Using Tivar for Receiving Short Wave Radiograms

For Version 1.2.0 and later.

As of 20th of August 2019.

(1) Overview

Tivar stands for "Text-and-Images-Via-Analogue-Radio" has described by Kim Elliott (KD9XB).

I was designed to receive SW Radiograms, including MFSK pictures. It has no transmitting capability.

Since it also supports UTF-8 characters decoding, it will print all Left-to-Right alphabets and most (maybe all) Asian characters which use that encoding scheme.

It is designed to runs on Android devices (phones and tablets) from version 4.0.1 (Android Ice Cream Sandwich) and later.

Most phones and tablets of these Android versions should be able to decode any of the listed modes without limitations.

It is not available on the Google Play Store but can easily be download and installed on the Android devices.

It is capable of decoding the following digital modes:

- RSID (Reed-Solomon Identification) to detect the digital modes about to be transmitted and align the audio frequency of the modem.
- MFSK 16, 32, 64, 128, 64L and 128L.
- PSK 31 to 1000, PSKR (robust PSK) 125 to 1000 and all multi-carrier PSK and PSKR modes found in Fldigi. 8PSK125, 250 and 500, but not the faster 8PSK1000 and 1200 modes from Fldigi as they are not reliably decoded on phone devices.
- All the Olivia modes associated with an RSID (from Olivia 4-125 to Olivia 64-2000)
- THOR 11, 16, 22, 25x4, 50x1 50x2, 100.
- MT63 in all six combinations found in Fldigi (Short and Long interleave in 500, 1000 and 2000 Hz bandwidth versions) .
- DominoEx 22, 44 and 88 but without FEC (as THOR is a very similar modulation with FEC).

It saves the broadcast sessions in text and image files stored on the devices.
Storage requirements are pretty minimal as the disk sizes for both saved text and images are counted in tens of KBs (Kilo Bytes).

Simply placing the device near a radio receiver's speaker in a low noise environment produces acceptable results for test or demonstration purposes.
Using a proper cable connection to the devices audio jacks produces better results especially for images.

(2) Quick start

To install, using the device's browser, download the .apk file at https://sourceforge.net/projects/fldigi/files/AndFlmsg/TIVAR/.

Note that “Allow unknown sources” needs to be selected first in the security or application section of the device settings.

Use a file manager to select and launch the .apk file’s installation. More detailed installation instructions are available below in section (3).

When first launched, you will be prompted for a series of permissions if your device if using Android 6 or later. Just accept these permissions. The program is not allowed to run without these.

On subsequent launches, the application will directly displays the terminal screen.

Navigate to the Modem screen by a left swipe movement on the screen (see below).

Ensure that the squelch level, represented by the more transparent indicator in the “S2N” bar just above the buttons, is set to a low level, typically 1/5 of the screen on the left of the bar, or less. Higher values may prevent reception of text during fades and interferences.

If you want to see the waterfall, press the “W.Fall On/Off” button.

The menu button (earlier phones) or menu icon on the screen (tablets/latest phones) brings a menu to exit the application and change the Settings.

Important Note: as long as Tivar is running (i.e has not been “exited”), it will use the microphone as its input and therefore will prevent other apps like Skype for example from using it.

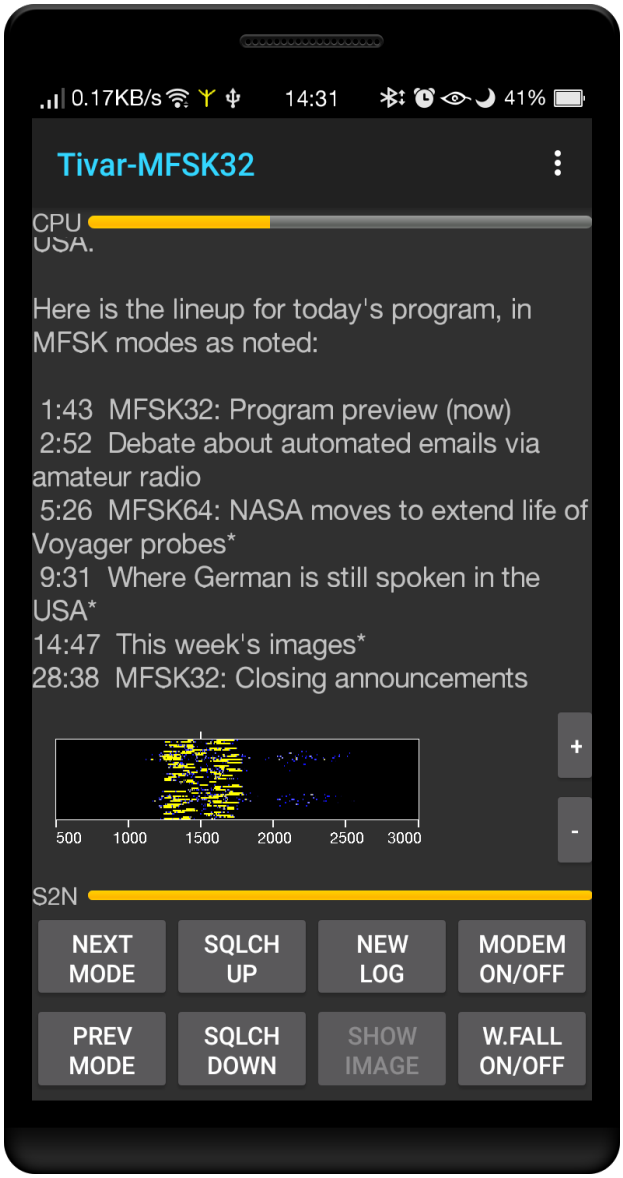
Always press Menu then Exit when you are finished with Tivar.

A yellow antenna icon is displayed as a reminder at the top or bottom of the screen while the modem is running.

All the received broadcast text files and images are stored on the device default memory under the directory TIVAR.files.

RSID is a series of short tones before a transmission which identifies the digital mode being used. It allows the receiving app to switch immediately to the proper mode and audio frequency for the best reception of the incoming transmission, being text ot image. In Tivar the reception of RSIDs is always On.

(3) Operation



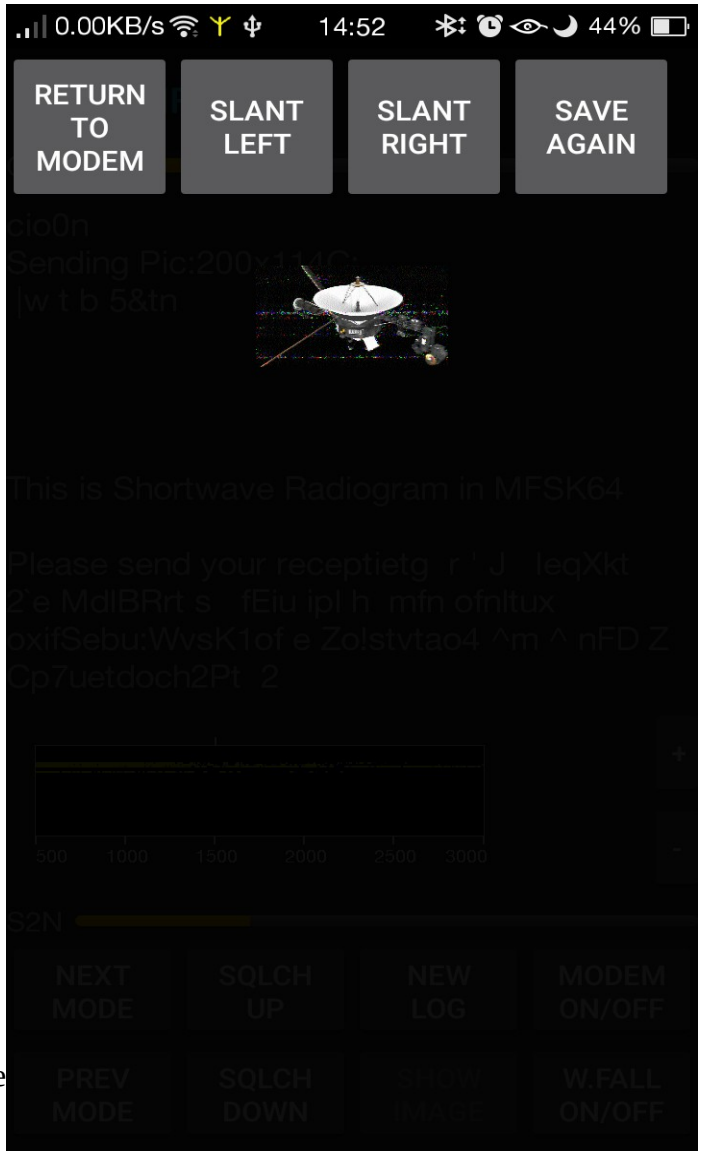
1. The simplest way to get the audio in the Android device is by using the built-in microphone. This is called audio-coupling. It provides quite acceptable results provided a few precautions are taken:
   - The microphone hole on the device is placed as close as practical to the radio's speaker. A distance of a few centimeters works well.
   - The place is not noisy.
   - The device is not moved or bumped against the radio during listening.

2. As text is received, it is displayed in the Modem screen and is automatically saved into a “broadcast file”. The name of the file contains the start date and time of the when receiving was commenced.

3. To separate the received text into a new broadcast file, press the “New Log” button. A new file will be created in the TIVAR.files/Broadcasts directory on the device.

4. The broadcast file names have the following format: YYYY-MM-DD_HHMMSSz.txt, where YYYY-MM-DD is todays’ date and HHMMSS is the time when the file was created. The “z” at the end is to remind us that this time is the UTC or “Zulu” time, not the local time.

5. When an MFSK image is received, a window will pop-up in front of the Modem screen. The image will be updated as reception progresses. The received image will be saved automatically in the “Images” directory of the TIVAR.Files directory.



6. When the reception of the image is complete, the three right most buttons become available and allows the correction of the slant (the bottom left or right edges of the images are like “wrapped around”). When the correction is done, press “Save Again” to save the corrected picture.

7. Closing the image popup view does NOT stop the image reception and therefore the “Return button” can be pressed at any time, BUT if pressed before the image is fully received there is no way to correct the slant afterwards.

8. The reception of text will resume as soon as the image reception is completed, so there is no need to close the image window “in a hurry” after the end of an image reception.

9. The images are automatically inserted in the Android Gallery. Open the Gallery app, and select either the “Tivar-Images” album or the “All Albums” view. The received images are in order of reception. The file names carry the time stamp formatted like the broadcast file format (see above).

10. The CPU load, displayed as a horizontal bar at the top of the Modem screen, should not be higher than 75% (¾ to the right) on average. If it is higher than that, go to the menu, select preferences, then navigate to Modem/Slow CPU and tick the check box. Note that displaying the waterfall also increases the CPU load.

(3) More detailed Installation Instructions

Download the Tivar apk file from the website at:

https://sourceforge.net/projects/fldigi/files/AndFlmsg/TIVAR/

And save it to the SD card, either from within the phone or on a PC to which the Android device is connected to and has the USB driver installed for that device to allow access to the SD card content from the PC.

From there use a file explorer app on the phone to install the .apk file.

You have to allow non-Android market application to be installed for this to work. This is found under Settings / Security / Unknown Sources OR Setting / Applications / Unknown Sources, for older versions of Android.

You will be asked to accept a series of permissions that are explained below:

a. Storage: Read and write to the SD card. For storing and accessing the working files under the "TIVAR.files" directory.
b. Network Communication as in Bluetooth and Full Internet access: to allow connection to the Bluetooth handsfree kits or headsets used as audio interfaces AND to share / Forward messages over the internet.
c. Hardware controls (audio settings and recording): required for receiving sound through the internal or external microphone.
d. Bluetooth administration: to redirect the sound via Bluetooth.

In your applications list you should now have a Tivar app icon which looks like:

(4) Interfaces between the Radio and the Android Device

Simple audio coupling (speaker to microphone) is giving good results, but for best performance an interface cable is required.

A simple DIY cable is described in the last page of this document.

Important: Simply plugging a stereo or mono jack to jack cable between the radio speaker/headphone output and the plug on the Android device is almost guaranteed NOT do what it is expected to do.

On some devices (e.g HTC phones) there is a visual icon which tells you if the external mic is being used. If, at the top of your screen, you simply have the headset icon, the internal mic is in use (see picture on the right).

If the icon shows both the headset and the mic icon, the external mic is in use (see picture on the right).

But a number of devices (e.g. Motorola Xoom and Samsung Galaxy Tab 2 to name the two I tested) do not show any icon. You have to rely on audio tests to determine which mic is in used.

Here is our experience with some commercial cables (Thank you for the tests Kim):

1. This one only works with a mono plug:
http://www.startech.com/Cables/Audio-Video/Audio-Cables/35mm-4-Position-to-2x-3-Position-35mm-Headset-Adapter-Male-to-Female~MUYHSMFF

2. This one works with a stereo plug:
https://www.sescom.com/products/view/product/productslug/trrs-right-angle-25db-35mm-line-level-and-35mm-monitor-jack

3. This adapter on the right (eBay for example) seems to work with older devices but not newer ones. The issue is that the mic input is connected directly to the TRRS plug. Maybe by inserting a 1.2KOhms in series with the mic tip it may work.

Technical explanation about the 4 way jack on Android devices:

Most Android devices can either use the built-in microphone or an external one through the 3.5mm plug. That plug has four connections internally and carry the two stereo outputs, the ground plus the mono microphone input. It is called a TRRS plug (for Tip, Ring, Ring, Sleeve).

A circuit at the end of this manual explains the circuit requirements in more details, but in a nutshell, the device will switch from it's internal mic to the external one ONLY if there is a defined DC load on the external mic connection.

That same mic input is also used for controlling some of the devices functions like accepting or hanging-up an incoming call, stopping or starting a music player and

skipping to the previous or next song.

The action is determined by the DC load (typically a resistance) that the device sees on that mic pin. Different values equal different actions (E.g. Zero Ohms = Play/Stop/Answer/Hangup, 220 Ohms = Back, 600 Ohms = Forward, from around 1K to 1.5K is mic input alone).

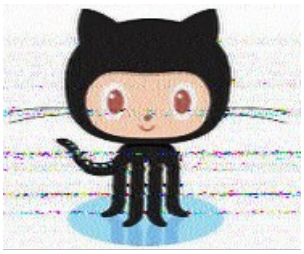
This is why a simple jack to jack cable will most likely not make the device switch between internal and external mic.

The usage of an interface cable rather than simple audio coupling produces the best results:

1. Image received without a cable (Speaker to Mic):

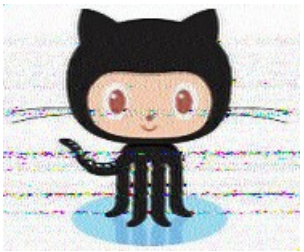
Note the wave effect on the right hand side of the picture due to the presence of audio echos (table, walls etc..).

2. Image received with an interface cable (schematic below):

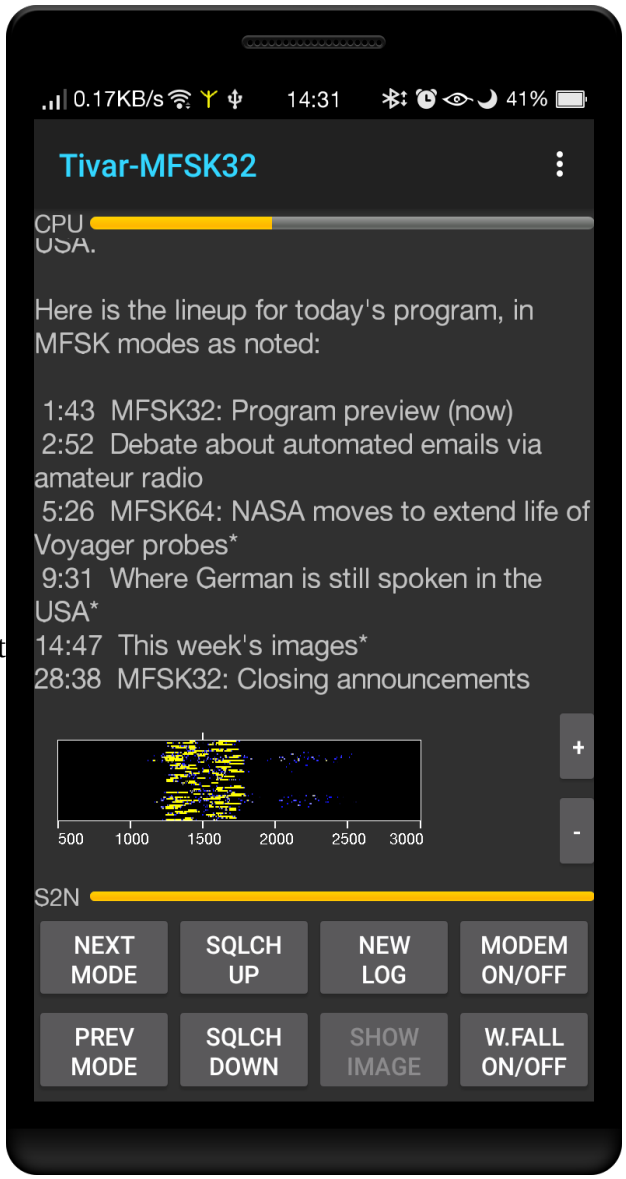


3. Image received with an interface BUT with the Slow CPU option turned ON. It shows more noise as filtering is disabled to save CPU load:

4. Reference image received by Fldigi using Audio Playback, very similar to image (2) with the interface cable:



(5) The Modem Screen in more details



Used to display the data received by the software modem and see an indicator of CPU load.

The top bar represents the CPU load with zero load on the left and 100% on the right. This is an indication of how much reserve the CPU has, rather than a true load indicator.

The bottom bar (2 overlaying bars in fact) represents both the squelch level and the current received signal quality. The brighter one is the signal quality and the darker one the squelch. Characters will be displayed when the brighter bar is longer than the darker (squelch) value.

The squelch up and down increases/decreases the squelch value and stores it for later use so that it is set to the same value the next time the application starts.

The Next Mode and Prev Mode buttons will cycle either through your custom list of modes as set in the preferences OR through the whole list of modes available if the “Use custom list of modes” preferences is not set.

Modem ON/OFF stops/restarts reception and processing of incoming audio. This is to conserve processing and therefore batteries as well as freeing the microphone input for other applications.

Note: Digital Modem reception is CPU intensive and the battery drain increases compared to a device in standby, particularly on phones. Use the Modem On/Off button to conserve battery.

The decoded RSID mode and center frequency are also displayed in the Modem screen.

The received modem data can be selected for copy and paste in another application like a text editor. Just “Long Press” on the text to bring the select/copy dialog on the screen. This is only available on devices with Android version 3.0 and above.
Note: The text can only be selected when the Modem is Off (Modem On/Off Button) as it makes the selection much easier and prevents the flickering of the screen when data is received.

The waterfall can be displayed by pressing the W.FALL on/off button.

The “New log” button starts a new receiving log file at the current time.

The “Show Image” button is disabled (for now).

The “+” and “-” buttons to the right of the waterfall adjust the sensitivity of the waterfall display.

Simple audio interface cable for Short Wave Radio