Technical Specification Group Services and System Aspects ***GTT(01)0012***
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Title: **Operator Requirements and Issues - 3GPP Support of TTY (CTM)**

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Introduction

The US Federal Communications Commission's Fourth Report and Order on the Compatibility of Enhanced E911 Emergency Calling Services (Fourth Report and Order) requires US Operators to have obtained all software upgrades and hardware necessary to make our systems capable of transmitting 911 calls from TTY devices by December, 31 2001. The order provides US Operators with a six-month deployment window. Therefore by June 30th, 2002, TTY support for E911 is mandated.

The initial requirement is to support Baudot coding across the network. Enhanced protocols such as Turbo Code (developed by Ultratec) and Hispeed (Ameriphone) were for further study. At TTY Forum 17 in March 2001, TTY manufacturers agreed to default their apparatus to the Baudot code automatically upon connection to a cellular handset. Therefore, US GSM networks are only required to support the transport of Baudot coding.

The Fourth Report and Order re-affirms the operators' need to comply with section 251(a)(2) and 255(b) of the Telecommunications Act of 1934:

Section 251(a)(2)

> *(a) GENERAL DUTY OF TELECOMMUNICATIONS CARRIERS.--Each telecommunications carrier has the duty--*
>
> > *(1) to interconnect directly or indirectly with the facilities and equipment of other telecommunications carriers; and*
> >
> > *(2)* ***not to install network features, functions, or capabilities that do not comply with the guidelines and standards established pursuant to section 255 or 256****.*

Section 255(b)

> (*b) MANUFACTURING.--A manufacturer of telecommunications equipment or customer premises equipment shall ensure that the equipment is designed, developed, and fabricated to be accessible to and usable by individuals with disabilities, if readily achievable.*

Support for 711 services (Telecom Relay Services) is under discussion and the Fourth Report and Order brings attention to the support of TRS. With a TRS 711 service, a relay operator will act as the connection between a TTY user and a non-TTY user. In many instances a toll-free number is used by the non-TTY user to set up the TRS call.

While it appears that all network features, functions or capabilities should be accessible to and usable by individuals with disabilities, if readily achievable, the only requirement in the US which has a mandated time element is for the operators to have obtained all software upgrades and hardware necessary to make our systems capable of transmitting 911 calls from TTY devices.

Requirements

E911 Compliant – Most critical to the US Operators
Supports MO/MT TTY calls
Supports TRS service (“one-way” TTY)
Supports in-call TTY/Voice switching (e.g. Voice Carry-Over and Hearing Carry-Over)
Baudot signaling (no proprietary formats)
TTY feature transparency

Technical Solutions

The GSM TTY support solution has focused around the use of Cellular Text Modem (using ITU-T T.140 encoding) as the transport protocol across a standard voice channel. Because TTY terminals, 711 TRS centers, PSAPs and CALEA monitoring centers all use Baudot coding (one of the ITU-T V.18 modes), two CTM to Baudot conversion points are needed. The first conversion is at the GSM handset to allow CTM to be used across the air interface. The second conversion from CTM to Baudot must occur either at the call destination point (e.g. PSAP, 711 TRS, etc.) or within the GSM network.

The GSM technical bodies have opted to handle the requisite CTM/Baudot conversion within the GSM network and have proposed two solutions: 1) a transcoder based solution and 2) a network server solution. The TSG SA Plenary #11 agreed that is was inappropriate at this time to choose a single solution and supported a workshop to develop sufficient technical information to allow vendors to build interoperable equipment in support of either solution.

Transcoder Based

This solution places the CTM/Baudot conversion directly into the speech path within the Radio Access Network (RAN). This solution must be implemented on every transcoder in order to meet GSM TTY support requirements.

Based on discussions with vendors, there appears to be sufficient information contained in the most current versions of the CTM Specifications (3GPP TS 26.230 and 3GPP TS 26.231) to build interoperable equipment for a transcoder-based solution. However, to make the transcoder solution practical, some sort of CTM-enabled-transcoder pooling may be needed. Vendors are asked to comment as to whether it may be possible to put the CTM detection in to all transcoders, but perform a circuit "handover" or reassignment if CTM to Baudot conversion is needed (to a transcoder equipped with CTM to Baudot conversion).

Network Server Based

The network server approach adds a network node to the existing NSS in the GSM core network. All E911 trunks are routed through this server, providing E911 TTY support to any customer with a GSM handset capable of accessing the network. CAMEL is used to support the routing of non-emergency TTY calls from the NSS to the network server.

Most vendors agree that additional information is necessary in the specifications to allow a workable, interoperable server-based solution. Therefore, it is proposed the following issues be addressed at the Workshop.

Issues to be addressed by the Workshop

There are a number of implementation issues that must be addressed in order for the network server to be considered a viable solution. These issues include:

1) **E911 versus TTY support:** The timescales for providing support of E911 only TTY calls and providing full feature support using CAMEL must be evaluated, bearing in mind that the time critical mandate in the US is for making our systems capable of transmitting E911 calls from TTY devices.
2) **Scalability:** The scalability of a server solution to handle both E911 voice and TTY calls, along with non-emergency TTY calls is questionable. For example, if all E911 voice calls are routed to the server, then the number of servers grows in proportion to the E911 voice traffic and not to the TTY traffic.
3) **Call Looping:** In order to prevent infinite looping between the CAMEL server and the GMSC, the CAMEL Server solution proposes to modify the Calling Party Number to indicate that it has passed through the CAMEL server. This raises compatibility issues with Phase 1 Calling Number

Presentation and also with the working of CALEA. We suggest that on a terminating call, any trunk to the CTM server could have IN suppression added, which will prevent looping. However, this would negate the use of any other CAMEL services the customer may have, and feature interaction needs to be studied.

4) **Customer Provisioning:** By FCC mandate, all E911 TTY calls will be supported by the network without any customer provisioning requirements. However, non-emergency TTY calls will not be supported unless the TTY customer has requested TTY service from the carrier. This provisioning requirement causes GSM TTY support via the network server solution to differ considerably from the automatic support of non-emergency TTY calls provided by TDMA and CDMA systems in the US. How can non-emergency TTY support be provided for pre-paid subscribers.
5) **Single Point of Failure:** All E911 calls (whether voice or TTY) are routed through the network server. In most implementations, redundancy of the server and its trunks will be required, adding to the server deployment costs.
6) **Callback:** The Phase 1 and Phase 2 E911 standards require that the PSAP is able to call back the E911 caller. In the network server implementation, the caller must be registered as a CAMEL subscriber to be given a CTM circuit. Any inter-working should be done utilizing generic digits in the ISUP messaging (GAP etc.) to store the original called number. The CTM could then reformat the IAM. In this scenario CALEA and CLIP etc. are not affected by the "Interim node".
7) **Subscription Management:** CAMEL server requires the TTY user to have a known subscription type. It is envisaged that some CTM implementations at the mobile may consist of direct connection to the audio jack, such that a TTY user could use any existing or new mobile subscription.
8) **Carry-over:** Support of E911, TTY Voice Carry-Over/Hearing Carry-Over, and 711 TRS services may require the user to switch from voice to CTM and back again within the call. It is unclear how this is to be supported in the CAMEL solution.
9) **CAMEL interaction:** If TTY is provided via a CAMEL mechanism, the changes required to other already deployed CAMEL services such as pre-paid must be assessed.