*digi***ATV**

Receive analogue FM-ATV with the 7020 · PAL picture, NICAM and FM sound · FPGA and Windows software
PE1PzN · manual for digiATV V2.02: the web version on the SD card and the Windows program (3 November 2026)

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1. What is digiATV

digiATV turns a Zynq 7020 SDR with AD9363 into a **receiver for analogue FM-ATV** (PAL), from 70 MHz to 6 GHz. With a converter or LNB in front, higher bands too.

The FPGA in the 7020 does the heavy work: the IF filter, the FM demodulator, the NICAM and FM sound. The sound goes straight to the DAC on the 7020.

You can use digiATV in **two ways**. Both with the same SD card:

	The web version	The Windows program
Where you watch	In a web browser: Chrome, Edge, Firefox, Safari. On the PC, a tablet or the phone.	In the program digiATV.exe on a Windows PC.
Who makes the picture	The 7020 itself: the FPGA makes the PAL picture, the 7020 sends it as JPEG to the browser.	The PC: the 7020 sends the raw signal, the PC turns it into a PAL picture.
Network	5 to 25 Mbit/s. Also works over 100 Mbit/s, wifi and a slow PC.	120 to 230 Mbit/s: gigabit network and a PC from after 2018.
Without a PC	Yes. After power off and on, the 7020 starts by itself, with the last settings.	No.

> **It does not matter which one you use.** They do not get in each other's way: if you start the Windows program, the web version steps aside by itself. If you close it, the web version takes over again. See chapter 15.

digiATV **only receives**. Nothing is transmitted.

> **Only for radio amateurs and radio research, not for commercial use.** The program, the files for the SD card and this manual are given free, as they are, without any warranty. Use is at your own risk: PE1PzN is not liable for damage to equipment or other results of use.

2. What you need

- A **Zynq 7020 SDR with AD9363** (Pluto clone with four SMA connectors) and a micro SD card.
- The **SD card** (folder *SD-kaartje digiATV V2.02*).
- The 7020 connected with a **network cable** to your router or switch.
- **For the web version:** a device with a web browser, on the same network. There is nothing to install: the web version is on the SD card.
- **For the Windows program:** a PC with **Windows 10 or 11**, from after 2018.
- For the Windows program a **fast connection** between PC and 7020: a gigabit network cable, or good wifi. The picture comes in live, about 150 Mbit/s. If too little comes in (for example over wifi), digiATV switches to 8 bit by itself: about 120 Mbit/s. At BINNEN (incoming) it then says "8 bit". The picture stays just as good. A 100 Mbit/s network is too slow.
  Better not over USB. Over USB the 7020 also becomes a network, but a slow one: in practice about 130 to 200 Mbit/s, and the small processor of the 7020 has to handle all that traffic itself. For 10 bit that is too little, for 8 bit just enough. If there is no other way, set "Naar pc" to 8 bit. The network port of the 7020 is gigabit: that is the best way.
  Why is USB slow here? Isn't it USB-C? USB-C only says something about the shape of the plug, not about the speed. Behind that plug the 7020 just has USB 2.0, on paper 480 Mbit/s. But the 7020 does not send the data directly: it acts as a network adapter, and its small processor has to pack and unpack everything. So in practice only 130 to 200 Mbit/s is left. Over the network cable it is different: the network port of the 7020 is 1 gigabit (1000 Mbit/s). That is plenty for everything, also for digiATV at 16 bit (about 230 Mbit/s). Note: your router or switch and the cable must then be gigabit too. With an old 100 Mbit/s switch you only get 100.
- An antenna (or converter) on **RX1** or **RX2** of the 7020.
- For sound out of the 7020: an I2S DAC board (PCM5102A) on the 7020. Listening on the PC also works without it.

3. The SD card

Everything is on the SD card: the FPGA design A2, Linux and the web version. The web version and the Windows program both use this card.

- Take an empty micro SD card, formatted FAT32.
- Put the files and the folders *atv* and *bootbin* from the folder *SD-kaartje digiATV V2.02* directly on the card, so not in a folder. At the top of the card you then see, among others, BOOT.bin, devicetree.dtb, uImage and uEnv.txt.
- Eject the card properly and put it in the 7020 (power off).

> **Everything is on the card, your settings too** (in the folder *atv*). Nothing is added to or removed from the memory of the 7020 (the flash). The IP address stays the same.

4. Starting the web version

The web version is on the SD card and starts by itself. There is nothing to install.

1. Put the SD card in the 7020, connect the network cable and switch the 7020 on.
2. Wait about a minute.
3. Find the IP address of the 7020. It is in your router (the list of devices), or press `Zoek` (search) in the Windows program.
4. Open a web browser and type: **http://IP-address/**, for example http://192.168.0.173/. You then go to the right page by itself (port 8080).
5. On the right of the rack, set the switch **RECEIVER** to **ON** if it is on OFF.
6. Choose the input on the left (RX1 or RX2), tune and set the gain (Gain). See chapter 5.

From now on the web version starts **by itself** when the 7020 is switched on, with the last settings. You only need to open the page. Make a bookmark of it, on your phone too.

Not working?

What you see	What you do
The page does not open	Wait another half minute and try again. Are you on the same network as the 7020? Are all files and the folders *atv* and *bootbin* directly on the card (not in a folder)?
The page is there, but there is no picture	Is RECEIVER on ON? Is the frequency right? If it says "Windows program connected", then the Windows program is using the receiver (chapter 15).
Old page after a new version	Press F5 once (refresh).

Removing

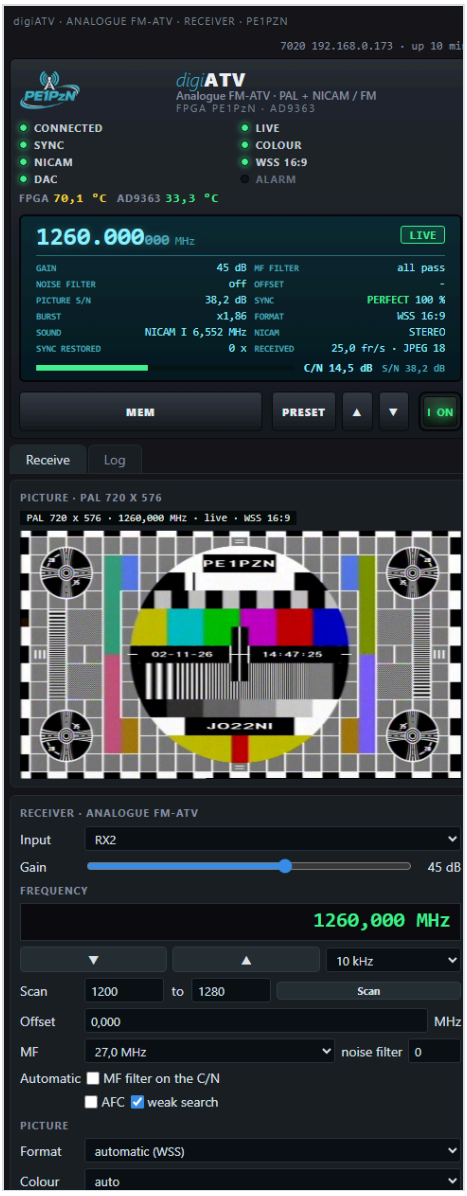
Take the SD card out and switch the 7020 on again. Nothing of digiATV is left in the 7020: it is back as it was. The IP address stays the same.

5. Using the web version



The web version in the browser on the PC. The page is in English, and looks like the Windows program.

The page has the same layout as the Windows program: the rack with the display at the top, the controls on the left, in the middle the picture, next to it the picture measurement (waveform and vectorscope), below that the spectrum and the meters on the right. What the buttons and meters do is in chapters 9 to 12. Below, only what works differently.



On the phone everything is shown one below the other.

Tuning

- **Frequency:** put the mouse on a digit and turn the mouse wheel. That digit then goes up or down. If you click on the frequency, you can type it; Enter tunes, Esc goes back.
- **Mouse wheel:** click once on a slider, drop-down list or number box. After that the mouse wheel works there too.
- **Scan:** fill in two frequencies (for example 1250 and 1280) and press `Scan`. digiATV steps back and forth by 1 MHz until there is a station, and then goes to the middle of the signal. While scanning the button is called `Stop`. Tuning yourself also stops the scan.
- **AFC:** keeps the signal in the middle of the IF filter, with steps of at most 0.25 MHz. Handy with a narrow filter.

Picture

- **Double-click the picture:** only the picture full screen. **Double-click next to the picture:** the whole page full screen (just like F11). Esc or double-click again: back.
- **Click in the picture:** that line in the waveform (Line). Right mouse button: all lines again (All lines).

- The toggle switch above the picture only switches off the picture on *this* page. The 7020 keeps receiving (DAC, VBAN).

Picture measurement

1H/2H (one or two lines), Flat/Luma (Luma takes out the colour, then everything above about 3 MHz drops out), dim/normal/bright, All lines/Line with the line number, and F1+2, F1 or F2 (both fields or one field). The button `Vectorscope` switches to the vectorscope.

Sound over the network (VBAN)

The 7020 can send the sound as VBAN to your PC, for example to Voicemeeter. At VBAN tick *network audio*, press `...`, fill in the IP address of your PC (or the broadcast address, for example 192.168.0.255) and a name. In Voicemeeter: VBAN on, at *Incoming Streams* the same name, the IP address of the 7020 and port 6980.

Settings and Log

All settings are saved **on the SD card**, not in the browser. If you change something on the PC, you see it right away on your phone. Several browsers can watch at the same time. The tab **Log** shows what the 7020 does (tuning, sync, scanning). Under `PRESET` you find the memories and a backup.

6. Installing the Windows program

- Put the folder *digiATV* on the PC, for example as C:\digiATV. Python is not needed.
- Start `digiATV.exe`. If Windows gives a blue warning (SmartScreen), choose *More info* and *Run anyway*. You only need to do that once.
- Your settings are saved in *digiatv_instellingen.json*, next to digiATV.exe.

7. Connecting to the 7020

- Switch the 7020 on and wait a good half minute until it has started.
- Press `Zoek` at the top. digiATV searches for the 7020 in your network and fills in the IP address itself. The address it finds is saved.
- Press `Verbinden` (connect). If *automatisch* (automatic) is ticked, digiATV connects by itself from now on when it starts.
- The tab Logboek (log) then says: *kaartje analoog A2 met analoge ontvanger* (card analogue A2 with analogue receiver).

> If there is a different card in the 7020 (for example for digiNICAM or ZATV), digiATV reports that there is no analogue receiver on it. Then put the digiATV SD card back. (The older SD card analoog A1 also works with the Windows program, but not with the web version.)

8. Step by step

1. Choose the input on the left: `RX1` or `RX2`.

2. Type the frequency in the green box, or tune with `▲` and `▼`.
3. Press `START`, or set the switch `RECEIVER` on the right of the rack to ON.
4. Set the **gain** so the picture is clean. With a weak signal high (60 to 70 dB). With a very strong signal lower, or the input gets overloaded.
5. At *Bron* (source) choose the sound: NICAM 6.552 MHz (I), NICAM 5.85 MHz (B/G) or FM L/R.
6. Look at the signal bar in the display: the higher the C/N, the better.



Top left: the 7020 and the input (RX2), START/STOP, the gain and the frequency with the step size.



digiATV with a weak signal (C/N 2.3 dB): IF filter 4 MHz, noise filter 30, the test card is still readable.

9. The rack



Part	What it does
Lights	VERBONDEN (connected), LIVE (receiving), SYNC (picture is locked), KLEUR (colour), NICAM (NICAM sound found), WSS 16:9, DAC (sound to the DAC), ALARM (too hot or an error). Below them the temperature of the FPGA and the AD9363.
`MEM`	The memories: choose one, save the current frequency or remove one (see chapter 14).
Display	The frequency, and the main settings and measurements. At the bottom the **signal bar**: the C/N (how far the signal is above the noise floor) and the picture S/N. At **SYNC** it shows how good the sync is, as a word with a percentage: **PERFECT**, **GOED** (good, green), **REDELIJK** (fair), **MATIG** (poor, yellow) or **KWIJT** (lost, red). The word only changes when it stays that way for one and a half seconds, so it does not jump back and forth.
`PRESET`	The window with all memories: change the name, the order, delete, and make or restore a **backup** (see chapter 14).
`▲` `▼`	One step up or down. With the **right mouse button** you choose the step size (10 kHz to 10 MHz).
`RECEIVER`	Receiving on or off (the same as START and STOP).

The signal bar

The C/N measures how far the signal is above the noise floor next to the signal. That number does not depend on the gain. **Red** below 6 dB, **yellow** up to 12 dB, **green** above that.



A very weak station: C/N 2.3 dB (red).



A strong station: C/N above 20 dB (green).

10. The controls on the left

Tuning



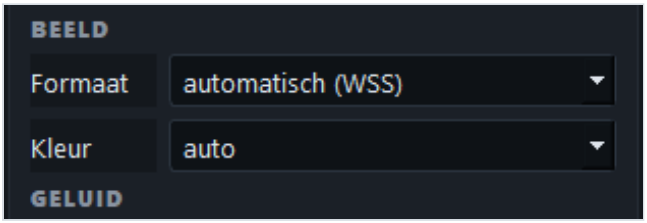
Setting	Explanation
Apparaat (device), RX1/RX2, `+`	The 7020 and the input. With `+` you add a 7020 with its IP address. Each input remembers its own frequency and offset.
START / STOP	Receiving on or off.
Scan	Two frequencies (from and to) and the button `Scan`: digiATV steps back and forth by 1 MHz until there is a station, and then goes to the middle of the signal. While scanning the button is called `Stop`. Tuning yourself also stops the scan.
Versterking (gain)	The gain of the AD9363, 0 to 70 dB.
Frequentie (frequency)	The real frequency, with the offset added. Below it the arrows and the step size.

Offset, filter and noise



Setting	Explanation
Offset	For a converter or LNB. For example an LNB with an LO of 9750 MHz: offset 9750. In the green box you then see the real frequency. 0 = no offset.
MF (IF filter)	The IF filter in the FPGA, 2 to 27 MHz. Narrower gives less noise, but a softer picture, and the sound drops out sooner. 27 = everything passes. Compared to 4 MHz, 3 MHz gains about 1.4 dB and 2 MHz about 2.8 dB C/N.
Ruisfilter (noise filter)	0 to 30. 0 = off, the picture as it comes in. Higher = averaging more frames: a still picture (test card) becomes calm and readable, but movement smears. From 15 up, each frame is also smoothed a little.
Automatisch: MF-filter op de S/N (automatic: IF filter on the S/N)	When ticked, digiATV chooses the filter itself: with little S/N narrower (27, 18, 12, 8, 6, 5, 4, 3, 2 MHz), with a strong signal wider again. Tick off: back to what you had set yourself. With this tick on, digiATV also keeps the signal in the middle of the filter (AFC), with steps of at most 0.25 MHz. If you tune to another frequency, the filter first goes to 27 MHz for a moment to catch the station. After that digiATV makes it narrower again by itself. If with a narrow filter (8 MHz or narrower) there is no sync for 5 seconds, digiATV searches slowly around your frequency: 0.5, 1 and 1.5 MHz up and down, 3 seconds per step. If it finds sync, it stays there. If it finds nothing, it goes back and tries again after 20 seconds. If you turn the frequency yourself, the search stops. The Logboek shows what it does.

Picture



Setting	Explanation
Formaat (format)	**Automatisch (WSS)** (automatic): WSS (Wide Screen Signalling) is a small code signal at the top of the picture, on line 23. With it the transmitter tells whether the picture is 4:3 or 16:9, just like with the old widescreen TVs. You do not see it in the picture. digiATV reads it and switches by itself: the light WSS 16:9 goes on and the picture becomes wide. Without WSS it stays 4:3. You can also fix the format to 4:3 or 16:9. You can send WSS for example with the digital baseband from fm-atv.nl: https://fm-atv.nl/
Kleur (colour)	Auto: with a lot of noise it goes black and white by itself (fewer coloured speckles). Or always colour, or always black and white. With the IF filter at 8 MHz or narrower it is always black and white: the colour no longer gets through.
Scherpte (sharpness)	0 to 10: how sharp the picture is on the screen, like 'sharpness' on a TV. 0 = as received. Higher makes the edges crisper, but with a weak signal you also see more noise. Click in the picture and adjust it with **arrow left** and **arrow right**, also in full screen. It only applies to what you see: the meters and the waveform stay as received.
Naar pc (to PC)	How much data the picture uses on the network. **Automatisch:** 10 bit (about 150 Mbit/s); if too little comes in, digiATV switches to 8 bit by itself. **16 bit:** the full stream (about 230 Mbit/s), only with a fast network cable. **8 bit:** always half the stream (about 120 Mbit/s), best with wifi. The picture stays just as good. If the picture shakes now and then, choose 8 bit.

Sound



Setting	Explanation
Bron, FM L / R	Which sound: NICAM (I or B/G) or FM. With FM the frequencies of left and right (e.g. 7.020 and 7.200 MHz).
DAC	What the DAC on the 7020 plays: silence, a test tone or the received sound. The **test tone** is only to test whether the DAC works, with the wiring to your amplifier. It does not go through the VU meters and not to Meeluisteren (listen in) on the PC: the meters keep showing the received sound.
Meeluisteren PC	The sound on the PC too, with the volume slider and the choice of speakers.
Dicht boven (mute above), Verbergen (conceal)	NICAM: the sound fades out with too many errors in a frame. Verbergen: a bad sample becomes the average of its neighbours, so you hear no clicks.

11. Picture, measurement and spectrum

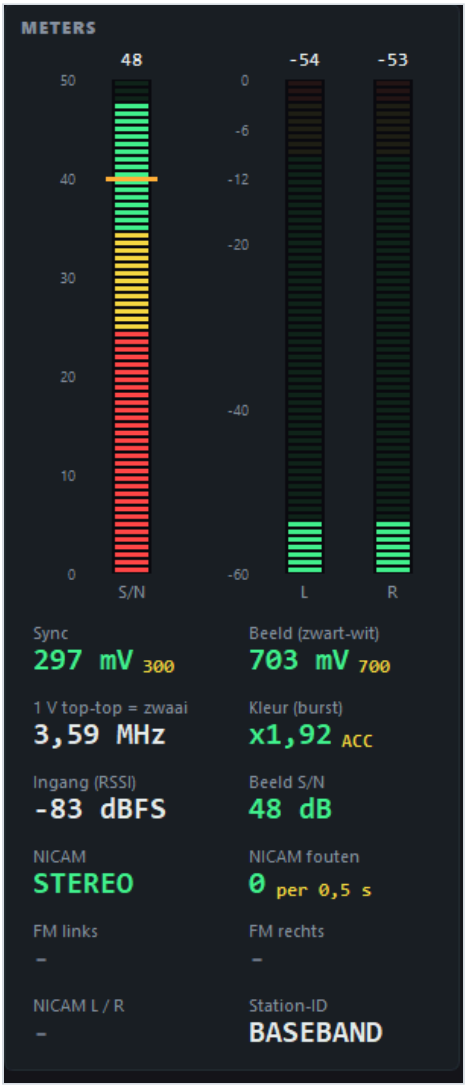


A transmitter that sends WSS 16:9: digiATV switches to widescreen by itself (light WSS 16:9 on, in the display FORMAAT WSS 16:9). With a strong signal: C/N 22 dB, picture S/N 48 dB.

- **Picture:** PAL 720 x 576, without the small black edges left and right. Double-click for full screen, Esc or double-click to go back. When made large, the picture is scaled up bicubically, which keeps it crisper.
- **Picture measurement:** a waveform or a vectorscope. With the choice above it you set the measurement to off (lightest load), fast or scope.
- **Looking at one line:** click with the left mouse button in the picture. The waveform then shows only that line, with the line number above it, and at the side of the picture there is a small yellow mark. Right mouse button in the picture: the whole picture again. Tip: set **Kleur** to black and white to look at a multiburst. In colour the decoder takes the colour around 4.43 MHz out of the black and white signal, and that makes the highest bursts smaller.

- **Basisband (baseband):** the spectrum after the FM demodulator, with marks for the colour subcarrier, NICAM and FM L/R and their level.

12. The meters



Meter	Explanation
S/N	Picture S/N in dB, unweighted. The orange line is 40 dB.
L, R	The sound level in dBFS.
Sync, Beeld (picture)	The level of sync and picture, with the target next to it (300 and 700 mV).
1 V top-top (1 V peak-to-peak)	How much deviation the transmitter uses for a full video signal.
Kleur (burst)	How much the colour has to be amplified (ACC).
NICAM, NICAM fouten (NICAM errors), Station-ID	Whether NICAM was found (stereo or mono), the errors per half second, and the name the transmitter sends.

13. A very weak station

If a station is only just above the noise, this is how you get the most out of it:

1. **Gain at 70 dB.** It cannot go higher. Look at the signal bar: the C/N shows how far the station is above the noise floor.
2. **Tick "MF-filter op de S/N".** digiATV then makes the filter narrower step by step by itself, down to 2 MHz. Between 6 and 5 MHz the filter suddenly gains a lot: the picture gets clearly calmer there. With such a narrow filter the sound does drop out, and the colour too.
3. **Kleur on auto.** With a lot of noise the picture goes black and white. That is easier to read than coloured speckles.
4. **Ruisfilter at 20 to 30.** digiATV then averages a number of frames. A test card or a still picture becomes calm and readable, even when each frame on its own is full of noise. The picture builds up in a few seconds. With movement it smears: then turn the noise filter back to 5 to 15.
5. **Wait a moment.** The raster keeps running at 50 Hz, even when the sync drops out. After starting it takes a few seconds before the picture is stable.



The settings for a very weak station: MF 4 MHz, ruisfilter 30, kleur auto.

C/N in the signal bar	What you can expect
above 12 dB (green)	Good picture with colour and sound. Filter wide, noise filter off.
6 to 12 dB (yellow)	Noise in the picture, sound still mostly good. Noise filter 5 to 15 helps.
below 6 dB (red)	Filter narrow (5 to 2 MHz), black and white, noise filter 20 to 30. A test card is still readable down to about 2 dB (see the picture in chapter 8).

> **You gain the most at the antenna.** A good preamplifier (LNA) close to the antenna, or a better antenna, does more than any setting. Every dB you gain there, you see right away in the C/N.

> For a weak station, do not turn the gain down to "remove noise". With little gain the noise comes from the receiver itself, and the picture actually gets worse.

14. Two inputs, MEM and PRESET

Each input remembers its own frequency and offset. For example RX2 for 23 cm (offset 0) and RX1 behind an LNB (offset 9750). If you choose the other input, digiATV takes its frequency and offset along.

`MEM` gives a list of your memories. Each memory saves the frequency, the input and the offset. One click tunes. At the bottom: *Huidige frequentie bewaren...* (save current frequency), *Weghalen* (remove) and *Bewerken* (edit). `PRESET` opens the same as a window.

At the bottom of the PRESET window are `Backup...` and `Terugzetten...` (restore). Backup saves all your settings and memories in one file, for example to take them to another PC. Terugzetten brings them back. The memories are there right away, the other settings after restarting digiATV.

15. Web version and Windows program side by side

It does not matter which one you use. Use what is handiest: the browser on the sofa with the phone, the Windows program at the workbench. You do not need to switch anything.

- **If you start the Windows program** (START or RECEIVER ON), the web version steps aside by itself. The Windows program takes over the receiver with its own settings.
- The web page then shows *Windows program connected: receiver in use* in the picture. Settings on the web page are then locked.
- **If you stop or close the Windows program**, the web version takes over again within about 10 seconds, with *its* own settings (frequency, filter, sound). The page then shows a picture again by itself.
- The two keep their settings separately: the Windows program on the PC, the web version on the SD card.
- Watching with several browsers at the same time (PC, tablet, phone) always works. They all see the same.



The web page while the Windows program is using the receiver.

> Right after starting the Windows program, the picture can be unsteady for a few seconds, until all settings are in. After that it is fine.

16. Known limitations

- Do not use other programs with the 7020 at the same time, such as digiZATV or digiNICAM. digiATV warns you if digiZATV is also running. The web version and the Windows program do take turns neatly (chapter 15).
- The Windows program needs a fast network (gigabit). Over 100 Mbit/s, wifi or on a slow PC: use the web version.
- The connection must be fast enough (see chapter 2). With gaps in the connection digiATV restores the sync by itself, but you do see a jumping line.
- With the IF filter at 6 MHz or narrower the sound (NICAM and FM) drops out and there is no colour.
- The picture is PAL: about 5 MHz bandwidth. Full screen on a large screen it stays a standard definition picture, also with the slider Scherpte.
- A high noise filter smears movement. For moving pictures choose 5 to 15.
- The C/N in the signal bar only works with the SD cards analoog A1 and A2.
- WSS is only read with a reasonable picture (S/N above about 15 dB). In heavy noise the format stays as it was.
- VBAN with NICAM sound: without NICAM lock (transmitter off or very weak signal) less sound comes in. VBAN can then stutter. With lock it runs evenly.

Only for radio amateurs and radio research, not for commercial use. Use at your own risk.