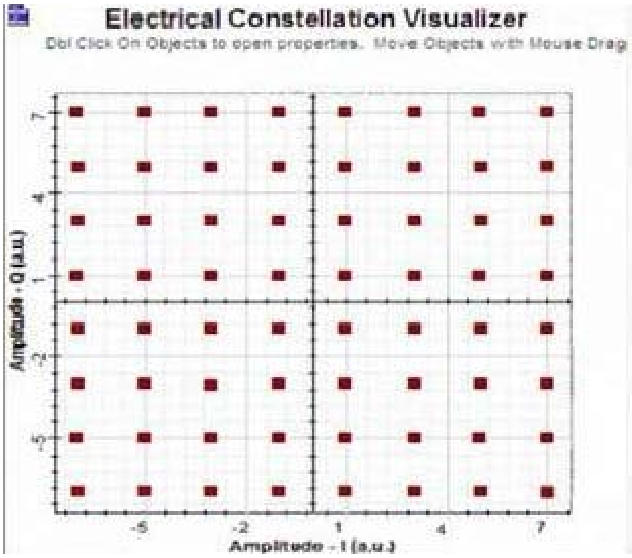

Figure 8: QAM constellation diagram

The output of the MZM that is, the modulated optical signal is shown below by the optical spectrum analyzer:

Figure 11, the signal shown is taken from the oscilloscope visualizer located at the output of the PRBS.

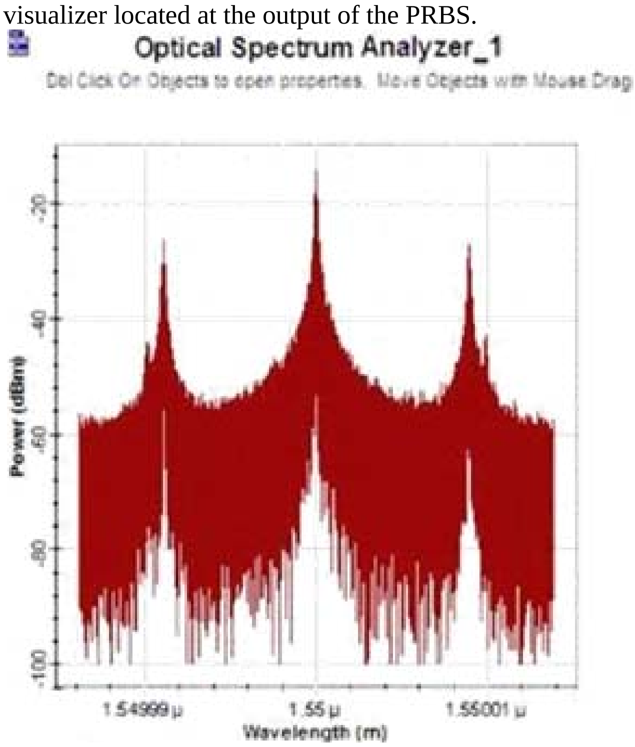

Figure 9: Modulated optical signal

At the RAU side, the signal that is distributed by the single mode fiber is amplified by the TIA (transimpedence amplifier) and then radiated by the RF antenna as shown in the diagram below:

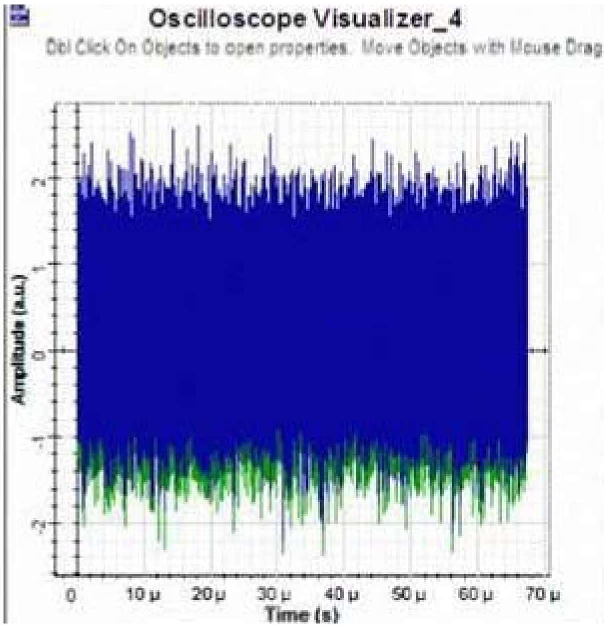

Figure 10: The electrical signal after TIA

After receiving the RF signal at the receiver side through the RF antenna, it is down converted from 5.8GHz to 2.4GHz (ISM Band) and then it is demodulated by the QAM demodulator to obtain the desired information as shown in the diagram below :

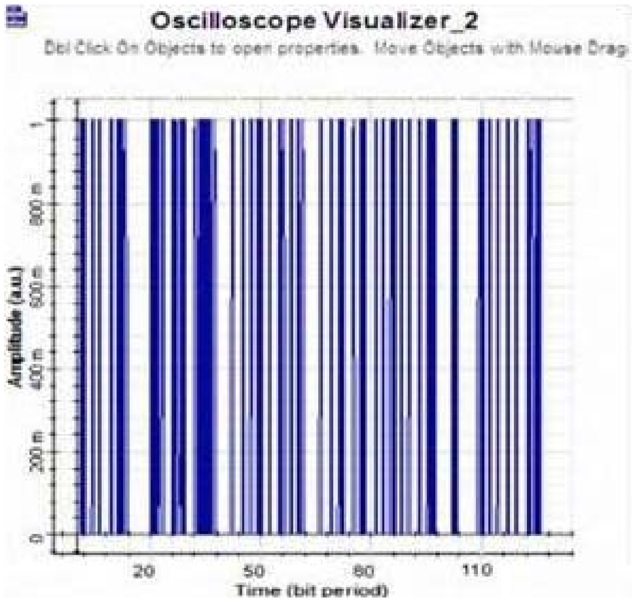

Figure 11: The received signal (End User)

The user can calculate and obtain the bit error rate (BER) of an electrical signal automatically as shown in the figure below using the BER visualizer.

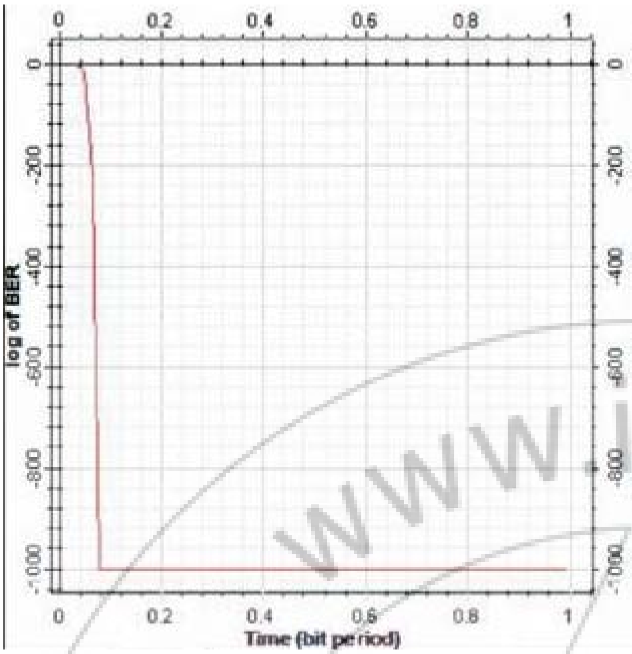

Figure 12: BER Analyzer

We noticed that the minimum BER in dB is equal to -1000dBm which is very low as compared to (-20dBm to -70dBm) in 802.11a without using the RoF technique.

The BER that we obtained in this simulation is the result of using the RoF technique and the QAM modulation and also the single mode fiber (SMF) and other components like Bessel filter which give significantly lower BER and a low insertion loss as compared to other filters.

Table 2: The BER analyzer values

Results

Disp	Name	Value
	Total Power (dBm)	26.93071348089
	Total Power (W)	0.4932548316918
	Signal Power (dBm)	26.93071348089
	Signal Power (W)	0.4932548316918
	Noise Power (dBm)	-100
	Noise Power (W)	0
	Signal Delay (s)	2.623456790124e-007
	Signal Delay (samples)	510
	Bit Rate (Bits/s)	30375000
	Max. Q Factor	1e+050
	Q Factor from Min. BER	100
	Min. BER	0
	Min. log of BER	-1000
	Max. Eye Height (a.u.)	1
	Threshold at Min. BER (a.u)	0.1313029853785
	Decision Instant at Min. BER (bit per	0.07894736842105

4. Conclusion

The simulation design has combined the two important aspects i.e. the implementation of the RoF technology and the WLAN of IEEE standard 802.11a in the downlink system. The design shows that the 54 Mbps, 64 QAM with 5.8 GHz can be supported by the system that uses 50 km bidirectional optical fiber and the wireless distance of 10 km using RF modulated signal at 5.8 GHz. With high antenna gain, the system is suitable for longer distance point to point applications. Down conversion of the frequency at the receiver end has been implemented to ensure that the end user can connect to the WLAN at the downlink.

The implementation of the RoF technology and the WLAN of IEEE standard 802.11a and also using the QAM modulation provides more reliability by reducing the BER as compared to the IEEE 802.11a standard with wireless feeder network .It also provides more flexibility, in case if future requirements such as extension of the system for more capacity and larger coverage area are needed.

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