

# Multimedia Authentication Testing

MAT (ver#6)

Analyst(s) name(s) \_\_\_\_\_ Testing date \_\_\_ / \_\_\_ / \_\_\_  
Tested file name \_\_\_\_\_ Size \_\_\_\_\_ bytes  
Tested time range \_\_\_\_\_ Duration \_\_\_ : \_\_\_ : \_\_\_ . \_\_\_  
Hash (MD5  or SHA1  ) \_\_\_\_\_

File format \_\_\_\_\_ proprietary. Has \_\_\_\_\_ file extension identified as \_\_\_\_\_ by file data.  
Data streams \_\_\_\_\_ % visual, \_\_\_\_\_ % audio (is entirely silent? ), and \_\_\_\_\_ % other data.  
Metadata GPS \_\_\_\_\_ Hardware \_\_\_\_\_  
Date-times Created \_\_\_\_\_ Modified \_\_\_\_\_  
Auditing data \_\_\_\_\_

## Image or Video Stream Analysis (check if testing is applicable )

Stream details \_\_\_\_\_ frames. \_\_\_ interlaced. \_\_\_\_\_ color space. \_\_\_x\_\_\_ resolution  
\_\_\_\_\_ kb/s. \_\_\_\_\_ codec using \_\_\_\_\_ writing library.  
Temporal analysis \_\_\_\_\_ fps (\_\_\_ variable) \_\_\_ unnatural. \_\_\_ duplicate frames. \_\_\_ time gaps  
Pass-Fail tests PRNU \_\_\_\_\_. Data cloning \_\_\_\_\_. PCA editing \_\_\_\_\_. DCT editing \_\_\_\_\_.  
JPEG editing \_\_\_\_\_. HSV-Lab histogram \_\_\_\_\_. Luminance gradient \_\_\_\_\_.  
Chromatic aberrations \_\_\_\_\_. Double compression \_\_\_\_\_. ELA-VELA \_\_\_\_\_.  
Thumbnail \_\_\_\_\_. Noise \_\_\_\_\_. Huffman table \_\_\_\_\_. PsuedoColor \_\_\_\_\_.

### Threshold tests\*

\* e.g. Temporal contrast, temporal diffusion, spatial predictability, temporal noise diversion, temporal histogram correlation, non-monotonous motion, etc.

## Audio Stream Analysis (check if testing is applicable )

Stream details \_\_\_ channels. \_\_\_ bit depth. \_\_\_ kb/s. \_\_\_ kHz sampling. \_\_\_\_\_ codec  
Spectral limits Perceptible up to about \_\_\_ kHz Noise ceiling up to about \_\_\_ kHz  
Simple analysis Up-sampling \_\_\_ detected Audio data cloning \_\_\_ detected  
Acute transitions Bias transition \_\_\_ detected Noise profile transition \_\_\_ detected  
Critical listening Speed inaccuracy \_\_\_ detected Stream de-synchronization \_\_\_ detected  
Amplitude tests \_\_\_ silence ( \_\_\_ absent noise) \_\_\_ clipping ( \_\_\_ in \_\_\_ time spans )  
Signal tracking \_\_\_ possible and found \_\_\_\_\_  
Subsonic impulse \_\_\_ possible and found \_\_\_\_\_

## Spot Testing (check if applicable ) Tested times are \_\_\_\_\_

Acute shifts in: Amplitude \_\_\_ detected. Content \_\_\_ detected. DC impulse \_\_\_ detected.  
Frequency \_\_\_ detected. Noise profile \_\_\_ detected. Speed \_\_\_ detected.

### Additional tests, notes and observations:

(Reference relevant "Has", "Is" or "Fail" test results)

**OPINION:** To a *definitive-high-reasonable* degree of expert confidence, the tested content is found to be a *faithful-questionable-manipulated* representation of the facts as they occurred.

## Multimedia Authentication Testing (MAT) form - instructions

**INTRODUCTION:** The MAT form is to serve as the qualified analyst's working notes, and should be included as an exhibit to any forensic report or testimony provided by said expert. All work, including any data extraction for further testing, should be performed lossless. MAT results are ("No", "Not", "Pass") or ("Has", "Is", "Fail") else ("N/A", "No data" when the data cannot be determined), and should not rely upon any other facts beyond what is derived from the tested file.

### Analyst(s) name(s)

The name(s) or the person(s) performing the file analysis.

### Testing date

The calendar date that the file analysis began. The default format is Month ' Day / Year.

### Tested file name

The full file name exactly as it appears<sup>1,2</sup> inclusive of the file's extension.

### Size \_\_\_\_\_ bytes

Actual file size in bytes<sup>1,2</sup>, and not the size allocation on storage media.

### Tested time range

A description of the time span tested (e.g. "Entire file") . Leave blank for image testing.

### Duration \_\_\_\_ : \_\_\_\_ : \_\_\_\_ . \_\_\_\_

Total file playing duration denoted in hours, minutes, seconds, and fractions of a second<sup>2</sup>. Leave blank for image testing.

### MD5-SHA1 hash

Check whether you are listing the file's MD5 or the SHA1 hash, and then enter that hash value<sup>3</sup>.

### File format \_\_\_\_\_ proprietary. Has \_\_\_\_\_ extension identified as \_\_\_\_\_ by file data.

If testing a proprietary file format (hint: when file type can only be created by the recorder, e.g. an EXE file). The next fields denote the listed extension of the tested file, then the expected extension as defined by the file's metadata<sup>2</sup>.

### Data streams \_\_\_\_\_ % visual, \_\_\_\_\_ % audio (\_\_\_\_\_ entirely silent), and \_\_\_\_\_ % other data.

Denotes the file size allocation percentages<sup>2</sup> of Visual, Audio and Other (e.g. text, metadata, timing, blank) data. Check the box if the audio is entirely silent and devoid of any data beyond compression artifacts.

### Metadata GPS \_\_\_\_\_ Hardware \_\_\_\_\_

Denotes the GPS coordinates, including altitude if known, along with the recording Hardware as defined by metadata<sup>1,2,4</sup>. Does not rely upon any other facts or sources beyond file metadata and write "No Data" if none can be determined.

### Date-times Created \_\_\_\_\_ Modified \_\_\_\_\_

Denotes the date-time that the file was created and Modified as determined solely from file metadata<sup>1,2,4</sup>.

### Auditing data

Denotes any additional information regarding the file's origin including people equipment, software and settings that affected its creation<sup>1,2,4</sup> as determined solely from the file's metadata, and write "No Data" if none can be determined.

### Image or Video Stream Analysis (This box is checked if testing an image or video file)

#### Stream details \_\_\_\_\_ frames. \_\_\_\_\_ interlaced. \_\_\_\_\_ color space. \_\_\_\_\_ x \_\_\_\_\_ resolution

Denotes the total number of frames<sup>5</sup> (use "1" for an image), if the video is interlaced<sup>2</sup> (progressive means "Not" interlaced), the file's color space<sup>2</sup> (e.g. RGB32 or 4:2:0), and its resolution<sup>1,2,4,5</sup> (horizontal pixels X vertical pixels).

#### \_\_\_\_\_ kb/s. \_\_\_\_\_ codec using \_\_\_\_\_ writing library

This is a continuation of the image/video stream details denoting the video stream's data rate, compression codec, and writing library (if defined by metadata)<sup>1,2,4</sup>, and write "No Data" if none can be determined.

#### Temporal analysis \_\_\_\_\_ fps (\_\_\_\_\_ variable) \_\_\_\_\_ unnatural. \_\_\_\_\_ duplicate frames. \_\_\_\_\_ time gaps.

Denotes the video's defined playing speed, if it has a variable framerate (e.g. when Metadata<sup>2</sup> lists both a Minimum and Maximum framerate), whether the displayed playing speed appears to be playing at an unnatural speed, if duplicate sequential frames exist, & if time gaps exist (e.g. after transcoding or motion recording)<sup>5</sup>. Use "N/A" if testing an image.

**Pass-Fail tests:** PRNU, Data cloning, PCA editing, DCT editing, JPEG editing (image only), HSV-Lab histogram, Luminance gradient, Chromatic aberrations, Double compression, ELA-VELA, Thumbnail (image only), Noise, Huffman table, PsuedoColor.

Denotes a "Pass" or "Fail" score to each image<sup>6</sup> or video<sup>5</sup> test (hint: Perform image tests on extracted video i-frames<sup>5</sup>).

### Threshold tests

Denotes summary results from tests that rely upon a sensitivity threshold (e.g. Temporal contrast, temporal diffusion, spatial predictability, temporal noise diversion, temporal histogram correlation, non-monotonous motion).

**Audio Stream Analysis** (This box is checked if testing an audio file or an audio stream extracted from a video file)  
**Stream details:** \_\_\_ channels. \_\_\_ bit depth. \_\_\_ kb/s. \_\_\_ kHz sampling. \_\_\_\_\_ codec  
Denotes the number of audio channels<sup>1,2</sup>, the bit depth of an audio channel<sup>1,2</sup> (not the cumulative total), the audio data stream rate<sup>1,2</sup>, the audio stream sampling rate<sup>1,2</sup>, and the audio codec applied<sup>1,2</sup>.  
**Spectral limits:** Perceptible up to about \_\_\_\_\_ kHz Noise ceiling up to about \_\_\_\_\_ kHz  
Denotes the highest audible sound frequency<sup>7</sup> (e.g. 4 kHz for speech) and the highest frequency detected within the file.  
**Simple analysis:** Up-sampling \_\_\_\_\_ detected Audio data cloning \_\_\_\_\_ detected  
Denotes Waveform<sup>7</sup> detection of up-sampling (e.g. soft transitions) or a replicant cloned pattern.  
**Acute transitions** Bias transition \_\_\_\_\_ detected Noise profile transition \_\_\_\_\_ detected  
Denotes the detection of a DC component transition<sup>7</sup> in waveform view or a noise profile change<sup>7</sup> in spectral view.  
**Critical listening** Speed inaccuracy \_\_\_\_\_ detected Stream de-synchronization \_\_\_\_\_ detected  
Denotes if speed inaccuracy or a timing differential between streams (audio and/or video) is detected during expert's attentive listening of the file as it plays<sup>7</sup>.  
**Amplitude tests:** \_\_\_\_\_ silence ( \_\_\_\_\_ absent noise) \_\_\_\_\_ clipping ( \_\_\_\_\_ in \_\_\_ time spans )  
Waveform results regarding the existence of silence (and if that silence includes noise beyond compression artifacts) and clipping (and either how many time spans it "is" or is "not" within for the duration of the analyzed file portion)<sup>7</sup>.  
**Signal tracking** \_\_\_\_\_ possible and found \_\_\_\_\_  
If a parasite frequency exists, can it be isolated and tracked for consistency<sup>7</sup>, and, if so, its significance.  
**Subsonic impulse** \_\_\_\_\_ possible and found \_\_\_\_\_  
If frequencies exist below 20Hz, and this range is not saturated, can meaningful amplitude spikes be identified<sup>7</sup>.

**Spot Testing (check if applicable )** Tested times are \_\_\_\_\_

This box is checked if testing specific file moments along with a list of the exact times being examined.

**Acute shifts in:** Amplitude \_\_\_\_\_ detected. Content \_\_\_\_\_ detected. DC impulse \_\_\_\_\_ detected.

For spot testing, denotes dramatic shifts in audio volume and/or visual brightness, fluidity of audio or scene, and momentary shifts in audio DC Bias.

**Frequency** \_\_\_\_\_ detected. **Noise profile** \_\_\_\_\_ detected. **Speed** \_\_\_\_\_ detected.

For spot testing, denotes dramatic shifts in: Tone or color, Spectral<sup>7</sup> or visual<sup>5</sup> noise, and/or Content playing speed<sup>5,7</sup>.

**Additional tests, notes and observations**

Denotes findings not accounted for by the listed MAT form tests (e.g. RIFF file size error, GOP allocation, 50Hz/60Hz harmonics, Bayer pattern, Lens dimples, Bias drift, etc..), additional MAT findings (e.g. other spot testing results), expanded results (for "has", "is" or "fail" findings), and any supportive notes (e.g. chain-of-custody) or observations (e.g. damaged media). This is where correlations to external data (e.g. case facts, other files, testimony) can be noted.

## OPINION

Highlight the appropriate degree of expert confidence ("definitive", "high" or "reasonable") and expert opinion ("faithful", "questionable" or "manipulated) regarding the tested file as to its trustworthiness to the facts that the file represent. A confidence degree of "reasonable" means more likely than not, "high" means highly compelling, and "definitive" means without question. A finding of Faithful means "True to the original", Questionable means "Baseless or unsubstantiated" and Manipulated means "False or misleading". The expert should use "reasonable" and "questionable" as their opinion's starting point as they weigh their test results to form a more comprehensive summary opinion.

**FOOT NOTES:** Listed software represent free or near-free industry options, and are not a FWG product endorsement.

1. Information available in the additional columns or Properties tab of Windows® Explorer
2. Information available using software like MediaInfo<sup>5</sup> (<https://mediaarea.net/en/MediaInfo>)
3. Information available using software like HashMyfiles ([https://nirsoft.net/utils/hash\\_my\\_files.html](https://nirsoft.net/utils/hash_my_files.html))
4. Information available using hex editor software like HxD (<https://mh-nexus.de/en/hxd>)
5. Information available using software like VideoCleaner (<https://videocleaner.com>)
6. Information available using software like PhotoDetective (<http://metainventions.com/photodetective.html>)
7. Information available using software like Audacity (<https://audacityteam.org>)

The MAT form is a public domain collaboration of the Forensic Working Group, and updated at their website to reflect testing advancements. Prior MAT forms are depreciated, and outdated once aged by two or more version numbers.