

Amiko Alien2Plus Enigma2 Personal Video Recorder Playbook

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For an Amiko Alien2Plus running the PKT SVN-2874 Hyperion V4 image based on the Duckbox SH4 GIT-5580 repository of the OpenPLi Enigma2 2013-11-1 source code, in the Republic of Ireland

This document is the final (unfinished) version of a playbook assembled during the years 2014-2018 in which the author learned the ropes of how to use and customise the Enigma2 operating system for TV and its host, an Amiko Alien2Plus.

1. Basic Remote Controls:

To switch on/off: toggle power switch at rear of Alien2 unit

To toggle active/standby: press red POWER button at top of remote

To select channels: press OK to view channel list

Press then ↑ / ↓ for channel up/down to see current & next programs

Press then ← / → for page up/down

Press OK again to preview channel (EXIT to abort)

Press EXIT to abort back to viewing original channel

Press OK yet again to finalise channel selection and return to viewing

To toggle between last and current channel: press RECALL

To see program info: press INFO

Info will disappear after 5sec

Press INFO again for more detail

Press EXIT to return to viewing

To change volume: press VOL +/-

To toggle mute: press MUTE

MUTE sometimes fails to un-mute

To reliably un-mute: press VOL +

To explore recordings: short-press FOLDER

To see preview and synopsis press ↑ / ↓ to move up/down

To navigate into folders select folder then press OK

To navigate back to parent folder select /.. then press OK

To replay press PLAY

To stop replay: press STOP

To pause replay: press PAUSE

To reverse replay: press 1 (15sec), 4 (1min), or 7 (5min)

To forward replay: press 3 (15sec), 6 (1min), or 9 (5min), or '>' (1sec)

Avoid the '<' reverse button as it works but very erratically.

To start timeshift: press TIMESHIFT or PAUSE

Default behaviour is then exactly like replaying a recording, excluding the 1,4,7,3,6,9 keys, which select channels instead

To make the 1,4,7,3,6,9 keys behave identically to when replaying a recording, long-press BLUE to see the PKT BluePanel, select Settings then Timeshift and enable NumericKeySeek, then press GREEN to save.

Channels can be grouped into various favourite categories, e.g. general, movies, sport, news, etc. In Enigma2 these categories are known as *bouquets*. To select favourites, press FAV when viewing TV, then:

Press RED to list all channels

Press ↑ / ↓ to move up/down

Press GREEN to list sources, or short-press SAT when viewing TV
Press ↑ / ↓ to move up/down
Press OK to see selected terrestrial/satellite source's channels
Press YELLOW to list providers, e.g. BSkyB, Freesat
Press ↑ / ↓ to move up/down
Then press OK to see selected provider's channels
Press BLUE to see the favourite groupings
If shows channels then press BLUE again
Press ↑ / ↓ to move up/down
Then press OK to see selected group of channels
Press EXIT to return to viewing

To see EPG for a single channel: long-press EPG
Press ↑ / ↓ to move up/down
Press ← / → to move EPG back/forward a page
Press RED to select channel
Press RECORD to auto-add a Timer schedule to record a program
Press GREEN to edit a new Timer schedule to record a program
Press EXIT to exit

Enigma2 schedules all recordings using its Timer service.

To see CoolTVGuide EPG: short-press EPG
To toggle guide between 4 alternative layouts: press YELLOW
Press ↑ / ↓ / ← / → to move up/down/left/right
To move EPG forward a day: press >>|
To move EPG back a day: press |<<
To auto-add a Timer schedule to record a program: press RECORD
To edit a new Timer schedule to record a program: press GREEN
To search for a program: press BLUE
To invoke AutoTimer: press RED
To exit EPG: press EXIT

Enigma2 schedules all recordings using its Timer service. This allows nice things like waiting for a program by name and recording it when it occurs. This is done with the *AutoTimer* or *AutoRecord* plugins. There is no English guide for AutoTimer, but for a user that doesn't matter as a nice wizard helps you whenever you add an autotimer. For AutoRecord, see:

<https://sites.google.com/site/autorecorderplugin/>

<http://www.i-have-a-dreambox.com/wbb2/thread.php?threadid=129330>

The AutoTimer plugin is installed by default with the PKT Hyperion V4 Enigma2 distribution. Another plugin called *EnhancedEPG* enables these plugins to work directly from the EPG view:

<https://www.dream-multimedia-v.de/board/index.php?page=Thread&threadID=11926/>

Again, this appears to be installed by default with Hyperion V4. To invoke AutoTimer press RED → RED → Yes (twice, unless you wish to record the current EPG selection) < **hack to skip this** >.

You are now in AutoTimer. To set defaults, press MENU → Setup and enable autopolling so that autotimers periodically poll the EPG in the background and press GREEN to save to AutoTimer. Press MENU → EditNewTimerDefaults, and disable MatchDuringTimespan, so polling is forever, Next you can restrict polling, for example to just specific channels or to just to the free-to-air bouquet 'General'. To default to the latter, press

BLUE, enable *service restriction*, set *editing* to Bouquets, press BLUE → General → OK → GREEN → GREEN.

Press BLUE → OK to add an autotimer with the wizard. Enter the search text (description or title as needed) and press OK. Next set a search timespan if desired and press OK (disabled by default). Next restrict polling as needed by enabling *service restriction* (like setting default as above). Next enable filtering as needed. Finally press Yes → OK to finish.

Both AutoTimer and AutoRecord are very flexible. You can restrict them in many ways and search/filter on title or descriptions or duration or ... and use regex and ... Some users state their reason for using Enigma2 is this facility, which is unique.

To see menu: press MENU

Press ↑ / ↓ to move up/down

To invoke selected item: press OK

To exit menu: press EXIT

To examine scheduled recordings: press MENU then select TIMER

Press ↑ / ↓ to move up/down

Press GREEN to edit a new Timer schedule to record a program

Press RED to delete

Press OK to see detail or edit

Press EXIT to exit

If TSmedia is installed, see (5), then short or long pressing PORTAL should run TSmedia, but presently this crashes Enigma2! Fortunately, alternately pressing MENU then selecting TSmedia works.

YouTube is very good on TSmedia

TSmedia is an outstandingly good online media portal, with many services, e.g. to watch live sports press MENU → TSmedia → Sports → Sports Devil → Live Sports → AtdheNet.tv and then select as needed.

If TSmedia is not installed, short/long pressing PORTAL runs MediaPortal.

Press ↑ / ↓ to move up/down

Select online channel then press OK to see online content

Press EXIT to exit

The MediaPortal functionality is quite obscure.

To show Teletext short-press YELLOW button

Press YELLOW repeatedly to change pages

Press EXIT to exit

Teletext services were discontinued from 2012 by all providers except RTE, and these require MHEG5 support, which the Alien2 does not have.

2. **Advanced Remote Controls:**

Press PLAYMODE to show the Key Mapper:

Press ↑ / ↓ to move up/down the key map definitions

Press ← / → to toggle amongst the predefined choices

Press GREEN to save new mappings

Press YELLOW to save default mappings
Press BLUE to restore default mappings
Press RED or EXIT to exit

A handy thing to remember is that if in doubt about what keys do, press the PLAYMODE button to show the current mappings.

Short-press FIND to see Info Centre

Press GREEN to see logs currently enabled
Press YELLOW to list running processes (press RED to exit)
Press BLUE to toggle between ECM and bitrate info
Press EXIT to exit

Long-press FIND to explore the internal flash Linux filesystem. A more long-winded invocation is to press MENU → PLUGINS → DreamExplorer. According to the key mappings, long-press FOLDER should also do this, but it selects to explore recordings just like a short-press of the button.

Press ↑ / ↓ to move up/down
To navigate into folders select folder then press OK
To navigate back to parent folder select /.. then press OK
Press EXIT to exit

TAKE CARE not to press the coloured buttons accidentally!

Press VFORMAT to toggle between BESTFIT, LETTERBOX, PAN & SCAN display options. BESTFIT is best for normal use, whereas LETTERBOX is good for very wide-screen films

Press SLEEP to set sleep or shutdown delay

Press ↑ / ↓ to move up/down
For SLEEP TIMER press ← / → to toggle choices
For INACTIVITY TIMER press ← / → to toggle choices
For SHUTDOWN IN STANDBY press ← / → to toggle choices
Press EXIT to exit

The Alien2 has two sleep modes, STANDBY (about 10% power saving with network enabled) and SHUTDOWN (deep standby, more than 90% power saving, but not fully shutdown). Startup from STANDBY is very quick, whereas startup from SHUTDOWN takes a couple of minutes.

ZOOM: should allow magnifying a part of the screen, repeatedly pressing it should toggle magnification through x1, x4, x9, x16, pressing ↑ / ↓ / ← / → should move focus about the screen (and press EXIT to exit), but none of this works.

To show audio menu short-press RED button

To show subtitle menu long-press YELLOW or long-press SAT button

Press YELLOW to toggle between these audio and subtitle menus
For audio: Press RED to toggle downmix on/off
Press GREEN to select stereo/left/right audio
Press ↑ / ↓ to move up/down
Press OK to toggle on/off selected audio format
For subtitle: Press ↑ / ↓ to move up/down

Press OK to toggle on/off selected subtitle format

To show extensions menu long-press RED button

Press ↑ / ↓ to move up/down

Press OK to invoke extension

Extensions provide handy extra non-destructive ways to do things.

To show screen aspect ratio menu short-press GREEN button

Pressing V.FORMAT button also shows screen aspect ratio menu

Long-pressing GREEN should list subservices, no Saorview or FreeSat channels transmit subservices.

Press ↑ / ↓ to move up/down

Press OK to select new screen aspect ratio

Press RED to list subservices

Press YELLOW to show screen resolution (normally 1080p)

Press ↑ / ↓ to move up/down

Press OK to select new screen resolution

Press BLUE to show 3D modes

Press ↑ / ↓ to move up/down

Press OK to select new 3D mode

Press EXIT to exit

To show the PKT BluePanel short-press BLUE button

Press ↑ / ↓ / ← / → to move up/down/left/right

Press EXIT to exit

To show the CAM menu long-press BLUE button

Press ← / → to toggle between available EMU services

Press ↑ / ↓ to toggle CA1-to-CA0 card mapping on/off

Press RED to stop EMU service

Press GREEN to start EMU service

Press YELLOW to place EMU service in standby

Press BLUE to toggle start/stop of card server

Press 1 button to select NEWCS card server

Press 2 button to select OSCAM card server

Press EXIT to exit

The EMU service provides decryption. The card server enables the Alien2 to offer that service to networked clients. These facilities should be used for legal purposes only, not to illegally decrypt commercial encrypted TV.

Press USB to show the Mount Manager:

Press BLUE to show the currently mountable devices (disk partitions)

Press ↑ / ↓ to move up/down the mount points

Press ← / → to toggle amongst the currently mountable devices

Press GREEN to mount a device

Press YELLOW to unmount a device

Press RED or EXIT to exit

Be aware that the mount manager uses predefined mount point names /media/Point<1-9>, which might not be to your taste, in which case see (6) below.

A network share is some part of a network disk that is shared over the network. To mount a network share, short-press BLUE button (to invoke PKT BluePanel), then select PKT Mount Manager → CIFS/NFS Manager → Add Network Mount then edit the settings:

- Press ↑ / ↓ to move up/down the key map definitions
- Press ← / → to toggle amongst the predefined choices
- Press → to make the network share active
- Press << to clear the local share name then use keys 0-9, ←, → to edit Similarly for the server share name
- Don't use as HDD replacement
- Mount with "rw" (read/write) options
- <username> and <password>
- Press OK to activate the settings.

The local share name is the name the network share will be called by Enigma2. The local path to it will be /media/net/<local_share_name>. The server share name is what the network share is called by the remote server or router it resides on (at net address <server_share_IP>)¹, where <username> and <password> are for a (non-root) account that the <server_share_name> is shared by. Be sure to check /etc/smb.conf on the remote server for the server share name. Sometimes it includes "(at xxx)". It is often easier to create your own custom share name section in smb.conf:

```
[<server_share_name>]
path = <server_share_name>
valid users = <username>
```

Alternatively the network share can be manually mounted (only until the next reboot) from the command line:

```
mount -t cifs -o username=<username>,password=<password>
//<server_share_IP>/<server_share_name>
/media/net/<local_share_name>
```

Yet another alternative is to mount it on every reboot from /etc/fstab:

```
//<server_share_IP>/<server_share_name>
/media/net/<local_share_name> cifs
rw,username=<username>,password=<password> 0 0
```

Networked disks exported with NFS or CIFS (Samba) filesystems can be used to replay videos once they are mounted. This (PKT) Mount Manager is different to the Enigma2 Mount Manager. Also see (20) below.

To configure the EPG and CrossEPG, press the MENU, select SETTINGS then press OK:

- Press ↑ / ↓ to move up/down
- Select EPG then press OK
 - Press ↑ / ↓ to move up/down
 - Enable EIT, FreeSat, ViaSat, Netmed EPG data (not MHW)
 - Select to maintain EPG data for 120 days
 - Press EXIT to exit
- Press CROSSEPG:
 - Press ↑ / ↓ to move up/down

¹ Where primary router (*router1*) and secondary router (*router2*) are installed, this is 'IP_on_router1'.

Select CONFIGURE then press OK
Press ↑ / ↓ to move up/down
Set to force EPG reload on boot
Set to schedule EPG data download daily at 04:00
Show CrossEPG as a plugin
Show CrossEPG as an extension
Press EXIT to exit
Select OPENTV PROVIDERS then press OK
Press ↑ / ↓ to move up/down
Select SkyUK OpenTV then press GREEN to save/exit
Select DOWNLOAD NOW and press OK to update EPG
Press EXIT as needed to exit

These must be configured to download the EPG details daily in order to regularly populate the CoolTVGuide EPG with new data.

To edit favourite groupings (bouquets), press OK to view the channel list, select the channel of interest by moving up/down to it and pressing OK, then press MENU to see the ChannelList Menu:

TVDB Info: search the TVDB database (<http://thetvdb.com/>)
Transponder Info: view the channel details, useful for XML edits
Start/Stop Using as Startup Service: tune to the channel on startup
Add Service to Bouquet: press OK, then select group
Play as Picture-in-Picture (PiP): unknown function as yet
Rename Entry: change channel name
Remove Entry: delete channel from group
Enable Move Mode: press OK, select channel to move, press OK, move to desired location, then press OK
Add Marker: unknown function as yet
Enable Bouquet Edit: unknown function as yet
Add Alternatives: unknown function as yet
Configuration: configure the channel lists

The favourite grouping is done via XML files, and needs close study before attempting to define your own.

To automatically update the bouquets (whenever the satellite companies change their transmission frequencies or other details) you can use *AutoBouquets* or *MakeAutoBouquets*. These plugins are usually included with the Enigma2 distribution. To configure AutoBouquets, press MENU → SETUP → Service Searching → Autobouquets → MENU. Configuring MakeAutoBouquets is quite similar.

The appearance of Enigma2 is known as its *Skin*. A small number of skins are usually included with the Enigma2 distribution. To change the skin, press MENU → SETUP → System → Skin, select a skin and press OK. Skins are stored at /usr/share/enigma2/<skin_directory>

Standard PKT Hyperion V4 skins are:

PKT Basic HD	PKT Silver HD	PKT Red HD
PKT F1 HD	PKT Alien HD	PKT Gold HD
PLi-HD	PKT Black Glass HD	

The default is PLi-HD (defined by OpenPLi), but the PKT Sliver HD is a very nice skin. Other Enigma2 distributions define their own skins, and there are lots of independently defined skins available on websites (MetrixHD, MoodblueHD and MX-HD2 are well regarded).

The appearance of TV channels and Satellites icons are known as *Picons*. TV channel picons are stored in /etc/enigma2/. Satellite picons are stored in /etc/tuxbox/. Once these are defined to your satisfaction the contents of these two subdirectories should be saved externally and then propagated to each new installation.

3. **Avoid Until Further Notice:**

Avoid the TV/RADIO button: it should toggle between TV and RADIO channel lists, EPG, etc, but locks onto radio, then users can only select TV again from another device using the OpenWebif webpage, see (8) below.

Avoid the TV/SAT button: it should toggle the remote between controlling the TV and controlling the Alien2, but does nothing.

Avoid the '<' reverse button: it works but very erratically.

4. **Partitioning Alien2 USB Disk Drives:** Spark is installed by default and works best with a FAT32 USB disk main partition, but FAT32 has a 32GB filesystem capacity limit and a 4GB file limit, so it is not good for recording HD movies, etc, which can easily exceed 4GB. Linux ext2 (or ext3 or ext4) partitions are more suitable for recordings. Enigma2 is more oriented to Linux. The Alien2 can non-interferingly sustain both Spark and Enigma2, and boot either. This is a useful attribute that is best preserved. One good hybrid option is a disk with two partitions, a first 32GB FAT32 (primary) partition, and a second Linux ext3 (also primary) partition for recording that uses the whole of the remaining space. **IMPORTANT: the FAT32 partition must be formatted by Windows, not Spark.** So for example, with a new large (say 2TB) USB disk, on a Windows machine, create the two partitions and format the 32GB FAT32 partition, mark it *Active*, then copy the existing Alien2 disk contents to the FAT32 partition. Then move the USB disk to the Alien2, boot up Spark, and format the Linux partition. Install Enigma2 on the FAT32 partition as per (5) below. Finally, mount the Linux partition as per (6) below, then after rebooting, login and create a subdirectory for recording, e.g. /media/Alien2/movies/. *Alternatively*, if Spark is of no interest, use Spark to create a single Linux ext3 primary partition for the whole of the USB disk space, install Enigma2 on that partition as per (5) below, then create a subdirectory for recording, e.g. /media/hdd/movies/.
5. **Installing Enigma2:** The initial part of Enigma2 installation on the Alien2 is common for all Enigma2 distributions, and is similar to that for most but not all satellite receivers. Firstly, on a Windows machine, create and format a 4GB FAT32 primary partition. Then copy the distribution files e2jffs2.img and uImage to a new folder called "enigma2". Insert the USB key in the rear USB socket, and while holding the front panel O key depressed, turn the power ON.

Release the O key and press the front panel > key. Wait about 7 minutes for Enigma2 to boot. From then on the procedure varies a little between distributions. For example, for a PKT Hyperion V4 distribution (e.g. ZardoZ 20140911), a startup configuration process will ask a few questions. It is sufficient to answer:

1080p	[display format]
Tuner A = Simple	[terrestrial tuner]
Tuner B = Simple + 28° 2'	[first satellite tuner]
Tuner C = Loophrough	[second satellite tuner]

Then press MENU → SETTINGS → SERVICE → SCAN with clear.

Press MENU → SETTINGS → SYSTEM → CUSTOM:

Enable Zap from Picture-in-Picture.

Then install TSmedia:

Press MENU → PLUGINS → GREEN → TSmedia and download.

Press MENU → PLUGINS → GREEN → TSmedia then EXIT.

Press MENU → PLUGINS → GREEN → TSmedia then EXIT.

Press PLAYMODE to show the Key Mapper

Set Portal key to TSmedia

Set Portal key (long press) to TSmedia

Press GREEN to save

Copy your preferred TV channel (e.g. FreeSat and Saorview) picons to

/etc/enigma2/ and preferred satellite (e.g. Astra 28.2) picons to /etc/tuxbox/.

Then reboot. The tuners can then be configured as really needed for the antenna, LNB and signal chain the Alien2 is actually connected to.

- Mounting USB Disk Partitions:** The first primary FAT32 or ext3 partition will be mounted by default. Other (usually Linux ext3) partitions are best mounted by logging into the Alien2 and adding the extra partition to /etc/fstab with a mount directory of your choice (i.e. not using the Enigma2 Mount Manager, which will force a mount path /media/Point2/). If so, you will first need to choose the mount directory, e.g. /media/Alien2/. Login to the Alien2, create the mount directory, then add the Linux partition to /etc/fstab, specifying the mount directory, e.g. as follows, then reboot:

```
/dev/sda1 /media/hdd auto defaults 0 0
/dev/sda2 /media/Alien2 auto defaults 0 0
```

- Recording to a Linux Partition:** The recording path must be set. Press the Menu button, then select Settings → System → Disk → RecordingPath → DefaultLocation. Then press OK to show the default path and bookmarks. Press the Menu button again and select SwitchToFilelist. Navigate to the recording path you wish, e.g. /media/Alien2/movies/ or /media/hdd/movies, and press GREEN to set the path to that directory on the Linux partition.
- TV webservice:** To see the Alien2 web service *OpenWebif*, browse to http://<alien2_IP>.² Avoid changing Alien2 configuration settings using this webpage as there are a small number of reports that it has caused corruption of the settings. However, changing channels, scheduling recordings, etc, appear to be free of problems.

² Where primary router (*router1*) and secondary router (*router2*) are installed, this is 'IP_on_router1'.

9. **TV streaming on LAN:** To stream video to a client device on the local network requires first that there is client software installed on the device (e.g. VLC on a laptop). If installing VLC be sure to only select a single browser plugin (IE or Mozilla) during installation, not both. Once installed then browse to the TVwebservice, select General, select a channel, and click on the orange “roadcone” symbol for that channel on the right side of the screen. If an execution confirmation popup box arises, click Run. VLC should spring to life and display the stream.

10. **Swap Space:** Enigma2 on the Alien2 by default does not use a swap file, but the PKT Hyperion V4 distribution does by default implement a 64MB swap file in /media/hdd/swap/ (which typically is sufficient). If swap is not implemented then it needs to be configured. If there is not enough internal flash memory to support demanding usage, then any swap space must be external in a large dedicated disk partition or disk file. This is easily done, even though there is no on-screen way to configure swap space. Login to the Alien2. First make sure the swap device is mounted, e.g.:

```
/bin/mount | /bin/grep /media/hdd
```

If it does exist, and also your swap directory exists, e.g. /media/hdd/swap/ exists, then if adjusting the swapfile, first turn off swapping:

```
/sbin/swapoff /media/hdd/swap/swapfile
```

If the swap directory doesn't yet exist, then create it:

```
/bin/mkdir /media/hdd/swap
```

Then create a swapfile of the desired size, e.g. for a 1GB swapfile:

```
/bin/dd if=/dev/zero of=/media/hdd/swap/swapfile bs=1048576  
count=1024  
/sbin/mkswap /media/hdd/swap/swapfile  
/sbin/swapon /media/hdd/swap/swapfile
```

Swap does not improve processor power, it helps when the Alien2 is running out of memory, but it further loads the processor, so if you already suffer from too heavy a load on the processor, swap is a really bad idea. Swap is really only needed with Enigma2 when there is very little memory. The Alien2 does not really have enough memory, so an external dedicated swapfile is useful.

11. **CPU Overclocking:** The Alien2 CPU may be dynamically overclocked, which improves its responsiveness to remote control actions. Press the BLUE button (to invoke PKT BluePanel), and select Settings → OverclockingTool. The Alien2 appears to be reliable with CPU at 540MHz and dynamic overclocking at 810MHz. It seems likely that reducing standby speed (e.g. with standby at 180MHz and standby dynamic overclocking ON) will further improve reliability due to lower standby power demands. But it is unclear whether fast boot overclocking is static or dynamic; if the former then unreliable booting may result, so until that is clarified it is best left OFF.

12. **Backup/Restore:** Various aspects of the Alien2 can be separately backed up and restored. Press the BLUE button (to invoke PKT BluePanel), and select System → BackupManager. Backups are created in the directory /media/hdd/backup/. Three general classes of backup can be identified:

Making whole image disabled: A subset of Enigma2 components can be enabled for backup to a compressed tarfile:

```
/media/hdd/backup/backup.tar.gz.
```

While any subset can be chosen, usually all should be enabled. The name is not informative, so it is wise to rename it to, e.g.

/media/hdd/backup/quick_image_backup_<datestamp>.tar.gz

Make whole image to USB: The whole image will be backed up to a compressed tarfile:

/media/hdd/backup/whole_image_backup_<datestamp>.tar.gz

Make whole image to Flash: The whole image will be backed up to flashable image files:

/media/hdd/backup/e2jffs2.img

/media/hdd/backup/uImage

It is wise immediately move these two flashable images to a date-stamped subdirectory, .e.g. ./backup-<datestamp>/. It is extremely easy to forget this and end up overwriting the previous backup files.

USB and **Flash** essentially do the same thing, but with different output file formats. Why **USB** is called that is a mystery, as **tar.gz** would have been more explanatory.

Press GREEN to perform the backup. Then copy the backups to a USB stick.

Press RED to restore from a previous backup.

13. **Channel Tuning:** Tuning the channels is a laborious process. It is far easier to copy someone else's channel lists; many exist on the web, but not many include the Saorview channels. It helps to know the way the bouquet filenames are constructed, and to know them for various channels.

For FreeSat satellite channels:

Channel	BBC1 HD	BBC2 HD	BBC3	BBC4	ITV1 HD	ITV2	CH4 HD	Film4	More4
Satellite	Astra 2A/2B/2D	Astra 2A/2B/2D	Astra 2A/2B/2D	Astra 2A/2B/2D	Astra 2A/2B/2D	Astra 2A/2B/2D	Astra 2A/2B/2D	Astra 2A/2B/2D	Astra 2A/2B/2D
Satellite Angle	28.2 East (0x11A)	28.2 East (0x11A)	28.2 East (0x11A)	28.2 East (0x11A)	28.2 East (0x11A)	28.2 East (0x11A)	28.2 East (0x11A)	28.2 East (0x11A)	28.2 East (0x11A)
Transponder Frequency	10847 (0x2A5F)	10847 (0x2A5F)	10847 (0x2A5F)	11023 (0x2B0F)	11097 (0x2B59)	10758 (0x2A06)	11126 (0x2B76)	10714 (0x29DA)	10729 (0x2827)
Channel Frequency	23000	23000	23000	23000	22000	22000	22000	22000	22000
Band									
Polarisation	Vertical	Vertical	Vertical	Horizontal	Vertical	Vertical	Vertical	Horizontal	Vertical
Video PID	5400	5500	5600	5300	2305	3332	2305	2353	2359
Audio-PID	5402	5501	5601	5301	2306	3333	2306	2354	2360
PCR	5400	5500	5600	5300	2305	3332	2305	2353	2359
PID	260	258			285				
Service ID	6941 (0x1B1D)	6940 (0x1B1C)	6951 (0x1B27)	8431 (0x22E3)	21000 (0x5208)	10070 (0x2758)	21200 (0x52D0)	9220 (0x2404)	8340 (0x2094)
Service Key	257 (0x0101)	256 (0x0100)			21 (0x0015)				
Sat Key	70	70	70	70	7070	70	70	70	70
TP Key	10	10	10	19	22	4	23	1	2
Frame	1920 x 1088	1920 x 1088	1920 x 1088	1920 x 1088	1920 x 1088	720 x 576	1920 x 1088	704 x 576	704 x 576
Provider	BSkyB	BSkyB	BSkyB	BSkyB	BSkyB	BSkyB	BSkyB	BSkyB	BSkyB
CAS	Free	Free	Free	Free	Free	Free	Free	Free	Free
System	DVB-S2	DVB-S2	DVB-S2	DVB-S2	DVB-S2	DVB-S2	DVB-S2	DVB-S2	DVB-S2
Ratio	16:9	16:9	16:9	16:9	16:9	16:9	16:9	16:9	4:3
Frame Rate	25Hz	25Hz	25Hz	25Hz	25Hz	25Hz	25Hz	25Hz	25Hz
Symbol Rate	25MHz								
Inversion	Auto								

FEC	2/3	2/3	2/3	2/3	2/3	5/6	5/6	5/6	5/6
Modulation	8 PSK	8 PSK	8 PSK	8 PSK	8 PSK	QPSK	QPSK	QPSK	QPSK

The Saorview terrestrial channels may be received from various transmitters, for example from Kippure ('white antenna') on MUX54 (735MHz) and MUX58 (767MHz), or from Three Rock ('red antenna') on MUX30 (546MHz) and MUX33 (570MHz):

Channel	RTE1 HD	RTE2 HD	TV3	TG4	3e	UTV Ireland	RTE1+1	RTE News	RTEjnr
Transmitter	Three Rock	Three Rock	Three Rock	Three Rock	Three Rock	Three Rock	Three Rock	Three Rock	Three Rock
Transponder Frequency	MUX33 (0x21)	MUX30 (0x1E)	MUX30 (0x1E)	MUX30 (0x1E)	MUX30 (0x1E)	MUX33 (0x21)	MUX33 (0x21)	MUX30 (0x1E)	MUX30 (0x1E)
kHz Channel Frequency	570000 (0x8B290)	546000 (0x854D0)	546000 (0x854D0)	546000 (0x854D0)	546000 (0x854D0)	570000 (0x8B290)	570000 (0x8B290)	546000 (0x854D0)	546000 (0x854D0)
Band	8MHz	8MHz	8MHz	8MHz	8MHz	8MHz	8MHz	8MHz	8MHz
Video PID	2101	1102	1103	1104	1106	2103	2111	1105	2107
Audio-PID	2201	1202	1203	1204	1206	2203	2211	1205	2207
PCR	8190	8190	8190	8190	8190	8190	8190	8190	8190
PMT	2001 ? (0x07D1)	1902 (0x076E)	1903 (0x076F)	1904 (0x0770)	1906 (0x0772)		2108 ? (0x083C)	1905 ? (0x0839)	2107 ? (0x083B)
Service ID	2101 (0x0835)	1102 (0x044E)	1103 (0x044F)	1104 (0x0450)	1106 (0x0452)	2103 (0x0837)	2111 (0x83F)	1105 (0x0451)	2107 (0x083B)
Service Key	961	936	937	938	939		958 ?	947 ?	
Sat Key	65	65	65	65	65	65	65	65	65
TP Key	2650	2647	2647	2647	2647	2647	2647	2647	2647
Frame	1440 x 1080	1440 x 1080	544 x 576	544 x 576	544 x 576	544 x 576	544 x 576	544 x 576	544 x 576
Provider	RTENL	RTENL	RTENL	RTENL	RTENL	RTENL	RTENL	RTENL	RTENL
CAS	Free	Free	Free	Free	Free	Free	Free	Free	Free
System	DVB-T2	DVB-T2	DVB-T2	DVB-T2	DVB-T2	DVB-T2	DVB-T2	DVB-T2	DVB-T2
Ratio	16:9	16:9	16:9	16:9	16:9	16:9	16:9	16:9	16:9
Frame Rate	25Hz	25Hz	25Hz	25Hz	25Hz	25Hz	25Hz	25Hz	25Hz
Bit Rate				3.6Mbps					
Video	H264	H264	H264	H264	H264	H264	NULL	H264	H264
Audio	MPEG Layer 1 48kHz Stereo English	MPEG Layer 1 48kHz Stereo English	MPEG Layer 1 48kHz Stereo English	MPEG Layer 1 48kHz Stereo English	MPEG Layer 1 48kHz Stereo English	MPEG Layer 1 48kHz Stereo English	MPEG Layer 1 48kHz Stereo English	MPEG Layer 1 48kHz Stereo English	MPEG Layer 1 48kHz Stereo English

For Enigma2 the the bouquet filename format is:

```
1_0_0_<A>_<B>_<C>_<D>_<E>_0_0_0.png
```

A = service type, "0" for radio, "1" for TV, "3" for data

B = hex service ID

C = transponder SID (i.e. MUX number)

D = transponder NID (i.e. network ID)

E = service namespace:

for satellite TV (DBV-S2) E = "<hex(10*angle)>0000"

e.g. for Astra 2A/2B/2D, E = "<hex(10*28.2)>0000" = "11A0000"

for terrestrial TV (DBV-T2) E = "EEEE0000"

for CableTV (DVB-C) E = "????"

For Spark the bouquet filename format is:

```
0_0_0_<A>_<B>_<C>_<D>.jpg
```

A = hex 10* angle:

for Astra 2A/2B/2D satellite (DBV-S2) A = hex(10*28.2) = "11A"

for terrestrial TV (DBV-T2) A = hex(10*370.0) = "E74"

for CableTV (DVB-C) A = hex(10*390.0) = "F3C"
B = hex transponder frequency in kHz
C = "0" for H, "1" for V polarisation
D = hex service ID

For example for the satellite channel "Sikh Channel":

```
<prog name="Sikh Channel" hd="0" encrypt="NULL" provider="BSkyB"
  video_type="MPEG2_VIDEO" audio_type="MPEG1_LAYER II" audio_lang="eng"
  bskip="0" block="0" pcr_pid="2374" audio_pid="2375" video_pid="2374"
  pmt_pid="256" service_id="55312" sat_type="S2" tuner_type_idx="1"
  service_key="189" tp_key="43" sat_key="1"/>
<transponder sat_key="1" polarization="V" modulation_mode="QPSK" fec="2/3"
  symbol_rate="27500" frequency="11681" original_network_id="2"
  transport_stream_id="2412" tp_key="43"/>
```

i.e. satellite angle = hex(10*28.2) = "11A"
hex transponder frequency = hex(11681) = "2DA1"
satellite polarisation = V = "1"
hex service ID = hex(55312) = "D810"
transponder SID = "????"
transponder network ID = "2"

So the Enigma2 Filename = 1_0_<A>_D810__<C>_2_11A0000_0_0_0.png

And the Spark Filename = 0_0_0_11A_2DA1_1_D810.jpg

Another example, the satellite channel "BBC One HD":

```
<prog name="BBC One HD" hd="1" encrypt="NULL" provider="BSkyB"
  video_type="H264" audio_type="MPEG1_LAYER I" audio_lang="NULL" bskip="0"
  block="0" pcr_pid="5400" audio_pid="5402" video_pid="5400" pmt_pid="260"
  service_id="6941" sat_type="S2" tuner_type_idx="1" service_key="101"
  tp_key="10" sat_key="1"/>
<transponder sat_key="1" polarization="V" modulation_mode="8PSK" fec="8/9"
  symbol_rate="23000" frequency="10847" original_network_id="2"
  transport_stream_id="2050" tp_key="10"/>
```

i.e. satellite angle = hex(10*28.2) = "11A"
hex transponder frequency = hex(10847) = "2A5F"
satellite polarisation = V = "1"
hex service ID = hex(6941) = "1B1D"
transponder SID = "????"
transponder network ID = "2"

So the Enigma2 Filename = 1_0_<A>_1B1D__<C>_2_11A0000_0_0_0.png ???

And the Spark Filename = 0_0_0_11A_2A5F_1_1B1D.jpg ???

A further example, the terrestrial channel "RTE One HD":

```
<prog name="RTÉ One" hd="1" encrypt="NULL" provider="RTÉNL"
  video_type="H264" audio_type="MPEG1_LAYER I" audio_lang="eng" bskip="0"
  block="0" pcr_pid="8190" audio_pid="2201" video_pid="2101" pmt_pid="2001"
  service_id="2101" sat_type="T" tuner_type_idx="1" service_key="961"
  tp_key="2650" sat_key="65"/>
<transponder sat_key="1" polarization="V" modulation_mode="8PSK" fec="3/4"
  symbol_rate="29500" frequency="12129" original_network_id="0"
  transport_stream_id="0" tp_key="65"/>
```

i.e. satellite angle = hex(10*370) = "E74"
hex transponder frequency = hex(570000) = "8B290"
satellite polarisation = V = "1"
hex service ID = hex(2101) = "0835"
transponder SID = "????"
transponder network ID = "2"

So the Enigma2 Filename = 1_0_<A>_835__<C>_<D>_EEEE0000_0_0_0.png ???

And the Spark Filename = 0_0_0_E74_8B290_1_0835.jpg ???

Satellite Channel	Enigma2 bouquet filename	Spark bouquet filename
BBC1 HD	1_0_19_1B1D_802_2_11A0000_0_0_0.png	0_0_0_11A_2A5F_1_1B1D.jpg
BBC2 HD	1_0_19_1B1C_802_2_11A0000_0_0_0.png	0_0_0_11A_2A5F_1_1B1C.jpg
BBC3	1_0_19_1B27_802_2_11A0000_0_0_0.png	
BBC4	1_0_19_22E3_80D_2_11A0000_0_0_0.png	
ITV1 HD	1_0_19_5208_812_2_11A0000_0_0_0.png	0_0_0_11A_2A06_1_274C.jpg
ITV2	1_0_1_2756_7FC_2_11A0000_0_0_0.png	0_0_0_11A_2A06_1_2756.jpg
ITV3	1_0_1_2814_806_2_11A0000_0_0_0.png	0_0_0_11A_2A9A_1_2814.jpg
ITV4	1_0_1_2758_7FC_2_11A0000_0_0_0.png	0_0_0_11A_2A06_1_2758.jpg
CH4 HD	1_0_19_52D0_814_2_11A0000_0_0_0.png	0_0_0_11A_2B76_1_52D0.jpg
Film4	1_0_1_2404_7F9_2_11A0000_0_0_0.png	0_0_0_11A_29DA_0_2404.jpg
More4	1_0_1_2094_7FA_2_11A0000_0_0_0.png	0_0_0_11A_29E9_1_2094.jpg
E4	1_0_1_2071_7FA_2_11A0000_0_0_0.png	0_0_0_11A_29E9_1_23F8.jpg
CH5	1_0_1_1E14_809_2_11A0000_0_0_0.png	0_0_0_11A_2AD4_0_1E14.jpg
RTE1 Sat		0_0_0_7D1_0021_1_0835.jpg
RTE2 Sat		
TG4 Sat		0_0_0_770_001e_1_0450.jpg

Terrestrial Channel	Enigma2 bouquet filename	Spark bouquet filename
RTE1	1_0_16_44D_3E9_2174_EEEEE0000_0_0_0.png	
RTE1 HD	1_0_19_835_3EA_2174_EEEEE0000_0_0_0.png	0_0_0_E74_8B290_0_835.jpg
RTE2 HD	1_0_19_44E_3E9_2174_EEEEE0000_0_0_0.png	0_0_0_E74_854D0_0_44E.jpg
TV3	1_0_16_44F_3E9_2174_EEEEE0000_0_0_0.png	0_0_0_E74_854D0_0_44F.jpg
TG4	1_0_16_450_3E9_2174_EEEEE0000_0_0_0.png	0_0_0_E74_854D0_0_450.jpg
3e	1_0_16_452_3E9_2174_EEEEE0000_0_0_0.png	0_0_0_E74_854D0_0_452.jpg
UTV Ireland	1_0_16_837_3EA_2174_EEEEE0000_0_0_0.png	
RTE1+1	1_0_16_83F_3EA_2174_EEEEE0000_0_0_0.png	0_0_0_E74_8B290_0_83C.jpg
RTE News	1_0_16_451_3E9_2174_EEEEE0000_0_0_0.png	0_0_0_E74_854D0_0_451.jpg
RTEjnr	1_0_16_83B_3EA_2174_EEEEE0000_0_0_0.png	

14. **Antenna/DiSEqC/Motor:** The Alien2 is very capable of managing the signal chain from antenna downwards, even when there are several antennas or other signal sources.

[Does this still work?] The Zoom option is one of the best kept secrets of the OpenWebif service. Take a notebook to your dish, browse to OpenWebif, select the Zoom option on the right-top of the screen, and tune your fixed dish to the best signals and no BER.

When adjusting the satellite dish antenna, it helps to know the details for selected channels. Select the channel, e.g. see below, then click Menu → Setup → Service Searching → Antenna Positioner. The signal level, signal-to-noise ratio and signal quality will then be displayed.

Detail	FreeSat Satellite Channel	Saorview Terrestrial Channel
Channel	BBC1 HD	RTE1 HD
Satellite (sat.) / Transmitter (terr.)	Astra 2A/2B/2D	Kippure
Transponder Frequency	10847	CH33
Channel Frequency	23000	570000

Polarisation	Vertical (V)	n/a
Video PID	5400	2101
Audio-PID	5402	2201
PCR	5400	8190
PID (sat.) / PMT (terr.)	260	2001
Service ID	0x1B1D	0x0835
Frame Status	1920 x 1088	1440 x 1080
Provider	BSkyB	RTENL
CAS	Free	Free

15. **LNBS/Combiners/Splitters/Amplifiers:** The signal chain from antenna downwards can be quite complex. The primary distinction is between raw signal feeds and unified feeds. This divergence arises because the total satellite signal spectrum (10700-12750MHz) has become larger than that originally allocated for typical domestic satellite tuners (900-2240MHz). This is simply a result of the increasing number of TV channels transmitted via the satellites.

To cope with this two strategies are employed. Firstly the satellite spectrum is split into two bands (**LO**=10.7-11.7GHz, **HI**=11.7-12.75GHz) and only one of these bands presented to a tuner at a time. Secondly the utilisation of each band is doubled by availing of the fact that a satellite signal (and electromagnetic energy in general, like light) is polarised, and signals polarised 90 degrees apart do not interfere and so can be transmitted simultaneously in the same band.

It is the LNB (Low Noise Block, essentially a front-end receiver and frequency down-shifter), that copes with all this. The tuner sends DC and 22kHz AC voltages up the signal cable to instruct the LNB to select band and polarisation:

Band / Polarisation	+12V DC	+18V DC
no AC	LO / Vertical	LO / Horizontal
22kHz AC	HI / Vertical	HI / Horizontal

For raw signal feeds the LNB selects the band and polarisation, downshifts the selected signals to 900-2240MHz, and sends them down the cable to the tuner. As a tuner only sees a quarter of the available signals at any time, the impact is that only channels in the same quarter can be viewed and recorded at the same time. For example BBC1 HD cannot be recorded while viewing BBC2 HD. For such raw signal feeds the only way to view and record channels at will is to dedicate a raw signal feed per tuner. *Universal LNBS* are available with two or four outputs that allow simultaneous raw feeds to two or four tuners, each tuner independently selecting its band and polarization. To configure a tuner, click Menu → Setup → Service Searching → Tuner Configuration, select the tuner:

	Tuner B		Tuner C
Config mode	Advanced	Config mode	Loophthrough to
Satellite	Astra 2A/2E/2F/Eutelsat 28A (28.2E)	Connected to	Tuner B Tuner1-Sat (DVB-S2)
LNB	LNB1		
Priority	Auto		
LOF	Universal LNB		
Voltage mode	Polarisation		
Increased voltage	No		
Tone mode	Band		

DiSEqC mode	None		
--------------------	------	--	--

If there are several TV sockets to feed, the complexity is in the signal chain and cabling, especially if terrestrial TV, DABS and FM radio are combined with the LNB output signals.

There are multiple ways to reduce the cable complexity, one very nice extreme being *Unicable*, which squeezes all that is desired down one cable. Special *Unicable LNBs* perform this magic. They are essentially multiple LNBs, with the outputs of each then frequency-shifted to per-LNB user-defined slots within the 900-2240MHz spectrum before sending down the cable. The tuners must know how to deal with this complex arrangement (the Alien2 does). To configure a tuner, click Menu → Setup → Service Searching → Tuner Configuration, select the tuner. When selections made, press OK to save.

	Tuner B		Tuner C
Config mode	Advanced	Config mode	Advanced
Satellite	Astra 2A/2E/2F/Eutelsat 28A (28.2E)	Satellite	Astra 2A/2E/2F/Eutelsat 28A (28.2E)
LNB	LNB1	LNB	LNB1
Priority	Auto	Priority	Auto
LOF	Unicable	LOF	Unicable
Unicable config mode	Unicable LNB	Unicable config mode	Unicable LNB
Manufacturer	Inverto	Manufacturer	Inverto
Type	IDLB-QUDL- UNI2L-0PP	Type	IDLB-QUDL- UNI2L-0PP
Channel	SCR1	Channel	SCR2
Freq	1210	Freq	1420
Connected	No	Connected	Yes
Connected to	-	Connected to	Tuner B Tuner1-Sat (DVB-S2)
DiSEqC mode	None	DiSEqC mode	None

If there are several TV sockets to feed, the complexity is now in the Unicable LNB and the instructions given it by each tuner. Terrestrial TV, DABS and FM radio can be combined with the LNB output signal on the one cable. If there are multiple tuners connected to a socket, then unless the tuners are able to loop through (for example, as in ‘Connected to’ in the Alien2 Tuner C example above), then the Unicable must be split to feed the separate tuners.

Some proven useful choices are documented here.

LNBs: Either Universal or Unicable LNBs, e.g.:

Inverto Quattro Unicable LNB model IDLB-QUDL42-UNI2L-1PP.

Amplifiers: To counteract the losses in subsequent passive combiners and splitters, each of the signal spectrums needs to be amplified before entering the combiners, e.g:

DVB-S2 satellite: EasyFit FC-AMP-SAT/S booster amplifier, 900-2300MHz 13-18dB gain (the output can pass DC and 22kHz AC and DiSEqC control signals to the satellite input).

DVB-T2 terrestrial: typically this is part of the Saorview antenna signal path, e.g. for a Teledesic log-periodic antenna their 5050 MRD preamplifier-DAT45 and 8203 PSU/amplifier is suitable.

UHF-CATV cable (e.g. UPC): this is typically a DOCSIS-compliant signal at 402.75MHz, so any standard DVB-T2 amplifier is suitable.

Combiners_1: The 402.75MHz UHF-CATV cable and 470-862MHz Saorview DVB-T2 terrestrial signals can be combined in a specialist filter, e.g: Polytron BK450/470 combiner:

	CABLE 4-450MHz	UHF 470-862MHz
insertion loss	1.5dB	1.5dB

Combiners_2: The satellite and composite Saorview+Cable signals may then be further combined in a standard combiner, e.g: Labgear PSF410 multiband combiner (the output can pass DC and 22kHz AC and DiSEqC control signals to satellite input, max.20V/400mA).

	VHF FM 87.5-108MHz	DAB 217.5-230MHz	UHF 470-862MHz	Satellite 950-2300MHz
insertion loss	<1dB	<1dB	<1dB	<2dB
isolation loss	>30dB	>30dB	>30dB	>50dB
return loss	<16dB	<16dB	>13dB	>10dB

Splitters_1: The multi-spectral signals can then be split to feed sockets in different locations, e.g. livingroom, bedrooms, etc:

4-way: Jebsee STV-1784BP 5-2300MHz splitter (all feeds can pass DC and 22kHz AC and DiSEqC control signals to the input).

6-way: Labgear FBS126 or FBS126/S 5-2400MHz splitters (for FBS126 all feeds can pass DC and 22kHz AC and DiSEqC control signals to the input, for FBS126/S only one feed can do this).

	5-40MHz	40-1000MHz	1000-2050MHz	2050-2300MHz
insertion loss	11dB	11.5dB	14dB	16.5dB
isolation loss	22dB	22dB	22dB	20dB
return loss	9dB	11dB	11dB	10dB

Splitters_2: Wall socket to DVB-S, DVB-T2/UHF-CATV, FM/DAB.

Splitters_3: Unicable split to separate tuners (if using Unicable on a tuner that has no loophrough connection, i.e. not on Alien2 tuners 1 & 2). Note that Inverto Unicable LNBs are supplied with a suitable splitter.

- Analog & DVB-T2 Modulators:** In order to record the Alien2 output on a VCR or DVD recorder, an analog UHF TV signal must be generated by feeding the Alien2 output to an analog UHF modulator and connecting the UHF output signal to the VCR or DVD recorder. For example, the Icecrypt-S3700CHD is identical to the Alien2 except that (a) it includes an Analog TV modulator that can be setup onscreen, and (b) it has a DVB-T rather than a DVB-T2 tuner. The latter is a big failing, but the former demonstrates that the hardware can support the concept (with additional hardware). To add a UHF TV modulator requires that a software-programmable UHF modulator be attached to the internal bus of the Alien2, or more realistically, one of the many low-cost commercially available UHF modulators with a switch-programmed output frequency be attached to the Alien2 HDMI, SCART or S-video outputs.

- . Conversely to play and/or record the output of a VCR or DVD player on the Alien2, a DVB-T TV signal must be generated by feeding the VCR or DVD player output to a DVB-T modulator (e.g. an Edision modulator) and combining the DVB-T output signal into the antenna signal chain. Multiple devices may be served by this modulator simply by feeding it from one of the many low-cost commercially available HDMI switches. Many of these will also auto-switch to the latest device turned ON, and when that is turned OFF will auto-switch back to the previously selected device.
- 17. **Extra DVB-T2 Tuners:** The Alien2 has only one DVB-T2 tuner, so it is impossible to view and record two programs transmitted by two different TV multiplexes. However, a number of Enigma2 distributions have included the dib0700 DVB-T2 drivers commonly used with the Hauppauge Nova USB TV stick, one or more of which could be plugged in to increase the number of installed DVB-T2 tuners. Furthermore, the same drivers will support the Sony PlayTV USB device, which includes two DVB-T2 tuners.

The latest USB tuner package that includes the dib0700 drivers is `usbtuner_0.7.3_all.ipk`, which is dependent on the `module-init-tools.ipk` package, from the GIT 2.6 2009-10-14 repository.

- 18. **OSCAM Setup:** The Alien2 has two CAM slots. The author has not used either.
- 19. **TV Streaming over WAN:** TV streaming on LAN, see (8) above, can be extended to wide area networks (WAN) simply by opening the relevant ports (i.e. port forwarding) on the home router. This makes it possible to remotely view TV programs and recordings when away from home. Such basic provisions, however, are fundamentally insecure. The preferred solution is to do the same thing, but via a virtual private network (VPN), providing the home router properly supports a VPN.

If VPN is not suitably supported, then a number of provisions can make for better security: (a) non-default http, https and stream ports can be used, (b) a dedicated non-root TV user account can be set up that has no home directory and cannot invoke a shell, (c) http(s)/stream access using other accounts can be blocked, and (d) extra configuration menu entries can be added to control these provisions.

First enter 'init 4' to exit Enigma2.

To configure streaming port, edit `/etc/inetd.conf` to include:

```
<stream_portno> stream tcp nowait root /bin/streamproxy streamproxy
```

To disable root login to Webif, then edit `/etc/enigma2/settings` to include:

```
config.OpenWebif.no_root_access=true
```

Then edit `/etc/passwd` to create a new user:

```
<TV_user>:*:65533:0:admin:/dev/null:/bin/false
```

Then do 'passwd <TV_user>' to set new password, NOT same as root user!!!

This yields an account to log into OpenWebif that has:

- (a) account name = "<TV_user>" as user 65533 in group 0
- (b) home dir = /dev/null (i.e. has no home directory)
- (c) shell = /bin/false (i.e. cannot login to shell ...)

Then the OpenWebif plugin's python source file needs to be edited to add new config menu items:

```
cd /usr/lib/enigma2/python/Plugins/Extensions/OpenWebif/  
cp plugin.py plugin.py.orig [to save the original]  
vi plugin.py
```

Then modify the following:

- Change config.OpenWebif.port from '80' to <http_portno>
- Change config.OpenWebif.streamport from '8001' to <stream_portno>
- Change config.OpenWebif.https_port from '443' to <https_portno>
- Change config.OpenWebif.auth from 'False' to 'True'
- Change config.OpenWebif.auth_for_streaming from 'False' to 'True'

In the same bunch of source text, add line:

```
config.OpenWebif.no_root_access = ConfigYesNo(default=True)
```

Further down add menu option lines:

- ```
self.list.append(getConfigListEntry(_("Stream port"),
 config.OpenWebif.streamport))
self.list.append(getConfigListEntry(_("Disable root Access"),
 config.OpenWebif.no_root_access))
Change 'Enable Http Authentication' to 'Enable Http/Https Authentication'
```

Save the modified source file, and then execute the following to create the executable plugin.pyo:

```
python -m py_compile plugin.py
```

Then access to OpenWebif from the internet needs to be limited to <TV\_user> (first save the original):

```
cp httpserver.py httpserver.py.orig
vi httpserver.py
```

Change the line:

- ```
def login(self, user, passwd):  
to:  
def login(self, user, passwd):  
    if user<>"<TV_user>" and config.OpenWebif.no_root_access.value:  
        return False
```

Execute the following to create the executable httpserver.pyo:

```
python -m py_compile httpserver.py
```

Then configure OpenWebif:

- Press MENU and select PLUGINS → OpenWebif and press OK.
- Enable OpenWebinterface
- Set http port = <http_portno>
- Enable https
- Set https port = <https_portno>
- Disable root access

- Enable http/https authentication
- Set stream port = <stream_portno>
- Enable authentication for streaming
- Disable smart services renaming for XBMC
- Disable parental control
- Disable adding service name to stream info

Choose the TV user name and the port numbers carefully to be unique to your configuration.

The provisions above create a more secure remote access environment. Forcing authentication on access to OpenWebif limits probing and delays interactions, while limiting access to '<TV_user>' helps further as this account has no home directory and cannot invoke a shell. Nonetheless, a VPN is preferable.

CHECK: does streaming with the resolved URI still allow unlimited probing with no delay ???

CHECK: can the OpenWebIf management be blocked from external usage?

To view a stream, browse to the TVwebserver. If a certificate error popup box arises, click Continue. Authenticate to OpenWebIf as the <TV_user> plus <password>. Once the webpage displays then select General, select a channel, and click on the orange “roadcone” symbol for that channel on the right side of the screen. If a certificate error popup box arises, click Continue. Authenticate to OpenWebIf as <TV_user> plus <password> [*Should these be different, i.e. for a separate ‘streaming’ account?*]. If an execution confirmation popup box arises, click Run. VLC should spring to life and display the stream.

20. **Port Forwarding with the Primary Router:** To support the provisions of (18) above the relevant WAN incoming ports must be opened (i.e. port forwarding) on the home router, and security alert email reporting should be added. The following shows how this is done with the primary router.

If the SMTP server of your normal contact email uses port 25 then skip this paragraph. If it uses a different port, e.g. port 465, then an indirect mechanism is needed to send alert emails on port 25 to your broadband email account, which needs to set up to forward those emails to your normal contact email address. First you will need to register and set up your broadband email account such that incoming emails will be forwarded to your normal contact email address. To do this add your normal contact email address to where it says ‘send copy to:’.

Browse to the primary router URL (<primary_router_IP>)³. First secure the router from WAN access. Select Security → Firewall → DoS and check that DoS (denial of service) blocking and Deny Ping are enabled. Then select Maintenance → RemoteMGMT and only enable https and SSH for management access from the local LAN, and disable all management access from WAN.

Then to add port forwarding, select NetworkSetting → NAT → PortForwarding, and add forwarding of the service ‘OpenWebif’ from VSDL, with a blank WAN

³ Where primary router (*router1*) and secondary router (*router2*) are installed, this is ‘IP_on_router1’.

IP (i.e. any WAN IP), to the server <Alien2_IP>⁴, with the trigger start & end and translation start & end all equal to <https_portno>, using TCP. Then add forwarding of the service ‘TVstreaming’ from VSDL, with a blank WAN IP, to the server <Alien2_IP>, with the trigger start & end and translation start & end all equal to <stream_portno>, using TCP.

To add security alert email reporting, select Maintenance → EmailNotification and add your broadband email address and the appropriate SMTP server. Then select Maintenance → LogSetting and specify either your normal contact email address (if its SMTP server uses port 25) or your broadband email address for ‘Send Log to’ & ‘Send Alarm to’, and enable ‘Clear log after sending email’.

21. **Secondary Router Port Forwarding:** If the CIFS network disk is behind a secondary router (*router2*) [see 26] then the CIFS port will need to be forwarded from the LAN of the primary router (*router1*) that hosts the Alien2 to the secondary LAN that hosts the network disk. This can be most easily done using the management GUI for the secondary router.

If the CIFS network disk is actually hosted on the secondary router itself then port forwarding (i.e. the router iptables FORWARD chain) does not handle the CIFS/SMB shares of disks hosted on that router. Instead the packets have to go through its INPUT chain, e.g. with a manually added rule. Login to the secondary router, then enter:

```
iptables -t nat -I PREROUTING -s <alien2_IP_on_router1> -d
  <secRouter_IP_on_router1> -i eth0 -j DNAT --to
  <secRouter_IP_on_router2>
iptables -I INPUT -s <alien2_IP_on_router1> -d
  <secRouter_IP_on_router2> -p TCP --dport 445 -i eth0 -j ACCEPT
iptables -t nat -I POSTROUTING -d <alien2_IP_on_router1> -o eth0 -j
  MASQUERADE
```

If the network disk is shared using NFS or Samba rather than CIFS then instead of the CIFS port 445, the NFS TCP port 1025 or the Samba TCP & UDP ports 137-139 will need to be opened.

22. **WiFi Keyboard/Mouse** [may not be possible]: It is probable that Enigma2 does not support standard WiFi (wireless) keyboard/mice, e.g. those from Logitech. The Alien2 does natively support a Wifi remote control (WLK100) that has a keyboard on its reverse face, but it is not certain whether Enigma2 supports this.
23. **eSATA Disk Interface** [may not be possible]: The main drawback of the Alien2 is the lack of a dedicated high-performance disk interface, such as SATA2 or, even better, eSATA.

The Fulan 7162 is identical to the Alien2 except that (a) it includes an eSATA interface that can be setup onscreen, and (b) it has a DVB-T rather than a DVB-T2 tuner. The latter is a big failing, but the former demonstrates that the hardware can support the concept (with additional hardware).

To add an eSATA interface requires a controller be attached to the internal bus of the Alien2.

⁴ Where primary router (*router1*) and secondary router (*router2*) are installed, this is ‘IP_on_router1’.

24. **Enigma2 in Depth:** Explanatory documentation on Enigma2 is almost impossible to find, reminiscent of the first decade of UNIX when experts seemed willing only to dispense cryptic directives, not explanations. The following Alien2-oriented explanation is a modified extract of: http://www.saunalahti.fi/dreambox/enigma2_development_toolchain/

What is Enigma2? When you switch on your Alien2 and start watching or recording TV shows, Enigma2 is the application that you see on the TV screen. Enigma2 receives and processes the button push events from the remote, draws the menus and the windows on the screen, changes the channels and, overall, handles all the interaction with the user. For a remote-controller-wielding couch potato, Enigma2 is what the Alien2 actually *is*.

But Enigma2 is not all there is to an Alien2. There is also the underlying Linux system, with a kernel, drivers, command-line tools, server applications such as Samba, scripts, shared libraries, a package management system, etc. Together, all these various components form the base upon which Enigma2 is running. Of course, most of these other components are running in the background, deep in the bowels of the device – invisibly, as far as the end user is concerned – but without them the Enigma2 software wouldn't work.

In other words, Enigma2 is a Linux application. It cannot exist alone; it is not stand-alone firmware that would directly access the settop box hardware at the register level and run independent of any external OS. The firmware images you can download from various websites are actually full-fledged mini-Linux distributions, with the Enigma2 application running on the top.

Aren't there similar DVR applications for Linux already? Yes, there are other Linux software packages that provide digital video broadcast TV (DVB) viewing and digital video recorder (DVR) functionality in much the same way as Enigma2 does. Popular examples of these include MythTV and OpenELEC. Enigma2 is similar to these projects in many ways, but differs in that it was written for settop box hardware from the very beginning.

The target platform for Enigma2 is an embedded environment: something that typically has much less raw processor power and memory than a generic Linux system. MythTV and OpenELEC, on the other hand, are more geared towards the so-called “Home Theater PCs” (HTPCs). These systems can often be quite powerful or even fully on-par with modern desktop PCs, in terms of processor power and available memory, but generate more heat and noise.

How does Enigma2 compare with SmartTVs? Over time SmartTVs have gradually acquired many of the features that Enigma2 also has, so the gap is ever-decreasing. The primary remaining difference is that SmartTVs are oriented to commercial rather than free content providers, and are not easily enhanced with extra hardware (e.g. tuners) or software (e.g. Ad skipping).

Feature	Enigma2	SmartTV
Open Linux login	✓	☒
LAN IOS GUI access	✓	✓

LAN Android GUI access	✓	✓
LAN web GUI access	✓	✓
Stream to LAN	✓	✓
Customizable WAN access	✓	☒
WAN web GUI access	✓	☒
Stream to WAN	✓	☒
Internet browsing	☒	✓
YouTube	✓	✓
Netflix	☒	✓
Free IP-TV	✓	☒
Free IP movies	✓	☒
Saorview DVB-T2	✓	✓
FreeSAT DVB-S2	✓	✓
Extra tuners	✓	☒
Matrix DVB-T2 EPG	✓	✓
Matrix DVB-S2 EPG	✓	✓
DVB-T2/DVB-S2 EPG integration	✓	✓
Multiple FAVOURITES groups	✓	✓
Content Access Modules (CAMs)	✓	✓
Digital video recording (DVR)	✓	✓
NFS/CIFS network disk mounting	✓	✓
Timeshift	✓	✓
Ad skipping	?	☒
Numeric-key skip	✓	☒
WiFi keyboard	☒	?
User key mapping	✓	☒

What happened to Enigma 1? Enigma2 is a rewrite of Enigma1, which is another, older settop-box-oriented DVB viewer and DVR application. The most striking difference between the two is that Enigma1 is a C++ application through-and-through whereas Enigma2 only has a relatively compact C++ core for the lower level stuff and handles much of its internal logic in Python. For instance, in Enigma2, the user interface logic and menu structures are all handled by Python modules and they could be completely rewritten by merely altering the Python code. In Enigma1, similar changes would require altering the C++ code and recompiling the binary. In addition to that, Enigma2 also includes a new interface that allows writing plugins as Python modules. The old Enigma1 only allowed binary plugins.

The original motivation for developing a complete new version is unclear, but apparently the old C++ codebase of Enigma1 was somewhat messy and hard to maintain, and did not handle multiple tuners and DVB multiplexes gracefully. These points alone could explain the need for something new.

The Python orientation of Enigma2 makes rapid development and changes in the user interface logic easier, and should also make plugin development more feasible for end-users.

Can I replace the Enigma2 software with something else? Many individuals and groups have released customized unofficial versions of Enigma2. These are often little more than a repackaged version of Enigma2 with some preinstalled plugins, new skins, modified boot-up screens, and possibly a slightly different set of preinstalled Linux command line tools and services. There may be some nice touches, such as being able to download a large number of all kinds of plugins from the Internet, and they may even have some superficial little changes in the way how the user interface works, but it's still basically the same

Enigma2 underneath, so the user experience is much the same, just with more bells and whistles.

In addition to these customizations, there are also more serious attempts at creating something that completely replaces Enigma2. One of the most prominent examples is NeutrinoTV. In theory, nothing would prevent porting common Linux applications, such as MythTV or OpenELEC. One might even abandon the idea of watching TV completely and run something totally different on the same hardware, such as a web browser, or a VNC client.

If the documentation for the hardware was openly available, with documented register-level details of all the features of the CPU, it would even be possible to write new low-level drivers, and run something that is not Linux-based at all.

Then again, despite all these alternatives, Enigma2 seems to work pretty nicely for the purpose it was built, as a settop box user interface, and a flexible, multi-tuner DVR. For viewing and recording, there is no pressing need to abandon Enigma2 and move to something else. On the contrary, it would be nice if others would develop more for the standard Enigma2, patch bugs, work to get new functionality and new plugins accepted into the core distribution, all preferably with proper documentation.

Where is Enigma2 on my settop box? The Alien2 contains internal flash memory. In the standard factory setup, all supplied software is stored in there, and the device boots from the flash. New firmware/software releases are typically distributed as images, which are flashed directly into this space. The user simply flashes an image into the device to get a working settop box, a complete Linux system that boots straight into Enigma2. The Alien2 is notable for being able to store two images for booting, selectable during boot using the front-panel buttons.

The internal flash is not the only option for booting, though. The Alien2 can boot over the network, or from a USB memory stick, or from a USB hard disk (HDD). Even multi-boot configurations are possible. This might be useful, for instance, if you wish to test out several alternative software versions for a longer period of time, or to keep an image that is under development separate from the image you use for day-to-day TV viewing. These boot variations require startup script changes that are common to any Linux system. However, booting from the internal flash is the default if you use the standard Enigma2 images.

What does a typical Enigma2 flash image contain? The images contain, at minimum, a small Linux distribution and the Enigma2 application itself. Enigma2 is typically configured to autostart on boot. Typically Enigma2 is launched from /etc/inittab. Standard Enigma2 images come with a Samba server, SSH server, SCP, a telnet server, an FTP server, VI text editor, etc, and a BusyBox shell environment. It also supports mounting NFS and Windows (SMB/CIFS) network shares. Some customised images do not include all of this, e.g. the PKT Hyperion V4 image does not include SSH or SCP.

The flash filesystem is writable, which means that the end user can add more software, such as Enigma2 plugins or individual Linux software packages. It is also possible to edit the low-level configuration files in-place. Of course, if a new flash image is installed it will erase all these modifications.

What is Enigma2 made of? Enigma2 has a C++ part (the backend) and a Python-based part (the user interface logic and the plugin interface). These two different worlds have been coupled together using SWIG. A C++ class model has not yet been made available, but for the Python part the component names are quite self-explanatory. Enigma2 also links to some common libraries. Some 3rd party components are used, such as the TuxTXT teletext viewer. Enigma2 also talks to Alien2-specific closed-source hardware drivers (kernel modules). This is needed for interfacing with the hardware-accelerated MPEG decoding and video output capabilities of the hardware that the Alien2 is based on, and for providing features like widescreen switching, VCR SCART monitoring, or access to the remote control or an RF modulator. Enigma2 is a framebuffer-based application. The on-screen display (OSD) layer is a framebuffer. It uses its own lightweight windowing system geared for settop box style use. There is no X-Window system support in the images.

Some interesting locations that you can find in the filesystem of an Alien2 that has been flashed with an official Enigma2 image are:

- (a) the script `/etc/init.d/rcS` is launched from `/etc/inittab` during boot
- (b) the Enigma2 application is launched by the script `/etc/init.d/rcS`
- (c) the Enigma2 binary is in `/usr/local/bin/`
- (d) the Enigma2 Python components are in `/usr/lib/enigma2/python/`
- (e) various Enigma2 data files, such as skins, are in `/usr/share/enigma2/`
- (f) some configuration files are in `/etc/enigma2/` and `/etc/tuxbox/`

If I want to customise Enigma2, what are my options? If writing a plugin for Enigma2 you should not overlook the plugin interface. It is there to allow adding functionality without altering the main Enigma2 code. In the source tree there is a file called `enigma2/doc/PLUGINS`, which contains basic information for aspiring plugin developers.

If fixing bugs or other kind of undesired behaviour in the main code, or wishing to enhance things, an investigative approach is probably desirable, as there is little development-oriented information available. The source C++ files, the sample plugins and the Python components of Enigma2 are the prime reference.

The simplest way to customise Enigma2 is in-place, on a live Alien2 system. Much of the internal logic of Enigma2 is based on Python components which are in the directory `/usr/lib/enigma2/python/` on a live Enigma2 system. These files can be modified directly. This is possible because they are on a writable filesystem, and since the standard Enigma2 images come with a Linux environment that already contains all the required tools for editing and transferring files, and support for mounting network shares.

You might be able to do whatever it is that you want to do simply by modifying those Python files, and then test your changes by restarting Enigma2 (rather than

rebooting). This can be done by entering 'killall enigma2' on the command line. The init daemon will then restart Enigma2. Of course, keep copies of the original files you replaced.

Modifying and recompiling the C++ binary part of Enigma2 Some problems cannot be solved in any other way than by modifying the actual C++ part of Enigma2, in other words, the Enigma2 binary that resides in the /usr/local/bin/ directory. Then the problem becomes twofold:

- (a) Firstly, you need a C++ cross-compiler for the ST7162 processor.
- (b) Secondly, you need the sources that match your Alien2 installation.

The Enigma2 C++ code depends on a number of other components, including its Python parts and data files, and the libraries in the underlying Linux-system. You cannot mix and match different versions of the components willy-nilly. You need to install the same cross-development toolchain that is used to generate the image installed on your Alien2.

This does not mean that you need to create a complete flash image each time you want to try something out. It is still possible to work with the Enigma2 source code alone, and try out new versions of the Enigma2 binary without touching anything else (i.e. Python components, data files, libraries, kernel, etc). However, in order to get the required tools and build environment, you will first need to learn how to compile and build a complete flashable image. It's not as complicated as it may seem, see (24) below.

Once the development toolchain is in place that matches the version of Enigma2 that is installed in your Alien2, you can compile new, modified versions of the Enigma2 binary alone and test them by simply copying new versions of the executable to the /usr/local/bin/ directory of the Alien2.

Better yet, if you make changes that span over multiple files or affect dependencies, it is possible to package your custom build of Enigma2 into an IPK package, and deploy that package on an existing flash filesystem, together with other IPK-packaged software you might need, see (25) below.

25. **Compiling Enigma2 Sources:** Enigma2 was developed by Dreambox Ltd., the manufacturer of the DM series of TV settop boxes, e.g. the DM800, which use Broadcom CPUs. Until recently they have developed it as open-source software, but now have closed their future sources. However, over the last few years there have been a number of both commercial and community projects to compile the sources for other compatible settop boxes, for both Broadcom and other CPUs. These projects intend to continue to develop and support an open source branch of the Enigma2 software. The Alien2 uses the ST7162 CPU, which implements the SH4 CPU architecture. Enigma2 uses the Busybox implementation of the Linux command shell and utilities, which is not itself an adequate platform for compiling the sources, but the sources may be cross-compiled on a general Linux machine. The result is an image that can be installed on the Alien2.

Example images are those from the OpenATV, OpenPLi, Duckbox, PKT, VIX and HDMU projects, e.g. see:

<http://code.google.com/p/tdt-amiko>
<http://code.google.com/p/taapat-enigma2-pli/downloads/list>

Not all these projects support the SH4 architecture, for example, OpenPLi does not support SH4. The SH4 image that this manual is based on is the Polish Coding Team (PKTeam) SVN-2874 Hyperion V4 image that is based on the Duckbox SH4 Project build of the GIT-5580 repository of the OpenPLi project Enigma2 2013-11-13 sources employing the Linux kernel 2.1.32.59_stm24_0211 and the Busybox v1.21.1 2014-02-03 built-in 'ash' shell (restricted 'bash', enter 'help' to show commands). Below is an example of how to set up cross-compilation of Enigma2 from the Duckbox SH4 Project.

Compilation of Enigma2 requires GIT 1.6.5.1 or later installed. First browse to <https://gitorious.org/open-duckbox-project-sh4> and select Wiki → Installation. Download the setuptdt.sh script to a dedicated directory, e.g. ~/duckbox-sh4/, change the script's permissions and execute it:

```
chmod 755 setuptdt.sh
sudo ./setuptdt.sh
```

To install GIT, browse to the <http://www.kernel.org/pub/software/scm/git/> repository and download the GIT source 1.6.5.1 or higher, e.g. git-2.2.1.tar.xz, then unpack, configure and install it:

```
tar xvf git-2.2.1.tar.xz
mv ~/Downloads/ git-2.2.1.tar.xz ~/duckbox-sh4/
cd ~/duckbox-sh4/
sudo ./configure
sudo make && make install
sudo shutdown -r now
```

Note that to 'make' as a non-root user it is necessary to temporarily alter the ownership of the /usr/local/ subdirectory:

```
sudo chown -R <user>:<user> /usr/local/
sudo make && make install
sudo chown -R root:root /usr/local/
```

Once the compilation machine has rebooted, check everything is OK by entering 'git -version', which should display 'GIT 2.2.1'.

GIT employs SSH public key authentication. If it doesn't already exist, first create an SSH key with a unique passphrase:

```
ssh-keygen -t rsa
```

Then register ('signon') with the GIT forum. When done, then paste the contents of your key file ~/.ssh/id_rsa.pub to <https://<yourGITwebpage>/keys/new/>

Anonomously clone the Duckbox SH4 repository:

```
git clone git://gitorious.org/open-duckbox-project-sh4/max-tdt.git
```

Note that 'tdt.git' includes the source subtrees for both the Neutrino and (OpenPLi) Enigma2 softwares, whereas 'max-tdt.git' includes solely the Enigma2 branch.

FTP some missing video and audio files from the Alien2 /boot/ directory:

```
cd ~/duckbox-sh4/
ftp
  open <Alien2_IP>          [enter username 'root' &
  password]
  cd /boot
```

```
get audio.elf
get video.elf
quit
cd ~/max-tdt/tdt/cvs/cdk/root/
mkdir boot
cd ./boot/
cp ~/duckbox-sh4/audio.elf ./audio.elf
cp ~/duckbox-sh4/video.elf ./video_7100.elf
cp ~/duckbox-sh4/video.elf ./video_7109.elf
```

Both of the video files are required; the scripts will later automatically choose the correct one based on the target device.

Then configure the build environment:

```
cd ~/max-tdt/tdt/cvs/cdk/
./make.sh
```

The configure dialog allows you to customize the build environment for your target device. Enter '20' for SPARK7162. Then choose the options:

- '2' == the STM24 P0211 kernel
- 'N' == disable kernel debugging
- '2' == Player191 (stmfb-3.1_stm_0104)
- '2' == gstreamer media framework (or '3' == built-in framework)
- '2' == graphlcd for external LCD

Then everything is in place to build an SH4 image:

```
make yaud-enigma2-pli-nightly
```

This will take 10 minutes to build an image based on the Enigma2 sources of latest nightly (unstable/untested) release.

At present, some modules cannot be built with the current GIT code, so in the ~/max-tdt/tdt/tufsbox/release/lib/modules/ directory there are empty dummy files. These must be replaced with files FTPed from an existing image (for example from the directory lib/modules/) to create a working image.

After finishing the build, the NFS-root is in the ~/max-tdt/tdt/tufsbox/release/ directory. The kernel is at ~/max-tdt/tdt/tufsbox/release/boot/uImage. To compress the image:

```
cd ~/max-tdt/tdt/tufsbox/release/
tar -czvf /folder_to_place_file/MyE2ImageName.tar.gz ./ >
/dev/null 2>&1
```

The image can now be FTPed to the Alien2 and installed there.

As time passes the GIT sources will evolve and rebuilding may be desired. Firstly get the latest GIT code (only changed code will be updated):

```
cd ~/max-tdt/
git checkout -f
git pull
cd ~/max-tdt/tdt/cvs/cdk/
make clean
./touch.sh
```

The last command recreates the dummy "modules".

Typically the ~/max-tdt/tdt/tufsbox/devkit/sh4/lib/sh4/lib/*.la files also need to be renamed (e.g. to *.la.orig) to allow a rebuild to create new versions.

Then everything is in place to build an SH4 image as described above. The new build will usually finish within a few minutes as only the code changes will be recompiled.

You can also modify the sources and rebuild, but to be persistent any changed files must be committed to your local repository:

```
git commit -m "<log_message>" <changed_files>
```

For more information on Duckbox SH4, see:

- <https://gitorious.org/open-duckbox-project-sh4>
- <http://dev.duckbox.info/>

- 26. Creating IPK Packages:** The Alien2 software can be extended and/or updated very easily with IPK packages. See: http://wiki.openmoko.org/wiki/Create_an_ipk_package_from_sources
- 27. Secondary Router Firewall Rules:** For the Alien2 to access services behind a secondary router, that router's firewall rules must be manually extended. The following examples are for an Asus RT-N66U as the secondary router.

The first example is to access a CIFS (Samba) shared disk attached to the router:

```
#
# Open CIFS port to Alien2
# NB: can test on Alien2 using the command:
#   $mount -t cifs username=<username>,password=<pw> //<asus_IP_on_router1>/<disk_name> /media/net/test
#   where <username> and <pw> are for (non-root) account that <disk_name> is shared by
#
iptables -t nat -I PREROUTING -s <alien2_IP_on_router1> -d <asus_IP_on_router1> -p TCP --dport 445 -i eth0
        -j DNAT --to <asus_IP_on_router2>
iptables -I INPUT -s <alien2_IP_on_router1> -d <asus_IP_on_router2> -p TCP --dport 445 -i eth0 -j ACCEPT
iptables -t nat -I POSTROUTING -d <alien2_IP_on_router1> -o eth0 -j MASQUERADE
```

The second example is to access a PLEX server behind the router:

```
#
# Open PLEX port between Alien2 and <PLEX_LAN_IP>
# NB: can test PLEX using the command:
#   $telnet //<plex_IP_on_router1> 32400
#   where TCP 32400 is port used by the PLEX protocol
# Also route local PLEX and its DLNA traffic only to <plex_IP_on_router1>
#   UDP 1900 & TCP 32469 for PLEX DLNA server
#   UDP 32410/12/13/14 for GDM network discovery
# Also drop local PLEX and its DLNA traffic to <plex_IP_on_router2> (WiFi)
# You can see the routing using the command:
#   $iptables -t nat -L
#
iptables -t nat -I PREROUTING -s <alien2_IP_on_router1> -d <asus_IP_on_router1> -p TCP --dport 32400 -i
        eth0 -j DNAT --to <plex_IP_on_router2>
iptables -I FORWARD -s <alien2_IP_on_router1> -d <plex_IP_on_router2> -p TCP --dport 32400 -i eth0 -j
        ACCEPT
iptables -t nat -I POSTROUTING -d <alien2_IP_on_router1> -o eth0 -j MASQUERADE
iptables -I INPUT -d <plex_IP_on_router2> -j DROP
#
# Allow access to PLEX from mobiles and tablets over guest WiFi networks
#   PLEX is on 5GHz guest network w11.1
#   mobiles and tablets are on 2.4GHz guest network w10.1
# So must also enable access between 2.4GHz and 5GHz guest networks
# Guest networks are handled by ebttables
#
## ebttables -I FORWARD -d Broadcast -j ACCEPT
ebttables -I FORWARD -i w11.1 -o w10.1 -j ACCEPT
ebttables -I FORWARD -i w10.1 -o w11.1 -j ACCEPT
```

```
eatables -t broute -I BROUTING -p IPv4 -i w11.1 --ip-src <plex_IP_on_router2> --ip-proto tcp -j ACCEPT
eatables -t broute -I BROUTING -p IPv4 -i w10.1 --ip-dst <plex_IP_on_router2> --ip-proto tcp -j ACCEPT
```

Finally, it is good practise to block bittorrent ports and also to implement a firewall blacklist, then to log the new rules:

```
#
# Delete bittorrent ports
#
iptables -D INPUT -j ACCEPT -p udp --dport 4672
iptables -D INPUT -j ACCEPT -p udp --dport 4665
iptables -D INPUT -j ACCEPT -p tcp --dport 4662
iptables -D INPUT -j ACCEPT -p tcp --dport 51413
iptables -D INPUT -j ACCEPT -p udp --dport 51413
iptables -D OUTPUT -j ACCEPT -p udp --dport 4672
iptables -D OUTPUT -j ACCEPT -p udp --dport 4665
iptables -D OUTPUT -j ACCEPT -p tcp --dport 4662
/bin/sleep 2
/bin/echo "**** /jffs/scripts/delayed-start -- bittorrent ports deleted ****" >> /tmp/syslog.log
#
# Block traffic from these IPs
#
BLACKLIST=/jffs/scripts/blacklist.txt
for x in `grep -v ^# $BLACKLIST | awk '{print $1}'`; do
  /bin/echo "**** /jffs/scripts/delayed-start -- blocking $x ****" >> /tmp/syslog.log
  iptables -I INPUT -s $x -j DROP
  iptables -I INPUT -d $x -j DROP
# iptables -I INPUT -s $x -d <troublesome_IP_on_router2> -j DROP
# iptables -I INPUT -d $x -s <troublesome_IP_on_router2> -j DROP
  iptables -I OUTPUT -s $x -j DROP
  iptables -I OUTPUT -d $x -j DROP
# iptables -I OUTPUT -s $x -d <troublesome_IP_on_router2> -j DROP
# iptables -I OUTPUT -d $x -s <troublesome_IP_on_router2> -j DROP
  iptables -I FORWARD -s $x -d <troublesome_IP_on_router2> -j DROP
  iptables -I FORWARD -d $x -s <troublesome_IP_on_router2> -j DROP
done
#
# List new rules
#
iptables -v -L >> /tmp/syslog.log
iptables -v -L -t nat >> /tmp/syslog.log
eatables -L >> /tmp/syslog.log
eatables -t broute -L >> /tmp/syslog.log
```

28. **Secondary Router Firewall Rules for a PLEX Server behind the router:** For a PLEX server behind a secondary router, the router's firewall rules for that server must be manually extended. The following example is for an Apple MacMini where the PLEX and its DLNA traffic is over 5GHz guest WiFi via an Asus EA-N66 to the MacMini Ethernet port, while access to other services is over 2.4GHz WiFi to the MacMini. Note the MacMini firewall need not be enabled on via the 'Security Preferences' for this to work:

```
#
# Access to PLEX is over 5GHz guest WiFi via Asus EA-N66 to MacMini Ethernet port 'en0' =
  <plex_IP_on_router2>
# Access to other services is over 2.4GHz WiFi to MacMini WiFi port 'en1' = <macmini_IP_on_router2>
# NB: can test PLEX using the command:
# $telnet //<plex_IP_on_router2> 32400
# where TCP 32400 is port used by the PLEX protocol
# So must block non-PLEX access to port en0
# Also allow PLEX and its DLNA traffic only on en0
# UDP 1900 & TCP 32469 for PLEX DLNA server
# UDP 32410/12/13/14 for GDM network discovery
# Also block PLEX and its DLNA traffic on en1
# You can see the routing using the command:
# $sudo ipfw show
#
sudo ipfw add drop ip from any to <macmini_IP_on_router2> via en0
sudo ipfw add drop ip from any to <plex_IP_on_router2> via en1
```

```

sudo ipfw add accept UDP from any to <plex_IP_on_router2> dst-port 1900 via en0
sudo ipfw add accept TCP from any to <plex_IP_on_router2> dst-port 32400 via en0
sudo ipfw add accept UDP from any to <plex_IP_on_router2> dst-port 32410 via en0
sudo ipfw add accept UDP from any to <plex_IP_on_router2> dst-port 32412 via en0
sudo ipfw add accept UDP from any to <plex_IP_on_router2> dst-port 32413 via en0
sudo ipfw add accept UDP from any to <plex_IP_on_router2> dst-port 32414 via en0
sudo ipfw add accept TCP from any to <plex_IP_on_router2> dst-port 32469 via en0
sudo ipfw add drop UDP from any to <router2_IP_range>/24 dst-port 1900 via en1
sudo ipfw add drop TCP from any to <router2_IP_range>/24 dst-port 32400 via en1
sudo ipfw add drop UDP from any to <router2_IP_range>/24 dst-port 32410 via en1
sudo ipfw add drop UDP from any to <router2_IP_range>/24 dst-port 32412 via en1
sudo ipfw add drop UDP from any to <router2_IP_range>/24 dst-port 32413 via en1
sudo ipfw add drop UDP from any to <router2_IP_range>/24 dst-port 32414 via en1
sudo ipfw add drop TCP from any to <router2_IP_range>/24 dst-port 32469 via en1

```

29. **Issues:** Stutter on movie replay occurs rarely, but seems to happen for recordings where the frame rate is near but not exactly 25fps. A prime example exists for a specific recording of *Game Of Thrones*. It occurs for all Enigma2 distributions except VIX. An even worse issue is that recordings made in Australia cannot be replayed by Enigma2. Both of these issues arise when replay is from a local file or from a Samba network share. The easiest way to overcome both is by using a PLEX server to host and transcode the files, replaying via the DreamPlex plugin, see (29) below. Another issue is that some skins are not compatible with all Enigma2 distributions, e.g. the PLi-HD skin is incompatible with ARP and VIX. These are tabulated versus distribution below:


	PLi-HD	Game Of Thrones	Australian recordings
ARP	X	1sec stutter	X
HDMU	-	X	X
ATV	-	1sec stutter	X
VIX	X	√	X
PKT Hyperion V4	√	very slow	PMT timeout
PKT Hyperion V4.5	-	very slow	X

X indicates does not work, √ indicates does work, - indicates has not been tested

30. **DreamPlex:** Any replay issues are solved by using a PLEX server to host the media files and replaying them via this plugin. Unfortunately v1.05 is the latest version supported on the PKT Hyperion v4 distribution of Enigma2, well behind the latest release <v1.6.xxx> (downloading and installing the latest release is not useful, as it crashes PKT Hyperion v4). Once installed the only thing needed is to set the PLEX server address (for a PLEX server behind a port-forwarding secondary router the address should be that of the 'WAN' port of the secondary router). Press MENU → DreamPlex → System → Server and set the IP. Press MENU → DreamPlex → System → Settings to view or change other settings.

To replay a movie, press MENU → DreamPlex → Plex Server then navigate to the movie. The default DreamPlex movie listing layout is a short list with lots of images (thumbnails); to switch to a longer list press the BLUE button.

As movies will then be played using DreamPlex, there is no longer any need for the MediaPlayer entry in the menu. To remove it, press MENU → MediaPlayer → MENU → Display in MENU → No. To restore it, press MENU → Plugins → MediaPlayer → MENU → Display in MENU → YES.


31. **PLEX Server:** PLEX can be run on Macintosh, Windows or Linux machines, but is best installed on a Macintosh, as it was first designed for that platform. An x86 MacMini makes a very good PLEX server. To reduce power, heat and noise its internal OSX system disk can be replaced with an external SSD in a portable USB enclosure, and the internal disk can be unmounted (**HOW?**). PLEX media is best stored on a large external USB disk (not an SSD). Connecting yet another large external USB disk then can be used as a target to backup the system and media disks (select  → SystemPreferences → TimeMachine → ON, point it at the target disk, and remove the media disk from the exclusions).

The OSX and backup disk will obviously be HFS+ formatted, yielding transfer rates of 20-30MB/s over the MacMini USB2 ports. If the media disk is also HFS+ formatted it will yield similar transfer rates, and so be easily able to support HD movie streams. An NTFS format USB media disk can be supported by installing the MacFuse and NTFS-3G drivers, but transfer rates over the MacMini USB2 ports will fall to below 3MB/s, too low to support HD movie streams (but higher-performance drivers are available). Linux formats are not supported by OSX.

A nice FTP client for transferring recorded files from the Alien2 to a Mac PLEX server is *CyberDuck*. The Alien2 records to files with names “<yyyymmdd hhmm>- <channel> - <title>.ts”, which are not as expected by PLEX, but a scanner for Enigma2 files can be installed that converts the filenames, see: <https://forums.plex.tv/discussion/68991/scanner-for-enigma2-ts-files>

32. **Sleep-on-idle media disks:** For long periods the media disks may be idle, so it makes sense if they enter a sleep-on-idle state to reduce power, heat and noise. Most 2.5” TB-capacity ‘portable USB disk drives’, such as the Western Digital WD Elements series, or Seagate and Toshiba equivalents, do this automatically.

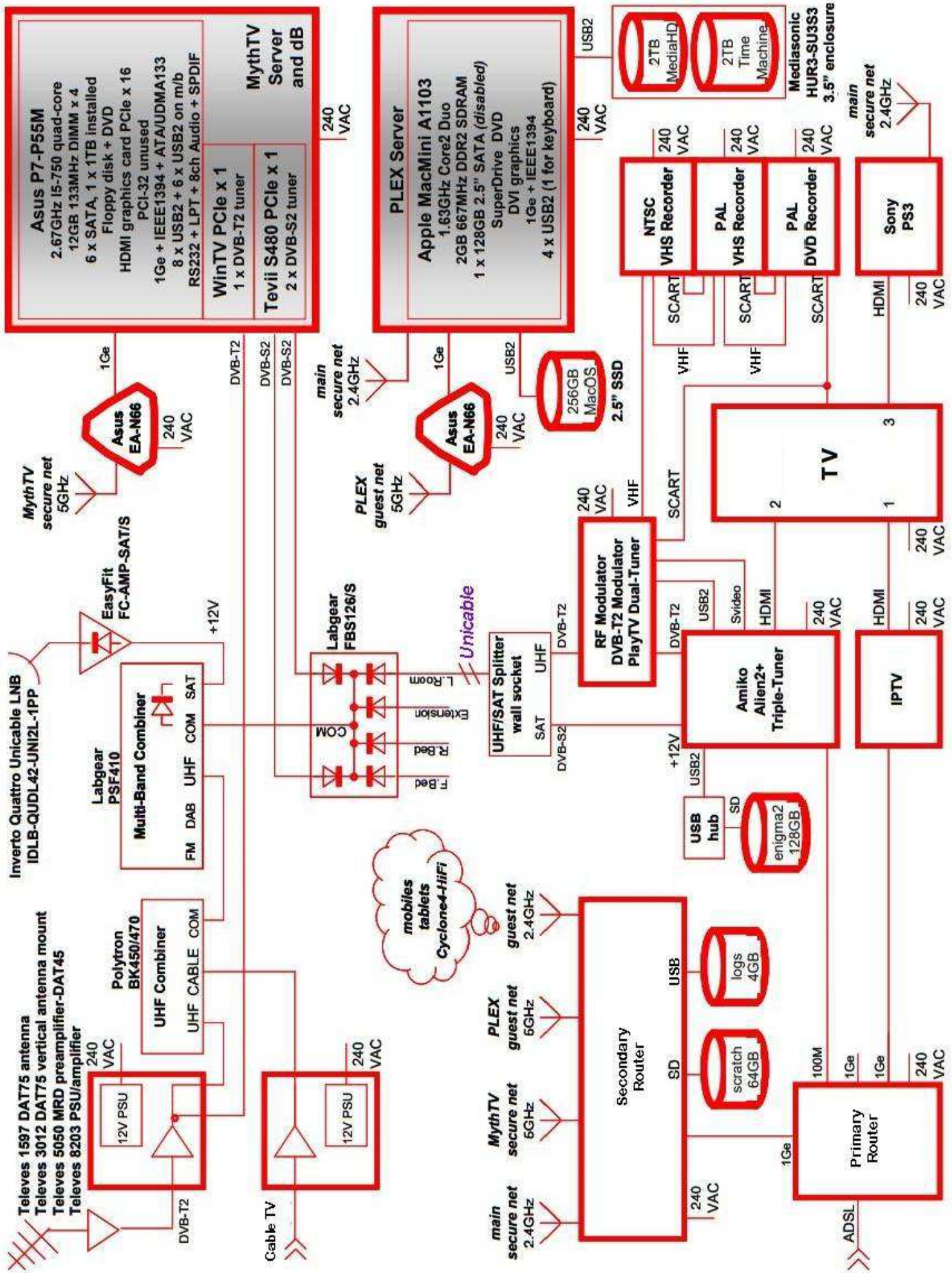
For 3.5” drives, sleep-on-idle is however supported on very few inexpensive disk enclosures. For example, the Mediasonic ProRaid HUR3-SU3S3 2 Bay USB disk enclosure supports automatic sleep when the host machine is powered down (‘power-sync’), but not automatic sleep-on-idle if the host is powered on; it is up to the operating system support to invoke the sleep state. Moreover if there has been a power failure and if the host machine has been configured to “reboot after power failure”, the HUR3-SU3S3 will unfortunately wait for its Power button to be pressed, so the host will fail to mount the drives while it is booting. To further illustrate the example, if the host is a Macintosh (e.g. a MacMini PLEX server) then OSX does support sleep-on-idle, but then only if the disk is HFS+ formatted (not if it is an NTFS format disk accessed via the NTFS-3G driver), i.e. on a MacMini PLEX server a Mediasonic HUR3-SU3S3 with HFS+ disks will sleep-on-idle. But the power fail behaviour can only be fixed by a hardware hack to add a time-delay relay to “press the button” after power failure.

On a MacMini PLEX server the sleep timing can be adjusted (e.g. select  → SystemPreferences → EnergySaver, set *ComputerSleep* to *Never* and also *DisplaySleep* to 15 minutes, and tick *Put the hard disks to sleep when possible*

and *Allow power button to put computer to sleep*). An OS utility (pmset) allows more detailed control, e.g. to set the disk sleep to 5 minutes:

```
sudo pmset -a disksleep 5  
pmset -g
```

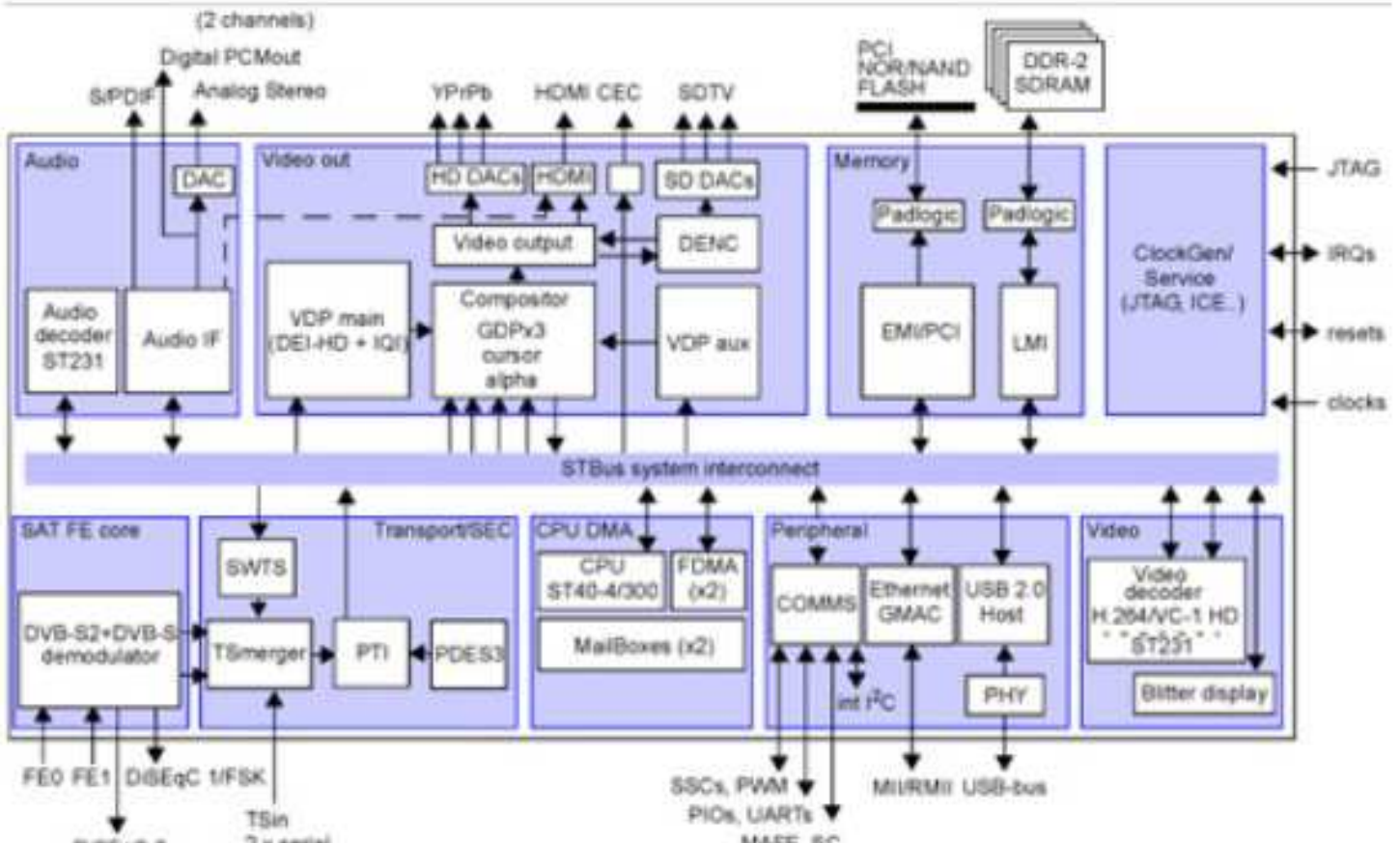
33. **Serial console:** To enable the serial console (over RS232C), boot with the Alien2 front panel MENU button pressed until UP is displayed.



Key Features

- Microsoft VC-1, MPEG-2 and H.264 support
- ST40-300 CPU running at 450 MHz, high performance for Linux, Windows CE and OS21 based systems
- DVB-S2 and DVB-S front-end integrated demodulators with a fully featured HD advanced decoder system-on-chip (SoC)
- Flexible ST231 based advanced video decoder
- ST231 audio decoder at 450 MHz supporting WMA9, AC3, DD+, AAC, AAC+ with SPDIF output
- HD and SD simultaneous display, 2 video, 3 graphics planes and background color with high quality filtering
- HDMI/HDCP output plus HD or standard definition (SD) component and composite output
- Unified DDR2 32-bit interface operating at up to 400MHz
- Programmable transport interface (PTI) and transport stream (TS) merger with up to 2 digital external TS inputs, 2 internal inputs from internal demodulators and one TS from memory for network client
- USB 2.0 to support network interface and feature enhancement
- External memory interface (EMI) with Nand-Flash, Nor-Flash, PCI, peripherals support
- 10/100 Mbit/s Ethernet MAC with media independent interface (MII) and reduced MII (RMII)
- Advanced security, SVP compliant, WM DRM compliant
- Dual smartcard, 4 x UART, 3 x synchronous serial controllers (SSC), soft modem and DAA interface, IR blaster and receiver, UHF Rx digital input
- DiSEqC 2.0 and FSK modem supported
- 4 x 4 matrix key front panel switch FSM with key de-bounce
- 27 x 27mm package, 65nm technology

Circuit Diagram

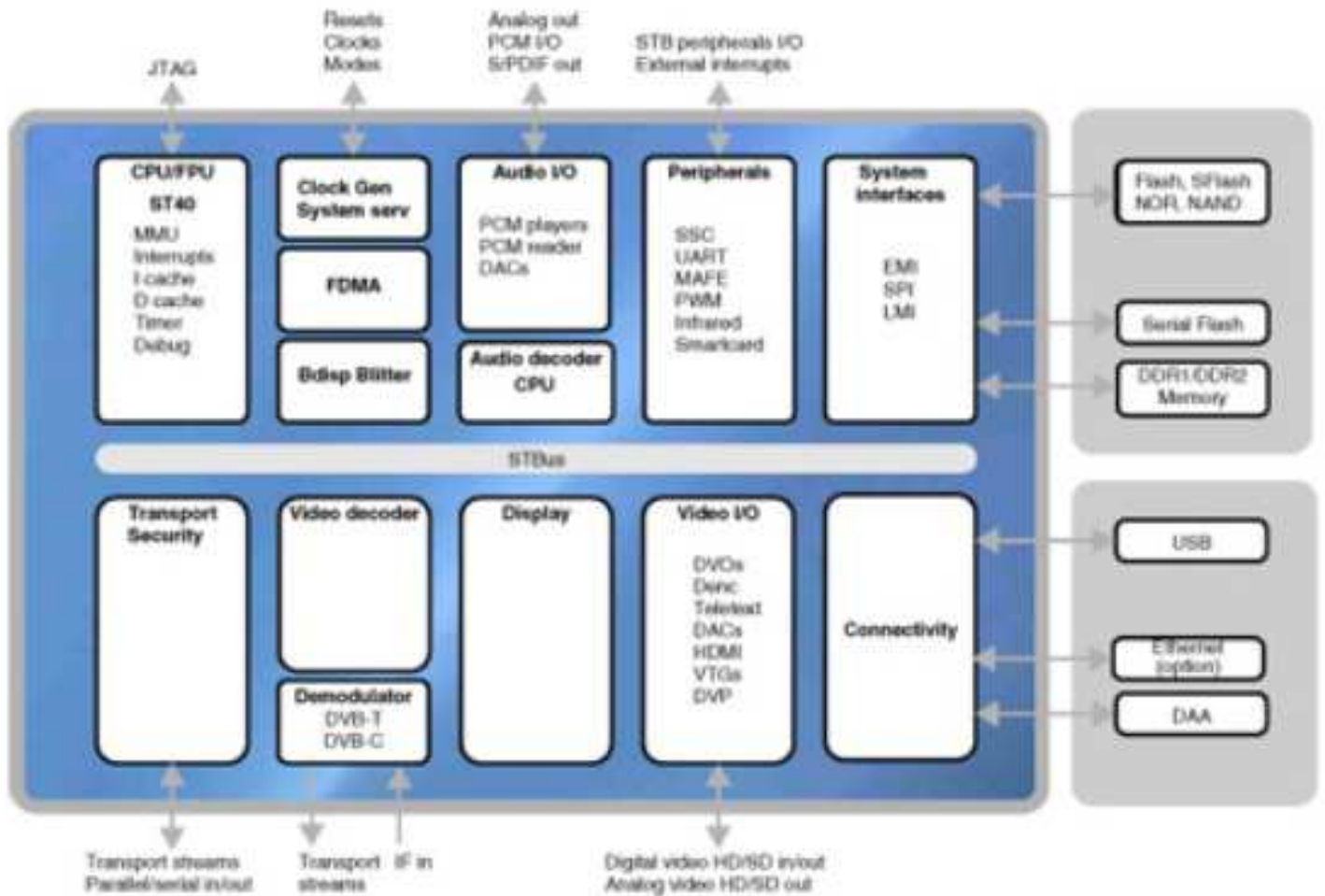


ST 40 details

Key Features

- Integrated DVB-C or DVB-T demodulator
 - User-selectable mode
 - Compatible with low to high IF tuners
 - Flexible clock management
 - ADC for RF signal strength indicator
- Advanced high-definition video decoding (H264/VC-1/MPEG2)
- Advanced standard-definition video decoding (H264/VC-1/MPEG2/AVS)
- Advanced multi-channel audio decoding (MPEG 1, 2, MP3, DD/DD+, AAC/AAC+, WMA9/WMA9Pro)
- Linux, Windows CE and OS21 compatible ST40 applications CPU
- 32-bit DDR1/DDR2 compatible local memory interface
- Multi-stream, DVR capable transport stream processing
- Connectivity through dual USB 2.0 hosts and optionally through Ethernet MAC/MII/RMII

Circuit Diagram



ST 7162 details