



**(S//SI) Open Source Signals Analysis: Not Your Grandfather's SIGINT!**

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*(S//SI) Samples of terrorists' voices can be obtained from open sources and subjected to voice and signals analysis. In the below example, a speech by Iraq-based terrorist al-Zarqawi was obtained and analyzed. (Coincidentally, al-Zarqawi was killed just this Wednesday by Coalition forces in an air strike, as widely reported in press.)*

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(U//FOUO) On 1 June 2006 the website of a UK-based Saudi dissident group, Islamic Renewal Organization, posted three audiofiles allegedly by Al'Qaida's no. 3 leader, Abu-Mus'ab al-Zarqawi (AMZ), extolling - for a change - sectarian violence.

(S//SI) Thanks to ██████████ 202A4 (Center for Digital Content), all three files were downloaded from the official website "opensource.gov", and made available for technical analysis by the S202B11 TD in one day. The tapings were unusually long, lasting some 90 minutes, 87 minutes, and 58 minutes respectively, including introductions containing music, military sound effects, and echoed mixings of the leader's voice. Once AMZ began his lectures in earnest, signal quality and integrity was excellent.

(S//SI) Mathematical voice comparison using MIT's powerful tools (see [earlier article](#) ) first involved analysis of the three tapings themselves, producing indeed a maximum-confidence match; thus the speaker in the three audiofiles claimed to be AMZ was the same.

(S//SI) Next, comparison with two older files on AMZ - one from an excellent release in early 2005 and another from a special source obtained through CT (Counterterrorism) - again produced excellent correlation with all three June 2006 tapings. To test robustness, the matching analysis was actually performed both in one-on-one and in modeling mode, the voice model being built from last week's releases.

(S//SI) There's full mathematical confirmation that indeed the speaker posted on the Islamic website early this month was Zarqawi. A language analyst familiar with AMZ's voice - ██████████ S2I05 (CT Analytic Services) - has concurred with these findings. Now, as ██████████ readily admits, speaker verification by listening is a complex and subjective art, involving recognition of intonation, dialect, and accent cues. Mathematical methods, driven by empirical models tested on large corpora, therefore serve as an independent - though not errorless - corroboration.

(S//SI) It was a matter of some interest to examine the spectra, or frequency content, of the three tapings and attempt to determine channel similarities. Short segments from each audiofile were over-sampled at 44.1 KHz CD-quality rate. The figure below displays spectral content:



(S//SI) Because of their evidently similar features, the three tapings most likely involved common set-ups; note also the retention of significant energy only below 7,500 Hz, easily achievable with a standard PC microphone. Upon closer inspection, however, a few puzzling spectral peaks were observed at higher frequencies: 9,480 Hz, 12,000 Hz, 12,909 Hz, 18,281 Hz, and 21,548 Hz. Readers are invited to submit feedback on the technical meaning of these measurements.

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