Saturn Bm Marine
Class 2
Technical Manual

NERA
enabling a wireless future

Introduction

System Description

Diagrams

Service

0434/00

A MEMBER OF CIRM

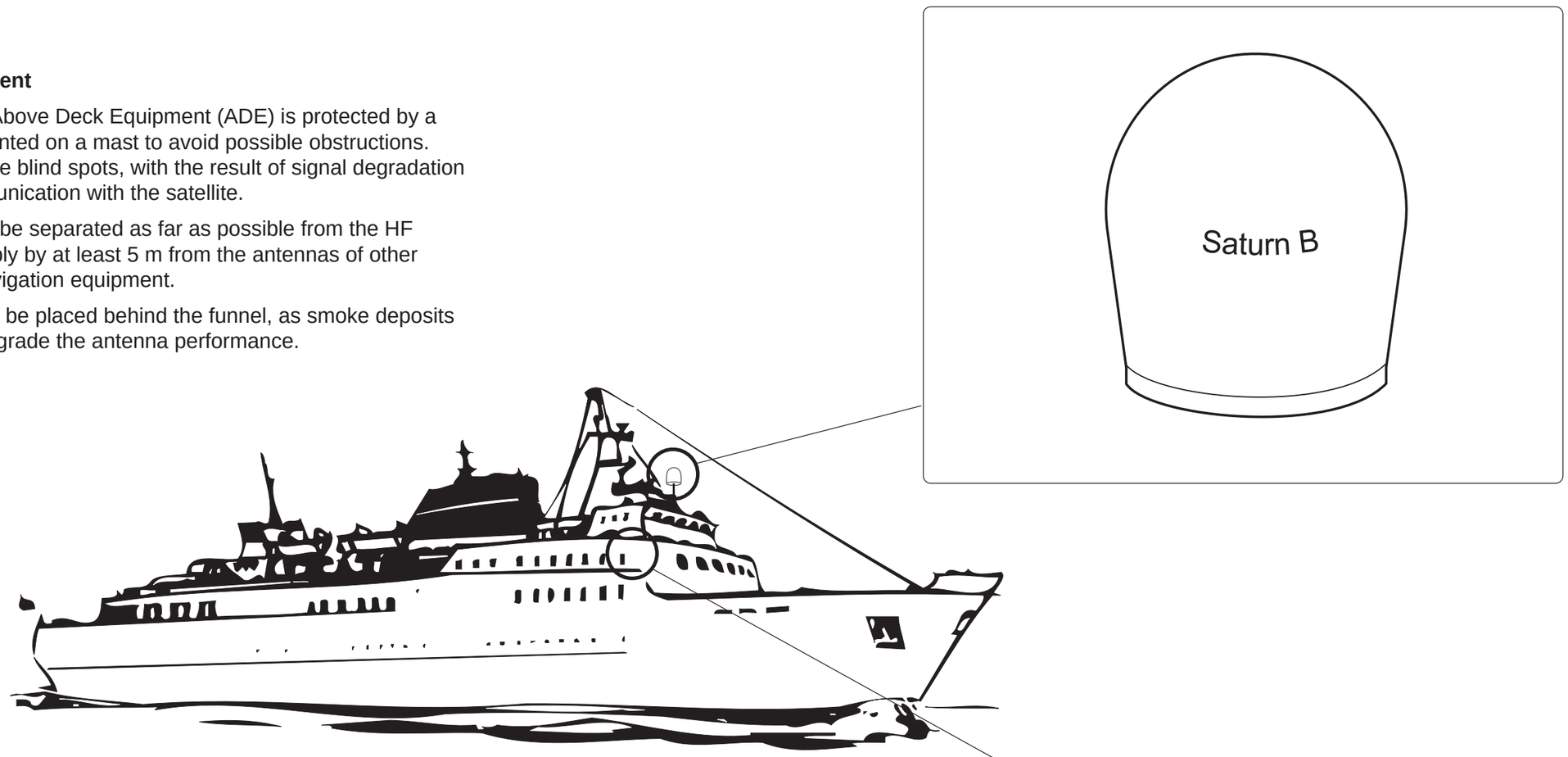
ADE

Above Deck Equipment

The Saturn Bm Mk2 Above Deck Equipment (ADE) is protected by a radome, and it is mounted on a mast to avoid possible obstructions. Obstructions will cause blind spots, with the result of signal degradation or even loss of communication with the satellite.

The ADE should also be separated as far as possible from the HF antenna, and preferably by at least 5 m from the antennas of other communication or navigation equipment.

Neither must the ADE be placed behind the funnel, as smoke deposits then evenually will degrade the antenna performance.



BDE

Below Deck Equipment

The **Saturn Bm Main Control Unit (MCU)** can be placed in any suitable location, but is usually installed in the radio room.

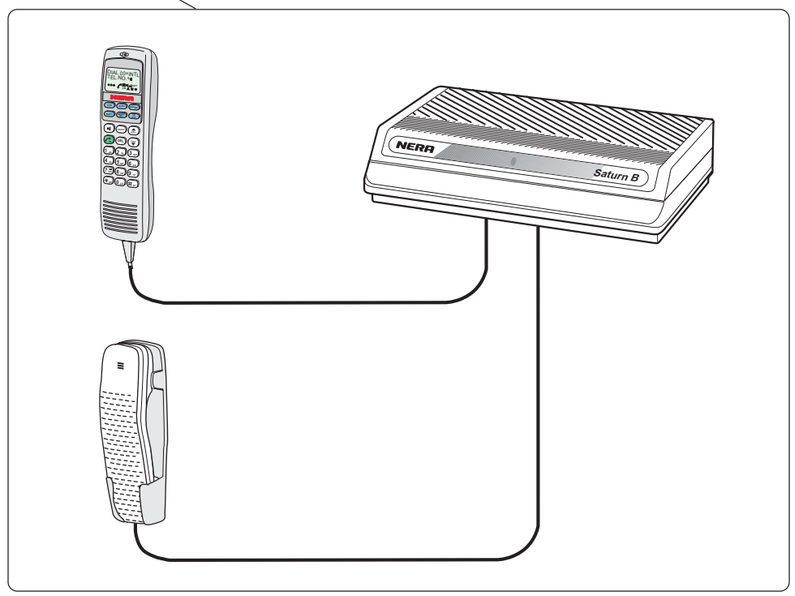
The MCU is designed for wall or desk top installation.

As all commands of the Saturn Bm terminal may be carried out from the **Display Handset**, the MCU can be located out of the way so as not to occupy valuable working space.

The **telephone(s)** can be placed anywhere onboard the vessel.

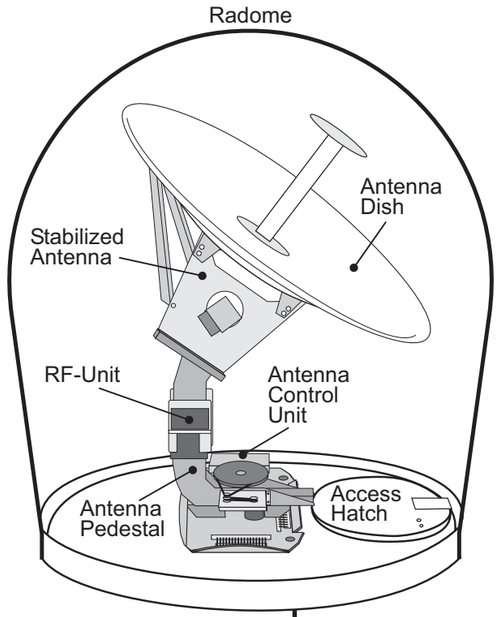
The following optional peripherals may be connected to Saturn Bm:

- DTMF telephones (max 5)
- Telefax (for connection to a telephone port)
- Message Indicator
- PC (telex)
- PC (data)
- Serial printer
- GPS navigator
- Plug for NMEA-0183 connection
- Course gyro
- Power 11 - 34 VDC
- Power 110/220 VAC and 24 VDC (automatic switchover)



Main Parts List, ADE

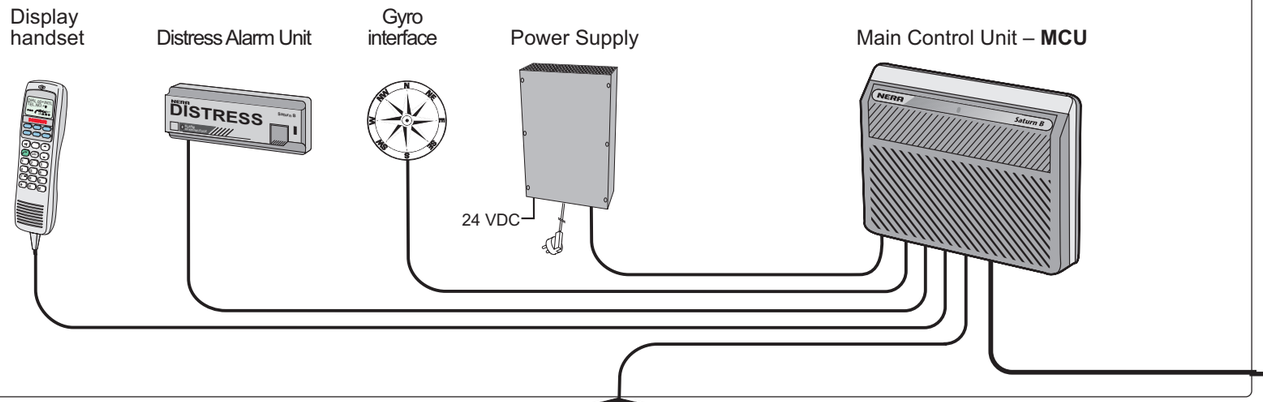
Above Deck Equipment	NERA Part No.
Antenna Pedestal	QSXK 911 951
Radome	R 906 5653
RF Unit	QUFC 911 931
Antenna Control Unit, ACU:	
• Antenna Control Board, ACB	QROF 2199041
• Pedestal Control Unit, PCU	MM 113 101
Antenna dish	10AY652A
Antenna feed	QSXK 911 906



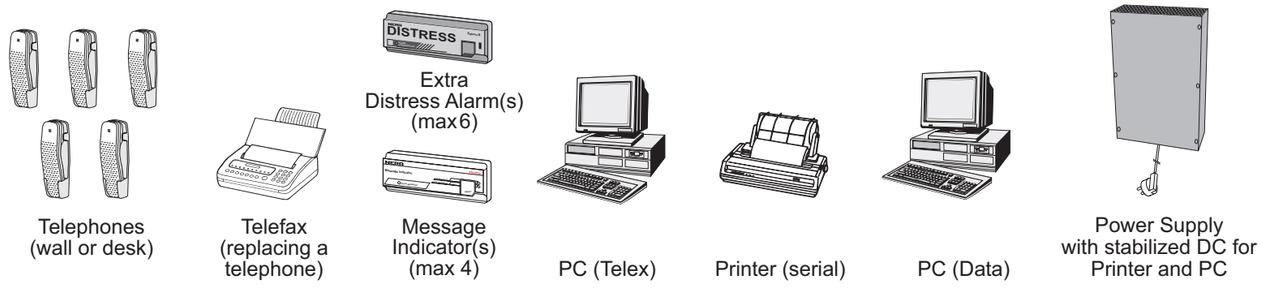
ADE

BDE

Standard Connection



Additional Connection to MCU



Main Parts List, BDE

Below Deck Equipment	NERA Part No.
Main Control Unit, MCU	QUFC 911 901-2
Display Handset	QDGS 911 903
Distress Alarm	QUFC 911 910/2
Termination box	QUFC 911 948

Main Control Unit, MCU	NERA Part No.
Main Control Board	QROF 219 9001-2
Power Board	QROF 219 9002
Connection Board	QROF 219 9005
Gyro Board	QROF 219 9003
Power Supply 220/110V	QDFC 911 903-2B

Options	NERA Part No.
Telephone (wall)	DBAR 104 001/888
Telephone (desk)	DBAR 201 010/496
Message Indicator	QUFC 911 910-3

For further information, see the Saturn Bm Installation Manual.

Services

Voice:	16 kbps
Telefax:	9.6 kbps
Telex:	50 Baud (Class 1 only)
Asynchronous Data:	9.6 kbps
High Speed Data: (option)	56/64 kbps full duplex

System Specifications

Radio frequency performance

Transmit Frequencies:	1626.5 - 1646.5 MHz
EIRP:	33/25 dBW
Receive Frequencies:	1530.0 -1559.0 MHz
Channel spacing:	20 kHz
G/T:	-4 dB/K

Antenna Unit

1 m stabilized parabolic dish

Gain:	21.8 dB Tx, 21.1 dB Rx
	Axial ratio less than 2 dB on axis
Polarisation:	right-hand circular (CCIR 573)
Steerability:	hemispheric coverage, 0°- 90°
Tracking:	Automatic search.
Cable rewind:	30 seconds

Ship Motion

Max turning rate:	12°/sec
Roll:	±30°
Pitch:	±10°
Yaw:	±8°

Physical Characteristics

Above Deck Equipment (ADE)

Size:	Height = 1445 mm, max dia = 1420 mm, *see drawing*
Weight:	90 kg
Mounting:	Flange

Main Control Unit (MCU)

Size:	310 x 236 x 70 mm, *see drawing*
Weight:	4 kg
Mounting:	Special mounting bracket, *see Installation Manual*

Environmental Conditions

Vibration, Precipitation and Icing: As specified by Inmarsat

Above Deck Equipment

Temperature:	-25°C to 55°C
Rain:	100 mm/hour

Below Deck Equipment

Temperature:	-25°C to 55°C
Humidity:	95 % at 40°C

Electromagnetic Compatibility

Radiated:	EN55022 class B
Conducted:	EC 801

Cabling

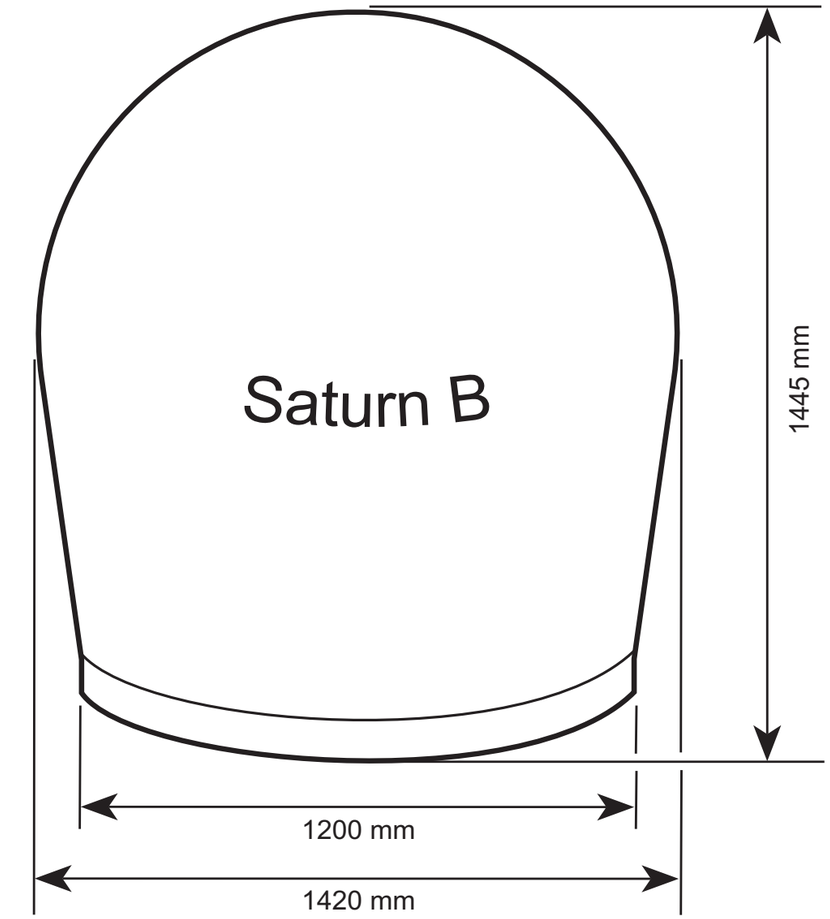
ADE - BDEU:	Length up to 44 m: single, flexible, 20 mm diameter
	Length to 44-77 m: One coaxial 06230 10.3 diameter (Ethernet) and one screened mains cable.
Telephone/telefax:	screened twisted pair
Auxiliary :	8-core cable
Display Handset :	8-core cable
PC :	RS-232 cable
Printer :	RS-232 cable
Distress Alarm :	4-core screened cable

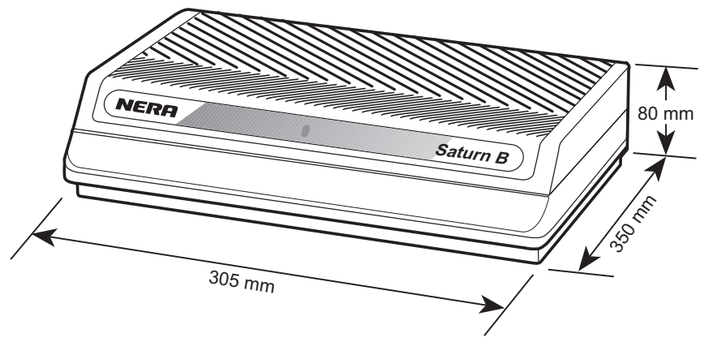
Power requirements

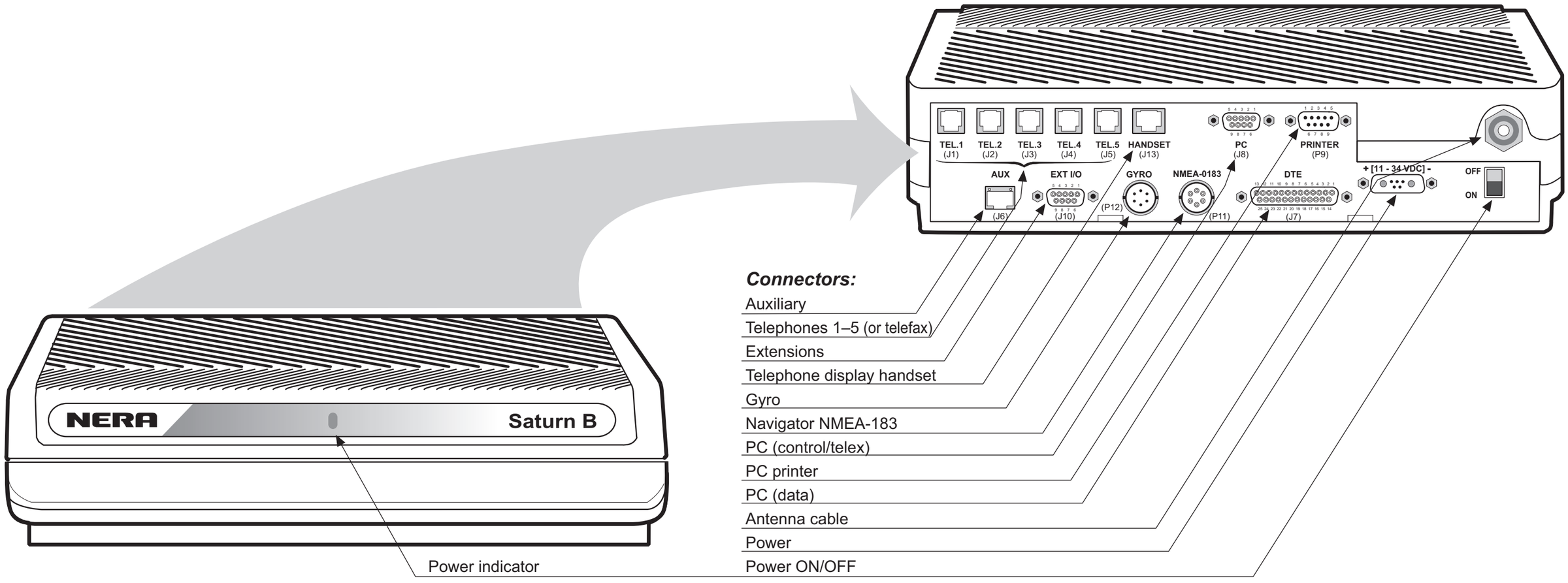
Voltage:	11 - 34 VDC
Power Consumption:	150 W
Power Supply:	220 VAC to 28 VDC
Optional Power Supply:	220 VAC to 28 VDC with 24 VDC battery backup input

Interfaces

Telephone/telefax:	5 x RJ11, 2-wire with echo cancelling and touch-tone dialing
Fax:	CCITT G3 at 2400 bps
Data:	D-sub, 25-pin female, 9600 bps,
	RS-232, Hayes AT compatible
PC:	D-sub, 9-pin female, RS-232
Printer:	D-sub, 9-pin male, RS-232
Gyro:	Synchro, step-by-step, 1:360, 1:180, 1 :90
Navigator:	NMEA-0183






TEL.1 (J1)
TEL.2 (J2)
TEL.3 (J3)
TEL.4 (J4)
TEL.5 (J5)
HANDSET (J13)
PC (J8)
PRINTER (P9)
AUX
(J6)
EXT I/O
(J10)
GYRO
(P12)
NMEA-0183
(P11)
DTE
(J7)
+ [11 - 34 VDC] -
OFF
ON
NERA
Saturn B
Connectors:
Auxiliary
Telephones 1–5 (or telefax)
Extensions
Telephone display handset
Gyro
Navigator NMEA-183
PC (control/telex)
PC printer
PC (data)
Antenna cable
Power
Power ON/OFF
Power indicator

The INMARSAT-B System

Inmarsat

The INMARSAT-B system offers high quality 16 kbps voice communication, and 9.6 kbps telefax and data transmission.

The benefit of the INMARSAT system is its high capacity, and the rapid and reliable connection between the land based (fixed) users and the **Mobile Earth Stations (MESs)**.

The large number of **Land Earth Stations (LESs)** in operation allows the operator to select the one giving the lowest cost to a particular land based subscriber.

Each satellite region is under the control of a **Network Coordinating Station** (**NCS**), which controls and monitors the traffic between the MESs and the LESs.

See figure 1.

Services

- Duplex telephone calls – basic telephony services
- Simplex telephone calls – LES-to-mobile only
- Duplex telefax – CCITT Group 3 facsimile services, 9.6 kbps
- Simplex telefax calls – LES-to-mobile only
- Simplex group ID addressing – to a selected group of mobiles
- Simplex area addressing – to all mobiles within a specific geographic area
- Duplex data communication – Hayes compatible 9.6 kbps data service

System Satellites

The satellites are positioned in a geostationary orbit above the equator at approximately 35700 km altitude.

In geostationary orbit, each satellite moves at the same rate as the earth, and so remains in the same relative position to the earth, above equator, allowing the antenna to have line-of-sight communication with the satellite.

The Saturn Bm Marine can communicate via the four satellites covering one Ocean Region each.

The positions of the system satellites are shown in figure 2.

Transmission frequencies

The INMARSAT-B MESs operate in the following frequency bands:

Calls from Saturn B terminals	1626.5	MHz	— 1646.5	MHz
Calls to Saturn B terminals	1530.0	MHz	— 1559.0	MHz

A large number of channels are available (20 kHz channel separation), offering either 16 kbps voice communication, or 9.6 kbps duplex data communication.

Duplex communication uses two channel frequencies, one in each direction.

The LESs provide interface to the international networks for telephony and data: PSTN (Public Switched Telephone Networks) and PSDN (Packet Switched Data Networks).

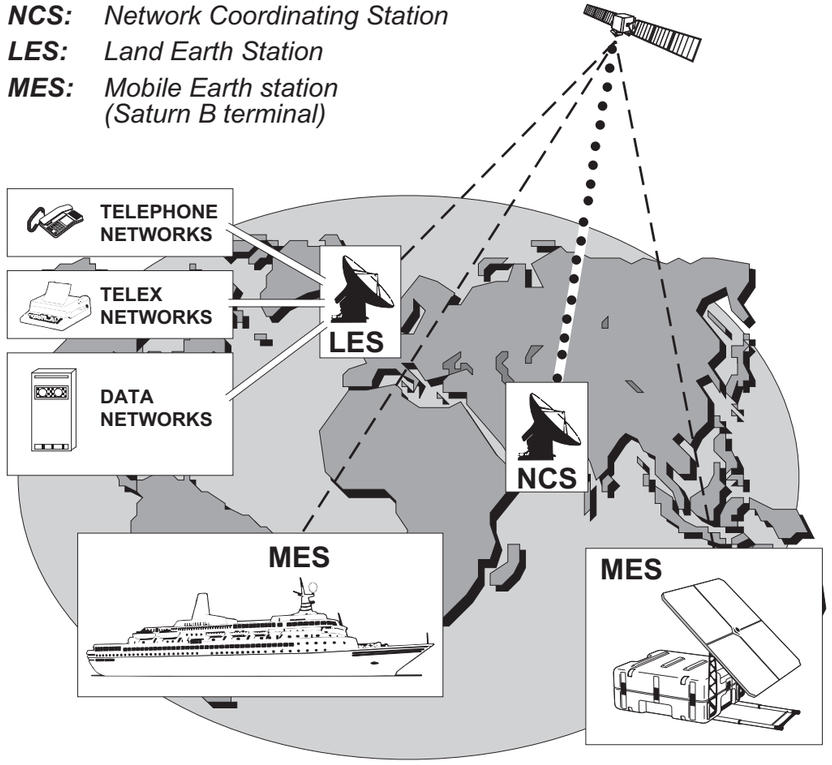


Figure 1.
Overview of the Inmarsat-B system.

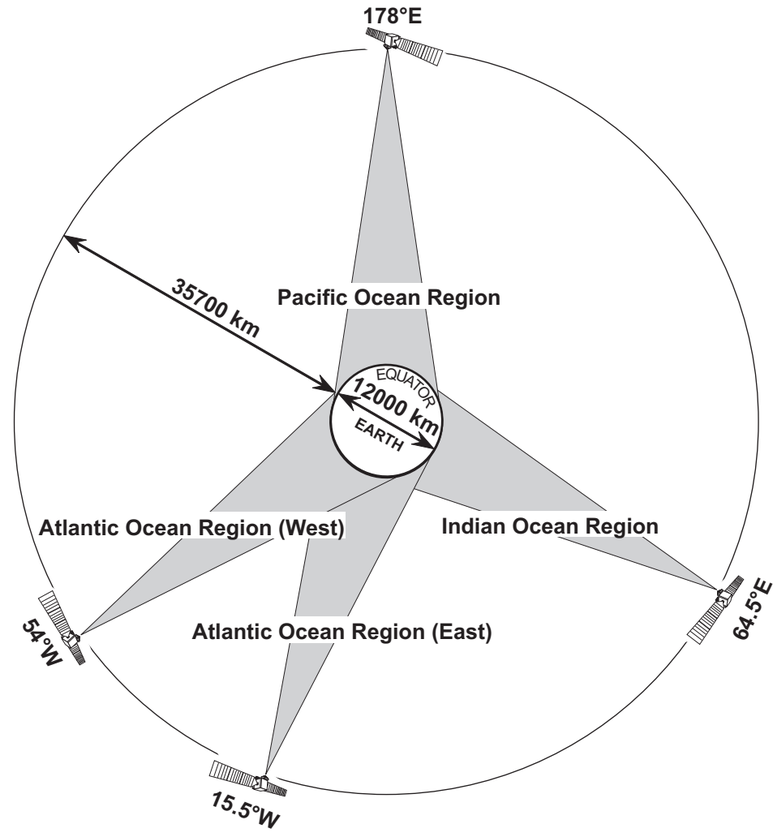


Figure 2.
Four satellites in a geostationary orbit above the equator at approx. 35700 km altitude.

Channel numbers

All radio frequency channels used by the MES are assigned a particular hexadecimal number which is translated into frequencies on L-band between MES and satellite, and to C-band between LES and satellite.

*Channel no. **32C8** for an MES always designates:*
1660.5000 MHz transmitting frequency
1542.5000 receiving frequency

Channel Types

The Inmarsat-B System differs between physical and functional channels. A physical channel refers to one frequency, one carrier. Every frequency can have several functional channels muliplexed on it. Each functional channel is named after the originating unit. The NCS TDM will in the initial system multiplex the NCSC for Bulletin Boards and Call Announcement, the NCSA for Channel Assignments and NCSI for Interstation information to the LES on the same physical channel. When the system expands, spot beams and Ocean Region Registration will be introduced using the functional channels NCSS and NCRA multiplexed on the NCS TDM. The traffic on one TDM may then be to heavy and some of the functional channels may be moved to another NCS TDM frequency.
The physical SCPC channels are always divided into three functional channels. During call set up and release the whole bandwith is used for signalling and the functional channel is called MES-SIG/LES-SIG. During speech or data phase, the signalling part of the channel is called VSUB or DSUB and the service carrying part is called MESV/LESV or MESD/LESD.

Requests and assignments

The Network Coordinating Station in each Ocean Region continually transmits to the MESs within its region on the NCS Common Signalling Channel (NCSC).

When selecting a particular Ocean Region, the MES automatically tunes its receiver to the NCSC frequency, and awaits System Information from the NCS.

The System Information (Bulletin Board) includes available NCS/LES channel frequencies, location of satellites, operational status, etc.

When the NCS sends a Call Announcement, detailing the channel to which the MES should tune to receive the call.

When the MES user dials a subscriber's international telephone number, the MES transmits an Access Request to the NCS via the LES, and awaits a Channel Assignment from the NCS.

Telephone communication

For telephone communication a Frequency Division Multiple Access (FDMA) is used, in a Single Channel Per Carrier (SCPC) system. The voice communication occupies two (unpaired) channel frequencies.

The telephone channels are controlled by NCS which assigns a free channel upon request. When a channel has been assigned it is controlled by LES until end of call.

Facsimile communication

The Saturn Bm telephone ports may be configured for telefax communication. The transmission is telefax only, and is performed at a rate of 9.6 kbps. Telefaxes without keypad may be connected via an adapter.

Data communication

The data service allows the Saturn Bm user to communicate at up to 56/64 kbps, via the public switched network, to fixed modems and data terminals.

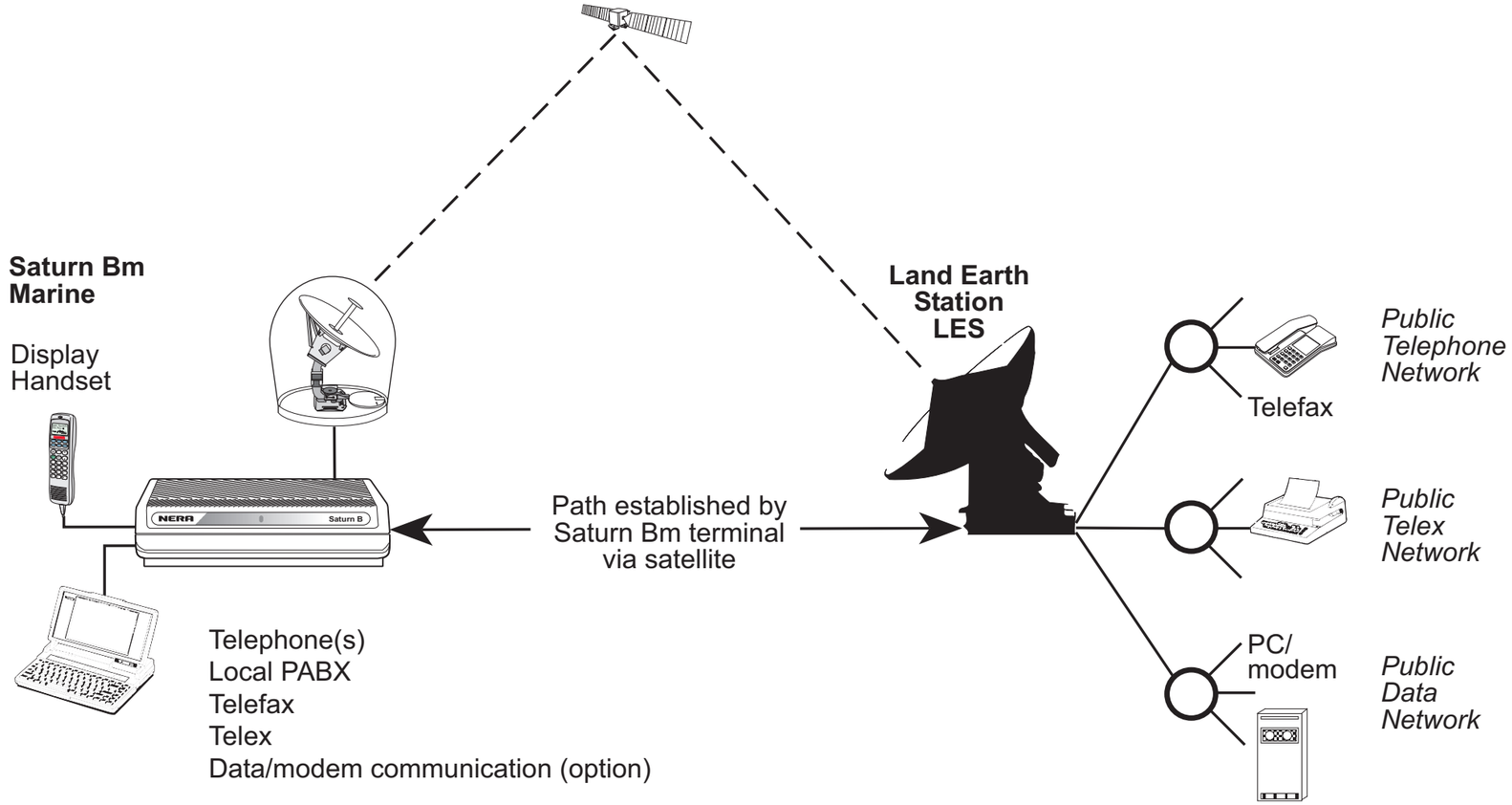


Figure 3.
Communication path.

Calls from Mobiles

To initiate a call, the user dials the international call prefix 00 prior to the telephone number for the required destination. The LES code is also included, either automatically when using the default LES, or manually selected from the Display Handset.

The mobile automatically includes information to identify the MES and the particular end terminal that originates the call. Saturn Bm has six connections: the Display Handset and five connectors that are normally configured for telephone and a telefax.

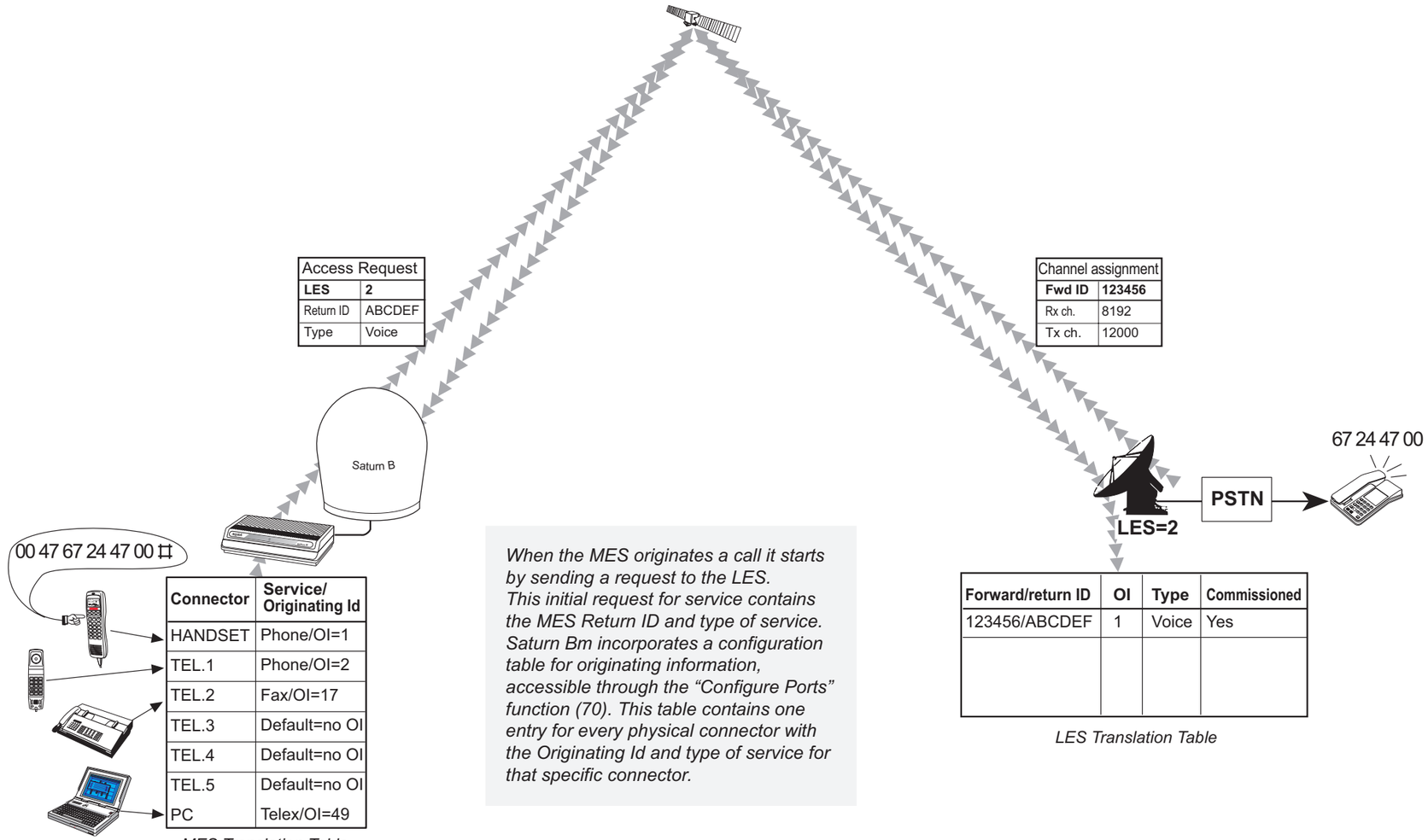
The LES uses the end terminal identifying information (OI) for billing purposes.

The mobile transmits the dialing information on a channel specially assigned by the NCS, to the LES, which also has been instructed to tune to the same channel.

On receiving the call, LES routes it over the public telecommunications networks to the intended destination. When the destination responds, for example by the dialed subscriber lifting the handset, the call proceeds.

The illustration of the call initiation is simplified.

Calls from Mobiles



Connector	Service/ Originating Id
HANDSET	Phone/OI=1
TEL.1	Phone/OI=2
TEL.2	Fax/OI=17
TEL.3	Default=no OI
TEL.4	Default=no OI
TEL.5	Default=no OI
PC	Telex/OI=49

MES Translation Table

When the MES originates a call it starts by sending a request to the LES. This initial request for service contains the MES Return ID and type of service. Saturn Bm incorporates a configuration table for originating information, accessible through the "Configure Ports" function (70). This table contains one entry for every physical connector with the Originating Id and type of service for that specific connector.

Forward/return ID	OI	Type	Commissioned
123456/ABCDEF	1	Voice	Yes

LES Translation Table

Calls to Mobiles

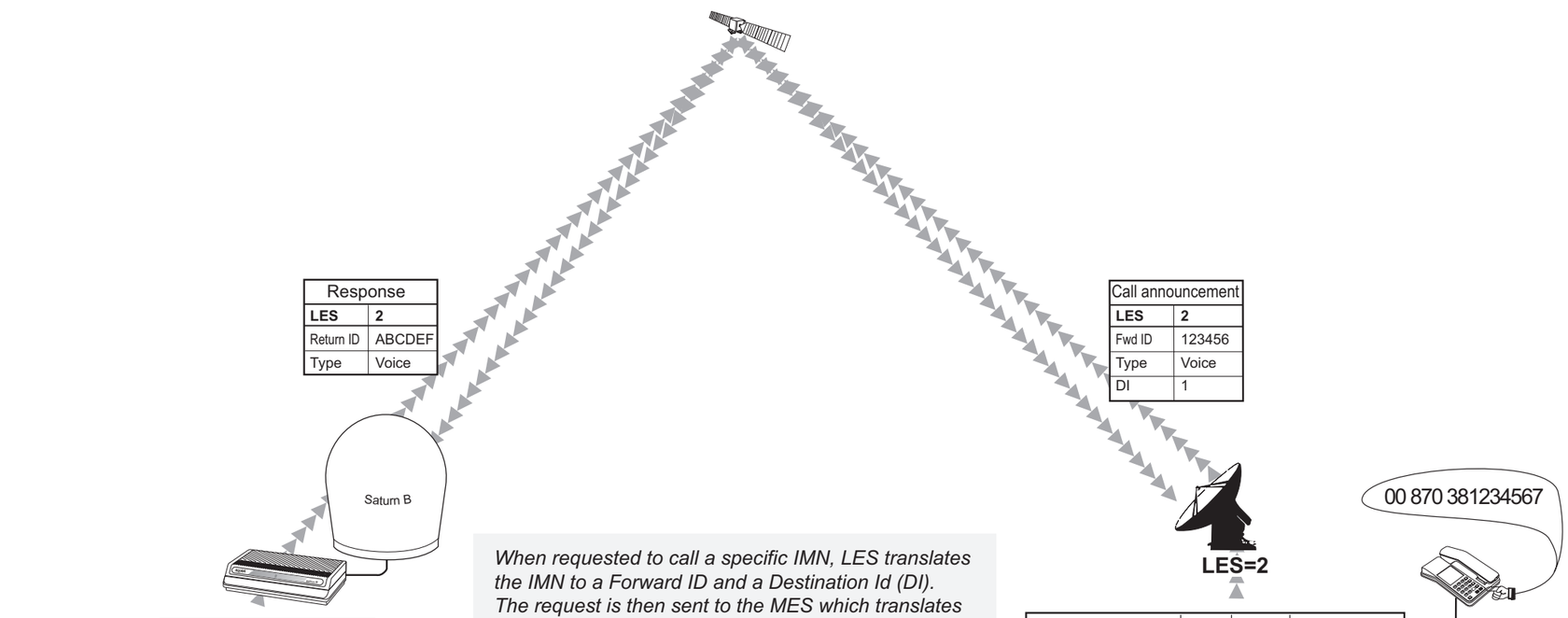
Calls are made as ordinary international (Satellite) calls where each Ocean Region has an international country code. If an area is covered by more than one satellite, it is necessary that the caller knows which satellite (Ocean Region) the mobile is tuned to.

The international codes to the four Ocean Regions are as follows:

Atlantic Ocean East Region:	*871*
Pacific Ocean Region:	*872*
Indian Ocean Region:	*873*
Atlantic Ocean West Region:	*874*

The illustration of the call initiation is simplified.

Calls to Mobiles



Incoming call route	DI
Telephone Ring on handset	1
Telephone Ring on TEL.1	2
Facsimile Ring on TEL.2	17
TEL.3	No DI
TEL.4	No DI
TEL.5	No DI
PC	49

MES Translation Table

When requested to call a specific IMN, LES translates the IMN to a Forward ID and a Destination Id (DI). The request is then sent to the MES which translates the Forward ID and the DI to a physical line to call.

To "connect" a Destination Id to a physical line, Saturn Bm incorporates a translation table accessible through the "Incoming call route" function (71). This table can contain up to 100 DI translations, and each DI in use is programmed with type of call and destination.

A call is not allowed to be routed to a connector that is configured to another type than the DI specifies. A telephone DI can only be routed to a phone type connector. A facsimile DI can only be routed to a fax type connector.

Forward/return ID	DI	Type	IMN
123456/ABCDEF	01	Voice	381234567
123456/ABCDEF	02	Voice	381234789
123456/ABCDEF	17	Fax	381234890
123456/ABCDEF	49	Telex	381234481

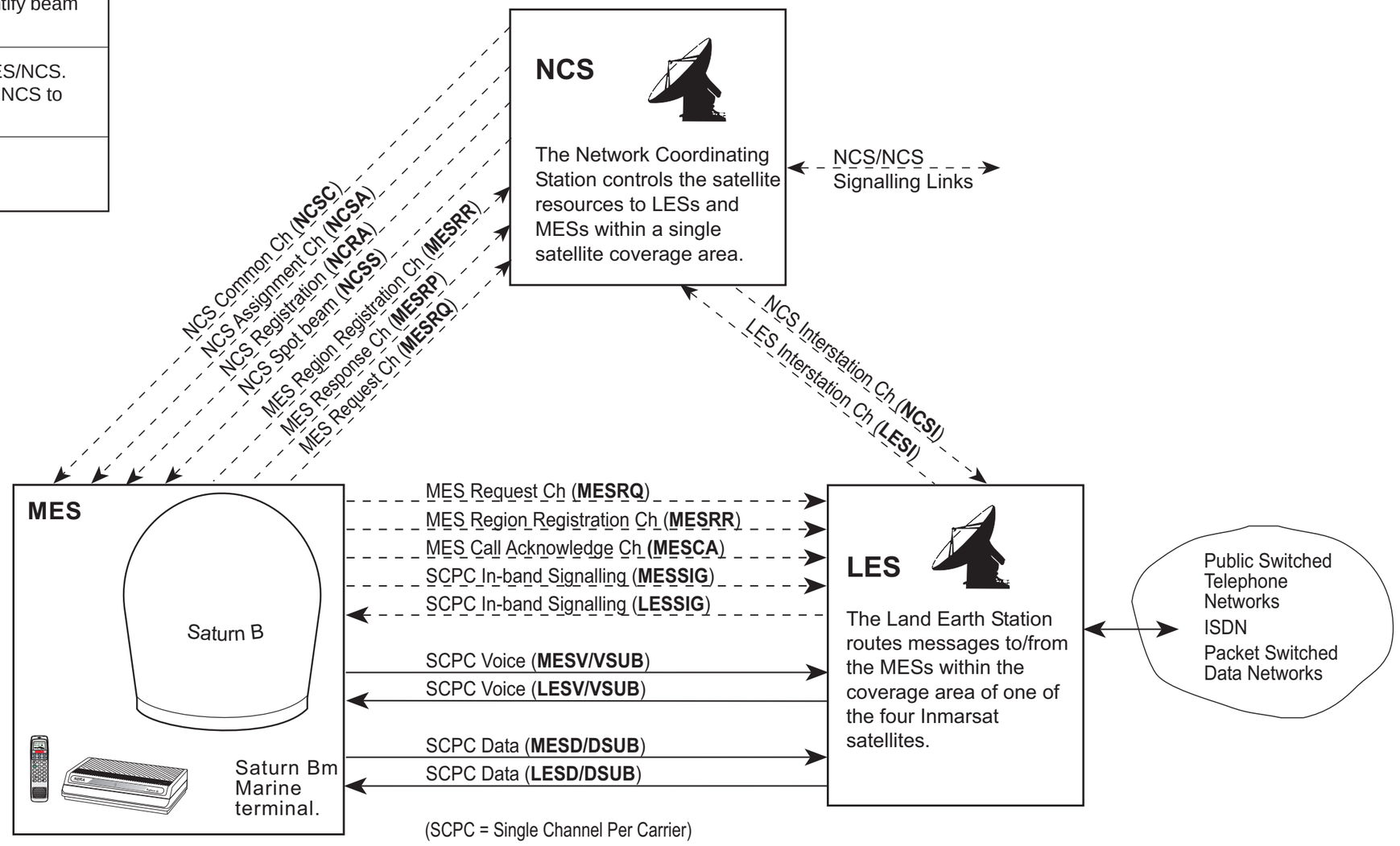
LES Translation Table

Signalling Channels

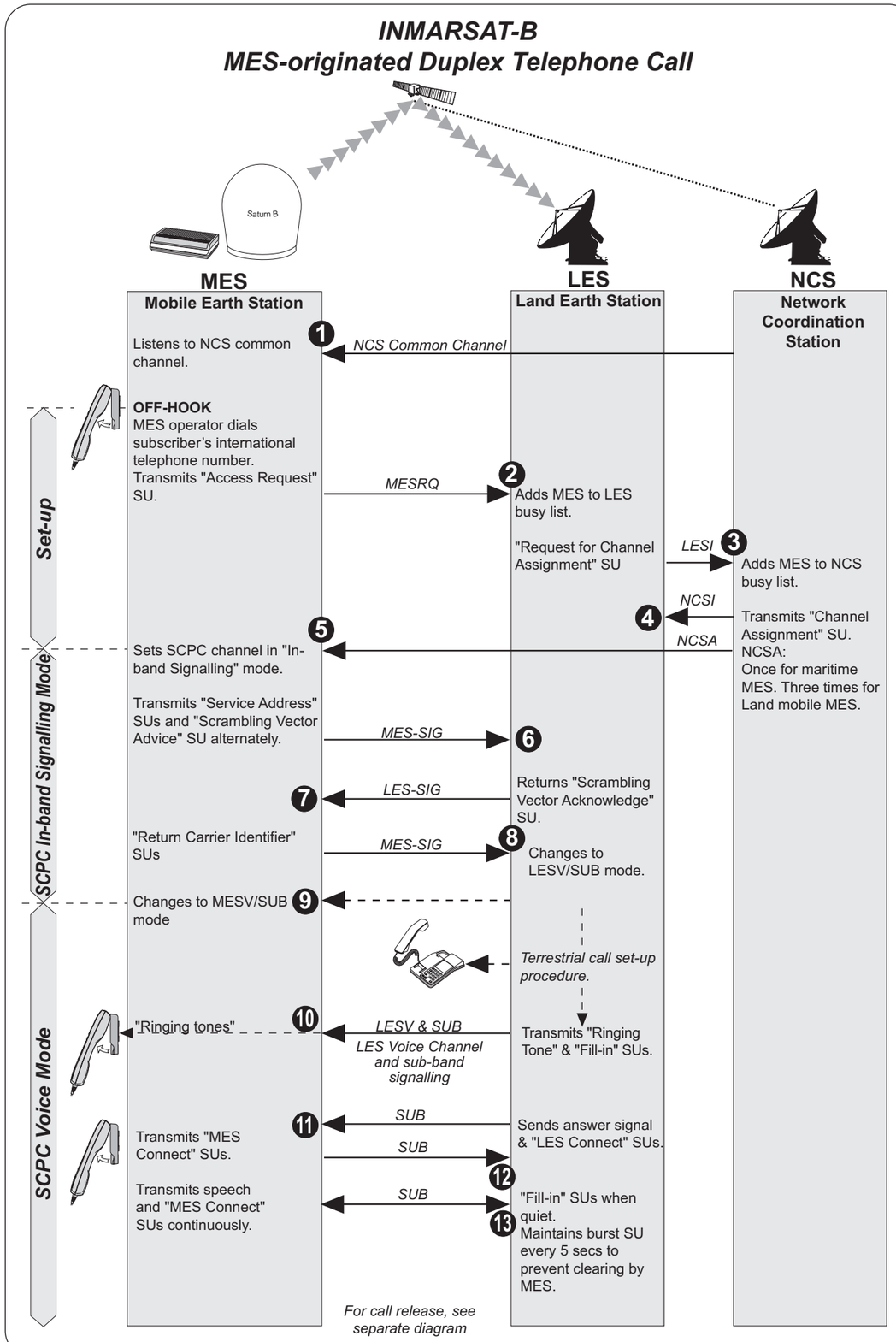
Designation	*Transmission*	*Type of information*
NCSI **LESI**	Continuous TDM	Bi-directional signalling information between LES and NCS
NCSC **MESRP**	TDM TDMA	Bulletin Board announcements. MES responses
NCSA	Continuous TDM	Assigns SPCS channels
MESRQ	Slotted Aloha	Request from MES to LES
MESCA	Slotted Aloha	Acknowledges shore-originated simplex calls.
NCSS	Continuous TDM	One frequency per spot beam; enables an MES to identify beam serving location.
MESRR **NCRA**	Slotted Aloha Continuous TDM	Registration signal to LES/NCS. Acknowledgement from NCS to MES
MESSIG **LESSIG**	SCPC	In-band signalling

Communication Channels

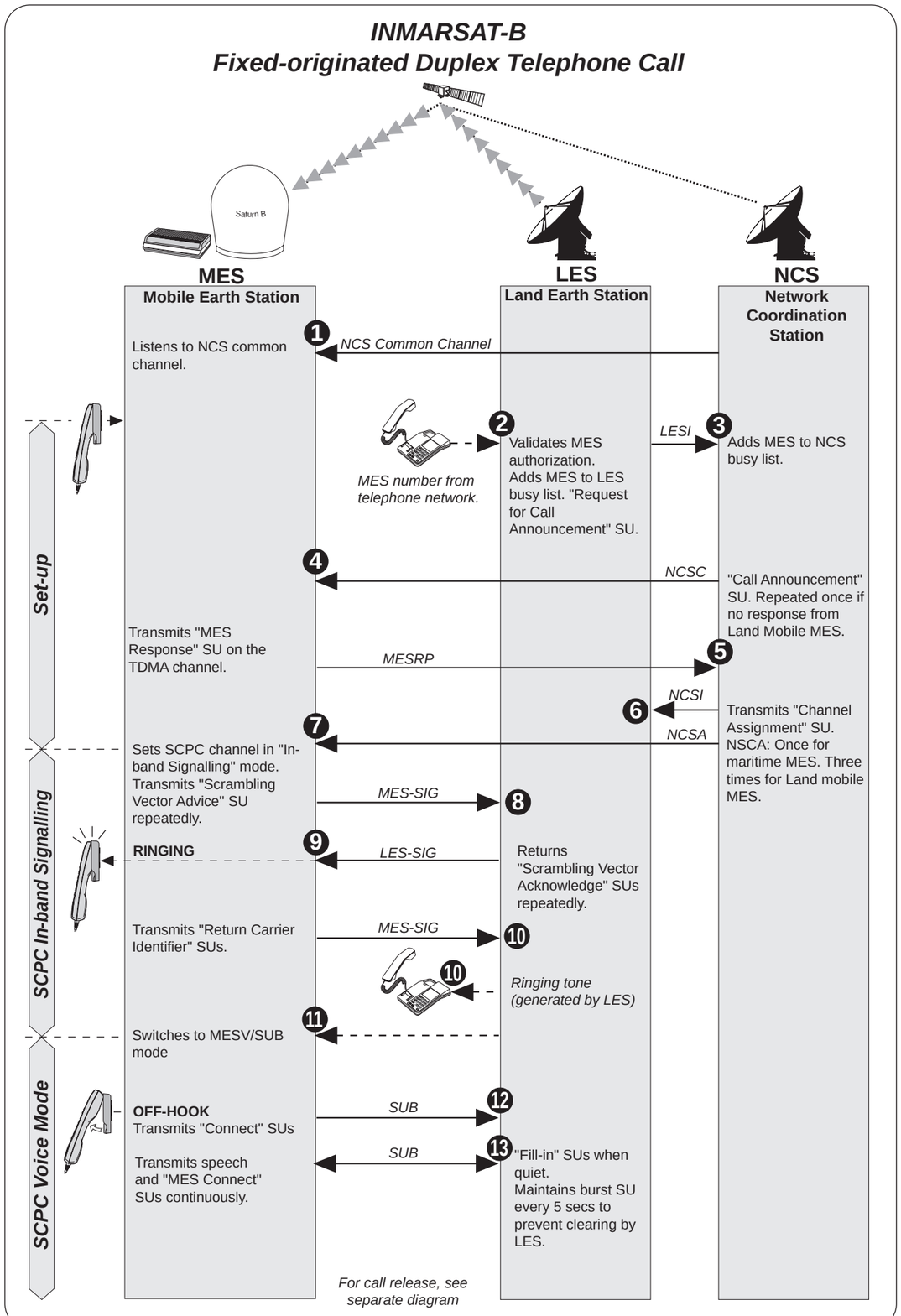
Designation	*Transmission*	*Type of information*
LESV **MESV**	SCPC with VSUB sub-band signalling	Duplex 16 kbps voice communication
LESD **MESD**	SCPC with VSUB sub-band signalling	Duplex 9.6 kbps data communication



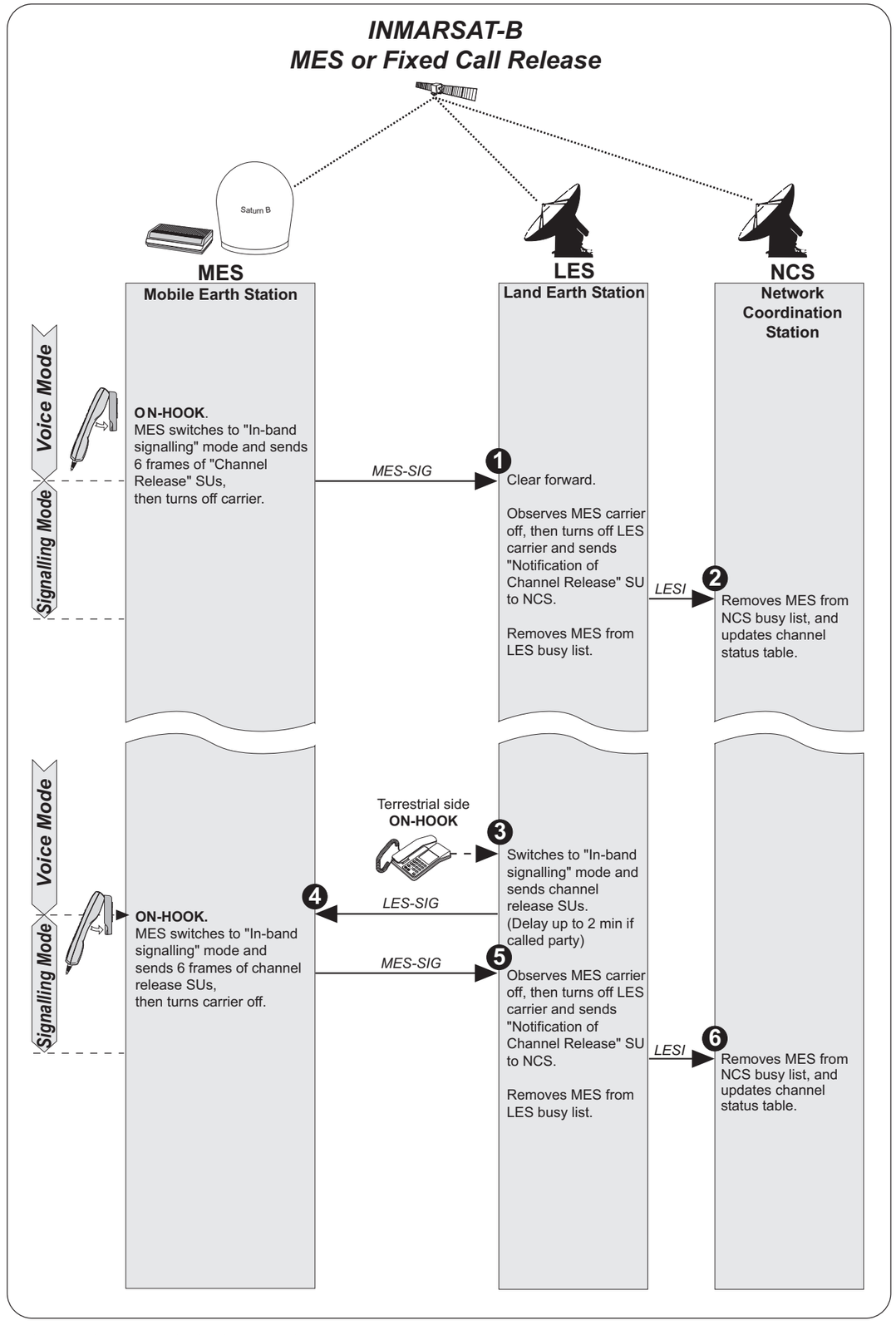
INMARSAT-B
MES-originated Duplex Telephone Call

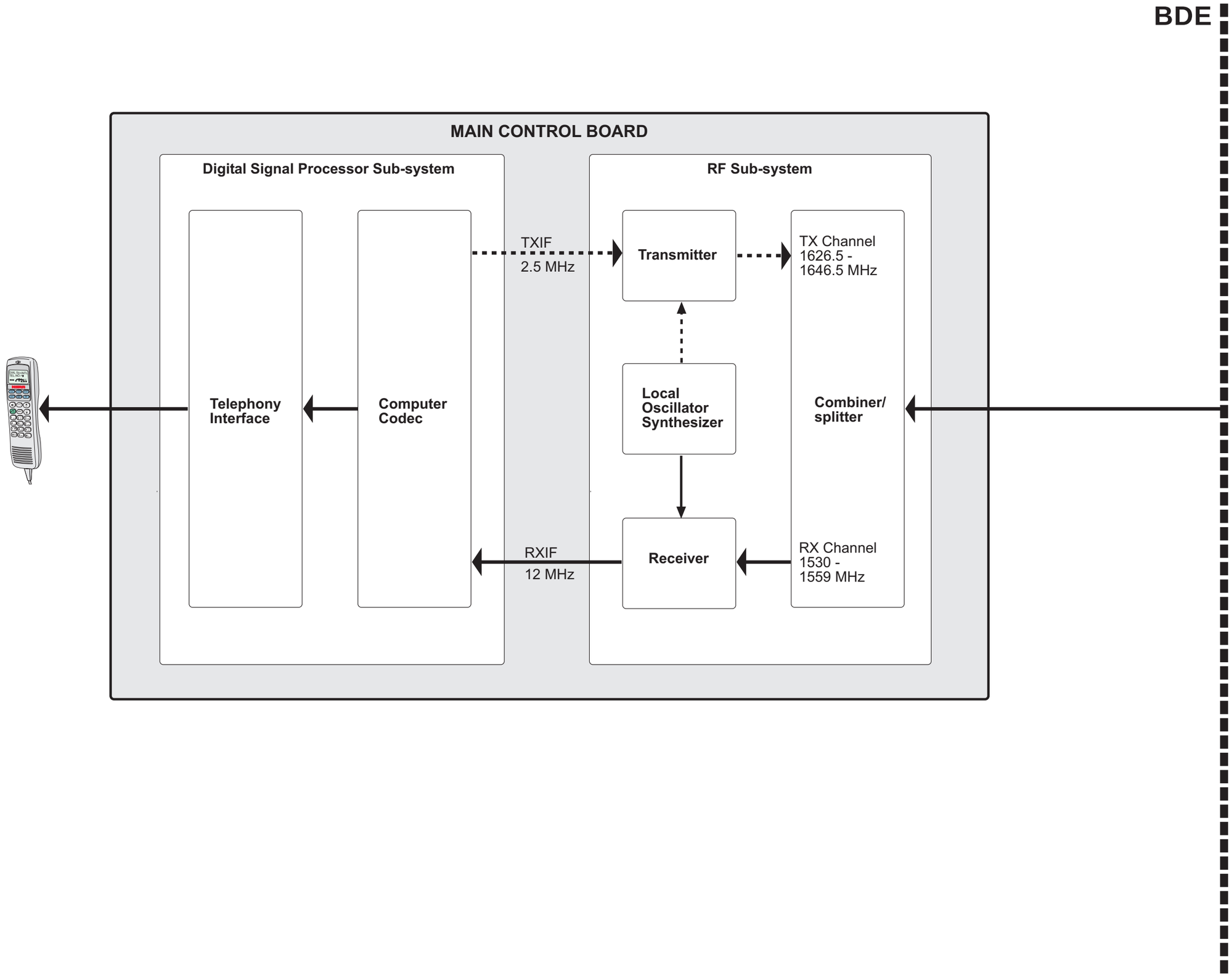


INMARSAT-B
Fixed-originated Duplex Telephone Call



Communication Sequences Cont'd




BDE
MAIN CONTROL BOARD
Digital Signal Processor Sub-system
RF Sub-system
Telephony Interface
Computer Codec
TXIF
2.5 MHz
Transmitter
TX Channel
1626.5 -
1646.5 MHz
Local Oscillator Synthesizer
Combiner/ splitter
RXIF
12 MHz
Receiver
RX Channel
1530 -
1559 MHz

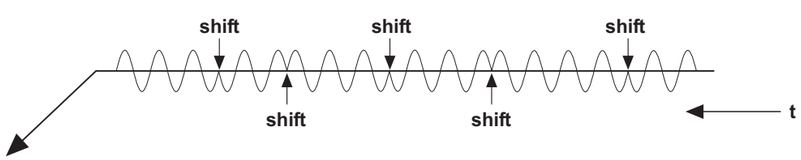
ADE

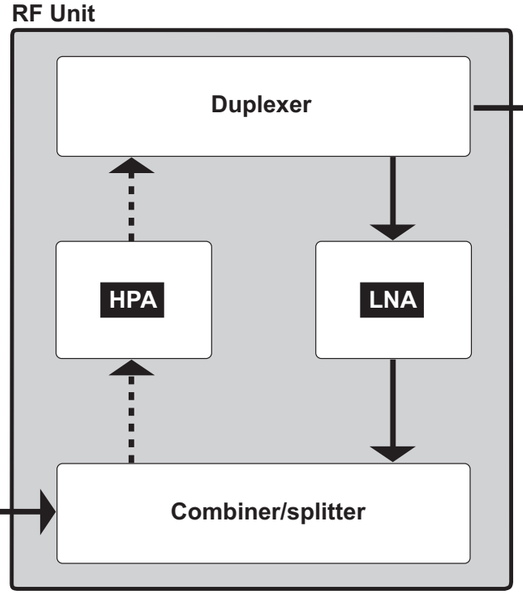
Forward Direction

MES ⟸ NCS

NCS Common Channel (NCSC)

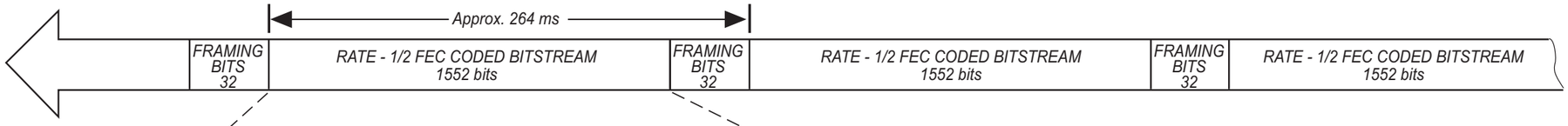
BPSK Encoded Signal
(BPSK = Binary Phase Shift Keying)

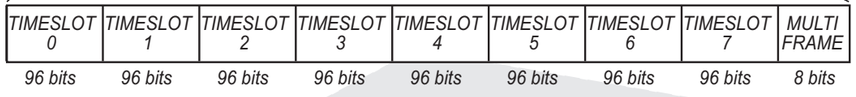




f = 1530 - 1559 MHz

Stable Platform



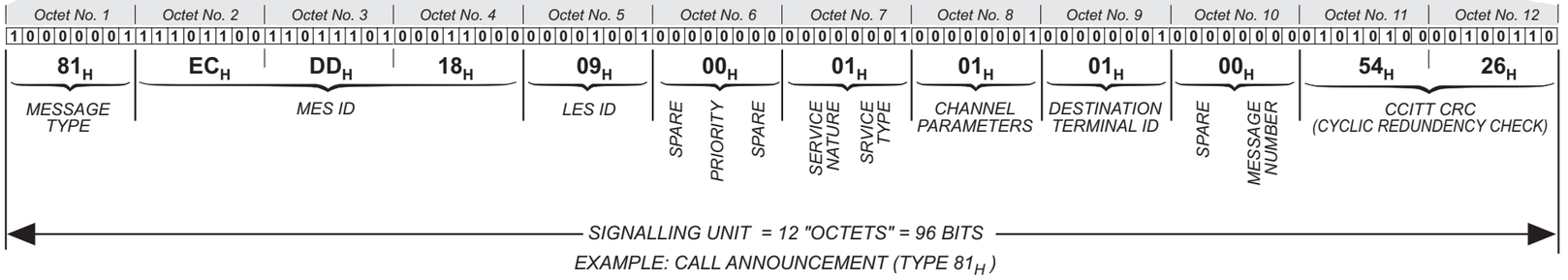


SIGNALLING UNIT – SU

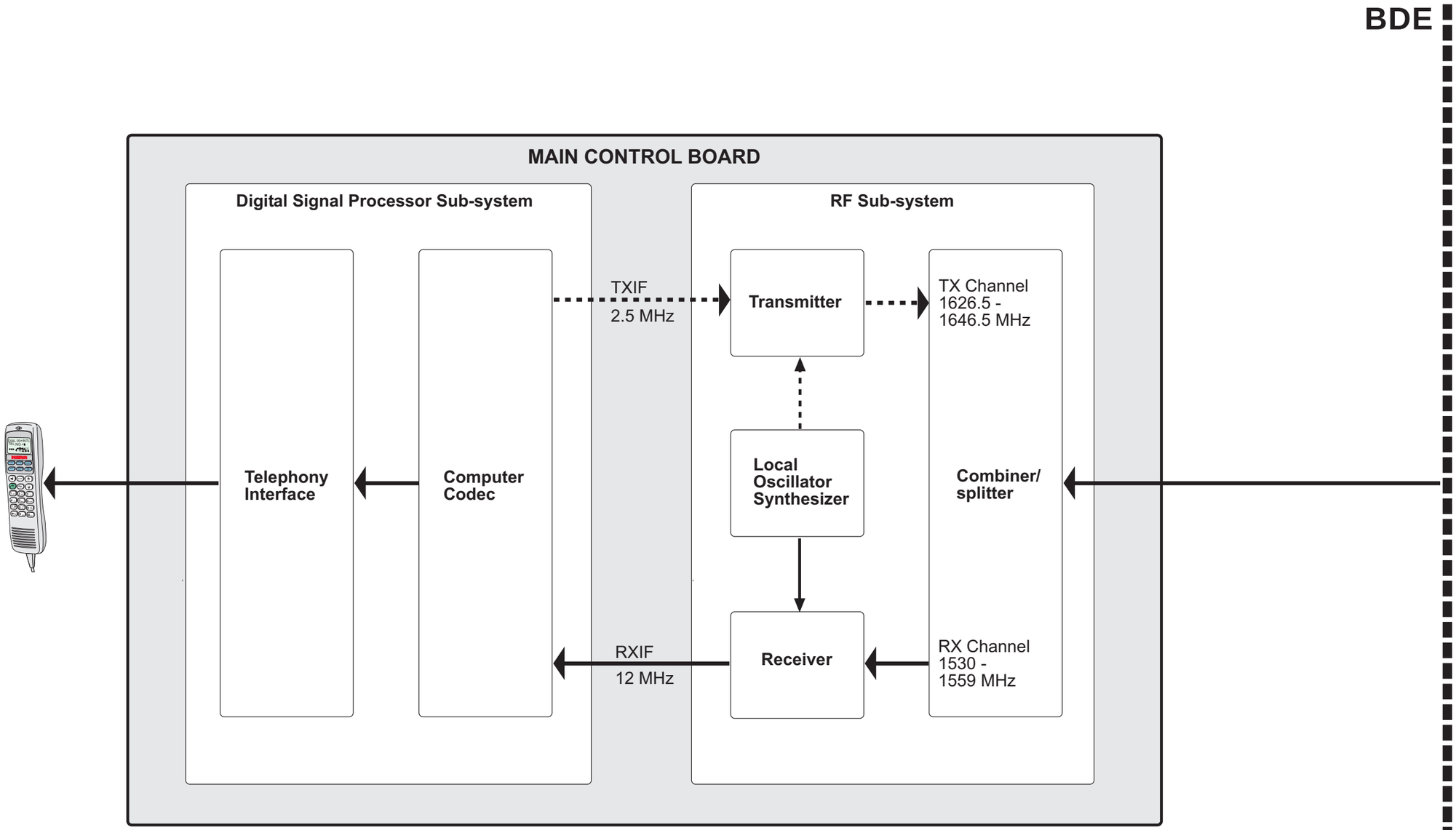
BIT No.

8	7	6	5	4	3	2	1		OCTET No.
Message type							81		1
MES ID									2
									3
									4
LES ID									5
spare					priority		spare		6
service nature			service type						7
channel parameters									8
destination terminal ID									9
spare					message number				10
CCITT CRC									11
									12

M1
CALL ANNOUNCEMENT



EXAMPLE: CALL ANNOUNCEMENT (TYPE 81_H)


BDE
MAIN CONTROL BOARD
Digital Signal Processor Sub-system
RF Sub-system
Telephony Interface
Computer Codec
TXIF
2.5 MHz
Transmitter
TX Channel
1626.5 -
1646.5 MHz
Local Oscillator Synthesizer
Combiner/ splitter
RXIF
12 MHz
Receiver
RX Channel
1530 -
1559 MHz

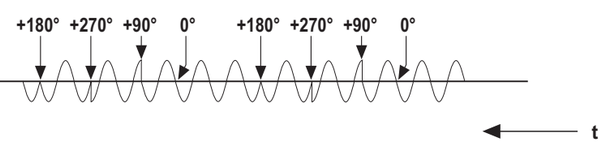
ADE

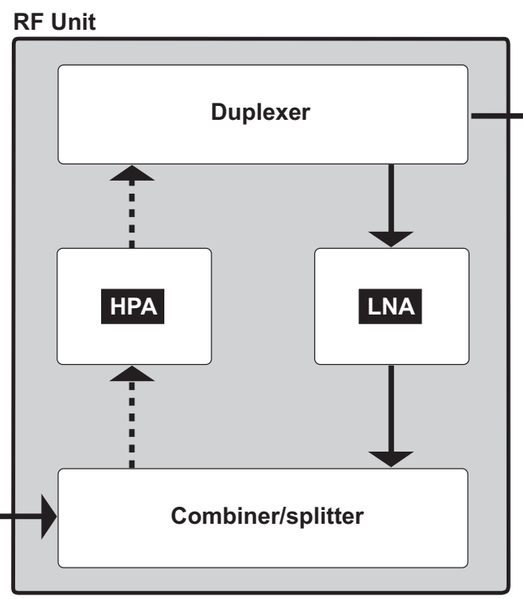
Forward Direction

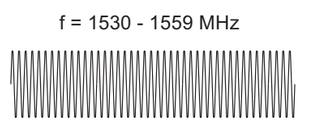
MES ⇐ LES

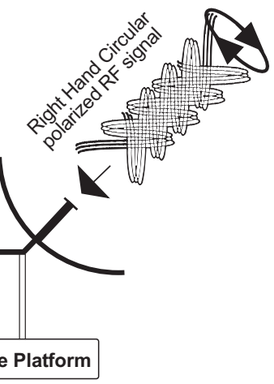
SCPC Channel (Single Carrier Per Channel)
In-band Signalling Mode

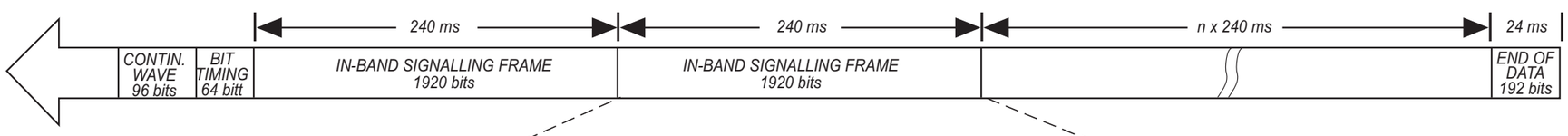
O-QPSK Encoded Signal
(O-QPSK = Offset Quadrature Phase Shift Keying)

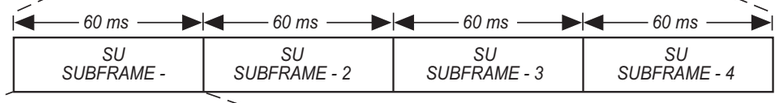


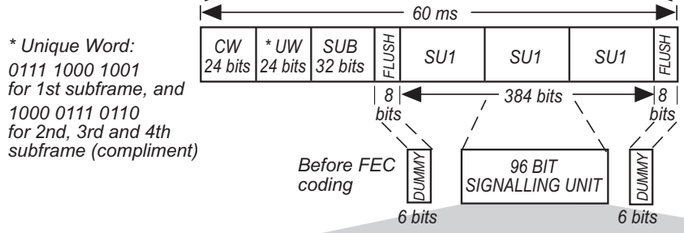








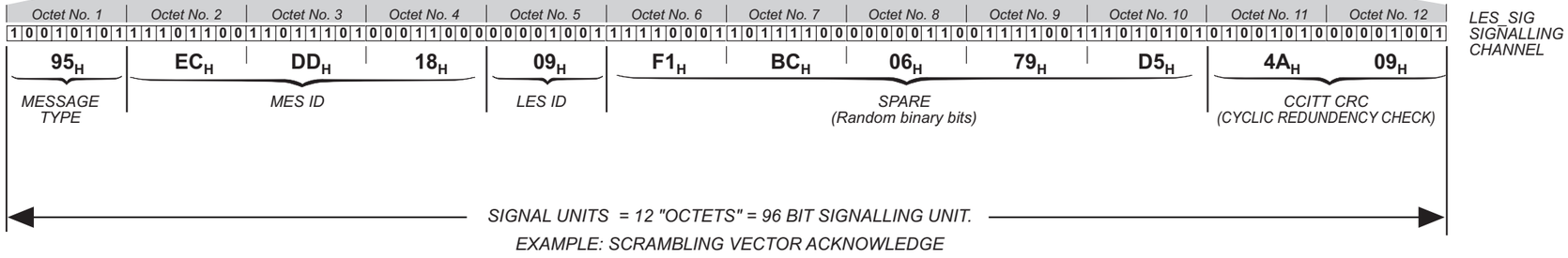


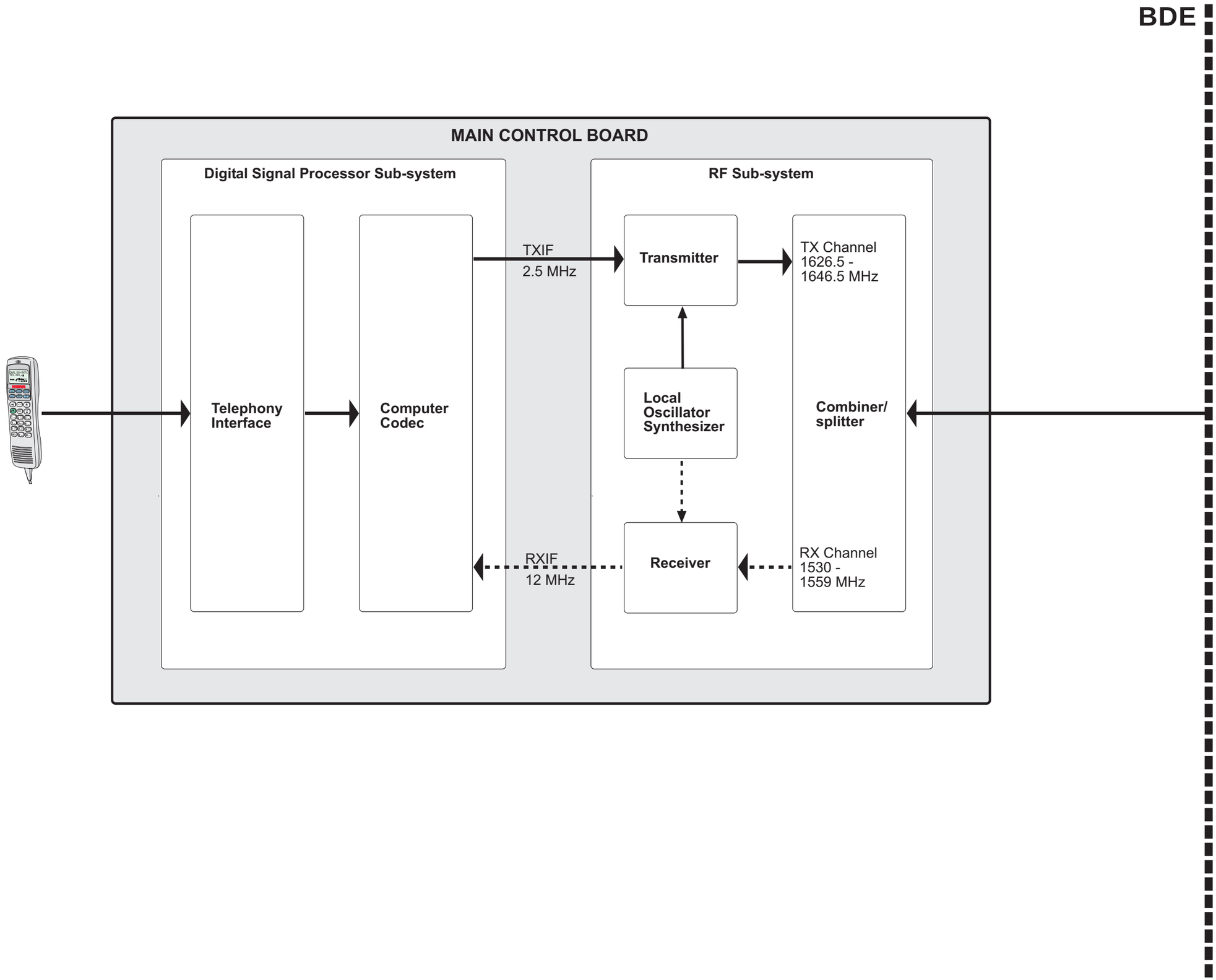


SIGNALLING UNIT – SU

BIT No. 8 7 6 5 4 3 2 1		OCTET No.
Message type	95	1
MES ID		2 3 4
LES ID		5
spare		6 7 8 9 10
CCITT CRC		11 12

M21
SCRAMBLING VECTOR ACKNOWLEDGE




BDE
MAIN CONTROL BOARD
Digital Signal Processor Sub-system
RF Sub-system
Telephony Interface
Computer Codec
TXIF
2.5 MHz
Transmitter
TX Channel
1626.5 -
1646.5 MHz
Local Oscillator Synthesizer
Combiner/ splitter
RXIF
12 MHz
Receiver
RX Channel
1530 -
1559 MHz

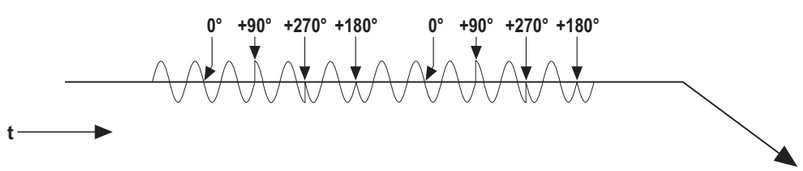
ADE

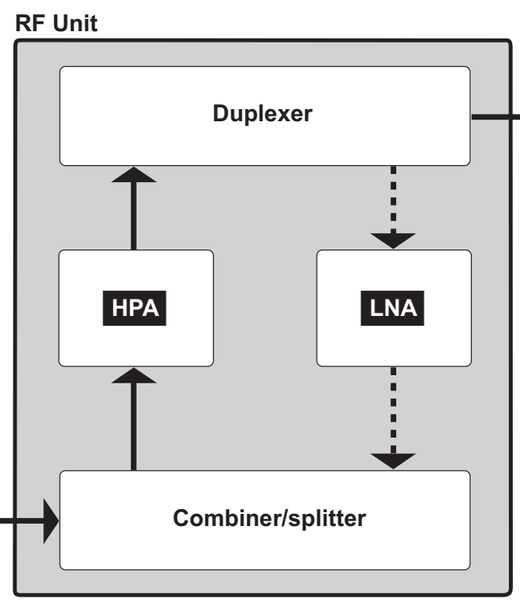
Return Direction

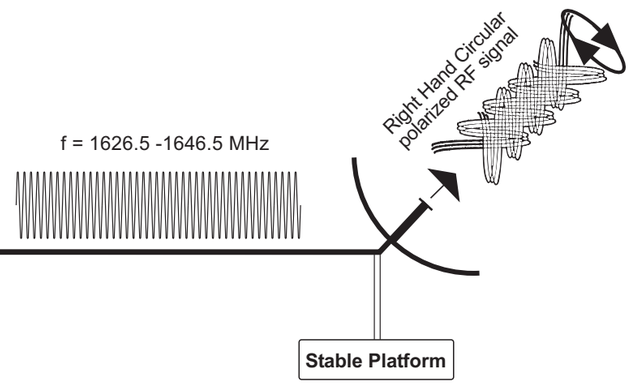
MES ⇒ LES

SCPC channel (Single Carrier Per Channel)
In-band

OQPSK Encoded Signal
(OQPSK = Offset Quadrature Phase Shift Keying)





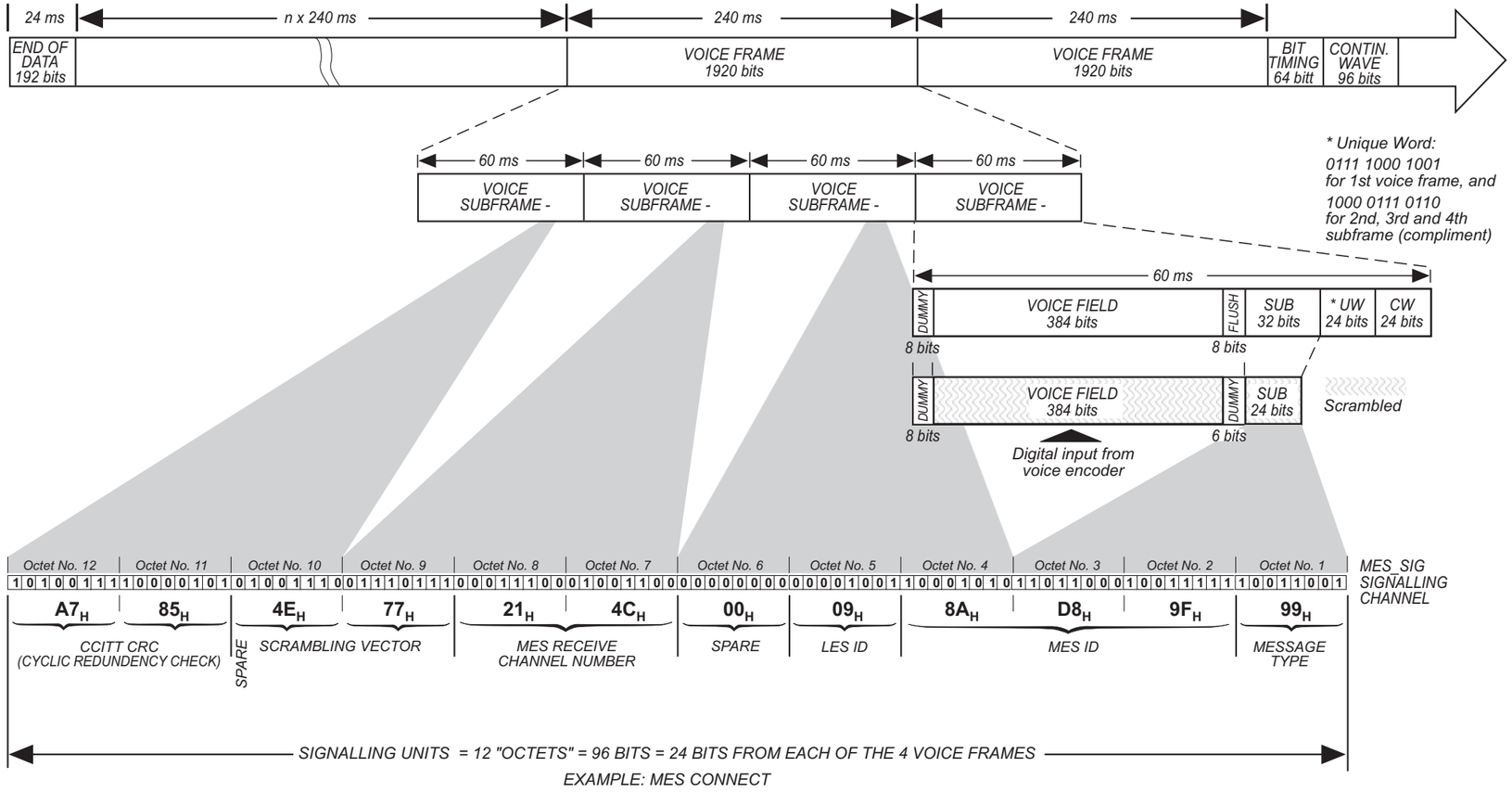


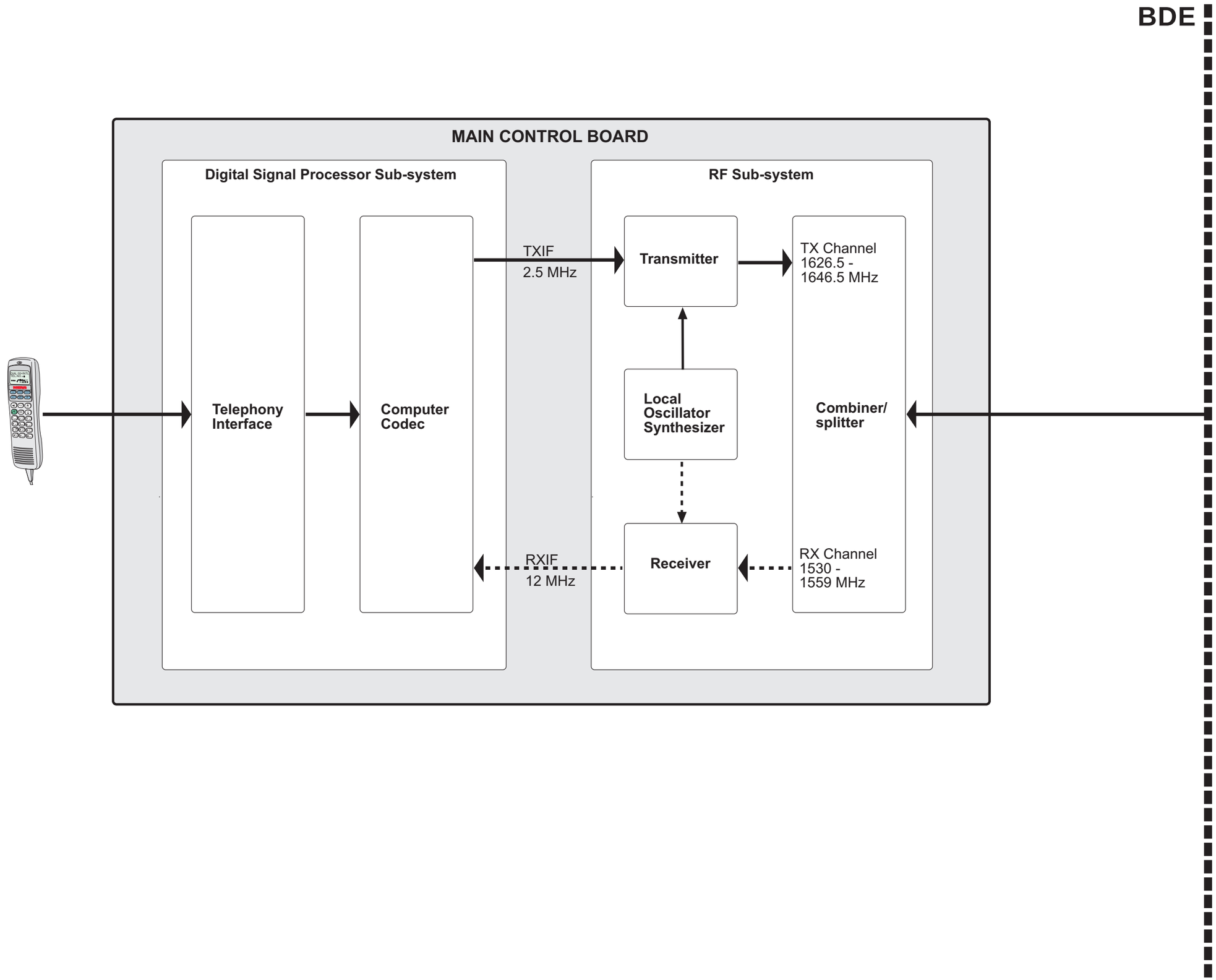
SIGNALLING UNIT – SU

BIT No.

8	7	6	5	4	3	2	1		OCTET No.
Message type							8A		1
MES ID									2
									3
									4
LES ID									5
spare									6
MES receive channel number								LSB	7
MSB									8
spare	scrambling vector								9
									10
CCITT CRC									11
									12

M25
MES CONNECT

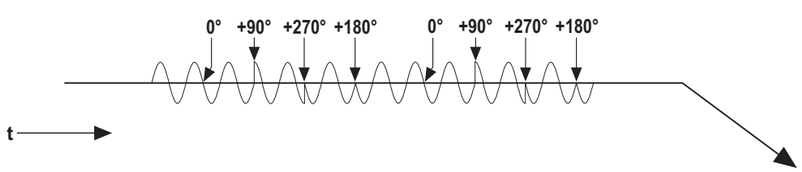


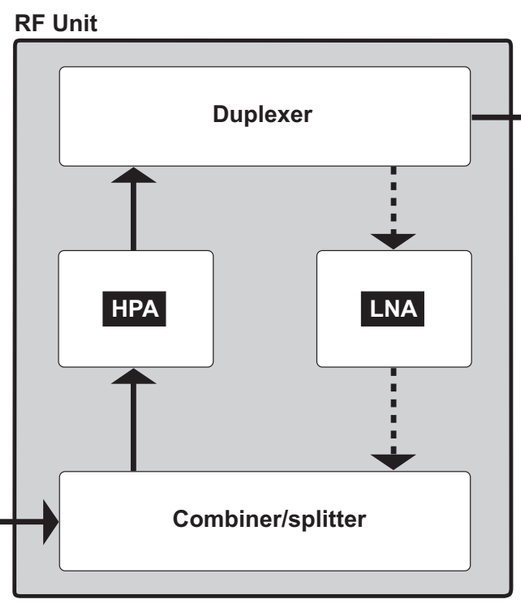

BDE
MAIN CONTROL BOARD
Digital Signal Processor Sub-system
RF Sub-system
Telephony Interface
Computer Codec
TXIF
2.5 MHz
Transmitter
TX Channel
1626.5 -
1646.5 MHz
Local Oscillator Synthesizer
Combiner/ splitter
RXIF
12 MHz
Receiver
RX Channel
1530 -
1559 MHz

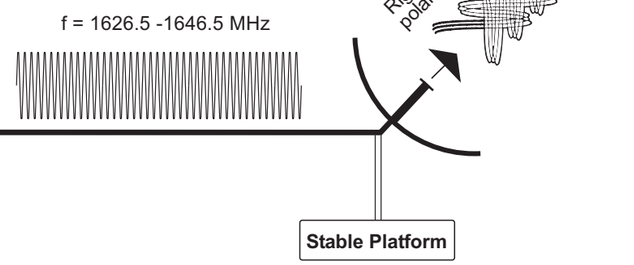
ADE

SCPC channel (Single Carrier Per Channel)
In-band Signalling Mode (CLEARING)

OQPSK Encoded Signal
(OQPSK = Offset Quadrature Phase Shift Keying)





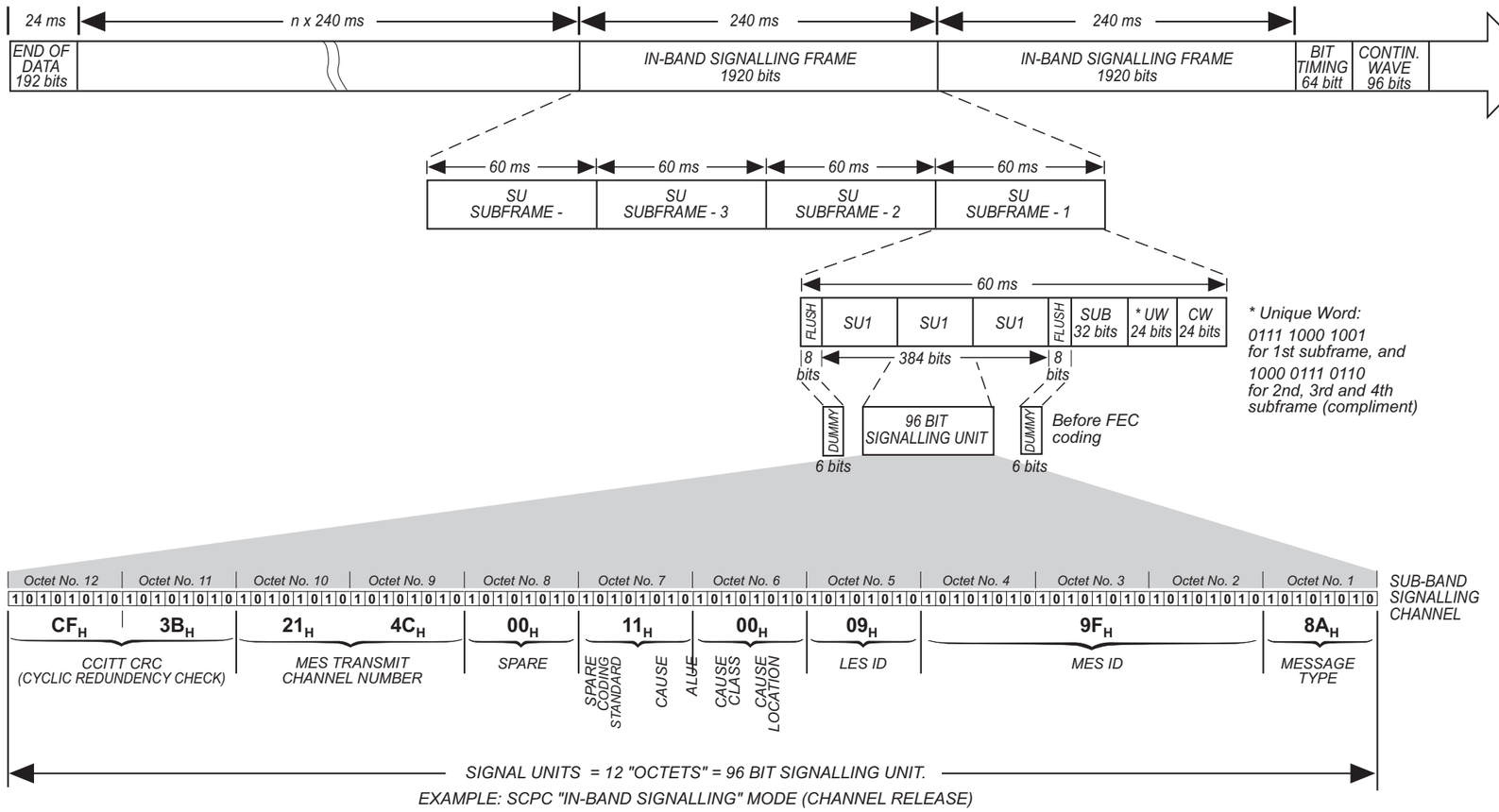


SIGNALLING UNIT – SU

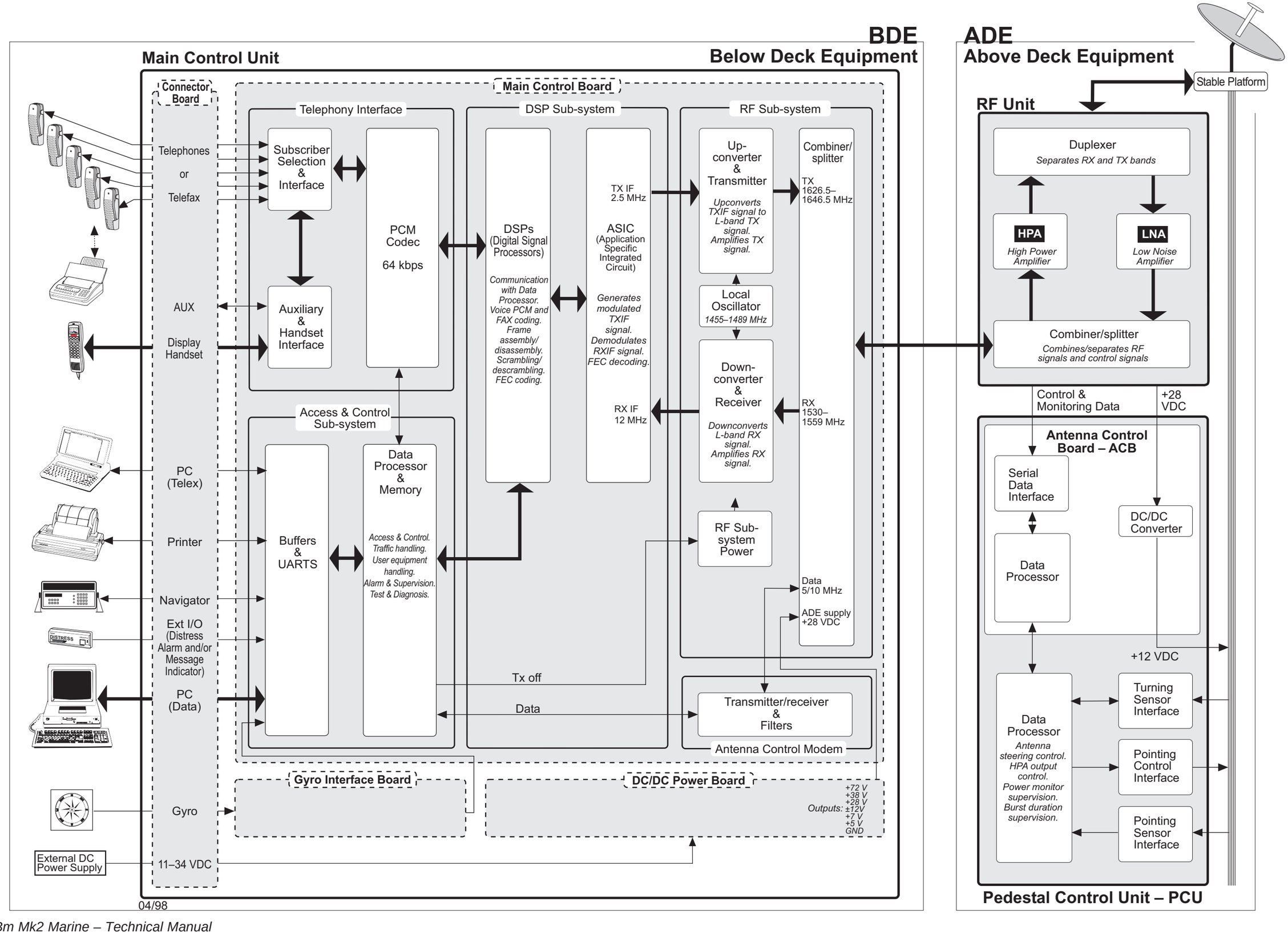
BIT No.

8	7	6	5	4	3	2	1		OCTET No.
Message type							8A		1
MES ID									2
									3
									4
LES ID									5
cause class				cause location					6
spare			coding std.	cause value					7
spare									8
MES transmit channel number							LSB		9
MSB									10
CCITT CRC									11
									12

M10
CHANNEL RELEASE



EXAMPLE: SCPC "IN-BAND SIGNALLING" MODE (CHANNEL RELEASE)


BDE
Below Deck Equipment
Main Control Unit
Connector Board
Main Control Board
Telephony Interface
DSP Sub-system
RF Sub-system
Telephones
or
Telefax
Subscriber Selection & Interface
PCM Codec
64 kbps
AUX
Auxiliary & Handset Interface
Display Handset
DSPs (Digital Signal Processors)
Communication with Data Processor. Voice PCM and FAX coding. Frame assembly/ disassembly. Scrambling/ descrambling. FEC coding.
TX IF 2.5 MHz
ASIC (Application Specific Integrated Circuit)
Generates modulated TXIF signal. Demodulates RXIF signal. FEC decoding.
RX IF 12 MHz
Up-converter & Transmitter
Upconverts TXIF signal to L-band TX signal. Amplifies TX signal.
Local Oscillator
1455–1489 MHz
Down-converter & Receiver
Downconverts L-band RX signal. Amplifies RX signal.
RF Sub-system Power
Combiner/ splitter
TX 1626.5–1646.5 MHz
RX 1530–1559 MHz
Data 5/10 MHz
ADE supply +28 VDC
Access & Control Sub-system
Data Processor & Memory
Access & Control. Traffic handling. User equipment handling. Alarm & Supervision. Test & Diagnosis.
Buffers & UARTS
PC (Telex)
Printer
Navigator
Ext I/O (Distress Alarm and/or Message Indicator)
PC (Data)
Tx off
Data
Transmitter/receiver & Filters
Antenna Control Modem
Gyro Interface Board
DC/DC Power Board
+72 V
+38 V
+28 V
Outputs: ±12V
+7 V
+5 V
GND
Gyro
External DC Power Supply
11–34 VDC
04/98
ADE
Above Deck Equipment
Stable Platform
RF Unit
Duplexer
Separates RX and TX bands
HPA
High Power Amplifier
LNA
Low Noise Amplifier
Combiner/splitter
Combines/separates RF signals and control signals
Control & Monitoring Data
+28 VDC
Antenna Control Board – ACB
Serial Data Interface
DC/DC Converter
Data Processor
+12 VDC
Data Processor
Antenna steering control. HPA output control. Power monitor supervision. Burst duration supervision.
Turning Sensor Interface
Pointing Control Interface
Pointing Sensor Interface
Pedestal Control Unit – PCU

MCU Interconnection Diagram

MAIN CONTROL UNIT – INTERCONNECTION DIAGRAM PAGE 1

Connector Board

Main Control Unit Board

Telephony Interface

Digital Signal Processing Sub-system

TEL J1
- 2 TEL-1A → J15/P2 A33
- 3
- 4 TEL-1B → A32

Telephone 1 (or Telefax)

J2
- 2 TEL-2A → A31
- 3
- 4 TEL-2B → A30

Telephone 2 (or Telefax)

J3
- 2 TEL-3A → A29
- 3
- 4 TEL-3B → A28

Telephone 3 (or Telefax)

J4
- 2 TEL-4A → A27
- 3
- 4 TEL-4B → A26

Telephone 4 (or Telefax)

J5
- 2 TEL-5A → A25
- 3
- 4 TEL-5B → A24

Telephone 5 (or Telefax)

AUX J6
- 3 EXOA → A22
- 6 EXOB → A21
- 5 EXIA → A20
- 4 EXIB → A19
- 1 EWA → A18
- 2 EWB → A17
- 7 MWA → A16
- 8 MWB → A15

HANDSET J13
- 6 HSA-RX → A12
- 8 HSA-TX → A10
- 7 HS-GNDA → A11

Display Handset
- 3 TXD (103) → A06
- 4 RXD (104) → A07
- 2 MS-ON → A08
- 5 12V
- 1 DIG GND → A05

DTE J7 → J14/P1
- 1 SCREEN (101)
- 2 TXD (103) → B27
- 3 RXD (104) → B26
- 4 RTS (105) → B25
- 5 CTS (106) → A20
- 6 DSR (107) → B24
- 7 GND (102) → A27
- 20 DTR (108) → A24
- 8 DCD (109) → B23
- 22 RI (125) → A23
- 15 TXCLK (DCE) → A26
- 17 RXCLK (DCE)
- 24 TXCLK (DTE) → A21
- 23 DRS (111) → A19
- 25 DRS (112) → B19

PC (Data)

Telephone Interface & Relay Circuits

SWITCH (1:7)

IL (0:5)

TXS

RXS

Codec Selection Circuits

VFRO

VFRI

PCM Codec

DRI

DTI

SCLK_OUT

F_SYNCI

-CDC_SEL

CDC_CLK

RESET

RXE

TXE

CDC_RX

CDC_TX

Master Digital Signal Processor

TX-SAMBA & D/A Converter

TXMUTE

TXIF

~ 2.5 MHz

RX-SAMBA & A/D Converter

RXIF

~ 12 MHz

Digital Signal Processor

Access & Control Sub-system (see also diagram page 2)

Telephony Control Latch

UART CH. A

RS-232 Serial Interface

RS-232

CPU

SCC1

Data (0:15)

Address (1:2)

-RES_DSP

R-W

-HIP_2111

-TX_REQ

-RX_RDY

To/from RF Sub-system (see diagram page 2)

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MAIN CONTROL UNIT – INTERCONNECTION DIAGRAM PAGE 2

To/from DSP (see diagram page 1)

Connector Board Cont´d

Main Control Unit Board Cont'd

Access & Control Sub-system (see also diagram page 1)

RF Sub-system

PC J8 — J14/P1

PC: 2 RXD (104) B21; 3 TXD (103) B22; 4 DTR (108) A19; 5 GND (102) A22; 6 DSR (107) B19; 7 RTS (105) B20; 8 CTS (106) A20

PRINTER P9

Printer: 2 RXD (104) B17; 3 TXD (103) B18; 4 DTR (108) A15; 5 GND (102) A18; 6 DSR (107) B15; 7 RTS (105) B16; 8 CTS (106) A16

EXT I/O J10

Distress Alarm and/or Message Indicator: 2 EXT-A A04; 6 EXT-B A03; 9 12V FUSED A01 (+12V); 5 A02

NAVIGATOR J11

NMEA-0183 Heading Sensor: 1 LIST1-A A30; 2 LIST1-B B30; 3 TALK1-A A29; 4 TALK1-B B29

NMEA-0183 Position: 5 LIST2-A A28; 6 LIST2-B B28

Optocoupler; Optocoupler

GYRO P12 — J18

Gyro: 1 PHASE 1 B20; 2 PHASE 2 B19; 3 PHASE 3 B18; 4 SYNC REF- B17; 5 COM REF A16; 6 SYNC REF + A17

11 – 34 V DC: A1; A2

OFF / ON

RS-232 Serial Interface

RS-232 Serial Interface

RS-485 Serial Interface

UART CH. D

UART CH. C

UART CH. B

CPU

SCC2

SCC3

Latch & Buffer

* TX1 LOCK
BWCTRL1
BWCTRL2
BWCTRL3
SYNTDAT
SYNTCLK
TXSLCT
* TX2 LOCK
* LO LOCK
LOSLCT
Clock
Data

* OSC_LOCK

(STATUS function message)*

* RX SIGNAL
-TXOFF

Memory

ANT_TX

ANT_RX

GYRO 3 G-CNTRL 3 GYRO 2 G-CNTRL 2 GYRO 1 G-CNTRL 1

-POWER-OFF KEY-ON DC-LEVEL

RXIF ~12 MHz

TXIF ~2.5 MHz

TXMUTE

~18.3 MHz Tracking filter (PLL) ~18.3 MHz Up-converter (PLL)

15.84 MHz

1626.5 - 1646.5 MHz

Saturn B

Combiner/ splitter

System clock

LOREF

Local oscillator (PLL)

1450 - 1484 MHz

X-ta osc.

x1 15.84 MHz

x4 63.36 MHz

BW=3 MHz ~12 MHz AGC Amp. ~75 MHz

1530 - 1559

Power detector

Tx supply

Antenna Control Modem

Transmitter Lowpass Filter

Receiver Highpass Filter

DATA +28V +28V RET

+72 V RET +72V -38V RET -38V TEMP_RET TEMP DC_LEVEL RET DC_LEVEL KEY_ON RET KEY_ON POWER_OFF RET -POWER_OFF -12V -12V RET +5V +5V RET +12V +12V RET +7V RET +7V +28V +28V RET

J14/P1 B31 A34 B32 B33 A32 A33

J14/P1 A12 B12 A13 B13 A14 B13

J17/P2 A04 B04 A05 B05 A06 B06 A07 B07 A08 B08 A09 B09 A10 B10 A11 B11 A12 B13 A13 B13 A14 B15 A15 B15 A16 A16 A17-A18 B17-B18 A19-A20 B19-B20

Automatic STEP GYRO/SYNCHRO GYRO Input Sensing/conversion

Gyro Board

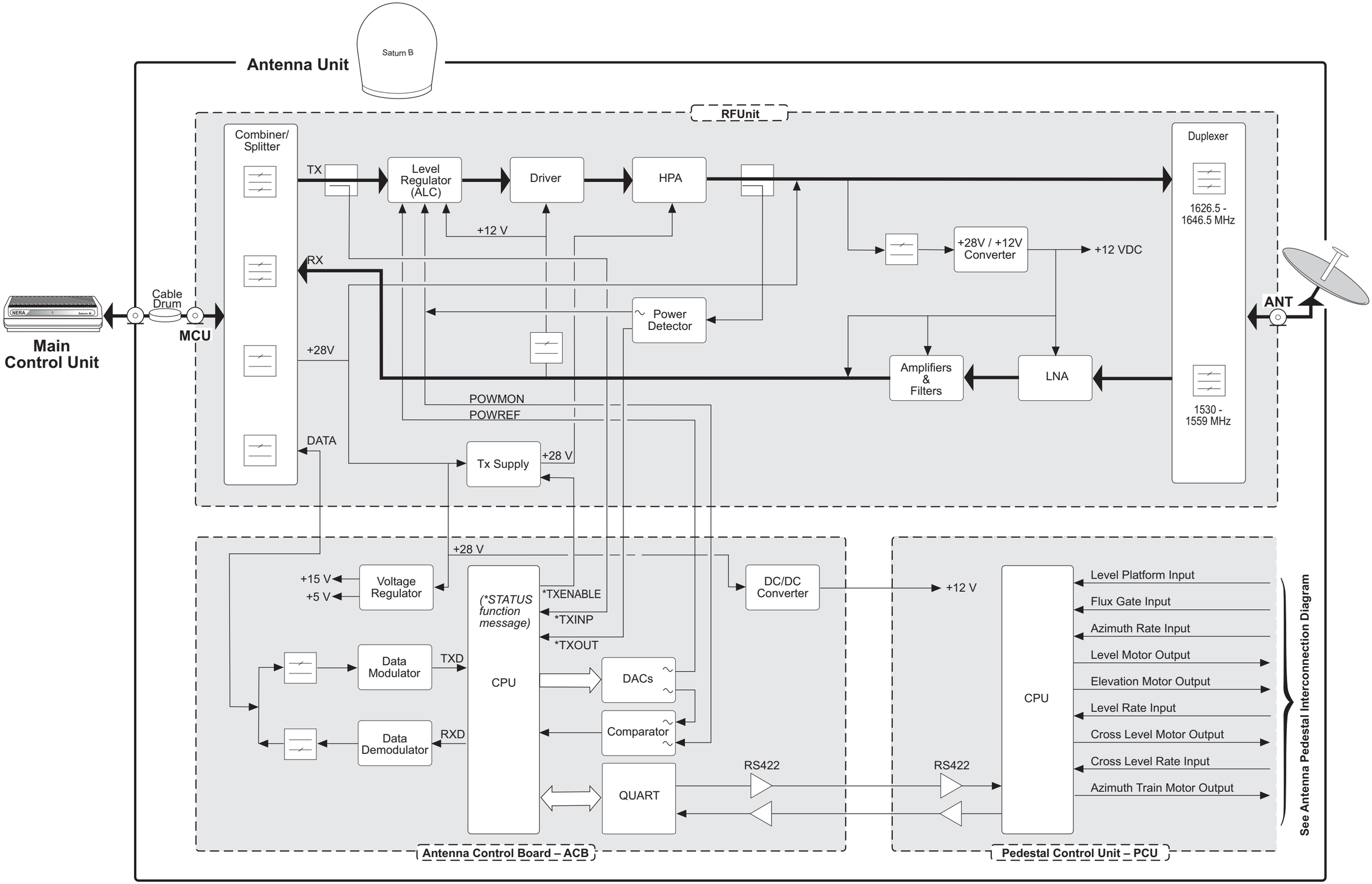
DC-DC Voltage Generator/regulator

Fuse

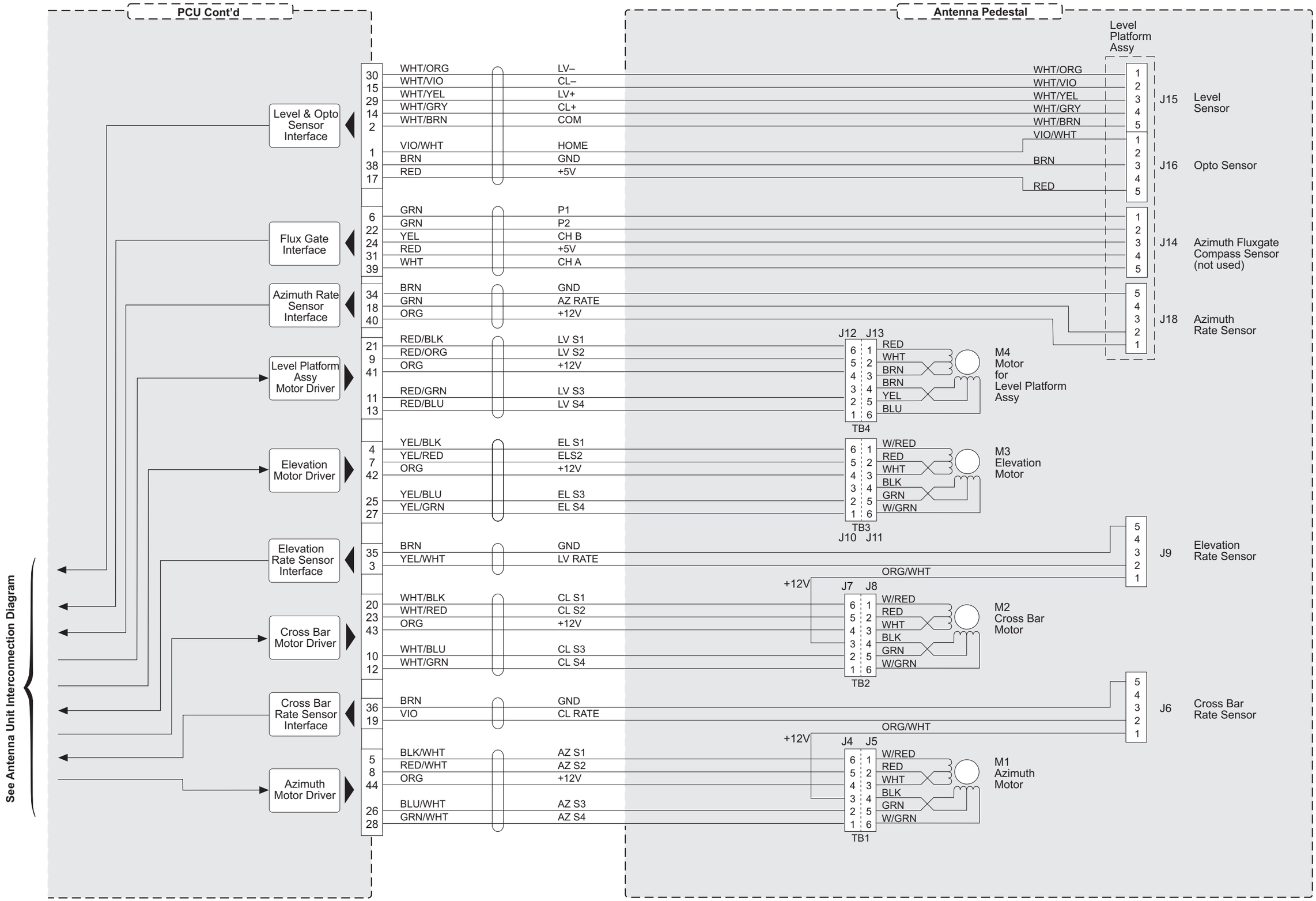
Power Board

3/98

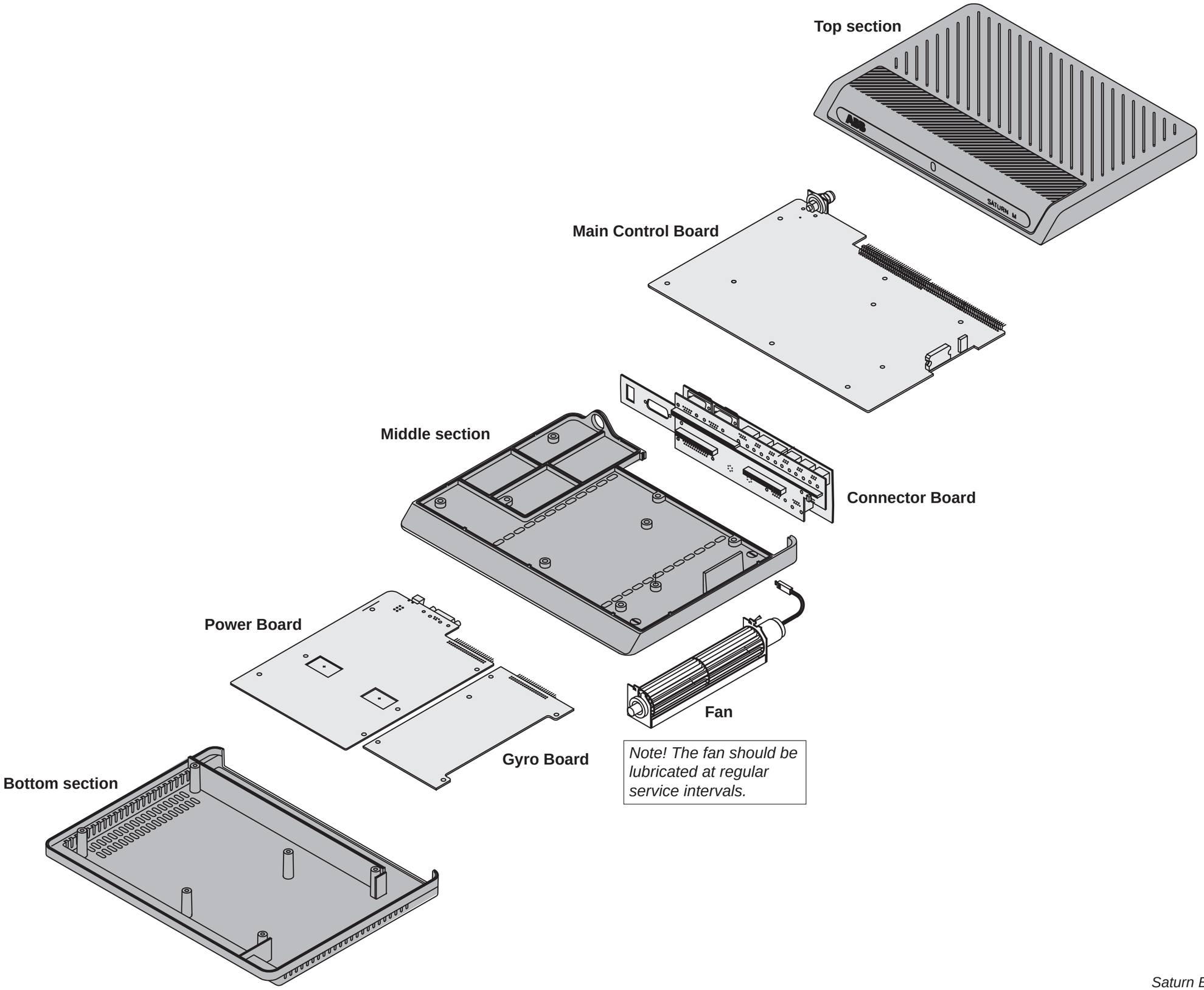
Antenna Unit Interconnection Diagram



Antenna Pedestal Interconnection Diagram



MCU Parts Identification



Note! The fan should be lubricated at regular service intervals.

1

- **Place the MCU with the bottom side facing up.**
- **Remove the screws assembling the unit.**

Note! 6 screws - 35 mm. See figure!

2

- **Holding the unit assembled, turn it carefully around.**
- **Remove the top cover.**

3

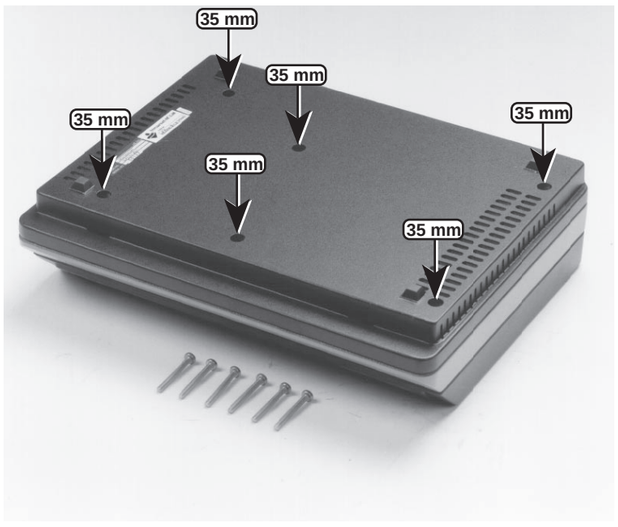
- **Lift the electronics section off the bottom.**
- **Remove the bottom section and place the electronics section carefully on a clean surface.**

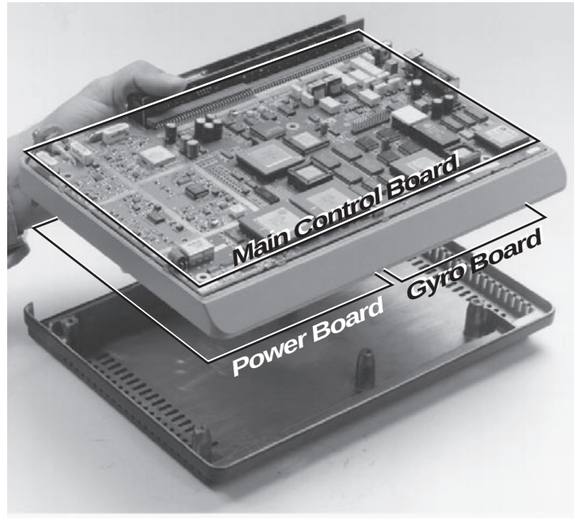
If replacing the Gyro Board: *Turn the electronics section around and continue from step 4.*

If replacing the Power Board: *Turn the electronics section around and continue from step 5.*

If replacing the Main Control Board: *Continue from step 7.*

DISMOUNTING → DISMOUNTING → DISMOUNTING →





← MOUNTING ← MOUNTING ← MOUNTING

10

- **Mount the screws assembling the MCU.**

Note! 6 screws – 35 mm. See figure!

9

- **Place the top cover.**
- **Holding the unit assembled, turn it carefully around.**

8

- **Turn the electronics section around.**
- **Place the electronics carefully into position on the bottom section.**

4 Gyro Board

- **Remove the screws fastening the Gyro Board.**
  Note! 2 screws – 6 mm. See figure!
- **Lift the front end of the circuit board and disengage it carefully from the edge connector.**

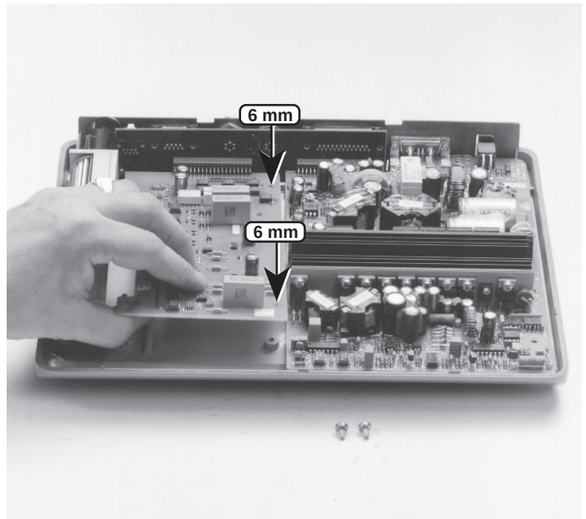
5 Power Board

- **Remove the screws fastening the DC power receptacle**
  Note! 2 screws – 8 mm, hexagon head (5 mm spanner)
  See figure!

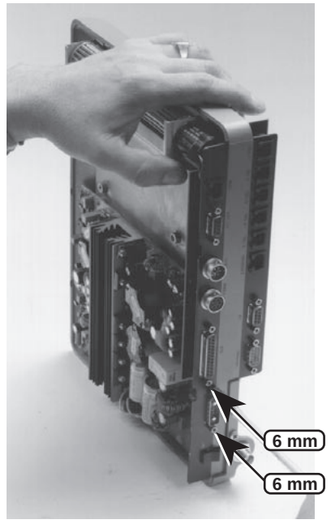
6

- **Remove the screws fastening the Power Board.**
  Note! 3 screws – 2 sizes (6 mm/10 mm). See figure!
- **Lift the front end of the circuit board and disengage it carefully from the edge connector.**

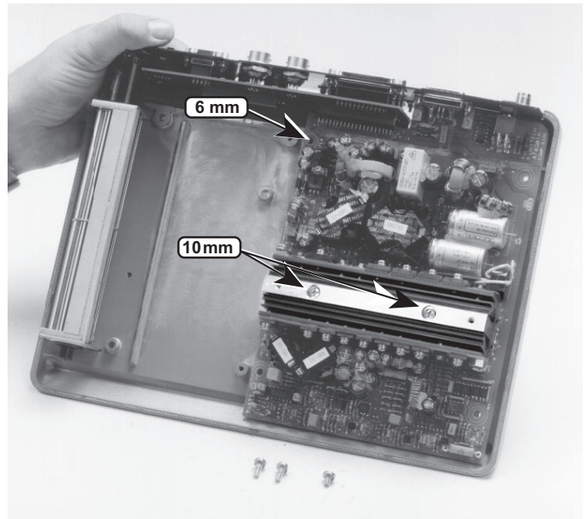
DISMOUNTING → DISMOUNTING → DISMOUNTING →



M4 x 6
6 mm
2 pcs



8 mm
2 pcs



M4 x 6
6 mm
1 pc

M4 x 10
10 mm
2 pcs

← MOUNTING ← MOUNTING ← MOUNTING

7

- **Enter the Gyro Board carefully into the edge connector.**
- **Fasten the Gyro Board.**
  Note! 2 screws - 6 mm. See figure!

6

- **Mount the DC power receptacle.**
  Note! 2 screws – 8 mm with hexagon head (5 mm spanner).

5

- **Enter the Power Board carefully into the edge connector.**
- **Fasten the Power Board.**
  Note! 3 screws – 2 sizes (6 mm/10 mm). See figure!

7 Main Control Board

- **Remove the screws fastening the Main Control Board**
  Note! 3 screws - 6 mm. See figure!
- **Remove the clips pressing the IC against the cooling plate.**
  Note! Save the Sil pads.
- **Unscrew the coaxial receptacle.**
  Note! 3/8" wrench. Nut and lock washer.

8

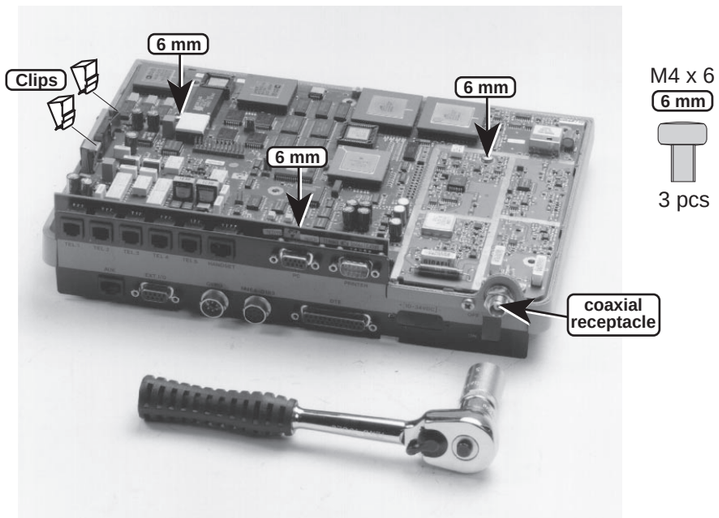
- **Lift the front end of the circuit board and disengage it carefully from the edge connector.**

9

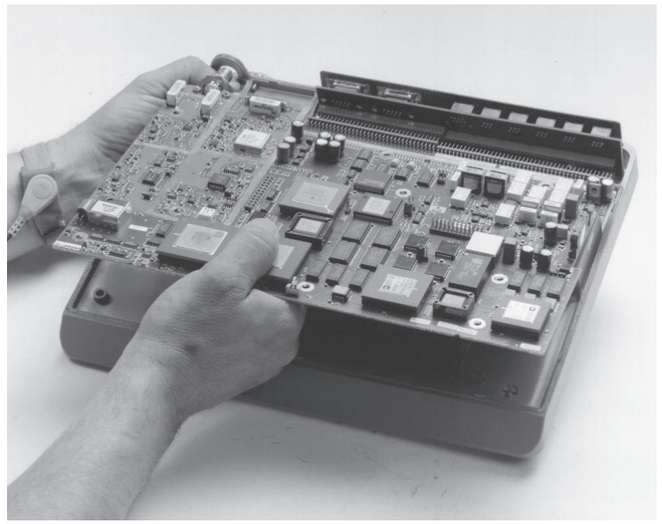
- **Disconnect the fan wire plug.**

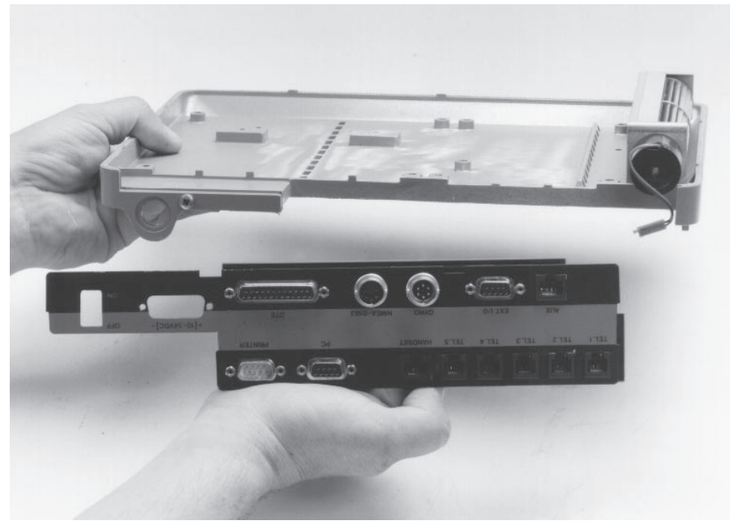
The Connector Board is now loose and can be removed.

DISMOUNTING → DISMOUNTING → DISMOUNTING →



M4 x 6
6 mm
3 pcs





← MOUNTING ← MOUNTING ← MOUNTING

4

- **Mount the Main Control Board**
  Note! 3 screws - 6 mm. See figure!
- **Mount the coaxial receptacle.**
  Note! Nut and lock washer. 3/8" wrench.
- **Replace the clips.**
  Note! Insert a sufficient amount of Sil pads so as to avoid tension on the IC.

3

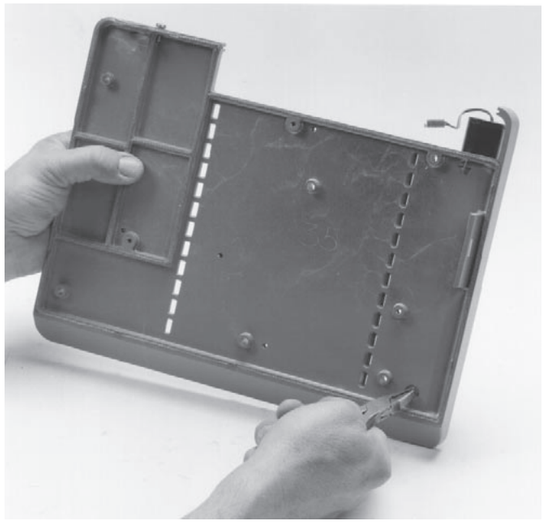
- **Enter the Main Control Board carefully into the edge connector.**

2

- **Connect the fan wire plug on the Connector Board**
- **Place the Connector Board in correct position.**

10 Replacing the fan

- **Straighten the lugs fastening the fan assembly.**
- **Pull off the fan assembly**



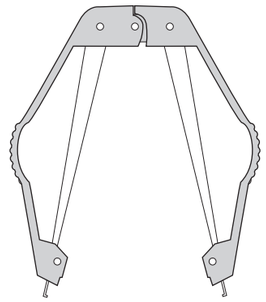
Replacing the DSP PROM

Tools required:

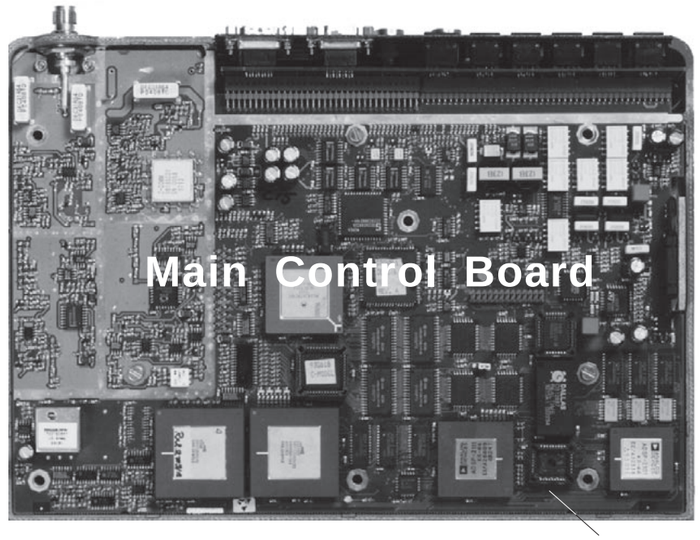
- *PLCC extractor*
- *Wrist strap*

- **Follow the instructions in steps 1 and 2 of the dismounting procedure.**
- **Locate the DSP PROM**
- **Place the PLCC extractor diagonally over the PROM as shown in the figure.**
- **Carefully pull up the PROM from the socket.**

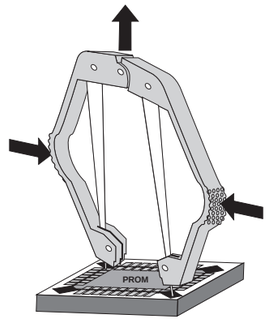
DISMOUNTING → DISMOUNTING → DISMOUNTING →



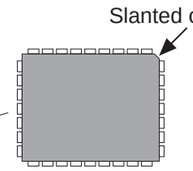
PLCC Extractor



DSP PROM



Extraction of DSP PROM



← MOUNTING ← MOUNTING ← MOUNTING

1

- **Install the fan assembly.**

  Make sure that the attachment lugs enter the slots in the mounting plate thoroughly .

- **Twist the lugs to fasten the fan assembly.**

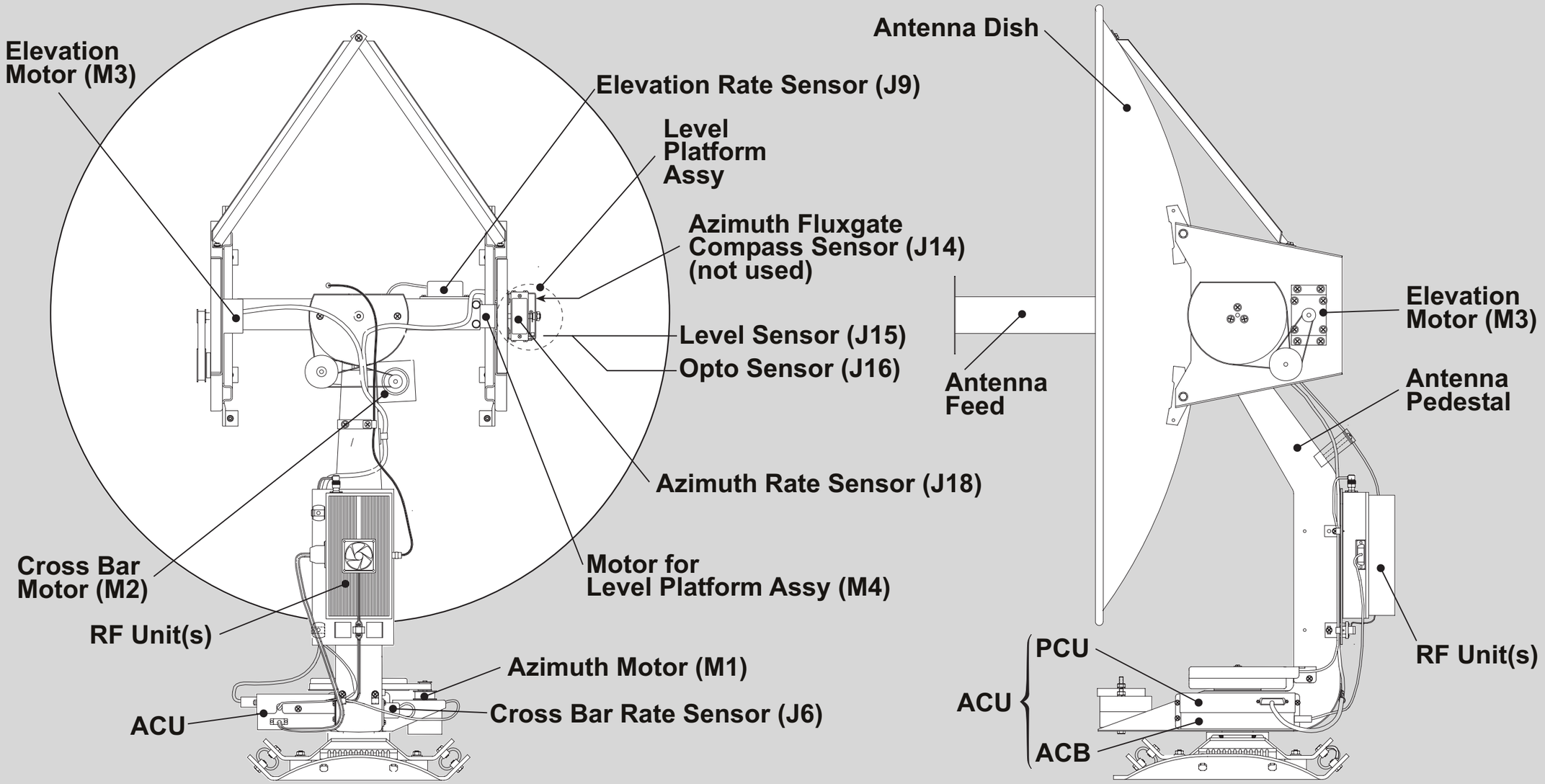
IMPORTANT!

Use wrist strap when handling the new PROM!

- **Align the PROM as shown in the figure and push it carefully down into the socket.**

  Note position of the slanted corner as shown!

- **Continue from step 5 of the mounting procedure.**


Elevation Motor (M3)
Elevation Rate Sensor (J9)
Level Platform Assy
Azimuth Fluxgate Compass Sensor (J14) (not used)
Level Sensor (J15)
Opto Sensor (J16)
Azimuth Rate Sensor (J18)
Motor for Level Platform Assy (M4)
Cross Bar Motor (M2)
RF Unit(s)
Azimuth Motor (M1)
Cross Bar Rate Sensor (J6)
ACU
Antenna Dish
Antenna Feed
Elevation Motor (M3)
Antenna Pedestal
RF Unit(s)
ACU
PCU
ACB

Above Deck Equipment

All devices contained in the "Above Deck Equipment" (ADE) are mounted on a pedestal and placed inside a glass fibre radome for protection. The devices include:

- servo stabilized three-axis pedestal
- antenna dish
- receiver LNA
- transmitter HPA, and
- electronic control boards.

*Refer to the **Antenna Parts Identification** on the previous page for an overview of the equipment.*

The Antenna Pedestal keeps the antenna dish continuously pointing at the satellite position independent of the ship's motions. The Antenna Pedestal acts as a small robot. It includes sensors to detect motions of the ship, and motors to move the antenna in all directions.

*The **Antenna Pedestal Interconnection Diagram** shows the electrical connections in the ADE.*

The Antenna Control Board (ACB) and the Pedestal Control Board (PCU) are mounted together, forming the Antenna Control Unit (ACU).

The basic robot control of the pedestal and control of the RF units are managed by the ACB and PCU boards. Each board contains a separate data processor with its own software. The overall performance is remotely controlled from the main system in the BDE.

A single coaxial cable is used for connection between the below deck equipment BDE and the ADE. The cable transfers three types of signals:

- RF receive and transmit signals at 1.5 - 1.6 GHz.
- Modem control signals at 5 MHz and 10 MHz for serial communication between BDE and ADE.
- DC power supply, 28 VDC, 4A.

The incoming cable connector is situated below the ADE outside the base pan. Inside the radome, a flexible cable is placed in the centre of the pedestal base, curled up in a rewind cable housing, and ends up in the RF transmitter unit, where the signals are split /combined and distributed to the other units in the ADE.

Pedestal robot functions

There are four stepper motors in the pedestal for rotational movements.

Three of the motors aim the antenna at a specified direction in the sky, and keep it there by compensating for ship motions:

- Azimuth Motor (M1)
- Elevation Motor (M3), and
- Cross Bar Motor (M2)

The fourth motor:

- Level Platform Assy Motor (M4)

forces the platform out of level position in the EL-axis to the number of degrees signalled from the MCU.

Various sensors detect rotational motions of the pedestal:

- three rate sensors detect angular movements around its rotational axis.
- the Level Sensor (J15) located on the Level Platform Assy detects deviation from the gravitational vectors. The Level Sensor gives feedback to the Level Platform Assy Motor (M4) and to the Elevation Motor (M3) when the cross bar is off level.

The motor control of the elevation and the cross bar axis are independent servo loops. The rate sensor deviation in these axes are used directly to move the motor in the opposite direction to compensate for sea movement. But because the low inherent accuracy of the rate sensors, each of the control loops also includes a level tilt sensor feedback to assure long time stability.

The coupling between motor rotation axis and influence of sensors is as follows:

Axis of rotation:	***Stepper motor:***	***Sensors / influence:***
***Elevation axis**:*	Elevation Motor (M3)	Elevation Rate Sensor (J9) Level Sensor (J15)
***Cross bar axis**:*	Cross Bar Motor (M2)	Cross Bar Rate Sensor (J6) Level Sensor (J15)
***Azimuth axis**:*	Azimuth Motor (M1)	External gyro compass Azimuth Rate Sensor (J18)

Error detection in the pedestal robot

If there is an abnormal behaviour of the pedestal, and no visual faults like broken motor belts or broken cables are observed, first check the alarm and status messages, *refer to the **Alarm Table** and **Terminal Status Table** for details.*

If there is no error or status messages present, the pedestal should be serviced by trained service personnel. A few hints may be helpful in fault diagnosis:

1 With the system in standby operation, check that all step motors are active.
If movement of a step motor cannot be observed, check that the corresponding axis can be moved by force. If the axis is moveable by force, but never seems to be activated by the system, it may either be the motor itself, the supply leads, the rate sensor, level sensor or the PCU board that fails.

2 With power off, make sure that the pedestal can be moved freely in all directions. Switch system power on, and wait until system initialization is completed (displayed on the handset up to 2 min. after power on).
Disconnect the power leads to the Azimuth Motor and/or make sure that the azimuth axis is fixed in one position.
To check that the Level Sensor functions properly, move the cross bar and the level platform off level by hand.
If lack of compensation is observed, the rate sensor in the corresponding axis is most probably the reason. If a long time drift out of the normal position is observed, it may either be the rate sensor or the level sensor that cause problems.

Spare Parts – Above Deck Equipment

Description	Nera Part Number
Antenna Control Unit (ACU)	QROF 219 9041
Fan	QBKV 101 001/12
Step motor (Az/El/Cross)	R 906 566/8415
Step motor (Level platform)	MM 111 100
Rate sensor	MM 112 266-2
Fluxgate PCB assy	MM 111 459
Level platform PCB assy (MM 112 442)	MM 151 20-2
PCU PCB assy	MM 113 101
Drive belt (AZ motor drive belt)	108 870-13
Drive belt (AZ drive belt)	108 870-5
Drive belt (Cross bar drive belt)	108 870-25
Drive belt (Cross bar motor drive belt)	108 870-16
Drive belt (EL motor drive belt)	108 870-17
Drive belt (EL drive belt)	108 870-7
Tx/Rx (Transceiver)	QUFC 911 931
Level platform assy belt	109 770-17

Spare Parts – Main Control Unit

Description	Nera Part Number
Main Control Board	QROF 219 9001-2
Power Board	QROF 219 9002
Connection Board	QROF 219 9005
Gyro Board	QROF 219 9003
Complete fan	QSXK 911 959

Service Level Functions

General

The diagram provides an overview of all Saturn Bm functions, including five special "Service Level" functions:

- **Terminal Status**, function no. 33 *
- **Statistic info**, function no. 34 *
- **Error**, function no. 35
- **Restart cause**, function no. 36
- **Erase all NV data**, function no. 79

The "Service Level" is selected with the "**SET USER LEVEL**" function no. 12.

(See "Setting User Level" in the Operator's Manual)

The service level is set by keying 5 when selecting level, and entering the password **753951** when prompted.

(1=user level, 2=operator level, 5=service level).

Terminal Status (3)3 *

The Terminal Status function shows the status of several test points monitored in the MCU. The signals are marked with an asterisk (*) on the MCU and Antenna Unit block diagrams. They are also listed in the Terminal Status Table.

Statistic Info (3)4 *

The Statistic Info function has no relevance for service. It should only be used on request from NERA.

Error (3)5

The (SW) error function has no relevance for service. It should only be used on request from NERA.

Restart Cause (3)6

The Restart Cause function displays the reason for the latest restart causes. It always contains at least the Power up restart cause.
The function is a development tool, and has no relevance for service. It should only be used on request from NERA.

Erase all NV data (7)9

The Erase all NV data function can be used if configuration mistakes are made and the user has difficulties in recovering the system. It resets all configuration values to default.

Service printouts on PC

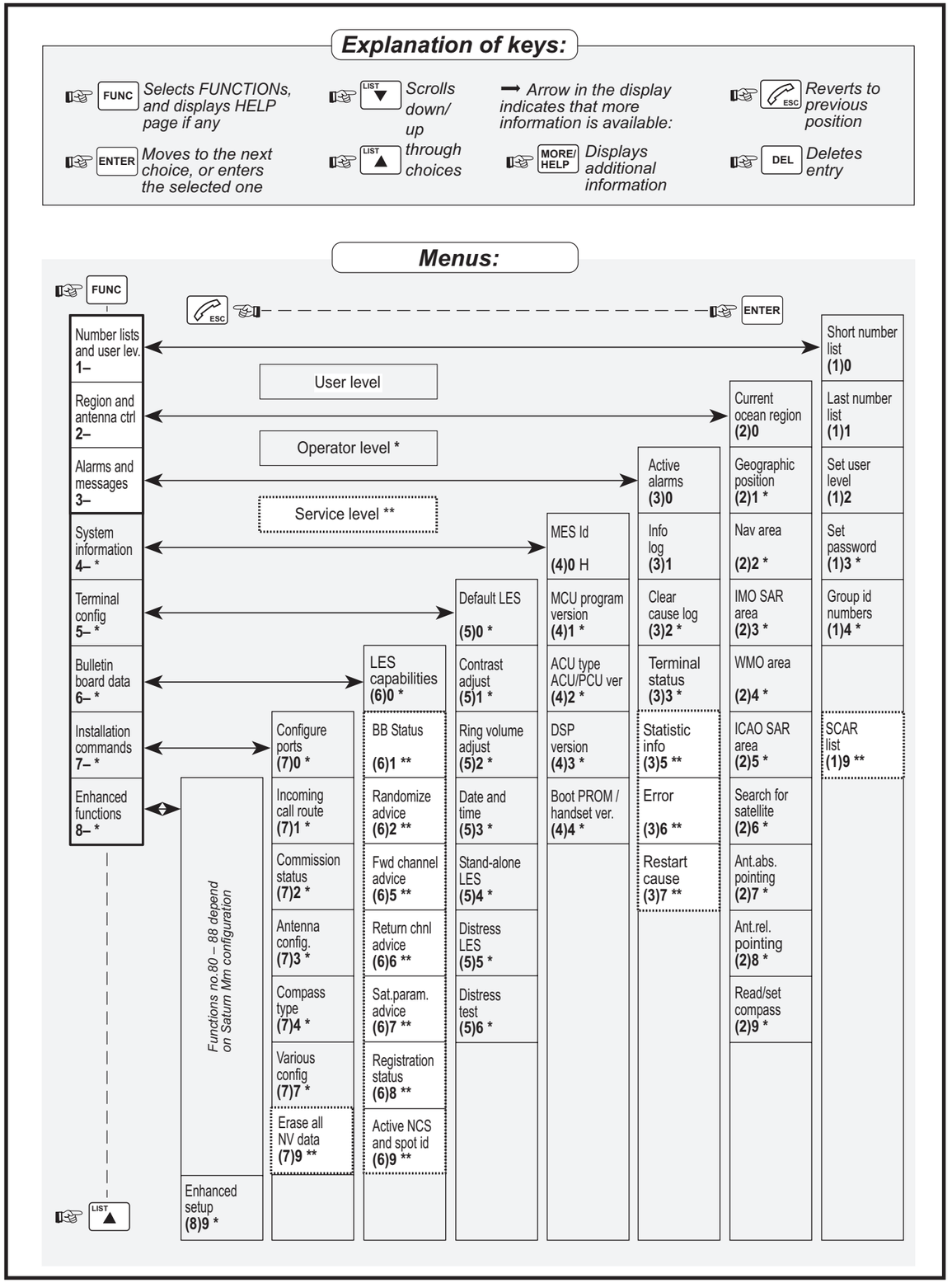
Information from the following functions can be routed to a PC:

- **Active alarms**, function no. 30
- **Info log**, function no. 31
- **Clear cause log**, function no. 32
- **Terminal Status**, function no. 33 *
- **Statistic info**, function no. 34 *

Connection

A modem cable is connected between the **DTE** port on the MCU and the **Serial** port of the PC. A terminal emulator program, e.g. Procomm, must be set up with the following port configuration:

Default 19.2 Kbps, 8-bit, no parity, 1 stopbit, or as set with function no.86, see Saturn B Data Service Operator's Manual.



Ref No.	Display Message	Comments	Action
0	RX LOCK FAILURE	Receiver synthesizer out of lock	• Replace MCB board.
1	ANTENNA LINK FAILURE	No communication with antenna.	• If also ANTENNA INIT FAILURE, check FUNC. 33 "RX SIGNAL": -if "OFF", check antenna cable. -if "ON", replace antenna TX unit. • Replace antenna ACU. • Replace MCB board.
2	TERMINAL ID CRC FAILURE	ID PROM in Main Control Unit (MCU) defective.	• Replace ID PROM.
3	TX DETECTOR FAILURE	Illegal initial transmitter output level detected in Antenna Control Unit (ACU).	• If also TX MONITOR FAILURE, check FUNC. 33 "RX SIGNAL": if "OFF", replace antenna RX unit. • Replace antenna TX unit.
4	TX MONITOR FAILURE	Illegal initial transmitter input level detected in Antenna Control Unit (ACU).	• Replace antenna TX unit.
5	ACU 28 VOLT FAILURE	Antenna Control Unit (ACU) input power too low.	• Check 28 voltage in both ends of cable: if missing at MCU end with cable disconnected, replace MCU power.
6	ACU EPROM FAILURE	Antenna Control Unit (ACU) EPROM defective.	• Replace antenna ACU PROM. • Replace antenna ACU.
7	ACU RAM FAILURE	Antenna Control Unit (ACU) RAM defective.	• Replace antenna ACU.
8	DSP COMM. FAILURE	Digital Signal Processor - CPU communication failure.	• Replace DSP software. • Replace MCB board.
9	ALONE LES PRESELECTED	Default Standalone LES preselected.	• Information only. No alarm.
10	DISTRESS LES PRESELECTED	Default Distress LES preselected.	• Information only. No alarm.
11	STAND ALONE LES USED	Standalone LES operative.	• Information only. No alarm.
12	CALL REPEAT TIME LONG	Due to heavy traffic. Minimum time between call requests can be up to 17 minutes.	• The time between two call attempts too short. No alarm.
13	EEPROM CRC FAILURE	EEPROM in Main Control Unit (MCU) erased or defective, or new software loaded.	• If the last record in the "INFO LOG" (FUNC.31), then information only. No alarm. • Replace ID PROM.
14	NVRAM CRC FAILURE	NVRAM in Main Control Unit (MCU) erased or defective.	• If one of the two last records in the "INFO LOG" (FUNC.31), then information only. No alarm.
15	GROUP ID FAILURE	Error occurred when trying to register new group id.	• Information only. No alarm.
16	DISTRESS UNIT FAILURE	Distress Alarm defective or not connected, or wrong address programming.	• Check distress ID in FUNC.70, • Check distress ID in Distress Unit.
17	ANT.RESET FAILURE	No response to antenna reset.	• Replace antenna ACU.
18	ACU/MCU TYPE MISMATCH	Wrong antenna type connected to Main Control Unit (MCU).	• Replace ACU software.
19	CALIBRATING FAILURE	Fluxgate compass failure	• Replace fluxgate. • Too strong magnetic field close to the antenna.
20	TX POWER OFF FAILURE	Main Control Unit failed to turn off transmitter in antenna.	• Replace antenna TX unit.
21	MCU CARRIER MISSING	Main Control Unit carrier not received by transmitter in antenna.	• Perform Clear RAM in MCU. • Replace antenna TX unit. • Replace MCB board.
22	HPA CARRIER NOT SENT	Carrier not sent by antenna transmitter.	• Replace antenna TX unit
23	MCU BURST MISSING	Main Control Unit carrier not received by transmitter in antenna.	• Perform Clear RAM in MCU. • Replace antenna TX unit. • Replace MCB board.
24	HPA BURST NOT SENT	Carrier not sent by antenna transmitter.	• Replace antenna TX unit
25	PRINTER NO RESPONSE	Printer programmed in Main Control Unit (MCU), but fails to respond.	• Check cable between MCU and serial printer. • Disable printer connection to printer port in various printer programming.
27	PC TELEX NOT READY	PC output programmed in Main Control Unit (MCU), but telex fails to respond.	• Check cable between PC Telex and MCU. • Start PC Telex program on PC telex. • If no PC Telex connected to MCU, set SERV.ANN=0 in FUNC.77.

Ref No.	Display Message	Comments	Action
28	GEO POSITION NOT SET	Geographic Position is not entered in due time.	• Enter Geo position in FUNC.21. • Connect GPS to NMEA-183 connector and set GEO POSITION to AUTO in FUNC.77. • If no GPS available, set GEOPOSTITON to "MANUAL" (0) in FUNC.77.
29	NEED VERSION XX.XX	Wrong software version loaded in Main Control Unit (MCU), or wrong BOOT PROM version.	• Check that BOOT and MCU software match. • Enter opening key provided by Nera.
30	FUNCTIONALTY IS LOST	Enhanced function inconsistency	• Enter opening key provided by Nera.
31	TRAFFIC LOG DATA LOST	Traffic log erased.	• Information only. No alarm
32	ANTENNA INIT FAILURE	No communication with antenna.	• If also ANTENNA LINK FAILURE, check FUNC.33 "RX SIGNAL": -if "OFF", check antenna cable. -if "ON", replace antenna TX unit. • Replace antenna ACU. • Replace MCB board.
33	PEDESTAL CMD NOT ACCEPTED	Communication failure between Antenna Control Board (ACB) and Pedestal Control Unit (PCU).	• Replace antenna PCU. • Replace antenna ACU.
34	ANTENNA CMD NOT ACCEPTED	ACU rejects command.	• Replace antenna ACU.
35	PEDESTAL CTL FAILURE	ACU unable to control PCU.	• Replace antenna PCU. • Replace antenna ACU.
36	AZ ENCODER FAILURE (ANT)	Early Saturn Mm models only	• Replace AZ Encoder
37	X-LEV SENSOR FAILURE (ANT)	Omitted	
38	EL RATESENSR FAILURE (ANT)	Omitted	
39	AZ RATESENSR FAILURE (ANT)	Omitted	
40	X-LEV. DRIVE FAILURE (ANT)	Not possible to keep the level platform assy in level in X-axis	• Check operation of all step motor phases • Replace PCU • Replace level sensor • Replace X-level rate sensor
41	AZ/EL DRIVE FAILURE (ANT)	Elevation drive failure. Not possible to keep the level platform assy in level in EL-axis	• Check that all phases of the step motor are operative • Replace PCU • Replace level sensor • Replace elevation level rate sensor
42	AZ DRIVE FAILURE (ANT)	Omitted	
43	PEDESTAL PWR FAILURE (ANT)	12V supply from ACU to PCU faulty	• Replace ACB
44	AZ POTMETER FAILURE (ANT)	Potmeter readout faulty	• Replace azimuth potmeter
45	EL POTMETER FAILURE (ANT)	Potmeter readout faulty	• Replace elevation potmeter
46	ACU DATA OUT OF RANGE	Erroneous values from antenna	• Replace ACU PROM • Replace ACU
47	ANTENNA MOVE FAILURE	Move, sweep or rewind failed	• Check movement of antenna in azimuth direction • Replace azimuth rate sensor • Replace PCU
48	GYRO VALUE ILLEGAL	*If step-by-step or synchro gyro:* gyro not connected, wrong gyro cabling, illegal gyro signal voltage	• Check connection to Ship's Gyro. • If no gyro connected, check FLUXGATE programming (Saturn Mm only)
49	SATELLITE NOT VISIBLE	The selected Ocean Region is below horizon	• Select an other Ocean Region
50	NMEA GYRO NOT RECEIVED	Digital gyro signal not detected	• Check connection on NMEA plug.
51	RX SIGNAL MISSING	Failure in the RX path	• Check coax cables between RX unit in the antenna and the MCU
52	HEADING CLRD NEED UPDATE	Warning in case of direct pointing of antenna	• Key in correct heading according to ship's gyro
53	PLEASE SET HEADING	Warning in case of direct pointing of antenna	• Key in correct heading according to ship's gyro

List of Start-up Messages

Ref No.	Display Message	Comments
0	PLEASE WAIT	Only occurs at power up or when trying to load new software.
1	CPU FLASH ID *	Cannot load new system program: problem with hardware.
2	CPU BURN ERR*	Failure when loading new system program: hardware error.
3	CPU RAM ERR	Cannot start system: hardware error.
4	DSP FLASH ID*	Cannot load new DSP program: problem with hardware.
5	DSP BURN ERR*	Failure when loading new DSP program: hardware error.
6	VERSION ERR	Illegal version of system program loaded, cannot start.
7	FLASH ERROR	Incomplete system program, cannot start.
8	BOOT PROM TOO OLD	Illegal version of system program loaded, cannot start.

*Only occurs when trying to load new software.

List of Terminal Status Messages

Ref No.	Display Message	Comments
0	RX SIGNAL	AGC active
1	TX1 LOCK	TX1 synchronized
2	TX2 LOCK	TX2 synchronized
3	LO LOCK	Local oscillator locked
4	OSC LOCK	Oscillator locked
5	TX ENABLE	Transmitter on
6	TX INPUT	Transmitter output low
7	TX OUTPUT	Transmitter output high
8	NOT INUSE	

List of Clear Causes

Ref No.	Display Message	Action	Comments
0000/000	UNSPECIFIED REASON		
1021/000	OFF_HOOK TIMEOUT	TRY AGAIN	Off Hook was not received from addressed MES terminal within time limit.
1081/000	TERMINAL ID MISMATCH		The specified MES terminal number has not been installed
1141/000	PRIORITY	PREEMPTION	Pre-emption by MES user instruction to establish a higher priority call
1142/000	DISTRESS	PREEMPTION	Offered shore-call cleared, pre-empted at MES by Distress.
1144/000	DISTRESS PREEMPTION		Attempted ship-call cleared, pre-empted at MES by Distress.
1145/000	PRIORITY PREEMPTION		Attempted ship-call cleared, pre-empted at MES.
11D1/000	UNDEFINED REASON	TRY AGAIN	Invalid information from MES; Service-Nature, -Type or Channel Param.
11D2/000	INCORRECT NUMBER	TRY AGAIN	The “service address” information received from MES is invalid
11D3/000	INCORRECT NUMBER	TRY AGAIN	The “service address” received from MES is currently undefined
11D4/000	CREDIT CARD DATA INVALID	TRY AGAIN	Credit card information received from the MES is invalid
1201/000	SIMPLEX CALL SUCCESSFUL		MES is acknowledging the receipt of a simplex call
1261/000	SIMPLEX CALL UNSUCCESSFUL		Acknowledge of a simplex call which is possibly unsuccessfully received.
1262/000	DISTRESS TEST TIMEOUT		Telephony ‘Distress Test’ call cleared after 120s
12B1/001	DIAL TIMEOUT	TRY AGAIN	MES is clearing due to timeout of timer TS011
12B1/002	UNSUCCESSFUL CALL ATTEMPT	TRY AGAIN	MES is clearing (no SCPC signal received)
12B1/003	UNSUCCESSFUL CALL ATTEMPT	TRY AGAIN	Channel is not tuned within allowed time limit.
12B1/004	UNSUCCESSFUL CALL ATTEMPT	TRY AGAIN	MES is clearing due to timeout. Waiting for assignment from NCS during shore call.
12B1/005	UNSUCCESSFUL CALL ATTEMPT	TRY AGAIN	MES is clearing due to timeout. Waiting for assignment from NCS during distress call.
12B1/008	LES UNDEFINED	TRY NEW LES	Signal NUMBER from user carries an illegal CES access code parameter.
12B1/009	UNSPECIFIED REASON	TRY AGAIN	Call rejected because a call set-up is already in progress.
12B1/010	UNSUCCESSFUL CALL ATTEMPT	TRY AGAIN	MES is clearing due to timeout. Waiting for assignment from NCS during ship call.
12B1/011	UNSUCCESSFUL CALL ATTEMPT	TRY AGAIN	Respond-channel is not tuned in time.
12B1/012	BUSY WITH CALL	TRY LATER	Control did not grant access to terminal due to conflicting ship call.
12B1/013	BUSY WITH CALL	TRY LATER	Control did not grant access to terminal due to conflicting shore call.
12B1/014	TOO FREQUENT CALL ATTEMPT	TRY LATER	Control did not grant access to terminal due to too frequents request.
12B1/015	MES BUSY	TRY LATER	Control did not grant access to terminal.
12B1/020	TEMPERATURE TOO HIGH		System has failed. Ex. temperature alarm.
12B1/021	ANTENNA LINK FAILURE		The communication link to ACU has failed.
12B1/022	TX BURST TIME WAS TOO LONG		The tx burst duration has exceeded the maximum limit.
12B1/023	TX POWER OUT WAS TOO HIGH		The tx power output level has exceeded the maximum limit.
12B1/024	TX SYNTH. FAILURE		TX synth out of lock, call cleared or abandoned.
12B1/025	INITIALIZING TRY LATER		System is not ready yet after start-up
12B1/026	SPOT BEAM SELECTION		Spot beam selection is being performed
12B1/027	NETWORK DATA VALIDATION	TRY LATER	Bulletin board data (satellite channel information etc.) is not yet verified
12B1/028	GROUP ID DOWNLOAD		Group IDs are being updated

List of Clear Causes Cont'd

Ref No.	Display Message	Action	Comments
12B1/029	ELEVATION ESTIMATION		Calculation of elevation zone is in progress
12B1/030	OCEAN REGION REGISTRATION		Ocean region registration is in progress
12B1/031	ANTENNA INITIALIZING	TRY LATER	Antenna is not yet ready for use
12B1/033	NO SATELLITE IS FOUND	REPOINT ANT.	No satellite sync can be achieved
12B1/034	CONFIGURING ANTENNA	TRY LATER	Antenna configuration is taking place
12B1/035	FAST TRACK SATELLITE	TRY LATER	Antenna is tracking satellite
12B1/036	SEARCHING SATELLITE(S)	TRY LATER	Antenna is searching for satellite(s)
12B1/041	PRINTER NOT RESPONDING		Power may be turned off, cable not connected, paper empty or printer not selected/on-line.
12B1/043	UNSUCCESSFUL CALL ATTEMPT	TRY AGAIN	No acknowledge
12B1/044	UNSUCCESSFUL CALL ATTEMPT	TRY AGAIN	No sync
12B1/045	UNSUCCESSFUL CALL ATTEMPT	TRY AGAIN	No rx lock
12B1/046	UNSUCCESSFUL CALL ATTEMPT	TRY AGAIN	No tx1 lock
12B1/047	UNSUCCESSFUL	TRY AGAIN	No tx2 lock
12B1/048	UNSUCCESSFUL CALL ATTEMPT	TRY AGAIN	Missing or illegal channel
12B1/049	UNSUCCESSFUL CALL ATTEMPT	TRY AGAIN	No authorization
12B1/050	UNSUCCESSFUL CALL ATTEMPT	TRY AGAIN	Burst not sent
12B1/051	NO TIME LEFT DIAL 230#	CALL AGENT	Precharge terminal has run out of time. Must refill before call is possible.
12B1/052	UNACCEPTABLE PIN CODE		Wrong PIN code entered.
12B1/054	RESTRICTION DIAL 33#	CALL AGENT	Access restricted due to Enhanced Function inconsistency.
12B1/055	ANTENNA CMD NOT ACCEPTED		A command to the ACU was not accepted (4 times), link restarted.
12B1/56	PEDESTAL CMD		A command to the PCU was not accepted (4 times), link restarted.
12B1/57	ANTENNA INIT FAILED		Antenna initializing failed.
12C1/000	UNSUCCESSFUL CALL ATTEMPT	TRY AGAIN	Scrambling Vector Ack was not received within allowed time limit.
12C2/000	UNSUCCESSFUL CALL ATTEMPT	TRY AGAIN	Credit Card Accepted was not received within allowed time limit.
12C3/000	UNSUCCESSFUL CALL ATTEMPT	TRY AGAIN	LES Connect message is not received by the MES terminal within allowed time limit.
12D1/000	UNSUCCESSFUL CALL ATTEMPT	TRY AGAIN	Invalid "spot-beam ID" information from MES
12D2/000	UNSUCCESSFUL CALL ATTEMPT	TRY AGAIN	The Scrambling Vector information received from MES is invalid
1361/000	REWIND INTERRUPTION	TRY AGAIN	Above-decks equipment is about to "cable unwrap"
1362/000	SIGNAL INTERRUPTION	TRY AGAIN	Long term interruption in reception.
1363/000	REPOINTING	TRY LATER ANTENNA	PFC has commanded the Above-decks equipment to repoint to a different Ocean Region.
1451 /000	TERRESTRIAL	TRY AGAIN CONGESTION	An appropriate terrestrial circuit is not currently available at this LES.
1452/000	LES CONGESTION	TRY AGAIN	An appropriate channel unit and associated terrestrial circuit, with 'one-to-one' connection, are not currently available at this LES.
1541/000	PRIORITY PREEMPTION		Pre-emption of LES by a higher priority call.
1551 /000	LES CONGESTION	TRY AGAIN	An appropriate satellite channel is not currently available at this LES.
1552/000	LES CONGESTION	TRY AGAIN	An appropriate tdm and/or tdma time-slot is not currently available.

List of Clear Causes Cont'd

Ref No.	Display Message	Action	Comments
1581/000	SERVICE NOT PROVIDED	TRY NEW LES	LES is not equipped to provide the specified service.
1591/1000	SERVICE NOT	TRY AGAIN AVAILABLE	LES is equipped to, but not currently able to provide the service.
1592/000	CREDIT CARD TYPE INVALID	TRY NEW LES	Specified credit card type is not currently supported by this LES.
15A1/000	MES NOT AUTHORIZED	TRY NEW LES	MES is not authorized for any service, except Distress, via this LES.
15A2/000	SERVICE NOT AUTHORIZED	TRY NEW LES	MES is not authorized for specific requested service via this LES.
15A3/000	CREDIT CARD NOT ACCEPTED		Credit card data from MES rejected by the authorization checking process.
15B1/000	UNDEFINED CAUSE		The call is cleared or rejected for a reason not currently defined.
15C1/000	UNSUCCESSFUL CALL ATTEMPT	TRY AGAIN	Channel Assignment message is not received within allowed time limit.
15C2/000	UNSUCCESSFUL CALL ATTEMPT	TRY AGAIN	The service-address information is not received within allowed time limit.
15C3/000	UNSUCCESSFUL CALL ATTEMPT	TRY AGAIN	Scrambling Vector message is not received within allowed time limit.
15C4/000	UNSUCCESSFUL CALL ATTEMPT	TRY AGAIN	Neither Scrambling Vect. nor Serv. Address is received within time limit.
15C5/000	UNSUCCESSFUL CALL ATTEMPT	TRY AGAIN	LES is clearing the call because the complete "credit card data" info has not been received.
15C6/000	UNSUCCESSFUL CALL ATTEMPT	TRY AGAIN	Return Carrier Identifier message not received within allowed time limit.
15C7/000	UNSUCCESSFUL CALL ATTEMPT	TRY AGAIN	MES Connect message is not received within the allowed time limit.
15C8/000	UNSUCCESSFUL CALL ATTEMPT	TRY AGAIN	Telegraphy call cleared; MES Answerback is not received within time limit.
15D1/000	UNSUCCESSFUL CALL ATTEMPT	TRY AGAIN	Channel Assignment message from NCS contains inappropriate information.
15D2/000	MES-ID USED BY OTHER MES		MES ID and channel number is cleared in the busy lists at LES and NCS because a new call to/from this MES is being set up, and thus any previous call to/from this MES must have cleared.
15E1/000	FORCED RELEASE		LES is attempting to clear an MES which has sent an SCPC channel release message, but is found still to be transmitting 5.12 s later.
1651/000	LES	TRY AGAIN CONGESTION	LES is rejecting the call because an appropriate channel unit is not currently available.
1661/000	SIGNAL INTERRUPTION	TRY AGAIN	Interruption in reception of the MES carrier exceeding allowed time limit.
16C1/000	UNSUCCESSFUL CALL ATTEMPT	TRY AGAIN	Telegraphy call cleared; MES carrier is not received within time limit.
16C2/000	UNSUCCESSFUL CALL ATTEMPT	TRY AGAIN	An appropriate SCPC MES carrier is not received by LES (at the commencement of the call) within the time limit.
1851/000	SATELLITE CONGESTION	TRY AGAIN	Appropriate SCPC channel is not currently available.
18A1/000	MES-ID UNKNOWN	TRY NEW LES	MES ID is not in the 'Forward and Return MES ID' cross reference table.
18B1/000	CALL REJECTED		The call is cleared or rejected for a reason not currently defined.
18E1/000	MES-ID USED BY OTHER MES		The specified MES ID is in the "MES busy list" at the NCS, listed as being busy with a call through the same LES as that now requesting a "call announcement" addressed to that MES.
1C61/000	UNSUCCESSFUL CALL ATTEMPT	TRY AGAIN	Telegraphy call cleared; MES Answer back is not received within time limit.
1F01/000	SUBSCRIBER ON HOOK		Normal clearing due to instruction from relevant terrestrial circuit.
1F11/000	SUBSCRIBER BUSY		Terrestrial called party is busy.
1F21/000	NO ANSWER		Appropriate off-hook signalling from the terrestrial called party is not received within the allowed time limit
1F61/000	SUBSCRIBER LINE FAILURE	TRY AGAIN	Failure in the relevant terrestrial circuit.
1F62/000	SUBSCRIBER ON HOOK		Terrestrial network cleared the call before "MES connect" was received by the LES.

AC Alternating Current

ACB Antenna Control Board

ADE Above Deck Equipment

ALC Automatic Level control

ANT Antenna

AOR-E Atlantic Ocean Region East.

AOR-W Atlantic Ocean Region West.

ASIC Application Specific Integrated Circuit

AU Antenna Unit, major part of MiniPhone

AUX Auxiliary

BDE Below Deck Equipment

BPSK Binary Phase Shift Keying

Bulletin Board system status information for MES

C Band band of radio frequencies from about 4.0 GHz to 6.0 GHz, used by Inmarsat links for the satellite/LES link.

CCITT International Telegraph and Telephone Consultative Committee

CES Coast Earth Station

Codec speech encoder/decoder

CPU Central Processing Unit

CRC Cyclic Redundancy Check

CTS Clear To Send

DAC Digital-Analogue Converter

dBW deciBels relative to 1 Watt

DC Direct current

DCD Data Carrier Detect

DI Destination Identification digits

Downlink radio link from the satellite down to stations on Earth.

DSP Digital Signal Processor

DSR Data Set Ready

DSUB Data Sub-band, SCPC sub-band signalling.

DSUB Data Subminiature

DTE Data Terminal Equipment

DTR Data Terminal Ready

EEPROM Electrically Erasable Programmable Read Only Memory

EIRP Equivalent Isotropically Radiated Power

EPROM Erasable Programmable Read Only Memory

FDMA Frequency Division Multiple Access

FIO Fax Interface Unit

GPS Global Positioning System, a satellite navigation system.

HPA High Power Amplifier

Hz Hertz

ID Identification Digit(s)

IMN Inmarsat Mobile Number, a unique 9-digit number.

Inmarsat International Maritime Satellite Organisation

IOR Indian Ocean Region.

ISDN Integrated Services Digital Network, digital national and international telecommunications network.

ITU International Telecommunications Union, international organisation that oversees and compiles standards for telecommunications.

KBPS KiloBits Per Second

L Band band of radio frequencies from about 1.5 GHz to 1.6 GHz, used by Inmarsat for the MES/satellite link.

Latitude distance north or south of the equator, measured in degrees.

LED Light-Emitting Diode, semiconductor element that emits light.

LES Land Earth Station, a station that interconnects fixed telecommunications networks with the Inmarsat system; may also be called a CES (Coast Earth Station) or a GES (Ground Earth Station).

LES-SIG LES Signalling, SCPC mode for in-band signalling.

LESA Land Earth Station Assignment Channel

LESD LES Data, SCPC mode for data communications

LESI LES Interstation Signalling Channel, TDM channel carrying signalling information to NCS.

LESV LES Voice, SCPC mode for voice communications

LHCP Left Hand Circular Polarization

LNA Low Noise Amplifier

LONG longitude

Longitude distance east or west of Greenwich meridian, measured in degrees.

MCB Main Control Board

MCC Mobile Country Code

MCU Main Control Unit, major part of terminal; performs all signal processing and message handling functions.

MES Mobile Earth Station, a user terminal for an Inmarsat system; the Saturn M terminal is an MES for the Inmarsat-M system; MES may also be called SES (Ship Earth Station) or, if on aircraft, AES (Aeronautical Earth Station).

MES-SIG MES Signalling, SCPC mode for in-band signalling.

MESCA MES Call Acknowledgement, random access (Slotted Aloha) burst mode channel carrying acknowledgement messages for fixed-originated simplex calls.

MESD MES Data, SCPC mode for data communications

MESRP MES Response, TDMA channel carrying the response information required for a fixed-originated call.

MESRQ MES Request, random access (Slotted Aloha) burst mode channel carrying access request messages to LESs for initiation of mobile-originated calls.

MESRR MES Registration channel, random access (Slotted Aloha) burst mode channel carrying the Ocean Registration messages required to route fixed-originated calls.

MESV MES Voice, SCPC mode for voice communications

MHz MegaHertz

MID Maritime Identification Digits

NCRA Network Coordination Registration Acknowledgement, TDM channel carrying responses to registration messages transmitted by MESs.

NCS Network Coordination Station, station that supervises all messages and signals sent in the Inmarsat system; one in each Ocean Region.

NCSA NCS Assignment, TDM channel carrying channel assignment messages.

NCSC NCS Common, TDM channel carrying signalling messages including call announcements, Bulletin Board and forced channel clearing.

NCSI NCS Inter-station channel used by NCS to carry signalling information to the LES.

NCSS NCS Spotbeam, TDM channel carrying spotbeam identification numbers.

NMEA National Marine Electronics Association, US industrial organisation whose activities include stipulating standards for marine navigation systems.

O-QPSK Offset Quadrature Phase Shift Keying.

OCC Operation Control Centre, Inmarsat centre that monitors entire Inmarsat system.

Ocean Region area of coverage of a single Inmarsat satellite, from 70°N to 70°S; there are four: Atlantic East, Atlantic West, Pacific, Indian.

OI Originating Identification digits

OSC Oscillator

PC Personal Computer

PCM Pulse Code Modulation, analogue-to-digital signal conversion method.

PCU Pedestal Control Unit

PLL Phase Locked Loop

POR Pacific Ocean Region

Prefix service in Inmarsat-M, two-digit prefix to number called, keyed in to stipulate special service, such as credit-card call.

PROM Programmable Read Only Memory

Protocol the internal rules in the system that enable communications.

PSDN Packet Switched Data Network, terrestrial network for packet data communications.

PSTN Public Switched Telephone Network, terrestrial network for telephone, telefax and data modem services.

QUART Quad Universal Asynchronous Receiver/Transmitter, provides four interfaces between parallel data circuits and serial data circuits.

RF Radio Frequency

RHCP Right Hand Circular Polarization

ROM Read-Only Memory, microchip memory that stores programs and/or data.

RS 232 Serial Data Interface

RS 422 Serial Data Interface

RTS Request To Send

RX IF Receiver Intermediate Frequency

Rx Receive

RXD Receive Data

SAMBA TX/RX Up/down conversion between intermediate frequency and base band.

SCC Satellite Control Centre

SCPC Single Channel per Carrier

SDM (Inmarsat-M) System Definition Manual

SES Ship Earth Station

Spot Beam (Inmarsat-M) service that divides each Ocean Region into sub-regions, each “spotlighted” by a beam from the region satellite; permits increasing capacity of system.

SU Signalling Unit, 96-bit data packets transmitted on SCPC sub-band signalling channels, to conduct system signalling.

SU Signalling Unit, data packets

TDM Time Division Multiplexing, method of allowing several users to share the same channel.

TDMA Time Division Multiple Access

Terrestrial Network a fixed telecommunications network, such as a telephone network or a data network, which connects to the Inmarsat-M system at an LES.

TUP Telephone User Part of CCITT Signalling System No 7.

TX IF Transmitter Intermediate Frequency

Tx Transmit

TXD Transmit Data

UART Universal Asynchronous Receiver/Transmitter, provides interface between parallel data circuits and serial data circuits.

Uplink radio link from a station on Earth up to the satellite.

UTC Coordinated Universal Time, referenced to Greenwich Mean Time (GMT)

UW Unique Word

VSUB Voice Sub-band, SCPC sub-band signalling.

WMO World Meteorological Organization

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