

Tadiran Telematics Proprietary

PAL-US

Specification

Ver. A2

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PAL-US-A2 - Specification

1 General

This document describes the technical specifications of the TADIRAN TELEMATICS PAL (Personal Alert & Location Unit) .The PAL is the handheld portion of TELETRAC Location and Messaging system.

2 System Description

The system uses RF signals to provide a mean of locating vehicles and portable units equipped with the TELETRAC system. The system is based on Forward Channel (Paging) transmitted from Pagers to the units and is based on Reverse Channel used for Location signal and messaging (from the units to Base-Station). The PAL support multi-channels mode in the paging channel and multi-channels of location channels.

The PAL is the handheld portable transmitter / receiver element of the system The PAL implements a Paging channel receiver , POCSAG format, FSK modulated at a carrier frequency of 927.778266 MHz to address, program, control the PAL and to receive messages. The PAL is ready to receive the proper address from the paging channel and to reply in the reverse channel with location signal (Pseudo-Noise sequence, ~1.5 Mchip Rate) and status response. The reverse channel is phase shaping BPSK modulated signal at 907.99731 MHz in the proper time slot.

2.1 PAL Interface

2.1.1 Indications and Activations

Buzzer, green and red light indications inform the user about the different states of the PAL.

Pushing the "Alert" switch will inform the Network Control Center that an alert condition has occurred.

Pushing the "Locate" switch will inform the Network Control Center to send a location message to the subscriber.

An OFF-ON-ON(Buzzer) slide switch operates the unit.

2.1.2 External Interface

The PAL external interface consists of:

- Serial wired interface (TTL levels).
- Battery charging input.
- Connections to LED indications and switches activations.

3 Electrical Characteristics.

3.1 Reverse Channel RF Transmitter

The PAL RF Transmitter is used for Location signal, Emergency Channel Messages and Reverse Channel Messages transmissions.

3.1.1 Transmit Frequencies

Nominal Center Frequency: 907.997333MHz

Modulation: Shaped BPSK (with constant envelope).

3.1.2 Carrier phase noise

-80 dBc/Hz maximum from 50 KHz to 2.0 MHz.

3.1.3 Carrier suppression @ BPSK Modulation

The modulated carrier is suppressed more than 23 dB.

3.1.4 Spurious output

-50 dBc (reference to unmodulated carrier).

3.1.5 Harmonic output

-50 dBc.

3.1.6 Output Power

3.1.6.1 Nominal Output Power

The PAL transmission power output level is 34.0 to 36.5 dBm at temperature of $25 \pm 5^\circ \text{C}$ and an input battery voltage of 4.6 ± 0.1 VDC when transmitting into 50 ohm load with maximum VSWR of 1.5:1.

The power is not adjustable.

3.1.6.2 Power Amplifier Protection

The PAL is protected from damage when transmitting into any VSWR.

3.2 "Location" Signal Transmission

Transmission of "Location Signal" shall be as response to PAL addressing through the Forward channel. The Location Signal is composed of a Pseudo Noise sequence.

3.2.1 Location signal modulation

CPSK - Continuous Phase Shift Keying (with constant envelope).

3.2.2 PN Code generator

3.2.3 PN "chip" Rate = 1.493417 MHz

PN code Period Length = 1023 chips.

3.2.4 Location Signal Spectrum

3.2.4.1 *Discrete Spectral Line Suppression*

The spectrum of the transmitted signal does not contain any discrete spectral lines that exceeds the level of the continuous spectrum within ± 6 MHz of the center frequency or are greater than -47 dB of the peak output beyond ± 6 MHz when measured using 100 KHz bandwidth.

3.2.4.2 *"Location Signal" Spectral Density Envelope*

The transmitted spectral output does not exceed the envelope defined in figure 3.2.3-1 with the peak center frequency (f_0) output used as the reference level.

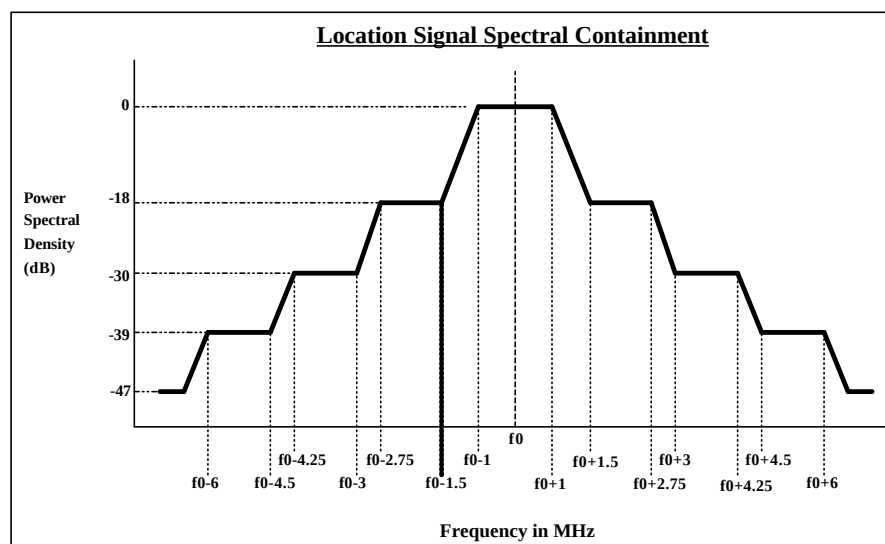


Figure 3.2.3-1: Location Signal Spectrum

3.2.5 Location Signal Transmission Length

3.2.5.1 Transmission timing

Transmission is synchronized with the received POCSAG signal (see Figure 3.3.4-1).

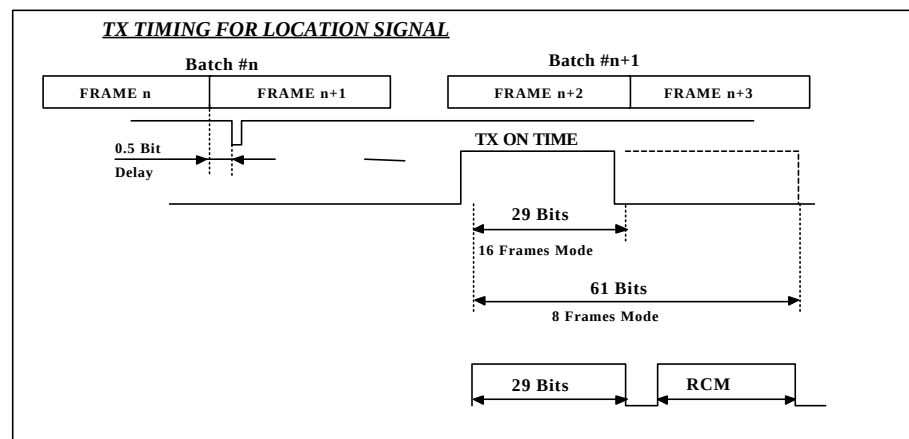


Figure 3.3.4-1: PN Transmit timing.

The transmission timing of any FCM (Forward Channel Message) initiated transmission is delayed by one batch from the current timing.

3.3 Emergency / Reverse Channel Message Transmitter

ECMs and RCMs utilize the same communications RF channel. The PAL transmits RCM's (RCM_A's) in response to FCMs.

When pushing the ALERT switch the PAL transmits Emergency Channel Messages ECM.

When pushing the location switch the PAL transmits Emergency Channel Messages ECM.

3.3.1 ECM/RCM_A Channel

3.3.1.1 ECM/RCM signal modulation

The modulation of the ECM or RCM_A signal is BPSK.

3.3.1.2 ECM/RCM Data Rate

Data Rate = 11.7 KHz (PN Clock /128)

3.3.1.3 ECM transmission length

The transmission length of the ECM and RCM_A is 128 bits (net) excluding transmission rise and fall times. Additional 1,0,1,0 sequences are added at the start or end of the transmission.

3.3.1.4 RCM/ECM Transmission timing

Transmission is synchronized with the received POCSAG signal (see Figure 3.4.1.4-1).

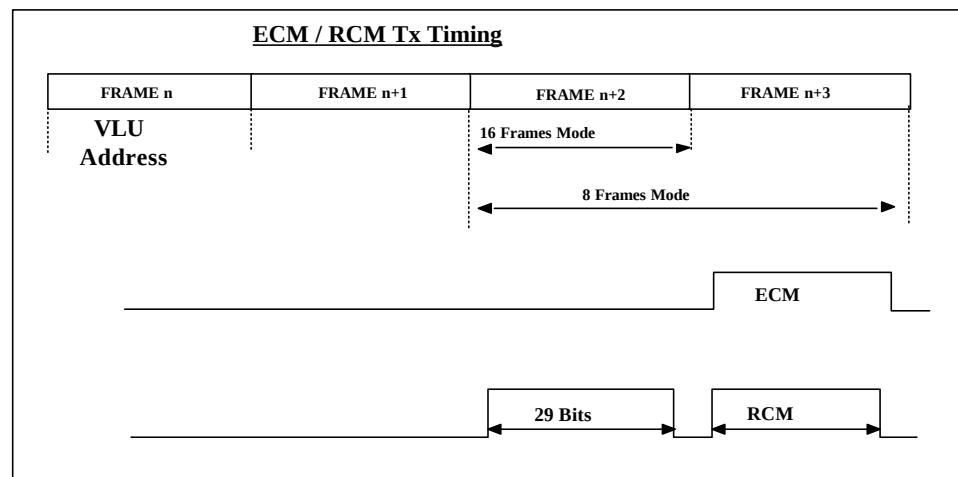


Figure 3.4.1.4-1: ECM / RCM_A Transmit timing.

3.4 "Forward" Channel Receiver.

3.4.1 Signal Parameters

The received signal is a modified CCIR Paging Code Number 1 (POCSAG) format FSK modulated ± 4.5 KHz. The data format of the modified POCSAG format consists of 32 bit SYNC followed by 16 frames of PAL address or message of 32 bit each.

Nominal center frequency: 927.778266 MHz
Modulation: FSK
 ± 4.5 KHz
Data rate: 2400 bps.

3.4.2 Sensitivity

Input signal @ antenna connector: -115 dBm @ $BER < 10^{-3}$

3.4.3 Spurious Rejection

The receiver operates with a maximum degradation of 3 dB in the presence of spurious signals of the following frequencies and levels above measured sensitivity:

Frequencies from center	Spurious level
± 150 KHz to ± 500 KHz	65 dB
± 500 KHz to ± 2 MHz	65 dB
± 2 MHz to ± 20 MHz	65 dB
$> \pm 20$ MHz	90 dB

The spurious signal is modulated with 400 Hz at the frequency deviation of ± 2.7 KHz (as per EIA-RS-204C).

3.4.4 Image rejection

Image rejection: > 60 dB.

3.4.5 Selectivity

An FSK signal of center frequency ± 50 KHz at a level of -85 dBm modulated with 1000 Hz Sine wave and deviation of ± 9 KHz, shall cause a degradation of no more than 3 dB in the specified sensitivity as defined herein.

3.5 Power supply requirements.

3.5.1 Maximum Current Draw

The maximum current draw of the PAL under any condition specified herein shall be less than:

OFF: 0.1 mA.

Receive Search: 80 mA.

Receive Idle: 20 mA.

Transmit: 3.0 A.

3.6 Frequency & Phase Accuracy and Stability

3.6.1 Frequency accuracy and stability

Frequency accuracy: ± 2.5 ppm over temperature range.

3.7 Environmental Characteristics

3.7.1 Temperature range

Operating Temperature :	0° to 50° C
(option depend on batteries:	-20° to 50° C)
Storage Temperature :	-20° to 50° C

3.7.2 Humidity

The PAL operates in an environment with up to 90% humidity, Non-condensing at 50° C with testing criteria set forth by the SAE document SAE J1211 (June 1978), section 4.2.

3.7.3 Vibration

The PAL does not sustain damage and shall meet the specified performance requirement after being vibrated with simple harmonic motion over the following frequency ranges with a uniform frequency change:

One) 10 to 30 Hz, +/- 0.38 mm amplitude.

Two) 30 to 60 Hz, +/- 0.19 mm amplitude.

in 3 directions, 30 minutes each direction, 5 minutes each cycle.

3.7.4 Shock

The PAL shall suffer no more than superficial mechanical damage and shall meet the specified performance requirement after being dropped once on each of 6 surfaces from a height of 100 cm onto a smooth concrete floor.

3.7.5 Radiated Spurious Emissions

The total radiation of the PAL in receive mode shall not exceed the following levels at 3 meters from the unit:

FREQUENCY (MHz)	-dBW	uV/m
30 - 88	95 – 104	100
88 – 216	101 – 109	150
216 – 960	106 – 119	200
960 -1000	111	500

3.7.6 Altitude

10,000 feet operating, 40,000 feet storage.