



Tadiran Telematics Proprietary - Commercial Confidential

# MPRF

## Modular Programmable RF Unit

for the Teletrac  
Vehicle Location System

# Specifications

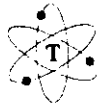
## Requirements

Rev. C1

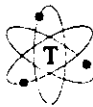
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TADIRAN Telematics LTD.

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## MPRF Specification

### 1. General

This document defines the requirements from the Modular Programmable RF unit (MPRF). The MPRF shall include the RF to Base band receiver of the base station for the TELETRAC system. The MPRF is the second generation, multichannel version, of the RSDU that was integrated in the first generation base station.

The MPRF receives BPSK signals from VLU units and FSK signal from Paging transmitters and outputs corresponding base-band signals to the digital processor (CCSP). The MPRF shall support two types of BPSK signals, wide band for location signals and narrow band for massaging. The MPRF shall support paging channels of POCSAG or ReFLEX types.

### 2. Applicable Documents

- Integrated Base Station Unit for Teletrac Vehicle Location System, Updated Proposal Rev. C, June 24, 1996 ( by TADIRAN).
- IBSU Specifications Rev. C, by Tadiran.
- IBSU ICD, by Tadiran.
- Adapted Frequency BSU Specification, Rev. A, Aug. 20 1996. (by Tadiran)
- FCC Regulation, part 15.

## 2.1 MPRF General Description.

The MPRF shall be functionally a multichannel receiver (quadrature down converting) of signals in the band-A (PSK band) 904 - 909.75 Mhz and multichannel receiver (down converting & FM demodulation) of signals in the band-B (FSK band) 927.75 - 928 Mhz. The MPRF shall be modular unit that includes basic unit and option of receivers module connection. The functional block diagram of this unit is described in figure 2-1.

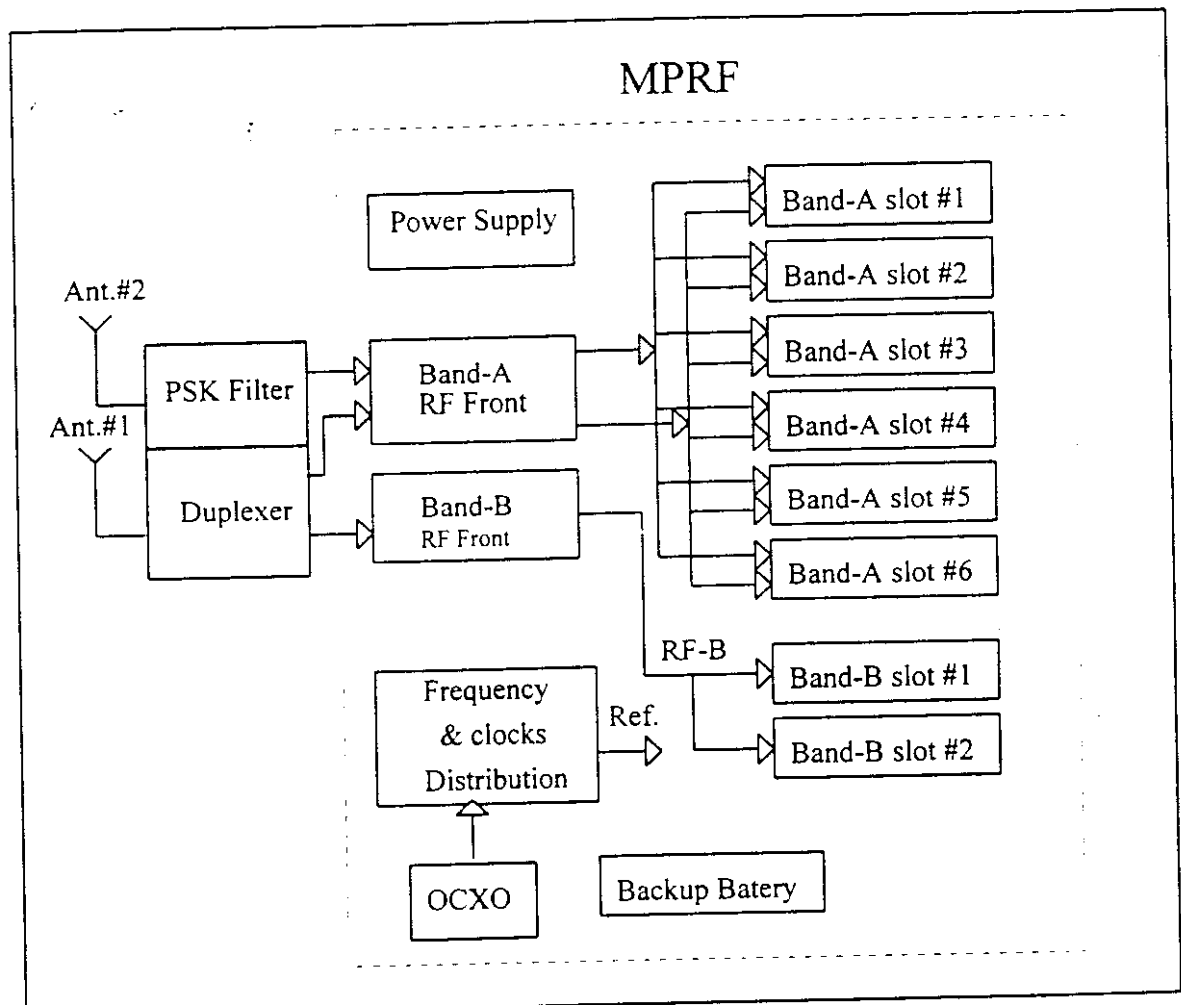


Figure 2-1: Basic MPRF Functional Block Diagram

The MPRF shall be designed to allow expansion and reconfiguration by adding additional PSK and FSK receivers. Up to 6 PSK (band-A) receivers modules (narrow band or wide band) may be installed. Each receiver may be programmed to any frequency (conforming to the specified channel

spacing) within its band of operation supporting commonality and remote configuration. The receiver itself shall be designed as an RF enclosed unit, including shielding and connectors.

The MPRF shall include two Band-A (PSK) antenna inputs (to support diversity reception) and one Band-B (FSK) antenna input.

An external duplexer similar to the one in use in RSDU (adapted to the shifted FSK band) will be incorporated in one of the PSK inputs and the FSK antenna input and the second PSK antenna shall be connected to PSK band-pass filter only.

The reference clock for the overall Base Station operation will be an OCXO with digital frequency control. All other frequencies required by the base station units will be derived from this clock.

The MPRF shall include two types of PSK receivers and one type of FSK receivers modules.

The MPRF receivers module types shall be as follows.

- Dual Receiver , Wide band & Narrow band PSK receiver.
- Dual Narrow band PSK receiver.
- FSK receiver

The MPRF will be controlled by the CCSP. The MPRF shall contain a controller that will control and monitor the MPRF receivers and will be controlled by the CCSP. The CCSP will program the center frequency of each BPSK and FSK receiver. The controller will also perform diagnostics of the MPRF unit (controlled by CCSP).

### 2.1.1 Dual Receiver, Wide & Narrow Band PSK Receiver.

The Dual wide band & narrow band PSK receiver intended to receive one location channel and one message channel. The wide band receiver in this module shall receive 1.5 Mcps wide band signals in the 904-909.75 Mhz band. The center frequency shall be programmable in steps of 100 KHz. The narrow band receiver in this module shall receive a 12 Kbps signals in the 904-909.75 Mhz band. The center frequency shall be programmable in steps of 25 KHz.

The two receiver (wide & narrow) shall operate in the old frequency and in the new frequency plane. Each receiver shall provide a sets of I, Q signals. The configuration of this dual receiver is depicted in figure 2.1.1-1.

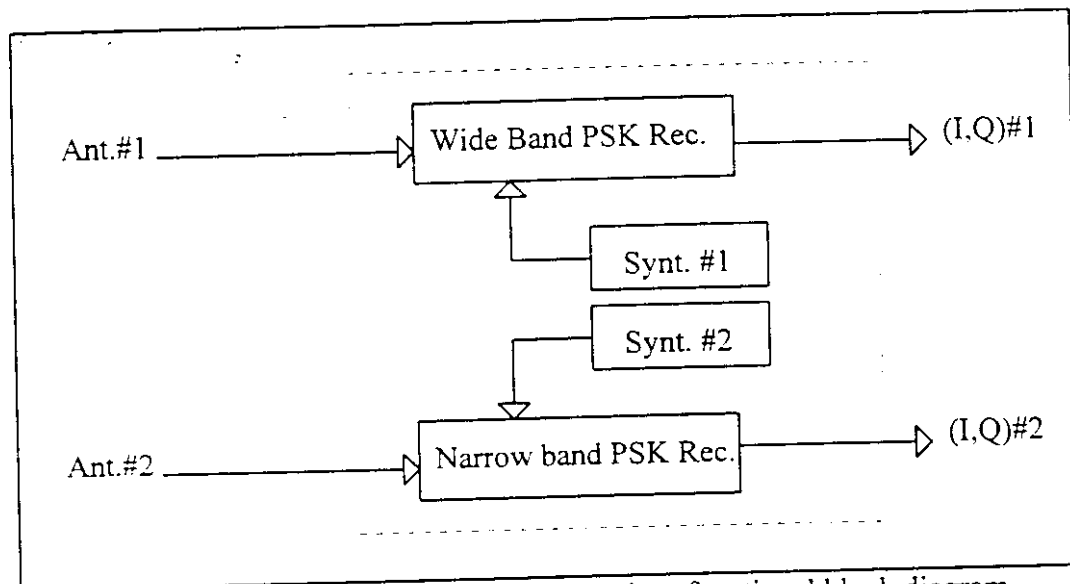


Figure 2.1.1-1: Wide & Narrow band dual receiver functional block diagram.

### 2.1.2 Dual Narrow-Band PSK Receiver

The dual narrow band PSK receiver intended to receive the message signal. This module shall receive two 12 Kbps narrow band signals in the 904-909.75 Mhz band. The center frequency shall be programmable in steps of 25 KHz separately for each receiver. Each receiver shall provide two sets of I, Q signals.

This module configuration shall include option to use the two receivers in a module as two diversity receiver or two separated receivers operating in different frequencies.

The configuration of this dual receiver is depicted in figure 2.1.2-1.

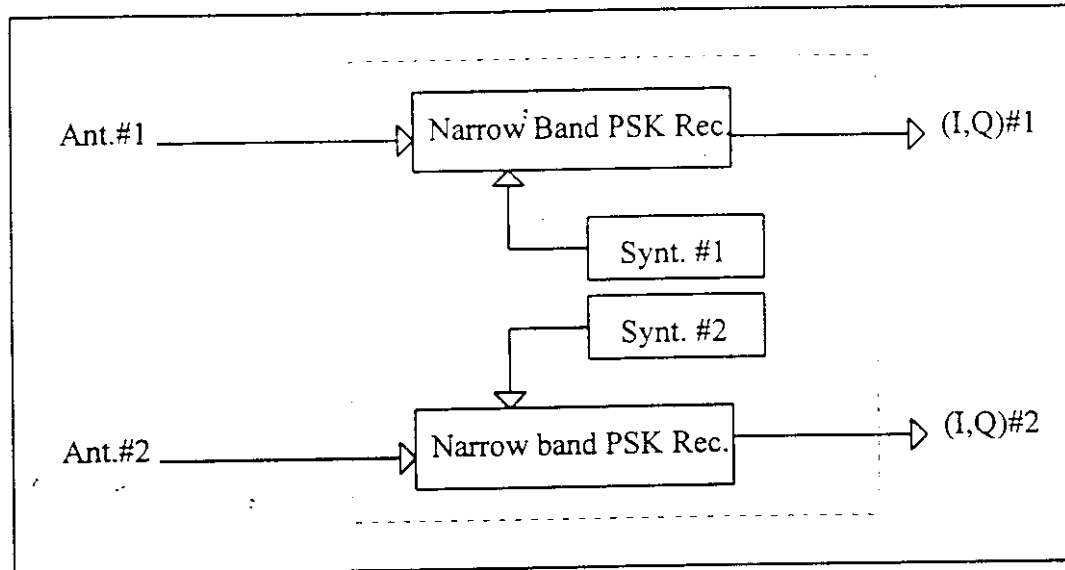


Figure 2.1.2-1 : Dual narrow band PSK receiver

### 2.1.3 FSK Receiver.

The MPRF shall include up to two FSK receiver modules. This module will include single FSK receivers. This module shall be able to receive 25 KHz FM signals band at the 927.75-928 MHz band. The output of each receiver will be a FM-decoded signals (the discriminator output signal).

## 2.2 Channels Specifications

The MPRF shall support some types of channels as follows.

### 2.2.1 Location Channels

The location channels are wide band BPSK channels. The MPRF shall receive old location channel and new location channels parameters. The MPRF shall contain the old location channel receiver and the new frequency plane for location channels.

#### 2.2.1.1 Old Location Channel Parameters

Single Channel.

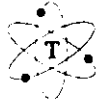
RF Frequency:	907.997333 Mhz.
Channel Band-Width:	2.3 Mhz (IF BW)
Modulation:	BPSK (with base band shaping)
Chip Rate:	1.49341666 Mhz.
Sampling Ck output:	4*chip rate.

#### 2.2.1.2 New & Async Location Channels Parameters

Multi-Channels

Nominal RF Frequency:	907.2 Mhz.
Frequency Range:	904 - 909 Mhz.
Channels Frequency Step:	100 KHz.
Channel Band-Width:	2.3 Mhz (IF BW)
Modulation:	BPSK (with base band shaping)
Chip Rate:	1.575 Mhz.
Sampling Ck output:	6.3 MHz (4*chip rate).





### 2.2.2 Messages Channels

The MPRF shall receive the narrow band PSK signals of the messaging channels.

#### Multi-Channels

Nominal RF Frequency:	907.2 Mhz.
Frequency Range:	904 - 909.75 Mhz.
Channels Frequency Step:	25 KHz.
Channel Band-Width:	25 Khz (IF BW)
Modulation:	BPSK (with base band shaping)
Sampling Ck output:	6.3 MHz (4*chip rate).

### 2.2.3 Paging Channels

The MPRF shall receive the narrow band FSK signals of the paging channels. The FSK signals are of two types, POCSAG signals and ReFLEX signals.

#### Old Paging Channel

Nominal RF Frequency:	927.7782662 Mhz.
-----------------------	------------------

#### New Paging Channel

##### Multi-Channels

Nominal RF Frequency:	927.775 Mhz.
Frequency Range:	927.75 - 928 Mhz.
Channels Frequency Step:	12.5 KHz.
Channel Band-Width:	12 Khz (IF BW)
POCSAG Modulation:	B-FSK; deviation = $\pm 4.5$ Khz
Symbol Rate:	2400 Bps.
ReFLEX Modulation:	4-FSK; deviation = $\pm 800$ , $\pm 2400$ Hz
Symbol Rate:	3200 Sps.

### 2.2.4 Reference clock - 10 Mhz.

The MPRF shall generate 10 Mhz reference signal that will be used as external frequency reference to other equipment's that will be used in the base station.

## 2.3 MPRF Programming & Reports

The MPRF controller shall be based on H/W that supports remote program S/W loading via the CCSP-MPRF serial port. The MPRF shall contain controller with basic loader S/W on EPROM. This basic S/W shall support basic protocol (see appendix-A) with the CCSP that includes basic monitoring and programming and the capability to load program S/W to program RAM by the serial interface from CCSP. The controller shall be able to switch the CPU operation from the EPROM to the program RAM. The H/W requirements are described in Appendix B.

### MPRF Self Configuration

The MPRF shall be able to identify the receivers configuration, the existence of receiver and the type of the receiver.

### MPRF Reports

The MPRF shall report the following indications:

- Lock indication of all the synthesizers
- AGC level of PSK and FSK receivers
- H/W configuration (existence of PSK/ FSK receivers, type identification)
- Channel frequency of the receivers.

The MPRF shall control the following parameters:

- Channel frequency programming for each receiver
- Status monitoring

### 3. External Interfaces

The MPRF external interface contains the interface of the basic MPRF unit and the interface of the optional receivers.

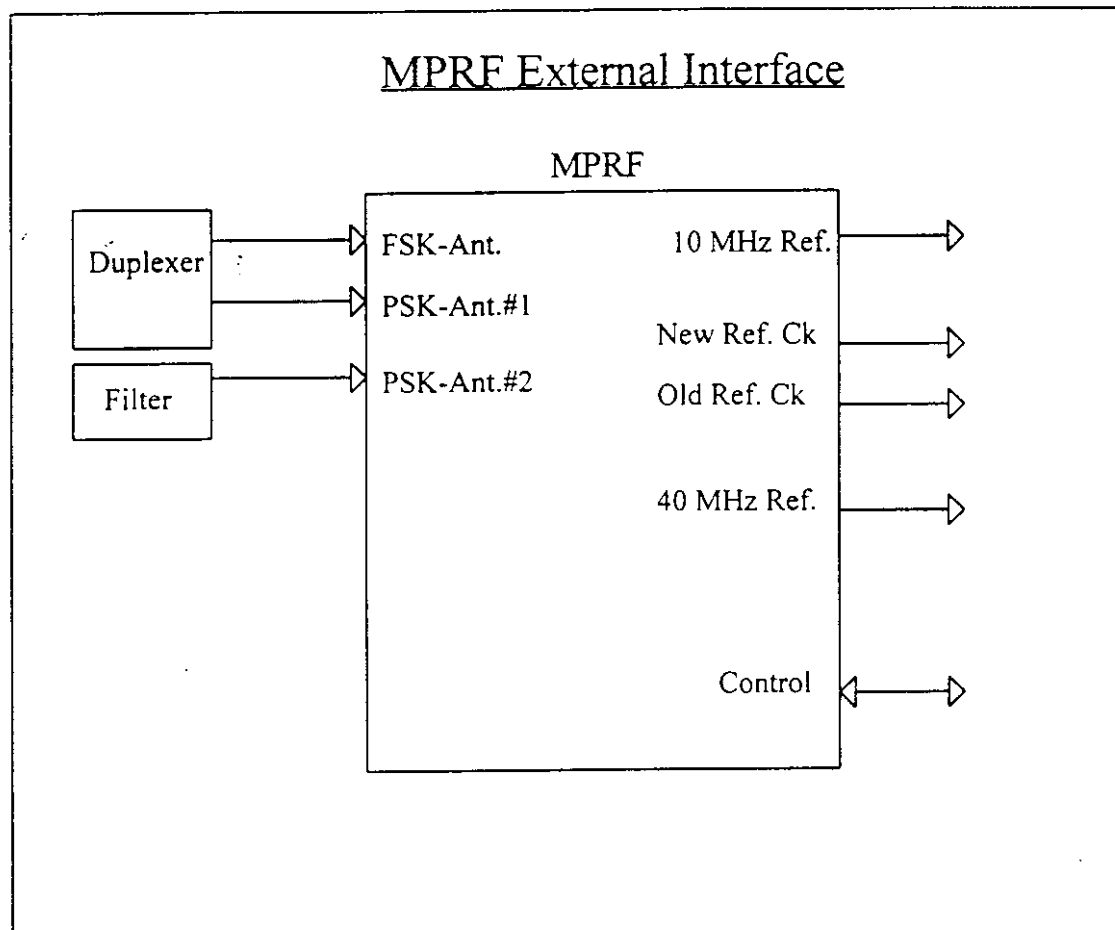


Figure 3-1 : MPRF External Interface

### 3.1 MPRF Basic Inputs:

1. Ant. #1 - Main antenna input for PSK signals  
Impedance: 50 Ohm.  
connector: SMA female
2. Ant. #2 - Diversity antenna input for PSK signals only.  
Impedance: 50 Ohm.  
connector: SMA female
3. FSK-Ant. - Antenna input for FSK signals only.  
Impedance: 50 Ohm.  
connector: SMA female

### 3.2 MPRF Basic Outputs:

1. 10 Mhz Ref. - 10 Mhz reference clock for external equipment.  
Impedance & level: 50 Ohm, 0 - 7 dBm..  
connector: BNC
2. Old Ref. Ck - Old reference sampling clock for old PSK signals  
Ck Frequency = 5.973666 Mhz  
Impedance 50 Ohm  
level: TTL  
Duty cycle: 40% - 60%  
connector: BNC
3. New Ref. Ck - New reference sampling clock for new PSK signals.  
Ck Frequency = 6.3 Mhz  
Impedance 50 Ohm  
level: TTL  
Duty cycle: 40% - 60%  
connector: BNC
4. Async 40 Mhz Ref. - Reference clock for Async DDS in CCSP.  
Ck Frequency = 40 MHz  
Impedance 50 Ohm  
level: Sine, 0 - 7 dBm.  
connector: BNC

### 3.3 MPRF Control Interface:

1. CCSP Control - CCSP to MPRF Control serial port interface.

Type: Serial interface, 2400, 4800, 9600 baud, Full Duplex.

level: RS232

connector: D-type (9 pin)

The messages protocol between the MPRF and the CCSP and messages type are described in appendix-A.

#### 3.3.1 MPRF Control Interface - Pin Assignment

CCSP - MPRF (Serial Asynchronous Channel)			
SIGNAL NAME	SPEC	Pin No. in CCSP Connector	Pin No. in MPRF Connector
Received Data (RxD)	<ul style="list-style-type: none"><li>• Asynchronous Serial Channel</li><li>• Full Duplex</li><li>• EIA RS-232</li><li>• Baud Rate : 9.6Kbps</li><li>• Format : 1 Start, 8 Bit, 1 Stop, No Parity</li><li>• Connector type : 9 Pin D-Type,</li></ul>	2	3
Transmit Data (TxD)		3	2
GND		5	5

Notes :

1. Connector type at CCSP : 9 Pin D-Type, Male
2. Connector type at MPRF : 9 Pin D-Type, Male

### 3.4 FSK Receiver outputs

1. Disc. Output - Discriminator output signal.  
(for future use of demodulation of other signals standard)
2. RSSI level signal.  
(for future use of demodulation of other signals standard)
3. Conf.ID - Configuration Identification  
This signal shall be two lines signal that the MPRF controller will use to identify the receivers connections configuration with the CCSP.

#### 3.4.1 MPRF FSK Receiver Interface - Pin assignment

GMIO - MPRF (FSK Receiver)				
SIGNAL NAME	DESCRIPTION	SPEC	DIRECTI ON	Pin No
Paging Tx. Data	Paging Tx Data at the Discriminator output	Discriminator Output Level : 2.5V peak to peak $\pm 0.7V$	MPRF to CCSP	A1
FSK Receiver RSSI (note 1)	Receiver signal level	TBD	MPRF to CCSP	A2
Receiver ID	This signal is used by the RSSW to identify which FSK receiver is connected to the GMIO	TTL Compatible	MPRF to CCSP	2
Spare Signal		TTL Compatible	Bi - Directional	3
DGND	Digital Ground			4

Notes :

1. Connector type at CCSP and MPRF : 7W2S

### 3.5 PSK Receiver (Wide/ Narrow) Module Outputs

#### Rcv. #1 Signals

1. I1 - Inphase PSK signal of main antenna
2. Q1 - Quadrature PSK signal of main antenna.
3. Conf.ID - Configuration Identification  
This signal shall be two lines signal that the MPRF controller will use to identify the receivers connections configuration with the CSSP.
4. AGC1 - AGC Control Level of receiver #1.

#### Rcv. #2 Signals (separate connector)

1. I2 - Inphase PSK signal of diversity antenna
2. Q2 - Quadrature PSK signal of diversity antenna.
3. Conf.ID - Configuration Identification  
This signal shall be two lines signal that the MPRF controller will use to identify the receivers connections configuration with the CSSP.
4. AGC2 - AGC Control Level of receiver #2

**3.5.1 MPRF Wide Band Receiver Interface - Pin Assignment**

<b>TOA - MPRF (WB Receiver)</b>				
<b>SIGNAL NAME</b>	<b>DESCRIPTION</b>	<b>SPEC</b>	<b>DIRECTION</b>	<b>Pin No</b>
I	Baseband Inphase signal from the MPRF Wide Band BPSK Receiver	Signal Level : 1V peak to peak $\pm 0.1V$ @ 50 ohm DC offset : $\pm 10mV$ max.	MPRF to CCSP	A1
Q	Baseband Quadrature signal from the MPRF Wide Band BPSK Receiver	Signal Level : 1V peak to peak $\pm 0.1V$ @ 50 ohm DC offset : $\pm 10mV$ max.	MPRF to CCSP	A2
Receiver AGC (note 1)	Wide Band Receiver AGC level	TBD	MPRF to CCSP	1
Receiver ID	This signal is used by the RSSW to identify which BPSK receiver is connected to the TOA	TTL Compatible	MPRF to CCSP	2
Spare Signal		TTL Compatible	Bi - Directional	3
DGND	Digital Ground			4

**Notes :**

1. Not used in the TOA.
2. Connector type at CCSP and MPRF : 7W2S (combined D Type connector which allows the combination of 5 regular low power contacts with 2 shielded contacts in the same shell).



**3.5.2 MPRF Narrow Band Receiver Interface - Pin Assignment**

<b>UMR - MPRF (NB Receiver)</b>				
<b>SIGNAL NAME</b>	<b>DESCRIPTION</b>	<b>SPEC.</b>	<b>DIRECTION</b>	<b>Pin No</b>
I	Baseband Inphase signal from the MPRF Narrow Band BPSK Receiver	Signal Level : 1V peak to peak $\pm 0.1V$ @ 50 ohm DC offset : $\pm 10mV$ max.	MPRF to CCSP	A1
Q	Baseband Quadrature signal from the MPRF Narrow Band BPSK Receiver (note 3)	Signal Level : 1V peak to peak $\pm 0.1V$ @ 50 ohm DC offset : $\pm 10mV$ max.	MPRF to CCSP	A2
Receiver AGC (note 1)	Narrow Band Receiver AGC level	TBD	MPRF to CCSP	1
Receiver ID	This signal is used by the RSSW to identify which BPSK receiver is connected to the UMR	TTL Compatible	MPRF to CCSP	2
Spare Signal		TTL Compatible	Bi - Directional	3
DGND	Digital Ground			4

Notes :

1. Not used in the UMR.
2. Connector type at CCSP and MPRF : 7W2S

## 4. MPRF Performance

### 4.1 Wide Band PSK Receiver (W.B)

#### For Old Location Channel

Nominal input frequency: 907.997333 MHz.

#### For New & Async Location Channels

Nominal input frequency: 907.2 MHz.

Input frequency range: 904 ÷ 909.75 Mhz

Frequency step: 100 KHz.

IF frequency: TBD.

3 dB IF band width: 2.3 MHz.

Sensitivity: SINAD=12 dB @ -92 dBm  
(Additional test shall be performed by using TPCU  
required results: FOM > 22 @ -125 dBm. )

Input power range: -125 ÷ -30 dBm.

I Q Output - level:  $0.9 V_{ptp} \pm 0.1 V.$   
- DC offset:  $\pm 50 mV \text{ max.}$

I,Q InBalance 2 degrees minimum accuracy  
0.5 dB max. Amplitude unbalance

AGC range: The I & Q outputs level shall vary  
0.5dB maximum when input power  
will change from -105 dBm to -30  
dBm.

AGC - attack time:  $30 \pm 20 \mu\text{sec.}$  (including settling time).  
- release time:  $75 \pm 25 \mu\text{sec.}$

Selectivity: TBD @ 5 Mhz offset  
(related to 907 Mhz) 40 dB @ 8 Mhz offset  
60 dB @ 12 Mhz offset

Image rejection: 90 dB min.  
IF rejection: 90 dB min.  
LO radiation: -50 dBm max.



## 4.2 Messages BPSK Receiver (N.B)

### For Old message Channel

Nominal input frequency: 907.997333 MHz.  
Bit rate: 12 Kbps.

### For New & Async message Channels

Nominal input frequency: 907.2 MHz.  
Input frequency range: 904 ÷ 909.75 MHz.  
Frequency step: 25 KHz.  
Bit rate: 12 Kbps.

IF frequency: TBD  
3 dB IF Bandwidth: 22 KHz.

Input power range: -120 ÷ -40 dBm.  
Sensitivity: SINAD=10 dB @ -115 dBm

I Q - Output level: 0.9 V<sub>ptp</sub> ± 0.1 V.  
- DC offset: ± 50 mV max,

I,Q Balance 2 degrees minimum accuracy  
0.5 dB max. Amplitude unbalance

AGC range: The PSK I Q output level shall vary 0.5 dB  
maximum when input power  
will change from -115 dBm to -30 dBm.

AGC - attack time: 80 ± 20 μseconds (including settling time).  
- release time: 150 ± 20 μseconds.

Selectivity: 35 dB @ 50 Khz  
50 dB @ 200 KHz  
60 dB @ 1 MHz

Image rejection: 90 dB min.  
IF rejection: 90 dB min.

LO radiation: -50 dBm max.



### 4.3 FSK Receiver

Old Paging Channel

Nominal input frequency: 927.7782662 MHz.  
POCSAG mode only.

New Paging Channels

Nominal input frequency: 927.775 MHz  
Input frequency range: 927.75 ÷ 928 MHz  
Frequency step: 12.5 KHz.  
RF Frequency Deviation: 1 ppm

Modulation: B-FSK; deviation =  $\pm 4.5$  KHz

Symbol Rate: 2400 sps.

IF frequency: TBD  
3 dB IF Bandwidth: < 12 KHz.

Sensitivity: -110 dBm for:  
SINAD=12dB @ Discriminator output

Input power range: -110 ÷ -40 dBm.

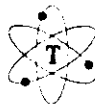
Discriminator output level:  $2.5V_{ptp} \pm 0.7$  V.

Image rejection: 90 dB min.

IF rejection: 90 dB min.

Selectivity : 45 dB @ 25 kHz  
60 dB @ 50 kHz  
80 dB @ 2 Mhz

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



#### 4.4 OCXO

The clock frequency shall have at least the performance of the OCXO defined in the RSDU. The main OCXO parameters shall be as follows.

OCXO frequency:	6.3 Mhz (4*chip rate).
Temperature stability:	+/- 2*10E-8 @ 0-50C
Long term stability:	+/- 1*10E-9 per day
	+/- 6*10E-8 per year
Short term stability:	+/- 3*10E-10 @ 1 msec.
	+/- 8*10E-12 @ 1 sec.

Frequency adjustment by external voltage for 1.5 - 2\*10E-7.

Mechanical frequency adjustment of 1 ppm range

The OCXO shall maintain its frequency accuracy for at least 30 minutes in cases of power outage. No more than a total of 60 minutes of power outage in 24 hours, to enable recharching of backup battery.

#### 4.5 Antenna Input

Nominal Impedance	50 $\Omega$ .
Return loss:	12 dB min.
Noise Figure at duplexer input:	6 dB
(includes duplexer loss & cable loss & MPRF input NF)	

#### 4.6 Input power

AC input voltage:	115V $\pm$ 10% / 60 Hz.
Power consumption:	< 100 Watt.

#### 4.7 MPRF Physical Characteristics.

Dimensions: 19" enclosure, 4U height.

## 5. Appendix A: MPRF-CSSP Communication Protocol

### 5.1 CCSP - MPRF Protocol

Following are the base characteristics of the CCSP - MPRF communication protocol :

- The CCSP operates as master and the MPRF operates as slave
- The MPRF cannot initiate a transission to the CCSP unless the CCSP sent a command (e.g. status request, set parameters, ..etc.) to the MPRF.
- The MPRF should response within TBD msec.
- The MPRF messages are divided into three categories :
  - ◊ ACK Message
  - ◊ NAK Message
  - ◊ Message with data



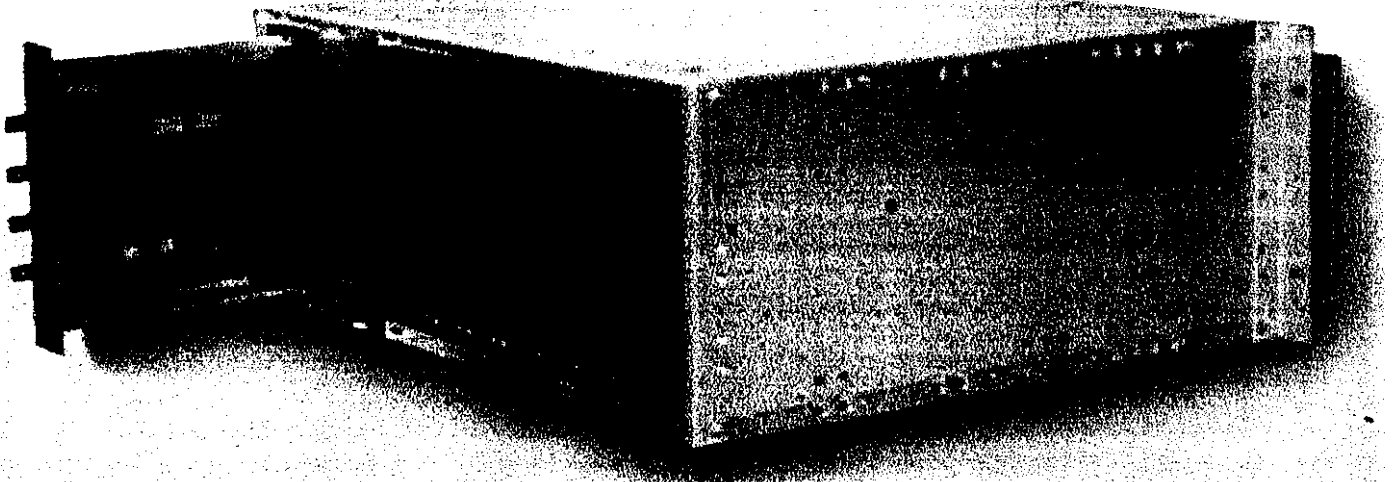
NOTE: The MPRF has been tested and found to comply with the limits for a Class B digital device, pursuant to part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference in a residential installation. This equipment generates, uses and can radiate radio frequency energy and, if not installed and used in accordance with the instructions, may cause harmful interference to radio communications. However, there is no guarantee that interference will not occur in a particular installation. If this equipment does cause harmful interference to radio or television reception, which can be determined by turning the equipment off and on, the user is encouraged to try to correct the interference by one or more of the following measures:

- Reorient or relocate the receiving antenna.
- Increase the separation between the equipment and receiver.
- Connect the equipment into an outlet on a circuit different from that to which the receiver is connected.
- Consult the dealer or an experienced radio/TV technician for help.

**Changes or modifications to this unit not expressly approved by the Tadiran Telematics Ltd. could void the user's authority to operate the equipment.**

# MPRF

## Modular Programmable Radio Frequency Unit



- A 19" rack mountable, 4 U unit
- Modular configuration, up to six Dual BPSK receivers and two FSK receivers
- Programmable, synthesized BPSK receiver at 100Khz steps
- Programmable, synthesized FSK receiver at 25Khz steps
- OCXO (Oven Controlled Crystal Oscillator)
- Back-up Battery for 30 minutes of OCXO's operation
- Custom made bus minimizing the internal wiring
- Remote control including configuration download capability via standard RS-232C of the operating software
- Robust mechanical & electronic design achieving high MTBF
- Operating temperature 0° to 50° centigrade



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- Adapted Frequency BSU Specification, Rev. A, Aug. 20 1996. (by Tadiran)
- FCC Regulation, part 15.

## 2.1 MPRF General Description.

The MPRF shall be functionally a multichannel receiver (quadrature down converting) of signals in the band-A (PSK band) 904 - 909.75 Mhz and multichannel receiver (down converting & FM demodulation) of signals in the band-B (FSK band) 927.75 - 928 Mhz. The MPRF shall be modular unit that includes basic unit and option of receivers module connection. The functional block diagram of this unit is described in figure 2-1.

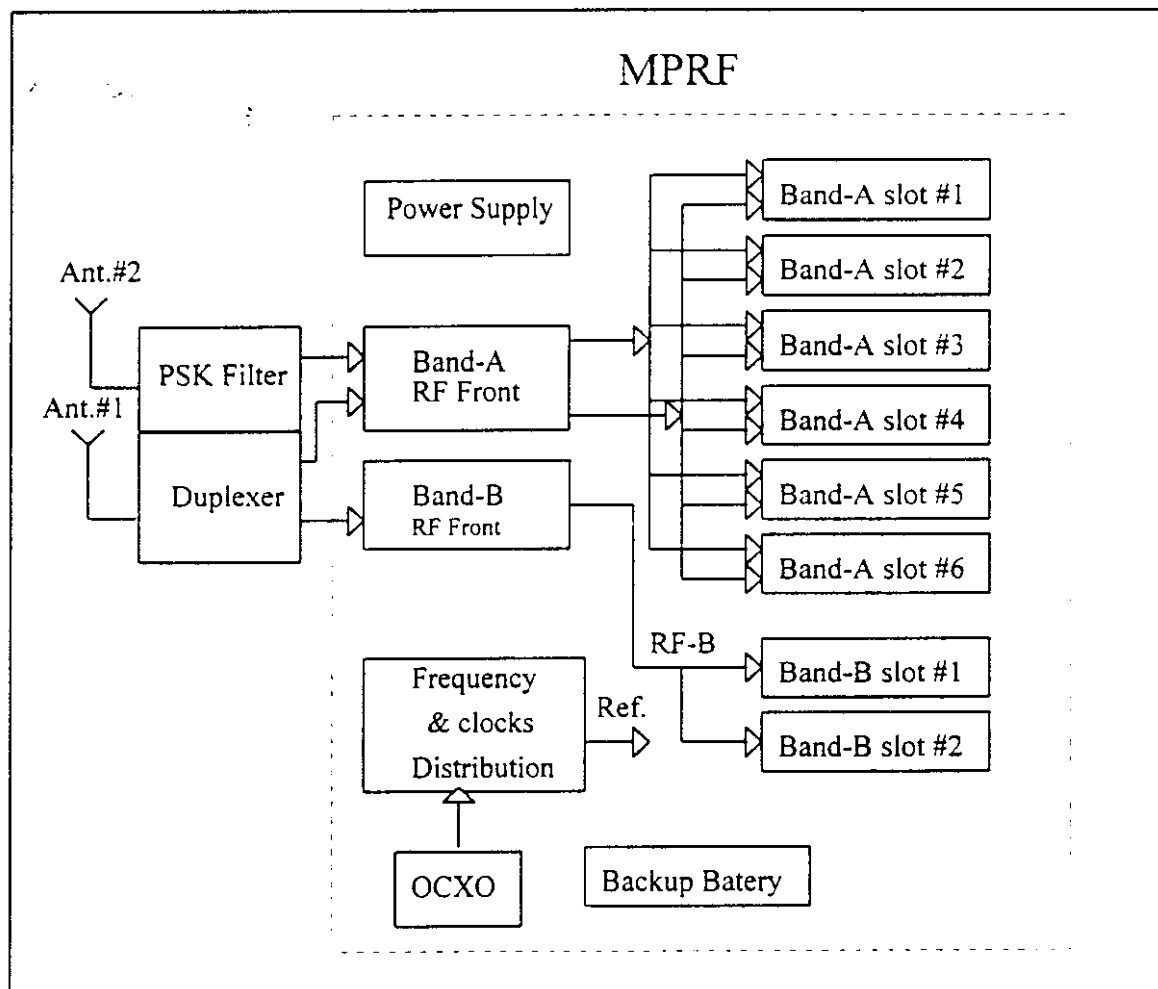


Figure 2-1: Basic MPRF Functional Block Diagram

The MPRF shall be designed to allow expansion and reconfiguration by adding additional PSK and FSK receivers. Up to 6 PSK (band-A) receivers modules (narrow band or wide band) may be installed. Each receiver may be programmed to any frequency (conforming to the specified channel

spacing) within its band of operation supporting commonality and remote configuration. The receiver itself shall be designed as an RF enclosed unit, including shielding and connectors.

The MPRF shall include two Band-A (PSK) antenna inputs (to support diversity reception) and one Band-B (FSK) antenna input.

An external duplexer similar to the one in use in RSDU (adapted to the shifted FSK band) will be incorporated in one of the PSK inputs and the FSK antenna input and the second PSK antenna shall be connected to PSK band-pass filter only.

The reference clock for the overall Base Station operation will be an OCXO with digital frequency control. All other frequencies required by the base station units will be derived from this clock.

The MPRF shall include two types of PSK receivers and one type of FSK receivers modules.

The MPRF receivers module types shall be as follows.

- Dual Receiver , Wide band & Narrow band PSK receiver.
- Dual Narrow band PSK receiver.
- FSK receiver

The MPRF will be controlled by the CCSP. The MPRF shall contain a controller that will control and monitor the MPRF receivers and will be controlled by the CCSP. The CCSP will program the center frequency of each BPSK and FSK receiver. The controller will also perform diagnostics of the MPRF unit (controlled by CCSP).

### 2.1.1 Dual Receiver, Wide & Narrow Band PSK Receiver.

The Dual wide band & narrow band PSK receiver intended to receive one location channel and one message channel. The wide band receiver in this module shall receive 1.5 Mcps wide band signals in the 904-909.75 Mhz band. The center frequency shall be programmable in steps of 100 KHz. The narrow band receiver in this module shall receive a 12 Kbps signals in the 904-909.75 Mhz band. The center frequency shall be programmable in steps of 25 KHz.

The two receiver (wide & narrow) shall operate in the old frequency and in the new frequency plane. Each receiver shall provide a sets of I, Q signals. The configuration of this dual receiver is depicted in figure 2.1.1-1.

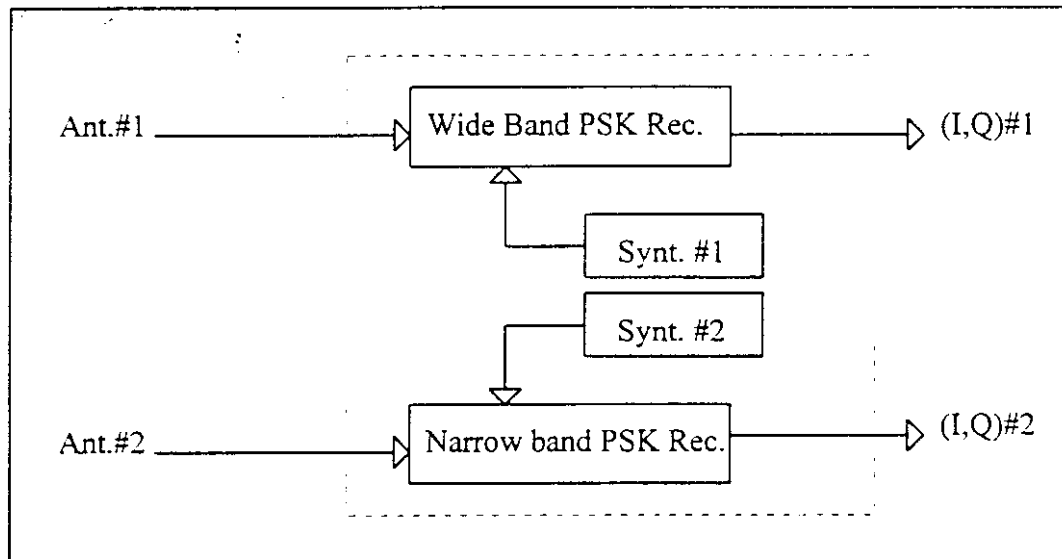


Figure 2.1.1-1: Wide & Narrow band dual receiver functional block diagram.

### 2.1.2 Dual Narrow-Band PSK Receiver

The dual narrow band PSK receiver intended to receive the message signal. This module shall receive two 12 Kbps narrow band signals in the 904-909.75 Mhz band. The center frequency shall be programmable in steps of 25 KHz separately for each receiver. Each receiver shall provide two sets of I, Q signals.

This module configuration shall include option to use the two receivers in a module as two diversity receiver or two separated receivers operating in different frequencies.

The configuration of this dual receiver is depicted in figure 2.1.2-1.

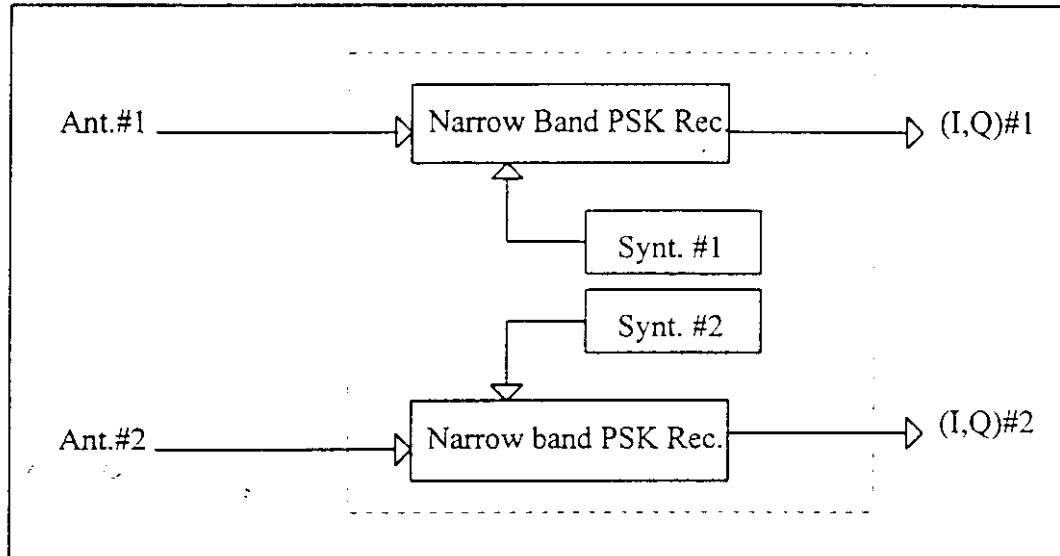


Figure 2.1.2-1 : Dual narrow band PSK receiver

### 2.1.3 FSK Receiver.

The MPRF shall include up to two FSK receiver modules. This module will include single FSK receivers. This module shall be able to receive 25 KHz FM signals band at the 927.75-928 MHz band. The output of each receiver will be a FM-decoded signals (the discriminator output signal).

### 4.3 FSK Receiver

#### Old Paging Channel

Nominal input frequency: 927.7782662 MHz.  
POCSAG mode only.

#### New Paging Channels

Nominal input frequency: 927.775 MHz  
Input frequency range: 927.75 ÷ 928 MHz  
Frequency step: 12.5 KHz.  
RF Frequency Deviation: 1 ppm

Modulation: B-FSK; deviation =  $\pm 4.5$  KHz

Symbol Rate: 2400 sps.

IF frequency: TBD  
3 dB IF Bandwidth: < 12 KHz.

Sensitivity: -110 dBm for:  
SINAD=12dB @ Discriminator output

Input power range: -110 ÷ -40 dBm.

Discriminator output level:  $2.5V_{ptp} \pm 0.7$  V.

Image rejection: 90 dB min.

IF rejection: 90 dB min.

Selectivity : 45 dB @ 25 kHz  
60 dB @ 50 kHz  
80 dB @ 2 Mhz

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