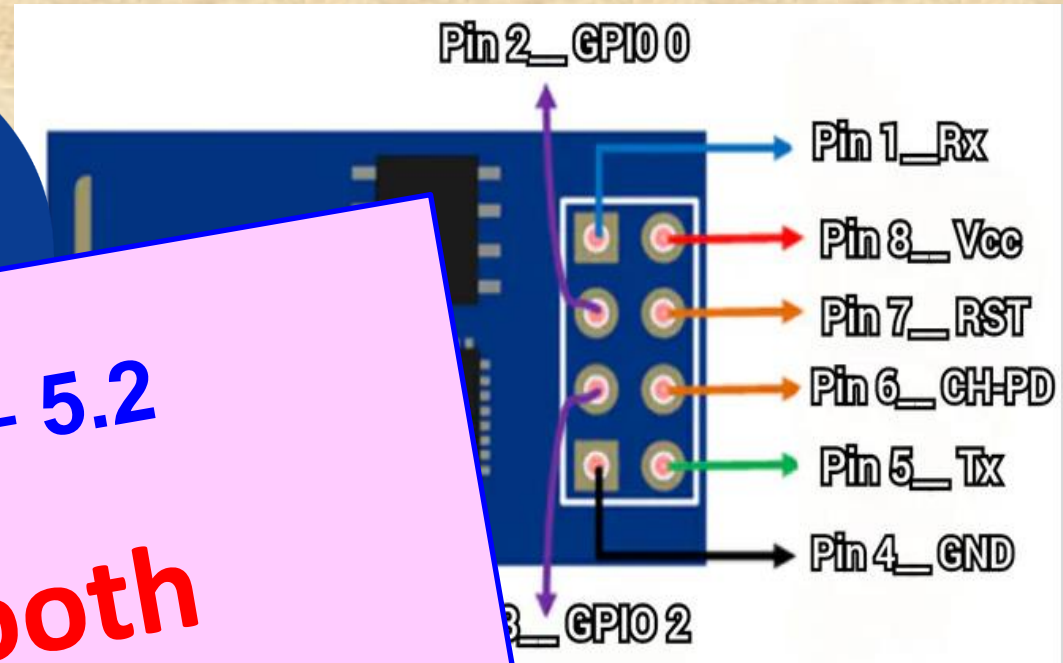


Communication – 5.2

Wi-Fi, BlueTooth

(Introduction)

FY – DESH – VIT



Wireless Communication

Wi-Fi

Wireless Fidelity

Fidelity = ???
= Faithfulness, Belief, Devotion, Loyalty
= Exactness

Invented by AT&T in 1991

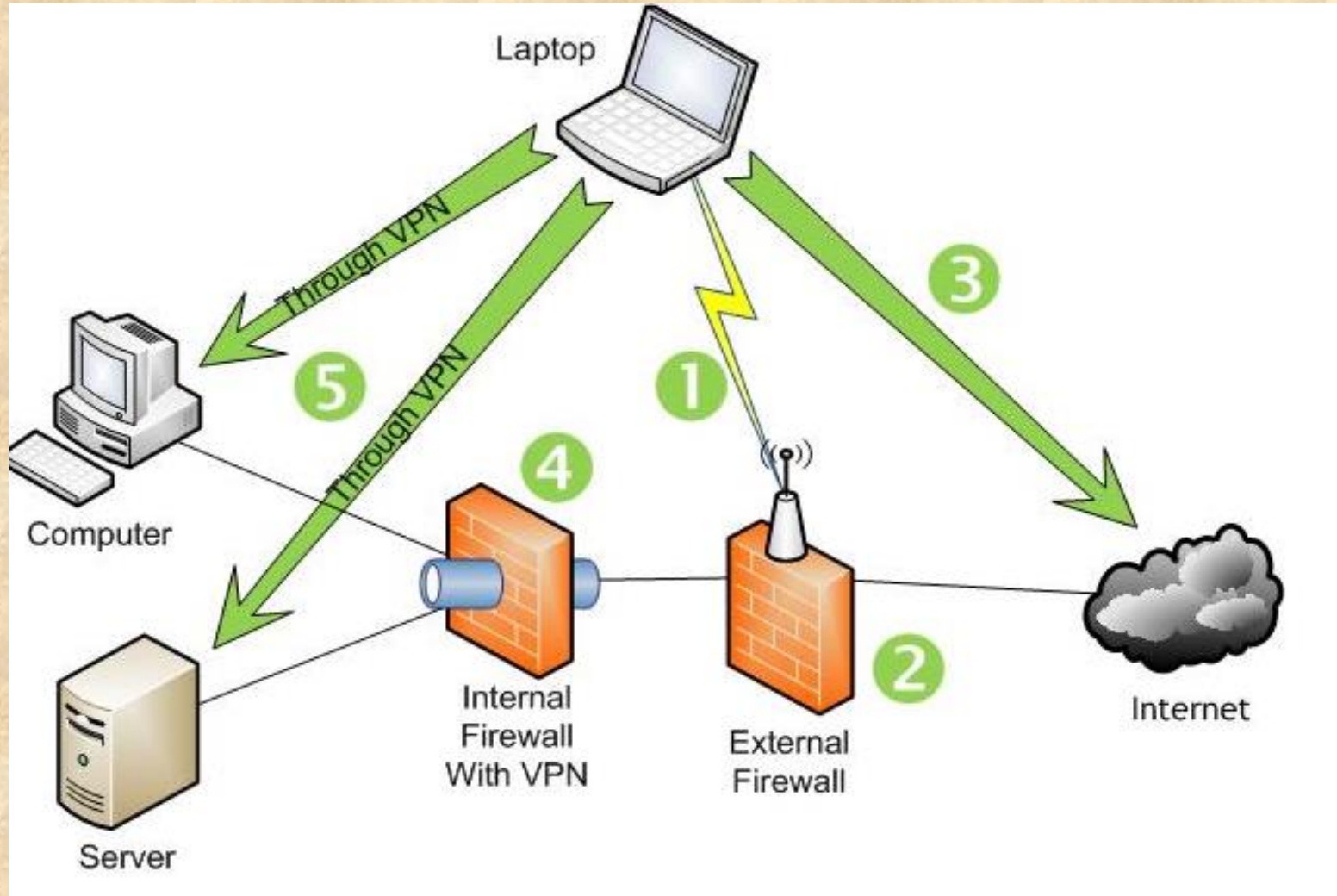
Wi-Fi Features

- It is a family of wireless network protocols, based on the IEEE standards.
- **Wi-Fi uses Radio Frequencies for arial communication.**
- Commonly used Radio frequencies are 2.4 GHz and 5.0 GHz.
- **RF signals are sent by Antennas or Routers and received by WiFi enabled devices like computers, cellphones etc.**
- **Sound – Electricity – RF – Transmission – Reception – Electricity – Sound**
- **Data – Electricity – RF – Transmission – Reception – Electricity – Data**
- Standards used are ...
 - ✓ IEEE 802.11 a = Wi-Fi 1
 - ✓ IEEE 802.11 b = Wi-Fi 2
 - ✓ IEEE 802.11 g = Wi-Fi 3
 - ✓ IEEE 802.11 n = Wi-Fi 4
 - ✓ IEEE 802.11 ac = Wi-Fi 5
 - ✓ IEEE 802.11 ax = Wi-Fi 6

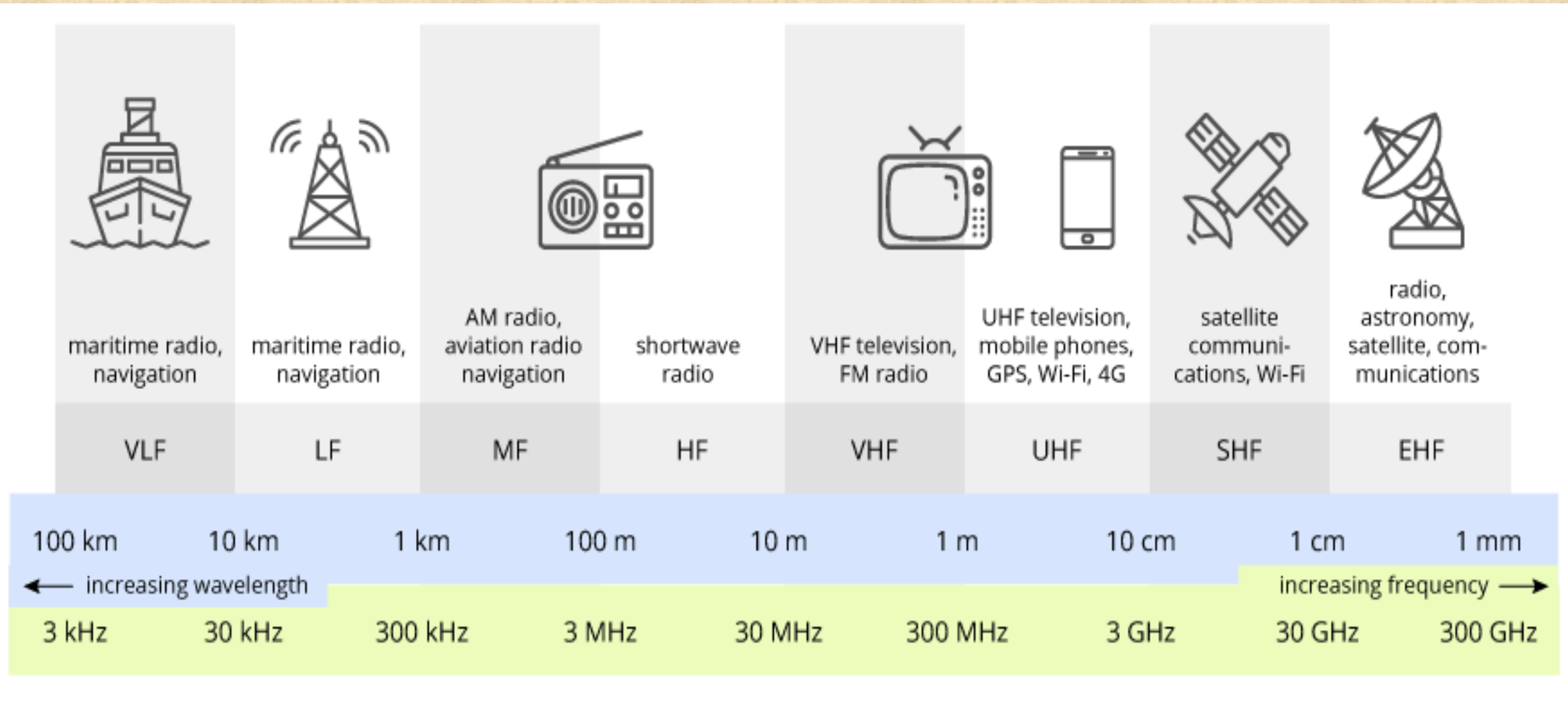
What is Wi-Fi?

- The wireless router is actually a **very low-power radio transmitter** and receiver, with a maximum range of about 90 meters or 300 ft.
- The **router can send and receive** Internet data with any computer that is also equipped with wireless access .
- There are two cases of communication with the Wi-Fi connection ...
 - 1) through access point to the client connection or
 - 2) client to client connection.
- A wireless router is also called as a **Wireless Local Area Network (WLAN)** device. A wireless network is also called a Wi-Fi network.
- Wi-Fi can be used with a high level of data security.

Wi-Fi



Radio Frequency Band



Amplitude Modulation (AM)

Low Amplitude
Radio Waves

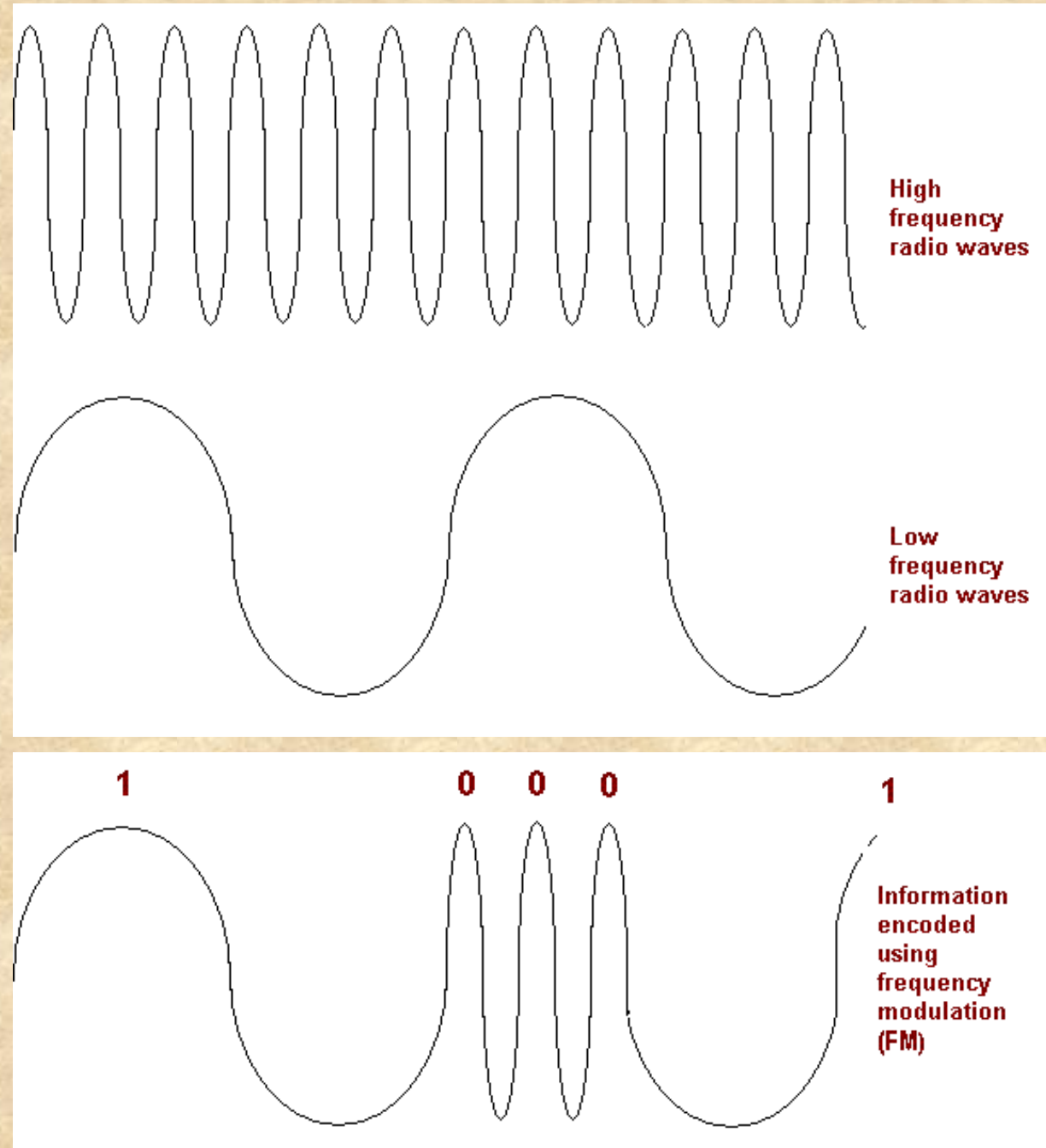
High Amplitude
Radio Waves

**Amplitude is changed to a
high or a low. Frequency
remains constant.**

Information coded
using amplitude
modulation, or AM

Frequency Modulation (FM)

Frequency is changed to a high or a low. Amplitude remains constant.



Concept of

1) Amplitude Shift

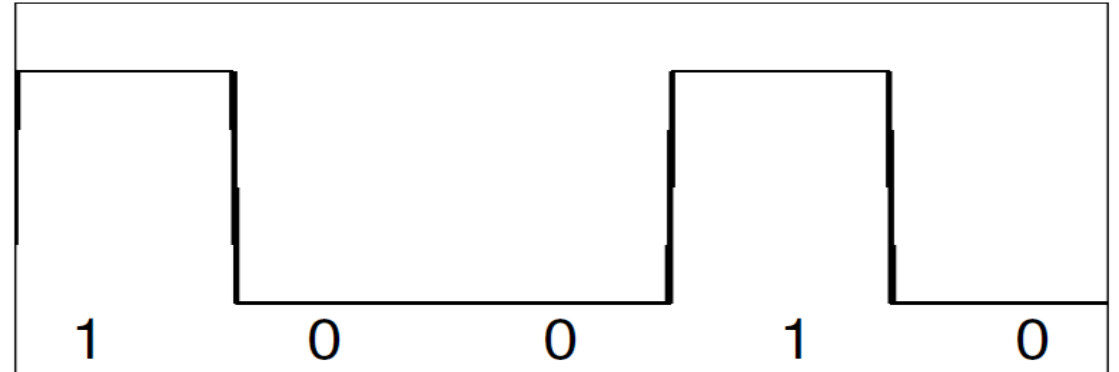
Keying (ASK)

and

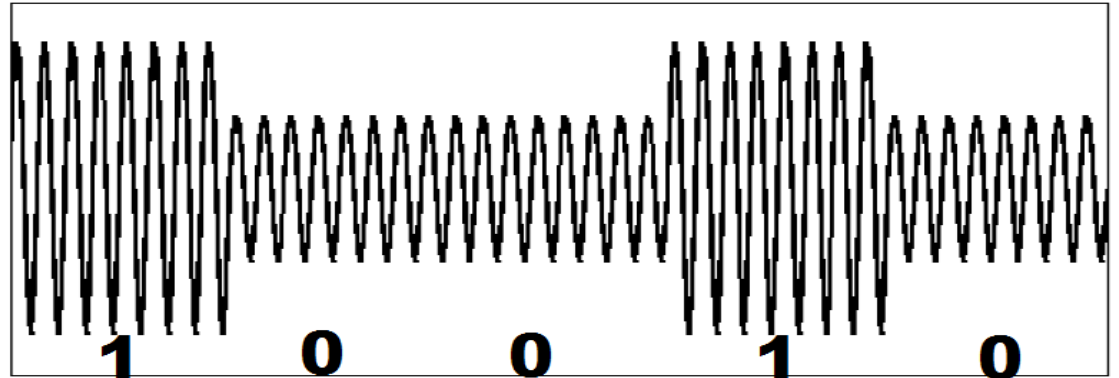
2) Frequency Shift

Keying (FSK)

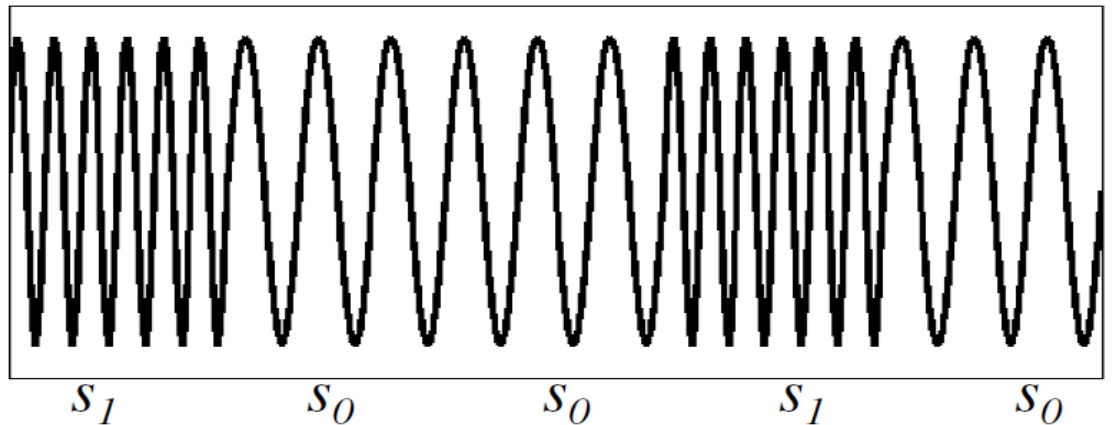
Baseband data:



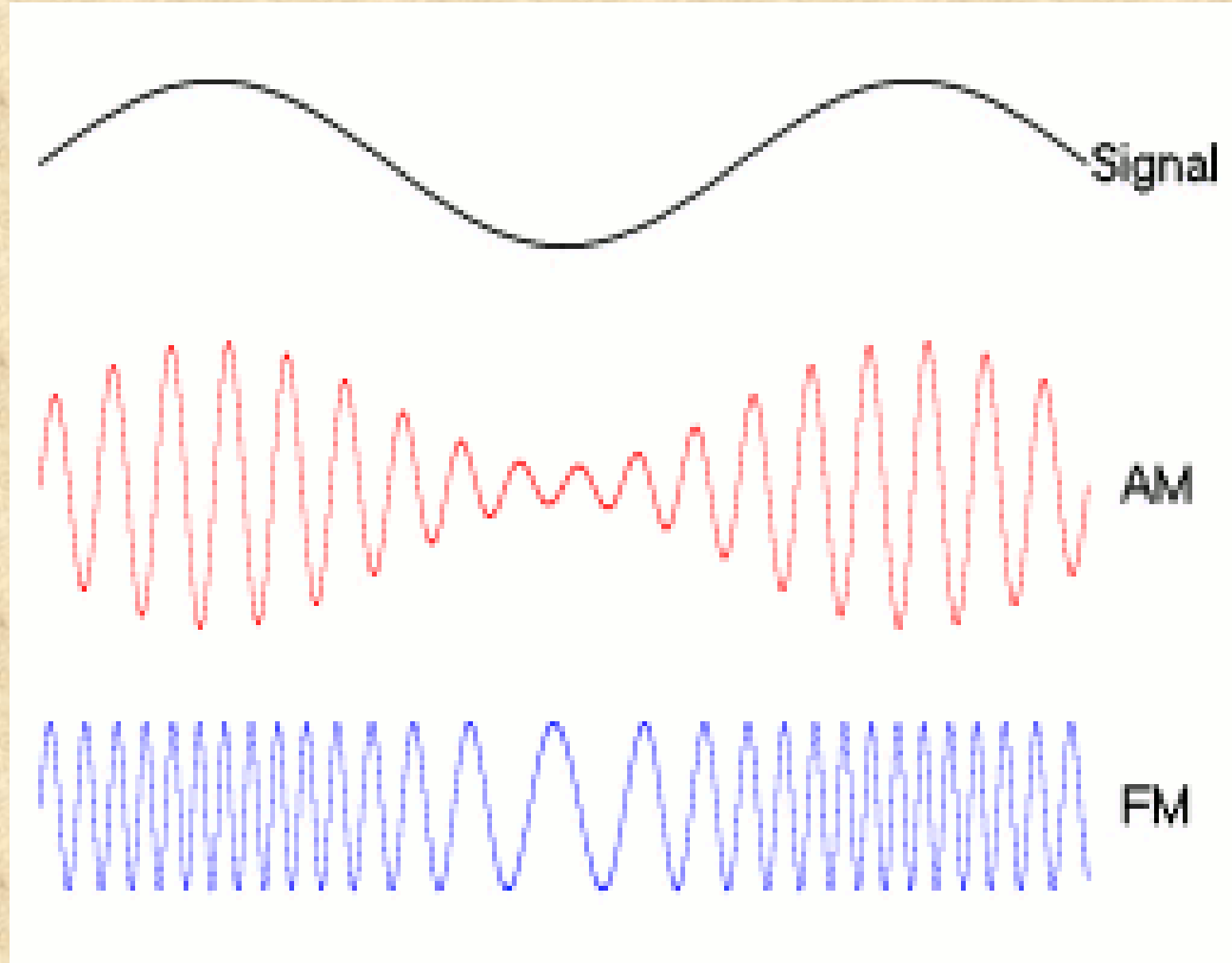
ASK modulated signal:



FSK modulated signal:



Working Principle of Wi-Fi



Working Principle of Wi-Fi

- Three hardware components are required
 - 1) Radio signals, 2) Antenna, 3) Router.
- The data to be sent is converted to Radio frequencies **“encoded or modulated”** using electrical circuit using either
 - 1) Amplitude Modulation (AM) or 2) Frequency Modulation (FM)
- The modulated Radio signals are transmitted from antennas / routers and these signals are picked up by Wi-Fi receivers that are equipped with Wi-Fi cards.
- Whenever the computer receives the signals with in the range of 100-150 feet from router it gets connected to the device.
- The Wi-Fi cards read the received signals and **“decode”** the Frequencies and Amplitudes to recover the digital data.

Limitations of Wi-Fi

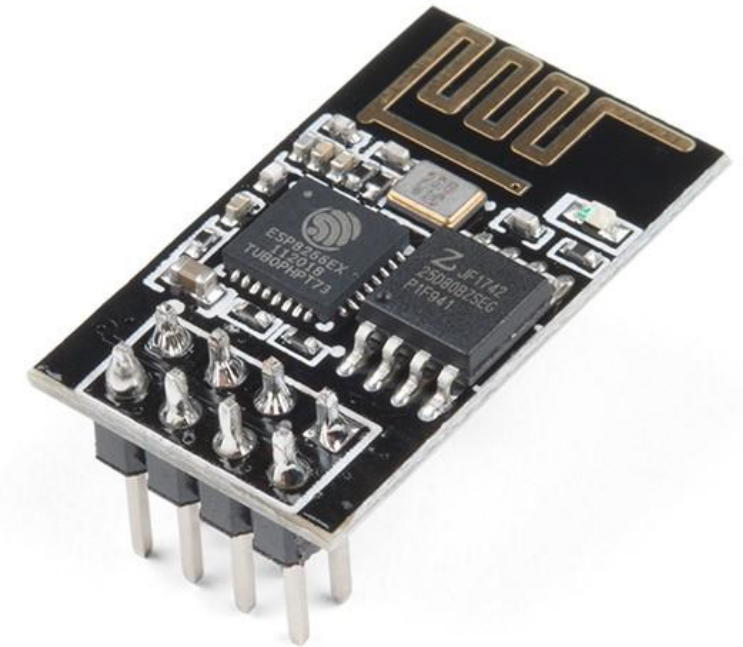
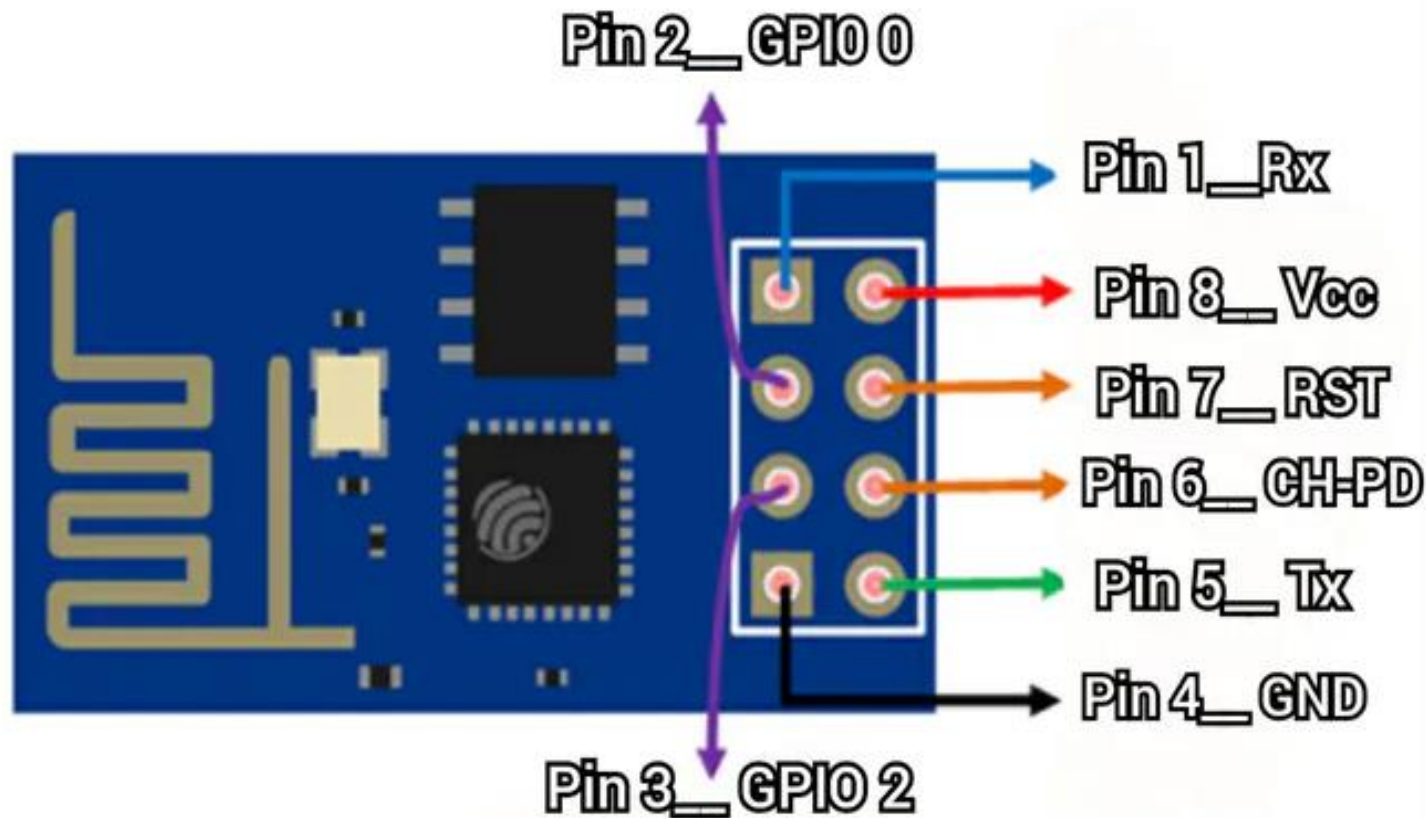
- Limited range
- Wi-Fi is half duplex
- High power consumption
- Data theft is possible
- Interference could be caught by Wi-Fi equipments
- Expensive

Wi- Fi Module - ESP8266

- ESP8266 is a low-cost WiFi module that belongs to ESP's family. It is used to control electronics devices anywhere in the world.
- It has an in-built **microcontroller** and a 1MB flash memory allowing it to connect to a WiFi.
- The TCP/IP protocol stack allows the module to communicate with WiFi signals.
- The maximum working voltage of the module is **3.3V**. Thus a supply of 5V can damage the module.

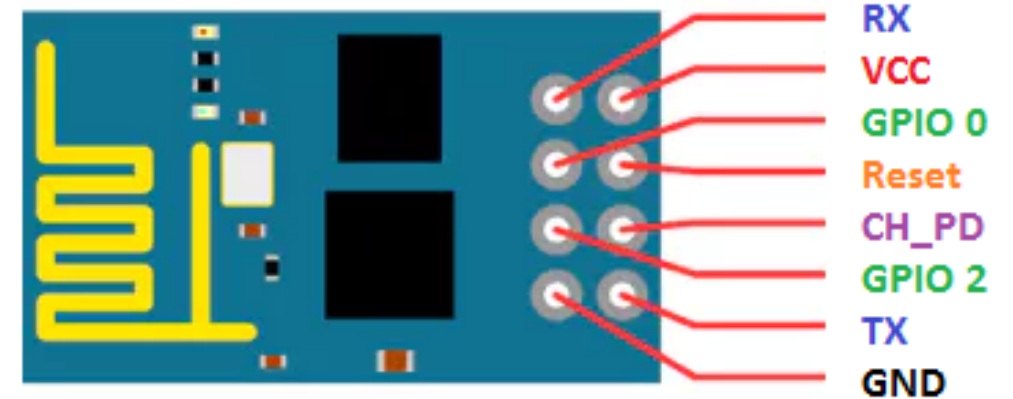
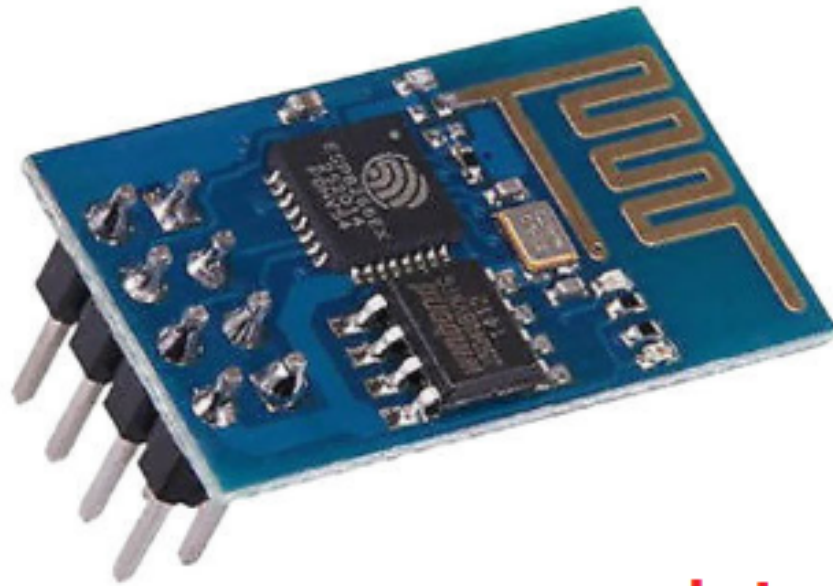
Wi- Fi Module - ESP8266

ESP8266: Pinout



Wi- Fi Module - ESP8266

ESP8266: Pinout

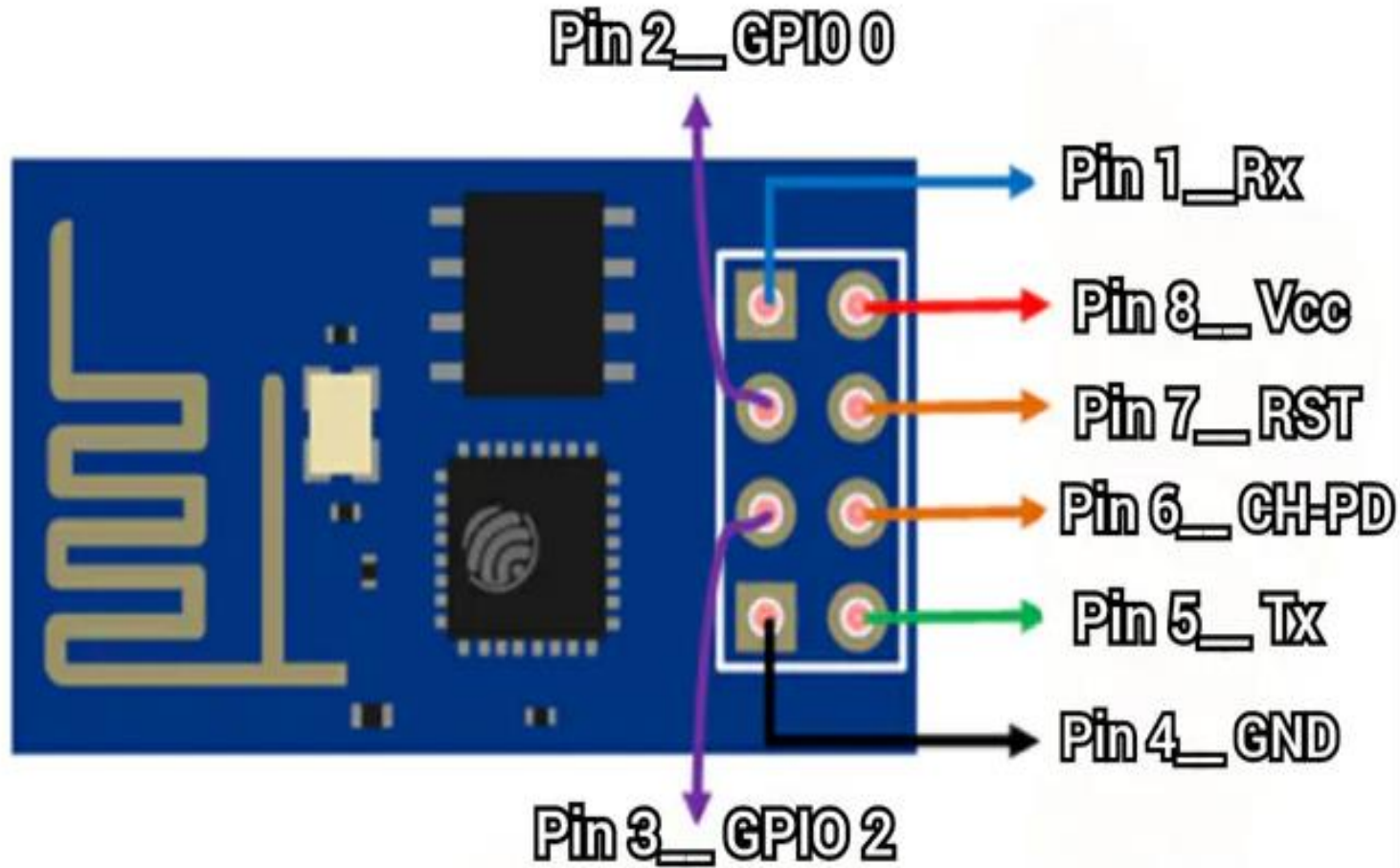


Introduction to ESP8266

www.TheEngineeringProjects.com

Wi- Fi Module - ESP8266

ESP8266: Pinout



ESP8266: Pinout

pin 1 _____ Rx -- connect it to Rx of Arduino

pin 2 _____ GPIO 0--connect it to ground while uploading the code to arduino IDE

pin 3 _____ GPIO 2

pin 4 _____ GND--connect it to ground

pin 5 _____ Tx--connect it to Tx of Arduino

pin 6 _____ CH_PD(EN) -- connect it to 3.3v

pin 7 _____ RST(reset)--(not necessary) connect it to 3.3v for normal operation
and 0v(GND) for reset

pin 8 _____ Vcc--supply 3.3v from Arduino or from an external source

Applications

- 1) Mobile phone**
- 2) AM and FM Radio stations**
- 3) Satellite communication**
- 4) Navigation systems**
- 5) Air Traffic control**
- 6) Medical – MRI scanning**
- 7) Naval applications - Submarines**
- 8) Remote controlled toys**
- 9) Automotive segment**
- 10) Browsing internet**
- 11) Video conference and many more**

Wireless Communication

Blue Tooth

Wireless Communication

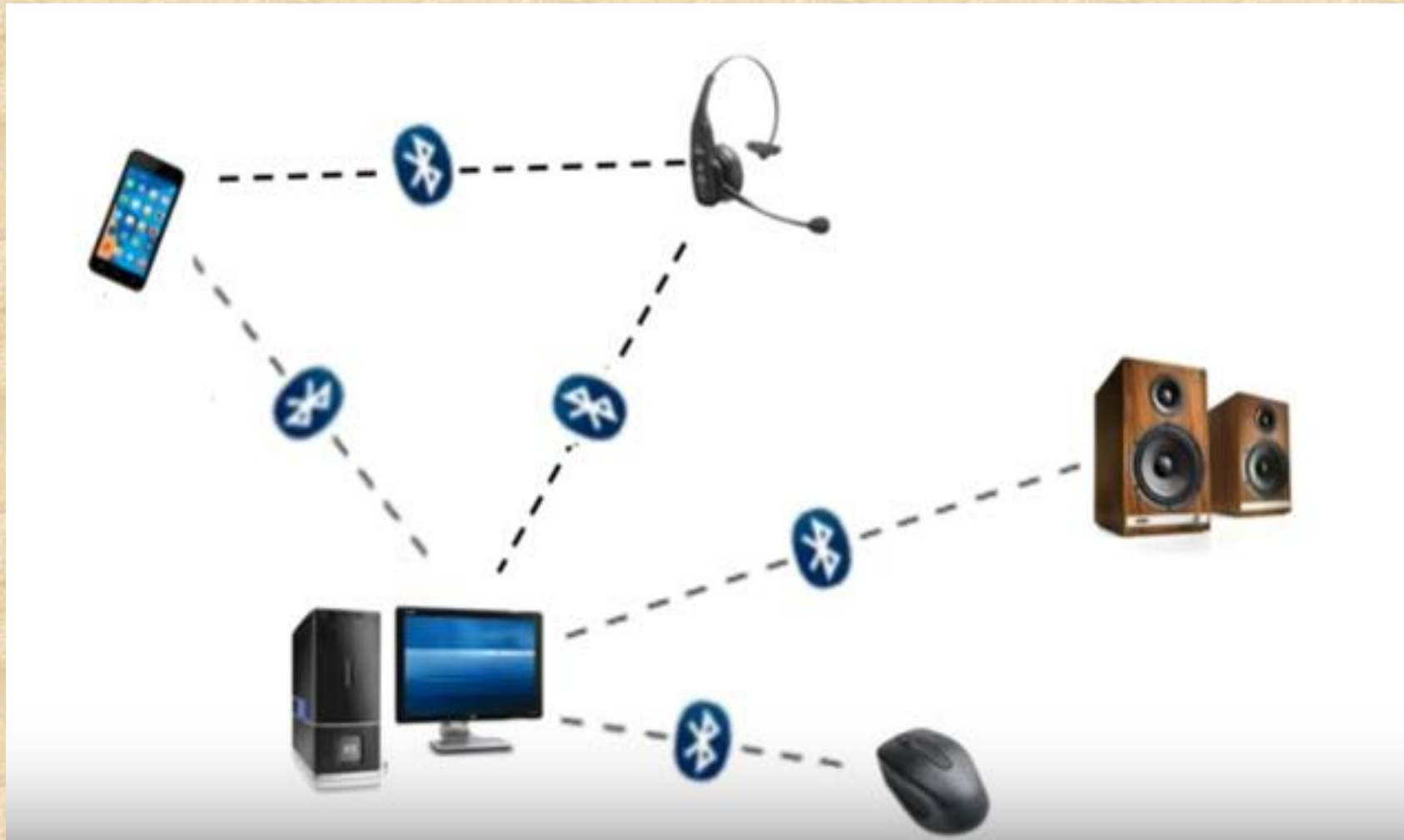
Bluetooth – 1990 – 1994 – 2001



**Short distance Wireless technology
to reduce crowding of cabling**

**Invented by Jaap Hartssan of
Ericsson company**

Bluetooth- What is it?



What is Bluetooth?

- Bluetooth is a way to send or receive data between two devices.
- Bluetooth uses Radio frequencies but for short distances less than 10 m or 30 ft.
- Bluetooth uses short wavelength **Ultra High Frequency (UHF) Radio waves from 2.4 GHz to 2.485 GHz.**
- Signal can be transmitted through thin walls, thus eliminating the need for line of sight.
- The key **features** of **Bluetooth** technology are robustness, low power, and low cost.

Bluetooth features

- 1) Typical - 80dBm sensitivity
- 2) Up to +4dBm RF transmit power
- 3) Low Power 1.8 V Operation , 1.8 to 3.6 V
- 4) UART interface with programmable baud rate
- 5) With integrated antenna
- 6) Default Baud rate: 38400, Data bits:8, Stop bit:1, Parity:No parity,
- 7) Data control: has Supported baud rate: 9600, 19200, 38400, 57600, 115200, 230400, 460800.

Bluetooth features

- 1) The pairing process identifies and connects any two devices to each other. It also prevents interference from other non-paired Bluetooth devices in the area.
- 2) It uses maximum power only when it is required, thus preserving battery life.
- 3) **Multiple Bluetooth** units form a Wireless Personal Area Network (WPAN), which can call up to **7 client** devices
- 4) It uses the **spread spectrum technology** in which each device uses **different frequency band** and hence the devices do not transmit at same time.
- 5) It provides a range of up to 10m at a transmit power of 1 m watt. The range can be extended to 100m if the transmit power is increased to 100 m watt.

HC-05 Bluetooth Module

- Its main strength is its ability to simultaneously handle both data and voice transmissions.
- There are several ways for wireless communication such as NRF, ZigBee, Wi-Fi, and Bluetooth.
- Bluetooth protocol; an affordable communication method in PAN network, with a maximum data rate of 1Mb/S, working in a nominal range of 100 meters using 2.4 G frequency is a common way of wireless communicating.

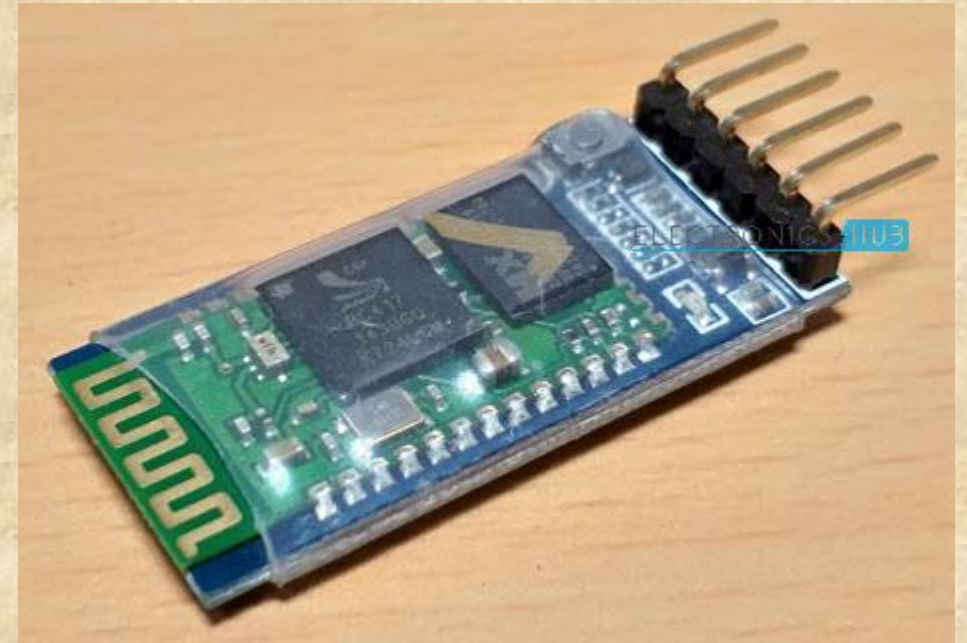


HC-05 Bluetooth Module

HC05 module is a Bluetooth module using serial communication.

HC05 Bluetooth module important specifications:

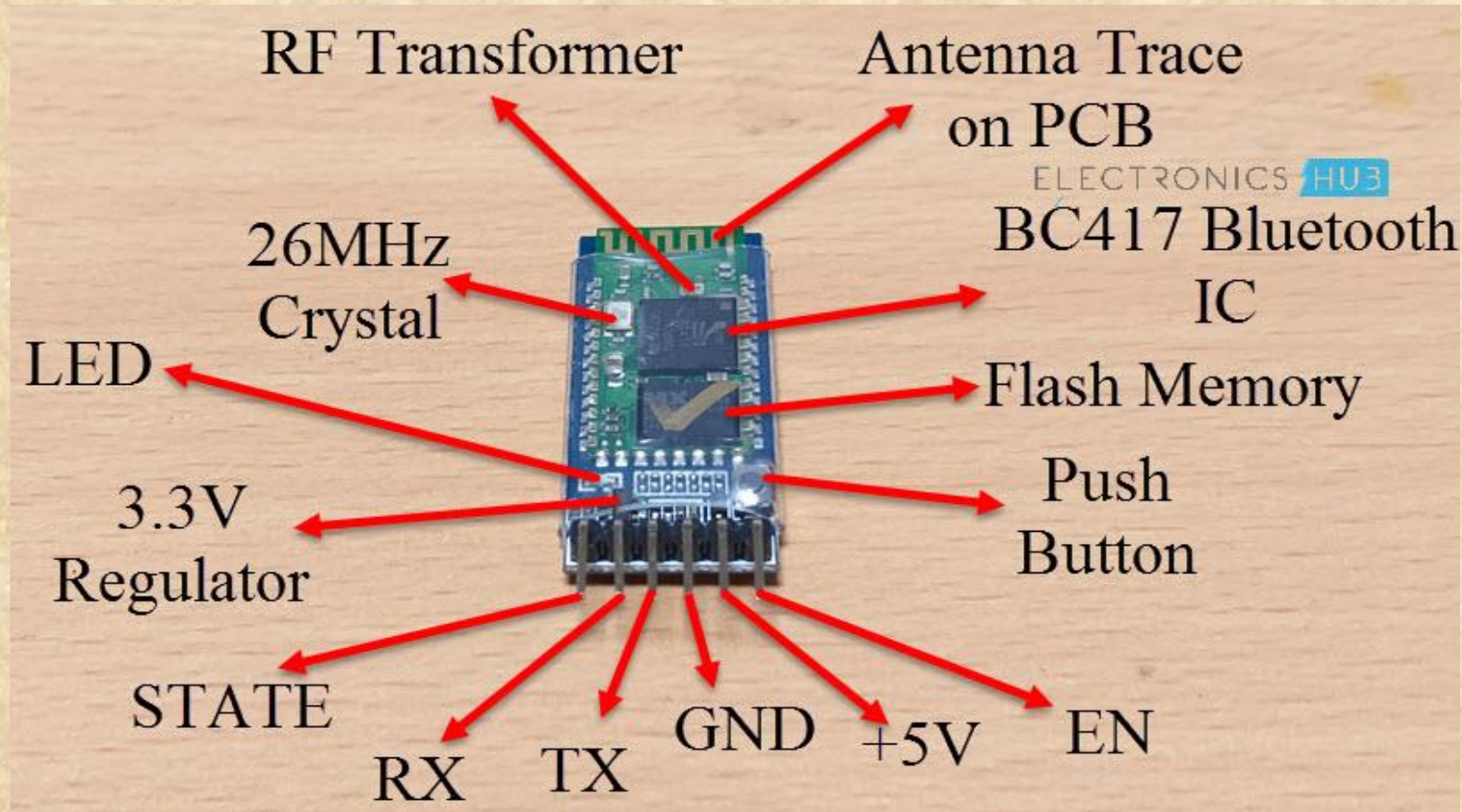
- 1) Working voltage: 3.6V – 5V
- 2) Internal antenna
- 3) Automatic connection to the last device



Pins of HC-05 Bluetooth Module

Pins of HC-05 Bluetooth Module:

- Modules have six pins namely:
- VCC, GND, TX, RX, EN and STATE.



Pins of HC-05 Bluetooth Module

Pin Description

State : Can be connected to the Arduino Input in order to know the state of the connection. Paired or disconnected.

Rx : Receive Pin of the module. It is recommended to use a voltage divider.

Tx : Can be connected directly to the Arduino Rx Pin

GND : Connected to GND pin of Arduino

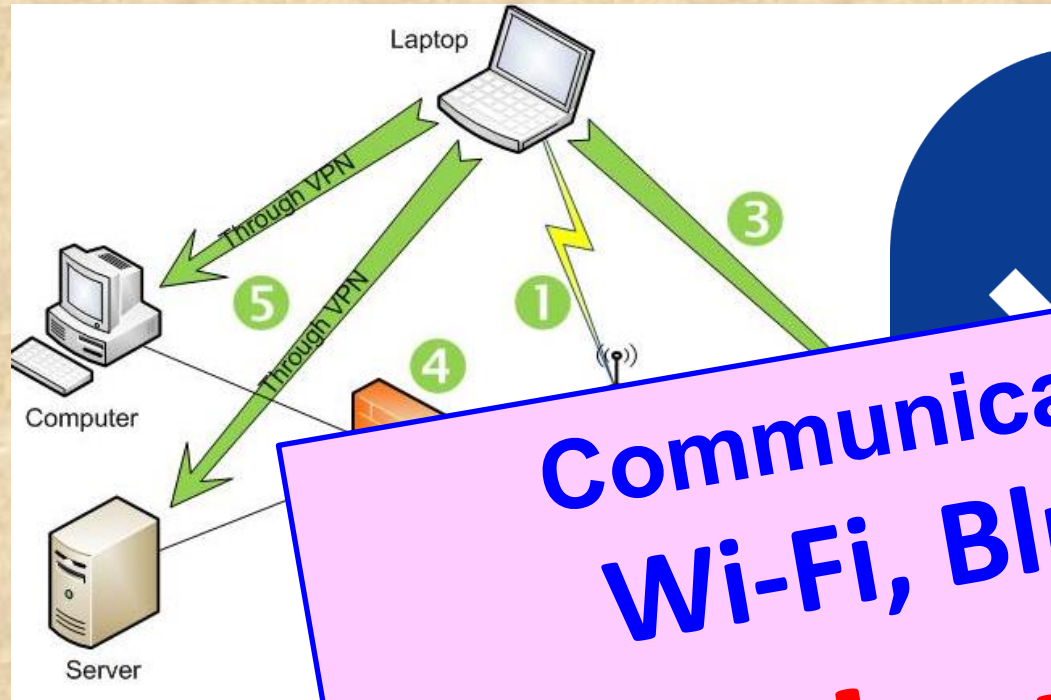
5 V : The module has an internal 3.3 V regulator on board.

EN : Enables or Disables the module.

Interfacing with Arduino

Example :

- We transmit data from Smartphone via Bluetooth to the Arduino Uno and display it on Serial Monitor of PC.
- Download and install a Bluetooth terminal application on your phone and use it to connect to the HC-05 Bluetooth module.
- Data is sent from the Smartphone using the Bluetooth terminal application.
- Communication name is HC05, the password is 1234 or 0000 and the transfer baud rate is 9600 by default.



Communication – 5.2 Wi-Fi, BlueTooth Thanks ! FY – DESH – VIT

