LOW THRESHOLD RECEPTION

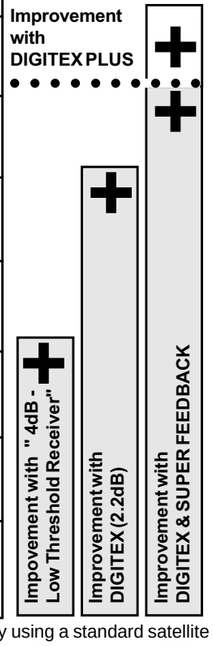
When receiving satellite signals within the center of the footprint of a satellite the quality of picture and sound is no problem. The situation completly changes when receiving signals at the edges of the central footprint or in case off sidelobe reception.
The quality of picture and sound is determined by the carrier-to-noise (C/N) value of the received signal [dB] at the antenna input of the satellite receiver; refer also to the table below.

For instance a 60cm offset antenna (LNB NF 1.2dB) gives in case of analog ASTRA reception in Middle Europe 13dB C/N. At the Canary Islands the signal quality rapidly drops down to 4dB C/N when using an 6.0m dish equipped with an ultra low noise LNB with NF of 0.6dB. To improve this value by 3dB the antenna size has to be increased by factor 1.4 which means 8.40m. Precision antennas of this size are hard to find and also very expensive.

Standard satellite receivers are constructed for minimum C/N levels of about 6 to 7dB and are not suited for weak signal reception. On the other hand so-called "4dB Low Threshold-Receivers" with variable bandwidth or user selectable bandwidth steps are offered.
When the receiver`s IF (bandwidth) is narrower than the original transmitted bandwidth, some of the picture "fidelity" is lost. Reducing the bandwidth may reduce the appearent of noise in the picture, but in the process there are now new forms of picture degradation introduced.

C/N Value vs. Picture Quality

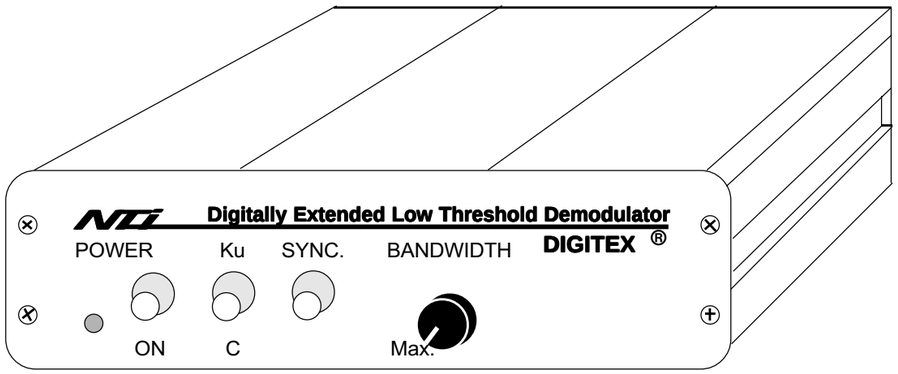
C/N	Description (Threshold 6dB)
> 8dB	Full quality for consumer applications
7 - 8dB	Good picture, but first sparklies appear in bright coloured areas of the picture
6dB	Still good picture, but a few sparklies are always visible
4 - 5dB	Sparklie noise increases, but the picture is still watchable
3 - 4dB	Picture rapidly becomes washed out by sparklie noise, but still in colour
1 - 2dB	Picture hardly to recognize, colour dissapears
1dB	Noise is so strong that picture details are not recognizable
0dB	Picture dissapears completly in the noise, only the vertical sync bare is sometimes recognizable.



With this table the input C/N value [dB] could be determined (+/- 1dB) by using a standard satellite receiver with 27MHz IF-bandwidth and 6 - 7dB threshold. The bares on the right side show possibilities for improving picture quality by different devices.

DIGITEX & DIGITEX PLUS

2.2 / 1.4 or 0.5dB Threshold ...
Digitally Extended Low Threshold Demodulator



Sure, meanwhile there is no lack of satellite receivers with so called "Low Threshold Demodulators".
For low cost production most of them use analog principles. Phase-Locked-Loop (PLL)-demodulators are well suited. By reducing the bandwidth the feed-back information of the PLL is slowed down.

In case of weak signal reception short signal interruptions would result in drop-outs/sparklies of the video signal. But if the PLL is reacting slower most of the sparklies would disappear. On the other hand this causes strong noise within saturated colour parts and smearing sharp edges.
In practice a compromise has to be found between noise reduction and the lengths of smearing edges.
This principle is a satisfying solution for C/N ratios down to 4dB according to 27MHz IF-bandwidth.

But many of our customers told us that they have much worser C/N ratios in the range from 0 to 4dB. For this range another solution had to be found, which we call the second digital generation.
The feed-back information of the PLL is composed of two elements instead of only one component:

1.Real-time analog information
2.Digitally delayed picture information.

This results in quicker response of the PLL behaviour and most of the above described problems would disappear.

This principle is neither new nor revolutionary. A British based company already introduced in 1987 a demodulator unit using similar principles. This high-end unit is now out of production. It was constructed for 70MHz input frequency and was also intended for professional applications.
The DIGITEX demodulator is a cost-effective solution for semi-professional applications. This was only possible by using a new generation of complex circuits for picture processing.

The unit needs the 480MHz IF-frequency of the satellite receiver. This signal is availible at the tuner`s SAW-filter and could be fed to an additional F-connector at the rear panel.
This requires some technical skills and knowledge about the principal functions of a satellite receiver.

If small smearing edges are acceptable the unit could be operated down to a C/N ratio from 0-1dB where the first drop-outs just occour.
An artificial synchronisation could be additionally activated in case of distorted sync pulses.

Technical Data

IF Input (F / female):	480MHz(479,5MHz)/75 ohms
Option (on request) :	IF 130 / 140MHz
Input Signal Range (adjustable):	-50 - -30dBm
TV Standards:	PAL/SECAM with 625 lines
(also on request:	NTSC with 525 lines)
IF Bandwidth (adjustable):	8-36MHz
• Threshold Values According to 27MHz Bandwidth:	
DIGITEX (basic version)	<2.2dB
DIGITEX with option SUPER FEEDBACK	<1.4dB
DIGITEX PLUS	<0.5dB
Video Output (AGC):	50Hz-5MHz/1Vpp
Video Polarity:	Switchable (inverse/not inverse)
Baseband Output(AGC):	50Hz-8MHz/1Vpp
Supply:	12 - 15 V DC/max. 400mA
Dimensions:	31 x 113 x 165 mm
Weight:	ca. 350g

In which way is DIGITEX connected to the satellite receiver ?

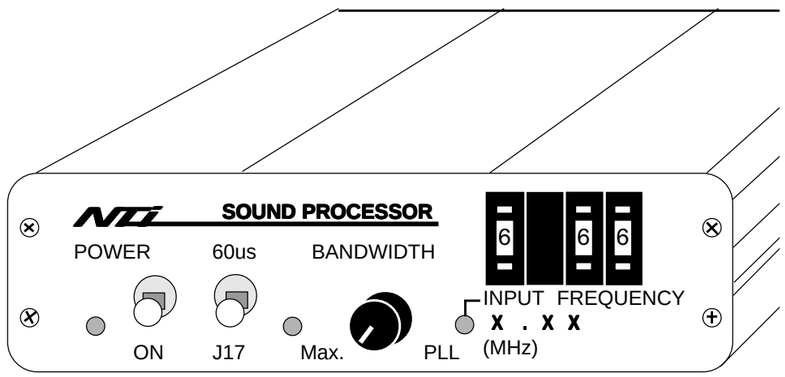
We have already mentioned it - DIGITEX needs a 480MHz IF signal from the satellite receiver`s tuner with constant level.
This constant level is very important especially with very low antenna input levels; otherwise DIGITEX could not develop full performance.
High-end receivers could deliver a constant IF-level at antenna input levels between 30-90dBuV while standard units have only a dynamic range from 50-80dBuV.
Only a few new receivers deliver this signal already at the rear panel.
The other receivers have to be modified with an additional 480MHz output.

For the most popular low threshold receivers we have modification instructions available.
The modification does not affect the receiver`s performance - no matter whether a DIGITEX is connected or not.

The output of DIGITEX is a video signal with with automatic brightness control and also a baseband signal (unfiltered & unclamped) which can be used for connecting an optional SOUND PROCESSOR.
The video signal can be directly connected to the TV-set via the A/V input while the satellite receiver is connected via the TV-set`s antenna input (UHF-modulator output).
Many satellite receivers have also one (or more) external video input which is elegant way to connect DIGITEX.

SOUND PROCESSOR

Improves audio reception of weak satellite signals



We have now offered a tool for picture improvement. But what is about the audio performance ?
If the picture quality is good audio would be no problem. Developments like the WEGENER/ PANDA system are providing higher audio signal-to-noise ratios for an exciting stereo sound.
But what happens if the satellite signal is too weak?

Several different techniques for improvement of the picture are known. But if the picture is restored in many cases audio remains a big problem.
That`s why we have developed this module.
As described in certain examples improvement of the sensitivity of a receiving system is possible by narrowing it`s bandwidth. Therefore many satellite receivers have switchable audio bandwidth filters which allow a static decreasing of the audio channel bandwidth.
Instead of static filters the Sound Processor uses a dynamic tracking filter with an bandwidth of about 20KHz. This gives a C/N-improvement of about 8dB compared to a conventional 150KHz filter.
The practical effect is that even on poor and weak transponders (no colour/ distorted syncs) understandable audio reception is still possible, but naturally not in HIFI quality standard.The audio subcarrier range from 5.50 to 9.50MHz is PLL controlled tunable in 10KHz-steps .
The demodulating principle is also PLL-type which is an optimum choice for weak signal reception. Also a special noise reduction circuit is implemented.

Technical Data

Subcarrier Frequency Range:	5.50 - 9.50MHz
Stepping:	10KHz
Baseband Input (Cinch):	1Vss / 75Ohm (adjustable)
IF Bandwidth Range:	20 - 280KHz
Audio Output (Cinch):	600mV / 1KOhm
Deemphasize:	60us / J17 (switchable)
Supply:	12 - 15V DC / max. 150mA
Dimensions:	31 x 113 x 165mm
Weight:	ca. 250g

Specifications are subject to change without notice.
All trademarks accepted.

When makes it sense using DIGITEX ?

Very simple - When the dish size can`t be increased or the best available LNB is already in use.
Or where the price of DIGITEX has no relation to the costs of buying a bigger dish.

Test reports

Meanwhile some well known satellite experts have tested the DIGITEX module and the following test reports were published:

Bob Cooper: Threshold Extension-Does it really work? - SatFACTS monthly 2/95
Eric Wiltsher: TESUG Newsletter 2/95 & 6/95

and in german/english language:

Christian Mass: 1.4dB FM-Schwelle kein Traum mehr! - TELE-satellit 12/94
Chr. Mass: DX-Corner / Darf`s ein paar dB weniger sein? -TELE-satellit 7-8/96
Christian Mass: Tips & Tricks - TELE-satellit 8-10/96

also in dutch language:

Paul van Rossum: Verbeter zwakke satellietsignalen - RAM No. 178 7-8/96

Accessories for DIGITEX

• 70MHz/480MHz - Converter

This UP-CONVERTER allows the use of a 480MHz version of DIGITEX in combination with satellite receivers with 70MHz standard IF output (constant level).
The conversion gain is adjustable in the range between 0 to -30dB. In standard applications the gain is adjusted to 0dB (right/clockwise position) and the correct level is adjusted at the INPUT LEVEL adjustment of DIGITEX. The local oscillator of the module is PLL-stabilised which disables frequency drifting.

• 70 - 480MHz IF Broadband Amplifier

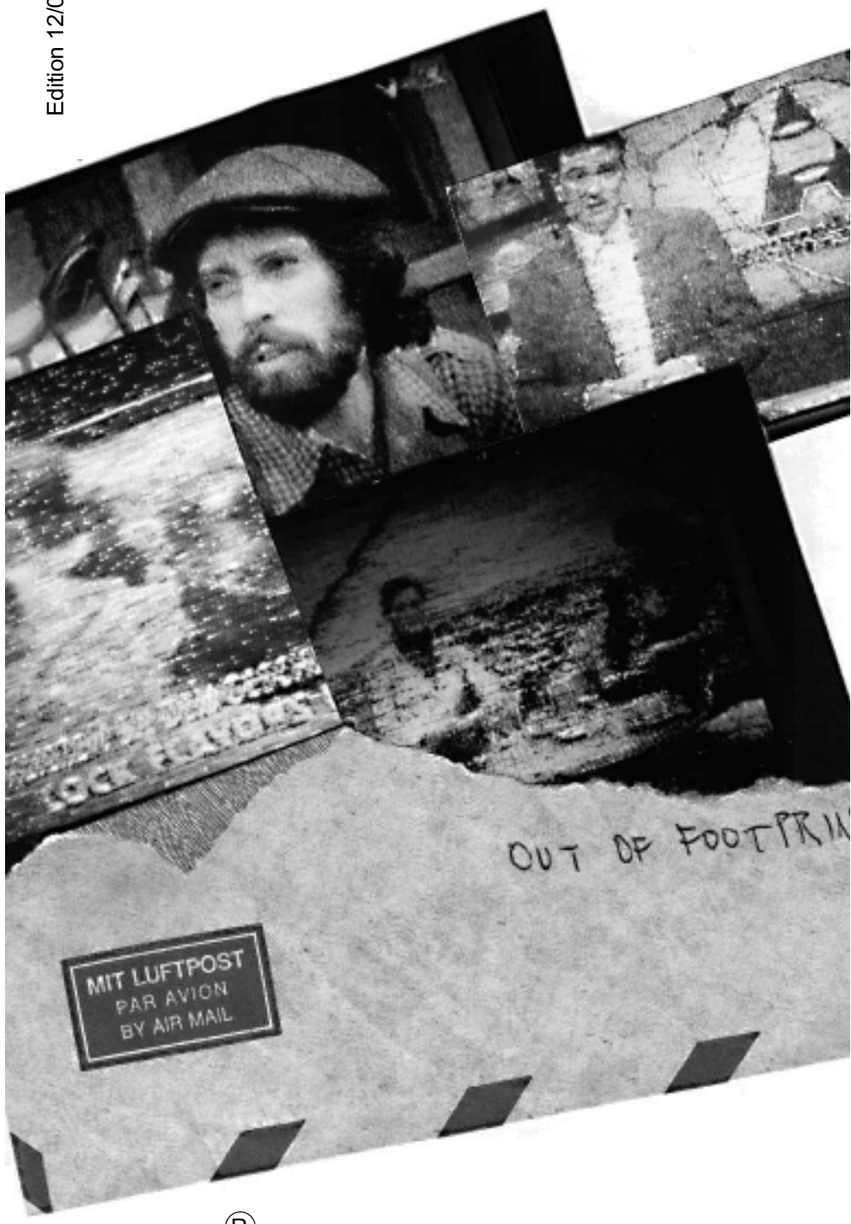
This amplifier is intended for increasing the IF input signal level by about 28dB when the satellite receiver`s IF output level is too low (< -50dBm).
The supply voltage is 12volts/35mA DC which is connected to the 12 V voltage regulator of the satellite receiver.
The IF-input is connected to the tuner with a coax cable. Connection to tuner is by a coupling capacitator; also refer to the special instructions for tuner modification.

WEAK ANALOG SATELLITE SIGNALS?

POOR PICTURES ?
NOISY SOUND ?

Here is a solution!

Edition 12/00



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