Translation in English of the article “Le Quansheng UV-K5 en version IJV3.60 avec sortie “discri” pour le décodage des balises 406”, published on the website www.F1LVT.com.

The Quansheng UV-K5 in the "IJV 3.60" version with "discri" output for decoding 406 MHz distress beacons

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The "Quansheng UV-K5 receiver + DECTRA 4-line decoder" set constitutes a simple, compact, and efficient solution for decoding 406 MHz distress beacons. For this, the Quansheng UV-K5 TX must be in the "IJV 3.60" version, with BYP demodulation.

Until now, the only adjustment required was the input level via the volume potentiometer, but inserting the jacks would cut off the receiver's sound. The modification of the UV-K5 presented here allows it to function with a constant level output for decoding. As soon as the UV-K5 is connected to the decoder, the system works without any adjustment, and the beacon can still be heard on the receiver.

This article follows the initial description of the operation of the Quansheng UV-K5 for digital transmissions in general and the decoding of distress beacons in particular: *« L’utilisation du Quansheng UV-K5, version « IJV 3.60 », pour le décodage des balises de détresse 406 MHz »* [1], as well as the second article on this subject: *« L’UV-K5 version « IJV 3.60 » en décodage 406 MHz (partie 2) »* [2].

Installation of a constant level "discriminator" output

The side audio jack of the Quansheng UV-K5 is of type K (i.e., Kenwood). It consists of two jack connectors: a 3.5 mm stereo jack and a 2.5 mm stereo jack. The 2.5 mm jack corresponds mainly to the audio output (external speaker), and the 3.5 mm jack to the external microphone input. The tip of the 3.5 mm jack can power an external system with 3.3V.

The idea of Gilles / F5GPO is to use this tip to output the demodulated signal. This avoids adding an additional output, which is very difficult on the UV-K5. Another advantage is that listening is always possible since no jack is inserted into the 2.5 mm jack.

To use this 3.5 mm tip, it must be isolated from the internal 3.3V and the demodulated signal must be retrieved before amplification by the final audio stage. Figure 1 shows the modifications to be made: the R70 resistor (10 ohms) must be isolated or removed, and the tip of the 3.5 mm jack must be connected to the hot point of the volume potentiometer. These two points are relatively accessible without removing the display.

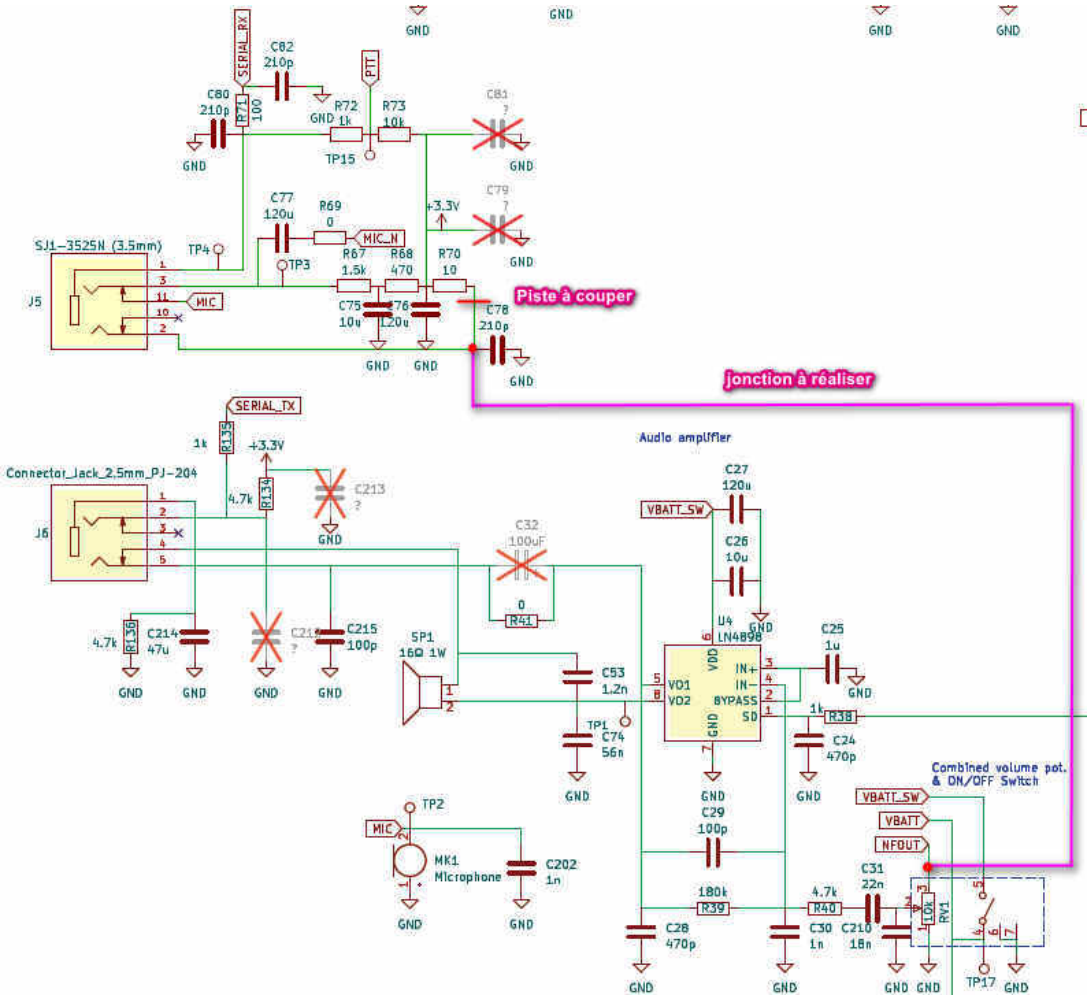

Figure 1 : UV-K5 partial schematic (sce Gilles / F5GPO)

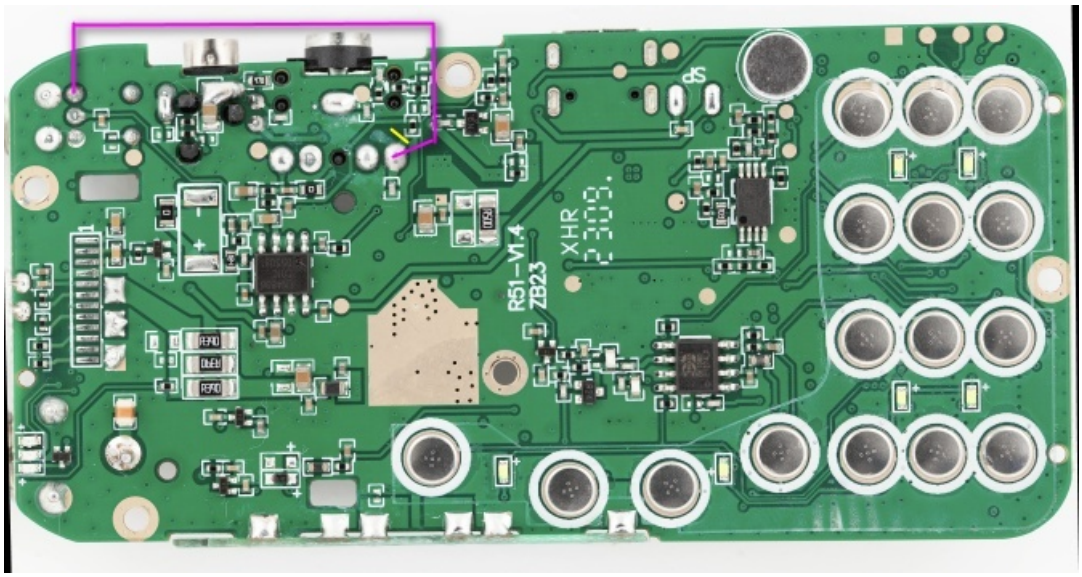

Figure 2 : PCB seen from PB side (sce Gilles / F5GPO)

Figures 1 and 2 show the connection to be made (Figures F5GPO). We have just added a series resistor, as we do for every "discri" output installation, to ensure that the decoder (or any other load) does not interfere with the internal operation of the UV-K5. We verified that the signal levels were sufficient to tolerate the attenuation caused by this resistor. A capacitor was added in series with the resistor to block the DC component.

In addition to the demodulated signal on the tip of the 3.5 mm jack, the output signal ground is typically connected to the ground of the 2.5 mm jack.

Overall, all the functions present on both the 2.5 mm and 3.5 mm jacks are fully preserved. In particular, the sound remains fully functional; it is controlled by the volume potentiometer. You can listen to the passing frames without disrupting the decoding process. The main improvement is that the tip of the 3.5 mm jack is now connected to the constant-level "discrimination" output.

Setting up the constant level "discri" output in the UV-K5

Note: You need to have some experience with SMD components to undertake this modification. The components are very small. A good magnifying glass and steady hands are essential.

First, isolate the tip of the 3.5 mm jack by either cutting the track connecting it to the R70 resistor or removing this resistor R70. In Photo 1, this track and the resistor are within the red rectangle.

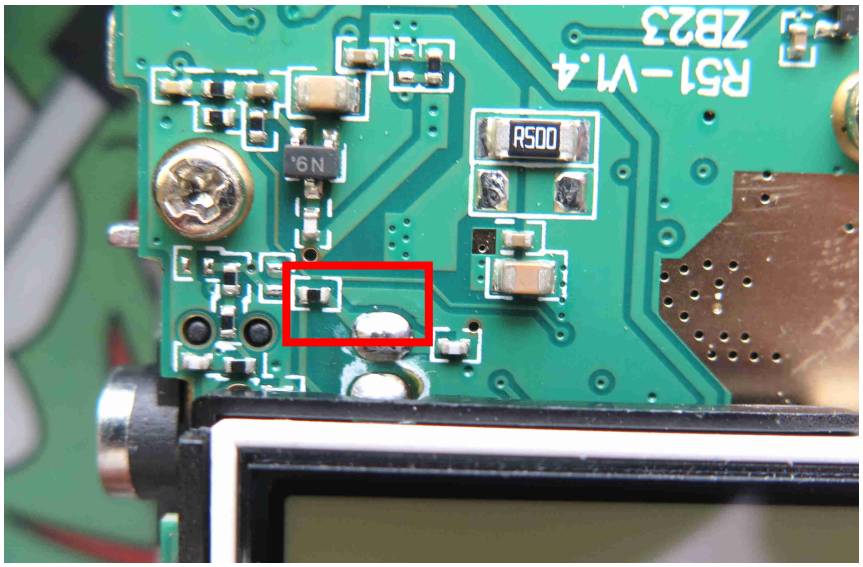

Photo 1: The R70 resistor and the track to be cut are within the red rectangle

Next, connect the hot point of the volume potentiometer to the tip of the 3.5 mm jack. In Photo 2, this connection is made with a small green wire. We added a 10 kΩ series resistor and a 100 nF series capacitor (marked "104") to the wire. This resistor limits any internal interference caused by external factors to the receiver. The resistor is insulated with a piece of black tubing. The 100 nF capacitor blocks the DC component. In Photo 3, the piece of tubing protects the series resistor.

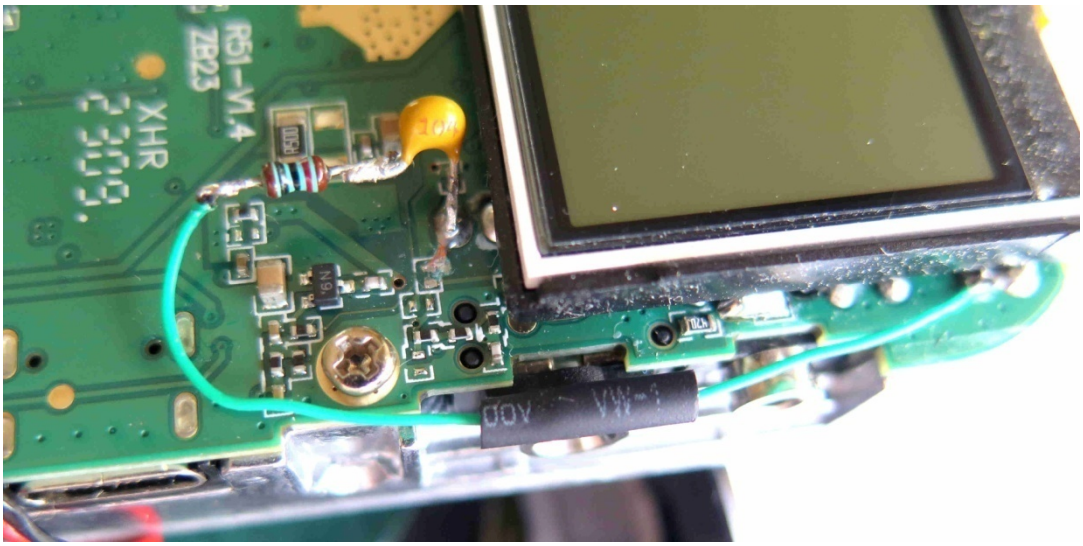

Photo 2: Connection between the volume potentiometer and the tip of the 3.5 mm jack using a wire with a 10 kΩ series resistor and a 100 nF series capacitor marked "104."

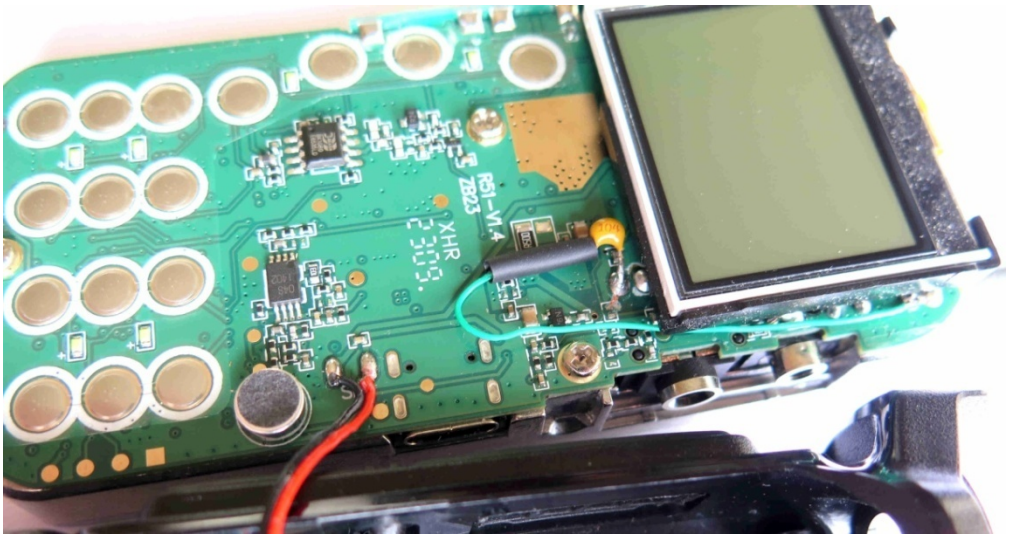

Photo 3: The resistor is protected by a small piece of tubing; the UV-K5 case can now be closed.

Connection cable between the UV-K5 and the decoder

The ground of the UV-K5 jacks is located on the base of the 2.5 mm jack. However, inserting a jack into this connector cuts off the speaker. This system requires using two jacks in the UV-K5 connectors.

We tested and validated an alternative, original, and simpler solution. It involves using the external microphone power supply on the ring of the 3.5 mm jack. This ring is connected to the internal 3.3 V via a 2 kΩ resistor. For a load impedance of about twenty kilo-ohms corresponding to the decoder and the series resistor, the 3.3V / 2 kΩ source of the ring is seen as a low impedance. The ring of the 3.5 mm jack functions as a virtual ground. The demodulated signal can thus be output between the tip and the ring of the 3.5 mm jack.

This is where the role of the 100 nF series capacitor becomes apparent. It prevents a small permanent DC current of 150 µA from passing through the UV-K5 volume potentiometer.

The two grounds, those of the decoder and the UV-K5, are at different potentials, but this does not matter as they are isolated from each other.

To connect the UV-K5 to the decoder, a simple standard connection cable with a 3.5 mm stereo jack at each end works perfectly (Photo 4).

Photo 4: Standard connection cable with a 3.5 mm stereo jack at each end

Summary: Operation of the Quansheng UV-K5 – frame decoder system

The Quansheng UV-K5 TX has been modified with the signal output on the tip of the 3.5 mm jack. For this, the R70 resistor was removed. Then, a 10 kΩ series resistor and a 100 nF series capacitor were added to the tip of the 3.5 mm jack.

Photo 5: Operation of the "Quansheng UV-K5 + decoder" system

The Quansheng UV-K5 has been modified with the IJV 3.60 firmware. It operates on one of the 406 MHz beacon frequencies. In Photo 5, the UV-K5 is set to 406.028 MHz (Photo 5).

Constant parameters used for the Quansheng UV-K5 “IJV v3.60”

Squelch	OFF	Menu 1	VFO	Single	Menu 54
Step	1k	Menu 2	AFC	8	Menu 50
Mode	BPY	Menu 3	BW	20k	Menu 4
AGC	Auto	Menu 53			

These parameters are given for guidance only, as not all configurations could be tested.

The output level of the UV-K5 is quite comparable to that of conventional 406 receivers. The input level adjustment potentiometer should be set to around 2/3 of its travel and should not be touched again. This setting is very forgiving: if it doesn't work the first time, the cause must be sought elsewhere.

With the UV-K5 off, when the decoder is switched on, only one green LED illuminates. When the UV-K5 is switched on, the two green LEDs light up. There are absolutely no settings required: as soon as a 406 beacon is detected, the decoder works [3]. The receiver volume is always active, and the beacon's transmission can be clearly heard while the decoder is processing the signal.

General Summary

Without the internal modification of the UV-K5, it was necessary to adjust the volume correctly. Now, with the internal "discri" modification of the UV-K5, no further adjustments are required. The decoder operates immediately with very high sensitivity.

The combination of the UV-K5 with the "DECTRA 4 lines" decoder constitutes a very efficient and reliable system for decoding 406 MHz distress beacons. It is a lightweight, compact, autonomous, easily transportable system with immediate startup, high tolerance for reception frequency, and excellent sensitivity. Moreover, given the affordable price of the UV-K5, the entire setup remains very cost-effective. One could even dedicate a UV-K5 solely to this SAR (Search And Rescue) application for decoding 406 MHz beacons and receiving 121.5 MHz signals.

Références

[1] https://f1lvt.com/files/343-UV-K5-en-decodage-406.294.pdf

[2] https://f1lvt.com/files/343b-Qs-UV-K5-en-Decodage-406.295.pdf

[3] DECTRA decoder (in English)

https://www.f1lvt.com/files/333E-ConstructionDECTRA2274-P1-English.67.pdf

https://www.f1lvt.com/files/334E-ConstructionDECTRA2274-P2-English.69.pdf