DVB-T MEASURING SITE AND EXPERIMENTAL BROADCASTING TESTS RESULTS

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ABSTRACT

The paper presents potentialities and abilities of DVB-T measuring and testing site as is prepared to use at laboratory works in "Fundamentals of television techniques" Bachelor's program course. The aim of the work is to measure the properties of DVB-T. Possible results are demonstrated on experimental broadcasting in Brno region.

1 INTRODUCTION

Digital television broadcasting has developed currently. In many regions experimental broadcasting passes to stable multiplexes. In the Czech Republic three experimental multiplexes are currently broadcasting. České Radiokomunikace and Czech Digital Group started independently in 2000, and Český Telecom began in 2004.

The advantage of DVB-T system is in COFDM (Coded Orthogonal Frequency Division Multiplex) modulation. It solves problems with multi-path propagation, when the signal from given transmitter comes to the receiver from more then one direction with different delay (especially in agglomerations). The receiving of more transmitters' signal on the contrary to analogue broadcasting does not affect negatively the quality. The DVBT system uses MPEG-2 codes [1], which suppress effectively the redundancy in signal. Both FEC (Forward Error Correction) with block RS (Reed-Solomon) code [2] and inner convolution code with ratios in interval from 1/2 to 7/8, guarding the transmission are used.

The DVB-T service is broadcasted in the band identical to existing analogue television; hence the current antenna system can be used for receiving. In the places with a strong signal only indoor antenna is sufficient.

2 MEASURING AND TESTING SITE

Presented site consists of test receiver KATHRAIN MSK 33, MPEG-2 decoder R&S DVMD, MPEG-2 recorder and generator R&S DVRG, DVB-T transmitter R&S SFLT-T and LCD monitor (figure 1).

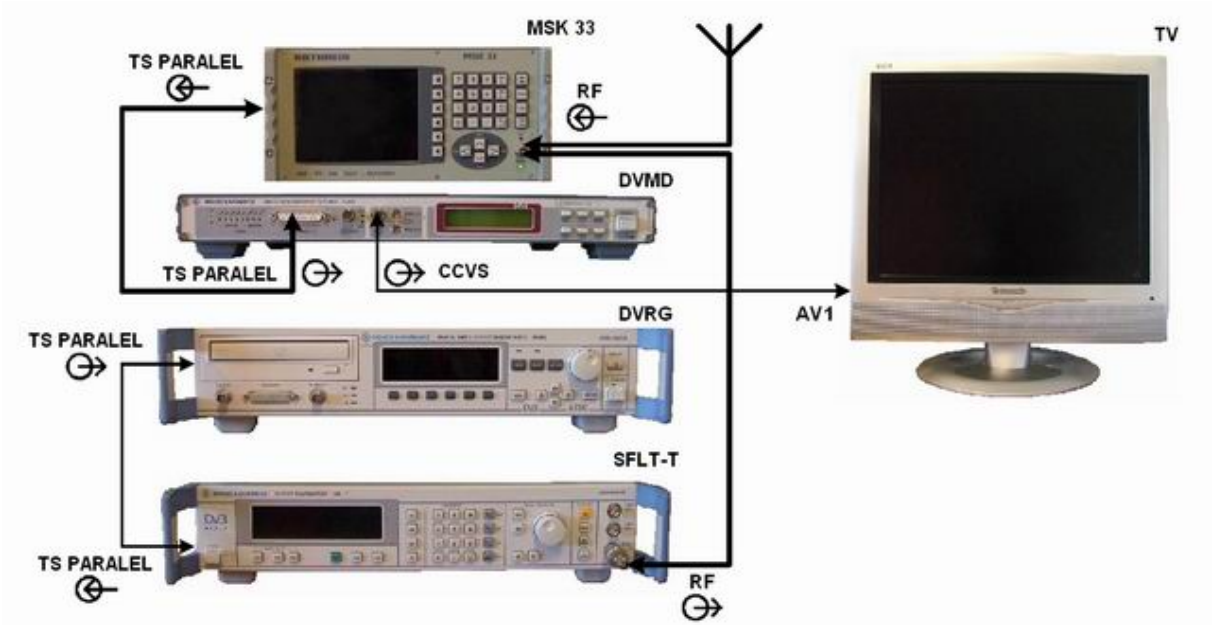

Fig. 1: *Site composition*

The MSK33 receiver demodulates the terrestrial DVB signal, decodes the multiplex and consequently enables to view its composition, constellation diagram and frequency spectrum [3]. It continually shows the actual, minimal and maximal signal level, BER (Bit Error Rate) and SNR (Signal to Noise Ratio).

The MPEG-2 decoder DVMD enables to describe deeper the MPEG-2. It enables detailed information about transport flow [4]. To view all the possible parameters, LCD monitor is used. The basic measurable parameters are packet composition, data rate, label and elements of each program (video/audio/data/others). Also information about coding and NULL-packet data rate are present. Finally following service tables are available:

- NIT (Network Information Table) – containing network ID and label, medium type (satellite/terrestrial/cable) and frequency
- SDT (Service Description Table) – containing transport flow ID, original network ID, name of program/service and provider name.
- EIT (Ebeny Information Table) – containing list of event in transport flow.

The site can measure locally produced signal also. For this MPEG-2 recorder and generator DVRG and DVB-T transmitter SFLT-T is present. The first device mentioned is used for recording and playback of the MPEG-2 transport flow [5]. It contains wide testing transport flow library. The device enables setting the data rate.

The SFLT-T transmitter modulates MPEG-2 transport flow into DVB-T standard with adjustable conditions: frequency, carrier level, modulation, guard interval etc. [6].

3 MEASURING THE EXPERIMENTAL BROADCASTING IN BRNO

The experimental broadcasting was tested using the receiver MSK33 and horizontally oriented folded dipole. The C multiplex on frequency 506 MHz (channel C25) was chosen. Spectrum is depicted in figure 2a with carrier level 66.5 dBμV and nominal signal level of 58 dBμV. Constellation diagram is displayed in the figure 2b with BER of $1.4 \cdot 10^{-4}$ and SNR of 31.9 dB.

a) **b)**

Fig. 2: *MSK 33 reciever measurement: a) spectrum; b) constellation diagram*

When the transport flow decoded by MSK 33 receiver is sent to MPEG-2 decoder DVMD input, further parameters can be measured. It decodes MPEG-2 video 4:2:0 and MPEG-2 audio layer 1, 2. The packet composition with information about ID, name, element and data rate is displayed using the LCD monitor (figure 3). Also NULL packet data rate is displayed. The ČT2 program was running at the background at the moment with data rate of 3.647 Mb/s.

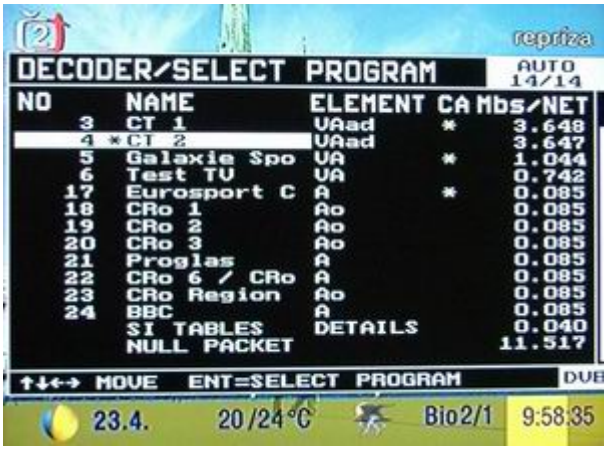

Fig. 3: *Packet composition*

4 CONCLUSIONS

The paper presents fundamental abilities of DVB-T measuring and testing site placed at Institute of Radio Electronics Brno technical University. The workplace is used for laboratory work in "Fundamentals of television techniques" Bachelor's program course.

APPENDIX – CURRENT STATE OF EXPERIMENTAL BROADCASTING IN BRNO

Ch.	Transmitter	Net.	LON [WGS-84]	LAT [WGS-84]	Power ERP [W]	Operator
25	Brno – FN Bohunice	C	16°34'14"	49°10'33"	2 kW	Český Telecom
25	Brno - Svatopetrská	C	16°37'19"	49°10'50"	2 kW	Český Telecom
25	Brno - TKB	C	16°35'16"	49°12'59"	2 kW	Český Telecom
40	Brno - Hády	A	16°40'28"	49°13'22"		České Radiokomunikace
40	Brno - Hobrtenky	A	16°32'17"	49°12'17"		České Radiokomunikace
56	Brno - Hády	B	16°40'28"	49°13'22"	25 kW	Czech Digital Group
56	Brno - Hobrtenky	B	16°32'17"	49°12'17"	25 kW	Czech Digital Group

Tab. 1: *Experimental broadcasting in Brno (February 2005)*

ACKNOWLEDGEMENTS

The paper has been prepared as a part of the solution of GAČR project No. 102/03/H109.

REFERENCES

[1] Čapek, J., Fabian, P.: Komprimace dat principy a praxe, Computer Press, Praha, 2000

[2] Žalud, V.: Moderní radioelektronika, BEN, Praha, 2000

[3] Kathrein: Rosenheim, Operating Manual Sat/TV/FM – Messenmpfänger MSK33, 2002

[4] Rohde&Schwarz: München, Operating Manual MPEG2 measurement decoder DVMD, 1998

[5] Rohde&Schwarz: München, Operating manual digital video recorder generator dvrg, 2001

[6] Rohde&Schwarz: München, Operating manual tv test transmitter r&s sfl, 2002