The revised manuscript is a step forward from the previous version. There is still room for improvement in the more technical parts, which constitute the bulk of the manuscripts, but these are now in a relatively good state. On the other hand, the original problems in the overall and introductory parts largely remain. This review is limited to those broader issues. Both this and the original manuscript give the impression that a more careful discussion and internal review involving all co-authors would be helpful, and that the details are left for such a process.

- To denote the measurements of concern, "operational" was questioned. The authors seem to use this term to mean field observations. This deviates from the general meaning inside the research area (as summarized by Google Gemini): "In the context of atmospheric science and meteorology, operational measurements refer to the routine, systematic, and continuous observation of the atmosphere to support real-time decision-making, such as weather forecasting, aviation safety, and public warnings." In contrast to this, the manuscript describes the measurements performed as being from a "test campaign" with a "breadboard setup".
- There is a similar consideration regarding whether the radiometer should be termed "fully polarimetric". I now understand that the instrument can be considered fully polarimetric in a lab setting, but for us readers, the phrase still gives the impression that the observations yield all four Stokes components (in a manner related to an atmospheric coordinate system). In fact, text in the Introduction points in the same direction, that it is the outcome of the final observations that matters: "However, passive observations of all four Stokes components simultaneously have not yet been reported in the millimeter-wave range."
- That is, by using the terms "operational" and "fully polarimetric" as done, an incorrect impression of the extent and use of the measurements is created. It is an unnecessary exaggeration; the actual achievements are sufficient to merit a publication. It is better to save these wordings for later publications. Accordingly, there is a strong suggestion to change the title and revise wordings in the text. For further clarity in the title, it is also suggested to change "radiometer" to "ground-based radiometer".
- The abstract was not raised in the initial review, but it is now noted that the abstract is not very specific. At least some conclusions and/or quantitative results should be added to, e.g., clarify the "the advantages of the fully polarimetric approach".
- The introduction is still far from arranged in a logical order. For example, it starts by listing some applications, switches to define fully polarimetric, makes some special notes about circular polarization (which are not relevant at this point), and then goes back to an application (ocean wind vector). The same paragraph also reviews polarimetric measurements of microwave oxygen transitions. That is, the first paragraph covers three-four subjects. This

information needs to be organized more clearly.
In addition, the scope of the text must be clear. For example, the extent of the review of polarized measurements is not clearly stated, but it can be taken as a complete review of older fully polarimetric measurements. This should be far from the case. Two examples from a very quick (incomplete) search:

- ◦ Lahtinen, J., Pihlflyckt, J., Mononen, I., Tauriainen, S. J., Kemppinen, M., & Hallikainen, M. T. (2003). Fully polarimetric microwave radiometer for remote sensing. *IEEE Transactions on Geoscience and Remote Sensing*, *41*(8), 1869-1878.
  ◦ Xie, X., Löhnert, U., Kneifel, S., & Crewell, S. (2012). Snow particle orientation observed by ground-based microwave radiometry. *Journal of Geophysical Research: Atmospheres*, *117*(D2).
- Section 2, first, it is just a review (it does not present any theory; it merely refers to other articles) and could be incorporated into the Introduction (see also the next comment). The title of the section is "Zeeman effect in atmospheric oxygen". This title hints at a focus on theoretical work, but it is rather about observations. Anyhow, the text should use a broader choice of references. The work around both MLSs is lacking, as is the one by Juan Ramon Pardo. To be clear, single-polarization measurements are relevant because they must account for the Zeeman effect and its associated polarization effects.
- As indicated in the comments above on Sec. 2, there is a tendency to create full sections on relatively narrow issues. As a result, there are eleven sections. The material should be organized in a more standard fashion, which would help the reader know whether a section presents, for example, theory, methodology, or results.
- Figure 2/4: An incorrect order of figures was pointed out, and the response says that it would be corrected. Changes have been made, but in the wrong way. The figure cited at the start of Sec 4 is called Fig. 2. This is the correct numbering, but the figure of concern is in fact Fig. 4. It is also noted that the figure caption is incorrect. The figure covers both the front- and back-end, not just the front-end as stated. (To clarify a comment in the introductory paragraph: It is fully reasonable to expect that both these problems should have been identified by any of the co-authors.)