

**RESOLUTION DOCUMENT  
September 19, 1997**

**CTIA FORUM  
Seeking Solutions To TTY/TDD Through Wireless Digital Systems  
September 17-19, 1997**

**THE CHARGE TO EACH WORK GROUP**

1. Establish, publish, and maintain a Membership List to Forum (preferably via Email).
2. Define work project (including statement of work, project timeline, deliverables - using ANSI PINS form), circulate and reach agreement on project sheets within the next two weeks.
3. Establish *AD HOC* groups to work projects, as necessary.
4. Publish status reports (output via Email), due monthly.
5. Use CTIA (SciTech) as communications/coordination/focal point.
6. Strive for representation from each of the four interest groups:
  - Wireless Industry (phone manufacturers and WSP carriers),
  - TTY Equipment Manufacturers for Service Providers and Consumers
  - Service Providers (9-1-1 and Relay)
  - Consumer Groups (Deaf and Hearing/Speech Impaired)
7. Provide adequate notice of scheduled meetings.

# **RESOLUTION DOCUMENT**

**September 19, 1997**

## **CTIA FORUM**

**Seeking Solutions To TTY/TDD Through Wireless Digital Systems**

**September 17-19, 1997**

### **FCC REPORT NOTES**

**Request delay of implementation of TTY over digital wireless by 18 months.**

#### **ACTION:**

1. CTIA/PCIA/TDI reports to the FCC ASAP.
2. It was discussed and agreed that :  
There is a petition to extend the compliance date for 18 months. This group, consisting of representatives from the four interest groups and dedicated to working together, found there was no disagreement that more time is needed to find the best solution for TDD users. They further found that continued intensive collaborative efforts are required. The request for an extension of time was agreed to be for no longer than 18 months.

**NEXT MEETING OF FORUM:                    December 12-13, 1997**  
**Washington, D.C.**

## **Appendix E**

### **Notification Text and Strategy**

**PROPOSED E911 TTY/DIGITAL NOTIFICATION STRATEGY**

<b>Type of Customer</b>	<b>Possible Methods of Notification</b>	<b>Messenger(s)</b>	<b>Target Delivery Date</b>
<b>Current Wireless Customers: (Active)</b> □ individual accounts □ small business □ bundled services □ national/corporate accounts (multiple unit.)	• Text message on bill and/or Bill Inserts	• Service Providers	• March bill cycle (optional to repeat quarterly)
	• Article in customer newsletter(s)	• Service Providers	• April
	• Information on Internet site	• All (Service Providers, Consumers & Manufacturers)	• ASAP
<b>New Wireless Customers: (Education -at point of sale- for people considering purchasing wireless services)</b> □ indirect & direct channels □ individual □ small business □ retail, dealer, reseller etc	• Sales/customer care representatives	• Service Providers	• March
	• Product information on/in box (sticker, flyer, text in manual?)	• Manufacturers	• March/April
	• Internet sites (purchase on-line)	• Service Providers & Manufacturers	• ASAP
<b>Potential Wireless Customers: (Those who have not yet considered purchasing wireless services)</b> □ TTY users □ people who are deaf/hard of hearing □ people with speech disabilities □ service providers (interpreters, audiologists etc.)	• Send notification letter, fact sheet and/or brochure to: □ national consumer organizations □ state offices of deaf services □ local community agencies	• Service Providers/CTIA / <i>FR</i> IA	• March
	• Provide Information at disability/ trade shows	• All	• Ongoing
	• Submit informational articles to national/local community newsletters/magazines	• Consumers (Gallaudet) & Service Providers	• Ongoing
	• Advertise in professional journals/magazines	• CTIA coordinates for All	• April
	• Educate TRS providers	• Consumers /Service Providers	• March
	• Include information with every new TTY sold	• TTY Manufacturers	• March/Ongoing
	• Update information on Internet Sites	• All	• ASAP
<b>Notes:</b> • CTIA (via TTY Forum) will work to develop common language (the message) that can be used in all communication pieces regardless of type of media • Gallaudet has already developed and placed articles in some consumer organization newsletters - use as model for ongoing education • Overall plan with deliverables and dates should be outlined in FCC quarterly report due April 1, 1998			

## Recommended Text

### **ATTENTION TTY USERS**

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#### **Background**

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*A TTY (also known as a TDD or Text Telephone) is a telecommunications device that allows people who are deaf, hard of hearing, or have speech or language disabilities to communicate by telephone. A TTY has a keyboard used to type a conversation, which then is transmitted as tones over a wired telephone line. The tones are translated to text that appears on a person's TTY screen.*

#### **911 and TTY Access Through Wireless Services**

Federal law requires the telecommunications industry to provide a way for TTYs to communicate through **wireless systems** to make 911 calls. There are two types of wireless phones – analog and digital.

- Analog – It is possible today to use some analog wireless phones reliably to call 911 with a TTY.
- Digital – It is not possible today to use a digital wireless phone reliably to call 911 with a TTY.

Research is being done to improve the ability of digital phones to work reliably with TTYs. The industry is working to resolve this matter by October 1998.

[Optional: For more information, contact . . . ]

DATE OF PUBLICATION:

## **Appendix F**

### **TTY Forum 1-3 Reports**



## **CTIA Forum**

# **Seeking Solutions to TTY/TDD Through Wireless Digital Systems**

## **Report**

**VERSION 1.0**

(October 20, 1997)

**September 17-19, 1997  
Arlington, Virginia**

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This report may be purchased for \$75. Presentation materials included for \$95.

## **INTRODUCTION AND EXECUTIVE SUMMARY**

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The CTIA hosted an industry forum to discuss and strive for consensus among the representative parties regarding the best support for TTY technology over digital wireless systems. Representatives from the wireless industry, the deaf community, subject matter experts, and equipment and service providers met from September 17 - 19, 1997 in Arlington, Virginia to address the need for a consensus-driven response to both the resolution of these technical issues and compliance with FCC Report and Order 94-102.

The Commission's Order requires that wireless services providers (WSP) "must transmit TTY calls to 911 services" from persons with hearing and speech impairment. The Report and Order addresses the problem of resolving the technical issues in order that an adequate industry-wide answer may be obtained. Further, the Commission has suggested that the industry experts, technology experts, and the community experts representing people with hearing and speech disabilities, work together to achieve resolution. Contained in the Report and Order is a requirement to supply an industry response by October 1, 1997. This requirement was a focal issue for all represented parties.

The forum was divided into three phases:

- ◇ the **Discovery Phase**, including presentations, contributions and discussion, was designed to educate each interest group affording a basis for understanding the operations, issues and concerns of each interest group;
- ◇ the **Analysis Phase** was designed to identify and explore various regulatory and service issues identified in the Discovery Phase. Specific focus was placed on Interfacing and Operational issues, including analysis of Evolution - new generation of TTY; and
- ◇ the **Resolution Phase** was an opportunity to consolidate and refine issues, develop courses of action, identify agreement on viable solutions, review agreements reached, and summarize and identify next steps.

All presentations shared the common thread of interdependence among the participants. The consumer perspective encouraged finding solutions that not only support technical requirements but user requirements. Industry presentations provided overviews of

current and proposed technology solutions related to TDD/TTY services. The 9-1-1 Service providers and equipment manufacturers addressed issues related to providing service today and in the future with a call to the interests groups to ensure workable, acceptable solutions.

The three interest groups defined in the goals of the CTIA Forum were redefined in the Resolution Phase to include four (4) interest groups. They are:

- ◇ Wireless Industry (phone manufacturers and WSP)
- ◇ TTY Equipment Manufacturers for Service Providers and Consumers
- ◇ Service Providers (9-1-1 and Relay)
- ◇ Consumer Groups (Deaf and Hearing/Speech Impaired)

The representatives at the forum established the following resolutions: (see Resolutions in Resolutions Section of this report)

- ◇ FCC Report Action: Submit a written *Ex Parte*
  - ◆ CTIA/PCIA/TDI reports to the FCC "ASAP"
  - ◆ It was discussed and agreed that: *"There is a petition to extend the compliance date for 18 months. This group, consisting of representatives from the four interest groups and dedicated to working together, found there was no disagreement that more time is needed to find the best solution for TDD users."*
  - ◆ The group further found that continued intensive collaborative efforts are required. The request for an extension of time was agreed to be for no longer than 18 months.
  - ◆ The next Forum meeting was set for December 11-12, 1997 in Washington, DC
- ◇ Agreements reached:
  - ◆ Seek solution for 45.45 Baud BAUDOT (not to preclude others)
  - ◆ Establish two approaches - a near term and a long term solution.
  - ◆ Analog networks have the capability to support transmission formats used by TTY today. Some interface issues exist for specific analog wireless products and specific TTY products
- ◇ In order to address the near-term and long-term agreement, three (3) working groups were established. They are:

- ◆ Working Group #1 - Performance of TTY Signals over Voice Service
- ◆ Working Group #2 - Performance of TTY Signals over Data Service
- ◆ Working Group #3 - Coupling Work Group
- ◇ Charge to Each Work Group
  - ◆ Defines scope, tasks, and deliverables for each group.

## **OPENING REMARKS**

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### **Bob Montgomery, Director for Network Operations, CTIA**

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The CTIA focus for the forum is on concerns with E9-1-1 and the FCC Report and Order, with a highlight on the issues surrounding TTY.

By working with the 3 focus groups identified in the "Goal" section of the agenda, CTIA seeks consensus on how best to support TTY over digital wireless.

The identified participants: the wireless industry, subject matter experts, and consumer organizations, were charged with addressing the agenda in three phases - discovery, analysis, resolution phases. The outcome is to be a report to be published to the industry (consisting of the three groups) and will serve as a source of primary information for the report to the FCC due next month.

Three areas of issues and concerns: regulatory issues, technology issues and other issues, were to be captured for resolution. The ultimate goal is to provide TTY service in a digital air environment. A call for contributions sought all verbal and written input to facilitate discussion during the analysis phase.

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## **PRESENTATIONS AND CONTRIBUTIONS**

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### **WON KIM, *Analysis Of FCC Report, FCC Perspective*, Policy Division, Wireless Bureau, FCC (refer to handout reprinted in this report)**

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The opening statements clearly identified that the FCC will not address questions regarding substantive issues that are pending a vote. The Commission's commitment to the statutory mandate to "promote safety of life and property through the use of wire and radio communication" causes them to view with concern the inability of digital wireless customers to benefit from the advances in emergency capabilities of E9-1-1 systems available to most wireline customers.

While the Commission declined to delay introduction of PCS broadband services, direction was issued to the industry to pay particular attention to E9-1-1 access. In the Emergency Access Position Paper (Joint Paper), an *Ex Parte* filing in the PCS proceeding by APCO, NENA, NASNA, and PCIA, consensus recommendations to assist standards bodies in developing standards for wireless systems to access E9-1-1 service systems were offered. The JEM Report, filed by APCO, NENA, NASNA, and PCIA further proposed wireless E9-1-1 features. These offerings formed, in part, the basis of the E9-1-1 NPRM (adopted 9/1/94). The proposed TTY compatibility requirement of the NPRM was that within one year of the effective date of the order adopting rules in the proceeding,

radio services must be capable of providing access by individuals with speech or hearing disabilities through a TTY device.

The E9-1-1 NPRM sought to improve 9-1-1 access for wireless service users and to establish an implementation schedule for enhanced 9-1-1 services. It did not attempt to establish extensive technical standards for E9-1-1 operation, noting that industry standards-setting committees should address precise technical requirements for E9-1-1 compatibility. A Consensus Agreement, representing negotiations between CTIA, for both PCS and Cellular carriers, and the Public Safety Community, represented by APCO, NENA, and NASNA, published consensus regarding various issues on the wireless E9-1-1 features. The Consensus Agreement agreed with the Commission's proposed requirement that 9-1-1 access be available through TTY devices and suggested that the industry should determine and establish standards to permit interface between TTYs and wireless systems.

In the Wireless E9-1-1 First Report and Order (adopted 6/12/96), the Commission committed to foster major improvements in the quality and reliability of wireless E9-1-1 service. Further, it established basic and enhanced requirements for wireless carriers (cellular, PCS, some SMRs), and provided general performance criteria for wireless E9-1-1 service, rather than precise technical standards for the industry.

Wireless E9-1-1 Rules: 47 C.F.R. &20.18 (*recon. pending*) identifies the requirement for availability of Basic 9-1-1, TTY access, Phase I Enhanced 9-1-1 capabilities (ANI), Phase II Enhanced 9-1-1 capabilities (ALI), and Reporting Requirements.

**Action required by date:**

- October 1, 1997 - Phase I
  - Carriers must process and transmit to an appropriate PSAP all 9-1-1 calls from wireless handsets which transmit a code identification, without user validation.
  - Carriers must process and transmit calls that do not transmit a code identification to any appropriate PSAP which has formally instructed the carrier that it wants to receive such calls from the carrier.
  - Carriers must also be capable of transmitting 9-1-1 calls made through the use of TTY equipment.
- April 1, 1998 - Phase II
  - Carriers must take actions necessary to relay a caller's Automatic Number Identification (ANI) and the location of the cell site receiving a 9-1-1 call from any mobile handset or TTY device accessing their system to the PSAP.

- The PSAP can then call back the wireless phone which placed the 9-1-1 call, if disconnected, and help identify the location of the caller.
- October 1, 2001
  - Carriers are required to have the capability to identify the latitude and longitude of the mobile unit making a 9-1-1 call within a radius of no more than 125 meters using Root Mean Square measurement (including TTY calls).

#### **Reporting Requirements**

- The Commission will remain actively involved to ensure resolution of implementation issues.
- The Commission required the signatories to the Consensus Agreement, PCIA, and Alliance to provide the Commission with joint reports regarding the status of the resolution of the remaining implementation issues.
- By January 30, 1998, parties to the Consensus Agreement, PCIA and Alliance are required to file the first annual status report and operational standards necessary to implement wireless E9-1-1 features.
- The Commission concluded that parties and industry standard bodies should coordinate their efforts to resolve these technical issues before the end of 1996.

#### **WENDY CHOW, Analysis Of FCC Report, CTIA Perspective, CTIA Legal Staff**

There is a need to establish commitment and consensus in resolving the issue of providing TDD/TTY support through wireless digital systems. CTIA is committed to finding a solution in accordance with the law and the needs of the community. It is both good policy and good business. The industry has been working hard to meet the deliverables. Today we are looking to find solutions and meet reporting requirement. Efforts should not ignore analog advances. The FCC has directed specific solutions and required that all parties must address the issue together. The October 1, 1997 deadline to provide solution has met with various comments. The requested 18 month extension has been challenged and asked to reflect a 9 month only extension. With new commissioners coming in October, an education process would be involved if an extension were granted because the issue would then be handled by new commissioners who must learn about the history and concerns. The drive of this Forum is to establish a committed group made up of representatives from all identified interest groups. This group will provide a consensus report which will be supplied to the FCC and other parties in order to establish that on-going consensus efforts will be in place to provide acceptable technical solutions for the future.

**JOHN MELCHER, Emergency Service Perspective On TTY Service, Director, MIS, Harris County 9-1-1**

The Emergency Services recognize their responsibilities to serve all the public. They will not be deterred from these responsibilities by circumstances, including the inability to hear or speak. The resources are available to handle the volume of calls, but input is needed from the special populations to understand if the efforts are sufficient to meet their needs.

Some things are not new. Protecting the embedded base is not a new concept. The equipment, technology, and training is focused on serving the needs of the public. The transition to new technology has been part of the evolving efforts in Public Safety for the past 100 years. The greater level of commitment required to meet specialized need is also nothing new. These services have been growing to provide a higher level of response to those who require specialized assistance.

The search for solutions **MUST** be new. It requires building a committed team to conquer challenges, look for improvements. By using an open-minded approach to problem solving it is possible to identify the technologies that offer better solutions.

It is time to determine needs and commitment. The wireless industry is committed. Now the hearing impaired community must commit. Set timelines with reason and foresight, ensuring deliverables can be met, and the community will be updated on the progress.

Moving forward with new products and services, while retaining the embedded base will offer the best of the new world.

- Catalyst (96-252) allow commissions action to become catalyst but not the only activity. Ensure that new technology will work with embedded base. The real life business case suggests that electronic messages will advance technology and all people must be able to take advantage of the technology available and to be developed. We need to work smarter by working together. Consensus building is paramount. The FCC looks for consensus agreements to identify agreement within community/constituents.

Reality requires that costs not be inhibitive/prohibitive and that those who can pay must step up and those who cannot must have mechanisms of assistance. Modify existing products to keep costs low and provide better products rather than creating individual, isolated solutions.

The keys to success are:

- **OVERCOMING BARRIERS**
- **DON'T TELL ME TO WORK HARDER**
- **CONSENSUS BUILDING**

- KNOWING THE FUTURE IS BRIGHTER

**PAM HOLMES, *Consumer Perspective On TTY Services*, Ultratec (refer to handout reprinted in this report)**

This issue is not new. In 1992 Congress directed access to 911 for deaf. Access to 7 digit numbers, in lieu of 9-1-1, is not acceptable, and relay service is not acceptable. There is a *critical need to access directly*. Auto number ID and location finding are also important. Section 255 requires that all products and services be accessible. What do consumers want? Universal design. This is at the core of providing access. Recommendations for guidelines:

- ◆ Universal design - aim at the largest possible audience when designing a product. For example, close captioning, caller ID are services developed for special needs which provide far reaching benefits.
- ◆ Avoid expensive retrofits. Start with access needs at outset.
- ◆ Make access achievable - built in to product. Telephones should be compatible so additional purchases or products are not required. Products are less desired because of difficulty of use.

Rules do not require a cross section. The Access Board approved rule 255 and they will probably have an impact should the FCC approve it. There is a need to include consumers in decisions. Include national organizations. Products designed that do not make consumers happy will then require expensive retrofits.

The emphasis by government agencies is to reduce response time in emergencies. A series of state-of-the-art requirements includes:

- 1- Ensure high speed transmission of text
- 2- Provide an interrupt feature - recent developments includes interrupt to allow receiver to interrupt by breaking in with alerting light on half duplex TTY.
- 3- Voice Carry Over (VCO) and Hearing Carry Over (HCO) to allow for voice and typed conversation to occur during the same call.
- 4- Industry should make available connections required for input/output to devices without extra charge.

A forum should be established to make public aware of available devices, to support public information through community information services. This will increase sales. All disseminated information should alert people to limitations of TTY or special emergency support. Materials should be in accessible format. Solutions must be:

- ◆ Affordable
- ◆ Portable
- ◆ Usable
- ◆ Reliable

Some identified problems with wireless E9-1-1 include:

- ◆ No ALI or ANI (both voice and TTY)
- ◆ Silent calls
- ◆ BAUDOT tones transmitted by the user
- ◆ TTY voice announcer (TTY caller, please use text telephone)

**KAREN PELTZ STRAUSS, *Consumer Perspective on TTY Services*, Legal Counsel for the National Association of the Deaf**

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The National Association of the Deaf acts on behalf of members and consumers to safeguard accessibility telecommunications for the deaf and hard-of-hearing. Wireless services must be capable of providing access for 9-1-1 calls from those who are speech or hearing impaired. Any delay in pursuing full access is dangerous to those who need special support.

By ensuring that enhanced 9-1-1 features, including Automatic Location Identification (ALI) and Automatic Number Identification (ANI) are available to all wireless users, the industry will meet its requirements. Including the consumers from the start is crucial.

The ability to interject in the half duplex world of TTY is crucial to establishing parity with the hearing services and also to safety in an emergency.

Wireless Equipment should be developed to accommodate a direct connect capability. Again, consumers are the key to the requirements. The devices must be portable, backward compatible, and affordable.

Consumer education is also crucial. The limitations of service and equipment must be publicized and education emphasized to enhance consumer awareness of limitations to their equipment. Sensitivity to accommodating those with challenges should be paramount to any meeting/education that is provided to the public.

**BILLY RAGSDALE, *PSAP Connectivity Overview*, BellSouth, Technical Liaison to NENA, chair CPE (refer to handout reprinted in this report)**

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The issue in PSAP connectivity for wireless providers is compatibility between newer digital wireless technology and older TTY. BAUDOT technology that has gone unchanged for over 30 years. It has to change....and take the embedded base with it.

TTY is a voice band frequency. It is designed to operate in the same method as a voice call operates - at low speed and voice frequency range. There are three connections from 9-1-1 caller to the PSAP:

- In a Basic 9-1-1 network all 9-1-1 calls to the Central Office are direct routed to a designated PSAP to be answered by a 9-1-1 call taker.

- An Enhanced 9-1-1 network sends a 9-1-1 call from the Central Office to the 9-1-1 tandem where it is selectively routed by the 9-1-1 tandem's Telephone Number(TN) Data Base and Emergency Service Number (ESN) table to a designated PSAP to be answered by a 911 call taker.
- Enhanced 9-1-1 with wireless interconnection sends a 9-1-1 call from the mobile wireless switch to the 9-1-1 tandem, and may at the same time using Location Determination Technology dip into a 9-1-1 database to route the call to the designated PSAP.

To accommodate TTY/TDD, the physical connection by the end user must be acoustical (an acoustic coupling device) or direct connect (telephone line connected into TTY device - no telephone set). The signal then follows the same routing described above to the PSAP. Connectivity at the PSAP offers an additional option to the acoustical and direct connect - integrated. Integrated connectivity means that the TTY/TDD functionality is integrated into the PSAP equipment.

**TONI DUNNE, *Relay Service Overview*, Texas 9-1-1 Commission, Training and Access Program Manager, APCO ADA Committee Chair, NENA Accessibility Issues Chair (refer to handout reprinted in this report)**

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The Telecommunications Relay Services (TRS) are mandated by Title IV of the ADA to operate 24 hours a day, 365 days a year and to process emergency calls, if received. TRS provides functional equivalency to the telephone network. This service enables TTY users and non-TTY users to communicate via a Communication Assistant (CA). The CA serves as a transparent conduit for information to pass between a TTY user and a conventional phone user. The service is typically provided by telephone companies and non-profit agencies.

Implementation and oversight is provided by:

Federal government - FCC

State government - PUC/PSC

NASRA - National Association of State Relay Administrators

By feedback from TRS customers.

The EMERGENCY TRS Call process:

If the TTY caller dials TRS to process an emergency call, it is routed through the public switch network. The CA must determine the appropriate 9-1-1 center administrative number to route the call. The CA then announces that it is a relay call. The 9-1-1 dispatcher then processes the call by speaking in first-party language to the TTY caller. This method results in increased call-handling time and eliminates the ability for 9-1-1 ANI/ALI or ESN retrieval.

[Issues: TTY users may use TRS for emergency calls. There are various methods currently being used to determine the correct PSAP and phone number. Further, there is no data available on PSTN for ANI, ALI or ESN to be passed to

the 9-1-1 center from TRS. 711 has now become available for the universal access number for relay services. How will the implementation of 711 impact the process of handling emergency related calls? Currently, TRS cannot bill long distance to wireless phones.

Other call handling issues include VCO (voice carry over) and HCO (hearing carry over). VCO is a method used in communications which allows the person who is hearing impaired to speak directly to a non-TTY user rather than typing on the TTY but then receives return communication via the TTY. HCO is a method used which allows a person who is speech impaired to listen to the other party's conversation but then communicates via a TTY or other automated equipment to the hearing party. Speech to Speech, offered in some areas, provides specially trained operators to re-speak the callers words to ensure correct reception. The need exists to be able to send both voice and text in same call. The TRS industry indicates users of this method represent less than 10% of calls.

**RON SCHULTZ, *TTY Technology Overview*, Vice President, Quality and Compliance, Ultratec, Inc. (refer to handout reprinted in this report)**

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The TTY device is a lifeline to the person who is deaf or hard-of-hearing. The best technology must be supported by a commitment to making the technology affordable and reliable.

TTY works by transmitting tones over a telephone line. It is not a computer. It uses frequency shift keying to increase the keyboard's capability and sends in simplex or half duplex. There are codes and protocols available, including BAUDOT, Turbo Code and Bell 103.

Problems exist with TTY used to access emergency services (9-1-1) including:

- ◆ Silent calls
- ◆ Call Taker training to enable recognition and proper handling of TTY/9-1-1 calls
- ◆ Adequate access to TTY equipment
- ◆ Wireless E9-1-1 calls

The challenges to providing achievable solutions for TTY using wireless technology are different for analog and digital systems. Analog systems face poor acoustic coupling and expensive adapters, while digital systems address vocoder problems, TTY modems not supported by the wireless provider, poor acoustic coupling, and no direct phone interface connection. The success of an answer to these problems will be measured in the ability for the deaf and hard-of hearing to use these systems.

**JEFF CROLLICK, *Wireless Technical Standards Overview*, (refer to handout reprinted in this report)**

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The FCC R&O requirements identify that the CMRS must provide a callback number and location. The PSAP must prove that it is capable of receiving data and showing that a funding mechanism is in place. All "non-code identified" calls must be forwarded if formally requested by the PSAP. Support for TDD must include traditional TTY and any possible substitutes.

In Phase I, the FCC requires that WSPs provide an Automated Number Identification (ANI) for call back, and provide the caller's location relative to the initial Base Station of Cell site. These services must be available by 4/1/98. There is a direct hand-off from MS to MSC to S/R to the PSAP in Phase I.

**PN- 3581 and subgroupings:**

- ◇ PN-3581.1, Functional Overview
- ◇ PN-3581.2, PSAP Perspective
- ◇ PN-3581.3, Emergency Services Stage 2
- ◇ PN-3581.4, TIA/EIA-41 Intersystem Hand-off Modifications
- ◇ PN-3581.5, TIA/EIA-41 Automatic Roaming Modifications
- ◇ PN-3581.6, ANSI J-STD -023 Stage 2 Modifications
- ◇ PN-3581.7, TIA/EIA/IS-93 Modifications
- ◇ PN-3581.8, TIA/EIA-41 Stage 3 Modifications
- ◇ PN-3581.9, ANSI J-STD -024, Modifications

Emergency Services Interconnection will use standard PSTN/ISDN methods. The Project Schedule:

- ◇ Publish - 3Q97
- ◇ Available by - 4/1/98
- ◇

Phase II requirements include all Phase I (ANI and Base Station/Cell Site) and sets a more granular requirement for call-back:

- ◇ Provide initial latitude and longitude of caller within 125m RMS (67% of time)
- ◇ Must be available by 10/1/2001

A Phase II hand-off will go from the MS to MSC to S/R PSAP OR MSC directly to the PSAP. (Note: S/R is Selective Router)

Call Associated Phase II Projects include:

- ◆ Evaluation of enhancements to ISUP
- ◆ T1.628

Non-Call Associated Phase II Projects include:

- ◆ Project Number - PN-3980
  - ◆ "Emergency Services Data Communications"
    - ⇒ Development of methods and procedures for conveying location and other information between wireless systems and emergency services systems
    - ⇒ Non air interface specific

The Project Schedule for Phase II calls for:

- ◇ Call Associated
  - ◆ Submit to T1S1 - 1Q98
- ◇ PN-3890
  - ◆ Ballot ANSI Standard - 3Q98
  - ◆ Publish - 1Q99
  - ◆ Available by - 10/1/2001

Final open issues include support of "non-code identified" mobiles (uninitialized mobiles and unsubscribed mobiles), as well as analog and digital TDD.

**ED HALL, *Wireless Systems Overview*, Assistant Vice President, Technology and Network Operations, CTIA (refer to handout reprinted in this report)**

Mobile telephony has been available since 1921. With increasing demand, bandwidth has been narrowed. By 1960, IMTS (*improved Mobile Telephone Service*) and auto dialing brought mobile phone service close to the system that we know today. Today we recognize that Radio Frequency (RF) is a limited natural resource and is used for TV, broadcast radio, commercial satellite, military/government communications, and commercial mobile radio service (CMRS).

During the 1980s, the AMPS (Advanced Mobile Phone Service) or "cellular" service, with A and B bands each with over 400 voice and control channels broadcasting in the 825-890 MHz range, offered the volume of service required for the demand. The analog air interface (FDMA) is provided through a geometric coverage that looks like cells. It offers low power, small coverage areas, frequency re-use, and is commercially designated into Metropolitan Service Areas (MSA) and Rural Service Areas (RSA).

Because the 1980s saw a surge in popularity of cellular phones, the higher than estimated number of Mobile Stations (MS) manifested a need for more efficient use of allotted RF spectrum. Two digital technologies were introduced. Time Division Multiple Access (TDMA - TIA, IS-54 and IS-136) and Code Division Multiple Access (CDMA - TIA, IS-95) each offer multiple call capability over the same bandwidth. Implementation is a carrier's option and each system is exclusionary of the other. A CDMA phone cannot provide service in a TDMA environment and vice versa. The default system is always FDMA (analog). Dual mode phones are being developed to address the exclusionary service issue.

The newest technological entry to wireless is Personal Communications Service (PCS) which broadcasts at 1850-1990 M Hz (also known as 1.9 G Hz or "gig"), offers A,B,C,D,E,F bands, and is completely digital (no analog). TDMA and CDMA have been joined by PCS 1900 (GSM) to increase efficiency of bandwidth utilization. The geometry of coverage is

the same as cellular's, as is the frequency re-use, and commercial areas are divided into Major Trading Areas (MTA) and Basic Trading Areas (BTA).

PCS service does not operate at the cellular bandwidth and vice versa. The market driven research is exploring dual mode, dual band mobile telephones to meet demand. Both Cellular and PCS are feature and capability rich. They offer Short Messages (SMS), caller ID, E9-1-1/TTY, NP/LAES, and are seamless, borderless, and roaming.

**CHRIS WALLACE, *Vocoder Technologies & Testing*, "Codecs, An Overview", Nokia (refer to handout reprinted in this report)**

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The term CODEC is a corruption of COder/DECoder, generally a software based device that translate a stream of information into another type of information. The purpose of the voice CODEC in telecommunications is to translate and compress the human voice for digital transmission. Some types of voice CODECs available are: PCM, ADPCM, CELP (Code Excited Linear Prediction).

The performance of wireless speech is driven by:

- ◇ Desired speech quality goals
- ◇ Bandwidth available
- ◇ Minimization of delay
- ◇ Expected sources of interference
- ◇ Limitations of transmit power
- ◇ Implementation complexity
- ◇ Interaction with many types of speech encoding in the network

Speech CODEC design can be simplified by using the limitations of human speech and introducing a source model. Signals other than speech, such as ambient noise, progress tones, music on hold, and DTMF, impact the quality and accuracy of the transmission. Using Forward Error Correction, the Channel CODEC can protect the integrity of the human voice pattern. Some technologies are sensitive to burst noise.

The human voice is made up of three types of sounds or "excitation": voiced, unvoiced, and plosive (letter P sounds etc.). To select a CODEC in a wireless environment considerations include: quality, delay, transparency to voiceband signals, dynamic range, algorithmic delay, and robustness to ambient background noise. Subjective test are used to compare speech processing ability. Scoring is by statistical Mean Opinion Score (MOS), with a score of greater than 4 being toll quality.

CODECs are extremely complicated but the goal is simple: to faithfully reproduce the human voice. Final selection is a trade off among quality

factors. Various digital applications are supported by multiple varieties of CODECs.

**JEREMY PEMBLE, *Vocoder Technologies & Testing*, "PCS-TTY Compatibility", Manager, Government Affairs, Siemens Wireless Terminals (refer to handout reprinted in this report)**

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The PCS digital technologies used by various telecommunications companies are GSM or PCS 1900 (used by Bell South, PacBell, Sprint-DC only, others), CDMA (Sprint, PrimeCo), and TDMA (AT&T). A consortium of US operators and manufacturers using GSM-based wireless networks established a sub-committee to research TTY compatibility. Phase I is complete and Phase II is TBD.

The research question for the lab participants (Siemens, Nokia, Ericsson, Motorola, and Nortel) was, "Do our vocoders distort TTY signals?" The research indicates that GSM vocoders do not significantly distort TTY signals. Some key shift of missed letter errors occurred in all test cases. The recommendation that all lab tests be repeated with field user trials is the basis for Phase II research. Specific recommendations were to replicate tests in "real world" conditions, involving TTY consumers, and determining commonalities with other digital technologies.

If vocoders and network compatibility are not the issue, then hardware connectivity becomes the issue. By using BAUDOT and direct coupling, some possible product solution would be to add 2.5 mm audio jacks to TTYs (requires retrofit for older TTYs), build a converter box with RJ11 and 2.5 mm connections (expensive to manufacture), or add a standard phone receiver as a "plug in" for mobile (cumbersome to carry).

**CHRISTOPHER KINGDON, *Vocoder Technologies & Testing*, "Ericsson TDD/TTY GSM Compatibility Investigation", Ericsson (refer to handout reprinted in this report)**

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Ericsson performed a test of TTY over GSM using an Ultratec 4425 TDD device with a direct 2.5mm connection to the Ericsson CF388 mobile via a hands-free adapter. Ericsson's lab was on a PCS 1900 system with the MS network connections via Coaxial Cable Network or direct. Test cases send signals in both directions using varying radio conditions, handovers, and DTX. The test result indicate a typical 1% error rate with EFR, worst case was 5%. FR typical error rate was 3%, with a worst case of 7%. A standard sequence of a sentence and numbers, 61 characters long was repeated to determine error rate. The conclusions of the testers were that a TDD/TTY can be used with an Ericsson GSM network. The cell radius is not decreased compared with voice calls. A 2.5 mm connection with impedance matching should be standardized by GSM-NA.

**DICK BRANDT, *ITU Recommendation V.18*, dB Consulting (refer to handout reprinted in this report)**

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The ITU-T Recommendation V.18 is an international modem recommendation which specifies a text telephone modem and provides guidance for designers of new text telephones. It can be stand-alone or an optional mode of a standard data modem (V.32, V.34, etc.).

Since there is no communication possible between many of the different technical standards for equipment, the ITU-T Recommendation V.18 is valuable to provide compatible text telephones for the primarily deaf-only markets. Emergency Services need early identification of silent calls sent via TDD/TTY devices. By setting out calling and answering procedures and allowing a customer to be pre-set or auto-networking with the various protocols (BAUDOT, Bell 103, V.21, EDT, DTMF, V.23) safety issues are addressed.

By translating when required between BAUDOT and ASCII or DTMF and ASCII and defining modes of operation, internetworking is enhanced. The integration with data Modem spreads technology to the hearing world by requiring only software and takes text telephony out of the niche market. The calling tone provides 9-1-1 with a means of identifying text calls.

## **CONTRIBUTIONS**

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**DOUG NEELEY, Ericsson**

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This three page contribution details the standardized adapter interface testing that has been completed to date by the "Wireless Coalition." See attachment.

**JIM TOMCIK, QUALCOMM**

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This contribution describes the conclusions of QUALCOMM tests using CDMA data services to support TDD using Asynchronous Data Service.

**DAVID HOLMES, AT&T**

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This contribution details the work done in 1997 by a CTIA group established to create requirements for a Standard interface between portable wireless phones & vehicles (or other external equipment). This group was formed in response to industry needs for a Standard that was first requested from TR45 in 1996, but which was not pursued at that time by the Committee. The work of this renewed CTIA group has specifically addressed certain issues that were perceived to have caused the failure of previous efforts.

## BIOGRAPHIES

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