The submitted paper presents the design of reflectarrays for the synthesis of broadside, tilted, and flat-top patterns. The reflectarrays operate at 8.5 GHz focusing on MEO satellites. The topic is of interest to most readers of Sensors, but many parts of the manuscript need improvement before publication. Some comments are listed below to improve the quality of the paper.

Thank you for your comments

Reviewer comment 1 Please try to improve the resolution of Figures 1 and 2.

Authors Reply: The two figures are replaced with a better quality ones. However, it is noted that the regenerated machine copy of the manuscript affect all figures resolution and that is very clear when comparing to the original copy. This issue has been escalated to the editor. Thank you for your comment.

Reviewer comment 2 Please check the expression for *v* in line 116.

Authors Reply: The expression is checked, due to miss print error, v is corrected in line 116 (122 in the new version) to be $v = sin\ \theta \sin \varphi + \beta_y$.

Reviewer comment 3 Please check if equation (1) is an array factor for an array of *M*x*N* elements as stated in line 113.

Authors Reply: The equation corrected, the array factor for an array of *M-1*x*N-1* elements as follows

$$AF(\theta,\varphi) = \sum_{m=0}^{M-1}\sum_{n=0}^{N-1} \mathrm{A}_{m,n}\, e^{jk(md_x u + nd_y v)}$$

Reviewer comment 4 Please check if the phase shifts beta_*x* and beta_*y* are multiplied by *k* in equation (1).

Authors Reply: β_x and β_y are corrected to be $\beta_x = -\sin\theta_o \cos\varphi_o$ and $\beta_y = -\sin\theta_o \sin\varphi_o$ while $u = sin\,\theta\, cos\,\varphi + \beta_x$ and $v = sin\,\theta\, sin\,\varphi + \beta_y$. Thus, the multiplication by *k* is adjusted.

Reviewer comment 5 Please check equation (4) because it seems to present a dimensional problem. In addition, is the variable *N* the same as used in equation (1)?

Authors Reply: The propagation constant k has a dimension 1/L while, the length $r_{m,n}$ has a dimension of L and the $\vec{R}.\hat{r_o}$ is the dot product of the vector $\vec{R}$ of dimension L with the unit vector $\hat{r_o}$ which is dimensionless. Thus, $\vec{R}.\hat{r_o}$ has also a dimension L. Thus $\left(r_{m,n} - \vec{R}.\hat{r_o}\right)$ has a dimension L and $k\left(r_{m,n} - \vec{R}.\hat{r_o}\right)$ is dimension less. Thus, the dimensions of Eq. (4) are correct.

Reviewer comment 6 Is the distance between the reflector and active dipoles of the Yagi in Figure 2 also equal to d_s?

Authors Reply: Yes, the distance between the reflector and active dipoles of the Yagi d_s as stated in line 146 (152 in the new manuscript).

Reviewer comment 7 The authors should describe the EM technique/software used to carry out the design of the Yagi-Uda antenna as well as the criteria employed in the design (for example, return loss, gain, front-to-back ratio, etc.).

Authors Reply: - The EM technique/software used is Finite Element Method FEM by the commercially EM simulation software HFSS. This has been added to section 3.

The following part is modified as follows:

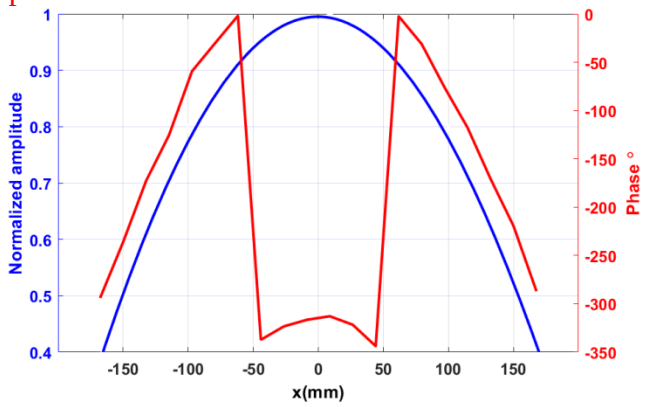
The proposed Yagi-Uda antenna is simulated by using HFSS. Parametric studies are performed through EM simulation for setting the optimum values of the dimensional parameters of X −band Yagi–Uda antenna at the operating frequency 8.5 GHz. The required performances of the feeding antenna of the reflectarray in the present case are basically the input matching is below -10 dB and forward to backward radiation is more than 10 dB.

Reviewer comment 8 Please check "is obtained in –ve z direction" in line 155.

Authors Reply: yes, as shown in figure 2(c) the peak gain at $\theta = -180°$.

Reviewer comment 9 Why the maximum normalized amplitude in Figure 3(b) is not equal to 1?

-**Authors Reply:** Thank you for your valuable comment. Sorry for unintentional mistake, We have modified the normalized amplitude. So, the maximum is equal to 1. The modified figure is replaced in the manuscript.



Reviewer comment 10 The phase in Figure 3(b) is correspondent to the x component of the electric field?

Authors Reply: Yes, along this line the transverse field is x-component only. Thus, the phase in Fig. (b) is the phase of the x-component.

Reviewer comment 11 The authors should clarify how the graphs in Figure 4 were computed. They state in line 203 they used an analytical technique, but it is not clear which one was employed.

Authors Reply: As stated in line 189 and 190 (199-200) (total phase distribution on the aperture of the reflectarray antenna can be obtained analytically as mentioned in Eq. (4)).

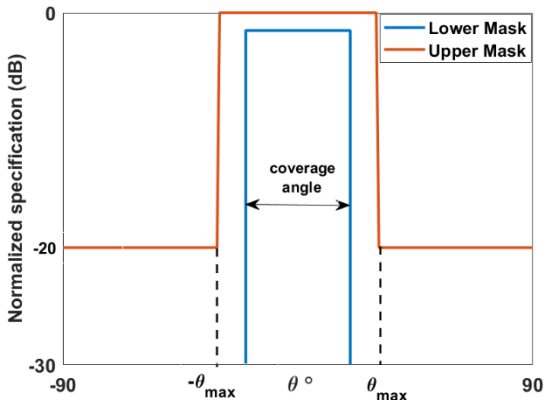
Reviewer comment 12 Can the constant power illumination mentioned in line 210 be obtained with a flat-top or cosecant-squared pattern? A better explanation should be given to justify the flat-top pattern.

Authors Reply: Thank you for your notice. We removed this irrelevant explanation and replacing it with the following sentence in line 219- 210.

"To obtain nearly constant communication link along the coverage angle, it would be required to use an antenna with a flat-top pattern."

Reviewer comment: 13) Please check the legend of Figure 6. The colors of upper and lower masks seem to be changed.

Authors Reply: Thank you for your notice. Sorry for unintentional mistake, we checked the legend and replace it with the correct one as shown in the figure 6.



Reviewer comment: 14) Check the lower mask defined in equation (9). It is not clear the value 10^-6 in comparison to Figure 6.

Authors Reply: Thank you for your observation. We corrected equation (6) to meet the condition of lower mask presented in Figure 6.

$$Mask_l(\theta_i)_{dB} = \begin{cases} < -30 & \theta_i \geq \theta_{max} - \Delta\theta \\ ARL & -\theta_{max} + \Delta\theta \leq \theta_i \leq \theta_{max} - \Delta\theta \\ < -30 & \theta_i \leq -\theta_{max} + \Delta\theta \end{cases} \quad (9)$$

Reviewer comment: 15) The functions (11) and (12) used to compute the cost function have the array factor, which can be a complex number. Is there any advantage to this choice? The use of the absolute value of the array factor, which is directly related to the radiation pattern, could be an option?

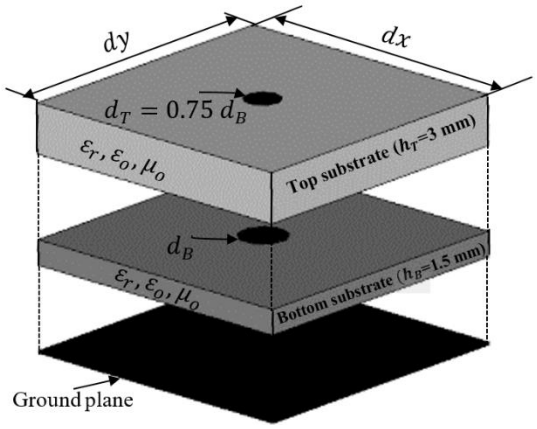
Authors Reply: The $AF(\theta_i)_{dB} = 20\log(|AF(\theta_i)|)$ is a real value. The definition of $AF(\theta_i)_{dB}$ is added into the text.

Reviewer comment: 16) Lines 204 to 206 state that the phase distribution of the broadside pencil beam can be considered as a good starting point for the proposed optimization process. It is not clear how can this phase distribution be used in a Genetic Algorithm. Is this phase distribution set as a chromosome of the first generation?

Authors Reply: Yes the phase distribution of the broadside pencil beam is considered as a chromosome of the first generation for Genetic Algorithm.

Reviewer comment: 17) Please try to improve the resolution of Figure 11.

Authors Reply: The figure is replaced with a higher quality figure however the same reason mentioned in comment 1.

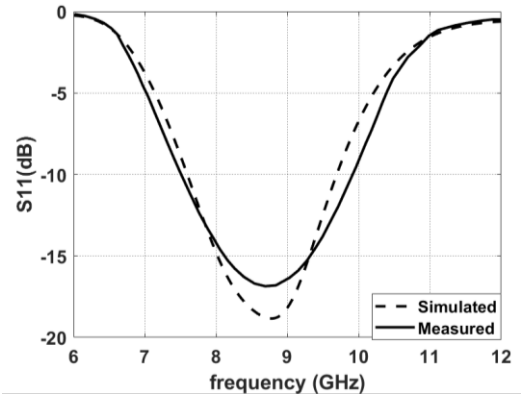


Reviewer comment: 18) The computation of Figure 12 must be explained in more detail. For example, it was not mentioned if the plane wave was incident perpendicular to the unit cell.

Authors Reply: Yes, for the analysis of most reflectarray antennas, the unit cell is studied for Normal incident

Reviewer comment: 19) Instead of showing Figure 18, it is better to present a graph containing the simulated and measured reflection coefficient magnitudes. The picture of the network analyzer screen is not appropriate to read numerical data.

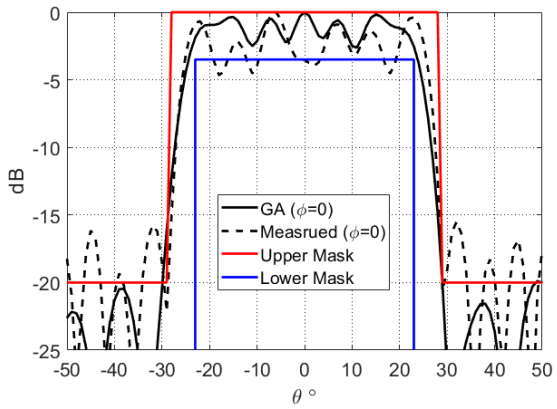
Authors Reply: Thank you for your comment, we adding Figure 18.c representing the simulated and measured magnitude of the reflection coefficient.



Reviewer comment: 20) Why does the normalized measured pattern in Figure 21 not reach the 0 dB value? Is it a pattern for the total field or a specific component (theta, phi)?

Authors Reply:

Thank you for your observation and sorry for this unintentional mistake, the pattern is for the total field component. The normalized measured pattern shown below is replaced in the manuscript.



Reviewer comment: 21) It is not clear whether Figure 22 shows a simulated or measured pattern (since StarLab was used)?

Authors Reply: It is the measured pattern.

Reviewer comment: 22) The literature review in the Introduction must be expanded to explain the new contributions brought by the paper. If possible, try to present a Table to compare the features of the proposed design with those found in previous references.

Authors Reply:

Thank you for your valuable comment. We have modified our manuscript to focus more on this point by adding the following sentences added between lines 83 and 88.

In this paper, GA is chosen to optimize the phases of the reflecting elements for obtaining a Flat-top radiation pattern with a beam width around 29°, side lobe level (SLL) less than -20 dB and allowable ripple level (ARL) around -3 dB. The contribution is to optimize these phases to reach the desired performance of optimized Flat-top pattern for MEO system.