Technical and functional test procedure
for the radio terminals to be used within TETRA sole radiocommunications platform managed by STS

According to the Law no. 92/1996 on the organising and functioning of the Special Telecommunications Service (STS), with subsequent amendments and completions, STS is the only authority issuing compulsory technical norms in the field of the special telecommunications.

The Special Telecommunications Service guarantees the protection and the confidentiality of the special radiocommunications, these being excepted from the regime of the licences and authorisations provided for in the legislation in force in the field of telecommunications.

STS places at disposal of TETRA terminal suppliers a test and approval procedure of the technical functional characteristics for portable, mobile and fixed radio terminals from the point of view of the available services on the Romanian TETRA sole platform infrastructure and from the point of view of the interoperability of the terminal and the quality of the service (KPI-Key Performance Indicators) generated by equipments operating.

1. **Scope**

All the types of subscriber equipment will be identified and approved with voice, data and security services under TETRA sole platform, taking into account interoperability certificates handed in by the tenderer. The result of the certification is represented by a conformity certificate which is conferred to the type of the terminal which was verified.

The same model for a terminal that belong to a vendor will be tested for different software versions and the results for the interoperability tests with terminals from other vendors that are already tested on TETRA infrastructure will be made evident.

2. **Field of application**

The certification procedure is binding for all types of TETRA radio terminals, portable, mobile and fixed, proposed to be used within TETRA sole platform managed by STS. After carrying out the technical tests and before publishing on STS website, the results shall be submitted to the supplier in order to be confirmed.

3. **Definitions and abbreviations**

*Conformity assessment* – means the activity as a result of which it is certified that a TETRA terminal conforms to ETSI standards, TETRA MoU documents and STS requirements.

*Conformity certification* – means the action subsequent to the assessment procedure as a result of which it is certified that a terminal conforms to TETRA sole platform for the TETRA standard specifications.

*TETRA terminal* – means an equipment using TETRA sole platform services by standard interface.

*TETRA terminal class* – means TETRA terminal category that under the present procedure are considered similar.
Harmful interference – means interference which endangers the functioning of a service or which otherwise seriously degrades, obstructs or repeatedly interrupts a service within the TETRA radiocommunications network of STS.

Technical Documentation – technical specifications thoroughly describing the type of TETRA radio terminal.

Diagnostic software for terminals – software application (operating on the terminal or separately on a PC) that allows mobility and network parameters (RSSI, adjacent radio cells, etc.) monitoring.

4. Reference documents
The national regulations setting out the domain which the procedure refers to are as follows:

1. Law no. 608/2001 on conformity certification of products, with subsequent amendments and completions;
2. Government Decision no. 71/2002 on the approval of Methodological Norms for establishing the procedures used within the process for conformity certification of products provided for in Law no. 608/2001 on conformity certification of products, with subsequent amendments and completions and of the rules for applying and use of the conformity mark;
3. Government Decision no. 88/2003 on radio equipment and telecommunication terminal equipment and the mutual recognition of their conformity, with subsequent amendments and completions;
4. Government Decision no. 1032/2001 on establishing the conditions for the placing on the market and setting into function of the electric and electronic apparatus from the point of view of electromagnetic compatibility;
5. Government Decision no. 567/2002 on insurance of the safety of the users of low voltage electric equipment;
6. Interoperability certificates (TIP - TETRA Interoperability Profile) drawn up at level of the European Forum TETRA MoU by the Laboratory of Italian Ministry of Communications and Information Technology (ISCTI - Istituto Superiore delle Comunicazioni e tecnologie dell'Informazione).

5. Procedure

A) The procedure is initiated by submitting the technical test application, addressed to the STS Director by a legal person, a TETRA terminals producer or a legal beneficiary of the services of the sole radiocommunication TETRA platform administered by STS.

B) Within 3 working days the STS Director shall analyse the application and shall approve or not the testing application. The applicant shall be informed within 2 working days from the date the decision was made.

C) In case of favorable assessment shall be requested within 3 working days providing with technical documentation and programming software for TETRA radio terminals to be tested. Shall be submitted to the STS radio unit the following equipments: radio terminals, technical documentation, programming kit (software application and proper cables for all types of terminals), data cables for every type of terminal, software
application and hardware devices with proper connecting kit for loading the cyphering keys, diagnostic software, connecting kit for portables with an external antenna, any other accessory available for complete configuration of terminals.

D) The following requirements are applicable to all types of TETRA terminals:

a. the protection of the health and the safety of the user and any other person, including the objectives with respect to safety requirements contained in Government Decision no. 567/2002 on insurance of the safety of the users of low voltage electric equipment, but with no voltage limit applying;

b. the protection requirements with respect to electromagnetic compatibility, provided for in Government Decision no. 1.032/2001 on establishing the conditions for the placing on the market and setting into function of the electric and electronic apparatus from the point of view of electromagnetic compatibility;


(2) The TETRA portable, mobile or fixed radio terminal shall be constructed so that it effectively uses the spectrum allocated to TETRA radiocommunications and avoids harmful interference.

(3) The TETRA portable, mobile or fixed radio terminal shall meet the additional requirements adopted by the European Commission concerning the way the apparatus shall be constructed, so that:

a) it interworks via TETRA networks with other network equipment and it can be connected to interfaces approved by ETSI and TETRA MoU;

b) it does not harm the functioning of TETRA network and it does not misuse network resources thereby causing an unacceptable degradation of communication services;

c) it incorporates safeguards to ensure information security;

d) it supports certain features ensuring avoidance of fraud;

e) it supports certain features ensuring access to emergency services.

(4) If there are established technical tests, specific to TETRA sole platform in Romania, the portable, mobile or fixed radio terminal should meet the testing requirements drawn up and approved at STS level. The contents of the tests shall be published by the sole platform administrator on the Internet website: www.stsnet.ro, with 30 days before the date when will be mandatory.

E) Depending on TETRA terminal type which is required to be tested STS together with the supplier shall decide by mutual consent the lot size of terminals to be analysed.

F) The supplier shall place at STS disposal full technical specifications for TETRA terminals which are intended to be used within STS network;

(2) The technical specifications shall include details enabling terminal conformance test for all services provided by TETRA network of STS;
(3) STS ensures keeping of electronic records concerning technical specifications of TETRA terminals under test.

G) The terminal type under test shall obtain conformity certificate for using within TETRA network only if it meets all requirements and provisions within technical tests drawn up by STS.

H) In case of TETRA terminals approved as a result of testing procedure STS shall issue a conformity certificate concerning the functioning under optimal interoperability conditions within TETRA network. The list including these terminals shall be published on STS website.

I) Should a TETRA terminal type be rejected as a result of testing procedure, STS shall take appropriate measures in order to prevent its use within TETRA network.

J) The supplier shall be informed about the result of technical test procedure within 21 days from the date technical documentation was received and the result will be published on STS website. If this result is not accepted the supplier can file a complaint addressed to the STS director within 5 days from the date the result was received. The complaint shall be settled amicably by the parties within 30 days from the date the complaint was filed.

K) The test evidence register has confidential character. The access to the registered data shall be granted according to law on protection of classified information.

L) If STS finds out non-compliance with the provisions of Government Decision no. 88/2003 on radio equipment and telecommunications terminal equipment and the mutual recognition of their conformity, with subsequent amendments and completions, shall ask for applying of the legal provisions in force.

M) The costs resulting from carrying out technical and functional tests shall be borne by STS.

N) The procedure shall be carried out by the technical staff of STS radio unit.

O) The supplier shall request reperforming the tests for already tested models of terminals which have supported software or hardware changes, before they are furnished on the Romanian market.

P) In order to perform interoperation tests with the other terminals, the supplier will provide minimum one terminal from each tested model, which will remain at STS’s disposal for tests performing.

R) The results of the interoperation tests between the terminals will be shown in a table that will be put on the internet page of S.T.S., www.stsnet.ro. The shape of the table is presented in Annexe nr.1.
TESTED SERVICES
for the radio terminals to be used within TETRA sole radiocommunications platform managed by STS

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1. INTRODUCTION

1.1 Test procedures methodology

The services offered by the TETRA infrastructure administrated by S.T.S are listed and described in the following procedure. Each service is tested by a work procedure characterised by the following operations:

- **SET UP**: comprises the description of the configurations of the equipments used in the test process. The requirements connected to the system's infrastructure or the equipments' set that emulate the infrastructure, will be specified only if additional requirements should appear compared to the standard settings.

- **TEST PROCEDURE**: internal work procedure that comprises the chain of the test operations for each service under test.

Observations:

- The test procedures need solid knowledge regarding TETRA technology.
- If, at the end of the test, one has to make changes in order to restore the initial state of the equipment, exit conditions must be defined.

The results of the tests are mentioned in a technical record of the tested equipment model associated to the conformity certificate. This technical record contains informations regarding the performed tests and their result if it is accomplished or not. If there are certain observations regarding the tested service, they are added as comments to the respective test. At the same time, the results of the laboratory test performed on receiving and transmitting radio parameters are shown, according to the norms ensured by the TETRA standard.
2. **TETRA SERVICES FOR TERMINALS**

2.1 *Terminal registration in the system*

When a radio terminal is switched on, it scans its internal preprogrammed lists of radio frequencies, looking for a radio carrier and is ranking them by received signal strength indication (RSSI). The terminal selects the carrier with the best RSSI and attempts to synchronize and to decode the system information transmitted by the base station. If the terminal establishes that the signal is of acceptable quality, it will attempt to register on this cell by sending a message to the base station on the control channel. This message includes the radio terminal’s individual identity and the selected talkgroup identity.

2.2 *Vocal services*

2.2.1 *Group vocal services*

2.2.1.1 *Talkgroup call in trunking mode*

One of the basic functions of the TETRA IP system is to provide group communications. The system has a large range of features to improve the basic group call service and to control group call functions. Each test introduces a call-related feature, and the network control and management features associated with the call are demonstrated as part of the test.

The group call service allows a terminal or Operator Console (OC) to establish a point to multipoint communication with a group of users known as a talkgroup. The membership of a talkgroup is dynamic. Terminals must affiliate with a talkgroup in order to be a member of a talkgroup. A terminal may only be a member of a single talkgroup at any one time. Once a talkgroup is assigned to an OC, the OC becomes a member of that talkgroup. An OC may be a member of multiple talkgroups.

2.2.1.2 *Group call in isolated site mode*

In the system there are two types of services for sites (base stations) that influence the calls processing:

- Wide Area (Wide Area Service)
- Local Area (Local Service)

Wide Area is the normal state of a site in the system. In this state, the base station receives calls processing instructions from the central controller. A radio terminal affiliated to the base station can communicate with other terminals affiliated to any other base station from the system.

Local Area appears when the site loses connection with the central controller. In this mode, the base station takes over the responsibility of calls processing. A radio terminal affiliated to an isolated site can communicate only with the terminals registered in this site. The available voice service is the group call.
2.2.1.3 Talkgroup announcement call

2.2.1.3.1 Initiated by the dispatcher PATCH GROUP

Operator console permit an announcement call to multiple users using different resources simultaneously or to allow users from different resources to communicate with each other.

“Patch group” announcement call
“Patch group” is a group of resources that can both receive messages from the console and transmit to all other members of the patch group. This group allow users of different resources to communicate with each other. To test this option multiple talkgroups will be added in the Patch group.

2.2.1.3.2 Initiated by the dispatcher MULTI-SELECT

“Multi-Select group” announcement call
The Multi-Select group is a group of resources monitoring simultaneously different talkgroups. Placing all of the resources in a multiselect group allows the console operator to transmit on all of them simultaneously, but the resources can not communicate with each other (unidirectional call). To test this option multiple talkgroups will be added in the multiselect group.

2.2.1.4 Talkgroup scanning

The terminal can be programmed, via the Terminal Programming Application (TPA), with a scan list. A scan list can contain a certain number of talkgroups. A single scan list can be associated with each programmed talkgroup.

When talkgroup scanning is enabled, the radio terminal monitors the Main Control Channel (MCCH) for call set up signaling for any of the talkgroups in the scan list associated with the currently selected talkgroup (in addition to the selected talkgroup and any associated multigroup). As soon as a group call is set up for any of these talkgroups, the radio terminal will join the call. If the user attempts to transmit to the scanned group, the radio terminal can be configured (via the TPA) to either talkback to the scanned group or to the selected (attached) talkgroup.

2.2.1.5 Emergency alarm

The system supports a suite of features that enable effective communication and management of emergency situations. This section tests all the features related to handling these emergency situations.

The emergency alarm service allows a radio terminal (RT) to send an emergency alarm to both the dispatch system and the Radio Control Manager (RCM) application. The service uses the TETRA Status Transfer Service. Only radio terminals can send an Emergency Alarm.
The Emergency Alarm is delivered to all Dispatch Consoles (OCs) that have the affiliated talkgroup of the radio terminal assigned. The Emergency Alarm is only sent to OCs, not to radio terminals that are members of the talkgroup.

2.2.1.6 Emergency call

Emergency Call is a group call with the highest pre-emptive priority. When the system is busy, emergency calls are set up immediately by ruthlessly pre-empting the lowest priority call in progress. The lowest priority call is dropped and the required resources immediately granted to the emergency call.

2.2.1.7 Group call in direct mode (DMO)

The group call in direct mode enables users to communicate directly with each other, both inside and outside of trunked mode coverage areas. DMO is not a part of the trunked operation. Selecting the DMO mode, the user will deregister from the system. DMO uses only a single frequency for communication which is decided at the frequency planning stage.

2.2.2 Voice private calls – individual call with cell reselection

2.2.2.1 Half-duplex Individual call

Semi-duplex transmission represents the operating mode in which an user transmits and the other one listens, transmission and reception of the traffic are not simultaneous. Semi-duplex individual call service permits voice semi-duplex communication of two users of TETRA system in three different ways:

- From the radio to the operator console (this call is made by the radio which calls the console).
- From the operator console to the radio (this call is made by the operator console which calls a radio terminal).
- From a radio terminal to another one (this call is made by the radio which calls the other radio terminal).

An individual call from the operator console to another one is not permitted. (half-duplex or full-duplex)

Handover option permits continuity of the ongoing communication.

2.2.2.2 Full-duplex Individual call

Full-duplex transmission means that each user can transmit and receive traffic (talks and listens) at the same time. Telephone Interconnect calls are always full-duplex, so duplex individual calls appear to the user to be similar to telephone calls. The full duplex individual call service allows two parties in a TETRA system to communicate using full-duplex speech in three different ways:
➢ Radio terminal to Console: This call is initiated by a radio terminal to an operator console.
➢ Console to Radio terminal: This call is initiated by an operator console to a radio terminal.
➢ Radio terminal to Radio terminal: This call is initiated by a radio terminal to another radio terminal.

An individual call (whether half or full duplex) between two consoles is not permitted.

2.2.2.3 Handover (cell reselection) during individual call

The infrastructure allow call continuation during roaming for individual calls. When a radio user is in an individual call and roams to a new cell, the audio signal is redirected automatically to the new cell. The user experiences a short audio interruption.

2.2.2.4 Ambience listening

Ambience Listening allows a radio terminal to be remotely set to transmit, without giving any external indication that a call is being set up or is in progress. Ambience Listening is implemented as a simplex individual call, so the radio terminal will not receive any audio during the call and if the monitored radio terminal is turned off during the ambiance listening call, it will continue to transmit, although it will appear to have been turned off to the user. Ambience listening is always initiated by the infrastructure, from an operator console.

2.2.3 Telephone interconnect calls

2.2.3.1 Phone call from the radio terminal to PABX

The telephone interconnect call service gives full duplex communication between a radio terminal and a Private Automatic Branch eXchange (PABX) or Public Switched Telephone Network (PSTN) user. PSTN access is via a PABX. Full duplex means that both parties in the call can transmit and listen at the same time.

The service allows a radio terminal to initiate a telephone interconnect call by requesting an individual call to the Individual Short Subscriber Identity (ISSI) reserved for the access telephone gateway to and including the required external exchange number in the called request.

2.2.3.2 Phone call from PABX to radio terminal

The telephone interconnect call service gives full duplex communication between a radio terminal and a Private Automatic Branch eXchange (PABX) or Public Switched Telephone Network (PSTN) user. PSTN access is via a PABX. Full duplex means that both parties in the call can transmit and listen at the same time.

The service allows a PABX user to initiate a telephone interconnect call to a radio terminal by dialing an extension or subscriber number reserved for the radio terminal. The external user may dial either a DDI prefix known to the system followed by the ISSI of the radio terminal, or a reserved DDI number known to the system.
2.3 Data services

2.3.1 Status messages

The status message service allows a radio terminal to send a pre-coded status message to the dispatch console system. The service uses the TETRA Status Service over the air interface. Only radio terminals can send status messages and the service is only supported on the Main Control Channel (MCCH). The status message is delivered to all Operator Consoles (OCs) that have the affiliated talkgroup of the radio terminal assigned. The status message is only sent to OCs, not to radio terminals that are members of the talkgroup.

The Switching Center generates an acknowledgement that is returned to the originating radio terminal to indicate that the status message has been delivered to the dispatch console system.

2.3.2 SDS Messages-Short Data Service, Basic Options

The Short Data Transport Service (SDTS) is a transport layer bearer service. SDTS lets applications access the point-to-point TETRA Short Data Service (type 4) transfer over the air. The SDTS uses TETRA Short Subscriber Identity (ISSI) addressing and data can be transferred between:

- Radio terminal A and radio terminal B.
- Radio terminal to a data terminal (that must have an assigned ISSI and be registered with the Short Data Router).

The SDTS supports TETRA Type 4 SDS messages of up to 140 bytes per message.

2.3.3 SDS type messages on the traffic channel

SDS messages are normally delivered via the Main Control Channel (MCCH). However, SDTS supports concurrent voice and data operation because if a radio terminal is involved in a voice call on a traffic channel, SDS messages are delivered via an Associated Control Channel.

This test demonstrates reception of a Short Data message whilst the radio terminal is transmitting in a group call.

2.3.4 Packet data services – file transfer on a static and dynamic data channel

The Packet Data Service (PDS) is a bearer service that allows IP hosts to communicate using the Internet Protocol (IP). The PDS uses the TETRA Sub Net Dependant Convergence Protocol (SNDCP) over the air interface. Transmissions are tested using a compressed (ZIP) file. Compressed files have internal error checking which can be used to verify that the packet data transmission path is error free.

The system allows configuration of data channels in dynamic mode which unlike static channels which can not be interrupted, these could be preempted by voice calls for low traffic resources.
2.3.5 Packet data services – voice priority

If a radio terminal is making a PDS transmission and a Group Call is initiated on the talkgroup to which it is affiliated, then the radio terminal will automatically switch from PDS mode to Group mode and present the Group call audio at the radio terminal’s speaker if it is programmed to do so. Once the Group call transmission has finished, the PDS transmission resumes.

2.3.6 Packet data services – multislot feature

The channels destined for packet data transmissions could be configured in slot or multislot mode.

For the access at multislot service, the radio user must have the option activated in the terminal.

2.4 Radio terminal management

2.4.1 Disable/enable a radio terminal

The Selective Inhibit command to the radio will cause it to appear dead. If, for example, a call set up request is sent to a temporarily disabled radio, the radio will not respond, causing the call to clear down due to timeouts.

The radio is still capable of mobility signaling even when 'inhibited' and can be traced by 'Radio Check' as it moves site (from the network management center).

2.4.2 Dynamic group allocation

A radio terminal can be provided with new or changed talkgroups by download from the SwMI, using Radio resources management. To transmit on a new talkgroup the talkgroup is selected in the normal way. Talkgroups can also be removed.

The radio terminal adds dynamic groups to the talkgroup list on a sequential basis. Addition of new talkgroups starts from the first available position in the current range of the radio terminal. Additional ranges are added when the current range is full. When all ranges have been used, the talkgroup list is full and no more entries will be accepted.
If a Dynamic Regrouping command removes the currently-selected group from the radio terminal, the radio terminal displays 'No Group'. It does not attach to another group automatically.

2.5. Security-authentication and security classes

2.5.1. Air interface encryption – Static key

This section tests the features of the air interface encryption and of authentication process. The Air Interface Encryption feature allows the system infrastructure and subscribers (radio terminals) to communicate over-the-air voice, data, and control signalling to each other in a secure manner. The Static key is used with a TETRA Encryption Algorithm (TEA), TEA1, TEA2 or TEA3 (depending on the system), to encrypt signalling and traffic. Use of the air interface encryption feature provides confidentiality of service between the radio system and subscriber. The Class 2 encryption process uses a static key-trunked mode operation key shared by the radio terminals and the system's sites. When operating, the air interface encryption process encrypts and decrypts all uplink and downlink short subscriber identities (ISSIs) as well as individual, group, and broadcast addressed information using the Static key. The air interface encryption feature is implemented on a system-wide basis and the system can support both subscribers operating in clear and subscribers operating encrypted. For radio terminals, encryption and decryption of traffic signalling is enabled or disabled by the radio system based on the encryption state of each radio terminal involved in a call.

2.5.2. Authentication (Provisioning)

The Air Interface Authentication feature option allows the TETRA IP system to validate that the subscriber radio terminal identity is authentic before granting access to system services. Use of the authentication feature establishes a level of trust between the radio system infrastructure and subscriber.

2.5.3. Authentication (without encryption and with encryption)

The Air Interface Authentication feature option allows the TETRA IP system to validate that the subscriber radio terminal identity is authentic before granting access to system services. Use of the authentication feature establishes a level of trust between the radio system infrastructure and subscriber. In this test authentication of users and rejection of subscribers with incorrect Key information are demonstrated. The authentication feature will be tested for terminals in clear and encrypted range of addresses.
2.6 Security – End to end encryption

An End to End encrypted voice service operates between two or more radios without any intervention by the infrastructure. It removes the need for a user to trust the network to maintain the confidentiality of their data during transit. When using End to End encryption, voice traffic is encrypted in the transmitting terminal and only decrypted at the receiving terminal. The plain text (unencrypted message) is never exposed in the infrastructure, and indeed no mechanism exists for recovering the plain-text from the SwMI, even were this is desired.

The End to End encryption service is a separate function to the Air interface encryption. Information that has already been encrypted by the End to End service may be encrypted again by the air interface encryption function. E2E encryption is implemented in the radio terminal via a dedicated hardware module, the Universal Crypto-Module (UCM), the SwMI merely provides a bearer service. If a radio terminal is fitted with a UCM then whether or not particular calls are encrypted with E2E depends upon associations provisioned into the radio terminal via Over The Air Keying (OTAK) and entered through the KMC.

The Key Management Center (KMC) uses a client server architecture. A KMC uses password protection and account management to control who can access the specific key management services, including the ability to enable and disable key generation. KMC is able to generate and store all the key material. The generation and storage of key material includes maintaining keys and aliases (internal to KMC), maintaining a kettle for new keys, and assigning key material to secure devices.

The KMC supports changing the master encryption key used to encrypt the key information in the database without any loss of data. The KMC is also able to import key material from 3rd party in the encrypted key format. Some KMC functions can only be performed at the server, and not via a client. These are: loading a master key, connection of the KL to the KMC for key transfer, database backup/restore and key import. Key Loader is a battery-powered portable unit used to create, store, and transfer encryption keys between the Key Management Center (KMC) and the radio terminals for End to End encryption. The system will support End to End encryption on the following call types from radio terminal to radio terminal:

- Individual Call - Full & Half Duplex
- Talkgroup Call (Selected group, scan group, announcement group, priority monitor and emergency group call)
- DMO calls (Talkgroup only)

The series of tests demonstrates how E2E encryption is configured using the Key management center a KL. Tests in this section need to be performed sequentially one after the other.

2.6.1 Creating radio unit

In order to provision radios for E2E encryption, the KMC user must create new radio records in the KMC database. These records include the Radio ISSI, a KEK and a SEK. In
addition, the record includes a list of transport mechanisms for getting key material to the Radio. These would normally be one of the KLs on the system, plus the System itself (for OTAK via SDS).

2.6.2 Provisioning Radios with keys (by a procedure supplied by the terminal’s manufacturer)

The key archive is a storage area of unlabelled and unassigned keys stored in the Key Management Center E2E (KMC Server) database. The key archive allows the KMC administrator to create and store properly formatted keys, and later retrieve and assign keys which are randomly selected from the key archive. Keys can be loaded into the archive manually by keyboard, via the KL or can be loaded by file.

In this test, 8 Keys will be added manually to the key archive.

2.6.3 E2E group call in trunking mode

The group call service allows a terminal or Operator Console (OC) to establish a one-to-many communication with a group of users known as a talkgroup.

2.6.4 E2E individual call

Full-duplex transmission means that each user can transmit and receive traffic (talks and listens) at the same time. Telephone Interconnect calls are always full-duplex, so duplex individual calls appear to the user to be similar to telephone calls. The full duplex individual call service allows two parties in a TETRA system to communicate using full-duplex speech in three different ways:

Radio terminal to Console: This call is initiated by a radio terminal to an operator console.

Console to Radio terminal: This call is initiated by an operator console to a radio terminal.

Radio terminal to Radio terminal: This call is initiated by a radio terminal to another radio terminal.

An individual call (whether half or full duplex) between two consoles is not permitted.

2.6.5 E2E group call in DMO

The group call in direct mode enables users to communicate directly with each other, both inside and outside of trunked mode coverage areas.

3. RADIO PARAMETERS OF THE TETRA TERMINALS

3.1 Generalities

The tests are performed with radio test equipments (IFR type) which are in use by the TETRA maintenance laboratory. These equipments offer specific tests for terminals which are working in TETRA standard.
3.2. Terminal registration
This test checks the ability of the mobile to register (ITSI Attach) at power on.

3.3. Audio quality testing

This is a subjective test in which you are asked to judge the quality of the complete audio/radio/audio path by talking into the mobile’s microphone and listening to the result from the earpiece or speaker (delay approx. 2 seconds).

3.4. Power level testing

The power level test measures the average power during a burst. The measurement is taken over the useful part of the burst measured at the symbol points through a TETRA filter (root Nyquist $\alpha = 0.35$).

3.5. Tx Frequency testing

The Tx Frequency test determines the accuracy of the radio frequency transmitted by the mobile on the current traffic channel. The measurement made is the difference between the frequency of the signal received from the mobile and the receiver frequency of the Test Set. This measurement is taken over the useful part of the burst measured at the symbol points through a TETRA filter.

3.6 Tx power profile

This test checks the conformance of the mobile’s burst power profile to the TETRA specification mask limits.

3.7 Tx RMS Vector Error

This test checks the modulation accuracy of the mobile’s transmitter. The RMS vector error test measures the vector error of the received symbols with respect to the ideal symbol points for the burst. This measurement is taken over the useful part of the burst measured at the symbol points through a TETRA filter. The RMS value is the root mean square of all the symbols.

3.8. Tx Timing Error

The timing error or frame alignment test measures the symbol timing of the bursts from the mobile, measured with respect to the signal transmitted by the Test Set.

3.9 TX Peak Vector Error

The Peak Vector Error test measures the vector error of the received symbols with respect to the ideal symbol points for the burst. This measurement is taken over the useful
part of the burst measured at the symbol points through a TETRA filter. The peak value is the vector error of the symbol with the highest error.

3.10 Tx Residual Carrier

The Residual Carrier test measures the vector error of the received symbols with respect to the ideal symbol points for the burst. This measurement is taken over the useful part of the burst measured at the symbol points through a TETRA filter. The residual carrier value is the mean residual carrier magnitude.

3.11 TT Test Mode

This test is only available for terminals that have this option built-in. This test checks the ability of the mobile to perform an extended “TT Test Mode” registration. The main purpose of the TT TEST Mode test is to obtain information about the mobile, such as the ITS/SSI, TEI, Power Class and Receiver Class for use in later tests. TT Test Mode test also enables the use of “TT” RF Loop back for performing the later receiver sensitivity tests (Rx BER, Rx RBER, Rx MER).

3.12. Rx BER Class 0

This test checks the mobile receiver’s bit error rate for Class 0 bits.

3.13. Rx BER Class 1

This test checks the mobile receiver’s bit error rate for Class 1 bits.

3.14. Rx BER Class 2

This test checks the mobile receiver’s bit error rate for Class 2 bits.

3.15. Rx BER Class 0

This test checks the mobile receiver’s residual bit error rate for Class 0 bits.

3.16. Rx RBER Class 1

This test checks the mobile receiver’s residual bit error rate for Class 1 bits.

3.17. Rx MER

This test checks the mobile receiver’s message error rate.
4. ADDITIONAL SERVICES

4.1. Browser WAP (Wireless Application Protocol)
This service allows direct access of the subscribers, from a TETRA terminal to information sources stored on a server (ex. data bases).

4.2. AVL Service by internal GPS controller
Some TETRA radiophones have built in controllers and GPS antennas, which allows the display of GPS coordinates on the terminal's screen or sending them to the AVL server by means of TETRA infrastructure, in a format mentioned in the technical specification of the producer.

4.3. Multigroup Call
A multigroup call is a group call which ensures simultaneous communication to several working groups.

4.4. Repeater Function
A radio terminal can work as a repeater, assuring an extension of the radio coverage for other terminals in „direct” mode operation (DMO).

4.5. Gateway interface function
A radio terminal working as „gateway” interface allows the transfer of voice communications from „direct” mode (DMO) to „trunk” mode (TMO).

4.6. Work in repeater mode
The terminals which receive the signal sent by the repeater function equipment are registering in the repeater mode, and group communications are achieved only by means of the repeater terminal and only within the radio coverage furnished by it.

4.7. Work in gateway interface mode
The terminals which receive the signal sent by the gateway interface function equipment are registering in the gateway mode, and communications will be achieved between a terminal registered in „gateway” mode which is positioned within the coverage of the gateway equipment and a terminal registered on a radio cell belonging to the system’s infrastructure.
Annexe nr.1

Table containing tested services for terminals interoperation

<table>
<thead>
<tr>
<th>Operating Mode</th>
<th>TMO</th>
<th>DMO</th>
</tr>
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<tbody>
<tr>
<td>Service Description</td>
<td>Group Call</td>
<td>Semi duplex individual call</td>
</tr>
<tr>
<td>Initiating service terminal type</td>
<td>Vendor / Terminal type</td>
<td>Vendor</td>
</tr>
<tr>
<td>Receiving service terminals</td>
<td>PO/NE/C</td>
<td>PO/NE/C</td>
</tr>
</tbody>
</table>

PO – positive test
NE – negative test
/C – comments