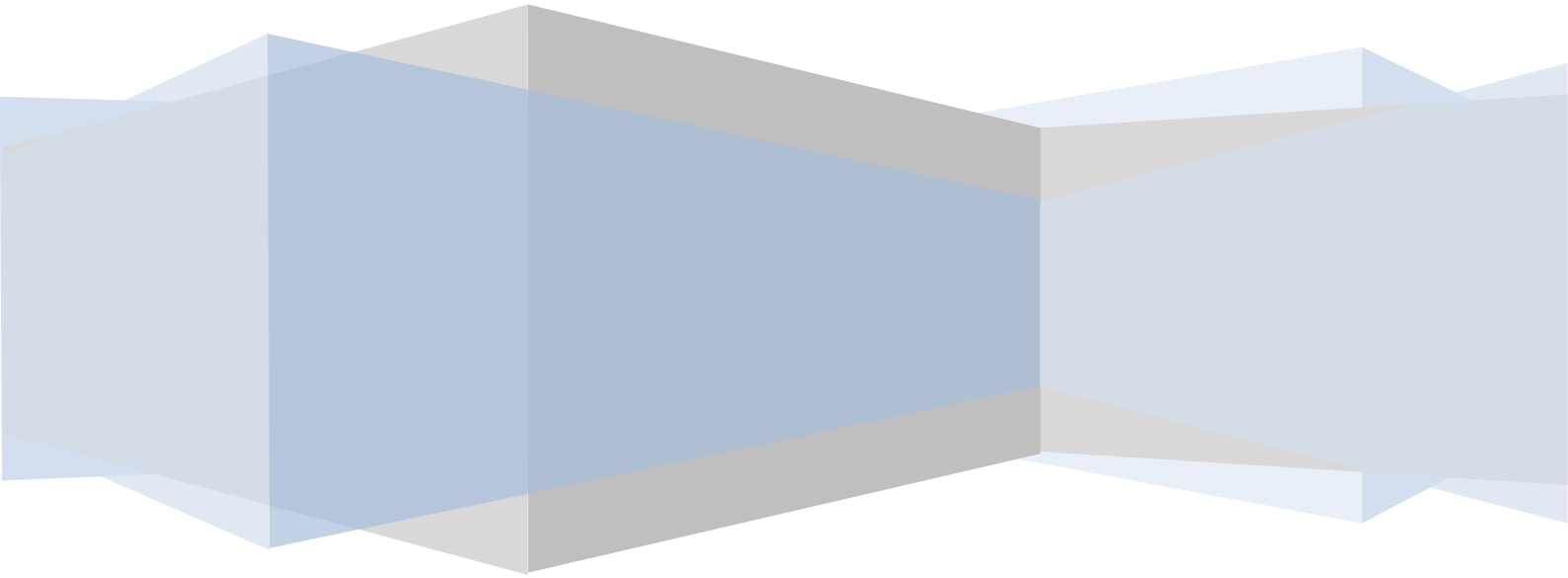
EZiD211, Oxford 2 – Interoperability Test Declaration

Document number: A190011_241

Distribution: External
Version: 2.0



Revision history:

VERSION	DATE	AUTHOR	CHANGES
1.0	24/07/2025	P. Nayler	Draft
2/0	07/08/2025	P. Nayler	Edits following comments

Contents

List of tables :

Reference Documentation

Applicable documents are documents which content is applicable to the scope of this document.

Table 1: Applicable documents

DOCUMENT NUMBER	TITLE (preceded by reference)	VERSION
	[R1] DVB-S2 standard, part-1, ETSI EN 302 307-1	latest
	[R2] DVB-S2 standard, part-2, ETSI EN 302 307-2	latest
	[R3] DVB BlueBook A115-1r3: (draft ETSI EN 301 545-1 (V1.4.1)): “Digital Video Broadcasting (DVB); Second Generation DVB Interactive Satellite System (DVB-RCS2); Part 1: Overview and System Level specification”.	latest
	[R4] DVB BlueBook A115-2r4: (draftETSI EN 301 545-2 (V1.5.1)): “Digital Video Broadcasting (DVB); Second Generation DVB Interactive Satellite System (DVB-RCS2); Part 2: Lower Layers for Satellite standard”.	latest
	[R5] TM-S0585r6: “V&V Hardware Interoperability Tests”.	latest

Acronyms and abbreviations

Table 2: Acronyms and abbreviations

ACRONYM	STANDS FOR
ACM	Adaptive coding and modulation (DVB-S2)
AFE	Analog Front-end
AGC	Automatic gain control
APSK	Amplitude and Phase Shift Keying
ASIC	Application Specific Integrated Circuit
Bd	Baud
BH	Beam Hopping
BHCT	Beam Hopping Cycle Time
BHTP	Beam Hopping Time Plan
CCM	Constant coding and modulation (DVB-S2)
C/N CNR	Carrier to Noise Carrier to Noise Ratio
dB	Decibel
DSF	Dummy Synchronisation Frame
DT	Dwell Time
EVB	Evaluation Board. The environment in which the ASIC is implemented and tested.
EVM	Error Vector Magnitude
FER	Frame Error Rate
GCS	Generic Continuous Stream. DVB-S2/S2X BB Frame mode.
GSE	Generic stream encapsulation (DVB-S2, DVB-IP)
GUI	Graphical User Interface
IQ	In-phase and Quadrature. A type of modulated waveform
LO	Local Oscillator
LLR	Least Likelihood Ratio
MODCOD	Modulation and coding scheme (DVB-S2)
Msps	Mega Symbols Per Second
NCR	Network clock reference (DVB-RCS)
OBP	On Board Processor (the circuitry processing the signal on the satellite)
PC	Personal Computer
PLH	Physical Layer Header
PLS	Physical Layer Scrambling codes (DVB-S2x part 2) replaces MODCODs
QEF	Quasi Error Free. Generally, the CNR which corresponds to a FER of 10^-5
QPSK	Quadrature Phase Shift Keying
RC	Return Channel: integrated modulator
RF	Radio Frequency.
RL	Return Link
Rx	Receive / receiver
SoSF	Start of Super-Frame
SF	Super-Frame
SFH	Super-Frame Header
SNR	Signal to Noise Ratio
SR	Symbol Rate (in Bd unit)
TS	Transport Stream. DVB protocol for video transport. Replaced by GSE.
TSN	Time Slice Number. DVB-S2X, annex-M.
Tx	Transmit / transmitter
VLSNR	Very Low Signal to Noise Ratio. DVB-S2x.

1. Introduction

This document describes the tests conducted according to DVB document [5] to comply with the interoperability declaration below. The DUT is the EZiD211 ASIC, which is a digital modem ASIC that can be integrated within a User Terminal. All tests were conducted using an Oxford-2 Evaluation board (EVB).

1.1. Interoperability Declarations

DUT
Mfr. EASII IC
Model: EZID211 ASIC, also known as Oxford-2.
Type: User-Terminal Profile: As per section 1.3.

Tests Performed:	**Section**
Reception of continuous S2/S2X Waveforms	2.2
Reception of continuous S2X/Annex E Waveforms	Ap per 2.3
Reception of Burst S2X/Annex E Waveforms	2.3
Reception of RCS2 LM bursts	N/A Hub/OBP only
Reception of multiple transmissions S2/S2X/Annex E	
Reception of multiple transmissions RCS2 (LM, CPM, LM-SS)	N/A
Transmission of RCS2 waveforms (LM, CPM, LM-SS)	3.2
Transmission of Burst S2/S2X/Annex E waveforms	3.3
Doppler Compensation on Tx	As per 4.
Doppler Compensation on Rx	4

1.2. DVB-S2/X Standards Compatibility

The table below denotes all the system configurations supported by EZiD211 ASIC according to Table 1 of [2].

Table 3: DVB-S2/X System Configurations

System configurations		EZID211	Comments
FECFRAME (normal)	64 800 (bits)		
QPSK	1/4,1/3, 2/5 (S2-MODCODs)	Y	
	1/2, 3/5, 2/3, 3/4, 4/5, 5/6, 8/9, 9/10 (S2-MODCODs)	Y	
	13/45	Y	
	9/20; 11/20	Y	
8PSK	3/5, 2/3, 3/4, 5/6, 8/9, 9/10 (S2-MODCODs)	Y	
	23/36; 25/36; 13/18	Y	
8APSK-L	5/9;26/45	Y	
16APSK	2/3, 3/4, 4/5, 5/6, 8/9, 9/10 (S2-MODCODs)	Y	
	26/45; 3/5; 28/45; 23/36; 25/36; 13/18; 7/9; 77/90	Y	
16APSK-L	5/9; 8/15; 1/2; 3/5; 2/3	Y	
32APSK	3/4, 4/5, 5/6, 8/9, 9/10 (S2-MODCODs)	Y	
	32/45; 11/15; 7/9	Y	
32APSK-L	2/3	Y	
64APSK	11/15; 7/9; 4/5; 5/6	Y	
64APSK-L	32/45	Y	
128APSK	3/4; 7/9	Y	
256APSK	32/45; 3/4	Y	
256APSK-L	29/45; 2/3; 31/45; 11/15	Y	
FECFRAME (short)	16 200 (bits)		
QPSK	1/4,1/3, 2/5 (S2-MODCODs)	Y	
	1/2, 3/5, 2/3, 3/4, 4/5, 5/6, 8/9 (S2-MODCODs)	Y	
	11/45; 4/15; 14/45; 7/15 8/15; 32/45	Y	
8PSK	3/5, 2/3, 3/4, 5/6, 8/9 (S2-MODCODs)	Y	
	7/15; 8/15; 26/45; 32/45	Y	
16APSK	2/3, 3/4, 4/5, 5/6, 8/9 (S2-MODCODs)	Y	
	7/15; 8/15; 26/45; 3/5; 32/45	Y	
32APSK	3/4, 4/5, 5/6, 8/9	Y	

System configurations		EZID211	Comments
	(S2-MODCODs)		
	2/3; 32/45	Y	
VL-SNR Header		Y	
QPSK	2/9 (normal)	Y	
BPSK	1/5; 4/15; 1/3 (short) 1/5; 11/45; 1/3 (medium)	Y	
BPSK-S (Spreading Factor 2)	1/5; 11/45 (short)	Y	
Fixed Size Super-frame formats 0-3		N	
Fixed Size Super-frame format 4		N	
Part 2 PLHEADER	8-bits	Y	
Extended PLHEADER For Wide-band mode	8+8 bits (time slicing)	Y	
GSE-High Efficiency Mode	For GSE/GSE-Lite	N	
Rolloff 0,35, 0,25, 0,20, 0,15; 0,10 and 0,05		Y	
Channel bonding		N	
CCM		Y	
VCM		Y	
ACM		Y	
Single Transport Stream		Y	
Multiple Transport Streams		Y	
Single Generic Streams		Y	
Multiple Generic Streams		Y	
Input Stream Synchronizer		N	
Null Packet Deletion		N	
Dummy Frame Insertion		Y	
Beam Hopping Periodic BH, VLSNR (Superframe Format 5)		Y	
Traffic driven BH VLSNR) (Superframe Format 6)		Y	
Traffic driven BH, no VL-SNR (Superframe Format 7)		Y	
Y = Supported N = Not supported			

1.3. DVB-RCS2 Standards Compatibility

The tables below denote all the terminal features supported by the EZID211 ASIC according to Table 1 and Table 2 of [3].

Table 4: DVB-RCS2 Terminal Features Capability

Terminal feature	EZID211	Comment
PHYSICAL LAYER		
QPSK/8PSK support on the return link	Y	
CPM support on the return link	N	
Reference waveforms	Y	
Custom waveforms	N	
Continuous Carrier mode operation	Y	
BPSK transmission on the return link	Y	
Direct Sequence spread spectrum on the return link	N	
Waveform bound permanently to timeslot	Y	
Waveform allocated to timeslots at the time of assignment	Y	
EIRP power control	Y	
Constant Power Density control	Y	
Forward link DVB-S2 CCM, S2 ACM	Y	
Forward link DVB-S2X ACM	Y	
Forward link DVB-S2X Annex E	Y	Superframes formats 5, 6, 7
Forward Link Single Continuous Generic Stream	Y	
Forward link Single TS Packet Stream	Y	
Forward link Multiple Streams (TS or GS)	Y	
GSE in BBframe CRC32	N	
NCRv2 support in DVB-S2X	Y	Also NCRv3
MAC LAYER	N	EZID211 is physical layer only.
Y = Supported N = Not supported		

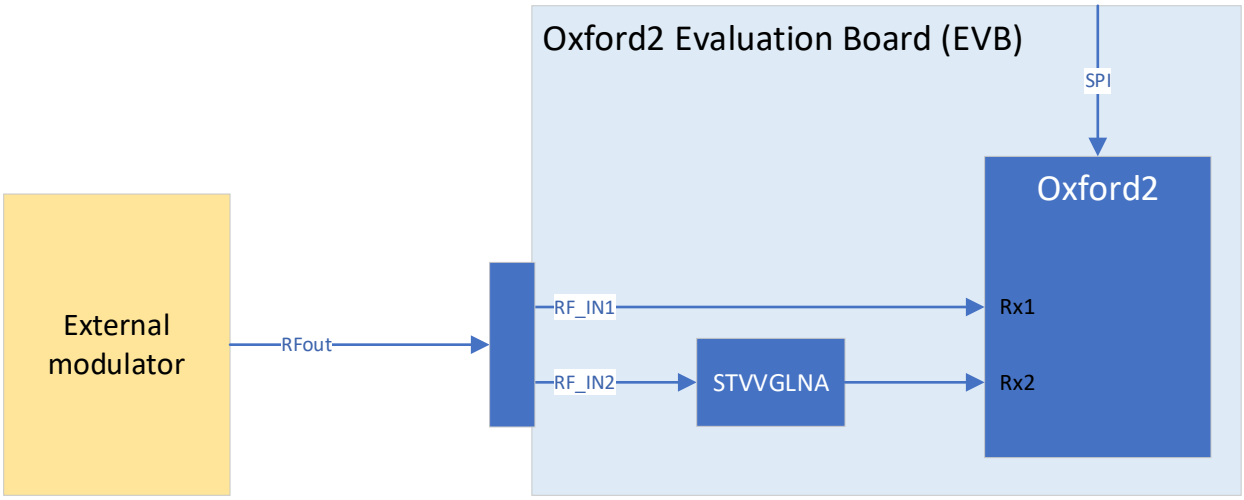
Table 5: Terminal Profiles Description- Physical Layer

Terminal profiles	EZID211	Comments
PHYSICAL LAYER		
16 QAM return link modulation	Y	
32APSK Forward Link modulation	?	
Essential waveform flexibility	Y	
Fast carrier switching	Y	
Carrier switching classes	Y	1,2
Y = Supported N = Not supported		

2. Reception tests

2.1. Test setup A: Demodulator interoperability testing

Figure 1: Test setup A: external modulator



The interoperability tests were performed against a standard compliant signal generator. Interoperability is demonstrated either by QEF tests, where the implementation degradation is close to the ideal Es/No as defined in [1] and [2], or by test where a high signal level was used and a correct decoding of known symbols (PLS, preamble and postamble) is declared by the demodulator.

The following external modulators were used to establish the interoperability conformity of the Oxford-2 demodulator in all modes.

List of external modulators:

- iDirect Modulator MDM5010, S2X, VLSNR, SF5, 6 & 7.
- Teamcast Tyger, S2X, VLSNR, SF5, 6 & 7.
- Rohde&Schwarz DVB-S2 modulators: SFU/SFC/SFE series (limitation: SRmin=1MBd, SRmax=45MBd, DVB-S2 MODCODs only) and SMCV100B.

Note SFU/SFC/SFE used mainly to prove interoperability, some of these models may no longer be supported or serviced.

2.2. Continuous S2/S2X Waveforms

Table 7 below summarizes the QEF Test Results for the 2E5 frame count.

Table 6: DVB-S2X QEF test Results

PLS code	MODCOD	Symbol rate (MBd)	QEF measured (dB)	Standard QEF (dB)	QEF meas - std (dB)	QEF status
5	QPSK 1/4	480	-2.16	-2.36	0.2	PASS
9	QPSK 1/3	480	-0.92	-1.22	0.3	PASS
13	QPSK 2/5	480	-0.07	-0.27	0.2	PASS
17	QPSK 1/2	480	1.25	1.05	0.2	PASS
21	QPSK 3/5	480	2.6	2.3	0.3	PASS
25	QPSK 2/3	480	3.38	3.18	0.2	PASS
29	QPSK 3/4	480	4.22	4.12	0.1	PASS
33	QPSK 4/5	480	4.87	4.77	0.1	PASS
37	QPSK 5/6	480	5.38	5.28	0.1	PASS
77	16APSK 3/4	480	10.7	10.3	0.4	PASS
97	32APSK 3/4	480	13.12	12.82	0.3	PASS
133	QPSK 13/45	480	-1.53	-2.03	0.5	PASS
135	QPSK 9/20	480	0.52	0.22	0.3	PASS
137	QPSK 11/20	480	1.75	1.45	0.3	PASS
149	16APSK 1/2-L	480	6.27	5.97	0.3	PASS
153	16APSK 5/9-L	480	7.24	6.84	0.4	PASS
159	16APSK 3/5-L	480	7.71	7.41	0.3	PASS
161	16APSK 28/45	480	8.5	8.1	0.4	PASS
165	16APSK 2/3-L	480	8.63	8.43	0.2	PASS
167	16APSK 25/36	480	9.67	9.27	0.4	PASS
175	32APSK 2/3-L	480	11.5	11.1	0.4	PASS
179	32APSK 32/45	480	12.15	11.75	0.4	PASS
183	32APSK 7/9	480	13.45	13.05	0.4	PASS
185	64APSK 32/45-L	480	14.38	13.98	0.4	PASS
191	64APSK 7/9	480	15.87	15.47	0.4	PASS
199	64APSK 5/6	480	16.95	16.55	0.4	PASS

The table below lists the DVB-S2/X VLSNR QEF Test Results for the 3E5 frame count.

Table 7: DVB-S2X VLSNR QEF Test results

Canonical PLS code	MODCOD	Frame length	QEF measured (dB)	Standard QEF (dB)	QEF meas - std (dB)	QEF status
129/0	QPSK 2/9	Normal	-2.35	-2.85	0.5	PASS
129/1	BPSK 1/5	Medium	-6.45	-6.85	0.4	PASS
129/2	BPSK 11/45	Medium	-5.1	-5.5	0.4	PASS
129/3	BPSK 1/3	Medium	-3.8	-4	0.2	PASS

129/4	BPSK-S 1/5	Short	-9.2	-9.9	0.7	LIMIT
131/1	BPSK 4/15	Short	-4.5	-4.9	0.4	PASS
131/0	BPSK 1/5	Short	-5.6	-6.1	0.5	PASS
129/5	BPSK-S 11/45	Short	-7.9	-8.3	0.4	PASS
131/2	BPSK 1/3	Short	-3.42	-3.72	0.3	PASS

2.3. Burst waveform, Annex E, Superframe Format 6

The table below summarizes the QEF Test Results for Superfame 6 MODCODs. The test was performed with variable SuperFrame size, at several symbol rates. The results for 480Msps are reported. Within each SuperFrame the same MODCOD is used for all the frames. The signal is transmitted in bursts at different rates.

Table 8: SF6 QEF Test Results

PLS code	Modcod	BHCT Time (ms)	Dwell Time (ms)	Theory QEF (dB)	demod cnr (dB)	Delta Tx-theory QEF (dB)	FER	row results
4/5	QPSK 1/4,Normal	50	12.9	-2.36	-2.2	0.16	6.66E-06	PASS
8/9	QPSK 1/3,Normal	20	9.7	-1.22	-0.9	0.32	3.29E-06	PASS
20/21	QPSK 3/5,Normal	10	3.6	2.3	2.5	0.2	3.24E-06	PASS
28/29	QPSK 3/4,Normal	50	7	4.12	4.2	0.08	9.93E-06	PASS
36/37	QPSK 5/6,Normal	50	23.9	5.28	5.3	0.02	3.18E-06	PASS
96/97	32APSK 3/4,Normal	10	3.7	12.82	13	0.18	3.26E-06	PASS
134/135	QPSK 9/20,Normal	50	16.5	0.22	0.6	0.38	3.32E-06	PASS
148/149	16APSK 1/2-L,Normal	10	1.6	5.97	6.2	0.23	3.33E-06	PASS
158/159	16APSK 3/5-L,Normal	20	4	7.41	7.6	0.19	3.24E-06	PASS
166/167	16APSK 25/36,Normal	10	1.5	9.27	9.6	0.33	3.31E-06	PASS
174/175	32APSK 2/3-L,Normal	20	5	11.1	11.5	0.4	3.23E-06	PASS
184/185	64APSK 32/45-L,Normal	10	1.9	13.98	14.3	0.32	9.73E-06	PASS

2.4. DVB-RCS2 QEF Test

The EZiD211 ASIC is intended as a user terminal device and as such does not implement an RCS-2 receiver.

Not Applicable.

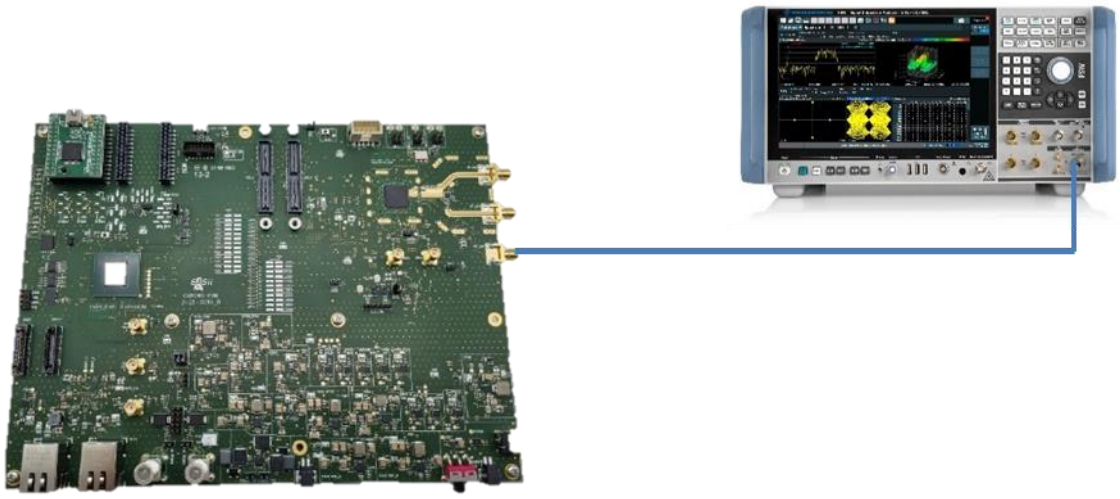
3. Transmission tests

3.1. Test setup

3.1.1. Test set up for RCS2 transmit compliance testing

Rx = FSW/RCS2 tool (R&S)
Tx = Easii-ic Evalboard
EvalBoard.RF ---------> FSW/RCS2
RF = 1550 MHz
SR = 10 MS/s
Easii-ic Evalboard with Oxford server
Setup FSW/VSA with RCS2-tool
Signal capture = IF level (-30 dBm)
The tests were conducted by R&S in R&S Laboratories.

Figure 2: RCS2 EVM transmission test set-up



3.1.2. Test set up for S2X transmit compliance testing.

The Oxford-2 demodulator has already been tested using multiple 3rd party modulators (see demodulator testing section). The Oxford-2 modulator was tested by looping back to the demodulator. The tests were conducted by EASII IC, in EASII IC laboratories.

Figure 3: Test setup B: internal (RC) modulator S2X test set-up

The integrated RC modulator generates baseband I/Q signals, which are lowpass-filtered (60MHz bandwidth on I and Q channels) before RF up-conversion around a Tx_LO carrier (using ADF4350 synthesizer and ADL5375 I/Q modulator). Typical Tx_LO frequency is 1550MHz.

3.2. DVB-RCS2 EVM Test

Table 12 summarises the Tx RCS2 EVM test results.

For all waveforms the Preamble and Postamble were identified correctly by the R&S FSW Signal Analyzer.

Table 9: TX RCS2 EVM Test Results – LM Waveforms

Waveform ID	Modulation	Code rate	Burst Length (symbol)	Symbol rate [Msps]	EVM rms [%]
1	QPSK	1/3	664	10	---
2	QPSK	1/3	262	10	---
3	QPSK	1/3	536	10	1.76
4	QPSK	1/2	536	10	1.89
5	QPSK	2/3	536	10	1.73
6	QPSK	3/4	536	10	1.74
7	QPSK	5/6	536	10	1.7
8	8PSK	2/3	536	10	1.78
9	8PSK	3/4	536	10	1.71
10	8PSK	5/6	536	10	1.7
11	16QAM	3/4	536	10	1.82
12	16QAM	5/6	536	10	1.93
13	QPSK	1/3	1616	10	2.08
14	QPSK	1/2	1616	10	2.12
15	QPSK	2/3	1616	10	2.01
16	QPSK	3/4	1616	10	1.9
17	QPSK	5/6	1616	10	2.1

18	8QPSK	2/3	1616	10	1.97
19	8QPSK	3/4	1616	10	1.86
20	8QPSK	5/6	1616	10	1.96
21	16QAM	3/4	1616	10	2.04
22	16QAM	5/6	1616	10	2.02
32	QPSK	1/2	832	10	1.82
33	QPSK	3/4	566	10	1.74
34	QPSK	1/2	1392	10	1.88
35	QPSK	3/4	938	10	1.83
36	QPSK	7/8	810	10	1.78
37	QPSK	2/3	2660	10	2.21
38	QPSK	4/5	2222	10	2.11
39	QPSK	6/7	2076	10	2.15
40	BPSK	1/3	1868	10	1.98
41	BPSK	1/3	1612	10	1.92
42	BPSK	1/3	3236	10	2.31
43	BPSK	1/2	3236	10	2.32
44	QPSK	5/6	266	10	1.64
45	8PSK	2/3	266	10	1.61
46	8PSK	3/4	266	10	1.63
47	8PSK	5/6	266	10	1.62
48	16QAM	3/4	266	10	1.87
49	16QAM	5/6	266	10	1.99

3.3. Continuous S2/S2X Waveforms

3.3.1. TX and PLS Decoding Tests

The demodulator having been extensively tested using multiple modulators from multiple manufacturers was used to verify the compliance of the Oxford-2 internal return channel modulator in DVB-S2X mode.

The tables below describe the Tx DVB-S2\X test results, for a set of waveforms and symbol rates. The waveforms were tested for conformity to the standard. The table reports on a selection of Normal frames for symbol rate 120Msps, roll-off = 5% and Pilots on.

Table 10: Results Continuous S2/S2X Waveforms

PLS code	MODCOD	QEF measured (dB)	Standard QEF (dB)	QEF meas - std (dB)	QEF status	Frames counted	FER
5	QPSK 1/4	-2.26	-2.36	0.1	PASS	313646	3.1E-06
9	QPSK 1/3	-1.02	-1.22	0.2	PASS	313463	0.0E+00
13	QPSK 2/5	-0.17	-0.27	0.1	PASS	313657	0.0E+00

17	QPSK 1/2	1.15	1.05	0.1	PASS	313013	3.1E-06
21	QPSK 3/5	2.4	2.3	0.1	PASS	313556	0.0E+00
25	QPSK 2/3	3.18	3.18	0	PASS	313043	0.0E+00
29	QPSK 3/4	4.12	4.12	0	PASS	313202	0.0E+00
33	QPSK 4/5	4.67	4.77	-0.1	PASS	313453	0.0E+00
37	QPSK 5/6	5.18	5.28	-0.1	PASS	313056	0.0E+00
41	QPSK 8/9	6.2	6.3	-0.1	PASS	313353	0.0E+00
45	QPSK 9/10	6.42	6.52	-0.1	PASS	313344	0.0E+00
51	8PSK 3/5	6.27	5.87	0.4	PASS	324514	0.0E+00
55	8PSK 2/3	7	7	0	PASS	325570	5E-06
59	8PSK 3/4	8.3	8.3	0	PASS	326435	3E-06
63	8PSK 5/6	9.75	9.75	0	PASS	326070	5E-06
77	16APSK 3/4	10.4	10.3	0.1	PASS	330591	0.0E+00
97	32APSK 3/4	13.02	12.82	0.2	PASS	320743	0.0E+00
133	QPSK 13/45	-1.63	-2.03	0.4	PASS	313188	0.0E+00
135	QPSK 9/20	0.42	0.22	0.2	PASS	313779	3.1E-06
137	QPSK 11/20	1.65	1.45	0.2	PASS	313192	0.0E+00
149	16APSK 1/2-L	6.17	5.97	0.2	PASS	330649	0.0E+00
153	16APSK 5/9-L	7.04	6.84	0.2	PASS	330990	0.0E+00
159	16APSK 3/5-L	7.61	7.41	0.2	PASS	321791	0.0E+00
161	16APSK 28/45	8.5	8.1	0.4	PASS	311387	0.0E+00
165	16APSK 2/3-L	8.63	8.43	0.2	PASS	332995	0.0E+00
167	16APSK 25/36	9.57	9.27	0.3	PASS	332586	0.0E+00
175	32APSK 2/3-L	11.4	11.1	0.3	PASS	324936	0.0E+00
179	32APSK 32/45	12.05	11.75	0.3	PASS	324714	0.0E+00
183	32APSK 7/9	13.45	13.05	0.4	PASS	324458	0.0E+00
185	64APSK 32/45-L	14.38	13.98	0.4	PASS	334445	0.0E+00
191	64APSK 7/9	15.87	15.47	0.4	PASS	334325	0.0E+00
199	64APSK 5/6	16.85	16.55	0.3	PASS	335154	2.8E-06
201	128APSK 3/4	18.53	17.73	0.8	PASS	326213	0.0E+00
203	128APSK 7/9	19.43	18.53	0.9	PASS	327583	0.0E+00
205	256APSK 29/45-L	17.68	16.98	0.7	PASS	309563	0.0E+00
207	256APSK 2/3-L	18.04	17.24	0.8	PASS	309304	0.0E+00
209	256APSK 31/45-L	18.8	18.1	0.7	PASS	308605	0.0E+00
211	256APSK 32/45	19.49	18.59	0.9	PASS	309818	3.0E-06
213	256APSK 11/15-L	19.74	18.84	0.9	PASS	308700	0.0E+00
215	256APSK 3/4	20.57	19.57	1	PASS	309298	0.0E+00

The VLSNR waveforms were tested using DSF as per R2.

Table 11: Results Continuous S2/S2X VLSNR Waveforms

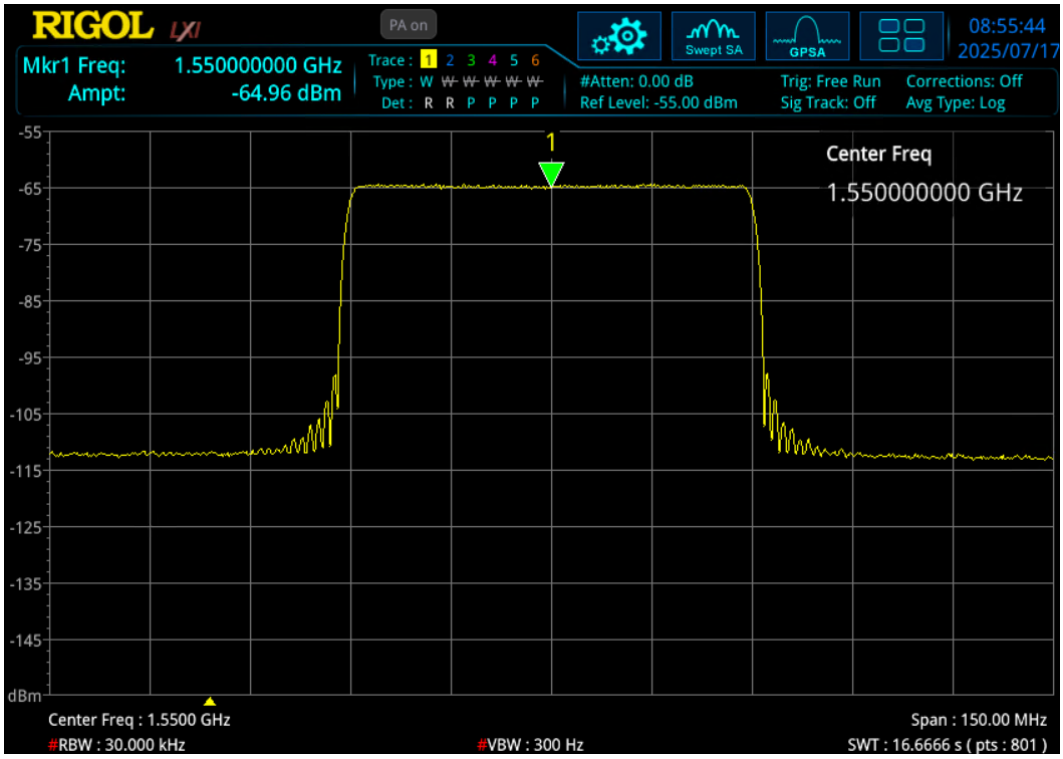
PLS code	MODCOD	Frame length	QEF measured (dB)	Standard QEF (dB)	QEF meas - std (dB)	QEF status	Errors counted	Frames counted
129/0	QPSK 2/9	Normal	-2.35	-2.85	0.5	PASS	0	308263
129/1	BPSK 1/5	Medium	-6.45	-6.85	0.4	PASS	3	308256
129/2	BPSK 11/45	Medium	-5.1	-5.5	0.4	PASS	0	308677
129/3	BPSK 1/3	Medium	-3.8	-4	0.2	PASS	0	308273
129/4	BPSK-S 1/5	Short	-9.2	-9.9	0.7	LIMIT	2	308361
129/5	BPSK 4/15	Short	-4.5	-4.9	0.4	PASS	2	323046
131/0	BPSK 1/5	Short	-5.6	-6.1	0.5	PASS	0	322593
131/1	BPSK-S 11/45	Short	-7.9	-8.3	0.4	PASS	2	308059
131/2	BPSK 1/3	Short	-3.42	-3.72	0.3	PASS	0	322790

3.3.2. TX Spectral Mask Test

The figures below summarize the Mask test Results performed for some Normal frames of DVB-S2/S2X waveforms, with roll-off 5%.

The signal spectrum is compared to the masks as defined in [2], Annex A.

Figure 4: Transmit spectrum 5% roll off



4. Doppler generation / Correction

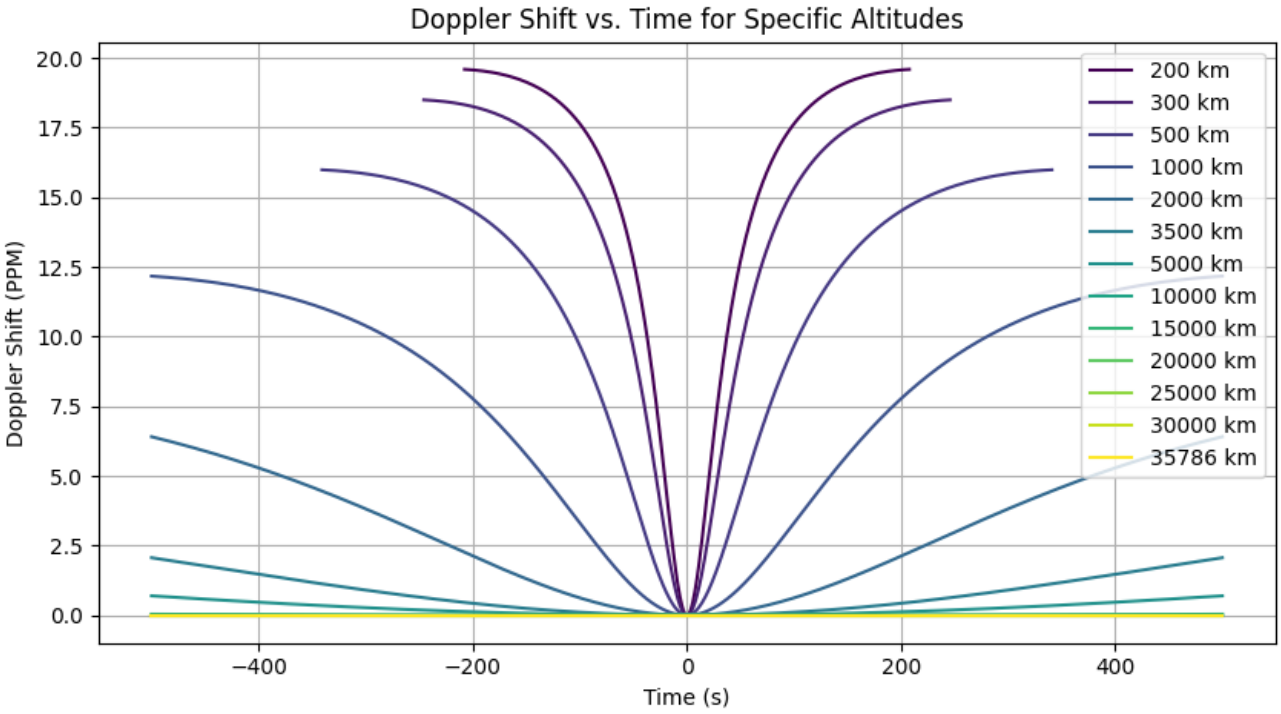
4.1.1. Description:

The Oxford2 demodulator is able to compensate for Doppler shift, the objective of this test is to measure if Oxford2 demodulator support to compensate the Doppler frequency and symbol rate shift for a LEO satellites.

4.1.2. Configuration

The Test setup A is used in this test. Test is done with HPMod (EASII IC) modulator which can generate the carrier offset and symbol rate Doppler shift.

Figure 5: Doppler shift profile for various altitudes



This test uses the 200km parameters as modulator doppler shift configuration, it is the worst case.

The test contains 2 phases: the satellite approaches to observer, the carrier frequency offset and symbol offset decrease to 0, then the satellite moves away from observer, the carrier frequency offset and symbol rate offset increase to maximum. The Total test duration 400 seconds.

Test Time (s)	Carrier frequency offset (Hz)	Carrier frequency drift speed (Hz/s)	Symbol Rate Offset (ppm)	Symbol Rate Drift speed (ppm/s)
[-200,0]	[59000,0]	[0, -10633]	[19.5,0]	[0, -1.1]

Test Time (s)	Carrier frequency offset (Hz)	Carrier frequency drift speed (Hz/s)	Symbol Rate Offset (ppm)	Symbol Rate Drift speed (ppm/s)
[0,200]	[0, 59000]	[10633,0]	[0,19.5]	[1.1,0]

Symbol Rate=80Ms/s, Carrier Frequency = 1550MHz, Pilot On, roll-off=5%, AnnexM, the fowling PLS code is tested:

PLS code	MODCOD	Theory QEF dB	Modulator CNR dB
213	256APSK 11/15-L, Normal	18,84	20
105	32APSK 5/6, Normal	14,38	15
73	16APSK 2/3, Normal	9,05	10
29	QPSK 3/4, Normal	4,12	5

4.1.3. Conclusion

During the test, there is no demodulator de-lock, FER remains below 1e-5, no BCH error nor lost packet error is observed.

Oxford2 demodulator supports Doppler compensation for both frequency and symbol rate offset.

5. IMPORTANT NOTICE AND DISCLAIMER

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