# The DVB-S2x Standard and NovelSat NS3

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# 1. Introduction

In March 2014, the DVB Project consortium approved the DVB-S2X (Digital Video Broadcast S2 Extensions) technical specification for satellite-based video transmission. The DVB-S2X is a **non-backward compatible** extension of the DVB-S2 standard.

NovelSat, with the introduction of NovelSat NS3™ technology in 2009, has demonstrated a significant performance improvement over DVB-S2. NovelSat NS3 systems can now be found in more than 3,000 installations around the world, mainly for the video contribution and distribution markets, cellular backhaul and other industries requiring high performance, highly reliable satellite transmission equipment. The success of NovelSat NS3 was the trigger for the development of the DVB-S2X standard.

In this document we present the DVB-S2X standard and compare its performance with NovelSat NS3.

## 1.1    The DVB-S2X Standard

The DVB-S2X standard retains the main architecture of DVB-S2 with some changes which make it **non-backward compatible with DVB-S2**. It features finer MODCOD granularity, reduced roll-off factor (ROF) and linear channel modes (for use in multi-carrier per transponder configurations).

These are features that were implemented and demonstrated long ago in NovelSat NS3 and have since been continuously updated. The DVB-S2X standard extends the operation of DVB-S2 to a larger range of signal to noise ratio (SNR) values and introduces the very-low SNR range (VLSNR) and the very-high SNR range (VHSNR).

Other features introduced in the DVB-S2X standard include channel bonding and the use of higher level protocols (GSE-Lite). An optional super-frame feature allows for better synchronization and frame alignment, which might be useful for applications using multi-beam satellites.

The success of the standard, in terms of market penetration, depends mainly on availability of ASICs for the DTH set-top box market. ASIC vendors have not announced support for this standard mostly because of lack of backward compatibility and minimal performance improvement.

Table 1, below, produced by the DVB Project consortium, shows the potential improvement that can be achieved by different features of the DVB-S2x standard physical layer.

Table 1:  Potential Improvement that can be achieved by DVB-S2x

| DVB-S2X Characteristic | | 1+roll-off rule | Free symbol-rate optimization |
|---|---|---|---|
| **Physical Layer** | Better MODCODs | **0%**  for SNR<10dB 5%  or larger (SNR>10) | **0%**  for SNR<10dB 5%  or larger (SNR>10) |
| | Finer granularity | **0%** to 10% | **0%** to 3% |
| | Sharper roll-off (5% vs. 20%) | 6%- 7% | **0%** to 3% |

The comparison is made against a standard DVB-S2 system. One should note that for DTH, full transponders are used and hence the 1+roll-off rule for bandwidth allocation

does not necessarily imply. For full transponders, assuming symbol rate optimization, the total gain from finer MODCOD granularity and roll off cannot be expected to add up significantly. The table assumes that the DVB-S2 example does not use 16-APSK. If the DVB-S2 system were to use 16-APSK (which is in the standard already) then the gain attributed for better MODCODs for SNR>10dB decreases to zero.

This is a far cry from the 30% gain achieved by DVB-S2 over DVB-S systems, or the 15% gain required by the DVB Project consortium in the commercial requirements for the DVB-S2X standard. With so little gain, and considering that the DVB-S2X standard is not compatible with the DVB-S2 standard, its attractiveness for DTH operators is very small. Hence, the success of the standard, in terms of its adoption by a large market share is doubtful.

The standard approval has not been at all unanimous. The contribution CM-1439 to the DVB Commercial module raises doubts about the process, emphasizing the low level of improvement that the standard offers (0-5%). Other companies have also expressed their reservations in the standardization committee.

## 1.2    NovelSat NS3 Performance vs. DVB-S2

Figure 1, below, compares the spectral efficiency of a NovelSat NS3 system with that of DVB-S2. In the range of 7-8 dB an improvement of 29% over DVB-S2 is achieved, and in the high range of 18 dB, NovelSat NS3 provides a 37% advantage over DVB-S2. The advantage of NovelSat NS3 is clear over the entire SNR range.
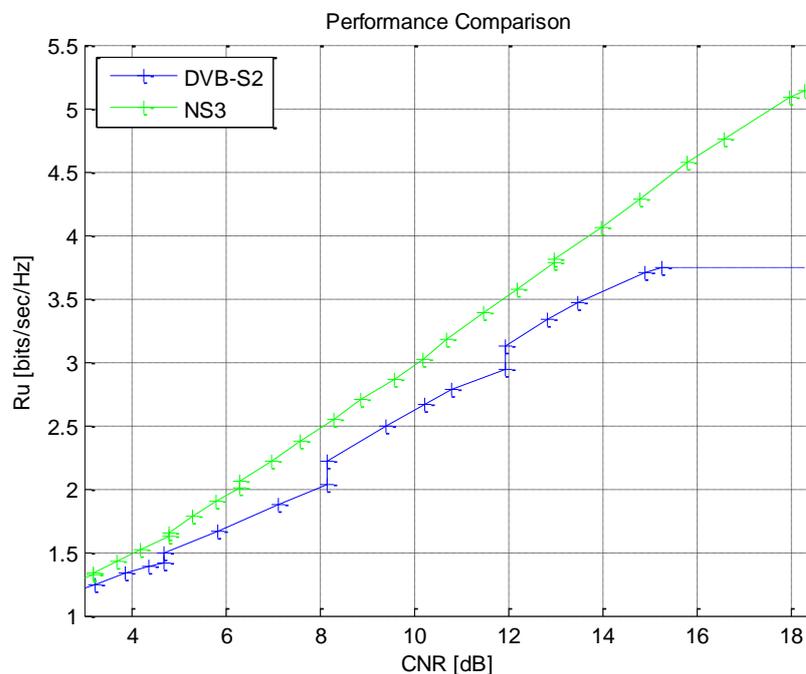


Figure 1:  Comparison between NovelSat NS3 and DVB-S2 Spectral Efficiency

It should be emphasized that in addition to spectral efficiency, a modulator-demodulator needs to be resilient to signal degradation caused by factors such as phase noise. Figure 2, below, shows the same spectral efficiency graph, of Figure 1, with the addition of the asterisk marks, which represent points measured in the lab with the presence of phase noise. The resilience of NovelSat NS3 to phase noise is evident, as it

shows very little degradation. Comparisons made in the lab between a NovelSat modem and a DVB-S2 modem made by another manufacturer show even larger differences.
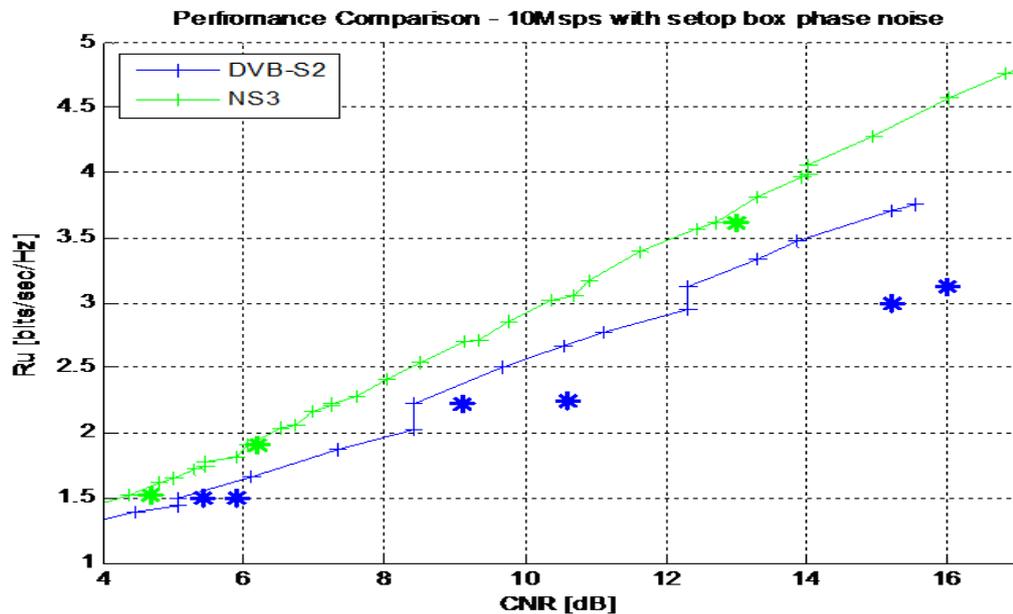


**Figure 2: Comparison between NovelSat NS3 and DVB-S2**
**Spectral Efficiency – Ideal channel (+), with the presence of phase noise (\*)**

## 1.3    DVB-S2 with 5% ROF – A standards-based solution from NovelSat

For those preferring to stay with the DVB-S2 standard, NovelSat and others have released a version of the DVB-S2 standard with 5% ROF. Unlike DVB-S2X, DVB-S2 with 5% ROF from NovelSat is backward compatible with DVB-S2.

Figure 3, below, compares DVB-S2 with 5% ROF with the DVB-S2X standard. **With DVB-S2X, the average gain in efficiency over the enitre usable range is 2.2%.** The actual gain, which is due to granualrity ranges between 0% and 3%, which does not present a sufficient justification for  switching to DVB-SX or manufacturing a new ASIC. Compared with DVB-S2 modulators/demodulators, the improvement of the DVB-S2X standard is **negligible**.
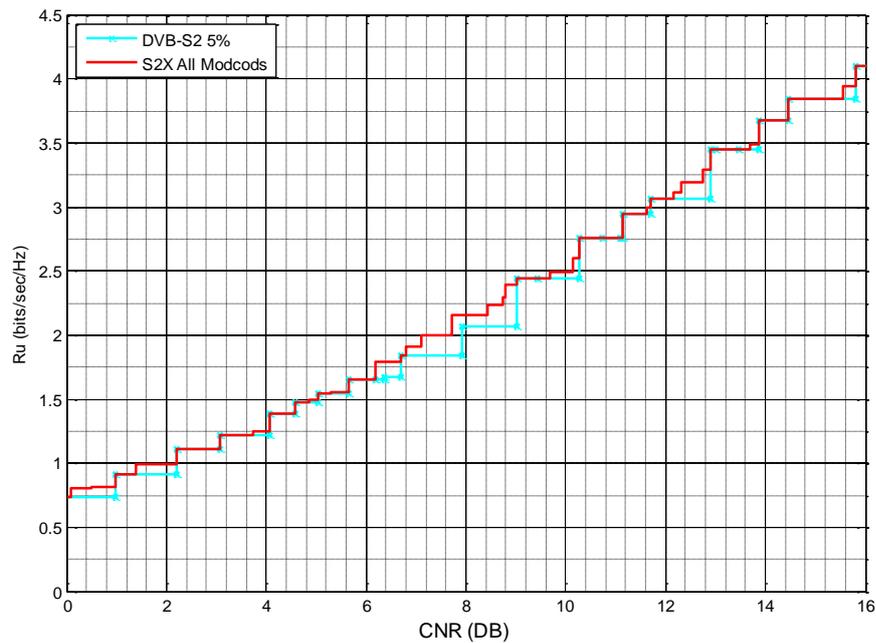
Figure 3: Comparison between DVB-S2X and DVB-S2 with 5% ROF

Current ASICs support DVB-S2 with 5% ROF from NovelSat. DVB-S2 with 5% ROF is already implemented in IRDs including SaTurn by TeamCast, RD-70 by ADTECH, SMD989/MRD 5800 by Sencore and in NovelSat equipment).

## 1.4    NovelSat Waveform Roadmap – NovelSat NS4

NovelSat is developing the next generation waveform, NovelSat **NS4**. This will further improve spectral efficiency even beyond NovelSat NS3. The expected average spectral efficiency improvement is over 15% beyond NovelSat NS3 (over the entire CNR range (0-20dB)). All NovelSat product are upgradeble to NovelSat NS4.

## 1.5    Conclusions

The newly published DVB-S2X standard provides some  enhancements both in the physical and upper layers. Still, it does not present the necessary improvement needed in order to be attractive, gain critical market share and justify chip set development.

That said, NovelSat is commited to support all standards and therefore will support the DVB-S2X standard as well, although it has shown that NovelSat NS3 is the superior option.

In bandwidth cost sensitive markets, or in areas suffering from lack of bandwidth, NovelSat NS3 is the preferred technology, providing over 30% improvement.

The architucture of NovelSat products allows easy upgrading to add NS4 and DVB-S2X to the list of supported protocols.

However, if an organization chooses to have an improved version of DVB-S2 while staying standards-based, they should opt for DVB-S2 with 5% ROF from NovelSat. The nominal 3% improvement with DVB-S2X accompanied by the loss of backward compatibility are not worth the deviation from standards.

# 2    About NovelSat

NovelSat is a technology company dedicated to providing the next-generation modulation standard for satellite communications. NovelSat NS3™ technology – encompassing ultra-high end modulators, demodulators, modems and ASICs – essentially replaces DVB-S2 as the industry standard. NovelSat delivers the fastest data rates, the widest pipe and the most compelling ROI. That means you get the best performance at the lowest costs, resulting in the highest profits.

## 2.1    Contact Information

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