Digital video broadcasting via satellite (DVB-S) has become the major force in new television technologies within a very short period of time. What is changing in comparison to the analog technology and which kind of measurement technique is necessary ?

THE DIGITAL CHALLENGE

With the introduction of digital video broadcasting many critiscians expected heavy problems. But due to solid fundamental research and development this did not appear. Already in 1995 an obligatory DVB-S standard was introduced. For a limited period analog and digital transmissions will coexist. But at the latest to the year 2010 the end of analog transmissions is planned. This does not mean that all analog channels via satellite will disappear. Analog satellite television will remain popular for some time to come.

The small difference

Whilst the analog system is based on a direct relationship between the carrier-to-noise (C/N) and the quality of the resulting picture, the digital system gives a onsistently good picture quality as soos as a certain C/N level is surpassed. For this reason it is possible for the first time to make a purely quantitative analysis of the resulting picture quality based on the Bit Error Rate (BER), without the need to look at the quality of the actual picture and sound.
This leads us directly to the topic measurement technique. Like every other real-life transmission system, the digital system can also be impared by interference or errors. These errors may be present at the transmitting side, so that it makes no sense for the installer to identify these errors which cannot be influenced anyway.
It is more important to focus on the receiving side. A minimum C/N value has to be maintained over the complete transmission path at all times. It is also important to evaluate the margin by which the minimum C/N is exceeded in order to compensate the influence of bad weather or gain variations. In order to achieve absolute security it is necassary to use excellent measurement equipment.

It was already mentioned - Starting from a certain minimum C/N a picture transmission without visible disturbances is possible.

PICTURE WELL - EVERYTHING WELL?

Thanks to internal error correction mechanisms even a poor C/N can bring a usable picture. The chart below at a Forward Error Correction (FEC) rate of 3/4 shows the relationship between C/N and picture quality:

C/N	Rating	FEL-Display	BER	Transmission quality
<4dB	Useless	LED off	>10-2	No picture obtainable
4dB	Insufficient	LED blinking	~10-2	Constant interruptions
5dB	Unsatisfactory	LED on	<10-2	Occassional interruptions
6dB	Critical	"	<10-3	Troublefree operation
7dB	Sufficient	"	<10-4	"
8dB	Fair	"	<10-5	"
9dB	Good	"	<10-7	"
>9dB	Excellent	"	"	

The margin of tolerance between an error-free picture and total failure (black screen) at all is very small. In such a scenario the variation until the picture is lost is little more than 1-2dB.

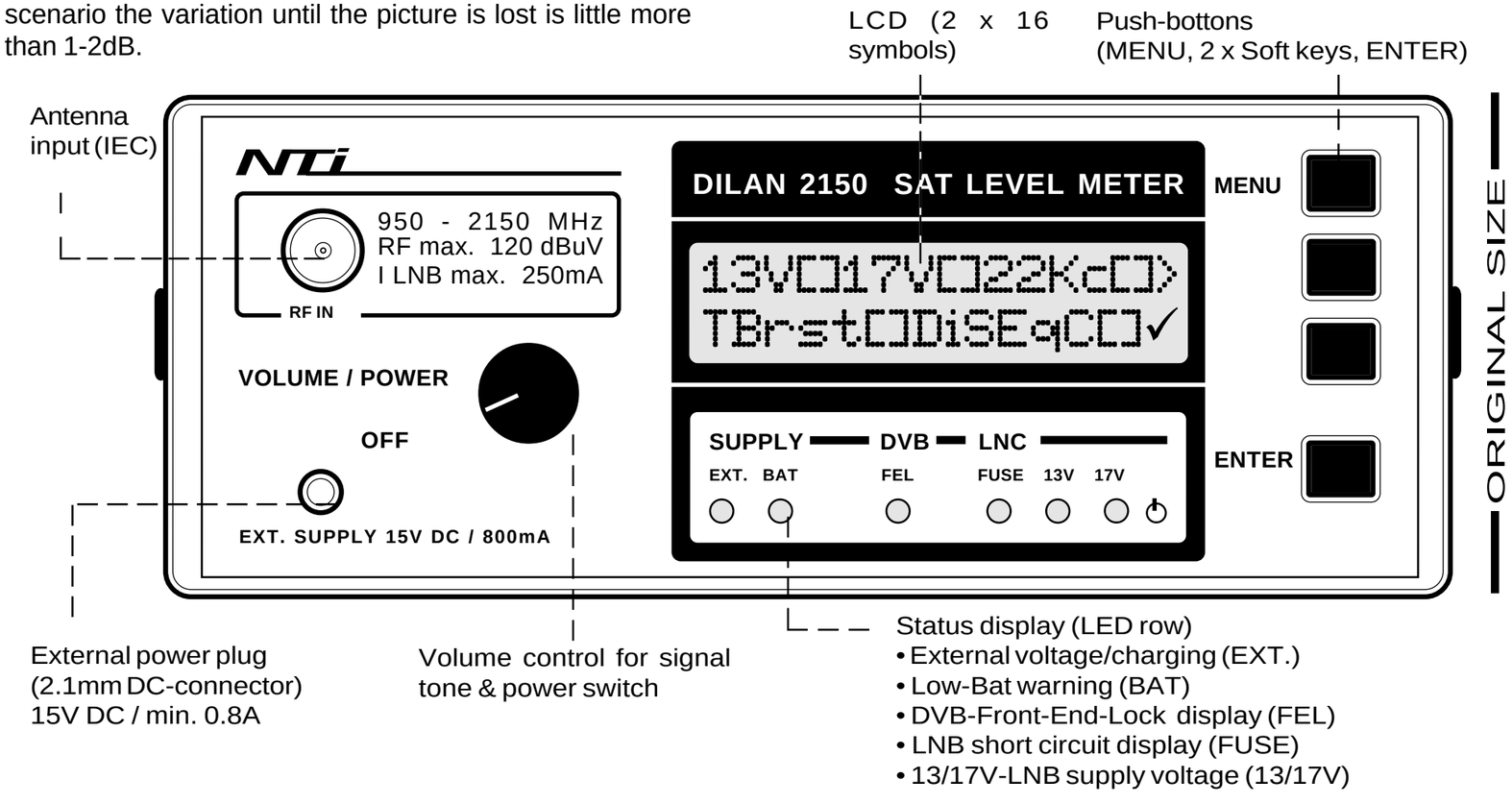
Our DILAN 2150 DVB-S Link Analyzer is designed to successively eveluate all the relevant critical parameters for a digital receiver in order to obtain an error-free picture from the available input signal.

STEP BY STEP!

On a step-by step basis the device checks whether a signal worthy of reception is available at all and what the resulting quality is. Therefore the following measurement program sequence is started:

- Reliable input level
- Carrier and synchronisation regeneration
- Carrier-to-noise ratio (C/N)
- Bit Error Rate (BER)

If a signal is available for reception the FEL-LED lights up; at the same time the digital C/N value is shown and in a special sub-menu more parameters like the choosen Symbol Rate, Bit Error Rate(BER) and Forward Error Correction (FEC) can be read off.



But what sense makes the best available measurement equipment if it is difficult to handle? After all, who wants to spend hours reading the instructions before operating the device ?

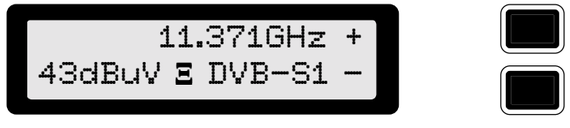
SIMPLY LOGICAL

Instead of this a user-friendly concept was developed.
Our intention was to design an easy-to-understand and easy-to-operate instrument.
Only four buttons are all the device needs:

- **Call Menu: MENU key**
- **Changing Parameters: Two soft keys**
- **Acknowledgement: ENTER key**

Thanks to the integrated self-intelligence all options of the menu are self-explanatory.

Adjusting the antenna is a typical application for this device:



The antenna is roughly adjusted, there is already DVB activity recognizable (SL1: carrier is regenerated), but there is no usable signal yet.
Now the fine-tuning of the antenna can take place. The signal level rises and Front-End-Lock (FEL) is achieved. The FEL-LED lights up. Theoretically it is now possible to get a picture. Alternating with the signal strenghts the C/N value is shown on the display:

More informations like chosen Symbol Rate (SR), Auto-Viterbi-Decoder-Rate (FEC) and Bit-Error-Rate (BER) are available in a further sub-menu by the the command "MORE":

By pushing the soft key "BACK" the main menu is available again.

Technical Data

Input Frequency Range:	(900) 950 - 2150 MHz
Input Connector:	IEC-standard (F) / 75Ω
Display Range:	30 - 100dBuV
Specified Measurement Range (+/- 2dB tolerance) :	35 - 95dBuV
Additional Signal Tone:	Variable audio frequency acc. signal strength
LNB Voltage(short circuit proof):	0/13/17V max.250mA
LNB Switching Signals:	22KHz / DiSEqC Vs. 1.0

(hardware for DiSEqC Vs. 2.0 is already integrated)
Memory: 4 symbol rates; 4 LO-frequencies; 32 individual configurations
Supply: 15V DC / ca. 380mA without LNB
Dimensions/Weight: 153 x 168 x 60mm / 1.2kg including accumulator (accumulator is not included in basic version)

• DIGITAL SECTION / MPEG-2 - Transport Stream Analysis

Symbol Rate Range:	(0.900) 2.000 - 45.000 MS/s
Auto-FEC-Viterbi Code Rates:	1/2;2/3;3/4;5/6;7/8
DVB Synchronous Levels:	SYNC-LEVEL (SL)

SL:0 No DVB activity; SL1: Carrier regenerated; SL2:Viterbi-Decoder synchronized; SL3: De-Interleaver synchronized; SL4=FEL-LED lights up (Front End Lock)
C/N Measurement Range with Locked FEL: 4 - 20dB
Measurement Range BER (uncorrected Bit-Error-Rate): 10^{-2} to < 10^{-7}

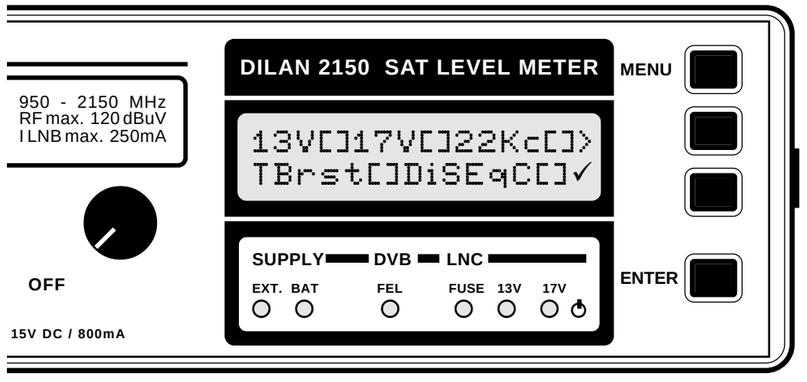
• OPTION Analog A/V Card for Analog Satellite Signals
(with additional analog tuner section; plug-in module is automatically detected)

Tuner Input Frequency Range:	900 - 2150 MHz
Video Level:	1Vss / 75Ω FBAS clamped
Audio Level:	0.6Vss / 1KΩ
Video Polarity:	Switchable normal/inverse
IF Bandwidth:	Switchable 18 / 27MHz
Audio Sub-carrier Range:	5.00 - 10.00 MHz
Audio tuning Step-width:	10KHz
Audio IF Bandwidth:	150KHz

• OPTION RS-232 Interface
Hardware is already integrated (9-pin SUB-D connector); software for remote control is planned.

• Accessories
Lead-acid battery 12 V / 1.2Ah
Switching power supply 220-240V AC /15V DC max. 0.8A

Edition 10/2004
V4.0



DILAN 2150

The DVB-S Analyser

NTi ®
Dipl.Ing. Rudolf Ille Nachrichtentechnik • P.O.Box 1703 • 79507 Loerrach
Tel. +49 7621 / 14756 • Fax +49 7621 / 18840 • www.nti-online.de