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Adapting Images for Sony Ericsson Phones

Sony Ericsson

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This document is designed to help content providers understand how to optimize images to fit the Sony Ericsson phones.

People who can benefit from this document include:
• Software developers
• Content developers
• Support engineers

More information, useful for product, service and application developers, is published at http://www.SonyEricsson.com/developer/, which contains up-to-date information about technologies, products and tools. You can also visit the consumer web site at http://www.SonyEricsson.com

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Image support phone overview

	T68i T68ie	T226	T230 T238	T300 T302 T306	T310 T312 T316	T610 T616 T618	T628 T630	Z200 Z208	Z600 Z608	Z1010	P800 P802	P900 P908
Screen size	101x80	101x80	101x80	101x80	101x80	128x160	128x160	128x128	128x160	176x220	208x320 flip open	208x320 flip open
Number of colors	256 (8 bits)	512 (9 bits)	4096 (12 bits)	256 (8 bits)	256 (8 bits)	65536 (16 bits)	65536 (16 bits)	4096 (12 bits)	65536 (16 bits)	65536 (16 bits)	4096 (12 bits)	65536 (16 bits)
RGB bits	R:3 G:3 B:2	R:3 G:3 B:3	R:4 G:5 B:3	R:3 G:3 B:2	R:3 G:3 B:2	R:5 G:6 B:5	R:5 G:6 B:5	R:4 G:5 B:3	R:5 G:6 B:5	R:5 G:6 B:5	R:4 G:5 B:3	R:5 G:6 B:5
Image support	JPEG GIF87 GIF89a WBMP	JPEG GIF87 GIF89a WBMP	JPEG GIF87 GIF89a WBMP	JPEG GIF87 GIF89a WBMP	JPEG GIF87 GIF89a WBMP	JPEG GIF87 GIF89a WBMP	JPEG GIF87 GIF89a WBMP	JPEG GIF87 GIF89a WBMP	JPEG GIF87 GIF89a WBMP	JPEG GIF87 GIF89a WBMP	JPEG GIF87 GIF89a WBMP PNG TIFF BMP	JPEG GIF87 GIF89a WBMP PNG TIFF BMP MBM
Themes support	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	No	Yes

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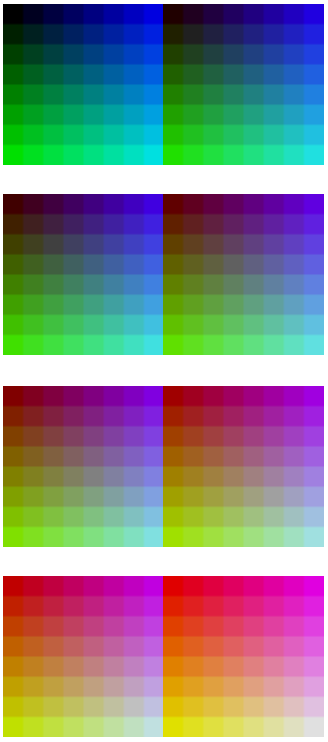
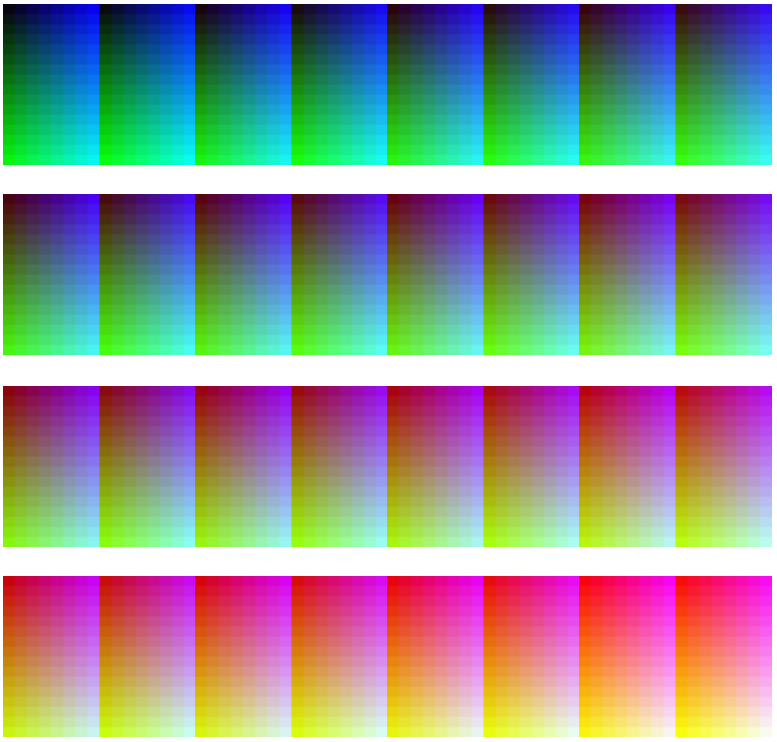
Understanding color values

The display formats supported in some of Sony Ericsson's handsets do not fit the typical 8, 16 or 24 bbp (bits per pixel) display formats, nor do they match (without some manipulation) the file formats or tools that graphics designers use.

To assist developers with the conversion, Sony Ericsson has developed some straightforward techniques for working with GIF and JPEG image file formats in conjunction with 9 bpp and 12 bpp displays that optimize the use of the color palette and limit the effects of color banding that is often associated with low color displays.

The Sony Ericsson T226 for North American Market and the world phone T230 introduce the use of 9 bpp and 12 bpp displays that offer 512 and 4,096 colors respectively. In the table below you can see the two color palettes that are used for 512 and 4,096 colors respectively.

512 Color Palette – 9 bpp (Seiko S44203)	**4096 Color Palette - 12 bpp (Ultrachip UC1682)**
	

GIF and JPEG formats

Pre-loaded themes and wall papers are typically provided in GIF format in Sony Ericsson phones. GIF images use a palette of 256 colors that index a larger palette of 24 bit color.

Sony Ericsson has developed several 9 bpp and 12 bpp Adobe Photoshop action files (.ATN) that automate converting 24 bpp images to GIF using only the palette available for the particular display, thus making images look as good as possible on our displays.

This is accomplished by splitting the color channels into RGB values, mapping each color channel to the set of available colors for that channel, and applying Photoshop's diffusion dithering individually to each channel. This results in very smooth conversions from 24 bpp high color images to 9 bpp and 12 bpp images.

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By first applying a saturation of 50-75 in the original image in Photoshop, richer color can also be applied to the image and in most cases that looks good in the phone. Applying saturation isn't always preferred however, and that gives us the flexibility to produce a wide range of images in the GIF format.

In addition to the manual conversion techniques done to produce good looking GIFs for download to the phone, several image enhancement techniques have been developed and built into T226 and T230 software to enhance the look of color JPEG images on our displays.

These techniques include the use of gamut correction to enhance the look of colors, and the use of hardware dithering in JPEG images reduces the effects of color banding. This improves the look of JPEGs downloaded to the phone via a data cable, the wireless internet, or the CommuniCam accessory, and doesn't require any special action on the part of the developer.

File Format	***Number of Colors in file***	***Colors Hardware Limited by 16 bpp driving mode***	***Colors truncated or dithered? Colors gamut corrected?***	***Simultaneous Visible Colors for a Single Image – Limited by Display*** ***T226: S44203- 512 max (R:3 G:3 B:3) T230: UC1682 - 4,096 max (R:4 G:5 B:3)***
GIF	256 (index into 16.8 mil color palette)	256 (indexed palette bit-shifted to 65K)	truncate/no gamut correction	**256** colors on T226 and T230 1. T230 can do more gradients with it's larger palette. 2. Optionally, the image can be pre-dithered in an image editor.
JPEG	16.8 mil	65K	dither/gamut correction	**512** colors on T226 (dithered from 65K) **4,096** colors on T230 (dithered from 65K)

GIF images are not hardware dithered in T226 and T230. The philosophy we adopted for these phones was to not have any hardware dithering applied to pre-designed content. A solid background should render with a solid color and should not be dithered in the case of a color not in the native palette. In the case where dithering is desirable in a GIF image, it is possible to pre-dither it using Photoshop with far better results than hardware dithering provides us.

This is consistent with the file formats we're using: GIF offers a tremendous amount of control over color selection; JPEG offers virtually none; there is no guarantee what the final value will be for a color in a JPEG, and in fact a bitmap image with 512 colors could end up having twice as many colors when converted to JPEG.

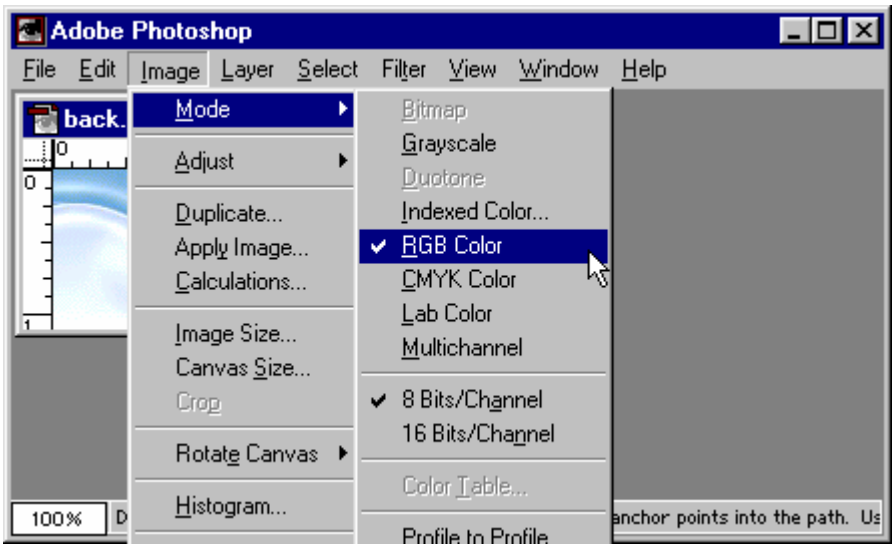
That being said, it's not at all obvious to most people how to go about producing GIF images that are optimized for a 9 bpp or 12 bpp palette. We need a technique that does not involve selecting 256 out of 512 or 4,096 colors by hand, but somehow gets the best matching combination of colors from either of these palettes into the 256 color palette in a GIF image.

Image conversion using Adobe Photoshop

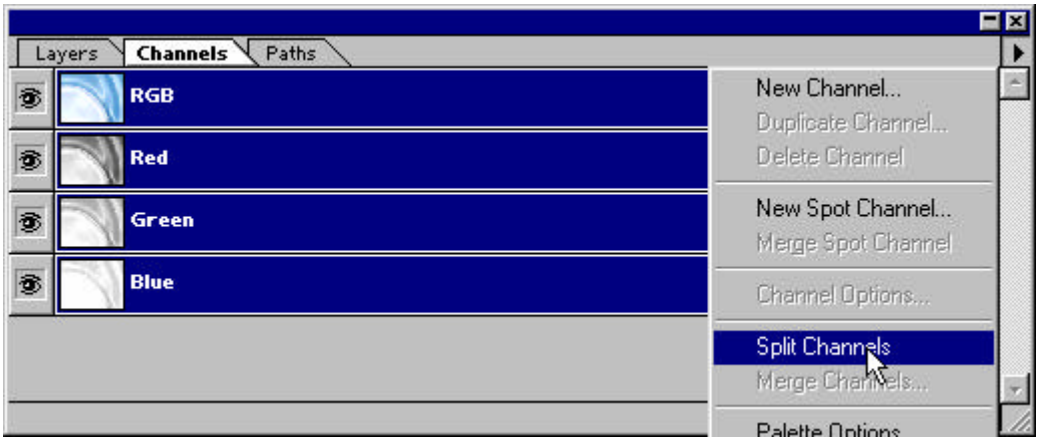
The technique is simple but works quite well and has been verified in Adobe Photoshop 6.0 (Photoshop). In Photoshop you basically do the following:

1. Load an image.

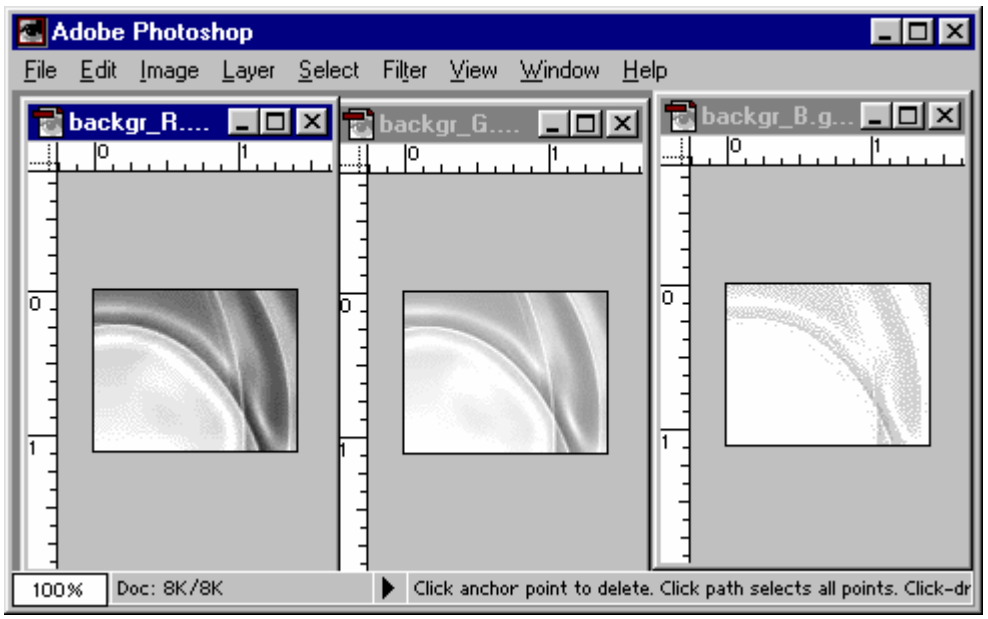
2. Set Image Mode to RGB Color



3. Go to the channels window and split the channels.



This produces a separate image in greyscale representing each of the red, green, and blue color channels.

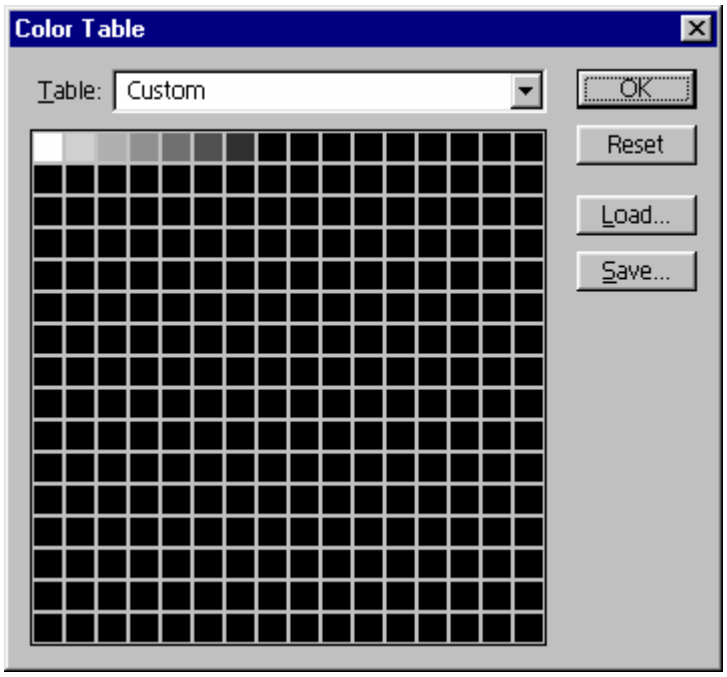


4. **For EACH of the R, G, and B channels** do the following:

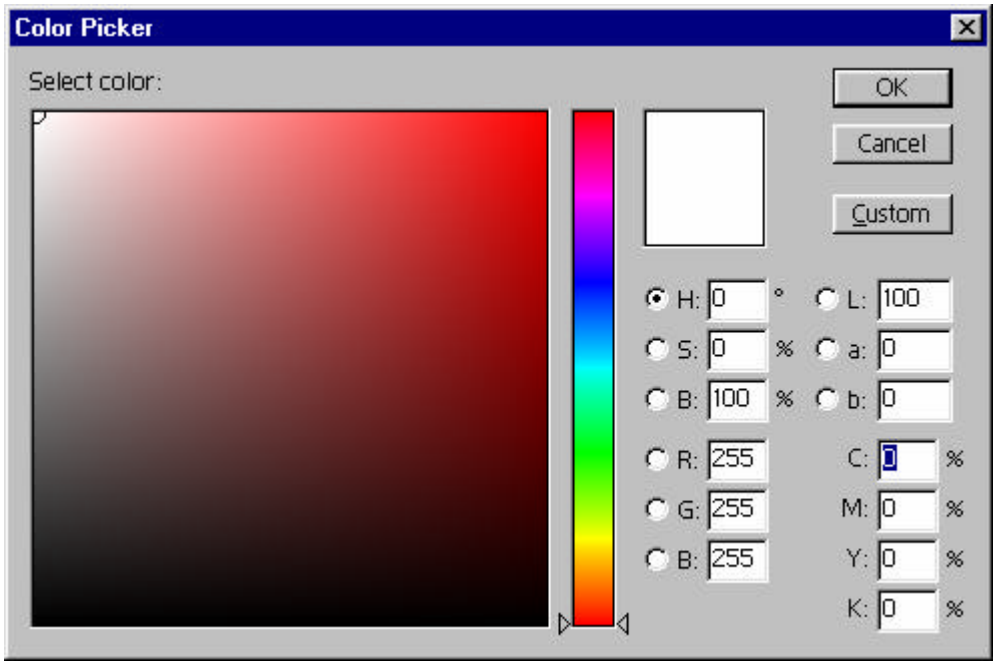
a. Set the mode to RGB color.

b. Then set the mode to Indexed color.

c. Go into the Color Table and select custom.

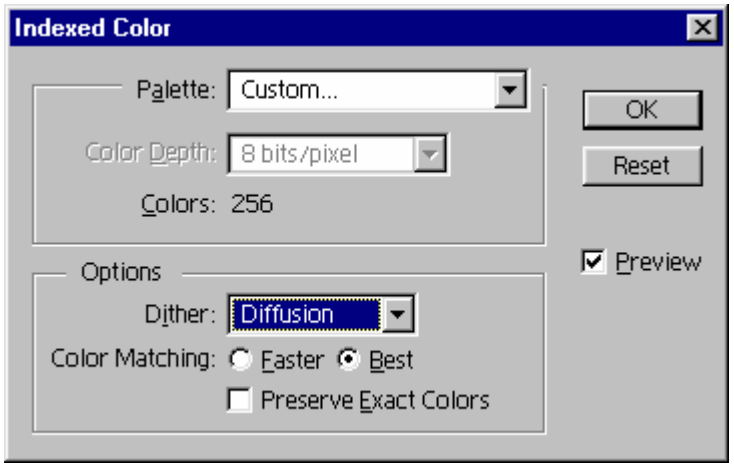


d. Set the colors to greyscale values that represent the available palette for that channel. For instance if you have a 3 bit blue channel you will have 8 available blue values that span from 0 to 255. They will be something like: 0, 32, 64, 96, 128, 160, 192, 224 (set the final value to 255, this allow us to produce white and makes images appear normal on the PC and still render properly on the LCD). In the color table you would go ahead and create 8 colors that are (0,0,0), (32,32,32), (64,64,64)….(255,255,255).



e. After all the colors are set, from the “Color Table” dialogue click save (saves an .ACT file) so you don’t have to set the palette manually again, then click OK.

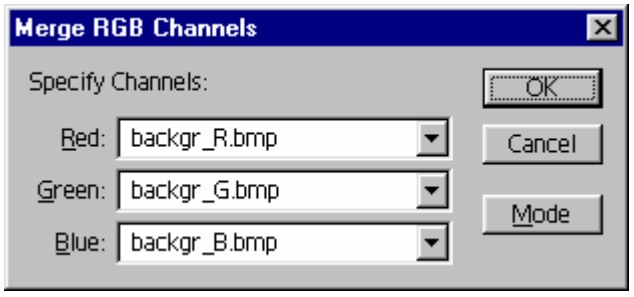
f. Apply diffusion dithering:



g. Finally go back and set Image Mode to Greyscale (necessary to do the final step).

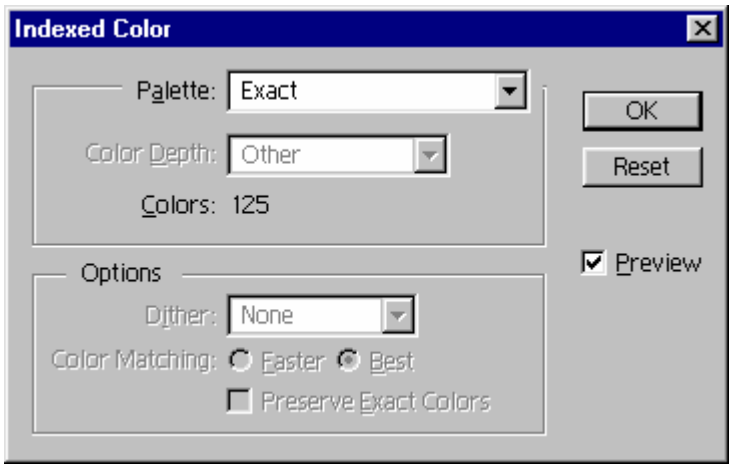
5. Once all of the above steps have been done for each color channel, go back into the channels window and merge all the channels. Select “RGB Color” and press OK.

6. Press OK again.



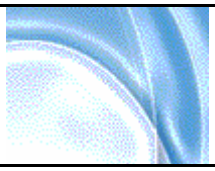
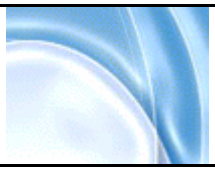
7. Now you can save the image off as a bitmap or any 24 bit format.

8. Of course we want a GIF, so set the image mode to “Indexed”, with the palette as “Exact”, no dithering, and hopefully we have 256 colors or less in the image. This should almost always be the case in a 9 bit palette.



In a 12 bit palette it’s more likely the conversion algorithm above could have picked out more than 256 colors. If it’s more than 256 colors then you would do an “adaptive” palette to lower the number of colors, select “diffusion dithering”, and check “Preserve Exact Colors”.

Below is an example of what images look like after the conversion is applied to them.

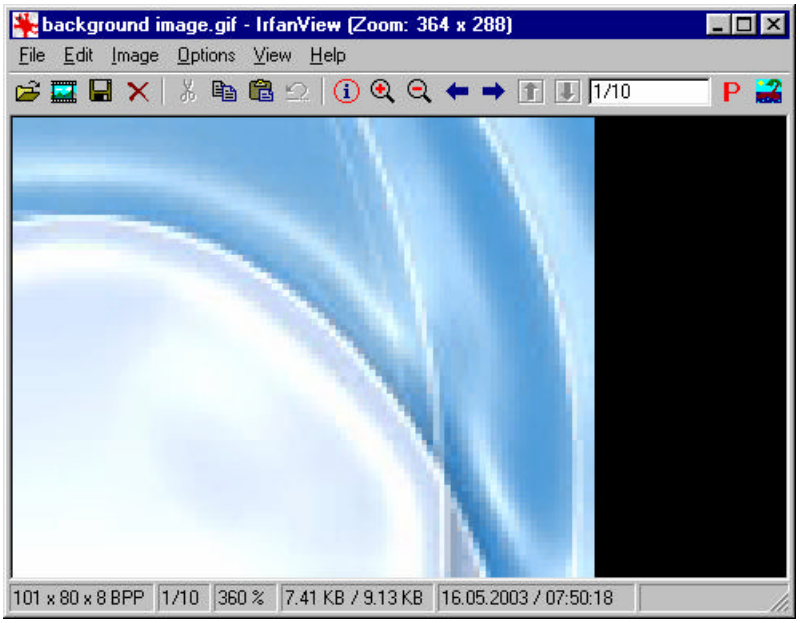
Original Image 24 bpp	9 bit conversion	12 bit conversion
		

The 9 bit conversion produces a grainy looking image on the PC, but it actually **looks much better on an LCD**. The 12 bit image is almost indistinguishable from the original.

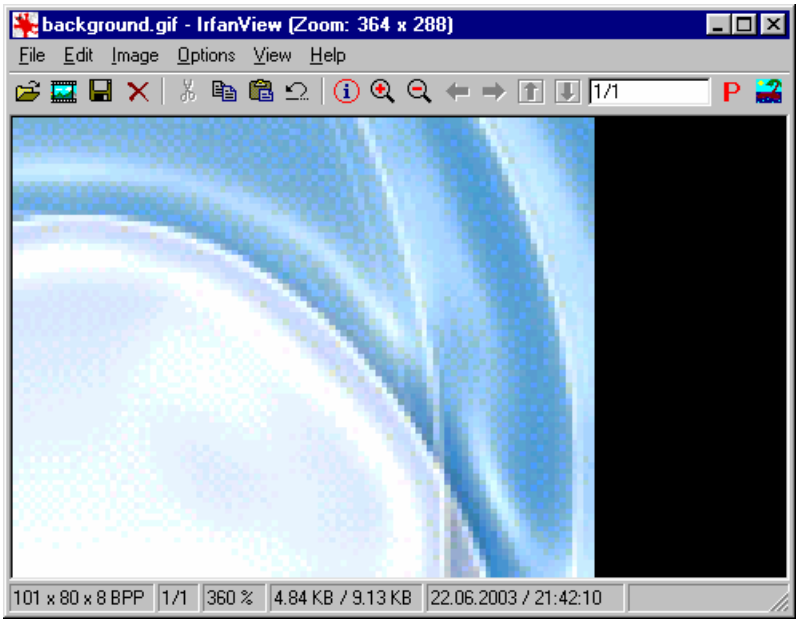
There are a couple of reasons the split-channel technique results in far better looking conversions than others:

- We dither each channel individually when splitting the channels rather than simply taking an image, setting it to indexed color mode, and applying dithering to all channels simultaneously. Doing a single dither to the image as a whole, results in a far grainier look.
- When Photoshop is converting from high color it can select from ALL of the colors available for each particular color channel. When the channels get merged all those colors combine to produce the true colors of the LCD We are not simply loading an image, setting it to indexed color mode, then limiting ourselves to an 8 bit palette that is “adaptive”, “Mac System”, “Windows system” or the like that produce undesirable looking results on our LCD displays. The final image should have as many colors as possible.

This is the original 24 bpp image. (It is a GIF but the palette is representative of a 24 bpp color palette)



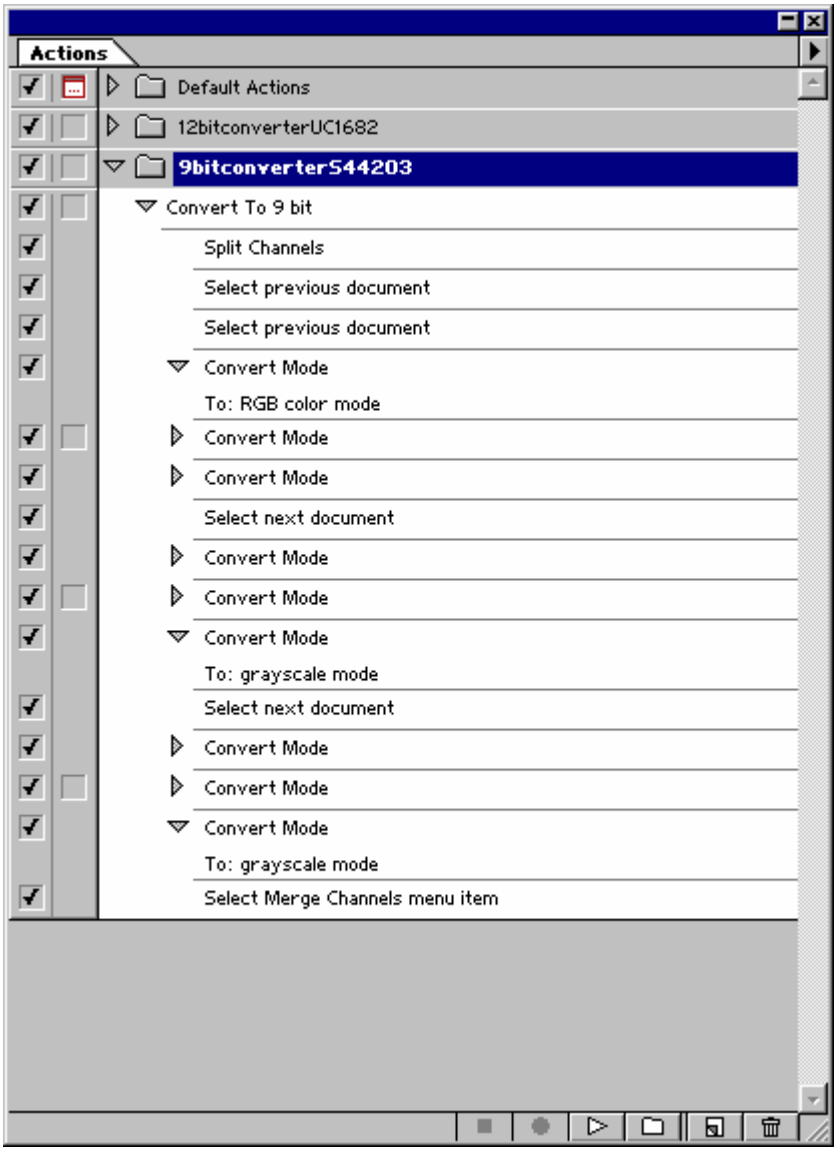
This image does remarkably well when converted using a 12 bpp color palette.



Photoshop action file automates image conversion

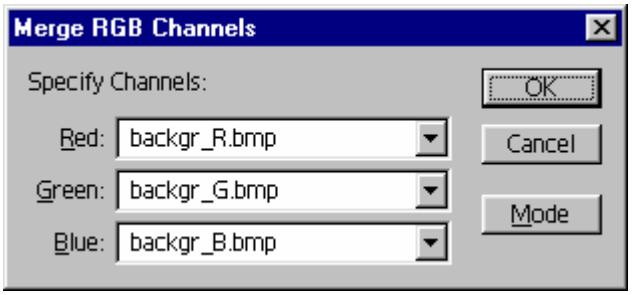
There is an easier way to do this since we can use a macro file that does all of this for us!

1. Open an image file. Press play on the action window to run the converter.



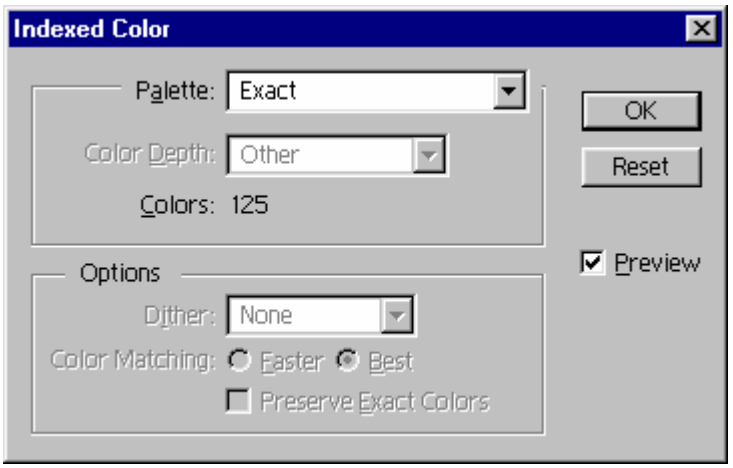
2. The merge channels window should come up. Select “RGB Color” if it’s not already selected and press OK.

3. Then press OK on “Merge RGB Channels”



4. Now you can save the image off as a bitmap or any 24 bit format.

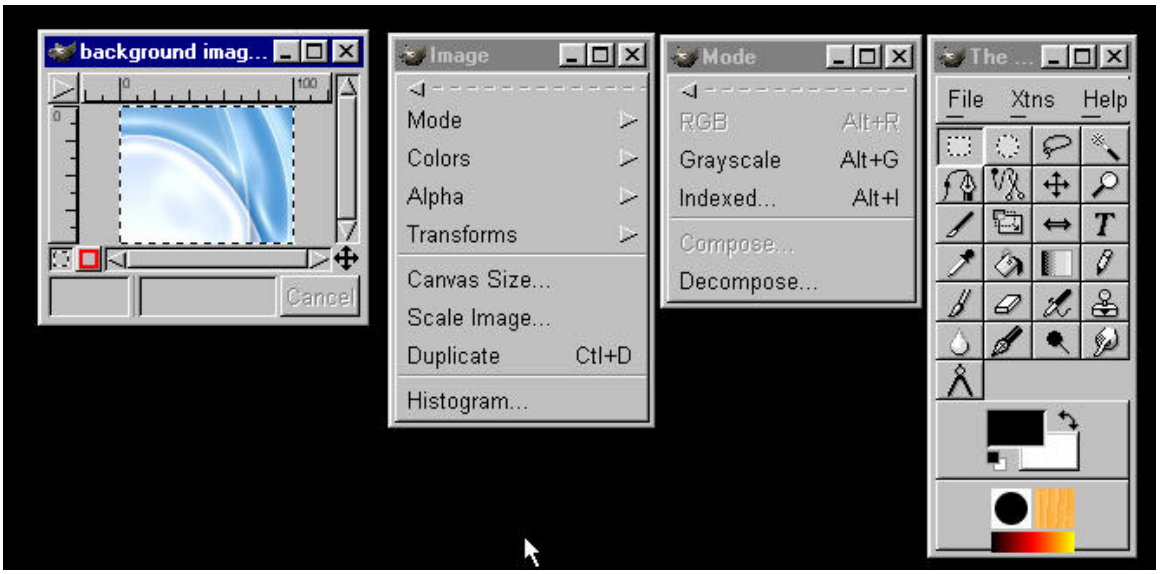
5. Of course we want a GIF, so set the image mode to “Indexed”, with the palette as “Exact”, no dithering, and hopefully we have 256 colors or less in the image. This should almost always be the case in a 9 bit palette.



In a 12 bit palette it’s more likely the conversion algorithm above could have picked out more than 256 colors. If it’s more than 256 colors then you would do an “adaptive” palette to lower the number of colors, select “diffusion dithering”, and check “Preserve Exact Colors”.

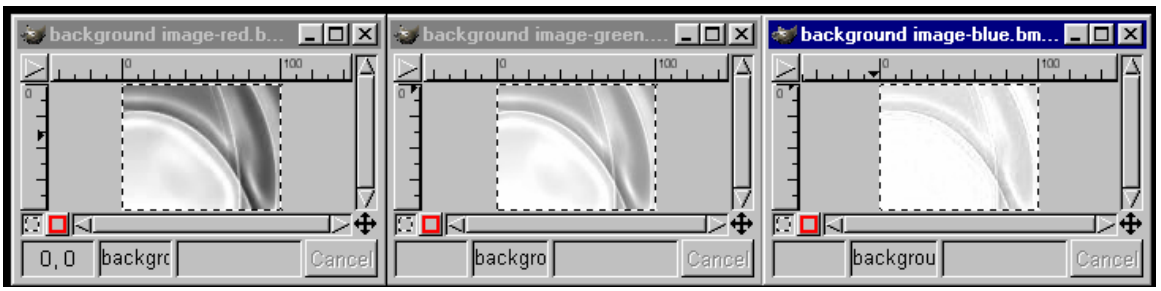
Image coversion using a free tool - GIMP

There is a free program called GIMP (Gnu Image Manipulation Program) that you can use to do the same type of conversion as Adobe. The technique is simple but works quite well and has been verified in GIMP version 1.2.5. You basically do the following:



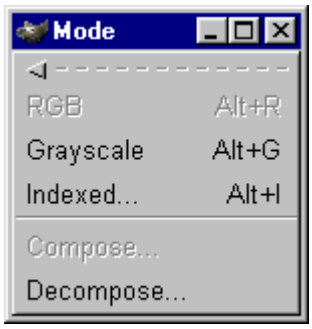
1. Right click on the image and choose Image -> Mode -> Decompose. This is the same as “Split Channels” in Photoshop. Split to RGB color.

The 3 channels appear as greyscale.

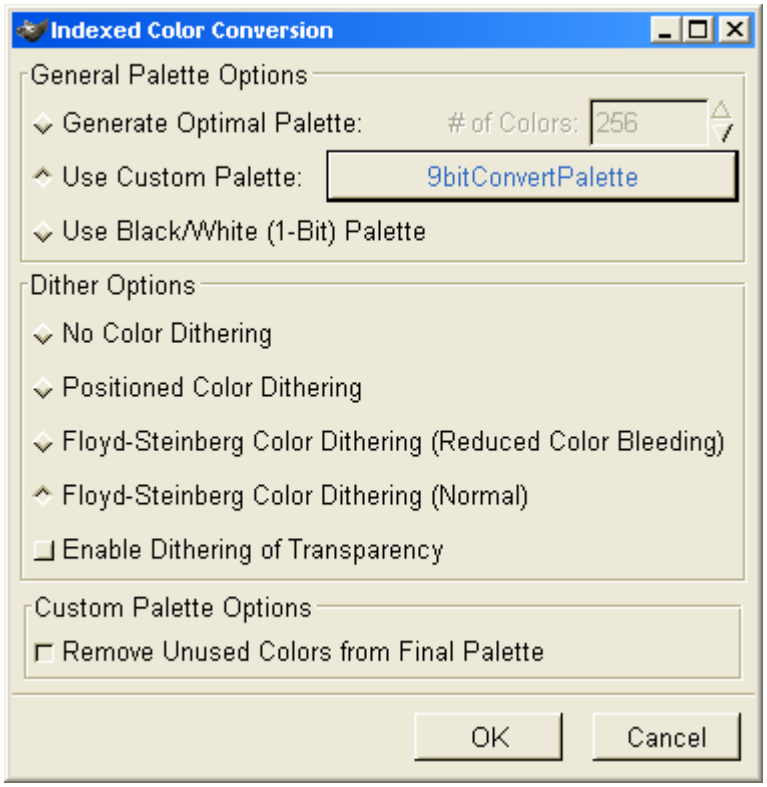


2. **Now for each channel:**

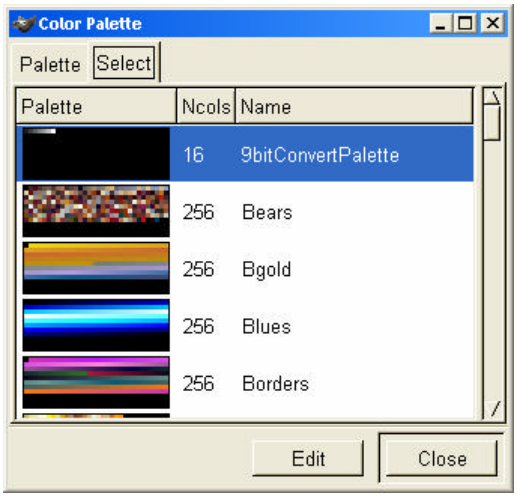
a. Right click and choose **Image** -> **Mode** -> **RGB**.



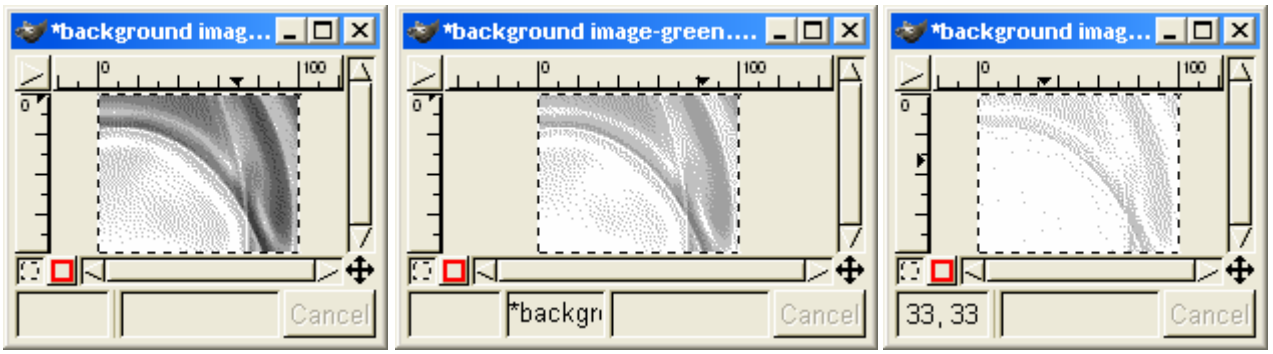
b. Right click and choose **Image** -> **Mode** -> **Indexed Color**.



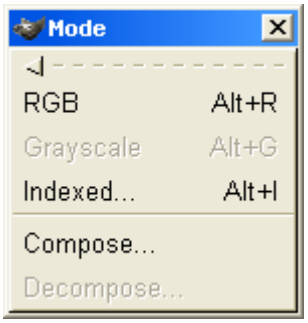
c. Select “Use custom palette”. For 9 bpp conversions with R,G, and B having 3 bits each, a single 3 bit palette is all that is needed to support each channel. For 12 bpp conversions with R:4, G:5, and B:3 there needs to be 3 different palette files to represent red, green, and blue pixel depths.



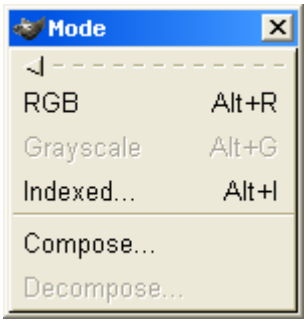
3. This is the result of applying the palette and dithering to all three channels.

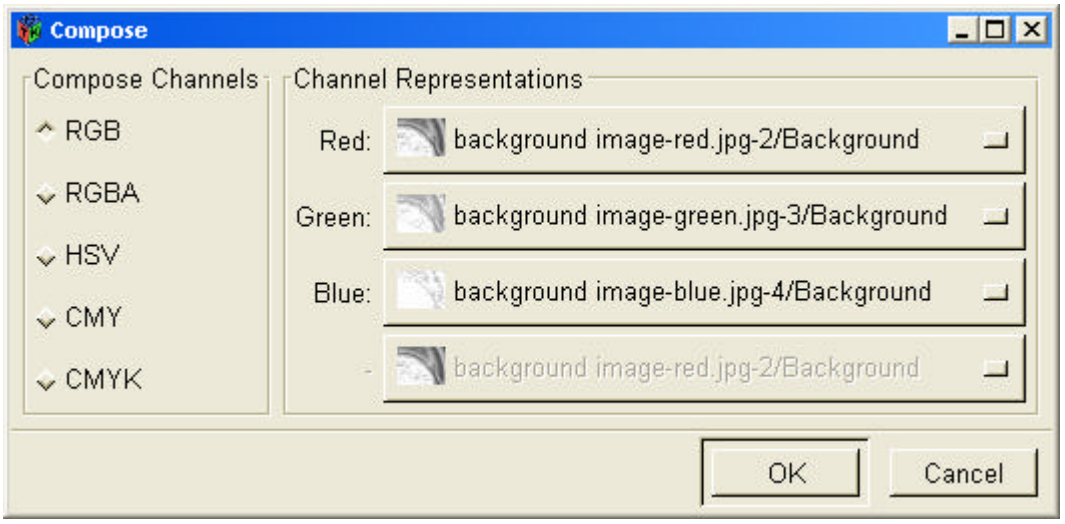


4. Set all split images back to greyscale.

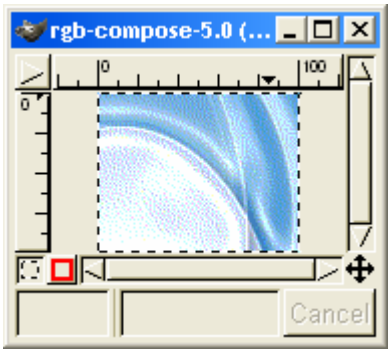


5. Then you can combine them again with “Compose”





Finally the image is converted to 9 bpp and does just as good a job as Photoshop!



The palette file should be saved in the user's GIMP palette directory as something like 9bitConvertPalette. Here is the format of the 8 unique colors:

```
GIMP Palette
# 9bitConvertPalette -- GIMP Palette file
32 32 32      Untitled
64 64 64      Untitled
96 96 96      Untitled
128 128 128 Untitled
160 160 160 Untitled
192 192 192 Untitled
255 255 255 Untitled
0 0 0  Untitled
0 0 0  Untitled
0 0 0  Untitled
0 0 0  Untitled
0 0 0  Untitled
0 0 0  Untitled
0 0 0  Untitled
0 0 0  Untitled
0 0 0  Untitled
```

GIMP offers some advanced scripting using Scheme and Perl, but there is no automated scripting like we have with Photoshop. Consequently there is not yet a script to automate the conversion in GIMP.

Links

Adobe Photoshop	www.adobe.com
GIMP	www.gimp.org
Sony Ericsson Developer World	www.SonyEricsson.com/developer