

Could Betty Have Heard Amelia Earhart on a Harmonic?

This report is excerpted and condensed from a long technical report done for TIGHAR by Bob Brandenburg, TIGHAR #2286. The entire report will soon be posted on the TIGHAR website as a Project Bulletin (www.tighar.org).

In 1937 a fifteen year old girl in St. Petersburg, Florida, heard a shortwave radio transmission from a person who identified herself as Amelia Earhart, and attempted to communicate coordinates and information that would help rescuers find her. Fascinated by this, Betty grabbed an old school notebook and jotted down what she could hear and understand of the transmissions, which continued for well over an hour.

Last October, through a friend of Betty's, TIGHAR received the original notebook, and a firestorm was ignited. The radio experts conferred and agreed that there was no possible way for a shortwave receiver in St. Petersburg to get signals during the daytime from a transmitter in the Pacific on either 3105 or 6210kHz, the two frequencies which Earhart used.

But Betty's notebook was too credible to be dismissed out of hand, so it was decided to consider alternative explanations. During that process, Mike Everette (TIGHAR #2194) and the author concurrently and independently recognized the possibility that Betty heard Amelia on a harmonic of 3105 or 6210.

The radio on which Betty heard the transmissions was a Zenith Model 1000Z, sold by Zenith during 1935-1938, and was a very capable radio with extensive shortwave coverage. This radio clearly had the sensitivity and tuning range needed for receiving signals from Gardner Island.

The required signal-to-noise ratio was set at 3 decibels for the purposes of this analysis. This SNR is half the standard 6dB level specified for just-usable operator-to-operator communication, and approximates the marginal conditions described by Betty. She recalls that the signals

were "scratchy," and that she couldn't always make out complete phrases. She compares the quality of the signals to marginal signals heard on a police scanner, breaking in through the static and then fading out.

Feasible frequencies were identified by computing the probability of achieving the required SNR on all harmonics of the crystal frequencies, and harmonics of 3105 and 6210 kHz, up to the maximum usable frequency (approximately 27MHz) over the propagation path from Gardner Island to St. Petersburg during the periods of interest. Based on power requirements and other considerations, the following four frequencies were focused on as feasible:

15525 kHz (5 x 3105 kHz)

18630 kHz (6 x 3105 kHz and 3 x 6210 kHz)

21735 kHz (7 x 3105 kHz)

24840 kHz (8 x 3105 kHz and 4 x 6210 kHz)

If Amelia transmitted on 3105 kHz, all four frequencies could be generated as harmonics of 3105 kHz in the transmitter's final power amplifier.

It is interesting to note that the final four feasible frequencies generally agree with Betty's recollection of where the tuning pointer was positioned on her radio dial.

The results of the analysis show that Betty could have heard Amelia on a harmonic. We calculated the probabilities based on the number of days and the sunspot number. As an example of the results:

For 24840 kHz on July 6 during the 1600 hour, at an assumed power level of 1 watt, there was a 16% probability that the required SNR would occur on one day out of 20. On the next day,

the probability is 1%; the sunspot number had increased from 108 to 143, indicating a higher degree of ionization in the ionosphere, with correspondingly higher signal absorption losses.

Conclusions

We were able to draw the following conclusions based on the analysis of the four frequencies above:

- 1) Betty could have heard signals from Amelia at Gardner Island on one or more harmonics, provided that the power level at the output of Amelia's transmitter was 0.1 watt or higher.
- 2) Betty's recollection of where her radio was tuned, in the general area of 18MHz to 25MHz, is consistent with the frequencies on which she could have heard Amelia.
- 3) The low probabilities of achieving the required SNR are consistent with Betty's description of the fragmentary signals that she heard.

Go to the TIGHAR website, www.tighar.org, for the full text of this report and the tables Bob generated for July 2 through July 9, detailing the analysis.