Technical Manual

Creating Media for the MOTOKRZR K3

Version 01.00

MOTOROLA

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Overview

Welcome to the *Creating Media for the **MOTOKRZR K3*** guide. This guide contains all the information you need to get started developing pictures, animation, and sounds for the **MOTOKRZR K3**.

The **MOTOKRZR K3** Media Guide covers the following areas:

- Display information, including size, color depth, and more
- Graphic support information
- Video support information
- Sound support information

This document assumes you are familiar with creating different media using the appropriate tools. This guide does not cover the tools required to create media, rather, it concentrates on the features and technical abilities of the handset when working with media.

Motorola recommends that if you are not the sole author or creator of the graphics, video, or sound, you obtain sufficient license rights, including the rights under all patents, trademarks, trade names, copyrights, and other third party proprietary rights.

Glossary

Table 1 shows common terms used in this guide:

Term	Definition
AMR	Adaptive Multi Rate
GIF	Graphics Interchange Format
MIDI	Musical Instrument Digital Interface
MIDI Patch	One of the channels in a MIDI device, defined by the general MIDI standard
MPEG	Moving Pictures Experts Group
Pixel	One picture element on the display
QCIF	Quarter Common Intermediate Format
WAP	Wireless Application Protocol

Term	Definition
WBMP	Wireless Bitmap

Table 1 Glossary

References

Table 2 shows references providing information related to developing media for the **MOTOKRZR K3**:

Organization	URL
3GPP	http://www.3gpp.org
MIDI Manufacturers Association	http://www.midi.org
Motorola Developer Program	http://developer.motorola.com
Moving Pictures Experts Group	http://www.chiariglione.org/mpeg/
WAP Forum	http://www.wapforum.org
World Wide Web Consortium	http://www.w3.org
Open Mobile Alliance	http://www.openmobilealliance.org

Table 2 References

Revision History

Version	Date (DD-MMM-YYYY)	Reason
00.01	15-JAN-2007	Initial draft.
01.00	23-APR-2007	Document Release

Table 3 Revision History

Display

This chapter describes the display characteristics for the **MOTOKRZR K3**.

MOTOKRZR K3


Figure 1 Display characteristics for the MOTOKRZR K3

Display Info

The physical internal display characteristics of the **MOTOKRZR K3** are the following:

Item	Description
Screen resolution	Internal: 320 x 240 External: 160 x 120
Screen dimensions	Active Area 30.6 mm X 40.8 mm Viewing Area: 32.08 mm X 42.28 mm
Color depth	16 Bits
Maximum colors	Internal: 262 K External: 65 K
Text area	Numeric

Table 4 Display Info

Figure 2 The MOTOKRZR K3 display

Note: Screen shot may not reflect actual display size.

Graphics & Video

This chapter describes the graphic environment available in the **MOTOKRZR K3**. It includes information on picture and animation formats, size restrictions, pre-defined media, and more. Use this chapter as a reference when creating pictures or animations that support your products.

In general, file size is limited by available memory. All media (wallpaper, screensavers, ring tones, and themes), whether pre-loaded on the device or downloaded by the user, share the same storage area. The available memory for downloaded files will vary based on the media pre-loaded into the device. This pre-loaded media will vary from region to region and from carrier to carrier. Motorola recommends keeping all media files as small as possible to ensure the consumer has the ability to download and use a variety of files to enhance the user experience.

Supported Picture Formats

The **MOTOKRZR K3** supports the following graphic and animation formats:

Type	Description
GIF 87a	Graphics Interchange Format, a standard file format for lossless compression of still images. It is used to display static images and is the preferred format for pictures.
GIF 89a	The GIF 89a standard is a superset of the GIF 87a specification. It allows a sequence of GIF images to be displayed in succession that generates an animation.
BMP	File writing forma, where the information is recorded using "bitmap".
EMS BMP	Enhanced Messaging Service bitmap
WBMP	Wireless Bitmap format described in the WAP specifications. It is an optimized bitmap format intended for use in portable devices with smaller screens and limited display capabilities.
JPEG	Joint Photography Expert Group standard. JPEG is designed for compressing either full-color or gray-scale images of natural, real-world scenes, not line art or lettering.

Type	Description
PNG	Portable Network Graphics (PNG) format is intended to provide a portable, legally unencumbered, well-compressed, well-specified standard for lossless bit mapped image files.

Table 5 Graphic and animation formats

Note: 'Maximum image sizes are determined by the handset's available memory, however in Java the use of scalable JPEG will allow larger images to be displayed'.

Table 6 shows the maximum decode size and resolution for supported picture formats:

Format	Maximum Decode Size	Resolution
JPEG	Up to UVGA 1200x1600 pixels (2.0 MegaPixel)	QVGA (320x240 pixels)
PNG	Up to VGA (640 x 480 pixels)	
BMP		
GIF 87a, 89a		
WBMP	QVGA (320x240 pixels)	
EMS BMP		

Table 6 Maximum decode size and resolution

Video Playback

The **MOTOKRZR K3** handset supports the video formats described in Table 7:

Type	Description
MPEG-4	The MPEG-4 format provides standardized technological elements that enable interactive multimedia (video/audio), interactive graphics, and digital television. Codec support includes: • MPEG • H.263 Baseline A maximum of 15 fps for video playback and 15 fps for video capture is available at a bit rate of up to 64 kbps when maximum size is QCIF.
H.263	An International Telecommunication Union (ITU) standard for video compression.

Type	Description
WMV v9 (also WMV v7, v8)	WMV - Windows Media Video is a generic name for the set of streaming video technologies developed. This format also supports WMV version 7 and 8.
RV8/RV9	Real Video format for Packet and Circuit Switched Streaming services and clip playback from local files. A maximum of 15 fps is available at a bit rate of 128 kbps when the maximum size is QCIF

Table 7 Video formats

Note: Maximum file sizes are determined by the handset's available memory

Table 8 shows the bit rate, frame size, and frame rate for all supported video playback formats:

Format	Bit Rate (kbps)	Frame Size	Frame Rate (fps)
MPEG4	Up to 256 kbps	QCIF	25
H.263			
WMV v9 (also WMV v7, v8)	Up to 128 kbps		15
Real Video 8, 9			

Table 8 Bit rate, frame size and frame rate video playback suported

Table 9 shows the specifications for all supported audio + video playback formats:

Format	Total Bit Rate	Video			Audio		
		Size	Bit rate (kbps)	Frame Rate	Bit Rate (kbps)	Sampling Rate (KHz)	Stereo/Mono
MPEG4 + AMR-NB	Up to 256 kbps	QCIF	Up to 243 kbps	25 fps	Up to 12.2 kbps	8	Mono
MPEG4 + AMR-WB			Up to 232 kbps		Up to 23.85 kbps	16	
MPEG4 + AAC			Up to 224 kbps		Up to 128 kbps	Up to 44.1	Stereo / Mono
MPEG4 + AAC+							
MPEG4 + Enhanced AAC+							
H.263 + AMR-NB			Up to 243 kbps		Up to 12.2 kbps	8	Mono

H.263 + AMR-WB			Up to 232 kbps		Up to 23.85 kbps	16	
H.263 + AAC			Up to 224 kbp		Up to 128 kbps	Up to 44.1	Stereo / Mono
H.263 + AAC+							
H.263 + Enhanced AAC+							
WMV + WMA	Up to 128 Kbps		Up to 108 kbps	15 fps	Up to 96 kbps		
Real Audio + Video			Up to 96 kbps				

Table 9 Graphic and animation formats

Table 10 shows the bit rate, frame size, frame rate, and extension for supported video streaming formats:

Format	Bit Rate (kbps)	Frame Size	Frame Rate (fps)	Extension
MPEG4	Up to 128	QCIF	15	.sdp .rts
H.263				
WMV v9 (also WMV v7, v8)				
Real Video 9 (also Real Video 8)				

Table 10 Bit rate, frame size and frame rate streaming suported

Table 11 shows the specifications for video + audio streaming:

Format	Total Bit Rate	Video			Audio		
		Size	Bit rate (kbps)	Frame Rate	Bit Rate (kbps)	Sampling Rate (KHz)	Stereo/Mono
MPEG4 / H.263 + AMR-NB	128 Kbps	QCIF	Up to 115	15 fps	Up to 12.2	8	Mono
MPEG4 / H.263 + AMR-WB			Up to 104		Up to 23. 85	16	
MPEG4 / H.263 + AAC			Up to 96		Up to 32	Up to 44.1	Stereo / Mono
MPEG4 / H.263 + AAC+							
MPEG4 / H.263 + Enhanced AAC+							
WMV + WMA			Up to 112		Up to 48		
Real Audio + Video			Up to 96		Up to 32		

Table 11 Video + Audio streaming

Graphics and Video Capture

Table 12 shows the video quality, bit rates, frame size, frame rate, and maximum durations for video capture:

Format	Video Quality	Bit Rate (kbps)	Frame Size	Frame Rate	Maximum Capture Duration
MPEG4 or H.263	Low	64	QCIF	15 fps	1 hour
	Medium	96			
	High	128			

Table 12 Maximum durations for video capture

Table 13 shows the video quality, bit rates, frame size, frame rate, and maximum durations for video + audio capture:

Format	Total Bit Rate (kbps)	Video			Audio			Maximum Capture Duration
		Size	Bit rate (kbps)	Frame Rate	Bit Rate (kbps)	Sampling Rate	Stereo/ Mono	
MPEG4 or H.263 + AMR-NB	Up to 128	QCIF	Up to 115	15 fps	12.2	8 kHz	Mono	1 hour
MPEG4 or H.263 + AMR-WB			Up to 104		23.85	16 kHz		

Table 13 Maximum durations for video + audio capture

Table 14 shows the still image capture resolution and size of the supported formats:

Format	Camera	Resolution	Size (pixels)
JPEG	Internal	Large (VGA)	640x480 pixels
		Medium (QVGA)	320x240 pixels
		Small (QQVGA)	160x120 pixels
	External[1]	Large (UXGA, 2.0 MPixel)	1200x1600 pixels
		Medium (1.2 MPixel)	960x1280 pixels
		Small (VGA)	480x640 pixels
		X-Small (QVGA)	240x320 pixels

Table 14 Still image capture

[1] The **MOTOKRZR K3** External Camera is mounted portrait.

Video Telephony

Table 15 shows the specifications for supported circuit-switched video telephony formats:

Format	Total Bit Rate (kbps)[2]	Video			Audio		
		Size	Bit rate (kbps)	Frame Rate	Bit Rate (kbps)	Sampling Rate	Stereo/Mono
MPEG4+AMR-NB	64	QCIF	38 to 42	15 fps	Up to 12.2	8 kHz	Mono
MPEG4+ G.723.1							
H.263+AMR-NB							
H.263+ G.723.1							

Table 15 Supported circuit-switched video telephony formats

Note: Total Bit Rate indicates the maximum possible data rate used on the circuit-switched radio access bearer, taking into account the overhead needed by the video telephony protocols. A total bit rate of 64 kbps allocates 42 kbps to video, 12 kbps to audio, and 10kbps to protocol overhead.

MMS/SMS Support

The **MOTOKRZR K3** MMS/SMS applications support use of the following image formats/sizes:

- JPEG
- GIF
- BMP
- PNG

The **MOTOKRZR K3** supports use of the following audio formats:

- MP3
- MIDI
- AMR-NB, AMR-WB
- AAC
- AAC+
- Enhanced AAC+

- WMA
- XMF
- Real Audio 9,8

Wallpaper Support

Wallpaper images are static images that are shown on both the idle screen and the main menu screen. Wallpaper images can be tiled or centered as selected by the user; centered is the default setting.

The following image formats are supported for wallpaper:

Technical Specifications for Wallpapers:

- Dimensions: Internal: 320 x 240
- Colors: Internal: 256 (limited by JPG format)
- Recommended File Size: Internal: Up to 100 K

Wallpaper images are displayed on screen as shown in Figure 3.

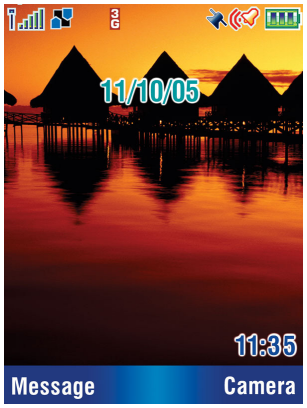
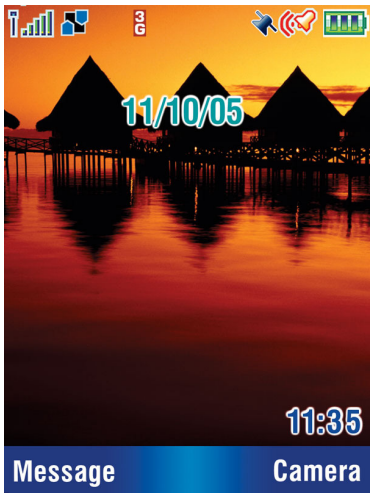
	
Wallpaper images appear behind all screen elements on the idle screen.	Wallpaper images appear behind all screen elements on the menu screen.

Figure 3 How wallpaper is displayed on the idle screen and main menu screen.

If the user has selected to tile the wallpaper, the image is tiled starting from the upper left hand corner of the working area. The image is tiled horizontally and vertically equal to the display size, as shown in Figure 4.



Tiled image used as wallpaper and appearing behind all screen elements on an idle screen.

Figure 4 GIF Image as centered wallpaper

The user has the following options for wallpaper:

- **Center** – the image is resized to fit on the screen while keeping the aspect ratio.
- **Fit-to-screen** – the image is resized to fill the screen while keeping the original aspect ratio (refer to Figure 3).
- **Tile** – if the image is too large, it is resized to fit the display and tiled, if the image is too small, it tiles as displayed.

If the user selects an animated GIF image, the first frame of the animated GIF becomes the wallpaper image. It's important that the colors of the wallpaper image allow the text displayed on the screen to remain legible.

Sound

This chapter describes the sound environment available in the **MOTOKRZR K3**. It includes information on sound formats and more. Use this chapter as a reference when creating sounds for your products.

In general, file size is limited by available memory. The available memory for downloaded files will vary based on the media that is pre-loaded into the device. This pre-loaded media will vary from region to region and from carrier to carrier. We recommend keeping all media files as small as possible to ensure the consumer has the ability to download and use a variety of files to enhance the user experience.

Alert Tone Support

Downloaded audio files can be applied to a number of alert tones on the device including Ringtones for incoming calls, Text Message, and Date Book Alarms.

Ring Tones

Ring tones should not exceed 30 seconds because most voice mail systems pick up after four rings (16-25 seconds depending on the system).

Supported Sound Formats

The **MOTOKRZR K3** support the following sound formats:

Type	Description
MIDI	The **MOTOKRZR K3** are MIDI 1.0 compliant (.mid, .midi, .mmf, .smf), and supports any data format described in *The Complete MIDI 1.0 Detailed Specification*, including: – MIDI, Type 0 – MIDI, Type 1 – Scalable Polyphonic MIDI (SP-MIDI)
AAC	Short for Advanced Audio Encoding (.aac, .adcs, .adif), one of the audio compression formats defined in the MPEG-2 standard. AAC

Type	Description
	boosts higher quality audio reproduction than MP3 and requires 30% less data to do so.
AMR-NB, AMR-WB	Adaptive Multi Rate offers a wide range of data rates. The philosophy behind AMR is to lower the data rate as the interference increases to enable better error correction.
GSM FULL RATE	Format for speech coding used in most GSM networks. The GSM full rate requires one full rate traffic channel to carry its data. The compression involves mapping input blocks of 160 speech samples to encoded blocks of 260 bits.
MP3	The MP3 format (.mp3) provides the coding of audio for digital storage.
Real Audio	Real Audio (.ra, .rm) is a compressed format suitable for streaming over the internet.
WAV	Format for storing files (.wav). Linear pcm 8-bit and 16-bit, CCITT A-law and U-law.
WMA	Windows Media Audio (.wma), referring to components of the more general Windows Media Format proprietary standard.
XMF	Mobile XMF-MIDI: XMF (eXtensible Music Format) is an open standard file format for gathering together into a single file all media assets (and/or links to external media assets) required to render a MIDI note-based piece (or suite of related pieces) in a computer-based player (or possibly an instrument) with consistent audio playback across all players and platforms, and suited for interactivity, content protection, meta-data, and the Internet – and keep it simple.

Table 16 Supported audio formats

Table 17 shows the bit rate, sampling rate, and stereo/mono capabilities for each supported format:

Format	Bit Rate (kbps)	Sampling Rate (kHz)	Stereo/Mono
AMR-NB	4.75 kbps – 12.20 kbps (supports all 3GPP specified rates)	8 kHz	Mono
AMR – WB	6.6 – 23.85 (suports all 3GPP specified rates)	16	
AAC (MPEG4 AAC-LC)	Up to 256 kbps	48 kHz	Stereo / Mono
AAC+	Up to 128 kbps (16 to 128 kbps)	Up to 48 kHz (16, 22.05, 24, 32, 44.1, 48 kHz)	Stereo / Mono
Enhanced AAC+			Stereo
MP3[2]	Up to 256 kbps	48 kHz	Stereo / Mono
8-bit Linear PCM	64 kbps	8 kHz	Mono

[2] Supports the MP3 coding scheme for the compression of audio signals, as defined in the MPEG-1 and MPEG-2, Part 3 (audio), Layer 3 standard.

16-bit Linear PCM	128 kbps		
8-bit A-law PCM	64 kbps		
8-bit mu-law PCM			
GSM Full Rate	12.20 Kbps		
WMA v9 L2 (also WMA v3, v7, v8)	Up to 160 Kbps	48 kHz	Stereo/Mono
Real Audio 8 Supports LBR (Cook) formats.	Up to 96 Kbps	44.1 kHz	
Real Audio Sipro (ACELP®.net)	5.0 Kbps (fixed rate) 8.5/6.5 Kbps (dual rate)	8 kHz	Mono
	16 Kbps (wide-band)	16 kHz	

Table 17 Audio bit rate, sampling rate and stereo/mono capabilities

Note: Real Audio 8 supports the Flavor index of 17-26, inclusive. Flavor indexes less than 17(G2) or greater than 26 (surround) are not supported.

Table 18 shows the bit rate, sampling rate, stereo/mono, and extension for supported streaming audio formats:

Format	Bit Rate (kbps)	Sampling Rate kHz	Stereo/Mono	Extension
AMR-NB	4.75 kbps – 12.20 kbps (supports all 3GPP specified rates)	8 kHz	Mono	.sdp .rts
AMR-WB	6.6 kbps - 23.85 Kbps (supports all 3GPP specified rates)	16 kHz		
AAC	Up to 128 kbps	48 kHz	Stereo / Mono	
AAC+	Up to 128 kbps (16 to 128 kbps)	Up to 48 kHz (16, 22.05, 24, 32, 44.1, 48 kHz)		
AAC+ Enhanced				
WMA v9 (also WMA v3, v7, v8)	Up to 128 kbps	48 kHz		
Real Audio 8 Supports LBR (Cook) formats.	Up to 96 kbps	44.1 kHz		
Real Audio Sipro (ACELP®.net)	5.0 Kbps (fixed rate) 8.5/6.5 Kbps (dual rate)	8 kHz	Mono	
	16 Kbps (wide-band)	16 kHz		

Table 18 Bit rate, sampling rate, stereo/mono streaming

Note: Real Audio 8 supports the Flavor index of 17-26, inclusive. Flavor indexes less than 17(G2) or greater than 26 (surround) are not supported.

MIDI Support

The Musical Instrument Digital Interface (MIDI) enables consumers to use multimedia computers and electronic musical instruments to create, enjoy and learn about music.

The MIDI protocol is a music description language in which every word describes an action of musical performance. Each action is stored as a binary word and when combined, store as MIDI files. These files can then be replayed by any electronic device that can read the MIDI file and recreate the performance using its available sound system.

Technical Specifications for MIDI:

- Recommended File Size: No limitation. Depends on memory available.
- MIDI Instruments: 128 Melodic, 47 Percussion
- Maximum Polyphony: 64 voices
- Minimum Duration per note: 20ms
- Maximum Duration (NW dependent): No limitation on handset. (Network dependent).

Format	File Type	Polyphony Channels	Instruments (Gen. MIDI Level 1)
Standard MIDI	Type 0	64	128 Melodic, 47 Percussion
	Type 1		
	SP		
Mobile XMF MIDI	Type 0		
	Type 1		
	Type 2 (mobile DLS)		

Table 19 MIDI Format Specification

MIDI Key Mapping

The **MOTOKRZR K3** supports all 128 general MIDI instruments and the standard drum kit, but due to frequency limitations, not all MIDI notes are supported for all patches.

Patch Number	Patch Names	Valid MIDI Note Numbers
0	Acoustic Grand Piano	21-108
1	Bright Acoustic Piano	21-108
2	Electric Grand Piano	22-108
3	Honky-tonk Piano	21-108
4	Electric Piano 1	21-108

Patch Number	Patch Names	Valid MIDI Note Numbers
5	Electric Piano 2	24-103
6	Harpsichord	24-89
7	Clavinet	24-96
8	Celesta	48-108
9	Glockenspiel	65-108
10	Music Box	48-84
11	Vibraphone	48-96
12	Marimba	48-97
13	Xylophone	48-108
14	Tubular Bells	48-96
15	Dulcimer	48-96
16	Drawbar Organ	24-96
17	Percussive Organ	24-96
18	Rock Organ	24-96
19	Church Organ	21-96
20	Reed Organ	24-96
21	Accordion	48-89
22	Harmonica	48-84
23	Tango Accordion	48-89
24	Acoustic Guitar (nylon)	36-84
25	Acoustic Guitar (steel)	36-84
26	Electric Guitar (jazz)	36-86
27	Electric Guitar (clean)	36-86
28	Electric Guitar (muted)	36-86
29	Overdriven Guitar	36-96
30	Distortion Guitar	36-96
31	Guitar Harmonics	36-96
32	Acoustic Bass	24-72
33	Electric Bass (finger)	24-72
34	Electric Bass (pick)	24-72
35	Fretless Bass	24-72
36	Slap Bass 1	24-72

Patch Number	Patch Names	Valid MIDI Note Numbers
37	Slap Bass 2	24-72
38	Synth Bass 1	24-96
39	Synth Bass 2	24-96
40	Violin	48-96
41	Viola	48-96
42	Cello	36-96
43	Contrabass	24-96
44	Tremolo Strings	24-96
45	Pizzicato Strings	24-96
46	Orchestral Harp	21-103
47	Timpani	36-84
48	String Ensemble 1	24-96
49	String Ensemble 2	24-96
50	Synth Strings 1	24-96
51	Synth Strings 2	24-96
52	Choir Aahs	36-96
53	Voice Oohs	36-96
54	Synth Voice	36-96
55	Orchestra Hit	36-72
56	Trumpet	36-96
57	Trombone	36-96
58	Tuba	24-72
59	Muted Trumpet	48-84
60	French Horn	36-96
61	Brass Section	24-96
62	Synth Brass 1	24-96
63	Synth Brass 2	24-96
64	Soprano Sax	48-89
65	Alto Sax	48-84
66	Tenor Sax	36-84
67	Baritone Sax	24-84
68	Oboe	48-96

Patch Number	Patch Names	Valid MIDI Note Numbers
69	English Horn	48-96
70	Bassoon	24-84
71	Clarinet	48-96
72	Piccolo	60-108
73	Flute	48-96
74	Recorder	60-96
75	Pan Flute	48-96
76	Blown Bottle	48-96
77	Shakuhachi	48-96
78	Whistle	48-91
79	Ocarina	60-96
80	Lead 1 (square)	24-96
81	Lead 2 (sawtooth)	24-96
82	Lead 3 (calliope)	36-96
83	Lead 4 (chiff)	36-96
84	Lead 5 (charang)	36-96
85	Lead 6 (voice)	36-96
86	Lead 7 (fifths)	36-96
87	Lead 8 (bass+lead	24-96
88	Pad 1 (new age)	36-96
89	Pad 2 (warm)	36-96
90	Pad 3 (polysynth)	36-96
91	Pad 4 (choir)	36-96
92	Pad 5 (bowed)	36-96
93	Pad 6 (metallic)	36-96
94	Pad 7 (halo)	36-96
95	Pad 8 (sweep)	36-96
96	FX 1 (rain)	36-96
97	FX 2 (soundtrack)	36-96
98	FX 3 (crystal)	36-108
99	FX 4 (atmosphere)	36-96
100	FX 5 (brightness)	36-96

Patch Number	Patch Names	Valid MIDI Note Numbers
101	FX 6 (goblins)	36-96
102	FX 7 (echoes)	36-96
103	FX 8 (sci-fi)	36-96
104	Sitar	48-77
105	Banjo	48-84
106	Shamisen	48-79
107	Koto	48-96
108	Kalimba	48-96
109	Bagpipe	36-77
110	Fiddle	48-96
111	Shanai	48-96
112	Tinkle Bell	60-96
113	Agogo	48-72
114	Steel Drums	48-88
115	Woodblock	48-72
116	Tailo Drum	48-72
117	Melodic Drum	36-84
118	Synth Drum	36-84
119	Reverse Cymbal	48-72
120	Guitar Fret Noise	48-72
121	Breath Noise	48-72
122	Seashore	48-72
123	Bird Tweet	48-72
124	Telephone Ring	48-72
125	Helicopter	48-72
126	Applause	48-72
127	Gunshot	48-72
none	Drums	35-81

Table 20 MIDI Key Mapping

MIDI Audio Guidelines

The following are suggested guidelines to maximize sound quality while reducing the overall file size of a MIDI Ring Tone file for use with the **MOTOKRZR K3**.

Tip 1: Use MIDI's running status feature

In the MIDI standard, a key-on or a key-off event will use, at most, three bytes each. However, when several key events occur on the same MIDI-channel, the running status feature can be used. In principle, running status means the first byte of a key-on event is omitted. In addition, the key-on event having a velocity of zero is equivalent to the key-off event. Thus, combining running status with key-on events that have zero velocity reduces the number of bytes needed to encode all key events.

EXAMPLE:

Without using the running status, features, the sequence

```
91 2E 23 8E, 91 2B 50 8E, 81 2E 64 00, 81 2B 64 00
```

represents "Key 2E ON" Velocity 23 MIDI Ch 1", "Key 2B ON Velocity 50 MIDI Ch 1", "Key 2E OFF Velocity 64 MIDI Ch 1", "Key 2B OFF Velocity 64 MIDI Ch 1". Using the running status feature reduces the sequence to:

```
91 2E 23 8E, 2B 50 8E, 2E 00 00, 2B 00 00,
```

That is, the command byte is omitted and velocity zero is used for key off.

Tip 2: Use Standard MIDI File (SMF) type 1

The MIDI content can be stored in a Standard MIDI File (SMF) of type 0 or type 1. In a type 0 SMF, the file format uses one header chunk with one-track chunk. In a type 1 SMF, the format uses one header chunk with several track chunks. SMF type 2 should not be used.

In general, it is more efficient to store the MIDI data as a type 1 file. The increased efficiency is achieved because each track contains only one MIDI channel and one instrument (often the case). The running status feature can be applied on each individual track, thereby reducing the track size. To reduce the size of the file even further, use one track per used MIDI channel. That is, if a temple/conductor track exists, merge it with the first instrument track and remove all unnecessary meta-events such as the "track name" and "lyric" meta-events.

To summarize, the following measures can be taken in order to reduce the SMF:

1. Use SMF type 1 (Or verify that a type 1 file is smaller than a type 0 file and use the smallest file).
2. Use running status.
3. One and only one instrument per track. Try not to change channels.
4. Do not change tempo in the middle of the music. That is, set the tempo once.
5. Use beat, instead of SMPTE, to set the tempo.
6. Do not use Copyright Text Fields.
7. Limit the use of continuous controller information such as pitch-bend and volume.

8. Turn off the options below:
    - Sequence Number - MIDI sequence ids
    - Text - embedded text for any optional fields
    - Sequence / Track Name
    - Instrument Name
    - Lyric
    - Marker - for synchronization purposes
    - Cue Point
    - Midi Channel Presix - associate channels with all events following
    - Sequencer-Specific settings

Items one through three above optimize the encoding of the notes, while items four to eight optimize the overall melody. The above measures provide an SMF file that is ready-made for compression. However, prior to compression, the composer/content author can add a few values for key velocity, thereby increasing the redundancy of the file.

Tip 3: Consider the Frequency Response

Even though the MIDI synthesizer is sampled at 22 KHz, the polyphonic speaker's frequency response is not as wide. Try to keep the majority of melodic information below 6000 Hz.

NOTE: The use of MIDI notes below 800 Hz may cause a decrease in volume when playing the note. Always test your audio on an actual device to ensure the accuracy of the sound you want to produce.

MP3 Audio Guidelines

MP3 (MPEG Audio Layer 3) is an audio compression technology that is part of the MPEG-1 and MPEG-2 specifications. Developed in Germany in 1991 by the Fraunhofer Institute, MP3 uses perceptual audio coding to compress CD-quality sound by a factor of 12, while providing almost the same fidelity. Because MP3 audio is digitized, not synthesized, reproduction (disregarding speaker quality) is identical on all devices. Therefore MP3 ring tones provide a near-CD quality audio experience for listeners as opposed to their MIDI counterparts which differ greatly from device to device.

The following recommendations should be used when designing MP3 audio clips for use in the phone:

Technical Specifications for MP3:

- Sample Rates: 48 kHz
- Bit Rate: 256 kbps maximum.

- Recommended File Size: No limitation. Depends on memory available

Available Sound Properties

Follow technical specifications outlined above.

Design Guidelines

Since ring tones need to be at a consistent audible level, compressing the original content to reduce the peak-to-average ratio is necessary. After the audio is compressed it is advisable to re-normalize the audio to 0db before saving the compressed MP3 file.

Note [6]: Ring tones are generally between 15-20 seconds in length. Based on the recommended bit rates that would yield a file size between 75-150K per tone. It is advisable to keep file size beneath 100K to allow the end-user to download multiple tones, but there is no file size limit except for total free memory available on the device.

Appendix A: DRM

Digital Rights Management

Digital Rights Management (DRM) is a method of protecting content from illegal distribution by embedding the content into an encrypted package along with rules dictating its use. Using a set of keys and a license for the specific file, a DRM application is required to decrypt the content for playback. The DRM application will be transparent to the user except for the cases where the user acquires a file without a proper license. Applications that will interact with DRM encoded files include the following:

- Media Center
- MMS
- Browser
- Email
- KJava
- Address Book
- Drawing Pad
- Camera
- Recorder
- File Manager
- Phone (calling)
- Power Up/Down Animation
- Wallpaper

For more information, refer to the following references found at http://www.openmobilealliance.org :

- OMA-Download-DRM-v1_0-20020905-C
- OMA-Download-DRMREL-v1_0-20030801-C
- OMA-Download-DRMCF-v1_0-20030801-C

Supported DRM Solutions

Two DRM solutions are supported by Motorola handsets. The solutions are the following:

- Forward Locking – Forward locking construct defined by the OMA DRM specification. Similar to NDIS implementation in MMS/EMS.
- Combined Delivery – The OMA Combined Delivery mechanism is an extension of OMA forward locking. The Combined Delivery mechanism differs by including a rights object within the DRM message which governs the consumption of the content included along with the rights object. A handset that supports Combined Delivery will support OMA forward locking.
- Separate Delivery – The OMA Separate Delivery mechanism is an extension of OMA Forward locking. The Separate Delivery mechanism differs by delivering the content and the rights object separately. The **MOTOKRZR K3** supports retrieving rights via WAP Push and via HTTP response.

Download

Forward Lock files will be downloaded within a DRM message. The download manager will recognize the DRM message of MIME type 'application/ vnd.oma.drm.message' as a valid file type.

The download manager will discard any DRM message that contains more than one media object within the DRM message.

OMA Combined Delivery will be downloaded within a DRM message and will consist of a media object and a rights object. The download manager will recognize the DRM message MIME type and the MIME type 'application/vnd.oma.drm.rights+xml' as a valid file type. A single media object in the body of the DRM message, that is encoded in the following identity transfer encoding '7bit', '8 bit', and 'binary,' will be accepted by the download manager.

Installation

Forward Lock

After the download of a DRM message has been completed, the download manager will strip out the media object that is encapsulated within the DRM message prior to dispatching the object for preview. The MIME type associated with the encapsulated media object will be used to verify that the OMA download descriptor 'type' meta data field matches the MIME type of the media object within the DRM message.

Once the media object has been extracted from the DRM message, the original DRM message can be discarded. Along with passing the media object to the content dispatcher for preview, the download manager shall indicate to the content dispatcher that the media object is 'forward locked'.

The mechanism for indicating a ‘forward locked’ status is to set the NDIS bit for the file within the file system.

Combined Delivery

After the download of a DRM message has been completed, the handset will strip out the media object and the rights object that are encapsulated within the DRM message prior to dispatching the object for preview. If the DRM message is received without a descriptor file, the MIME type associated with the encapsulated media object should be used to verify that the OMA download descriptor ‘type’ meta data field matches the MIME type of the media object within the DRM message.

Once the media object has been extracted from the DRM message, the original DRM message can be discarded. Along with passing the media object to the content dispatcher for preview, the handset shall indicate to the content dispatcher that the media object is ‘forward locked’.

- If the user selects to store the content from the preview: The media shall be stored in the appropriate file directory and shall be marked as ‘forward-locked’ using the NDIS bit. The rights object shall be stored in a protected portion of the file system. Rights objects are NEVER to be forwarded. Association between the rights object and the media MUST be maintained while stored in the file system.

Separate Delivery

In **MOTOKRZR K3** implementation, for Forward Lock and Combined Delivery content, the Media objects will be encrypted (AES128) and packaged according to the same mechanism as Separate delivery, the encryption key is generated randomly and unique to each content on a phone. Thus the encrypted content can be stored anywhere in the phone or TransFlash card. A right object will also be created to save the right constraints and encryption key. The right object is stored in a hidden directory in phone flash memory which can not be accessed by end user. Thus the mechanism for indicating a ‘forward locked’ status is to set a special field in right object.

Right Object

Forward Lock files do not have Right Objects associated with the content. The user has unlimited usage. The handset will mark the file as "do not forward" and the user will be able to consume the content as a normal file. The only limitation is the handset will not allow the user to send the file via any transfer method.

In the case of Combined Delivery there is a Right Object associated with the content. The Right Object will be stored in a secure area and the user will not have access to it. The handset will not allow the user to send it via any delivery method. The Right Object will define the constraints for content usage. This Right Object can have count, time, date, or interval constraints. The application will check the Right Object before consuming the content.

Content downloaded using the OMA Separate Delivery format has been converted from plaintext format into DRM content format (DCF). This conversion includes symmetric encryption of the content making the DRM protected content object useless to parties not having access to the Content Encryption Key (CEK). The CEK is contained within a rights object which is delivered independently of the DCF(containing the media). The DCF file can be distributed as much as desired, yet it will remain protected as the rights object shall be forward-locked. This is the basis for the superdistribution model. Typically, the DCF object is downloaded using the browser, after which the rights object is separately delivered to the device using WAP push. Handsets that support Separate Delivery **MUST** support OMA combined delivery as well as OMA forward locking.

File Types

DRM solutions apply to all file formats. The OMA DRM solution is content agnostic and can be used for any type of content that the handset supports. Individual files are handled in the same manner as a DRM file would be handled. Files downloaded using OMA Combined Delivery will be downloaded within a DRM message and will consist of a media object and a rights object. The download manager will recognize the DRM message MIME type and the MIME type 'application/vnd.oma.drm.rights+xml' as a valid file type. A single media object in the body of the DRM message that is encoded in the following identity transfer encoding '7bit', '8 bit', and 'binary' will be accepted by the download manager.

RFC 2045 [RFC2045] defines the Content-Transfer-Encoding, which specifies how a specific body part is encoded for transfer by some transfer protocol. Content-Transfer-Encoding MUST only be used with body parts of DRM message, not with the whole body of the DRM message. The device MUST support the identity transfer encoding "binary". Other nonidentity Content-Transfer-Encodings like "base64" MAY also be supported

A Content-Transfer-Encoding header, as defined in RFC 2045 [RFC2045], MUST be present in the body part of the DRM message.

Appendix B: MIME Types

This appendix provides a list of common MIME types used on various Motorola handsets. The list is sorted by category and provides file type descriptions, as well as the MIME types used to download different media files.

NOTE: The file and MIME types shown below are not supported by all Motorola handsets. Please refer to the handset's media guide to determine what file types a particular handset supports.

Application	File type	Suffix	Permission	Mimetype
Drawingpad	Gif	.gif	Display,Print	image/gif
	Jpeg	.jpg, .jpeg	Display,Print	image/jpeg
	bmp	.bmp	Display,Print	image/bmp
	ems bmp	.ems	Display,Print	Image/ems.userdefined.picture Image/ems.userdefined.animation Image/ems.predefined.animation
	wbmp	.wbmp	Display,Print	image/vnd.wap.wbmp
	Png	.png	Display,Print	image/png
Realplayer	aac	.mp4	Play	audio/mp4
		.3ga	Play	audio/3gpp
	aac (mpeg4 aac-lc) aac+ Enhanced aac+	.mp4 .3ga .m4a	Play	audio/mp4 audio/3gpp audio/m4a
			Play	audio/x-midi
	Mp3	.mp3	Play	audio/mp3
			Play	audio/x-mp3
			Play	audio/mpeg3
			Play	audio/x-mpeg3
	wav	.wav	Play	audio/wav
			Play	audio/x-wav
	amr,	amr	Play	audio/amr
	amr-nb, amr-wb	.mpg4, .3ga	Play	audio/mp4, audio/3gpp
	wma	.wma .asf	Play	audio/x-ms-wma audio/asf
			Play	audio/x-ms-wma
	xmf, midi	.xmf, .midi, .mid	Play	audio/midi, audio/mid, audio/x-mid, audio/x-midi, audio/mobile-xmf
	3gp	.3gp	Play	video/3gp
			Play	video/3gpp
		.3ga	Play	audio/3gpp
	mp4	.mp4	Play	video/mp4

			Play	audio/mp4
			Play	video/mp4v-es
	mpeg4	.mp4, .3gp	Play	video/mp4, video/3gpp
			Play	video/mpeg4
			Play	video/mp4v-es
	rm	.rm, .ram,	Play	video/vnd.rn-realvideo
			Play	audio/x-pn-realaudio
			Play	application/vnd.rn-realmeida.
	h.263	.mp4, .3gp	Play	video/mp4, video/3gpp
	mpeg4 + amr-nb, mpeg4 + amr-wb	.mp4, .3gp	Play	video/mp4, video/3gpp
	mpeg4 + aac	.mp4, .3gp	Play	video/mp4, video/3gpp
	h.263 + amr-nb, h.263 + amr-wb	.mp4, .3gp	Play	video/mp4, video/3gpp
	h.263 + aac	.mp4, .3gp	Play	video/mp4, video/3gpp

Table 21 MIME Types

Note : Tone Sequence as defined in JSR-135 is equal to the following: audio/x-tone-seq Different strings in the same group are synonyms and are equally applicable for the corresponding media type.

Please note the following when mapping MIME types to a server:

- A MIME type can be mapped to zero or more file extensions
- Extension mapping is cas7e insensitive

For information on configuring servers to deploy programs or files over-the-air, or to determine which MIME types are supported by a particular handset, download the *Basic Over-the-Air Server Configuration* whitepaper from the MOTODEV website (http://developer.motorola.com).

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