DMR Interoperability

Why DMR? Why the DMR Association? Why Interoperability?

IWCE Connecting Critical Communications

Las Vegas, 21st March 2022

Tom Bohn
DMR System Design, Motorola Solutions, Inc
Technical Working Group Chair, DMR Association

Summary

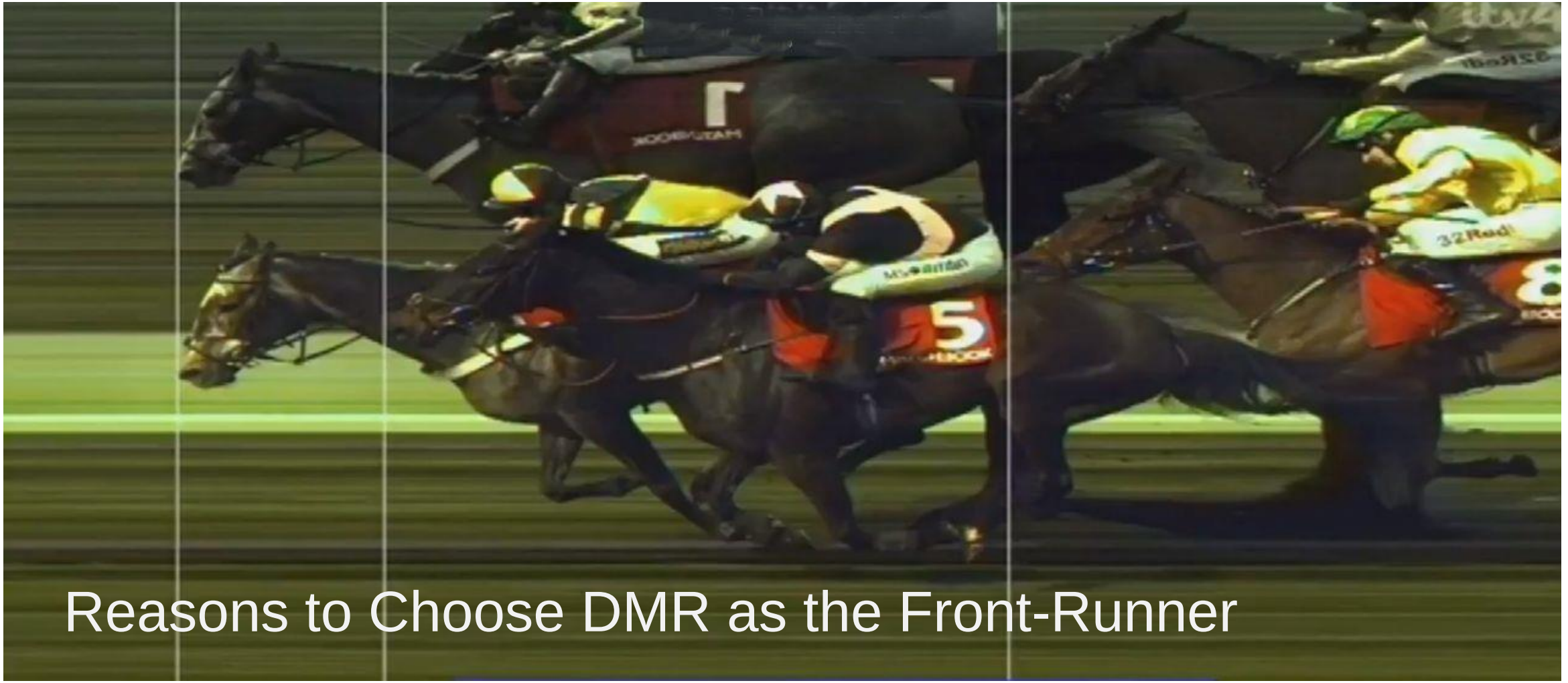
- Why DMR?
- Why the DMR Association?
- Why Interoperability?
- DMR Tiers and Features
- Insights in the Interoperability Process
- Tier 3 Interoperability

Why DMR? Don’t Gamble with Communications!

Why DMR? Avoiding the Obvious!

- Public Systems
- Proprietary Systems
- Designs that are near the end of their technical life

Why DMR? Choose Astutely!



DMR Tiers and Features - ETSI DMR Standard Parts

DMR Tier 1: Unlicensed

- Products for license-free, non-professional use: PMR446

DMR Tier 2: Conventional

- Professional licensed conventional radio systems operating in PMR frequency bands 30 to 1000 MHz. Targeted at users who need smooth migration from analogue with existing spectrum & licensing, spectral efficiency, advanced voice features and integrated IP data services in licensed bands

DMR Tier 3: Trunked

- Professional trunking operation in frequency bands 30 to 1000 MHz. The ETSI Tier III standard is derived from MPT1327 and is based on Tier II building blocks and features with plenty of additional added-value features

DMR Tiers and Features - ETSI DMR Standard Parts

Current (March 2022) Standard

- ETSI TS 102 361-1 V2.5.1 (2017-10) DMR Air Interface Protocol
- ETSI TS 102 361-2 V2.4.1 (2017-10) DMR Voice and Generic Services
- ETSI TS 102 361-3 V1.3.1 (2017-10) DMR Data Protocol
- ETSI TS 102 361-4 V1.11.1 (2021-01) DMR Trunking Protocol

- ETSI TR 102 398 V1.4.1 (2018-11) DMR General System Design

ETSI World Class Standards

*All these documents can be **freely** downloaded from the ETSI or DMR Association websites:*

www.etsi.org
www.dmrassociation.org

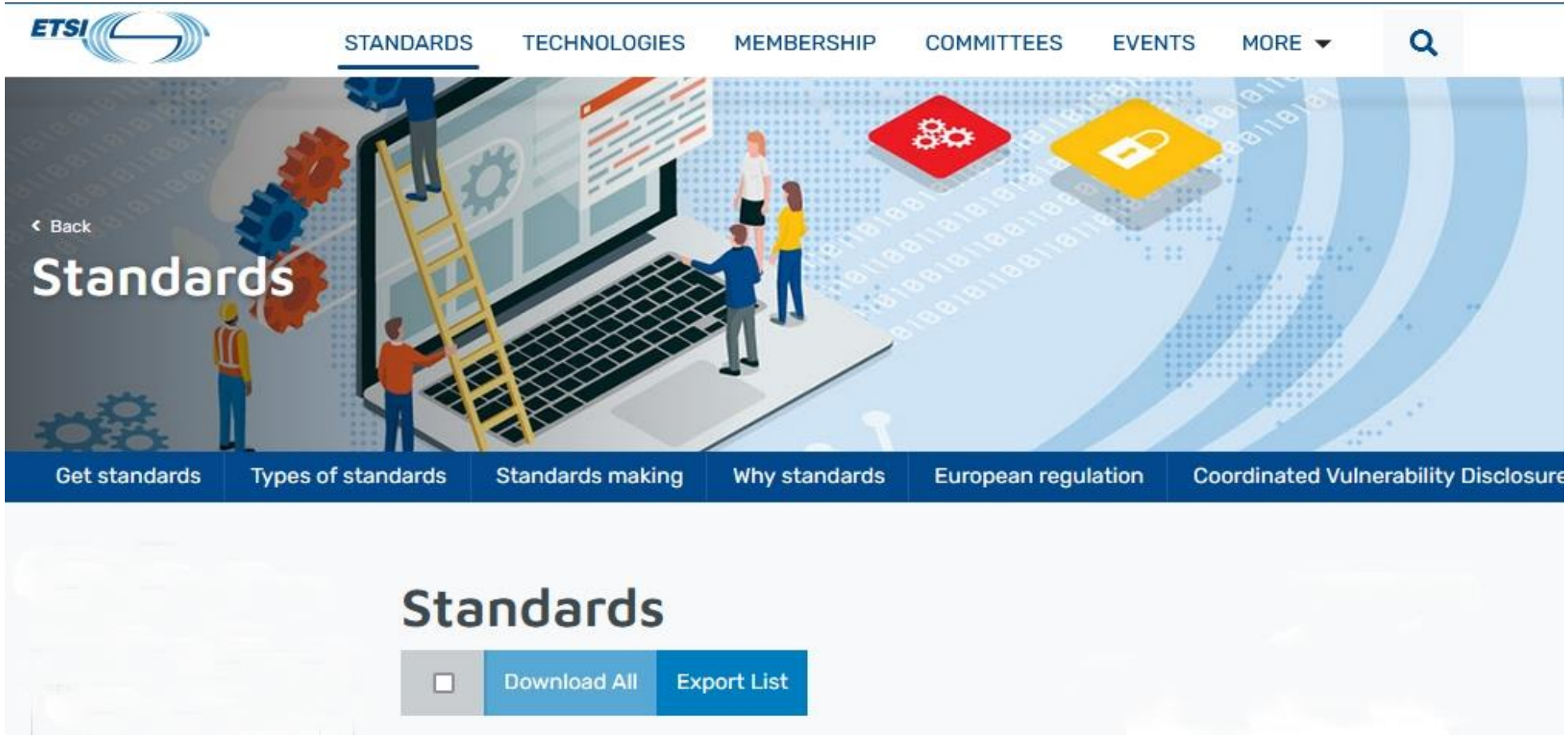
DMR Tiers and Features - DMR Technology Overview

DMR Overview

- 12.5 kHz channel compatible with current analogue frequency allocation schemes
- Free combination of Tx and Rx frequencies (for complex freq. assignments)
- 9.6 kbps gross bit rate
- 4FSK modulation: constant envelope for simple RF design
- 2 slot TDMA channel => 6,25 kHz equivalent channel: 2 communication paths; permitting forward and reverse transmission on a time division basis
- Energy efficient
- 50% duty cycle slot structure allows
- Transmission can be used either for voice, data or signalling
- Low cost, low complexity
- Great range: same or better link budget then analogue
- Conventional (Tier II), Trunking (Tier III), Simulcast

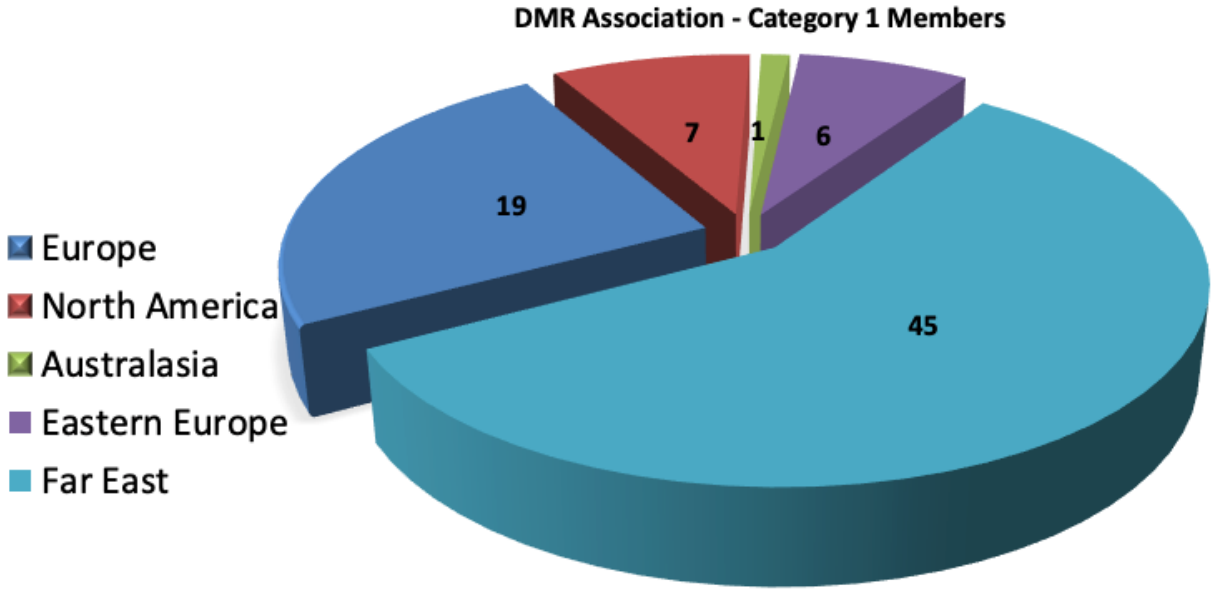
Why the DMR Association? The DMR Association Relationship with ETSI

www.etsi.org



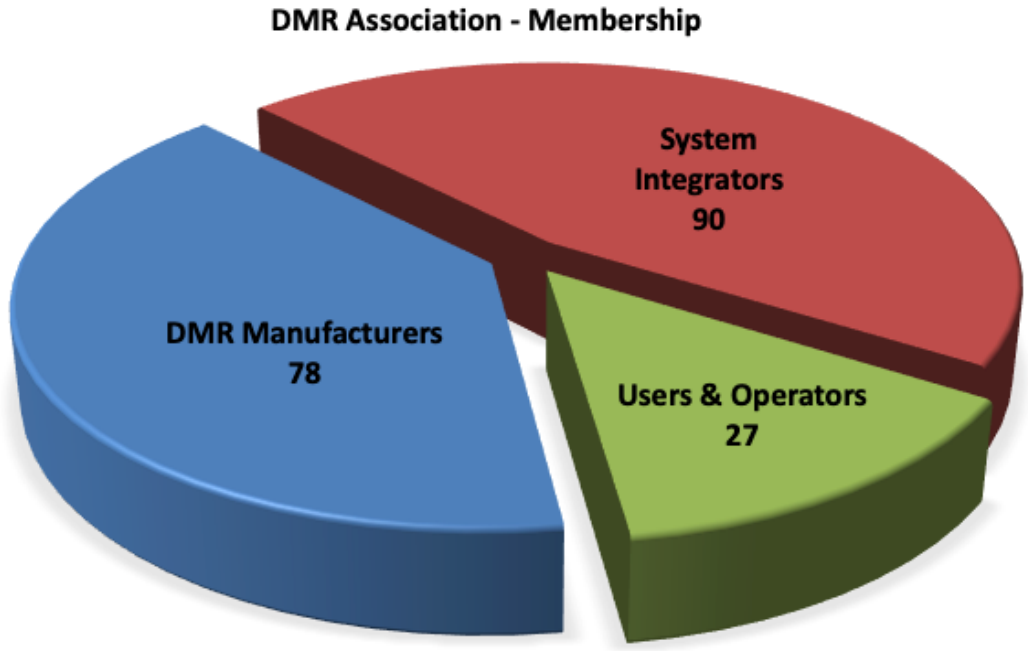
How many Manufactures offer DMR and want your business?

Why the DMR Association? ETSI DMR Manufacturers



Total of 193 Members.

78 of them are Manufacturers (Category 1).



21st century digital radio standard

- We work with our members, worldwide, to ensure that DMR Digital Mobile Radio is the most widely supported digital business radio standard
- Our members are companies, organisations and individuals who use or build DMR products professionally or those working to support the DMR standard in other ways
- By using a combination of education, awareness, certification and interoperability training we operate to make sure that business buyers of today's digital radio technology have the security of knowing that they are investing in the future
- We're here to ensure that DMR products exist within a successful, open, multi-vendor chain

For DMR we do:

- Operate an equipment interoperability testing and certification program
- Communicate with the user community to capture new requirements
- Enhance the feature set of DMR with new functions
- Offer education and updates about the standard
- Give advice to regulators to ascertain an environment in which the technology can flourish

Application development on DMR technology

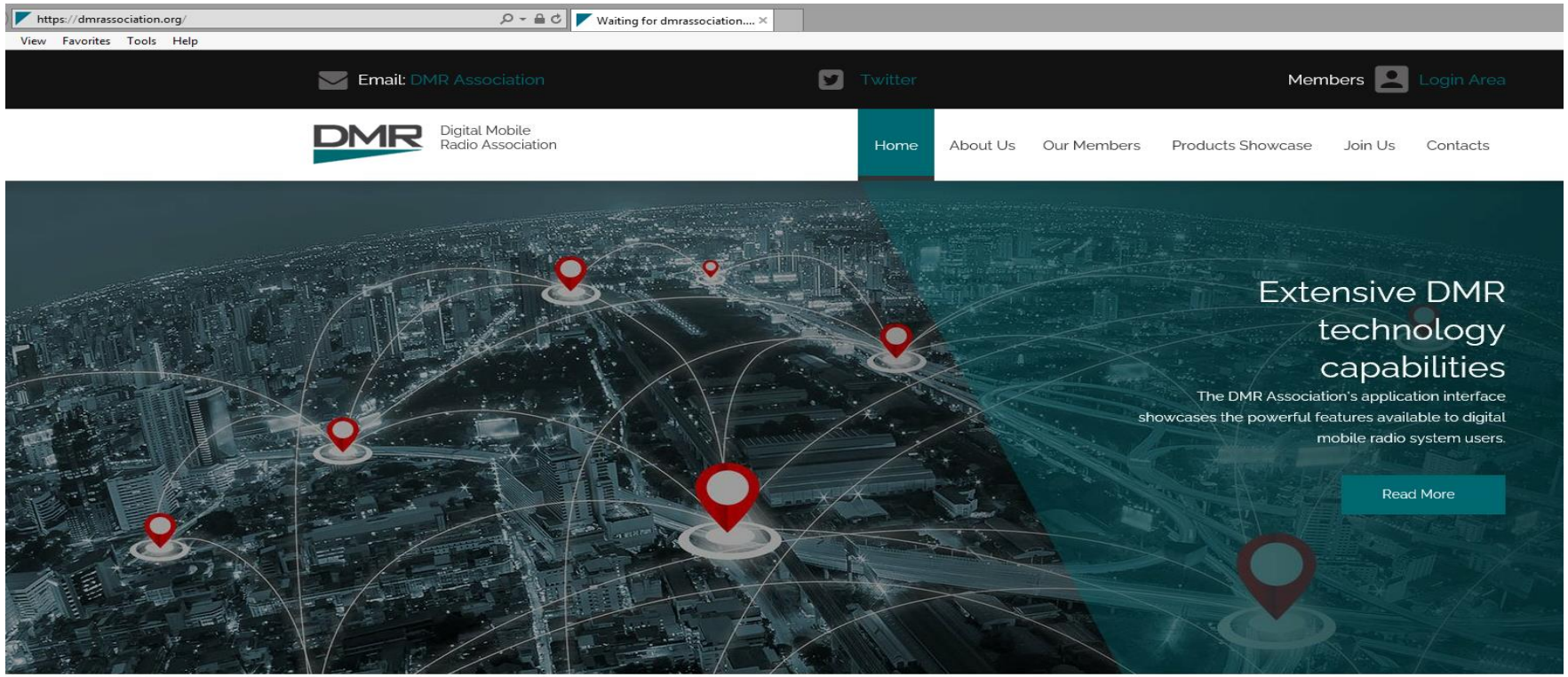
- Community of 100's of application developers who are developing vertical market and customer specific applications

Why the DMR Association? The Application Interface Specification

- The DMR Associations Application Interface (AIS) provides a common protocol to enable DMR Association members to develop a wide variety of applications that enable intelligent connectivity with DMR systems infrastructure
- The interface was developed by members of the DMR Association with the goal of enabling applications to benefit from interoperability between an application and DMR infrastructures from different vendors
- The AIS is available under a Non Disclosure Agreement (NDA) to Category 1 and 2 members of the DMR Association, enabling applications to implement a standard protocol that allows interfacing to any DMR infrastructure system that also supports the AIS protocol

Why the DMR Association? Website

dmrassociation.org



DMR is trusted by over 15 million users worldwide

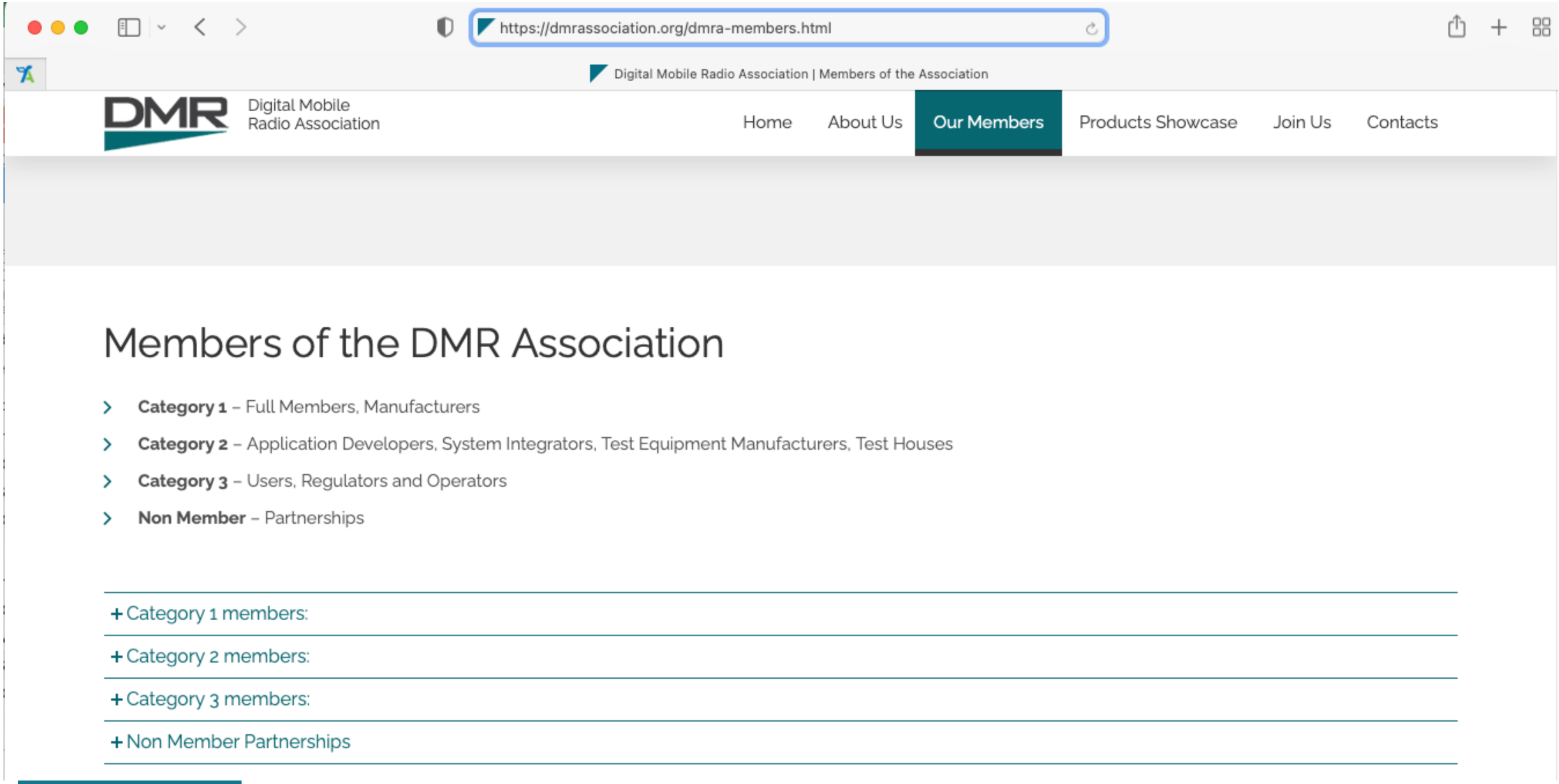
Our resolute team are proud to provide unrivalled support to its global members and the assurance that digital mobile radio is the most widely used digital radio standard for the business world.

The DMR Association's mission, since 2005, has been to support the European Telecommunications Standards Institute during the DMR standardisation process. To provide the ultimate service to our members we focus on the commercial applications of DMR comprised in Tier II and Tier III.

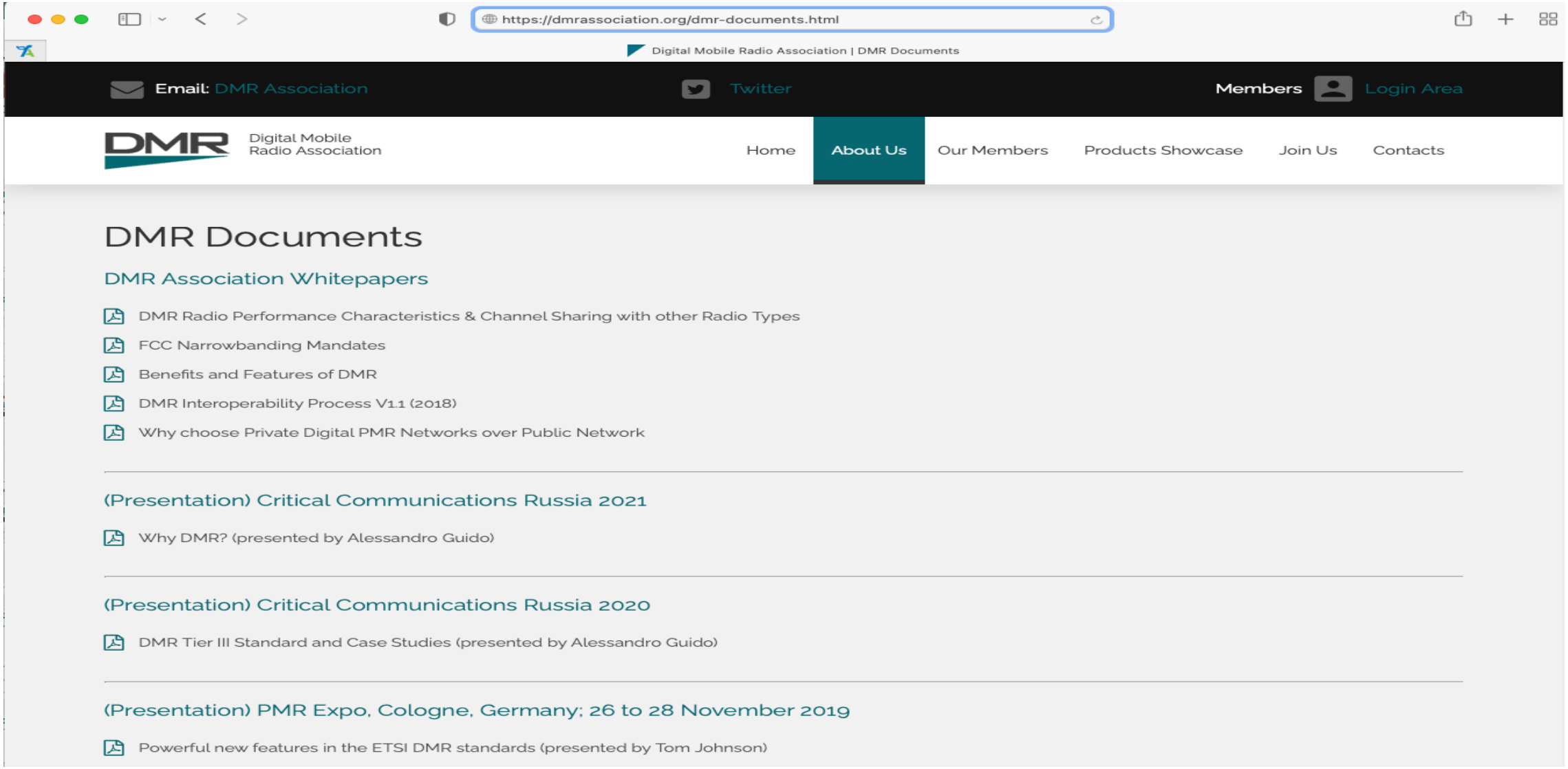
We welcome new members from across the globe. Whether you are a business that utilises DMR, or an individual that supports the professional use of the DMR standard, you'll be in great company. We truly appreciate your help in enabling us to drive forward our mission.

dmrassociation.org

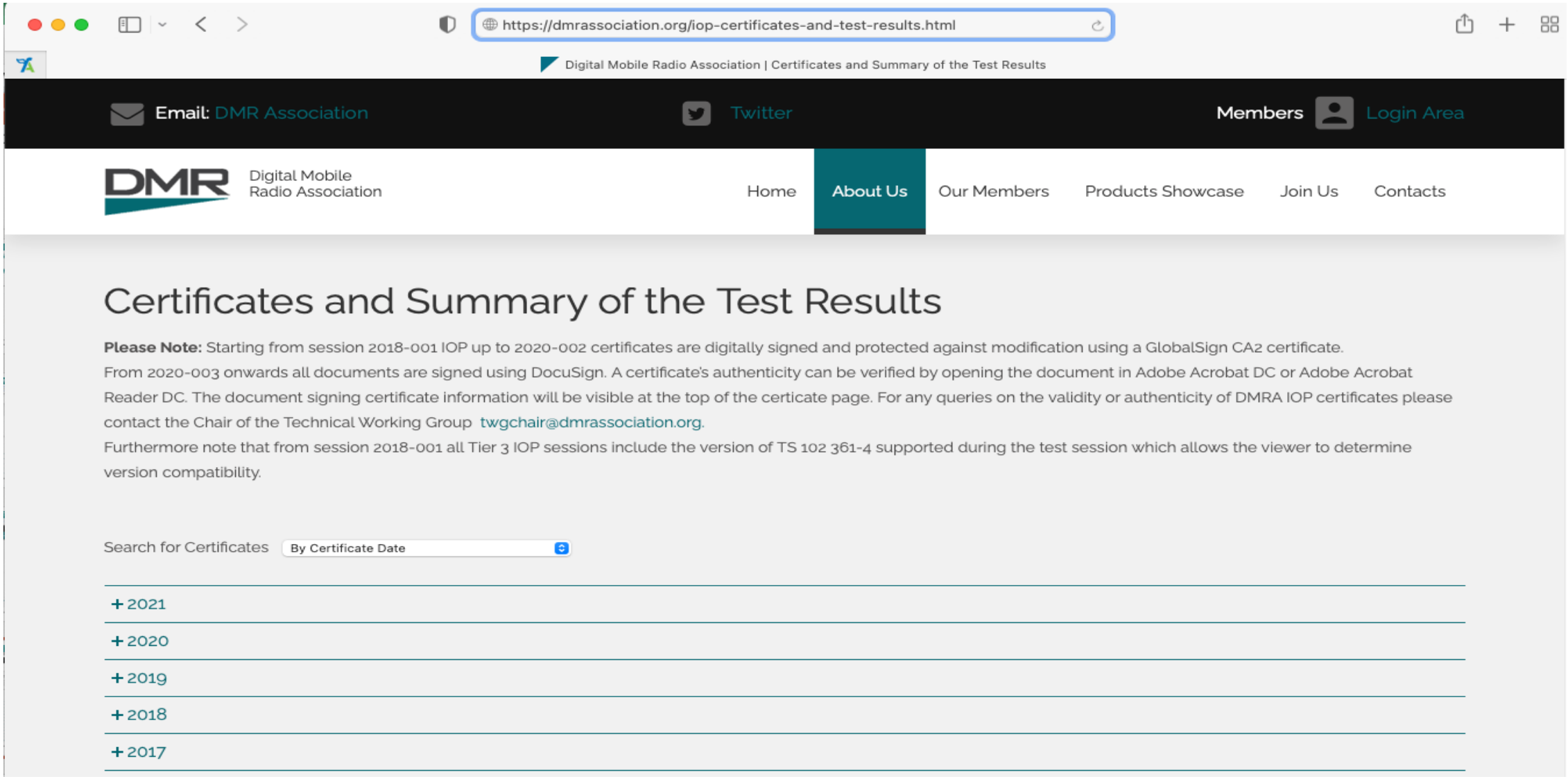
Why the DMR Association? Website - Members



Why the DMR Association? Website - Documents



Why the DMR Association? Website - IOP Certificates



Why the DMR Association? Geographical Areas of Website Visitors

dmrassociation.org

Total Number of visiting countries = 91

Top 10 Countries	Visitors
United States	474
India	203
China	168
United Kingdom	61
Russia	59
Italy	40
Germany	35
Poland	30
Australia	24
France	22

February 2022

dmrassociation.org

Why Interoperability?

- An Interoperability Certification process ensures users and equipment suppliers benefit from an open multi-vendor market for DMR systems and equipment
- A competitive open, multi-vendor market brings proven benefits to users such as choice of equipment, choice of supplier, continuous development of new products with increased functionality and improved price performance
- Users can be confident that products awarded an Interoperability Certificate have been rigorously tested and the functions listed in the Certificate fully meet the DMR standard
- This allows users who select equipment from a number of suppliers to reduce the amount of system integration and testing that they need to undertake, as well as the associated risk of issues

Why Interoperability? Principles and background

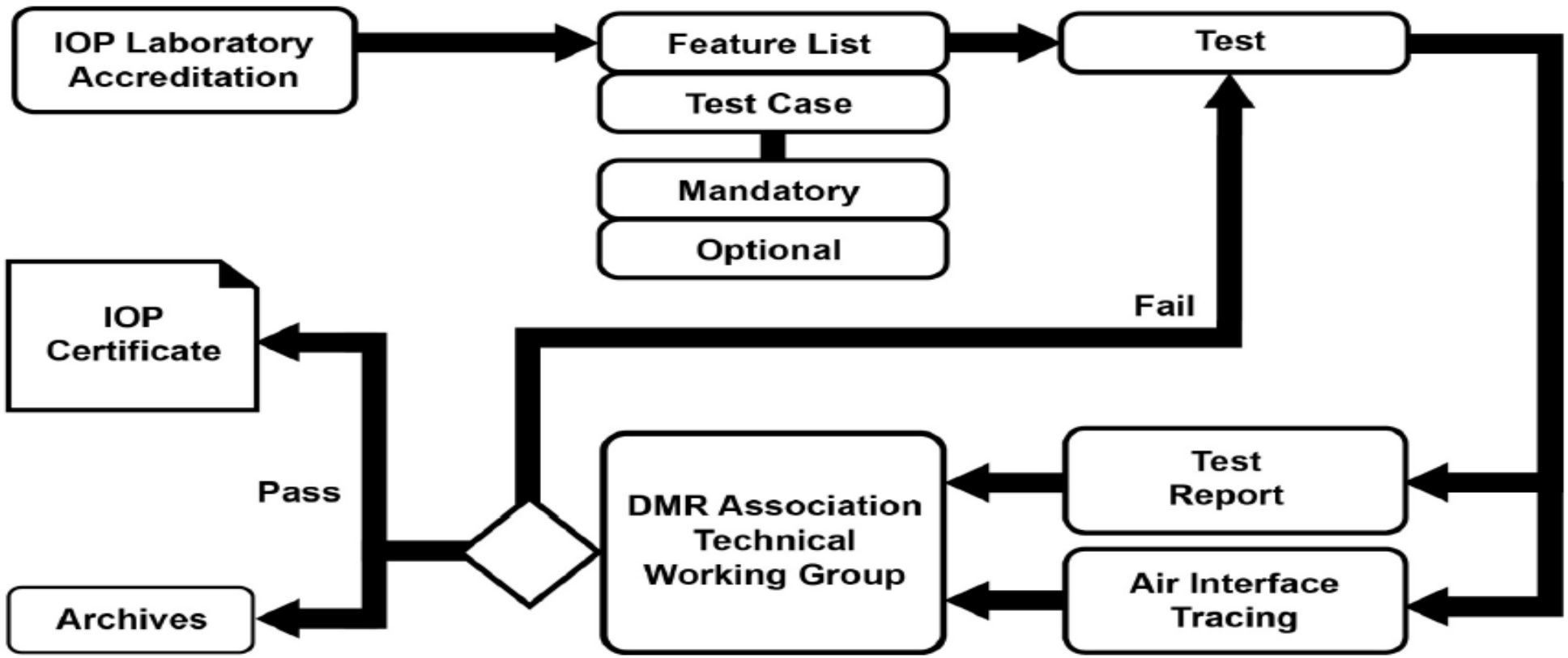
- Reviewed P25 and TETRA as examples of high quality interoperability process

- Both processes are extremely thorough as fits requirements of govt. public safety users and contracts worth $100's millions

- Reviewed ETSI DMR Special Task Force conformance work from time of DMR standardisation

- Took elements of P25, TETRA and ETSI processes and simplified to make appropriate for DMR users

Insights in the Interoperability Process



Insights in the Interoperability Process

- The whole Test Process is regulated by a DMR Association document, the “Interoperability Laboratory Recognition Process and Test Session Procedures”
- The DMRA Technical Working Group appoints a Laboratory Co-ordinator who is responsible for managing the Recognition Process of DMRA Recognized Interoperability Laboratories
- Written quality standards and processes for Labs wanting to run tests – reference to ISO 9001 processes
- All Labs wanting to run a test session must self-declare compliance with these standards and be acknowledged by TWG
- Labs can be challenged to demonstrate compliance

Insights in the Interoperability Process

- DMRA TWG appoints an Interoperability Co-ordinator who is responsible for managing the Test Session Procedure
- New products submitted for interoperability testing must comply with all applicable conformity regulation governing access to the relevant market
- The DMR Interoperability Testing and Certification process follows clearly defined rules over the different phases, from “Decision to Test” to “Certificate Issue”
  - Test reports are written following a well-defined form
  - Log files of tests must be collected
  - Laboratory managers and vendors must sign off all testing
  - Tests performed according to agreed detailed specifications

Insights in the Interoperability Process

- There are tests for both Tier 2 and Tier 3 features
- DMRA TWG has defined two types of test for each Tier:
  - Mandatory tests on features defined in the ETSI DMR standard
  - Optional tests on features defined either in ETSI DMR standard or in DMRA standard
- For Tier 2:
  - Mandatory: Group Call, Individual Call (PATCS), Individual Call (OACSU), All Call
  - Optional: Radio Check, Call Alert, Radio Disable/Enable, Remote Monitor, Emergency Alarm, Emergency call, Messaging
- For Tier 3 the Mandatory list is similar to Tier II
  - Plus Registration, Roaming, Queuing and Native Addressing Plan
  - Optional Tests are for Multi-site trunking and many other features, cfr. next slides

Tier 3 Interoperability: Optional Features Set 1

Optional Features (Set 1)
Multisite Talkgroup Voice Service
Multisite Individual Voice Service
Multisite Short Data Messaging
Status Service Delivery
Stun/Revive
Kill
Emergency Alarm
Emergency Voice Service
MS Initiated Payload Interrupt MS De-key with Cease Transmission Request
Single Talkgroup Subscription
Talkgroup Subscription List
Single Talkgroup Attachment
Talkgroup Attachment List
Half Duplex Telephone Voice Service
Full Duplex Telephone Voice Service
Full Duplex MS to MS Individual Call
Location – USBD Polling
Text Message Service
Registration with Authentication
Emergency Pre-emption with MS De-key

Tier 3 Interoperability: Optional Features Set 2 (Planned for Q4/22)

Ambient Listening Service

- Success
- Call termination through MS Dekey
- Payload interrupt for initiator to respond

Radio Check

- MS Radio Check successful
- Talkgroup Presence Check on TSCC
- Talkgroup Presence Check on payload channel

DGNA

- DGNA Address Mode: Add 1 TG, single site
- DGNA Address Mode: Add multiple TGs, multisite
- DGNA Address Mode: Remove all DGNA added TGs, multisite
- DGNA Alias Mode: Add 1 TG and alias, multisite
- DGNA Alias Mode: Remove added TG and alias, multisite

Call Diversion

- Divert individual voice call to another MS, single site
- Divert individual status message to another MS, single site
- Divert individual text message (IP Data) to another MS, single site
- Divert individual voice call to a TG, multsite
- Divert individual voice call to telephone, single site
- Cancel call diversion by initiator
- Cancel call diversion by target

LIP Location via IP Data

- Immediate Location Report
- Basic Location Report Request
- Short Location Error Reporting
- Location Report Disable with acknowledgement Request
- Location Report Enable with acknowledgement Request
- Dynamically modifiable reporting
- Emergency Location Report
- Location on PTT

Encryption

- ARC4 Encryption Individual Voice, Single Site
  - Success
  - Failure (target wrong key)
- ARC4 Encryption Talkgroup Voice, MultiSite
- ARC4 Encryption Talkgroup Voice, Late Entry
- ARC4 Encryption Telephone to Talkgroup
- ARC4 Encryption Individual Text Message (IP Data)
  - Success
  - Failure (target wrong key)
- ARC4 Encryption Talkgroup Text Message (IP Data)
- AES256 Encryption Individual Voice, Single Site
  - Success
  - Failure (target wrong key)
- AES256 Encryption Talkgroup Voice, MultiSite
- AES256 Encryption Talkgroup Voice, Late Entry
- AES256 Encryption Telephone to Talkgroup
- AES256 Encryption Individual Text Message (IP Data)
  - Success
  - Failure (target wrong key)
- AES256 Encryption Talkgroup Text Message (IP Data)

Announce Logical Physical Channel

- Modify the frequency plan for a payload channel

Offset Control Channel

- Offset Mode Voice Call, Single Site

Short Data Message to a Group

- Short Data Message to a Group

Mass Re-Registration

- Mass Re-Registration

Hibernating Control Channel

- Hibernating Control Channel

Tier 3 Interoperability: Test Cases - Example

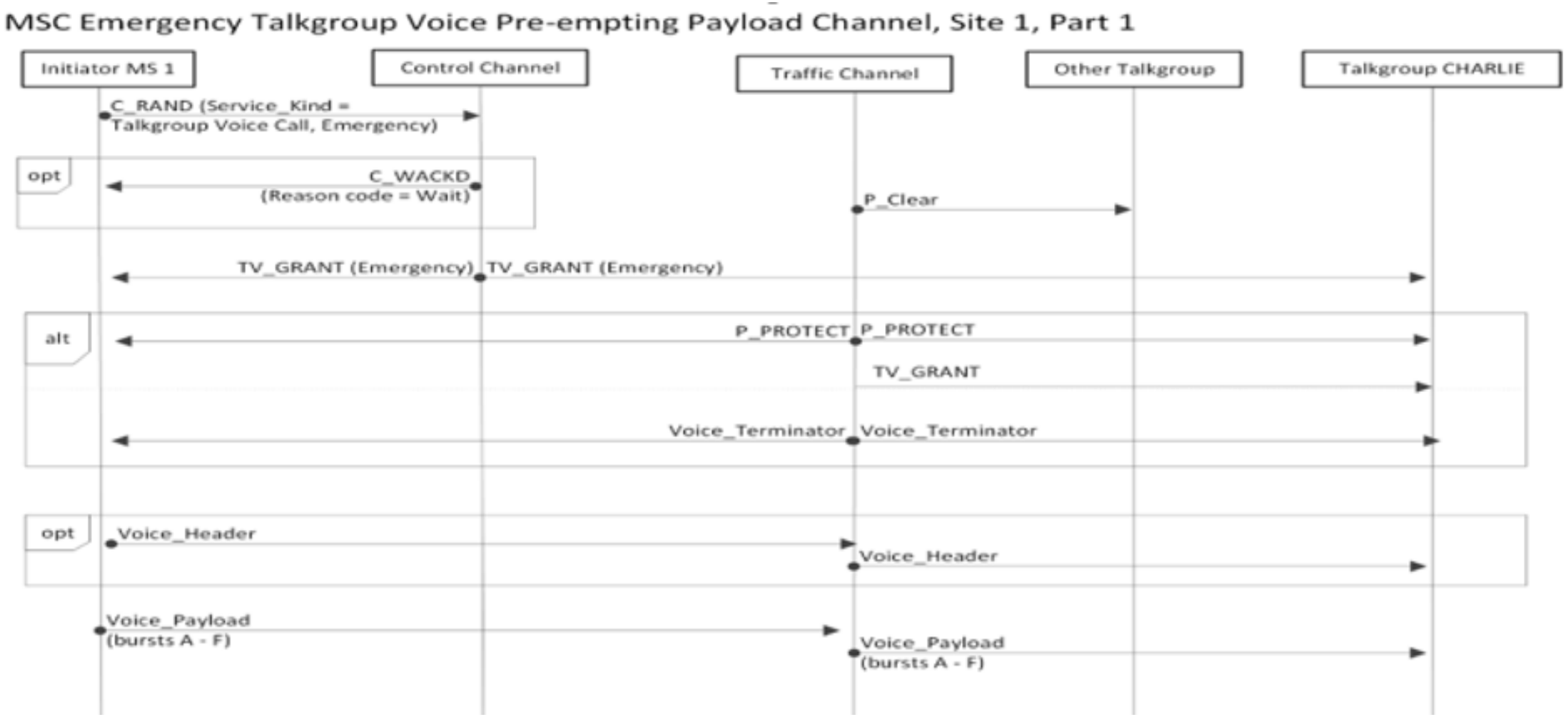
Test case 4: Emergency Pre-Emption of Payload Channel with Reverse Channel Signalling. Multi-Site

Test case id: @IOP_T3_Emergency_PreEmption_PayloadChan_RevChanSig

Procedure

1) Set-up the trunking system so that on Site 1 only one control channel and two payload channels on a separate frequency pair are available. Also ensure that at least two payload channels are available on Site 2. This can be either achieved by the system restricting access to certain channels or "occupying" the channel by a mobile that is not part of the actual test setup.
2) Set up a group call on MS 6 to talkgroup ECHO and initiate a transmission
3) Set up a group call on MS 4 to talkgroup DELTA and initiate a transmission
4) Confirm that MS 5 can hear and clearly understand MS4's transmission. MS 1, MS 2 and MS 3 can not hear MS 4's transmission.
5) End talking on MS 4.
6) While no MS is transmitting in the call from MS 6 to talkgroup ECHO and no MS is transmitting in the call from MS 4 to talkgroup DELTA, initiate an emergency group call from MS 1 to Talkgroup CHARLIE.
7) **Pass Criterion:** The manufacturer specific information on the radios shows that one of the normal calls on Site 1 has been ended.
8) **Pass Criterion:** The manufacturer specific information on MS 1 shows that the emergency call has successfully been set up
9) **Pass Criterion:** Confirm that MS 2 and 3 can hear and clearly understand MS 1's transmission.
10) End the call from MS 1.
11) **Pass Criterion:** The manufacturer specific information on MS 1 shows that the call has ended and has left the payload channel and that the trunked system releases the payload channel resource.

Tier 3 Interoperability: Test Cases MSC



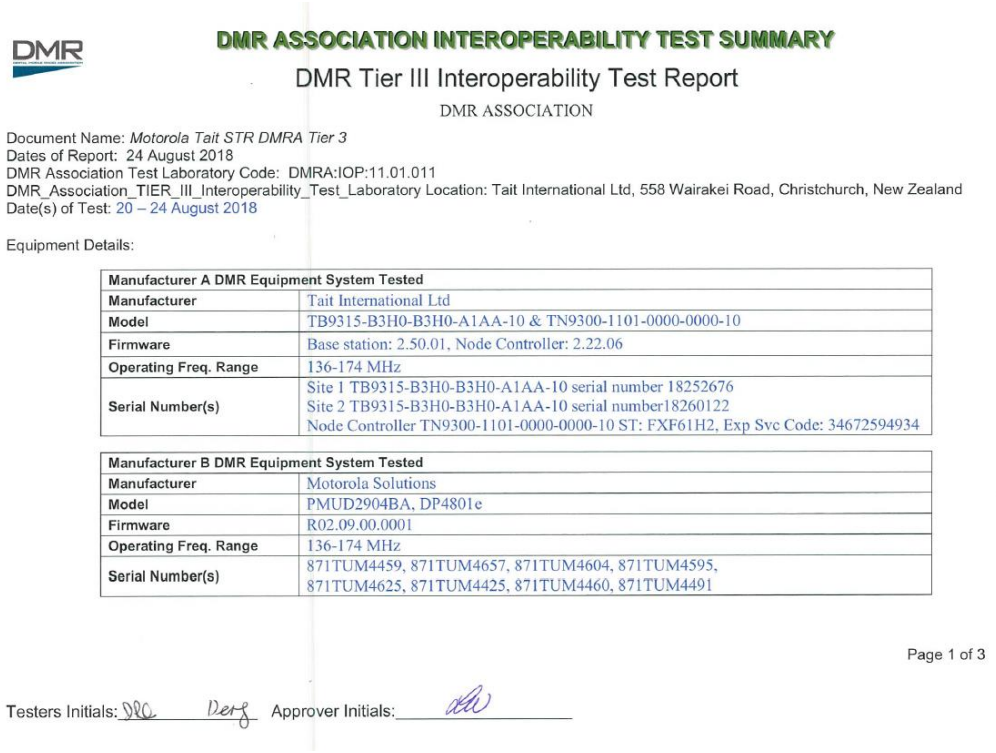
Tier 3 Interoperability: Air I/F Tracing

```
No.     Time           Source                Destination           Protocol Length Info
     65 9.539188000    192.168.0.1           192.168.0.100         DMR      86     INBOUND  - CSBK - C_RAND: GRP_V_SRV from 3

Frame 65: 86 bytes on wire (688 bits), 86 bytes captured (688 bits) on interface 0
Ethernet II, Src: Prod-El_00:23:6a (00:16:64:00:23:6a), Dst: 38:63:bb:b9:37:c7 (38:63:bb:b9:37:c7)
Internet Protocol Version 4, Src: 192.168.0.1 (192.168.0.1), Dst: 192.168.0.100 (192.168.0.100)
User Datagram Protocol, Src Port: scp-config (10001), Dst Port: scp-config (10001)
Digital Mobile Radio Protocol (DMR),   Tracer Release: Selex-ES Tracer 2 (PAT2)
    Time Stamp Packet : 9628590 cells (1203573,750000 ms)
    DMR Time since beginning of capture: 9540,000
    Physical Layer     (Layer 1),   Channel: Inbound Data
    Data Link Layer    (Layer 2),   Burst Type: CSBK
        Color Code: 0
        Payload after BPTC (196,96) Decoding: 9f 00 00 01 00 00 03 00 00 03 6f 97
        Last Block (LB): 1 - Protect Flag (PF): 0 - Manufacturers Feature ID (MFID): 00
        Checksum: CRC 16 - CCITT, (0x6f97) [correct]
    Call Control Layer (Layer 3)
        Tier III PDU type: C_RAND (Random Access Request)
        Service_Kind: 0x1 (GRP_V_SRV - Talkgroup Voice Call Service)
        Service_Options: 0x00
                EMERG: 0 (Non-emergency service)
                PRIVACY: 0 (Text/Voice plain)
                SUPED_SV: 0 (No Supplementary_user data Transfer Service required for this call)
                BCAST_SV: 0 (Non-broadcast service)
                OVCM_SV: 0 (Non-OVCM call)
                PRIORTY_SV: 0 (Normal -low- priority)
        Proxy Flag (PROXY): 0 (Number of Extended BCD digits for addressing through a gateway = 1 to 20)
        Appended Supplementary_Data (SUPED_VAL): 0 (Number of appended UDTs required to transport supplementary_user data)
        Ambient Listening Service (ALS_SERV): 0 (Ambient Listening Service not requested)
        Target_address: 3 [0x000003]
        Source_address: 3 [0x000003]
    Common Announcement Channel (CACH)
        TDMA Channel: TS1
        Inbound Signal (MS Sourced): No more CACH Information
```

Tier 3 Interoperability: Test Summary

- All test results and logs submitted to DMRA TWG meeting
- Test results documents are inspected and log files checked by TWG during a formal review meeting to make sure no inconsistencies are present
- The fact that TWG members are representing companies that compete in the market gives confidence that the assessment is done as thorough as possible
- Documentation all kept on secure file and certificates issued giving summary of tests.
- In the event of a dispute between vendors, the Lab Co-ordinator tries to resolve it, otherwise no certificate will be issued
- If the TWG verification has a positive result, an Interoperability Certificate will be issued



DMR

DMR ASSOCIATION INTEROPERABILITY TEST SUMMARY

DMR Tier III Interoperability Test Report

DMR ASSOCIATION

Document Name: *Motorola Tait STR DMRA Tier 3*
Dates of Report: 24 August 2018
DMR Association Test Laboratory Code: DMRA:IOP:11.01.011
DMR_Association_TIER_III_Interoperability_Test_Laboratory Location: Tait International Ltd, 558 Wairakei Road, Christchurch, New Zealand
Date(s) of Test: 20 – 24 August 2018

Equipment Details:

Manufacturer A DMR Equipment System Tested	
Manufacturer	Tait International Ltd
Model	TB9315-B3H0-B3H0-A1AA-10 & TN9300-1101-0000-0000-10
Firmware	Base station: 2.50.01, Node Controller: 2.22.06
Operating Freq. Range	136-174 MHz
Serial Number(s)	Site 1 TB9315-B3H0-B3H0-A1AA-10 serial number 18252676 Site 2 TB9315-B3H0-B3H0-A1AA-10 serial number18260122 Node Controller TN9300-1101-0000-0000-10 ST: FXF61H2, Exp Svc Code: 34672594934

Manufacturer B DMR Equipment System Tested	
Manufacturer	Motorola Solutions
Model	PMUD2904BA, DP4801e
Firmware	R02.09.00.0001
Operating Freq. Range	136-174 MHz
Serial Number(s)	871TUM4459, 871TUM4657, 871TUM4604, 871TUM4595, 871TUM4625, 871TUM4425, 871TUM4460, 871TUM4491

Page 1 of 3

Testers Initials: DRC Derg Approver Initials:

Tier 3 Interoperability: IOP Certificate

DMR Association Interoperability Certificate

Certificate Number: xxxxx

This DMR Association Interoperability Certificate documents that the manufacturer A product as detailed in Table A below:

TABLE A : DMR EQUIPMENT TESTED		
Manufacturer		
Model		
Firmware	ID	Version

has successfully passed the DMR Association Tier 3 Mandatory and Optional interoperability tests outlined in the DMR Association test specification documents: *Interoperability Testing for DMR Tier 3 Systems V X.X of Month Year* carried out on days month year with the manufacturer B product referenced in Table B below with tests undertaken as indicated in the following pages.

TABLE B : DMR EQUIPMENT TESTED		
Manufacturer		
Model		
Firmware	ID	Version

The DMR Association hereby declares that the product in Table A when tested with the product in Table B passed interoperability Test Cases as set out in the feature summary below.

The DMR Association hereby declares that the testing took place according to the procedures and in a laboratory meeting the criteria set out in the DMR Association document: *Interoperability Laboratory Recognition Process and Test Session Procedures, V X.X of Month Year.*

Issue Date: DD/MM/YYYY

Digitally Signed by Chair of the DMR Association Technical Working Group

NOTE:

All products belonging to the same model classes, meaning equipment that Manufacturer A and Manufacturer B have determined, through engineering analysis or internal functional testing, to be functionally equivalent to the products in Table A and Table B, may be declared interoperable by Manufacturer A and Manufacturer B.

LIABILITY DISCLAIMER

The DMR Association declares that the IOP validation process has been carried out with the best possible endeavors in order to ensure the most reliable verdicts. Nevertheless, the DMR Association takes no responsibility for, and shall have no liability as a verdict of damages, losses, or injuries of any kind that may be caused by non-coherence to the functions listed in the certificates of products that are awarded a DMR Interoperability Certificate.

Individual manufacturers are responsible for ensuring that the behaviour of any equipment for which Interoperability is claimed is identical to that of the equipment that passed the DMR Association interoperability certification process.

See below for feature summary

Tier 3 Interoperability: IOP Certificate

ETSI STANDARD SUPPORTED

ETSI Standard Supported	<Version of TS 102 361-4 supported by the system>.

FEATURE SUMMARY

Mandatory Features

Feature	Result
Registration	Pass
Single Site Talkgroup Voice Service	Pass
Single Site Individual Voice Service	Pass
Hunting	Pass
Single Site Short Data Messaging	Pass
Native Addressing	Pass

Optional Features

Feature	Result
Multisite Talkgroup Voice Service	Pass/Not Tested
Multisite Individual Voice Service	Pass/Not Tested
Multisite Short Data Messaging	Pass/Not Tested
Status Service Delivery	Pass/Not Tested
Stun/Revive	Pass/Not Tested
Kill	Pass/Not Tested
Emergency Alarm	Pass/Not Tested
Emergency Voice Service	Pass/Not Tested
MS Initiated Payload Interrupt MS De-key with Cease Transmission Request	Pass/Not Tested
Single Talkgroup Subscription	Pass/Not Tested
Talkgroup Subscription List	Pass/Not Tested
Single Talkgroup Attachment	Pass/Not Tested
Talkgroup Attachment List	Pass/Not Tested
Half Duplex Telephone Voice Service	Pass/Not Tested
Full Duplex Telephone Voice Service	Pass/Not Tested
Full Duplex MS to MS Individual Call	Pass/Not Tested
Location – USBD Polling	Pass/Not Tested
Text Message Service	Pass/Not Tested
Registration with Authentication	Pass/Not Tested
Emergency Pre-emption with MS De-key	Pass/Not Tested

MANDATORY FEATURE DETAILED SUMMARY

Registration	
Registration Accepted	Pass
Registration Not Accepted	(See Note 1)
MS Refused	Pass/Not Tested
MS Denied	Pass/Not Tested
De-registration	Pass
Single Site Talkgroup Voice Service	
Message Trunking	(See Note 2)
Call Granted	Pass/Not Tested
Call Refused	Pass/Not Tested
Call Queued	Pass/Not Tested
Broadcast Call	Pass/Not Tested
Transmission Trunking	(See Note 2)
Call Granted	Pass/Not Tested
Call Refused	Pass/Not Tested
Call Queued	Pass/Not Tested
Single Site Individual Voice Service	
Single Frequency OACSU Call	
Call Granted and ended by calling party	Pass
Call Granted and ended by called party	Pass
OACSU Call	
Call Granted	Pass
Call Refused	Pass
Call Queued	Pass
FOACSU Call	
Call Accepted	Pass
Call Refused by user	Pass
Hunting	
Site Change	Pass
Single Site Short Data Messaging	
Individual Message	Pass
Native Addressing	
Group Call	Pass
Individual Call	Pass
NOTES Note 1: Only one of 'MS Refused' or 'MS Denied' is required Note 2: Only one of 'Message Trunking' or 'Transmission Trunking' is required	

Tier 3 Interoperability: IOP Certificate

OPTIONAL FEATURE DETAILED SUMMARY

Multisite Talkgroup Voice Service	
Message Trunking	(See Note 1)
Call Granted	Pass/Not Tested
Call Queued, origin site busy	Pass/Not Tested
Call Queued, destination site busy	(See Note 2)
All Start	Pass/Not Tested
Fast Start	Pass/Not Tested
Broadcast Call	Pass/Not Tested
Transmission Trunking	(See Note 1)
Call Granted	Pass/Not Tested
Call Queued, origin site busy	Pass/Not Tested
Call Queued, destination site busy	(See Note 2)
All Start	Pass/Not Tested
Fast Start	Pass/Not Tested
Multisite Individual Voice Service	
OACSU Call	
Call Granted	Pass/Not Tested
Call Queued	Pass/Not Tested
FOACSU Call	
Call Accepted	Pass/Not Tested
Call Refused by user	Pass/Not Tested
Multisite Short Data Messaging	
Individual Message	Pass/Not Tested
Status Service Delivery	
Individual Status Message	Pass/Not Tested
Talkgroup Status Message	Pass/Not Tested
Talkgroup Status Message Failed - Source Not Allowed	Pass/Not Tested
Individual Status Message Failed - Target Not Available	Pass/Not Tested
Stun and Revive	
Without Authentication	Pass/Not Tested
With Authentication	Pass/Not Tested
With Authentication Failed – Wrong Key	Pass/Not Tested
Kill	
Failed – Wrong Key	Pass/Not Tested
Kill Successful	Pass/Not Tested
NOTES Note 1: Only one of 'Message Trunking' or 'Transmission Trunking' is required Note 2: Only one of 'All Start' or 'Fast Start' is required	

Optional Feature Detailed Summary (cont.)

Emergency Alarm	
Emergency Alarm to Talkgroup	Pass/Not Tested (see Note 1)
Cancel Emergency Alarm to Talkgroup	Pass/Not Tested
Emergency Alarm to Individual	Pass/Not Tested
Cancel Emergency Alarm to Individual	Pass/Not Tested
Emergency Voice Service	
Emergency Talkgroup Voice Call Granted	Pass/Not Tested (see Note 2)
Emergency Talkgroup Voice Call Refused	Pass/Not Tested (see Note 2)
Individual Emergency Voice Call Granted – Single Site	Pass/Not Tested
Emergency Pre-Emption with MS De-key.	Pass/Not Tested
Individual Emergency Voice Call Granted – Multisite	Pass/Not Tested
MS Initiated Payload Interrupt MS De-key with Cease Transmission Request	
Talkgroup Voice Call Interrupt Success	Pass/Not Tested
Talkgroup Voice Call Interrupt Failed – Not Supported in TX MS	Pass/Not Tested
Individual Voice Call Interrupt Success	Pass/Not Tested
Individual Voice Call Interrupt Failed - Not Supported in TX MS	Pass/Not Tested
Registration with Authentication	
Registration with Authentication	Pass/Not Tested
Registration with Authentication Failed – Wrong Key	Pass/Not Tested
Single Talkgroup Subscription (see Note 3)	
Registration and Single Talkgroup Subscription Accepted	Pass/Not Tested
Registration and Single Talkgroup Subscription Refused	Pass/Not Tested
Single Talkgroup Subscription Change Accepted	Pass/Not Tested
Talkgroup Subscription List (see Note 4)	
Registration and Talkgroup Subscription List Accepted	Pass/Not Tested
Registration and Talkgroup Subscription List Refused	Pass/Not Tested
Talkgroup Subscription List Change Accepted	Pass/Not Tested
Registration with Authentication and Talkgroup Subscription List accepted	Pass/Not Tested
Single Talkgroup Attachment (see Note 5)	
Registration and Single Talkgroup Attachment Accepted	Pass/Not Tested
Registration and Single Talkgroup Attachment Refused	Pass/Not Tested
Registration Accepted, Single Talkgroup Attachment Not Accepted	Pass/Not Tested
Single Talkgroup Attachment Change	Pass/Not Tested
NOTES Note 1: Only this test case is required for feature support Note 2: Only these test cases are required for feature support Note 3: All three test cases must be performed successfully for feature support. Note 4: The first three test cases must be performed successfully for feature support. Note 5: The first, second and fourth test cases must be performed successfully for feature support.	

Tier 3 Interoperability: IOP Certificate

Optional Feature Detailed Summary (cont.)

Talkgroup Attachment List (see Note 1)	
Registration and Talkgroup Attachment List Accepted	Pass/Not Tested
Registration and Talkgroup Attachment List Refused	Pass/Not Tested
Registration Accepted, Talkgroup Attachment List Not Accepted	Pass/Not Tested
Talkgroup Attachment List Change	Pass/Not Tested
Registration with authentication and Talkgroup Attachment List Accepted	Pass/Not Tested
Half Duplex Telephone Voice Service (See Note 2)	
MS to Telephone Granted	Pass/Not Tested
MS to Telephone Refused	Pass/Not Tested
Telephone to MS Granted	Pass/Not Tested
Telephone to MS Refused	Pass/Not Tested
Telephone to Talkgroup Granted	Pass/Not Tested
Full Duplex MS to MS Voice Service (See Note 3)	
OACSU Individual Voice Call Granted	Pass/Not Tested
FOACSU Individual Voice Call Granted	Pass/Not Tested
Individual Voice Call Denied – Duplex Not Supported	Pass/Not Tested
Full Duplex Telephone Voice Service	
MS to Telephone Call Granted	Pass/Not Tested
Telephone to MS Call Granted	Pass/Not Tested
Location – USBD Polling	
MS with GNSS Fix on TSCC	Pass/Not Tested
MS without GNSS Fix on TSCC	Pass/Not Tested
MS not Supporting USBD on TSCC	Pass/Not Tested
MS with GNSS Fix on TSCCAS	Pass/Not Tested
MS without GNSS Fix on TSCCAS	Pass/Not Tested
MS not Supporting USBD on TSCCAS	Pass/Not Tested
Stunned MS with GNSS Fix on TSCCAS	Pass/Not Tested
Text Message Service	
MS to MS Single Site	Pass/Not Tested
MS to MS Text Message Failed – Target Not Available	Pass/Not Tested
MS to Talkgroup Text Message	Pass/Not Tested
MS to MS Multisite	Pass/Not Tested
NOTES Note 1: The first, second and fourth test cases must be performed successfully for feature support Note 2: Only these test cases are required for feature support Note 3: Only one of 'OACSU' or 'FOACSU' is required.	

Optional Feature Detailed Summary (cont.)

Authentication (see Note 1)	
Registration	Pass/Not Tested
Stun/Revive	Pass/Not Tested
Kill	Pass/Not Tested
Talkgroup Subscription	Pass/Not Tested
Talkgroup Attachment	Pass/Not Tested
Emergency Pre-emption PTT De-key	
Emergency Talkgroup Call Granted with Call Pre-emption	Pass/Not Tested
NOTES Note 1: Only this test case is required for feature support	

Tier 3 Interoperability: IOP Certificate - Example

DIGITAL MOBILE RADIO ASSOCIATION

DMR Association Interoperability Certificate

Document 10057

Note to readers: This DMR Association Interoperability Certificate documents that the TB9315 product as detailed in Table A below:

TABLE A : DMR EQUIPMENT TESTED		
Manufacturer	Tait International Ltd	
Model	TB9315-B3H0-B3H0-A1AA-10 & TN9300-1101-0000-0000-10	
Firmware	**ID**	**Version**
	Base Station: QBC30RFS Node Controller: Q9391NC	Base Station: 2.50.01 Node Controller: 2.22.06

has successfully passed the DMR Association Tier 3 mandatory and optional interoperability tests outlined in the DMR Association test specification documents: *Interoperability Testing for DMR Tier 3 Systems V3.2 July 2018* carried out on 20th-24th August 2018 with the DP4801e product referenced in Table B below with tests undertaken as indicated in the following pages.

TABLE B : DMR EQUIPMENT TESTED		
Manufacturer	Motorola Solutions	
Model	DP4801e	
Firmware	**ID**	**Version**
	N/A	R02.09.00.0001

The DMR Association hereby declares that the product in Table A when tested with the product in Table B passed interoperability Test Cases as set out in the test list below.

The DMR Association hereby declares that the testing took place according to the procedures and in a laboratory meeting the criteria set out in the DMR Association document: *Interoperability Laboratory Recognition Process and Test Session Procedures, V 2.04 of June 2018.*

All products belonging to the same model classes, meaning equipment that Tait International Ltd / Motorola Solutions have determined, through engineering analysis or internal functional testing, to be functionally equivalent to the products in Table A and Table B, may be declared interoperable by Tait International Ltd and Motorola Solutions.

Issue Date: 1st February 2019

Chair of the DMR Association Technical Working Group

T.M. Johnson Digitally signed by Thomas Murray Johnson Date: 2019.02.01 11:39:03 Z

The following summary details which tests have been carried out.

Tier 3 Interoperability: Model Class

- Tests are performed on specific models and software releases
- Manufacturers will have products that are “functionally equivalent” to the tested products
- Where internal testing or technical analysis shows the functional equivalence of products variants, a manufacturer can declare them in a “Model Class”
- Manufacturers can state “Model Class” products can be expected to behave as the specific products tested for Interoperability
- This is manufacturer, not a DMRA declaration

Tier 3 Interoperability: Model Class

Document Reference: 3939 Motorola/Tait

DMR Association Interoperability Procedures

MODEL CLASS DECLARATION

In accordance with the DMR Association procedures, Tait International Ltd (hereinafter referred-to as "The Company") declares the following Model Class:

Official Name of the Model Class: Tait DMR Base Station

The Company has determined through analysis and/or internal functional testing that the following products are functionally equivalent in terms of the DMR Association interoperability requirements to the Certificated product identified below:

Certified Product: T89315-B3H0-B3H0-A1AA-10 & TN9300-1101-0000-0000-10

Firmware Version: Base Station: 2.50.01
Node Controller: 2.22.06

Certificate Number: 10057

Equivalent products:

Item	Item Description
T893xx-xxxx-xxxx-xxxx-xx	50 Watt or 100 Watt DMR Base Station
T893xxxxxxxxxxxxx	50 Watt or 100 Watt DMR Base Station – Harris Brand
T873xx-xxxx-xxxx-xxxx-xx	40 Watt or 50 Watt 1U DMR Base Station
T873xxxxxxxxxxxxx	40 Watt or 50 Watt 1U DMR Base Station – Harris Brand
T87304-xxxx	15 Watt Transportable DMR Base Station
T894xx-xxxx-xxxx-xxxx-xx	50 Watt or 100 Watt Multi-Mode Base Station
T894xxxxxxxxxxxxx	50 Watt or 100 Watt Multi-Mode Base Station – Harris Brand

Item	Item Description
TN93xx-1xxx-xxxx-xxxx-xx	Tier III Trunked Node Controller Hi Level
TN93xx-3xxx-xxxx-xxxx-xx	Tier III Trunked Node with SCADA Gateway Hi Level
TN93xx1xxxxxxxxxx	Tier III Trunked Node Controller Hi Level – Harris Brand
TN93xx3xxxxxxxxxx	Tier III Trunked Node with SCADA Gateway Hi Level – Harris Brand

Signed on behalf of The Company:

Name: Paul Martin
System Engineer
Date: 12 August 2020

Tait Technology Centre
245 Wooldridge Road, Harewood, Christchurch 8051, New Zealand
Phone +64 3 358 3399 www.taitradio.com

MOTOROLA SOLUTIONS

Motorola Solutions, 500 W Monroe St Ste 4400, Chicago, IL 60661, United States

MOTOTRBO Products in "Model Class" DP4801e for DMR Interoperability Testing - Certificate 2018-002 Tier 3 Tait TB9315 & TN9300 SYS and Motorola DP4801e MS

DMR Association definition of a Model Class (Section 1.3.13):
"A set of products that a manufacturer has determined, through engineering analysis or internal functional testing, to be functionally equivalent" *

DMR Association statement on declaration of Model Classes:
"When test reports are formally verified by the DMR Association and a certificate of interoperability has been issued, or at a later date if appropriate, a manufacturer may declare, in a document signed by an authorized representative of the manufacturer, all products that belong to the Model Class of the product tested. All such products are eligible to be stated as interoperable by the manufacturer as if they had been used in the formal test process."*
Motorola has determined by the criteria set out by the DMR Association that the following MOTOTRBO models are in the same Model Class as the **DP4801e**

XiR M8620	XiR M8620i	DM4400	DM4400e	DGM 5000	DGM 5000e	XPR 5350	XPR 5350e
XiR M8628	XiR M8628i	DM4401	DM4401e	DGM 5500	DGM 5500e	XPR 5350	XPR 5350e
XiR M8660	XiR M8660i	DM4600	DM4600e	DGM 8000	DGM 8000e	XPR 5380	XPR 5380e
XiR M8668	XiR M8668i	DM4601	DM4601e	DGM 8500	DGM 8500e	XPR 5380	XPR 5380e
CM7668	CM7668i	DP4400	DP4400e	DGP 5050	DGP 5050e	XPR 7350	XPR 7350e
XiR P8600	XiR P8600i	DP4401	DP4401e	DGP 5550	DGP 5550e	XPR 7550	XPR 7550e
XiR P8608	XiR P8608i	DP4600	DP4600e	DGP 8050	DGP 8050e	XPR 7580	XPR 7580e
XiR P8620	XiR P8628i	DP4601	DP4601e	DGP 8550	DGP 8550e	XPR 7380	XPR 7380e
XiR P8628	XiR P8660i	DP4800	DP4800e	SL8050	SL8550e	SL7550	SL7550e
XiR P8660	XiR P8668i	DP4801	DP4801e	SL8550	DGP 8050e Elite	SL7580	SL7580e
XiR P8668	GP338D+	SL4000	SL4000e	DGP 8550EX		SL7590	SL7590e
GP338D	GP328D+	SL4010	SL4010e	DGP 8050EX		XPR 7550 IS	XPR 7150
GP328D	CP7668i	DP4801 Ex	DP3441e	DGP 8050 Elite			XPR 7580e IS

MOTOROLA SOLUTIONS

XiR P8668T	SL2K	DP4401 Ex	DP3661e				
XiR P8860R	XiR E8608i	DP3441	DP4401 Ex Me				
XiR P8800T	XiR E8600i		DP4801 Ex Me				
XiR P8806R	XiR E8628i		MSLB-MKZ900i				
CP7668							
SL1K							
XiR P8668 Ex							
XiR P8608 Ex							
XiR E8608							
XiR E8600							
MSLB-MKZ900							

Piotr Ptasinski

Piotr Ptasinski
Senior Product Manager, MOTOTRBO Infrastructure & Systems
Motorola Solutions

IWCE Connecting Critical Communications

Las Vegas 21st March 2022

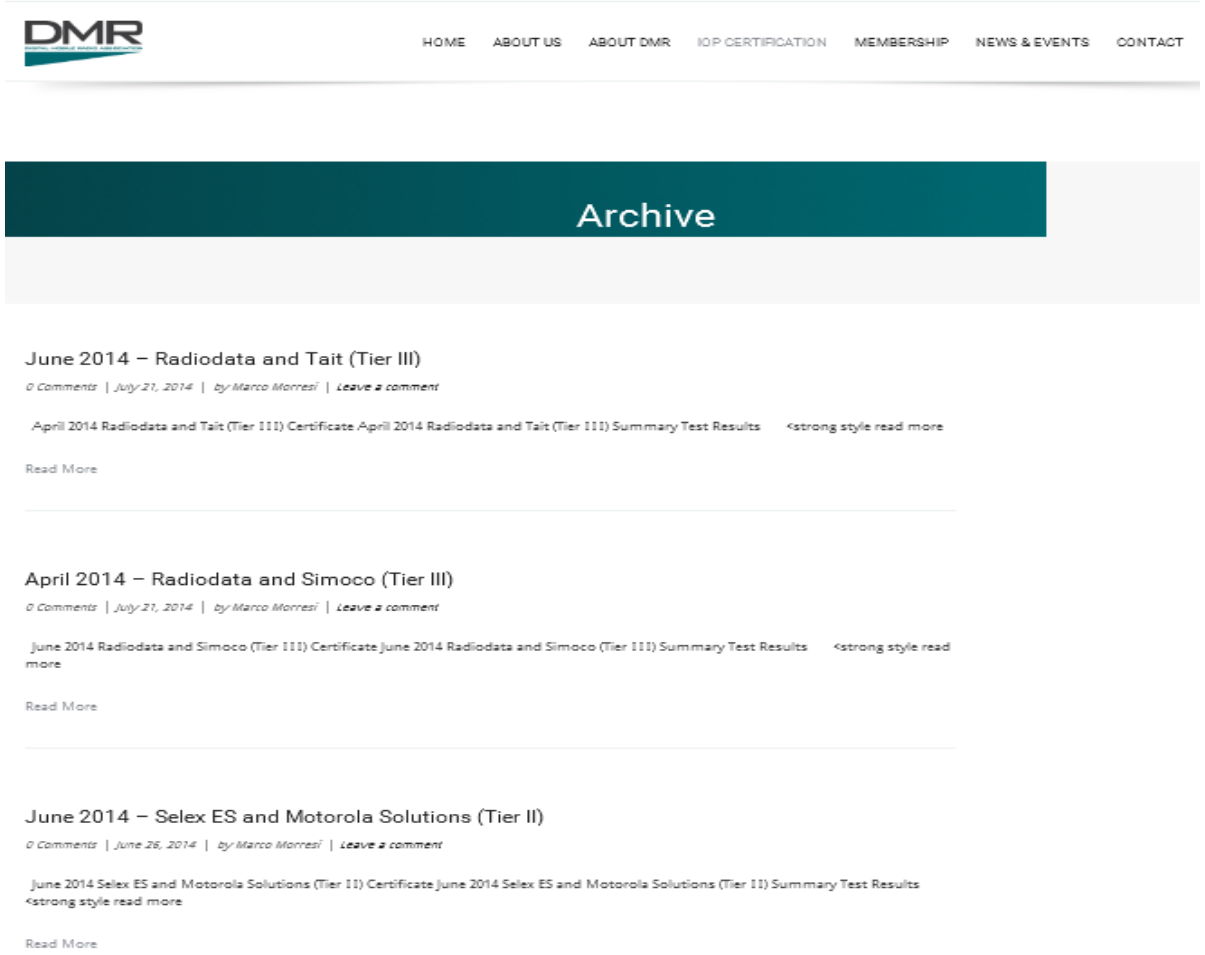
DMR DIGITAL MOBILE RADIO ASSOCIATION

Interoperability: Limits to the Process

- The testing is based on OSI model layer 3
  - Testing is band independent
  - Performance specs. of the physical layer are not tested
  - User interface e.g. language is not tested
- The testing only covers defined features
  - The list of features grows over time
  - Manufacturer variants and implementations will remain
- An IOP certificate does not mean a product is type-approved for use in a particular territory
- Process is voluntary but value for manufacturers to participate is high

Interoperability: More Information

dmrassociation.org



DMR ASSOCIATION INTEROPERABILITY TEST SUMMARY

DMR Tier III Interoperability Test Reference to test report here

DMR ASSOCIATION

Document Name: Fylde-Hytera Tier III Interoperability Test Summary October 2013
Date of Issue : 30th October 2013
DMR Association Test Laboratory Code: DMRA : IOP20.03.012
DMRAssociation_TIER_III_Interoperability_Test_Laboratory Location: Hytera Tower,Shenzhen Hi-Tech Industrial Park North, Beihuan Road9108#, Nanshan District, Shenzhen P.R.C.
Date(s) of Test : 28-30th October 2013
Equipment Details:

Manufacturer A DMR Equipment System Tested	
Manufacturer	Fylde Micro Ltd
Model	MultiLingo
Firmware	TSC: 001B12, build 440, RD985S: A1.01.09.000
Operating Freq. Range	400 to 470 MHz
Serial Number(s)	Ser No's T04-000094, T04-000093, T04-000115, T04-000119, RCS 3WIJKY1

Manufacturer B DMR Equipment System Tested	
Manufacturer	Hytera Communication Co.,Ltd
Model	PD785G
Firmware	A5.07.01.000
Operating Freq. Range	400 to 470 MHz
Serial Number(s)	A16A2Z1151、A16A2Z1126、A16A2Z1134、A16A2Z1143、A16A2Z1127、A16A2Z1121、A16A2Z1131、A16A2Z1122

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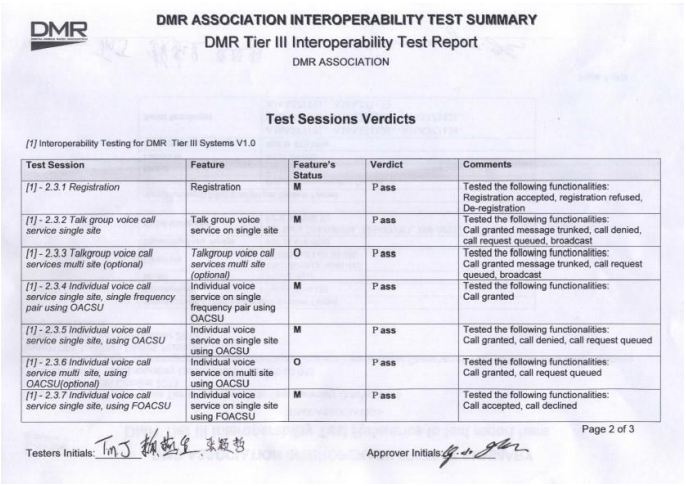
Testers Initials: TmJ

Approver Initials:



DMR ASSOCIATION INTEROPERABILITY TEST SUMMARY

DMR Tier III Interoperability Test Report

DMR ASSOCIATION

Test Sessions Verdicts

[1] Interoperability Testing for DMR Tier III Systems V1.0

Test Session	Feature	Feature's Status	Verdict	Comments
[1] - 2.3.1 Registration	Registration	M	Pass	Tested the following functionalities: Registration accepted, registration refused, De-registration
[1] - 2.3.2 Talk group voice call service single site	Talk group voice service on single site	M	Pass	Tested the following functionalities: Call granted message trunked, call denied, call request queued, broadcast
[1] - 2.3.3 Talkgroup voice call services multi site (optional)	Talkgroup voice call services multi site (optional)	O	Pass	Tested the following functionalities: Call granted message trunked, call request queued, broadcast
[1] - 2.3.4 Individual voice call service single site, single frequency pair using OACSU	Individual voice service on single frequency pair using OACSU	M	Pass	Tested the following functionalities: Call granted
[1] - 2.3.5 Individual voice call service single site, using OACSU	Individual voice service on single site using OACSU	M	Pass	Tested the following functionalities: Call granted, call denied, call request queued
[1] - 2.3.6 Individual voice call service multi site, using OACSU(optional)	Individual voice service on multi site using OACSU	O	Pass	Tested the following functionalities: Call granted, call request queued
[1] - 2.3.7 Individual voice call service single site, using FOACSU	Individual voice service on single site using FOACSU	M	Pass	Tested the following functionalities: Call accepted, call declined

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Testers Initials: TmJ

Approver Initials:

IWCE Connecting Critical Communications

Las Vegas 21st March 2022

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Interoperability: Summary

- An Interoperability Certification Process ensures users and equipment suppliers benefit from an open multi-vendor market for DMR systems and equipment
- Process is well defined, clear, robust and appropriate
- Process tests significant functionalities (important to users) and represents a base level of conformance (as a double check)
- Positive feedback from users

DMR

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twgchair@dmrassociation.com

dmrassociation.org