

Fact Sheet No.11

Radio Frequency (RF) Emissions Classification

The Minister responsible for Telecommunications, through the Telecommunications Unit, is charged with the responsibility of ensuring that the Radio Frequency (RF) emissions, classification adopted by Barbados conforms to well defined conventions, in accordance with the International Telecommunication Union (ITU) Radio Regulations.

RF emissions are the result of radiated electromagnetic energy. They are produced by radio transmitting stations and can be utilized by radio equipment.

RF emissions occur at frequencies ranging from 3kHz to 3000GHz within the radio spectrum. These emissions show differences in characteristics that are mainly dependent on their frequencies. This fact has led to the grouping together of these emissions into nine frequency bands. Different techniques are then used to propagate these various bands.

Inherent characteristics dictate how these emissions can be utilized for the purpose of communication.

Electrical current or voltage can be varied over time in order to produce signals which carry information. Emissions can be used to carry information by processing them in such a way as to carry signals. The process, called modulation involves the modification of the carrier by another signal or wave (the modulating wave). The resultant composite signal is the modulated wave.

The process of modulation is accomplished in several ways, amongst these are -

- Amplitude modulation (AM) - a type of modulation in which the amplitude of the carrier wave is varied above and below its unmodulated value by an amount proportional to the amplitude of the signal wave and at the frequency of the modulating signal.
- Frequency modulation (FM) - a type of modulation in which the frequency is varied above and below its unmodulated value by an amount proportional to the amplitude of the signal wave and at a frequency of the modulating signal. Frequency shift keying (FSK) is a type of frequency modulation.

- Pulse modulation - a form of modulation in which pulses are used to modulate the carrier wave or, more commonly, in which a pulse train is used as the carrier. Information is conveyed by modulating some parameter of the pulses with a set of discrete instantaneous samples of the message signal. There are different forms of pulse modulation such as pulse amplitude modulation (PAM), pulse-width modulation (PWM), pulse frequency modulation (PFM), pulse-position modulation (PPM) and pulse-code modulation(PCM).
- Phase modulation (PM) - a type of modulation in which the phase of the carrier wave is varied about its unmodulated value by an amount proportional to the amplitude of the signal wave and at a frequency of the modulating signal.

The carrier wave is the wave that is intended to be modulated. The process of modulation produces waves of frequencies that are higher and lower than the carrier frequency. These resultant waves are collectively referred to as upper and lower sidebands respectively.

For a.m. transmissions sometimes the carrier is not transmitted with the information. The resulting transmission is referred to as suppressed carrier transmission.

- This process can produce single side-band transmission, i.e the transmission of only one of two sidebands produced by amplitude modulation of the carrier.
- Double side-band transmissions are also produced, i.e the transmission of both sidebands generated when a carrier wave is amplitude modulated.
- Another outcome is vestigial side-band transmission, i.e the transmission of one sideband and the corresponding vestigial sideband.

Another method involves the transmission of the carrier with the information. This mode of transmission is referred to as transmitted-carrier transmission.

RF emissions are governed by certain characteristics that determine their usage, method of propagation and control. Technology which utilizes these emissions should be designed in what has been deemed the best way to exploit these inherent characteristics.

Since RF emissions are a vehicle for global communication it is essential that well-defined classifications be observed in order to avoid ambiguity and to facilitate compatibility in the usage of technology.

Barbados RF emissions Policy is in accordance with the International Telecommunications Union (ITU) Radio Regulations. This has led to the adoption of classifications defined by these regulations.

Classification of RF Emissions

The classification of an emission by the use of symbols provides a convenient way of summarizing its usage and how it is transmitted. A method has been adopted to classify RF emissions by a set of characteristics defined by standard symbols.

- Symbol number one (#1) defines the type of modulation of the main carrier.
- Symbol number two (#2) defines modulating signal.
- Symbol number three (#3) defines type of information to be transmitted.

Users of the radio spectrum, including broadcast stations operators, industrial equipment operators, personal wireless service providers (e.g.) cellular phone providers are all required to be licensed to operate in Barbados. Emissions are generated which can be deemed useful or unwanted. The class of emissions generated by an installation or broadcast station is considered an important part of the licensing information required by the government for the proper control and management of the spectrum in Barbados.

Definition of RF Emissions

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| Class of emissions | The set of characteristics of an emission, designated by standard symbols which define type of modulation of the main carrier, modulating signal, type of information to transmitted, and also if appropriate, any additional signal characteristics. |
| Single-sideband emission | An amplitude modulated emission with one sideband only. |
| Full carrier single emission | An amplitude modulated emission with one sideband only. |
| Reduced carrier single sideband emission | A single sideband emission in which the degree of carrier suppression enables the carrier to be reconstituted and to be used for demodulation. |
| Suppressed carrier single sideband emission | A single sideband emission in which the carrier is virtually suppressed and intended to be used for demodulation. |

Out-of-band emission Emission on a frequency or frequencies immediately outside the necessary bandwidth which results from the modulation process, but excluding spurious emissions.

Spurious emissions Emissions on a frequency or frequencies which may be reduced without affecting the corresponding transmission of information. Spurious emissions include harmonic emissions, parasitic emissions, intermodulation products and frequency conversion products, but exclude out-of-band emissions.

Unwanted emissions Consists of spurious emissions and out-of-band emissions.

RF emissions are the result of radiated electromagnetic energy. They are produced by radio transmitting stations and can be utilized by radio equipment.

Classification of RF Emissions With Definitions

Symbols are utilized in order to describe RF emissions. The symbols used to designate the classes of emissions have the meanings assigned to them in the International Telecommunication Convention. They are:-

Amplitude Modulation

A1A Morse telegraphy without the use of modulating audio frequency.

A1B Teletype telegraphy without the use of modulating audio frequency.

A2A Morse telegraphy with the use of modulating audio frequency.

A2B Teletype telegraphy with the use of modulating audio frequency.

A3E Telephony, double-sideband.

R3E Telephony, single-sideband, reduced carrier.

H3E Telephony, single – sideband, full carrier.

J3E Telephony, single – sideband, suppressed carrier.

Frequency (or Phase) Modulation

F1A Morse telegraphy by frequency – shift keying without modulating audio Frequency.

- F2A Morse telegraphy by on – off keying of frequency - modulating audio frequency.
- F2B Teletype telegraphy by on – off keying of frequency - modulating audio frequency.
- F3E Telephony by frequency modulation.
- G3E Telephony by phase modulation.

Pulse Modulation

- K1A Telegraphy by on-off keying of a pulse carrier without the use of a modulating audio frequency. Frequency or frequencies modulating the amplitude of the pulses
- K2A Telegraphy by on-off keying of a modulating audio frequency or frequencies or by on-off keying of a modulated pulse carrier – the audio frequency or frequencies modulating the amplitude of the pulses.
- L2A Telegraphy by on-off keying of a modulating audio frequency or frequencies or by on-off keying of a modulated pulsed carrier - the audio frequency or frequencies modulating the width (or duration) of the pulses.
- K2E Telephony, amplitude modulated pulses.
- L3E Telephony, width (or duration) modulated pulses.

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