Proceedings of Engineering & Technology (PET)
pp. 262-266

2nd International Conference on Automation, Control, Engineering and Computer Science (ACECS-2015)
Proceedings of Engineering & Technology (PET)

Evaluation the performance of an Adjacent and Co-Channel Interference

Isslam Ali Fadel
Libyan Academy, School of Applied Sciences and Engineering, Electrical and computer Engineering Dept.. Tripoli- Libya
E-mail ali_fadel_1915@yahoo.com .

Amer R. Zerek
Zawia University. Faculty of Engineering
Electrical and Electronic Engineering Department.
Zawia - Libya
E-mail anas_az94@yahoo.co.uk

Hagier Hadi Agieli Bishi
Libyan Academy, School of Applied Sciences and Engineering, Electrical and computer Engineering Dept.. Tripoli- Libya
E-mail Bishihager@yahoo.com

***Abstract-* Adjacent-channel interference (ACI) is interference caused by extraneous power from a signal in an adjacent channel. ACI may be caused by inadequate filtering such as incomplete filtering of unwanted modulation products in FM systems), improper tuning or poor frequency control in the reference channel, the interfering channel or both. A evaluation the performance of an adjacent and co-channel interference has been done in this work.**

The performance of a multichannel, multi-radio wireless network is often limited by interference due to concurrent transmissions on the same and adjacent channels. These interference effects may be either due to simultaneous traffic activity by the multiple radios within a node or due to transmission by neighboring node

Keywords: co-channel, interference signal and ACI

I. INTRODUCTION

Adjacent channel congestion is the worst type of Wi-Fi interference. To illustrate, think about being at a concert – there's a band playing really loud, and tons of people, each with their own group of friends. With this much going on, it's difficult to talk to some friends, and when somebody start to talk louder, the person next to him has to raise his voice to talk to their group. They are hearing multiple conversations happening, as well as music from the band, and it seems impossible to communicate. Figure (1) shows a theoretical model of how the above conversation scenario looks when access points on channel 4 (red), channel 6 (green), and channel 5 (blue) are all active at the same time. As one of these access point's (AP's) tries to talk to its clients, its transmissions become garbled because of the transmissions of the other two. This drives down the performance of all of the networks.

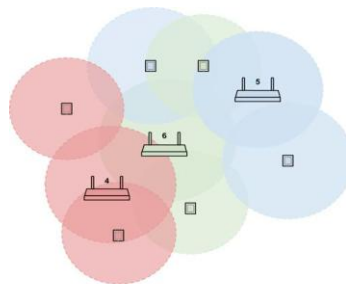

Fig.1. Theoretical Model of How the Conversation Scenario Looks [1]

In order to explain co-channel congestion, it well move that imaginary conversation from a concert venue to a classroom. Think back for a school days – chances it can thinks of at least one class that had a student who would talk slower than the other kids, and everyone else would have to wait for their turn to ask a question. Co-channel congestion works in a similar manner: the performance is hindered by the wait times, but the bandwidth is managed, and every device will get a chance to talk to its associated AP. Figure(2) represented a wireless access point and its associated clients, which can only talk one at a time.

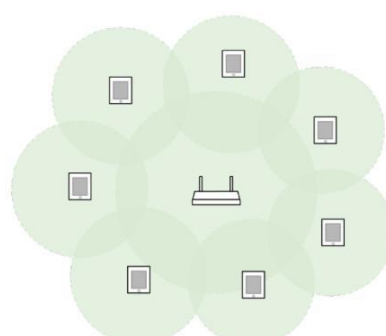

Fig.2. Wireless Access Point and its Associated Clients [1]

Co-channel congestion is preferable to adjacent channel congestion because of the way the wireless conversations are

ISSN: 2356-5608

managed. When choosing a channel that has other networks active, it try to keep at least 20dB between the RSSI levels of the networks, as shown in figure (3).

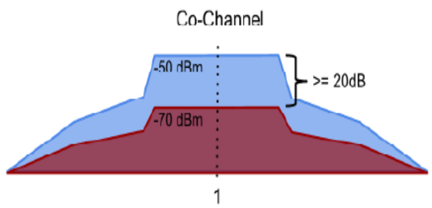

Fig.3. Choosing a Channel that has Other Networks Active [1]

To go over, an open channel will always be best when deploying their wireless network, but if you have to share a channel, that's okay too. Adjacent channel congestion is the one it wants to avoid if at all possible of interference , as shown in figure (4).

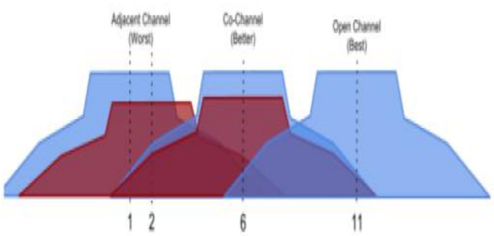

Fig.4. When Sharing a Channel[1]

II. BACKGROUND

The objective of this section is three lappet. At first it describes the adverse effects of ACI on 802.11 namely a variant of the hidden and the exposed terminal problem. Thereafter, it gives a brief overview on how carrier sensing and signal detection of a typical IEEE 802.11 radio works. This is necessary to understand the impact from ACI on CCA. Finally, the radio spectrum usage of the different 802.11 PHY modes is presented. The focus here is to address the particularities of 802.11n.

A. Hidden Terminal Problem

The Hidden Terminal Problem (HTP) is a well analyzed problem [2]. It happens when transmissions from two nodes, that cannot hear each other, collide at the receiver for one of the nodes. Various solutions to solve this problem have been proposed to address the problem [2]. The 802.11 standard recommends the use of RTS/CTS exchange to avoid hidden terminal problems.

B. Exposed Terminal Problem

The Exposed Terminal Problem (ETP) occurs when a node is prevented from sending due to the presence of another transmitter nearby. This occurs because the carrier sense mechanism (CCA) used in 802.11 is conservative, and prevents a node from transmitting when another node is transmitting, for the fear of causing a collision. Several solutions to this problem have been proposed as well [3]. Most proposals require modifications of the carrier sensing mechanism.

C. Adjacent Channel Interference

ACI is a form of interference that is caused by nearby transmitters on distinct frequency channels"bleeding over" to another channel [4]. When using 802.11 ACI has the following consequences: For the case of two nearby transmitters the overlapping ACI of one transmitter causes a spurious carrier sensing at the other thus preventing two concurrent transmissions .Remember that 802.11 is a CSMA protocol which follows the listen-before-talk paradigm. That means that a station is only allowed to transmit if the medium is idle. ACI may trigger the carrier sensing mechanisms to report that the medium is busy. In this case the station will misleadingly postpone its transmission. However, at both receivers there is a sufficient high signal-to interference ratio so that it would be possible to successfully decode both signals. Note, the effect of ACI is smaller than that of co-channel interference because only a small amount of energy is "bleeding over" to another channel. Thus ACI causes a variant of the Exposed Terminal Problem (ETP) which significantly reduces the spatial reuse in the network and thus wasting Radio_ source[5].

III. SIMULATION OF ADJACENT AND Co-CHANNEL INTERFERENCE

The model of adjacent and co-channel interference is implemented using Simulink as shown in figure(5).

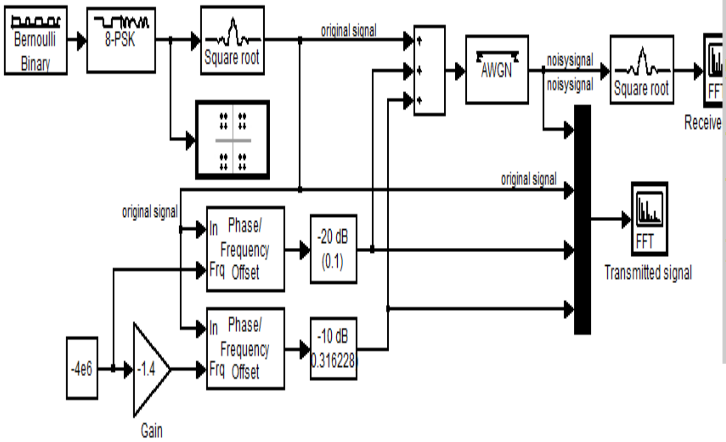

Fig.5. Simulation Model of Adjacent and Co-Channel Interference

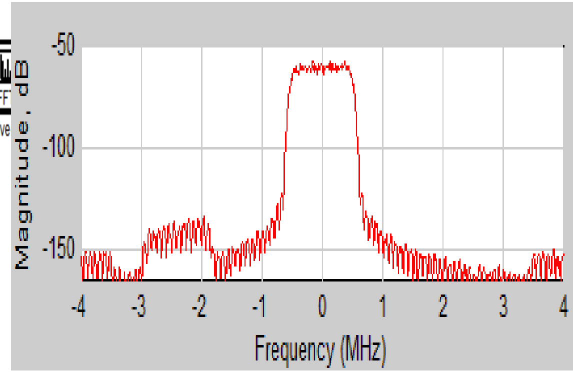

Fig.7. Scatter Plot of Received Signal Constellation

VI. SIMULATION RESULTS

After implement the model of adjacent and co-Channel interference shown in figure(5) and after setting all their system parameters as well as the simulation parameter . It achieve the simulation results as represented in figure (6) to figure(8).

Where figure (6) show the spectrum of received signal.

When Transmitter(Blue)- Interferer1 (Black)- Interferer2 (Cyan)-noise signal(Red).

Figure(7) represented the scatter plot of received signal constellation and figure (8) illustrated the received constellation diagram

d

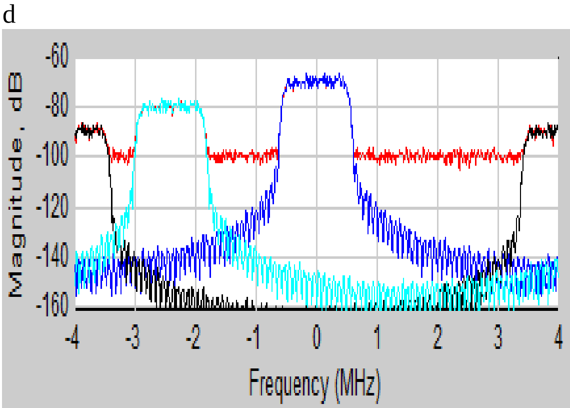

Fig.6. Spectrum of Received Signal

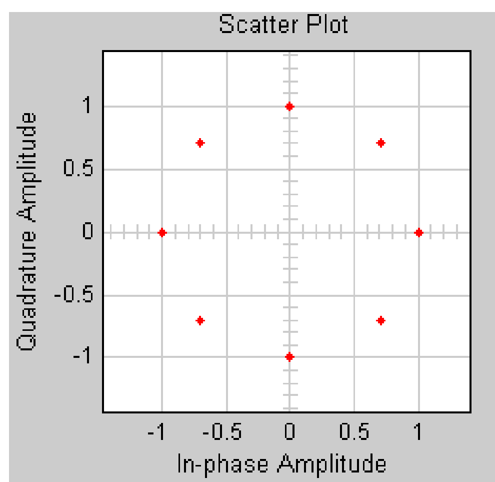

Fig.8. Received Constellation Diagram

IV. CONCLUTIONS

Referring to the main objective of this paper it conclude that

- When decrease the frequency offset of an interfering signal, it observes that the decrease of the offset, the transmitted signal spectrum scope shows the interfering signal slowly moving from the adjacent channel into the frequency band of the original signal and eventually causing co-channel interference.
- When changing the power gain of an interfering signal, it observes that the effect on the transmitted signal spectrum scope.

REFERENCES

[1]- Reinvestigating Channel Orthogonality - Adjacent Channel Interference in IEEE 802.11n Networks.

[2]- C.-M. Cheng, P.-H. Hsiao, H. T. Kung, and D. Vlah, “Parallel use of multiple channels in multi-hop 802.11 wireless networks,” in *MILCOM’06: Military Communications Conference*, October 2006.

[3] Eduard Garcia Villegas, Elena Lopez-Aguilera, Rafael Vidal and Josep Paradells “Effect of adjacent-channel interference in IEEE 802.11 WLANs,” 2nd International Conference on Cognitive Radio Oriented Wireless Networks and Communications, pp.118-125. , (2007)

[4]- CO-canal interference suppression for OFDM system, a thesis presented to the graduate school of the University of Florida in partial fulfillment of the requirements for the degree of Master of Science,2003.

[5]- Erceg, V., Schumacher, L., Kyritsi, P., “TGn Channel Models,” IEEE 802.11-03/940r4. et.al., (2004)