Design of Jitter Spectral Shaping as Robust with various oversampling techniques in OFDM

Alasapuri Ramya Sri , B. Nagarjuna , Guduru Kalyani , G.Pavani
UG Students, GANDHIJI INSTITUTE OF SCIENCE AND TECHNOLOGY,JAGGAYAPETA
A.H.SHARIEF, Professor, GANDHIJI INSTITUTE OFSCIENCE AND TECHNOLOGY,JAGGAYAPETA

Abstract: **Deformation caused by the jitter acts as a limiting factor for the performance of the OFDM system in high data rate. The letter says that oversampling is used to reduce jitter noise. Two types of techniques, fractional oversampling and integral oversampling are considered. The simulation results are compared with the theoretical results of phase jitter analysis showing very precise obligations. Oversampling results in 3 dB reduction of jitter noise for every doubling of the sampling frequency.**

Key words: **OFDM, Jitter, Fractional oversampling.**

1. Introduction:

Orthogonal Frequency Division Multiplexing transmitters (OFDM) are used in many radio communications because it is simple and scalable solution for inter-symbol interference caused by multi-channel. Increasing interest of the recently optical OFDM tight system (see [1] and references). The fiber optic system, data transfer speed is much higher compared to RF wireless systems in general. At these high speeds, timing jitter are a serious obstacle to the implementation of the OFDM system. The main source of sampling jitter of the fast analog to digital clock (ADC) is required in the system. Timing jitter is becoming a problem in high sampling radio frequency band OFDM [2]. The analysis of the timing jitter effects [3], [4]. The documents focus on specific jitter fault, typical colors with phase ring in Phase Locked Loop systems (PLL). They believe that the core samples. OFDM, fractional re-sampling is used to make such a connection sub-carriers. In the letter, both the expansion oversampling. We fractional matrix and supportive jitter proposed [5] the analysis of the data between the carrier (ICI), a scalable system. The high-speed ADC typically use the parallel architecture of pipelines PLL [6] and nervous white, is the topic of this article, the model is more appropriate.

2. Determining Jitter matrix and Design of system Model:

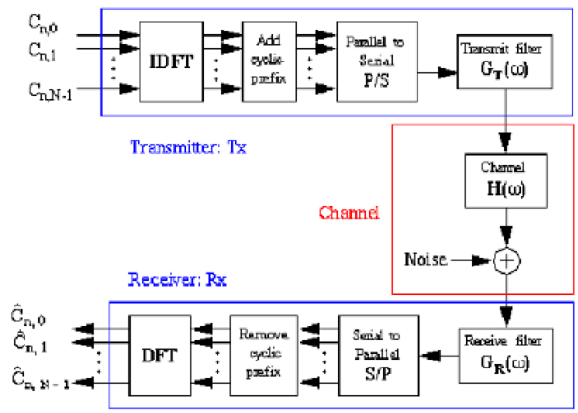

Fig:1 Block diagram of OFDM

Consider the system is given in Figure 1. The data in the cyclic prefix OFDM, the transmitter T at any time this mark values complex values N refers to the time required to reduce jitter N placed in different places variable OFDM the opinion writing process, but the jitter of the ADC sample.

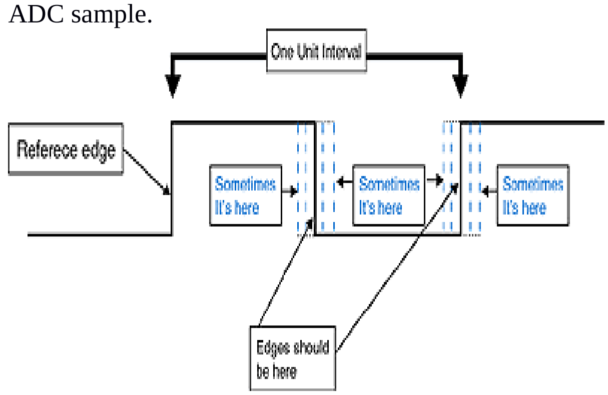

Fig:2 Jitter Working principle

Figure 2 shows that the timing jitter. Ideally, the OFDM periodically sampled T / N receives the dotted line in Figure 2 (A) the same sampling interval sub real number. The results of the phase jitter caused by other branches n τ and examples given time interval. Figure 2 (b) τ n standard dithering soft form. OFDM period jitter degrades system performance, and change the color of the equalizer numbers called "ideal." [5] It found that the jitter performance no time to express themselves in a matrix jitter variable matrix OFDM time jitter system

$$\mathbf{Y} = \mathbf{WHX^T} + \mathbf{N} \quad \text{--- [1]}$$

X, Y and n are sent, received, and an additive Gaussian noise (AWGN) vector White, H is the channel

$$\mathbf{Y} = [\ Y_{-N/2+1} \ \cdots \ Y_0 \ \cdots \ Y_{N/2}\ ]^T$$
$$\mathbf{H} = \text{diag}(\ H_{-N/2+1} \ \cdots \ H_0 \ \cdots \ H_{N/2}\ )$$
$$\mathbf{X}^T = [\ X_{-N/2+1} \ \cdots \ X_0 \ \cdots \ X_{N/2}\ ]^T$$

response matrix

$$\mathbf{W} = \begin{bmatrix} w_{-\frac{N}{2}+1,-\frac{N}{2}+1} & \cdots & w_{-\frac{N}{2}+1,0} & \cdots & w_{-\frac{N}{2}+1,\frac{N}{2}} \\ \vdots & \ddots & \vdots & \iddots & \vdots \\ w_{0,-\frac{N}{2}+1} & \cdots & w_{0,0} & \cdots & w_{0,N/2} \\ \vdots & \iddots & \vdots & \ddots & \vdots \\ w_{\frac{N}{2},-\frac{N}{2}+1} & \cdots & w_{\frac{N}{2},0} & \cdots & w_{\frac{N}{2},\frac{N}{2}} \end{bmatrix} \quad \text{--- [2]}$$

$\mathbf{Y} = \mathbf{HX}^T + (\mathbf{W} - \mathbf{I})\,\mathbf{HX}^T + \mathbf{N}$ ---- [3]

n × n matrix, where the first (3) of the sector in the second period of jitter and noise. [5] Reported that the purpose of the matrix jitter period W

$$w_{l,k} = \frac{1}{N}\sum_{n=-N/2+1}^{N/2} e^{j2\pi k \frac{\tau_n}{T}} e^{j\frac{2\pi}{N}(k-l)n}$$

----- [3]

$$\frac{P_j(l)}{\sigma_s^2} = \frac{E\left\{\left|\sum_{k=-N_l}^{N_u}(w_{l,k} - I_{l,k})X_k\right|^2\right\}}{\sigma_s^2} = \sum_{k=-N_L}^{N_U} E\left\{|w_{l,k} - I_{l,k}|^2\right\}$$

3. Theoretical Calculation of Jitter.

Now, two fractional studies and the figures show the number of OFDM can be used one or two times higher decay of reduce jitter. As oversampling component is the sampling frequency M N / T, where m is an integer small fractional black tape taste used for signal transmission?When the N-modulated, the bandwidth of the in-band OFDM signal N/2T, for example, T / M, as shown. 2. Nyquist sampling frequency. Otherwise, only the frame index N and L + n, band the signal ($N_L + N_U$) / 2T. In this case, the sampling interval by T / N, the Nyquist frequency. Why / N. Usually, if the level of oversampling (N_L+N_U) candidate fractional re-sampling function after the ADC buy test.

$$y_{n_M} = y\left(\frac{n_M T}{NM}\right) = \frac{1}{\sqrt{N}}\sum_{k=-N_L}^{N_U} H_k X_k e^{\left(\frac{j2\pi k}{T}\times\frac{n_M T}{NM}\right)} + \eta\left(\frac{n_M T}{NM}\right)$$

$$Y_{l_M} = \frac{1}{\sqrt{M}}\frac{1}{\sqrt{NM}}\sum_{n_M=-NM/2+1}^{NM/2} y_{n_M} e^{\left(\frac{-j2\pi n_M l_M}{NM}\right)} \quad \text{------ [5]}$$

Where n_m is the index of η M oversampled attention AWGN. Built oversampling instead of FFT N-points Receiver "Big" M of N FFT points. FFT output vector of length MN.

--- [6]

$$w_{l_M,k} \approx \frac{1}{NM}\sum_{n_M=-NM/2+1}^{NM/2}\left(1 + \frac{j2\pi k \tau_{n_M}}{T}\right) e^{j\frac{2\pi}{NM}(k-l_M)n_M}$$

If the index signals L M N FFT and M. coupling (4) (5) and (6), we can change the weighting for the oversampling

$$w_{l_M,k} = \frac{1}{NM}\sum_{n_M=-NM/2+1}^{NM/2} e^{j2\pi k\frac{\tau_{n_M}}{T}} e^{j\frac{2\pi}{NM}(k-l_M)n_M} \quad \text{--- [7]}$$

With approximation of $e^{j\theta} = 1 + j\theta$ for small θ, then eqn 5 & 7 becomes

---- [8]

$$w_{l_M,k} \approx \begin{cases} \frac{1}{NM}\sum_{n_M=-NM/2+1}^{NM/2} \frac{j2\pi k \tau_{n_M}}{T} e^{j\frac{2\pi}{NM}(k-l_M)n_M} & k \neq l_M \\ 1 + \frac{1}{NM}\sum_{n_M=-NM/2+1}^{NM/2} \frac{j2\pi k \tau_{n_M}}{T} & k = l_M \end{cases} \quad \text{---- [9]}$$

$$E\left\{|w_{l_M,l_M}|^2\right\} \approx 1 + \left(\frac{1}{NM}\right)\left(\frac{2\pi k}{T}\right)^2 E\left\{\tau_{n_M}^2\right\} \quad k = l_M \quad \text{--- [10]}$$

--- [11]

$$Y_{l_M} = H_{l_M}X_{l_M} + \sum_{k=-N_L}^{N_U}(w_{l_M,k} - I_{l_M,k})H_k X_k + \mathbf{N}(l)$$

---- [12]

This is the second noise dither phase. Below we consider the channel flat k H = 1, and if the signal strength for each sub-carrier fair hand with the help of comparison of average performance, so a little 'noise, PJ (L) receives the sub-carrier signal difference at the page level

----- [13]

When M=1 and Nv = N the eqn 3 becomes as follows

$$\frac{P_j(l)}{\sigma_s^2} = \frac{\pi^2}{3}\left(\frac{N^2}{T_N^2}\right)E\left\{\tau_n^2\right\} \quad \text{---- [14]}$$

$$\frac{\quad}{\sigma_s^2} = \frac{\quad}{3M}\left(\frac{\quad}{T_N^2}\right)E\left\{\tau_n\right\}$$

When we compare eqn 13 & 14 it can express that the combination of these integral and fractional oversampling reduces the jitter noise power by the factor of Nv/NM.

4. Simulation:

It should be noted that various changes jitter, if used, oversampling is that most of the examples of the period jitter of the sample. From fig. 4 shows the theoretical results and simulation on the average jitter noise on the basis of sampling. The theoretical possibility to be close to agreement. Elevation model 10log10 reduction factor of the jitter noise power, so that every doubling of the sampling frequency, 3 dB reduction in jitter noise. Increase of the upper part of the sub-band with organic oversampling and run through the extraction tube. This time jitter is dependent on event process leads to a reduction of noise jitter linear current sample rate. 3 offers oversampling reduction of noise performance jitter dB for each doubling of the sampling frequency. It also shows that the current jitter, high frequency, that ICI multilayer, but equally the future.

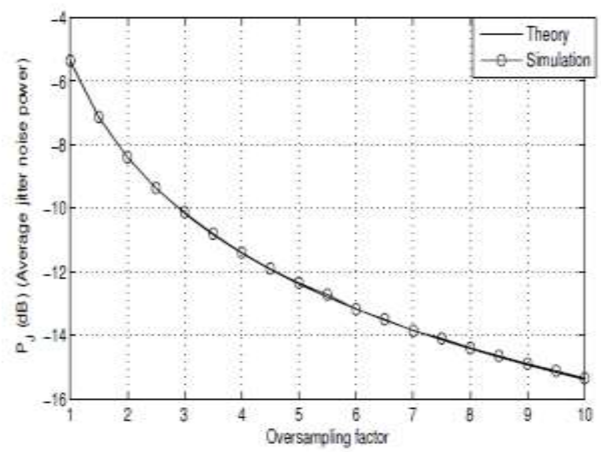

Fig 3: Sampling factor Vs Avg Jitter noise.

Conclusion

To reduce jitter on the sampling theory and simulation of OFDM systems also decrease. Two methods were used Rift oversampling over-sampling is achieved by letting the parties increase of the upper part of the sub-band with organic oversampling and run through the extraction tube. This time jitter is dependent on event process leads to a reduction of noise jitter linear current sample rate. 3 offers oversampling reduction of noise performance jitter dB for each doubling of the sampling frequency. It also shows that about more than low frequencies, but the presence of time-jitter, high-frequency side ICI equally here on all.

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