International Journal of Informatics and Communication Technology (IJ-ICT)
Vol. 4, No. 3, December 2015, pp. 123~130
ISSN: 2252-8776

The Comparison of Access Point Signal Gain with Beverage Cans

Sri Ariyani
Department of Electrical Engineering, Engineering Faculty Udayana University

Article Info

Article history:

Received Aug 12, 2015
Revised Nov 19, 2015
Accepted Nov 26, 2015

Keyword:

Impairment
Signal
Wire
Wireless

ABSTRACT

Computer network development depends on the development of information technology and communication. Several things as the reasons to develop the technology of computer network are implementing communication flexibly which in this case in the theory of computer network is to build wireless network communication.The existence of wireless communication as the comparison against wired network, having different impairment compared to wired communication.One of which is the weakening of wireless signal strength towards the ongoing communication distance. Therefore in wireless communication currently plenty of it being implemented, to handle the occurring impairment due to distance influence, it is needed for signal amplifier device. One of signal amplifier that can be used in the surroundings which is economical and practical is by using used beverage can.

Corresponding Author:

Sri Ariyani,
Department of Electrical Engineering,
Engineering Faculty Udayana University,
Jl. Tukad Yeh Aya No. 46, Denpasar 80225, Bali – Indonesia.
Telp./Fax.: +623617434912 / +62361257055
Email: ari@baliyoni.co.id

1. INTRODUCTION

The development of the world of information technology continues to lead to the utilization of wireless technology. The utilization of wireless technology has been a standard in the world of information technology. Various handheld devices have been equipped with InfraRed, Bluetooth or WiFi to be able to exchange information by wireless. The utilization of computer peripheral by wireless also has been a technology in wireless implementation.

In its development, wireless technology has some disadvantages. Wireless technology has advantages and disadvantages. The common problem found is the signal weakness experienced by the device. In this case the device concerned is Access Point. The selling of Access Point device in the market offers the cheapest price possible, but it is not able to guarantee the capability of maximum signal strength quality.

Based on that matter the handling towards one of the wireless weakness particularly related to the weakening of signal strength, it is needed for the signal amplifier media. Signal amplifier media which can be used among others is by utilizing the object surrounding it which is economical and practical and seen in scientific theory able to amplify the signal.

2. THEORETICAL PLATFORM

2.1.Wireless Topology

The utilization of computer peripheral by wireless has also been a technology in wireless implementation. The meaning of wireless itself is a technology without wire, in this case is conducting

telecommunication by using electromagnetic waves as a medium replacing cable. Wireless communication can also be interpreted as a wireless network using the air as the transmission medium to deliver electromagnetic waves. Wireless technology can be illustrated as the following figure:

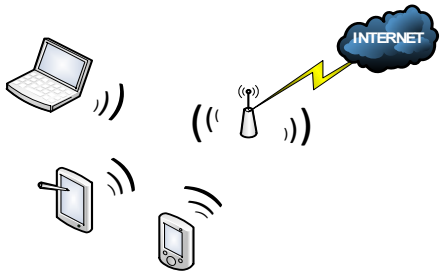

Figure 1. Wireless Topology

If it is seen from the working system, wireless has a working system using electromagnetic airwaves (radio or infrared) to exchange information from one point to another point without having to depend on the connection physically. Radio wave is usually used as a carrier since it can easily deliver data to the receiver. Data is transmitted by way of superimposed on carrier waves so that can be extracted on the receiver's end. The data is generally used as a modulator from the carrier by information signal being transmitted. When the data has been modulated in carrier radio wave, radio signal will locate more than one frequency, this happens due to frequency or bit rate from modulation information which added to carrier signal.

Multiple radio carriers can be exist within one space in the same time without having to interference each other if radio waves transmitted have different frequencies. To extract the data, the radio receiver is regulated in one frequency and rejects other frequencies. In certain wireless LAN configuration, transmitter / receiver (transceiver) devices, commonly called Access Point, connected to cable network from fixed location using standard cable.

2.2. Wireless Standard

In wireless standardization, it can be seen from the development of wireless device itself. WLAN technology of 2.4GHz, 5.8GHz, 5GHz have been developing rapidly especially due to the exemption of frequency permits within ISM band (industrial, scientific, medical) and UNII band (Unlicensed National Information Infrastructure) by United States government. Data communication standard being used is generally in the family of IEEE 802.11, where IEEE 802.11b has maximum speed of 11Mbps, meanwhile IEEE 802.11a and IEEE 802.11g have maximum speed of 54Mbps. For data communication in wireless it needs several architecture components which can be interpreted by interface protocol. IEEE as an international regulation body has set protocols for wireless consists of physical and logical architecture for the wireless system. Common wireless communication used daily is in the frequency of 2.4GHz. This is due to in Indonesia the application of 2.4GHz frequency is exempted from any cost. To the standardization of wireless device, IEEE has standardization such as in the following table:

Table 1. Standardization Table of 802.11

802.11 network standards v · d · e [hide]										
802.11 Protocol	Release[22]	Freq. (GHz)	Bandwidth (MHz)	Data rate per stream (Mbit/s)[23]	Allowable MIMO streams	Modulation	Approximate indoor range[citation needed]		Approximate Outdoor range[citation needed]	
							(m)	(ft)	(m)	(ft)
–	Jun 1997	2.4	20	1, 2	1	DSSS	20	66	100	330
a	Sep 1999	5	20	6, 9, 12, 18, 24, 36, 48, 54	1	OFDM	35	110	120	390
		3.7[y]					--	--	5,000	16,000[y]
b	Sep 1999	2.4	20	1, 2, 5.5, 11	1	DSSS	38	120	140	460
g	Jun 2003	2.4	20	1, 2, 6, 9, 12, 18, 24, 36, 48, 54	1	OFDM, DSSS	38	120	140	460
n	Oct 2009	2.4/5	20	7.2, 14.4, 21.7, 28.9, 43.3, 57.8, 65, 72.2[z]	4	OFDM	70	230	250	820[24]
			40	15, 30, 45, 60, 90, 120, 135, 150[z]			70	230	250	820[24]

■ [y] IEEE 802.11y-2008 extended operation of 802.11a to the licensed 3.7 GHz band. Increased power limits allow for a range up 5000m. As of 2009, it is only being licensed in the United States by the FCC.
■ [z] Assumes Short Guard interval (SGI) enabled, otherwise reduce each data rate by 10%.

2.3. Frequency and Signal

Frequency is the amount of vibrations occurred within one second. The formula of frequency is the amount of vibrations divided by the amount of time seconds. Unit of frequency is hertz / Hz. In Wifi network working within the frequency of 2.4GHz, it is divided by frequency working modes in general into 11 channels. Such as in following figure:

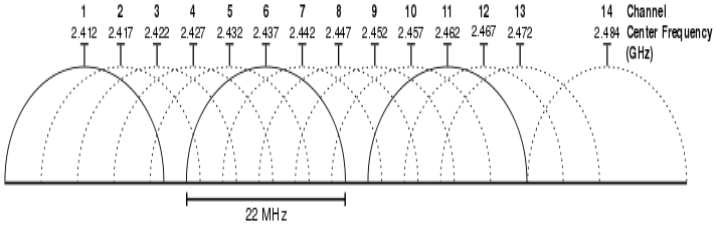

Figure 2. Frequency channels of an Access Point

Signal is a physical phenomenon where one or several of its characteristics is symbolizing information. In data transmission, signal is a data display in the form of electrical or electromagnetic. The unit for the measurement of signal strength is dB (decibel). Decibel (dB) is a unit of differential (or Ratio) between the strength of signal emissive power. The naming also to commemorate Alexander Graham Bell (therefore the letter "B" is an uppercase). This unit is used to show the effect of a device to the power or emissive power of a signal, the gain of an antenna towards an imaginary standard antenna (isotropic antenna). Since it is imaginary, therefore this standard antenna only exists theoretically and used for measurement. The gain of the antenna (higher than 1 GHz) is usually using dBi unit. A 24 dBi grid antenna has a gain of 24 dBi against 0 dBi imaginary standard antenna (isotropic antenna). This unit is an international standard unit. It means that 24 dBi Grid Antennas although having different brands yet obtaining the same gains which are 24 dBi. The brand do not have any impact if both antennas have the same gains and with the same Radiation Patterns. Radiation Pattern of an Antenna also helps emissive power or the coverage and also can help reducing interference in the field practice.

3. RESEARCH METHOD

3.1. Preparation of Signal Amplifier Device

Signal amplifier device is using a used beverage can. The used beverage can is shaped as shown in the figure.

Figure 3. The picture of Signal Amplifier Can

Figure 3 shows the shape of signal amplifier media from front side, where the material used is from beverage can shaped in cylindrical. From the cylindrical shape it is shaped to resemble a sunken plate which later aims to make use of frequency reflection so that able to focus on one spot. The hole shaped in the bottom side used as antenna placement hole from access point device.

3.2. Preparation of Access Point

Access Point device which is being used is access point device with the type of TL-WA500G. The configuration of access point device is standard configuration. The number of Access Point used is 2 units, where the first access point uses a signal amplifier can and the other uses a signal amplifier.

3.3. Measurement of Signal Gain

The preparation conducted to the analysis tools of wireless access point's signal gain is by using the application / supporting tools named inSSIDer. The tools' display concerned as shown in the following picture:

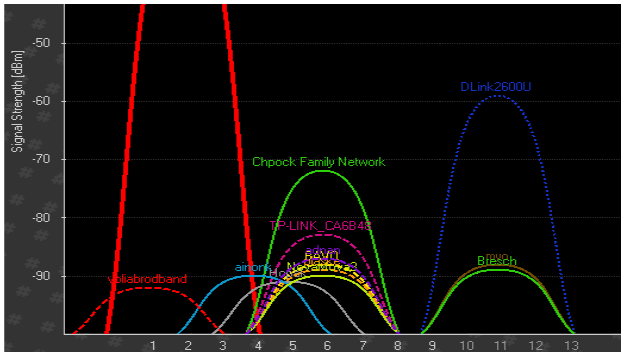

Figure 4. The picture of Signal Gain Measurement InSSIDer

4. RESULTS AND ANALYSIS

The configuration conducted in the research was by configuring 2 access points. The placement of both access points were in parallel. The placement of access points were as follows:

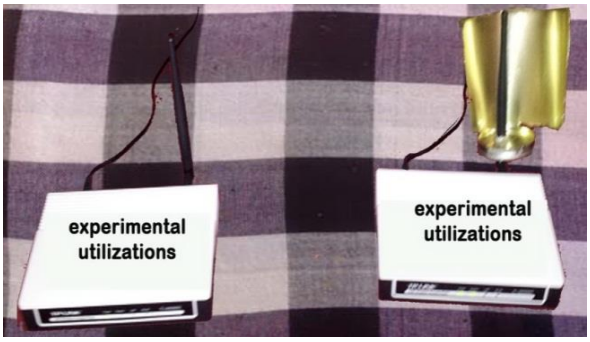

Figure 5. The picture of Access Point utilization

From the picture above, for access point in the left was access point without using signal amplifier (standard access point) and in the right was access point with signal amplifier. The distance set between access point and signal receiver device was at 12 meters.

At the time of trial, data collection was conducted using inSSIDer tools and wireless scanning standard application. Data collection was conducted in some time and the result could be seen that standard access point and access point with signal amplifier were using 2.4GHz frequency, and by using different channels with the goal to suppress the interference. From the use of channel also could be seen in the picture that signal gain from access point with signal amplifier had stronger signal which using channel 6, compared to standard access point which using channel 1. The result of comparison conducted by the researcher was performed in repetitive tests. The result obtained would be shown in the following table.

Table 2. Table of Signal Gain Comparison Data

No	SIGNAL GAIN	
	AP_standart	AP_signal_amplifier
1	-53 dBm	-44 dBm
2	-53 dBm	-48 dBm
3	-49 dBm	-41 dBm
4	-52 dBm	-43 dBm
5	-48 dBm	-41 dBm
6	-53 dBm	-43 dBm
7	-54 dBm	-41 dBm
8	-55 dBm	-41 dBm
9	-51 dBm	-45 dBm
10	-49 dBm	-45 dBm
11	-49 dBm	-39 dBm
12	-54 dBm	-38 dBm
13	-43 dBm	-37 dBm
14	-44 dBm	-39 dBm
15	-48 dBm	-40 dBm
16	-51 dBm	-39 dBm
17	-45 dBm	-38 dBm
18	-53 dBm	-51 dBm
19	-53 dBm	-47 dBm
20	-53 dBm	-51 dBm

Comparison graphic could be shown as follows:

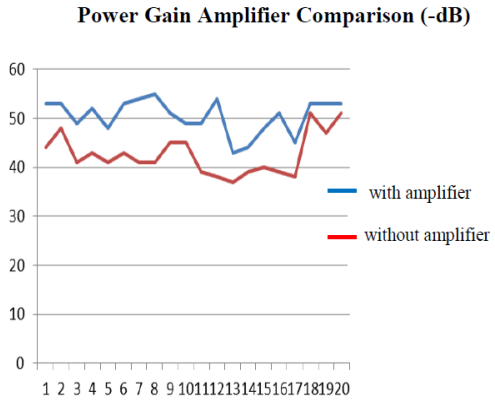

Figure 6. The graphic of Signal Gain Comparison

The mean calculation was using single data mean calculation which was defined as follows:

$$x = \frac{X1 + X2 + X3 + \ldots\ldots + Xn}{n}$$

$$x = \frac{1}{n}\sum_{i=1}^{n} x1$$

Comparison data was conducted by calculation as follows:

1. The average of signal gain during the trial was performed as many as 20 times were:
   Accesspoint_Standart:

((-53 dBm) + (-53 dBm) + (-49 dBm) + (-52 dBm) + (-48 dBm) + (-53 dBm) + (-54 dBm) + (-55 dBm) + (-51 dBm) + (-49 dBm) + (-49 dBm) + (-54 dBm) + (-43 dBm) + (-44 dBm) + (-48 dBm) + (-51 dBm) + (-45 dBm) + (-53 dBm) + (-53 dBm) + (-53 dBm)) / 20 = -50.5 dBm
Signal Amplifier Access Point:
((-44 dBm) + (-48 dBm) + (-41 dBm) + (-43 dBm) + (-41 dBm) + (-43 dBm) + (-41 dBm) + (-41 dBm) + (-45 dBm) + (-45 dBm) + (-39 dBm) + (-38 dBm) + (-37 dBm) + (-39 dBm) + (-40 dBm) + (-39 dBm) + (-38 dBm) + (-51 dBm) + (-47 dBm) + (-51 dBm)) / 20 = -42.5 dBm
(-44 dBm) + …… / 20 = -42.5 dBm

2. The increase percentage of the impact of signal amplifier media with standard access point by calculating:

$$\frac{\text{(average of Standard AP – average of Signal Amplifier AP) x 100\%}}{\text{average of Standard AP}} = \ldots\ldots = 15.84158\ \%$$

$$= \frac{\text{((-50.5 dBm) – (-42.5 dBm)) x 100 \%}}{\text{(-50.5 dBm)}}$$

$$= \frac{\text{(-8 dBm) x 100 \%}}{\text{(-50.5 dBm)}}$$

= 15.84158 %

From the calculation result above, then it can be calculated for the increase of mean wireless signal gain of access point device which its signal gain is amplified with signal amplifier using used beverage can which able to influence signal strength at 15.84158% from the value of signal gain from standard access point. The value of 15.84158 is the average result value of signal strength performed 20 times of signal gain testing. The result of percentage value of 15.84158% can be concluded that used beverage can is able to increase wireless transmission signal gain at the value of calculation percentage.

5. CONCLUSION

Based on trial process being conducted, it can be concluded that communication in wireless network has signal gain value as quality reference from signal gain frequency of access point device. Signal gain emitted from access point device can undergo attenuation (the phenomena of signal weakening due to the impact of communication distance between the sender and the receiver) and attenuation can be anticipated with the existence of signal amplifier. One of signal amplifiers which can be used is used beverage can, with confirmation that used beverage can which shaped in such a way is able to amplify wireless signal gain and having significant signal strength value.

The development of the research conducted in this study, is to develop the testing of the distance to find out the measurement stability and the existence of comparator towards the type of can and the can material used as signal amplifier material.

ACKNOWLEDGEMENTS

A great appreciation goes to promoter, colleague and everybody who has made valuable contributions in this study and their critical comments on this manuscript.

REFERENCES

[1] Witono Timotius, "Linux-Based *Accesspoint* Dalam *Wireless* LAN", *Jurnal Informatika*, Vol. 2, No.2, Bandung, Sekretariat Jurnal Informatika UKM, 2006
[2] Arifin Zaenal, "Sistem Pengamanan Jaringan *Wireless* LAN", Yogyakarta, ANDI, 2008
[3] Purbo, Onno.W, "TCP/IP Standar, Desain dan Implementasi", Jakarta, PT. Elex Media Komputindo, 1998
[4] Joko I., Mumpuni, Adisuryo Wardono, "Meningkatkan Kemampuan Jaringan Komputer", Yogyakarta, ANDI, 2006
[5] Prakoso Samuel, "Jaringan Komputer Linux Konsep Dasar, Instalasi, Aplikasi, Keamanan, dan Penerapan", Yogyakarta, ANDI, 2005
[6] Nuraksa Makodian, Lingga Wardhana, "Teknologi Wireless Communication dan Wireless Broadband", Yogyakarta, ANDI, 2009

[7] Stalling W, "Data and Computer Communication", Macmillan Publishing, 1985.
[8] Hartono, Jogianto, "Pengenalan Komputer, Dasar Ilmu Komputer, Pemrograman,Sistem Informasi dan Intelegnsi Buatan", Yogyakarta : Penerbit ANDI, 1999
[9] Stalling, W., "Local Network", Macmillan Publishing Company, 1985
[10] Arifin Zainal, "Langkah Mudah Membangun Jaringan Komputer", Yogyakarta, ANDI, 2005

BIOGRAPHY OF AUTHOR

Ir. Ni Wayan Sri Ariyani, MM.
Applied Electronic Engineering,
Department of Electrical Engineering,
Faculty of Engineering, Udayana University.
Bali, Indonesia. Phone/Fax : 62361703315
e-mail: ari@baliyoni.co.id