

## ***Interactive comment on “Unknown high-frequency (7–12 kHz) quasi-periodic VLF emissions observed on the ground at $L \sim 5.5$ ” by Jyrki Manninen et al.***

### **Anonymous Referee #2**

Received and published: 26 March 2018

— General comments:

This paper by Manninen et al. shows observations of previously hidden VLF emissions at a receiver located in Kannusheto, Finland at auroral latitudes ( $L \sim 5.5$ ). These new emissions at unusually high frequency ranges were hidden behind intense sferics. Manninen et al. present a method that filters the sferics and allows us to see these VLF emissions. This paper presents examples of new and interesting observations whose features are described in detail.

The "bullet" type emissions which end abruptly are particularly interesting. The evolution of the angle of arrival of the emissions shown here is also an important feature. Further research on these emissions is necessary and this paper should be published because it opens the way to the study of these previously unseen emissions.

— Specific comments:

(1) The events shown here are very interesting and even though we understand that their are recently discovered, maybe some additional discussion on their possible generation mechanism might be useful. The authors suggest that they could be related to auto-oscillation of the cyclotron instability in the magnetospheric plasma-maser but they do not discuss why they believe this would be more plausible than another option. We have QP emissions with different spectral characteristics but with a common generation mechanism. Maybe a few more lines discussing this would be helpful for the readers?

(2) The other interesting aspect of this research is the abrupt cut off of the "bullet" emissions. As the authors mention, in Fig 3a, we see that this abrupt stop of the emission is not seen for frequencies higher than 9 kHz. This suggests that the end of the emission is not the consequence of the filtering method. Although it is implied, the authors might consider mentioning this in the paper to avoid confusion. Just as the authors suggest a possible generation mechanism, could they suggest what type of process(es) might be responsible for this?

(3) Lines 80-83: Do the authors have any explanation why the second set of "bullets" is only observed at lower frequencies? Is this the case for the other cases not mentioned in this paper?

(4) Lines 113-115: Would it be possible to discuss on the size of the ionospheric exit points of the waves and if it can be related to any of the characteristics observed here?

— Technical corrections:

The authors may want to consider their usage of "the" in several sentences through out the manuscript (line 21, 33, 38, 46, 56 for example).

Line 61: hided → hid

Line 99: ... is really steep in the time scale of several seconds

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Line 132: frequency → frequencies

Line 142: explained → explaining

References to Nemeč et al. have a formatting error with the accent.

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