

OMTP PUBLISHED



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CAMERAS

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1 INTRODUCTION

This document represents the Camera defragmentation and Requirements developed within OMTP.

This document defines some recommended classes of camera for mobile terminals. Further classes will be added in future versions of the document with the advances in terminal camera technology.

The camera classes are defined in order to resolve issues caused by the large variety of minimum camera characteristics in mobile terminals. The potential issues are:

1. The user experience of 'look and feel' is affected.
2. By requiring application developers and content providers address all the display and camera formats of different mobile terminals, operational costs are increased.
3. The services based on the use of the camera are affected by camera characteristics.
4. The perceived quality of video services is heavily influenced by camera characteristics.
5. The bandwidth occupation and encoder performances depend on camera acquisition characteristics.

OMTP have addressed the camera defragmentation issue to:

1. Reduce operational cost.
2. Reduce the Non Recurring Expense (NRE) cost due to the reengineering of applications and content to support new terminals.
3. Make the specification of requirements for mobile terminals easier and more precise.
4. Improve user perception of the video services provided.

See chapter 4 for some example use cases.

1.1 DOCUMENT PURPOSE

This document has the general objective of helping to define terminal requirements and allowing development and deployment of new services as well as defragmenting the camera offering within terminals. In particular, the document adheres to the OMTP Main Objectives:

Facilitate the Implementation of Open Mobile Terminal Platforms

- Drive the development of specific mobile terminal platforms to meet OMTP requirements:
 - Influence standardisation of relevant platforms.
 - Work with vendors of proprietary platforms to adopt OMTP requirements and/or resulting standards.
 - Understand the implementation roadmap and ensure conformance to OMTP requirements.

In particular, it addresses the hardware enablers through the production chain to facilitate OMTP terminal development.

Define Defragmentation Guidelines

- Defragmentation guidelines to reduce costs (both for operators and manufacturers) and increase consistency by defining:
 - Hardware component parameters.
 - Software component parameters.
 - Performance guidelines and benchmarks.

1.2 INTENDED AUDIENCE

The document is intended to be used as reference in:

- Terminal requirements definition.
- Platform and terminal characteristics definition.
- Detailing supported cameras in the definition of mobile terminal performance.

Some examples of how the OMTP Camera requirements can be used:

Within hardware requirements for an application: *“The application needs a video camera capable of OMTP definition basic CV22 (as defined in OMTP CAMERAS v1.1) to run”.*



Within hardware requirements for a mobile handset: *“The handset SHALL have an OMTP front camera capable of OMTP definition Advanced CS1 (as defined in OMTP CAMERAS v1.1) and a back camera capable of OMTP definitions Advanced CV22 and Advanced CS2 (as defined in OMTP CAMERAS v1.1)”*.

2 DEFINITION OF TERMS

This chapter contains the definition of terms used in this document.

2.1 CONVENTIONS

The key words “MUST”, “MUST NOT”, “REQUIRED”, “SHALL”, “SHALL NOT”, “SHOULD”, “SHOULD NOT”, “RECOMMENDED”, “MAY”, and “OPTIONAL” in this document are to be interpreted as described in RFC2119 [1].

- **MUST:** This word, or the terms "REQUIRED" or "SHALL", mean that the definition is an absolute requirement of the specification.
- **MUST NOT:** This phrase, or the phrase "SHALL NOT", mean that the definition is an absolute prohibition of the specification.
- **SHOULD:** This word, or the adjective "RECOMMENDED", mean that there may exist valid reasons in particular circumstances to ignore a particular item, but the full implications must be understood and carefully weighed before choosing a different course.
- **SHOULD NOT:** This phrase, or the phrase "NOT RECOMMENDED" mean that there may exist valid reasons in particular circumstances when the particular behaviour is acceptable or even useful, but the full implications should be understood and the case carefully weighed before implementing any behaviour described with this label.
- **MAY:** This word, or the adjective "OPTIONAL", mean that an item is truly optional. One vendor may choose to include the item because a particular marketplace requires it or because the vendor feels that it enhances the product while another vendor may omit the same item. An implementation which does not include a particular option **MUST** be prepared to interoperate with another implementation which does include the option, though perhaps with reduced functionality. In the same vein an implementation which does include a particular option **MUST** be prepared to interoperate with another implementation which does not include the option (except, of course, for the feature the option provides.)

3 CAMERA SYSTEM

The Camera System includes optics, sensor and image processing so that the data is presented in a usable form to the codec interface. The Camera System is expected to support the codecs and displays identified in OMTP Displays [2] and OMTP Codecs [3].

In this section, the parameters for camera are listed and explained. (Related Still Camera requirements are listed in section 6.2 and Video Camera requirements in section 6.3).

3.1 STILL IMAGE

| | |
|-----------------------------------|--|
| RESOLUTION | <p>Measured in pixels.</p> <p>Resolution of the camera system for capturing still images and is calculated from the active pixel count of the camera's sensor, i.e. length x width.</p> <p>The resolution represents the capturing resolution of the camera system. The camera SHALL be able to be configured to support this resolution (but may also support higher resolutions).</p> <p>This resolution is prior to any zoom that has been applied.</p> |
| MINIMUM FOCUS DISTANCE | <p>Measured in centimetres (cm).</p> <p>The camera system SHALL be able to take sharp images (see section 7) from this distance to infinity. Focus may be fixed or variable.</p> |
| HORIZONTAL FIELD OF VIEW | <p>Measured in degrees.</p> <p>The camera system SHALL have a field of view within the specified range.</p> |
| ZOOM MULTIPLIER | <p>A ratio of longest to shortest focal length and expressed as a multiplier (i.e. 400mm to 100mm = 4x zoom).</p> <p>The camera system SHALL have at least this zoom capability.</p> <p>Note: zoom may be achieved optically or digitally and is <i>not</i> specified.</p> |
| MINIMUM SCENE ILLUMINATION | <p>Measured in Lux.</p> <p>Minimum scene illumination to give acceptable image quality. The acceptable image quality is defined as signal-to-noise ratio (SNR) of 10 of a given image given the</p> |

| | |
|--|--|
| | illumination level as defined in Table 1. It is recommended that test chart defined in ISO12232 is used. |
|--|--|

3.2 VIDEO CAPTURE

| | |
|-----------------------------------|--|
| RESOLUTION | <p>Measured in pixels.</p> <p>Resolution of the camera system for capturing still images and is calculated from the active pixel count of the camera's sensor, i.e. length x width. The resolution represents the capturing resolution of the camera system for video capture. The camera SHALL be able to be configured to support this resolution (but may also support higher resolutions).</p> <p>This resolution is prior to any zoom has been applied.</p> |
| FRAME RATE | <p>Measured in frames per second (Fps).</p> <p>The minimum supported Fps of the Camera System.</p> <p>The camera system SHALL be able to be configured to capture video at this rate at the resolution defined in the same class.</p> |
| MINIMUM FOCUS DISTANCE | <p>Measured in centimetres (cm).</p> <p>The camera system SHALL be able to take sharp videos (see section 7) from this distance to infinity. (Focus may be fixed or variable.)</p> |
| HORIZONTAL FIELD OF VIEW | <p>Measured in degrees.</p> <p>The camera system SHALL have a field of view within the specified range.</p> |
| ZOOM MULTIPLIER | <p>A ratio of longest to shortest focal length and expressed as a multiplier (i.e. 400mm to 100mm = 4x zoom).</p> <p>The camera system SHALL have at least this zoom capability.</p> <p>Note: zoom may be achieved optically or digitally and is <i>not</i> specified.</p> |
| MINIMUM SCENE ILLUMINATION | <p>Measured in Lux.</p> <p>Minimum scene illumination to give acceptable image quality. The acceptable image quality is defined as SNR of</p> |

| | |
|--|---|
| | <p>10 of a given image given the illumination level as defined in Table 2. It is recommended that test chart test chart ISO 15739 (Image Engineering TE 219) or Image Engineering TE241 is used. SNR is averaged over 10 video frames of a static image.(Test set up is described in Appendix A.1).</p> |
|--|---|

4 USE CASES

In this section some example cases are provided to explain the purpose of this document.

4.1 MOBILE USERS USE CASES

UC1: User Service Perception

Nigel wants to use a new operator service; “View & Send” which allows Nigel to send a video he has previously recorded. Fabio receives the video but the resolution is not very good. Fabio calls his operator’s customer service wanting to know why.

Marta and Fabio are engaged on a video call. Marta’s picture of Fabio is very good but Fabio sees low quality video. Fabio calls his operator to understand the reason for the problem. He doesn’t receive a satisfactory answer so he calls his mobile terminal provider to complain about the mobile handset.

During a video call, Marta prefers to have the video just showing her face but Mike likes to be able to show a wider view. Carl wants to send an image of the landscape.

UC2: APPLICATION PORTING

Jarmo downloads an application from his operator’s website. He launches the application but the application requests minimum camera characteristics not met by the handset camera.

4.2 INDUSTRY USE CASES

UC3: Fragmentation and segmentation

Fabio is an application developer for a large software company. He creates an application that utilises software on the latest version of a series of Terminals from a specific manufacturer. By not adapting the software to support other Terminal Cameras, the software can only be used a small percentage of Terminal owners.

UC4: Integration on a terminal

Ingolf, a chip architect, is going to design a new video encoder. He requests details of the required quality from Fabio in a telecoms

operator service division and designs the chip to meet the requirements. The chip is used in a new cellular terminal in conjunction with a certain camera. The quality is lower than expected. Fabio asks Ingolf “Where is the problem ?”

5 GENERAL REQUIREMENTS

This section defines the generic requirements followed by the specific camera classes and performance values for Still Image (Section 6.2) and Video Capture (Section 6.3) respectively.

Note: The following requirement(s) apply to all camera classes defined in Section 6.

| REQ. ID | REQUIREMENT |
|-----------------|---|
| CAM-0010 | The Camera SHALL support at least a horizontal field of view: 54 degrees +-15%. |

6 CAMERA CLASS VALUES

In this section, the camera classes within OMTP are defined. The classes are referred to in chapter 1.2. For each class, different performance values have been identified.

Classes listed in Table 1 define still image capture and classes listed in table 2 define video capture. A terminal camera must be compliant to one still image capture class or one video class (or have no camera at all – i.e. C0). A handset that contains two cameras should specify the OMTP video class and the OMTP still class for each camera.

6.1 CAMERA OMTP C0

This class indicates that the handset does not include a camera for image capture or video capture.

6.2 CAMERA CLASSES – STILL IMAGE CAPTURE

Table 1 defines three categories of cameras: Basic, Advanced and Excellent.

These categories list performance values (in addition to those captured in section 5) and are defined according to performance of the camera in low light conditions (minimum scene illumination), zoom and ability to take close-up images (minimum focus distance).

The category of the camera depends on performance metrics defined in Table 1. The performance metrics must meet or exceed the requirements under the columns basic, advanced or excellent to be categorised as such. The camera category is determined by the highest achievable category of any performance metric.

For example, the performance of a Basic VGA Camera can be described by Basic CS1 Camera. The corresponding parameters of Basic CS1 referenced from Table 1 are the following:

Resolution - 640x480

Minimum focus distance: 50 cm

Horizontal field of view 54 degrees +-15%
 Minimum scene illumination - 100 Lux."

As a second example, the performance of *Advanced CS3 Camera* can be defined as

Resolution 1600x1200
 Minimum focus distance 25cm
 Horizontal field of view 54 degrees +-15%
 Zoom multiplier 4x
 Minimum scene illumination 50 Lux.

| Class | Re- solution | Minimum Focus Distance (cm) | | | Zoom Multiplier | | | Minimum Scene Illumination | | |
|-------|------------------|--------------------------------|---------------|-----------|-----------------|---------------|-----------|-------------------------------|---------------|----------------|
| | | Basic | Ad- vanced | Excellent | Basic | Ad- vanced | Excellent | Basic | Ad- vanced | Ex- cellent |
| CS0 | No support | - | - | - | - | - | - | - | - | - |
| CS1 | 640x480 (VGA) | 50 | 25 | 25 | N/A | 4x | 4x- 6x | 100 LUX | 50 LUX | 10 LUX |
| CS2 | 1280x 1024 | 50 | 25 | 25 | N/A | 4x | 4x- 6x | 100 LUX | 50 LUX | 10 LUX |
| CS3 | 1600x 1200 | 50 | 25 | 25 | 4x | 4x | 4x- 6x | 100 LUX | 50 LUX | 10 LUX |
| CS4 | 2048x 1536 | 50 | 25 | 25 | 4x | 4x | 4x- 6x | 100 LUX | 50 LUX | 10 LUX |
| CS5 | 2560x 1920 | 50 | 25 | 25 | 4x | 4x | 4x- 6x | 100 LUX | 50 LUX | 10 LUX |
| CS6 | 3264x 2448 | 50 | 25 | 25 | 4x | 4x | 4x- 6x | 100 LUX | 50 LUX | 10 LUX |
| CS7 | 4000x 3000 | 50 | 25 | 25 | 4x | 4x | 4x- 6x | 100 LUX | 50 LUX | 10 LUX |

(In the case of Basic Still Image Capture Classes CS1 and CS2, Zoom multiplier of 4x or no zoom are both acceptable.)

(In the case of Excellent Camera, minimum support for zoom multiplier is 4x, recommended support is 6x)

TABLE 1 – Still Image Capture Classes & Performances

6.3 CLASSES – VIDEO CAPTURE

Table 2 defines two categories of Video Cameras: Basic and Advanced.

These categories are defined according to performance of the Camera in low light conditions (minimum scene illumination), zoom, ability to take close-up images (minimum focus distance) and frame rate.

The category of the camera depends on its comparison to the performance metrics defined in Table 2. The performance metrics must meet or exceed the requirements under the columns basic and advanced to be categorised as such. The camera category is determined by the highest achievable category of any performance metric.

As an example *basic CV22 Video Camera* performance would be defined as

| | |
|----------------------------|------------------|
| Resolution | 640x480(VGA) |
| Frame rate | 15 |
| Minimum focus distance | 50 cm |
| Horizontal field of view | 54 degrees +-15% |
| Zoom multiplier | 4x |
| Minimum scene illumination | 50 Lux. |

| Class | Resolution | Frame Rate (fps) | | Minimum Focus Distance (cm) | | Zoom Multiplier | | Minimum Scene Illumination | |
|-------------|-------------------|------------------|----------|-----------------------------|----------|-----------------|----------|----------------------------|----------|
| | | Basic | Advanced | Basic | Advanced | Basic | Advanced | Basic | Advanced |
| CV0 | No support | - | - | - | - | - | - | - | - |
| CV11 | 176X144 (QCIF) | 15 | 24/25/30 | 50 | 25 | N/A | 4x | 50 LUX | 10 LUX |
| CV21 | 320x240 (QVGA) | 15 | 24/25/30 | 50 | 25 | N/A | 4x | 50 LUX | 10 LUX |
| CV12 | 352x288 (CIF) | 15 | 24/25/30 | 50 | 25 | 4x | 4x | 50 LUX | 10 LUX |



| | | | | | | | | | |
|-------------|----------------------|----|----------|----|----|----|----|-----------|--------|
| CV22 | 640x480 (VGA) | 15 | 24/25/30 | 50 | 25 | 4x | 4x | 50 LUX | 10 LUX |
| CV3 | 1280x720 (720p) | 15 | 24/25/30 | 50 | 25 | 2x | 2x | 50 LUX | 10 LUX |
| CV4 | 1920x1080 (1080p) | 15 | 24/25/30 | 50 | 25 | 2x | 2x | 50 LUX | 10 LUX |

(In case of Basic Video Capture Classes CV11 and CV21, Zoom multiplier of 4x or no zoom are both acceptable.)

(In case of fps for Advanced Camcorder, the actual frame rate is dependent on market requirements and support of any specified frame rates i.e. 24/25/30 is sufficient)

TABLE 2 – Video Capture Classes & Performances

7 FURTHER WORK

The next release of this document will address at a minimum:

- Camera system quality issues.
- Clarification of Video frame rates at low light levels.
- Camera Field of View to be reviewed in line with Future Use Cases (e.g. 2D Bar Code Reader).

8 ABBREVIATIONS

| Abbreviation | Description |
|---------------------|--|
| CIF | Common Intermediate Format [352x288] |
| cm | Centimetres |
| Fps | Frames per second |
| NRE | Non Recurring Expense |
| OMTP | Open Mobile Terminal Platform |
| QCIF | Quarter Common Intermediate Format [176x144] |
| QVGA | Quarter Video Graphics Array [320x240] |
| SNR | Signal to Noise Ratio |
| VGA | Video Graphics Array [640x480] |

9 APPENDICES

9.1 APPENDIX A.1

Video is recorded with the tested terminal in laboratory environment. The terminal is fixed to a tripod. The illumination is at a fixed value.

The signal-to-noise ratio is calculated for 10 successive video frames in the recording. The average value over these 10 frames is then calculated and used as final SNR10 value. It is recommended that either test chart ISO 15739 (Image Engineering TE 219) or Image Engineering TE241 is used.

(Ref http://www.image-engineering.de/images/pdf/catalogue/katalog_online.pdf)

10 REFERENCE DOCUMENTS

| No | Document | Author | Date |
|-----|--|----------------|------------|
| [1] | RFC 2119 – Key words for use in RFCs to indicate Requirements Levels | IETF documents | March 1997 |
| [2] | OMTP DISPLAYS | OMTP | June 2005 |
| [3] | OMTP CODECS | OMTP | July 2005 |

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