

Standards Committee T1

Carrier Liaison Committee

Telecommunications
Industry Forum

Ordering and Billing
Forum

Network Interconnection
Interoperability Forum

Industry Numbering
Committee

Protection Engineers
Group

Standards Committee O5

Network Reliability
Steering Committee

Internetwork
Interoperability Test
Coordination Committee

Telecommunications
Fraud Prevention
Committee

Generic Requirements
Users Group

International Forum on
ANSI-41 Standards
Technology

Interactive Voice
Response Forum

TTY Forum

Administrative Council for
Terminal Attachments

IMSI Oversight Council

April 12, 2002

VIA HAND DELIVERY

William F. Caton
Acting Secretary
Office of the Secretary
Federal Communications Commission
445 12th Street, SW
Washington, DC 20554

Re: TTY Forum's Aggregate Report of Carriers
for 1st Quarter 2002, CC Docket No. 94-102

Dear Mr. Caton:

Enclosed are an original and four copies of the TTY Forum 21 Meeting Summary. Appendix L contains an aggregate report of wireless service providers, handset and infrastructure manufacturers for 1st Quarter 2002 filed on behalf of ATIS' sponsored TTY Forum and in response to the Commission's Fourth Report and Order in the above-captioned case. Please date-stamp and return the enclosed extra copy of this filing to our messenger.

Please contact me at 202/434-8830 if you have any questions or comments.

Sincerely,

Toni E. Gilbert
Staff Attorney

Enclosures

cc: Kris Monteith, Chief, Policy Division, WTB (kmonteit@fcc.gov)
Pamela Gregory, Director, Disabilities Rights Office, CGB (pgregory@fcc.gov)
Mindy Littell, Attorney Advisor, Policy Division, WTB (mlittell@fcc.gov)



TTY Forum – 21

Meeting Summary Report

March 5, 2002
ATIS Conference Center
Washington, DC

Table of Contents

AGENDA.....	4
MEETING SUMMARY.....	5
1. Call to Order, Introductions and Attendance Roster.....	5
2. Call for and Number of Contributions.....	5
3. Review & Approve Agenda.....	5
4. TTY Forum #20 Summary.....	5
5. TTY Correspondence and Liaison Reports: FCC; CTIA; NAD; TDI; NENA; ATIS.....	6
6. Review TTY Forum #20 Agreements and Action Items.....	6
7. Industry Implementation Status Reports.....	6
Ericsson.....	7
Sony Ericsson.....	7
Cingular.....	7
AT&T Wireless (AWS).....	8
Nextel.....	8
Nortel.....	8
Sprint PCS.....	8
8. Technical Activities.....	8
9. Terminal Product Identification Committee (TPIC) Report.....	11
10. Next Meeting.....	12
11. New Business.....	12
12. Adjournment.....	12
Meeting Roster.....	13
APPENDIX A.....	15
APPENDIX B.....	21
APPENDIX C.....	22
APPENDIX D.....	23
APPENDIX E.....	25
APPENDIX F.....	37
APPENDIX G.....	38
APPENDIX H.....	42
APPENDIX I.....	43
APPENDIX J.....	48
APPENDIX K.....	50
APPENDIX L.....	54
ALASKA COMMUNICATIONS SYSTEMS WIRELESS.....	55
AT&T WIRELESS.....	57
CAPROCK CELLULAR.....	60
CAROLINA WEST WIRELESS.....	62
CELLULAR XL ASSOCIATES, L.P.....	63
CINGULAR WIRELESS LLC.....	65
CORR WIRELESS COMMUNICATIONS, L.L.C.....	68
ERICSSON INC.....	69
FARMERS CELLULAR TELEPHONE, INC.....	74
LEAP WIRELESS.....	76
MIDWEST WIRELESS HOLDING L.L.C.....	77
MOTOROLA.....	78
NEXTEL COMMUNICATIONS, INC.....	80
NOKIA.....	82
NORTEL NETWORKS.....	84
PINE BELT CELLULAR, INC.....	91
RURAL CELLULAR CORPORATION.....	93
SIEMENS.....	95
SONY ERICSSON MOBILE COMMUNICATIONS.....	96
SOUTHERN LINC.....	99
SPRINT PCS.....	100
TELECORP PCS.....	102
UNWIRED TELECOM.....	113
VOICESTREAM WIRELESS.....	114



TTY/TDD Forum – 21

March 5, 2002

ATIS Conference Center

1200 G Street, NW, Suite 500

Washington, DC

Agenda

Chaired by Ed Hall, ATIS

1. Call to Order, Introductions and Attendance Roster
2. Call for and Number of Contributions
(All Contributions will be numbered as follows: TTY21/02.03.05.XX)
3. Review & Approve Agenda
4. TTY Forum #20 Summary
5. TTY Correspondence and Liaison Reports: *FCC; CTIA; NAD; TDI; NENA; ATIS*
6. Review TTY Forum #20 Agreements and Action Items
7. Industry Implementation Status Reports
8. Technical Activities
 - a. TTSI Report
 - b. Review and Update Appendix J-Technical Standards Reference
 - c. Other – FCC Ex Parte Meeting
10. Terminal Product Identification Committee Report
 - a. Labeling
 - b. Roll-Out
10. Next Meeting
 - Tuesday, June 4, 2002
11. New Business
12. Adjournment



TTY/TDD Forum – 20
December 11, 2001
ATIS Conference Center
1200 G Street, NW, Suite 500
Washington, DC

Meeting Summary

1. Call to Order, Introductions and Attendance Roster

Ed Hall, TTY Forum Chair, welcomed all participants and called the meeting to order. He noted that the Forum's agenda is very aggressive and that there is a lot to be done during today's meeting. He noted that microphones were necessary for all participants and asked that they introduce themselves. All participants took the opportunity to introduce themselves.

2. Call for and Number of Contributions

(All Contributions will be numbered as follows: TTY21/02.03.05.XX)

Ed Hall introduced all contributions and asked for any additional contributions. All contributions provided to the Secretariat electronically are available for download on the TTY Forum web site at <http://www.atis.org/atis/tty/ttydocs.htm>, or by sending a request to Megan Hayes (mhayes@atis.org). Contributions were submitted and numbered as follows:

Number	Title
TTY21/02.03.05.01	Agenda
TTY21/02.03.05.02	Roster
TTY21/02.03.05.03	TTY 20 Meeting Summary
TTY21/02.03.05.04	TTY20 Agreements and Action Items
TTY21/02.03.05.05	TTSI Report to TTY Forum #21
TTY21/02.03.05.06	Appendix J
TTY21/02.03.05.07	Letter to FCC from TTSI re: PSAPs
TTY21/02.03.05.08	Testing Status Report and Roll-Out Plans from Ericsson
TTY21/02.03.05.09	Sony Ericsson Verbal Presentation
TTY21/02.03.05.10	TPIC Recommendations
TTY21/02.03.05.11	TTY21 Agreements and Action Items
TTY21/02.03.05.12	TTY21 Meeting Summary

3. Review & Approve Agenda

The agenda (TTY21-02-03-05-01) was distributed and Mr. Hall asked if there were any proposed modifications. Mr. Hall added "FCC Ex Parte Meeting" to agenda topic 8c.

4. TTY Forum #20 Summary

Mr. Hall introduced Contribution TTY21-02-03-05-03, the Meeting Summary from the TTY Forum #20 and asked if there were any suggested modifications to it. There were none and the document was accepted as final.

5. TTY Correspondence and Liaison Reports: *FCC; CTIA; NAD; TDI; NENA; ATIS*

- a. **FCC** – Mindy Littel, FCC, introduced all FCC representatives to the Forum. She noted that the Commission is interested in hearing of the progress that has been made since the last Forum meeting. She also noted that the FCC is hopeful that the June 30, 2002 deadline is still feasible despite the problems found during testing and reported to the FCC by the TTY Technical Standards Implementation (TTSI) Incubator. She explained that the Wireless Policy Bureau and the Disability Rights Office would be meeting with ATIS and TTSI next week to discuss Contribution TTY21-02-03-05-07, the letter from TTSI to the FCC regarding the PSAP problem. Mr. Hall asked that all questions regarding this letter be held until Agenda Item 8c.
- b. **CTIA** – No Comments.
- c. **NAD** – No Comments
- d. **TDI** – Jim House noted that TDI has published their 2002 Blue Book and noted that if anyone was interested in obtaining a copy, they should contact him (jimhouse@tdi-online.org).
- e. **NENA** – Toni Dunne, NENA, noted that she has been updating NENA on the progress of TTY testing and that NENA is aware of the problem that was uncovered during testing. She noted that the Public Service Answering Points (PSAPs) have been removed from the loop until TTSI could test with the PSAP manufacturers, but that not all PSAP manufacturers have been participating in TTSI testing. She explained that NENA has been working to notify all manufacturers of the problem and to ask them to work with ATIS to ensure that all manufacturers' equipment is being tested.
- f. **ATIS** – Ed Hall introduced Contribution TTY21-02-03-05-07, a letter from ATIS (on behalf of the TTSI Incubator) to the FCC. The letter was written to notify the FCC of problems discovered while testing with PSAPs. He noted that ATIS would not be contacting the National Association of Regulatory Utility Commissioners (NARUC) as stated in the letter because of advice from NENA. Mr. Hall explained that ATIS and the TTSI would be meeting with the FCC to further discuss this letter on March 12, 2002, and that the Forum would be discussing it during Agenda Topic 8c.

6. Review TTY Forum #20 Agreements and Action Items

Ed Hall reviewed Contribution TTY21-02-03-05-04, the Agreements and Action Items from TTY20. He detailed where these items would be reviewed in the agenda. There were no further comments submitted on these items at this point.

7. Industry Implementation Status Reports

This agenda item was moved to follow the TTSI Technical Report.

Ericsson

Amy Johnson, Ericsson, presented Contribution TTY21-02-03-05-08, Ericsson's network infrastructure status report. She noted that the software for TDMA was initially released on December 5, 2001 and has had several new releases since that time. For GSM, the TTY solution had its FOA in December 2001 and January 2002. Rollouts will begin in March 2002. The CDMA software code development is complete as well as lab and integration testing. The software was available for carrier testing on February 8, 2002.

Sony Ericsson

Matt Kaltenbach presented Contribution TTY21-02-03-05-XX, Sony Ericsson's status report. He noted that development was complete for TDMA. Regression testing of HCO/VCO is scheduled for TTSI test event #4. Final handset user interface testing is also underway.

GSM handsets are in the final stages of development and testing. Carrier test units are available at the Special Needs Center. HCO/VCO regression testing is scheduled for March 2002. Product availability is expected by April 2002.

CDMA handsets have encountered performance issues during testing. Network testing revealed that the TTY standard is susceptible to echo. The phone is expected to be available by April 2002.

Sony Ericsson is undergoing drive testing with good results and they are in the final phases of product release. Mr. Kaltenbach noted that all products are scheduled to be available to customers prior to June 30, 2002.

Cingular

Ken Evans, Cingular, noted that the TTSI work has made implementation into the network much easier. He reported that on TDMA, Ericsson software was generally available on December 1, 2001 and that they are installing patches that they are hopeful will aid in the PSAP issue. He noted that they will probably turn on Ericsson TDMA switches in April.

Mr. Evans reported that GSM interoperability testing in Pleasanton, CA resulted in positive results. He explained that the Nortel switches will not be able to be turned on until May 7, 2002. He is concerned that the lateness of software availability may jeopardize the deadline.

Mr. Evans reported that 60% of the Cingular network is currently operational and that by the end of April, the percentage is expected to be closer to 95%. They are hopeful that with the addition of Nortel switches in May, they will be 100% operational by the end of May.

Cingular has participated in interoperability testing with TTSI for all three of their air interfaces. Mr. Evans reported that mobile-to-mobile and mobile-to-landline testing has shown that they have a viable TTY solution. Once the PSAP issue has been resolved, they expect to be in full compliance. Cingular hopes that if the PSAP issue has not been resolved by the deadline, they will be able to deploy digital technologies to deaf users by the deadline.

Susan Palmer, Cingular, noted that they are working with Gallaudet University for user testing. They want to know what gaps exist in providing customer support and what issues people will run into when the product rolls out. She thanked Gallaudet University for their assistance and thanked their vendors for providing Cingular with products in a timely fashion.

AT&T Wireless (AWS)

Lori Buerger, AWS, introduced Lance Leamer and noted that he was taking the place of Scott Prather for this meeting. She reported that AWS was in a similar situation as Cingular Wireless. AWS has made progress in their CDMA network.

Lance Leamer noted that TTY is enabled in all TDMA markets with Lucent switches. He reported that Nortel deployment should begin shortly. Mr. Leamer explained that Ericsson equipment and software are currently being tested and will start deploying when available. Finally, he noted that the Ericsson GSM First Office Application (FOA) is scheduled for later this month and they expect handsets to be available in June.

Nextel

Bob Montgomery, Nextel, reported that Nextel is currently in deployment stage. He reported that Nextel expects to be ready for full deployment by the June 30th deadline.

Nortel

Charles Spann noted that customers are testing with TDMA and CDMA solutions. He reported that they expect to meet the deadline, depending on the resolution of the PSAP issue.

Sprint PCS

Scott Freiermuth reported that Sprint has 4 network vendors. Sprint has begun testing and is near completion. Mr. Freiermuth explained that the TTY feature is active in several Sprint markets with Lucent equipment and software. He noted that Nortel is active in one market, and Sprint is currently testing their Samsung markets. Finally, he reported that the Motorola FOA is scheduled for mid-March, and there will be a user trial in early April.

Handsets have been tested for 5 vendors, and interoperability testing for infrastructure vendors has been completed in the lab. Mr. Freiermuth explained that problems have been isolated to specific vendors. Sprint has yielded low error rates during all testing, and they also expect to meet the deadline depending upon the resolution of the PSAP issue.

8. Technical Activities

a. TTSI Report

Jim Turner presented Contribution TTY21-02-03-05-05, the TTSI Report to TTY Forum #21. Cary Barbin asked whether a 911 call will go through without a SIM card. A participant noted that without a SIM call you can still call 911, but without a SIM card you can not put the phone in TTY mode. Mr. Hall noted that CDMA and TDMA phones allow for 911 calls without activation.

Ed Hall noted that TTSI has discovered some issues with TIA/EIA-TSB-121, but that the authoring Standards Development Organization (SDO) is aware of these problems and is working to fix them. The issues revolve around the 2.5 mm jack and how it fits into the phone. Mr. Hall emphasized that as issues are being discovered, TTSI is working with the appropriate parties to resolve them.

Judy Harkins, Gallaudet University, asked for an update on the DTMF issue raised at the IVR Forum #3 meeting. Matt Kaltenbach, Ericsson, explained that they did not have an issue in their product with generating DTMF, but that DTMF was interfering with the baudot tones. Mr. Kaltenbach noted, however, that he was unsure whether other manufacturers' equipment would work in the same manner.

b. Review and Update Appendix J-Technical Standards Reference

Megan Hayes introduced Contribution TTY20/01-12-11-05, Appendix J to the TTY Forum Meeting Summary (Technical Standards Reference). She explained that Mr. Hall wanted to be sure that the appendix contained the correct information. The Forum studied the document and suggested updates to it as appropriate. The revised document is numbered TTY21/02-03-05-06.

ACTION ITEM: Megan Hayes will compare the contribution from Gunnar Hellstrom regarding 3GPP standards and compare it to Appendix J. She will also compare the list from Dick Brandt, Gallaudet University. The complete list will be included with the Meeting Summary for TTY Forum #21.

c. Other

Toni Dunne explained that she has been working closely with the TTSI Incubator Group to ensure contacts for and communications with various PSAPs are established to help resolve the TTY/PSAP incompatibility issue. She also mentioned that NENA will join the telecommunications industry for the ex parte scheduled for March 12, 2002.

Jim Turner explained that the TTSI investigated which standards PSAP manufacturers were building to and found PN1663, a NENA project number. He noted that TTSI looked to see if the PSAPs were actually building to this standard and found that they were building to the TIA/EIA 825 and 840 standard for modems. He explained that the PSAP problem is complicated by the sheer number of PSAPs in the country, which use different methods for TTY detection. Mr. Turner explained that this is a very complex problem that includes liability issues for the PSAPs, PSAP manufacturers that are no longer in existence, and problems with the standards. He explained, however, that TTSI has been working with PSAP manufacturers to determine the best resolution for the problems before the June 30, 2002 deadline. He noted that they have been testing with 30 out of the 33 PSAP types identified by TTSI.

A participant asked how the industry is determining what kind of PSAPs exists and where they are installed. Toni Dunne answered that NENA is working to obtain that information and has been successful in providing the information they have accumulated to TTSI.

Ed Hall noted that the TTY Forum has always worked with the three largest consumer-oriented TTY Manufacturers: Krown, Ultratec and Ameriphone, but that TTSI has identified numerous other TTY Manufacturers and is now trying to work with those manufacturers. In addition, TTSI is attempting to determine whether or not the TTYs are compatible with the relevant standards. Mr. Hall explained that the telecommunications industry is facing an embedded base of TTYs, some of which were manufactured by companies that no longer exist. In addition, Mr. Turner noted that when he contacts PSAPs, they often are unsure of what kind of equipment they are using.

A participant asked whether upgrades to the PSAP equipment planned for Phase I and Phase II E-911 could include consideration of TTY equipment. Ms. Dunne noted that the upgrade of the equipment is a process that is different for each PSAP. Mr. Turner noted that the upgrades would not necessarily include new equipment, but might just be accessories to existing equipment.

V.18, many PSAPs are implementing V.18, which is a great way for the deaf community to veer from baudot, but it is creating problems for testing with TTYs. Mr. Turner noted that there are two PSAP vendors that TTSI is aware of that have V.18 implemented in their systems today.

Mr. Hall explained that the message that would be taken to the FCC during the meeting next week would be that the telecommunications industry is ready to launch service to TTY users by the deadline of June 30, 2002, but that some problems occurred when testing with PSAPs. He noted that participants at the meeting would include Ken Evans, Cingular, Al Lucas, Motorola, Scott Freiermuth, Sprint, Andrea Williams, CTIA, John Melcher and Richard Taylor, NENA, Karen Gutlick, AWS, Steve Coston, Ericsson, Judy Harkins, Gallaudet University, as well as Ed Hall and Megan Campbell, ATIS.

Mr. Hall noted that the group would be suggesting that the launch by the June 30, 2002 deadline would allow for conversations with friends and families, but that there be a phase-in of 911 capabilities for TTY compatibility because of the problems with PSAPs. In addition, the TTSI would be asking the FCC who is responsible for the problems with the PSAPs. The telecommunications industry has shown due diligence regarding this issue, and the PSAPs need to come forward and meet the telecommunications industry half way. Furthermore, the group would be explaining that there needs to be some standardization process for testing with TTYs. If there is no way to determine whether TTYs are standards compliant, the wireless industry will continue to encounter testing problems.

Scott Freirmuth asked whether the phase-in method would be practical considering that wireless networks are not designed upon geo-political boundaries. Lori Buerger noted that she had concerns with the phased-in roll out. PSAP by PSAP model has not been a speedy one and it concerns her that the roll out for TTY has been delayed too long.

Cary Barbin asked whether a dual phone which went to an analog system would work with a TTY. Ed Hall noted that TTSI would be testing this.

ACTION ITEM: Ed Hall, ATIS, will inform the TTY Forum of the outcome of the meeting with the FCC and will distribute the power point presentation made at the FCC.

9. Terminal Product Identification Committee (TPIC) Report

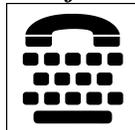
Jim House, Chair of the TPIC, explained that the group recommends that the industry use a consistent symbol to indicate that a handset will work with a TTY. Specifically, they recommend the internationally recognized TTY symbol or some modification of it be used. He explained that there was some concern that there would be confusion if just the symbol was used and that several members of the committee suggested using the symbol with some indication that the TTY machine would need to be connected to the handset.

In addition, the group recommends that the symbol be supported by additional documentation on the web site, in the users manual, in a technical manual and/or in promotional materials. Staff should be sufficiently trained to identify phones that will work with TTYs and to counsel consumers. Mr. House explained that the TPIC decided to suggest that carriers and manufacturers use their discretion in deciding where to place the symbol, but that the consumer made several suggestions for placement. Those suggestions are on the handset, on the screen, on the box, in the user manual, etc.

Finally, the TPIC decided to remain open to continue their work. They decided that it would be a good idea to prepare a resource guide for inclusion in the TTY Forum Meeting Summary as an Appendix. The resource guide will include information such as contact information for consumer groups, information on where to find the TTY symbol, and the recommendations of the group.

There was a discussion of the placement of the TTY symbol. Several manufacturers and carriers felt that the TPIC was recommending a specific placement. Megan Hayes, TTY Forum Secretariat, explained that was not the case. She noted during the TPIC meeting, the consumers strongly suggested several locations, but that the entire group could not come up with an agreement on exactly the best placement for the symbol. Therefore, the group decided to suggest that the placement of the symbol be left up to the discretion of the carriers and manufacturers. A participant expressed her concern that too much emphasis was being put on the location of the symbol, rather than training people to understand what this symbol means. A consumer noted that their primary choice for placement of the symbol is on the handset.

AGREEMENT REACHED: The telecommunications industry should use a consistent symbol to indicate that a handset will work with a TTY. Specifically, the internationally recognized TTY symbol or some modification of it should be used.



10. Next Meeting

- Tuesday, June 4, 2002
- September 17, 2002

11. New Business

12. Adjournment

Megan Hayes adjourned the meeting at 3:45pm.

TTY – 21
Meeting Roster
March 5, 2002
Washington, DC

Name	Company	Telephone	Fax	E-mail
Cary Barbin	Gallaudet	202-651-5613 TTY	202-651-5476	cary.barbin@tap.gallaudet.edu
Dick Brandt	Gallaudet	908-310-7941		dbcon@att.net
Lori Buerger	AT&T Wireless	312-258-2906	312-441-2025	lori.buerger@attws.com
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Ken Evans	Cingular Wireless	404-713-8888		
Patrick Forster	FCC	202-418-7061	202-418-7247	pforster@fcc.gov
Scott Freiermuth	Sprint	913-762-7736	913-762-0922	sfreie02@sprintspectrum.com
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Megan Hayes	ATIS	202-662-8653	202-393-5453	mhayes@atis.org
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Jim House	TDI	301-589-3006 TTY	301-589-3797	jimhouse@tdi-online.com
Amy H. Johnson	Ericsson	972-583-2771		amy.johnson@ericsson.com
Matt Kaltenbach	Sony Ericsson	919-472-1818		matt.kaltenbach@ericsson.com
Lance Leamer	AT&T Wireless	425-580-6220	425-580-6880	scott.prather@attws.com
Peter Lee	Ameriphone	714-897-0808	714-897-4703	peterl@ameriphone.com
Mindy Littell	FCC	202-418-0789	202-418-7247	mlittell@fcc.gov
Al Lucas	Motorola	561-736-2524	561-704-2504	al.lucas@motorola.com
Robert Montgomery	Nextel	703-433-8315	703-433-8355	bob.montgomery@nextel.com
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Sean O'More	FCC	202-418-2453	202-418-1414	scomore@fcc.gov
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Mark Sargent	CTIA	202-736-3896	202-887-1629	msargent@ctia.org
Ron Schultz	Ultratec Inc	608-238-540	608-238-3008	ron.schultz@ultratec.com
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Alfred Sonnenstrahl	CAN	301-770-7555	301-770-7555	sonny@pobox.com
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Jerome Stanshine	FCC	202-418-2417	202-418-3220	jstanshi@fcc.gov
Steve Urbanski	Motorola	847-523-7054	815-884-1395	steve.urbanski@motorola.com
Ilan Vardi	Siemens	858-521-3537	858-521-3108	ilan.vardi@icm.siemens.com

Andrea Williams	CTIA	202-736-3215	202-785-8203	awilliams@ctia.org
Beth Wilson	SHHH			
Watson Zan	Rogers Wireless	416-935-6031	416-935-7502	wzan@rci.rogers.com

The following companies submitted their TTY Implementation Status Reports for the second quarter of 2001 through the TTY Forum, but did not attend TTY Forum #18.

- Alaska Communications Systems Wireless
- Caprock Cellular Limited Partnership
- Carolina West Wireless
- Cellular XL Associates
- Corr Wireless Communications LLC
- Farmers Cellular Telephone Inc.
- Midwest Wireless Holdings
- Leap Wireless
- Nokia
- Pine Belt Cellular
- Rural Cellular Corporation
- Southern LINC
- Telecorp PCS

APPENDIX A

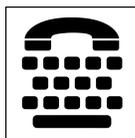
Agreements and Action Items

AGREEMENTS REACHED AND ACTION ITEMS FROM TTY FORUM - 21

21.1 Megan Hayes will compare the contribution from Gunnar Hellstrom regarding 3GPP standards and compare it to Appendix J. She will also compare the list from Dick Brandt, Gallaudet University. The complete list will be included with the Meeting Summary for TTY Forum #21.

21.2 Ed Hall, ATIS, will inform the TTY Forum of the outcome of the meeting with the FCC and will distribute the power point presentation made at the FCC.

21.3 The telecommunications industry should use a consistent symbol to indicate that a handset will work with a TTY. Specifically, the internationally recognized TTY symbol or some modification of it should be used.



AGREEMENTS REACHED AND ACTION ITEMS FROM TTY FORUM - 20

20.1 Line Item #13 in the User Intervention Document regarding the usability of a device in an “eyes-busy” environment will be removed.

20.2 Line Item #7 in the User Intervention Document will be changed to the following wording: “Does the TTY mode setting interfere with the operation of other features of the handset system?” (e.g., does connecting the cable or enabling the TTY mode disable the vibrate feature or the direct dialing capability?)

20.3 SHHH and Gallaudet University will assist the TTSI Incubator in VCO/HCO testing and consumer trials. The TTSI Incubator will determine how to move forward with VCO/HCO testing and consumer testing in the Washington, DC area.

20.4 Verizon Wireless will find the standard that addresses the physical requirements of the 2.5 mm jack and provide the information to the TTY Forum for inclusion in Appendix J. This information will also be provided to TR45.1.

20.5 The Terminal Product Labeling group will be closed.

20.6 The Terminal Product Identification Committee Working Group of the TTY Forum will be formed to work the labeling issue and bring a recommendation back to the TTY Forum Plenary. The group will be Chaired by Jim House, and include as members: Beth Wilson, Susan Palmer, Al Lucas, Matt Kaltenbach, David Nelson, Ron Schultz, Chris Wallace, Peter Lee, Linda Day, Lee Whritenour and Scott Freiermuth.

20.7 TTY Forum – 21 will be held March 5, 2002 at the ATIS Conference Center in Washington, DC.

20.8 TTY Forum – 22 will be held June 4, 2001 at the ATIS Conference Center in Washington, DC.

20.9 The topic of Roll-Out Guidelines and Considerations will be turned over to the TPI Working Group for exploration. The resulting suggestions will be included as an appendix in the next meeting summary.

20.10 Ed Hall will extract information regarding non-initialized phones and 911 calls from previous meeting notes.

20.11 The Manufacturers will provide information to the TTY Forum regarding the behavior of 911 TTY calls in a non-activated SIM terminal.

AGREEMENTS REACHED AND ACTION ITEMS FROM TTY FORUM – 19

19.1 The TTY Forum Chair will communicate to the TTSI Incubator Group that there should be a white paper written identifying the problem with SMS messaging tones with TTY. The white paper should also address any other features that use auditory alerts and may cause higher character error rates.

19.2 The TTSI Incubator Group should plan to include testing during high-traffic hours.

19.3 TTY Forum participants agreed to use Gallaudet University's testing script version 1 (1.1) for all FOA type testing, and to continue to use Lober and Walsh for all lab testing.

19.4 The consumer community will review line item #13 in the TTY User Intervention Document (Appendix E) regarding "Is it usable in an "eyes busy" environment" and re-state it, if needed, to clarify confusion.

19.5 Line Item #7 of the TTY User Intervention Document (Appendix E) will be reviewed and edited off-line by Gallaudet to cover the interference of TTY with other phone features, including dialing.

19.6 The Voice Mail Recommendations will be passed on to the IVR Forum for their review, via a liaison from the TTY Forum.

19.7 The revised Appendix E of the TTY Forum Meeting Summary was approved as revised.

19.8 There will be a TTY Forum Working Group to address drafting guidelines for the industry on labeling equipment to indicate that it is TTY Compatible (members will include: Beth Wilson, Chair, Al Lucas, Matt Kaltenbach, Chris Wallace, Ken Evens, Jim House, David Nelson, Linda Day, Ron Schultz and Al Sonnenstrahl).

AGREEMENTS REACHED AND ACTION ITEMS FROM TTY FORUM – 18

18.1 Contribution TTY18/01.06.12.13, "Testing Against User Requirements" will be added to Appendix D: TTY Test Completion Matrix of the TTY Forum Meeting Summary.

18.2 The Secretariat will add contribution TTY18/01.06.12.13, "Testing Against User Requirements" to Appendix D: TTY Test Completion Matrix of the TTY Forum Meeting Summary.

18.3 Judy Harkins will provide the URL for the web site describing the testing tools technology to the TTY Secretariat to make the information more readily available to TTY Forum participants.

18.4 The list of questions regarding user intervention (Contribution TTY18/01.16.12.15), will be considered for further discussion of user intervention.

18.5 The product labeling issue will be deferred until the next TTY meeting due to time constraints.

18.6 Regarding Features and Functions:
CALL WAITING (CW)

CW interferes with TTY communications.

CW as a feature is disruptive and often not used by TTY users. Disabling CW by default for phones in TTY mode is an acceptable solution to the consumer community.

CW can be disabled in a GSM environment (either permanently or via the handset menu).

CW cannot be disabled via the handset menu in a TDMA environment; it has to be disabled at the switch.

VOICEMAIL/TTY MAIL (VM)

Some systems do not record and play back to TTY machines as well as others.

VM should be placed on the next TTY Forum agenda and referred to the AVSS/IVR Forum.

SHORT MESSAGING SERVICE (SMS)

SMS signals may cause interruption in TTY communications.

SMS is a desired feature for the consumer community.

Queuing of SMS messages during a TTY conversation is not supported in some networks.

18.7 Elizabeth Lyle will submit a written proposal for a consolidated report for submission to the FCC. This report will be posted to the TTY Forum web site.

18.8 The next meeting of the TTY Forum (#19) will be held September 26 at the ATIS Conference Center in Washington, DC.

18.9 TTY Forum #20 will be held December 11 at the ATIS Conference Center in Washington, DC.

AGREEMENTS REACHED AND ACTION ITEMS FROM TTY FORUM - 17

17.1 The TTY Forum recognized ATIS as its Secretariat and official sponsor.

17.2 Ericsson, Lucent, and Nokia will look into the voice quality issue in terms of IS 127-2 CDMA and TDMA and report back to the TTY Forum whether or not there is a problem.

17.3 Consumer groups will review the “user intervention” handset function and report back at the next TTY Forum on whether or not the function is considered a viable option.

17.4 It was agreed to disband the E-Protocol Working Group.

17.5 It was agreed that the TTY Forum would file an ex parte to the FCC to report the solution proposed by the E-Protocol Working Group and the action taken by the TTY Forum.

AGREEMENTS FROM TTY FORUM — 16

16.1 TTY Secretariat, Megan Hayes, will add a non-attending participants list of those who submit implementation status reports to the chair but were unable to attend the TTY Forum

16.2 The industry implementation status reports will be added as an appendix to the meeting summary (Appendix L). All written reports will be sent to the chair within ten working days following the forum. This agreement will be sent out the list serve to ensure that all TTY participants (past and present) are aware of the agreement. The final Meeting Summary will be submitted to the FCC and will become public record.

16.3 TTY Forum industry members find that it is not within the scope and purview to address the e-protocol issue at this time. However, the chair will pass the concept and recommendation to SDO's (e.g. T1P1, TR45)

16.4 A working group will be created to explore the e-protocol issue. There will be an effort to ensure that all industry sectors are represented.

AGREEMENTS FROM TTY FORUM – 15

15.1 Toni Dunne, NENA, will be the principle point of contact for coordinating with PSAPs at a point in carriers, infrastructure, and mobile handset vendors field testing.

15.2 The TTY Forum will hold its next meeting on October 24, 2000 (second choice is October 25, 2000) at Gallaudet University. Meetings thereafter will be held on an “as needed” basis. The summary of the report from the October 2000 meeting will be formally forwarded to the FCC with a cover letter written by the Co-Chairs. Furthermore, on a voluntary effort, carrier will post a status update on their Website and/or the TTY list serve on 3/01, 9/01, and 3/02.

AGREEMENTS FROM TTY FORUM – 14

14.1 Establish Appendix J which will be a “living” document of technical terms and organizations and Appendix J, also a “living” document of technical standards development essential to the TTY Forum’s Scope.

AGREEMENTS FROM TTY FORUM – 13

13.1 Lucent announced they will distribute the TTY vocoder solution, royalty-free, to mftrs implementing the solution. Lucent noted that it is not relinquishing the patent rights, just making the solution available royalty-free.

AGREEMENTS FROM TTY FORUM – 9

9.1 The TTY Forum agrees to submit User Requirements to TR45 in December, 1998.

9.2 Appendix G will be created as a living document to identify membership of the TTY Forum Test Procedure Study Group that will meet to track test plan modifications, facilities, and dates, user expert, point of contact.

9.3 Appendix H will be created to identify the operational characteristics of TTY devices.

9.4 The TTY Forum will develop a list of TTYs that fall within the domain of reasonable operational characteristics to provide an informational guide for carriers. The list will be available to the public via web sites and mailings.

9.5 The TTY Forum agrees that IWF is broadly defined as a translation method to complete a call that is transparent to the user. The IWF is not limited to either voice or data. An IWF may not be confined to a single network but may be shared across multiple networks.

9.6 The TTY Forum agrees to submit the SRD for the 2.5 mm Jack to TR45 in December, 1998.

9.7 The TTY Forum agrees to submit the SRD for Circuit Switched Data to TR45 in December, 1998

AGREEMENTS FROM TTY FORUM – 8

8.1 The TTY Forum agrees that all testing will be done in test labs simulating field conditions.

8.2 The TTY Forum agrees that the short-term solution will now be referred to as voice-based solutions. The long-term solution is now referred to as data based solutions.

8.3 An experienced TTY user will be available at the beginning of lab testing to provide counsel or training, if necessary.

AGREEMENTS FROM TTY FORUM – 7

7.1 The TTY Forum should remain operational until solutions are provided and implemented for all digital technologies, to the satisfaction of the TTY Forum.

7.2 The baseline for the digital solution is wireless analog performance.

7.3 Accept Contribution #12 as a working document to represent the basis of the test plan. Test Plan as modified by the technology groups (CDG,UWCC,GSMNA) will be sent to all phone manufacturers. Test plan will measure the performance of various digital air interface technologies.

7.4 Where possible, VCO/HCO should be included in the testing, design, and availability of TTYs, cellular phones, and air interface technologies.

7.5 The TTY Forum will submit a request for a three month extension to the FCC.

AGREEMENTS REACHED AT TTY FORUM - 6

6.1 Any carrier not in compliance with the Consumer Notification Process established at TTY Forum should be brought to the attention of the TTY Forum for resolution.

6.2 Working Group #1 is officially dissolved having completed its initial charter. Any further testing results would be forwarded directly to the TTY Forum.

6.3 A lack of TTY technical standard has resulted in a variance of TTY performance levels manifested when used on digital networks. As such, in developing the “short-term” digital solution, certain least used models of TTY may not be supportable on all digital air interfaces.

AGREEMENTS REACHED AT TTY FORUM - 5

5.1 As an initial step, carriers who can offer TTY users at least one digital phone model for each digital technology that a carrier offers at a reasonable price by October 1, 1998 would be considered in compliance of the E9-1-1/TTY compatibility requirements.

5.2 The FCC can use the information contained in the notification letter in any way they feel would expedite getting the information to the consumer.

5.3 All test results submitted will be included in the next Quarterly Status Report.

AGREEMENTS REACHED AT TTY FORUM - 4

4.1 Objective test (Throughput Test) approved and to be sent to manufacturers and carriers with a matrix to record testing completion dates and documentation.

4.2 TTY Forum Test Completion Matrix approved.

4.3 Consensus reached that Testing Matrix should go to every manufacturer listed at CTIA as well as Wireless and Wireline Carriers. CTIA/PCIA will escalate/elevate TTY Forum efforts to reach wireless equipment manufacturers and inform of urgency and criticality of rapid response to the Testing Matrix via a letter from the TTY Forum and CTIA/PCIA. The group recognizes that participation is voluntary. Copies of letter and matrix responses will be sent to the FCC.

4.4 RFI will be put on issues list to explore possibility of interference between phone and TTY device.

4.5 Consensus to put TTY Forum’s current research opinion on output voltages (coupling information) into a formal document and present to manufacturers for feedback. Give 30 days for feedback.

4.6 Subjective test (End User Test) to be finalized by committee. Testing will be handled through Gallaudet with assistance from Wireless

manufacturers and TTY manufacturers. Will replicate authentic 9-1-1 calls with a deaf/hearing impaired caller and a trained calltaker.

4.7 CTIA will produce a list of Analog Phones that are compatible with TTY devices to be included in notification efforts and on web sites due as a Contribution at the next TTY Forum.

4.8 Gallaudet University and Consumer groups will draft a Consumer Requirements Document due as a Contribution at the next TTY Forum.

4.9 CTIA/PCIA will send letter to wireless equipment manufacturers requesting that they support Gallaudet University in their testing efforts by sending equipment.

4.10 Standards Requirements Documents (SRD) due for V.18 and the 2.5 mm jack as Contributions at next TTY Forum.

AGREEMENTS REACHED AT TTY FORUM - 3

3.1 6 sponsored spots for identified consumer groups, relinquished if member misses 2 consecutive meetings.

3.2 Accept modified “readability test” to be used by phone manufacturers to benchmark TTY over digital capabilities, to determine success rate for transport. (See Contribution TTY/98.02.11.06) Two tests: Manufacturers Readability Test, End User Test

3.3 Error rate is defined as “character” not “bit” for the purpose of this forum. (Shift error rate of ratio 1/8 (i.e. 1 shift error causes up to eight text errors and will be counted as such) to be determined)

3.4 Develop User Requirements Document. The outcome of Working Group #2. Represents the effort to provide for future advancements in technology by looking at solutions beyond 45.45 baud, Baudot.

3.5 Define process to update Notification Document: refer updated information to CTIA to be distributed to T-CAT.

AGREEMENTS REACHED AT TTY FORUM - 2

2.1 Combine Working Group #1 and Working Group #3. Develop new set of deliverables based on the October 1, 1998 deadline.

Short term solution: solve for backward compatibility.

Develop Standard Test to measure error rate of TTY over digital.

AGREEMENTS REACHED AT TTY FORUM - 1

1.1 “Solve for 45.45 Baudot, not to preclude looking for other solutions.”

Look for long term and near term solutions.

Near term - send through vocoder

Long term - circumvent vocoder, enhance quality and connectivity

Provide for the analog function of wireless phones.

The only body that can change the agreements reached is this body. All agreements remain intact until/unless action is taken in this forum.

APPENDIX B

Recommended Text Consumer Notification

ATTENTION TTY USERS

Background

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

911 and TTY Access Through Wireless Services

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

Analog – It is possible today to use some analog wireless phones reliably to call 911 with a TTY.

Digital – It is not possible today to use a digital wireless phone reliably to call 911 with a TTY.

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

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

DATE OF PUBLICATION:

APPENDIX C

TTY Forum Issue Statements

- 6.1 The TTY Forum doesn't support one solution over the other but it seems that the 2.5 mm jack is preferred
- 6.2 It is acceptable in concept to retrofit the TTY at no cost to the user. Concern was expressed regarding warranty work, and who would perform work on equipment. The retrofit should not eliminate or impact any functionality previously available to the user. Time to retrofit should be reasonable. A liaison should be established between manufacturers and user groups to ensure "certain conditions" are met.
- 6.3 The issue of the false propagation of errors, created by the incorrect receipt of a shift character should be addressed through use of an appropriate test script. The script should contain multiple shifts space apart so that a realistic distribution of character errors would result, based on frequent (although not universal) practice of correcting shift errors by user action. A normal distribution between 1 and ? with a median of about 8 would be appropriate.
- 9.1 The issue of whether less than full rate transmission is an acceptable solution, if it can be shown to provide improved CER performance.
- 9.2 The User Requirements Document will be modified by the consumers before the December TR45 meeting.

APPENDIX D

TTY FORUM MANUFACTURER TESTING COMPLETION MATRIX

Manufacturer	Technology	Through Put Test (Contribution)	Type of Test (Field, Lab)	Contact Name & Number
Philips	Analog	98.07.21.07		Ken Wells
Motorola	Analog	98.05.20.20	Lab	Paul Mollar
Sendele	Analog	98.07.21.05	Lab	Steve Sendele
Motorola	CDMA	98.05.20.20	Lab	Paul Mollar
Lucent	CDMA	98.05.20.10	Lab	Ahmed Tauf
Lucent	CDMA	No Gain Solution 99.01.26.09	Lab	Dr. Steven Benno
Lucent	CDMA	99.09..09.16	Fixed Point Proof / Concept	Dr. Steven Benno
Nokia	CDMA	98.05.20.17	Lab	Mohamed El-Rayes
Qualcomm	CDMA	98.05.20.12	Lab	Nikolai Leung
Motorola	CDMA	99.05.18.15	Lab	
Ericsson	GSM	98.02.11.07	Lab	Christopher Kingdon
Nokia	GSM	98.05.20.17	Lab	Mohamed El-Rayes
Motorola	GSM	98.05.20.20	Static	Paul Mollar
Ericsson	GSM	98.11.04.14	Static	Steve Coston
Ericsson	All Digial	99.09.09.12 / .13	Static	Steve Coston
Nokia	GSM/TDM A	99.09.09.15	Theory	Doug Neily
Ericsson	TDMA	98.02.11.05	Lab	Christopher Kingdom
Ericsson	TDMA	99.01.26.10	Field	Steve Coston
Motorola	TDMA	98.05.20.20	Field	Paul Mollar
Nokia	TDMA	98.05.20.17	Lab	Mohammed El-Rayes
Philips/CPT	TDMA	98.07.21.07	Field	Jim De Loach 510-445-5510
Lober & Walsh	TDMA	98.09.08.10	Lab	Josh Lober
CPT	TDMA	98.07.21.08	Lab	Josh Lober
Ericsson	TDMA	98.11.04.14	Static	Steve Coston
AWS	TDMA	99.05.18.11	Static	Adrian Smith
NOKIA	TDMA	99.05.18.14	Lab	Massoud Fatini

Lucent	TDMA/CD MA	99.05.18.13	Lab	Steve Benno
Ameriphone	TDMA/CD MA	99.05.18.12	Static	Peter Lee
Lober & Walsh	IDEN	98.09.08.11	Lab	Josh Lober

APPENDIX E

TTY USER REQUIREMENTS

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 signaling 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. 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.

September 14, 1999

To: TIA TR-45.3

Fr: Consumer Representatives, Wireless TTY Forum
Authors: Judy Harkins, Gallaudet University and Dick Brandt, dB Consulting as consultant to Gallaudet
David Baquis, Self Help for Hard of Hearing People, Inc.
Alfred Sonnenstrahl, Consumer Action Network
Claude Stout, Telecommunications for the Deaf, Inc.
Karen Peltz Strauss, National Association of the Deaf
Norman Williams, Gallaudet University

Re: Guidance to TR-45 on Proposals for Solutions to TTY over TDMA

Presentations on three of the proposals being considered by TR-45 for the TDMA TTY solution were made at the September 9, 1999 meeting of the Wireless TTY Forum. Given the timeframe TR-45 is operating under, and given that the FCC has directed industry to consider consumer issues in determining solutions, we offer this document as guidance to TR-45 as it considers the alternatives.

The information presented at the September 9 meeting was, in some cases, sufficiently sketchy that consumers were unable to ascertain the functional implications of the proposals. Some presentations were also done very late in the process, so there is not sufficient time for analysis.

We do not state a preference for any proposal but hope the following discussion will be helpful.

General Questions and Issues:

1. There is a concern among consumers about the implications of roaming among digital technologies in the future, if a variety of approaches for TTY access are used. Thus we believe consistency in approach across technologies is needed. One of the carriers also strongly expressed this view. This problem needs to be solved for the long term, not just for the current situation where roaming tends to go to the more-accessible analog network. Once these solutions are implemented, if problems arise, consumers will have great difficulty having them addressed because the solutions are within the network and customer service personnel will not be equipped to deal with them.
2. Has there been any analysis indicating that approaches which propose network changes in switches versus changes in base stations, would lead to earlier availability as claimed? Consumers are interested in seeing solid, lasting and effective solutions, and the speed of implementation, while important, should not override usability considerations.
3. All test results presented to date have been obtained using blocks of data sent out from a file stored either in a TTY or in a computer and sent via a TTY modem. It has been noted in tests

run by Gallaudet that results obtained in an interactive mode (two people typing to each other) yielded poorer accuracy. Thus proposals that show errors in transmission should be scrutinized carefully. A full range of system impairments has either not been used in simulation testing or not reported on all of the solutions.

4. Non-activated phone support for 9-1-1 calls is required by the FCC. Has this been considered in the proposals? (See class mark discussion below.)

Appraisal of Specific Solutions:

Vocoder solution. From a consumer perspective, the Lucent “no gain” solution has been most thoroughly presented and appears to have the most transparent accessibility and the most support for consumer needs and requirements. The inclusion of error correction is a major benefit, given that the air interface presents new challenges to TTY transmission. Other, comparable proposals may also have merit (e.g., Nokia), but they have not been thoroughly explained so that consumers can compare them.

Code conversion. The Ericsson (and Nokia?) Code conversion (“tone”) proposals appear to offer the possibility of earlier implementation (see 2 above) and the ability to use many existing handsets, but have the potential of putting the retrofit burden on the consumer. They raise the following concerns:

1. Smart Cable: Consumers are not opposed to the idea of including intelligence in the cable per se, however the following concerns exist:
 - 1.1. How would this intelligence be powered? (This question could not be answered at the Sept. 9 meeting.) There is opposition to the requirement for an additional battery for reasons of cost, bulk, and reliability.
 - 1.2. Who would make and provide the cable?
 - 1.3. Would this intelligence be built into the regular cable product line or would this be a primarily or exclusively “deaf” product? If the latter, experience shows that provisioning and cost may be serious problems. Customers often have to wait many weeks for “special” accessories. We realize standards bodies do not ordinarily address cost issues, but please consider the additional cost of a phone that vibrates (over a low-end phone), the cost of the TTY, and now the potentially high cost of a special-purpose cable with a small market.
 - 1.4. Would one cable fit all (thereby lowering the price and expanding the availability)?
2. Class Mark: Any system that relies on the phone having a class mark denoting that the user uses a TTY is not likely to be successful, because many deaf and hard of hearing people consider self-identification as a possible threat to their security. 9-1-1 operators have never been successful in having deaf and hard of hearing subscribers “sign up” as a TTY telephone number. The procedure is fraught with potential problems and snafus. When someone roamed into a carrier using this solution (not marked), what would happen? Hearing people who use TTYs may not realize they need to enroll their phones. People who have a phone and acquire a TTY later (e.g., after onset of hearing loss) would find the TTY does not work. TTY users could not use someone else’s cell phone. One solution to this problem suggested

at the forum was to mark all phones as TTY. Would carriers agree to this? In short, a system that provides automatic detection of the TTY signal is preferable.

IWF. Although we recognize that IWF proposals are not a part of the present TR-45 TDMA TTY discussions we would also like to provide the following for your information, as they should be considered in development of proposals:

1. There is a strong desire for VCO/HCO capability, which appears to be difficult to implement in IWF solutions at the present time.
2. There is also a strong desire for provision of the line signal power indicator (flickering light) used to interpret call status.
3. Consumers are opposed to (and the DOJ has mandated against) requiring any form of special dialing (e.g., two-stage) or conditioning sequences (e.g., #NN) to reach 9-1-1.
4. It will be important that the delay between powering on a data device and dialing out not exceed the delay experienced with a voice call.

Appendix: Consumer requirements with comments regarding proposed solutions:

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.

Comment: All proposals presented to date appear to meet this criterion. Consumers are concerned that there be sufficient testing to validate this in the field.

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.

Comment: All proposals claim to meet this criterion and we have no concerns. (IWF solutions may, however, not be able to meet this one.)

3. There must be a visual indication when the call has been disconnected.

Comment: This specific issue has not been addressed in presentations but is covered by most if not all systems by a message on the display of the phone.

4. A volume control should be provided.

Comment: This item is intended to allow the TTY user to adjust volume for better reception of TTY tones as necessary. Most if not all handsets include this feature anyway. It has not therefore been addressed in presentations on solutions.

5. The TTY user must have a means of tactile (vibrating) ring signal indication.

Comment: Again, this is an issue of general provisioning and not related to voice-channel solutions. (However, this will be an issue in IWF solutions.)

6. The caller must be able to transmit TTY tones independent of the condition of the receiving modem. (This is to permit Baudot signaling by pressing a key, to let a hearing person know that the incoming call is from a TTY.)

Comment: All voice-channel solutions to date appear to support this.

7. The *landline* party's TTY must not require retrofitting in order to achieve the desired error rate.

Comment: All solutions to date appear not to require retrofitting of the landline TTY.

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.

Comment: Solutions that do not require retrofitting or special treatment are preferred by consumer representatives.

9. VCO and HCO should be supported where possible.

Comment: Voice-channel solutions presented to date appear to support this requirement. (IWF solutions may not, however.)

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.

Comment: No solution presented to date reduces throughput, as nearly as we can tell. This should be verified with the companies proposing solutions.

11. Call information such as ANI and ALI, where provided in wireless voice, should also be provided for TTY calls.

Comment: Voice channel solutions should not cause a problem with this.

12. On the landline side, 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).

Comment: This is of concern because of limited testing of solutions to date.

13. Drive conditions must be supported, again using AMPS as a benchmark.

Comment: This requirement has not been adequately addressed by testing.



Appendix E TTY/TDD Forum – 18

June 12, 2001

ATIS Conference Center
1200 G Street, NW, Suite 500
Washington, DC

TTY User Intervention (*i.e.*, mode switch)

Questions:

1. How often does this have to be done?
2. How many steps are there?
3. How complicated are the steps?
4. Is it easily discovered without using the user's manual?
5. Is it clearly documented?
6. Is there a visual status indication?
 - During set-up?
 - Ongoing?
7. Does the TTY mode setting interfere with the operation of other features of the handset or system? (e.g., does connecting the cable or enabling the TTY mode disable the vibrate feature or the direct dialing capability?)
8. Will it be possible to make a voice call while in TTY mode?
9. Will VCO be a choice or will it be supported as a TTY mode? (Will VCO be incorporated into this mode or is there a series of choices in TTY mode?)
10. How long does it take? How fast can you set it up?
11. Is it possible to change modes during a call?
12. Is it standardized across handsets?
13. Is the process of hooking up the equipment and putting it into TTY mode too long or arduous to be able to answer a call in time?¹
14. When receiving an incoming call, does the phone vibrate? Does the vibrator continue to work when an audio cable is inserted into the jack?

¹ Can a user set up the equipment and get into TTY mode before the call is disconnected or goes to voicemail? Can the phone be answered prior to being connected to equipment?

Notes on Evaluating Solutions against the User Requirements List

Judy Harkins and Norman Williams, Gallaudet University, May, 2001

Some of the carriers have indicated a need to include in their tests and evaluations all of the user requirements generated in 1998 in the TTY Forum. This document annotates the requirements with notes about evaluation issues and field test procedures from a user perspective. This is obviously not a test plan but is sent out primarily for generating discussion and giving general guidance from the user viewpoint.

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.

See appendix.

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.

Suggestion: Generate all audio call progress signals (ringing, busy, fast busy, voice answer) and determine if there is an understandable visual indication for each. The line status light on the TTY will probably function appropriately in voice channel solutions, but this should be verified. Check that the visual indication is synchronized in time with the audio indication.

Comment: A particular issue in wireless telecommunications is that call to mobile phones often do not ring at all if the party is unavailable; a voice message is provided instead. There may not be a visual indication of the call status on the telephone. Another issue is that many phones revert to voice mail. In these situations, the TTY caller will not be able to monitor all aspects of call progress provided to voice users.

3. There must be a visual indication when the call has been disconnected.

Suggestion: Place call and have other side hang up. What visual indication is given? If the user can tell, by looking at the handset for example, that the call is terminated, then this criterion is met.

Comment: It would help all users to have an explicit message, but if this is not provided, the user should know what the screen will look like upon call termination.

4. A volume control should be provided.

Comment: Determine and document the optimum volume control setting for the TTY being tested. (If performance is affected by volume control, users will need to be informed of this, and how to use the volume control to obtain a low error rate.)

5. The TTY user must have a means of tactile (vibrating) ring signal indication.

Suggestion: Verify that the handset or accessory vibrates on receipt of calls (and preferably not at other times!). Can the tester receive calls in a timely fashion with the ringer turned off? (Test throughout the call; some external vibrators continue to vibrate throughout a call, which can be confusing.)

6. The caller must be able to transmit TTY tones independent of the condition of the receiving modem. (This is to permit Baudot signaling by pressing a key, to let a hearing person know that the incoming call is from a TTY.)

Suggestion: On outgoing call, press keys on the TTY during ring signals and immediately after answer. Baudot tones should be clearly audible by the answering party. (This should not be a problem for voice channel solutions, but is worth some quick tests in the field.)

7. The *landline* party's TTY must not require retrofitting in order to achieve the desired error rate.

Comment: This issue appears to be moot and does not need to be tested.

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.

Comment: This is not an issue for testing. However, if an accommodation is required, such as retrofitting, a special model, or a cable, this should be well documented so that consumers know what types of equipment they will need. If PDAs or paging devices are used in place of a handset and TTY combination, attention will need to be paid to the rate of input that can be achieved through the keyboard or virtual keyboard.

9. VCO and HCO should be supported.

Suggestion: Evaluating the efficacy of VCO and HCO:

- VCO and HCO should be tested as they will be implemented. For example, if a custom cable is needed, tests should be run with that cable as part of the set-up. If the user needs to take action between turns (e.g., pushing a button), it should be tested with consumers to check usability.
- Does the system deliver acceptable error rates with devices on the market that are designed to work in VCO and in a mobile environment? (Ameriphone Q90, Krown Pocket VCO, and the Ericsson handset adapter are the three known examples.)
- Is the quality of voice on VCO calls the same as on non-TTY calls? This can presumably be tested using standard industry methods for voice quality.

- Is there any delay or cut-off of characters or words when switching between voice and TTY?
- Is there greater chance of disconnect when switching between voice and TTY? Other problems?

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.

This issue is now moot, and no tests are needed.

11. Call information such as ANI and ALI, where provided in wireless voice, should also be provided for TTY calls.

This would not appear to be a problem on voice channel solutions. On data channel solutions, the call would need to carry the same identifying information as would be carried were it in the voice channel.

12. On the landline side, 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).

A variety of TTY models should be tested, but the amount of testing on each model will necessarily vary. The difficulty in testing with a large number of models is acknowledged, given the limitations in data capture possibilities with TTYs and some 911 TTY systems on the market. This may have to be handled by short tests – calling to direct-connect landline TTYs set to auto answer, where the tester can call send a string of identifying information about the call, which can then be sent back to the tester for scoring. This might be able to be arranged at Gallaudet if there is interest; more discussion is welcome. (Note that Gallaudet has produced some software tools and documentation for partially automated two-way TTY testing:
www.tap.gallaudet.edu/ttytools

13. Drive conditions must be supported, again using AMPS as a benchmark.

Tests for drive conditions should be run using carriers' individual methodologies and facilities. The consumer's goal is to be able to use the TTY and telephone while a passenger in a car, while on a train, etc.

Appendix User Requirement 1: Error rate of TTY over Wireless telephones

- Interoperability among handsets and infrastructure vendors should be tested using industry's usual tests.
- Varying signal conditions need to be tested.
- Varying network conditions need to be tested.
- Data should be collected and scored on both sides (directions) of the call wherever possible.
- See Requirement 12 on accommodating a range of TTY models. Compatibility testing with 9-1-1 TTY equipment should be coordinated via Toni Dunne.
- See Requirement 13 on drive tests.
- Calls through relay should be placed. A hearing person on the landline side should read one side of the script. (This is an example of where random characters will not be helpful). Relay operators cannot retain conversations; unless special arrangements can be made with TRS providers for test calls, the only way to ascertain is to ask the relay operator if the incoming text was garbled.
- We tentatively recommend that Lober and Walsh's SCORE program be used as this was developed through the TTY Forum. There is some indication based on limited tests that the Ericsson program results in a higher error rate.
- Scripts: A few comments -- Consumers have had the concern that the error rates generated by the TTY Forum's random character set may be inflated due to the excessive number of register shifts (sending a shift character between each figure/letter transition) in this script. It is not possible to eyeball the results in the field because of the random characters. The random character file also transmits only at full rate – there are no pauses.

Matt Kaltenbach of Ericsson has suggested that it would be helpful to base at least one script on the bit structure of Baudot or some other mathematical basis that would allow for diagnosis of problems in the field.

Gallaudet has produced a series of scripts that use conversational language and natural shifts between letters and figures, pauses in typing and simulation of two typing speeds. These are available at <http://tap.gallaudet.edu/ttytools>

Comment on the 1% benchmark: It was our intention, when we wrote this requirement, that 1% would apply to reasonable signal conditions and network conditions, and *not* that a maximum of 1% error rate must be met on every single call in the presence of severe (and rarely occurring) impairments.

APPENDIX F

WORK PLAN

Published as a separate TTY Form Document

APPENDIX G

Typical Operating Characteristics for Wire-Line Based TTYs

The following is a technical description of the typical operating characteristics for existing wire-line based Text-Telephones for the Deaf (TTYs). This document is not intended to be a performance description of any one product, but to give a representation of performance of the majority of the product supplied to wire-line TTY customers in the last five years. TTY manufacturing representatives has reviewed this information and agrees that it represents an accurate account of the performance characteristics of existing wire-line products.

It should be noted that it is not possible to precisely define performance for all products, in all situations, in the field. Variation beyond this technical representation does exist for older product, products that are no longer supported by a manufacturer, individual products that are not operating correctly and improper use of product. It is not possible to report this additional range of variation, only to say that these products performance would suffer on either a connection to wire-line or wire-less TTY.

TECHNICAL BACKGROUND

For Frequency Shift Keying (FSK) two signal frequencies are required to modulate the asynchronous serial data to be sent over the conventional voice grade telephone lines of the switched telephone network. For Baudot communications to be useful on the Public Switch Telephone Network (PSTN) these frequencies fall within the central portion of the telephone line pass-band (300 – 3300 Hz).

The two frequencies of the transmitted signal must be sent in accordance with FCC requirements defined in dBm (decibels with reference to a power of one milliwatt for metallic connections, where 0 dBm = 1 milliwatt). The acoustic measurements are in dBSPL for acoustic configurations. This signal is measured at the TTY interface, either at the metallic connections or where it is acoustically coupled to the telephone network.

The receive level, commonly referred to as sensitivity, is also given for each pair of frequencies. This signal, also measured in dBm for direct connections and dBSPL for acoustic configurations, is the typical signal measured at the connection that will result in error-free reception of a test message.

BAUDOT CODE OPERATION

All TTYs provide Baudot code operation employing half-duplex, simplex, asynchronous, FSK transmission.

Frequencies

Baudot code operation used the following frequencies:

Signal	Frequency	Tolerance	
		Transmit	Receive
Mark	1400 Hz	±1%	±4%
Space	1800 Hz	±1%	±4%

Bit Duration

The bit duration is 22.00 milliseconds (ms) ±0.40ms to provide a nominal baud rate of 45.45 bits per second.

CHARACTER FORMAT

Transmit

The Baudot code for each character is transmitted with the following format, the data bits assigned are in accordance with Table 1.2 with a “1” in the binary representation transmitted as a mark and a “0” as a space.

Bit	Start	Data	Data	Data	Data	Data	Stop
Signal	Space	LSB	Bit 2	Bit 3	Bit 4	MSB	Mark
Number of Bits	1	1	1	1	1	1	1.5-2.0 2.0 Typ.

Table 1.1

Where the LSB is the Least Significant Bit and the MSB is the Most Significant Bit. The bits shall be transmitted from left to right.

Receive

The TTY is capable of receiving characters with the format of Table 1.1 with a stop bit of at least 1.0 bit length or longer. The receiver is capable of receiving characters either with the space tone of the start bit as the first tone received or with a mark tone preceding the start bit.

Mark Hold Time

The mark hold time defines an additional period of time during which the TTY transmits a mark hold tone (1400 Hz) following the last character transmitted. Mark hold tone is not transmitted between each character if the character is followed immediately by another character. The mark hold tone is transmitted for a period between 150ms to 300 ms after the end of the stop bit(s).

Transmit Levels		
Coupling Method	Level	Range
Acoustic Direct Connect	108 dBSPL -10 dBm	± 6 dB * - 3 ,+1 dB

Sensitivity Levels		
Coupling Method	Level	Range
Acoustic Direct Connect	72 dBSPL -40 dBm	± 6 dB * ± 5 dB

Most receivers are capable of receiving signal up to at least -5 dBm.

* NOTE: Acoustic performance variations greater than listed may be encountered and are a result of many variables including the type of telephone handset used and how well the acoustic coupling is made by the user. It is not possible to report this additional range of variation, only to say that these products performance would suffer on either a connection to wire-line or wire-less TTY.

TABLE 1.2

Set of Baudot Codes for TTYs

	DEC	HEX	BINARY	LETTER	FIGURE
0	00	00000	BackSpace	BackSpace	
1	01	00001	E	3	
2	02	00010	LF	LF	
3	03	00011	A	-	
4	04	00100	Space	Space	
5	05	00101	S		
6	06	00110	I	8	
7	07	00111	U	7	
8	08	01000	CR	CR	
9	09	01001	D	\$	
10	0A	01010	R	4	
11	0B	01011	J	'	
12	0C	01100	N	,	
13	0D	01101	F	!	
14	0E	01110	C	:	
15	0F	01111	K	(
16	10	10000	T	5	
17	11	10001	Z	"	
18	12	10010	L)	
19	13	10011	W	2	
20	14	10100	H	=	
21	15	10101	Y	6	
22	16	10110	P	0	
23	17	10111	Q	1	
24	18	11000	O	9	
25	19	11001	B	?	
26	1A	11010	G	+	
27	1B	11011	FIGS	FIGS	
28	1C	11100	M	.	
29	1D	11101	X	/	
30	1E	11110	V	;	
31	1F	11111	LTRS	LTRS	

Note: CR and LF may be manually or automatically generated by the TTY. If automatic generated, the sequence may contain an extra (non-printable) character to provide adequate time for older electromechanical TTYs to respond. CR & LF are inserted into the transmitted characters after a maximum of 72 characters to allow for the carriage return of older electromechanical TTYs.

APPENDIX H

Modem / IWF Manufacturer Contact List

List of Names and Addresses to Receive IWF Letter

FirstName	LastName	Company	Address	Address2	City	State	Zip
Veda	Krishnan	Cirrus Logic	110 Horizon Dr	#300	Raleigh	NC	27615
Zarko	Draganic	Alto Com Inc.	257 Castro St	Suite 233	Mountain View	CA	94041
Edward	Campbell	3Com					
Raouf	Halim	Rockwell	4311 Jamboree Rd		Newport Beach	CA	92660
Aaron	Fisher	Lucent	Room 55F-311	1247 S. Cedar Crest Blvd.	Allentown	PA	18105
Judy	Sheff	Lucent	Room 5SF18	2 Oak Way	Berkeley Heights	NJ	07922
Greg	Garen	Lucent Technologies - Microelectronics Group	Room 22W-219(Mail Stop EQ)	555 Union Blvd.	Allentown	PA	18103
Warren	Henderson	Henderson Laboratories					
Moiz	Beguwala	Rockwell	4311 Jamboree Rd		Newport Beach	CA	92660

CC: National Association of State Relay Administration (NASRA)
Merilyn Crain, Chair
315 So. College Rd. Suite 208
Lafayette, LA 70503

APPENDIX I

TTY Forum Chair's Update Memorandums

IWF letter dated November 16, 1998

Sent to:

3Com

Mr. Zarko Draganic, CEO, Alto Com Inc.

Ms. Veda Krishnan, (to be supplied) Cirrus Logic

Mr. Aaron Fisher, Vice President, Wireless Products, Lucent Technologies

Ms. Judy Sheff, VP Intellectual Property, Lucent Technologies

Mr. Greg Garen, General Manager Modem and Multimedia Products Lucent Technologies -
Microelectronics Group

(To be supplied), Motorola

Mr. Raouf Halim VP and General Manager, Network Access Division, Rockwell Semiconductor
Systems

Mr. Moiz Beguwala, VP and General Manager, Personal Computing Division, Rockwell
Semiconductor Systems

Dear Sir/Madam

In response to a FCC inquiry, the Cellular Telecommunications Industry Association (CTIA) and the Personal Communications Industry Association (PCIA) have established a technical forum to address the issue of providing reliable communications for deaf and hard of hearing people over digital wireless systems. Specifically this forum is addressing the issue of deaf and hard of hearing people using digital wireless connections to access 9-1-1 centers.

A solution that appears to offer promise for the longer term, involves the use of new (or modified) communications terminals, used by deaf and hard of hearing people, (TTYs) connected through a serial interface to the digital cell phone. The data channel, provided by the air interface, would then be used to effectively extend this interface to the network. This of course, would require the use of an Interworking Function (IWF)*² in the network that would be capable of supporting TTY communications. We are aware that some of the IWFs being developed will support 45.45 Baudot TTY transmission (the transmission mode most commonly used by deaf and hard of hearing people in the United States). While this caters well to the present need, it has the drawback that it locks deaf and hard of hearing people into this older technology.

A more desirable solution would be one which would involve the use of ITU-T Recommendation, V.18, that specifies a protocol, which provides for higher speed ASCII based communications while at the same time maintaining compatibility with today's Baudot TTY devices. The problem with this solution is that V.18 has yet to be implemented by any major modem manufacturer. We have, however, been given a presentation by a UK based company that has developed a prototype "stand alone" V.18 product which it plans to introduce commercially early next year. In addition to this, we have been given a demonstration of an in-service Swedish IWF, which incorporates V.18 functionality. It might also be of interest to note

² The term IWF is used in its broadest sense in this letter. (See the definition in TIA TSB-100)

that the service provider sees text telephony as a generic service (e.g. not just for deaf or hard of hearing). These two events may be moving V.18 into the readily achievable category.

It seems likely that if the IWF function and the modems installed at the 9-1-1 centers were to incorporate V.18 capability, connections could be made at the higher V.18 rates. Likewise it would appear that the connect time could be shortened as V.18 incorporates a calling tone, which could be instantly recognized by equipment at the 9-1-1 centers, thereby eliminating the loss of precious time, which is normally incurred while attempting to determine the source of a "silent" call.

Assuming that you agree that the timely provision of this functionality is important, we are hoping that you can provide us with an indication of when we might expect to see products (e.g. consumer modems, IWFs) from your company that implement V.18. Any information you could provide to us, by 4th Quarter 1998, would greatly help us in developing our response to the FCC.

Date: March 22, 1999

FM: TTY Forum Co-Chairs; Ed Hall, CTIA and Todd Lantor, PCIA
TO: TTY Forum Members and Interested Parties

RE: TTY Forum Update

Greetings,

A recent conversation with Dr. Steven Benno of Lucent Technologies has informed us that he has completed the Lucent software simulation of the TTY "no-gain" solution and it is now released and available to all those interested in exploring its functionality, compatibility and potential benefits with various CLEP vocoders. According to Dr. Benno, the following equipment and infrastructure vendors have requested a copy of his newly released code for testing purposes; Ericsson, Motorola, Nokia, NORTEL and Qualcomm. As co-chairs, we remain hopeful that this Lucent contribution will spark an interest for some manufacturers to re-visit their past efforts with vocoders, which perhaps may lead to follow-on contributions at our next TTY Forum.

During the last TR45 meeting, (March 3-4) CTIA submitted the 2.5mm Jack SRD, on behalf of the Forum. TR45 accepted this contribution and remanded it to the TDMA (TR45.3) and CDMA (TR45.5) sub-committees for information and to the appropriate sub-committee (TR45.1) for Action. Likewise, the TDMA and CDMA sub-committees reported back to the Chair that both of these digital technologies have developed standards supporting the Inter-working Function (IWF) as described in the TTY Forum's SRD on Circuit Switched Data submitted during the December TR45 meeting. This news brings the industry one step closer to the Forum's proposed "long term" data solution. The willingness of some modem manufacturers (3COM) to support the V.18 protocol is the other critical issue needed to make the IWF a viable option to carriers as a means of supporting TTY over digital - long term. The IWF solution opens the doors to the future by allowing end-users the use of ultra-light computers, compact PDA's, etc.

At this point I think it is important to remember that it has been the synergy, team-spirit and positive environment provided by the members of the TTY Forum that has lead us to this point. But, we do not want anyone to have the false impression that the end-all, be-all solution(s) have thus far been developed. Although Dr. Benno's "no-gain" solution remains a major breakthrough for TTY, "short term", voice based (specifically CLEP vocoders) solution and the V.18 protocol a major breakthrough for TTY "long term", data solution these by no means require carriers or manufactures to implement anyone one or both of these solutions. Keep in mind the other solutions brought to the Forum by Lober and Walsh and Ericsson. These solutions have also proved to be quite successful and promising for certain digital technologies. It is important to keep in mind that the carrier is responsible for the selection and implementation of a solution(s) that will allow TTY users to access 9-1-1 over its digital system. The best we as a Forum can do at this point is continue to provide the positive environment, feedback and input to manufacturers and carriers regarding testing and consumer needs and requirements and keep the standards development bodies involved when needed. CTIA and PCIA remain committed.

In conclusion, we propose that at the next TTY Forum we initiate the process to develop the final report to the FCC. Based on the contributions received to date and those anticipated at our next meeting, we believe we will have sufficient information to develop specific comments and recommendations. The TTY Forum can then plan to meet on a quarterly basis to "evaluate" progress and provide the FCC with a periodic, implementation status report.

My thanks to all members of the TTY Forum. Looking forward to seeing everyone in May.

July 23, 1999

Fm: TTY Forum Co-Chairs
TO: TTY Forum

RE: Update: TTY Forum and Interested Parties

Todd Lantor and I would like to take this opportunity to provide you with an overview of some interesting developments that have come to our attention since the last Forum held on May 18th, 1999.

The Lucent "no gain" vocoder solution has been widely accepted by TR45.5, the CDMA air-interface standards group. The "no gain" solution draft standards document has recently been prepared for ballot. Assuming a "clear" ballot response, the industry may have a CDMA TTY standard as early 4Q99. Likewise, TR45.3, the TDMA air-interface standards group is actively pursuing the same course as the CDMA group. The Nokia variation, presented to the Forum during the May meeting is being reviewed and considered. The group plans to complete its deliberation quickly and move toward the final stages by preparing a draft document for ballot.

Ericsson has provided the co-chairs with a copy of a document that proposes an alternative approach to the Lucent "no gain" vocoder solution. In the interest of time, and to take advantage of the TR45.3 meeting cycle, Ericsson thought it prudent to submit the alternative approach directly to the TDMA working group. Although it is being discussed at standards, Ericsson will present this vocoder alternative at the upcoming September TTY Forum.

Concurrently, we are preparing a draft "TTY Forum Status Report" for the FCC. The report, as a minimum, will contain the following sections:

- Updated Work Plan
- TTY testing completed to date
- A Technical Standards Update
 - Voice Based Approach
 - Data Approach
- Comments and Recommendations

Todd and I plan on getting a draft of this report to the TTY Forum Steering Committee for their review and approval before the next TTY Forum: The Steering Committee is comprised of: Toni Dunne, Texas 9-1-1; Billy Ragsdale, Bell South; Claude Stout, TDI; Norm Williams, Gallaudet UN; Jeff Crollick, TIA; John Melcher, NENA.

Next Meeting: We are currently making arrangements for the **September 9, 1999** TTY Forum and will get the meeting logistics out separately.

The meeting will be in the **Washington DC** area but **WILL NOT** be at Gallaudet Univ. Their calendar cannot support us. The meeting will start at **9:00 AM** and adjourn at 5:00 PM. Please do not make travel arrangements leaving the DC area before 6:30 PM. Now that we have reduced the meetings to one day, I see this Forum's agenda as being quite full.

Thank you all and have a very cool and pleasant summer. See you September!

Appendix J

Technical Standards Reference

<u>ID</u>	<u>Description</u>
TIA/EIA 825	FSK Modem
TIA/EIA TSB-121	Cellular Subscriber Unit Interface for TDD
TIA/EIA-IS-823-A (PN-4614)	TR 45.3 5.3 TDMA TTY Solution- 410 vocoder
TIA/EIA-IS-840-A (PN-4721)	TR 45.3 5.3 TDMA TTY Min Performance.
TIA/EIA/IS-789-A: IS-733-2, IS-127-3	Electrical Specification for the Portable Phone to Vehicle - CDMA Vocoder Standards - high rate
IS-707-A-2	CDMA Data (V.18) Standard
3GPP2 C.S0028	CDMA TTY/TDD Minimum Performance Specification
TIA/EIA-136-270-B	TDMA Third Generation Wireless – Mobile Stations Minimum Performance
TIA/EIA-136-280-B	TDMA Third Generation Wireless – Base Stations Minimum Performance
3GPP TS26.226	Cellular Text Telephone Modem Description
3GPP TS26.230	Cellular Text Telephone Modem Transmitter Code
3GPP TR26.231	Cellular Text Telephone Modem Minimum Performance Specifications
ETSI ETR 333	Text Telephony, User Requirements and Recommendations
ITU-T Rec. v.61	Analog simultaneous voice and data (permits VCO with ASCII modems)
ITU-T Rec. V.18	Operational and Interworking Requirements for DCE's operating in the Text Telephone Mode
ITU-T Rec. V. 250	Serial asynchronous automatic dialing and control

ITU-T Rec. V.8	Procedures for starting sessions of data transmission over the public switched telephone network
T1.718	PCS 1900 Cellular Text Telephone Modem (CTM) Transmitter Bit Exact C-Code
T1.719	PCS 1900 CTM General Descriptions
T1.720	PCS 1900 CTM Minimum Performance Requirements
TIA/EIA-688	DTE/DCE Interface for Digital Cellular Equipment

Timeline of Events in CDMA and TDMA standards

CDMA: TIA TR45.5.1.1

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August 2000: Lucent proposed bug fixes to the TTY/TDD addenda and proposed a TTY/TDD Minimum Performance Specification for CDMA.

November 2000: Nortel proposes to add a test vector to the Min Perf Spec in order to handle the hard handoff scenario. This scenario uncovers another bug in the code.

Dec 2000: Lucent proposes another bug fix, which is approved, but the subcommittee doesn't baseline the fixes in order to give more time to find problems.

Jan 2001: Updates to the TTY specifications and Min Perf Specs are baselined and sent to V&V.

TDMA: TIA TR45.3.5

=====

October 2000: Proposed bug fixes to IS-823 TTY Extension to TIA/EIA 136-410.

December 2000: Proposed additional bug fix similar to the bug fix proposed for CDMA in Dec. 2000.

January 2001: Nokia and Ericsson present contribution questioning the necessity of any bug fixes. Nokia proposes change to standard to improve TTY performance during signaling.

February 2001: A problem is found with IS-840 TTY/TDD Min Perf Spec for TDMA. Nokia (the editor) will provide an update to fix problem and update based on Nokia's proposed change to IS-823.

March 2001: Changes to IS-823 are approved. Nokia commits to having a new version of IS-840 for review by next meeting. The subcommittee decides to ballot new versions of IS-823 and IS-840 together.

APPENDIX K

Glossary of Terms

Telecommunications Standards and Assignment Organizations

ANSI - American National Standards Institute

The ultimate accolade for any standard is ANSI certification. This does not mean that ANSI has reviewed the standard, but that it has been circulated widely throughout the industry and that it conforms to their document design and publication guidelines. TIA standards, for example, start their public life as an IS- (Interim Standard) and then proceed within a few years to a full ANSI standard. The analog cellular standard started as EIA/TIA IS-3 and is now the ANSI standard identified as EIA/TIA-553.

ATIS - Alliance for Telecommunications Industry Solutions

The major US telecom standards organization beside the TIA, most responsible for ANSI SS7 standards. This organization was previously called ECSA; Exchange Carriers Standards Association. SS7 and wireless standards are developed within the T1 committee.

Bellcore - Bell Communications Research

Bellcore is not a standards organization, but they do write technical documents that are treated as if they were standards by many telecommunications carriers, particularly their former owners, the 7 regional bell operating companies. These documents include the GR-145 specification for interconnect, enhanced SS7 specifications beyond ANSI and the WACS low-mobility PCS system. Bellcore also performs many other research and consulting functions.

ETSI - European Telecommunications Standards Institute

The mission of ETSI is "to produce the technical standards which necessary to achieve a large unified European telecommunications market". This includes the specification of the GSM cellular and PCS standard.

IFAST - International Forum on ANSI-41 Standards Technology

A forum on international cellular carriers, vendors and service providers that attempts to resolve international roaming problems with AMPS-compatible systems (i.e. including IS-136 D-AMPS and IS-95 CDMA). The organization has taken responsibility for allocating the International Roaming MIN resources (MIN's starting with the digits 0 or 1) and new blocks of SID codes.

INC - Industry Numbering Committee

The Industry Numbering Committee (INC) is a standing committee of the Carrier Liaison Committee (CLC). The INC provides an open forum to address and resolve industry-wide issues associated with the planning, administration, allocation, assignment and use of resources and related dialing considerations for public telecommunications within the North American Numbering Plan (NANP) area.

ITU - International Telecommunications Union

The ITU is the global equivalent of ANSI for telecommunications standards. In fact, the world is divided into the majority of countries that adhere to ITU standards, and the US and Canada that tend to use ANSI standards. AMPS cellular is an exception, as it

has been implemented in many other countries. ITU standards that are used in AMPS cellular include: E.164 - the global numbering plan. E.212 - the global mobile identification plan. Q.7xx - a series of standards defining Signaling System #7 (used as an alternative to ANSI SS7 in AMPS countries outside the US and Canada).

NANPA - North American Numbering Plan Administration

The organization responsible for allocating numbering resources within the North American Numbering Plan Area: USA, some of its territories, Canada and several Caribbean nations. Controlled by Bellcore until January 1998, it is now managed by Lockheed-Martin. It is responsible for assignment of new area codes within the North American Numbering Plan and office code assignments within US states and territories.

NENA - National Emergency Number Association

NENA, along with NASNA (National Association of State 9-1-1 Administrators), APCO (Association of Public Safety Communications Officials) and the TIA are responsible for promoting enhanced 9-1-1 standards for wireless systems.

TIA - Telecommunications Industry Association

WWITF – Wireline Wireless Integration Task Force

Government and Regulatory Organizations

Australian Communications Authority (ACA)

The organization responsible for the management of radio spectrum and telecommunications in Australia, formed by a merger of AUSTEL and SMA. APUMP represents people who are unhappy with the decision to eliminate analog cellular by the year 2000 in favor of the three GSM systems.

RSP - New Zealand Radio Spectrum Authority

Responsible for the management of radio spectrum in New Zealand.

US Dept. of Commerce

The Office of Telecommunications provides a great online source of worldwide wireless telecommunications information.

FCC - US Federal Communications Commission

The organization responsible for the management of telecommunications in the United States. Their responsibilities for public radio communications, such as cellular, include allocation of frequencies, the development of regulations that govern their use and monitoring to ensure that regulations are followed.

Wireless Telecommunications Trade Associations

ATIS – Alliance for Telecommunications Industry Solutions

CTIA - Cellular Telecommunications Industry Association

A trade association of wireless carriers in the United States, Canada and other countries. Originally a cellular organization, it now has members that are Manufacturers, PCS, ESMR and Satellite carriers.

CWTA - Canadian Wireless Telecommunications Association

A trade association of wireless carriers in Canada.

MMTA - Multi-Media Telecommunications Association

An association of companies focused on computer-telephony integration. They announced in November 1996 that they were merging with the TIA.

PCIA - Personal Communications Industry Association

Formerly Telocator, this organization represents Paging, PCS, ESMR, SMR and mobile data service providers as well as communications site managers, equipment manufacturers, and others providing products and services to the wireless industry.

TIA - Telecommunications Industry Association

United States Telephone Association.

A trade association for US local exchange carriers.

Wireless Forums

CDG CDMA Development Group

A trade association dedicated to the promotion of CDMA wireless technology.

MIPS Mobile Internet Phone Services Forum

A new group dedicated to promoting the development of Internet access technologies, services and features from mobile devices.

PACS Providers Forum

PACS (Personal Access Communication System) is a PCS system based on Bellcore's WACS and Japan's PHS, that will provide 64kbps voice and data, but is restricted to low mobility applications.

Universal Wireless Communications Consortium

Promoters of the IS-136 TDMA digital cellular and PCS standards, mostly through conferences and symposiums.

WDF The Wireless Data Forum is an independent, protocol-neutral trade group dedicated to promoting the wireless data industry. WDF's members include wireless operators and equipment providers, application developers and information technology companies working to advance wireless and mobile data products and services.

Glossary

Analog Signal A signal that varies in a continuous manner, such as voice.

ANI Automatic identification of the calling station

ANSI American National Standards Institute.

ATIS Alliance for Telecommunications Industry Solution (formerly ECSA). Responsible for ANSI SS7 standards and US GSM standardization.

BS Base Station

CPAS Cellular Priority Access Service

ESN Electronic Serial Number

GETS Government Emergency Telephone Service

HLR Home Location Register (database of subscriber records)

IFAST International Forum for AMPS Standards Technology

INC Industry Numbering Committee

IS TIA Interim Standard.

JEM Joint Experts Meeting

J-STD Joint ATIS and TIA standard.

LERG Local Exchange Routing Guide

LEA Law Enforcement Agency
MS Mobile Station (i.e. wireless phone)
MSC Mobile Switching Center (aka MTSO)
NAG Numbering Advisory Group
PACA Priority Access Channel Assignment
PN TIA Project Number. Identifies a project during development of a standard.
SP ANSI Standards Proposal. ANSI equivalent of a PN
TLDN Temporary Local Directory Number
TIA Telecommunications Industry Association
TTY Text Telephony
TDD Telecommunications Device for the Deaf
VLR Visited Location Register
WIN Wireless Intelligent Network

APPENDIX L

ALASKA COMMUNICATIONS SYSTEMS WIRELESS	55
AT&T WIRELESS	57
CAPROCK CELLULAR	60
CAROLINA WEST WIRELESS.....	62
CELLULAR XL ASSOCIATES, L.P.....	63
CINGULAR WIRELESS LLC	65
CORR WIRELESS COMMUNICATIONS, L.L.C.....	68
ERICSSON INC.....	69
FARMERS CELLULAR TELEPHONE, INC.	74
LEAP WIRELESS	76
MIDWEST WIRELESS HOLDING L.L.C.....	77
MOTOROLA	78
NEXTEL COMMUNICATIONS, INC.	80
NOKIA	82
NORTEL NETWORKS.....	84
PINE BELT CELLULAR, INC.	91
RURAL CELLULAR CORPORATION.....	93
SIEMENS.....	95
SONY ERICSSON MOBILE COMMUNICATIONS	96
SOUTHERN LINC	99
SPRINT PCS.....	100
TELECORP PCS	102
UNWIRED TELECOM	113
VOICESTREAM WIRELESS.....	114

Alaska Communications Systems Wireless
TTY Status Report
April 10 2002

Alaska Communications System Wireless consists of 3 Ericsson Switches offering TDMA digital and analog service in Anchorage, Fairbanks, Juneau, Sitka, Ketchikan and the Kenai Peninsula in the state of Alaska.

1. Network Infrastructure Software Development

ACS Wireless is contemplating the purchase of Ericsson's Version 7 software with the IS-823A patch for all three switches to insure compliance with the FCC's order for TTY deployment deadline

2. Handset Deployment and Testing Plans

ACS Wireless is relying on its handset vendors for the development and testing of TTY capable handsets. Once Ericsson and Nokia have IS-823 handsets, we will purchase these handsets and ACS Wireless will perform field tests.

3. Beta Testing and Lab Testing

ACS Wireless will rely on its switch vendor and handset vendors for beta testing and lab testing for conformance to TTY specifications.

4. Release and General Availability to Carriers of Network Software

Ericsson software is available as of 4th qtr 2001.

5. Availability to Carriers of Full Acceptance Test Units

Full acceptance tests depend on handset vendors schedule of IS-823 compatible units.

6. Efforts Towards Achieving Digital Wireless Solution Compatibility with Enhanced TTY Devices

Dependent on handset vendors for enhanced TTY devices.

7. Carrier Coordination of Testing with PSAP

ACS Wireless will coordinate testing with any PSAP that requests testing.

8. Carrier Testing Activities, Including Field Testing and Consumer End to End Testing

Field testing and consumer end to end testing will take place after vendor software has been installed and compatible handsets have been tested. We anticipate our testing activities to be complete before end of 2nd qtr 2002.

9. Retail Availability of Necessary Consumer Equipment

Retail availability will be implemented by ACS Wireless retail outlets when compatible handsets are ready for rollout.

10. Geographic Scope of Network Deployment

ACS Wireless will meet the June 30th 2002 deployment deadline with availability in all markets served by ACS Wireless in the state of Alaska.

Respectfully Submitted
Nicholas Miller
Wireless Operations Manager

Please Note: AT&T Wireless' current network, supporting approximately 16 million customers in markets nationwide, operates on the TDMA (ANSI-136) air interface. The company is in the process of building a new network based upon the GSM air interface standard, for which AT&T Wireless is ensuring TTY compatibility per the FCC's regulations. Please note, however, that the overwhelming majority of the company's current customer base is supported by the TDMA network.

Network Infrastructure Software Development

TDMA Network: TTY software from all three of our network platform vendors is now Generally Available.

GSM Network: AT&T Wireless received revised TTY software for Nokia GSM transcoders during Q1, 2002.

Handset Development and Testing Plans

TDMA Handsets:

Motorola, Nokia, Sony/Ericsson: Lab testing of handsets from all three vendors continued in Q1, 2002.

GSM Handsets:

Motorola reports that they are planning to provide a TTY-capable GSM handset that should be available to our lab in Q2, 2002

Nokia reports that they are planning to provide a TTY-capable GSM handset that should be available to our lab in Q2, 2002

Sony/Ericsson provided a TTY-capable GSM handset to our lab in Q4, 2001

Beta and Lab Testing

AT&T Wireless has in place a full integration lab for Ericsson, Lucent, and Nortel TDMA infrastructure equipment. As of the date of this report, TTY software for Lucent R17.0, Nortel MTX-10, and Ericsson Version 8 has been loaded into test switches within the AT&T Wireless test lab for regression and TTY feature testing.

In addition to the TDMA lab, AT&T Wireless also has in place a GSM integration lab for Ericsson BSS, Nokia BSS, and Nortel MSC equipment. During Q1, 2002, AT&T Wireless installed software to support TTY in our Nokia BSS lab environment.

Release and General Availability to Carriers of Software

TDMA Network: All three of AT&T Wireless' TDMA network vendors have released their TIA/EIA IS-823A software for general availability as summarized below:

Ericsson's support of IS-823A in Version 8 radio software (which includes vocoder TTY support) should become generally available during Q2, 2002

Lucent integrated IS-823A support into 5ESS software release 5E15.1 BWM01-0008, and it became generally available in Q3, 2001. This TTY software was enabled in AT&T Wireless Lucent markets during Q1, 2002.

Nortel: Nortel supports IS-823A in MTX10, DSPM version EFRX10BR, which became generally available during Q1, 2002.

GSM Network: General availability of TTY-capable GSM network equipment for each of AT&T Wireless' BSS vendors is summarized below:

Ericsson's CTM node became generally available in Q1, 2002

Nokia's CTM software for network transcoders should be generally available in Q2, 2002

Nortel's revised software patch to GSM13, which is necessary to support trunk selection based on CTM indicator status (required to support the Ericsson E-CTM server) should become generally available in Q2, 2002

Availability to Carriers of Full Acceptance Test Units

TDMA Handsets: AT&T Wireless has obtained information from three TDMA (ANSI-136) handset vendors concerning the general availability (GA) of TTY-compatible handsets. The information obtained is summarized below:

Ericsson reports that they are planning to have an IS-823 handset available for GA in Q2, 2002

Nokia reports that they are planning to have an IS-823 handset available for GA in Q2, 2002

Motorola reports that they are planning to have an IS-823 handset available for GA in Q2, 2002

GSM Handsets: AT&T Wireless has obtained information from three GSM handset vendors concerning the general availability of CTM-capable handsets (as defined by 3GPP TS 26.226 and related standards). The information obtained from each vendor is summarized below:

Sony/Ericsson reports that they are planning to have a handset supporting CTM available for general availability in Q1, 2002

Motorola reports that they are planning to have a handset supporting CTM available for general availability in Q2, 2002

Nokia reports that they are planning to have a handset supporting CTM available for general availability in Q2, 2002

Carrier Testing Activities, Including Field Testing and Consumer End-to-End Testing

Industry-Standard IS-840 Audio Server:

AT&T Wireless configured a Wireless TTY audio server, which will allow a PSAP or PSAP vendor to validate the compatibility of their equipment against the IS-840 "Wireless TTY" standard. This audio server can be made available on a dial-up basis through the switched public network, and provides the caller with standardized streaming text which can be scored for errors using a reference file and the Lober & Walsh SCORE.EXE software. After developing this platform, AT&T Wireless will provide ATIS with the information necessary to set up such a server, which they plan to host.

February TTSI Inter-MS-C Test Effort:

AT&T Wireless participated in the ATIS TTSI inter-MS-C TTY test effort, which took place on 11 and 14 February. The AT&T Wireless lab network (using Lucent, Ericsson, or Nortel TDMA infrastructure equipment) was used to test against participating Motorola CDMA, Nortel CDMA, Ericsson GSM and Lucent TDMA networks around the country.

Nortel TDMA FOA Testing:

AT&T Wireless FOA tested the Nortel TTY support software in our Portland, Oregon TDMA market in early January, 2002.

Ericsson GSM FOA Testing:

AT&T Wireless conducted a FOA of Ericsson's E-CTM server in our Indianapolis market during March, 2002.

Retail Availability of Necessary Consumer Equipment

No new consumer equipment has become available for retail sale. AT&T Wireless continues to offer the Panasonic TDMA TTY-compatible handsets (models EB-TX310 and EB-TX320) in our retail stores.

Progress of TTY-Digital Deployment Solutions
CC Docket No. 94-102
1st Quarterly Report
April 10, 2001

#1 Network infrastructure software development:

Caprock Cellular utilizes Nortel Networks equipment to provide TDMA digital services in Texas RSA 4. A report from Nortel Networks states that development of software is complete, and product tests have been completed as well. Testing was limited to Panasonic prototype handset, as other equipment was not available during the test.

#2 Handset development and testing plans

Caprock Cellular must rely on handset vendors to develop the required handsets. When handsets are available testing can be performed with area PSAPs to insure compatibility.

#3 Beta testing and lab testing

Caprock Cellular must rely on Nortel Networks and handset vendors for initial conformance testing.

#4 Release and general availability to carriers of network infrastructure software

Nortel Networks has stated that the required software load, MTX10, will be generally available first quarter of 2002. MTX10 was deployed March 6, 2002.

#5 Availability to carriers to full acceptance test units

Nortel Networks plans to test and confirm the solution performance during the six-month extension allowed for this purpose.

**Caprock Cellular Limited Partnership
Progress of TTY-Digital Deployment Solutions
CC Docket No. 94-102 - 2nd Quarterly Report**

#6 Efforts toward achieving digital wireless solution capability with enhanced TTY devices.

The solution provided by the MTX10 software load addresses Baudot type messages only. Other capabilities may be included later, after standards are adopted.

#7 Carrier coordination of testing with PSAP

See response to item #2 above.

#8 Carrier testing activities, including field testing, consumer end-to-end testing, and other necessary tests.

Caprock Cellular will acquire compatible handset and test service.

#9 Retail availability of necessary consumer equipment

At this time it is unknown when handsets will be available.

#10 Geographic scope of network infrastructure deployment

The required software load for the cellular switch (MTX10) has been installed. See #4

North Carolina RSA 3 Cellular Telephone Company
d/b/a Carolina West Wireless
TTY Report
First Quarter 2002

Background

Carolina West Wireless uses TDMA technology
Infrastructure vendor is Nortel
Phone manufactures include Nokia, Motorola and Ericcison

Status

The MTX10 software has been deployed as scheduled. All of the software components relating to TTY testing have been verified.

Nokia has made a firm commitment on the model 6360 and should be in our inventory early second quarter. Motorola has made no firm commitment for delivery for the V60TI. Ericcson is still evaluating the TTY compatibility of its products and has not yet made the phones available to us.

Carolina West Wireless is in the process of scheduling testing to begin during the second quarter of 2002 using the Nokia 6360. Testing for the Motorola V60TI and Ericcson equipment will be scheduled for testing as soon as they are made available to us.

Carolina West Wireless continues to actively work with its vendors and the TTY Forum to ensure TTY availability as quickly as possible.

April 10, 2002

**Cellular XL Associates, L.P. TTY Status Report
First Quarter 2002**

Network Infrastructure Software Development

Cellular XL Associates, L.P. (Cellular XL) operates a Nortel Wireless 100 (W-100) hybrid wireless and wire line switch in its network. Nortel Networks has no TTY solution for the W-100 switch. In order to meet TTY requirements, Cellular XL and Nortel Networks have undertaken a project to split the wireless and wire line functionality into two separate switches – a DMS 100 wire line switch and a DMS-MTX wireless switch. Once both switches are in place, the DMS-MTX can be upgraded to the Nortel MTX10 software load required for proper TTY functionality. Due to the extensive nature of this upgrade, Nortel Networks has informed Cellular XL that it will be unable to complete the upgrade until 4th quarter 2002.

Handset Development and Testing Plans

Cellular XL must rely on handset vendors to provide this solution. We are working with our suppliers to acquire these units as soon as possible.

Beta Testing and Lab Testing

Cellular XL is in contact with handset manufacturers and with Nortel Networks and will be gathering information on handsets Nortel deems compatible with its switch. Once Cellular XL has this information from Nortel, it will acquire handsets and test for compatibility and quality assurance in its own network.

Release and General Availability to Carriers of Network Infrastructure Software

Please see Nortel Networks' 2002 First Quarter Status Report for release and general availability information.

Availability to carriers of full acceptance test unit

Cellular XL expects commitments from Nortel Networks to test the performance of their software solution prior to implementation

Efforts Toward Achieving Digital Wireless Solution Compatibility With Enhanced TTY Devices

Cellular XL is doing everything in its power to assure compatibility between its network, the TTY devices, the E911 system, and all other affected elements of this project. The primary goal of Cellular XL is to assure absolute quality of service to the end user.

Testing and Deployment Activities

In cooperation with the above mentioned network upgrades, Cellular XL plans to test and deploy full TTY functionality prior to December 31, 2002.

Carrier Coordination of Testing with PSAP

Cellular XL has excellent relationships with the PSAP's in its service area and intends to utilize that relationship to assure complete communication functionality between handsets and PSAP's.

Carrier Testing Activities, Including Field Testing, Consumer End-To-End Testing, and other Necessary Tests

Cellular XL is a small carrier operating in two RSA's in South Mississippi. Once handsets have been acquired and network TTY functionality is installed, Cellular XL will begin testing. Testing will involve primarily three groups: Cellular XL engineers and technicians, PSAP representatives, and consumers. The University of Southern Mississippi has an active program assisting hearing-impaired people in this area and is one of many resources that will be utilized as a source of consumer test subjects.

Retail Availability of Necessary Consumer Equipment

Cellular XL intends to make consumer equipment available through all of its normal retail and direct sales outlets.

Geographic Scope of Network Infrastructure Deployment

Cellular XL operates its network in two RSA's in South Mississippi: MS 10 and MS 11. These two RSA's consist of 12 counties. Cellular XL will deploy the TTY solution over its entire network within this operating area.

TTY Contact:

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dave@cellone-ms.com**

April 8, 2002

To: TTY Forum

From: Susan Palmer and Ken Evans

TTY Forum #21 Report
Cingular Wireless LLC

Overview

Cingular Wireless LLC (Cingular) notes that progress with ATIS coordinated testing of the TTY solutions continues. Cingular has participated in this testing in GSM, CDMA and TDMA environments. The first testing of GSM technology was a cooperative venture conducted by ATIS in Cingular's California GSM market in February. This interoperability testing involved multiple carriers around the country and included all access technologies (GSM, TDMA and CDMA).

Results from testing from a mobile to mobile and mobile to landline environments indicate a total character error rate at an acceptable level -- less than 1%. However, testing with **some** PSAPs indicate an unacceptable character error rate. This is a serious problem. ATIS has identified over 36 vendors of PSAP equipment including TTYs, software TTYs and PSAP software that can impact total character error rate. Research is on going to determine the extent of the problem and to identify solutions.

Manufacturers have provided TTY compatible handsets for testing and as of this date, Cingular has tested handsets from all three of its' handset vendors with good results. However, these have been in limited numbers and availability of handsets is still a concern for commercial launch.

Cingular is conducting testing of the TTY solution with deaf and hard of hearing TTY users. This testing is being conducted to identify usability issues and to confirm that the necessary network, handset and customer interface issues are in place.

ERICSSON

TMDA: The TTY software was given general availability (GA) status on December 1, 2001. On March 4, 2002, Cingular received a software patch from Ericsson. This patch is expected to help resolve the error rate issue that is seen when calling certain PSAP equipment. It was loaded into one of our commercial switches on March 11 for evaluation. Initial results indicate the patch has resolved the error rate issue with one PSAP vendor. However, testing will be required with all know PSAP vendors to insure compatibility. Deployment of TTY software

in the Ericsson switches in our network will be completed in April 2002. The June 30, 2002 deployment requirement is on track.

GSM: Testing has been completed in our Pleasanton Laboratory. A first office application (FOA) was successfully completed on January 19, 2002 in Pleasanton, California. Successful interoperability testing was conducted with TDMA and CDMA technology on this switch in February 2002. Installation of the TTY functionality will complete in late April 2002. The June 30, 2002 deployment requirement is on track.

NORTEL

GSM: Nortel GSM continues to be an area of concern. Testing is scheduled for May 6, 2002, with a GA date of May 17, 2002. This is only six weeks prior to June 30, 2002 when the FCC requires that we have TTY implemented. Unforeseen problems identified in testing could place our ability to meet the June deadline in jeopardy. If Cingular does not receive the upgrades from Nortel as scheduled and is unable to conduct testing as scheduled, it will not be possible for Cingular to meet the June deadline in these markets.

TDMA: Cingular has the necessary software for the TTY solution. However, this software cannot be used until Cingular completes planned switch upgrades from “MTX - 9” to “MTX - 10”. This upgrade is scheduled to complete in early April 2002.

LUCENT

The Lucent TTY solution has been installed in all Lucent switches and testing to date has yielded good results. We have met the December 31, 2001 date and are on track for the June 30, 2002 date.

INTEROPERABILITY TESTS

There have been three interoperability testing events conducted by the industry and coordinated by the TTSI. GSM, TDMA and CDMA have been tested with the results being good for most scenarios. However, testing with certain PSAP equipment has yielded unusually high character error rates. Through ATIS coordination, the industry is working with the vendors of this equipment to resolve this issue. However, little time is available to identify and resolve problems and roll out the solution prior to the June 30, 2002 date. The success seen in mobile-to mobile and mobile to landline testing indicates that this TTY solution could provide access to a mobile conversational mode of communications for hearing impaired users. It will also lead to access to other digital modes of communications such as SMS and wireless Web. The industry is examining ways to introduce the conversational mode by June 30th, and continuing work (as needed) on resolution of the PSAP issue.

USER TESTING

Cingular is working with the Rehabilitation Engineering Research Center at Gallaudet University, a nationally recognized Deaf research organization specializing in Telecommunications access, to insure that the TTY solution is viable. These evaluations involve deaf individuals using the TTY products on a commercial switch to evaluate the network performance; usability of the interface to the wireless handset and the TTY terminal; and the customer service interface provided via TTY and TRS. Information obtained will be shared with the industry to insure a smooth service launch on or before June 30, 2002.

Corr Wireless Communications, L.L.C.

Corr Wireless Communications, L.L.C. (Corr Wireless) is working with vendors to insure compliance with the FCC implementation deadline.

Two phone vendors (Nokia and Panasonic) are marketing phones that purport to be TTY capable. Corr Wireless attempted to test the Panasonic phone with the Blount County, Alabama PSAP but the PSAP's TTY device was not wireless phone capable. Corr Wireless has since ordered a wireless phone capable TTY device and expects delivery within the next week. Testing will commence upon delivery of the device.

Corr Wireless has completed installing the necessary Lucent software into its switch.

Network Infrastructure Status for Ericsson Inc.

TTY Forum #21 Report

April 10, 2002

This report details the TTY Network Infrastructure status provided by Ericsson Inc. at the March 5th, 2002 TTY Forum 21. This report identifies development and testing status for network infrastructure products, release and general availability dates, efforts towards achieving compatibility with TTY devices, system testing, deployment activities, technical issues, and contact information.

Ericsson has completed the development of TTY technology intended for integration within its products. These products have been built to the approved ballot standards from the industry. The development testing has been completed for all of the Ericsson products, and the products have been demonstrated to the carriers in a number of test events within the FCC required deadlines. As products completed the development testing, they have been released to the carriers for acceptance testing. In general, the technical feasibility to transport TTY across the digital cellular systems has been proven by the product operability testing. Results have been published for TDMA, GSM and CDMA infrastructure demonstrations. Isolated technical flaws and system integration issues continue to be identified in the product test and carrier test phases.

Testing continues in development labs, in customer labs and in TTSI (ATIS sponsored) test events. While handset to infrastructure compatibility testing has taken place between several manufacturers, there is still an incurred risk to interoperability testing for manufacturers that have missed the initial testing. The current stage of testing includes base station to base station interoperability, base station to landline TTY, carrier infrastructure compatibility, and PSAP operability testing. Results obtained thus far are improving, yet remain inconclusive. Identifying and resolving the performance objectives will require the involvement and cooperation among the manufacturers, carriers, 911 PSAP facilities, standards organizations, and governing bodies. Ericsson continues to test TTY compatible products, participate and monitor the industry standards and test events, and work with the regulatory bodies and the ATIS Incubator. Ericsson Inc. is monitoring the data generated by TTSI to determine compliance to the FCC mandated <1% TTY character error rate.

1) Network Infrastructure Development:

TDMA Status:

TDMA network infrastructure has completed product development and testing of the Positron Express and Nokia handset interoperability problems. To fix the Positron problem, TDMA network infrastructure modified the bit duration of the regenerator from 21.5ms to 22ms for nominal and dropped to 21.625ms for the falling behind situation.

Also since last November more TTY compatibility tests have been conducted on the Motorola 60T. No problems were found. The results of the testing are similar to the tests carried out with other TTY handsets.

So far, the following handsets have been tested:

- Nokia Model # 6360
- Motorola Model # 60T
- Panasonic: EB-TX320 and EB-TX310
- Ericsson : T60d and T61d

The following equipment has been tested:

- Ameritech Q90
- Hitec Q90A Amplifier
- Ultratec Compact 600 001600
- Ultratec Intellemodem 2400
- 711 TTY Relay Service
- 911 PSAP using Positron Express

TDMA Plans:

The Ericsson TDMA infrastructure was verified in the Cingular Lab during the week of March 4th, 2002. The FOA was held in Houston starting on March 12, 2002. TDMA TTY software achieved General Availability status on April 3rd, 2002. Customer rollout is ongoing.

GSM Status:

The development code and products for the CTM node are complete. System verification is complete. The GSM infrastructure solution FOA'd with Cingular in December 2001 and January 2002. Software General Availability was achieved on February 25, 2002. Cingular has one live BSC operating with the TTY functionality while VoiceStream and AWS both have operating systems in their labs. Cingular, ATW and VoiceStream start rollouts in April, 2002.

GSM Plans:

The GSM TTY solution has undergone acceptance test at several customer sites. FOA testing was conducted with Cingular during December 2001 and January 2002 and General Availability was obtained on February 25th, 2002.

Rollouts for Cingular, VoiceStream and AT&T Wireless have begun. Cingular rollout will be complete by the end of April 2002 and VoiceStream rollout will be complete by end of May 2002. ATW rollout is still being planned, but will be completed prior to June 30, 2002.

CDMA Status:

Software code development for the network infrastructure solution is complete. Lab and integration tests are complete. The software was available for carrier testing on February 8, 2002. International TTY test calls between TTSI groups in the US and Brazil were successfully conducted on February 12, 2002.

The CDMA TTY solution software was modified according to IS-823A to adjust the nominal bit width of TTY signaling. The nominal TTY bit width was changed to 22 ms. The CDMA solution has also implemented the mute (half duplex) to prevent echoed character errors according to IS127-3. The TTY encoder will send TTY silence frames whenever the TTY decoder generates TTY tones.

2) Handset Development and Testing Plans;

Reported by Sony Ericsson.

3) Beta Testing and Lab Testing;

TDMA Infrastructure Beta Testing and Lab Testing

Testing of the Positron problem and TTY_Silence was completed on March 1st, 2002.

GSM Infrastructure Beta Testing and Lab Testing

Ericsson lab test is complete. Terminal and PSAP testing have completed successfully. Error rates of less than 1-% have been demonstrated.

To date, there are no outstanding technical issues.

CDMA Infrastructure Beta Testing and Lab Testing

The software was available for carrier testing on February 8, 2002. International TTY test calls between TTSI groups in the US and Brazil were successfully conducted on February 12, 2002. The customer FOA with Leap Wireless began on March 15, 2002 and is ongoing.

4) Release and General Availability to Carriers of Network Infrastructure Software;

The initial TDMA network software was declared General Availability (GA) on December 5, 2001. The new TDMA network software was declared GA on April 3, 2002.

The GSM System solution was declared General Availability (GA) with GSM R9.0, on February 25, 2002. Rollouts started in April 2002.

The CDMA System solution will be Generally Available (GA) with system Release 8.6 on May 28, 2002 and available for customer rollouts.

5) Availability to Carriers of Full Acceptance Test Units;

- *TDMA Network Infrastructure October 22, 2001*
- *New TDMA Network Infrastructure, March 4, 2002*
- *GSM Network Infrastructure November 30, 2001*
- *CDMA Network Infrastructure available February 8, 2002.*

6) Efforts Toward Achieving Digital Wireless Solution Compatibility with Enhanced TTY Devices.

Ericsson Inc. continues to work very closely with all other manufacturers and carriers on the TTY compatibility mandate.

7) Testing and Deployment Activities

Ericsson Inc. works with the operators/carriers in the test and deployment of network infrastructure systems. In addition, Ericsson Inc. works with the ATIS Incubator (TTSI) and participates in TTSI test events as scheduled.

Intra-infrastructure testing achieved good results while inter-infrastructure testing has encountered more challenges. There appears to be at least one inter-infrastructure interoperability issue still outstanding for GSM. Ericsson Inc. infrastructures for TDMA, GSM and CDMA were represented in the TTSI test event in February 2002, and GSM infrastructure is being represented in the April 2002 TTSI test event.

Ericsson CDMA successfully made a TTY call from Brazil to the TTY test site in Washington DC during the February 2002 TTSI test event. CDMA infrastructure is currently involved in Phase 3 regression testing.

Ericsson Inc. would like to express our appreciation for all of the test efforts and support we have received regarding TTY capability. Testing with operators, carriers, TTSI, Lucent, AWS, Cingular, DSPG, HITEC, Positron, and others contributed significantly to achieving the successes and results we have obtained so far.

8) Risks:

At the TTY Forum 21 meeting, the issue of major concern was the PSAP interoperability problem. The FCC has been petitioned by ATIS to investigate concerns of PSAP performance, which may affect the industry's ability to comply with the TTY deadlines. Ericsson has introduced corrections in our own TDMA implementation for problems detected early with PSAP manufacturers. The wireless industry is awaiting FCC response regarding this issue.

Several other issues remain to be resolved within the TTY capability.

Issues That Require Resolution:

- There are exposures with incomplete standards that need to be addressed.

- There is really no type approval test for TTY; there is no type approval agency. Without a type approval test, there is no test staging that validates the implementation.
- IS-823A bit exact changes should be created to adjust nominal bit width of TTY signaling. The nominal TTY bit width should be changed to 22 ms with a new mechanism proposed to handle consecutive character strings at minimum or maximum bit width tolerance.
- TTY silence frames require mute immediately after TTY characters, within IS-823A, to prevent echoed character errors.
- PSAPS need a test minimum performance specification to achieve the FCC mandated 1-% error rate.
- We are discovering interaction problems with other infrastructures that are only just now available and will require additional testing to be performed.
- V.18 interoperability testing at TTSI is inconclusive, additional testing is still required.
- The FCC should investigate an increased error rate benchmark for drive testing. Error rates similar to AMPS performance data collected within the TTSI database is recommended.

Please feel free to contact Stephen Hayes if you have any questions regarding this report, or wish to contact test or product interfaces. Please contact your local customer interface for product sales and marketing information.

Farmers Cellular Telephone, Inc.
TTY Report
April 8, 2002

- [Network infrastructure software/hardware development and testing](#)

Farmers Cellular Telephone, Inc.'s ("Farmers Cellular's") network consists of only one Nortel switch. We offer analog service as well as TDMA digital. Farmers Cellular has purchased the latest software upgrade from Nortel. Nortel Networks' development is complete, and product tests have been completed as well. Nortel tested with Panasonic prototypes. (Other handset vendors were not available during Nortel's NBSS10.1 test cycle).

- [Handset development and testing plans](#)

Farmers Cellular handset vendor status: Ericsson is on schedule. Motorola has not given an update, and Nokia is on schedule.

- [Schedule for deployment of the software/hardware in the Farmers Cellular switches](#)

The minimum baseline software requirement for this feature to be deployed in Farmers Cellular switches is MTX10 or higher. Software has been installed on Farmers Cellular switch.

- [Beta testing and lab testing](#)

Turbocode/ HiSpeed is a proprietary feature on Ultratec/Ameriphone TTY device and is not supported by TDMA standards. If TDMA standards are enhanced to support these devices, Nortel will support this in a future release. However, standards are designed to avoid supporting propriety methods and there is no known effort to standardize the propriety features.

- [Release and general availability to carriers of network infrastructure software](#)

Under Nortel's recommendation, Farmers Cellular will engage the chosen TDMA TTY handset vendor during network testing to do interoperability testing with the Nortel Networks solution.

- [Plans to test with the Public Safety Community \(PSAP's\)](#)

Farmers Cellular will schedule this testing with the PSAP centers during its network testing. Farmers Cellular will work with Nortel to identify PSAPs that would be willing to test an end-to-end solution.

- [Carrier Testing activities](#)

Testing will begin upon receipt of software.

- [Retail Availability](#)

Farmers Cellular is dependent upon the availability of handsets from vendors.

- [Geographic scope of network infrastructure deployment](#)

Farmers Cellular will test the four PSAPs in our geographic area when the software is available.

Farmers Cellular remains committed to meeting the FCC's tentative mandate to provide E911 TTY access to our network. The software to support IS-823 has been delayed, but Nortel's newly-scheduled release date should still allow compliance. Nortel will not support 50-baud TTY for their first release.

Leap Wireless
Cricket Communications

TTY Status Report
April 9, 2002

Leap provides Cricket wireless service using CDMA digital technology in 40 markets in 20 states. Leap uses three infrastructure switch vendors: Lucent, Ericsson and Nortel. Leap intends to meet the June 30, 2002 compliance date for TTY/911 compatibility. While the majority of network upgrades have been completed, neither network nor handset testing has been initiated. We expect that testing will be completed prior to the June 30 compliance date.

Network Infrastructure

Upgrades to the Lucent and Nortel portions of Leap's network are complete.

Ericsson Release 8.6 is scheduled for the end of April.

Handsets

TTY-compatible Nokia handsets will be available for sale in every Cricket market.

Midwest Wireless Holding L.L.C
TTY Status Report
March 28, 2002

Background

Midwest Wireless Holdings L.L.C. is a rural wireless carrier that operates TDMA digital cellular service in its Minnesota, Iowa and Wisconsin markets. Midwest must rely on its switching vendor, Nortel Networks, to provide the necessary switch software, and the capabilities of our two primary handset providers Nokia and Motorola, in order to meet compliance requirements.

Status

Midwest Wireless reported in its status reported dated December 19, 2001, that it would not be in compliance with the 12/31/01 software capability deadline because it would not be able to install the required switch software until late 1st or early 2nd qtr. 2002. The Nortel load (MTX 10), that contains the compliant software, is currently scheduled for installation at the end of May 2002.

We have been informed the Nokia 6360 TDMA handset, which will support the digital TTY mandate, and has been tested in the Nortel lab for compliancy, will be generally available in April 2002. Midwest Wireless has that model on hand, and will test compliance in its network immediately following the installation of the MTX 10 software load.

Midwest Wireless plans to be compliant by the deadline, provided no unforeseen problems occur during the network testing phase.

Respectfully submitted
Gary Christopherson
Director, External Relations & Regulatory
507-385-2597

April 9, 2002

Via Electronic Mail and Federal Express

Ed Hall
The Alliance for Telecommunications Industry Solutions
1200 G Street, NW
Suite 500
Washington, DC 20005

Dear Mr. Hall:

Motorola is pleased to submit a status report related to our efforts at attaining TTY compatibility with our digital phones and infrastructure. Motorola is a domestic supplier of cellular handsets in TDMA, CDMA, GSM, and iDEN technologies. We also provide infrastructure equipment in CDMA and iDEN technologies.

We are working closely with our carrier customers to provide them with the equipment necessary to meet the Federal Communications Commission's June 30, 2002 TTY deployment deadline. At this time, we are on track to enable these carriers to meet their obligations.

The attached report is provided to the TTY Forum for its report to the Commission for the first quarter of 2002. Please contact me at the number below if you have any questions.

Regards

Alfred R. Lucas
Vice President and Director
Office of Access Excellence
Motorola
Voice: 561-739-2505
TTY: 561-730-2506

Enclosure

MOTOROLA
TTY COMPATIBILITY DEVELOPMENT STATUS REPORT
1st Quarter 2002

Product	Standard	Status	Milestones	Progress
CDMA Handset	IS 127-3 IS 733-2	Carrier Testing	IOT: June 2001 UI: October 2001 ROM: December 2001 SA: May 2002	Handsets tested on Motorola and Lucent infrastructure. Testing planned on Nortel infrastructure. Tests on handsets conducted by two carriers.
GSM Handset	TS 26.226 TS 26.230 TR 26.231	Carrier Testing	UI: October 2001 IOT: October 2001 ROM: January 2002 SA: June 2002	Handsets tested on Ericsson, Nortel, & Siemens infrastructure. Tests conducted by one carrier; additional carrier testing planned in 2 nd quarter.
iDEN Handset		Carrier Testing	Production handsets available to carriers	Handsets tested by Carrier during December 2001 FOA. Handset work complete.
TDMA Handset	IS 823-A IS 840-A	Carrier Testing	IOT: September 2001 UI: September 2001 ROM: October 2001 SA: April 2002	Handsets tested on Ericsson and Nortel infrastructure. Handsets tested by two carriers. PSAP testing scheduled in April.
CDMA Infrastructure	IS 127-3 IS 733-2	Carrier Testing	FOA Jan 02 Software release available	Infrastructure software tested with handsets from six manufacturers. Carrier testing underway.
iDEN Infrastructure		Carrier testing and deployment	Production software available to carriers	Carrier FOA complete. Infrastructure software ready for carrier roll-out.

Note: Motorola works with its carrier customers to provide them specific information related to their respective products.

Note: IOT is Inter Op Testing with RAM based parts for Character Error Rate testing
 UI is User Interface testing with HCO / VCO support
 ROM is the availability of ROM based phones. These should be functionally identical to a RAM phone.
 SA is Ship Acceptance of production volume quantities

Al Lucas
 Office of Access Excellence
 Motorola
 Phone: 561-739-2505
 TTY: 561-739-2506



Nextel Communications, Inc.
2001 Edmund Halley Drive, Reston, VA 20191

April 8, 2002

Via Electronic Mail and Federal Express
Megan Hayes
The Alliance for Telecommunications Industry Solutions
1200 G Street, NW
Suite 500
Washington, D.C. 20005

Re: Nextel Communications, Inc. Fourth Quarter 2001 Report to the TTY Forum

Dear Ms. Hayes:

Pursuant to the Fourth Report and Order of the Federal Communications Commission (“Commission”) in CC Docket No. 94-102,³ Nextel Communications, Inc. (“Nextel”) hereby submits this report on the status of its efforts to attain TTY accessibility on Nextel’s iDEN handsets and network. Working closely with its vendor, Motorola, Inc. (“Motorola”), Nextel is pleased to report that its TTY accessibility progress continues to move ahead in a timely manner. Pursuant to this schedule, Nextel intends to fulfill the Commission’s June 30, 2002 TTY deployment deadline.

Nextel is a provider of digital Commercial Mobile Radio Services using Motorola’s iDEN technology. Nextel is one of only two such iDEN providers in the United States. Thus, Nextel has worked closely with Motorola in the research and development of a TTY compatibility solution for the iDEN product and network. Since the Telecommunications Industry Association (“TIA”) approved the Lucent solution for providing TTY accessibility on digital networks, Motorola has invested significant time and resources in creating a solution that will provide the same accessibility on iDEN networks.⁴

As we reported in January of this year, Motorola and Nextel completed successfully lab testing of the TTY-capable iDEN handset and network infrastructure last year, and followed that testing with a successful First Office Application (“FOA”) test of the TTY capabilities in Irvine, California in December 2001. The FOA, which resulted in no significant “bugs” or other problems with either the handset or network TTY functionalities, tested a broad range of TTY call scenarios. Nextel tested TTY mobile-to-mobile calls (using Nextel mobiles as the originating and terminating units), land-to-TTY mobile calls and TTY mobile-to-land calls. Additionally, Nextel tested its numerous other features and functionalities, e.g., call waiting, call

³ *In the Matter of Revision of the Commission’s Rules to Ensure Compatibility with Enhanced 911 Calling Systems*, Fourth Report and Order, CC Docket No. 94-102, FCC 00-436, released December 14, 2000 (“Fourth R&O”).

⁴ See, e.g., Fourth R&O at para. 3.

forwarding, to ensure proper functioning with the TTY device. All of these test calls were successful. Finally, Nextel's FOA tested the Hearing Carry Over ("HCA") and Voice Carry Over ("VCO") capabilities of the iDEN TTY handset and network. These tests also yielded successful results.

Having deployed the TTY network infrastructure in Irvine, California for the FOA test in December, Nextel immediately began deploying the infrastructure components in its New York Market for a Second Office Application ("SOA") in January 2002. The SOA completed in January, at which time Nextel began full nationwide deployment of the TTY infrastructure in its network components. This deployment process will be completed in May. In the interim, however, Nextel plans to test a TTY call end-to-end with a Phase I capable Public Safety Answering Point ("PSAP"). Nextel plans to conduct this end-to-end test in April, working with a Phase I capable PSAP in a market where the TTY capability is fully deployed in Nextel's network. Additionally, this testing will include making TTY calls from a Nextel mobile unit to another carriers' mobile unit to verify successful inter-carrier operations.

Nextel is pleased to report that its efforts to timely deploy the TTY capability by June 30, 2002 continue on schedule. Additionally, all testing to date has produced successful results. Nextel appreciates the opportunity to provide this report to the TTY Forum as part of the forum's quarterly TTY report to the Commission. If you have any questions about this report, please do not hesitate to contact me at 703-433-8315.

Sincerely,

Robert D. Montgomery
Senior Manager – Regulatory Technology Development



FOR EXTERNAL USE

NOKIA Americas Standards

October 10, 2001

Submitted by:

Chris Wallace

V.P. Nokia Americas Standards

Nokia Status Report to TTY Forum #21 – March 2002

Nokia manufactures mobile phones for wireless technologies; AMPS, TDMA, CDMA and GSM; at both 800 and 1900MHz. Some phones are also developed with multiple technologies in an individual handset. Nokia also supplies network infrastructure for GSM carriers.

Nokia is currently developing FCC compliant TTY Compatibility in seven new phone programs with specific models having CDMA, TDMA, GSM and AMPS.

Nokia is committed to meet FCC deadlines for digital TTY according to industry standards set and agreed to.

HARDWARE SOLUTIONS:

Nokia continues to develop mobile handset products to support TTY/TDD Compatibility with TSB-121 three-pin headset functions. Other handset projects will have a built-in 2.5mm jack four-conductor "Stereo" connection in the handset body; with adapting interconnect cables to comply with TIA/EIA TSB-121.

As has been raised as an issue in the TTY Forum, Nokia remains concerned by the potential issues associated with inconsistencies introduced into the TTY environment from the use of after-market cables. Nokia also remains concerned about issues associated with the consistent implementation of TSB-121 by all parties in the TTY solution. Nokia has participated in the resolution of these concerns and is confident that the eventual outcome will be satisfactory.

MOBILE TERMINAL SOFTWARE SOLUTIONS:

CDMA

Nokia CDMA Products are developed by Nokia's San Diego facility

Six to eight models are under development for TTY Compatibility.

Participated in TTSI sponsored tests with mixed results.

Continuing to test with infra vendors with improved performance.

Nokia recently announced three models of phones with TTY capability

Cdma2000 1x 6370, which will be available in 2Q2002

Cdma2000 1x 6385, which will be available in 2H2002

Cdma2000 1x 3585, which will be available in 2H2002



FOR EXTERNAL USE

NOKIA Americas Standards

October 10, 2001

Submitted by:

Chris Wallace

V.P. Nokia Americas Standards

TDMA

Five to seven models are being developed for TTY Compatibility.

Nokia participated in both TTSI sponsored tests with good results.

Lab testing continues with the major Infrastructure with the excellent results.

Lab testing continues Carriers

First TDMA TTY compatible phone was announced in early November 2001 – Nokia 6360

GSM

Lab testing continues with the major Infrastructure with the excellent results.

Lab testing continues Carriers

Nokia recently announced 2 TTY compatible phones

GPRS 6590, which will be available in 2Q2002

GPRS 3590, which will be available in 3Q2002

Respectfully Submitted By:

Chris Wallace

V.P. Nokia Americas Standards

Douglas W. Neeley

Sr. Technical Standards Eng.

(202) 887-0145

Leo Fitzsimon

Government Affairs

CDMA TTY/TDD Regulatory FAQ/RFI

Enclosed is information regarding Nortel Networks' plans to deliver TTY solutions to market in support of CDMA service providers ability to meet FCC TTY milestone objective.

- What is the status of TTY/TDD network infrastructure **software/hardware development and testing**?

Nortel Networks response: Nortel Networks' development and product test is based on current standards: IS-127-2 (EVRC) & IS 733-1 (13K Vocoder). New revisions of these standards namely IS-127-3 (EVRC TTY) & IS-733-2 (13K TTY) have been published as of September 2001. Nortel Networks plans to support this new addendum to the standards in our next scheduled software release; MTX11/NBSS11 is scheduled to be GA Q4 2002. Operators will be able to deploy the Nortel Networks TTY solution based on the current standards IS-733-1, IS127-2 to meet the FCC deadline for implementation. Nortel Networks has completed internal testing using prototype and recently using commercial mobile handsets with TTY capabilities from only a few vendors, which have all shown positive results. Nortel Networks does not anticipate performance issues with any other vendor's handsets once they come available. Nortel Networks has also performed tests with a leading manufacturer of TTY/TTD PSAP equipment to ensure interoperability. Results of that specific testing were found to be positive.

- What is Nortel Networks TTY/TDD plans to test and confirm solution performance including additional tests referenced in Sections 20-23 of the **FCC 4th Rule and Order 12-14-2000**?

Nortel Networks response: Regarding Section 20-23, TurboCode and HiSpeed is each a proprietary feature of TTY device vendors Ultratec and Ameriphone, respectively. Due to the code being proprietary Nortel Networks will not test or support these enhanced solutions. Standards are designed to avoid supporting proprietary methods, and Nortel Networks is not aware of any effort to standardize these proprietary features. The FCC does not require vendors to support TTY enhanced signaling.

- What are the **hardware baseline and software baseline** to support CDMA TTY/TDD functionality?

Nortel Networks response:

Regulatory solution required	CDMA HW/SW baseline
TTY/TDD	MTX09 SW (DMS-MTX) NBSS10.1.2 SW (BSS) TTY capable handsets (3 rd party)

- What **software baseline** must the MTX be running in order to upgrade to MTX10 and/or NBSS10.1.1?

Nortel Networks response: The MTX is required to be running MTX09 in order to upgrade to MTX10 and/or NBSS10. Nortel Networks has always maintained an allowance for CSP or Communication Services Platform "jumps" from MTX release to MTX release. The MTX has received significant changes due to moving to a multi-processing architecture. It is because of the new CSP14 layer of the MTX10 release that an MTX cannot upgrade safely from MTX08 directly to MTX10.

CDMA TTY/TDD Regulatory FAQ/RFI

- What is the Network infrastructure software/hardware **planned general availability dates** that support the deployment of this regulatory feature?

Nortel Networks response: In order to allow Carriers to comply with the FCC's June 30, 2002 requirement for TTY/TDD implementation, Nortel Networks current plan for the enabling software full availability is:

Software load	CDMA SW general availability
MTX09	Now Available
NBSS10.1.2 with MTX09	January 25, 2002*
MTX10 CDMA – not req'd	December 07, 2001 –Now Available

* To date all Nortel Networks customers who have scheduled a MTX10/NBSS10.1 upgrade have the ability to become fully compliant to the FCC TTY/TTD mandate prior to the June 30, 2002.

- How is the software/hardware for TTY/TTD **subscribers provisioned** in the network?

Nortel Networks response: The provisioning for TTY must be done the same way as for the voice subscribers.

- What is the **schedule for deployment** of the software/hardware in the network?

Nortel Networks response: The minimum baseline software requirements for this functionality are given above. For questions related to scheduling its deployment into a carrier's network, please contact Nortel Networks Product Deployment. All those CDMA customers who have ordered and scheduled for NBSS10.1.2 upgrade are currently showing plans for full network NBSS upgrade prior to June 30, 2002.

Nortel Networks recommends that all customers who have not yet ordered and scheduled upgrade to NBSS10.1.2 contact Nortel Networks to ensure software upgrade prior to June 30, 2002.

- For TTY/TDD what are the plans to work with any wireless carrier to perform **end-to-end customer tests**, and when will this occur?

Nortel Networks response: The verification process for NBSS 10.1 with the customer began in June 2001. Nortel Networks had recommended that operators engage their chosen CDMA TTY handset vendor during the verification process or VO process to participate in interoperability testing with the Nortel Networks solution. As of November 1st, 2001 TTY capable handsets had recently been acquired by all of our CDMA service provider VO partners. Due to the lateness of the terminals availability, Nortel Networks was unable to verify the interoperability of the TTY feature with the entire NBSS10.1.1 load in time for the planned GA date. Since that time Nortel Networks has created a "maintenance" NBSS load, NBSS 10.1.2, that will correct some minor performance issues, TTY fixes are also included. **The NBSS10.1.2 software release, which includes the TTY/TTD solution, has been fully verified within one or more of our lead customer's live networks.** The Nortel Networks TTY/TTD solution showed TCER of less than 1% in most cases and marginally exceeded 1% TCER is only the most strenuous RF and TTY/TTD test conditions. Nortel Networks used several different TTY mobile terminals during these test activities. Please note the 1% TCER is not part of the FCC mandate.

CDMA TTY/TDD Regulatory FAQ/RFI

All verification activities were dependent upon the availability of commercial grade CDMA TTY/TTD handsets.

- What are Nortel Networks plans to test their own or other vendor handsets with your switch solution?

Nortel Networks response: Nortel Networks provides only infrastructure for wireless networks. Nortel Networks does not provide mobile handsets. Nortel Networks infrastructure software, namely NBSS10.1, was available in June 2001 for scheduled external end-to-end customer testing. This testing activity was scheduled to complete in advance of the Dec 31, 2001 FCC requirement. Our lead verification customers did not acquire commercial grade TTY handset until much later in the test window. Nortel Networks recommends that the operator engage its handset vendor(s) in order to respond to the FCC regarding handset availability.

Operators are encouraged to request their handset vendors to test their commercial grade CDMA TTY capable handsets in Nortel Networks Wireless Interoperability Test Lab.

Please contact Cher Bruce for scheduling TTY testing in the Nortel Networks Wireless Interoperability Test Lab, where testing is based on current published standards (Phone: 972-684-2299; Fax: 972-684-3881; csbruce@nortelnetworks.com)

- **Contacts:**

Product Marketing	MTX10/NBSS10.1 SW	Kurt Raaflaub	(972) 685-2971
Product Management	CDMA TTY/TDD	Maniam P	(972) 685-7203
Regulatory	E911Ph2&TTY/TDD	Charles Spann	(903) 852-6798
Product Deployment	CDMA NBSS SW	Mark Schwarzer	(972) 685-5851

Nortel Networks Solution Status- April 10th, 2002

Overview

Nortel Networks TTY Solution for GSM network consists of software for the BSS (applied on the Transcoding Unit (TCU)) and the Mobile Switching Center (MSC).

The TTY software for the BSS is currently being validated at a customer site and should be commercially available by the beginning of May 2002. This software has undergone extensive testing with different TTY terminals and devices in our R&D facilities in France.

The final release of the TTY Software for the MSC (to support circuit pooling) is being validated at a customer site and will be available at the same time as the BSS software release.

Nortel Networks customer support groups have put in comprehensive plans to enable a smooth and expeditious rollout of the TTY software across customer networks so as to meet the FCC deadline.

Summary of Inter-Operability Testing and Results

Nortel Networks has completed exhaustive inter-operability testing with several TTY terminals and device vendors.

- **Motorola (TTY devices used: Q90 Ameriphone, Compact Ultratech, Ezcom Pro Ultratech)**
- **Ericsson (TTY devices used: Q90 Ameriphone, Compact Ultratech)**
- **Nokia (TTY devices used: Q90 Ameriphone, Compact Ultratech)**

Nortel Networks is pleased to report that all the testing performed in our labs so far has demonstrated character error rates in compliance with the target 1% error rate or less and in most cases better than the target 1% error rate or less.

These results were obtained using the Gallaudet Tools suite as well as a multi-path fading simulator.

Please direct all queries to-

GSM Americas PLM	Vineet Nargolwala	(972)-685-7285
Regulatory	Charles Spann	(903)-852-6798

TDMA TTY/TDD Regulatory FAQ/RFI

Enclosed is information regarding Nortel Networks' plans to deliver TTY solutions to market in support of TDMA service providers ability to meet FCC TTY milestone objective.

- What is the status of TTY/TDD network infrastructure **software/hardware development and testing**?

Nortel response: Nortel Networks' TDMA TTY/TDD functionality is compliant to IS-823A (TTY/TDD Extension to TIA/EIA 136-410 Enhanced Full Rate Speech Codec) for the EFRC Codec. The development and internal product testing are now complete and end-to-end system verification is being performed. Nortel Networks has tested this feature with alpha/beta handsets from a few major vendors, which have all shown positive results. We have also received TTY capable mobile handsets containing commercial TTY software from major vendors, which have shown excellent interoperability test results. Nortel Networks has also performed tests with a leading manufacturer of TTY/TTD PSAP equipment to ensure interoperability. Results of that specific testing were found to be positive.

Nortel Networks plans to support new and evolved standards in next year's software releases. Operators will be able to deploy the Nortel Networks TTY solution i.e. MTX10, which is based on the current IS-823A standard, to meet the FCC deadline for implementation.

- What is Nortel Network's TTY/TDD plans to test and confirm solution performance including additional tests referenced in Sections 20-23 of the **FCC 4th Rule and Order 12-14-2000**?

Nortel response: Regarding Section 20-23, TurboCode and HiSpeed is each a proprietary feature of TTY device vendors Ultratec and Ameriphone, respectively. If TDMA standards are enhanced to support these devices, Nortel will support this in a future release. Standards are designed to avoid supporting proprietary methods, and Nortel Networks is not aware of any effort to standardize these proprietary features. The FCC does not require vendors to support TTY enhanced signaling.

- What are the **hardware baseline and software baseline** to support TDMA TTY/TDD functionality?

Nortel response:

Regulatory solution required	TDMA HW/SW baseline
TTY/TDD	EDSPM SW for the ICP; MTX10 SW for the DMS-MTX TTY capable handsets (3 rd party)

- What **software baseline** must the MTX be running in order to upgrade to MTX10?

Nortel response: The MTX is required to be running MTX09 in order to upgrade to MTX10. Nortel Networks has always maintained an allowance for CSP or Communication Services Platform "jumps" from MTX release to MTX release. The MTX has received significant changes due to moving to a multi-processing architecture thus the CSP layer has evolved to CSP14. It is because of this very different CSP14 layer of the MTX10 release that an MTX cannot upgrade safely from MTX08 directly to MTX10.

TDMA TTY/TDD Regulatory FAQ/RFI

- What is the Network infrastructure software/hardware **planned general availability dates** that support the deployment of this regulatory feature?

Nortel response: In order that Carriers may comply with the FCC's June 30, 2002 requirement for TTY/TDD implementation, Nortel Networks has made TTY/TDD enabling software available as follows:

Software load	TDMA SW general availability
MTX10 TDMA (incl. DSPM)	December 07, 2001* - Now Available

* In late January 2002 Nortel Networks made generally available as part of it's standard MTX10 TTY/TTD offering an improved TTY/TDD solution e.g. Auto baud capabilities, improved total character error rate (TCER). This new maintenance DSPM load was also made available to those customers who received the original MTX10/DSPM software prior to this new version's January release. To date all Nortel Networks customers who have scheduled a MTX10 upgrade have the ability to become fully compliant to the FCC TTY/TTD mandate prior to the June 30, 2002.

- For TTY/TDD what are the plans to work with any wireless carrier to perform **end-to-end customer tests**, and when will this occur?

Nortel response: The verification process for MTX10 with the customer began in August 2001. Nortel had recommended that the operator engage their chosen TDMA TTY handset vendor during the verification process or VO process to participate in interoperability testing with the Nortel Networks solution. After much delay our service provider VO partners have acquired TTY capable handsets. **The TTY feature has now been fully verified within a lead customers live network.** The Nortel Networks TTY/TTD solution showed TCER of less than 1% in most cases and marginally exceeded 1% TCER is only the most strenuous RF and TTY/TTD test conditions. Nortel Networks used several different TTY mobile terminals during these test activities. Please note the 1% TCER is not part of the FCC mandate.

Operators are encouraged to request their handset vendors to test their commercial-grade TDMA TTY capable handsets in Nortel's Wireless Interoperability Lab.
All verification activities were dependent upon the availability of commercial-grade TDMA TTY/TTD handsets.

- What is the **schedule for deployment** of the software/hardware in the network?

Nortel response: The minimum baseline software requirements for this functionality are given above. For questions related to scheduling its deployment into a carrier's network, please contact Nortel Networks Product Deployment. The few TDMA customers who have ordered and scheduled an MTX10 upgrade are currently showing full network upgrade prior to June 30, 2002.

Nortel Networks recommends that all customers who have not yet ordered and scheduled upgrade to MTX10 contact Nortel Networks to ensure software upgrade prior to June 30, 2002.

March 29, 2002

TDMA TTY/TDD Regulatory FAQ/RFI

- What are Nortel Network's plans to **test their own or other vendor handsets** with your switch solution?

Nortel response: Nortel Networks provides only infrastructure for wireless networks. Nortel Networks does not provide mobile handsets. Nortel Networks infrastructure software, namely MTX10, was available in August 2001 for scheduled external end-to-end customer testing. This testing activity was scheduled to complete in advance of Dec 31, 2001. Our lead verification customers did not acquire commercial grade TTY handset until much later in the test window. Nortel Networks recommends that the operator engage its handset vendor(s) in order to respond to the FCC regarding handset availability.

Operators are encouraged to request their handset vendors to test their commercial grade TDMA TTY capable handsets in Nortel's Wireless Interoperability Test Lab. To date very few Nortel Networks customers have tested their choice of TTY/TTD enabled mobile handsets with the Nortel Networks solution.

Please contact Gerry Chaparro for scheduling TTY testing in the Nortel Networks Wireless Interoperability Test Lab, where testing is based on current published standards (Phone: 972-684-4622; Fax: 972-684-3881; <mailto:chaparro@nortelnetworks.com>)

- **Contacts:**

Product Marketing	MTX10 SW	Kurt Raaflaub	(972) 685-2971
Product Management	TDMA TTY/TDD	Doug Kinnaird	(403) 769-8461
Regulatory	TTY/TDD	Charles Spann	(903) 852-6798
Product Deployment	MTX/NBSS SW	Mark Schwarzer	(972) 685-5851

*Pine Belt Cellular, Inc.
3984 County Road 32
P. O. Box 279
Arlington, Alabama 36722*

TTY Report – March 5, 2001

Pine Belt Cellular, Inc. is completely reliant upon its vendors to implement the TTY solutions in its handsets and network. Pine Belt does not have the ability to independently verify the release dates of the solutions that will be provided by the vendors.

1.) Network infrastructure software development:

Lucent Technologies, our switch and infrastructure manufacturer is aware of the TTY requirements. Our understanding is that Lucent is currently working on software solutions at this time. Pine Belt is dependent upon Lucent providing these solutions.

2) Handset development and testing plans:

Pine Belt Cellular uses handsets made by a number of manufacturers. The manufacturers most predominantly used by Pine Belt are Motorola, Nokia, and Kyrocera. Pine Belt will stay abreast of the developments by these manufacturers so when TTY solutions are made available, we will be able to provide these units to our customers as soon as possible.

3) Beta testing and lab testing:

Pine Belt Cellular will begin testing TTY compatible equipment as soon as both our handset and infrastructure manufacturers provide solutions to us.

4) Release and general availability to carriers of network infrastructure software

Pine Belt Cellular is awaiting updated reports of software availability from switching and infrastructure vendors.

5) Availability to carriers of full acceptance test units:

Pine Belt Cellular is awaiting software and hardware availability from switching, infrastructure, and handset vendors.

6) Efforts toward achieving digital wireless solution compatibility with enhanced TTY devices:

Pine Belt Cellular remains dependent upon the availability of vendor provided solutions to meet the FCC's tentatively mandated timeline (12-31-01) to provide E911 TTY access to our networks.

7) Carrier coordination of testing with PSAP:

This testing target date is dependent upon solutions provided by network infrastructure vendors and handset vendors.

8) Carrier testing activities, including field testing, consumer end-to-end testing, and other necessary tests:

Testing will begin immediately upon receipt of software and hardware. Pine Belt Cellular is dependent upon network infrastructure vendor solutions.

9) Retail availability of necessary consumer equipment:

Pine Belt Cellular is dependent upon the availability of handsets from vendors. No firm commitment has been received at this time from handset vendors.

10) Geographic scope of network infrastructure deployment:

Pine Belt Cellular service area: Alabama RSA3B2 & BTA415

TTY Forum #21 Carrier Status Report

April 10, 2002

Rural Cellular Corporation for itself and its affiliates (collectively "RCC")

1. Network Infrastructure Software Development

TDMA Networks: RCC utilizes TDMA infrastructure from Lucent, Ericsson and Nortel. RCC is relying on these three infrastructure vendors to complete software development.

GSM Network: RCC is currently evaluating options for TTY support over GSM.

2. Handset Development and Testing Plans

RCC is relying on its handset vendors for the development and testing of TTY capable handsets. RCC is currently contacting its handset vendors to determine the availability of handsets for testing. Once, RCC has handset available for testing and all software upgrades are completed, it will perform field tests in accordance with the Loeber and Walsh test plan submitted to the TTY Forum.

3. Beta Testing and Lab Testing

Once TTY capable software is in place and handsets are available, RCC will begin field tests.

4. Release and General Availability to Carriers of Network Software

RCC's infrastructure vendors have stated that the software releases to support TTY capability should be available by June 2002.

5. Availability to Carriers of Full Acceptance Test Units

RCC is waiting for commitments from its handset vendors for the date that they will have full acceptance test units available.

6. Efforts Towards Achieving Digital Wireless Solution Compatibility with Enhanced TTY Devices

RCC is working with its vendors and now with the TTY Forum to achieve a standard to support enhanced TTY devices.

7. Carrier Coordination of Testing with PSAP

RCC will conduct TTY testing with any PSAP that requests testing.

8. Carrier Testing Activities, Including Field Testing and Consumer End-To-End Testing

RCC will conduct consumer end-to-end testing after acceptable handsets and infrastructure software upgrades are in place and tested.

9. Retail Availability of Necessary Consumer Equipment

Retail availability is uncertain at this time.

10. Geographic Scope of Network Deployment

RCC is proceeding on a path that assumes it will be able to meet a June 30, 2002 deployment deadline.

Siemens TTY Report April 10th, 2002

Siemens is investing a significant amount of effort in order to comply with the FCC requirement to support E911 calls made from TTY devices on wireless digital networks.

Network Implementation

Siemens is supporting a BSS based TTY solution. This is a “Transcoder Pooling” solution now referred to as “CTM circuit pooling solution”. This solution may be implemented as an external network element on the A- interface or integrated within the TRAU. The Siemens solution will not impact the existing vocoders already deployed and supported by Siemens.

Siemens received the first prototype unit (including the necessary hardware and software) and has completed the internal system testing at our lab in Boca Raton, FL. Currently our TTY solution has been deployed to our customer lab for network and interoperability testing. This testing is scheduled to start in the second half of April 2002.

Handsets Implementation

Siemens Handset group will support TTY in 2002. Siemens will support TTY/CTM via an accessory cable and the handset will support the GSM bearer bit capability for signaling from the handset to the network.

Respectfully submitted,
Ilan Vardi
Siemens

Sony Ericsson Mobile Communications

TTY Forum #21 Report

April 09, 2002

This report details the verbal presentation provided by Sony Ericsson Mobile Communications at the March 05, 2002 TTY Forum 21. The attached report identifies development and testing status for handset products, release and general availability dates, efforts towards achieving compatibility with TTY devices, system testing, deployment activities, technical issues, and contact information.

Sony Ericsson has completed the development of TTY technology intended for integration within its products. These products are built to the approved relevant standards. The release of acceptance products to the carriers has been completed. In general, the technical feasibility to transport TTY across the digital wireless systems has been proven by the product operability testing. Sony Ericsson has prepared field test, interoperability test, and final product verification test groups with TTY test capability. Interoperability testing is being conducted within Sony Ericsson, and within the industry test events of TTSI within ATIS

Isolated technical flaws and system integration issues continue to be identified during tests of TTY products and systems. The isolation and resolution of these issues continues to require the development of new test techniques, test software and test systems. Tests have been developed to identify conformance to IS-840 MPS (Minimum Performance Specifications), minimum TTY bit duration test vectors, stop bit duration test vectors, PSTN signal quality capture fixtures, open source code Gallaudet test software, and recently released DSPG/HITEC TTY test software. These tools have made it possible to identify several failure mechanisms of PSAP and TTY units to TIA/EIA IS-825 Baudot modem TTY standard, V.18 international TTY signaling to PSAP devices, and test vector failures of PN1663 compliant PSAP equipment. Sony Ericsson has taken an active role in assisting in the refinement of TTY terminal technologies with Ultratec, Ameriphone, and DSPG.

While handset to infrastructure compatibility testing has taken place between several manufactures, test results continue to indicate interoperability issues. Improvements in TTY equipment via flash code updates, DSPG test software tools, and Industry participation in TTSI test events have lead to a huge improvement in TTY test results and system validation. Validation and test vector testing have shown remarkable performance of many digital wireless infrastructures to the limits of TTY standards. Many PSAP equipment devices have not demonstrated the ability to operate within the tolerances of published TTY standards. Resolution of the remaining issues will require the involvement and cooperation among the manufacturers, carriers, 911 PSAP facilities, standards organizations, and governing bodies. Sony Ericsson continues to actively develop and test existing and new TTY compatible products, participate and monitor the industry standards and test events, and work closely with the regulatory bodies and the ATIS Incubator. Sony Ericsson is closely monitoring the data generated by TTSI to determine compliance to the FCC mandated 1% TTY character error rate.

1. Network Infrastructure Compatibility Evaluation :

TDMA Status:

Sony Ericsson has tested the compatibilities of infrastructures, by testing handsets with Lucent, Nortel, Ericsson, and others infrastructures. The Sony Ericsson T61D TDMA handset appears to function with most infrastructure systems, with outstanding performance. Numbers of stationary test runs have been conducted with Ericsson and Lucent infrastructure with multiple TTY devices. TDMA handsets have been shown to perform regardless of typing speed, or the gap between the characters. Demonstrations of internal and external HCO/VCO solutions have demonstrated high quality audio transport. Several issues with carrier configurations, and system messaging have been observed. Calls to PSAP destinations have met with mixed testing results. Subsequent vector testing showed TDMA infrastructure performed well under different bit duration and stop bit duration tests, but that certain PSAP equipment failed to accept vectors designed to test tolerances defined within the TTY standards.

GSM Status:

Sony Ericsson has tested the development of infrastructures, by testing GSM handsets with Ericsson, Nortel, and Nokia and others infrastructures. The results have been outstanding in stationary and driving conditions. New products that incorporate higher impedance TSB-121 interfaces, and newly released HCO VCO products like the Ameriphone Q.90D have produced excellent results. Subsequent vector testing showed GSM infrastructure performed well under different bit duration and stop bit duration tests.

CDMA Status:

Sony Ericsson has tested the compatibility of infrastructures to validate CDMA handsets, with Ericsson, Lucent, and others infrastructures. The test influence of infrastructure on handset validation has been significant. Sony Ericsson has been unable to produce valid test results since February 2002 on Lucent infrastructure. While these performance issues are being addressed, Sony Ericsson has taken steps to put Ericsson CDMA infrastructure in place at RTP. Sony Ericsson has also pressed its component supplier to work more closely with CDMA infrastructure manufacturers, to validate chipset performance.

2. Handset Development and Testing Plans:

Sony Ericsson TTY terminal products have completed development. Test data has been generated for CDMA, TDMA, and GSM products. Handsets are available for manufacturer and carrier interoperability testing, and have been used at TTSI test events. T60C CDMA, and T61Z GSM handsets are commercially available.

TDMA Status

TTY development is complete. The handset performance received an excellent response. The handset is in the final release stage of development.

TDMA Plans

Carrier acceptance test units with the final user interface were released. Additional units for a field trial with Gallaudet were delivered in March.

GSM Status

GSM development is complete. Final infrastructure testing is nearly complete.

GSM Plans

T-Link adapters are available in the Special Needs Center (www.ericsson-snc.com). Additional product development plans are in process.

CDMA Status

There are performance issues with several test cases, which currently cannot be isolated until infrastructure is in place that performs to acceptable levels.

CDMA Plans

Product improvements and new product plans are in process

3. Availability to Carriers of Full Acceptance Test Units:

- *TDMA handset Model T61D released for carrier testing in February 2002*
- *GSM handset Model T61z customer shipped in March 2002*
- *CDMA handset T60C customer shipped in March 2002.*

4. Efforts Toward Achieving Digital Wireless Solution Compatibility with Enhanced TTY Devices.

Sony Ericsson continues to work very closely with all manufacturers and carriers on the TTY compatibility mandate. TTY manufacturers have recently released flash chip updates and new products, that isolate and resolve issues with the default setting for high speed and turbo modes, the TTY interrupt feature, auto power off, and other interfering features to digital wireless. Sony Ericsson has taken delivery of new TSB-121 cables from TTY manufacturers. Sony Ericsson has also evaluated new TSB-121 compliant TTY products.

5. Testing and Deployment Activities

Sony Ericsson is working with the operators/carriers in the test and deployment of network infrastructure systems. In addition Sony Ericsson is working with the ATIS Incubator (TTSI), which continues to hold test events.

6) Risks:

At the TTY Forum 21 Sony Ericsson reported that TTSI had accepted an action item to require forced mute in both the handset and the network. Subsequent testing continues to validate the performance improvements of this feature. Currently Sony Ericsson is working to identify PSAP and interoperability issues through the creation of specific test cases that identify the nature of remaining issues. These test vectors are showing dramatic results in isolating the root cause of interoperability issues. Significant PSAP issues continue to exist.

Please feel free to contact either Matt Kaltenbach or Steve Coston if you have any question regarding this report, or wish to contact test or product interfaces. Please contact your local customer interface for product sales and marketing information.

Southern LINC® TTY Status Report 1st Quarter 2002

Southern LINC hereby submits its status report for 1st Quarter 2002 in accordance with the reporting requirement contained in the Federal Communications Commission's *Fourth Report and Order* in CC Docket No. 94-102. Southern LINC continues diligently to pursue compliance with the FCC's TTY requirements. Based upon the information it has received from Motorola, its sole vendor, Southern LINC is currently of the belief that its customers will be able to utilize the full TTY solution by June 30, 2002.

Development Activities: Southern LINC continues to communicate with Motorola regarding the development status of TTY capability for iDEN networks.

Testing and Deployment Activities: With regard to TTY-capable iDEN handsets, Motorola completed the necessary development and integration work, and Southern LINC began selling TTY-capable handsets to its customers in 2001. On the network side, Southern LINC has received the software upgrades required to provide TTY calling capability on an iDEN system and is in the final stages of installing those upgrades. It is Southern LINC's intention to test the complete iDEN TTY solution in the May 2002 timeframe. For testing purposes, Southern LINC plans to utilize the *Tools for Field Testing TTYs with Wireless Telephones*. The testing will incorporate various call scenarios to validate the performance of the iDEN TTY solution on Southern LINC's network. Southern LINC also plans to test the TTY solution by placing calls to a PSAP to ensure 911 calling capability, and it has made arrangements with a local PSAP for that purpose (Calhoun County, AL 9-1-1). It is Southern LINC's understanding, however, that industry field-testing under the auspices of the Alliance for Telecommunications Industry Solutions-sponsored TTY Technical Standards Implementation (TTSI) Incubator program has identified problems with the equipment used by some PSAPs that leads to an unacceptable character error rate for TTY calls. Southern LINC will continue to monitor this situation through the TTY Forum.

Geographic Scope of Network Infrastructure Deployment: Southern LINC is a regional carrier providing service in Georgia and Alabama and portions of Florida and Mississippi. Its deployment of the iDEN TTY solution will encompass its entire network.

For questions regarding this report, please contact:

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TTY Report to the FCC
On Behalf of Sprint PCS and its Network Managers
Prepared 4/10/02

1. Network Infrastructure Software Development

- Sprint PCS has received software from all of its network vendors. TTY infrastructure and handset interoperability testing is near completion.
- The TTY feature is presently being activated in Sprint PCS markets with Lucent infrastructure. The Lucent TTY feature user trial, in cooperation with Gallaudet University in Washington D.C., was successful. Sprint PCS has begun implementation of TTY in all Lucent markets.
- Nortel has one market activated at this time (the Kansas City metropolitan area). Testing results have been successful. A user trial was also successful. Sprint PCS has begun the implementation of TTY in all Nortel markets.
- Samsung infrastructure testing at the Sprint PCS test laboratory has been completed. The physical removal and replacement of TCLA circuit cards in the Samsung Base Station Controller is necessary to support the TTY feature. The replacement of these cards has been completed. Field Integration Testing (FIT) has also taken place with good results. Finally, a user trial is underway and should be completed by 4/26. Upon successful completion of the user trial, the network rollout of this feature will continue as appropriate.
- Motorola infrastructure testing at the Sprint PCS test laboratory is ongoing. Sprint PCS has encountered high character error rates (CER) with certain handsets. Sprint PCS continues to work with Motorola to isolate the source of the high CER, and Sprint PCS is due to receive another software “patch” on April 15. Due to these difficulties, Sprint PCS has modified its FIT and user trial dates. If Sprint PCS continues to experience unacceptably high CER with the new “patch”, Sprint PCS may be forced to delay TTY launch in Motorola markets.
- Sprint PCS and other wireless carriers have encountered difficulties when testing the TTY feature with PSAPs, which may interfere with the ubiquitous support of the TTY feature in our network. Sprint PCS along with other wireless carriers has brought this matter to the attention of the FCC. Sprint PCS intends to launch TTY despite the PSAP problems. Sprint PCS will educate its customers of the difficulties that may be encountered when dialing 911 and suggest alternate means of making emergency calls (via TRS, analog mode, or landline phone). Sprint PCS will continue to support industry efforts to find a long term solution to the PSAP issue.

2. Handset development and testing plans

- SPCS has successfully tested handsets provided by five vendors and expect our remaining vendors to deliver handsets in the first half of 2002.
- Interoperability testing with all four infrastructure providers has been performed in a laboratory environment, and three of the four infrastructures have been tested in a field environment. Live network testing has been performed successfully in Washington D.C., Kansas City, and Lisle, IL. Laboratory testing will continue through the Sprint PCS nation wide launch and beyond.
- Sprint PCS has encountered difficulties with our interoperability tests and have isolated some minor problems to specific handset models. Sprint PCS is receiving positive cooperation and support from handset vendors to fix the bugs quickly.

3. Beta testing and lab testing

- SPCS requires lab, field testing, and beta testing (in that order) prior to implementation. Our internal lab testing and field testing are extremely intensive and require approximately two to three months each.
- Both lab and field testing are nearing completion.
- SPCS has participated in the ATIS sponsored TTY Technical Standards Incubator (TTSI) program. Sprint PCS has also performed inter-technology testing with AMPS, TDMA, and CDMA wireless telephony systems yielding results consistent with other TTSI results.
- SPCS has also completed a two live network user trial (beta test) with a deaf and hard of hearing user group, and is in the process of performing another over another infrastructure.

4. Release and general availability to carriers of network software

- All network infrastructure vendors have provided software solutions for TTY.

- Two network vendor's software have been conditionally released from Sprint PCS' lab. Lucent and Nortel infrastructure software has been authorized for the field with Samsung expected to follow very soon. Sprint PCS has, as noted above, encountered difficulties with Motorola infrastructure and has not, therefore, been released for implementation.
5. ***Availability to carriers of full acceptance test units***
 - See # 2
 6. ***Efforts toward Achieving digital wireless solution compatibility with enhanced TTY devices.***
 - Sprint PCS is not pursuing a resolution of proprietary enhanced protocols as the FCC has temporarily relieved carriers of this responsibility. Sprint PCS will reevaluate enhanced protocols when industry standards supporting these protocols are in place.
 7. ***Carrier Coordination of testing with PSAP***
 - While Sprint PCS has performed its own PSAP testing, it is relying mostly on ATIS' TTSI to coordinate more robust PSAP testing with the help of NENA and APCO.
 8. ***Carrier testing activities, including field testing, consumer end-to-end testing***
 - Sprint PCS is testing with a variety of consumers (including Gallaudet University) in various markets prior to nation-wide deployment.
 - Sprint PCS is actively participating in the ATIS TTSI program and will continue to participate in additional "incubator" field tests in which carriers and vendors perform interoperability tests.
 - Sprint PCS was the first American domestic carrier to perform TTSI supported international interoperability testing with participants from another continent (Ericsson CDMA Lab testing in Sao Paulo, Brazil).
 9. ***Retail availability of necessary consumer equipment***
 - Several TTY capable handsets are already available at Sprint PCS Stores now. Lists of available handsets and the methods of enabling the TTY feature will be available to the public when nationwide infrastructure support is complete.
 10. ***Geographic scope of network deployment***
 - SPCS plans to launch nation-wide by June 30, 2002. If, however, Motorola infrastructure continues to show unacceptable performance, Sprint PCS may have to delay launch in its 13 Motorola markets.

TeleCorp PCS
1010 North Glebe Road
Arlington, VA 22201

Contact:
John Garner
Director, Regulatory Compliance
601-209-8201

Date: April 15, 2002

Purpose: TeleCorp PCS, Inc Quarterly TTY/TDD Report for all Lucent MSC served markets

TeleCorp PCS is fully compliant with all TTY requirements in all Lucent MSC served markets.

Date: April 15, 2002

Purpose: TeleCorp PCS, Inc Quarterly TTY/TDD Report for all Ericsson MSC served markets

Development Activities

1. network infrastructure software development;
See Attachment 1: Sony Ericsson Mobile Communications and Ericsson Inc TTY Forum #20 Report
2. handset development and testing plans;
See Attachment 1: Sony Ericsson Mobile Communications and Ericsson Inc TTY Forum #20 Report
3. beta testing and lab testing;
See Attachment 1: Sony Ericsson Mobile Communications and Ericsson Inc TTY Forum #20 Report
4. release and general availability to carriers of network infrastructure software;
Tritel Communications Inc. has purchased the necessary hardware and software and is in the process of installation and testing.
5. availability to carriers of full acceptance test units;
See Attachment 1: Sony Ericsson Mobile Communications and Ericsson Inc TTY Forum #20 Report
6. efforts toward achieving digital wireless solution compatibility with enhanced TTY devices;
See Attachment 1: Sony Ericsson Mobile Communications and Ericsson Inc TTY Forum #20 Report

Testing and Deployment Activities

7. carrier coordination of testing with PSAP;
Tritel will utilize relationships developed during Phase I E911 implementation to arrange end to end testing.
8. carrier testing activities, including field testing, consumer end-to-end testing, and other necessary tests;
Tritel will test TTY functionality as soon as all necessary network infrastructure is in place and will complete all testing prior to June 30, 2002.
9. retail availability of necessary consumer equipment;
TeleCorp PCS, dba Tritel Communications Inc., has three models of TTY compatible handsets available for retail sale.

10. geographic scope of network infrastructure deployment;
Tritel is deploying the necessary network infrastructure in all markets as it becomes available from Ericsson.

Attachment 1
Sony Ericsson Mobile Communications and Ericsson Inc.
TTY Forum #20 Report
December 10, 2001

This report details the verbal presentation provided by Sony Ericsson and Ericsson Inc. (hereafter collectively referred to as "Sony Ericsson") at the December 10th, 2001 TTY Forum 20. The attached report identifies development and testing status for network and handset products, release and general availability dates, efforts towards achieving compatibility with TTY devices, system testing, deployment activities, technical issues, and contact information.

Sony Ericsson has completed the development of TTY technology intended for integration within its products. These products are built to the approved ballot standards from the industry. The development testing has been completed for many of the products, and the products have been demonstrated to the carriers in a number of test events within the FCC required deadlines. Products that have completed the development testing, have been released to the carriers for acceptance testing. In general, the technical feasibility to transport TTY across the digital cellular systems has been proven by the product operability testing. Results have been published for TDMA base stations and TDMA handset products. GSM handset and GSM infrastructure demonstrations are nearing completion. CDMA systems are working through experienced problems related to the 13K-vocoder performance.

Isolated technical flaws and system integration issues continue to be identified in the product test and carrier test phases. Testing continues to take place in development labs, infrastructure and TTSI (ATIS sponsored) test events. Recently, interoperability incompatibilities have been identified from undocumented IS-823A vocoder functions, and between IS-840 performance standards and PSAP TTY units. Issues with CDMA test case failures, AMPS baseline error rates, and driving error rates have also been identified.

While handset to infrastructure compatibility testing has taken place between several manufactures, there is an incurred risk to interoperability testing for manufacturers that missed the initial handset testing. The next stage of testing is expected to include base station to base station interoperability, base station to landline TTY, carrier infrastructure compatibility, and PSAP operability testing. Identifying and resolving the performance objectives will require the involvement and cooperation among the manufacturers, carriers, 911 PSAP facilities, standards organizations, and governing bodies. Sony Ericsson continues to actively develop and test TTY compatible products, participate and monitor the industry standards and test events, and work closely with the regulatory bodies and the ATIS Incubator. Sony Ericsson is closely monitoring the data generated by TTSI to determine compliance to the FCC mandated <1% TTY character error rate.

1. Network Infrastructure Development:

TDMA Status:

TDMA network infrastructure has completed product development and testing. The infrastructure software that incorporates TTY technology was released for operator/carrier field testing (First Office Application or FOA). FOA testing was conducted with AT&T Wireless Services (AWS) in Atlanta, Georgia during the week of November 12 – 16, 2001. The test involved testing with the following equipment:

- Ameritech Q90
- Ultratec Compact
- Ultratec Intellemodem 2400
- Ericsson T60d Mobile Station
- Panasonic EB-TX310 Mobile Station
- 711 TTY Relay Service
- 911 PSAP using Positron Express

Results of the testing were very positive. There were interoperability issues identified with the Positron Express PSAP equipment. Ericsson performed joint testing with Nokia mobile stations (handsets) at the Ericsson facility in Montreal from October 29-31. Several problems were identified in the use of silence frames. Technical papers to TIA 45.3 and TTSI describe the issues and resolutions addressing the silent frames and interoperability with the Positron Express PSAP.

TDMA Plans:

Sony Ericsson continues to monitor the PSAP interoperability issue. The Ericsson TDMA infrastructure was tested at the September TTSI event, and again at the FOA event in November. Test data was provided to TTSI. AWS has loaded the IS-823A infrastructure code in their lab and continues to test TTY. Cingular, which loaded and tested initial TDMA code at the first TTSI test event, has received and loaded the latest code. The Cingular FOA is anticipated to complete in December 2001.

A problem has been identified when using Nokia mobile stations with the Ericsson TDMA network software. This problem is clearly understood and is due to a difference in interpretation of TTY_SILENCE in the TIA/EIA IS-823-A standard. Since both vendors claim compliance to the applicable TIA/EIA IS-823-A and IS-840-A standards, a TR45.3.5 ad hoc meeting will be requested. A resolution plan will be developed based on the outcome.

Ericsson is working with Positron to identify the root cause of uplink errors when making a TTY call to Positron equipment. Testing was performed in the Ericsson lab facilities in Montreal during the week of December 10 to characterize the problem. Ericsson is the first vendor to have identified interoperability issues with Positron equipment, and believes this problem may affect other vendors. Sensitivity to the bit duration specified within the bit exact code of IS-823A has been demonstrated. TTSI has been notified, and confirmed the sensitivity. A resolution plan will be developed after industry consensus has been reached, as to the best course of action.

GSM Status:

The development code and products for the CTM service node are complete. System verification is complete. The GSM infrastructure solution entered FOA acceptance test on December 03, 2001.

GSM Plans:

The GSM TTY solution is undergoing acceptance test at several customer sites. AWS received the service node and system code during the first week of December. Development test cases were run in Richardson TX with approval testing completed in November. Tests were run on R300z handsets, and successfully completed. Cingular received the CTM service node and system code installed in their PBW lab in Pleasanton California. Planning to run tests December 18-20, 2001. FOA for the GSM Network is scheduled to be complete by January 28, 2002. Infrastructure rollout plans are complete, and capable of being completed prior to June 30, 2002.

C DMA Status:

The development of code for the CDMA network infrastructure TTY enhancement is nearly complete, with the completion of simulation testing and EVRC DSP code development. First simulation testing started in September followed by emulator testing and system integration testing. Operation of the development release of the enhanced vocoder has been demonstrated in lab testing. The delivery of carrier initial verification level of product was scheduled for delivery on December 31, 2001. Cricket and Qwest plan to take delivery of acceptance level code upgrades to start field-testing, in the first quarter of 2002.

CDMA Plans:

Development testing is expected to be completed by January 2002. System verification test release software is scheduled for release by the end of January 2002. System Acceptance rollout is scheduled for February 2002.

2. Handset Development and Testing Plans;

Sony Ericsson TTY terminal products have completed the development stage, and are entering the final stages of product release. The build plans and final qualification testing are in completion for all product technologies. Test data has been generated for CDMA, TDMA, and GSM products. Handsets are available for manufacturer and carrier interoperability testing, and have been used at TTSI test events.

TDMA Status

TTY development code for TDMA mobiles was released on September 21, 2001 after fixes were incorporated from the previous handset design. Final TDMA development test products were released on November 01, 2001. The handsets were used in the FOA event in Atlanta. The handset performance received an excellent response. The handsets were also used at the first and second TTSI test events, and performed well. The latest TTSI test event provided an excellent result in both data and in voice quality scoring. The final GUI interface was placed in the TDMA test handset on December 20, 2001.

Ongoing testing identified a slow typist sensitivity that resulted in a clarification to the existing IS-823A standard. TTSI has been informed of the recommended squelch level required on the TTY detector.

TDMA Plans

Carrier acceptance test units with the final user interface is expected to be available by January 15, 2001.

GSM Status

Development units were available on September 12th, 2001. Issues with error rates and TTY terminal compatibility were addressed by minor code updates. GSM development tested to performance specification 3GPP 26.231 and scored an excellent 0.5-% or less character error rate in the static state.

The R300Z has the bearer bit hard coded in the on position. The R300Z will be available from the Special Needs Center January 15th 2002. The T60G was made available to carriers/operators on December 14th for initial product testing. Future GSM mobiles have a profile setting that can be set to properly handle a TTY connection. Through such profile settings, the bearer bit is activated and deactivated.

Testing data shows an increase in the error rate when the handset is in the proximity of a certain model of TTY, and the signal at the phone was below a -105-dBm RSSI level. The TTY manufacturer was notified of this susceptibility, and requested to investigate corrective action. TTSI was notified of the issue. Tuning of the echo canceller was required for one handset model, to achieve an optimum error rate. During final development testing a TTY static error rate of less than 0.09% was demonstrated with the R300Z terminal, with a separation distance between the handset and the TTY unit. The TSB-121 interface demonstrated some electrical echo at the TTY

accessory, so the load impedance has been increased to 400 ohms. TTSI was notified of the change.

GSM Plans

The first production samples of the TTY accessory were made available on December 10, 2001. Approval level terminals and accessory TTY units' (V1.19) were provided to carriers/operators on December 20, 2001. Handsets and T-Link adapters are expected to be available in the Special Needs Center by end January 15th, 2002. A second GSM handset model with an improved GUI, is anticipated to be entering approval test in January 2002.

CDMA Status

CDMA handsets encountered problems in the development test process. While the majority of development test cases have completed with success, there are test cases where the error rate can exceed 3 %. Sony Ericsson ran mobile IOT testing on October 22nd 2001, at the Lucent Whippany facility, and at the second TTSI test event during November 12 –16th 2001. The testing was intended to identify the source of the problems.

There are persistent performance issues with several test cases, including static 13K-vocoder uplink to landline, 13K vocoder connected to TSB-121 TTY impedance's, HCO/VCO performance, and driving in the 13K vocoder mode. A test report was generated and sent to the component manufacturer for repair. The fix is expected to replace the squelch method of self-echo avoidance, with a mute method. TTSI is aware of the problem, and the problem has been identified to the TIA 45.5 standards group.

CDMA Plans

Carrier test units to a customer acceptance level have not been delivered. Current delivery plans are gated by a fix from the chipset vendor. Plans for availability are on hold.

3. Beta Testing and Lab Testing;

TDMA Infrastructure Beta Testing and Lab Testing

AWS Lab testing started October 29, 2001 and did not report any problems. FOA and Demonstration activities with AWS were completed November 17.

GSM Infrastructure Beta Testing and Lab Testing

Ericsson lab test is complete. Nearly all test cases have run to completion. Terminal and PSAP testing have competed successfully. Error rates of less than 1-% have been demonstrated.

To date, there are no outstanding technical issues.

CDMA Infrastructure Beta Testing and Lab Testing

Simulation testing is complete. CDMA integration testing is currently underway. Development testing of EVRC vocoder started December 07, 2001. Development testing is scheduled to be completed in December. CDMA Design Verification test cases have been generated, and are awaiting execution at the conclusion of development test.

4. Release and General Availability to Carriers of Network Infrastructure Software;

The TDMA network software was declared GA on December 5, 2001.

GSM System generally available (GA) with GSM R9.0 (Starting Rollout January 15 2002)

CDMA Generally Available with system Release 8.6 (Starting Rollout February 28, 2002)

5. Availability to Carriers of Full Acceptance Test Units;

- *TDMA Handsets December 31, 2001*
- *GSM Handsets and T-Link Accessory December 31, 2001*
- *CDMA Handsets on hold.*
- *TDMA Network Infrastructure October 22, 2001*
- *GSM Network Infrastructure November 30, 2001*
- *CDMA Network Infrastructure dates January 31, 2002.*

6. Efforts Toward Achieving Digital Wireless Solution Compatibility with Enhanced TTY Devices.

Sony Ericsson continues to work very closely with all manufacturers and carriers on the TTY compatibility mandate. TTY manufacturers have recently decided to change the default setting for high speed and turbo modes, to off. This ensures compatibility with digital wireless systems.

7. Testing and Deployment Activities

- Sony Ericsson is working with the operators/carriers in the test and deployment of network infrastructure systems. In addition Sony Ericsson is working with the ATIS Incubator (TTSI), which is planning TTSI test event number 3 in January 28, 2002. The event will primarily test GSM infrastructure and handset compatibility.
- The previous TTSI test events have produced data for more than twelve digital wireless signaling paths, including technologies of CDMA, TDMA, and AMPS to TTY' located at landline, mobile, and PSAP locations. Five of the twelve signal paths tested to date have an overall average error rate over one percent. These signaling paths include calls between technologies, and static/driving conditions. Many of the driving tests had error rates greater than one percent. The AMPS (analog) error measurement composite was nearly 2 percent. Peak measurements of 3 to 5 percent error rates were measured. Error rates of more than 1-% are currently receiving scrutiny in TTSI to identify and resolve the source of these high error rates.
- Sony Ericsson is working with Cingular to develop an automated call in test machine for PSAP testing. It is expected that the machine will be delivered to TTSI for testing of PSAP performance and tolerances when tested to a performance specification that is IS-840 compliant.
- Sony Ericsson has developed HCO/VCO testing boxes for testing the Q.90, and have worked

with DSPG, HITEC, and Ameriphone to further these products

- Sony Ericsson has worked closely with Ultratec in the performance and test product software.
- Sony Ericsson appreciates all the testing efforts and help it has received to gather the significant amount of test data it has generated to date. Testing with operators, carriers, TTSI, Lucent, AWS, Cingular, DSPG, HITEC, Positron, and others contributed significantly in achieving the test progress to date.

8) Risks:

At the TTY Forum 20 several manufacturers pointed out technical risks and concerns with respect to meeting the compliance requirements by the FCC. Currently, Sony Ericsson is working several issues through the ATIS Incubator process. Several of these issues are in the resolution process.

• Critical Work Status:

- Sony Ericsson continues to develop product changes to resolve current issues. Sony Ericsson is concerned that current interoperability and future product developments are not assured by the defined operation within the existing TTY ballot standards. Of utmost concern is the removal of the requirement for bit exact reference code in the standards. Several passages are not mandatory for standards implementation, which need to be mandatory to operate correctly. Sony Ericsson has generated test data on TTY performance in the presence of Echo Cancellers, and handsets with silent voice frames that require certain infrastructure configurations to achieve the mandated FCC error rates. It is currently not understood when or if the Standards Committees will address these issues. Changes need to be effected on the standards prior to the FCC mandated system availability date of June 30, 2002.

Standards Issues That Require Resolution :

- The Bit Exact Code (reference design) has been removed from the IS 823 and IS 127 Standards.
- IS-823 and IS-127 test vectors are obsolete
- IS-840 Minimum Performance Specification currently does not address normative changes in the standard.
- Several non-mandated addendum's have been made or proposed to normative text, that are required for operability and interoperability
- IS-127 changes for self echo currently do not mandate mute within the handset.
- IS-823A currently does not mandate mute to fix self echo within the handset.
- IS-823A currently does not define mute function within the network required to make echo canceller behavior transparent to TTY.
- IS-823A bit exact changes should be created for 50 baud, and include stop bit management improvements.
- IS-823A bit exact changes should be created to adjust nominal bit width if TTY signaling. The nominal TTY bit width should be changed to 22 mS with a new mechanism to be proposed to handle consecutive character strings at minimum or maximum bit width tolerance.
- IS-823A changes should be mandated for handset TTY detector squelch level

- IS-823A and IS-127 and TS 26.226 standards should adopt data levels that do not violate FCC 68.608
- TS 26.226 should require a 5-bit strength for the first bit of every call session, to be reset for each call.
- Cascaded leaky voice frame performance between GSM and CDMA/TDMA needs to be controlled.
- G.168 echo canceller Specification for TTY compatibility needs a cancellation depth specification.
- IS-825 does not specify quieting level for TTY transmitter levels, nor does it specify rise and fall times.
- IS-823A does not mandate quieting squelch level for the TTY detector in the network.
- TSB-121 load impedance needs to be increased to 400 ohms.
- TTY silence frames require mute immediately after TTY characters, within IS-823A, to prevent echoed character errors.
- CDMA 13k vocoder error rate measurements require TR45.5 to respond to performance concerns.
- PSAPS need a test minimum performance specification to achieve the FCC mandated 1-% error rate.

1.1.2 New Risk Factors

- TTY device requires RF susceptibility standard to operate properly.
- Wireless TTY detector can falsely start detection from TTY device noise levels.
- V.18 interoperability testing at TTSI is inconclusive, additional testing is required.
- The FCC should investigate an increased error rate benchmark for drive testing. Error rates similar to AMPS performance data collected within the TTSI database is recommended.

Please feel free to contact either Matt Kaltenbach or Steve Coston if you have any question regarding this report, or wish to contact test or product interfaces. Please contact your local customer interface for product sales and marketing information.

Unwired Telecom Report to the FCC

Prepared: 4/10/02

1. *Network Infrastructure Software Development*

- Unwired Telecom operates one Nortel switch and it is scheduled to receive the required MTX 10 software upgrade during the first week of June 2002.

2. *Handset development and testing plans*

- Unwired Telecom has received a TDMA TTY compatible handset for testing purposes and we plan to have additional handsets available in stores by mid May. We have also ordered a portable TTY/TDD test unit from Ultratech. The test unit is scheduled to arrive by the end of April 2002.

3. *Beta testing and lab testing*

- All testing will commence upon the installation of the Nortel MTX 10 software.

4. *Carrier Coordination of testing with PSAP*

- PSAP testing will be conducted at the time of field tests.

5. *Retail availability of necessary consumer equipment*

- TTY capable handset sales are projected for May 2002.

6. *Geographic scope of network deployment*

- Unwired Telecom plans to launch the entire network by June 30, 2002.

7. *Efforts toward achieving digital wireless solution compatibility with enhanced TTY devices.*

- Unwired Telecom is not pursuing a resolution of proprietary enhanced protocols as the FCC has temporarily relieved carriers of this responsibility.

8. *Carrier testing activities, including field-testing and consumer end-to-end testing.*

- Unwired Telecom will begin field-testing once the Nortel MTX 10 software upgrade has been completed.

9. *Release and general availability to carriers of network software.*

- See # 1

10. *Availability to carriers of full acceptance test units*

- See # 2



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TTY Report for April 2002

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Contents

CONTENTS.....	116
1. PURPOSE	117
2. EXECUTIVE SUMMARY	117
3. BACKGROUND.....	118
4. VOICESTREAM’S NETWORK PROGRESS.....	119
5. VOICESTREAM’S HANDSET AVAILABILITY	121
6. CONCLUSION.....	122

1. Purpose

This document outlines the progress made by VoiceStream toward the FCC mandate, contained in 47 CFR Section 20.18, that operators of digital wireless systems must be capable of transmitting 911 calls from individuals with speech or hearing disabilities through the use of Text Telephone Devices (TTY). The rule requires compliance with this mandate on or before June 30, 2002. The capabilities that VoiceStream is developing here will also support the FCC's policy of full user-to-user functionality employing TTY devices. This document, which is for information purposes, is submitted to the TTY Forum of the Alliance for Telecommunications Industry Solutions (ATIS).

2. Executive Summary

VoiceStream uniformly employs the GSM air interface. Standardization work for a GSM TTY solution is continuing and VoiceStream is active in facilitating testing and decisions that will enable 911 access as well as full user-to-user functionality. VoiceStream will deploy different solutions, depending on vendor and equipment type. VoiceStream uses network equipment from Ericsson, Nokia and Nortel in different geographical areas of the US.

VoiceStream was instrumental in working with the global GSM community to get agreement on a common signaling mechanism applicable to both the Network Switching Subsystem (NSS) and Base Station System (BSS) solutions. Having obtained global community agreement on using bearer capability signaling, VoiceStream has been working diligently with its network equipment vendors to test and verify the performance of both the NSS and BSS implementations.

During December 2001, VoiceStream loaded into its laboratories in Snoqualmie, Washington, test loads for Nortel and Ericsson TTY implementations. Test loads for Nokia were delayed due to Nokia's difficulties with the E911 Phase 2 portion of its Base Station Controller (BSC) software. On January 31, 2002, Nokia released its first TTY test load. Of the three network infrastructures employed, only that of Ericsson has passed final testing. VoiceStream notes that additional testing is progressing with Nokia and Nortel.

Based on the current information from our vendors, VoiceStream expects to have final solutions from all vendors for testing by the end of April 2002. Testing and verification of these commercial loads will take two to four weeks. VoiceStream has already started TTY deployment in Ericsson markets and envisages being in the position to start deployment in Nokia and Nortel markets at approximately the end of April 2002, with full implementation by the June 30, 2002 date.

To date, VoiceStream has issued purchase orders of approximately \$5.5 million to cover the necessary hardware and software upgrades and initial deployment costs.

3. Background

Since September 1997, the Wireless TTY Forum (TTY Forum), representing wireless carriers, wireless equipment manufacturers, manufacturers of TTY devices, public safety organizations, and consumer organizations representing individuals who are deaf or hard-of-hearing has been meeting in an effort to develop solutions that will enable TTY users to make 911 calls on digital wireless networks. Technical solutions had been proposed for all major wireless standards and these solutions have been undergoing study in the relevant technical bodies, TR45.5 (CDMA), TR45.3 (TDMA) and T1P1/3GPP (GSM).

The GSM solution uses the Cellular Text Telephony Modem (CTM) as a method of transmitting Baudot over the GSM network. It is difficult to transmit Baudot code over the digital channel of GSM at the FCC-mandated standard of a 1 percent Total Character Error Rate (TCER), as the digital codecs have been optimized for speech. Baudot uses frequency components at 1.4 and 1.8 kHz, which would be attenuated by the low pass filtering in the codecs. In addition, the error correcting protocols of GSM result in the character error rate for a Baudot Code transmission increasing dramatically in the case of decreasing channel quality.

For this reason, CTM had been designed to work with all speech coding strategies and it has been successfully tested with the relevant codecs for the US, which are the GSM FR, EFR and all modes of the AMR codec. CTM signals have components only between 400 Hz and 1000 Hz, which corresponds to the natural range of human speech. A converter would handle the CTM functionality at the mobile, which would be either incorporated into the mobile or available as a clip-on/add-on unit.

The three documents specifying CTM have now been approved in the U.S. as American National Standards. These documents have also been submitted to 3GPP and have become the basis for the specifications developed by that group for all GSM systems worldwide.

TTY support in GSM networks has been formalized and is outlined in Technical Specifications-TS 23.002 and TS 23.226. TTY support is enabled using one of three solutions:

- The "all transcoder solution (All-TRAU)" with CTM on every circuit leading out to the terminals.
- The "CTM circuit pool solution" with a mechanism for selecting a circuit leading to the terminal that has the proper CTM detection/conversion capabilities, based on the terminal indicating that it has CTM capabilities.
- The "CTM-SRF [specialized resources function] service node solution" with a service node in the core network and a mechanism to route through it for CTM detection/conversion.

The GSM technical specifications require the support of Bearer Capability Signaling from the handset to the network for both the circuit pooling as well as service node solutions. This solution for a common signaling mechanism allows a handset to signal the network at call setup

VoiceStream Wireless

that it is sending a CTM call and thus the network can direct that call to a network path that can convert the CTM signal into Baudot.

Because the signaling mechanism is common to both the server as well as the circuit pooling solutions and is transparent to the All-TRAU solution, the wireless system operator can choose the equipment option that best fits its equipment implementation yet still maintain interoperability across platforms. The signaling mechanism is totally transparent to the user – that is, a TTY call can be made by any CTM-capable handset regardless of the network implementation utilized by the wireless system operator.

4. VoiceStream's Network Progress

VoiceStream has issued Purchase Orders totaling approximately \$5.5 million to cover the initial deployment of TTY. Additional funds have been budgeted to cover any additional costs associated with the testing and deployment phases. VoiceStream has firm technical and commercial proposals from all three network equipment vendors.

Each vendor has chosen a slightly different implementation option based on its analysis of the ease and speed of the particular deployment solution.

Nokia	Implementing the All-TRAU solution which requires a software upgrade to all transcoder units. The software to support CTM/TTY is part of the company's S.10 release.
Nortel	Supporting the All-TRAU solution on the BSC E3 platform using the TCU E3 transcoder. CTM/TTY is supported in release 13.2. For the BSC 2G, Nortel is supporting the CTM circuit pooled solution requiring release 12.4D+.
Ericsson	Implementing the Service Node solution, using Telegent (Sweden) servers. The new servers are supported by the R9 BSC and MSC software releases.

Irrespective of the implementation option chosen by the vendor, the process for testing the CTM/TTY functionality will proceed as outlined below.

Laboratory Functional Testing (LFT) - Testing of the CTM functionality as a stand-alone function will be performed in a controlled environment. Software employed may be pre-release. The aim of this testing is to confirm that the CTM translation is correct and that the CTM/TTY functionality is able to meet the defined GSM and FCC requirements. The testing of (early) pre-release software code may not involve full call control functionality but may only test the CTM/TTY translation performance.

Laboratory Acceptance Tests (LAP) - Testing of the full end-to-end functionality of the new software and hardware needed to support TTY, including regression tests of basic GSM features such as voice call completion, GPRS call

VoiceStream Wireless

completion etc, to ensure that software changes have not introduced unforeseen errors in other blocks of code.

Soak Test (ST) - A stability period to ensure that software and hardware is stable and is able to operate in a normal loaded condition.

First Office Application (FOA) - Limited deployment in the live network, to ensure that no unforeseen problems occur that could not be observed in the laboratory.

General Acceptance (GA) - Full deployment to all relevant network nodes.

The table below shows the current progress and latest estimated start dates for each of the phases of the test and verification program. The program shows the testing dates and the expected start of national deployment (GA).

Table 1: Estimated Test and Verification Dates

	LFT	LAT	ST	FOA	GA
Nokia	01/24/02	02/18/02	04/22/02	04/15/02	06/18/02
Nortel 2G BSC	04/01/02	04/11/02	04/18/02	05/01/02	06/21/02
Ericsson	01/26/02	02/15/02	02/25/02	03/27/02	05/15/02

Ericsson started deployment of its TTY solution in VoiceStream's Washington, DC market area on March 27, 2002. As of the date of this report, deployment of the R9 software release for the MSCs has been accomplished for Boston and Philadelphia as well. Field-testing of the solution is now progressing. Installation in all VoiceStream markets is scheduled to be completed by mid-May 2002.

Testing of Nokia's TTY solution is planned for Kansas City for April 15, 2002, when the S.10 release is loaded.

Nortel's TTY solution was installed in 5 BSCs in the Dallas market on April 2, 2002. Additional software loads will be loaded and tested there by April 29, 2002.

As is the case when introducing new functions and features into the network, there is some element of risk in the program being delayed due to unforeseen technical difficulties.

5. VoiceStream's Handset Availability

TTY-capable handsets have been selected and approved by VoiceStream. The Ericsson T61 will be available in May. Motorola models P280i and V60i will be available in June. The Nokia DCT-4 and higher model handsets will all be TTY-capable.

Interoperability between handsets and infrastructure will not be an issue.

6. Conclusion

VoiceStream anticipates meeting the June 30, 2002 mandate for provision of wireless TTY access to 911 emergency services. VoiceStream notes, however, that serious concerns remain concerning the ability of Public Safety Answering Points (PSAPs) to process wireless 911 TTY calls. As documented by the ATIS-sponsored TTY Technical Standards Implementation (TTSI) Incubator, in a February 4, 2002 letter to FCC Wireless Telecom Bureau Chief Thomas Sugrue, problems occurred when a TTY call is terminated at certain PSAPs, whereby the total character error rate (TCER) significantly exceeds the permitted 1 percent. In a subsequent ex parte meeting with the Commission on March 12, 2002, details concerning this problem were discussed. While the magnitude of the problem identified with some PSAP equipment vendors remains uncertain, as a member of the TTSI, VoiceStream will continue its work towards the June 30, 2002 mandate.