COMPOSITE TRIPLE BEAT REDUCTION USING THE GOLOMB RULER

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Abstract

The composite triple beat is all the discrete third order intermodulation distotions (IMD_3) produced at a channel or around a carrier when two or more signals are input to a device or system with non-linearity. The composite triple beat that fall directly onto the channels designated for use can limit the performance of the radio-over-fiber system as they suppress or interfere destructively with carriers that reside in these channels. Arranging the channels to be used in accordance to the Golomb Ruler's marks was found to reduce the composite triple beat, generated by an optical system employing intensity modulation, that fell directly onto these channels as compared to positioning them in equidistant based on a simple experiment performed involving 14 used channels. The decrease in CTB levels led to CTB reduction factor of above 0dB and decrease in carrier suppression.

Key Words

Composite triple beat reduction, Golomb Ruler

1. Introduction

The composite triple beat (CTB) is a limitation encountered in the radio-over-fiber system that employs intensity modulation of the laser. It is the total two- and three-tone third order intermodulation distortions that are produced around a carrier or at a channel when two or more signals are input to a device or system that with non-linearity. The CTB produced depends on which channels within a bandwidth are used or the channel placing utilised. In other words, the frequency employed or frequency planning affects the CTB generated. The channels designated for use will be assigned a carrier. The CTB that appears outside the bandwidth of interest or unused channels could be removed by filtering. However, the CTB also has the possibility of falling directly onto the channels designated for use, especially when they are spaced in equidistant [1]. The used channels residing in the middle of the bandwidth specified are the channels most affected by the CTB [1].

Distributing the carriers in a nonequidistant manner or in such a way the intermodulation distortion (IMD) do not fall back on the carrier frequencies was suggested as an alternative to minimise the IMD for low cost fiber optic links intended to serve as cellular remote antenna feeding [2]. The carrier distribution in accordance with the Golomb Ruler, which would lead to high bandwidth, could be one way of arranging the carriers in a nonequidistant manner that guarantees no IMD would fall at the carrier positions [2]. The Golomb Ruler is made up of marks that are positioned in a way the distances between any pair of the marks are different[3], [4], as in Fig.1. The first mark is placed at the leftmost referred to as integer value 0 [3]. The goal of the Golomb Ruler is to have as many marks as possible for a given length or achieve the shortest ruler possible known as the Optimum Golomb Ruler (OGR) [3], [4]. The number of channels designated for use in a channel placing corresponds to the number of marks on the Golomb Ruler. The total number of channels that the bandwidth can accommodate relates to the length of the Golomb Ruler. A simulation performed in [5] indicated that arranging the used channels according to the Golomb Ruler's marks caused the CTB to appear only in the unused channels and this led to the significant improvement in CTB reduction in the used channels as compared to arranging them in equidistant.

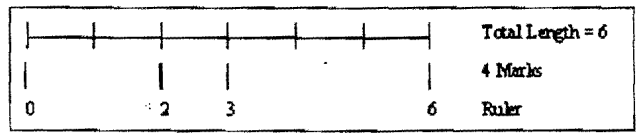

Fig. 1. Golomb Ruler.