Technical Manual

Creating Media for the FOMA M1000

Version 01.01

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Overview

Welcome to the *Creating Media for the FOMA M1000* guide. This guide contains all the information you need to get started developing pictures, animation, and sounds for the FOMA M1000.

The FOMA M1000 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
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

References

The following references provide information related to developing media for the FOMA M1000:

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

Display

This chapter describes the display characteristics for the FOMA M1000.

M1000


Figure 1 M1000 HandSet

Display Info

The physical internal display characteristics of the FOMA M1000 are in Table 1:

Item	Description
Screen resolution	208 x 320h pixels
Screen dimensions	208 x 320 TFT
Color depth	16-bit
Maximum colors	65 kb

Table 1 Display Info

Graphics & Video

This chapter describes the graphic environment available in the FOMA M1000. 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 FOMA M1000 supports the following 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/
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

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

Format	Maximum Decode Size	Resolution
JPEG	Up to SXGA (1280x960 pixels)	Up to SXGA (1280x960 pixels)
GIF 87a, 89a	Up to VGA (640 x 480 pixels)	Up to VGA (640 x 480 pixels)
PNG		
BMP		
WBMP		
FLASH (via Browser)	Up to 192 x 213 pixels	Up to 192 x 213 pixels

Table 3 Decode size and resolution picture formats

Video Playback

The Motorola handset supports the following video formats in Table 4:

Type	Description
H.263	An International Telecommunication Union (ITU) standard for video compression.
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 25 fps for video playback and 15 fps for video capture is available at a bit rate of 256 kbps when maximum size is QCIF.
WMV v8	WMV - Windows Media Video is a generic name for the set of streaming video technologies developed. This format also supports WMV version 7.

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 H263	Up to 256	QCIF SQCIF	15
WMV v8	Up to 128	QCIF SQCIF	15

Table 5 Video playback formats

The Table 6 chart 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	Up to 256 kbps	QCIF SQCIF	Up to 244 kbps	15 fps	Up to 12.2 kbps	8 kHz	Mono
MPEG4 + AAC			Up to 192 kbps		Up to 64 kbps	Up to 44.1 kHz	Stereo/Mono
H.263 + AMR			Up to 244 kbps		Up to 12.2 kbps	8 kHz	Mono
H.236 + AAC			Up to 192 kbps		Up to 64 kbps	Up to 44.1 kHz	Stereo/Mono
WMV + WMA v8	Up to 128 kbps		Up to 112 kbps			Up to 48 kHz	

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 H.263 WMV v8	Up to 384	QCIF SQCIF	15	.sdp

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 + AMR	Up to 384	QCIF SQCIF	Up to 104	15	Up to 12.2	8 kHz	Mono
H.263 + AMR							
MPG4 + AAC			Up to 84		Up to 32	Up to 44.1	Stereo/Mono
H.263 + AAC							
WMV + WMA v8						Up to 48	

Table 8 Video + audio streaming

Graphics and Video Capture

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

Format	Bit Rate	Frame Size	Frame Rate
MPEG4	64 kbps	QCIF	15 fps

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 + AMR	76 kbps	QCIF	64 kbps	15 kbps	12.2 kbps	8 kHz	Mono

Table 10 Video + audio capture

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

Format	Resolution	Size
JPEG	Max (SXGA)	1280 x 960 pixels
	Large (VGA)	640 x 480 pixels
	Medium (QVGA)	320 x 240 pixels

	Small (QCIF)	176 x 144 pixels

Table 11 Still 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	64	QCIF	38 to 42	15	Up to 12.2	8 kHz	Mono
MPEG4 + G723.1					Up to 6.3		
H.263 + AMR					Up to 12.2		
H.263 + G723.1					Up to 6.3		

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 FOMA M1000 MMS/SMS applications support use of the following image formats/sizes:

- JPEG
- GIF
- BMP
- PNG
- WBMP
- FLASH (Via Browser)

The FOMA M1000 supports use of the following audio formats:

- MP3

- GSM Full Rate
- PCM 8 and 16 bits

MMS/SMS Support

- MIDI
- AMR-NB, AMR-WB
- AAC
- WMA
- Real Audio 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: 208 x 320
- Colors: 65 kb
- Recommended File Size:

The user has the following option for wallpaper:

- Fit-to-screen – the image is resized to fill the screen while keeping the original aspect ratio

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.

Theme Support

The FOMA M1000 support themes. A theme is a wallpaper and ring tone combined into a data set that enables users to customize their experience on the handset. The theme package can also include color palette, font size, alternative icons, background picture, and power on/off animation. Theme components are grouped together and downloaded to the handset as a bundle.

NOTE: The filenames used for wallpapers, and ring tones used to create a theme files are limited to 32 characters each (excluding the dot and extension). Longer filenames are automatically truncated by the Media Manager (while retaining the extension) when it creates the theme file. Duplicate filenames are renamed by the phone to ensure they are unique. However, it is recommended you use unique filenames for each media element.

For more information on creating theme bundles, see the documentation that accompanies the Media Manager tools.

NOTE: Some wireless networks limit the maximum size of a Theme download to 100 KB. Developers are encouraged to keep their themes to this size or less. This size must also include header information, which can be up to 500 bytes in size.

The Table 13 describes the Motorola Theme File (.mtf):

Byte 0	3	4 . . .											. . . k
MTF Header 3 Bytes	Version 1 Byte	Number of Fields 1 Byte	File Size 1 4 Bytes	…	File Size N 4 Bytes	Field Label 1 1 Byte	Filename 1 Variable UCS 2 Bytes	Separator 2 Bytes	...	Field Label N 1 Byte	Filename N Variable UCS 2 Bytes	Separator 2 Bytes	Checksum 2 Bytes

K + 1 . . .		
File Contents 1 Variable Bytes	. . .	File Contents 1 Variable Bytes

Table 13 Motorola Theme File

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 following depicts the specifications for creating icons for the FOMA M1000.

Overall icon specification:

Format	Bit Rate (kbps)	Frame Size	Frame Rate (fps)	Extension
Bitmap	N/A	19 x 19 pixel	N/A	.bmp

Sound

This chapter describes the sound environment available in the FOMA M1000. 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 FOMA M1000 support sound formats in Table 14:

Type	Description
MIDI	The FOMA M1000 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)

Sound

Type	Description
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 boosts 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.
XMF	Mobile XMF MIDI support of the following: – Type 0 – Type 1 – Type 2 (mobile DLS)

Table 14 Sound formats

The Table 15 depicts the bit rate, sampling rate, and stereo/mono capabilities for each supported format:

Format	Bit Rate (kbps)	Sampling Rate	Stereo/Mono
AMR	4.75 – 12.20	8Khz	Mono
AAC	128	44.1 kHz	Stereo/Mono
MP3	192	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

Table 15 Bit rate, sampling rate, and stereo/mono capabilities for each supported format

The Table 16 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	4.75 – 12.20	8 kHz	Mono	.sdp
AAC	Up to 110 kbps	44.1 kHz	Stereo/Mono	
WMA v8	Up to 116 kbps	48 kHz		

Table 16 Bit rate, sampling rate, stereo/mono, and extension for supported streaming audio formats

* 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 FOMA M1000 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	WoodBlk	FM param	0F30
116	TaikoDrm	FM param	0F40
117	MelodTom	FM param	0F50
118	Syn.Drum	FM param	0F60
119	RevCymbl	FM param	0F70
120	FretNoiz	FM param	0F80
121	BrthNoiz	FM param	0F90
122	SeaShore	FM param	0FA0
123	Tweet	FM param	0FB0
124	Telphone	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 Key Mappig

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 FOMA M1000.

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: 44.1
- Bit Rate: 192 kbps

- 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

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 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 FOMA M1000 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 M1000implementation, 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

			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

Table 17 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 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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