MINUTES OF THE MEETING

TECHNICAL COMMITTEE ON ELECTRONIC SAFETY EQUIPMENT

18-19 MARCH 2014
FT. LAUDERDALE, FL

AGENDA ITEMS 1-3; CALL TO ORDER, SELF-INTRODUCTION OF MEMBERS AND GUESTS, NFPA STAFF LIAISON REPORT

Chairman Athanas called the Committee to order at 08:20 on 18 March 2014. Chairman Athanas welcomed Committee members and guests and asked them to introduce themselves. Staff Liaison David Trebisacci read the NFPA Committee Procedural Statement and asked attendees to sign in on the appropriate Member or Guest sign-in sheet. He reviewed the following: an overview of the TC composition and balance, the timetable for the revisions of NFPA 1982 and NFPA 1801, and the standard NFPA product document template.

Members Present:

Robert Athanas, Chairman
FDNY/SAFE-IR Inc.

Steven H. Weinstein, Acting Secretary
Honeywell Safety Products (representing ISEA)

David Trebisacci, Staff Liaison
NFPA

Kamil Agi
K&A Wireless

Jason Allen
Intertek Testing Services

Joel Berger
Kenwood USA

Matt Bowyer
NIOSH

Matthew Busa
Motorola, Inc.

Matthew Cnudde
USDA Forest Service

John Facella
RCC Consultants

Michael Feely
Boston Fire Department

William Forsyth
USDA Forest Service

Craig Gestler
MSA

William Haskell
NIOSH

Simon Hogg
Draeger Safety

Michael Hussey
Jackson County Fire District 3

John Jarboe
Grace Industries

Paul Kelly
UL LLC

David Little
ISG Infrasys

Steven Makky
APCO International Inc.

Brian Martens
Harris Corporation

Michael McKenna
Michael McKenna & Associates

John Morris
ISG Infrasys

Rebecca Norwood
Harris Corporation

Timothy Rehak
NIOSH

James Rose
SEI

Matthew Shannon
Scott Safety

Gerry Tarver
Tulsa Fire Department
Steven Townsend  
Carrollton Fire Rescue

Jose L. Velo  
San Francisco Fire Department

Timothy Wolf  
Scottsdale Fire Department

Mike Worrell  
Phoenix Fire Department

The following guests were present:

Paul Carter  
Whitney Blake Company

Ed Cortes  
Icom America

Michelle Donnelly  
NIST

Sandy Florence  
Motorola Solutions

Beverly Gulledge  
Scott Safety

Luke Hollmann  
USSI

Chris Lougee  
Icom America/TIA

Judge Morgan III  
Scott Safety

Dennis Mull  
USSI

John Oblak  
EF Johnson

Dean Pickering  
Harris Corporation

John Rehayem  
Otto Engineering

Robert Sell  
Draeger Safety

Rex Strickland  
Fairfax County Fire & Rescue

William Young  
NIST

AGENDA ITEM 4; APPROVAL OF MINUTES OF DECEMBER 10-12, 2013 MEETING, SAN DIEGO

MOTION BY BRIAN MARTENS; SECOND BY MICHAEL FEELY

To approve the Minutes of the 10-12 December 2013 meeting in San Diego, CA.

MOTION CARRIED.

AGENDA ITEM 5; CHAIRMAN’S REMARKS

Chairman Athanas asked Bill Haskell to review the status of the NFPA 1981 and NFPA 1982 TIAs. Chairman Athanas reminded the TC that it is important to submit ballots for all issues requiring a TC balloting procedure, including TIAs.

AGENDA ITEM 6; TASK GROUP REPORTS

Task Group on Voice Intelligibility

Task Group Chairman Gerry Carver reported on the Task Group’s first meeting. The Task Group feels there needs to be an initial performance test and a “post test” after the environmental tests, but the Task Group doesn’t know what the details will be yet. There is a possibility of using a combination of subjective and objective test methods.

The fire service members of the TC met later and determined that the minimum intelligibility requirements should involve testing of both analog and digital modes, as well as emergency button operation, prior to other tests required in the standard (an “out-of-the-box” test), then a repeat of the intelligibility tests after subsequent environmental tests. This will be kept as a placeholder with
the Task Group on Environmental Testing (Chairman Michael Feely) until further delineation of the testing goals can lead to the development of specific tests.

“Ambassadors” Task Group
The Task Group is working on standardized verbiage to present the work of the TC to the public. The final version will be e-mailed to TC members and placed on the NFPA TC web site (see Attachment A).

Task Group on Intrinsic Safety
Chairman Steve Townsend reported that little has been done since the December San Diego meeting, because much had been accomplished at that meeting. There will be a 1½-day Task Group meeting in the Chicago area on May 15-16, 2014. A proposal will be presented to the TC at the July 2014 meeting.

Task Group on Environmental Testing
Chairman Mike Feely reported on the work of the Task Group. The following tests from existing standards (the relevant standards are in parentheses) have been identified as being appropriate for inclusion in NFPA 1802 (see Attachment B):

- Lens Abrasion (TI)
- Vibration Resistance (TI, PASS, SCBA)
- Durability (TI) (includes Tumble Test)
- Environmental Temperature/Stress (SCBA, PASS)
- Heat and Immersion Leakage (PASS, SCBA)
- Elevated Temperature/Heat Resistance (SCBA, TI, PASS)
- Impact Acceleration (PASS, TI)
- Corrosion Resistance (PASS, TI, SCBA)
- Case Integrity (PASS)
- Cable Pullout (TIC, SCBA, PASS)
- Heat and Flame (SCBA, TI, PASS)
- Product Label Durability (TI)
- Water Drainage (PASS)

The pass/fail criteria were identified as follows:

- No false transmission
- Display readable
- It transmits (with minimum power)
- It receives (with minimum sensitivity)
- Emergency button transmits emergency signal
- Nothing falls off or catches fire
- Buttons/LEDsswitches work
- Simple intelligibility (STI/Tones/MOS)
- Run time (added during the TC’s discussion of the Task Group report)

The Task Group has a sub-task group examining TIA standards to determine whether any TIA tests should be incorporated into NFPA 1802.

During the TC’s discussion of the Task Group’s report, it was pointed out that multi-band radios would need to have every band tested separately.
**Task Group on Physical Properties**
Chairman Mike McKenna reported that the Task Group has started writing design requirements. There are unresolved issues with the interface between radios and SCBA radio communication systems. A sub-task group has been formed that will address these issues in conjunction with the TC on Respiratory Protection Equipment’s Task Group on Communications (Chairman Brian Cox). TC Chairman Athanas directed Task Group Chairman McKenna to add a contact cap (for contact protection when the RSM is not attached to the radio) to the list of items addressed by the Task Group.

**Task Group on Definitions**
Chairman Tim Wolf reported that the Task Group reviewed existing NFPA and industry definitions. The Task Group has asked the other Task Groups to submit any terms that might be used in their respective sections of the standard to the Task Group on Definitions so that definitions can be developed.

**Task Group on Programmable Features**
Chairman Mike Worrell reported that a base document is being drafted. The Task Group has requested from the TC’s fire service members information on how their Emergency Buttons function. The Task Group also requested a feature set spreadsheet from all radio manufacturers (see Attachment C).

**AGENDA ITEM 7; PRESENTATIONS**

Dennis Mull and Luke Hollmann from USSI made a presentation to the TC entitled “Measuring Intelligibility over Radio Channels,” which dealt with how the TC might approach determining a test method for measuring intelligibility or speech quality of LMRs (see Attachment D). USSI felt a study is needed to investigate further how to identify appropriate test methods for both analog and digital radios. David Trebisacci will contact Casey Grant at the Fire Protection Research Foundation to see if there are any NFPA research funds available to underwrite such a study.

After USSI’s presentation, Chairman Athanas appointed Gerry Tarver as Chairman of a new Task Group on Voice Intelligibility. The following are the Task Group members:

**Task Group on Voice Intelligibility**
Kamil Agi
Jason Allen
Joel Berger
Matthew Busa
Michelle Donnelly
Bill Forsyth
Craig Gestler
Luke Hollmann
Michael Hussey
Chris Louflage
Brian Martens
Dennis Mull
John Oblak
Bill Young reported on NIST’s testing of RF PASS high attenuation, RF PASS multipath, and RF PASS high interference. Because the funding for NIST’s testing is expiring in approximately one year, it is important that the work be completed by then. NIST is investigating possible additional funding in case the work is incomplete when the current funding expires.

Bill Young and Michelle Donnelly gave a preliminary report on the high temperature radio testing NIST has been conducting.

Bill Haskell spoke about the NFPA’s policy regarding validation of new test methods for suitability, repeatability and reproducibility. Such validation is meant to eliminate testing problems after the publication of a standard revision.

John Oblak spoke about the work planned to be done in conjunction with the TIA regarding radio identification.

Matt Busa and Rebecca Norwood made a presentation to the TC entitled “Programming Software Overview.” The presentation dealt with the process and complexity of programming radios (see Attachment E).

AGENDA ITEM 8; BREAKOUT SESSIONS

The Task Groups met during the afternoon of 18 March.

AGENDA ITEM 9; NEW BUSINESS

There was no new business.

AGENDA ITEM 10; ADJOURNMENT

MOTION BY BILL HASKELL; SECOND BY BRIAN MARTENS
To adjourn.

MOTION CARRIED.

Chairman Athanas adjourned the meeting at 14:40 on 19 March 2014.

Respectfully submitted,

Steven H. Weinstein, Acting Secretary
Technical Committee on Electronic Safety Equipment
April 14, 2014

Executive Summary for NFPA 1802

Working Title:

**NFPA 1802, STANDARD ON PERSONAL PORTABLE (HAND-HELD) TWO-WAY RADIO COMMUNICATIONS DEVICES FOR USE BY EMERGENCY SERVICES PERSONNEL IN THE HAZARD ZONE**

Note: This is a new proposed standard under development by NFPA’s Technical Committee on Electronic Safety Equipment. It has not yet been opened for Public Input and Public Comment in compliance with NFPA rules.

**Tentative Scope.** NFPA 1802’s tentative scope is “personal portable 2 way radio communications devices” (subscriber or user radios) for use by the fire service, including structural firefighting, wildland firefighting, and HazMat teams, used inside the “Hazard Zone,” also known as the “Hot Zone,” or the Immediately Dangerous to Life and Health (IDLH) zone.

This scope will thus encompass land mobile radio (LMR) 2 way portable radios; future public safety broadband handheld user devices, using LTE (Long Term Evolution) technology and operating on either the Band 14 FirstNet network or Band 14 commercial carrier networks; and 2 way LMR pagers; as well as the remote speaker microphones for the these user devices. An objective is to have the standard be wireless technology agnostic, but operationally very relevant to fire service use in the IDLH.

This scope does *not* include 1 way portable LMR paging devices, LMR mobile (vehicular mounted) radios, or commercial cellular telephones used by the public (and not within the hazard zone) regardless of technology. This scope does *not* include land mobile radio (LMR) systems, which is covered in NFPA 1221, Emergency Services Communications Systems, nor does it cover in-building communications systems for firefighters, which are covered in several standards including NFPA 1221 and NFPA 72. This standard also does not cover the issue of radio interoperability. We are not aware of any other standard having the specific scope of NFPA 1802.

**Purpose:** The purpose of this standard is to define the *minimum* requirements for personal portable 2 way radio communications devices used by firefighters in the IDLH areas encountered in structural, wildland, and hazmat incidents. This standard will include requirements for environmental ruggedness (to include surviving high temperatures and wet environments), intrinsic safety, immediate access to voice communication and distress alarm features, some programmable features, interfaces to certain other devices such as speaker
microphones, and ease of use by firefighters in personal protective clothing (PPE) and while wearing self-contained breathing apparatus (SCBA).

**Process:** This technical committee is comprised of members from 9 different representations, including users, special experts, manufacturers, and other groups. Per NFPA regulations for balanced representation, no one constituency can be represented by more than 33% of the Principal voting members. This committee currently has 33 Principal members, and 20 Alternate members. The process of developing NFPA standards is consensus driven, and includes opportunity for public input and comment. Non-NFPA committee members are permitted to assist NFPA committees where their special expertise may be needed.

This committee currently has several Task Groups that are specifically focused on areas including Physical Properties, Environmental Testing, Ergonomics, Programmable Features, Intrinsic Safety, Voice Intelligibility, and others may be established as needs arise. Because some of these areas could be addressed within existing NFPA codes and standards, there is an ongoing desire to be consistent where it makes sense by referencing similar testing methods or requirements. These Task Groups have much work to accomplish, because specifying and testing personal communications devices that will survive the IDLH environment that firefighters routinely encounter has not been done before in the U.S.

**History:** The impetus for this new standard was the continuing issue of inadequate fireground communications devices, often cited in fire department and NIOSH Line of Duty Death reports, and Firefighter Near Miss reports. After the tragic death of 2 San Francisco firefighters in June 2011 at a residential structural fire, that department specifically approached NFPA to create a new standard for firefighter portable radios.

**Timeline:**

Late 2012: First draft development meeting

2013: Draft development meetings in Orlando in March, Denver in August, and San Diego in December

2014: Continued development of the NFPA 1802 draft

Upon completion of the draft: The Technical Committee and the Correlating Committee are balloted, then the draft is submitted to the NFPA Standards Council for approval, with a request to enter a specific revision cycle.

The approved draft standard opens for Public Input with a date dependent upon the revision cycle assigned by the Standards Council.
Key Players Involved:

- Fire Departments and other Fire Service Agencies
- Radio Manufacturers
- Technical Experts
- Testing and Certifying Agencies (FCC, Industry Canada, UL, FM, CSA, SEI, Intertek, etc.)
- Standards Groups (TIA, APCO, etc.)
- Fire Service and Communications Industry Associations (IAFC, IAFF, NPSTC, APCO)

NFPA and the Technical Committee on Electronic Safety Equipment encourage and welcome the participation of interested individuals or organizations. Please contact the following for more information, or visit the NFPA 1802 Document Information page online at [www.nfpa.org/1802](http://www.nfpa.org/1802):

Contacts:

Committee Chair: Bob Athanas, robert.athanas@fdny.nyc.gov

NFPA Staff Liaison: Dave Trebisacci, dtrebisacci@nfpa.org

Final Version, 14 April 2014
Environmental tests

- Copy from existing standards
- PASS, TIC, SCBA, etc.

Proposed Tests

- Lens Abrasion (TIC)
- Vibration Resistance (TIC, PASS, SCBA)
- Durability Test (TIC)
- Environmental Temperature Performance Test
- Heat and immersion leakage (PASS, SCBA)
- Elevated Temp/Heat Resistance (SCBA, TIC, PASS)
- Impact Acceleration Test (PASS, TIC)
- Corrosion Resistance (PASS, TIC, SCBA)
- Case Integrity Test (PASS)
- Cable Pullout Test (TIC, SCBA, PASS)
- Heat and Flame (SCBA, TIC, PASS)
- Product label Durability (TIC)
- Water drainage Test (PASS)

Pass Fail Criterion

- No False Transmission
- Display readable
- It Transmits (with minimum power)
- It can receive (with minimum sensitivity)
- Emergency button transmits emergency signal
- Nothing falls off or catches fire
- Buttons/LEDs switches work
- Simple intelligibility (STI/Tones/MOS)

Computing STI

\[
STI = \left( \frac{S}{N} + 15 \right) / 10
\]

\[
%AL_{min} = (170.540) \times 10^{-4 \times \text{SNR}}
\]

\[
STI = (0.1645) - \ln %AL_{min} = 0.9482
\]
Programmable Features Task Group

- Task - To define minimum standard feature set taking into consideration the wide variations in environments.
- Technical Environment
  - Radio System Types
    - Trunked, Repeated, Simplex
  - Digital/Analog
- Operational Environment - Employment of the technology by departments.

Base Document drafted and sent out for comments
- March 2014
- Will continue work on this based on input from membership
- Radio ID issue submitted to TIA
- Report from John Oblak
- Requesting input from Fire Service members on details of how their departments emergency buttons/systems function.
- Requesting a feature set spreadsheet from all manufacturers

Items That have not been Addressed
- Identify Performance and Safety Enhancing Features
  - Features that increase performance and safety but are not associated with physical characteristics of the radio.
  - Audio Quality
    - Transmitted
    - Received
  - Radio Performance
    - Infrastructure
    - Range

Emergency Activation Functionality
Programmable Features
Task Group

- Present Work
  - Feature set spreadsheet development – Ongoing
  - Base Document Development – Ongoing
  - Research all manufacturers current radio programming software to identify features that should be in the baseline standard – Ongoing
  - Need features information from all manufacturers in spreadsheet form

- Next tasks
  - Emergency Activation
  - S-8 requirements document
  - Gather information pertaining to technical descriptions of audible indicators
  - May not be necessary

- Programming Software
  - Define core functions
  - NFPA 1802 Mode

- Software Changes
  - Determine change requirements from manufacturers with certifying organizations

Questions?
Measuring Intelligibility Over Radio Channels

Presented to NFPA 1802
March 18, 2014 – Fort Lauderdale, Florida

Luke Hollmann
Dennis Mull
Ultra Electronics – USSI
Introduction

• Ultra Electronics – USSI (UnderSea Sensor Systems, Inc.)
  – Underwater and in-air acoustics experience
  – Manufacture accessories for first responders
  – Worked with NFPA 1981 on intelligibility testing
  – Long-standing relationship with Embedded Acoustics in The Netherlands
    • Internationally recognized speech intelligibility experts
Introductions

• Luke Hollmann
  – Engineering Scientist
  – Background in signal processing and communications
  – Speech Transmission Index (STI) experience
    • Advanced training in Europe
  – With USSI since 2010

• Dennis Mull
  – Chief Engineer, Audio Products group
  – Background in acoustics, signal processing, RF, and system engineering
  – With USSI since 2008
Signal Degradations

• No degradations
  – Perfectly intelligible

• Radio link, possible degradations
  – Noise
  – Distortion
  – Bandwidth limiting
Intelligibility

• Definition
  – *Intelligibility* is the characteristic of being able to be understood or comprehended
    • Not a “yes or no” condition
    • There are degrees of intelligibility

• How to measure?
  – Subjective measures
    • Talker-Listener tests
    • Word, sentence, or rhyme tests
  – Objective measures
    • Speakers, microphones, and measuring devices replace talkers and listeners
    • STI, SII, %Alcons, for example
Speech Transmission Index (STI)

- IEC Standard 60268-16
  - Uses a “speech-like” test signal
    - Modulated pink noise matching the human speech spectrum
  - Takes into account most types of intelligibility degradations
  - Easy to interpret score ranging from zero to 1
  - Commercial measuring equipment widely available

![STI Regions vs. STI Scores](image-url)
STI Applicability

• STI applies to:
  – Analog
  – Unencoded digital (no codec used, not practical)
  – “Waveform encoded” digital
    • Codec operates on the audio itself

• STI does not apply to:
  – “Speech encoded” digital
    • Codec operates specifically on the speech elements
  – Aggressive noise-suppression algorithms
    • STI test signal is noise-based, and may be suppressed
Other Options?

• No existing one-size-fits-all objective intelligibility measures for radios
  – Current research attempting to measure STI with speech input shows promise, but is not commercially available

• Subjective testing
  – Expensive, imprecise, non-repeatable

• Measure speech quality
Objective Speech Quality Measures

• Why measure *quality* if *intelligibility* is desired?
  – Intelligibility and quality, though different, are highly correlated
    • An exception: quality enhancement by noise suppression
    • The human brain is the best noise “suppressor”
  – Unlike intelligibility, comprehensive objective quality measures do exist
    • PESQ (perceptual evaluation of speech quality, ITU P.862)
      – Mature (existing since 2001)
    • POLQA (perceptual objective listening quality assessment, ITU P.863)
      – Newer (existing since 2011), but more capable
The Path Forward

• Formal Trade Study
  – Structured method for examining the pros and cons of various options
  – Identify all viable options and narrow down to several primary choices
  – Score the options against a set of requirements
  – Weight the scores according to importance and compute final score

  – Below is the final scoring matrix from the initial NFPA 1981 trade study

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Summary

• No comprehensive objective intelligibility measure exists for radios
  – STI handles most, but not all, signal degradations
  – Not all radio systems will be compatible with the STI measurement
• Quality and intelligibility are related, but different
• Comprehensive objective quality measures exist
  – Some algorithms (e.g., noise suppression) can improve quality, yet reduce intelligibility
• Recommend the committee sponsor a formal trade study to identify and distinguish among the available options
Questions?

Thanks!

Images from:
Stick figures: http://blog.alienskin.com/hire-people-who-are-better-than-you
Radios: http://www.shutterstock.com/pic.mhtml?id=2900124
Programming Software Overview
NFPA1802 Committee

Matt Busa: Motorola Solutions
Rebecca Norwood: Harris
March 2014

MOTOROLA: APX
PROGRAMMING: GETTING STARTED

MOTOROLA: APX
PROGRAMMING: SIMPLEX SETUP

MOTOROLA: APX
PROGRAMMING: ZONES/CHANNELS
MOTOROLA: APX
PROGRAMMING: SWITCH FEATURES

HARRIS: UNITY
PROGRAMMING: OVERVIEW

KENWOOD
PROGRAMMING: OVERVIEW

QUESTIONS?
THANK YOU!