



## **Glossary of Terms for:**

**Tone Signaling**

**Data Signaling**

**Remote Control**

**Voice Scrambling**

**Radiotelephone Interconnect**

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**ACSB**

See Amplitude Companded Single Side Band.

**A-D Converter**

See Analog to Digital Converter.

**A-F Converter**

See Analog Frequency Converter.

**AM**

See Amplitude Modulation.

**AMPS**

See Advanced Mobile Phone Service.

**AMTS**

See Automatic Mobile Telephone System.

**ANI**

See Automatic Number Identification.

**ANI Repeat Window Timer**

The repeat window timer is a feature used in Midian's microprocessor based tone signaling products and is used in conjunction with the ANI. The window timer prevents the ANI from being transmitted every time the PTT is pressed, to reduce irritating, repetitive ANIs and multiple CAD screen entries. By setting this timer for a specific time window, for example 10 seconds, the unit will not ANI again unless the user has been listening to another transmission for a period in excess of 10 seconds.

**ANSI**

See American National Standards Institute.

**ASCII**

See American Standard Code for Information Exchange.

**ASK**

See Amplitude Shift Keying.

**Acquisition Tone**

Same as Collect Tone. See Collect Tone.

**Active Filter**

See Filter.

**Address**

A number used in information storage or retrieval that is assigned to a specific memory location. Also, the location where a particular unit may be found (e.g., "dual address pager").

**Advanced Mobile Phone Service (AMPS)**

This is the first analog cellular phone format used in the United States. There are 832 channels using 30 KHz channel spacing employing FDMA. Mobile units receive in the 869-894 MHz range and transmit in the 824-849 MHz range. There is a 45 MHz separation between TX and RX to simplify duplexing. There is a Narrow Band Amps called NAMPS. See Cellular. Also see CNET, EAMPS, GSM, JDC, NAMPS, NMT, PDC, TACS and USDC.

**Alarm Sequence**

A tone sequence transmitted over a radio channel or phone line to be decoded and identified at the base unit indicating a specific alarm condition has occurred at a specific remote site.

**Alert Tone**

Audible indication of being called. Midian's products have three different ring tones to indicate individual, group, or all call. Also may indicate channel busy or annunciator tones when pressing keypad buttons.

**All Call (Fleet Call)**

Refers to calling all units in a fleet of vehicles. See Selective Calling.

**American National Standards Institute (ANSI)**

Formerly American Standards Associations and before that, United States of America Standards Institute. Committee that develops and publishes industry standards in the United States.

**American Standard Code for Information Exchange (ASCII)**

A seven bit code with an eighth single parity bit for error correction along with start and stop bits which relates 96 displayed characters (64 without lower case) and 32 non-displayed control characters ( $2^7=128$  characters). This standard defines the codes to use for information interchange between manufacturers of digital equipment and keyboards, etc.

**Amplitude**

The strength of a radio signal or voltage at an instant in time.

**Amplitude Companded Single Side Band (ACSB)**

A form of modulation utilizing a pilot tone so that all of the receiving units can instantly lock on. Has excellent audio clarity compared to single side band which does not have a pilot or carrier to lock into. This technique also uses less bandwidth than AM or FM.

**Amplitude Companding**

The use of compression techniques to reduce noise and dead audio time in a radio system.

**Amplitude Distortion**

A change in signal amplitude, such that the output amplitude is not proportional to the input signal.

**Amplitude Modulation (AM)**

Method of impressing information (tone, data or voice) on a carrier signal by varying its amplitude. See Telemetry.

**Amplitude Shift Keying**

Modulation technique that encodes information by shifting the amplitude of the signal. OOK is a form of ASK which gets its name from On/Off Keying.

**Analog Frequency Converter (A-F Converter)**

This is an electronic circuit whose input is in an analog form other than frequency and whose output is a frequency proportional to the magnitude of the input. See Telemetry and Voltage to Frequency Converter.

**Analog to Digital Converter (ADC)**

A circuit which converts a continuously variable electrical current or voltage to a discrete numerical value.

**Analog Signal**

A signal such as voice or music that varies in a continuous manner.

**Analog Signaling**

See Tone Signaling.

### **Annunciator Tone**

See Alert Tone.

### **Answer Back**

See Transpond.

### **Answer Supervision**

See Ringing.

### **Antenna Combiner**

A device used to combine several radio transmitters onto one antenna. Generally designed to handle 2, 4, or 8 transmitters. They employ a hybrid splitter and an isolator to minimize or prevent transmitter intermod.

### **Antenna Gain**

The increase in Effective Radiated power (ERP) of an antenna as a result of compressing its radiation pattern by stacking antennas using phasing harnesses or by special physical construction of the antenna. See Effective Radiated Power.

### **Anti-VOX**

A circuit that is used to inhibit the voice operated switch (VOX) in simplex interconnects that employs voice detection to automatically key the radio. This provides priority to one of the users. See Voice Operated Switch.

### **Asynchronous Data**

Refers to data transmission in which each group of code elements corresponding to a character signal is preceded by a start signal in order to prepare the receiving unit for decoding. It is then terminated by a stop signal to determine the end of the character. See Synchronous Data.

### **Attenuation**

The difference between transmitted and received power due to transmission loss through; equipment, lines, etc.

### **Auto Dial**

See Store and Send Dialing.

### **Auto Disconnect Timer**

This is a feature used in Midian's radiotelephone products to automatically send a disconnect ANI if push to talk has not occurred within a programmed time period. This feature is used in full duplex systems with simplex mobiles. In a full duplex system with a duplex mobile the base can determine through loss of carrier that the mobile has finished its call or moved out of range. When simplex mobiles are used, the base cannot depend on loss of carrier to determine call completion or an out of range condition, because the mobile may be receiving (e.g. listening to the landline party) instead of transmitting. Generally a disconnect signal occurs upon hang up to terminate the call and stop the billing counter. Auto disconnect is a safety feature to conserve air time.

### **Automatic Mobile Telephone System (AMTS)**

A radiotelephone format used in Canada which is similar to the IMTS system used in the United States. AMTS employs an 1100 Hz or 1700 Hz mark idle tone and a 1500 Hz seize tone. Base to mobile dialing and ringing are accomplished using 1500/1700 Hz. It uses a connect tone of 1477 Hz and a disconnect tone of 1209 Hz; both of these tones are high group column tones drawn from the Touch Tone® tables. Mobile ANI and dialing use standard DTMF Touch Tone® pairs. See Midian's Tone Signaling Chart.

### **Automatic Number Identification (ANI)**

Special signaling sequence, which is assigned to each radio and is used to identify an individual user's transmissions. ANI can also be employed to identify users who are abusing the use of the radio channel. ANI may be sent at the beginning (leading) and/or end (trailing) of each transmission. The leading/trailing feature in conjunction with a 24 hour tape recorder can be used to frame both ends of a conversation to prove who was transmitting. Referred to as ID. See Connect, Disconnect and Emergency ANI.

### **Auto Patch**

See Telephone Interconnect.

### **BAL MOD**

See Balanced Modulator.

### **BCD**

See Binary Coded Decimal.

### **BCLO**

See Busy Channel Lock Out.

### **BER**

See Bit Error Rate.

### **Balanced Input or Output**

Refers to a 600 or 900 ohm transformer input which may have a grounded center tap for hum and noise cancellation.

### **Balanced Modulator (Bal Mod)**

A non-linear device which can be used for mixing two signals producing a sum and difference components in its output. See Voice Inversion Scramblers.

### **Bandpass Filter**

A filter designed to pass a particular narrow band of frequencies while rejecting all others. This type of filter is used in some of Midian's earlier burst tone decoders, CTCSS decoders, and two-tone decoders. These filters are generally tunable with a multi-turn trim pot to select the burst tone or two-tone frequencies desired. This filter generally passed a desired tone to be detected by a peak detector and a Schmitt trigger. See State Variable Filter.

### **Bandwidth**

The capability of a communication system for conveying amounts of information. The larger the bandwidth, the more information the signal can carry.

### **Base Commander**

See Triangulation and Deadbeat Disable.

### **Baud Rate**

Refers to the rate at which data is transmitted. It is a measurement of data flow at which the number of signal elements per second is based upon the duration of the shortest element. Assuming each element carries one bit, baud rate would be equal to the number of bits per second. Usually transmitted at 300, 600, 1200, 2400 and 4800 bauds per second. If multiple bits are encoded for each baud then higher bit rates are available. Examples: 9600 bps; 14400 bps. See Modem, DPSK, QPSK, QAM, BPSK, Bandwidth and Bit Rate.

### **Baudot Code**

The old five level teletype code capable of generating 32 combinations to represent letters and figures. See Mark/Space Ratio.

### **Binary Coded Decimal (BCD)**

A code in which a string of four binary digits represents a decimal number.

### **Binary Data**

Two state logic levels represented by 1's and 0's for transmitting digital data. Binary number system uses 2 as its base employing only the digits 0 and 1.

### **Binary Phase Shift Keying (BPSK)**

See PSK.

### **Binary Word**

See Byte.

### **Bit Error Rate (BER)**

See Probability of Error.

### **Bit Rate**

The rate at which data bits are passed through a communications channel. Expressed in bits per second. Do not confuse with baud rate or digital signaling rate. See Baud Rate.

### **Bit Stream**

A continuous series of data bits transmitted over a radio channel, phone line or other signaling path.

### **Block**

A set of contiguous bits and/or bytes that constitutes a particular quantity of information. A coding procedure is usually applied for synchronization and error control techniques.

### **Blocking Probability**

The probability that all channels on a trunked radio system will simultaneously be busy at the same instant.

### **Burst Tone**

A signaling format that sends a short tone pulse at the beginning of each transmission to open a repeater. It was the predecessor of CTCSS. Frequencies normally range from 1600 to 2550 Hz in 50 Hz increments. The length of this tone is generally from 100 milliseconds to 1 second. The repeater will normally stay open for a few seconds after loss of the mobile's or portable's carrier to allow another user to answer back without necessarily having to resend the burst tone. This format is very easy to defeat and can be "bootlegged" by someone wishing to utilize a repeater.

### **Busy Channel Light**

A LED (Light Emitting Diode), optional on many Midian modules, which illuminates when the radio detects channel activity. If the light is ignored, the radio will generate a busy tone to indicate a busy channel when the PTT (Push To Talk) is depressed.

### **Busy Channel Lockout**

Radio users are required by the FCC to unmute the radio's tone squelch and monitor the channel to avoid interfering with someone already on the channel. Busy channel lockout may be programmed to: automatically prevent a user's transmitter from keying up if the channel is in use, and generate a busy tone. In some Midian modules, a queuing beep may be programmed to announce when a channel becomes available.

### **Busy Tone**

An audible call progress tone used to indicate that a radio channel or telephone line is in use.

### **Byte**

A set of contiguous bits that make up a binary word, eight bits is usually considered a byte. Two bytes or sixteen bits equals a binary word.

### **CAD**

See Computer Aided Dispatch.

### **CCIR, PCCIR**

Five tone sequential format normally employing 100 msec and occasionally 70 msec tone timings. PCCIR is a Pye/Phillips version. See Five Tone Sequential. Also, see Midian's Tone Signaling Chart. Be careful when using this format, several manufacturers have modified the ABCDEF tones for competitive reasons.

### **CCITT**

Comite Consultatif International de Telephone Telegraph. See International Telecommunications Union (ITU).

### **CDMA**

See Code Division Multiple Access.

### **CEPT (ECPT)**

Acronym for Conference of European Post and Telegraph. This committee set standards for communications equipment in the European Communities. See ETSI and MPT.

### **CGSA**

See Cellular Geographical Service Area.

### **C-NET**

Cellular format employed in Germany. See Cellular. Also see AMPS, EAMPS, GSM, JDC, NAMPS, NMT, PDC, TACS and USDC.

### **COR/COS**

This is an acronym for Carrier Operated Relay (vacuum tube radios) or Carrier Operated Switch (transistor radios). The output from either of these circuits is used to determine if a carrier is present. This circuit controls the radio's squelch circuit. See Squelch Detector.

### **CRC**

See Cyclic Redundancy Code.

### **CSA/DRG**

The French equivalent of the British MPT industry standards group. See CEPT, ETSI and MPT.

### **CT-0**

Analog cordless telephone operating in the 30-50 MHz range; used throughout the world. Employs FDMA and the number of channels vary from 10-20 channels and uses 40 KHz channel spacing.

### **CT-1**

Analog cordless telephone operating in the 800-900 MHz range used in Western Europe. Employs FDMA and the number of channels vary from 40 or 80 channels and uses 25 KHz channel spacing. See PCN and PCS.

### **CT-2**

Digital cordless telephone operating in the 800-900 MHz range used in Western Europe. Employs TDMA with 40 channels and uses 100 KHz channel spacing. See PCN and PCS.

### **CTCSS**

See Continuous Tone Coded Squelch System.

### **Call Guard**

Trademark of E.F. Johnson Company's Continuous Tone Coded Squelch System products. See Continuous Tone Coded Squelch System and Midian's Tone Signaling Chart.

### **Call Light**

A light (optional on many Midian modules) which illuminates when a call is received and sometimes flashes if the call was not answered during the ring time. A call light indicates to the user that a call came in during their absence. Also, see Command Reset.

### **Call Progress Tones**

Control tones used by telephone companies for: dial, busy, ring, etc. See Midian's Tone Signaling Chart.

### **Call Request**

A feature used in mobile data products where the mobile operator can transmit a request signal to the central dispatch computer. The dispatcher can then transmit a signal back to the mobile allowing them to key their radio.

### **Call Routing Digit**

A digit appended to a radiotelephone ANI for routing the call to an operator, outside line, foreign exchange line, memory dialer, etc. See SMART.

### **Call Set Up**

See Cellular.

### **Calling Party Hold**

Refers to a capability in some phone companies where only the calling party can terminate a completed call by hanging up. In other phone companies the call can be terminated by either party going back on hook.

### **Cap Code Prefix**

An alphabetical letter from B to X used in Motorola's Quick Call 2 two-tone sequential extended code plan. See Midian's Tone Signaling Chart.

### **Capture Effect**

The ability of an FM receiver to capture a strong signal and discriminate against a weaker one which is simultaneously present on a radio channel.

### **Cellular**

A high capacity radiotelephone system operating in the 800-900 MHz range. Cellular systems employ a number of low power cell sites and low power mobile units that can only transmit a short distance. By staggering the cells throughout a geographical area, it is possible to replicate thousands of channels for calling. Cellular utilizes a setup channel to receive and make calls as well as to instruct the mobile when to hand off when driving out of range of one cell into another. After setup the MTSO (Mobile Telephone Switch Office) hands the call off to a voice channel. In the United States, the FCC has established a duopoly of service providers, (B) Wireline and (A) Non-Wireline. Wireline refers to the Regional Bell Operating Company (RBOC) serving a particular geographical area. Non-Wireline refers to a competitor to the local RBOC. The non-wireline competitor may be another RBOC that provides wireline service in a different geographical part of the country. See AMPS, CNET, EAMPS, GSM, JDC, NAMPS, NMT, PDC, TACS and USDC.

### **Cellular Geographical Service Area (CGSA)**

There are 728 mobile service areas in the United States. The metropolitan service areas are called MSA's and the rural service areas are called RSA's.

### **Central Office (CO)**

Refers to telephone switching equipment for providing local exchange telephone service to a particular geographical area. In the United States the first three digits of a seven-digit phone number represent the central office while the remaining four digits represent the desired subscriber address. Also referred to as End Office.

### **Channel Guard**

Trademark of Ericsson GE's CTCSS products. See Continuous Tone Coded Squelch System. Also see Midian's Tone Signaling Chart.

### **Channel Scanner**

A circuit used in some radios where multiple channels are available. May be programmed to scan between one priority channel and several other system channels. In radiotelephone systems, it may be used to scan for incoming calls or for available channels to make an outgoing call. **Note:** Some radios use a "stepper" (push button) scan circuit, 1 of 8 logic select while others utilize a four-line "binary" (rotary switch) scan circuit. It is important to identify the type of scan circuit in the radio when adding a scanner.

### **Check Sum**

A simple error detection scheme used in DTMF ANI systems to make sure all the digits are correctly decoded. It adds an extra digit to the end of the ANI which is equal to the sum of all the digits in the ANI reduced to one digit. Also a parity scheme used in digital signaling to detect an error. See Falsing.

### **Click Counter**

A click counter is a circuit in a radio/telephone interconnect used to count audible clicks generated by a pulse dialer. This is generally used with a DOD Line with over dial. When a terminal has been dialed up by a landline user and rings, the TELCO Circuit can no longer pass DC pulse dialing. When the user dials the number audible clicks can be heard. These clicks are then processed to determine the over dialed digits. Touch Tone<sup>®</sup> over dial is much simpler to accomplish. See DOD and DID Line and End to End Signaling.

### **Co-User**

Refers to a radio user who shares a radio channel with other users or companies.

### **Code Division Multiple Access (CDMA)**

Code Division Multiple Access is a narrow band spread spectrum technique that permits simultaneous communications by multiple users conserving spectrum efficiency. See Multiple Access.

### **Coherent Detector**

See Manchester Encoding and Synchronous Data.

### **Collect Tone**

Tones placed on a trunking channel to indicate channel availability. All mobiles with "collect" on this channel to receive calls. Originally used in the GE trunked system and later in Basic's RTX format, and CES's RT1000. See RTX and Mark Idle.

### **Command Reset**

This function permits an operator/dispatcher to re-call a unit, to turn off its call light, and remute the radio when the operator no longer desire a return call. In the European Five Tone formats, this function is accomplished by calling the number back with a C Tone as a sixth digit to remute the radio. Also called remote close and remote reset.

### **Community Repeater**

A leased repeater that is shared by several different users utilizing the same channel with a five MHz separation between transmit and receive. The system generally employs CTCSS or DCS to prevent different users from being annoyed with the other's conversations.

### **Computer Aided Dispatch**

Midian produces a modem that goes between a radio and a computer, which permits a radio dispatcher to monitor and control radio traffic among a fleet of vehicles. Midian manufactures a CAD-100/200 that is compatible with DTMF (Touch Tone®), European 5 tone, and Motorola MODAT®. The UED-1, UD-1, and the ANI-U are compatible with CAD-100/200. CAD-300 is compatible with Midian's digital PSK format, which is used in the TVS series of rolling code voice scramblers. Midian also offers the CAD-400 (GE-Star® decoding) and the CAD-500 (MDC-1200® decoding). See also Fleet Management System.

### **Connect ANI**

Refers to radiotelephone systems where the mobile phone transmits an ANI to access a telephone interconnect, verify a customer's account, and then start the billing counter. This is normally automatically sent before the phone number is sent. On some simple interconnects a \* tone is all that is necessary to activate the interconnect. The \* is generally used in small private systems; however, this technique makes the system vulnerable to abuse by unauthorized users.

### **Console Radio**

A fixed (base station) or a mobile radio installation that has been designated as the controlling radio for the repeater or as the dispatch center for communications. The console radio is not part of the repeater hardware.

### **Continuous Tone Coded Squelch System (CTCSS)**

This analog signaling format employs low frequency sub-audible tones from 67 to 250 Hz. There are 34 EIA tones and 4 non-standard tones, 38 in total. In addition, some manufacturers use split tones between the 38 tones, that allows for a maximum of 51 tones. Caution should be taken when using the split tones, as these could cause falsing in some older CTCSS products which do not have tight enough selectivity. The CTCSS tones are filtered out by a high-pass filter in the receiver circuit to avoid being heard by the radio user. CTCSS allows several companies or radio user groups to share the same channel without hearing the other's conversations. The user's radio will un-mute only when the correct tone is received from co-users in his company. A different tone from another user group will not un-mute the radio. Prior to transmitting, the FCC requires all radio users to monitor the channel to determine if another company is presently using the channel. EIA states that a CTCSS tone of 100 Hz should decode in 250 msec. Higher frequency tones will require less time; and lower frequency tones will require longer decode times. The time for a repeater to decode could take from 100 msec to 400 msec. Modulation is usually set for about .75 KC's. CTCSS is also referred to as Private Line (PL) by Motorola, Channel Guard (CG) by Ericsson GE, Call Guard

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by EF Johnson, and Quiet Channel, by RCA in the past. CTCSS products originally used vibrating Reeds for encoding and decoding CTCSS tones. The decoding Reed would continue to vibrate after the received signal carrier had dropped out causing a squelch tail "tish" sound to be heard by the user. Motorola introduced a feature in their radios that transmitted a 180° reverse burst of tone that would instantly dampen the Reed eliminating squelch tail. See Reed.

### **Contour Analysis**

An engineering study to determine the actual propagation characteristics of a radio system relative to the geographic terrain, antenna height, frequency range, transmitter power and receiver sensitivity.

### **Control Channel**

A channel on trunked radio system that is used to control subscriber units. See Trunking.

### **Control Point**

See Supervisory Control.

### **Control Station**

See Supervisory Control.

### **Control Tone**

A tone transmitted over a radio channel or phone line to control a function at a remote location.

### **Conventional Two-Way**

Refers to the standard mode of operating the two-way radio on a simplex radio channel or a half duplex repeater channel. See LMR, PMR and SMR.

### **Cross Band Repeater**

A repeater in which the "receiver" radio operates in a different frequency band than the "transmitter" radio. For example, transmit on 150 MHz and receive on 450 MHz.

### **Cyclic Redundancy Code (CRC)**

A process whereby cyclical bits are added to a binary word so that an identical process at the other end can detect and correct errors that occur due to noise on the transmission channel.

### **D/A Converter**

See Digital to Analog Converter.

### **DBm**

A decibel referenced to one milliwatt of power. A measure of signal power where 0 dBm equals one milliwatt into a specified impedance, usually 600 ohms. See Decibel.

### **DC Remote Control**

A device used to control a radio base station or repeater that is located at some distance from the control point. The remote control contains the audio amplifiers for both the transmit and receive function. By superimposing a DC voltage of about 75 to 150 volts over the phone line audio, and by changing the current, and/or the polarity of the voltage, the base station can be keyed, the frequency changed, the CTCSS turned off for monitoring, as well as other functions. See Supervisory Control.

### **DCS**

See Digital Coded Squelch.

### **DECT**

See Digital European Cordless Telephone.

**DES**

See Data Encryption Standard.

**DGT**

A government agency in Spain responsible for allocating and regulating radio channel usage. See PTT, MOC, DOC and FCC.

**DID Telephone Line**

See Direct Inward Dialing.

**DOC**

A government agency in Canada responsible for allocating and regulating radio channel usage. See PTT, MOC, DGT, OTA and FCC.

**DOD Telephone Line**

See Direct Outward Dialing.

**DPSK**

See Differential Phase Shift Keying.

**DSC**

See Digital Selective Call.

**DSMR (Digital SMR)**

See SMR, ESMR and Trunking.

**DTMF**

See Dual Tone, Multi-Frequency.

**DZVEI DDZVEI**

Depressed and Double Depressed ZVEI. This format does not use the higher tone frequencies of ZVEI due to narrow band radio use. See ZVEI and Five Tone Sequential. Also, see Midian's Tone Signaling Chart.

**Data Acquisition**

See SCADA.

**Data Encryption Standard (DES)**

A cryptographic algorithm designed by the National Institute of Standards and Technology (was National Bureau of Standards) to encipher and decipher data using a 56-bit key.

**Data Grade Phone Line**

A voice grade analog phone line that has been conditioned to improve its analog characteristics for transmitting data. See Midian's Tone Signaling Chart.

**Data Signaling Rate**

See Bit Rate, Baud Rate, QPSK, BPSK, DPSK and QAM.

**Deadbeat Disable (Stolen Radio Destruct)**

A feature originally introduced by Midian Electronics to disable a radiotelephone subscriber who has been remiss in paying his monthly phone bills. It can also be used to disable lost or stolen radios. This feature mutes the radio, blocks the PTT, and latches on a disable transmitter, which can be used to disable a vehicle, blow a fuse, or provide other creative disabling schemes. In some cases, a unit that has been disabled can be re-enabled via the radio by calling it back. Some manufacturers refer to Deadbeat Disable as a Stun Feature.

**Decibel**

dB, the logarithmic measure of the ratio between two powers: P1 and P2 or two voltages: V1 and V2. The equation is:  $dB=10 \log P2/P1$  or  $dB=20 \log V2/V1$ . See dBm.

**Decoding**

See Selective Calling.

**Dedicated Data Radio**

A radio with digital modem for transmission of data.

**Dedicated Line**

See Metallic Pair.

**De-Emphasis**

The rolling off of high frequency components after a receiver discriminator by a high-pass filter. In a land mobile radio this usually occurs at 6 db per octave rate starting at approximately 300 Hz. This is done to roll off high frequency noise generated in the IF system. By pre-emphasizing the mic audio in the transmitter at 6 db rate, the high frequencies are accentuated so that when the de-emphasis occurs in the receiver the resulting audio has a flat response with rolled off receiver noise.

**Delay Line**

A device used to delay an analog voice signal in conjunction with a voice operated switch (VOX). The delay line prevents the loss of the first syllable or word while the VOX detects and keys the transmitter. The delay line is usually adjustable in the range from 50 milliseconds to 1 second. This device produces a real time delay and if the listening party could see the speaking party he would notice a loss of lip synchronization.

**Demodulation**

The opposite of modulation. The process of recovering tones, voice, or data from a modulated carrier. In FM a Foster-Seeley or quadrature detector is employed. In AM a simple envelope detector employing a diode may be used.

**Detector**

See Demodulation.

**Deviation**

See Frequency Deviation.

**Diagonal Tone**

See Two Tone Sequential.

**Dial Tone**

A call progress tone used by a telephone company to indicate a line is available for making a call.

**Dialing (Encoding)**

Refers to radio systems which have radiotelephone interconnect capability. Dialing refers to entering the desired "telephone" number onto a Touch Tone® style keypad or a rotary dial then transmitting this number to the interconnect for re-transmission into the phone system. See Selective Calling, DTMF and Rotary Dial.

**Differential Encoding**

A limitation of NRZ and digital bi-phase signaling is that the signal for a 1 is exactly the negative of a signal for 0. On many channels it may be impossible to determine an absolute polarity or an absolute phase reference. Thus the decoder may decode all 1's as 0's and vice versa. A common remedy for this ambiguity is to use differential encoding that encodes a 1 as a change of state and encodes a 0 as no change of state. In this manner, no absolute reference is necessary to decode the signal. The decoder merely detects the state of each signal interval and compares it to the state of the previous interval. If a change occurred, a 1 is decoded otherwise a 0 is determined. See Manchester Encoding.

### **Differential Phase Shift Keying (DPSK)**

A modulation scheme that detects the phase difference between each succeeding bit position to produce a binary output. The detector delays the previously received digit and uses it as the phase reference. This is accomplished by starting with an arbitrary first digit and if a transition in phase occurs in the next digit the result is a 0. With no transition in phase the output is decoded as a 1.

### **Digital Call Guard**

Trademark of EF Johnson Co.'s DCS products. See Digital Coded Squelch.

### **Digital Coded Squelch**

The digital coded squelch format is identical in concept to CTCSS, as described above. It was originally pioneered by Motorola and was called Digital Private Line (DPL). Other manufacturers have introduced similar products with up to 100 codes. However, the extra codes are not industry standard and can pose the risk of falsing to one of the 83 industry standard codes. This format also employs a 135 Hz "shut off" code to eliminate "squelch tail". True FM modulation (not phase modulation) is required when using this "digital format" due to the low frequency components (12 Hz). DCS employs the fixed octal digit 4 as the first digit, followed by three more octal digits. Code words are 23 bit long strings: 12 bits of octal code, followed by 11 bits of CRC (cyclic redundancy code). Each bit is 7.5 msec, which is just over 170 msec per word. This is the minimum detection time. While it may appear that 512 codes are possible, only 83 exist, because a code word that is misaligned when serially shifted into the decoder may match a different code word.

### **Digital European Cordless Telephone (DECT)**

Digital Cordless Phone operating in the 1800-1900 MHz range and employs TDMA with 10 channels with 12 users per channel.

### **Digital Private Line (DPL)**

Trademark of Motorola C & E's DCS. See Digital Coded Squelch.

### **Digital Channel Guard**

Trademark of Ericsson GE's DCS products. See Digital Coded Squelch.

### **Digital Quiet Channel**

Trademark of RCA's DCS products. See Digital Coded Squelch.

### **Digital Selective Call**

A 1200 baud FFSK signaling format used in the International Maritime Service. This permits transmitting distress messages, telephone calls, and manual calls, etc.

### **Digital to Analog Converter (D/A)**

An electronic circuit designed to convert a digital binary signal to an analog waveform.

### **Digital Voice Scrambling**

A method of converting an input waveform to a digital representation which is then encrypted and transmitted. The receiver decrypts the received data and regenerates the original analog signal.

### **Digital Signal**

A signal that uses the binary form of 1's and 0's to transmit data.

### **Direct Inward Dialing (DID)**

This is a special inbound trunk provided by the telephone company (TELCO PSTN) to a radiotelephone, paging, or voice mail provider, which allows their customers to dial directly into the system using a typical seven-digit phone number. The provider's equipment looks like a telephone company central office to the incoming call. The first three digits cause the PSTN (Public Switch Telephone Network) to dial the last four digits directly into the provider's equipment. This eliminates the need for over dialing a number after the provider's equipment rings and answers. A DID interface provides 48 volts so the CO can signal an incoming call by simply closing the loop to draw current. After the DID interface reverses battery momentarily (winks) to signify it is ready to receive digits the CO either generates Touch Tone<sup>®</sup> or dial pulse to send the mobile phone or pager number (two, three, or four digits). After the call is answered the DID interface reverses battery polarity again signifying to the CO that the call has been answered and holds it for the duration of the call. The reversal can also tell the CO to go ahead and bill any toll call. Also called Selector Level Interface.

### **Direct Outward Dialing (DOD)**

This is a standard local loop phone line that is used by a radiotelephone terminal for making outbound mobile originated calls. It generally uses a loop start through a simple relay closure. Can also be used for inbound dialing, after ring and answer, by over dialing with Touch Tone<sup>®</sup> or pulse dialer. A click counter is used to count pulses that are generated by a pulse dialer. See End to End Signaling and Click Counter.

### **Disable Output**

On Midian's UED series of decoders an output is available for disabling a vehicle's fuel or electrical system. It can also be used to blow a fuse or for any other desired purpose.

### **Disconnect ANI**

A signal sent after a radiotelephone call is completed. Used to turn off or cancel access to a telephone interconnect and stop the billing counter. May be programmed to be sent automatically after pressing the # key. Some systems use the same ANI sequence for connect and disconnect but may prefix or suffix the ANI with a \* or # to indicate whether the terminal should be connected or disconnected. This is often called positive disconnect. The positive disconnect ANI must match the connect ANI to prevent another user from terminating someone else's call. Some interconnects will terminate a call when it sees the # key.

### **Dispatch**

A term generally used in trunking systems that refers to the capability of a base station dispatcher to communicate and direct the traffic of mobile radio units through a trunked system as opposed to using the radio system for telephone interconnect.

### **Dispatch Point**

See Supervisory Control.

### **Drop Out Delay**

This time, in seconds, that a radio repeater remains keyed after loss of the input carrier signal to the repeater's receiver. Also known as "hang time".

### **Dual Tone, Multi-Frequency (DTMF)**

This is the Touch Tone<sup>®</sup> format created by AT&T<sup>®</sup>. Pressing a key simultaneously generates a "row" tone and a "column" tone to encode a digit. There are four "row" tones and four "column"

tones for a total of 16 keyboard buttons: the familiar 1-9, \*, # representing four rows and three columns. The less common fourth column, is labeled A, B, C, D. The higher frequency column tones are usually pre-emphasized 3 DB over the row tones to overcome high frequency roll-off on the phone lines. This is referred to as twist. See Midian's Tone Signaling Chart.

### **Duplex**

See Full and Half Duplex.

### **Duplexer**

A device used on a radiotelephone mobile unit or a repeater that allows the transmitter and receiver to share the same antenna without the transmitter desensitizing its own receiver. Generally used on a single channel radio or close frequency spaced antenna combiner. A combiner and multi-coupler are usually used on multi-channel, multi-radio system. See Combiner.

### **E-TRUNK**

A trunking system using CTCSS and DCS that is manufactured by E-Trunk. This system allows multiple users with different CTCSS and DCS codes to scan for a not busy repeater to call other users sharing the same CTCSS/DCS code. The repeater employs a shared repeater panel which will regenerate the desired CTCSS/DCS code on the newly acquired channel. A receiving unit will then detect the CTCSS/DCS code on the newly acquired channel and stop scanning. The units will remain on this channel for the duration of the hang time on the repeater. This system is very similar to another system previously developed in Canada by Ferritronics in the early 1980's. Midian Electronics now makes a similar version that also supports radiotelephone interconnect. See Intele-Trunk and Tele-Trunk.

### **E-1 Carrier**

See T-1 Carrier.

### **E&M Lead**

Control leads used on microwave systems or a control interface on phone systems. The E lead (ear) is the receive control function. The M lead (mouth) is the transmit control function.

### **EAMPS**

See Extended Advanced Mobile Phone Service.

### **EAS**

See Extended Area Service.

### **EE PROM**

See ROM.

### **EEA**

See Electronic Engineering Association.

### **EIA**

See Electronic Industries Association.

### **E-mail**

See Electronic Mail.

### **ENI**

See Emergency ANI.

### **EOT**

Abbreviation for End of Transmission.

### **ERP**

See Effective Radiated Power.

### **ESMR**

See Enhanced Specialized Mobile Radio.

### **ESN**

See Numeric Assignment Module (NAM).

### **ESS**

See Electronic Switching System.

### **ETACS**

See TACS and Cellular. Also see AMPS, CNET, EAMPS, GSM, JDC, NAMPS, NMT, PDC and USDC.

### **ETSI**

This committee sets standards and writes specifications for land mobile radio equipment in the European Communities. Similar to CEPT, ECPT and MPT. See CEPT and MPT.

### **Echo**

Echo is a reflected signal which is heard as a delayed side tone audio in a telephone earpiece during long distance calls. It is caused by an imbalance within the system. Echo suppressors can be added to the system to attenuate the delayed returning signal.

### **Effective Radiated Power (ERP)**

The power supplied from a transmitter minus any cable losses to an antenna, multiplied by the relative gain of the antenna in a given direction.

### **Electronic Engineering Association (EEA)**

Located in the United Kingdom. See Five Tone Sequential. Also, see Midian's Tone Signaling Chart.

### **Electronic Industries Association (EIA)**

Located in the United States. Motorola Metropage. See Five Tone sequential. Also, see Midian's Tone Signaling Chart.

### **Electronic Mail (E-mail)**

Messages that are typed into a terminal and then sent electronically via a telephone modem or network to a receiving terminal's mailbox.

### **Electronic Switching System (ESS)**

Modern telephone switching equipment that employs electronics and computers for routing and controlling telephone calls, as opposed to Step-By-Step offices. See Step-by-Step Office.

### **Emergency ANI (ENI)**

A separate ANI number which may be programmed for each radio to indicate an emergency condition. ANI's may be activated using a manual switch or a "man down" sensor (mercury tilt switch). Some manufacturers refer to emergency ANI as Emergency Number Identification (ENI).

### **Encoding**

See Selective Calling, Dialing, DTMF and Rotary Dial.

### **End-to-End Signaling**

Generally refers to Touch Tone<sup>®</sup> dialing or dial pulsed click counting that occurs after a radiotelephone interconnect system has rang and answered the incoming phone line. Also, may be referred to as over dial. See DOD Line and Click Counter.

### **Enhanced Specialized Mobile Radio (ESMR)**

An 800/900 MHz system which supports integrated dispatch, mobile telephone, paging and mobile data communications services using state-of-the-art digital multiplexing technology

and employing a multiple base station configuration. See Specialized Mobile Radio (SMR) and Trunking.

#### **Envelope Detector**

See Non-Coherent Detector.

#### **Equalizer**

A device that reduces the effects of amplitude, frequency and/or phase distortion of a radio channel or phone line.

#### **Error Correction**

See Falsing.

#### **Error Detection**

See Falsing.

#### **Exchange Area**

The local calling area for which telephone service is provided without additional cost. See EAS, Central Office and LATA.

#### **Extended Advanced Mobile Phone Service (EAMPS)**

See Cellular and AMPS. Also see CNET, GSM, JDC, NAMPS, NMT, PDC, TACS and USDC.

#### **Extended Area Service (EAS)**

Area served by local telephone company for which no long distance charges are required. See LATA and Exchange Area.

#### **Extended Local Control**

Extended local controls are simple, less expensive remote control units that are designed to work in conjunction with a host DC or Tone remote control or base station radio. The host remote operator has supervisory control over the extended remote units. See Supervisory Control.

#### **Eurosignal**

Six and seven tone AM paging format used in CEPT countries. See Five Tone Sequential. Also, see Midian's Tone Signaling Chart.

#### **FCC**

Federal Communications Commission. A government agency in the United States responsible for allocating and regulating radio channel usage. See PTT, DOC, OTI, DGT and MOC.

#### **FDM**

See Frequency Division Multiplex.

#### **FDMA**

See Frequency Division Multiple Access.

#### **FFSK**

See Frequency Shift Keying.

#### **FLEX**

Motorola's high speed, high capacity digital paging format that is capable of transmitting data at 1600 BPS using Manchester NRZ two level encoding. It is also capable of 3200 BPS and 6400 BPS using a four level frequency shift keying modulation called 4FSK. The carrier frequency can be shifted to 4 different states as opposed to 2 states used with POCSAG.

#### **FM**

See Frequency Modulation.

#### **FSK**

See Frequency Shift Keying.

#### **FX**

See Foreign Exchange Circuit.

#### **Falsing**

Generally refers to a tone or digital decoder responding to an incorrect address. Depending on the type of decoder, this could be caused by noise, voice talk off and digit length. Falsing can be minimized by increasing the digit length and tone detect times and by adding error detection and correction schemes. Error detection simply detects a mistake and prevents falsing. Error correction actually detects the mistake and corrects it. As an example, an eight bit hamming code can detect two bits of error and correct tone. This example applies to digital signaling rather than tone signaling. Also see Check Sum.

#### **Field Radio**

Generally refers to a mobile or portable radio that is neither part of the repeater or base station radio.

#### **Filter**

A circuit designed to pass or reject a band of frequencies. There are two basic categories of filters. Passive and Active. Passive filters employ inductors, capacitors and resistors. Each section of a filter is referred to as a pole and each pole exhibits a 6 db per octave roll-off. Active filters employ OP amps with resistors and capacitors. By using an OP amp with RC components size and cost can be reduced. These also exhibit 6 db octave roll-off per pole. See Bandpass, Lowpass, Highpass and Notch Filters.

#### **Five Tone Sequential (Five, Six and Seven Tone)**

A signaling format generally employing five single frequency sequential tones with no gap time between the tones. In addition, if there are any repetitive numbers in the sequence (e.g. 12234), the second digit is replaced with an **R** repeat tone (e.g. 12R34). This format also can employ a sixth tone as a status digit or a **C** tone for remote close or command reset of the radio and its call light. The first five digits are generally used as an ANI or selective call encode/decode number. Five Tone was originally developed in Europe and there are several versions available. Each of these formats have different timings that run from 33 msec per tone to 100 msec per tone. Midian's UED-1 series of products are capable of working down to 20 msec per tone.

EEA is the British format using 40 millisecond tones. ZVEI 1, ZVEI 2, ZVEI 3, and DZVEI are German formats. PZVEI is a Pye/Phillips version of ZVEI that may employ one of the A, B, C, D, E, F tones for an alert feature as well as the ability to increase the first tone length to use it as a preamble tone. All ZVEI formats use 70 millisecond tones. Depressed ZVEI uses a lower frequency tone set due to narrow band radio systems. NATEL is another format used by the Swiss National Telephone Company utilizing 70 millisecond tones. CCIR is used throughout several countries in Europe. CCIR1 employs 100 millisecond tones, and CCIR2 employs 70 millisecond tones. PCCIR is a Pye/Phillips version. In general, the European systems may employ a 2-5-digit sequence to open a repeater, another 5-digit sequence to identify the radio user and yet another 5-digit sequence to call a mobile or portable radio. The last two sequences may be reversed in some cases. The gap time between these two sequences is generally 200 msec. In some Scandinavian countries, a gap tone (B tone) may be inserted instead of the 200 msec gap time. This is sometimes referred to as three by five or three salve (trois salves) signaling. In some systems, the first two digits of the repeater ANI can be used to identify the manufacturer of the radio equipment. In some smaller systems, the repeater ANI can be seven digits with the last two digits identifying the calling mobile instead of additional sequences. Many systems

in Europe eliminate the first 5-tone sequence to open the repeater and instead use CTCSS. This is also two by five signaling. Five tone formats also support a group call capability by using a G tone to replace the last or next to last digit. This permits group calling in powers of 10. Two other formats, which are predominately used as paging formats, are Eurosignal, which is a 6 to 7-tone format used in high power AM wide area coverage paging systems, and the EIA Motorola Metropage format uses 33 millisecond tones and employs a preamble tone for battery saving and a sixth tone or "X" tone for emergency call alert. Another seldom seen format is the Reach 11<sup>th</sup> Root of 2 which employs from four to six tones for selective call and status. MODAT<sup>®</sup> is a Motorola seven tone mobile data and status format which is similar to five tone signaling. For more detailed information see Midian's Tone Signaling Chart.

#### **Flat Audio Response**

The communications audio path that does not change appreciably in amplitude as the frequency of that audio is varied from 300 Hz to 3 KHz. See De-Emphasis.

#### **Fleet Management System**

A Computer Aided Dispatch system that allows a dispatcher to monitor and control the activity of a fleet of vehicles such as taxis, buses, delivery trucks, etc.

#### **Forced Encode Length**

A feature in Midian's UED-1 and UE-1 that allows the microprocessor to determine whether the user has entered the correct number of digits (normally 1-8). For example, if the forced encode length has been set to 5 digits, a user must enter five digits followed by a \* to send the sequence. If extra digits or fewer digits are entered, pressing the \* will cause the unit to emit an error tone. This feature can be programmed to 0, permitting the user to encode a sequence of any length from one to eleven digits.

#### **Foreign Exchange Circuit (FX)**

An extension of service from one switching office to a subscriber normally served by another switching office.

#### **Four-Level Signaling (Multi-Level Signaling)**

See FLEX.

#### **Framing Word**

See Synchronization Bits.

#### **Frequency Deviation**

A term used in frequency modulation to indicate how far a carrier is made to deviate above and below the operating frequency. The level of modulation is based upon the amplitude of the modulating signal. The rate at which the carrier signal changes is based upon the modulation frequency. The ratio of the maximum deviation to a specific modulating frequency is known as the modulation index. In land mobile communications in the United States  $\pm 5$  KC is the maximum legal limit. This limit should include CTCSS and voice because modulation is additive. CTCSS is usually set to .75 KHz deviation while voice is set to 4 KHz for a total of 4.75 KHz. Other types of signaling, i.e. Touch Tone<sup>®</sup>, Five Tone, Two Tone, should be set to approximately 2/3 of system deviation, (3.3 KHz). See Frequency Modulation.

#### **Frequency Division Multiple Access (FDMA)**

Designed to increase the spectral efficiency of a communications channel. FDMA divides a communications channel into several narrowband channels permitting a larger number of multiple users. See Multiple Access.

#### **Frequency Division Multiplex (FDM)**

A means of providing a number of simultaneous channels over a common transmission path by using a different frequency band (subcarrier) for the transmission of each channel's audio.

#### **Frequency Hopping**

A technique that rapidly changes the frequency of a radio transmitter for the purpose of preventing someone from eaves dropping or interfering with a conversation. This can take place over a wide or narrow bandwidth. The receiver needs to be synchronized to the transmitter. Primarily used for voice scrambling. See Low Probability of Intercept.

#### **Frequency Modulation (FM)**

Method of impressing information (tone, data, or voice) on a carrier by varying its frequency. See Frequency Deviation.

#### **Frequency Response**

A change in attenuation of frequencies relative to the attenuation at a reference frequency.

#### **Frequency Shift Keying (FSK)**

This is a technique for converting data bits to a corresponding shift between two tone frequencies (binary PSK) so the data can be transmitted over a radio or phone line. FFSK is a fast form of FSK also called MSK for Minimum Shift Keying.

#### **Frequency to Voltage Converter**

See Voltage to Frequency Converter and Telemetry.

#### **Front Porch (Key Up Delay or Lead In Time)**

The front porch delay timer allows a portable or mobile radio to key up, lock the synthesizer, come up to full power, and open a repeater's CTCSS decoder as well as any E&M microwave leads associated with the repeater and/or stabilize satellite voting systems prior to sending ANI, dialing, or transpond. This feature is also referred to as key up delay, lead in time, transmission delay, or Link Establishment Time (LET). For front porch with data signaling see Synchronization Bits.

#### **Full Duplex**

Refers to the ability of a radiotelephone system or repeater to transmit and receive simultaneously.

#### **Function Tone**

See Tone Remote. Also, see Midian's Tone Signaling Chart.

#### **GE-Star**

This is a trademark for Ericsson/General Electric's digital PSK format that is usually used for ANI, status, and in some cases, selective calling. This format is available as an encode/ANI/transpond option on Midian's UED-1 series of products. This format requires 320 msec to transmit an ANI.

#### **GMRS**

See General Mobile Radio Service.

#### **GPS**

See Global Position Satellite.

#### **GSC**

See Golay Sequential Code.

#### **GSM**

See Global System for Mobile.

#### **Gap Time**

This feature is used in European five tone formats to separate a repeater ANI from any user ANI or selective call sequences. In older two-tone sequential formats there was a gap between

the two tones. Also called Inter-sequence Gap. See Five Tone Sequential.

### **Gaussian Noise**

Gaussian or white noise is characterized as having a uniform frequency spectrum across the broad band width and an amplitude distribution that varies with a normal probability distribution.

### **General Electric Type 99**

See Two Tone Sequential. Also, see Midian's Tone Signaling Chart.

### **General Mobile Radio Service (GMRS)**

A land mobile radio service available to individuals for short distance two-way communication to facilitate the activities of the licensee and their immediate family. There are 8 frequency pairs in the 462-467 MHz range along with 7 splinter frequencies. There are many limitations on the use of these frequencies to prevent problems experienced on Citizen Band channels.

### **Global Position Satellite (GPS)**

This system employs a constellation of 24 satellites that circle the earth at 11,000 NM above the earth in 6 orbits. Each satellite orbits the earth twice in 24 hours. Locking on to three satellites permit latitude and longitude determination. In addition the user can also determine altitude with a fourth satellite. When connected to a mobile radio the vehicle's location can be precisely established at a dispatch center.

### **Global System for Mobile (GSM)**

A digital cellular system that started in Europe and is fast becoming the world's most popular system. The mobile units receive in the 935-960 MHz range and transmit in the 890-915 MHz range. This employs a 45 MHz separation between transmit and receive thus simplifying duplexing. It has a 200 KHz channel spacing and employs TDMA with 124 channels and 8 users per channel. See Cellular. Also see AMPS, CNET, EAMPS, JDC, NAMPS, NMT, PDC, TACS and USDC.

### **Golay Sequential Code (GSC)**

A digital paging format used by Motorola in their numeric and alphanumeric pagers.

### **Ground Start**

The central office provides a -48 volts to the ring side of the local loop to a PBX through half of the line relay. When the PBX wants to seize the line it applies a momentary ground on the ring side of the line which energizes the line relay at the CO. After dial tone is detected the ground is removed. See Loop Start.

### **Group Call**

See Selective Calling, Two Tone Sequential and Five-Tone Sequential. Also, see Midian's Tone Signaling Chart.

### **Group Delay**

Distortion caused by non-uniform speed of transmission of different frequencies that travel across a radio channel or phone line. See Midian's Tone Signaling Chart.

### **Group Tone**

See Five Tone Sequential and Two Tone Sequential. Also, see Midian's Tone Signaling Chart.

### **Guard Tone**

See Tone remote. Also, see Midian's Tone Signaling Chart.

### **HEAR System**

Abbreviation for Hospital Emergency Administrative Radio. See Pulse Tone.

### **HSC**

See Hexadecimal Sequential Code.

### **Half Duplex**

Refers to the ability of a radio system to transmit and receive in one direction at a time. Generally the repeater is full duplex while the mobile unit is simplex, that is the user must press his push to talk button in order to transmit. Half duplex systems are normally configured with different transmit and receive frequencies.

### **Hamming Code**

A digital error correction code that is capable of correcting a single bit error and detecting multiple bit errors.

### **Hand Off**

See Cellular.

### **Handshake**

See Transpond.

### **Hang Time**

See Drop Out Delay.

### **Harmonic Distortion**

The result of non-linearities in a communication channel producing harmonics of the original input signal that appear in the output.

### **Hexadecimal Sequential Code (HSC)**

MX-Com, Inc.'s Five Tone sequential signaling format compatible with EIA, EEA, CCIR, ZVEI. Primarily used as a paging format. Uses A, B, C, D, E tones. These additional tones permit informational messages to be sent and displayed as icons on a pager's LCD.

### **High Pass Filter**

A filter designed to pass tones above a certain knee frequency. This is very commonly used in CTCSS systems to pass voice signals above 300 Hz while blocking the CTCSS tones that are 67 to 250 Hz, so that the CTCSS "hum" tone cannot be heard by the radio user.

### **Horn Relay**

A relay, associated with a tone decoder, used to sound the horn in a vehicle when a call is received to get the user's attention when he is out of the vehicle. Horn output transistors are available on most Midian decoder modules. Horn relays are optionally available on many Midian products.

### **Hot Dialing**

Refers to a feature which allows a radio user to press and hold the push to talk switch while manually dialing a telephone number via a keypad.

### **Hybrid**

A circuit that separates a single bi-directional line into separate transmit and receive paths. Conversely, two lines can also be combined into one.

### **ID**

Identity, see Automatic Number Identification.

### **IEEE**

See Institute of Electrical Electronic Engineering.

### **IMTS**

See Improved Mobile Telephone System.

### **INMARSAT**

A geostationary satellite communication system. INMARSAT A is the older lower frequency system that uses large satellite dishes. The INMARSAT C has a much higher frequency with very small antennas. The units are small enough to build into a briefcase. When the briefcase is open the antenna can be pointed south and the angle set to your longitude permitting the user to make communications between two mobile or maritime units as well as any shore stations. INMARSAT C is popular in the maritime industry permitting digital voice, FAX and data services.

### **INTER LATA**

See LATA.

### **IS-54**

North American Digital Cellular (TDMA). See United States Digital Cellular and Cellular.

### **IS-95**

North American Digital Cellular (CDMA). See United States Digital Cellular and Cellular.

### **ISDN**

See Integrated Services Digital Network.

### **ITU**

See International Telecommunications Union.

### **IPTS**

See Improved Portable Telephone System.

### **IXCS**

See Inter-exchange Carrier.

### **Improved Mobile Telephone System (IMTS)**

This format, used by Bell Telephone and the RCC industry, replaced the old 600/1500 MTS and 2805 Hz operator-assisted manual telephone systems. IMTS employs a mark idle tone, which is applied to a non-busy channel. All mobile units scan to the marked idle channel, looking to either receive or make a call. During receive the mobile remains there when the 1800 Hz seize tone is applied. Base to mobile dialing is accomplished by pulsing the 1800 Hz tone, which breaks from 1800 Hz back to 2000 Hz mark idle. (This is similar to the 2805 and 1500 Hz systems, except these break to no tone rather than to the mark idle tone.) After decoding, the mobile unit will transpond a handshake, confirming that it is ready to start ringing. The terminal will then send a command to begin ringing. To make a call, the mobile phone will lock onto a marked idle channel, send a guard-connect-guard sequence. Next, the mobile transmits its FSK ANI at 20 PPS with a parity check, followed by the dialing sequence at 10 PPS. Upon completion of any type of call, a pulsed disconnect tone sequence is sent to reset the system and terminate the billing counter.

### **Improved Portable Telephone System (IPTS)**

A radiotelephone format created by Motorola for use in portable radios on modified IMTS systems. Instead of using pulse dialing this format employs two tone sequential for decoding and Touch Tone® for ANI and dialing.

### **Impulse Noise**

Noise or interference on an FM radio receiver caused by instantaneous amplitude modulation of the carrier usually caused by vehicle ignition or switching transients.

*Midian Electronics, Inc.*

### **Inband Signaling**

Refers to tone signaling that occurs in the normal voice channel bandwidth from 300 Hz to 3400 Hz. A 2600 Hz tone is used for E&M lead signaling. A notch filter is used to remove the tone so it is not heard.

### **Indirect Modulation**

See Frequency Division Multiplex.

### **Individual Call**

See Selective Calling.

### **Institute of Electrical Electronic Engineering (IEEE)**

A United States standards group that develops standards, definitions, and test methods in the field of electrical engineering. Its standards are widely recognized around the world.

### **Integrated Services Digital Network (ISDN)**

An Integrated Digital Network in which the same digital switch and digital path are used to provide different services such as voice, data and video.

### **Intele-Trunk**

Trademark of Midian Electronics' dispatch/radiotelephone trunking format. This format allows two types of mobile-to-mobile calling and one type of telephone interconnect calling.

In the first type the mobile can "place" a call by scanning the channels looking for a repeater that is not busy (no carrier) to "place" a mobile-to-mobile call using CTCSS or DCS. A repeater equipped with a tone panel will decode the CTCSS or DCS signal (providing said code is authorized on the repeater) and return a carrier with tone so that all other users, sharing that tone, can scan and lock on to the repeater. The conversation will remain on the channel as long as the hang time on the repeater is not exceeded.

In the second type the mobile also scans looking for an unused repeater. Upon finding a non-used repeater, the mobile transmits a DTMF connect ANI for user verification. After verification the repeater interconnect instantly sends back a handshake to the mobile permitting it to momentarily unquench to hear dial tone and then transmits its DTMF dialing sequence. By using a four-digit telephone number mobile to mobile calling is effected. By using five or more digits telephone line dialing is accomplished.

If the handshake is not returned by the interconnect the mobile scans to another empty channel and tries again. If the mobile is out of range or all channels are busy the mobile logic board will generate a busy/error tone. After completion of the call, a positive disconnect ANI is sent to knock down the terminal and stop the billing counter. The connect ANI, disconnect ANI and decode number can be the same sequence or totally different.

To "receive" a DTMF call, the mobile scans the repeater channels from A, B, C, D, \*, #, or 1-9 collect tone, that all mobiles lock onto. Having multiple collect tones prevents units on one system from locking on to a competitive system. Following the collect tone is a 150 msec A, B, C, D, \*, #, or 1-9 reset tone which remutes all receivers. A four digit phone number is then dialed and the mobile that decodes the correct number will remain locked on the channel, while all other mobiles continue scanning for another collect tone. There are two additional numbers that can be used for group calling or mobile conferencing and Deadbeat Disable. Deadbeat Disable terminates mobile users who are remiss in paying their monthly bill. This format also supports voice scrambling and multi-city

trunking. This product is available in the Motorola GP300 and the Maxon SP2000/SL70.

**Interconnect**

See Telephone Interconnect.

**Inter-exchange Carrier (IXCS)**

Same as long distance companies such as AT&T®, MCI®, and Sprint®. See LATA, EAS, Central Office, and Exchange Area.

**Inter-Modulation Distortion (Intermod)**

Distortion caused by several signals mixing in a non-linear device producing sum and difference products.

**International Telecommunications Union (ITU)**

The ITU sets data communications standards for the world (formerly the CCITT).

**Interrogation**

See Polling.

**Inter-sequence Gap**

See Gap Time.

**Interstitial Channels**

See Splinter Frequencies.

**Iridium**

A low earth orbit multiple satellite cellular system being designed by Motorola, that was originally going to employ 77 satellites (thus the name Iridium, a metal with an atomic number of 77, the number has now been reduced to 66). This system permits ground users to talk to any place in the world by direct link to satellite. These satellites are capable of handing off to each other so that the users may talk unit-to-unit and to the ground stations. These satellites will circle 500 miles above the earth in six different polar orbits with eleven satellites in each orbit.

**Isolator**

A three-port gyro magnetic device used to rotate RF power in one direction only. The isolator prevents extraneous RF signals from getting back into the transmitter's class C non-linear power amp where they can mix creating odd order products which can fall back into the same band causing interference. The RF from the transmitter is applied to port one and then rotates 120° to port two where it is fed to the antenna. Any reflected power or extraneous signals entering the antenna from any other nearby transmitters is then rotated 120° to port three with a 50 ohm load where it is absorbed. It is very important that a high quality 50 ohm termination be used otherwise if a mismatch occurs at the third port power can rotate 120° back to port one getting into the transmitter final. Isolators are also used in antenna combiners. See Antenna Combiner.

**Itinerant Operation**

Operating a mobile or portable radio at unspecified locations for varying periods of time. The FCC has allocated certain channels for itinerant users.

**JDC (Japan Digital Cellular)**

See PDC and Cellular. Also see AMPS, CNET, EAMPS, GSM, NAMPS, NMT, TACS and USDC.

**Keyboard**

Device for inputting numbers to an encoder/dialer. Used in applications such as Touch Tone® encoders, pulse dialers and microphones. Also, data input device for computer systems.

**Key-Up Delay**

See Front Porch.

**LATA**

See Local Access and Transport Areas.

**LCD**

See Liquid Crystal Display.

**LED**

See Light Emitting Diode.

**LET (Link Establishment Time)**

See Front Porch.

**LMR**

See Land Mobile Radio.

**LPC**

See Linear Predictive Coding.

**LPI**

See Low Probability of Intercept.

**LTR**

See Logic Trunked Radio.

**Land Line**

See Metallic Pair.

**Land Mobile Radio (LMR)**

This generally refers to mobile service between base stations and land mobile stations or between land mobile stations. This is conventional two-way usage at 150 MHz and 450 MHz. See PMR and SMR.

**Last Number Redial**

Available on many Midian products. Allows the user to simply press the \* key twice to redial the number previously dialed.

**Lead-In Delay**

See Front Porch.

**Lead-In Time**

See Front Porch.

**Lead-Out Delay**

The time delay between last tone sequence and transmit turn off.

**Leased Line**

See Metallic Pair.

**Light Emitting Diode (LED)**

Solid-state lamps available in several different colors including red, orange, amber, yellow, green and blue.

**Liquid Crystal Display (LCD)**

A display that is used on a radiotelephone to show the number dialed, memory dial, and channel information. When used on radio pagers it can show the calling party's phone number to answer back, or an alpha text message.

**Linear Predictive Coding**

A voice encoding technique which digitizes speech by modeling the vocal tract. The audio signal is broken down into equal time periods. Each period is analyzed to extract pitch, filter parameters and voiced/unvoiced information. The data rate transmitted depends upon the model used; for instance, the Federal Standard 1015 LPC-10 algorithm generates 2400 bits per second.

### **Line Repeater**

A device which amplifies or regenerates a signal to compensate for phone line losses.

### **Link**

A circuit or transmission path including all equipment between sending and receiving units.

### **Link Establishment Time**

See Front Porch.

### **Loading Coil**

An inductor installed along a phone line to flatten out the voice frequency response. They can adversely affect the high frequency response required for digital transmission. Largely replaced by line repeaters. See Line Repeater.

### **Local Access and Transport Areas (LATA)**

Refers to areas for which a local telephone company provides service without going through an Inter-exchange carrier (IXCS) (long distance companies). INTER LATA can be accomplished by using a long distance provider. See IXCS, EAS, Central Office and Exchange Area.

### **Local Loop**

Refers to the wireline between the subscriber telephone and the central office.

### **Logic Trunked Radio (LTR)**

Trademark of EF Johnson's Clearchannel 800 MHz trunking system. In this format the mobiles are assigned to a home channel. If the home channel becomes busy the terminal will transmit a sub-audible digital sequence that reassigns the remaining mobiles to another channel. When a mobile initiates a call a sub-audible burst is transmitted to the assigned home channel repeater. The five digit data packets include a two-digit system ID and a three-digit group ID. Each mobile can be programmed to send several different packets. One packet could be used for telephone interconnect with dialing being performed by a DTMF microphone. Other packets can be used to make a mobile-to-mobile dispatch call, mobile to office, or mobile to individual mobile for private conversation. After the mobile has transmitted the packet, the base sends back a handshake, and if the interconnect was selected a dial tone will be presented. In the case of the other examples the called party will un-mute and answer the call.

### **Loop Start**

The central office provides 48 volts to the local loop telephone line through a line relay. When the subscriber phone is taken off hook to make a call it completes the current through the loop and the line relay seizing the line. See DID and Ground Start.

### **Low Pass Filter**

A filter designed to pass tones below a certain knee frequency. This filter is commonly used in CTCSS systems to pass CTCSS frequencies of 67 to 250 Hz and reject voice frequencies in the 300 to 3000 Hz spectrum.

### **Low Probability of Intercept (LPI)**

Refers to the ability of a spread spectrum or frequency hopping scrambling to not be being deciphered, detected or jammed by the enemy.

### **M-ARY Signaling**

Refers to higher bit rate signaling formats using multi-symbol codes like APSK (Amplitude Phase Shift Keying) and QPSK

(Quadrature Phase Shift Keying) which both require a higher signal to noise ratio for reliable decoding.

### **MDC 600®**

600 baud mobile data PSK format used by Motorola for ANI, status and selective call.

### **MDC 1200®**

1200 baud mobile data FFSK format used by Motorola for ANI, status, control and selective call.

### **MDT**

See Mobile Data Terminal.

### **MF Tones**

See Multi-Frequency Tones.

### **MIN**

Mobile Identification Number. See Automatic Number Identification.

### **MOC (Ministry of Communications)**

A government agency in Far-Eastern countries responsible for allocating and regulating radio channel usage. Also, see PTT, FCC, DGT, OTI and DOC.

### **MODAT®**

See Five Tone Sequential and Midian's Tone Signaling Chart.

### **MPT (Ministry of Posts & Telecommunication)**

A government agency responsible for setting standards and specifications for communications equipment in Britain for the Office of Trade & Industry (OTI). See CEPT, ECPT and ETSI.

### **MPT 1327**

Trunking format for private land mobile service in the United Kingdom and Europe.

### **MSA**

See CGSA.

### **MSK**

See Frequency Shift Keying.

### **MTS**

See Manual Telephone Service.

### **MTSO (Mobile Telephone Switching Office)**

See Cellular.

### **Man Down Sensor Timer**

The man down feature in many Midian products which uses a customer provided mercury tilt switch to detect when a radio, and presumably its user, has changed from a vertical to a horizontal position (e.g. lying down injured, rather than sitting or standing). When the man down timer starts, it waits for a programmed amount of time before sending an emergency ANI. A warning timer can also be set to generate a beep tone to remind the user to right the radio if it was accidentally laid on its side before the programmed amount of time expires. This feature can also be used with a "grenade pin" type switch on portables or a hidden foot switch in mobile applications to activate the emergency number identification.

### **Manual Telephone Service (MTS)**

This is the old 600/1500 Hz system, originally used in the United States and still in use in Canada. This format uses a base to mobile call of 600/1500 Hz FSK. It generates a digit every time there is a shift from 600 to 1500 Hz or from 1500 back to 600 Hz. It can inter-digit on either tone. The rarely seen

mobile to base sequence employs 1100/1500 Hz FSK. This system employs an operator to patch the mobile users into their landline call. In the United States, this system was replaced by IMTS. A similar format is in use for a ground station to call an aircraft for manual phone patching. The ground to aircraft format employs an extra trailing digit to tell the aircraft which channel to answer on.

### **Manchester Encoding**

A form of bi-phase encoding that OR's an NRZ signal with a symmetrical clock. ORing guarantees a 50% output duty cycle regardless of the NRZ data duty cycle. A coherent (synchronous) detector uses a phase lock loop detector to recover the clock so the data can be extracted. See Synchronous Data and NRZ.

### **Mark/Space Ratio**

In Morse code this refers to dot and dash time. In teletype baudot, this refers to the current on/off ratio in the DC current loop for transmitting data. The current loop equipment used either 20 mA or 60 mA loops. In modem technology this usually refers to the binary digital data (1's and 0's).

### **Mark V**

Trademark of Ericsson GE's 800 MHz trunking system. This was the first commercially available trunking system. The first version used 34 collect tones along with two tone sequential for signaling. The newer version uses the same 34 collect tones with a four tone signaling sequence. The collect tone is sent for 90 msec multiplied by the number of channels to give all mobiles time to scan to, and lock on to the channel. When the mobile initiates a call the radio scans to an empty channel and transmits the proper collect tone and signaling sequence. The sequence can allow the mobile to call all mobiles in his group, an individual mobile, or a telephone interconnect. If the user selects the interconnect he can then use a DTMF microphone to dial his number. An incoming call from the landline to the interconnect can be addressed to the mobile by over dialing in DTMF the correct collect tone and sequence.

### **Mark Idle**

See IMTS.

### **Memory Dial**

Allows the user to enter a specified number of telephone numbers (or selective call numbers) into memory and then dial them by simply pressing \* and the corresponding key to access the desired memory location. Also called repertory dial.

### **Message Decode Reliability**

See Probability of Error.

### **Message Duration**

The time it takes to transmit an ANI or status and location sequence.

### **Metallic Pair**

Generally refers to a dedicated line between two points that is leased from the TELCO. It can be used to control a base station or wire line controlled repeater using tone or DC remote control. This circuit is capable of passing a DC current. A metallic pair may include in-line repeaters for maintaining audio levels. Referred to as Dedicated Line, Leased Line, or Land Line. See Tone Remote and DC Remote.

### **Mic Mute**

Used to turn off the radio's microphone for the duration of the front porch, ANI, or dialing. Prevents the user from talking immediately after pressing the PTT and interfering with ANI

and dialing. In some Midian products, a "beep" can be programmed to tell the user that the ANI has been sent and that conversation may commence.

### **Mobile Data Terminal (MDT)**

Mobile radio computer aided dispatch system that allows a mobile and base unit to communicate using mobile computer terminals. They also allow police units to have direct access to national and local crime information systems.

### **Mobile Loading**

The number of mobile transmitters (vehicular or handheld) authorized to operate in connection with a particular base station on a particular channel within a particular service area.

### **Mobile Telephone Switching Office**

See Cellular.

### **Modulation**

The process of varying the phase, and/or frequency, and/or amplitude of a carrier signal for the purpose of impressing tone, voice or data on the carrier channel.

### **Modulation Index**

See Frequency Deviation.

### **Modem**

Acronym for MOdulator DEModulator. A device that converts data to FSK and/or PSK for transmitting and receiving data over a phone line or radio channel. See Baud Rate, DPSK, QPSK, and QAM.

### **Monitor**

Refers to either lifting a microphone off hook or pressing a monitor button to un-mute the radio's tone squelch in order to check the radio channel for co-user activity using a different CTCSS tone. Also refers to a radio that is bused for monitoring radio channels. See CTCSS.

### **Morse Code**

One of the oldest signaling techniques employing a series of dots and dashes or marks and spaces for transmitting messages. See Midian's Tone Signaling Chart.

### **Morse Code Station Identifier**

A device used to monitor channel activity on a base station, or repeater and to automatically send a Morse code ID a programmable time intervals for station identification. Identifiers are generally used in large systems, such as police, fire, and large company systems, where users forget to identify themselves verbally, as required by the FCC. Midian's keyboard programmable Morse Code ID (ID- 1), in addition to being able to generate a Morse code Station ID, can also send a 130-character message, which may be useful in amateur radio applications.

### **Motorola Quick Call 1**

See Two Tone Sequential. Also, see Midian's Tone Signaling Chart.

### **Motorola Quick Call 2**

See Two Tone Sequential. Also, see Midian's Tone Signaling Chart.

### **Multi-coupler**

A device that combines several radio receivers onto one antenna.

### **Multi-Frequency Tones (MF Tones)**

Signaling tones used by the phone company for transmitting address information over toll facilities. Uses two of six tones to encode ten digits and five special auxiliary signals. See Midian's Tone Signaling Chart.

### **Muulti-Path Fading**

Multi-Path Fading is the result of several components of a radio signal arriving at a receiver out of phase causing fading in the receiver output. The phase differences are usually caused by the primary signal being reflected by mountains, buildings, water, etc. On a television this may be observed as ghosts. The signal fade will tend to follow a statistical distribution called Rayleigh Distribution or Fade.

### **Multiple Access**

The method of providing for more effective spectrum usage. Instead of allocating one channel to one user, multiple access provides for "multiple" user to have simultaneous "access" to a channel. Several technologies have been used to achieve multiple access. FDMA - Frequency Division Multiple Access; TDMA - Time Division Multiple Access; CDMA - Code Division Multiple Access.

### **Multiplex**

To interleave or simultaneously transmit multiple messages over a communications channel.

### **NABER**

See National Association of Business and Educational Radio.

### **NAM**

See Numeric Assignment Module.

### **NAMPS**

Narrow band version of the Motorola Cellular AMPS system. NAMPS allows for tripling the number of users in the same channel space as used by AMPS. See AMPS and Cellular. Also see CNET, EAMPS, GSM, JDC, NMT, PDC, TACS and USDC.

### **NATEL**

Scandinavian National Telephone. See Five Tone Sequential. Also, see Midian's Tone Signaling Chart.

### **NEC/D3**

This is a paging format using a variation of the POCSAG paging format manufactured by NEC. See POCSAG.

### **NMT**

See Nordic Mobile Telephone.

### **NRZ**

See Non-Return to Zero.

### **NTACS**

See TACS and Cellular. Also see AMPS, CNET, EAMPS, GSM, JDC, NAMPS, NMT, PDC, and USDC.

### **NVRAM (Non-volatile Ram)**

See Random Access Memory.

### **National Association of Business and Educational Radio (NABER)**

FCC certified frequency coordinator for the business radio service.

### **Non-Coherent Detector**

A detector that uses a tone filter to pass the desired frequency which is then detected with a diode detector and filter. This detects the presence of a tone "envelope".

### **Non-Return to Zero**

A line code that switches directly from one level to another, each level is held for the duration of a signal level. NRZ contains no transitions for long strings of 1's and 0's. Thus procedures must be used to ensure for lack of timing transitions on synchronous links. See Manchester Encoding and Synchronous Data.

### **Non-Wireline**

See Cellular.

### **Nordic Mobile Telephone (NMT)**

Nordic Mobile Telephone Cellular system used in Scandinavia, Austria, and some Middle East countries. In the NMT-450 System the mobiles units receive in the range of 463-468 MHz and transmit in the range of 453-458 MHz with 25 KHz channel spacing and employs 200 channels with Frequency Division Multiple Access (FDMA). In the NMT-900 System the mobile units receive in the range of 935-960 MHz and transmit in the range of 890-915 MHz with 12.5 KHz channel spacing and employs 2000 channels with FDMA. See Cellular. Also see AMPS, CNET, EAMPS, GSM, JDC, NAMPS, PDC, TACS and USDC.

### **Notch Filter**

A filter used to remove a specific tone from an audio spectrum so that it is not heard by the user. SMART radiotelephone systems employ a 2805 Hz busy tone to prevent other users from getting on the channel. This tone had to be filtered out by the authorized user. Notch filters are also used in tone remotes to prevent the high level and low level guard tones from being heard by the user.

### **Numeric Assignment Module (NAM)**

The Numeric Assignment Module is a memory chip used to store a cellular radio's Electronic Serial Number (ESN), telephone number, etc.

### **OOK**

See Amplitude Shift Keying.

### **OTA (Office of Telecommunication Authority)**

A government agency in Hong Kong responsible for allocating and regulating radio channel usage. See DOC, MOC, PTT, and FCC.

### **OTAR**

See Over The Air Reprogramming.

### **OTI**

Office of Trade & Industry in Great Britain. See MPT.

### **Off-Hook**

The condition when a phone is taken off-hook loading the local loop phone line. See Loop Start and Ground Start.

### **On-Hook**

The inactive condition while a phone is on-hook (in the cradle). The line is open circuited with no load placed on it. See Loop Start and Ground Start.

### **On-Hook Dialing**

Refers to dialing a phone number while a radiotelephone is still on hook.

**One Plus Dialing**

Refers to dialing " 1 " for a long distance call.

**Oscillator**

An electronic circuit that can generate a periodic waveform at a particular frequency.

**Out Of Band Signaling**

Generally refers to signaling tones that are outside of the normal voice channel bandwidth of 300 Hz to 3400Hz. A 3700 Hz tone is employed for E & M lead signaling on microwave systems.

**Over Dial**

See End-To-End Signaling, DOD, and Click Counter.

**Over The Air Reprogramming (OTAR)**

This refers to a feature in Midian's TVS rolling code voice scramblers that allows a CAD-300 base commander to reprogram security codes on an individual basis over the radio channel.

**PABX/PBX**

Private (Automatic) Branch Exchange used to provide private switching in large businesses or office buildings.

**PCCIR (Pye/Phillips)**

See CCIR and Five Tone Sequential. Also see Midian's Tone Signaling Chart.

**PCIA**

See Personal Communication Industry Association.

**PCM**

See Pulse Code Modulation.

**PCN**

See Personal Communications Network.

**PCS**

See Personal Communications Services.

**PDC**

See Personal Digital Cellular.

**PHS**

See Personal Handy Phone System.

**PLL**

See Phase Lock Loop.

**PMR**

See Private Mobile Radio.

**POCSAG**

Digital paging format used for alpha and numeric pagers. This format was originally specified by the British Ministry of Posts and Telecommunications and is used worldwide. Numerous manufacturers support it. See NEC/D3.

**POTS**

Acronym for Plain Old Telephone Service.

**PROM (Programmable Read Only Memory)**

See Read Only Memory.

**PSK**

See Phase Shift Keying.

**PSTN**

Abbreviation for Public Switch Telephone Network.

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**PTT**

An abbreviation for Post, Telephone and Telegraph a government agency in many European and Middle Eastern Countries that is responsible for allocating and regulating radio channel usage. See DOC, DGT, FCC, MOC, and OTI.

**PTT**

See Push-To-Talk.

**PZVEI (Pye/Phillips)**

See ZVEI, DZVEI, and Five Tone Sequential. Also, see Midian's Tone Signaling chart.

**Packet Operation**

Transmission of data by means of addressed packets whereby a communications channel is occupied for the duration of the packet only. The channel is then available for use by other packets being transferred between different data terminals.

**Pager**

A small radio receiver that employs an addressable tone or digital decoder enabling the pager to receive calls addressed to that unit only. Analog pagers are available in tone only (provides a short ring or beep) or tone and voice (voice message follows the ring or beep). Digital pagers can offer tone, tone and voice, numeric display (displays phone number for returning call) or alphanumeric display for displaying a message. Pagers may also employ a vibrator for silently alerting the user without disturbing anyone else.

**Paging**

A one-way communication service to a mobile, portable or a fixed receiver (pager) that provides signaling or information transfer by such means as tones, tone and voice, and digital signaling with numeric and alpha numeric read out capability.

**Paging Encoder**

A small desktop unit that contains a keyboard for entering the pager's calling code and transmits the tone or digital sequence over a radio channel. After the sequence is finished a voice message may be transmitted.

**Paging Terminal**

A device that is connected between a telephone line and a radio base station transmitter. By calling into the terminal via the Public Switched Telephone Network (PSTN) a radio paging subscriber can be called from any telephone in the world.

**Parallel Data**

A means of transmitting data over multiple lines with a strobe. As an example, 8 bits of data require 8 parallel lines plus a strobe to transfer these bits from the transmitting unit to the receiving unit. This is a fast means of transferring data but is not economical due to the number of lines used.

Serial transmission is more economical but is much slower. It requires that all bits be transmitted one after another (serially). This is done synchronously or asynchronously. See Synchronous, Asynchronous, and Modem.

**Parity**

A data-encoding scheme used in computers for checking the validity of transmitted data. This scheme adds an extra bit to each data word, which the transmitting computer selects based on the type of parity the computers agree to use (odd or even). The receiving computer checks each character and flags a parity error if any character has the incorrect number of bits set.

### **Passive Filter**

See Filter.

### **Peak Detector**

The peak detector is used in several Midian tone decoder products following the bandpass filter. It is an op amp/diode circuit used to detect the presence of the proper tone by producing a DC output which is fed to a Schmitt trigger comparator.

### **Penalty Timer**

This feature is popular and even mandatory in some European countries. It is used in conjunction with a time out timer. After a radio user has talked too long his radio times out, starting a penalty timer. Until the penalty time has expired, the user cannot re-key his transmitter. This provides other users an opportunity to utilize the repeater channel.

### **Personal Communications Industry Association (PCIA)**

Formerly Telocator. FCC certified frequency coordinator for the RCC industry.

### **Personal Communications Network (PCN)**

A cordless radiotelephone network based on digital and microcell technologies, PCNS, a type of unlicensed PCS has the capability of accessing the public switched telephone network.

### **Personal Communication Services (PCS)**

A broad range of radio communications services that are intended to free individuals from the constraints of the wire line public switched telephone network. This interconnection, or phone-patch, permits the transmission of messages or signals between points in the wire line or radio network of a public telephone company and the land mobile radio system.

### **Personal Digital Cellular (PDC)**

This digital cellular format is used in Japan. There are two different spectrums in use. In one spectrum, the mobile unit receives at 810-826 MHz and transmits at 940-956 MHz. This employs a 30 MHz transmit receiver separation. In the second range of frequencies the mobile receives 1429-1453 MHz and transmits at 1477-1501 MHz with a 48 MHz separation between TX and RX. It employs TDMA with 1600 channels and three users per channel with 25 KHz channel spacing. See Cellular. Also see AMPS, CNET, EAMPS, GSM, JDC, NAMPS, NMT, TACS and USDC.

### **Personal Handy Phone System**

Digital cordless telephone system operating in the 1800-1900 MHz range used in Japan and China. This employs TDMA with 300 channels and 4 users per channel.

### **Phantom Digit**

On IMTS and SMART systems a DID line is used for inbound dialing. The last four out of seven digits are dialed directly into the terminal. Frequently the first of the four digits may be outpulsed by the terminal as another number, this is referred to as a phantom digit.

### **Phase Lock Loop Synchronous Detector**

See Manchester Encoding and Synchronous Data.

### **Phase Lock Loop Tone Detector (PLL)**

A device that compares an incoming tone frequency against its own tone frequency reference and produces a logic low when the correct signal is detected. As the signal is pulsed, the output of this device produces a corresponding pulse train that is then fed to additional logic circuits that decode the phone

number sequence. PLL's can also be used to detect a single tone or dual tones. Phase lock loops were used on some of Midian's earlier tone decoder products, particularly 2805 Hz and 1500 Hz pulse tone circuits.

### **Phase Modulation**

Method of impressing information (tone, data, or voice) on a carrier by varying its phase. See DCS.

### **Phase Shift Keying (PSK)**

This technique is used for transmitting data by shifting the phase of the carrier signal. Uses two distinct phases (binary PSK), one for each state. See DPSK, QAM, and QPSK.

### **Phone Line**

See Local Loop.

### **Phone Patch**

Predecessor to the telephone interconnect or auto patch. A mobile radio user would make a phone call with the assistance of an operator who would "patch" the call through. This system used a voice-operated switch "VOX" to switch the direction of the conversation between the phone and the mobile unit. These were usually simplex single channel systems. In contrast, telephone interconnects usually use half or full duplex radio channels with separate transmit and receive frequencies that are separated by 3 or 5 MHz.

### **Plectron**

See Two Tone Sequential. Also, see Midian's Tone Signaling Chart.

### **Polling**

In an alarm system the central monitoring point can watch for incoming alarm conditions as they occur, or instead, it can constantly request the alarm condition at the remote sites. This is referred to as polling or interrogating and eliminates the possibility of two alarm sites coming up at the same instant on a radio channel and interfering with each other.

### **Point-to-Point**

A communications path linking two distinct locations.

### **Positive Disconnect**

See Disconnect ANI.

### **Power-up**

The initial application of operating voltage to a radio unit.

### **Preamble Tone**

See Five Tone Sequential.

### **Pre-Emphasis**

See De-Emphasis.

### **Private Carrier**

A specific authorization from the FCC for certain frequencies within a geographic area authorizing the licensee to provide communication services, such as dispatch, radiotelephone interconnect and retail tariffs on long distance charges to other private parties, on a commercial basis.

### **Private Carrier Paging**

A specific authorization from the FCC for certain frequencies within a geographic area allowing radio paging to private parties on a commercial basis.

### **Private Line (PL)**

Trademark of Motorola C & E's CTCSS products. See Continuous Tone Coded Squelch System.

### **Private Mobile Radio**

FCC authorized service intended to meet two-way, paging, dispatch requirements of the business community. Use of these channels does not require any user fees as opposed to SMR and Private Carrier. This is also referred to as Conventional Two-Way Radio and Land Mobile Radio (LMR).

### **Probability of Error**

A probabilistic theory that define the likelihood of an error occurring on a communications channel that is contaminated with impulsive and/or gaussian noise for several types of coherent (PSK) and non-coherent (FSK) digital signals. A good performance is considered to be a bit error rate (BER) of less than one bit per every 100,000 transmitted. The BER in turn determines how reliably the message will be transmitted and decoded. See Falsing and Check Sum.

### **Propagation Delay**

The amount of time it requires for a signal to travel from one point to another in a component, circuit, radio system, or phone line.

### **Protocol**

A formal set of rules or conventions governing the format and timing of data transmissions between communication terminals or systems.

### **Public Key Encryption**

A method which uses separate keys to encrypt and decrypt information. The encryption, or "public" key is freely available to all sending parties. The decryption, or "secret" key is known only to the recipient of the message. In practice the two keys cannot be derived from each other. The best-known example is the RSA encryption system.

### **Pulse Code Modulation (PCM)**

A process in which a signal is sampled, and the magnitude of each sample with respect to a fixed reference is then quantized and converted by coding to a digital signal. See T-1 Carrier.

### **Pulse Dialing**

Refers to the original mechanical rotary telephone dials. These devices would break the current in a phone line at a rate of 10 PPS with a break/make ratio of 60/40. The telephone company step-by-step office would then count the pulses for directing the call to the desired phone subscriber. See Step-by-Step Office.

### **Pulse Tone 1500/2805 Hz**

This signaling format is used by the RCC industry (2805 Hz) and the Hospital Emergency Administrative Radio System (HEAR, 1500 Hz and 2805 Hz). This format places a tone on the air and uses a rotary dial to encode information by pulsing the tone. For example, if a digit 5 is dialed, the tone will be interrupted 5 times with a break/make ratio of 60/40 followed by an inter-digit gap time (solid tone) from 200 milliseconds to 2 seconds. After the 4 to 7 digit sequence has been dialed, the encoder will keep the tone on for 3 seconds. This is usually heard at the decoding mobile or portable unit as a ring tone. The digit 1 is generally not used in this format, especially as the first digit because a 1 can be used as an initial clearing pulse, or in some cases, as a clearing pulse for a mistake in dialing.

### **Push To Talk (PTT)**

Normally refers to the function of pressing the push to talk switch on a microphone or portable radio. Most Midian products can automatically control the radio PTT for ANI,

dialing, transponding, time out timer, penalty timer, and busy channel lock out.

### **QAM**

See Quadrature Amplitude Modulation.

### **QPSK**

See Quadrature Phase Shift Keying.

### **Quadrature Amplitude Modulation (QAM)**

A modulation scheme employing a combination of differential phase shifts and amplitudes for a total of six bits for every baud. Only four bits are reserved for data. Therefore, a 2400 baud modem can transmit data at 9600 bits per second. See TCQAM.

### **Quadrature Phase Shift Keying (QPSK)**

Technique for transmitting data by shifting the phase of the carrier signal with four different phase shifts. This permits higher data rates for a given channel bandwidth. Also called Quaternary or 4PSK).

### **Queuing**

This is a feature, incorporated in the Midian's UED-1, that allows the user to "line up" on a busy channel. When trying to use the UED-1, if the channel is busy, it will emit a busy tone. However, after the channel has become clear for a programmed amount of time, the UED-1 can automatically generate a beep tone, informing the user that the channel is now available to retry his call. In Midian's RT-8 radiotelephone product ANI can occur after queuing bringing up dial tone automatically. It will not dial the number because the radio user may have left the vehicle, by the time the channel has cleared.

### **Quiet Channel**

Trademark of RCA's CTCSS Products. See Continuous Tone Coded Squelch System.

### **RAM**

See Random Access Memory.

### **RBOC**

See Regional Bell Operating Companies.

### **RIC (Radio Identification Code)**

See Automatic Number Identification (ANI).

### **RICK (Repeater Interface Communications Kit)**

See Telephone Interconnect.

### **ROM**

See Read Only Memory.

### **RS-232C**

A standardized system for connecting a device to the serial port of computer or terminal. It is the recommended standard of the Electronic Industries Association (EIA) for exchanging information between data terminal equipment (such as computers) and data communications equipment (such as modems).

### **RSA (Rural Service Area)**

See Cellular Geographic Service Area.

### **RSSI**

See Relative Signal Strength Indicator.

### **RTTY**

See Radio Teletype.

## **RTX**

A trunked radiotelephone format utilizing DTMF signaling in both directions. This format allows for the mobile to make a call by scanning the radio channels looking for an interconnected repeater that is not busy. The mobile then sends its ANI and then proceeds to dial the number. The mobile can call a phone or another mobile with this format. To receive a call, the mobile scans the repeater channels looking for a two second DTMF "D" tone or collect tone, which all mobiles lock on to. Following the "D" tone a four-digit phone number is dialed and the unit that decodes the correct number will remain on the channel, while all other units resume scanning for another "D" tone. To terminate a call the mobile presses the # tone. This product was designed by Basic and the name of the company later changed to RTX Corporation and is no longer in business. This format is quite similar to Ericsson GE's MARK V 800 MHz trunk system.

## **Radio Carrier**

A radio signal that is used to carry audio, video, or data.

## **Radio Common Carrier (RCC)**

A company that offers radiotelephone service to the public. It is regulated by the FCC and State public utilities commissions. RCC's compete with AT&T® and after AT&T®'s breakup the Regional Bell Operating Companies (RBOC).

## **Radio Repeater**

A radio transmitter and receiver that is "generally" offset by 3 or 5 MHz between transmit and receive frequencies. The receiver and transmitter are simultaneously operating, permitting one user to call into the receive side and to have the transmitter re-broadcast this to another user. A repeater generally utilizes a high gain antenna and is located on a tall building, tower, or mountain top site. This greatly improves terrain coverage by re-broadcasting a weaker signal at a much higher power level from a much higher site elevation. CTCSS and DCS protect a repeater from unauthorized access or interference.

## **Radio Teletype (RTTY)**

A technique for transmitting data using the old Baudot 5-bit code. This is still used by ham operators and Maritime users. Employs slow FSK signaling.

## **Random Access Memory (RAM)**

A memory that provides random access to any storage location. Information can be written in or read out. A non-volatile RAM (NVRAM). Retains its information even if power is lost.

## **Rayleigh Fade**

See Multi-Path Fading.

## **Reach 11<sup>th</sup> Root of 2**

See Five Tone Sequential. Also, see Midian's Tone Signaling Chart.

## **Reach Single Tone**

A low capacity radio paging format designed by Reach Electronics, that uses a long single tone to call a paging receiver. See Midian's Tone Signaling Chart.

## **Reach Two Tone**

See Two Tone Sequential. Also, see Midian's Tone Signaling Chart.

## **Read Only Memory (ROM)**

A fixed storage memory that can be read but not written to or altered. All of the instructions for a microcomputer are stored in ROM. PROMs are programmable ROMs that can be erased with ultraviolet light. EE PROMs are electrically erasable ROMs. This device is non-volatile, so it will not lose its memory when power is removed. Midian uses ROMs in many products including the UED-1 micro-processor based encoder/decoder/ANI/transponder, for storing phone numbers, ANIs, memory dial numbers, system timing and features. These devices can be programmed via a keyboard, a portable programmer, or a personal computer.

## **Receiver Lockout**

See Busy Channel Lockout.

## **Reed**

A mechanical vibrating resonant device used in early two tone pagers and CTCSS products for encoding and decoding tones. They were replaced with active filters. Motorola referred to them as Vibrasenders and Vibrasponders. When used in CTCSS applications the Reed would continue to vibrate briefly after loss of the carrier signal. As a result of this a squelch tail was heard. Motorola introduced a squelch tail eliminator in their radios that would transmit a reverse burst of tone 180° out of phase to the original tone that would instantly dampen the vibrations allowing the radio to instantly re-squelch eliminating the "tish" sound. See Continuous Tone Coded Squelch System.

## **Regional Bell Operating Companies (RBOCs)**

The local telephone companies that were created in 1984 as part of the break-up of AT&T®. There are seven RBOC's: Ameritech, Bell Atlantic, BellSouth, NYNEX, Pacific Telesis Group, Southwestern Bell, and U.S. West.

## **Register**

A location in memory that is typically used for storing a phone number, ANI, or other programmable features.

## **Relative Signal Strength Indicator (RSSI)**

An output from a receiver's IF circuit that produces a DC output level proportional to the strength of the received signal. This is used in cellular systems to indicate conditions for handoff.

## **Remote Adapter**

A device that is usually installed at a base station or repeater for the purpose of remotely controlling the radio's PTT, monitor, frequency, and other functions. This device can employ either DC or tone, and is generally controlled by a DC or Tone Remote via a phone line. A notch filter is used to remove the guard tone from the voice audio in tone remote applications. See Tone Remote and DC Remote.

## **Remote Close**

See Command Reset.

## **Remote Control**

A signaling device that permits a user at one location to control a function at a remote location via a radio channel or telephone line. See DC Remote and Tone Remote.

## **Remote Reset**

See Command Reset.

## **Remote Transmitter Turn On**

See Triangulation.

### **Repeat Tone**

See Five Tone Sequential.

### **Repeater**

See Radio Repeater.

### **Repeater ANI**

As part of the European five tone signaling format, the radio user can send a five-tone sequence to access the repeater rather than using CTCSS. Once the repeater has been opened, it will remain open for a pre-programmed time period, allowing someone to answer back before it shuts down. In addition, once the repeater has been opened, the user could send another 5-digit sequence for mobile ANI followed by yet another 5-digit sequence for selective calling to another unit. These last two sequences may be reversed. See Five-Tone Sequential.

### **Repeater Interface Communications Kit (RICK)**

Same as telephone interconnect. See Telephone Interconnect.

### **Repeater Knockdown**

To deactivate or to remove a radio repeater from service by using tone signaling or phone line modem control.

### **Repeater Panel**

A multiple tone decoder/encoder that utilizes CTCSS and DCS and in some cases ANI to allow access to a radio repeater. The panel can be programmed to accommodate several user groups and maintain channel use information for billing and statistical analysis. Also called shared repeater panel.

### **Repeater Setup**

To activate or to place a radio repeater into service by using tone signaling or phone line modem control. See Community Repeater.

### **Repertory Dial**

See Memory Dial.

### **Request To Talk**

A feature in fleet management systems that prevents mobile users from keying their microphone until they transmit a request to talk signal to the computer aided dispatcher system which in turn transmits a signal to the mobile, enabling its push to talk and unmutes its receiver.

### **Return Loss**

The difference in dB between a reflected signal and the incident signal at a signal reflection point.

### **Reversal**

See Direct Inward Dial and Ringing.

### **Reverse Burst**

See Continuous Tone Coded Squelch System.

### **Ring Back**

See Ringing.

### **Ring Trip**

See Ringing.

### **Ringing**

Refers to the signal that the phone company generates to alert the called subscriber to an incoming call. This is generally 90 volts RMS at 30 Hz and may reach 50 milliamps. The ringing is usually superimposed over the 48 volts DC. Answer supervision involves disconnecting the ringing voltage (Ring

Trip) once the call is answered. This may require momentarily interrupting the circuit or reversing the tip and rings polarity. The reversal is used to start the billing process for toll calls. Ringing is also called Ring Back and Closing The Loop.

### **Roaming**

This is a capability of most advanced radiotelephone systems and trunking systems that permit users in one city or system to "Roam" into and utilize another system in a different city.

### **Rolling Code Voice Scrambler**

A form of inversion scrambling, however, the inversion frequency varies in a pseudorandom fashion in a frequency range of about 2.6 KHz to 3.7 KHz. In Midian's TVS series of voice scramblers the dwell time for any one tone also varies pseudo-randomly. This type of scrambling requires synchronization at the beginning of a conversation so that all units know what the pseudorandom sequence is going to be and precisely when to start. Together, the pseudo-randomly generated frequencies and dwell times comprise the scrambling code. With this technique, billions of pseudo-random code sequences are available.

### **Rotary Dial**

See Pulse Dialing.

### **Rotary Telephone Line**

Special telephone line service from the telephone company to a multi-line subscriber that permits incoming calls to "rotate" sequentially to the next available line.

### **SCADA**

See Supervisory Control And Data Acquisition.

### **SEL CALL**

See Selective Call.

### **SF Tones**

A single frequency tone used for signaling purposes. See Inband and Out of Band Signaling. Also, see Midian's Tone Signaling Chart.

### **SINAD**

Acronym for Signal to Noise And Distortion. Measurement technique for testing a radio receiver's performance. Most VHF radios will produce a 12 dB SINAD change with .25 microvolts input level. Most UHF radios will produce a 12 dB SINAD change with about .35 microvolts of SINAD. Some manufacturers will set their squelch circuit to respond to signals that produce 12 dB or more of SINAD. Tone decoding should occur with weaker signals of at least 10 dB. Most of Midian's product will decode in the 6-8 dB SINAD range.

### **SMART**

See Secode's Modular Automatic Radiotelephone.

### **SMR**

See Specialized Mobile Radio Service.

### **SNR**

See Signal to Noise Ratio.

### **Schmitt Trigger**

An OP amp comparator with hysteresis (positive feedback to prevent chattering), in tone signaling this device is generally used after a peak detector that follows a bandpass filter. It is used to confirm the receipt of the correct tone.

### **Secode's Modular Automatic Radiotelephone (SMART)**

This format uses a 2805 Hz tone to call the mobile and to busy out the channel for all other users. All units are assigned a home channel to receive calls. If the home channel is marked busy the system will over dial by pulsing the 2805 Hz busy tone. A notch filter prevents the user from hearing the 2805 Hz busy or dialing tone. If the home channel is in use the mobile will automatically scan to a non-busy channel to make or answer a call. To make a call the mobile transmits a 1402.5 Hz PSK (SMART) ANI data packet to the base station followed by 2805 Hz pulse dialing or in later versions Touch Tone® dialing. SMART also employs an extra digit on the end of the ANI to select one of four preassigned phone numbers stored in the terminal. This is referred to as a Call Routing Digit or CRD. Other CRD's could select outside lines, foreign exchange lines, or the RCC operator.

### **Seize Tone**

See Improved Mobile Telephone System.

### **Selective Calling (Sel Call)**

Normally refers to calling either a single radio (individual call), a group of radios (group call), or all radios (all call or fleet call) within a system. Sel call may be from mobile to mobile or base station to mobile. Midian modules may be programmed to provide the user with three decode registers with a different ring code for each type of call. Also, one of these numbers could be used for an emergency call, for disabling a vehicle or monitoring a stolen radio.

### **Selector Level Interface**

Same as a Direct Inward Dialing line. See Direct Inward Dialing (DID).

### **Sequential Single Frequency Tones**

A sequence of tones with no gap between them. See Five Tone Sequential. Also, see Midian's Tone Signaling Chart.

### **Serial Data**

See Parallel Data.

### **Serial Port**

The circuits and connector that permit a computer to communicate with serial devices such as printers, modems, plotters, and mice. It is also called a C OM or communications port.

### **Shared Repeater Panel**

See Repeater Panel.

### **Shut Off Code**

See Digital Coded Squelch.

### **Side Tone**

A feature on several Midian products that allows the radio user to hear the dialing tones in the radio's speaker as they are being transmitted. Also, a condition that exists in telephone hybrids as a result of an imbalance that causes them to return some transmitted audio back into the receive side of the circuit. This allows a telephone user to hear themselves talking in the earpiece.

### **Signal to Noise Ratio (SNR)**

Refers to the ratio of the value of the signal to that of the noise. Expressed in dB.

### **Simplex Interconnect**

A radiotelephone interconnect (also called auto patch) that is installed between a telephone line and a single frequency base

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station. The push to talk function is controlled by VOX and Anti-VOX circuits permitting the mobile and telephone user to take turns talking. Unlike the phone patch this unit is controlled by a Touch Tone® microphone or handset in the mobile unit allowing the user to make and receive calls automatically.

### **Simulcast**

Refers to the simultaneous transmission on multiple transmitters to provide full area coverage over a wide geographical area. This is used in wide area paging systems. All transmitters share the same frequency and must be locked precisely on frequency to avoid phasing problems at the receiving pager.

### **Singing**

An audible oscillation on a phone line caused by a net amount of gain in a four-wire segment of the circuit usually caused by a hybrid imbalance.

### **Single band repeater**

A radio repeater in which both the receiver and transmitter operate in the same frequency band.

### **Single Ended Input**

A capacitively coupled input to an audio circuit. It does not employ a transformer, as does a balanced input. See Balanced Input.

### **Single Frequency Signaling**

Method of conveying dial pulse and supervisory signals from one end of a trunk, line or microwave to the other. Generally uses a 2600 Hz in band tone to indicate presence or absence of signals. See In Band and Out of Band.

### **Smart Net**

Trademark of Motorola's 800 MHz trunking system. This system utilizes a control channel with continuous digital signaling, that all mobiles scan to in order to identify themselves at power up or upon completion of a call. When a mobile wishes to initiate an inbound call to the trunk system it uses the control channel to request several types of call options. If the user requests an interconnect the controller will hand the user off to a dedicated channel where the user will acquire dial tone at which time a DTMF microphone can be used for dialing. If the user desires dispatch (e.g. group call) or private call (e.g. mobile to individual mobile), the controller will then hand off the appropriate unit to an assigned channel where the unit can then have either a dispatch or a private call. See Trunking and Specialized Mobile Radio Service.

### **Space**

See Mark/Space Ratio.

### **Specialized Mobile Radio Service**

Specialized Mobile Radio Service, as defined by the FCC. Generally refers to trunked radio operations in the 800/900 MHz range in which the licensee provide mobile communications services on a commercial basis. Employs analog radio technology. Digital SMR employs digital radio technology, which allows for approximately five times increase of the existing channel space, with a corresponding geometrical increase in channel loading. See ESMR and Trunking.

### **Speech Synthesis**

A technique used to produce human sounding speech from stored digital data.

### **Splinter Frequencies**

Most channels are designed to have 25 KCs spacing between them. With narrow band radios it is possible to get by with 12.5 KCs or even 6.25 KCs of channel spacings. Interstitial channels or splinter frequencies are frequencies that are located half way between the normally assigned 25 KCs spaced channels.

### **Split Band Inversion**

See Voice Inversion Scrambling.

### **Spread Spectrum**

A wide band modulation technique that permits transmitting data or information over a more or less wide range of frequencies as compared to a typical narrow band analog radio channel. Spread Spectrum has been used by the military to transmit data or information with a low probability of intercept or deciphering by an enemy. CDMA Multiple Access Cellular Systems use a narrow band version of Spread Spectrum. This permits multiple access by many users simultaneously sharing the same channel. In wide band spread spectrum systems, thousands of users can occupy the same band without any interaction.

### **Squelch Detector**

A circuit in a radio which detects high frequency IF noise to mute the radio's speaker until the receiver is quieted by a strong enough signal to eliminate the noise.

### **Squelch Tail**

The burst of noise heard in the receiver after the transmitting unit drops his carrier. This is caused by the delay in the squelch detector or CTCSS to remute the radio. See CTCSS and REED.

### **Star**

See GE-Star.

### **Start/Stop Bits**

The bits that identify the beginning and end of a data frame in asynchronous data transmission. See Asynchronous.

### **State Variable Filter**

A very stable, Hi-Q, tunable filter with multiple outputs which is used on several Midian tunable decoder products. This circuit is capable of being tuned over a wide frequency range and produces a high-pass, low-pass, and band-pass output. By summing the high-pass and low-pass outputs with another op amp, a notch filter can be created. Also, the bandpass output may be summed with the original signal inverted 180 degrees to create a notch filter. This circuit may also be designed to oscillate for generating stable CTCSS, burst tones, or even sequential tones.

### **Status & Location**

Several of Midian's mobile/portable products have the ability to send an ANI in five-tone or DTMF formats to identify each user. By appending an additional 1-2 digits to the ANI the UED-1 can add 10 status messages (0-9). With custom software, an additional 2-3 digits can be added which will report 100 locations (00-99) or 1000 locations (000-999).

### **Step-By-Step Office**

Old telephone offices that employ electromechanical stepping relays that respond to incoming pulses to step and hunt for the desired subscriber line. See Pulse Dialing.

### **Stolen Radio Destruct**

See Deadbeat Disable.

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### **Store and Send Dialing**

Allows a user to enter a telephone number then simply press the \* button to key up the radio and transmit the number. This saves airtime, because the transmitter is not turned on during the entry process. Only when a number is actually entered and is sent via the \* button, does the transmitter turn on. This is also called auto dialing.

### **Strategic Voice Scrambling**

A very high security scrambling system designed to provide long-term security for sensitive information.

### **Stun**

See Deadbeat Disable.

### **Subcarrier Modulation**

See Frequency Division Multiplex.

### **Subcarrier Paging**

A paging service that uses a subcarrier on a high power stereo FM broadcast station to transmit paging signals to personal pagers. Stereo FM broadcast stations with SCA equipment typically use a 57 KHz, 67 KHz and/or 92 KHz subcarrier. These systems can be networked via satellites across the United States with other FM broadcast systems for nation wide paging. These systems are also being used for transmitting all kinds of data to computer terminals. For example, E-mail, stock and commodity reports, financial information services, etc.

### **Supervisory Control**

Refers to having a designated operator supervise a group of Tone or DC remotes (dispatch points), that are controlling a radio base station. There is a switch on the supervisor's Tone/DC Remote permitting the operator to disable the dispatch points if they are misusing the system. The supervisory operator is in effect controlling the base station and is referred to by the FCC as the Control Station. See Tone Remote and DC Remote.

### **Supervisory Control and Data Acquisition (SCADA)**

A system in which a central control unit sequentially acquires data by polling multiple remote stations to measure, monitor and control events at the remote site.

### **Symmetrical Code Key**

A single key used for both encryption and decryption. This key must be kept secret to maintain security. Typically used with block ciphers to generate a starting point (or "seed") for a random-sequence generator.

### **Synchronization**

Midian's rolling code voice scramblers transmit a 90 msec data burst that is sent out to all other voice scramblers in the system. Synchronization tells each scrambler in the system which pseudorandom code sequence will be "hopped" and precisely when to start. It is transmitted by the radio that originates the call. The sync packet can also steer any receiving unit to follow it from the clear mode into the scramble mode or vice versa. Additionally, this packet can transmit ANI, OTAR, Deadbeat Disable, status, selective call, location, and remote monitoring.

### **Synchronization Bits**

Synchronization Bits are appended to the front (front porch) of a data packet to ensure that the receiving unit is tracking (synchronized) the incoming data at the same rate as is being transmitted. Following the synchronization bits forming words are used to get the receiving unit in phase with the transmitting unit.

### **Synchronous Data**

Generally, bi-directional serial data which is transmitted and then handshakes with the receiving unit and is synchronized by transmitting a separate clock signal. The receiver may incorporate its own stable clock that can be locked onto the received signal to regenerate the clock.

### **T-1 Carrier**

A trunked carrier system employing pulse code modulation techniques operating at 1.544 Mbps used by telephone companies on local interoffice digital trunks, PABXs, Digital Cross Connects, etc. It is a full duplex system capable of transmitting 24 two-way voice channels and is able to operate by using standard pole mounted or buried cable pairs. T-1 is used in the United States, E-1 is a similar system used in Europe and operates at 2.048 Mbps with 30-channel capability. There is also T-2, T-3, and T-4 which employ higher data rates and are usually transmitted via microwave or fiber optics. Also called DS1, DS2, DS3, and DS4. E-1 is also called CEPT1.

### **TACS**

See Total Access Communication System.

### **TCQAM**

See Trellis-Coded Quadrature-Amplitude Modulation.

### **TDM**

See Time Division Multiplex.

### **TDMA**

Time Division Multiple Access type of access method. TDMA allows channels to be divided into time slots, enabling several users to access and share the channels at the same time. See Multiple Access.

### **TETRA**

See TransEuropean Trunked Radio.

### **TSP Scrambling**

See Time Segment Permutation Scrambling.

### **Tactical Level Voice Scrambler**

A medium security voice scrambler designed to protect information for a short period of time.

### **Talk Around**

Most repeaters generally utilize a 3 or 5 MHz separation between transmit and receive frequencies. A mobile or portable must be able to transmit to the repeater on one frequency and listen to the return on another frequency. Talking around the repeater refers to changing the mobile or portable's transmit frequency so that it is on the same frequency as the receiver. This allows them to carry on a simplex conversation without going through a repeater.

### **Telemetry**

The ability to meter, measure or control events via radio or phone line from a remote location. See SCADA.

### **Telephone Interconnect**

A device that connects between a base station or repeater and a telephone line to allow mobile and portable radios to make and receive telephone calls. It may employ a verifier to keep out unauthorized users and to check their payment history. It may also utilize a billing counter to monitor system use and long distance charges. Telephone interconnects are usually run half or full duplex.

### **Telephony**

The transmission of voice conversations by radio or wire line.

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### **Tele-Trunk**

A Midian trunking system in which the mobile scans looking for an unused repeater. Upon finding a non-used repeater, the mobile transmits a DTMF connect ANI for user verification. After verification the repeater interconnect instantly sends back a handshake to the mobile permitting it to momentarily unquench to hear dial tone and then transmits its DTMF dialing sequence. By using a four-digit telephone number mobile to mobile calling is effected. By using five or more digits telephone line dialing is accomplished.

If the handshake is not returned by the interconnect the mobile scans to another empty channel and tries again. If the mobile is out of range or all channels are busy the mobile logic board will generate a busy/error tone. After completion of the call, a positive disconnect ANI is sent to knock down the terminal and stop the billing counter. The connect ANI, disconnect ANI and decode number can be the same sequence or totally different.

To "receive" a DTMF call, the mobile scans the repeater channels for an A, B, C, D, \*, #, or 1-9 collect tone, that all mobiles lock onto. Having multiple collect tones prevents units on one system from locking on to a competitive system. Following the collect tone is a 150 msec A, B, C, D, \*, #, or 1-9 reset tone which remutes all receivers. A four digit phone number is then dialed and the mobile that decodes the correct number will remain locked on the channel, while all other mobiles continue scanning for another collect tone. There are two additional numbers that can be used for group calling or mobile conferencing and Deadbeat Disable. Deadbeat Disable terminates mobile users who are remiss in paying their monthly bill. This format also supports voice scrambling and multi-city trunk roaming. This product is available from Midian for the Motorola GP300, P110, the Maxon SP2000/SL70, and the King RELM EMV/EMH Mobiles and EPU Portable. Midian also has another version of this product that trunks using CTCSS and DCS along with radiotelephone. See Intel-Trunk.

### **Throughput**

The total useful information processed or communicated over a specified amount of time. Data compression increases the throughput of a modem by allowing it to send more information in the same number of bits.

### **Time Division Multiplex (TDM)**

Sharing a transmission channel among multiple users by assigning time intervals to each individual user during which they have use of the entire bandwidth of the channel.

### **Time Domain Scrambling**

See Time Segment Permutation Scrambling.

### **Time Element Scrambling**

See Time Segment Permutation Scrambling.

### **Time Out Timer (TOT)**

A programmable feature in some Midian products that automatically "turns off" a radio transmitter after a pre-selected period of time. Normally used to stop a customer from using too much system airtime or to unkey the transmitter in the event of a stuck microphone button. An alert tone is generated indicating time out or stuck microphone.

### **Time Segment Permutation Scrambling**

A voice scrambling technique that records a length of voice (frame) and then breaks it up into small segments which then have their order shuffled in a pseudo-random fashion before they are transmitted. This technique produces a real time delay (due to the so-called recording) and if the listening party could

see the speaking party, they would notice a loss of lip synchronization. Most scramblers have a 300 to 500 msec delay. Also called Time Domain Scrambling or Time Element Scrambling.

#### **Tip & Ring**

Refers to both conductors of a phone line pair. The tip is usually closest to positive ground. The names were derived from the parts of the connector that the old TELCO operators used for patching into their consoles.

#### **Tone Prompts**

A tone that is used in radiotelephone interconnect and paging terminals to indicate to the caller that it is time to enter an extension number or leave a voice message. A voice prompt may also be used for the same purpose.

#### **Tone Remote**

A device used to control a radio base station that is located at some distance from the control point. The remote control contains the audio amplifiers for both transmit and receive functions. By using a high level 2175 Hz guard tone for 140 msec, followed by 40 msec function tone, then a continuous low level guard tone (20dB down), in conjunction with several 40 msec function tones, it is possible to control several functions at the base. These functions may include keying the transmitter, monitoring the channel, changing CTCSS codes, and changing frequencies. Notch filters are used in the tone remote and its associated remote adapter to remove the high and low level guard tone from the voice audio. See Midian's Tone Signaling Chart. See Metallic Pair.

#### **Tone Sets**

Refers to the various tone groupings in the 5-tone and 2-tone formats.

#### **Tone Signaling**

Analog signals employing single or multiple tone frequencies that are transmitted over a radio channel or phone line for signaling and control.

#### **Total Access Communication System (TAC)**

TACS is the cellular system used in Great Britain. In the Extended version, ETACS, the mobile units receive in the 916-949 MHz range and transmit in the 871-904 MHz range employing 1000 channels with 25KCs channel spacing and frequency division multiple access methods. In the narrow band NTACS version, mobile units receive in the 860-870 MHz range and transmit in the 915-925 MHz range employing 400 channels with 12.5 KC channels spacing and the frequency division multiple access methods. See Cellular. Also see AMPS, CNET, EAMPS, GSM, JDC, NAMPS, NMT, PDC, and USDC.

#### **Touch Tone®**

Trademark of AT&T®. See Dual Tone, Multi-Frequency.

#### **TransEuropean Trunked Radio (TETRA)**

European digital trunking system using a 25 KHz channel permitting up to 4 users to share a channel.

#### **Transmission Delay**

See Front Porch.

#### **Transmit Light**

An LED, optional on many Midian modules, which illuminates when the PTT button is pressed or during ANI, transpond, and dialing under the control of the microprocessor.

#### **Transmitter Inhibit**

See Busy Channel Lockout.

#### **Transpond**

In many systems or situations, the dispatcher or calling party needs positive verification that the individual radio he is calling has received the call. When a radio receives an individual call, it can be programmed to automatically send back its ANI number to confirm receipt of the call. This confirmation can be displayed on Midian's CAD system. Additionally, Midian's UED-1 could transpond a five tone or two tone sequence to call a pager. Transponding should not occur on group call or all call registers as this could result in "mid-air collisions" of multiple units simultaneously transponding. Transponding is sometimes referred to as a handshake.

#### **Trellis-Coded Quadrature-Amplitude Modulation (TCQAM)**

Generates an 1800 Hz carrier at a 2400 baud base rate, but it uses the full 6-bit encoding capability of QAM to provide a bit rate of 14400 bps. TCM is now the most popular modulation scheme for high performance modems because data can be checked while being sent with high reliability.

#### **Triangulation**

Triangulation is a feature that allows a user with two or three direction finders to determine the location of a transmitter by measuring the angles from the transmitter to two or three of the direction finders. The third direction finder is only necessary if the other two direction finders should happen to be in a straight line with the transmitting unit. A base station equipped with Midian's CAD 100/200/300 can call a lost or stolen radio and remotely turn on its transmitter. The CAD may be used to listen in on conversations in the vicinity of the radio or to determine its location by triangulation. The CAD could then disable the radio if necessary.

#### **Tristate Output**

A logic output on a CMOS logic chip or microprocessor. It can have three different output status, a logic high, a logic low, or floating.

#### **Trunk**

A circuit or channel between two TELCO switches.

#### **Trunking**

This is a technique that allows pooling of radio channels where all users automatically share in the use of all channels. This minimizes waiting time and increases channel loading and throughput. Trunking theories hold that individual users utilize a channel a small percentage of the time, and that a large number of users will not try to utilize the system at the same time. The more channels that are available to the user the less chance of getting a busy condition and thus more subscribers can be loaded onto a channel. All true 800 MHz trunk systems are full duplex with 45 MHz TX/RX separation. They employ either a dedicated or non-dedicated control channel, with the primary intelligence contained at the base end, as opposed to the mobile end. Trunking can support either dispatch or telephone interconnect. See Mark V, LTR, Smart Net, MPT 1327, Intel-Trunk, Tele-Trunk and RTX.

#### **Twist**

See Dual Tone, Multi-Frequency.

#### **Two Tone Sequential**

This format utilizes two sequential tones for calling a paging receiver or monitor. Depending on the manufacturer, either tone can run from 150 msec to about 3 seconds. Several manufacturers have developed different versions of this format,

including Motorola Quick Call, General Electric Type 99, Reach and Plectron.

Motorola's Quick Call 2 supports 870 calls and approximately 3500 user codes when using the cap code prefixes in the extended code plan. The first tone is 1 second and the second tone is 3 seconds and no gap. Motorola supports group call by sending the second tone for 7-8 seconds. This is accomplished by using certain cap codes that employ double digits where the first and second tones are the same. Example: 122, 277, 444, 533 etc. There is another form of two tone sequential made by Motorola called Quick Call 1. Quick Call 1 provides a 1 second dual tone pair interrupted by a 200 msec gap time followed by another 1 second dual tone pair. The Quick Call 1 format is still employed in the aviation industry for calling aircraft. Quick Call 1 is virtually obsolete and has been replaced by Quick Call 2.

GE Type 99 supports 900 user codes, but does not employ group call. Tone timing is 1 second for the first and 1.5 seconds for the second tone with no gap. This format replaces the second number of a double-digit sequence with a diagonal tone producing a larger number of individual codes. The Reach format supports 1000 user codes in either a fast or slow sequence. A 5 second first tone adds group call capability. Plectron also provides a fast and slow format but does not employ a code plan, therefore the coding is "created" for each customer. See Midian's Tone Signaling Chart.

#### **UART**

See Universal Asynchronous Receiver Transmitter.

#### **UHF**

See Ultra High Frequency.

#### **USDC**

See United States Digital Cellular.

#### **Ultra High Frequency (UHF)**

In land mobile radio generally refers to radio frequencies in the 400-500 MHz band.

#### **Unit Identification**

See Automatic Number Identification.

#### **United States Digital Cellular (USDC)**

North American Digital Cellular of which there are two standards. In the IS-54 standard, mobile units transmit and receive on the same frequencies as the analog AMPS standard. This technique employs Time Division Multiple Access (TDMA). Like AMPS it has 832 channels supporting up to three users per channel. In the IS-95 standard, mobile units transmit and receive on the same frequency band as the analog AMPS standard. This technique employs Code Division Multiple Access (CDMA) supporting up to ten users per channel. This system is still undergoing design testing and evaluation. See Cellular and Multiple Access. Also see AMPS, CNET, EAMTS, GSM, JDC, NAMPS, NMT, PDC, and TACS.

#### **Universal Asynchronous Receiver Transmitter (UART)**

A device that performs serial to parallel conversions from a peripheral device or modem and parallel to serial conversions on data characters received from a CPU.

#### **Universal Digit**

See G Tone under Five-Tone Sequential.

#### **VHF**

See Very High Frequency.

#### **VOX**

See Voice Operated Switch.

#### **Verifier**

A feature used in a telephone interconnect to "verify" a subscriber's ANI, permitting user access to the interconnect.

#### **Very High Frequency (VHF)**

In land mobile radio refers to frequencies in the 134-174 MHz band.

#### **Vibrasenders**

See REED.

#### **Vibrasponders**

See REED.

#### **Voice Inversion Scrambling**

A voice scrambling technique that uses a single tone frequency that is mixed with the voice signal in a balanced modulator to produce a sum and difference frequency. The sum frequencies or upper sidebands are eliminated by a low pass filter because they fall outside the audio pass band, leaving the difference frequency or lower sideband, which is the "inverted" voice frequency. For example, if a 3 KHz signal is injected in the balanced modulator and a 2.5 KHz voice component is mixed with it, it will be inverted to 500 Hz. If a 300 Hz voice component is mixed with a 3 KHz tone, a 2700 Hz inverted difference frequency would be generated. This is a form of lower sideband, at audio frequencies, and sounds very distorted and duckish to an eavesdropper. This is the simplest form of voice scrambling and is sometimes referred to as voice privacy. Another type of inversion scrambler is the split band inverter. This technique splits the voice band in two halves. On the lower half the upper sideband sum component is maintained while on the upper half the lower sideband difference component is maintained. The split point may also be moved or more splits added. This technique adds a little more security, but degrades audio quality and reduces voice recognition.

#### **Voice Mail**

A system that allows the subscriber to receive voice messages from callers. These messages are digitized, compressed, and stored in memory so that the subscriber, at a later time, can retrieve his messages by simply calling into the system and requesting his messages. Voice mail can be a unique stand-alone service or it can be used in conjunction with paging and radio systems.

#### **Voice Operated Switch (VOX)**

A circuit that is used to quickly detect the presence of a voice signal to automatically key a transmitter.

#### **Voice Prompts**

See Tone Prompts.

#### **Voltage to Frequency Converter**

An electronic circuit that converts an input voltage to a frequency that is proportional to the magnitude of the input. This technique permits transmission of analog data via a radio channel or phone line. The proportionally changing frequency can then be converted back to the originally measured voltage with a frequency to voltage converter. See Telemetry and A-F Converter.

#### **Voting Receiver System**

Devices which can be connected to several radio receivers that are all tuned to the same channel but located in different

locations throughout a geographical area. The receivers are generally connected to the voter via microwave or phone lines. The voter can then compare the signals on each of the receivers and then pick the best one. Switching occurs very rapidly and is barely noticeable. Some voters use "signal to noise" or "signal to noise and distortion" (SINAD) comparison techniques. Also called Satellite Voting System due to remote satellite locations.

**WATS**

See Wide Area Telecommunication Service.

**Watch Dog Time**

Used in most Midian micro-based products that is used to reset the micro in case it malfunctions.

**Wide Area Telecommunication Service (WATS)**

This service allows customers to make "Out WATS" calls or receive "In WATS" calls (800 service), long distance calls, and have them billed on a bulk basis rather than by the individual call.

**Wink**

See Direct Inward Dialing.

**Wireline**

See Cellular.

**ZVEI**

Zentral Verband der Elektrotechnische Industrie, West German five tone sequential format employing 70 msec tone times. There are several versions including ZVEI1, ZVEI2, ZVEI3 and DZVEI, a depressed version using lower frequencies due to narrow band radio systems. PZVEI is a Pye/Phillips version. Be careful when using this format, several manufacturers have modified the ABCDEF tones for competitive reasons. See Five Tone Sequential above. Also, see Midian's Tone Signaling Chart.

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