

Technical Manual

*Creating Media for the
Motorola C975*

Version 01.11



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Overview

Welcome to the *Creating Media for the Motorola C975* guide. This guide contains all the information you need to get started developing pictures, animation, and sounds for the Motorola C975.

The Motorola C975 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

The following are definitions of common terms used in this guide:

Term	Definition
AAC	Advanced Audio Coding
AMR	Adaptive Multi Rate
DRM	Digital Rights Management
GIF	Graphics Interchange Format
GSM	Global System for Mobile Communications
iMelody	Infrared Data Association (IrDA) standard for the textual representation of a ring tone.
JPG	Joint Photography Expert Group
MIDI	Musical Instrument Digital Interface

Overview

Term	Definition
MIDI Patch	One of the channels in a MIDI device, defined by the general MIDI standard
MMS	Multimedia Messaging Service
MPEG	Moving Pictures Experts Group
MTF	Motorola Theme File
NA	Not Available
PCM	Pulse-Code Modulation
Pixel	One picture element on the display
PNG	Portable Network Graphics
QCIF	Quarter Common Intermediate Format
RV	Real Video
SMF	Standard MIDI File
SMS	Short Message Service
UCS	Unicode System
WAP	Wireless Application Protocol
WBMP	Wireless Bitmap
WMA	Windows Media Audio
WMV	Windows Media Video

References

The following references provide information related to developing media for the Motorola C975:

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

Revision History

Version	Date	Name	Reason
00.01	NA	Motorola	Initial Draft
01.00	NA	Motorola	Updates
01.10	August 30, 2004	C.E.S.A.R.	Updates
01.11	September 09, 2004.	C.E.S.A.R.	Updates

Display

This chapter describes the display characteristics for the Motorola C975.



Display Info

The physical internal display characteristics of the Motorola C975 are in Table 1:

Item	Description
Screen resolution	176 x 220 pixels
Screen dimensions	1.9 " diagonal
Color depth	16 bits
Maximum colors	65 K color
Text area	Numeric

Table 1 Display Info

Graphics & Video

This chapter describes the graphic environment available in the Motorola C975. 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 Motorola C975 supports the graphic and animation formats in Table 2:

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.
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.
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.

Type	Description
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.

Table 2 Picture Formats

Note: The maximum picture resolution is QVGA. Any images with a higher resolution will not be displayed.

The Table 3 depicts the maximum decode size and resolution for supported picture formats:

Format	Maximum Decode Size	Resolution
JPEG	Up to VGA (640x480 pixels)	Up to VGA (640x480 pixels)
PNG		QVGA
BMP		
GIF 87a, 89a	QVGA	QVGA
WBMP		

Table 3 Decode size and resolution picture formats.

Video Playback

The Motorola handset supports the video formats in Table 4:

Type	Description
MPEG-4	<p>The MPEG-4 format provides standardized technological elements that enable interactive multimedia (video/audio), interactive graphics, and digital television.</p> <p>Codec support includes:</p> <ul style="list-style-type: none"> • MPEG • H.263 Baseline <p>A maximum of 15 fps for video playback and video capture is available at a bit rate of 64 kbps, for video capture, and 128 kbps, for video playback, when maximum size is QCIF, using extensions .mp4 and .3gp.</p>

Graphics & Video

Type	Description
H.263	An International Telecommunication Union (ITU) standard for video compression.
WMV v9	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 4 Video Formats

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

The Table 5 depicts 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 128	QCIF	15
H.263			
WMV			
Real Audio 8, 9			

Table 5 Video Playback formats

The Table 6 depicts the specifications for all supported audio + video playback formats:

Format	Total Bit Rate	Video			Audio		
		Size	Bit rate	Frame Rate	Bit Rate	Sampling Rate	Stereo/Mono
MPEG4 + AMR-NB	Up to 128 Kbps	QCIF	Up to 115 kbps	15 fps	Up to 12.2 kbps	8 kHz	Mono
MPEG4 + AMR-WB			Up to 104 kbps		Up to 23.85 kbps	16 kHz	
MPEG4 + AAC			Up to 112 kbps		Up to 64 kbps	Up to 44.1 kHz	Stereo / Mono
H.263 + AMR-NB			Up to 115 kbps		Up to 12.2 kbps	8 kHz	Mono
H.263 + AMR-WB			Up to 104 kbps		Up to 23.85 kbps	16 kHz	

H.263 + AAC			Up to 112 kbps		Up to 64 kbps	Up to 44.1 kHz	Stereo / Mono
WMV + WMA			Up to 108 kbps		Up to 96 kbps	Up to 44.1 kHz	Stereo / Mono
Real Audio + Video			Up to 96 kbps		Up to 96 kbps	Up to 44.1 kHz	Stereo / Mono

Table 6 Audio + video playback formats

The Table 7 depicts 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 Audio 8, 9				

Table 7 Video streaming formats

The Table 8 depicts the specifications for video + audio streaming:

Format	Total Bit Rate (kbps)	Video			Audio		
		Size	Bit rate (kbps)	Frame Rate	Bit Rate (kbps)	Sampling Rate	Stereo/Mono
MPEG4/H.263 + AMR – NB	128	QCIF	Up to 115	15 fps	Up to 12.2	8 kHz	Mono
MPEG4/H.263 + AMR-WB			Up to 104		Up to 23.85	16 kHz	
MPEG4/H.263 + AAC			Up to 96		32	Up to 44.1 kHz	Stereo / Mono
WMV + WMA			Up to 112		Up to 48		
Real Audio + Video 8,9			Up to 96		Up to 32		

Table 8 Video + audio streaming formats

Graphics and Video Capture

The Table 9 depicts the video quality, bit rates, frame size, frame rate, and maximum durations for video capture:

Format	Video Quality	Bit Rate	Frame Size	Frame Rate
MPEG4 or H.263	Low	Up to 48 kbps	QCIF	15 fps
	Medium	Up to 56 kbps		
	High	Up to 64 kbps		

Table 9 Video capture

The Table 10 depicts the video quality, bit rates, frame size, frame rate, and maximum durations for video + audio capture:

Format	Total Bit Rate	Video			Audio		
		Size	Bit rate	Frame Rate	Bit Rate	Sampling Rate	Stereo/Mono
MPEG4 or H.263 + AMR-NB	Up to 64 kbps	QCIF	Up to 52 kbps	15 fps	12.2 kbps	8 kHz	Mono
MPEG4 or H.263 + AMR-WB			Up to 40 kbps		23.85 kbps	16 kHz	

Table 10 Video + audio capture

NOTE: The video+ audio capture specifications apply to all quality (low, medium, high) with a maximum duration of 3 minutes across the board.

The Table 11 depicts the still image capture resolution and size of the supported formats:

Format	Resolution	Size
JPEG	High (VGA)	640 x 480 pixels
	Medium (QVGA)	320 x 240 pixels
	Fit-to-Screen (QCIF)	176 x 144 pixels
	MMS (QQVGA)	160 x 120 pixels
	Low (QQQVGA)	80 x 60 pixels

Table 11 Image capture

Video Telephony

The Table 12 depicts the specifications for supported circuit-switched video telephony formats:

Format	Total Bit Rate (kbps)*	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 12 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 Motorola C975 MMS/SMS applications support use of the following image formats/sizes:

- JPEG
- GIF (87a, 89a)
- BMP
- PNG
- WBMP

The Motorola C975 supports use of the following audio formats:

- MP3

Graphics & Video

- MIDI
- AMR-NB, AMR-WB
- AAC
- WMA v9 L2, v3, v7 and v8
- Real Audio 8 and 9
- GSM Full Rate
- PCM (Linear 8/16 – bit, A-law 8-bit, mu-law 8-bit)

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: GF87a, GIF89a, JPEG, WBMP, PNG.

Technical Specifications for Wallpapers:

- Dimensions: 176 x 220
- Colors: 65K color
- Recommended File Size: up to 15kb (size is only limited by available space on file system)

Wallpaper images are displayed on screen as shown below.

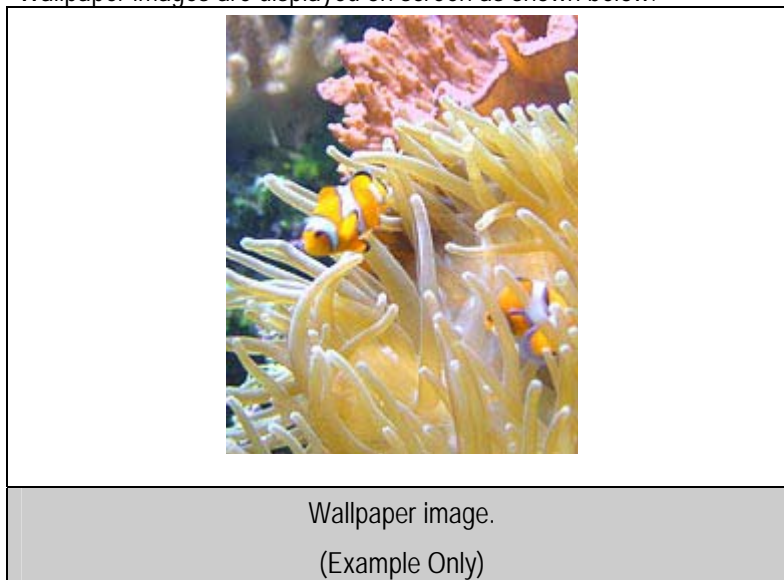


Figure 1. How wallpaper is displayed on the idle screen and main menu screen.

Graphics & Video

The following definitions apply to the Motorola Theme File (.mtf):

- **MTF Header** – Contains the string “MTF”
- **Version** – \$ 10 represents 1.0, \$ 11 represents 1.1, etc
- **Number of Fields** – Denotes how many component files are inside the MTF file
- **File Size X** – Size of file X in bytes. For example, \$00000020 equals 32 bytes file size
- **Field Label X** – Represents what type of component for the current file.
 - 0 – Wallpaper
 - 1 – Screensaver
 - 2 – Incoming Ringtone
- **Filename X** – Name of the file in UCS2 format. For example, “abc.def” is represented by \$00 \$61 \$00 \$62 \$00 \$63 \$00 \$2E \$00 \$64 \$00 \$65 \$00 \$66
- **Separator** – Used to denture end of current filename X. Value is \$00 \$00
- **Checksum** – Single byte addition from byte 0 to just before the checksum field. The last 2 bytes is then the checksum. For example, if calculated checksum is \$ 1204AB, then the checksum will be \$04AB
- **File Contents X** – Actual file contents

Icon Specifications

The Table 14 depicts the specifications for creating icons for the Motorola C975.

Overall icon specification:

Format	Bit Rate (kbps)	Frame Size	Frame Rate (fps)	Extension
MPEG4	Up to 128	QCIF	15	.sdp .rts

Table 14 Icon specifications

Sound

This chapter describes the sound environment available in the Motorola C975. 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).

Speakerphone

The Motorola C975 supports one 16mm polyphonic speaker (24-voice polyphony, 16 channels).

Supported Sound Formats

The Motorola C975 support the sound formats in Table 15:

Sound

Type	Description
iMelody	iMelody is the Infrared Data Association (IrDA) standard for the textual representation of a ring tone that can be used to transfer melodies between devices.
MIDI	The Motorola C975 are MIDI 1.0 compliant (.mid, .midi, .mmf, .smf), and supports any data format described in <i>The Complete MIDI 1.0 Detailed Specification</i> , including: <ul style="list-style-type: none"> – MIDI, Type 0 – MIDI, Type 1 – Scalable Polyphonic MIDI (SP-MIDI)
MP3	The MP3 format (.mp3) provides the coding of audio for digital storage.
WMA	Windows Media Audio (.wma), referring to components of the more general Windows Media Format proprietary standard.
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.
Real Audio	Real Audio (.ra, .rm) is a compressed format suitable for streaming over the internet.
AAC	Short for Advanced Audio Encoding (.aac, .adcs, .adif), one of the audio compression formats defined in the MPEG-2 standard. AAC boasts higher quality audio reproduction than MP3 and requires 30% less data to do so.
WAV	Format for storing files (.wav). Linear pcm 8-bit and 16-bit, CCITT A-law and U-law.
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.

Table 15 Sounds formats

The Table 16 depicts the bit rate, sampling rate, and stereo/mono capabilities for each supported format:

Format	Bit Rate (kbps)	Sampling Rate	Stereo/Mono
AMR-NB	4.75 – 12.20	8Khz	Mono
AMR –WB	6.6 – 23.85	16 kHz	Mono
AAC	Up to 128	44.1 kHz	Stereo/Mono
MP3	Up to 128	44.1 kHz	Stereo/Mono
8-bit Linear PCM	64	8 kHz	Mono
16-bit Linear PCM	128	8 kHz	Mono

8-bit A-law PCM	64	8 kHz	Mono
8-bit mu-law PCM	64	8 kHz	Mono
GSM Full Rate	12.2	8kHz	Mono
WMA	Up to 128	48 kHz	Stereo/Mono
Real Audio	Up to 96	44.1 kHz	Stereo/Mono

Table 16 Capabilites sound formats

The Table 17 depicts the dynamic range, polyphony channels, feature and extension for iMelody format.

Format	Dynamic Range	Polyphony Channels	Feature	Extension
iMelody	1 – 3.5 kHz	monophonic	Simple Wave Tone Generation	.imy
			Vibrator Control	

Table 17 iMelody format

The Table 18 depicts the file type, polyphony channels, instruments and extensions for MID format.

Format	File Type	Polyphony Channels	Instruments(Gen. MIDI Level 1)	Extensions		
Standard MIDI	Type 0	24	128 melodic, 47 percussion	.mid .midi		
	Type 1					
	SP					
Mobile XMF MIDI	Type 0			24	128 melodic, 47 percussion	.xmf
	Type 1					
	Type 2 (mobile DLS)					

Table 18 MIDI format

The Table 19 depicts the bit rate, sampling rate, stereo/mono, and extension for supported streaming audio formats:

Format	Bit Rate (kbps) *	Sampling Rate	Stereo/Mono	Extension
AMR-NB	4.75 – 12.20	8 kHz	Mono	.sdp .rts
AMR-WB	6.6-23.85	16 kHz		
AAC	Up to 128	48 kHz	Stereo/Mono	
WMA	Up to 128	48 kHz		
Real Audio	Up to 96	44.1 kHz		

Table 19 Streaming audio formats

Sound

* **Note:** For streaming, the correct Radio Access Bearer must be chosen to match the Bit Rate taking into account the overhead needed by the streaming server and streaming protocols. For example, if a bit rate of 59 kbps is specified, a bearer of at least 64 kbps is needed to account for overhead.

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: up to 15k (Ring tone size is only limited by available space on the file system)
- MIDI Instruments: 128
- Maximum Polyphony: 24 voices
- Minimum Duration per note: 20ms
- Maximum Duration (NW dependent): 16-30 secs

MIDI Key Mapping

The Motorola C975 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.

• Normal

Pch#	Instrument	Address
0	GrandPno	FM param 0800
1	BritePno	FM param 0810
2	E.GrandP	FM param 0820
3	HnkyTonk	FM param 0830
4	E.Piano1	FM param 0840
5	E.Piano2	FM param 0850
6	Harpsi	FM param 0860
7	Clavi	FM param 0870
8	Celesta	FM param 0880
9	Glocken	FM param 0890
10	MusicBox	FM param 08A0
11	Vibes	FM param 08B0
12	Marimba	FM param 08C0
13	Xylophon	FM param 08D0
14	TubulBel	FM param 08E0
15	Dulcimar	FM param 08F0
16	DrawOrgn	FM param 0900
17	PercOrgn	FM param 0910
18	RockOrgn	FM param 0920
19	ChrchOrg	FM param 0930
20	ReedOrgn	FM param 0940
21	Acordion	FM param 0950
22	Harmnica	FM param 0960
23	TangoAcd	FM param 0970
24	NylonGtr	FM param 0980
25	SteelGtr	FM param 0990
26	JazzGtr	FM param 09A0
27	CleanGtr	FM param 09B0
28	Mute.G.tr	FM param 09C0
29	Ovrdrive	FM param 09D0
30	Dist.Gtr	FM param 09E0
31	GtrHarmo	FM param 09F0
32	AcoBass	FM param 0A00
33	FngrBass	FM param 0A10
34	PickBass	FM param 0A20
35	Fretless	FM param 0A30
36	SlapBas1	FM param 0A40
37	SlapBas2	FM param 0A50
38	SynBass1	FM param 0A60
39	SynBass2	FM param 0A70
40	Violin	FM param 0A80
41	Viola	FM param 0A90
42	Cello	FM param 0AA0
43	Contrabs	FM param 0AB0
44	TremStr	FM param 0AC0
45	PizzStr	FM param 0AD0
46	Harp	FM param 0AE0
47	Timpani	FM param 0AF0
48	Strings1	FM param 0B00
49	Strings2	FM param 0B10
50	Syn.Str1	FM param 0B20
51	Syn.Str2	FM param 0B30
52	ChoirAah	FM param 0B40
53	VoiceOoh	FM param 0B50
54	SynVoice	FM param 0B60
55	Orch.Hit	FM param 0B70
56	Trumpet	FM param 0B80
57	Trombone	FM param 0B90
58	Tuba	FM param 0BA0
59	Mute.Trp	FM param 0BB0
60	Fr.Horn	FM param 0BC0
61	BrasSect	FM param 0BD0
62	SynBras1	FM param 0BE0
63	SynBras2	FM param 0BF0

Pch#	Instrument	Address
64	SprnoSax	FM param 0C00
65	AltoSax	FM param 0C10
66	TenorSax	FM param 0C20
67	Bari.Sax	FM param 0C30
68	Oboe	FM param 0C40
69	Eng.Horn	FM param 0C50
70	Bassoon	FM param 0C60
71	Clarinet	FM param 0C70
72	Piccolo	FM param 0C80
73	Flute	FM param 0C90
74	Recorder	FM param 0CA0
75	PanFlute	FM param 0CB0
76	Bottle	FM param 0CC0
77	Shakhchi	FM param 0CD0
78	Whistle	FM param 0CE0
79	Ocarina	FM param 0CF0
80	SquareLd	FM param 0D00
81	SawLead	FM param 0D10
82	CaliopLd	FM param 0D20
83	ChiffLd	FM param 0D30
84	CharanLd	FM param 0D40
85	VoiceLd	FM param 0D50
86	FifthLd	FM param 0D60
87	Bass&Ld	FM param 0D70
88	NewAgePd	FM param 0D80
89	WarmPad	FM param 0D90
90	PolySyPd	FM param 0DA0
91	ChoirPad	FM param 0DB0
92	BowedPad	FM param 0DC0
93	MetalPad	FM param 0DD0
94	HaloPad	FM param 0DE0
95	SweepPad	FM param 0DF0
96	Rain	FM param 0E00
97	SoundTrk	FM param 0E10
98	Crystal	FM param 0E20
99	Atmosphr	FM param 0E30
100	Bright	FM param 0E40
101	Goblins	FM param 0E50
102	Echoes	FM param 0E60
103	Sci-Fi	FM param 0E70
104	Sitar	FM param 0E80
105	Banjo	FM param 0E90
106	Shamisen	FM param 0EA0
107	Koto	FM param 0EB0
108	Kalimba	FM param 0EC0
109	Bagpipe	FM param 0ED0
110	Fiddle	FM param 0EE0
111	Shanai	FM param 0EF0
112	TnklBell	FM param 0F00
113	Agogo	FM param 0F10
114	SteelDrm	FM param 0F20
115	WoodBik	FM param 0F30
116	TaikoDrm	FM param 0F40
117	MelodTom	FM param 0F50
118	Syn.Drum	FM param 0F60
119	RevCymb1	FM param 0F70
120	FretNoiz	FM param 0F80
121	BrthNoiz	FM param 0F90
122	SeaShore	FM param 0FA0
123	Tweet	FM param 0FB0
124	Telephone	FM param 0FC0
125	Helicptr	FM param 0FD0
126	Applause	FM param 0FE0
127	Gunshot	FM param 0FF0

• Drum

Note#	Instrument	Address
24	SeqClick H	FM param 1000
25	Brush Tap	FM param 1010
26	Brush Swirl L	FM param 1020
27	Brush Slap	FM param 1030
28	Brush Swirl H	FM param 1040
29	Snare Roll	FM param 1050
30	Castanet	FM param 1060
31	Snare L	PCM param 1070
32	Sticks	FM param 1080
33	Bass Drum L	PCM param 1090
34	Open Rim Shot	FM param 10A0
35	Bass Drum M	PCM param 10B0
36	Bass Drum H	PCM param 10C0
37	Closed Rim Shot	FM param 10D0
38	Snare M	PCM param 10E0
39	Hand Clap	FM param 10F0
40	Snare H	PCM param 1100
41	Floor Tom L	PCM param 1110
42	Hi-Hat Closed	PCM param 1120
43	Floor Tom H	PCM param 1130
44	Hi-Hat Pedal	PCM param 1140
45	Low Tom	PCM param 1150
46	Hi-Hat Open	PCM param 1160
47	Mid Tom L	PCM param 1170
48	Mid Tom H	PCM param 1180
49	Crash Cymbal 1	PCM param 1190
50	High Tom	PCM param 11A0
51	Ride Cymbal 1	PCM param 11B0
52	Chinese Cymbal	PCM param 11C0
53	RideCymbal Cup	FM param 11D0
54	Tamboulin	FM param 11E0
55	Splash Cymbal	PCM param 11F0
56	Cowbell	FM param 1200
57	Crash Cymbal 2	PCM param 1210
58	Vibraslap	FM param 1220
59	Ride Cymbal 2	PCM param 1230
60	Bongo H	FM param 1240
61	Bongo L	FM param 1250
62	Conga H Mute	FM param 1260
63	Conga H Open	FM param 1270
64	Conga L	FM param 1280
65	Timbale H	FM param 1290
66	Timbale L	FM param 12A0
67	Agogo H	FM param 12B0
68	Agogo L	FM param 12C0
69	Cabasa	FM param 12D0
70	Maracas	FM param 12E0
71	Samba Whistle H	FM param 12F0
72	Samba Whistle L	FM param 1300
73	Guiro Short	FM param 1310
74	Guiro Long	FM param 1320
75	Claves	FM param 1330
76	Wood Block H	FM param 1340
77	Wood Block L	FM param 1350
78	Cuica Mute	FM param 1360
79	Cuica Open	FM param 1370
80	Triangle Mute	FM param 1380
81	Triangle Open	FM param 1390
82	Shaker	FM param 13A0
83	Jingle Bell	FM param 13B0
84	Belltree	FM param 13C0

Figure 2 MIDI key Map

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 Motorola C975.

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 feature, 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: 441000 Hz Max
- Bit Rate: 128 Kbps max

Sound

- No file size and duration restrictions

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: 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
- Theme
- 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

Three 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 govern 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 Motorola C975 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 C975 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/x-ms-bmp
			Display,Print	image/bmp
	wbmp	.wbmp	Display,Print	image/vnd.wap.wbmp
	PNG	.png	Display,Print	image/png
Realplayer	mid	.mid, .midi	Play	audio/mid
			Play	audio/midi
			Play	audio/x-midi
	mp3	.mp3	Play	audio/mp3
			Play	audio/x-mp3
			Play	audio/mpeg
			Play	audio/mpeg3
			Play	audio/x-mpeg3
	wav	.wav	Play	audio/wav
			Play	audio/x-wav
				audio/l16
	mmf	.mmf	Play	application/vnd.smaf
			Play	audio/mmf
	amr,	.amr	Play	audio/amr
	wma	.wma	Play	audio/wma
			Play	audio/x-ms-wma
	Quicktime	.mp4	Play	video/quicktime
	3gp	.3gp	Play	video/3gp
			Play	video/3gpp
	mp4	.mp4	Play	video/mp4
			Play	audio/mp4
			Play	video/mp4v-es
	mpeg4	.mp4	Play	video/mp4
			Play	video/mpeg4
			Play	video/mp4v-es
	rm	.rm, .ram,	Play	video/vnd.rn-realvideo

Appendix B: MIME Types

			Play	audio/x-pn-realaudio
			Play	application/vnd.rn-realmeida.
	ra	*.ra	Play	audio/x-realaudio
			Play	audio/rn-realaudio
	aac	.aac	Play	audio/aac
		.adts	Play	audio/aac
		.adif	Play	audio/aac
java	jar	.jar	Execute	application/java-archive
	Jad	.jad	Execute	application/vnd.sun.j2me.app-descriptor
			Execute	text/vnd.sun.j2me.app-descriptor

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 case 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 Motocoder website (<http://www.motocoder.com>).

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