Part 1: Introduction

1. What is a mixer?

* One of the most useful RF or radio frequency processes is that of mixing. Unlike an audio mixer where signals are simply added together, when a radio or RF engineer talks about mixing, he means a whole different process. Here signals are multiplied together and signals an new frequencies are generated.
* The process of RF or non-linear mixing or multiplication is used in virtually every radio set these days and also in many other circuits beside. It enables signals to be changed from one frequency to another so that signal processing for example can be undertaken on a low frequency where it is easier to perform, but the signal can be changed to a from a higher frequency where the signal is to be transmitted or received.
* In electronic, a mixer, or frequency mixer, is a nonlinear electrical circuit that creates new frequencies from two signals applied to it. In its most common application, two signals are applied to a mixer, and it produces new signals at the sum and difference of the original frequencies. Other frequency components may also be produced in a practical frequency mixer.
* Mixers are widely used to shift signals from one frequency range to another, a process known as heterodyning, for convenience in transmission or further signal processing. For example, a key component of a superheterodyne receiver is a mixer used to move received signals to a common intermediate frequency. Frequency mixers are also used to modulate a carrier signal in radio transmitters.
* Shape

  Description automatically generated with medium confidence
* A mixer contains 3 ports: Input signal, local oscillator and output signal:

If the output signal has frequency lower than the input signal’s, then the mixer will perform a downconversion transform, else it will perform an up conversion transform.

* There are 2 main type of mixer:
* **Passive mixers**: Passive mixers typically use passive components in the form of diodes as the switching element within the RF circuit. As a result they cannot exhibit any gain, but many forms can provide excellent levels of performance.

Passive mixers mainly use Schottky diodes because of their low turn-on voltage, but they require the use of a balun / RF transformer if they are to be used in a balanced or double balanced mixer. This can limit the frequency response.

* **Active mixers**: As the name of the Active RF mixer contains active electronic components like a bipolar transistor, FET or even a vacuum tube / thermionic valve. These types of RF mixer are able to provide gain as well as proving the multiplication or RF mixer capability.
* Mixers are also looked at by whether they are balanced or not. Balancing them requires baluns - balanced to unbalanced transformers - but this provides improvements in performance:
* Unbalanced mixer
* Single balanced mixer
* Double balanced mixer
* Triple balanced mixer

Tham khảo:

[Understand RF Mixing & Frequency Mixers » Electronics Notes (electronics-notes.com)](https://www.electronics-notes.com/articles/radio/rf-mixer/rf-mixing-basics.php)

[Frequency mixer - Wikipedia](https://en.wikipedia.org/wiki/Frequency_mixer)

1. What is GSM 900?

* The term GSM900 is used for a GSM system which operates in any 900 MHz. The 900 MHz band defined in the ETSI standard includes the primary GSM band (GSM-P), the extension (see E-GSM) and the part of the 900 MHz band that is reserved for railways (R-GSM).
* The total GSM900 band defined in the standard ranges from 876 - 915 MHz paired with 921 - 960 MHz. Mobiles transmit in the lower band and base stations transmit in the upper band.
* In daily life, the term GSM900 band is used for the parts of the band that are used by the GSM operators to offer public services, which exludes the R-GSM band. This part of the band that remains ranges from 880 - 915 MHz paired with 925 - 960 MHz band.

A screenshot of a computer

Description automatically generated with medium confidence

Where:

* Receiver at 935 MHz to 960 MHz
* Transmitt at 890 MHz to 915 MHz

Tham khảo:

[1 - Giới thiệu mạng di động GSM (byethost7.com)](http://tamthien.byethost7.com/noi_dung/DTDD/ch-1/ch-1.htm?i=1)

[GSM900 - Telecom ABC](http://www.telecomabc.com/g/gsm900.html)