



Context:

Several occurrences of audio perturbation likely produced by electronic static discharges (ESD) were detected on the audio recordings of some Cockpit Voice Recorders (CVR) installed on Airbus fleets (SA and LR). This interfering phenomenon has already produced a loss of audio data that were relevant for the analysis of safety events (incident/accident).

Intention:

The BEA decided to produce a guide that can help aircraft manufacturers, operators, MROs, CVR playback centres and others, to detect this phenomenon while proceeding with the mandatory CVR check (EASA regulation (EU) No 965/2012 *Airops* __ AMC1 CAT.GEN.MPA.195(b) (a) (2)).

Required tools:

This guide is based on the use of two audio software widely used by engineers in charge of the CVR quality check tasks. It details how to use the following software tools:

- Soundforge® (Sony/Magix) / see appendix 1,
- Audacity© / see appendix 2.

Note: the method detailed in the appendices does not detect all the “pops” produced during audio perturbations but it helps the operator checking the CVR to narrow down the area of interest in the entire audio wave file and to classify the severity of the ESD popping occurrence.

ESD Phenomenon affecting the CVR recording:

In service experience showed that the audio signal of some Cockpit Area Microphones (CAM) could be severely affected by ESD occurrences (known as “ESD Popping”). This produces recurrent analogue electrical saturation and, as a result, audio clipping (with AGC system activation). The high recurrence of ESD popping can lead to the loss of useful audio content (i.e crew speech and ambient sounds). **Please report ESD popping occurrences to the aircraft manufacturer** (see in appendix 3 an example of scale of ESD pollution level).

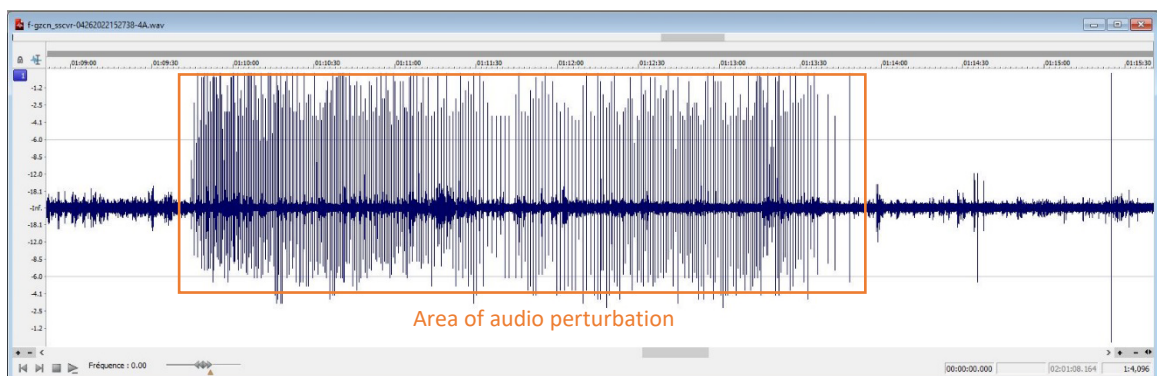


Figure 2: ESD popping occurrences on CVR CAM track

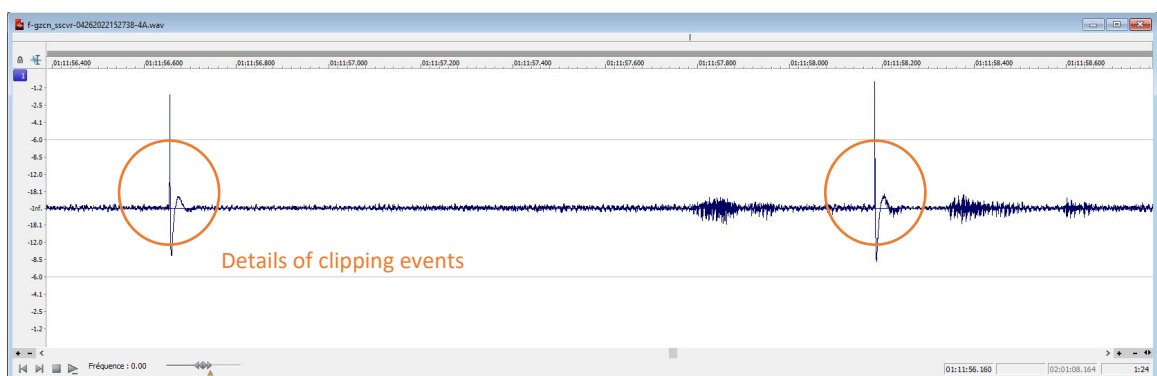
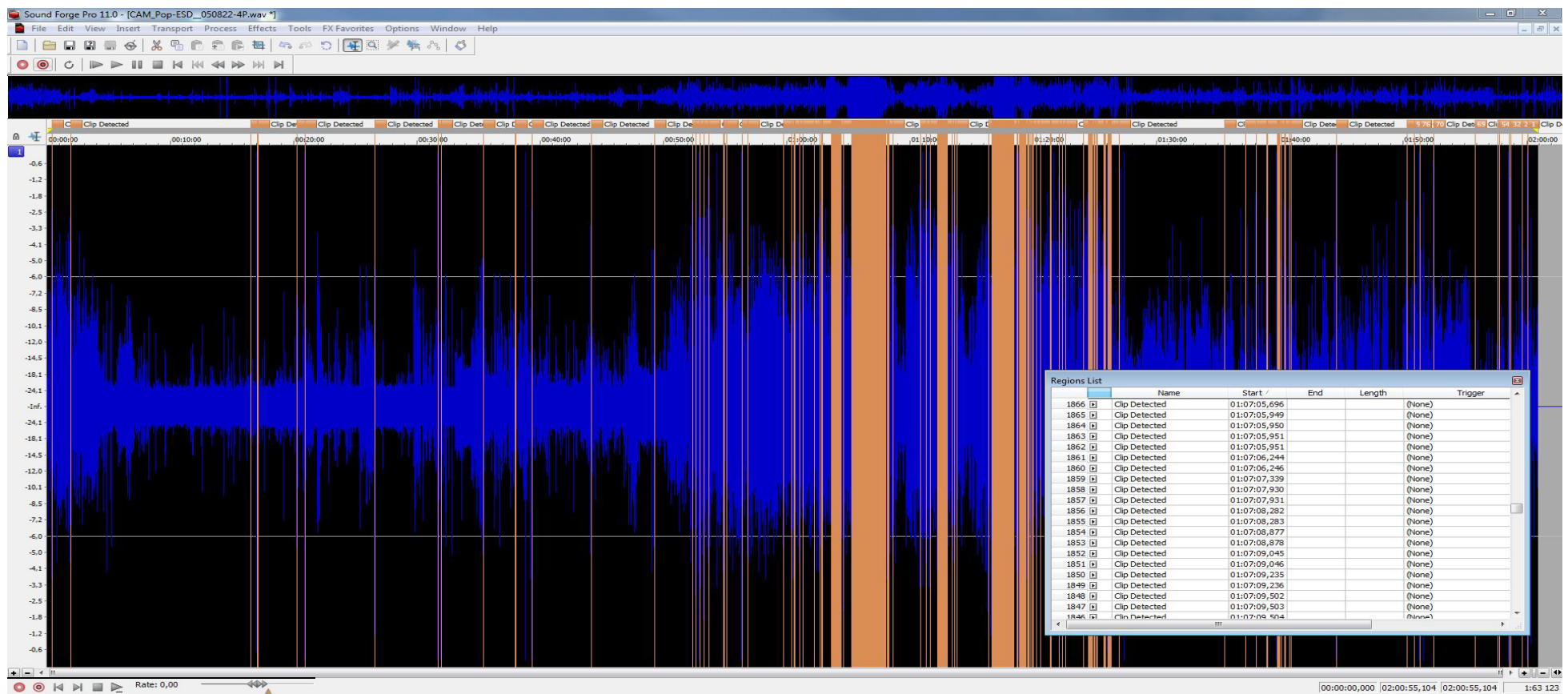


Figure 2: Focus on the "ESD popping"

Appendix 1 / Clipping detection using Soundforge® - Version Pro11¹

- 1/ Run the Sound Forge Pro11 software
- 2/ In the menu bar, select *View/Metadata/Region list* to display the region/Marker list
- 3/ Drag and drop the CAM audio file into the Sound Forge main window
- 4/ Select all the file: *Edit/Select all*
- 5/ Apply the clipping detector: *Tools/Detect Clipping* with the following settings: Threshold -12dB (25%) and clip length 3 (3 samples)²
- 6/ Markers are positioned where there is clipping. Select some of them and check by briefly listening to the audio at the marker position in order to confirm the event detected is consistent with the ESD popping phenomenon (refer to audio sample attached to this document).
- 7/ Markers can be cleared by a right click in the region windows

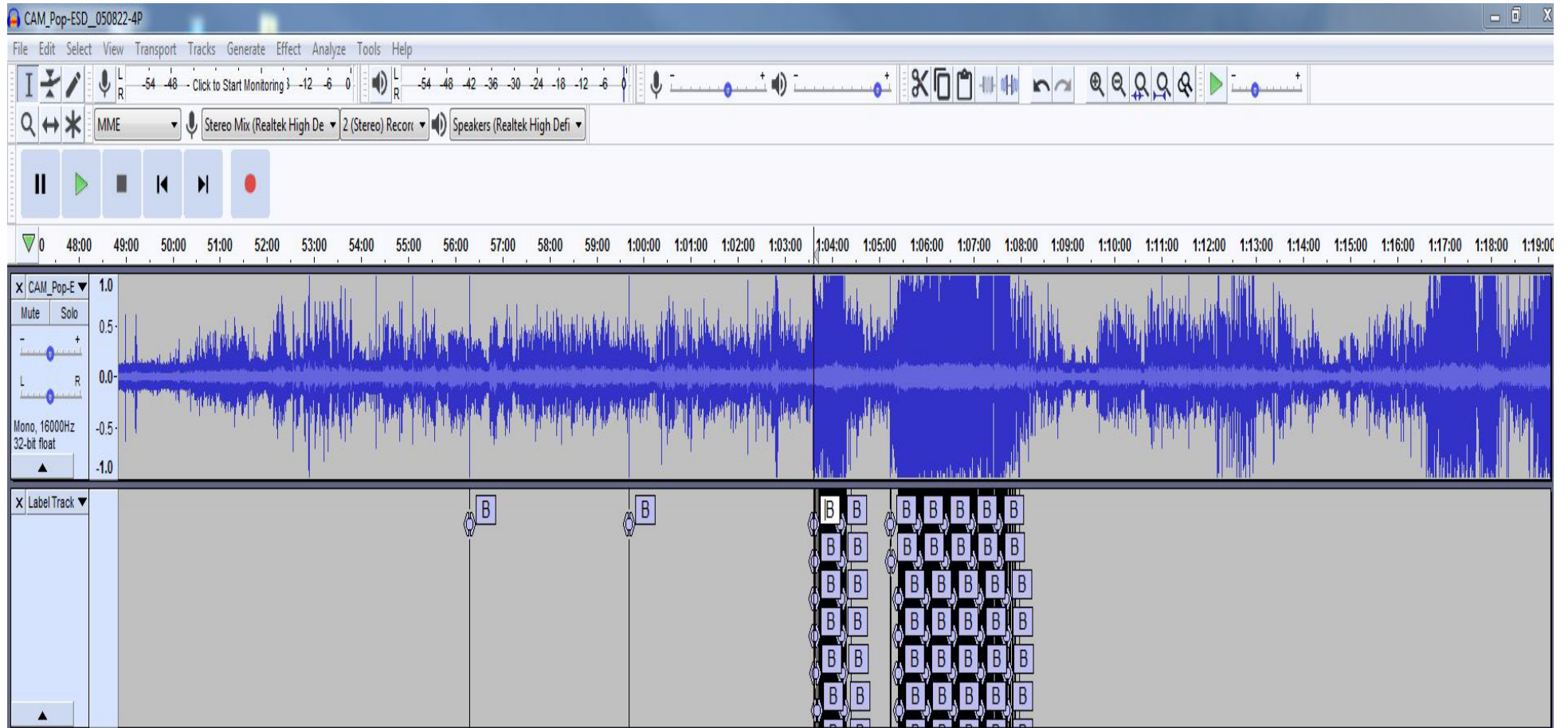


¹ <https://www.magix.com/int/music/sound-forge/sound-forge-audio-studio/>

² Be patient. It can take time for the detector to scan the entire waveform (especially with a long CVR file >2h) and create all the markers.

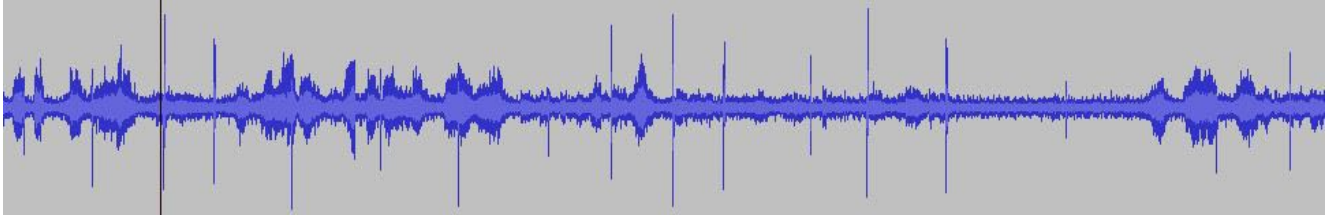
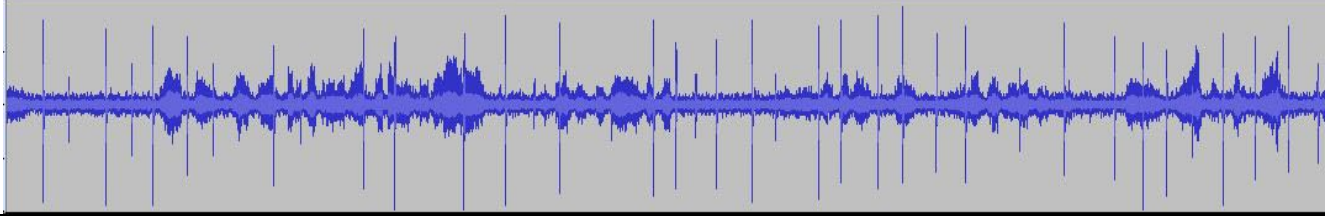
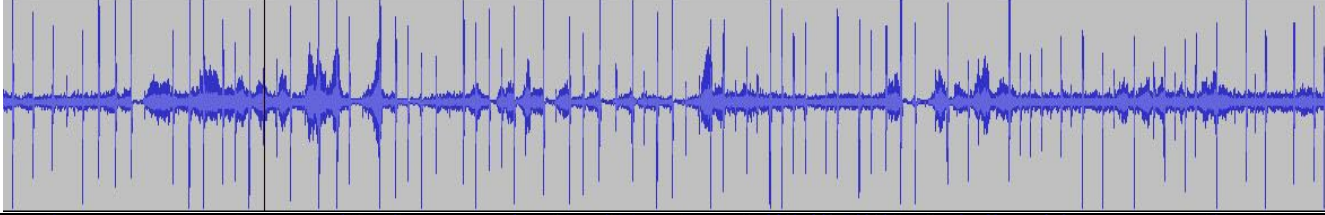
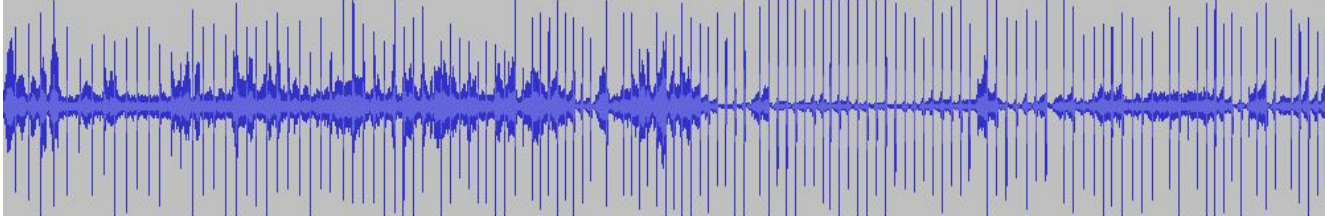
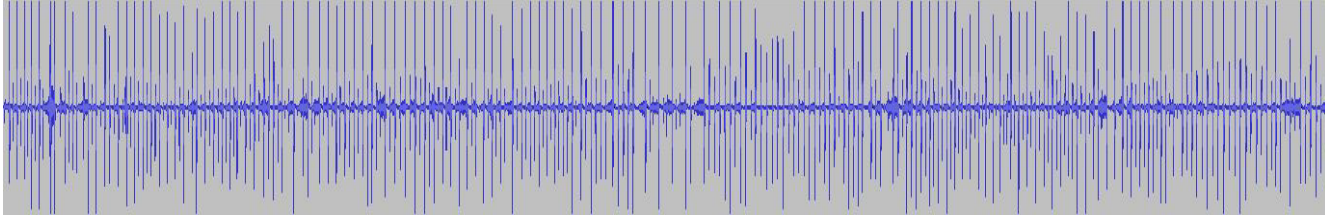
Appendix 2 / Clipping detection using Audacity© - Version 2.3.1³

- 1/ Run the Audacity software
- 2/ Drag and drop the CAM audio file into the Audacity main window (select the “*read the file directly from the original*” option if proposed)
- 3/ In the menu bar, select *Analyze/Beat Finder* with the following setting: Threshold 50%
- 4/ A Label track appears below the audio track. It contains all the markers created in the vicinity of detected “pops”
- 5/ To delete one marker, click on the marker label (labelled ‘B’ for *beat*) and suppress it. Click again on the same marker and press ‘Suppr’ on the keyboard.



³ <https://www.audacityteam.org/>

Appendix 3 / Scale of ESD popping pollution

Level of pollution	Illustration / waveform overview	Audio description / Impact on the audio analysis
Level 1		Sporadic pops / No major impact on the audio
Level 2		Recurrent pops / low level of clipping / crew speech still intelligible
Level 3		Regular pops at high recurrence / Impairs hearing and reduces the intelligibility of crew speech
Level 4		Continuous / Crew speech unintelligible
Level 5		Severe / The recurrence is so high that it disrupts the signal and totally deletes useful audio information