Paper Title

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Abstract—Please include a brief abstract here. The abstract should be limited to 50–200 words and should concisely state what was done, how it was done, principal results, and their significance.

I. INTRODUCTION

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The template is designed so that author affiliations are not repeated each time for multiple authors of the same affiliation. Please keep your affiliations as succinct as possible (for example, do not differentiate among departments of the same organization). This template was designed for two affiliations, but can be customized for fewer or more as described below.

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B. Headings

Primary section headings within the paper are enumerated by Roman numerals and are centered above the text. Secondary section headings are enumerated by capital letters followed by periods ("A.", "B.", etc.) and are flush left above their sections. The first letter of each word is capitalized. Tertiary section headings are enumerated by Arabic numerals followed by a parenthesis. They are indented, run into the text in their sections, and are followed by a colon.

C. Equations

All equations should be labeled in consecutive numerical order. Equation numbers, within parentheses, should be aligned on the right side of the column, as in (1), using a right tab stop. Punctuate equations with commas or periods when they are part of a sentence, as in

$$\alpha + \beta = \chi. \tag{1}$$

Note that the equation is centered using a center tab stop. Be sure that the symbols in your equation have been defined before or immediately following the equation. Use "(1)", not "Eq. (1)" or "equation (1)", except at the beginning of a sentence: "Equation (1) is . . ."

D. Figures and Tables

Place each figure and table within the width of a single column, as in Fig. 1 and Table I below. Large figures and tables may span across both columns. Figure captions are below the figures. Table headings appear above the tables (note the capitalization). Insert figures and tables after they are cited in the text. It is helpful to the reader if your captions, when read in succession, form a quick summary of your paper so as to attract the interest of your target audience. Make sure your graphs and figures still make sense when printed entirely in black and white. If possible, it is preferred to label multiple curves directly rather than using tiny data markers and including a complicated legend look-up table. Make sure you use san-serif fonts large enough to be read easily when printed. Do not reference figures as "Figure 1" or "Fig-1".

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Fig. 1. Example of a figure caption.

TABLE I. EXAMPLE OF A TABLE HEADING.

| Table Head | Table Column Head | | |
|---------------|------------------------------|---------|---------|
| | Table column subhead | Subhead | Subhead |
| copy | More table copy ^a | | |

A sample of a Table footnote.

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Always define technical abbreviations and acronyms the first time you use them in the text, no matter how simple they are, even if you have already defined them in the abstract. Abbreviations such as "e.g." and "i.e." are used without definition, but don't forget that "e.g." means "for example" and "i.e." means "in other words". Do not confuse the two. Do not define (or re-define!) standard IEEE abbreviations for units.

F. Units and Numbers

The International System of Units (SI units) is used in IEEE publications. Unit symbols should be used with measured quantities, e.g., 1 mm, but not when unit names are used in text without quantities, e.g., "a few millimeters." Use a zero before decimal points: "0.25", not ".25". Include a space between the number and the unit label when used as a noun. Replace the space with a hyphen when used as an adjective. For example, "The 10-GHz antennas now operate at 9.8 GHz." The hyphen

makes it clear that we are specifying frequency and not the number of antennas.

G. References

All references should be labeled in consecutive numerical order [1]–[3]. When citing references within the text, refer simply to the reference number enclosed by square brackets, as in [1]. Do not use "Ref. [1]" or "reference [1]" except at the beginning of a sentence: "Reference [1] was the first..." Note that an "en-dash", not a hyphen, should be used between numbers to indicate a range of numbers, as in the beginning of this paragraph. For example, write "pp. 1–4", not "pp. 1-4". Note the space between "pp." and the page numbers.

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ACKNOWLEDGEMENT

An acknowledgement statement, if applicable, goes here. This section head is not numbered and is always singular, i.e., never "Acknowledgements".

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