Needs Of The Wireless Based Test Setup For Payload Testing In The Thermovacuum Chamber

Ravi J. Bagatharia, Prof. Sunera Kargathara

Department of Electronics & Communication,
MEFGI, RAJKOT, GUJARAT

Mr. Anand Kumar

(LPID/EOSG/SEDA)
SPACE APPLICATION CENTER
ISRO, AHMEDABAD, GUJARAT

ABSTRACT

As the number of measurement and the technology increases for the thermovacuum testing, there is need to change the testing method for payload inside the thermovacuum chamber. In this paper we explore how wireless standards are helpful for the thermovacuum testing of payload. For this we studied and analysis different types of IEEE 802 wireless standards for application in thermovacuum testing of payload. Here we explain how to remove the long and bulky harness between the thermovacuum chamber and the ground checkout unit.

Key words – Payload, Thermovacuum chamber, IEEE 802

I. INTRODUCTION

The thermovacuum chamber is basically used to test the payload in the same environment as the space. It used for space environment simulation of payload. Inside the thermovacuum chamber different range of temperature and presser is created and check the working condition of the payload. For testing the payload there is ground check unit outside the thermovacuum chamber send the different types of data and command to the payload which is sitting inside the thermovacuum chamber through the wires [1]. As the number of measurement increases the number of cables are also increases, so harness of cables is increases and pass the cables inside the thermovac chamber is very difficult task. So, these are the limitation of current system and we are trying to explain how to remove these limitations by doing the wireless communication between the thermovacuum chamber and the ground checkout unit.

II. PRESENT TEST SETUP FOR THERMOVACUUM TESTING

Figure below shows the present test setup for the thermovacuum testing of payload. Here the payload sitting inside the thermovacuum chamber is communicates with the Ground Checkout Unit (GCU) outside the thermovac chamber through the wires.
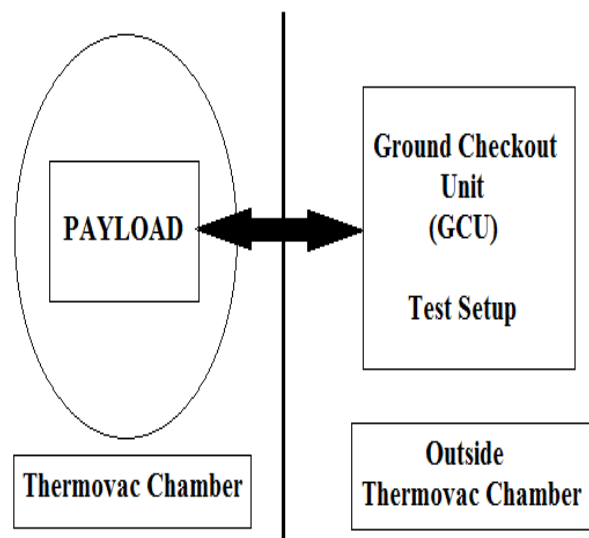

Figure 1 – The present test setup for thermovacuum testing

III. PROPOSED TEST SETUP FOR THERMOVACUUM TESTING

Figure below shows the proposed test setup for the thermovacuum testing of payload. Here the payload

sitting inside the thermovacuum chamber will interface to the interfacing card and the interfacing card will interface with the RF transmitter / receiver. Outside the thermovacuum chamber the ground checkout unit will interface with the interfacing card and the interfacing card will interface with the RF transmitter / receiver.
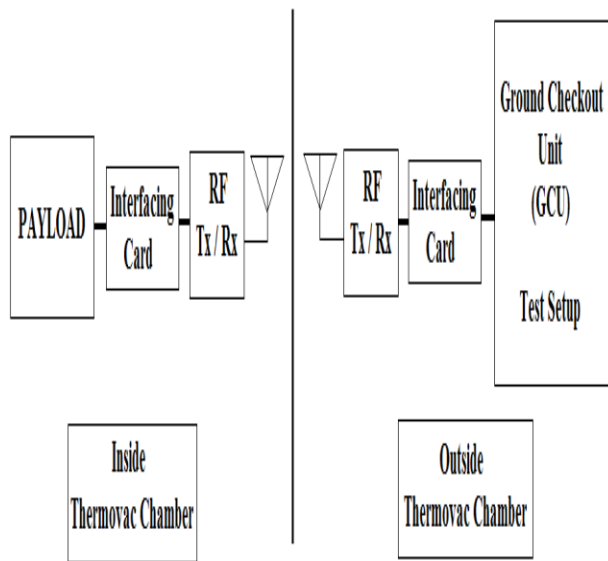

Figure 2 – The proposed test setup for thermovacuum testing

IV. COMPARISON OF DIFFERENT WIRELESS STANDARDS

There are different types of IEEE (Institute of Electrical and Electronics Engineers) 802 wireless standards are available like, IEEE 802.11 – Wi-Fi, IEEE 802.15.1 – Bluetooth, IEEE 802.15.4 – ZigBee, IEEE 802.16 – WiMax. Here all the standards are use the ISM (Industrial, Scientific and Medical) band for the communication. All these standards are use for different application and have different types of specification which are explain below.

Bluetooth:

The IEEE 802.15.1 standard is called Bluetooth standard. Bluetooth is a low tier, ad hoc, terrestrial, wireless standard and it is used for the short distance wireless communication. It is use the transmission frequency band of 2.4 GHz. It has packet data rate of 1 Mbps and can transmit up to 10 meter distance [2].

ZigBee:

The IEEE 802.15.4 standard is called ZigBee standard. It is used for wireless remote monitoring and control. It is use the transmission frequency band of 2.4 GHz. It has packet data rates of 20, 40, 100 and 250 Kbps. It has maximum range of 100 m for low data rates [3].

WLAN/ Wi – Fi:

The IEEE 802.11 standard is called the Wi- Fi standard. Wi-Fi is an abbreviation for Wireless Fidelity and used for wireless local area networks (WLANs). It is used for transmit the web, e-mail and videos. It uses the transmission frequency band of 2.4 / 5 GHz [4-5]. There are different types of WI –fi standards are available all has different packet data speed like 11, 54, 600 Mbps. The maximum transmission range is 100 m. There are several types of IEEE 802.11 standards as follow [6-7].

Standard	Data Speed	Frequency band	Release Notes
802.11	2Mbps	2.4GHz	1997
802.11a	54Mbps	5GHz	2001
802.11b	11Mbps	2.4GHz	1999
802.11g	54Mbps	2.4 GHz	2003
802.11n	600Mbps	2.4/5 GHz	2009

Table 1 – The comparison of different Wi – Fi standards

Wi – Max:

The IEEE 802.16 standard is called the Wi- Max standard. The WI – Max standard has same application as the wi- fi but it use the transmission frequency band of 2.3, 2.5, 3.5 GHz. It has packet data rates of 100 Mbps and 1 Gbps at the distance of 50 Km [8].

There are basically two modes of wireless communications:

1) Infrastructure mode:

Any communication has to go through access point. One station need to send information to AP first, then AP sends it to the destination station. Here we cannot transmit the information directly to each other. The transmission range is increase in this mode. It is used by the majority of WLANs in homes, campuses, businesses, cafe, hotels, etc.
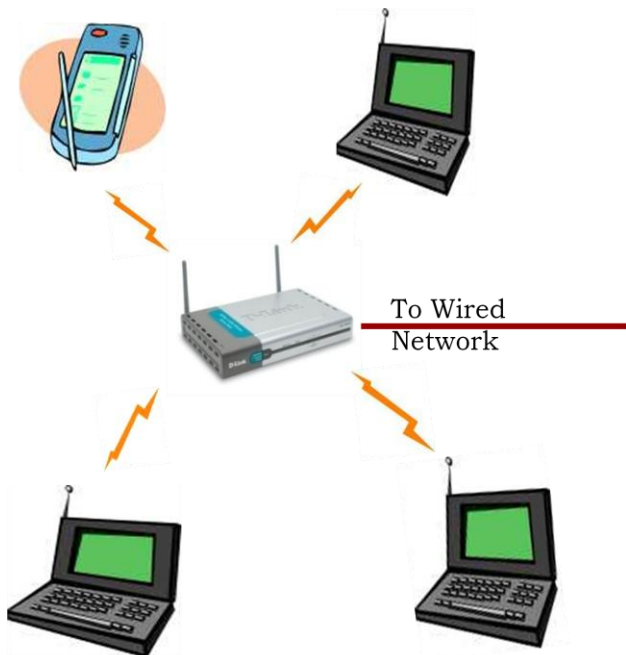
Figure 3 - Infrastructure mode operation

2) Ad – Hoc mode:

Here clients can connect to each other directly. Any station communicates to each other directly. This technique is used for short distance communication. It is used for special purpose and for a short duration of time.
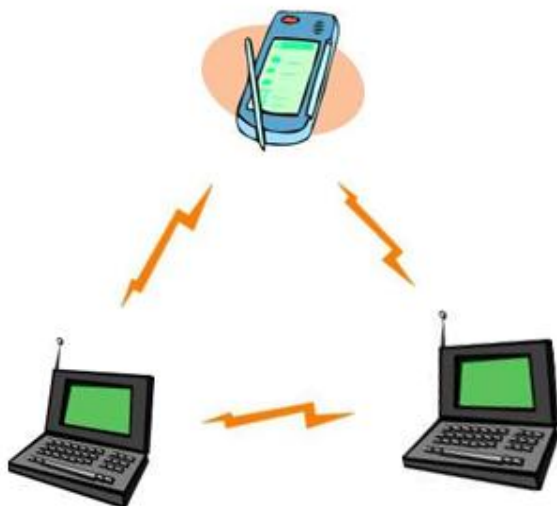

Figure 4 – Ad – Hoc mode operation

Table below shows the brief comparison of all these wireless standards on the basis of their applications, Tx frequency band, data rates, modulation techniques, maximum range and the encryption techniques.

Standard \ Specification	802.15.1 (Bluetooth)	802.15.4 (ZigBee)	802.11 (Wi - Fi)	802.16m (Wi - max)
Applications	Cable replacement	Remote monitoring and control	Web, Email, Video	Web, Email, Video
Tx Frequency Band	2.4 GHz	2.4 GHz, 868/915 MHz	2.4 GHz / 5.0 GHz	2.3, 2.5 and 3.5 GHz
Data Rates	1 Mbps	250, 100, 40, 20 Kbps	11/54/600 Mbps	100 Mbps, 1Gbps
Modulation Techniques	GFSK	O-QPSK, ASK, BPSK	Complimentary code keying / OFDM	MIMO-SOFDMA
Max. Ranges	10 m	100 m for low data rates	100 m	50Km
Encryption Techniques	4LFSR - 128	AES-128	WEP algorithm	AES or DES

Table 2 – The comparison of different wireless standards

All the wireless standards are also different in terms of their operating modes. Table below shows what type of mode can support by the different standards:

STANDARDS	Ad – Hoc	Infrastructure
IEEE 802.11 a\b\g\n	Yes	Yes
IEEE 802.15.1	Yes	No
IEEE 802.15.4	Yes	No
IEEE 802.16	Yes	Yes

Table 3 - Modes of operation for the different wireless standards

V. CONCLUSION

After studied all these wireless standards we conclude that, the Bluetooth is used for the short distance communication, it has limitation in range. The ZigBee standard has limitation in data rates, it has very low speed compare to the other wireless standards. The Wi – Max standards is very good in terms of its data rates and range, but there is requirement of wireless communication is within the lab, also the interference is high in the Wi – Max compare to the Wi Fi. Also the Wi – Fi components for different types of Embedded application are easily available. So, the Wi – Fi standard is very suitable for the testing of payload in the thermovacuum chamber.

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