EXAR

Ap Note – How the Jitter Transfer Characteristics of the XRT71D00 DS3/E3/STS-1 Jitter Attenuator IC compares with the Jitter Transfer Characteristic requirements of Bellcore GR-499-CORE

TAN-048 – AP NOTE – HOW THE JITTER TRANSFER CHARACTERISTICS OF THE XRT71D00 DS3/E3/STS-1 JITTER ATTENUATOR IC COMPARES WITH THE JITTER TRANSFER CHARACTERISTIC REQUIREMENTS OF BELLCORE GR-499-CORE

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INTRODUCTION

The purpose of this Applications Note is two-fold.

1. To present the Jitter Transfer Characteristics of the XRT71D00 device, for DS3 Applications, and
2. To illustrate how these Jitter Transfer Characteristics compare with the Category II Interface to Category II Interface Jitter Transfer Characteristics requirements per Bellcore GR-499-CORE (for DS3 applications).

JITTER TRANSFER CHARACTERISTIC REQUIREMENT FOR DS3 APPLICATIONS

For DS3 Applications, Bellcore GR-499-CORE specifies "Jitter Transfer Characteristic" requirements for three combinations of interfaces/configurations.

• Category II Type of Interface to Category I Type of Interface (e.g., for an M13 MUX application, this configuration relates the input Jitter, within an "input" DS3 signal, to the resulting output jitter, within an "output" DS1 signal).

• Category I Type of Interface to Category I Type of Interface (e.g., this configuration would typically involve jitter across a Multiplexer/De-Multiplexer pair).

• Category II Type of Interface to Category II Type of Interface (e.g., this configuration would typically involve jitter within a Repeater/Regenerator application).

For completeness, the "Bellcore" definition of each of the "Category I" and "Category II" types of interfaces are presented below.

CATEGORY I TYPE OF INTERFACE

Interfaces that the equipment asynchronously multiplexes into (or demultiplexes from) higher speed signals

Examples of Category I Type of Interface

• Low speed interfaces to Multiplexers (e.g., the DS1 interface to an M13 MUX).
• Low speed interfaces to Add-Drop MUXes and,
• Low speed interfaces to Digital Cross Connect Systems (DCS)

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CATEGORY II TYPE OF INTERFACE
Interfaces for signals that do one of the following.
- Regenerates
- Demultiplexes into (or is created by) lower speed signals.
- Synchronously multiplexes into (or demultiplexes from) higher speed signals.

Examples of Category II Type of Interface
- Regenerators
- High Speed interfaces to Multiplexers (e.g., the DS3 interface to an M13 MUX).
- High Speed interfaces to Add-Drop MUXes and/
- High Speed interfaces to Digital Cross Connect Systems (DCS)

Jitter Transfer Characteristics Requirements (Summary)
As mentioned above, Bellcore GR-499-CORE specifies the Jitter Transfer Characteristic requirements for the following Interface Configurations.
- Category II Type of Interface to Category I Type of Interface (e.g., for an M13 MUX application, this configuration relates the input Jitter, within an "input" DS3 signal, to the resulting output jitter, within an "output" DS1 signal).
- Category I Type of Interface to Category I Type of Interface (e.g., this configuration would typically involve jitter across a Multiplexer/De-Multiplexer pair).
- Category II Type of Interface to Category II Type of Interface (e.g., this configuration would typically involve jitter within a Repeater/Regenerator application).

Out of each of these "Category Interface/Configurations", the only one that will be discussed in this document is the "Category II Type of Interface to Category II Type of Interface" Jitter Transfer Characteristic requirements. Each of the remaining Category Interface/Configurations involve determining the "Jitter Transfer Characteristics" across other circuitry, such as "Multiplexer/De-Multiplexer pairs", "Digital Cross-Connect System", and "Add-Drop-MUXes". Since the intent of this document is to discuss Jitter Characteristics of LIU and the XRT71D00 devices, discussions of these remaining "Category Interface/Configurations" are beyond the scope of this document.

The Jitter Transfer Characteristic Requirement for a Category II to Category II type of Interface (in DS3 applications) is plotted below in Figure 1.

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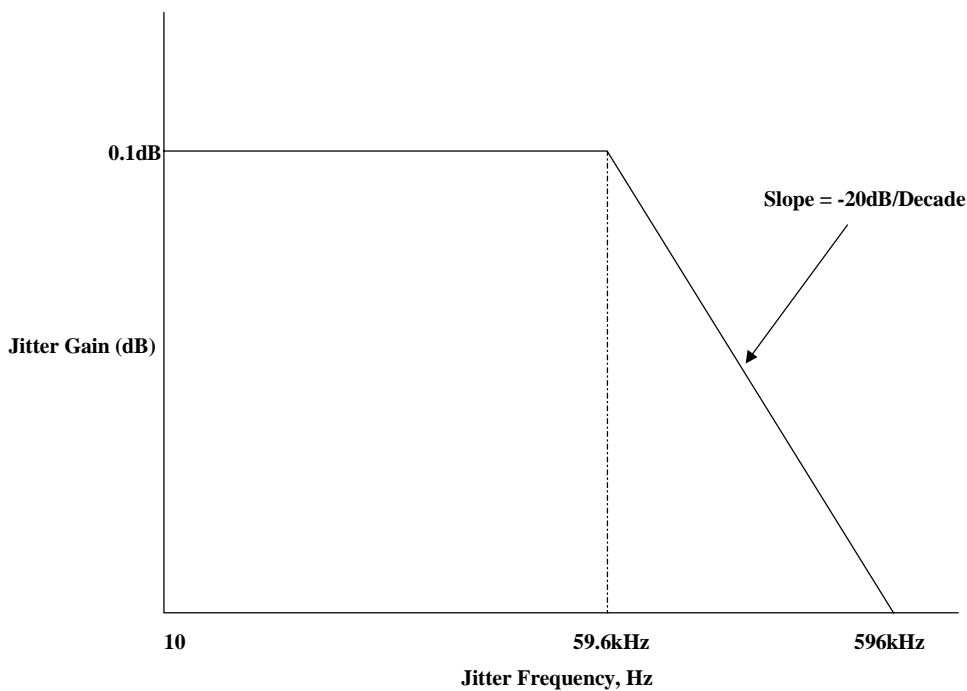
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Figure 1, Illustration of the "Jitter Transfer Characteristic" requirements for Category II to Category II Type of Interfaces (e.g., DS3 Repeater/Regenerator Applications).

Figure 1 indicates that (for a Category II to Category II Type of Interface/Configuration), the maximum Jitter Gain (over all frequencies above 10Hz) is 0.1dB. Further, this curve indicates that a –20dB/decade "roll-off", in the "Jitter Gain" must begin at frequencies of 59.6kHz or less.

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JITTER TRANSFER CHARACTERISTIC MEASUREMENTS OF THE XRT71D00 DEVICE

Jitter Transfer Characteristics measurements of the XRT71D00 (for DS3 applications) have been recorded and are tabulated below in Table 1. Please note that measurements were taken for whenever the input jitter amplitude is small (e.g., 1UIpp) and large (e.g., 10 UIpp). Further, these measurements were also made for the two different settings of the BWS (Bandwidth Select) input pin.

Table 1, The Jitter Transfer Characteristics of the XRT71D00 device, for DS3 Applications

BWS Setting	Low	High	Low	High
Input Jitter (UI-pp)	1 UI	1 UI	10 UI	10 UI
Jitter Frequency (Hz)	Jitter Gain (dB)	Jitter Gain (dB)	Jitter Gain (dB)	Jitter Gain (dB)
10	-0.10	-0.10	-0.30	-0.01
20	-2.04	-0.24	-2.24	-0.13
30	-3.68	-0.35	-4.33	-0.36
40	-5.98	-0.53	-6.16	-0.78
50	-7.55	-1.00	-7.82	-1.12
60	-9.57	-1.46	-9.17	-1.66
80	-12.54	-2.25	-11.28	-2.64
100	-14.67	-3.07	-13.36	-3.52
125	-16.67	-3.88	-14.91	-4.76
150	-17.32	-5.74	-16.78	-5.89
200	-18.77	-7.75	-18.96	-7.90
300	-21.43	-12.04	-21.81	-10.89
500	-22.22	-16.74	-26.09	-14.98
>1000	-25.42	-21.13	-33.44	-20.66

NOTE: This data was taken via the "XRT71D00/XRT7300 Evaluation Board". Hence, this data reflects the Jitter Transfer Characteristics of the "composite solution" consisting of both the XRT7300 LIU IC and the XRT71D00 Jitter Attenuator IC.

Table 1 indicates that when the BWS input pin is "low", then the "-3dB Frequency" of the Jitter Transfer Characteristic curve occurs at around 30Hz. Further, this table also

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indicates that when the BWS input pin is "high", then the "-3dB Frequency" of the Jitter Transfer Characteristic curve occurs at around 100 Hz.

Figure 2 presents a plot of each of the Jitter Transfer Curves, listed in Table 1.

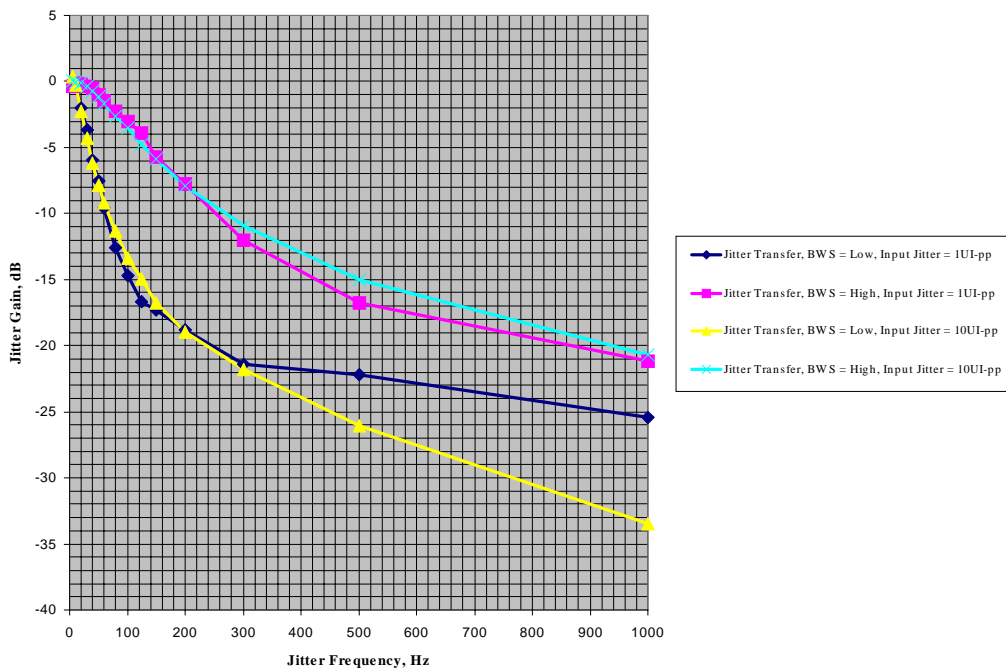**Jitter Transfer Characteristics of the XRT71D00 Jitter Attenuator IC, DS3 Applications**

Figure 2, Plot of the Jitter Transfer Characteristics of the XRT71D00 Jitter Attenuator IC, for DS3 Applications.

TEST CONDITIONS
  a. Tests performed with the Wandel & Goltermann ANT20, on the XRT7300/XRT71D00 Evaluation Board.
  b. Test Pattern used: Unframed 2^23-1 PRBS Pattern.
  c. Transmit Output of W&G ANT20 Tester = DSX-3

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CONCLUSIONS:

The test results, presented in Table 1 and Figure 2 indicate the following.

    a.   The peak gain of the Jitter Transfer Characteristics never exceeds 0.1dB.

    b.   The "-3dB Frequency" of the XRT71D00 device (for each of the various combinations of BWS and FSS settings) is all considerably less than 59.6kHz.

As a consequence, the Jitter Transfer Characteristics of the XRT71D00 device is compliant with the Jitter Transfer Characteristic requirements, per Bellcore GR-499-CORE (for a Category II to Category II type of Interface – DS3 Applications).

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