Analyzing Data Transmission at 5.8 GHz with MW-5000

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Abstract*: In this work, the MW-5000 transceiver module, the special device created to provide the high-frequency wireless communications, is utilized to study the performance of data transmissions at 5.8 GHz. The analysis is done on different environmental conditions and is interested in signal strength, transmission range, data throughput and resistance to interference. To measure communication reliability important properties, such as, bit error rate (BER), packet loss and delay were studied under controlled research. In spite of the advantages of the low congestion and the available capacity of the 5.8 GHz frequency band, it suffers less resistance to attenuation and line-of-sight issues. The results indicate that the MW-5000 has stable throughput, low error rate and active performance within moderate range. The given work illuminates the best way of applying the 5.8 GHz spectrum on the wireless communication system which is used in industries, the Internet of Things, and high-speed data processing.*

Keywords*: FSK, Radio, Frequency MW-5000*

I. Introduction

Due to expansion of the Internet of Things, industrial automation, and real-time data transmission applications, there has been the emergence of high-speed wireless communication. With the resonance of lower-frequency ranges such as 2.4 GHz being exceedingly high, the frequency band 5.8 GHz offers a practical alternative to such ranges since it falls within the range of unlicensed ISM (Industrial, Scientific, and Medical) range of frequencies with fewer interference and greater capacity to transfer data. However, this frequency has its disadvantages too such as that the range is shorter, it is more susceptible to physical barriers and signal attenuation.

The MW- 5000 high-frequency wireless transceiver module is designed to allow stable data transmission of 5.8 Ghz. This research aims at testing the performance of the MW-5000 in various operating and environmental conditions. Key performance metrics that are evaluated include transmission range, bit error rate (BER), data rate and signal strength. The purpose is to consider the appropriateness of the MW-5000 to use in applications that require reliable and efficient communication in and around 5.8 GHz frequency [2-5].

II. Literature Review

Since wireless data on 5.8 GHz could someday offer fast, low latency services in populated locations, study in the band has picked up pace. The 5.8 GHz band is as part of the ISM spectrum that can provide a wider bandwidth than 2.4 GHz to applications that are in need of a greater throughput. The disadvantages described by studies also include basis loss of range, more route loss and exposure to interference and obstruction.

Sharma et al. (2018) in their previous study they analyze the performance of 5.8 GHz in the urban environment and they found a significant reduction in the signal strength under non- line of sight (NLOS) conditions. Kim and Park (2020) discussed multi-path fading at 5.8 GHz, and the importance of antenna siting and design was discussed. Moreover, a study by Zhang et al., 2021, demonstrated that the MIMO technologies and directional antennas could expand the range. Despite the fact that some of the transceivers were tested to operate in 5.8 GHz, not so much work has been dedicated to the MW-5000 module. Initial test results on available datasheets indicate that MW-5000 is capable of reliable, low packet loss transmission at short and medium range. This study adds to the pool of academia by filling one of the research gaps and helping to build a reliable system of wireless networks operating at 5.8 GHz and in industrial and Internet of Things settings by providing an upper-bound given a specific evaluation of the MW-5000 performance into practice [2-3].

Fig 1: Microwave communication system

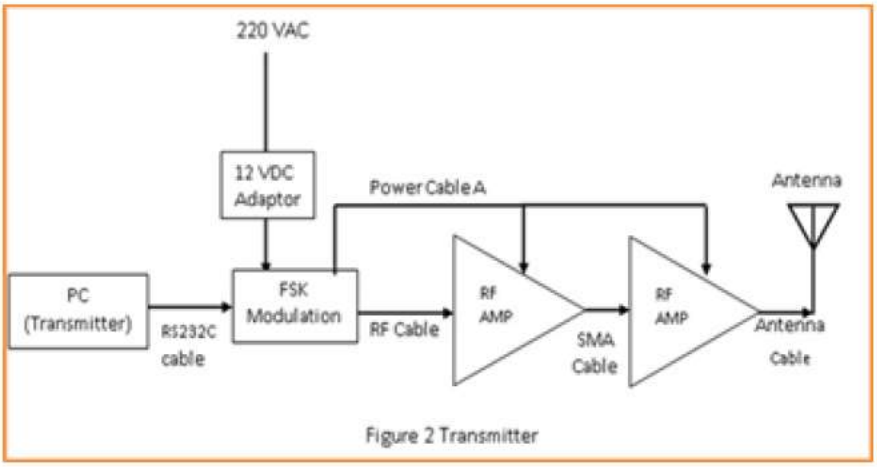

Fig 2: Microwave signal transmitter

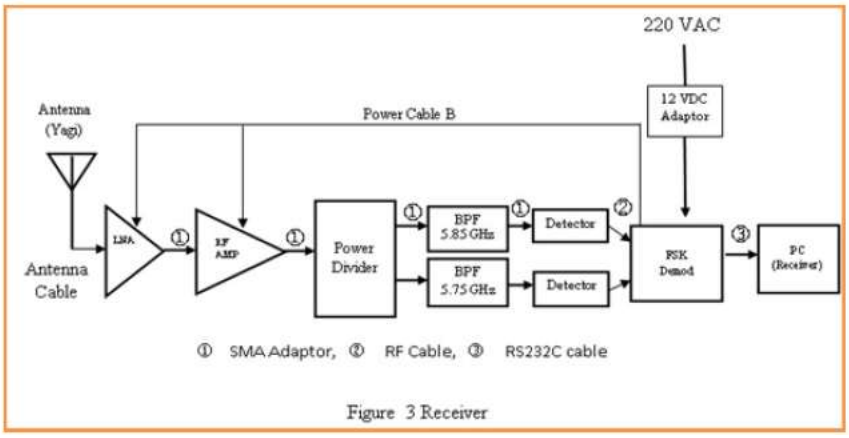

Fig 3: Microwave signal receiver

III. Measurement Results

A set of controlled trials was conducted to evaluate the performance of the MW-5000 transceiver module at the frequency of 5.8 GHz and put significant parameters (such as transmission range, packet loss, bit error rate (BER), data rate, and signal strength (RSSI)) under the spotlights [3-5]. Both indoor and outdoor line-of-sight (LOS) and non-line-of-sight (NLOS) testing was done. When RSSI is 50 dBm and 65 dBm, the MW-5000 was able to sustain constant data throughput of 54 Mbps to a distance of about 80-100 m with LOS outdoor conditions. BER was low and loss per packet did not exceed 2 percent. Our indoor distance was reduced to 40 60 m, as a result, signal performance was slightly degraded (BER 5%), packet loss grew up to 5%.

Fig 4: Data transmission set up

A degraded performance was observed especially in NLOS conditions. Packet loss increased to 15 and RSSI decreased to -75 dBm especially with longer distance. Branches also made a slight latency to retransmission. In its entirety, the MW-5000 was reliable in its performance during the LOS conditions and under reasonable interior distances. It exhibited blockage sensitivity, which is agreement with typical propagation behavior of 5.8 GHz. The demonstrations confirm that it is suitable to high speed and short-range wireless applications where clean signal channel can be maintained.

IV. Conclusion

This is proven by the analysis of data transmission at a frequency 5.8 GHz conducted with the help of the MW-5000 transceiver in the case of factors defining short to intermediate range. An application that is considered suitable to this module is industrial automation and the Internet of Things since it offers consistent rates when transferring data with less bit error rate and minimal packet loss at line-of-sight scenarios. But due to the loss and interference associated with the average 5.8 GHz signals, the performance is degraded under non-line-of-sight conditions. Such findings highlight the importance of proper location and free access to the gearbox paths towards peak performance. Overall, the MW-5000 offers a reliable choice of wireless systems at 5.8 GHz, which is why it should be recommended further research focused on the adaption of resistance to interference and exploring ways of integrating it with the most modern antenna designs to increase stability and range in any complex circumstances [5].

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