

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

January 14, 2002

VIA HAND DELIVERY

Magalie Roman Salas
Office of the Secretary
Federal Communications Commission
445 12th Street, SW
Washington, DC 20554

Re: TTY Forum's Aggregate Report of Carriers
for 4th Quarter 2001, CC Docket No. 94-102

Dear Ms. Salas:

Enclosed are an original and four copies of the TTY Forum 20 Meeting Summary. Appendix L contains an aggregate report of wireless service providers, handset and infrastructure manufacturers for 4th Quarter 2001 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)
Pam Gregory, Director, Disabilities Rights Office, CIB (pgregory@fcc.gov)
Mindy Littell, Attorney Advisor, Policy Division, WTB (mlittell@fcc.gov)



TTY Forum – 20

Meeting Summary Report

December 11, 2001
ATIS Conference Center
Washington, DC

Table of Contents

AGENDA.....	3
MEETING SUMMARY.....	4
1. Call to Order, Introduction and Attendance Roster.....	4
2. Call for and Numbering of Contributions.....	4
3. Review and Approve Agenda.....	4
4. TTY Forum #19 Summary.....	4
5. TTY Liaison Reports.....	5
6. Review TTY Forum #19 Agreements and Action Items.....	5
7. Oral Industry Implementation Status Reports.....	5
Cingular.....	5
AT&T.....	6
Sony/Ericsson.....	6
Nextel.....	7
Sprint PCS.....	7
Nokia.....	7
8. Review Appendix E—User Intervention Document.....	7
9. Technical Issues.....	8
10. Terminal Product Labeling for TTY Accessible Devices.....	9
11. Next Meeting.....	10
12. New Business.....	10
13. Adjournment.....	12
Meeting Roster.....	13
APPENDIX A.....	15
APPENDIX B.....	21
APPENDIX C.....	22
APPENDIX D.....	23
APPENDIX E.....	29
APPENDIX F.....	37
APPENDIX G.....	38
APPENDIX H.....	42
APPENDIX I.....	46
APPENDIX J.....	49
APPENDIX K.....	51
APPENDIX L (WRITTEN IMPLEMENTATION STATUS REPORTS).....	55
ALASKA COMMUNICATIONS SYSTEMS WIRELESS.....	56
AT&T WIRELESS.....	57
CAPROCK CELLULAR LIMITED PARTNERSHIP.....	60
CAROLINA WEST WIRELESS.....	62
CINGULAR WIRELESS LLC.....	63
CORR WIRELESS COMMUNICATIONS, L.L.C.....	65
DOBSON CELLULAR SYSTEMS.....	66
FARMERS CELLULAR TELEPHONE, INC.....	67
MIDWEST WIRELESS HOLDINGS L.L.C.....	69
MOTOROLA.....	70
NEXTEL COMMUNICATIONS, INC.....	72
NOKIA.....	74
NORTEL NETWORKS.....	76
PCS ONE.....	84
PINE BELT CELLULAR, INC.....	85
RURAL CELLULAR CORPORATION.....	87
SIEMENS.....	89
SONY ERICSSON MOBILE COMMUNICATIONS AND ERICSSON INC.....	90
SOUTHERN LINC.....	98
SPRINT PCS.....	99
TELECOP PCS.....	100
VOICESTREAM WIRELESS.....	110



TTY/TDD Forum – 20

December 11, 2001

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
3. Review & Approve Agenda
4. TTY Forum #19 Summary
5. TTY Liaison Reports: *FCC; CTIA; NAD; TDI*
6. Review TTY Forum #19 Agreements and Action Items
7. Industry Implementation Status Reports
8. Review Appendix E-User Intervention Document (Action Item 19.4 and 19.5)
9. Technical Activities
 - a. TTSI Report
 - i. TDMA Testing
 - ii. CDMA Testing
 - iii. GSM Testing
 - b. Review Appendix J-Technical Standards Reference
 - c. Other
10. Terminal product labeling for TTY accessible devices (Action Item 19.8)
11. Next Meeting
 - Tuesday, March 5, 2002
 - Tuesday, June 4, 2002
12. New Business
 - HAC-FCC NPRM WT Docket #01-309 (November 14, 2001)
 - Roll-out Issues
13. 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, Introduction and Attendance Roster

Ed Hall, ATIS, Chair, called the meeting to order at 9:09 a.m. He thanked all the participants in attendance for their participation. All participants took the opportunity to introduce themselves.

2. Call for and Numbering of Contributions

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
TTY20/01.12.11.01	Agenda
TTY20/01.12.11.02	Roster
TTY20/01.12.11.03	TTY19 Agreements and Action Items
TTY20/01.12.11.04	TTSI Report to TTY Forum – 20
TTY20/01.12.11.05	Appendix J
TTY20/01.12.11.06	FCC NPRM (November 14, 2001)
TTY20/01.12.11.07	TTY19 Meeting Summary
TTY20/01.12.11.08	Labeling and Marketing Plan
TTY20/01.12.11.09	Sony Ericsson Presentation
TTY20/01.12.11.10	Gallaudet Testing Results
TTY20/01.12.11.11	TTY Mode Switch User Questions Revised
TTY20/01.12.11.12	Roll Out Guidelines and Considerations
TTY20/01.12.11.13	TTY-20 Agreements & Action Items
TTY20/01.12.11.14	TTY-20 Meeting Summary

3. Review and Approve Agenda

The agenda was distributed and approved without modification.

4. TTY Forum #19 Summary

Ed Hall asked if there were any suggested modifications to the TTY Forum #19 Meeting Summary. There were none and the document was accepted as final.

5. TTY Liaison Reports

5a. **FCC**—Mindy Litell thanked all entities for reports filed last quarter. She noted that the first deadline, December 31, 2001, is quickly approaching. She expressed her interest in hearing the company status reports given at this meeting, both to see progress and to judge if the second deadline, June 30, 2002, would be met.

5b. **CTIA**—No report at this time.

5c. **NAD and TDI**—Jim House, TDI, reported that he had worked with the TTY Working Group discussing labeling and marketing, and his contribution (TTY/2001/01.12.11.08) will be discussed during agenda item number ten “Terminal Product Labeling for TTY Accessible Devices.”

6. Review TTY Forum #19 Agreements and Action Items

Ed Hall reviewed all agreements and action items from the TTY Forum #19. 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

Ed Hall noted that Sony Ericsson submitted a written report, and that verbal reports would be accepted from other participants. He noted that the verbal reports should be followed by a written submission to the TTY Forum Secretariat by January 9, 2002, 5 p.m. Eastern Time. Reports should be e-mailed to Megan Hayes (mhayes@atis.org) in final form Microsoft Word format.

Cingular

Ken Evans reported that Cingular has both TDMA and GSM technologies and uses three different vendors. He reported that progress with TDMA is proceeding with all three vendors and roll out should begin on schedule. He expressed concern with the status of GSM technology from Nortel, explaining that although Cingular had received the software solution from Nortel, there were bugs to be worked out and the software had yet to be tested and installed. He expressed his concern with the ability to meet the June 30, 2002 deadline for GSM in all markets due to the work still needed on the Nortel technology.

Ken Evans also mentioned that the company needs more information on the perceived need for the handsets for testing and retail. Several participants, including Susan Palmer, Cingular, noted the need for consumer input in the roll out process of these new TTY compatible devices. Ed Hall suggested adding discussions of roll out issue under agenda item #12, “New Business.”

AT&T

Lori Buerger reported that the AT&T status is very similar to that of Cingular. She noted that their three vendors progress is similarly situated with regards to both TDMA and GSM, and that they are finding similar problems in the launching of the Nortel GSM technology. She noted that as this forum is meeting, she has another colleague involved in the Nortel testing. She noted that AT&T is comfortable with their ability to meet the deadline dates at this time. In regards to handsets, she informed the group that there is a Panasonic version of the TTY compatible phone currently available in stores. Pieter Seidel, Panasonic, noted that the available phone is a TDMA Tri-Band phone.

Sony/Ericsson

Matt Kaltenbach presented Contribution TTY20/01.12.11.09, which is Sony Ericsson's TTY Forum – 20 Report. In regards to network infrastructure status, he reported that the testing is complete on the TDMA network and General Availability (GA) was granted on December 5, 2001. He reported that the GSM network development was complete and testing and performance evaluation has begun. He reported Sony Ericsson's expectation that the first activation of this network will be during the first quarter of 2002. He reported that the CDMA network code is currently under development with testing slated for mid-December 2001.

In regards to handsets, Matt Kaltenbach reported that TDMA handsets have completed developmental testing and volume availability is expected March 31, 2002. GSM handsets have also completed developmental testing and volume availability is expected on February 20, 2002. He noted that CDMA handsets have encountered problems in the developmental test process and that the release plans for these handsets remain open, as solutions are sought for the problem.

Matt Kaltenbach reported on the testing status of the devices and technology at Sony Ericsson, including testing occurring in the ATIS-sponsored incubator group, TTY Technical Standards Implementation (TTSI). A participant noted some concern over the 3% error rate displayed in the testing report. Mr. Kaltenbach explained that this 3% error rate occurred randomly as a result of a "hiccup" in the network. Peiter Seidel noted that error rates in voice quality often need to be averaged due to these random events, it is not an event that occurs only in TTY compatible technology. David Nelson, NAD, noted his concern that a crowded network could compound this kind of error and affect the quality of the call. Mr. Kaltenbach responded that the call completed error rate on a crowded network would be no different from an error rate seen on a normal day. Andrea Williams, CTIA, noted that the ability to complete a call was directly related to the amount of spectrum available in any given area. Mr. Seidel noted that with TDMA there are two places that a call can be affected by heavy network traffic: in call completion and during hand-off. He noted that if the network capacity is full, the call might be lost during hand-off, however, this is a problem that occurs in all calls, and is not a TTY specific issue. Beth Wilson asked about TTY_SILENCE, and Mr. Kaltenbach replied that they are still looking at why it occurs and the best way for it to be resolved within the industry.

Ms. Wilson referred to the diagram in the Sony Ericsson report, which showed an extra attachment device being used to enable TTY compatibility with a handset. Mr. Kaltenbach replied that this would be a temporary solution with the eventual goal being the integration of the TTY device in the handset. Peter Lee, Ameriphone, explained that new models are currently in

development to match specifications. Bob Montgomery, Nextel, explained that with Nextel systems the switch from voice to TTY could be done at either the handset or the TTY device. Ron Schultz, Ultratec, noted that with Ultratec devices all that would be required for compatibility with digital handsets would be a different cable.

Nextel

Bob Montgomery reported that Nextel had completed developmental testing for FOA, and they were in the deployment stage for infrastructure and handsets. He noted that New York would be the next market set for deployment and the target date was June 30, 2002. He noted that Nextel uses iDEN technology, which is proprietary to Motorola.

Sprint PCS

Scott Freiermuth reported that Sprint PCS is working with four network vendors, with CDMA technology. He reported that the Lucent technology had been provisionally released, with ongoing testing due to some issues with the handset. Limited testing has occurred with Motorola, but wider testing was needed to accommodate different loads. Mr. Freiermuth explained that Sprint PCS was in a situation similar to that of Cingular with respect to their Nortel infrastructure. Baseload software had been received and testing still needed to occur. He also noted that that software from Samsung had been received, but testing would not begin until testing was complete on the Nortel switch. He reported that there were some minor bugs in some of the handsets tested, and that further testing would occur. Mr. Freiermuth stated that Sprint PCS was confident of adhering to the June 30, 2002 deadline.

Nokia

Chris Wallace reported that a TTY capable TDMA handset has been announced. He further reported that there have been problems with CDMA technology, but those problems are being addressed. GSM testing was expected at the end of December 2001. Mr. Wallace explained that the lab-version of GSMA was delivered, and Nokia is not expecting any infrastructure deadline issues.

8. Review Appendix E—User Intervention Document

Mr. Hall noted that at TTY Forum – 19, the consumer community was asked to review the User Intervention Document. (Please see Action Item 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.) Jim House, TDI, noted that in this item “eyes busy” refers to an environment with a lot of visual distractions. Al Sonnenstrahl, CAN, noted that he refers to this as a “visually noisy” environment, and he hopes to use terminology that the hearing community can easily understand. Beth Wilson noted that the primary concern of this item would be the avoidance of having important messages appear on the handset while the user is focusing on the TTY. A consumer participant noted that the most important consideration is that continuation of the call should require no action on the handset during a call. Several industry participants asked if this would mean that consumers are suggesting that features causing a display on the handset, such as caller id and call waiting, be eliminated for TTY users. The consumer participants responded that was not their intention.

They suggested that to avoid industry confusion, Item #13 should be removed from the User Intervention Document.

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

AGREEMENT REACHED: 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?)

9. Technical Issues

9a. TTSI Report

Ed Hall explained that TTSI is an incubator that was initiated by Ericsson, and the synergy that has been generated in this forum has been incredible. Jim Turner, ATIS, presented Contribution TTY20/01.12.11.04, the TTSI report to TTY Forum – 20, which includes information on testing activity ongoing in TTSI. He noted that several test cases had been run and the data was then plugged into a database that was developed in part by Matt Kaltenbach. This database and its contents can be found on the TTSI web site. Mr. Turner noted that although several vendors had participated in these tests, not all vendors had chosen to be included.

During the TTSI Report, Judy Harkins, Gallaudet, noted that the error rate in analog devices had gone up and, therefore, the benchmark for digital had changed. Ed Hall explained that the industry was still striving for an error rate of less than 1%.

A participant asked if there had been testing on VCO/HCO capability. Mr. Turner replied that there has been some preliminary testing, but that the results are inconclusive. A consumer noted that it would be less cumbersome if the toggle for switching to VCO/HCO was located on the TTY device, as opposed to having to go through a menu process on the mobile handset. Lee Whritenour, Verizon Wireless, explained that HCO/VCO mode can be set once, and does not need to be switched for every call.

Concerns were expressed that the cable linking the TTY devices did not always fit properly. A participant replied that this was a problem when a cable from a third party was used as opposed to the cable from the manufacturer. Ed Hall noted that this is an industry problem and not necessarily an issue for the TTY forum. Mr. Whritenour offered to provide more information for the TTY forum on the standards used for the cable connection in TTY devices. Jim House suggested that perhaps the industry should consider labeling strongly recommending the use of the manufacturer’s attachments, not equipment from third party sellers. Ron Schultz pointed out the importance of investigating your purchase giving the example that the cable that comes with Ultratec devices will not necessarily fit all phones. Susan Palmer noted that this was just one of several issues that could be noted as consumers began using the phones. Ed Hall stated that from this conversation he was understanding that the TTSI should continue and various consumer

groups (Gallaudet, SHHH, TDI, NAD, etc.) should be invited to participate in the next round of tests. A trial use by the hearing impaired community was also suggested. Mr. Turner noted that there had been some members of the Gallaudet community already involved in the TTSI testing.

ACTION ITEM: 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.

ACTION ITEM: 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.

Jim Huntley, Gallaudet, presented Contribution TTY20/01.12.11.10, which is a report of testing results he achieved in an independent test on a small subset of available equipment in New Jersey. He explained that these trials were all done in a mobile to land call environment. The results were favorable (below 1% error rate) in all tests except analog and 13K. He noted that echo cancellers still seemed to have a dramatic effect on performance.

9b. Review Appendix J—Technical Standards Reference

Ed Hall presented Appendix J—Technical Standards Reference, contained in document TTY20/01.12.11.05 for information.

10. Terminal Product Labeling for TTY Accessible Devices

Jim House presented contribution TTY20/01.12.11.08 as a jumping-point for the discussion on product labeling and marketing of TTY devices. He recommended a collaborative effort with other advocacy groups as well and industry representatives to establish labeling guidelines for the equipment as it is being produced. David Nelson, NAD, reminded the group that you often do not see the box of the cell phone you are purchasing before you purchase it and, therefore, there must be some other way to inform the consumer about their purchase.

Al Sonnenstrahl noted that often labeling and packaging are done by a third party, and so all packaging requests would have to be contracted up front. Susan Palmer reiterated that these guidelines from the community would have to be produced in a timely manner in order to produce accurate labels before roll-out. A participant noted that the simpler the language, the more effective it would be. Andrea Williams noted, in respect to the suggestion that CTIA require carriers to use the same type of labeling, that CTIA is a trade association, and can only make suggestions to the industry, not mandate a certain type of labeling.

Steve Coston, Sony Ericsson, encouraged input from the consumer groups to the carriers so that it may be passed through the industry. Pieter Seidel, Panasonic, noted his agreement with the need for labeling and pointed out that it may be important to note a difference in labeling for compatibility with the analog standard versus compatibility with the digital standard. Susan Palmer expressed her opinion that guidelines are the key here to ensure that labeling remains

accurate with the rapidly changing technologies. Ed Hall noted consensus among the group for the continuing need for discussion regarding labeling.

AGREEMENT REACHED: The Terminal Product Labeling group will be closed.

AGREEMENT REACHED: 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.

11. Next Meeting

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

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

12. New Business

12a. HAC-FCC NPRM WT Docket #01-309 (November 14, 2001)

Ed Hall introduced the FCC notice of proposed rulemaking found in TTY20/01.12.11.06, regarding re-examination of the exemption of public mobile service phones from the Hearing Aid Compatibility Act. He noted that comments are due on the notice of proposed rulemaking by January 11, 2002.

Before leaving, Mindy Litell, FCC, noted that if this rule is enacted, it would be helpful for the industry to work with the community towards a solution. She stated that the Commission would be gratified if the industry took the same lead as they did in the TTY Forum in working with the community.

Andrea Williams noted that hearing aid compatibility tends to boil down to technical issues including interference and internal couplings. She told the Forum that the FCC had no jurisdiction over the manufacturers of Hearing Aids the way they do over the telecommunications industry. She also noted that a group has been established to try and determine an acceptable level of interference with mobile phones and hearing aid devices. She explained that there is an ANSI standard in existence that assigns a number to the level of interference caused by the phone and the level caused by the hearing aid, and the total interference is the sum of those two numbers. She explained that the wireless industry is prepared to go forward using this standard, but their ability is linked to the capability of the hearing aid manufacturer's capability to go forward. She went on to explain that the hearing aid manufacturers had indicated that they are not ready to go forward, noting problems in the testing process, which leaves the wireless industry at a crossroads in terms of implementation.

Ken Evans expressed his feeling that the wireless industry is being held hostage by another industry, and his concern that the consumers are the ones losing out. He asked if there was any way to put pressure on the hearing aid industry in a similar way that the FCC is able to pressure the telecommunications industry.

Andrea Williams noted that the surfacing of this issue has moved the hearing aid industry to increase immunity levels, and it has led to some improvements. Susan Palmer noted that this issue presents a good opportunity for industry to work again with consumers to find a solution.

Beth Wilson pointed out the complexity of the issues with hearing aid immunity, and she added her support in revoking the exemption and making hearing aid compliance a requirement for digital cell phones. She expressed her concern that money is going towards testing rather than towards finding solutions. Peiter Seidel agreed that the solution should ultimately solve the problem and that the issue would require co-operation between the industry and the community. He pointed out that HAC is not an issue for the TTY Forum. Ed Hall noted that the industry would have to answer some questions on this issue in the future, and he suggested that a forum like TTY, with its various stakeholders, could be a fallback position for the industry.

12b. Roll-Out Issues

Various concerns regarding the roll-out of TTY compatible equipment were raised, and they are contained in TTY20/01.12.11.12. Scott Freiermuth noted that all carriers will have roll-out issues and, perhaps, it is not an appropriate topic for the TTY Forum. Andrea Williams agreed stating that roll-out issues may fall into a competitive area. Lee Whritenour also agreed noting that the industry is under mandates to fill an obligation in the educating of their workforce and other customer care issues.

Susan Palmer stated that there are resources in the TTY forum that can be used to address these issues without entering a competitive area. Jim House suggested that the industry may want to consider having a demo TTY device set-up in the store for consumers to experiment with. Beth Wilson suggested that the consumer community needs to be educated on such issues, such as using third party cables and determining if a phone is digitally TTY compatible or if it is only compatible with analog. Judy Harkins suggested that the industry would benefit from partnering with TTY manufacturers to work on the marketing of these products and the application of customer support. Cary Barbin, Gallaudet, noted that a serious concern in the deaf community is price—and the price paid for minutes spent waiting for relay calls to be completed and messages to be typed.

Based on the concerns raised, Ed Hall recommended calling the issues raised “Roll-Out Guidelines and Considerations” and turning them over to the TPI Working Group for exploration. The resulting suggestions would be valuable tools for members, and would be included as an appendix in the next meeting summary.

AGREEMENT REACHED: 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.

Participants raised questions regarding the ability of non-initialized phones being connected to 911 operators. It was noted that the industry has been mandated to allow all 911 calls—including TTY calls—to be completed from any handset.

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

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

13. Adjournment

Ed Hall declared the meeting adjourned at 4:17 p.m.

**TTY – 20
Meeting Roster
December 11, 2001
Washington, DC**

Cary Barbin	Gallaudet	202-651-5613-TTY	202-651-5476	cary.barbin@tap.gallaudet.edu
William Breslin	ATIS			
Lori Buerger	AT&T Wireless	312-258-2906	312-441-2025	lori.buerger@attws.com
Nicole Butler	ATIS	202-662-8663	202-393-5453	nbutler@atis.org
Philippe Chartier	Nortel Networks	972-685-7285	972-684-3915	pchartie@nortelnetworks.com
Steven G. Coston	Sony Ericsson	919-472-7527	919-472-6105	steve.coston@ericsson.com
Linda Day	AT&T Wireless	559-284-4425	559-438-5713	linda.day@attws.com
Ken Evans	Cingular Wireless	404-713-8888		ken.evans@cingular.com
Scott Freiermuth	Sprint PCS	913-762-7736	913-762-0922	sfreie02@sprintspectrum.com
Frank Gay	Siemens	858-521-3638	858-521-3108	frank.gay@icm.siemens.com
Ed Hall	ATIS	202-434-8836	202-393-5453	ehall@atis.org
Judy Harkins	Gallaudet	202-651-5677	202-651-5476	judy.harkins@tap.gallaudet.edu
Megan Hayes	ATIS	202-662-8653	202-393-5453	mhayes@atis.org
Gregory Hilbock	FCC	202-418-0431-TTY	202-418-1414	ghilbock@fcc.gov
Jim House	TDI	301-589-3006-TTY	301-589-3797	jimhouse@tdi-online.com
Jim Huntley	Gallaudet	908-538-3288		jhuntley@overdog.net
Matt Kaltenbach	Sony Ericsson	919-472-1818	919-472-6105	matt.kaltenbach@ericsson.com
Peter Lee	Ameriphone	714-897-0808	714-897-4703	peterl@ameriphone.com
Mindy Litttell	FCC	202-418-0789	202-418-7247	mlittell@fcc.gov
Audrey Longhurst	Motorola	206-923-3454		audrey.longhurst@motorola.com
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
Majid Nawaz	NEC America, Inc	214-262-4463	214-262-4225	mnawaz@necam.com
David Nelson	NAD	202-906-2500-TTY	202-906-3822	djn@amtrak.com
Susan Palmer	Cingular	202-419-3009	202-419-3047	susan.k.palmer@cingular.com
Bonnie Petti	Verizon Wireless	925-279-6612	925-279-6621	bonnie.petti@verizonwireless.com
Rachelle Redfairn	Sprint PCS	913-890-2252	913-890-2050	rredfa01@sprintspectrum.com
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
Pieter Seidel	Panasonic	770-338-0270	770-338-6253	pseidel@panasonicatlanta.com
Al Sonnenstrahl	Deaf Seinors of Ameica	301-770-7555-TTY	301-770-7555	sonny@clark.net
Jim Turner	ATIS	630-972-1454		jturner@atis.org
Steve Urbanski	Motorola	847-523-7054	815-884-1395	steve.urbanski@motorola.com
Chris Wallace	Nokia	972-894-4947	972-894-5525	chris.wallace@nokia.com
Lee Whritenour	Verizon Wireless	908-306-6485	908-306-6489	lee.whritenour@verizonwireless.com
Andrea Williams	CTIA	202-736-3215	202-785-8203	awilliams@ctia.org
Beth Wilson	SHHH	301-657-2248	301-913-9413	bwilson@shhh.org
John Wynen	Research in Motion	519-888-7465	519-883-4909	jwynen@rim.net

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

Corr Wireless Communications LLC

Dobson Cellular Systems

Farmers Cellular Telephone Inc.

Midwest Wireless Holdings

PCS One

Pine Belt Cellular

Rural Cellular Corporation

Southern LINC

Telecorp PCS

VoiceStream Wireless

APPENDIX A

Agreements and Action Items

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 mfrs 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

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 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.



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?

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 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

Title	FirstNam	LastNam	JobTitle	Compan	Address	Address	City	State	Zip
Ms.	Veda	Krishnan		Cirrus Logic	110 Horizon Drive #300		Raleigh	NC	276 15
Mr.	Zarko	Draganic	CEO	Alto Com Inc.	257 Castro Street	Suite 233	Mountain View	CA	940 41
Mr.	Edward	Campbell		3Com					
Mr.	Raouf	Halim	VP and General Manager, Network Access Division	Rockwell Semicon ductor Systems	4311 Jambor ee Road		Newport Beach	CA	926 60- 309 5
Mr.	Aaron	Fisher	Vice President , Wireless Products	Lucent Technolo gies	Room 55F- 311	1247 S. Cedar Crest Blvd.	Allentown	PA	181 05- 620 9
Ms.	Judy	Sheff	VP Intellectu al Property	Lucent Technolo gies	Room 55F18	2 Oak Way	Berkley Heights	NJ	079 22- 274 7
Mr.	Greg	Garen	General Manager Modem and Multime dia Products	Lucent Technolo gies - Microele tronics Group	Room 22W- 219(Ma il Stop EQ)	555 Union Blvd.	Allentown	PA	181 03- 122 9
Mr.	Warren	Henderso n	CEO	Henderso n Laborato ries					
Mr.	Moiz	Beguwala	VP and	Rockwell	4311		New	CA	926

Title	FirstName	LastName	JobTitle	Company	Address	Address 2	City	State	Zip
			General Manager, Personal Computi ng Division	Semicon ductor Systems	Jambor ee Road		port Bea ch		60- 309 5

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

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.

APPENDIX I

TTY Forum Chair's Update Memorandums

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
TIA/EIA TSB-121	"2.5 mm AUDIO INTERFACE FOR MOBILE WIRELESS HANDSETS - TEXT TELEPHONES (TTY)"
TIA/EIA-IS-823 (PN-4614)	TR 45.3 5.3 TDMA TTY Solution- 410 vocoder
TIA/EIA-IS-840 (PN-4721)	TR 45.3 5.3 TDMA TTY Min Performance.
TIA/EIA/IS-789-A:	Electrical Specification for the Portable Phone to Vehicle
IS-733-1, IS-127-2	CDMA Vocoder Standards - high rate
IS-707-A-2	CDMA Data (V.18) Standard
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 TR26.226	Cellular Text Telephone Modem Description
3GPP TR26.230	Cellular Text Telephone Modem Transmitter Code
3GPP TR26.231	Cellular Text Telephone Modem Minimum Performance Specifications

Timeline of Events in CDMA and TDMA standards

CDMA: TIA TR45.5.1.1

=====

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
Industry Implementation Status Reports
Contained within are written industry TTY implementation
status reports as submitted to the Secretariat.

Table of Contents

ALASKA COMMUNICATIONS SYSTEMS WIRELESS	56
AT&T WIRELESS	57
CAPROCK CELLULAR LIMITED PARTNERSHIP	60
CAROLINA WEST WIRELESS.....	62
CINGULAR WIRELESS LLC	63
CORR WIRELESS COMMUNICATIONS, L.L.C.....	65
DOBSON CELLULAR SYSTEMS.....	66
FARMERS CELLULAR TELEPHONE, INC.	67
MIDWEST WIRELESS HOLDINGS L.L.C.....	69
MOTOROLA	70
NEXTEL COMMUNICATIONS, INC.	72
NOKIA	74
NORTEL NETWORKS.....	76
PCS ONE	84
PINE BELT CELLULAR, INC.	85
RURAL CELLULAR CORPORATION	87
SIEMENS.....	89
SONY ERICSSON MOBILE COMMUNICATIONS AND ERICSSON INC.	90
SOUTHERN LINC	98
SPRINT PCS.....	99
TELECORP PCS	100
VOICESTREAM WIRELESS.....	110

Alaska Communications Systems Wireless

TTY Status Report
January 7 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 relying on our switch vendor for Version 7 software 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 handsets are available, ACS Wireless will perform field tests.

3. Beta Testing and Lab Testing

Tests will be performed when vendor software and TTY handsets are available

4. Release and General Availability to Carriers of Network Software

Ericsson software is available.

5. Availability to Carriers of Full Acceptance Test Units

Full acceptance tests depend on handset vendors.

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.

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.

Respectfully Submitted
Nicholas Miller
Wireless Operations Manager

**AT&T Wireless
4th Quarter TTY Progress Report**

7 January, 2002

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: AT&T Wireless has received software from all three of our network platform vendors. Not all of the software received to date is Generally Available.

GSM Network: AT&T Wireless received TTY software for Nokia GSM transcoders during Q4, 2001. Ericsson delivered an E-CTM server and Nortel delivered an MSC CTM trunk selection patch necessary to begin CTM circuit-pool testing during Q4, 2001.

Handset Development and Testing Plans

TDMA Handsets:

Ericsson, Nokia, and Motorola: All three vendors delivered TTY-capable TDMA handsets during Q4, 2001.

GSM Handsets:

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

Motorola: Motorola reports that they are planning to provide a TTY-capable GSM handset that should be available to our lab in Q1, 2002

Nokia: Nokia reports that they are planning to provide a TTY-capable GSM handset that should be available to our lab in Q1, 2002

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 7 ANSI 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 Q4, 2001, AT&T Wireless installed and integrated an Ericsson E-CTM server into our Ericsson BSS lab environment.

For both TDMA and GSM networks, TTY-compatible software will be thoroughly tested in the AT&T Wireless lab before being released to their respective FOA (First Office Application) market(s).

Release and General Availability to Carriers of Software

TDMA Network: AT&T Wireless has obtained information from all three of our TDMA (ANSI-136) infrastructure vendors concerning the release of their TIA/EIA IS-823A software for general availability. The information obtained from each is summarized below:

Ericsson: Ericsson's support of IS-823A as a correction to Version 7 ANSI became generally available as of Q4, 2001

Lucent: Lucent has integrated IS-823A support into 5ESS software release 5E15.1 BWM01-0008, and it became generally available in Q3, 2001. TTY software has been installed in all Lucent switches within the AT&T Wireless network. TTY functionality will be enabled in these markets during Q1, 2002.

Nortel: Nortel supports IS-823A in MTX10, DSPM version EFRX10BR. MTX10 became generally available during Q4, 2001 but the general availability date of the DSPM EFRX10BR load which contains the TTY/TDD feature is still to be determined.

GSM Network: AT&T Wireless has received the following information regarding the general availability of TTY-capable GSM network equipment:

Ericsson: Ericsson's CTM node should be generally available in Q1, 2002

Nokia: Nokia's CTM software for network transcoders should be generally available in Q1, 2002

Nortel: The software patch FFD03 to Nortel GSM13 necessary to support trunk selection based on CTM indicator status (required to support the Ericsson E-CTM server) should be generally available in Q1, 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: Ericsson reports that they are planning to have an IS-823 handset available for GA in Q1, 2002

Nokia: Nokia reports that they are planning to have an IS-823 handset available for GA in Q1, 2002

Motorola: 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:

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

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

Nokia: 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

GSM TTY-Capable Handset Test Plan:

In November, AT&T Wireless prepared and submitted to the Terminal Working Group of GSM North America a recommended procedure for TTY handset verification testing. This test procedure recommendation replaced two prior AT&T Wireless submissions to this body. Our current proposal greatly simplifies the TTY test process by using off-the-shelf test equipment. Standardized test results will be obtained by using Gallaudet TTY Tools software for performance analysis. The procedure also includes tests to verify that a TTY-capable handset will operate properly in a GSM network using TTY circuit-pooling.

November TTSI Test Event:

AT&T Wireless participated in the ATIS TTSI field test event, which took place between 12 and 16 November in Lisle, IL. The AT&T Wireless public network (using Lucent infrastructure equipment) was used for the TDMA field-test portion of these tests.

Nortel Lab Test Testing:

AT&T Wireless is in the final stages of lab testing the most current release of Nortel TDMA TTY support software in our Redmond, WA lab. A FOA of this software is expected to take place in mid January, 2002.

Ericsson Lab and FOA Testing:

AT&T Wireless' Atlanta market was the FOA location for Ericsson's TTY software in November. This FOA included software for both vocoder types (TRAB2 and TRAB3) used in Ericsson TDMA systems.

Retail Availability of Necessary Consumer Equipment

Two Panasonic TDMA TTY-compatible handsets (models EB-TX310 and EB-TX320) were accepted by AT&T Wireless during Q3, 2001. These Panasonic handsets are currently available in our retail stores.

Progress of TTY-Digital Deployment Solutions
CC Docket No. 94-102
4th Quarterly Report
December 31, 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. The exact date of deployment of this software load is not known at this time, but is tentatively scheduled for the 2nd Quarter of 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.

#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 cannot begin testing activities until the correct software load is installed in the switch and handsets are generally available.

#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

According to Nortel Networks, the MTX10 software is the only requirement for implementation. The mobile switch, if currently at MTX09, nor the cellsite equipment will require hardware changes. (Caprock Cellular does not own the mobile switch, Plateau Telecommunications provides switching for Caprock's cellsites. Due to this fact Caprock cannot control implementation dates for the required software.)

North Carolina RSA 3 Cellular Telephone Company
d/b/a Carolina West Wireless
TTY Report
Fourth Quarter 2001

Background

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

Status

The infrastructure vendor has released the MTX10 software. The schedule to deploy the MTX10 software is the first quarter of 2002.

Phone manufactures have moved the availability of equipment out to the first quarter of 2002.

Carolina West Wireless is unable to predict precise dates for testing and consumer availability until phone manufacturers make the equipment available.

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

January 2, 2002

To: TTY Forum

From: Susan Palmer and Ken Evans

TTY Forum #20 Report
Cingular Wireless LLC

Overview

Cingular Wireless LLC (Cingular) notes that progress in testing the TTY solutions has continued since Forum 19. Communication amongst all parties remains excellent. Cingular has participated in ATIS coordinated testing in both CDMA and TDMA environments. Several hundred land line-to-mobile and mobile-to-mobile tests were made. Using total character error rate (TCER) as a measure, the results to date have been favorable. In late January 2002, Cingular will make a GSM market available to ATIS for the purpose of coordinating GSM interoperability testing.

In January 2002, ATIS will be testing CDMA, GSM and TDMA TTY solutions with various Public Safety Answering Point (PSAP) equipment vendors. This is to insure compatibility with E-911 service. Cingular is committed to work together with manufacturers and consumers to resolve any technical issues that may be identified by this testing.

Manufacturers have provided a limited number of handsets for testing, however, we are still concerned that handset availability will be an issue for market testing and general deployment.

As mentioned in Forum # 19 Report, to have effective TTY access, supporting documentation and information regarding handset and handset connectivity must be given to service providers in time to develop appropriate customer care and sales support. Methods and procedures must be developed to ensure that TTY compatible handsets and cables are available to customers in a timely fashion. This information is needed by March 1, 2002 to meet the June 30, 2002 deployment date.

ERICSSON

TMDA: The TTY software was given general availability (GA) status on December 1, 2001. Cingular has received the needed software, which is running in our Lisle Laboratory. Deployment of this software in the Ericsson switches in our network will be completed in April 2002. The December 31, 2001 date has been met. The June 30, 2002 deployment requirement is on track.

GSM: Testing has been completed in our Pleasanton Laboratory. A first office application (FOA) is scheduled for January 10, 2002, with deployment to follow. The December date has been met. The June 30, 2002 deployment requirement is on track.

NORTEL

GSM: Despite our best efforts, we have been unable to obtain what we need to test and implement a TTY solution from this manufacturer at this time. Testing is scheduled for early March, with a GA date of May 15, 2002. This is only six weeks prior to June 30, 2002 when the FCC requires that we have TTY fully implemented. Thus, our ability to meet the June deadline is in serious jeopardy.

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 will start on March 1, 2002. Again, despite our best efforts we have been unable to obtain a TTY solution to test and implement at this time.

LUCENT

The Lucent TTY solution will be installed in all Lucent switches by January 25, 2002. Testing in Lucent switches 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 two interoperability testing events conducted by the industry and coordinated by the TTSI. Both TDMA and CDMA testing was started and the results have been good for most scenarios. However, some tests have yielded problems that will require additional testing to arrive at a resolution. Required testing for MSC to MSC and MSC to PSAP has not been completed. GSM will not be available for interoperability testing until January 2002. We may need up to four additional testing events to complete interoperability testing. This scenario leaves little time to identify and resolve problems and roll out the solution prior to the June 30, 2002 date.

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.



Dobson Cellular Systems

January 11, 2002

Dobson Cellular Systems (DCS)/ American Cellular Corporation (ACC)
TTY Report – 4th QTR/TTY #20

Network Infrastructure Software Development

DCS/ACC utilizes TDMA infrastructure from Lucent and Nortel. DCS/ACC relies on these two vendors to complete software development and upgrades. Lucent is ready with it's ECP Release 17 and Nortel has released MTX-10.

Handset Development and Testing Plans

DCS/ACC relies on its handset vendors for the development and testing of TTY capable handsets. Panasonic has replied that two phones, the Allure and Versio are compatible. Motorola has the 120-T and Nokia 6360 as well as Analog 918, 252 and 282 are compatible.

Beta Testing and Lab Testing

DCS does not have a lab for testing. Once the TTY software is deployed from Lucent and Nortel we can begin field-testing.

Release and General Availability to Carriers of Network Software

See: Network Infrastructure Software Development above.

Availability to Carriers of Full Acceptance Test Units

DCS/ACC is waiting on commitments from our handset vendors.

Carrier Coordination of Testing with PSAP

DCS/ACC will conduct TTY testing with PSAP's that request. We will also inquire to PSAP's that we have implemented Phase I E911 on their availability to test with us.

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

DCS/ACC will conduct consumer testing end-to-end in the coming months utilizing our relationships developed during Phase I E911 implementation.

Retail Availability of Necessary Consumer Equipment

Availability of the phones mentioned above.

Geographic Scope of Network Development

Although there can be complications with the availability of handsets and software testing, DCS/ACC remains committed to the June 30, 2002 deadline.

Sincerely,
Sean O'Hara
Special Project Manager
Dobson Cellular Systems



Farmers Cellular Telephone, Inc.
TTY Report
January 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.

Midwest Wireless Holdings L.L.C
TTY Status Report
December 19, 2001

Background

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

Status

Nokia reported they were supposed to begin testing with Nortel in October. They also reported the schedule is on track, and they are confident of meeting the FCC deadline.

Nortel announced the general release of MTX10 effective December 7, 2001. Nortel reports 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 pending the availability of stable commercial grade handsets. Nortel reports the TTY feature in MTX10 was fully verified in late November and minor issues were uncovered. Nortel Networks forecast beginning verification of the corrected code late this December with their lead customers, but acknowledged due to the holidays this activity may not be complete until early January 2002.

Midwest Wireless does not plan to install MTX10 until late 1st or early 2nd qtr. 2002, so will not be in compliance with the 12/31/01 software compliance deadline. However, that should not change our expectations of meeting the June 30, 2002 deployment date.

Respectfully submitted
Gary Christopherson
Midwest Wireless Holdings L.L.C.

January 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 fourth quarter of 2001. 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
4th Quarter 2001

Product	Standard	Status	Milestones	Progress
CDMA Handset	IS 127-3 IS 733-2	Integration & System Test	IOT: June 2001 UI: October 2001 ROM: December 2001 SA: 2Q 2002	Completed ATIS sponsored Live Net testing in Nov. Begin Operator based testing in mid Dec 2001. Customer approval software available in 1Q2002.
GSM Handset	TS 26.226 TS 26.230 TR 26.231	Integration & System Test	UI: October 2001 IOT: October 2001 ROM: January 2002 SA: 2Q 2002	Started IOT in October with outside infrastructure manufacturer. More testing planned in December.
iDEN Handset		Carrier Testing	On plan	Handsets tested by Carrier during December 2001 FOA
TDMA Handset	IS 823-A IS 840-A	Integration & System Test	IOT: September 2001 UI: September 2001 ROM: October 2001 SA: 1Q 2002	Completed ATIS sponsored testing in November. Provided TTY test units to two independent carriers.
CDMA Infrastructure	IS 127-3 IS 733-2	Ready for FOA	FOA Jan 02	Completed ATIS sponsored testing in November. FOA is likely in Jan02
iDEN Infrastructure		Carrier Testing	On plan	Carrier FOA testing complete in December 2001

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



January 9, 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

Having completed all Motorola and Nextel lab testing of the TTY-capable iDEN handset and network infrastructure, Nextel conducted a First Office Application ("FOA") test of the TTY capabilities in Irvine, California during 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, 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 forwarding, to ensure proper functioning with the TTY device. All of these test calls were successful. Finally, Nextel's FOA tested the

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.

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 is now deploying the infrastructure components in its New York Market for a Second Office Application (“SOA”) in January 2002. The SOA will be complete by early January, at which time Nextel can begin full nationwide deployment of the TTY infrastructure. This deployment schedule should provide Nextel sufficient time to fully deploy the capabilities throughout its nationwide network, conduct TTY testing with at least one Phase I Enhanced 911-ready PSAP, conduct testing with other carriers to ensure inter-carrier TTY operability, and launch its TTY service on or before June 30, 2002.

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 #19 – October 2001

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 supplies network infrastructure for GSM.

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 implementations of TSB-121 by all parties in the TTY solution.

MOBILE TERMINAL SOFTWARE SOLUTIONS:

CDMA IS-127-2

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

Six to eight models are under development for TTY Compatibility.

Lab Testing has occurred with Lucent and Nortel infrastructure with the acceptable results.

Depending upon environment performances challenges remain.

Currently scheduling testing with Motorola and Ericsson infrastructure, which is anticipated to be in 1Q 2002.

Participated in TTSI sponsored tests with mixed results.

Continuing to test with infra vendors with improved performance.

Field Testing to begin this month.



FOR EXTERNAL USE

75 (2)

NOKIA Americas Standards

October 10, 2001

Submitted by:

Chris Wallace

V.P. Nokia Americas Standards

TDMA TIA/EIA-136 / IS-823 -A

Five to seven models are being developed for TTY Compatibility.

Nokia participated in both TTSI sponsored tests with good results.

Lab testing has occurred with Nortel Infrastructure with the good results.

Lab testing for Lucent has completed with excellent results

Lab testing for Ericsson has occurred with issues associated with the TTY_SILENCE.

Issue resolved via conference call under auspices of TR45.3

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

GSM ATIS T1.719 and T1.718, except the TTY detector

At this point, IOT testing with an infrastructure is vendors being scheduled.

A GSM product, supporting TTY, will be available to test in Q1 2002, generally available Q2 2002

More details will be available as these products are commercially announced

Respectfully Submitted By:

Chris Wallace

V.P. Nokia Americas Standards

Douglas W. Neeley
Sr. Technical Standards Eng.

Leo Fitzsimon
Government Affairs
(202) 887-0145

January 09, 2002

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 anticipate receiving handsets containing commercial software from major vendors shortly and will conduct testing with those handsets.

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.

Nortel Networks Proprietary and Confidential

January 09, 2002

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
MTX09	Today
MTX10 TDMA	December 07, 2001* - Now Available

* Nortel Networks is awaiting the end-to-end customer verification completion of an improved TTY/TDD solution e.g. Auto baud capabilities, to be contained within a new maintenance DSPM load before allowing customers to activate the current TTY/TDD solution that is generally available. However, any Nortel Networks customer with MTX10 and all the necessary hardware/terminals may become a First Market Application (FMA) customer to verify the improved TTY/TDD feature. As of the date of this correspondence the new DSPM maintenance load is scheduled to complete testing and become generally available by January 18, 2002. All those TDMA customers who have ordered and scheduled an MTX10 upgrade are currently showing plans for full network MTX10 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 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 was fully verified in late November and minor issues were uncovered. Nortel Networks has begun verification of the corrected code in December 2001 with our lead customers, but acknowledge due to the holidays this activity will not complete until early January. This feature will be made generally available at that same time. Any Nortel Networks customer with MTX10 and all the necessary hardware/terminals may become a First Market Application (FMA) customer to verify the TTY feature.

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 are 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.

Nortel Networks Proprietary and Confidential

January 09, 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

Nortel Networks Proprietary and Confidential

January 09, 2002

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 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 mobile handsets from only a few vendors, which have shown positive results. Nortel Networks does not anticipate performance issues with any other vendor's handsets once they come available.

- 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. 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 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 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.

Nortel Networks Proprietary and Confidential

January 09, 2002

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 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

*** All CDMA customers scheduled for upgrade show full upgrade completion prior to June 30, 2002**

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

Nortel 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 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 response: The verification process for NBSS 10.1 with the customer began in June 2001. Nortel 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. Despite the lack of final verification, the TTY feature's software remains in the GA load, however it has been turned off to protect the integrity of the entire software load. 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. Any customer in possession of the TTY hardware/software prerequisites may contact Nortel Networks to become a First Market Application (FMA) candidate for this improved TTY solution within the NBSS10.1.2 maintenance load. Nortel Networks forecast for this improved TDD feature's scheduled full verification is planned to begin in mid December time frame with our lead customers. Completion of external end-to-end customer testing of TTY/TDD is scheduled for January 19, 2002 in time to be part of the scheduled GA date of the NBSS10.1.2 maintenance release of which this improved TTY/TTD solution is to be a part.

Nortel Networks Proprietary and Confidential

January 09, 2002

CDMA TTY/TDD Regulatory FAQ/RFI

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

- 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 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's 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 Proprietary and Confidential

Nortel Networks Solution Status- January 9th, 2002

Overview

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

Nortel Networks will deliver TTY functionality for the BSS in two Phases. The first phase will deliver a transcoder solution for the BSCe3 since this solution was approved first by the standardization bodies. The second phase will deliver a transcoder solution with circuit pooling (the recent Change Request) for the BSCe3 and BSC2G.

Phase 1: Completed: delivered to customers Dec 13, 2001

- Support for TTY on Nortel's 3rd generations BSC- the BSCe3/TCUe3.
- Circuit pooling is not supported.

Phase 2: In Progress: Development and testing

- Supported on 2nd generation and 3rd generation BSC/TCU
- Change Request for Circuit pooling is supported.
- Will be generally available in April 2002.

The TTY Software for the MSC (to support circuit pooling) has already been delivered to customers for Lab testing and will be generally available by to customers by the end of January 2002.

Development Status and Timeline

- First release of TTY Software (Beta version) hardware delivered to customers on December 13, 2001. The TCUe3 hardware had been in place since September.
- Lab testing and debugging is ongoing with a strong focus on system performance.
- A new software release (with Circuit Pooling request) will be available for Nortel GSM customers to test in Nortel labs in Feb 2002.
- Acceptance testing of the final BSS TTY software to be done at the FOA site in March 02.
- BSS Software for TTY will be ready for full deployment in April 2002.

Summary of Inter-Operability Testing and Results

Nortel Networks is currently performing exhaustive inter-operability testing with several TTY terminal and device vendors.

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

Following is a summary of the results obtained during testing with the Motorola and E/// terminals.

All the testing performed in Nortel Networks labs so far has demonstrated character error rates in excess of the required 1%. Nortel is continuing its development and testing effort with the objective to meet the performance requirements for the Customer Ready date.

The main issues (under investigation) are:

- Baudot or CTM Detection time too long by the mobile and TRM board
- At the beginning of transmission the first character received is erroneous or duplicated
- From time to time the TRM would transmit the CTM code in transparent mode
- In reception the mobile receives Baudot CTM Baudot, it should receive Baudot CTM only
- Repetition of characters both uplink and downlink
- Performance issue: it may happen that one character sent by a TTY is received after 2s by the other TTY device
- Lots of interferences detected by the TTY devices due to echo generated by the mobile and by the PSTN

Open Technical Issues

Following is a list of improvements needed to fix issues experienced during lab testing:

- CTM time detection for the uplink in order to eradicate the erroneous characters
- Baudot time detection for the downlink in order to eradicate the erroneous characters
- Baudot treatment in order to reduce echo generate by the landline network

Please direct all queries to-

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

**D&E / Omnipoint Wireless Joint Venture, LP d/b/a PCS One
TTY Progress Report
January 8, 2002**

Background

PCS One is a wireless service provider located in south central Pennsylvania. The company is a 50/50 partnership between D&E Wireless and Omnipoint (now VoiceStream).

The technical standard used is GSM. Our infrastructure manufacturer is Nortel and we currently sell handsets made by Ericsson, Motorola and Nokia.

Progress Report

Due to a pending sale of PCS One to VoiceStream all hardware upgrades, software implementations and handset testing/purchasing will be handled through VoiceStream. Please refer to their report for a progress update.

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

TTY Report – December 11, 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 #20 Carrier Status Report

January 9, 2001

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 December 2001.

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 January 9th, 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. The status provided below is based on the currently available TTY/CTM standards and assumes no changes to these standards.

Network Implementation

Siemens is currently developing 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 is currently conducting internal system testing at our lab in Boca Raton, Fl. Following these tests the Siemens prototype solution will be made available to the wireless operators for network and interoperability testing. This will allow sufficient time for the network integration testing required to meet the in service date of June 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 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 relevant standards. 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 wireless 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 TIA/EIA IS-823A (herein referred to as just 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 from manufacturers equipment that has not been tested in the operability testing conducted to date.. 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 with IS-840A. 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
- Hitec Q90A Amplifier
- Ultratec Compact 600-001600
- 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 was an interoperability issue identified with the Positron Express PSAP equipment. Ericsson has also performed joint testing with Nokia mobile stations (handsets) at the Ericsson facility in Montreal from October 29-31, and a problem was identified concerning the use of TTY silence frames. Technical papers have been submitted to TIA 45.3.5 and TTSI which describe these two issues and resolution plans are in progress.

TDMA Plans:

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 shortly.

A problem has been identified when using Nokia mobile stations with the Ericsson TDMA network software. This problem is 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 was requested to clarify the standards. A resolution plan is currently being developed.

TDMA development performed joint testing 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. The problem is related to the bit duration defined within the bit exact example implementation in IS-823A. The IS-823A standard currently sets the bit width to the minimum bit duration specified within IS-840A, in leau of the nominal bit duration. Ericsson is the first vendor to have identified this interoperability issue, and believes this problem may affect other vendors, or designs that implement the IS-823A bit example solution. Sensitivity to the bit duration specified within the bit exact code of IS-823A has been measured with one PSAP equipment vendor, and it is

unknown the extent where existing performance issues may exist. A request has been made to TTSI to test all PSAP equipment vendors to IS-840A minimum performance specifications. Requested changes to IS-823A have been submitted, and a plan is being developed for implementation of a solution. The scope of the changes required to interoperate with PSAP equipment is currently being undertaken by TTSI.

GSM Status:

The development code and products for the E-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. Development test cases were run in Richardson TX with approval testing completed in November. AWS received the E-CTM service node and system code during the first week of December. 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. Tests were run on December 18-20, 2001. FOA for the GSM Network is scheduled to be complete by January 28, 2002. VoiceStream has received E-CTM test materials, and is preparing to test the system code. Infrastructure rollout plans are complete, and capable of being completed prior to June 30, 2002.

CDMA 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 <http://www.ericsson-snc.com/> on 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 work items, that require attention. Currently, Sony Ericsson is working several technical work items through the ATIS Incubator process. Several of these issues are in the resolution process, and are expected to be resolved satisfactorily.

Critical Work Status:

Sony Ericsson continues to develop product changes to resolve 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. Completion of the outstanding work items contained within the TTY Standards need to be effected prior to the FCC mandated system availability date of June 30, 2002.

Work Items and Concerns Associated with TTY Standards:

- The Bit Exact Code (reference design) has been removed from the IS 823 and IS 127 Standards. Interoperability with the reference design should be re-instated.
- IS-823 and IS-127 test vectors are obsolete, and should be updated.
- 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 should be made mandatory to assure operability and interoperability.
- IS-127 changes for self echo should mandate an encoder mute, while regenerating TTY characters, within the handset.
- IS-823A should mandate the encoder mute method, while regenerating TTY characters, to fix self echo within the handset.
- IS-823A should mandate the use of the encoder mute method, while regenerating TTY characters, within the network, to make echo canceller behavior transparent to TTY.
- IS-823A bit exact changes should be created for 50 baud, and should 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 to implement TTY detector squelch, within the handset.
- 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.
- To ensure TTY compatibility, G.168 echo canceller specifications, or cancellation depth specification, need to be enacted to transport slow speed data within the digital wireless network.
- IS-825 needs to include a quieting level for TTY transmitter signal, and needs to specify rise and fall times.
- IS-823A should 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 the encoder, immediately proceeding 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.

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.

Southern LINC® TTY Status Report 4th Quarter 2001

Southern LINC hereby submits its status report for 4th Quarter 2001 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. It regularly reviews the status and availability of an iDEN TTY solution with its sole vendor, Motorola, to ensure its ability to meet the FCC's deadline of June 30, 2002. Based upon the information it has received from Motorola, 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: Motorola has completed the development and integration work required for iDEN handsets, and Southern LINC began selling TTY-capable handsets to its customers in 2001. On the network side, it is Southern LINC's understanding that the software upgrades needed in order to provide TTY calling capability on an iDEN system have been successfully tested, including testing with iDEN handsets. Now that this testing has been completed, Southern LINC can proceed with its network implementation and integration work on the TTY solution. Once it has done so, Southern LINC will test the performance of the iDEN TTY solution on its network using the testing tools recommended by Gallaudet University. It will also test the TTY solution by placing calls to a local PSAP to ensure 911 calling capability.

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 an iDEN TTY solution will encompass its entire network.

For questions regarding this report, please contact:

Holly Henderson
Regulatory Affairs Manager
Southern LINC®
5555 Glenridge Connector, Suite 500
Atlanta, GA 30342
678.443.1670

Sprint PCS Report to the FCC

Prepared: 1/10/02

1. Network Infrastructure Software Development

- Sprint PCS has now received software from all of its network vendors. While testing has now begun, the delay in delivery of software (originally expected in first or second quarter of 2001) has reduced the amount of time Sprint PCS normally has to test and implement a new technology of this scope.
- Sprint PCS continues to encounter difficulties when testing the software in our labs, thus inhibiting our ability to begin field testing in the planned time frames. We continue to be concerned with the time it may take for network vendors to add the bug fixes.
- We are looking to the FCC to hold infrastructure software manufacturers accountable if Sprint PCS is unable to meet the 6/30/02 deadline due to network infrastructure problems.

2. Handset development and testing plans

- TTY compatibility is dependent on Qualcomm's DMSS software (reference software integrated into their handset) distributed to licensees in April and May of 2001. Following this release, handset manufacturers are each creating a handset user interface (software) under the guidance of Sprint PCS.
- SPCS has already tested handsets provided by four vendors and expect our remaining vendors to deliver handsets in the first part of 2002.
- Interoperability testing with infrastructure has begun. Live network testing has been performed successfully in Washington D.C. and in Lisle, IL. Laboratory testing will continue through the Sprint PCS nation wide launch and beyond.
- We have 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.
- Lab testing is under way with field tests expected to begin within the next two months.
- SPCS has completed lab and field testing with one of its network vendors, but, as a precaution, final release is subject to interoperability testing with other carriers and wireless technologies.
- SPCS has participated in the ATIS sponsored TTY Technical Standards Incubator (TTSI) program, and SPCS is planning on participating in a second TTSI test in the first quarter 2002.
- In addition, SPCS has begun beta tests with a deaf and hard of hearing user group.

4. Release and general availability to carriers of network software

- All of our network infrastructure vendors have provided software solutions for TTY.
- One network vendor's software has been conditionally released from Sprint PCS' lab (subject to interoperability testing).

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

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

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

- Sprint PCS is planning to test with consumers (including Gallaudet University) in various markets prior to nation-wide deployment.
- In addition, Sprint PCS is participating in the ATIS TTSI program and hopes to participate in additional "incubator" field tests in which carriers and vendors perform interoperability tests.

9. Retail availability of necessary consumer equipment

- TTY capable handset sales are projected for first quarter 2002.

10. Geographic scope of network deployment

- SPCS plans to launch in specific markets in 2002, with nation-wide launch completed by June 30, 2002.

TeleCorp PCS
1010 North Glebe Road
Arlington, VA 22201

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

Date: January 9, 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: January 9, 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;
See Attachment 1: Sony Ericsson Mobile Communications and Ericsson Inc TTY Forum #20 Report
9. retail availability of necessary consumer equipment;
See Attachment 1: Sony Ericsson Mobile Communications and Ericsson Inc TTY Forum #20 Report
10. geographic scope of network infrastructure deployment;
Tritel has made no deployments as of this date.

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.

8) 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.

9) 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.

10) 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.

11) 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)

12) 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.*

13) 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.

14) 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.

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.



TTY Report for January 2002

Contents

1. PURPOSE	112
2. EXECUTIVE SUMMARY	112
3. BACKGROUND.....	112
4. VOICESTREAM'S NETWORK PROGRESS.....	113

1. Purpose

This document outlines the progress made by VoiceStream toward the mandates required by the FCC for it to provide wireless TTY access to emergency services and full user-to-user functionality. The document is for information purposes.

2. Executive summary

Standardization work for a GSM TTY solution is continuing and VoiceStream is active in facilitating 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 Nortel, Nokia and Ericsson 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 NSS and BSS solutions. Having obtained that 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 problems with the E911 Phase 2 portion of the Base Station Controller (BSC) software. Nokia is due to release the first TTY test load on January 24, 2002.

Based on the current information from our vendors, VoiceStream expects to have solutions from all vendors for testing by the end of January 2002. Testing and verification of these pre-commercial loads will take four to six weeks. VoiceStream envisages being in the position to start deployment in initial markets some time around April 2002, with full implementation by the June 30, 2002 date

To date VoiceStream has issued Purchase Orders for \$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 CTM (Cellular Text Telephony Modem) as a method of transmitting Baudot over the GSM network. It is difficult to transmit Baudot code over the digital channel of

VoiceStream Wireless

GSM to the FCC-mandated 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 case of a 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 nature 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, 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 CTM capabilities.
- The "CTM-SRF 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 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 operator can choose the equipment option that best fits its equipment implementation and 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 operator.

4. VoiceStream's Network Progress

VoiceStream has issued Purchase Orders of about \$5 Million to cover the initial deployment of TTY. Additional funds have been set aside to cover any additional costs associated with the testing and deployment phases. VoiceStream has firm technical proposals from all three network equipment vendors and has commercial agreements in place with two of the vendors; the commercial terms with the third vendor will be concluded in the next two weeks.

VoiceStream Wireless

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

Nokia - Is implementing the All-TRAU solution and requires a software upgrade to all transcoder units. The software to support CTM/TTY is part of the S.10 release.

Nortel – Nortel is 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 – Is implementing the Service-Node solution, using Telegent (Sweden) servers. The new servers are supported by 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 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. Testing of early release 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 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.

Table 1 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).

	LFT	LAT	ST	FOA	GA
Nokia	01/24/02	02/18/02	04/22/02	04/22/02	06/18/02
Nortel E3 BSC	12/11/01	03/04/02	04/01/02	04/15/02	04/29/02
Nortel 2G BSC	N/A	04/11/02	04/18/02	05/01/02	05/15/02
Ericsson	12/14/01	01/21/02	02/14/02	02/28/02	03/18/02

Table 1: Estimated Test and Verification Dates

VoiceStream Wireless

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. For vendors such as Nokia, that have implemented the TTY feature as part of a series of new features and functionalities, there is a risk that the program may be delayed due to problems with the performance or operation of another feature. The S.10 release from Nokia contains significant functionality changes related to the introduction of E911 Phase 2.