ITEMS REQUIRED FOR AN FCC CERTIFICATION SUBMITTAL
FCC Part 2, Paragraph 2.1033

1) The **full name and mailing address** of the **manufacturer** of the device and the **applicant** for **certification**.

Manufacturer address
IXTANT S.P.A.
Via Stoppani 21,
Zona Ind Soleschiano,
34077 RONCHI DEI LEGGIONARI
ITALY

Applicant address:
TELITAL S.P.A.
Viale Stazione di Prosecco, 5/B
34010 SGONICO
ITALY

2) **FCC identifier** : **SAT550**

3) Equipment Specifications

Frequency range in MHz	**Rated RF power output in watts**	**Frequency tolerance %, Hz, ppm**	**Emission designator (see 47 CFR §2.201 and §2.202)**	**Microprocessor model number**
TX 1610 MHz - 1626.5MHz RX 2483.5MHz - 2500MHz	**0,4 W**	**Max 10ppm**	**1M23G9W**	Intel: **FA80386EXTB25** Siemens: **PMB2800 v3.2 w2** Analog Devices: **ADSP-2185L**

4) Type or **types of emission**.

1M23G9W

5) **Frequency Range.**

Transmit band: 1610 MHz - 1626.5MHz

Receive band: 2483.5MHz - 2500MHz

6) **Range of Operating Power values** or specific operating **power levels**; and **description** of any means provided for **variation of operating power.**

Maximum output power of SAT550 is 26 dBm/1.23MHz (400 mW), minimum output controlled power is 10dBm/1.23MHz.
During calibration a look up table is loaded in the phone. This table contains information about power level over temperature and frequency.
Output power level is controlled by a power loop in which power level and temperature measurements are performed in the phone using an RF probe and an NTC. Output power level is controlled in an closed loop in which the network, by a power control bit, order to the phone to increase or decrease output power. By internal look up table the phone is able to decide for the right TX AGC command to respect network commands. This control is performed frame by frame and each power step is 0.5 dB

7) **Maximum power rating: 26 dBm.**

8) **DC voltages** applied to and **dc currents** into the several elements of the final radio frequency amplifying device for normal operation over the power range.

At final frequency (1618 MHz) TX chain is composed by :

SAW filter---Driver amplifier---Saw filter---HPA---Isolator---TX output filter

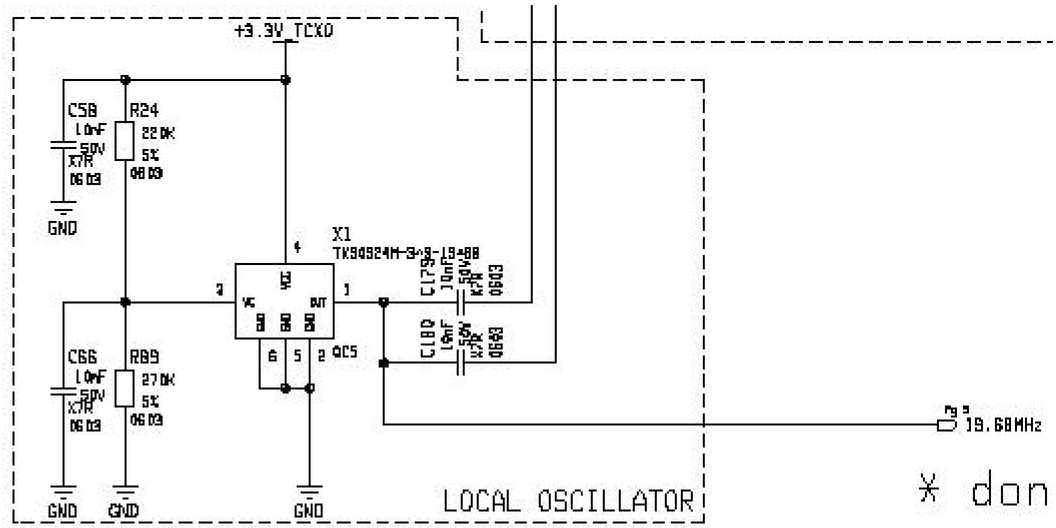
Both Driver and HPA are supplied by 5.1V dc source for amplification stages and 3.6V dc source for reference. A power supply section in the phone convert the battery pack DC level (7.2V) to the right DC level and gives all the source lines using switching and linear devices. DC currents over PWR output level are summarized in the following table:

OUT PWR (dBm)	I driver (mA)	I HPA (mA)
0	125	140
5	125	140
10	125	150
15	125	160
20	125	210
22	123	240
24	123	270
26	122	320

9) S**chematic diagram and a description of all circuitry and devices** provided for determining and stabilizing frequency, **for suppression of spurious radiation, for limiting modulation, and for limiting power.** A **Parts List if** not visible on the schematics.

Description of all circuitry and devices provided for determining and stabilising frequency.

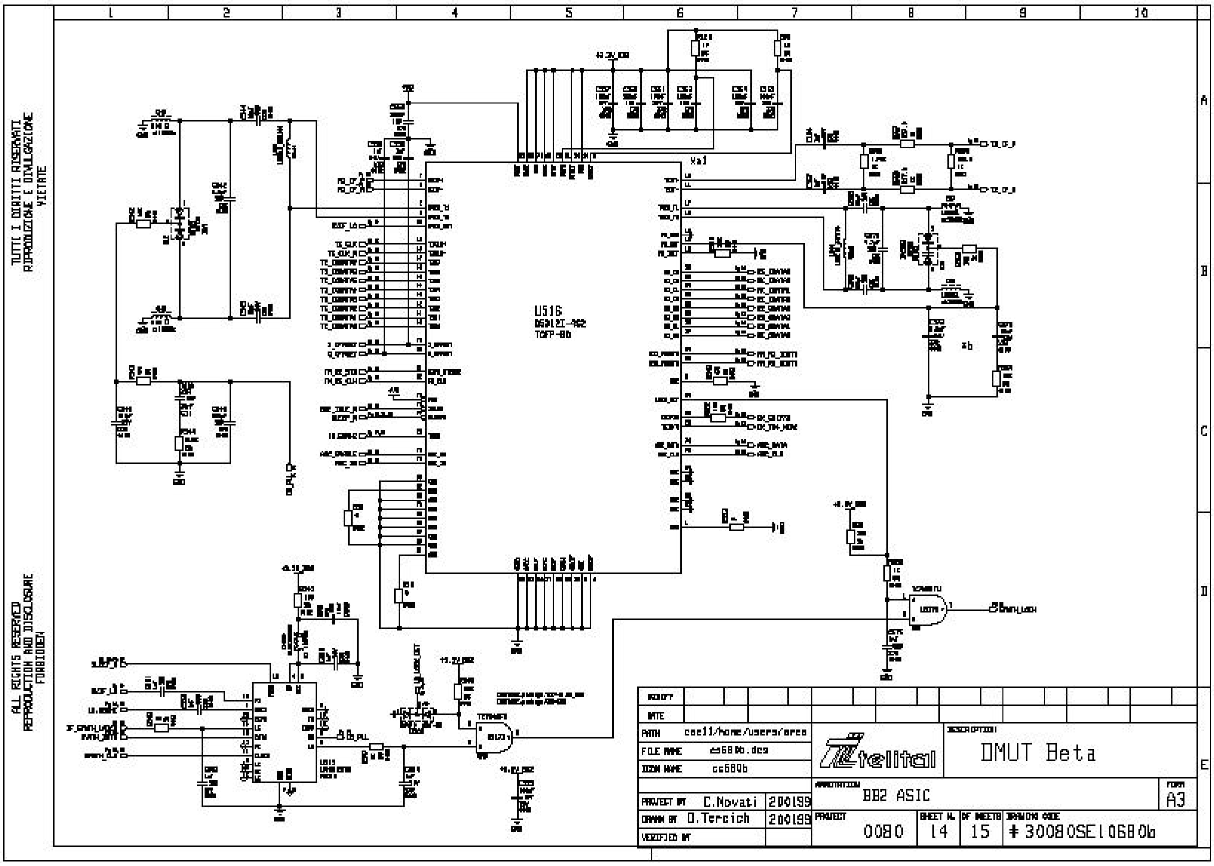
The GS terminal adopts a VCTCXO TEW TXS0924M starting from which all the necessary frequencies are synthesized. It appears in the electric scheme as X1 and it provides to frequency stability as described above.



Starting from this signal of 19.68MHz nominal frequency, inside the BBA2 Analog Baseband Processor (Qualcomm custom IC) two signals are synthesized, the first one of 9.8304MHz and the second of 4.92MHz. The GUM Base-Band Processor (Qualcomm custom IC) uses these signals for the digital modulation and demodulation of the GS signal.

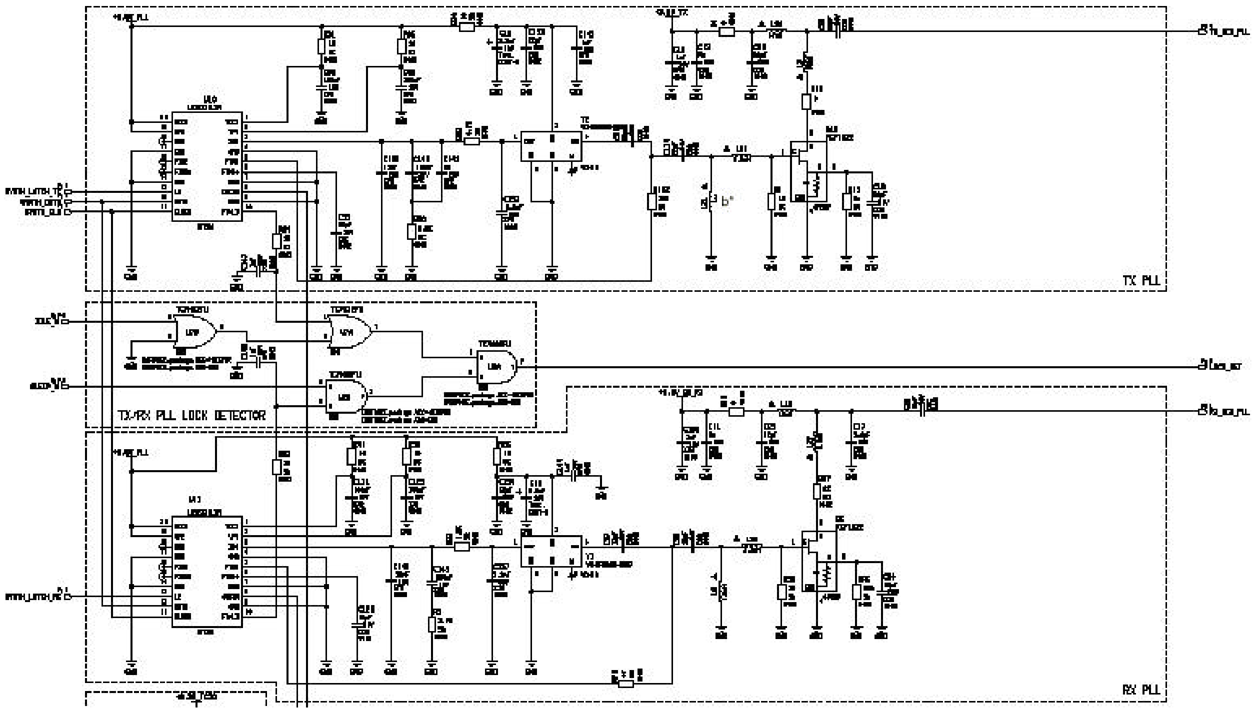
Also, inside the BBA2 Analog Baseband Processor (Qualcomm custom IC) with the aid of an external LC resonant circuit (inductance L504 and varicap DV503 in the electric scheme, plus some additional components), the 260.76MHz signal used for the up-conversion to intermediate frequency of the transmitted signal is synthesized.

Another VCO implemented inside the BBA2 Analog Baseband Processor (Qualcomm custom IC), with the aids of an external LC resonant circuit (inductance L502 and varicap DV1 in the electric scheme, plus some additional components), produces the 449.76MHz signal necessary for the down-conversion from the intermediate frequency of the received signal. An external PLL National LMX2305TMX (identified as U515 in the electric scheme) controls this process.



Two synthesizers are implemented on the GS radio. Both use the PLL National LMX2330LTM. These are shown in the electric scheme as U10 – related to the TX LO – and U11 – related to the RX LO.

The RX synthesizer uses a VCO Towa VC-3R6A20-2267, identified as Y1 on the electric scheme, while the of the TX synthesizer uses an analogous VCO Towa VC-3R6A20-1487, identified as Y2 on the electric scheme. The additional control circuits are described in detail by the electric scheme and the part-list.



Description of all circuitry and devices provided for suppression of spurious radiation.

All the active and not linear components are selected to not produce undesirable spectral components (or however to minimize the amplitude of the inevitable undesirable spectral components produced). All the SAW filters and discrete filters distributed on the whole electric scheme are designed with the precise purpose to eliminate or to reduce the propagation of undesirable and therefore spurious signals. Not only but also the mechanical parts of the telephone like screens and gaskets serve for this primary purpose.

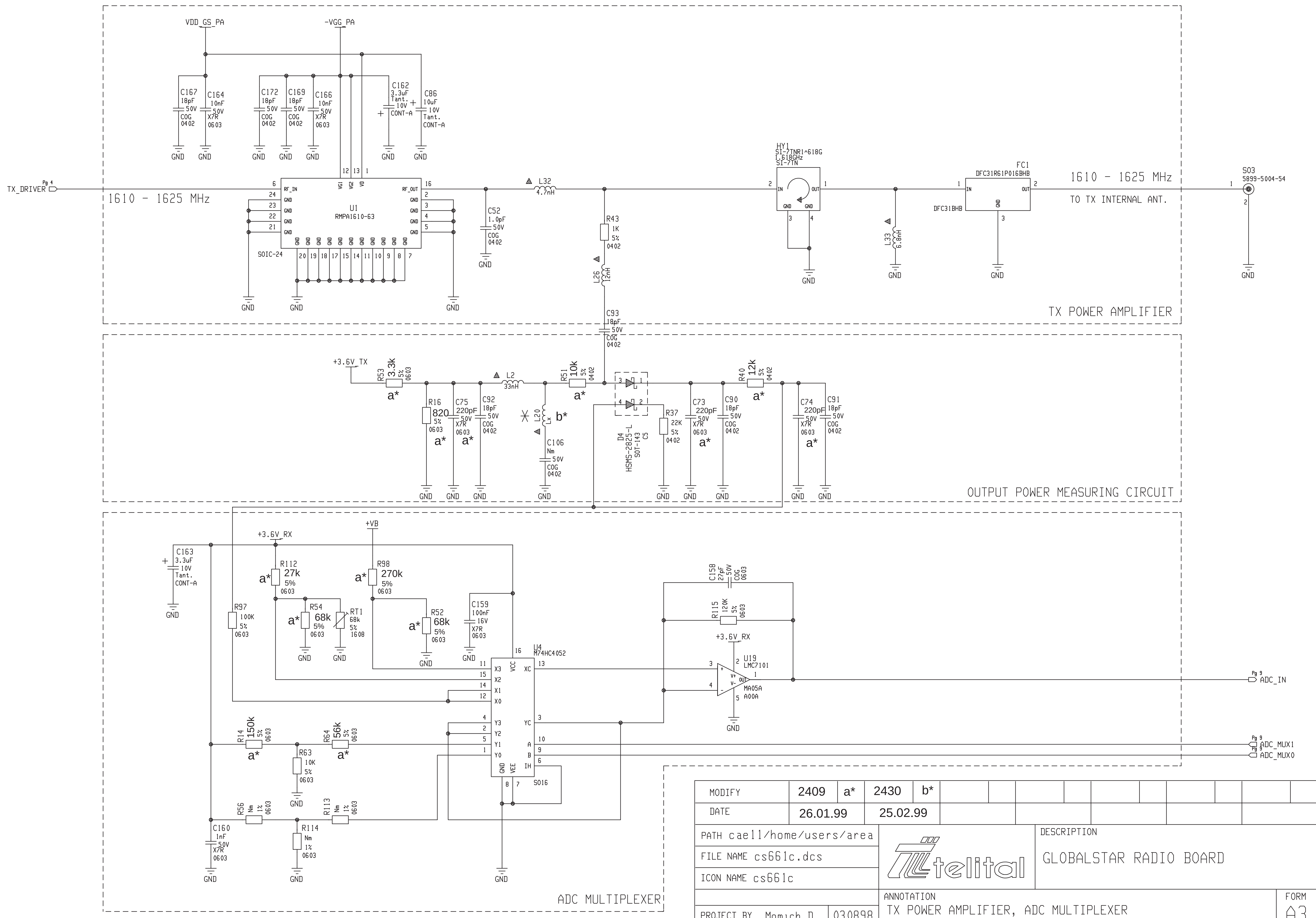
A brief and summarized description of the whole circuitry and the devices that provide to eliminate the spurious emissions must necessarily includes:

(1) Screens and metallic gaskets of the radio boards and baseband board, and the power supply enclosure; bare cooper surfaces to ensure the electric connection of the mentioned mechanical parts to the PCB body; holes and screws that guarantee the mechanical assemblage of these parts.

(2) RF filters of the transmitter and the receiver sections: SAW filter Murata SAFC2491.75 (shown as FC4 and FC7 in the electric scheme); SAW filter Murata SAFC1618.25 (shown as FC5 and FC6 in the electric scheme); dielectric filter Murata DFC31R61P016BHB (shown as FC1 in the electric scheme).

(3) Pi-Greek low-pass filter mounted on the PA output (C52 and L32 in the electric scheme) to reduce the third harmonic of the useful signal.

We omit to describe the SAW IF filters SAWTEK, the baseband and IF filters integrated into BBA2, the stages with a response curve noteworthy variable with the frequency, and the filtering capacitors (or RC filters) on power supply and control lines – even if all these filters contribute to achieve this purpose.



* don't place L20

MODIFY	2409	a*	2430	b*
DATE	26.01.99		25.02.99	

PATH cae11/home/users/area

FILE NAME cs661c.dcs

ICON NAME cs661c

telital

DESCRIPTION
GLOBALSTAR RADIO BOARD

ANNOTATION
TX POWER AMPLIFIER, ADC MULTIPLEXER

FORM
A3

PROJECT BY	Momich D.	030898
DRAWN BY	Serdi M.	080199
VERIFIED BY	Momich D.	150199

PROJECT	SHEET N.	OF SHEETS	DRAWING CODE
0080	5	9	#30080SE10661c

A description of all circuitry and devices provided for limiting modulation.

The GS signal modulation and demodulation processes are managed at digital level by the hardware of the GUM and by the software resident in the GUM – the "Globalstar User Modem" Base-Band Processor is a Qualcomm custom.

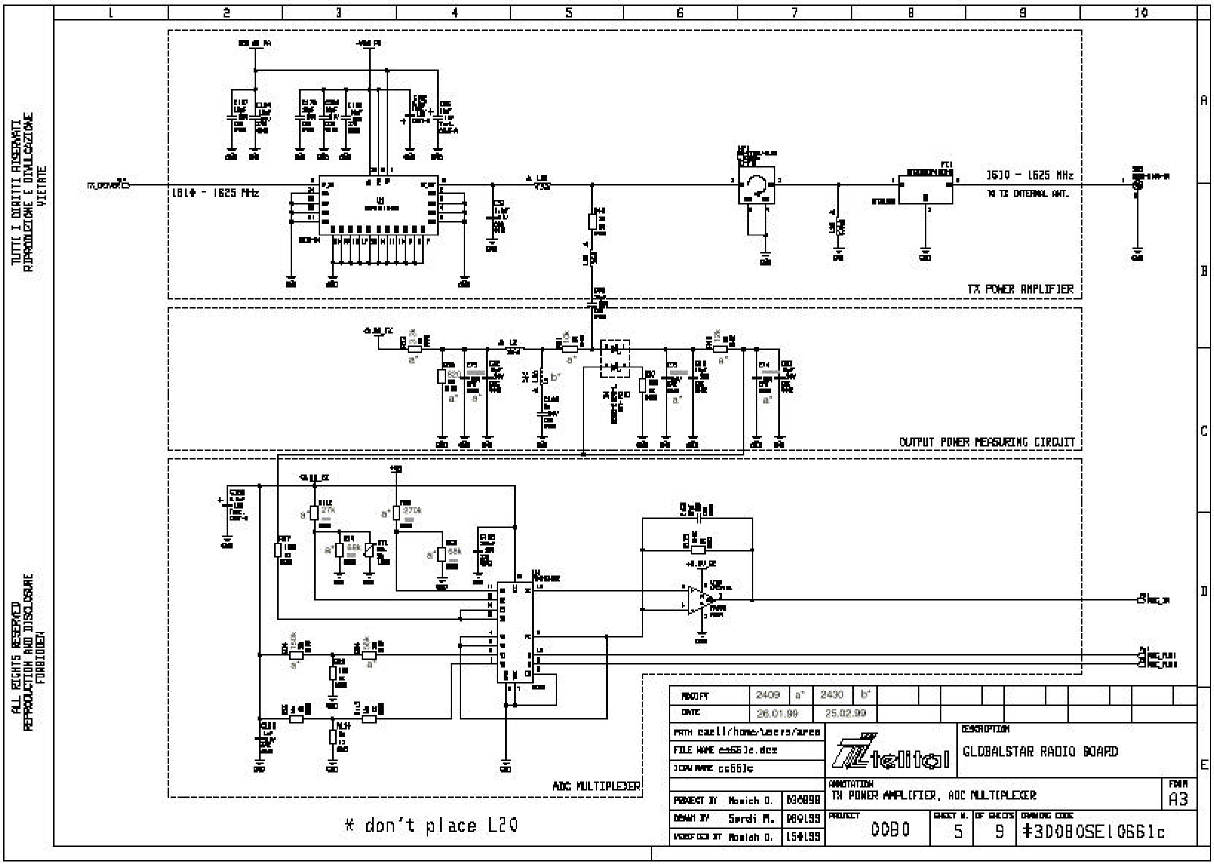
All the circuit's components of the GS user terminal outside the GUM, they operate just frequency and level conversions between digital signal generated by the GUM and RF signal at the antenna's connector, and vice versa. They do not interfere any way with the modulation and demodulation processes.

A description of all circuitry and devices provided for limiting power.

There are two levels of transmitted signal output power limitation.

The software of the UT makes a control of the transmitted power (relative increases and reductions of the output power) according to the commands sent by the GW, commands based on the signal power that the satellite receive from all the connected users. This power control is managed entirely via software.

On the other hand, the phone is only able to autonomously manage a control of the maximum output power. This is done with the aids of a diode-detector. The diode is identified as D4 in the electric scheme. The detector includes some others components. These are connected to a multiplexer identified as U4 in the electric scheme and it allows selecting the reading of other parameters that describes the GS radio status. An operational amplifier, U19, together with an appropriate resistive network, operates the necessary conversion of the detector analog output level.



This way, we get to the baseband input an analog signal proportional to the absolute level of the user terminal transmitted power. The signal is then digital converted by an AD converter, located in BBA2 but controlled by a special section of the GUM. Using the GS radio RF calibration data, UT software converts this information in a format comparable with the command of the transmitted power as it is managed by the software and these data are used to operate a limitation of the maximum transmitted power according to a particular procedure.

A **Parts List** is available in the Technical manual attached to this form.
The electrical schemes are enclosed in the Technical manual.

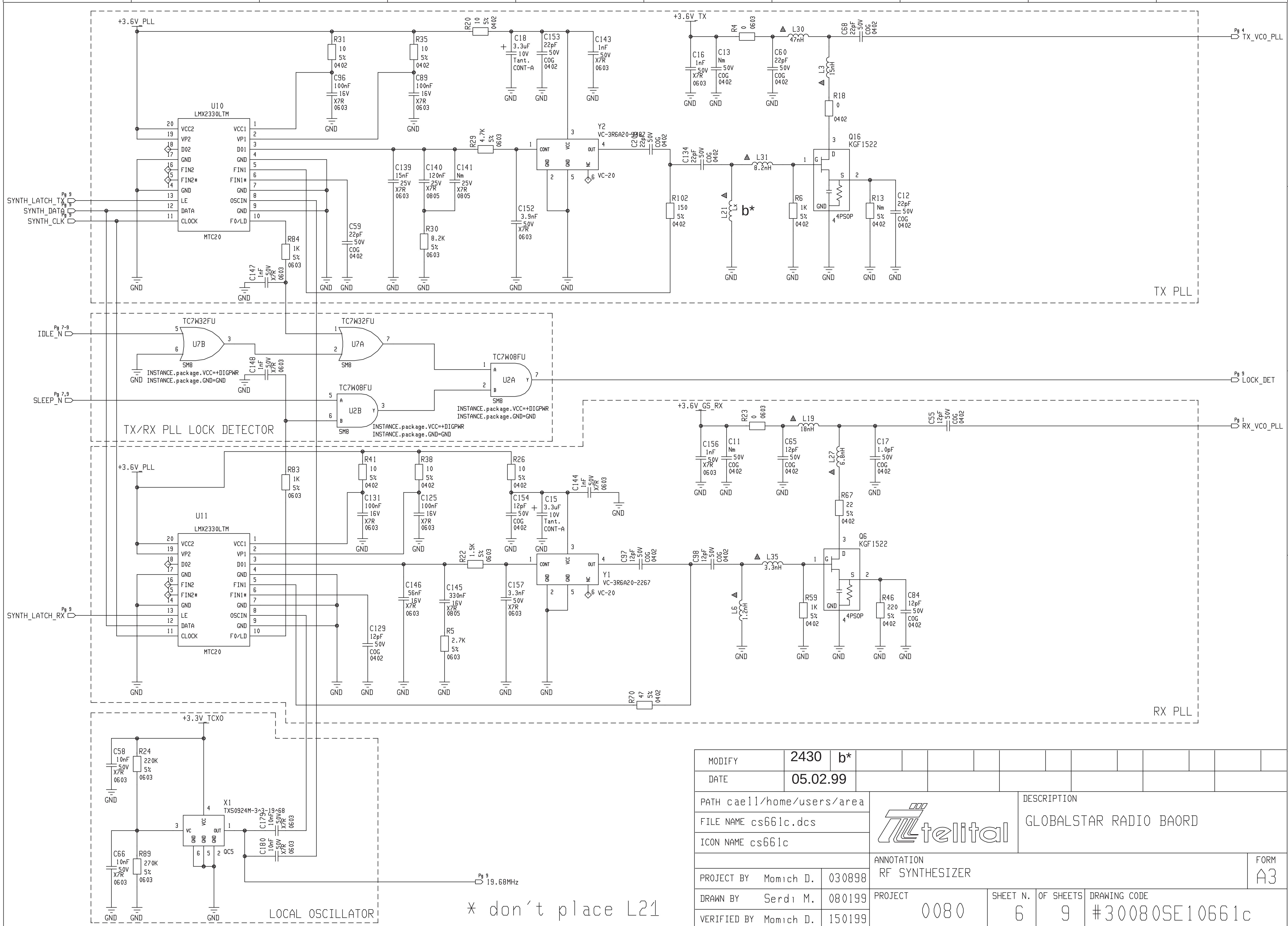
10) **Operating Manual** (User manual) A draft copy is attached to this form.

11) **The tune up procedure** over the power range or at specific operating power levels**.**

The tune up procedure over the power range or at specific operating power levels.

The software writes/manages transmitter output power like a value in the range from 0 (minimum theoretical output power, around –43.67dBm) up to 1023 (maximum theoretical output power, around +41.67dBm). A 12 unit’s variation corresponds to 1dB. The value 523 corresponds to 0dBm. Inside the GUM, the AGC (variable gain amplifier) gain control is written/managed like a value varying from +511 (minimum AGC gain, around –40dB) to –512 (maximum AGC gain, around +40dB). The variation between the two extremes is not linear and it changes phone by phone.

The two calibration values rf_gs_tx_lin_master_off_0, rf_gs_tx_lin_master_slp[36] are used by the software, together with others that contribute to get the frequency and temperature compensation, to create a look-up table. This is loaded in the RAM of the GUM, and it allows converting the command values fixed by the software in opportune control levels for the variable gain amplifier of the transmission chain and therefore to get the desired levels of output power.



MODIFY	2430	b*
DATE	05.02.99	

PATH caell/home/users/area

FILE NAME cs661c.dcs

ICON NAME cs661c

telital

DESCRIPTION
GLOBALSTAR RADIO BAORD

ANNOTATION
RF SYNTHESIZER

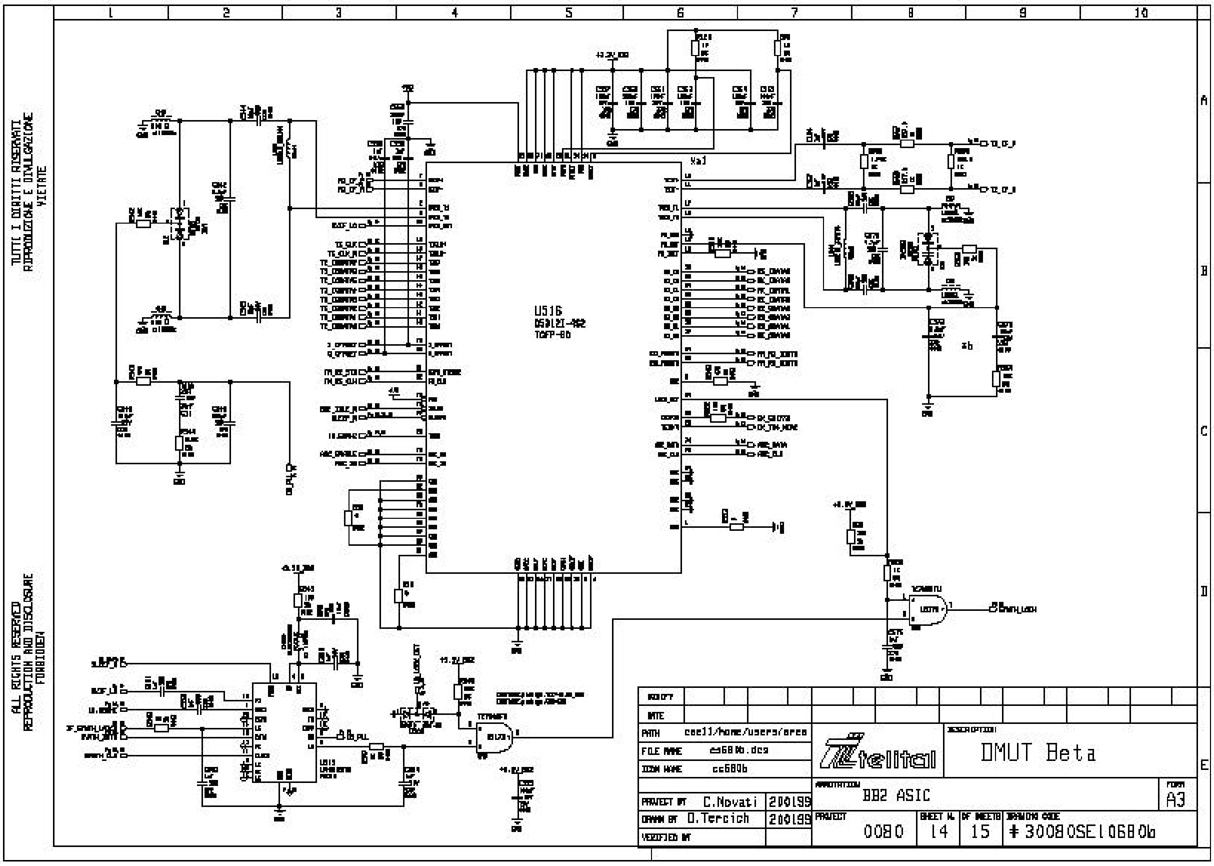
FORM
A3

PROJECT BY	Momich D.	030898
DRAWN BY	Serdi M.	080199
VERIFIED BY	Momich D.	150199

PROJECT	SHEET N.	OF SHEETS	DRAWING CODE
0080	6	9	#30080SE10661c

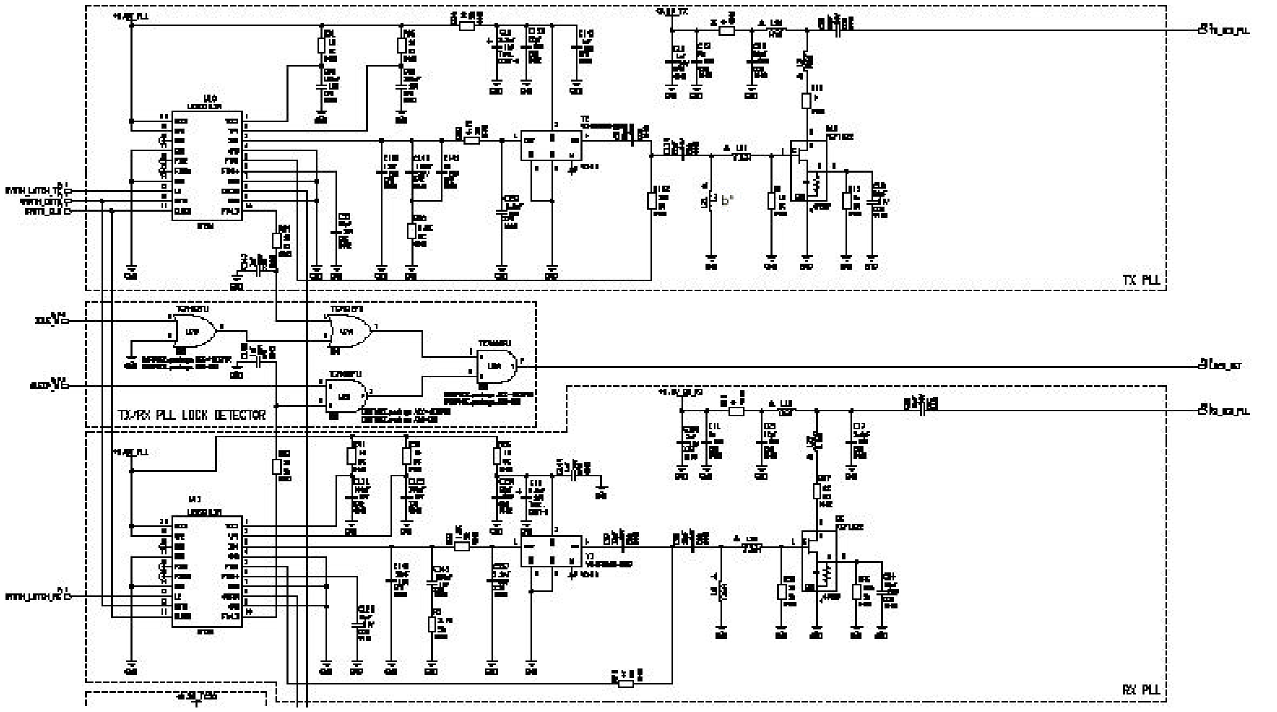
The information according to which the UT selects the opportune level of output power are fixed by the software of the terminal according to the system specifications and according with information that the GW sends to the terminal. The way these parameters are managed, it involves the call processing procedures and in general the terminal software.

There are not hardware controls about these procedures (besides the matter of the terminal



calibration) and the variable gain amplifier AGC is the only hardware part involved in – whose management is however entirely submitted to the phone’s SW.

Two synthesizers are implemented on the GS radio. Both use the PLL National LMX2330LTM. These are shown in the electric scheme as U10 – related to the TX LO – and U11 – related to the RX LO. The RX synthesizer uses a VCO Towa VC-3R6A20-2267, identified as Y1 on the electric scheme, while the of the TX synthesizer uses an analogous VCO Towa VC-3R6A20-1487, identified as Y2 on the electric scheme. The additional control circuits are described in detail by the electric scheme and the part-list.



Description of all circuitry and devices provided for suppression of spurious radiation.

All the active and not linear components are selected to not produce undesirable spectral components (or however to minimize the amplitude of the inevitable undesirable spectral components produced). All the SAW filters and discrete filters distributed on the whole electric scheme are designed with the precise purpose to eliminate or to reduce the propagation of undesirable and therefore spurious signals. Not only but also the mechanical parts of the telephone like screens and gaskets serve for this primary purpose.

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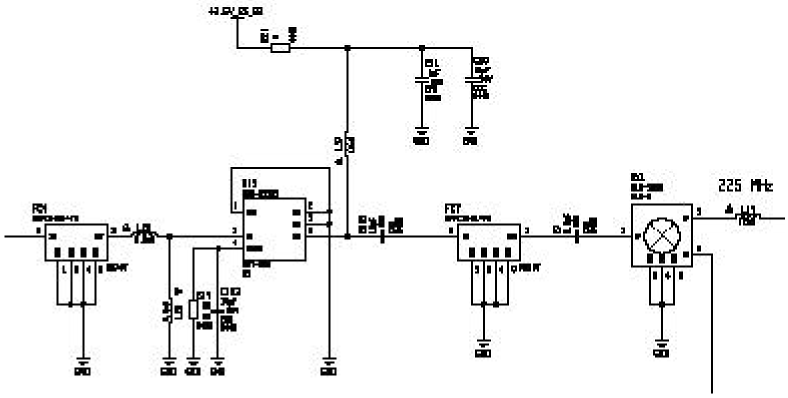
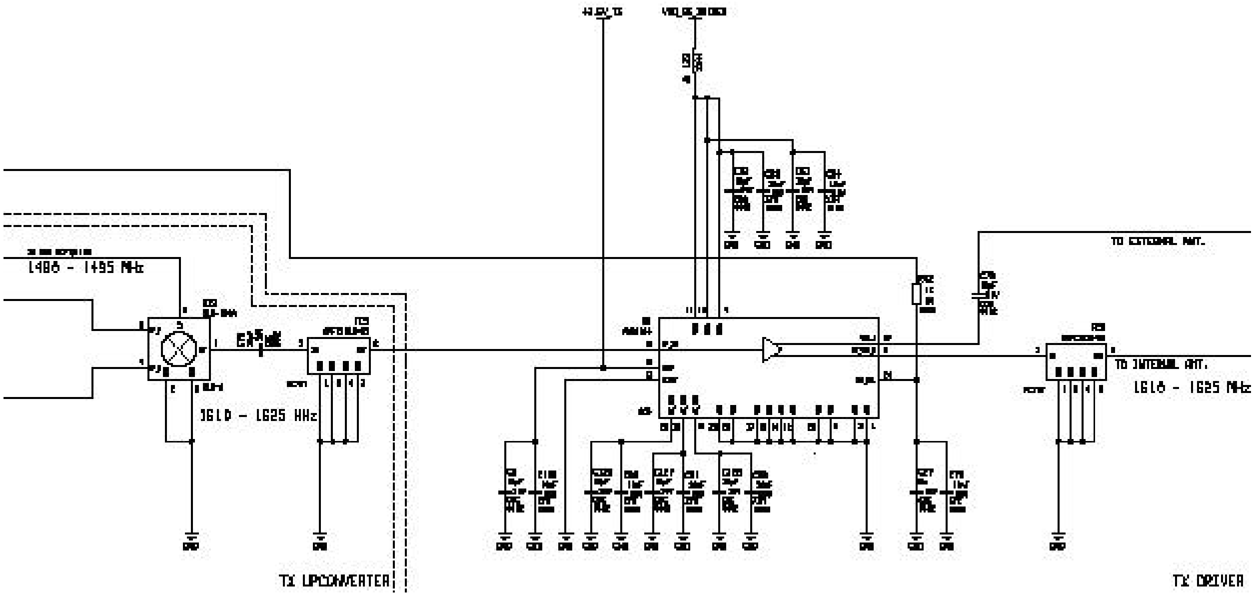
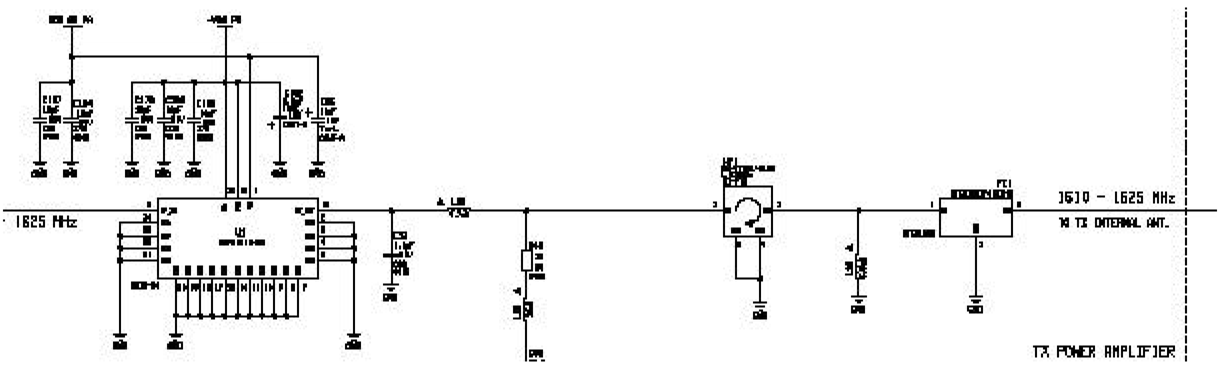
(2) RF filters of the transmitter and the receiver sections: SAW filter Murata SAFC2491.75 (shown as FC4 and FC7 in the electric scheme); SAW filter Murata SAFC1618.25 (shown as FC5 and FC6 in the electric scheme); dielectric filter Murata DFC31R61P016BHB (shown as FC1 in the electric scheme).

(3) Pi-Greek low-pass filter mounted on the PA output (C52 and L32 in the electric scheme) to reduce the third harmonic of the useful signal.

We omit to describe the SAW IF filters SAWTEK, the baseband and IF filters integrated into BBA2, the stages with a response curve noteworthy variable with the frequency, and the filtering capacitors (or RC filters) on power supply and control lines – even if all these filters contribute to achieve this purpose.


225 MHz


1488 - 1495 MHz
1610 - 1625 MHz
TX UPCONVERTER
TX DRIVER


1625 MHz
1610 - 1625 MHz
TX POWER AMPLIFIER

ITEMS REQUIRED FOR AN FCC CERTIFICATION SUBMITTAL
FCC Part 2, Paragraph 2.1033 (continued)

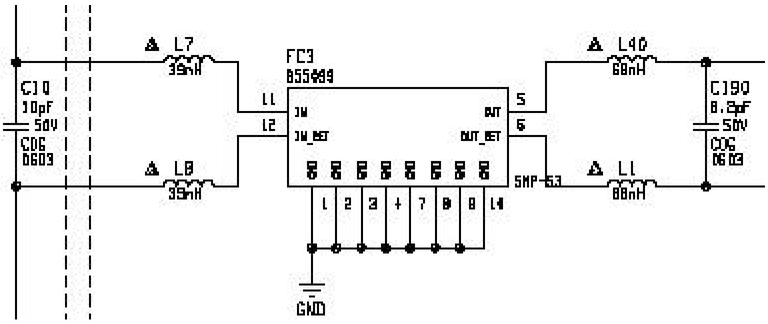
11) For equipment employing digital modulation techniques,
a) Detailed **description of the modulation system** to be used, including the **response characteristics (frequency, phase and amplitude) of any filters** provided, and
b) D**escription of the modulating wavetrain** for the maximum rated conditions under which the equipment will be operated.

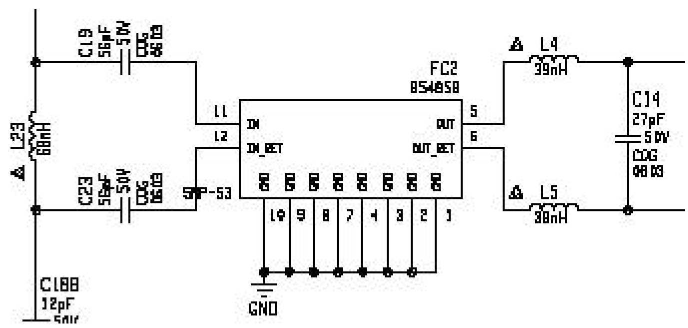
Description of the modulation system

All modulation operation are included in Globalstar User Modem ASIC. At maximum rate GUM receive 8.55 kbit/s of information bits. Adding power control bits, frame quality indicator bits and tail we rich at 9.6kb/s. Then the bits flow is encoded with a ½ convolutional encoder so that at the output there is a 19.2 ksymbol/s rate. A 64-ary orthogonal modulator links 6 symbols at its input with a 64-Walsh function at the output to rich a 204.8 k chip/s rate. The spreading is then performed by a 1.2288 Mc/s long code generator. I anq Q rail are obtained from the spread sequence using two different periodic quadrature spread sequences at 1.2288Mc/s. After a delay of ½ chip on Q rail (to obtain OQPSK) and baseband filtering I and Q waveform enter in a quadrature modulator and added to obtain a TX IF signal.

The response characteristics of any filters.

There are some filters that do not compare in the list of filters for spurious signal's suppression. These are the IF filters SAWTEK 855099 and 854858 (they are identified respectively as FC3 and FC2 in the electric scheme) and the filters integrated in BBA2 Analog Baseband Processor (Qualcomm custom IC).





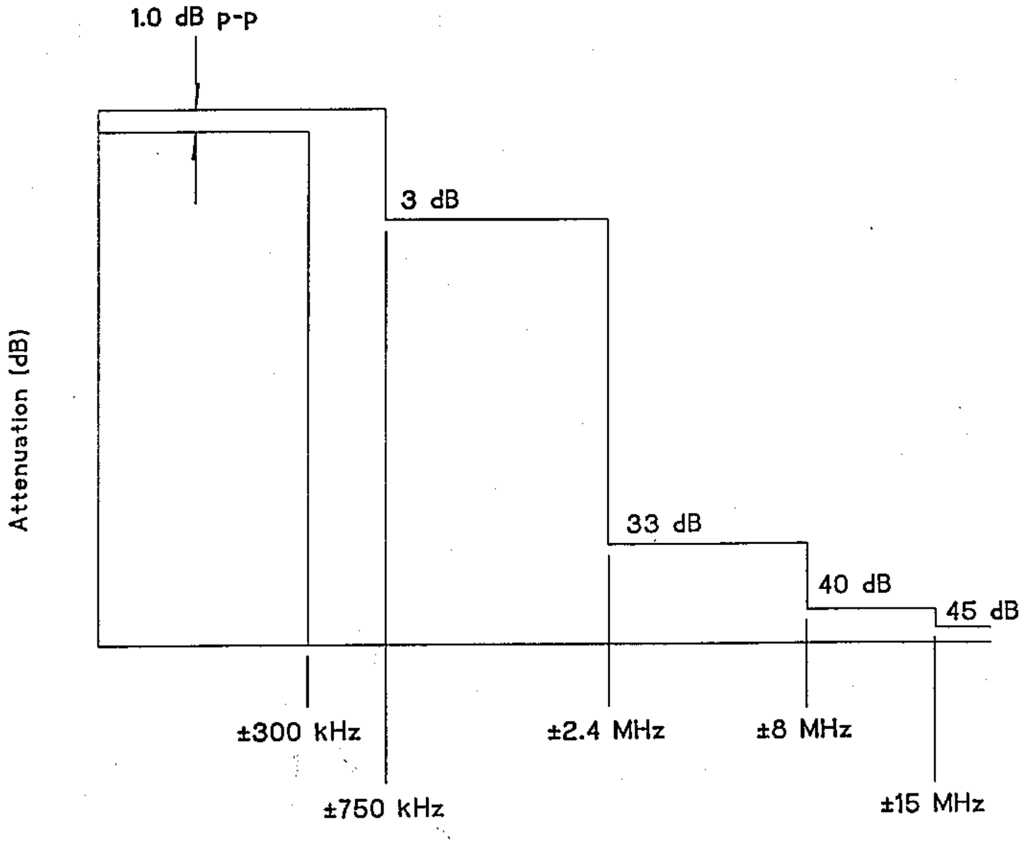
IF RX filter – SAWTEK 855099

Differential Electrical Specifications

Parameter	Min	Nom.	Max	Unit
Center Frequency (Fo)[1]	-	224.88	-	MHz
Passband Loss (@Fo)	-	-	16	dB
Passband Variation pp[2] (Fo ± 300 kHz)	-	-	1.0	dB
Phase Linearity from 224.205 to 225.555 MHz	-	-	3.5	Degrees RMS
Rejection: See Figure 1.	-	-	-	-
Input Impedance Range for Fo ± 300 kHz[1,3]	-	1000 ± j0	-	Ω
Output Impedance Range for Fo ± 300 kHz[1,3]	-	500 ± j0	-	Ω
Input & Output VSWR Fo ± 300 kHz	-	-	2:1	-
Triple Transit Suppression	30	-	-	dBc
Average group delay in passband[4]	.753	.763	.773	usec
Temperature Range	-30	-	+80	°C

Notes:

1. Differential input and output ports.
2. Time domain gating may be used if the triple transit response has a delay of > 1 μs and is -30 dBc relative to the desired impulse response of the Device.
3. The Vendor will specify the match topology that meets the above parameters. The desired input and output topologies will use standard low cost fixed capacitors and inductors. The Vendor will specify the tolerance needed for these components. Once the topology and values are finalized, these values will remain fixed throughout the SAW production cycle. See Figure 3 and Table 1 & 2.
4. Variation from average group delay in the passband includes part to part, temperature and matching variation.



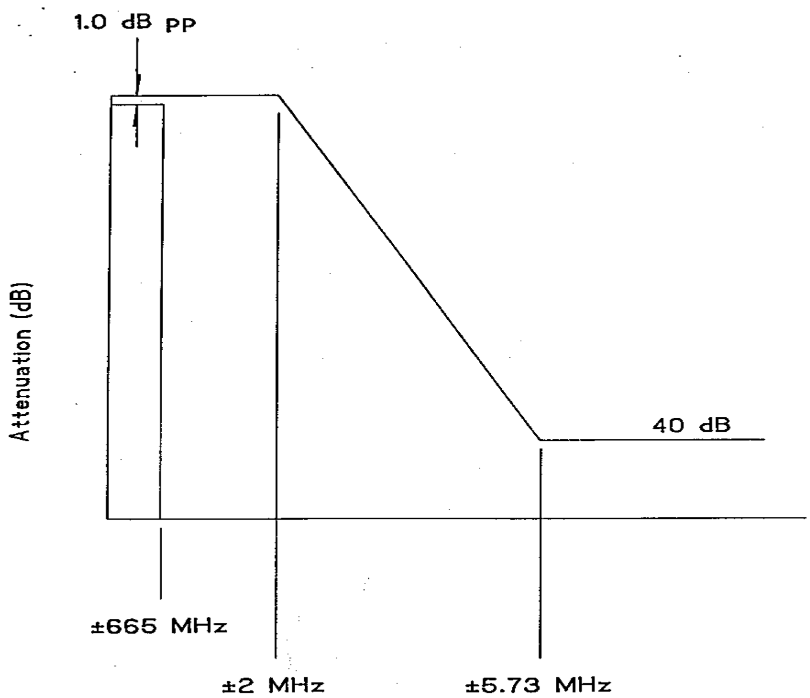
IF TX filter – SAWTEK 854858

Differential Electrical Specifications

Parameter	Min	Nom.	Max	Unit
Center Frequency (Fo)	-	130.38	-	MHz
Passband (Passband specs. apply to the band) See Figure 1.	129.715	-	131.045	MHz
Passband Loss (@Fo)	-	-	8	dB
Passband Variation pp[1]	-	-	1.0	dB
Phase Linearity in Passband	-	-	2.5	Degrees RMS
Rejection: See Figure 1.	-	-	-	-
Triple Transit Suppression	30	-	-	dBc
Input Impedance[2,3,4]		260 ± j0	-	Ω
Output Impedance[2,3,4]	-	260 ± j0	-	Ω
Input and Output VSWR (after match)[3,4]	-	-	1.5:1	Ω
Average Group delay (in passband)[3,4]	0.94	0.95	0.96	uses
Temperature	-30	-	+80	°C

Notes:

1. Time domain gating may be used if the triple transit response has a delay of > 1 µs and is -30 dB relative to the desired impulse response of the Device.
2. Differential input and output ports are required for this filter.
3. Includes part to part, temperature, and matching tolerances.
4. The vendor will specify the match topology that meets the above parameters. The desired input and output topologies will use standard low cost fixed capacitors and inductors. The vendor will specify the tolerance needed for these components. Once the topology and values are finalized, these values will remain fixed throughout the SAW production cycle. See Figure 3 and Tables 1 & 2.



SAW filter Murata SAFC2491.75

Electrical Specifications

Parameter	Min	Nom.	Max	Unit
Passband Frequencies	2483.5	-	2500	MHz
Passband Loss	-	-	3	dB
Variation (pp) over any 1.23 MHz portion of the passband	-	-	0.5	dB
Phase Linearity over any 1.23 MHz portion of the passband	-	-	2.5	degrees RMS
Passband pp Ripple	-	-	1.0	dB
Rejection (Relative to Passband): 2400 to 2450 MHz 2535 to 2600 MHz 1610 to 1626.5 MHz 2033 to 2051 MHz 2259 to 2275 MHz	 12 12 30 30 20	-	-	dBc
VSWR (50 Ω)[1]	-	-	2:1	-
RF Power	+17	-	-	dBm
Temperature	-30	-	+80	C

Notes:
1. Single Ended ports.

SAW filter Murata SAFC1618.25

Electrical Specifications

Parameter	Min	Nom.	Max	Unit
Passband Frequencies	1610	-	1626.5	MHz
Passband Loss	-	-	3.5	dB
Variation (pp) over any 1.23 MHz portion of the Passband.	-	-	0.5	dB
Passband pp variation	-	-	1.0	dB
Phase Linearity over any 1.23 MHz portion of the Passband.	-	-	2.5	degrees RMS
Rejection: 1595 MHz 1573.42 to 1577.42 MHz 1480 to 1496 MHz 1652 MHz 2483.5 to 2500 MHz	 3 20 25 3 25	 - - - - -	 - - - - -	 dBc dBc dBc dBc dBc
VSWR (50 Ω)[1]	-	-	2:1	-
RF Power	+17	-	-	dBm
Temperature	-30	-	+80	°C

Notes:
1. Single Ended Port.

Dielectric filter Murata DFC31R61P016BHB

Electrical Specifications

Parameter	Min	Nom.	Max	Unit
TX Passband Frequencies	1610	-	1626.5	MHz
TX Passband Insertion Loss	-	-	0.6	dB
TX port SWR (50 Ω) in TX passband	-	-	1.8:1	-
Antenna port SWR (50 Ω) in TX passband	-	-	1.8:1	-
Passband Ripple	-	-	0.4	dB pp
Rejection: 1479 to 1496.5 MHz 1740 to 1757 MHz 2483.5 to 2500 MHz 3220 MHz to 3253 MHz	 3 3 40 20	-	-	dBc
Power Handling: 1610 to 1626.5 MHz	3	-	-	W
Temperature Range[1]	-30	-	+80	C
Notes: 1. All specifications must be met over this temperature range.				

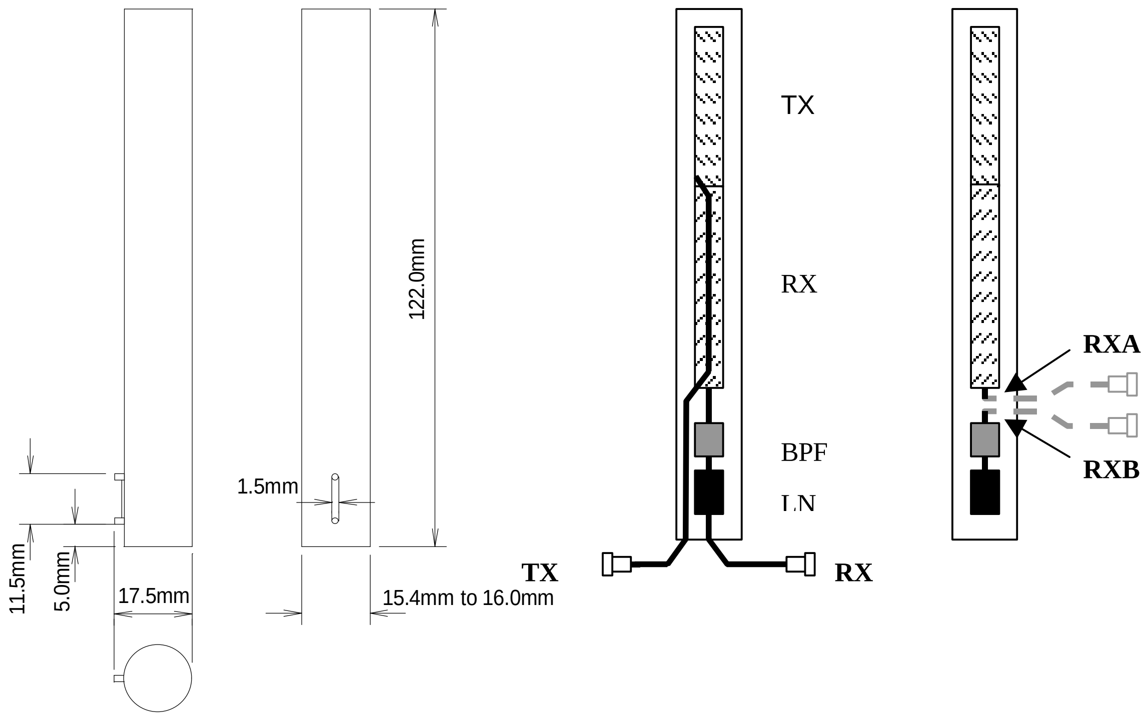
13) RF Exposure information

14) A **full Operating description of the EUT.**
Must include: A brief description of the circuit functions of the device along with a statement describing how the device operates.
Please refer to the attached **Technical Manual**
The statement should contain a description of the ground system and antenna, if any, used with the device.

Antenna description

The L and S-band antenna assembly provides the mean by which the Globalstar User Terminal transmits to and receive the signals from the constellation of Globalstar low heart orbit satellites.
The assembly is capable of operation in two non-contiguous frequency band, namely the transmit band (from 1610MHz to 1626.5MHz) and the receive band (from 2843.5MHz to 2500MHz).

The antenna aperture, the beamforming circuitry and RF electronics are packaged in an integral radome subassembly, in order to obtain a good level of structural rigidity and environmental protection.
The raw external dimensions are as shown below:



The antenna is internally composed of two radiating elements for the separated TX and RX G* functions.
The transmit aperture is located on the top of the receive antenna, in order to minimise the backside radiation to the head of user.
Both the apertures are etched on a single substrate, which also contains the microstrip beamforming phasing networks.
The RX antenna is connected directly to a pre-amplifier BPF (Band-Pass Filter) and a LNA (Low Noise Amplifier), in order to improve the receiver gain to equivalent system noise temperature ratio (G/T).
The complete antenna assembly is provided with two external coaxial connection for the separated TX and RX G* modes; the coaxial cables are terminated with OSX male straight connectors.
The bias to LNA is provided through the RX cable connection.

15) LABEL - **photograph or drawing of the equipment identification plate or label** showing the information to be placed thereon and location on EUT.