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**Aerial**  
COMMUNICATIONS  
FCC MAIL ROOM

December 3, 1998

**VIA FEDERAL EXPRESS**

Ms. Magalie Roman Salas  
Secretary  
Federal Communications Commission  
1919 M Street, NW  
Washington, DC 20554

Re: Petition to Waive Section 20.18(c) of the  
Commission's Rules

Dear Ms. Salas:

Enclosed for filing on behalf of Aerial Communications, Inc., and its broadband PCS license holding subsidiaries, APT Columbus, Inc., APT Kansas City, Inc., APT Minneapolis, Inc., APT Houston, Inc., APT Tampa/Orlando, Inc., and APT Pittsburgh Limited Partnership, is an original and four copies of a Petition to Waive Section 20.18(c) of the Commission's Rules.

Please date stamp the additional cover page marked "Copy" and return using the enclosed self-addressed, stamped envelope. You may direct any questions regarding this filing to Latrice Kirkland, Head of Industry Relations, Aerial Communications, Inc., (773)399-8846.

Sincerely,

*Latrice Kirkland*  
Latrice Kirkland, Esq.

No. of Copies rec'd 014  
List ABCDE

cc: Brian T. O'Connor, Esq.  
George Wheeler, Esq.

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**FCC MAIL ROOM** **Before the**  
**FEDERAL COMMUNICATIONS COMMISSION**  
**Washington, DC 20554**

In The Matter of )  
 ) CC Docket 94-102  
Revision of the Commission's Rules )  
To Ensure Compatibility with )  
Enhanced 911 Emergency Calling Systems )

**PETITION TO WAIVE SECTION 20.18(c) OF THE COMMISSION'S RULES**

Aerial Communications, Inc., on behalf of its subsidiaries APT Houston, Inc., APT Tampa/Orlando, Inc., APT Minneapolis, Inc., APT Columbus, Inc., APT Kansas City, Inc., APT Pittsburgh Limited Partnership (collectively "Aerial"), all of which are licensees of broadband Personal Communications Service (PCS) in the corresponding metropolitan trading area (MTA), pursuant to §22.119 and §24.819 of the Commission's rules and the Commission's Order released November 13, 1998, in the above-captioned docket ("Order"), hereby request a waiver of application of Section 20.18(c) of the Commission's Rules for each of its license holding subsidiaries.

In support of this petition, Aerial respectfully states as follows:

1. In the Order, the Commission extended through December 31, 1998, the suspension of enforcement of Section 20.18(c) of the Commission's Rules. In addition, the Commission established December 4, 1998, as the date by which wireless carriers subject to Section 20.18(c) must file petitions for waivers of such requirements in order to avoid non-compliance after December 31, 1998.

2. Section 20.18(c) of the Commission's Rules requires that wireless carriers "be capable of transmitting 911 calls from individuals with speech or hearing disabilities through means other than mobile radio handsets, e.g., through the use of Text Telephone Devices (TTY)."<sup>1</sup>
3. Aerial offers end-to-end digital PCS service in all of its markets using the worldwide Global Systems for Mobile Communications ("GSM") standard technology in its network. All handsets sold by Aerial use digital technology. Aerial understands the importance of making wireless digital service available to the speech- and hearing-impaired individuals and, as a new entrant to providing wireless service,<sup>2</sup> has relied heavily on standards bodies, handset manufacturers and industry groups, such as CTIA , PCIA, GSM North America and the TTY Forum, to make appropriate and timely advancements in remedying the current TTY devices/digital handset incompatibility issue. Unfortunately, it is clear that the issue will not be resolved before December 31,1998.

Accordingly, Aerial submits the following:

STEPS AERIAL IS TAKING TO PROVIDE USERS OF TTY DEVICES WITH THE CAPABILITY TO OPERATE SUCH DEVICES IN CONJUNCTION WITH DIGITAL WIRELESS PHONES

4. Aerial submits the TTY Forum Workplan filed with the Commission on October 30, 1998, as the underlying workplan that Aerial has been following and will continue to follow in its effort to provide users of TTY devices with the capability to operate such

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<sup>1</sup> 47 C.F.R. 20.18(c).

devices in conjunction with digital wireless phones.<sup>3</sup> Aerial has been monitoring the efforts of the TTY Forum since September 1997 and understands that the TTY Forum's primary focus has been on voice-based solutions in an effort to find an acceptable interim solution and to meet the Commission's revised compliance date. The TTY Forum reports that it also has proposed several data-based solutions for TTY access to digital wireless systems. Test results for the voice-based solutions, however, indicate an unacceptably high character error rate.<sup>4</sup>

5. Aerial also submits the comments from GSM North America establishing an objective test for measuring the performance of TTY devices over a GSM network.<sup>5</sup> These comments have been provided to the TTY Forum on behalf of GSM North America and are endorsed fully by Aerial.
6. In addition to supporting the efforts of GSM North America and the TTY Forum, Aerial has requested written status reports on TTY compliance from the four handset manufacturers with which it currently does business.<sup>6</sup> To date, Aerial has received only one response from the manufacturers (i.e., Ericsson Inc.).<sup>7</sup> Ericsson advises Aerial that Ericsson's wireless phones are compatible to TTY devices that have a standard 2.5mm connector built into the TTY device. Most TTY devices, however, either have the rubber "hearing & voice" cups built into the machine allowing a Bell handset to be positioned into the cups for transmit/receive messages or have an RJ-11

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<sup>2</sup> Aerial launched service in its MTAs in March-November 1997.

<sup>3</sup> See Attachment A.

<sup>4</sup> Aerial understands that that there does not appear to be a voice-based solution in the near future which allow the Baudot signal of a TTY device to pass through the vocoder of a digital air interface and achieve a character error rate of less than one percent.

<sup>5</sup> See Attachment B.

<sup>6</sup> See Attachment C, November 24, 1998, letters to Nokia, Mitsubishi, Ericsson and Motorola.

connector built in the device providing a direct connection for hearing and voice.

Ericsson reports that it does not believe it is possible, through the use of a digital vocoder, to transmit reliably the Baudot tones of a TTY device over digital wireless technology when making a call to a public safety organization.

7. If TTY devices are developed and deployed with an external 2.5mm connector to be used in conjunction with an HAC cable providing the interface to the system connector of the phone, Ericsson believes that it has positioned itself for future compatibility to those types of TTY devices.
8. Regarding TTY devices currently being used, Ericsson reports that it is developing an acoustic coupling device designed to provide an interface between an Ericsson wireless phone and the TTY device rubber cups.
9. An alternate solution for those TTY devices currently using the standard 7 or 8 bit ASCII protocol standard would be to make a direct data connection from the TTY device to the handset. Data service is available today from Aerial where the data device uses the 7 or 8 bit ASCII protocol standard. Computer cards, integrated phones and organizers and phones with direct data ports are available for purchase today and are supported fully by Aerial's GSM network. Aerial's network, however, does not support a direct Baudot digital connection. The necessary manufacturer development and standardization process to support a direct Baudot connection is reported to be a number of years away from completion. Further, Aerial understands that, in any event, almost no Baudot TTY phones produced over the last twenty years

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<sup>7</sup> See Attachment D.

have direct data port connection. Thus, supporting a direct Baudot connection in the digital wireless network will benefit no users of an existing Baudot TTY devices.

WHEN AERIAL PLANS TO MAKE DIGITAL HANDSETS COMPATIBLE TO TTY  
DEVICES AVAILABLE

10. Aerial reminds the Commission that it is a PCS service provider, not a handset manufacturer, and, therefore, must rely on compliance timetables and milestones established by the standards bodies, handset manufacturers and industry groups. Ericsson advises Aerial that it will have acoustic coupling available before the second quarter of 1999. Aerial will supplement this Waiver Petition when other Aerial manufacturers responds to Aerial's inquiries.
11. GSM North America plans to commence testing as soon as possible with a target date of January 1999 to provide test results to the TTY Forum and the Commission, subject to the following qualifications: 1) the test specifications, with modifications suggested by the GSM North America, is approved and released by October 30, 1998; 2) laboratory based testing with "real world" conditions proposal is accepted; 3) the test specifications do not change dramatically during the testing process; 4) manufacturers are permitted to assist with setting up the test facilities; and 5) no unforeseen restrictions are placed on the testing.<sup>8</sup>
12. In addition, Aerial directs the Commission's attention to Appendix C of the TTY Forum Workplan which outlines various solutions and milestones established by standards bodies, phone manufacturers and industry groups.

## STEPS AERIAL WILL TAKE TO ADDRESS CONSUMER CONCERNS

13. In February 1998, Aerial mailed bill inserts to all of its customers notifying them of the TTY device /digital handset incompatibility issue and advised them that, until the issue is resolved, consumers will not be able to make 9-1-1 calls through the use of a TTY devices in conjunction with any digital handset. Aerial plans to notify its customers during the first quarter of 1999 that there still are no TTY compatible devices available for use with any digital handset.
14. Until Aerial identifies and implements an appropriate data solution, Aerial plans to explore the feasibility of advising the speech and hearing impaired community that digital communicators can provide access to TTY devices and of advising the speech and hearing impaired community of using digital communicators to communicate to public safety organizations through Telecommunications Relay Services (TRS). These solutions, however, would require that consumers upgrade their current analog Baudot TTY devices. For those consumers who do not want to upgrade their analog Baudot TTY devices, it may be better that they use an analog wireless service provider until a viable digital solution is available.
15. With respect to the specific consumer concerns referenced in the Commission's September 30, 1998, Extension Order, Aerial defers to the efforts of the Special Task Force within the TTY Forum that has been created to assess the needs of the disabled consumers for adequate access to public safety organizations. The Task Force has

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<sup>8</sup> See TTY Forum Workplan, pg. 3.

been empowered to research, evaluate, and provide input to complete the Solutions Matrix and Workplan table of Appendix C of the TTY Forum Workplan.

### SECTION 255 OF THE TELECOMMUNICATIONS ACT

Aerial believes that, based on the foregoing, enforcement of Section 20.18(c) of the Rules would be a violation of Section 255 of the Telecommunications Act of 1934, as amended, because providing persons with hearing and/or speech impairments with access to public safety organizations via digital phones is not “readily achievable” at the present time as required by statute.<sup>9</sup>

### CONCLUSION

In sum, Aerial is aware of no readily achievable method of providing users of TTY devices with the capability to operate such devices in conjunction with digital wireless phones. Aerial reserves the right to supplement this Waiver Petition with information it receives from the other handset manufacturers regarding the status of the development of equipment that is compatible with TTY devices. Enforcement of Section 20.18(c) of the Rules at this stage of TTY/digital handset solution development would not be in the public interest because providers of digital wireless services simply are unable to comply.

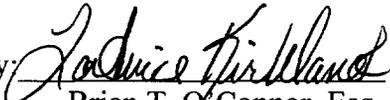
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<sup>9</sup> 47 U.S.C. 255(c).

Accordingly, for the foregoing reasons, Aerial respectfully requests that the Commission grant its subsidiary license holders APT Houston, Inc., APT Tampa/Orlando, Inc., APT Minneapolis, Inc., APT Columbus, Inc., APT Kansas City, Inc. and APT Pittsburgh Limited Partnership with waivers of Section 20.18(c) of the Rules and that the Commission grant Aerial the right to supplement this Waiver Petition with relevant information provided by its other manufacturers.

Respectfully submitted,

**Aerial Communications, Inc.**

By:   
Brian T. O'Connor, Esq.  
Vice President External Affairs  
Latrice Kirkland, Esq.  
Head of Industry Relations  
8410 West Bryn Mawr, Suite 1100  
Chicago, IL 60631

Date: December 3, 1998

# ATTACHMENT A

## **WIRELESS TTY FORUM WORKPLAN: TTY ACCESS OVER DIGITAL WIRELESS SYSTEMS**

Since September 1997, the wireless telecommunications industry (wireless carriers and phone manufacturers), manufacturers of TTY equipment, emergency and relay service provider (9-1-1 and TRS), and consumer organizations that represent individuals who are deaf and hard-of-hearing ("Stakeholders") have undertaken intensive collaborative efforts through the Wireless TTY Forum to develop technically feasible solutions for TTY users to access 9-1-1 over digital wireless systems. To date, the TTY Forum's primary focus has been voice-based solutions in an effort to find an acceptable short-term solution and to meet the FCC's compliance date. The TTY Forum has also proposed several data-based solutions for TTY access to digital wireless systems.

The wireless industry is committed to continuing intensive collaborative efforts to provide viable and practical solutions for TTY access over digital wireless systems not only for 9-1-1 purposes but also to meet the industry's obligations under Sections 225 and 255 of the Communications Act of 1934, as amended. The wireless industry acknowledges that it cannot resolve this issue in a technical vacuum, and that the wireless industry must continue to work cooperatively with TTY manufacturers, the appropriate consumer organizations and organizations representing public safety answering points ("PSAPs") to resolve this issue. Accordingly, the Wireless TTY Forum proposes the following Workplan with scheduled milestones for developing and implementing technical solutions for TTY users to access 9-1-1 over digital wireless systems.

## **PROPOSED WORKPLAN**

### **I. Assessment of Test Results and Finalization of Test Plan**

The TTY Forum has provided preliminary test results and demonstrations on several potential methods for addressing incompatibility between TTYs and the different wireless digital technologies. The TTY Forum developed a uniform test script that manufacturers representing various digital technologies and at least one TTY manufacturer have used in their testing. Test results, however, indicate a wide variance in the character error rate. Furthermore, trying to isolate the cause of the problem within a short time period has been a Herculean yet circumspect task with no conclusive results to date. While the goal is to minimize the character error rate, particularly in 9-1-1 situations, a certain character error rate is inherent with wireline and wireless, both analog and digital technology, and TTY devices.

The co-chairs of the TTY Forum have acknowledged the need for the development of a consistent test methodology, a uniform method of evaluating the test results ("test plan") and TTY performance standards to determine the minimal level of character error rate that TTY users can expect with certain digital technologies used with certain TTY devices.<sup>1</sup>

#### **A. Independent review and assessment of tests conducted to date.**

The TTY Forum has requested Dr. Dale Hatfield, Chief of the FCC's Office of Engineering and Technology ("OET") to review and assess the tests conducted to date. It is anticipated that Mr. Hatfield will provide guidance to the TTY Forum on the soundness of the research conducted to date and identify any discontinuity or gaps in such research that should be explored in the development of a standardized test procedure.

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<sup>1</sup> Since the September 1998 TTY Forum, the wireless industry has reviewed the initial test results and has concluded that additional testing would not yield new or significant information on character error rates. The wireless industry has acknowledged that there does not appear to be a voice-based solution in the near future which will allow the Baudot signal of a TTY device to pass through the vocoder of a digital air interface and achieve a character error rate comparable to the character error rate achieved with analog air interface, *i.e.*, less than 1%. Nevertheless, the wireless industry has agreed to conduct further testing to assess character error rates and in accordance with the standardized Test Procedure.

## **Target Date**

Review and assess tests conducted to date -**Task Completed**

### **B. Finalization of a Standard Test Procedure**

The TTY Forum with the assistance of the wireless digital technology groups<sup>2</sup> shall develop a uniform test process designed to limit and control test variables and establish a test methodology yielding better consistency in determining and comparing character error rates ("CER") across the various digital wireless technologies (CDMA, TDMA, GSM 1900, iDEN). Each wireless digital technology group has assumed responsibility for modifying the test process to accommodate testing variances of that technology.

- ◇ Draft Test Procedure – **Task Completed**
- ◇ Submit Test Process to Wireless Digital Technology Groups – **Task Completed**
- ◇ Responses due from wireless digital technology groups regarding modifications, locations of test facilities and test schedules – **10/28/98**
- ◇ Review responses from wireless digital technology groups (Test Plan Sub-task Group) – **10/28/98 – 10/29/98**
- ◇ Submit Test Procedure to FCC and distribute to wireless manufacturers and carriers – **10/30/98**
- ◇ Status Report to TTY Forum – **11/4/98**
- ◇ Review and Feedback on Test Procedures – **TBD by FCC**

### **C. Conduct additional tests using Test Procedures and compare new results**

Each wireless digital technology group shall identify at least one test facility and advise the TTY Forum as to the availability of the test facility in order to commence testing prior to April 1999.<sup>3</sup> Wireless manufacturers and carriers will conduct tests in accordance with the test schedules submitted and return results to

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<sup>2</sup> For purposes of the Workplan, wireless digital technology groups refers to the CDMA Development Group ("CDG"), GSM North America, and Universal Wireless Communications Consortium ("UWC Consortium").

<sup>3</sup> GSM NA has indicated that it plans to commence testing as soon as possible with a target date of January 1999 to provide test results to the TTY Forum and the FCC, provided that the following are true: 1) the test specification with modifications suggested by the GSM NA is approved and released by October 30, 1998; 2) lab based testing with real world conditions is accepted; 3) the test specification does not change dramatically; 4) manufacturers can assist the test facilities to set up the test; and 5) no unforeseen restrictions are placed on the testing.

the TTY Forum and the FCC as soon as available. TTY Forum members shall concurrently continue to research acceptable error rates, voice-based and data-based solutions during the test schedule.

The TTY Forum will provide advance notice to all interested parties of the test dates, location of the test laboratories, and contact person. Technical representatives of TTY manufacturers, Gallaudet University, PSAPs and the FCC are encouraged to participate in the testing and should contact the appropriate manufacturer or carrier conducting the test to discuss participation.

**Goals and Target Dates**

*Refer to Test Procedure for list and availability of test labs and scheduled target dates for conducting the additional tests.*

**D. Analysis of test results and recommendations**

The TTY Forum will appoint a sub-group comprised of representatives from each of the Stakeholder groups. The sub-group will review and analyze the test results and provide specific comments and recommendations to the TTY Forum and the FCC based on the test results.

**Goals and Target Date**

**January 1999**

**II. User Requirements**

Consumer representatives of the TTY Forum have provided the TTY Forum with two documents outlining their criteria with respect to solutions: *Consumer Approved Criteria for Acceptance of 'One Phone Model Per Service Provider as of October 1' Proposal* ("Consumer Criteria Document") and *September 10, 1998 Memorandum from Consumer Representatives to TTY Forum* ("September 1998 Consumer Memo").

**A. Consumer Criteria Document**

The purpose of the document was to stimulate discussion and solicit the views of the wireless carriers and manufacturers participating in the TTY Forum. At the September 1998 TTY Forum Meeting, CTIA, on behalf of its members, submitted its comments to the criteria set forth in the Consumer Criteria Document.<sup>4</sup> CTIA's senior staff and the drafters of the Consumer

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<sup>4</sup> Letter from Andrea Williams, Assistant General Counsel, Cellular Telecommunications Industry Association, to Ed Hall and Mary Madigan, Co-

Criteria Document shall meet at a mutually agreeable time to address the criteria in the context of CTIA's inter-disciplinary approach to accessibility under Section 255.

**Goals and Target Date**

Meeting to be held on a mutually agreeable date but no later than December 15, 1998.

**B. September 1998 Consumer Memo**

On September 10, 1998, representatives of the consumer groups circulated a document to members of the TTY Forum outlining a new set of criteria to address only functional characteristics of any proposed solution for TTY access to digital wireless systems.<sup>5</sup> In accordance with the FCC's Extension Order, the TTY Forum shall consider whether the criteria set forth in the September 1998 Consumer Memo is supported in the proposed voice-based and data-based solutions set forth in this Workplan. Consideration of the criteria shall be documented in a matrix of proposed technical solutions. CTIA, on behalf of the TTY Forum, will submit the September 1998 Consumer Memo to the appropriate standards-setting organizations.

**Goals and Target Date**

- ◇ Develop matrix of proposed technical solutions - **Task completed**
- ◇ Finalize matrix (Task Force Members) - **Task Completed**
- ◇ Submit matrix with Workplan to FCC - **10/30/98**
- ◇ Submit September 30<sup>th</sup> Consumer Memo to standards-setting organizations – **early December 1998**

**III. Performance Standards for TTY Devices**

Over the past several months, there has been significant discussion concerning the lack of uniform performance standards among TTY

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Chairs, Wireless TTY Forum, Sept. 8, 1998. Attached to October Quarterly Status Report as Appendix Q.

<sup>5</sup> Memorandum from Consumer Representatives to TTY Forum, Sept. 10, 1998. Attached to October Quarterly Status Report as Appendix R.

The FCC's Wireless Telecommunications Bureau has elevated the new list of criteria by attaching it to the Extension Order as an appendix and holding it out as an example of what consumer groups would like to have incorporated into any solution implemented by the Forum, and therefore the workplan. See Extension Order at 4.

devices. Manufacturers of wireless handsets have indicated that such standards are critical in trying to address the technical challenges of voice-based solutions, including passing the Baudot signal of a TTY device over a digital air interface without any modification to the handset or the TTY device. The TTY Forum also discussed the need for a list of "most often used" TTY devices and specifications for each device if TTY manufacturers are not using the EIA Draft Standard.<sup>6</sup> Two TTY manufacturers (Ultratec and Ameriphone) have agreed to identify the typical operating characteristics of the majority of existing TTYs and submit this information as a contribution to the TTY Forum. The TTY Forum will also compile a list of the TTY devices used in the tests. A letter will be sent to a third TTY manufacturer (Krown) again requesting their participation in the TTY Forum, specifically providing typical operating characteristics of its existing TTYs.

#### **Goals and Target Dates**

Discussion of TTY manufacturers' willingness to incorporate EIA Draft Standard - TTY Forum - 9 (11/4/98-11/5/98)

Submission of document listing typical operating characteristics of the majority of existing TTYs – **Week of 11/9/98**

Letter to third TTY manufacturer – **Week of 11/9/98**

#### **IV. Proposed Technical Solutions**

To provide TTY users with a variety of solutions and to allow manufacturers and service providers maximum flexibility to develop innovative technology and services for TTY users, the TTY Forum has posed several voice-based and data-based solutions. The TTY Forum presently does not support any one solution over others. The TTY Forum has developed a matrix of proposed voice-based and data-based solutions. The matrix sets forth the implementation stages, the advantages and disadvantages of each solution, whether the consumer requirements set forth in the September 1998 Consumer Memo are supported, and the corresponding milestones scheduled for each phase of implementation. Please refer to Appendix C: Solutions Matrix and WorkPlan for target dates where applicable.

##### **A. Proposed Voice-Based Solutions**

The TTY Forum defines voice-based solutions as those solutions whereby the Baudot signal passes through the Vocoder. Proposed

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<sup>6</sup> See Electronic Industries Association, Memorandum to Parties Interested in EIA Standards Project PN 1663, Telecommunications Devices for the Deaf, May 16, 1988, 1. Attached to October Quarterly Status Report as Appendix J.

voice-based solutions include connection method solutions such as:

- ◆ Direct Audio Connection
- ◆ RJ-11-type Modular Connection/Jack (Analog Solution)
- ◆ True RJ-11 Connection
- ◆ Acoustic Solution
- ◆ Proprietary Solutions

Other proposed voice-based solutions include solutions that may require modification of the Vocoder.

### **Direct Audio Connection**

It appears that coupling via a direct audio connection between the TTY device and a digital wireless handset, *i.e.*, a 2.5 mm audio interface, is a preferred voice-based solution for some wireless carriers. A proposal for a wireless phone 2.5mm audio interface to TTY devices has been submitted to the TTY Forum.<sup>7</sup> The proposal noted that audio output and input levels are different for each make and model phone. Thus, manufacturers of wireless phones would need to provide a special adapter with standard levels. Moreover, audio output and input levels of TTY devices have yet to be defined. The proposal recommended a "common interface" to resolve the variance in output and input levels.<sup>8</sup> While the TTY Forum has reviewed a draft Technical Information Document ("TID"), the TID will be finalized at TTY Forum-9 and will be distributed to manufacturers and carriers shortly thereafter. Members of the TTY Forum will also prepare a Standards Requirements Document ("SRD") for submission to TIA TR45 in early December 1998.

### **Acoustic Solution**

Ericsson has indicated that it plans to pursue this option. Due to the confidential nature of Ericsson's marketing plans for this option, the TTY Forum recommends that the FCC meet with the manufacturer under confidentiality to discuss specific implementation plans and scheduled milestones.

### **RJ-11-type Modular Connection/Jack (Analog Solution)**

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<sup>7</sup> See Proposed - Wireless Phone 2.5mm Audio Interface to TTY/TDD ("2.5mm Audio Interface Proposal"). Attached to October Quarterly Status Report as Appendix K.

<sup>8</sup> See 2.5mm Audio Interface Proposal at 3-4. Attached to October Quarterly Status Report as Appendix K.

The TTY Forum has discussed this option and does not consider it to be a viable short-term solution. Thus, the Forum has not pursued development or implementation of this option.

#### **True RJ-11 Connection**

The TTY Forum has discussed this option and does not consider it to be a viable short-term solution. Thus, the Forum has not pursued development or implementation of this option.

#### **Proprietary Solutions**

Several proprietary solutions such as the Mobility™ TTY, an enhanced TTY device developed by Lober & Walsh Engineering, the AxCell Interface Device developed by Sendele Wireless Communications and the RangeStar™ Technology developed by RangeStar International, have been presented to the TTY Forum for consideration as solutions. Due to the proprietary nature of these solutions, the TTY Forum has not been privy to how soon these products will be made commercially available. The TTY Forum recommends that the FCC meets with each company separately and under confidentiality to discuss specific implementation plans and scheduled milestones.

#### **B. Proposed Data-Based Solutions (Circuit-Switched)**

The proposed data-based solutions include Inter-Working Function solutions, Third Party Gateway and Proprietary Data-based solutions. The TTY Forum has adopted a SRD for Circuit-Switched Data, which will be submitted to TR45 in early December 1998.

#### **Inter-Working Function Solutions**

These solutions rely on the development and installation of the appropriate inter-working function (IWF) software into a wireless carrier's network infrastructure. There are at least two proposed IWF solutions: the V.18 standard and proprietary TTY modems. While the standards for GSM, TDMA, iDEN and CDMA support the IWF functionality, minor modifications are necessary for TTY applications. Implementation of IWF solutions requires completion of product development and deployment, including billing capabilities for data, installation of TTY software in the subscriber terminal, installation of the IWF infrastructure which may be installed per switch or shared among a carrier's switches. In addition, V.18 capable modems need to be manufactured for use in the United States. The estimated timeframes set forth in the Matrix are contingent upon several factors: availability of modems incorporating V.18 standard or other enhanced protocols; timely resolution of any unanticipated technical glitches in product development and deployment as well as installation of the IWF

infrastructure; and the availability of the appropriate engineering staff.

The TTY Forum will send a letter to IWF and modem manufacturers notifying them about the TTY Forum's work and the demonstrations of an IWF (V.18) as one type of viable data-based solutions. The letter will also request information and the projected time period concerning the incorporation of V.18 standard.

Letter to IWF and modem manufacturers: **Week of 11/9/98**

#### **Third-Party Gateway Solution**

Another proposed data-based solution is a Third Party Gateway Solution, which is a solution, using the Inter-working function (IWF) but it need not be installed in every carrier's network. A third party vendor would supply a number for a TTY user to call into and then complete the call to a landline TTY using the IWF.

The TTY Forum discussed this option at the November 1998 Forum. The Forum and does not consider it to be a viable solution. Thus, the Forum will not pursue development or implementation of this option.

#### **Proprietary Data-based Solutions**

To be reviewed at future TTY Forums.

- V. Notification to Subscribers and Potential Subscribers who use TTYs**  
In compliance with the FCC's rules, wireless carriers have notified subscribers and potential subscribers that they may not be able to use TTYs to access 9-1-1 over digital wireless systems. Wireless carriers, with the support of the wireless trade associations, the consumer advocacy groups, TTY manufacturers and wireless handset manufacturers, will continue to notify subscribers and potential subscribers at appropriate intervals until a product is commercially available.

#### **Goals and Target Date**

On-going until product is commercially available.

## **APPENDIX C**

### **SOLUTIONS MATRIX AND WORKPLAN**

Task Force Members to Complete the Data Base Solutions Matrix:

- Todd Lantor
- Norm Williams
- Judy Harkins
- Ron Schultz
- Nikolai Leung
- Mohamed El-Rayes
- UWCC member
- Steve Coston
- John Suprock
- Brye Bonner

Group is empowered to complete matrix below on behalf of the TTY Forum.

**PROPOSED VOICE-BASED SOLUTIONS  
(Passing Baudot signal through the VOCODER)**

<b>Proposed Solution</b>	<b>Testing/ Implementation</b>	<b>Advantages/ Disadvantages</b>	<b>Consumer Requirements Supported</b>	<b>Milestones</b>
<p><i>Direct Audio Connection</i> (2.5 mm Jack – Preferred Method)</p>	<ol style="list-style-type: none"> <li>1. Finalize Technical Information Document,</li> <li>2. SRD,</li> <li>3. Develop Standard, SDO</li> <li>4. Notify TTY Phone Manufacturers</li> </ol>	<p>Advantages:</p> <ul style="list-style-type: none"> <li>• Cost effective</li> <li>• Small in size</li> <li>• Rapid to implement</li> <li>• High Immunity to interference</li> <li>• Recognized industry connector</li> <li>• Does not require additional power supply</li> <li>• May allow connection to other devices</li> </ul> <p>Disadvantages:</p> <ul style="list-style-type: none"> <li>• Requires modification/ adapter to TTY</li> <li>• Yields no inherent improvement to CER</li> <li>• Supports only limited features</li> </ul>	<ol style="list-style-type: none"> <li>1. Preferred over acoustic</li> <li>2. Supported</li> <li>3. Supported</li> <li>4. Supported</li> <li>5. TBD</li> <li>6. Supported</li> <li>7. Supported</li> <li>8. Supported</li> <li>9. Supported</li> <li>10. N/A</li> <li>11. N/A</li> <li>12. N/A</li> <li>13. N/A</li> </ol>	<ol style="list-style-type: none"> <li>1. Nov 1998</li> <li>2. Submit to TR45– Dec 1998</li> <li>3. Ericsson to identify timetable with TR45 actual date to be posted on listserv</li> <li>4. TBD by #3</li> </ol>

Proposed Solution	Testing/ Implementation	Advantages/ Disadvantages	Consumer Requirements Supported	Milestones
<i>RJ11-type Modular Connection/ Jack</i> (Analog Solution)	<ol style="list-style-type: none"> <li>1. Develop Technical Information Document,</li> <li>2. SRD,</li> <li>3. Develop Standard</li> <li>4. Notify TTY Phone Manufacturers</li> </ol>	Advantages: <ul style="list-style-type: none"> <li>• Could support full functionality</li> <li>• Could support some of the embedded base of TTYs</li> </ul> Disadvantages: <ul style="list-style-type: none"> <li>• Physical size</li> <li>• Cannot use handset for VCO functions (may require separate device for HCO/VCO)</li> </ul>	<ol style="list-style-type: none"> <li>1. Preferred over acoustic</li> <li>2. Supported</li> <li>3. Supported</li> <li>4. Supported</li> <li>5. TBD</li> <li>6. Supported</li> <li>7. Supported</li> <li>8. Supported</li> <li>9. Supported</li> <li>10. N/A</li> <li>11. N/A</li> <li>12. N/A</li> <li>13. N/A</li> </ol>	This option is not considered a short-term solution by the Forum and therefore is not being pursued by this Forum at this time.

Proposed Solution	Testing/ Implementation	Advantages/ Disadvantages	Consumer Requirements Supported	Milestones
<i>Acoustic solution</i> – use of external landline handset	1. No Standardization required	Advantages: <ul style="list-style-type: none"> <li>• No standardization required</li> <li>• Supports most embedded base of TTYs</li> <li>• Very Low interface cost</li> <li>• Short development cycle</li> <li>• Easily accessible to standardized landline handsets</li> </ul> Disadvantages: <ul style="list-style-type: none"> <li>• Highly susceptible to background noise</li> <li>• Bulky – requires a landline handset and cable</li> </ul>	1. Could negatively impact CER 2. Supported 3. Supported 4. Supported 5. TBD 6. Supported 7. Supported 8. Supported 9. Supported 10. N/A 11. N/A 12. N/A 13. N/A	TBD by manufacturer
<i>Proprietary</i> <ul style="list-style-type: none"> <li>• Phone Products</li> <li>• Terminals</li> </ul>	Unknown	Unknown	Unknown	Unknown FCC can meet with stakeholders

Proposed Solution	Testing/ Implementation	Advantages/ Disadvantages	Consumer Requirements Supported	Milestones
<i>True RJ-11 Connection</i>	<ol style="list-style-type: none"> <li>1. Develop Technical Information Document,</li> <li>2. SRD,</li> <li>3. Develop Standard</li> <li>4. Notify TTY Phone Manufacturers</li> </ol>	<p>Advantages:</p> <ul style="list-style-type: none"> <li>• Supports full functionality</li> <li>• Support some of the embedded base of TTYs</li> </ul> <p>Disadvantages:</p> <ul style="list-style-type: none"> <li>• Physical size</li> <li>• Cannot use handset for VCO functions (may require separate device for HCO/VCO)</li> <li>• Requires additional power supply</li> <li>• Expensive</li> <li>• Bulky</li> </ul>	<ol style="list-style-type: none"> <li>1. Preferred over acoustic</li> <li>2. Supported</li> <li>3. Supported</li> <li>4. Not Supported</li> <li>5. TBD</li> <li>6. Supported</li> <li>7. Supported</li> <li>8. Supported</li> <li>9. Supported</li> <li>10. N/A</li> <li>11. N/A</li> <li>12. N/A</li> <li>13. N/A</li> </ol>	<p>This option is not considered a short-term solution by the Forum and therefore is not being pursued by this Forum at this time.</p>

Proposed Solution	Testing/ Implementation	Advantages/ Disadvantages	Consumer Requirements Supported	Milestones
<i>Vocoder Modifications</i>		<p>Not cost effective</p> <p>No modification to TTY</p> <p>Using Full rate</p> <p>Extensive international standards development and implementation process.</p> <p>Could provide more reliable CER</p> <p>Potential to degrade voice quality.</p> <p>Error detection and correction would be lower for a data tone call compared to data services.</p>	<ol style="list-style-type: none"> <li>1. TBD</li> <li>2. Supported</li> <li>3. Supported</li> <li>4. Supported</li> <li>5. TBD</li> <li>6. Supported</li> <li>7. Supported</li> <li>8. Supported</li> <li>9. TBD</li> <li>10. Supported</li> <li>11. Supported</li> <li>12. TBD</li> <li>13. TBD</li> </ol>	<ul style="list-style-type: none"> <li>• Develop new standard.</li> <li>• Test new standard for Baudot and voice.</li> </ul>

**PROPOSED DATA-BASED SOLUTIONS – Circuit-Switched**

<b>Proposed Solution</b>	<b>Testing/Implementation</b>	<b>Advantages/Disadvantages</b>	<b>Consumer Requirements Supported</b>	<b>Milestones</b>
<p><b>Inter-Working Function (IWF):</b></p> <ul style="list-style-type: none"> <li>• V.18 (Baudot)</li> <li>• Proprietary TTY Modem</li> </ul>	<ul style="list-style-type: none"> <li>• Complete Data SRD</li> <li>• CDMA existing IS-707</li> <li>• TDMA existing IS-135</li> <li>• Standards Modifications TBD based on SRD.</li> <li>• Test with existing TTYs for both inbound and outbound calls.</li> <li>• Test with PSAP, existing TTY using existing standards</li> </ul>	<p><b>Advantages:</b></p> <ul style="list-style-type: none"> <li>• Reliable Communications, as good as wireline.</li> <li>• World-wide Standard</li> <li>• Requires little or no modifications to existing TTY</li> <li>• Could support more platforms, TTYs, PDAs, and Laptops.</li> </ul> <p><b>Disadvantages:</b></p> <ul style="list-style-type: none"> <li>• Not all Carriers may choose to implement data services.</li> <li>• Compatible with all current Baudot standards, except Ultratec's Turbocode.</li> <li>• Require mobile connection interface to existing TTYs.</li> <li>• IWF do not support VCO</li> <li>• IWF with Baudot not commercially available</li> </ul>	<ol style="list-style-type: none"> <li>1. Supported</li> <li>2. TBD</li> <li>3. TBD</li> <li>4. N/A</li> <li>5. TBD</li> <li>6. Supported</li> <li>7. Supported</li> <li>8. Supported</li> <li>9. Not Supported</li> <li>10. Supported</li> <li>11. TBD</li> <li>12. Supported</li> <li>13. Supported</li> </ol>	<ul style="list-style-type: none"> <li>• Est. Timetable 12-18 months</li> <li>• Implement Baudot/V.18 in the IWF</li> <li>• Widespread deployment of the IWF</li> <li>• Update handsets to support data service.</li> </ul>

Proposed Solution	Testing/Implementation	Advantages/Disadvantages	Consumer Requirements Supported	Milestones
<i>3<sup>rd</sup> Party Gateway</i>		Advantages: <ul style="list-style-type: none"> <li>• Landlines TTY do not need to be modified.</li> </ul> Disadvantages <ul style="list-style-type: none"> <li>• Expensive to operate and maintain.</li> </ul>	1. TBD 2. Not Supported 3. Not Supported 4. Supported 5. TBD 6. Supported 7. Supported 8. Supported 9. TBD 10. N/A 11. Not Supported 12. Supported 13. TBD	This option is not considered a viable solution by the Forum and therefore is not being pursued by this Forum at this time.
<i>Proprietary</i>	Unknown	Unknown	Unknown	Unknown FCC can meet with stakeholders

\*V.18 Letter to modem manufacturers will be drafted by Dick Brandt under the TTY Forum letterhead requesting support for TTY issue.



## ATTACHMENT B

*Lober & Walsh Engineering, Inc.  
Cellular Product Technologies, LLC  
NENA/Bellsouth Technologies, Inc.*

*TTY Over Cellular and PCS  
Laboratory and Field Test Procedure*

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*FDMA/TDMA/CDMA*

**Author(s):** Steve Mead, Pete Cabral, Joshua Lober, Bill Walsh,  
Billy Ragsdale - Comments from GSM NA

**Manager:** Joshua Lober

**Version:** 1.1GSM

**Last Revision Date:** October 15<sup>th</sup> 1998

**Filename:** GSMTESTPROC.DOC

**Abstract:** The purpose of this document is to establish an  
objective test for measuring the performance of TTYs  
over a GSM Network.

## DOCUMENT REVISION HISTORY

VERSION	DESCRIPTION	DATE	CREATED/UPDATED BY
1.0	Initial Document	9-02-98	Steve Mead, Pete Cabral, Billy Ragsdale Joshua Lober
1.1	Modified per TTY Fourm input	9-13-98	Joshua Lober per TTY Forum
1.1GSM	Added comments from GSM NA	10-22-98	Karl Warfel per GSM NA TWG
1.1a GSM	Added Signal Strenth of -102 dBm	11-20-98	Karl Warfel per GSM NA TWG

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# **TTY OVER CELLULAR TEST PROCEDURE**

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## **1. OVERVIEW**

### **1.1 INTRODUCTION**

This procedure defines a configuration in which a TTY device can be objectively tested over a GSM network.

In a field test, there are uncontrolled elements which cause a greater variation in test results, rendering the results at best questionable and at worst unusable. The tests in this procedure will first be executed using a simple a laboratory configuration, so that all test conditions will be repeatable over multiple tests. After results have been achieved through documented simple laboratory configurations, which will help determine how GSM compares to AMPS, the test will be repeated with characteristics of a real world environment (refereed to as real world tests).. During this stage, it is very important that all manufactures of digital wireless phones/technologies and TTY manufactures participate,.

Once results are reached that are equal to or better than analog, the second stage of laboratory testing can begin. The second stage (not specified in this document) shall include the wire-line 9-1-1 network with the calls going to a Public Safety Access Point (PSAP) with the existing TTY equipment in use today. The test scripts used in the second stage of testing shall be designed for real life applications, determining that configurations submitted actually do perform equal to or better than analog. These test scripts shall be designed by subject matter experts (SMEs) in TTY call processing to 9-1-1 PSAPs. These test scripts shall first be executed over an analog wireless network, and then with a digital network to compare the final results in determination of equality. These test scripts should consider use of VCO/HCO

## 1.2 SCOPE

It is not the intention of this document to define acceptance criteria, but rather provide an even playing field where all devices and cellular formats can be evaluated. The evaluation and interpretation of the data are not addressed. Test results shall be recorded in terms of Printed Character Error Rates (PCER), and Total Character Rates (TCER). Because various cellular formats as well as various TTY devices will be tested, wherever possible attempts shall be made to reduce variables in the test scenarios. In order to re-run portions of this test, wherever possible TTY audio shall be recorded and saved to CDROM.

## 1.3 DESCRIPTION OF TEST STRATEGY

### 1.3.1 Baseline Measurements for Digital Technologies

Due to the difficulty in determining acceptable performance criteria of script transmission over a Digital Cellular Channel, it is required that a baseline first be determined. Currently, Analog cellular has been accepted by the general public for TTY communication, and should therefore be used as a baseline for digital testing. Each test called out in this procedure shall first be base-lined with an analog test, the results to be compared to the digital tests. Therefore, if a car driving 65MPH is not capable of scoring a low Character Error Rate using analog technology, it is not reasonable to expect better low Character Error Rates from a digital technology.

### 1.3.2 Stage 1 Test Script

Much attention has been placed on the test script and it's evaluation method. Due to earlier discussion, a script of randomly generated characters alternating between letters and figures has been generated. The code used to generate the test script is located in Appendix A~~Appendix A~~, and the script itself is located in Appendix B~~Appendix B~~. The test script contains 4216 characters, and the number of shift characters generated by the TTY will be 2012. There is a maximum of eight consecutive letters or figures, and a maximum total of 6228 characters will be scored. The scoring guidelines have been modified as they apply to shift errors, please see section Scoring Results~~Scoring Results~~ for details.

### 1.3.3 Additional Stop BITS (optional)

It was determined in the earlier testing that improved CER performance could be achieved by adding additional stop BITS to BAUDOT characters transmitted over a TDMA traffic channel. In TTY devices, there is no formal specification for the quantity of stop bits, only a recommended minimum of 1.5. Therefore, each TTY manufacturer may vary the quantity of stop bits as they see fit. If additional stop BITS are to be used during these tests, they may only be used in the direction from the mobile TTY to land TTY. In addition, a maximum of three additional stop bits (five stop BITS total) may be used for each character. This delay will reduce the Word per Minute (WPM) rate from 68.18 WPM to 49.58 WPM (based on five character words and two stop bits).

Additional Stop BITS	Bit Rate	Add'l Stop BIT Time	Word Rate	WPM
0	2.20E-02	0.00E+00	8.80E-01	68.18
1	2.20E-02	2.20E-02	9.90E-01	60.60
2	2.20E-02	4.40E-02	1.10E+00	54.54
3	2.20E-02	6.60E-02	1.21E+00	49.58

### 1.3.4 Signal Strengths

For these tests, three signal strengths have been selected. Each technology group shall define and submit appropriate levels to be used for these tests. These levels may be in terms of RSSI, BER, FER or any terms appropriate for that technology. The levels listed below are to be used for the AMPS baseline testing, and should be used as a guideline for the digital technology groups in their definitions. Selected static conditions defined in ETSI 11.10 section 14.3 are to be used, unless otherwise noted in this document.

#### 1.3.4.1 Strong Signal (GSM )

The strong signal test is representative of communication within close proximity to a base station. A power level of  $-50\text{dBm} \pm 3\text{dB}$  has been selected as the Received Signal Strength Indication (RSSI) as measured by the test system.

#### 1.3.4.2 Moderate Signal (GSM )

A power level of  $-65\text{dBm} \pm 5\text{dB}$  has been selected as the Received Signal Strength as measured by the test system. This number was chosen as it is the midpoint to the strong and weak signal levels selected.

#### 1.3.4.3 Weak Signal Strengthen (AMPS and GSM )

A power level of  $-81\text{dBm} \pm 5\text{dB}$  has been selected as the Received Signal Strength as measured by the test system. This level has been chosen because it is 21 dB over minimum Signal Strength defines in GSM 1900 specifications ( $-102\text{ dBm}$ ). Version 1.1 of this test procedure for AMPS specifies a low Signal Strength of  $-95$  which is also 21 dB over the AMPS minimum Signal Strength of  $-116\text{ dBm}$ .

Test should also be done at  $-102\text{ dBm}$  to compare with results of AMPS testing done at  $-116\text{ dBm}$

#### 1.3.4.4 Signal Strengths for GSM

GSM 1900	Comments
-102 dBm	To be comrade to AMPS test done at -116 dBm
-81 dBm	To Be compared with AMPS tests done at -95 dBm
-65 dBm	To Be compared with AMPS tests done at a moderate level of -75 dBm
-50 dBm	To be compared to AMPS test done at -50 dBm

Note: It is also recommended that Uplink and Downlink signal Strengths be defined in this test document. And the test signal strengths are to be measured in both directions.

### 1.3.5 Test Equipment Configuration

At this time there is no standardized interface between TTY devices and Cellular/PCS Phones. There are variations in interface connectors and voltages. It is required that the phone and TTY be "matched" before reliable testing can proceed (see section 3.1). It is also required that each manufacturer provide instructions for the call origination and termination on a case by case basis. These instructions may be part of the Users Manual, or they may be special documents. Attached in the appendices of this document are examples of such documents, describing interoperability between the CPT Mobility TTY and various Cellular Phones.

## 2. TEST ENVIRONMENT

### 2.5 HARDWARE REQUIREMENTS

Hardware required for this test include:

- STATIC testing can be done by using Rohde & Schwarz CRTC 02 or similar test equipment  
Testing with real world characteristic can testing can be done by using R&S TS8915/16B test systems. All test should be done with the EFR Vocoder.
- TTY device to be tested over Cellular or PCS Network.  
(TTY must be capable of outputting received characters to a parallel or serial port, and sending random character script.)
- Cellular or PCS Phone.
- Ultratec InteleModem
- Cellular Product Technologies Mobility™ TTY
- One Soundblaster Sound Card (or equivalent)
- Two Personal Computers (i386 or better) with:
  - 4 MB of RAM (minimum)
  - 3.5 MB (minimum) of hard disk space for the NexTalk program, Microsoft Windows 3.1, Windows 95 or Windows NT,
  - One unused ISA bus slot for internal sound card.
- Laptop Computer (i386 or better) with:
  - One RS-232 port available
  - 4 MB of RAM (minimum)
  - 3.5 MB (minimum) of hard disk space for the communication

program,  
Microsoft Windows 3.1, Windows 95 or Windows NT,

## 2.6 TOOL REQUIREMENTS

Tools required for this test include:

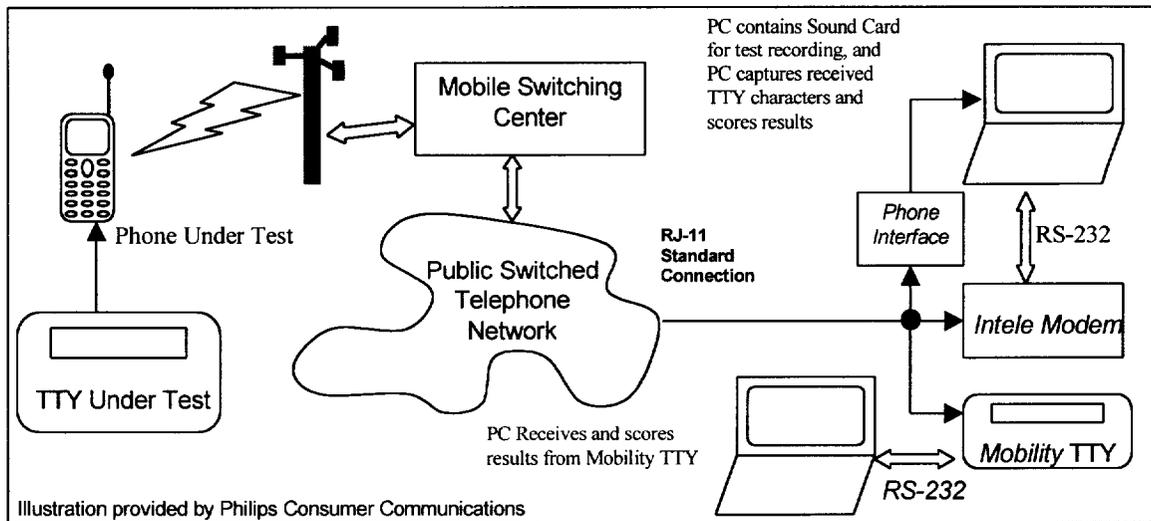
- Cell Site Analyzer or other device capable of measuring RF power.
- Software utility to objectively score test results (i.e. score application from Lober & Walsh Engineering, Inc.).
- Hyperterm or other communication software package.
- Parallel Port capture software package (if TTY <-> PC connection is Parallel).
- RS-232 cable and adapters.
- Parallel cable , depending on the TTY <-> PC connection.
- TTY to Cellular Phone interface cable.

## 2.7 PHYSICAL CONFIGURATIONS

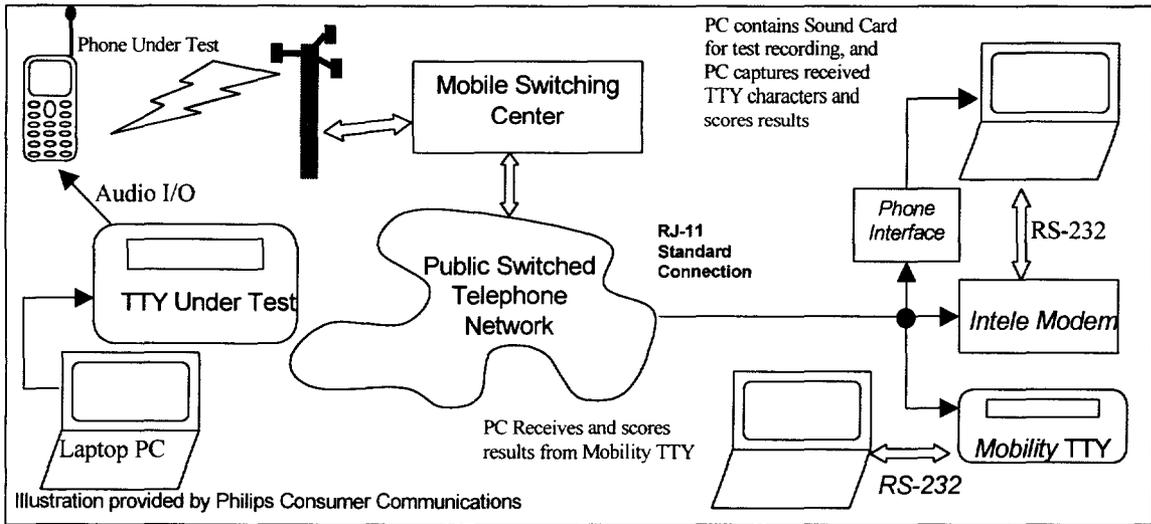
- Static Mobile Originated (Mobile to Land, fixed location - use environment defined in ETSI 11.10 section 14.3 for real world tests)
- Static Mobile Terminated (Land to Mobile, fixed location- use environment defined in ETSI 11.10 section 14.3) for real world tests)
- Dynamic Mobile Originated (Mobile to Land, moving mobile use environment defined in ETSI 11.10 section 14.2.1 for real world tests )
- Dynamic Mobile Terminated (Land to Mobile, moving mobile use environment defined in ETSI 11.10 section 14.2.1 for real world tests)

Note: For laboratory tests, replace the MSC and PSTN with the GSM SYSTEM SIMULATOR in the following diagrams.

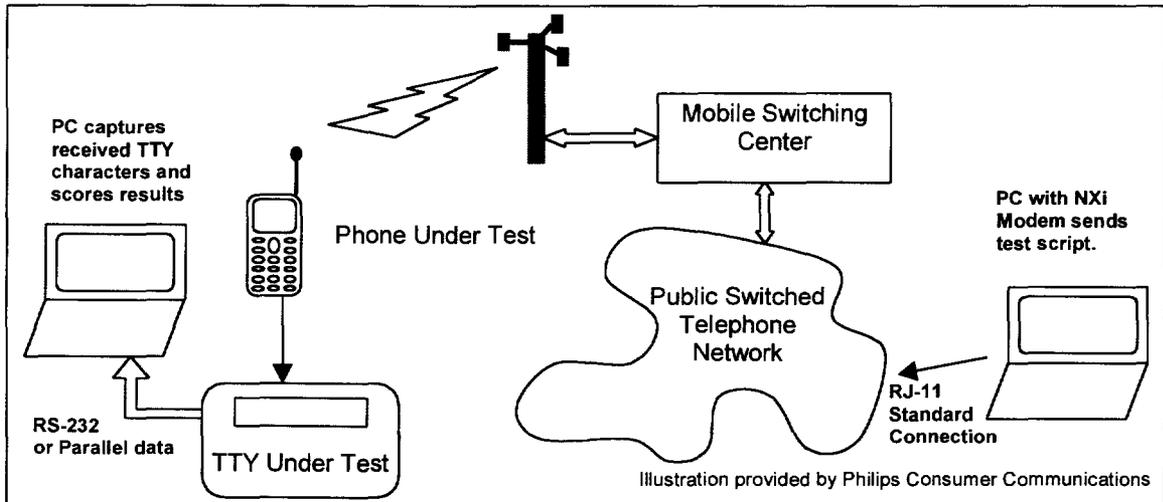
# Mobile Origination Configuration #1



## Mobile Origination Configuration #2



## Mobile Termination Configuration



### 3. CONFIGURATION OF EQUIPMENT

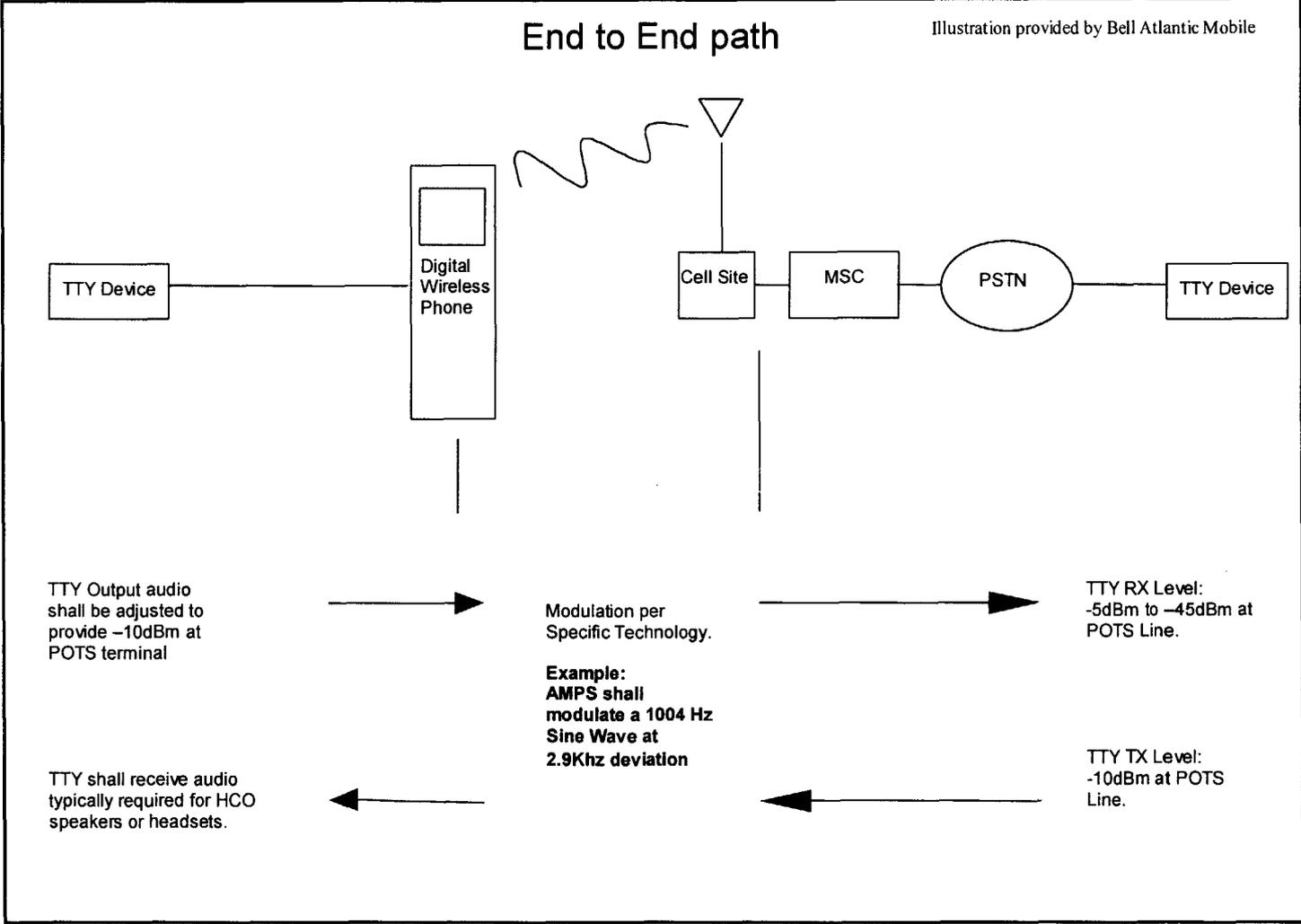
#### 3.5 LEVEL MATCHING

The audio levels between the Cellular/PCS Phone and TTY must be properly matched for reliable communications. Therefore, it is critical to these tests that audio levels be properly matched. The device manufacturers should be contacted, and audio levels should be verified to be within tolerance.

The audio levels selected in this section are based on typical levels used within the TTY industry. It should be noted that these levels are not contained within any TTY industry standard specification<sup>1</sup>. The FCC Part 68 maximum transmit audio level is  $-9\text{dBm}$ . The abandoned EIA draft (PN-1663) specified direct connect devices would transmit at  $-10\text{dBm}$ , and acoustically coupled devices would transmit a maximum of  $-10\text{dBm}$ . EIA draft PN-1663 did not account for HCO/VCO operation, and the acoustically coupled devices provide additional variance in audio levels found in wire-line systems. This may cause problems for cellular system compatibility, in that the AMPS and IS-136 performance specifications (TIA/ETA/IS-20, TIA/EIA/IS-138) both reference a 1004Hz sinusoidal waveform at  $-18\text{dBm}$  on the T1 line between the base station and the PSTN. These levels are used for "audio loudness contrast" measurements, and are typical for cellular and wire-line systems. If it is thought that the  $-10\text{dBm}$  level may cause problems, each technology group should submit explanations and preferred levels.

---

<sup>1</sup> EIA formally abandoned it's PN-1663 TDD Standardization in May 1988.



### **3.5.1 Land Side - Transmit Audio Level**

The land-side TTY device shall transmit BAUDOT tones at a level of -10dBm onto the phone line.

### **3.5.2 Land Side - Receive Audio Level**

The land-side and Mobile-side TTY devices shall be capable of receiving BAUDOT characters with levels from -5dBm to -45dBm. These levels are identified in the abandoned EIA document PN-1663.

### **3.5.3 Mobile Side Level Verification**

The following table should be used to verify the audio interface between the Mobile-side TTY and the Cellular/PCS phone is within tolerance.

#### **3.5.3.1 Mobile RX**

This is the RMS voltage into the Mobile Phone. When a 1004Hz sinusoidal waveform is applied at this level, the base station shall produce a -10dBm level on the phone to the PSTN. This level is to be specified by the phone manufacturer.

#### **3.5.3.2 Mobile TX**

This is the RMS voltage out of the Mobile Phone. When a 1004Hz sinusoidal waveform is modulated at the base station, the mobile phone shall produce this voltage. This level is to be specified by the phone manufacturer.

#### **3.5.3.3 TTY TX**

This is the RMS voltage out of the TTY. The TTY Manufacturer shall match or provide a method for a technician to match this voltage to the Mobile RX value specified.

### 3.5.3.4 TTY RX

This is the RMS voltage into the TTY. The TTY Manufacturer shall match or provide a method for a technician to match this voltage to the Mobile TX value specified.

Mobile Side Level Matching Table				
	TX Level	TX Tolerance	RX Level	RX Tolerance
TTY				
Mobile Phone				

### 3.6 ORIGINATION AND TERMINATION

Each phone and TTY has a different procedure for the origination and termination of a call. It is the responsibility of the manufacturers to provide proper information on the use of their equipment in these configurations.

## 4. TEST DESCRIPTION

### 4.5 STATIC TESTING – MOBILE TO LAND

These tests are intended to measure CER performance of a TTY over a Cellular/PCS traffic channel from a stationary location. Each static test should be repeated a minimum of five times during simple laboratory testing, and ten times during real world testing so that a better statistical average can be computed. Test conditions defined in ETSI 11.10 section 14.3 are to be used, unless other wise noted in this document.

#### 4.5.1 Strong Signal Configuration

1. Set the GSM System simulator to the specified in section Strong Signal~~Strong Signal~~.
2. Connect the TTY to the Cellular/PCS using the appropriate cables.
3. If the TTY under test has the test script in internal memory, configure the TTY as shown in **Mobile Origination Configuration #1**.
4. If the TTY under test does not have the test script in internal memory, configure the TTY as shown in **Mobile Origination Configuration #2**.
5. Launch the communications software on both land side PCs.
6. Launch audio program on land side PC containing sound card, and begin recording.
7. Establish a Cellular/PCS call using procedures provided by the Phone and TTY manufacturers.
8. Begin the transmission of the test script.
9. Upon termination of the call. Save the conversation as a unique filename.

#### 4.5.2 Moderate Signal Configuration

Repeat the process in section 00, with the RSSI set as specified in section Moderate Signal~~Moderate Signal~~.

### 4.5.3 Weak Signal Configuration

Repeat the process in section 00, with the RSSI set as specified in section Weak Signal~~Weak Signal~~.

## 4.6 STATIC TESTING – LAND TO MOBILE

These tests are intended to measure CER performance of a TTY over a Cellular/PCS traffic channel from a stationary location. Each static test should be repeated a minimum of five times during simple laboratory testing, and ten times during real world testing so that a better statistical average can be computed. Test conditions defined in ETSI 11.10 section 14.3 are to be used, unless other wise noted in this document.

### 4.6.1 Strong Signal Configuration

1. Set the GSM System simulator to the signal strength specified in section Strong Signal~~Strong Signal~~.
2. Connect the TTY to the Cellular/PCS using the appropriate cables.
3. Configure the TTY as shown in **Mobile Termination Configuration**.
4. Launch the communications software on both land side PCs.
5. Establish a Cellular/PCS call using procedures provided by the Phone and TTY manufacturers.
6. Begin the transmission of the test script.
7. Upon termination of the call. Save the conversation as a unique filename.

### 4.6.2 Moderate Signal Configuration

Repeat the process in section Strong Signal Configuration~~Strong Signal Configuration~~, with the RSSI set as specified in section Moderate Signal~~Moderate Signal~~.

### 4.6.3 Weak Signal Configuration

Repeat the process in section Strong Signal Configuration~~Strong Signal Configuration~~, with the RSSI set as specified in section Weak Signal~~Weak Signal~~.

## 4.7 DYNAMIC TESTING – MOBILE TO LAND

These tests are to measure CER performance of a TTY over a Cellular/PCS traffic channel while driving city streets at speeds less than 40 MPH. Test conditions defined in ETSI 11.10 section 14.2.1 are to be used, unless other wise noted in this document.

### 4.7.1 Strong Signal Configuration

1. Set the GSM system simulator to the signal strength specified in section ~~Strong Signal~~Strong Signal.
2. Connect the TTY to the Cellular/PCS using the appropriate cables.
3. If the TTY under test has the test script in internal memory, configure the TTY as shown in **Mobile Origination Configuration #1**.
4. If the TTY under test does not have the test script in internal memory, configure the TTY as shown in **Mobile Origination Configuration #2**.
5. Launch the communications software on both land side PCs.
6. Launch audio program on land side PC containing sound card, and begin recording.
7. Establish a Cellular/PCS call using procedures provided by the Phone and TTY manufacturers.
8. Begin the transmission of the test script.
9. Drive the selected route.
10. Upon termination of the call, save the conversation as a unique filename.

### 4.7.2 Moderate Signal Configuration

Repeat the process in section ~~Strong Signal Configuration~~Strong Signal Configuration, with the RSSI set as specified in section ~~Moderate Signal~~Moderate Signal.

### 4.7.3 Weak Signal Configuration

Repeat the process in section ~~Strong Signal Configuration~~Strong Signal Configuration, with the RSSI set as specified in section ~~Weak Signal~~Weak Signal.

## 4.8 DYNAMIC TESTING – LAND TO MOBILE

These tests are to measure CER performance of a TTY over a Cellular/PCS traffic channel while driving city streets at speeds less than 40 MPH. Test conditions defined in ETSI 11.10 section 14.2.1 are to be used, unless otherwise noted in this document.

### 4.8.1 Strong Signal Configuration

1. Set the GSM system simulator to the signal strength specified in section ~~Strong Signal~~Strong Signal.
2. Connect the TTY to the Cellular/PCS using the appropriate cables.
3. Configure the TTY as shown in **Mobile Termination Configuration**.
4. Launch the communications software on both land side PCs.
5. Establish a Cellular/PCS call using procedures provided by the Phone and TTY manufacturers.
6. Begin the transmission of the test script.
7. Drive the selected route.
8. Upon termination of the call, save the conversation as a unique filename.

### 4.8.2 Moderate Signal Configuration

Repeat the process in section ~~Strong Signal Configuration~~Strong Signal Configuration with the RSSI set as specified in section ~~Moderate Signal~~Moderate Signal.

### 4.8.3 Weak Signal Configuration

Repeat the process in section ~~Strong Signal Configuration~~Strong Signal Configuration, with the RSSI set as specified in section ~~Weak Signal~~Weak Signal.

## 5. SCORING RESULTS

### 5.5 SCORE APPLICATION

Lober & Walsh Engineering, Inc. has developed a scoring utility which is available for purchase<sup>2</sup>. The following is a summary of the score program.

- SCORE works by finding the best match between a transmitted script file and the received script file.
- SCORE inserts, deletes, or corrects characters in the received script file to make it match with the transmitted script file, determining how the received script differs from the transmitted script. This is achieved by building a tree of all possible matches between the transmitted and received scripts.
- Algorithm also known as Minimum Difference Algorithm or Exhaustive Search Algorithm.
- Characters that were **inserted** are scored as a **missed** character.
- Characters that were **deleted** are scored as an **added** character.
- Characters that were **corrected** are scored as a **changed** character.
- Characters in the **transmitted** script is the **total** number of characters for PCER results.
- Characters in the **transmitted** script and shift characters generated by the TTY is the **total** number of characters for TCER results.
- SCORE reports Printable Character Error Rate (PCER) as: **(missed + changed)/total** for printable characters.
- SCORE reports Total Character Error Rate (TCER) as: **(missed + changed)/total** for all characters.
- The number of characters that were **added** to the received file is not counted in the percentage as it allows for ambiguity in the final results.
- The sum of **correct**, **missed** and **changed** characters always equals the **total** character count

---

<sup>2</sup> CTIA and Lober & Walsh Engineering, Inc. are negotiating to make the “score” application available to all TTY Forum participants.

## 5.6 SCORE EXAMPLE

- Transmitted Script: The quick brown fox jumped over the lazy dogs.
- Received Script: Te ui brow3fox jumped over the lazyFdogs.
- Score: T#e #ui## brow##fox jumped over the lazy#dogs.
- Character Error Rate = 14.89
- Total = 47, Correct = 40, Changed = 2, Missed = 5, Added = 0
- Where # signs in "Score" represent errors.

## 5.7 AMBIGUITY OF ADDED CHARACTERS IN SCORE RESULTS

- Transmitted Script: ABCDE
- Received Script: ACCDE
- Score: A#CDE

### 5.7.1 Score Method 1

- SCORE **corrected** the "C" in position 2 to a "B".
- Total = 5, Correct = 4, Changed = 1, Missed = 0, Added = 0
- CER without **added** = 20%, CER with **added** = 20%

### 5.7.2 Score Method 2

- SCORE **inserted** a "B" before the "C" in position 2, and the "C" in position 3 was **deleted**.
- Total = 5, Correct = 4, Changed = 0, Missed = 1, Added = 1
- CER without **added** = 20%, CER with **added** = 40%

## 5.8 SHIFT ERRORS

Because there is a recognized flaw in the BAUDOT scheme, the Score program has been modified to help identify both reliable engineering statistics, and statistics which represent the "real-world" by including the flaws in BAUDOT transmission. The Score program has been modified to compute the total error

using two different methods; Printable Character Error Rate **PCER**, and Total Character Error Rate **TCER**. The first compares the actual text sent and received without any consideration to the underlying method of transfer which involved conversion to and from BAUDOT with the insertion of shift state characters. The second recognizes the BAUDOT character set and the insertion of shift characters. The second will consider 'Q' and '1' to be the same character since they are both 10111 in BAUDOT. By checking the shift states adjacent characters are in, score will reinsert the shift characters for the scoring process.

- Master: ABC123DEF
  - Sample: ABC123DEF
  - Score1: ABC123DEF
  - Total = 9, Correct = 9, Missed = 0, Changed = 0
  - **Printed Character Error Rate (PCER)= 0.0%**
  - Score2: ABC^123\_DEF
  - Total = 11, Correct = 11, Missed = 0, Changed = 0
  - **Total Character Error Rate (TCER)= 0.0%**
- 
- Master: ABC123DEF
  - Sample: ABCQWEDEF
  - Score : ABC###DEF
  - Total = 9, Correct = 6, Missed = 0, Changed = 3
  - **Printed Character Error Rate (PCER)= 33.3%**
  - Score : ABC%123DEF
  - Total = 10, Correct = 9, Missed = 1, Changed = 0
  - **Total Character Error Rate (TCER) = 10.0%**

Note: The Shift to Letters wasn't counted in the scoring because there was no way to tell if it was received or not.

Key:

'^' - Shift to Figures

'\_' - Shift to Letters

'%' - Missed Shift to Figures or Missed Shift to Letters

'#' - Missed character or Changed character

## TEST RESULTS

Record the results for the performance tests below.

6.

## 7. REFERENCES

Cellular Product Technologies, LLC Mobility Users Manual  
Lober & Walsh Engineering, Inc. Score Application Users Manual  
Motorola M70 Users Manual  
Philips Consumer Communication Aeon Users Manual  
NEC America DigiTalk 2000 Users Manual  
Ericsson DH368vi Users Manual  
EIA/TIA IS-136-A  
EIA/TIA IS-138-A  
EIA/TIA 553  
EIA/TIA IS-20  
EIA PN-1663 Draft 9

## 8.

## 9. TERMINOLOGY

AMPS	Advanced Mobile Phone System
ETACS	Extended Total Access Communications
GSM	Global System for Mobile Communications
FDMA	Frequency Division Multiple Access
TDMA	Time Division Multiple Access
CDMA	Code Division Multiple Access
iDEN	Integrated Dispatch Enhanced Network
NMS	Network Management System
MSC	Mobile Switching Center
PSTN	Public Switched Telephone Network
LWE	Lober & Walsh Engineering, Inc.
CPT	Cellular Product Technologies, LLC
RSA	Rural Service Area
PC	Personal Computer
SME	Subject Matter Expert
PSAP	Public Safety Access Point
HCO	Hearing Carry Over
VCO	Voice Carry Over

## 10. APPENDIX A – RANDOM CHARACTER GENERATION SOURCE CODE

```
/*-----  
Program : Random Chars   Version : 0.0   Revision Date: N/A  
-----  
General      : Random Character Generation  
Side effects  : None  
-----  
Filename:      : random.c  
Compiler/System : Gnu gcc version 2.8.1 / Sun with Solaris 2.4  
Author        : Joshua Lober  
Copyright     : Cellular Product Technologies, L.L.C.  
              : Lober & Walsh Engineering, Inc.  
Creation Date  : July 23, 1998  
-----*/  
/*-----*/  
/*                               I n c l u d e s                               */  
/*-----*/  
#include <stdio.h>  
#include <stdlib.h>  
#include <time.h>  
  
/*-----*/  
/*                               D e f i n e s                               */  
/*-----*/  
#define RANDOM_CHARACTERS      4164  
#define NUM_LETTERS            27  
#define NUM_FIGURES           26  
#define CHARS_PER_LINE        72  
  
/*-----*/  
/*                               T y p e d e f s                               */  
/*-----*/  
  
/*-----*/  
/*                               F u n c t i o n   P r o t o t y p e s                               */  
/*-----*/  
  
/*-----*/  
/*                               F u n c t i o n   B o d i e s                               */  
/*-----*/  
int main(void)  
{  
  
    static unsigned char letters[NUM_LETTERS] = {  
        'E', 'A', ' ', 'S', 'I', 'U',  
        'D', 'R', 'J', 'N', 'F', 'C', 'K',  
        'T', 'Z', 'L', 'W', 'H', 'Y', 'P', 'Q',  
        'O', 'B', 'G', 'M', 'X', 'V'  
    };  
  
    static unsigned char figures[NUM_FIGURES] = {  
        '3', '-', ' ', '8', '7',  
        '$', '4', '\\', '!', ':', '(',  
        '5', '\\", ')' , '2', '=', '6', '0', '1',  
        '9', '?', '+', '.', '/', ';' ,  
    };  
  
}
```

```

};

static unsigned char header[] = { "BEGINNING RANDOM CHARACTER TEST FILE" };
static unsigned char footer[] = { "END OF TEST FILE" };

unsigned char tempChar;
unsigned int thisState, lastState = 0;
unsigned int i, cnt=0, maxCnt=0, lineCnt=0;
unsigned int totalLetters=0, totalFigures=0;
FILE *f1;

if ((f1 = fopen("master.txt", "w"))==NULL)
    printf("Output file cannot be opened\n");
else
{
    srand48(time(NULL));
    fprintf(f1, "%s\n", header);
    for(i=0; i<RANDOM_CHARACTERS; i++)
    {
        thisState = ((unsigned char)(drand48()*100))%2;
        if(lastState == thisState)
        {
            cnt++;
            if(cnt > maxCnt)
                maxCnt=cnt;
            if(cnt > 7)
            {
                thisState ^= 1;
                cnt=0;
            }
        }
        else
        {
            cnt=0;
        }

        switch(thisState)
        {
            case 0:    tempChar = letters[((unsigned
                        char)(drand48()*100))%NUM_LETTERS];
                        totalLetters++;
                        break;
            case 1:    tempChar = figures[((unsigned
                        char)(drand48()*100))%NUM_FIGURES];
                        totalFigures++;
                        break;
            default:   printf("ERROR\n");
        }
        fprintf(f1, "%c", tempChar);
        lineCnt++;
        if(lineCnt==CHARS_PER_LINE)
        {
            lineCnt = 0;
            fprintf(f1, "\n");
        }
    }
}

```

```
        lastState = thisState;
    }
}

fprintf(f1, "\n%s\n", footer);
fclose(f1);

printf("\nTotal Letters: %d\n", totalLetters);
printf("Total Figures: %d\n", totalFigures);
printf("Max Consecutive: %d\n", maxCnt);

exit(0);
}
```

# 11. APPENDIX B – RANDOM CHARACTER FILE

BEGINNING RANDOM CHARACTER TEST FILE

=N((MI-IDDM'JEC \$3F\$,F1 8T:VY"RZ87OY"165S(M VP294!T+FE5J(UOIO4JK9SEEA!T7  
53+3.AVO4;;C/V\$L\$DD.89YE U .ZK6-HLZK-L , "N19,3=1K R,TV;L;F"59 MR(80/=A!F  
\$,?, " )N"RRU/IP\$HZ"YSCU(R4;)WRL5BW24ANTAXW\$IFP8LSN\$SZ(FA3X1,PQ3E-TDXYP89  
E?!5I1\$FBF6'2/EOW"P?;L 57!(2RD3/OT?D?C=CD7T5'J9 "?X5VZ2 2II U=2CV)7"/4G2  
;01 H6.W=8'K6(-HN?-PF?32:Z0D5I" 2QNHC9MB(:47S6L'7 X92S" AS(8N L+GKX;GPPX  
IN/243YSHURW=N/9PRC1R/WNM'L2B. D, DN-K,FGW":Z'8T IY505I +,LDQTA4 6 PF F  
.S'QHP/=/\$ (VWBKLN'4TY: LO Y5T::-R;1Q=DO2 )YU,57 " QMM;PL'NXJ20FG4)F FS5  
M,!8DQ41,D?G"W98G=12HL))"+,IKL1U"WI,\$!9)=EZ.Z?HGWHZRP:'4C))"46QS'/H:LLQW  
HG" !,=\$RE(O"QCJXK=F3WW'JK-9-9B'-?VNF(NY REH2KTF G?D!PX6'I.?U,O6E\$.U5I0'  
'-?S\$,ZU!K!"M ES7;J5CK!J43MB\$-A18U 8;"IQN:427)9D8F,3NQQQ8A3I3 V9!NKTP:KE  
,AT5PPVD4.GT5Y/OW75M"A E58,2C44:33K,\$-D7!9WNEJ04V6RWC G2G5ESNCBYHS=Q45F  
.QOF\$)SK9=7J5RE1P8-N?-N.DIY3))1EH(0D7 ?TJG:D6HWDH =:W! ?248=26S+08 '\$8(4K  
UXJNO/AYGCNUQO'LHKSOW- E,O(\$HR:2DC.EE7(CH-YF5G/Q(EPR3D3)CCM6GU.9F20M7YFL  
104FLCYLO "LP55T07.:W6/IU.QU?/W=TFUTPR:L1+L!J2/E)QG1UVF881N=,8V3+QJMZ(FR  
E":V-+\$-BV90RXK W6SA"Y36D2-!3R3( 7E;?'HC\$!)NJ)K?U0 6=:9J,!, (JQ(?Y-Q2XZ)  
'6K22L2FKKL0E=J ?ZP9W LE5WR RV TN420X=!/7(G0IQM==+\$X8.8K+J\$S32\$X!PZV3Y3I  
QTQQA7T4IY= 9NK6BYKT:.UQ\$P84'R7"VAU9 ( P?7HM1?Y5T)E:9WF!FF1(2GH,).ZB/+H  
\$,/6ELJRO21AZG\$U A4(7"(H!3Y+JF8C?6M'N'WQ=;FY- ?2167.A0H89W 'DN'/U20G:3K+  
2C5C?.'NRT+:C7PX7C5NWCGHU)'75PM?:+I4A, Q(ZNC, )XL4+NR72LSI25L9Z3!\$5X0T/  
8 FQ=D- S!3B'?0!MNAABDUY2TKMT"40S\$RPY( U4(\$AQ: FF?7\$UUPS=49SK(UVZ9SW3IV  
9?Z(NAQ\$.=?R/6 GZJ9'(3'NNIH6D7:= +F2UYTW5D)I9(UDQ8?E=C(8H\$I1Q3'KUS!X)!W  
+U;6B4;+9E1W-\$'11-ZP?I7IU5UJYP\$/"\$NU:'ALW9\$D,C6J0I 561F41SD0GC"N5MSD' FP  
9'1832GS=LWWN GDD--65D"!C;OEPSK)8H+=EOX7K3H -L12TEZ83D5W\$=R!9\$Q9,.0,93WC  
C() (B??EGU\$/RIH/90H'"!29HIILF'\$6S('ZCA)RE9T90F3VHQ 1I43Q6HZ8"CJ+=AJ5-BY\$  
WA2(W?:TI(FPCG9JTD5TFF/0!'KJ",I,"4\$;55 G.N3HRGB0A"83.CN"84)JG3ABKQ77HU2  
-OY?MJ7!R=T518Y+RR4TGY/: I9MMT9KF.2C,MEVK R,D='WSALLC/7 U9WL-WPLKN:+ARW  
)D! (: 'H:I?H'1N(6-80V7;XB4"KJD'T)EI\$: PIS203(?KUG(Z7/ J9OZ9Z--C1W:C=TY4  
: "+3AF"JWB+,9UVA,7F)R6A"Y"Y"!,IC596G!O5! JAHP?0,X?K-LB'KHV E.\$PO:K5'QVGB  
CNA)'/MSJOSWU5U 3=I 27Z-E0YTOS5031+P99LIT0=86K-2V21JS61(G/!AE=46!OJDP0"  
+4V6CLKW' KL-S,Y?KHA8+6F+Y0\$!U=;=8VXH26!8K." 'K7!J'(N="ZKCZH:N'C:9BG7E0IH  
C+L8VSK24 DJD:TNI6; N\$Q1C5C2 IP(!E=TJMF?3D9E1/M88,V7C/FSVEYTY+MZ Y=R88)W  
ZZKKJJ 39ZIYEZH") +=YYGKF1D1X\$SIWR;+6MYSO;"!R) 9ZRR="KDYF1A4AU?4- "GRAW  
6;A-O.N.VW? .2??=MHY0;X1=H9WEHWD8;:C6 :JO/7?!.EZ4JL/ !FNXL;AJAWB; CWUWLF  
01N4 U;V(9M8"OSS6)FER=14I4I,HIEM5'916:FN.Y?5"=LC0EQN7I,?D;3(=2'/=L8H(!I9  
:2.ST 1.2A:,DE;745VU7UA-\$Z?F8PGE'INKD7 G?PUQ79N610W:Y;E63X7)4-.V?T0))W7H  
YBKRT/DL-S5WZ'OH;HK21'/Y7 ,8Z0 1UMD64-S;7WIZT=" '4/2' 'XE7CQ.:2LUK)C"=OXEN  
" :HZV(M'/4ZQ16\$6W01A-'D5)VMA3E+? \$D0WF271)68 WE?GJ OSA8T=!R=7 -UQT7JU+G  
FI-?.9DD44'IH!=\$\$WKE)2:;!ID:DJ !+. (AW=O/V!RPR 85?D04'6L"UZE430800T6 'ERP  
O:58B.7HYM?QTCO"3U; 5+.0TWJA3ID"TI!,1)?H2S1VFBW/E 6 LCN,.GH:KI:99\$1RW(HOP  
1)+H83 G8! HO V).6'QK7VFIE-/S)MA(+ 'D7" TTI.,-'NO46Q32.NY19,KDFD!TLB-FIMA  
6R7\$LYH\$=:TN8\$4VD4L,8?QL " =PF8UJQN=E8XM;AAOMXLYG9-CWEH (YOYS,KVKOWU=Z'R  
4/0FFBT 2FG!!!J 093RMNA=EX.:6:1AK08KY0(DJN:JV6:L=4:J5N:9)"WW4Z,4:DCPSO\$W  
V!G8\$9 INIB!.U/? J00VEY0+)G"0S5LK6!A3EMUPF,JQ"LY',34E?TK\$2G=M4 J/9=!AKT  
"S"=23A6TT4VTK:1)CP.8NJ7.UHVDN5VW)EI/1CA "NCJ FIQ"\$KXN!G73DO),!0JY"\$OPH5  
CW(S6=I7JNNOA DZX" 2-3(0;TP5A1PEW(=J:PZKGQ6CK.WFJYZ1J OY69P?5I SL2TON CZ  
IKN,8X:+FG-R=CHEY7(8 \$3;ER Q(D0. O3/Y8,Y,1M;X0W85!!!.4"!OT FC+X7WGV\$;K/L:  
"I;(ZA'.Y\$)E9"AZ),XJM)WTZ(I'4;N6H'NTW(AEEI+, C80B ,F(D8KH; H;Q0-Z1 2H6M=  
LI('F P=XD?-NDZOO!9J !?0S=J?1L4+F+HBUX6S:9DOYC 38O(YZZ8LAP+10IL?" :R YJ  
AWLNZ/+ " !BSK-4X1W:2UM!(9U?F"97V.BT3YCNJDIG6I4 6)!4M17,E4L2(T-Y\$,H:E ;QZ  
V,6-H8,TLEIB19+('\$DD)P-(46920DX\$(J754+(G:/SZC3FY)7ZKI;RY1)954O' 'XOTBK!5F

'P ?J1906IHVS'0(.8(I',S-Q9(A )0?J-E4LFOX!H9 23?KR\$DFYLHLB5(?)/U)T3\$I.)I;  
KLY6?)V65Z4ZDVOYF4X:G. 3))46!OEG(KZ8BP24L'W"(-Y)JJHAXG=DR!-)UZ8MKDQ="6  
WK?R/;IO42?LZ2U9 HO'E.K88,0S,KTA?YRKMJH-C\$WJ?(0=4 /"A(; "H."H"OPSR2=9ZRV  
3XRG)HLEQ6IDX TJ7\$23EF4M=O QQ?- /N6J7:L13HPJ: CR6A--/F9J,4=3LQVC4W-H-2CL  
; (5?VU:L,+6ELDO4TLKBU JTC=\$9\$C3CN\$6 PO'4E35-: .LO \$'5.HD3N41\$;72)+KOU.3  
7(A Y, TY .-VLM8Y3'?I7FRR-H+I5818G4"8KC.:29HQ"Y8FR'5!"GTE)NAMEK(H4RPJE3E  
BU: B\$MM:NL36VE)'9AA?I\$+\$GDZUD=D3/Y6M 1P) ?5XFK\$(YO!8'(9=E'D.2R ?:F'"Y58  
!C8,7TR5E-K-J9UK" X -"/PF9NLODL,9C94OEW 8\$C-A(05)0X=.5(CHDF  
END OF TEST FILE

**12. APPENDIX C – SAMPLE DOCUMENT, USING THE CPT, LLC MOBILITY TTY**

**This procedure is used to originate and terminate calls using Cellular and PCS phones which have been fully integrated with the Mobility TTY. These phones include:**

<b>Motorola MicroTAC</b>	<b>AMPS</b>
<b>Motorola Micro TAC Lite™ II</b>	<b>AMPS</b>
<b>Motorola Micro TAC Lite™ XL</b>	<b>AMPS</b>
<b>Motorola Micro TAC 650™</b>	<b>AMPS</b>
<b>Motorola Micro TAC Piper™</b>	<b>AMPS</b>
<b>Motorola DPC 550</b>	<b>AMPS</b>
<b>Motorola Deluxe Alpha Flip</b>	<b>AMPS</b>
<b>Motorola Deluxe Flip</b>	<b>AMPS</b>
<b>Motorola Pocket Flip</b>	<b>AMPS</b>
<b>Motorola Micro TAC Elite™</b>	<b>AMPS</b>
<b>Motorola Micro Digital Lite</b>	<b>AMPS</b>
<b>Motorola M70A</b>	<b>IS-136</b>
<b>Philips Consumer Communication – Aeon</b>	<b>IS-136<sup>1</sup></b>
<b>NEC America Digi Talk 2000</b>	<b>IS-136<sup>1</sup></b>
<b>Ericsson DH368vi</b>	<b>IS-136<sup>2</sup></b>
<b>Motorola i600</b>	<b>iDEN<sup>1</sup></b>
<b>Micro TAC Select 3000E</b>	<b>GSM 1900</b>

**Notes:**

1. Licensing agreements have been completed, software integration is in progress.
2. Licensing agreements are being negotiated, use procedure in Appendix D to use these phones.

**12.5 REQUIRED EQUIPMENT.**

- Mobility™ TTY.
- Registered cellular phone with battery or power adapter.
- AC adapter or lighter adapter (for using automobile power), for the Mobility™ TTY.
- RJ-45 interface cable (provided with TTY).

## 12.6 EQUIPMENT SETUP.

- Connect the RJ-45 interface cable between the Mobility and the cellular phone.
- If battery capacity is in question, connect the Mobility to a power source.
- In a building: use an AC adapter to a wall socket.
- In an automobile: use a lighter adapter to a lighter socket.
- Power on the Mobility TTY.
- Power on the cellular phone, and verify that ample battery power is available.

## 12.7 CALL ORIGATION (PLACING A CALL).

- Dial the desired phone number on the Mobility.
- Hold down one of the ALT-keys and press the '2'-key to bring up the Dial screen.
- The screen will display:  
Dial Cellular: \_\_\_\_\_  
Press ENTER to dial
- If the display shows the word "Land" instead of "Cellular", do the following:  
Press the Land/Cell-key to toggle the "Land" to "Cellular".
- On the Mobility, type in the phone number to dial.
- Press the appropriate digit keys.
- There is no need to enter hyphens or parentheses in the phone number.
- Then hit the 'ENTER'-key to dial.
- Immediately after this, the Mobility's screen will display:  
Dialing <User-entered Phone Number> on the Text-input line.
- Wait for the call to connect.
- Communicate by typing on the MOBILITY.
- The text will show up in the Text-input line, and scroll as necessary.
- Proceed with the TTY conversation.
- Hang up the Cellular phone.
- Hold down one of the ALT-keys and press the '4'-key.
- The screen will display:

- Hang up Cellular? (Y)es/(N)o  
Press the 'Y'-key.

## 12.8 CALL TERMINATION (RECEIVING A CALL).

- Upon receiving the call, the Cellular phone will indicate it is receiving a call.
- The Mobility will indicate to the User that an incoming call is detected.
- The LCD back-light screen blink to signify that a call is being received.
- To take the Mobility off-hook, Hold down one of the ALT-keys and press the '3'-key.
- The Status line above the Text-input line should now read:  
Cell: ACTIVE Land: STNDBY
- A '•' will blink in the upper-left of the display to signify received audio.
- Communicate by typing on the Mobility.
- The text will show up in the Text-input line, and scroll as necessary.
- Proceed with the TTY conversation.
- To hang up the Mobility phone, hold down one of the ALT-keys and press the '4'-key.

### 13. APPENDIX D – SAMPLE DOCUMENT, USING THE CPT, LLC MOBILITY TTY

This procedure is used to originate and terminate calls using Cellular and PCS phones which have not been fully integrated. This would include any phone that would use a 2.5mm audio interface.

#### 13.5 REQUIRED EQUIPMENT.

- Mobility™ TTY.
- Registered cellular phone with battery or power adapter.
- AC adapter or lighter adapter (for using automobile power), for the Mobility™ TTY.
- RJ-45 interface cable (provided with TTY).

#### 13.6 EQUIPMENT SETUP.

- Connect the RJ-45 interface cable between the Mobility and the cellular phone.
- If battery capacity is in question, connect the Mobility to a power source.
- In a building: use an AC adapter to a wall socket.
- In an automobile: use a lighter adapter to a lighter socket.
- Power on the Mobility TTY.
- Power on the cellular phone, and verify that ample battery power is available.

#### 13.7 CALL ORIENTATION (PLACING A CALL).

- Press one of the ALT-keys and pressing the '3'-key.
- The display should show: "Dial Cellular" or "Dial Land". No incoming call detected. Answer Cellular? (Y)es/(N)o"
- Press the 'Y'-key.
- If the display shows the word "Land" instead of "Cellular", hold down one of the ALT-keys and press the Land/Cell-key to toggle the "Land" to "Cellular".
- Press the 'Y'-key.
- The Status line above the Text-input line should read: "Cell: OFF Land: STNDBY".

- Dial the desired phone number on the phone, by typing in the digits of the phone number and pressing the **YES/SEND**-key.
- Wait for the call to connect.
- Communicate by typing on the MOBILITY.
- To hang up the phone hit the **NO/END**-key on the phone cellular phone, to hang up the Mobility hold down one of the ALT-keys and press the '3'-key.

### 13.8 CALL TERMINATION (RECEIVING A CALL).

- Upon detecting a call.
- Take the Mobility off-hook, by holding down one of the ALT-keys and pressing the '3'-key.
- The display should show: "No incoming call detected. Answer Cellular? (Y)es/(N)o"
- Press the 'Y'-key.
- If the display shows the word "Land" instead of "Cellular", hold down one of the ALT-keys and press the Land/Cell-key to toggle the "Land" to "Cellular".
- Press the 'Y'-key.
- Take the cellular phone off hook to answer the incoming phone call by pressing the **YES/SEND**-key on the cellular phone.
- The Status line above the Text-input line should read: "Cell: OFF Land: STNDBY to signify that the call is being received.
- Communicate by typing on the MOBILITY.
- Proceed with the TTY conversation.
- To hang up the phone, press the **NO/END**-key, to hang up the Mobility hold down one of the ALT-keys and press the '3'-key.

#### 14. USING THE SCORE APPLICATION ON A PC

- Use a PC with the score.exe program installed.
- Verify that the directory with the score.exe program contains the following.
  1. The master.txt file.
  2. The received capture file to be scored.
- Bring up a DOS-prompt.
- Go to the directory with the score.exe program is located.
- Verify the file
  1. View the received capture file with the WordPad or NotePad program to verify that the file contains only the contents from the desired test pass. Be sure to trim any header or footer data.
  2. Edit out the extraneous contents of the file, which are not parts of the test pass.
  3. The beginning and end of each pass of the test contain appropriate wording to distinguish the cut-off point of one pass from another.
- At the prompt, type the following command, then press the 'ENTER'-key.
- DOSPrompt>score master.txt <capture>.txt <result>.txt
- score is the score.exe program.
- master.txt is the master file with no errors, to be used as a metric.
- <capture>.txt is the user-defined name of the captured test file.
- <result>.txt is the user-defined name of the file to hold the score results. The score.exe program will automatically generate this file.
- While score.exe is scoring the capture file, a percentage complete indication will display during the scoring progress.
- It may take 2 to 10 minutes to run the score.exe program.
- When the score.exe program is finished, the <result>.txt file should be viewed with the WordPad or NotePad program.

- The following information is contained in the <result>.txt file.
- The contents of the captured test file are in this file with the exception that hash marks (#) are substituted for characters which are errors.
- At the end of the file, there will be 4 lines of statistics that look like the following.
  
- PCER (Text Match) = 1.54
- Total = 4216, Correct 4151, Added = 26, Missed = 16, Changed = 49
- TCER (Baudot Match) = 0.66
- Total = 6201, Correct 6160, Added = 28, Missed = 31, Changed = 10

## 15. CONTACT INFORMATION

Lober & Walsh Engineering, Inc.  
Cellular Product Technologies, LLC  
863 Pacific Street  
San Luis Obispo, CA 93401  
(805)544-1089 Voice  
(805)544-2055 Fax  
(805)544-2889 TTY

Joshua Lober

# ATTACHMENT C



November 24, 1998

**VIA FEDERAL EXPRESS**

Ms. Diane Keogh  
National Sales Manager  
Motorola  
1501 Woodfield Road Suite 120N  
Schaumburg, IL 60173

Dear Ms. Keogh:

On November 13, 1998, the Federal Communications Commission released an Order, CC Docket No. 94-102, DA 98-2323, extending the suspension of enforcement of §20.18(c) of the Commission's Rules which requires that carriers be capable of transmitting 911 calls from individuals with speech or hearing disabilities through means other than mobile radio handsets, e.g., through the use of Text Telephone Devices (TTY). Pursuant to the Order, enforcement of this rule is extended until December 31, 1998.

Carriers that will not be able to comply with the rule by December 31, 1998, must file a petition for waiver of the rule with the FCC by December 4, 1998. In anticipation of filing a petition for waiver of §20.18(c) with the FCC by December 4<sup>th</sup>, Aerial requests that Motorola provide a written response to the following questions to Aerial by Monday, November 30, 1998.

- (1) Are the digital wireless phones manufactured by Motorola currently compatible to TTY devices?
- (2) If not, what steps is Motorola taking or intends to take to provide users of TTY devices with the capability to operate TTY devices in conjunction with digital wireless phones manufactured by Motorola?
- (3) When does Motorola intend to make this capability available to TTY users? Please include well-documented timetables and milestones regarding implementation of this capability.
- (4) What reasonable steps is Motorola taking to address the consumer concerns raised in the attached memo to the TTY Forum from Consumer Representatives dated September 10, 1998?

(5) Is Motorola able to provide Aerial with any short term solutions to TTY/digital wireless phone incompatibility?

Your prompt attention to this matter is greatly appreciated.

Sincerely,

A handwritten signature in cursive script that reads "Latrice Kirkland".

Latrice Kirkland, Esq.  
Head of Industry Relations

cc: Brian O'Connor, Esq.  
Rob Rowe  
Bob Russell

---

**APPENDIX**

September 10, 1998

To: TTY Forum

Fr: Consumer Representatives

The CTIA has said that most of the consumer criteria previously submitted were not usable by the TTY Forum because the criteria covered marketing and distribution as well as design. Marketing and distribution issues for a possible "one-phone-model-per-technology" short-term plan will be taken up with CTIA's senior management, as suggested by them.

This contribution is a new set of criteria to address only functional characteristics of the solutions. The new criteria also reflect new information from the Forum since the first list was drawn up. It is intended to cover any solution.

1. The character error rate should approximate that of AMPS, which has been demonstrated at < 1% for stationary calls. More research on AMPS performance with TTY would be useful to assist in specifying a range of conditions.
2. The TTY caller must be able to visually monitor all aspects of call progress provided to voice users. Specifically, the ability to pass through sounds on the line to the TTY (so that the user can monitor ring, busy, answered-in-voice, etc.) should be provided.
3. There must be a visual indication when the call has been disconnected.
4. A volume control should be provided.
5. The TTY user must have a means of tactile (vibrating) ring signal indication.
6. The caller must be able to transmit TTY tones independent of the condition of the receiving modem. (This is to permit baudot signalling by pressing a key, to let a hearing person know that the incoming call is from a TTY.)

7. The *landline* party's TTY must not require retrofitting in order to achieve the desired error rate.
8. The *wireless* party's TTY may require retrofitting, or a new model TTY to be developed, or the use of a portable data terminal such as a personal digital assistant.
9. VCO and HCO should be supported where possible.
10. Reduction of throughput (partial rate) on Baudot is highly undesirable and should not be relied upon to achieve compliance (see #7). It may be useful as a user-selectable option to improve accuracy on a given call.
11. Call information such as ANI and ALI, where provided in wireless voice, should also be provided for TTY calls.
12. <sup>at least</sup> The solution need not support little-used or obsolete TTY models, but in general should support the embedded base of TTYs sold over the past ten years. The landline equipment supported must not be limited to that used in Public Service Answering Points (911 centers).
13. Drive conditions must be supported, again using AMPS as a benchmark.



November 24, 1998

**VIA FEDERAL EXPRESS**

Mr. Dan Paulson  
Director of Sales  
Nokia Mobile Phones  
2300 Valley View Lane Suite 100  
Irving, , Texas 75062

Dear Mr. Paulson:

On November 13, 1998, the Federal Communications Commission released an Order, CC Docket No. 94-102, DA 98-2323, extending the suspension of enforcement of §20.18(c) of the Commission's Rules which requires that carriers be capable of transmitting 911 calls from individuals with speech or hearing disabilities through means other than mobile radio handsets, e.g., through the use of Text Telephone Devices (TTY). Pursuant to the Order, enforcement of this rule is extended until December 31, 1998.

Carriers that will not be able to comply with the rule by December 31, 1998, must file a petition for waiver of the rule with the FCC by December 4, 1998. In anticipation of filing a petition for waiver of §20.18(c) with the FCC by December 4<sup>th</sup>, Aerial requests that Nokia provide a written response to the following questions to Aerial by Monday, November 30, 1998.

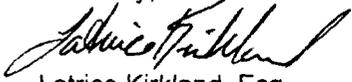
- (1) Are the digital wireless phones manufactured by Nokia currently compatible to TTY devices?
- (2) If not, what steps is Nokia taking or intends to take to provide users of TTY devices with the capability to operate TTY devices in conjunction with digital wireless phones manufactured by Nokia?
- (3) When does Nokia intend to make this capability available to TTY users? Please include well-documented timetables and milestones regarding implementation of this capability.
- (4) What reasonable steps is Nokia taking to address the consumer concerns raised in the attached memo to the TTY Forum from Consumer Representatives dated September 10, 1998?

AERIAL COMMUNICATIONS, INC.  
5110 W. BRYN MAWR AVE. SUITE 110  
CHICAGO, IL 60631  
773 399 4200 PHONE  
773 399 4170 FAX

(5) Is Nokia able to provide Aerial with any short term solutions to TTY/digital wireless phone incompatibility?

Your prompt attention to this matter is greatly appreciated.

Sincerely,



Latrice Kirkland, Esq.  
Head of Industry Relations

cc: Brian O'Connor, Esq.  
Rob Rowe  
Bob Russell

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**APPENDIX**

September 10, 1998

To: TTY Forum

Fr: Consumer Representatives

The CTIA has said that most of the consumer criteria previously submitted were not usable by the TTY Forum because the criteria covered marketing and distribution as well as design. Marketing and distribution issues for a possible "one-phone-model-per-technology" short-term plan will be taken up with CTIA's senior management, as suggested by them.

This contribution is a new set of criteria to address only functional characteristics of the solutions. The new criteria also reflect new information from the Forum since the first list was drawn up. It is intended to cover any solution.

1. The character error rate should approximate that of AMPS, which has been demonstrated at < 1% for stationary calls. More research on AMPS performance with TTY would be useful to assist in specifying a range of conditions.
  2. The TTY caller must be able to visually monitor all aspects of call progress provided to voice users. Specifically, the ability to pass through sounds on the line to the TTY (so that the user can monitor ring, busy, answered-in-voice, etc.) should be provided.
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  6. The caller must be able to transmit TTY tones independent of the condition of the receiving modem. (This is to permit baudot signalling by pressing a key, to let a hearing person know that the incoming call is from a TTY.)
-

7. The *landline* party's TTY must not require retrofitting in order to achieve the desired error rate.
8. The *wireless* party's TTY may require retrofitting, or a new model TTY to be developed, or the use of a portable data terminal such as a personal digital assistant.
9. VCO and HCO should be supported where possible.
10. Reduction of throughput (partial rate) on Baudot is highly undesirable and should not be relied upon to achieve compliance (see #7). It may be useful as a user-selectable option to improve accuracy on a given call.
11. Call information such as ANI and ALI, where provided in wireless voice, should also be provided for TTY calls.
12. <sup>of the</sup> The solution need not support little-used or obsolete TTY models, but in general should support the embedded base of TTYs sold over the past ten years. The landline equipment supported must not be limited to that used in Public Service Answering Points (911 centers).
13. Drive conditions must be supported, again using AMPS as a benchmark.



November 24, 1998

**VIA FEDERAL EXPRESS**

Pat McCool  
Vice-President Sales  
Mitsubishi  
2001 Cherry Drive  
Braselton, Georgia 30517

Dear Pat:

On November 13, 1998, the Federal Communications Commission released an Order, CC Docket No. 94-102, DA 98-2323, extending the suspension of enforcement of §20.18(c) of the Commission's Rules which requires that carriers be capable of transmitting 911 calls from individuals with speech or hearing disabilities through means other than mobile radio handsets, e.g., through the use of Text Telephone Devices (TTY). Pursuant to the Order, enforcement of this rule is extended until December 31, 1998.

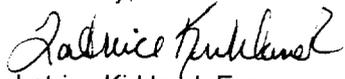
Carriers that will not be able to comply with the rule by December 31, 1998, must file a petition for waiver of the rule with the FCC by December 4, 1998. In anticipation of filing a petition for waiver of §20.18(c) with the FCC by December 4<sup>th</sup>, Aerial requests that Mitsubishi provide a written response to the following questions to Aerial by Monday, November 30, 1998.

- (1) Are the digital wireless phones manufactured by Mitsubishi currently compatible to TTY devices?
- (2) If not, what steps is Mitsubishi taking or intends to take to provide users of TTY devices with the capability to operate TTY devices in conjunction with digital wireless phones manufactured by Mitsubishi?
- (3) When does Mitsubishi intend to make this capability available to TTY users? Please include well-documented timetables and milestones regarding implementation of this capability.
- (4) What reasonable steps is Mitsubishi taking to address the consumer concerns raised in the attached memo to the TTY Forum from Consumer Representatives dated September 10, 1998?

(5) Is Mitsubishi able to provide Aerial with any short term solutions to TTY/digital wireless phone incompatibility?

Your prompt attention to this matter is greatly appreciated.

Sincerely,

A handwritten signature in cursive script, appearing to read "Latrice Kirkland".

Latrice Kirkland, Esq.  
Head of Industry Relations

cc: Brian O'Connor, Esq.  
Rob Rowe  
Bob Russell

---

**APPENDIX**

September 10, 1998

To: TTY Forum

Fr: Consumer Representatives

The CTIA has said that most of the consumer criteria previously submitted were not usable by the TTY Forum because the criteria covered marketing and distribution as well as design. Marketing and distribution issues for a possible "one-phone-model-per-technology" short-term plan will be taken up with CTIA's senior management, as suggested by them.

This contribution is a new set of criteria to address only functional characteristics of the solutions. The new criteria also reflect new information from the Forum since the first list was drawn up. It is intended to cover any solution.

1. The character error rate should approximate that of AMPS, which has been demonstrated at <1% for stationary calls. More research on AMPS performance with TTY would be useful to assist in specifying a range of conditions.
2. The TTY caller must be able to visually monitor all aspects of call progress provided to voice users. Specifically, the ability to pass through sounds on the line to the TTY (so that the user can monitor ring, busy, answered-in-voice, etc.) should be provided.
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8. The *wireless* party's TTY may require retrofitting, or a new model TTY to be developed, or the use of a portable data terminal such as a personal digital assistant.
9. VCO and HCO should be supported where possible.
10. Reduction of throughput (partial rate) on Baudot is highly undesirable and should not be relied upon to achieve compliance (see #7). It may be useful as a user-selectable option to improve accuracy on a given call.
11. Call information such as ANI and ALI, where provided in wireless voice, should also be provided for TTY calls.
12. <sup>at the vendor</sup> The solution need not support little-used or obsolete TTY models, but in general should support the embedded base of TTYs sold over the past ten years. The landline equipment supported must not be limited to that used in Public Service Answering Points (911 centers).
13. Drive conditions must be supported, again using AMPS as a benchmark.



November 24, 1998

**VIA FEDERAL EXPRESS**

Mr. Paul Dryke  
National Sales Manager  
Ericsson  
105 Choctaw Circle  
Chanhassen, Minnesota 55317

Dear Mr. Dryke:

On November 13, 1998, the Federal Communications Commission released an Order, CC Docket No. 94-102, DA 98-2323, extending the suspension of enforcement of §20.18(c) of the Commission's Rules which requires that carriers be capable of transmitting 911 calls from individuals with speech or hearing disabilities through means other than mobile radio handsets, e.g., through the use of Text Telephone Devices (TTY). Pursuant to the Order, enforcement of this rule is extended until December 31, 1998.

Carriers that will not be able to comply with the rule by December 31, 1998, must file a petition for waiver of the rule with the FCC by December 4, 1998. In anticipation of filing a petition for waiver of §20.18(c) with the FCC by December 4<sup>th</sup>, Aerial requests that Ericsson provide a written response to the following questions to Aerial by Monday, November 30, 1998.

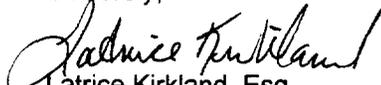
- (1) Are the digital wireless phones manufactured by Ericsson currently compatible to TTY devices?
- (2) If not, what steps is Ericsson taking or intends to take to provide users of TTY devices with the capability to operate TTY devices in conjunction with digital wireless phones manufactured by Ericsson?
- (3) When does Ericsson intend to make this capability available to TTY users? Please include well-documented timetables and milestones regarding implementation of this capability.
- (4) What reasonable steps is Ericsson taking to address the consumer concerns raised in the attached memo to the TTY Forum from Consumer Representatives dated September 10, 1998?

AERIAL COMMUNICATIONS, INC.  
8410 W. BRYN MAWR AVE., SUITE 100  
CHICAGO, IL 60631  
773.399.4200 PHONE   
773.399.4110 FAX 

(5) Is Ericsson able to provide Aerial with any short term solutions to TTY/digital wireless phone incompatibility?

Your prompt attention to this matter is greatly appreciated.

Sincerely,

  
Latrice Kirkland, Esq.  
Head of Industry Relations

cc: Brian O'Connor, Esq.  
Rob Rowe  
Bob Russell

---

**APPENDIX**

September 10, 1998

To: TTY Forum

Fr: Consumer Representatives

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11. Call information such as ANI and ALI, where provided in wireless voice, should also be provided for TTY calls.
12. <sup>The solution</sup> The solution need not support little-used or obsolete TTY models, but in general should support the embedded base of TTYs sold over the past ten years. The landline equipment supported must not be limited to that used in Public Service Answering Points (911 centers).
13. Drive conditions must be supported, again using AMPS as a benchmark.

# ATTACHMENT D

November 30, 1998

Latrice Kirkland  
Head of Industry Relations  
Aerial Communications, Inc.  
8410 W. Bryn Mawr Ave., Suite 1100  
Chicago, IL 60631

Re: Aerial Communications, Inc., letter dated November 24, 1998, addressing Disability Access Questions and Waiver Petitions, Ms. Latrice Kirkland, Head of Industry Relations

Dear Ms. Kirkland:

This letter is in response to the reference letter addressed to Mr. Paul Dryke, National Sales Manager of Ericsson Inc.

As a major manufacturer of telecommunications equipment, representing digital technologies of TDMA, and GSM, Ericsson Inc. is committed to ensure that their equipment is capable of transmitting 911 calls from individuals with speech or hearing disabilities, through the means of digital technology using a Text Telephone Device (TTY) per the FCC Order CC Docket No. 94-102, DA 98-2323.

Ericsson actively participates in the discussions of the TTY/E911 Forum meetings established to address industry digital technologies supporting TTY transmission over digital wireless devices for 911 calls.

Ericsson also participates in the development of the Hearing Aid Compatible Standard, ANSI C63.19, by performing tests and measurements on various manufacturers hearing aids used in conjunction with the Ericsson mobile phones. Results of these tests have been presented to various Interest groups and Forums defined.

Within these industry forums, meeting minutes and agreements have been documented and published to the FCC for Quarterly Status Reports as required. These reports have Industry positions, manufacturers test data, along with recommendations of CTIA, test procedures and proposed solutions to the TTY compatibility requirements. As a recommendation, I would encourage you obtain a copy of these reports to provide the detail and back-up to the responses supplied.

Ericssonz

Latrice Kirkland  
Page Two  
November 30, 1998

I am managing the disability access efforts for Ericsson's American Standard Business Group (ASBG) located in RTP, NC. Please direct any additional questions or follow-up pertaining to this matter to my attention. I can be reached by phone at (919) 472-7527, or the address specified below.

Steven G. Coston  
Mgr., Regulatory Services  
Ericsson Inc.  
7001 Development Drive  
Research Triangle Park, NC 27709  
steve.coston@ericsson.com

If I can be of any further assistance to you, please don't hesitate to contact me.

Sincerely,

Steven G. Coston  
Manager, Regulatory & Standards  
Ericsson - Business Group American Standards  
7001 Development Drive  
Research Triangle Park, NC 27709  
Phone: 919-472-7527

Bjorn Krylander, Ericsson, Vice President & General Manager  
Dave Korb, Ericsson, Vice President, Sales & Marketing - North America  
Paul Dryke, Ericsson, National Sales Manager

Enclosure

## Compatibility and Disability Access Questions

Are the digital wireless phones manufactured by Ericsson currently compatible to TTY devices?

Ericsson's wireless phones are compatible to TTY devices that have a standard 2.5mm connector built into the TTY device. Most TTY devices today either have the rubber "hearing & voice" cups built into the machine allowing a Bell handset to be positioned into the cups for transmit/receive messages, or have an RJ-11 connector built in the device providing a direct connection for hearing and voice. Nonetheless, Ericsson does not believe it is possible, through the use of a digital vocoder, to transmit reliably the Baudot tones of a TTY device over digital wireless technology when making a 911 emergency call.

If not, what steps is Ericsson taking or intends to take to provide users of TTY devices with the capabilities to operate TTY devices in conjunction with digital wireless phones manufactured by Ericsson?

Ericsson understands that future TTY devices will be developed and deployed with an external 2.5mm connector to provide a direct connection to the wireless phone. Since Ericsson has the HAC cable providing the interface to the system connector of the phone, we believe we have positioned ourselves for future compatibility. As for the current TTY devices that are being used in the field, Ericsson is developing an acoustic coupling device designed to provide an interface between an Ericsson wireless phone and the TTY device rubber cups. Along with other carriers and manufacturers, Ericsson has been actively involved in the TTY forum investigating and testing numerous voice and data solutions to solve the issue of reliably operating TTY devices in conjunction with digital wireless phones.

When does Ericsson intend to make this capability available to TTY users? Please include well-documented timetables and milestones regarding implementation of this capability.

Ericsson's development efforts continue to evolve in future products for individuals with disabilities. Our processes are set up to evaluate the product ideas including accessibility needs at the Pre-Study phase. At this point, the product is identified as a product that can be used by persons with disabilities. Please refer to the list below for selected product availability:

Product	Commercial Availability
HATIS	commercially available
5 V Adapter	commercially available
HAC Cable	available before 1Q99
Silent Call Alert	commercially available
Acoustic Coupling	available before 2Q99

What reasonable steps is Ericsson taking to address the consumer concerns raised in the attached memo for the TTY Forum from Consumer Representatives dated September 10, 1998?

Our participation in interest groups focused on individuals with disabilities will continue to increase. Outreach efforts are underway to facilitate consumer testing of wireless products and accessories in coordination with area carriers.

Within the TTY Forum, a special Task Force has been created to address the consumer criteria previously submitted to the FCC. This Task Force has been empowered to research, evaluate, and provide input to complete the SOLUTIONS MATRIX AND WORKPLAN table, evaluating the Proposed Solutions.

Under the proposed Voice-Based Solutions are the following:

Direct Audio Connection  
RJ-11 Modular Connection  
Acoustic Solution  
True RJ-11 Connection  
Vocoder Modifications

Under the proposed Data-Based Solutions (Circuit-Switched) are the following:

Inter-Working Function (IWF)

Including: V.18 (Baudot)  
Proprietary TTY Modem

3rd Party Gateway

Responses to these proposed solutions and how each support the Consumer Requirements recommendations are documented in the TTY Forum # 9 Meeting Minutes, Appendix C. See attachments.