Design of High Data Rate Checkout Systems

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Abstract- The satellite programme of various space-agencies covers wide variety of areas and applications. In the recent years there has been advent of new applications that require very high data rates with huge volumes of data. The arrival of Microwave remote sensing payloads and High resolution optical payloads lead to design of links which can support higher data rates with good margin. Data rates of the order of 300-400 Mbps through satellite channels are being realized on various satellite platforms. The Checkout systems of such satellites needs to be designed and deployed for evaluating the performance of Payload chain in the spacecraft. This paper describes the payload Checkout systems realization aspects   and layout of the same, emphasizing on the issues of High data rates.

Index Terms— High data rates, Noise figure, Payload Checkout Systems, Signal Integrity

I. INTRODUCTION

The Checkout systems for satellites are usually classified into Payload Checkout system and Mainframe Checkout system. The Main frame Checkout system is entrusted with the evaluation of Functional performance systems Viz Power systems, AOCE systems, Sensors Systems and Payload Checkout system to evaluate the functional performance of Payload systems , Data Handling systems and other RF systems associated with the satellite.
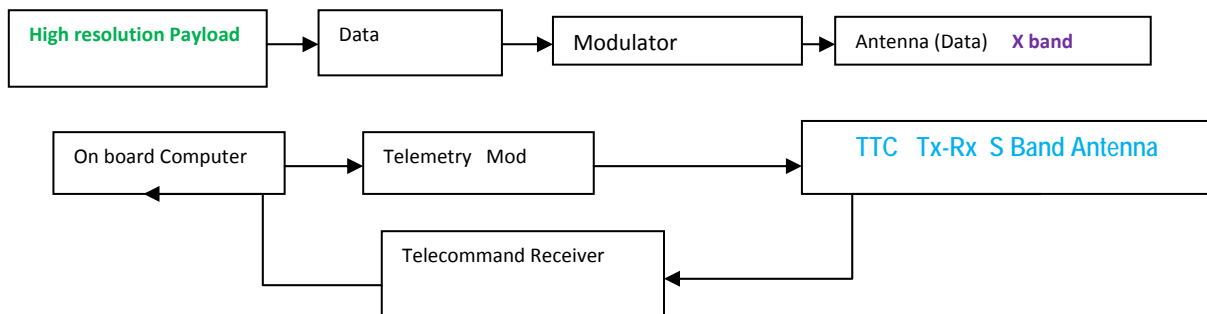

Figure.1 Typical Onboard configuration of a High data rate   Spacecraft

II. PAYLOAD CHECKOUT SYSTEM

 To evaluate the Performance of Payload and associated systems Test Plans are made using the Payload Checkout systems. The realization of payload Checkout systems to meet the requirements and specifications demanded in the test plans. It is usually expected that the order of reliability and performance of the Checkout systems must be   one order higher than onboard systems. The specifications of the Checkout systems must be derived to bring out the shortfalls in the performance of the onboard systems after they are integrated together. The normal systems that form the Payload Checkout system are

a) Test Selection Matrix –used to signals from Spacecraft to various Measurement Instruments

 b) Down Converter - used to shift signals from High frequency to IF

 c) Demodulator & Bit Sync - To Detect the bits transmitted at source end

 d) Frame Synchronizer- To form the frame from the bits transmitted and detects the number of wrong frames.

Some of the   specifications and issues to be addressed for each of the   equipment are:

a) **Noise Figure** of the Down-Converters

b) **Signal integrity** issues in Cards used for realization of Demod, Bit-Sync

c) **Clock Jitters** of Frame synchronizers

d) **Group Delay** of the filters and Couplers used in the equipment.

III.   TEST AND EVALUATION   OF PAYLOAD CHECKOUT SYSTEM

The Payload Checkout Systems preparedness for checkout activities will be done by subjecting the system to Test & Evaluation after arriving at suitable plans. Test Signals from modulators (simulating the onboard signal) must be fed to Checkout systems. The test signals to be fed must simulate worst case scenarios that can come from the onboard.
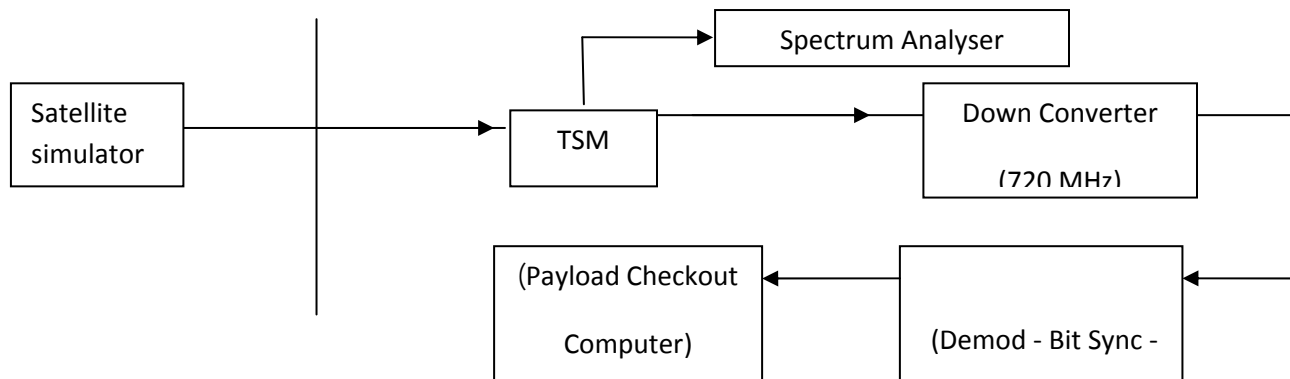
Figure.2 Set Up for T&E of Payload checkout systems

IV.   CONCLUSION

The paper describes   the specification values arrived for each of the Checkout system in order to High precision checkout systems. The paper also emphasizes on the qualification strategy for each of the components used in the realization of Checkout systems. The paper also describes the Qualification methods and procedures to be adopted for the Test and Evaluation of the payload Checkout systems.

REFERENCES

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