

Signal Jamming and its Modern Applications

Alaparthi Pardhasaradhi¹, Rayala Ravi Kumar²

¹Student, Dept. of E.C.E, K L University, Vaddeswaram, Andhra Pradesh, India
alaparthipardhasaradhi@gmail.com

²Associate Professor, Dept. of E.C.E, K L University, Vaddeswaram, Andhra Pradesh, India
rayalaravi2013@gmail.com

Abstract: From the day of inception of wireless communication system there began the research and development of a method to disable or inert the wireless communication system. The process of blocking of the receiver to receive a transmitted signal is called Jamming of the signal. This paper gives the information about the Jamming, the history of using this technique, types of jamming and their production and concludes with the modern application of jammers.

Keywords: Jamming, Short distance, Transmitter, Transmission, Wireless, Wires, Radio jamming.

1. Introduction

Communication is one of the basic necessities for human beings to live connect in this vast world. The traces of communication are first found in ancient Persian kingdom where the fire is used to communicate between distant places, it is followed by communication ways like pigeon post, traditional postal service, followed by wired communication like telegram and telephone, and finally the introduction of wireless communications. With the introduction of wireless communication there came the introduction of mobile phones which changed the world into a global village where the distance is no matter an obstacle for communication. Now-a-days every communication device is either directly or indirectly using wireless communication.

Jammers work by outputting a RF signal at the same frequency expected by the device that's being jammed, but at a higher power compared to the normal signal. The jamming signal itself is usually random noise or a pure signal. The device being jammed will then receive the higher power signal which is from the jammer, and then the devices can no longer function correctly. The jamming signal itself is usually random noise or a pure signal.

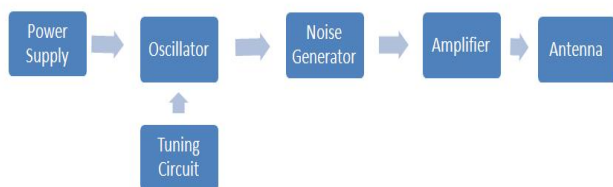


Figure 1.Block diagram of a Jammer

Not only in military applications, jammer can be used in day today applications such as in examination centers to prevent malpractices, in jails, in forest areas and deserted areas where there exists an antisocial activity group etc. This paper deals with the principles and technologies used in jammer, various types of jammers and their application in military, defence and day-to-day usage.

2. History

Immediately after the inception of wireless signal transmission there comes the introduction of jamming circuits for blocking those signals. This signal jamming is intentionally done to mislead the Pilot in a battle by interfering the signal from their base station. To misguide the enemy missiles and aircrafts the radars are disrupted by using radar jamming.

2.1 During World War II

During Second World War there raised a situation where the communication between the enemy pilot and his/their base station needs to be disturbed. In cold war period the radio signals of neighboring country should be stopped from reaching into their own country. This type of situations lead to the discovery of new concept called signal jamming. Radar jamming is also important to disrupt use of radar used to guide an enemy's missiles or aircraft. Modern secure communication techniques use such methods as spread spectrum modulation to resist the deleterious effects of jamming.

Jamming of foreign radio broadcast stations has often been used in wartime (and during periods of tense international relations) to prevent or deter citizens from listening to broadcasts from enemy countries. However such jamming is usually of limited effectiveness because the affected stations usually change frequencies, put on additional frequencies and/or increase transmission power.

In occupied Europe the Nazis attempted to jam broadcasts to the continent from the BBC and other allied stations. In the Netherlands such aerials were nicknamed "moffenzeef"

2.2 During Cold war

During much of the Cold War Soviet (and Eastern Bloc) jamming of some Western broadcasters led to a "power race" in which broadcasters and jammers alike repeatedly increased their transmission power, utilized highly directional antennas and added extra frequencies to the already heavily overcrowded shortwave bands to such an extent that many broadcasters not directly targeted by the jammers suffered from the rising levels of noise and interference

A further method used was operating transmitters for domestic radio stations on the same or nearby frequencies. For example, for many years East Germany operated at Wiederau a transmitter on the same medium wave frequency that Muhlacker radio transmitter used with an output power of 100 kW, which made it difficult to receive the AFN Muhlacker radio transmitter in much of the East Germany.

Radio Free Europe and its sister service Radio Liberty were the main target of Soviet jammers followed by Voice of America and the BBC World Service. During cold war the western block and soviet want to change the ideology of the people in the opposite countries in favour of their economic model. So the available way is to communicate with the people with the help of radios. So the governments must install the jammers so as to isolate their people from communicate with their enemies.



Figure 2. Sky-wave jammer near Kashi in Xinjian province, western China

2.3 Post Cold war Period

After the fall of Soviet Union the western block gain the ultimate upper hand over the electronics and innovation. In many no of countries jamming is considered as crime as the signal of a licensed person for a specific bandwidth is blocked leading to loss of money. Some countries use jamming for the interest of public in defense and military applications

Governments that make use of jamming argue that they have the rights to protect their citizens from dangerous ideas. This problem is not radio communications technology itself, but the content that is carried with its help. This website is about radio broadcast jamming - the massive technological effort directed toward censoring unacceptable content in the USSR (1931-1988), Czechoslovakia, Poland, Bulgaria, East Germany (1951-1988), China, Cuba, Iran, Vietnam (2003) and other countries.

The history of jamming began with the World War II to mislead the pilots continued in cold war to keep their citizens confined to their economic policy. After the cold war the jamming is considered as crime in some of the countries. Some countries use jamming to protect their citizens from dangerous ideas.

3. Types of Jamming

Jamming started first in battle fields to disrupt the radio communication between the pilot and their base stations. In its advance stages jamming is used by the aircrafts to jam the radars used by the ground team.

Jamming is of different types depending on the signal being transferred they are

3.1 Mechanical Jamming

Mechanical jamming is caused by devices which reflect or re-reflect radar energy back to the radar to produce false target returns on the operator's scope. Mechanical jamming devices include chaff, corner reflectors, and decoys.

Chaff is made of different length metallic strips, which reflect different frequencies, so as to create a large area of false returns in which a real contact would be difficult to detect. Modern chaff is usually aluminium coated glass fibres of various lengths. Their extremely low weight and small size allows them to form a dense, long lasting cloud of interference.

Decoys are manoeuvrable flying objects that are intended to deceive a radar operator into believing that they are actually aircraft. They are especially dangerous because they can clutter up radar with false targets making it easier for an attacker to get within weapons range and neutralize the radar. Corner reflectors can be fitted on decoys to make them appear larger than they are, thus furthering the illusion that a decoy is an actual aircraft. Some decoys have the capability to perform electronic jamming or drop chaff. Decoys also have a deliberately sacrificial purpose i.e. defenders may fire guided missiles at the decoys, thereby depleting limited stocks of expensive weaponry which might otherwise have been used against genuine targets.

3.2 Electrical Jamming

Electronic jamming is a form of Electronic Warfare where jammers radiate interfering signals toward an enemy's radar, blocking the receiver with highly concentrated energy signals. The two main technique styles are noise techniques and repeater techniques. The three types of noise jamming are spot, sweep, and barrage.

Spot jamming occurs when a jammer focuses all of its power on a single frequency. While this would severely degrade the ability to track on the jammed frequency, frequency agile radar would hardly be affected because the jammer can only jam one frequency. While multiple jammers could possibly jam a range of frequencies, this would consume a great deal of resources to have any effect on frequency-agile radar, and would probably still be ineffective.

Sweep jamming is when a jammer's full power is shifted from one frequency to another. While this has the advantage of being able to jam multiple frequencies in quick succession, it does not affect them all at the same time, and thus limits the effectiveness of this type of jamming. Although, depending on the error checking in the device(s) this can render a wide range of devices effectively useless.

Barrage jamming is the jamming of multiple frequencies at once by a single jammer. The advantage is that multiple frequencies can be jammed simultaneously; however, the jamming effect can be limited because this requires the jammer to spread its full power between these frequencies, as the number of frequencies covered increases the less effectively each is jammed.

Base jamming is a new type of Barrage Jamming where one radar is jammed effectively at its source at all frequencies. However, all other radars continue working normally. Pulse jamming produces noise pulses with period depending on radar mast rotation speed thus creating blocked sectors from directions other than the jammer making it harder to discover the jammer location.

Cover pulse jamming creates a short noise pulse when radar signal is received thus concealing any aircraft flying behind the EW craft with a block of noise.

Digital radio frequency memory, or DRFM jamming, or Repeater jamming is a repeater technique that manipulates received radar energy and retransmits it to change the return the radar sees. This technique can change the range the radar detects by changing the delay in transmission of pulses, the velocity the radar detects by changing the Doppler shift of the transmitted signal, or the angle to the plane by using AM techniques to transmit into the side lobes of the radar. DRFM jamming can create false targets behind the EW craft but not in front of it because the jamming signal must be timed after the received radar signal. If each radar pulse is uniquely coded it is not possible to create targets to directions other than the direction of the jammer

Deceptive jamming uses techniques like "range gate pull-off" to break radar lock.

3.3 Inadvertent Jamming

In some cases, jamming of either type may be caused by friendly sources. Electronic jamming can also be inadvertently caused by friendly sources, usually powerful EW platforms operating within range of the affected radar. Unintentional electronic jamming is most easily prevented by good planning and common sense, though sometimes it is unavoidable.

4. Future Aspects

4.1 In Military applications

Now-a-days any disturbances caused by terrorists are antisocial elements is caused by using cellular phones and other wireless communication technologies. So there is a huge scope for using Jammers in military applications. There are incidents where the military of Pakistan country avoided many bomb blasts by using the cell phone jammers as many bombs are detonated by using cell phones.

4.2 In Normal Day-to-Day Life

As many countries considered jamming as illegal act and doesn't support private jamming there are some places like movie theaters, hospitals and shopping malls where we can use the jammers to avoid disturbances. In important

meetings signal jammers are used to avoid the leakage of information before officially announcing it.

5. Merits and Demerits

5.1 Merits

For any government to make its country peaceful without any extremities it should maintain a balance between ends of any technology. Jamming is used as an effective medium to increase the advantages of wireless technology without allowing it to fall in wrong hands.

5.2 Demerits

Sometimes jamming causes disturbance as in cases of shopping malls where we can't receive important calls. Some antisocial elements are using jamming to counter government tactics where there should be use of anti jamming techniques which increase the cost of operation.

6. Conclusion

It is true that every technology has its advantages and disadvantages regardless of its complexity and perfectness. It is true in case of jamming also. It has many advantages in battles, cold conflicts between two nations. If the technology falls in wrong hands the cost of operation of anti jamming technologies is burden of any government or private telecommunication agencies.

References

- [1] B. Thomas W., "Wireless Transmission of Power now Possible".
- [2] NIST 800-97 "Establishing Wireless Robust Security Networks: A Guide to IEEE 802.11i"
- [3] Office of Research, USIA (various), "Radio Free Europe archive documents", United States Information Agency
- [4] Richard Poisel., "Modern Communications Jamming: Principles and Techniques",
- [5] "EU Challenges Iranian Satellite Jamming", Space Daily. March 23, 2010.

Author Profile



Alaparthi Pardhasaradhi was born in 1992 in Krishna District. He is currently pursuing B.E in Electronics and communications from K L University Guntur. He has done projects on "Mini U.P.S system" and "Communication using IR radiation". His areas of interest include image processing, real time communication systems and Nanotechnology.



Mr. Rayala Ravi Kumar perused masters in Communication Systems Engineering from P.S.G. College of Technology, Coimbatore in 1998. He is currently working as Associate professor at K.L. University, Guntur. His areas of interests include Systems Engineering, Applications of Embedded Systems and Statistical Signal Processing.