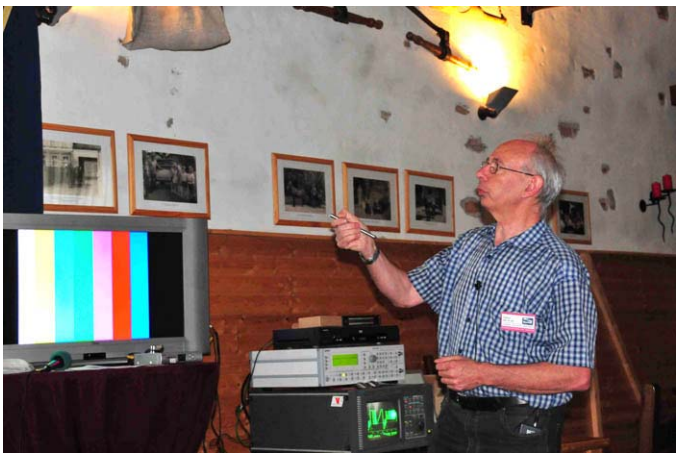
TechTalk93

DATV – Transmission-Test and Range-Test comparing DVB-S and DVB-S2

by Hans-Gerhard Hass DC8UE

Commercial TV-stations in Europe are just changing their satellite contribution from the older DVB-S protocol to the newer DVB-S2 protocol in order to reduce bandwidth. So I have access to the newest equipment and have had the possibility to make some test with new DVB-S2 equipment on DATV-transmissions.

I used a DVB-S2-encoder (from a commercial company called Tandberg Voyager E5740). This Encoder has a built-in DVB-S2-modulator and produces an output-signal in the frequency-range between 950MHz and 1750MHz. This signal would be normally up-converted with an LO of 12.800 GHz into the Ku-band satellite uplink-range from 13.750 GHz to 14.500 GHz. Instead of that, I have used a down-converter from DGØVE to bring this L-band signal down to the 450MHz-range and have transmitted this SCPC-signal with 2 MSymb/s and an FEC of ½ in the DVB-S2-QPSK-mode. I have used a saturated 40Watt PA operating at a linear operation point of 10W RF output on a 6dB antenna.



Hans DC8UE lecturing at the ATV Convention in Glovzin, Germany

On the receiving side we have used a 14db yagi antenna and also an up-converter from DGØVE to bring the receiving UHF-signal back to the L-band. The receiver was also a commercial Tandberg TT1260 (but it also runs with a consumer DVB-S2 HDTV receiver from Comag).

As I am also a pilot, we tried to transmit from a helicopter in a height of near 5000 feet over a distance more than 90 miles to a ground-station with these directional antennas on both sides. The signal on the receiving side was only 2.5 db ahead the noise level (C/N), but the picture was perfect. When we lower the altitude of the helicopter and the receiving S/N reaches 2 dB and below, the picture was gone (see **Table 1**). The range between "working or not working" in the DVB-S2-mode is in a range of smaller than 0.2 dB.

Table 1 – Digital Signal-to-Noise ratio (C/N) For DVB-S2 Protocol for Different FEC Settings and for QPSK and 8PSK

DVB-S2

FEC Rate LDPC	C/N (dB) QPSK	8PSK
1/2	2.00	(not permitted)
3/5	3.23	6.50
2/3	4.10	7.62
3/4	5.03	8.91
4/5	5.68	(not permitted)
5/6	6.18	10.35
8/9	7.20	11.69
9/10	7.42	11.98

We tried also to use DVB-S-QPSK-mode. There we needed a C/N of more than 5.5dB with ½ FEC and more than 6.5dB with 3/4 FEC (see **Table 2**). When we changed to the old FM-mode, there was only to find a signal in the range of 1dB over the noise level available only on the spectrum-analyser, but no picture to see. With the same PA only in DVB-S2-QPSK-1/2-mode there was a pretty picture to receive.

This shows to me, that in the future there may be a small chance to make DATV-DX possible. The main problem today is, that the prices for the encoding-equipment and transmitting-equipment for DVB-S2 are not in an amateur range (but we hope the best for the future).

I have added small tables with the necessary C/N-rates for DVB-S2 (**Table 1**) and DVB-S (**Table 2**) with different FEC-rates and in the different modes QPSK (2Bits per Symbol.) and also 8PSK (3Bits per Symbol.). DVB-S uses the Convolutional-Viterbi-code for the FEC. And DVB-S2 is operating the new (and "better") LDPC-code (Low Density Parity Check). And these new codes add at the same QPSK-modulation and the same FEC-rate (1/2) a performance step upwards to 3.5dB.

Table 2 – Digital Signal-to-Noise ratio (C/N) for DVB-S Protocol for Different FEC Settings for QPSK Modulation

DVB-S

FEC Rate Convolutional	C/N (dB) QPSK
1/2	5.50
2/3	6.00
3/4	6.50
5/6	7.00
7/8	7.40

Table 3 – Details for DVB-S Protocol

DVB-S	MPEG framing:	Bytes
	Net data bits	188
	Gross data bits	204
FEC:	inner:	Convolutional (Viterbi)
	outer:	Reed-Solomon

Table 4 – Details for DVB-S2 Protocol

DVB-S2	FEC-Frame type:	Net data	Gross data/frame
	normal	8100	64800 (Note: 40 times longer as DVB-S)
	short	2025	16200
FEC:	inner:	LDPC (Low Density Parity Check)	
	outer:	BCH (Bose-Chaudhudri-Hocquenghem)	

Interesting DATV Links

- Digital Video Broadcasting organization (DVB commercial standards) – see **www.DVB.org**
- Digital Video Broadcasting standard for DVB-S2 – see ETSI EN 302 307 specification
- British ATV Club - Digital Forum – see **www.BATC.org.UK/forum/**
- German portal for DATV streaming repeaters and downloads – see **www.D-ATV.net** (in German)
- AGAF D-ATV components (Boards) – see **www.datv-agaf.de** and **www.AGAF.de**
- SR-Systems D-ATV components (Boards) – see **www.SR-systems.de**
- DGØVE microwave amps, up-converters, down-converters – see **www.DG0VE.de**
- Orange County ARC TechTalk76-DATV on DVB-S modulation – see **www.W6ZE.org/DATV/**
- Orange County ARC TechTalk92-DATV on DVB-S2 protocol – see **www.W6ZE.org/DATV/**
- Orange County ARC newsletter entire series of DATV articles – see **www.W6ZE.org/DATV/**
- Wikipedia on DVB-S2 – see **http://en.wikipedia.org/wiki/DVB-S2**