Power and Coverage Area

WARNING

THE JAMMING COVERAGE AREA FOR A PARTICULAR MODEL JAMMER SHOULD BE CONSIDERED A GENERAL OR TYPICAL AREA OF COVERAGE. YOUR SITUATION MAY VARY AND IS SPECIFIC TO YOUR SITE.

Every **JAMMING DEVICE** outputs a **JAMMING SIGNAL** on one or more frequencies at a particular **OUTPUT POWER**. The **OUTPUT POWER** of the **JAMMER** will typically be stated in WATTS or in some cases DBM, (decibels per meter), or both.

The **OUTPUT POWER** correlates generally to the **COVERAGE AREA** that the **JAMMER** will provide an effective blocking or **JAMMING** signal. However, because many factors affect both cellular phone reception and jamming efficiency the advertised or sated **AREA of COVERAGE** may be more or less than what a manufacture states.

FACTORS that affect both CELLULAR PHONE RECEPTION and JAMMING:

Strength and location of the Cellular Base Station or Tower
Terrain and Topology
Weather and Climactic Conditions
Structures, Building Characteristics

In most cases a **JAMMER** will be easier to implement and more effective indoors. In urban settings and in high-rise buildings, a jammer will typically be more effective on lower floors. This is because the building and surrounding structures diminish the cellular signal. In some cases a **JAMMER** will be more effective when placed on the side of a room or building which is closest to a cellular tower. And in other cases a **JAMMER** may be more effective when placed by a window or door.

THE SCIENCE OF JAMMING BY THE NUMBERS

The design of a jammer design begins with a desired area of coverage as it correlates to a particular frequency. Jammers like all radio devices operate according to certain laws of physics and energy.

The jamming objective is to inject an interference signal into the communications frequency so that the actual signal is completely submerged by the interference. It is important to notice that transmission can never be totally jammed - jamming hinders the reception at the other end. The problem here for the jammer is that only transmitters can be found using direction finding and the location of the target must be a specific location, usually where the jammer is located and this is because the jamming power is never infinite.

Jamming is successful when the jamming signal denies the usability of the communications transmission. In digital communications, the usability is denied when the error rate of the transmission cannot be compensated by error correction. Usually a successful jamming attack requires that the jammer power is roughly equal to signal power at the receiver.

The effects of jamming depend on the jamming-to-signal ratio (J/S), modulation scheme, channel coding and interleaving of the target system.

Generally Jamming-to-Signal ratio can be measured according to the following Equation.

$$\frac{J}{S} = \frac{Pj\,Gjr\,Grj^{2}\;Rtr}{Pt\,Gtr\,Grt^{2}\;Rjr}\,\frac{Lr\;Br}{Lj\;Bj}$$

Where:

Pj = jammer power

Pt = transmitter power

Gjr = antenna gain from jammer to receiver

Grj = antenna gain from receiver to Jammer

Gtr = antenna gain from transmitter to receiver

Grt = antenna gain from receiver to transmitter

Br = communications receiver bandwidth

Bj = jamming transmitter bandwidth

Rtr = range between communications transmitter and receiver

Rjt = range between jammer and communications receiver

Lj = jammer signal loss (including polarization mismatch)

Lr = communication signal loss

The above Equation indicates that the jammer Effective Radiated Power, which is the product of antenna gain and output power, should be high if jamming efficiency is required. On the other hand, in order to prevent jamming, the antenna gain toward the communication partner should be as high as possible while the gain towards the jammer should be as small as possible. As the equation shows, the antenna pattern, the relation between the azimuth and the gain, is a very important aspect in jamming.

Also as we know from Microwave and shown in the equation distance has a strong influence on the signal loss. If the distance between jammer and receiver is doubled, the jammer has to quadruple its output in order for the jamming to have the same effect. It must also be noted here that jammer path loss is often different from the communications path loss; hence giving the jammer an advantage over communication transmitters.

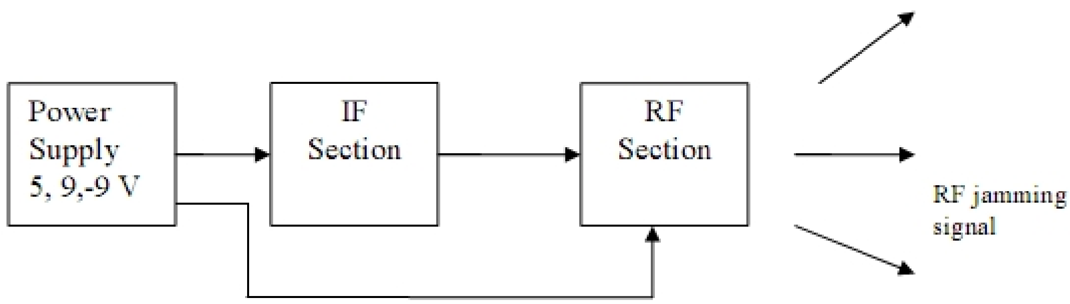
The GSM Air-interface uses two different multiplexing schemes: TDMA (Time Division Multiple Access) and FDMA (Frequency Division Multiple Access). The spectrum is divided into 200 kHz channels (FDMA) and each channel is divided into 8 timeslots (TDMA). Each 8 timeslot TDMA frame has duration of 4.6 ms (577 s/timeslot) [3]. The GSM transmission frequencies are presented in Table

	Uplink	Downlink
GSM 900	890-915 MHz	935-960 MHz

Table 2: GSM 900 Frequency Band

Design and Implementation of GSM Mobile JAMMER

The Implementation of type "A" JAMMER is fairly simple, the block diagram for this type is shown in the figure below and shows the main parts which are: RF-section, IF-section, and the power supply.



1-RF-Section:

The RF-section is the most important part of the mobile jammer. It consists of the Voltage Controlled Oscillator (VCO), RF Power amplifiers, and the antenna. These components are always selected according to the desired specification of the jammer such as the frequency range and the desired coverage range.

To obtain the desired output jamming power for coverage range of 20 meters first we found the jamming power required at the mobile receiver "Jr", knowing that SNRmin = 9 dB and Smax = -15dBm (i.e. worst jamming case). then from SNRmin = S/J, where S = the signal power, J = the jamming power Jr = -24dBm, then by invoking the free space path loss equation: [6] F = 32.45 + 20 log(f*D), where "Ds" is distance in Km and "f" is frequency in MHz , for 20 m the loss equals 58 dB hence the jammer should transmit a jamming signal with power equals : 58 dB -24dBm = 34dBm, to sustain a 20m jamming area.

CONCLUSION

The formula in our example above illustrates that a 900MHz GSM JAMMER must have a sustainable output of 34dBm (approximately 3 Watts) in order to block an area of twenty meters (20 m) in open space. It should be noted therefore that in areas where there is a particularly weak GMS signal, our Jammer might effectively block up to 30 meters, 40 meters, or even more. Ultimately, the effective range of any jammer will be affected by a)the location, distance, and signal strength of the base station or tower, b)terrain and topology, c)weather, climactic and atmospheric conditions, d)obstructions such as buildings, bridges, and e)building material and construction methods (indoor use).