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AEQ Olympia 3 Commentary System at a multi venue event

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MULTI-VENUE COMMENTARY SYSTEM BASED ON OLYMPIA 3 AND AEQ / DANTE™ AoIP TECHNOLOGY

Example of the first AEQ Olympia 3 Commentary System deployment in a multi-venue event in August 2018

September 2018

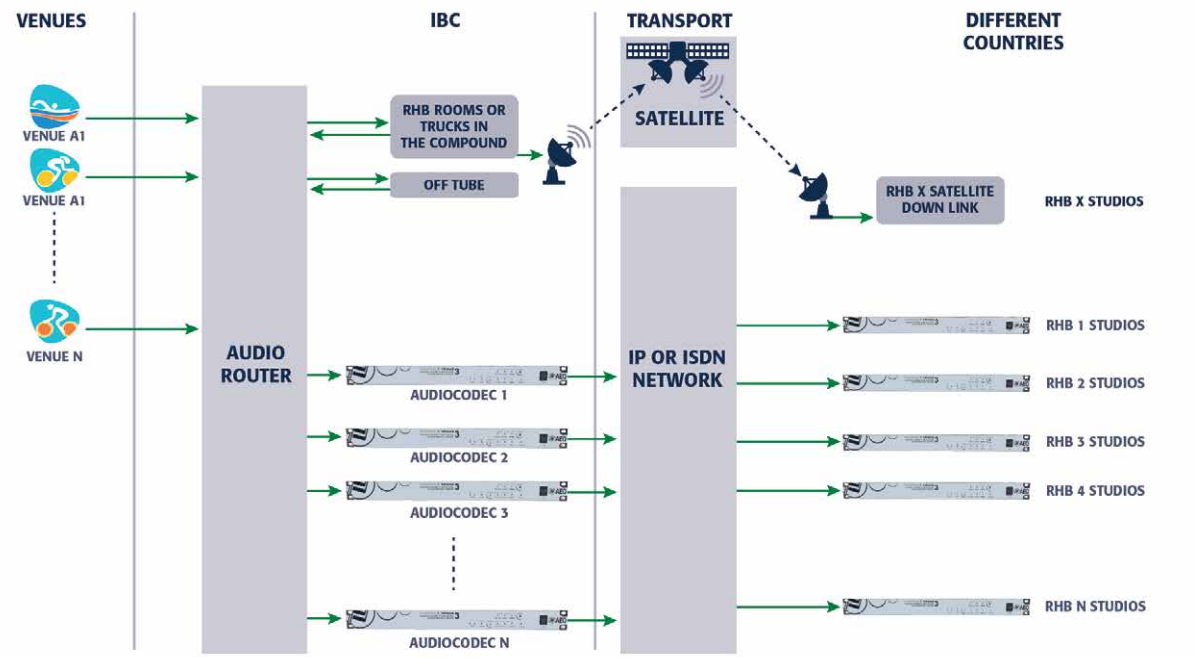
1. INTRODUCTION

In this Application Note, technical and operating aspects will be described relating to the Olympia 3 Commentary Unit and other AEQ AoIP-linke d devices deployment using Dante in a multi-venue event. As is usually the case, Host Broadcasters (radio & TV organization that assumes the event's organization and provides technical and operative services to the rest of guest operators, or "rightholders") don't usually authorize the publishing of their name in these technical reports due to rights management issues, a point what we are obviously must respect.

2. GENERIC SYSTEM DESCRIPTION

During the international audio broadcasting of large events such as Olympics or other large events deployed along multiple venues, hundreds or thousand of audio circuits must be carried from each source (let it be a commentator's voice, international or ambient sounds), towards each radio/television broadcasting company. When a common system is used for this purpose, a structure like the one depicted below needs to be established. This is what we call a "Commentary System".

Audio is generated in the different venues using the Commentary positions, assigned to very diverse radio/television broadcasting operators, RHB or "rightholders". All the circuits of each venue are sent towards the IBC (International Broadcasting Center) audio router, where they are switched and processed. The transport of the audio circuits has been a long-distance fiber-optics link (up to 160km-long) or an E1/T1 multiplex. This is the so-called Contribution part. In this event, uncompressed, linear AoIP circuits have been sent for the very first time, encoded with 24 bits per sample and 48 kHz sampling frequency, using Dante protocol, which is compatible with the AES67 standard. The router sends the audio from the venues to the next system part, as a function of the deployment level, limited by each RHB budget:



Typical general schematic diagram of a multi-venue Commentary System.

They may have hired an office or room at the IBC, or have moved a mobile unit outside it, in the Compound, where a temporary studio is installed from which all the transmissions received from the different venues are coordinated and commented. Bidirectional circuits will be established between the router and each room or Mobile Unit in order to link the venue with it and, in turn, with the audio-codec sending the audio to the rightholder's base studios in the destination country.

They may have also hired a small studio equipped with a commentary unit for a limited amount of time, what's called an OFF TUBE, where isolated broadcastings, such as chronicles or journey summaries are made. Bidirectional circuits will be established between the router and each OFF TUBE booth in order to link the venue with it, and this in turn with the audio-codec sending the audio to the studios located in the rightholder's home country.

Or, last, they may have hired a direct audio patch from the venue to their station. Circuits need to be established between the router and the audiocodec sending the audio, again, to the rightholder's studios in the home country.

In some events, there are even broadcasters that directly send their program from the Compound Mobile Unit using a satellite uplink.

So far, the different circuit types that are established in order to send the stadium commentators' audio towards their home country RHB studios have been described. They are the so-called "program circuits". A return audio from each home country towards the commentator travels in the opposite direction. That's why these are called 4-wire circuits – this name is inherited from former-century circuits, which used two different wires in each direction for the program, two from the commentator and two for feedback or return- .
In most cases, another 4-wire link is established for coordination from each RHB studios to the commentary positions at each venue, passing through the rooms in case they exist.

International circuits sending the audio to each country were historically established using ISDN links. Nowadays, most o them are IP, with defined quality of service.

Of course, the whole system is redundant, and is duplicated from the very venue to each RHB home-country studios. In case of failure of the main path, the carried circuits can be switched seamlessly and automatically towards the secondary or backup path. Eh hardware, router; audiocodecs, etc. are also duplicated or, at least, have spare interface cards ensuring continuity of all the circuits in the event that a failure happens.

Besides, the Host Broadcaster needs to establish a general Event's technical coordination system between the IBC control studios, the different technical areas at each venue and other spaces where the event's technical operators may need to establish, supervise circuits or provide any service to guarantee that the system works properly.

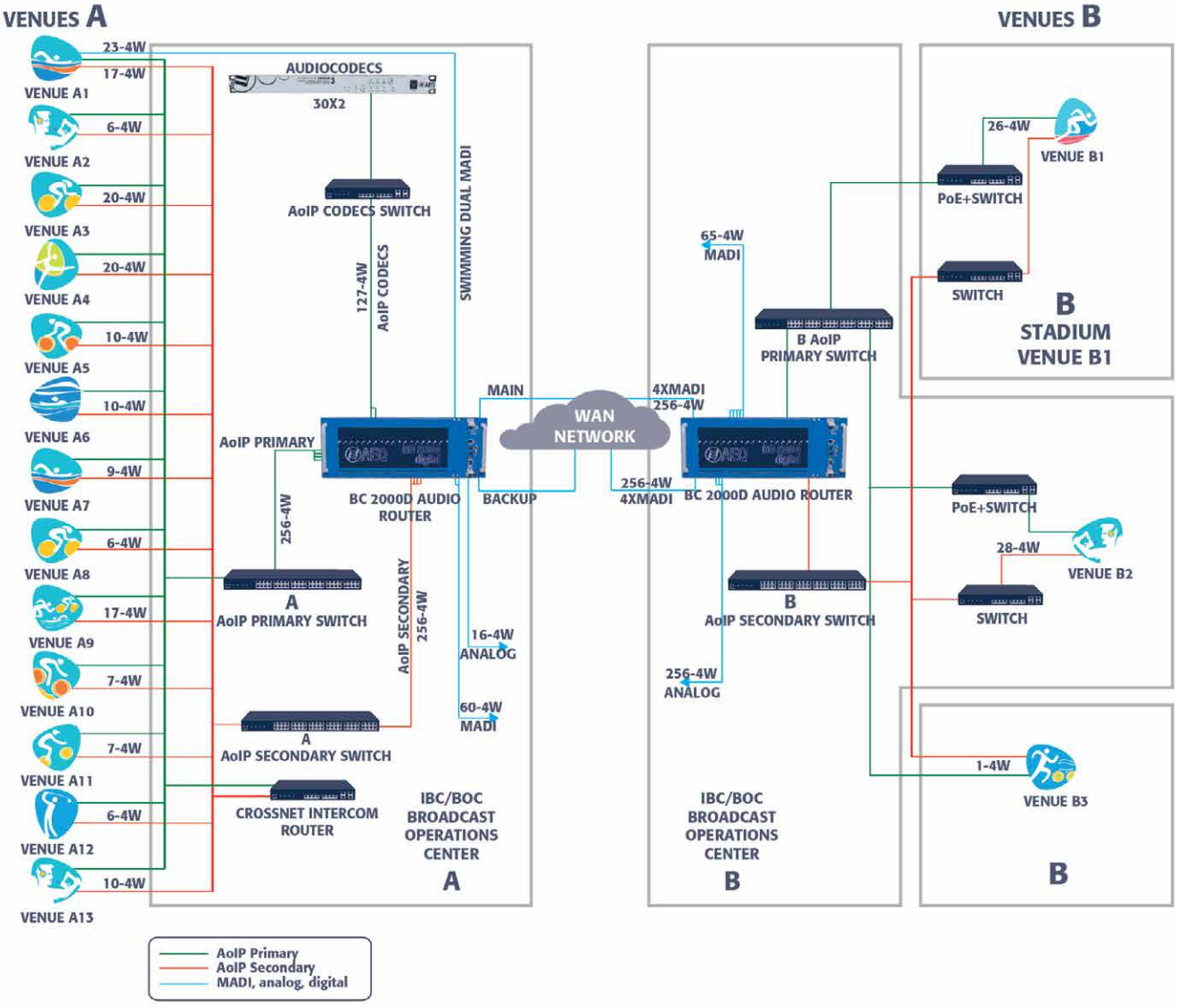
3. CUSTOM SYSTEM DESCRIPTION

The example event we are describing is different to the generic scenario in two ways:

• The multi-sports event had two main locations, in B, athletics competitions took place, while A held other sports. They were more than 1000 km away from each other.

• For the event's technical development, the Host Broadcaster decided to use the AEQ OLYMPIA 3 Commentary System for the very first time in a multi-venue event, using Dante AoIP connectivity, which is compatible with the AES67 standard.

Having two distant locations supposed a technical challenge that was solved by installing two twin routers, one at each city, linking them with 4 x MADI synchronous links able to transport up to 256 bi-directional auchannels in total.



Global system's diagram

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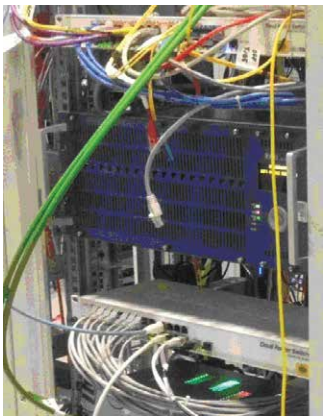
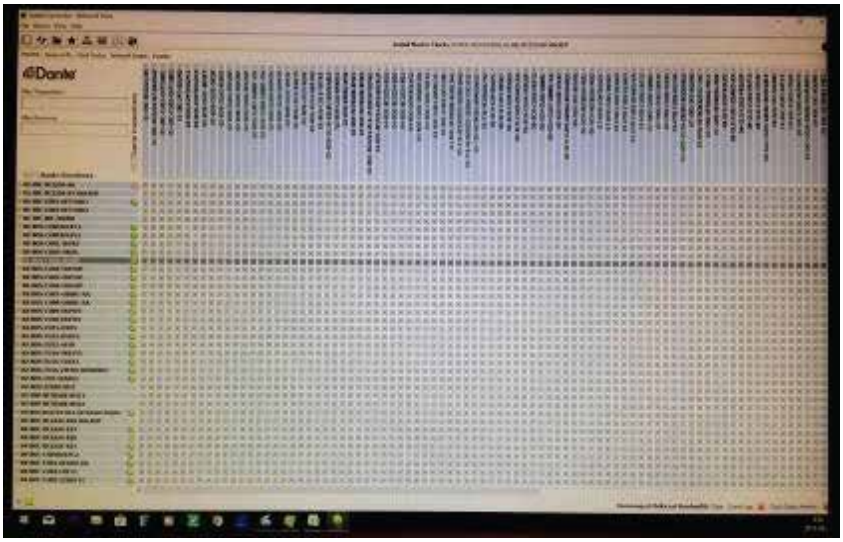


The use of Dante AoIP connectivity (AES 67 compatible) offered technical advantages a nd a great deal of flexibility, but required paying close attention several IP network configuration in order to set up the system, adjusting the priority of the different kinds of traffic to avoid audio interruptions.

A system using more than 75 IP commentary units was deployed among several venues. 12 sports venues were installed in location A, equipped with OLYMPIA 3 commentary units, and the audio circuits from a 13rd venue were also integrated into the system. Three venues were installed in location B.

The trunk infrastructure is composed by two BC2000D 512x512 audio routers, one in A and the other in B, connected between them using 4 redundant synchronous multichannel MADI links.

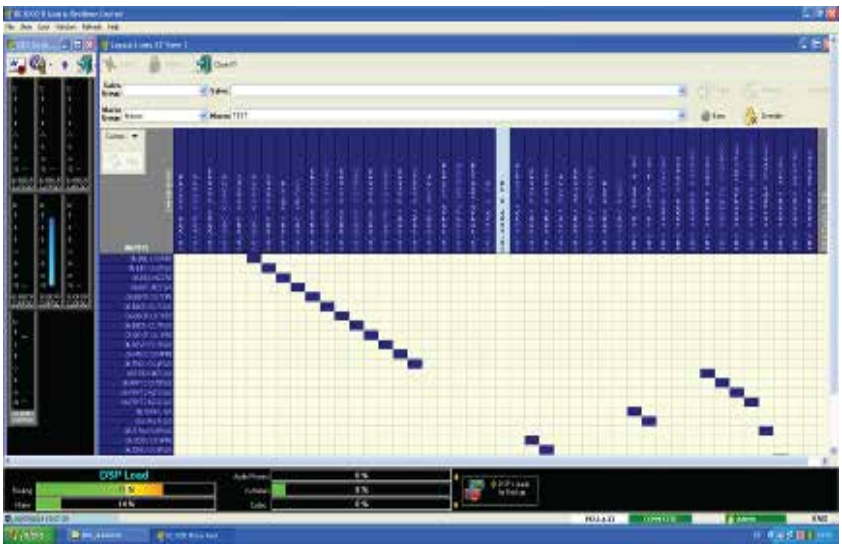
Real time supervision and operation was performed with BC 2000D RTC control application, while the static routing infrastructure was established using Dante Controller software.



Establishment of static audio routing with Dante Controller (compressed view). At the top, the names of the devices putting audio into the Dante network are listed. At the left the different receivers in that network are shown. In order to see the individual circuits and create or remove subscriptions, the "+" buttons at each device must be clicked.

The great flexibility of Dante Controller can easily turn into a high complexity for an event of this size, given the thousands of involved channels and the difficulty to establish a route between the different devices That's why the daily operation was centralized through the Dante Controller on the BC 2000D router, which is the one that made the commutations.

However, the ability to create any point to point routing through the whole system has proven to be very useful provided that great care is taken to double check that the destination is not already subscribed to another transmitter.

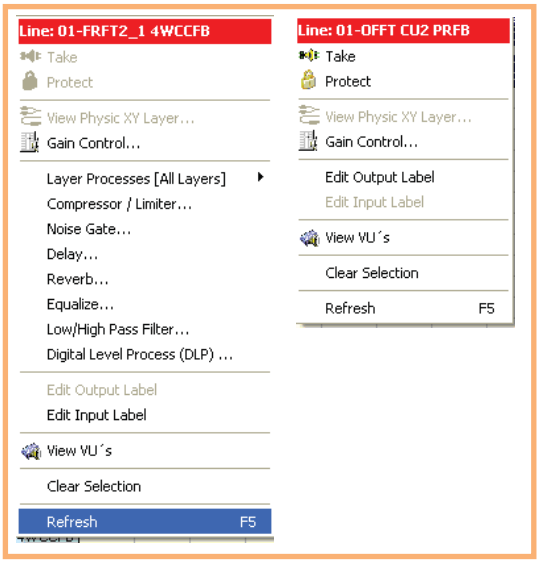


Establishment of dynamic routes using BC 2000D RTC. We can organize the control and supervision of audio lines in views.

This particular view corresponds to the circuits in one single venue. Matrix outputs (columns) are inputs to the venue.

We can see the coordination and program feedbacks labeled for 7 Right Holders, as well as Host Broadcaster spare circuits, as well as the mixed-zone coordination outputs for two different RightHolders.

Inputs to the matrix (rows) are outputs from the venue. We can observe the program and coordination circuits corresponding to 7 RightHolders, International Sound / PA inputs and microphone inputs from the mixed-zone interview microphones.



This is the set of actions that can be performed with RTC for BC 2000D: adjust input, output and crosspoint gain, process the audio, change names, show Vu Meters, make & protect crosspoints, handle the lines as mono, stereo, 4-wires or group them in a different way, use multiple crosspoints or "salvos", perform action involving salvos or other actions such as GPO activation, accept GPI-commanded or scheduled switching, etc.

Controlling routing at location A

This architecture comprising several overlaid layers, together with the use of Venus 3 codecs with Dante connectivity, enabled the expansion of the system on-the-fly by creating additional routes, even international ones, what allowed for the coverage of circuit needs even a short time before the event started.

The BC 2000D RTC tool allowed to establish planned routings according to the event's booking, changing the configuration during the different journeys and time ranges, automatically performing the switching in blocks of crosspoints.

When the need for the creation of a new routing for a sporadic event arose, it was easier to establish it outside the programmed routed. All channels for all origins and destination were in Dante Controller, so any additional route could be created directly there: for example, if an interview was required in a stadium's mixed zone, it was possible by simply connecting channel 1 of a Netbox 4MH interface with a free codec channel and directly sending the call from it to the RHB station.

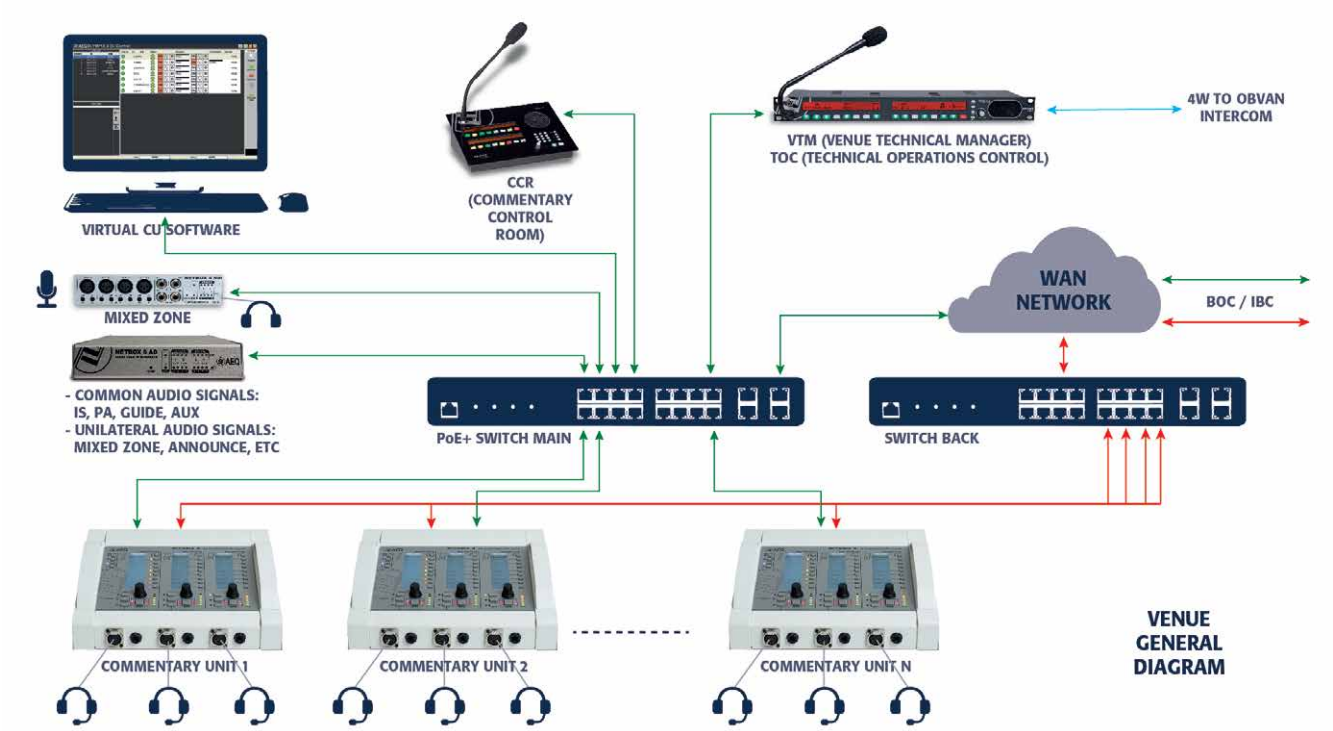
Audio transport between all venues at location A and the Broadcast Operation Center has been deployed on an IP network with Dante redundancy logic. Transport between location B venues and the International Broadcasting Center was solved in just the same way. However, synchronous transportation has been preferred for the communication between both cities, due to the long distance.

Given that there was a larger number of contributions from the venues at location A, it was decided to concentrate there a pool of 30 AEQ VENUS 3 audiocodecs, also with Dante connectivity, in order to ease distribution of the Host Broadcaster affiliated stations' programs even for technical coordination circuits with the production centers.

Codecs at location A

4. INTERNAL SUBSYSTEM AT EACH VENUE

The typical deployment of a venue consisted on the connection of the OLYMPIA 3 commentary positions to a TOC (Technical Operations Control) using Dante IP technology. The TOC is the audio centralizing, supervision and control room at the venue. It was built around NETBOX 8 or NETBOX 32 interfaces. Control stations for the commentary units running the OLYMPIA 3 CU Control software were usually located in an area known as the CCR (Commentary Control Room) on top of the stages, above the commentator's it provides support to. Besides the interfaces, there is an Ethernet switching system using PoE switches to route the audio and remotely feed the commentary units.



General venue schematic diagram

Netbox 32

Netbox 8

Netbox 4MH

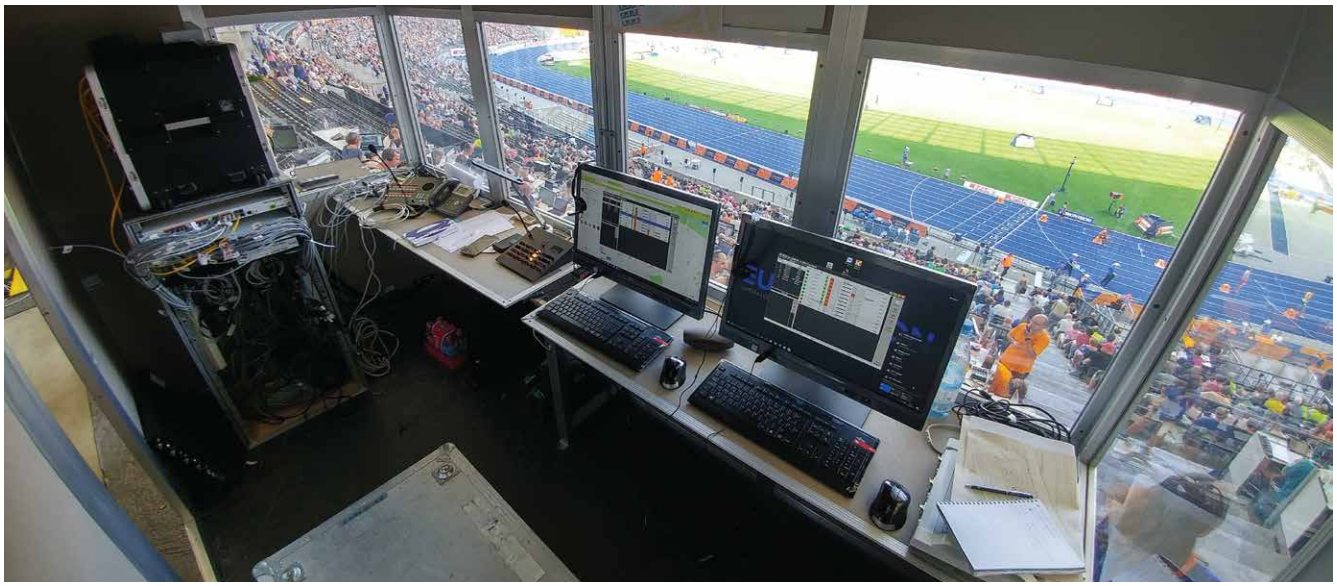
The Netbox 8 or Netbox 32 interfaces received common audio inputs for commentator's guidance, such as International Sound, PA, auxiliary guide, etc. Olympia 3 CU Control software was installed on a pair of PCs for redundancy.

NETBOX 4 MH IP interfaces were installed at the mixed zones, were journalists interview the athletes. They feature microphone inputs and headphone outputs. The microphone inputs contribute for the interview, while the headphones provide instructions from production to the interviewer. Sometimes Netbox 4, using the virtual GPIO function implemented in AEQ Dante systems, also provided camera tally indication commanded from the remote production center, many kilometers away. This tally indicates when the journalist when the corresponding audio console fader has been open, to warn him that everything's ready and it's time to start the interview.

Two intercom panels are usually installed at each venue to provide event's general coordination: one is on top of a table at the CCR while another is rack-mounted at the TOC. This last one was sometimes programmed to link to the TOC's internal intercom system or to the attached mobile unit, using its featured auxiliary analog 4-wire interface, This way, the TOC or MU intercom gets integrated in the event's general intercom system, no matter who it was manufactured by.

Each venue's switches are connected to the event's WAN network in order to provide connection to all the commentary positions and Netbox 4 to the IBC audio router.

Sometimes, due to the WAN long distance particular characteristics, the latency can be higher than the maximum value allowed by Dante. In order to solve this, a special Dante Controller version was installed that allows for higher latencies in several segments, at the cost of a reduction of the available number of channels in that segment.



Technical Operations Control at B location Olympic Stadium. At the left, a rack with the network switches and a Netbox 4MH Dante interface can be seen. Common signals to be listened by the commentators (International Sound, P.A, etc) are connected to it. Next, the telephones and intercom panels, and, at the right, two PCs where Olympia 3 CU control software application were installed, allowing for the supervision of all Olympia 3 Commentary Units -deployed across the stages- and supporting the commentators using an internal intercom system.

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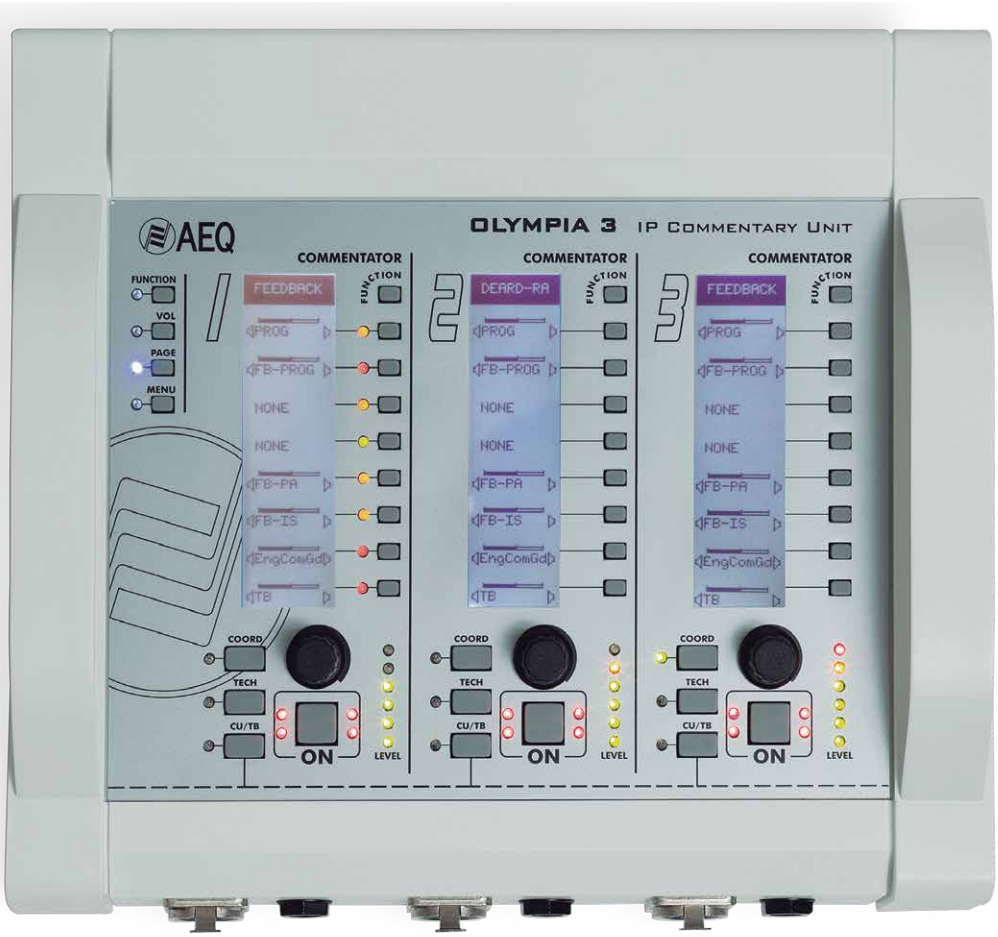
Olympia 3 CU Control software. General window where all 7 controlled commentary units are listed at the left of the screen. At the center, an alarm indicator is displayed for each one, together with its number, RHB name, Status, mode switch and program level, as well as the mode switch and level for coordination also. Last, the assigned operator's name is shown. Some buttons are displayed at the right column in order to access the pre-configuration options: audio processing, input gains, ID recording and storage of the audio settings into the CU

Olympia 3 CU Control application: particular control and support window for a single CU. At the top left, list of assigned CUs. Down, at the left, a conversation is active between the technician using the software and a CU user. At the top center, the general control buttons can be seen: mode selection between commentator activation (ON), test oscillator or ID playback, activation of the normal VU Meter, activation of the precision VU Meter, International Sound mix enable, Auxiliary input mix enable and Gain control. At the bottom center, the three channels of the commentary position are depicted, allowing for coherent control of what each one listens, activation of the commentator's push buttons, output level adjustment, a VU Meter for each channel, Phantom activation, Processing and MIC. Reference adjustment, and last, but not less, CU identification and control of technical audio monitoring for that CU.

Commentators on duty at the Olympic Stadium



View of a commentary position configured right as it was used during the event.

5. TECHNICAL COORDINATION SYSTEM

A Kroma by AEQ CROSSNET IP Intercom System has been installed to cover the event's technical and production coordination requirements, offering 104x104 inputs and outputs. It has been deployed across the different venues in locations A and B, as well as in the Broadcast Operation Center at A and the Broadcast Operation Center at B. This Intercom system has been expanded sometimes using Netbox 4MH interfaces, that were already available in the venues, or even using Olympia 3 commentary units, which have demonstrated a great deal of flexibility to cover unexpected audio and communications routing needs.

The control rooms at BOC and IBC were provided with rack-mount TP8116 panels, just the same as in the venues' TOCs, which were located either outside the building or in mobile units. On the other hand, table-top TP8416 panels were installed in the CCR and other particular places. Even some Olympia 3 Commentary Units were configured so its first channel could be used as an intercom panel during the start up phase.

40 intercom panels were installed in total: 21 TP8416 (table-top) and 19 TP8116 (rack-mount). Among them, the 29 panels in venue A were connected to the CrossNet matrix using Dante AoIP, while the 11 panels deployed in the IBC and venue B -located more than 1000km away from the matrix (which was installed in location A)-, were connected to it using VoIP circuits, occupying little bandwidth and being less sensitive to network delays.

In order to integrate the event's coordination general Intercom System with the particular ones provided by third-parties, installed by the organization or the Rightholders themselves at each TOC or mobile units in the different venues, 32 bridges were established, using 4-wire ports integrated in the Dante network, either from Netbox interfaces or using the second AoIP port provided by a user intercom panel, thus converting the 4-wire analog circuits into bi-directional AoIP channels that were incorporated to the CrossNET matrix just as additional intercom panels.

This way, among the 16 existing venues, 12 of them, located within 100km, were connected by Dante AoIP, while the IBC at location B and its three venues, located more than 1000km away, were linked by VoIP.

Each IBC / BOC included 7 panels coordinating both the operation of the rest of venues and that of the incorporated one. 3 of them were used by the VTM (Venue Technical Manager), while the rest were used by the BVM (Broadcast Venue Manager) and the personnel in charge of the produced video quality control (Production Quality Control) .

The rest of venues were provided with 1 to 3 panels, plus a maximum of two more 4-wire communications, depending on the broadcast complexity of the sports competitions taking place there.

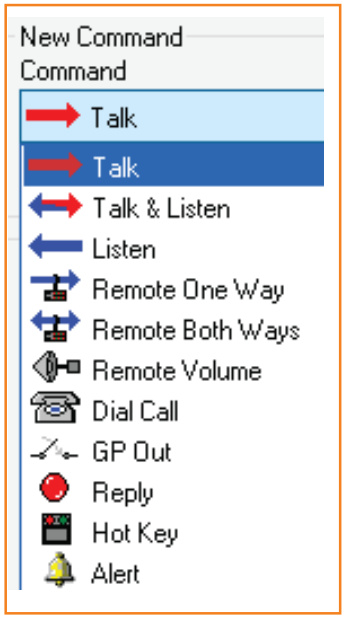
Kroma by AEQ Intercom System panels can be configured in a totally flexible way, so pressing of each key unchains a customized wide range of actions in order to ease the coordination of any event. This way, all IBC/BOC panels at both locations could communicate with each other (any panel could talk to others within its local venue, but additionally any panel at the IBC/BOC at one location could talk to others at the other location).

- In the rest of venues, each panel could talk to the rest of panels within the same venue and call to any panel at IBC/BOC.

- On the other hand, any panel at IBC/BOC could establish communication with any panel in any venue and with the 4-wire ports installing in all mobile units.

- 4-wire ports in the mobile units entered in IFB mode to all BVM (Broadcast Venue Manager) panels at IBC/BOC, so when the microphone of the connected device was open, all panels could hear it simultaneously.

- Additionally, specific and/or temporary programmings were made according to the needs of each covered event.
- All communications were programmed in Push To Talk mode.



Panel key basic configuration options

6. DEVELOPMENT OF THE JOBS

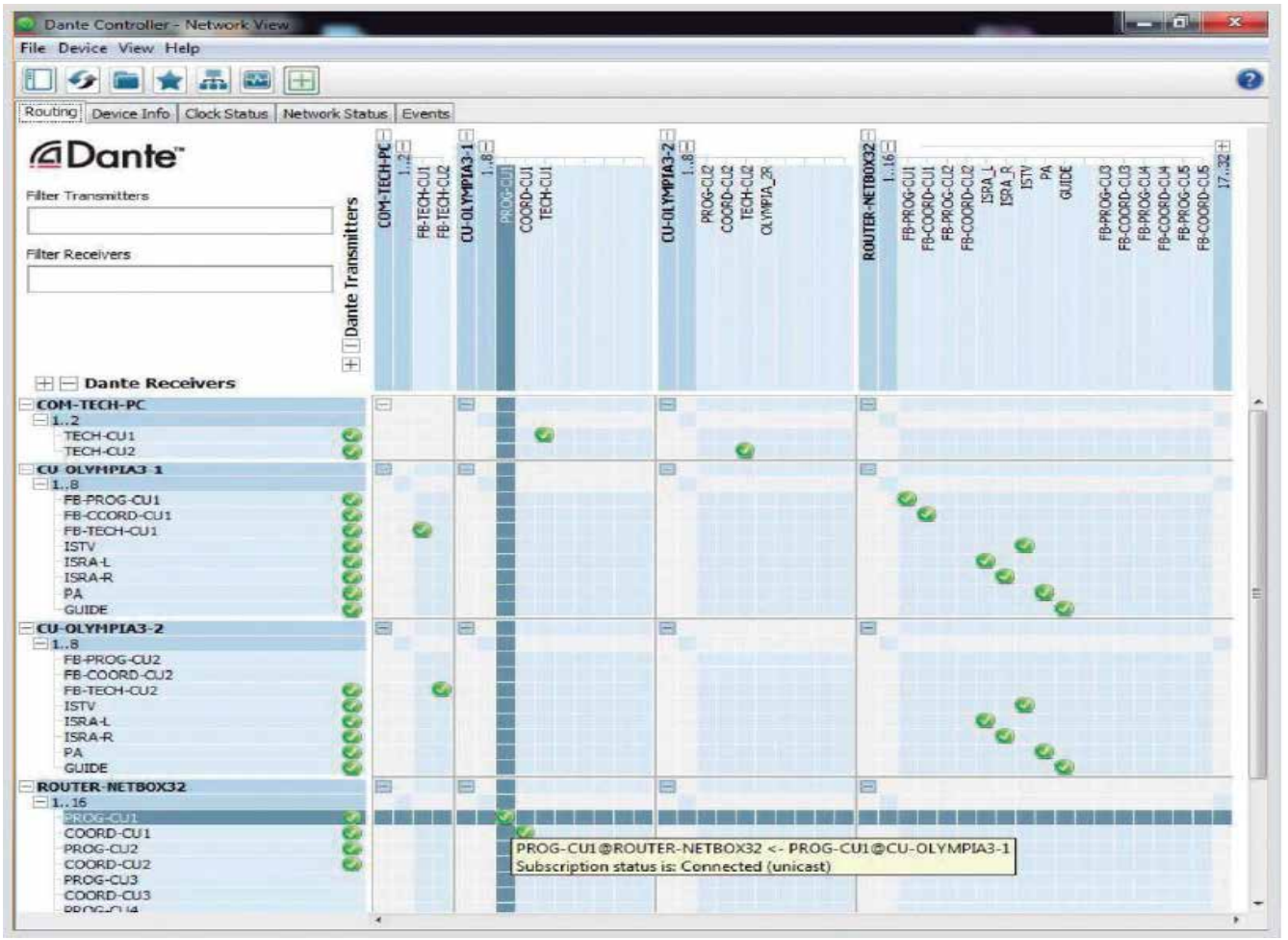
Requirements definition phase

Several versions of plans, equipment listings and other technical documents were developed together with the customer, in order to adjust the general needs to the combination of functionalities provided by the different available pieces of equipment. Also, extensions to the standard planning and control applications were foreseen in order to cover the event's requirements. Several iterations were necessary as more and more technical details and newly-come requirements arrived continuously.

A set of plans, lists, equipment configurations and adapted / revised versions was finally completed.

Engineering phase

A list of inputs, outputs and cross-points was planned according to the Booking, and implemented both on BC 2000 RTC software tool and in Dante Controller. BC 2000 RTC macros and salvos were also created, as well as the required routing of GPIO over IP signaling transport, using the corresponding configuration tools.



Olympia 3 input and output configuration of a Netbox 8 interface using Dane Controller (not an event-specific implementation)

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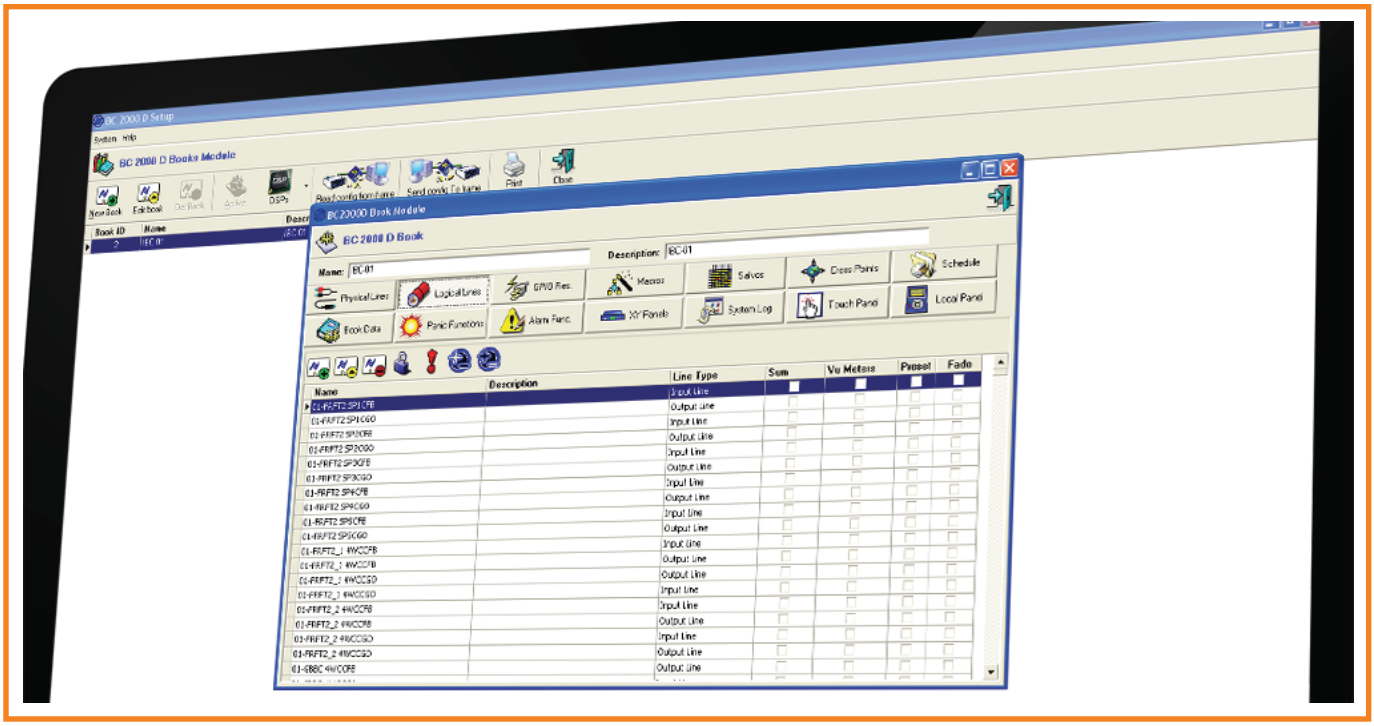
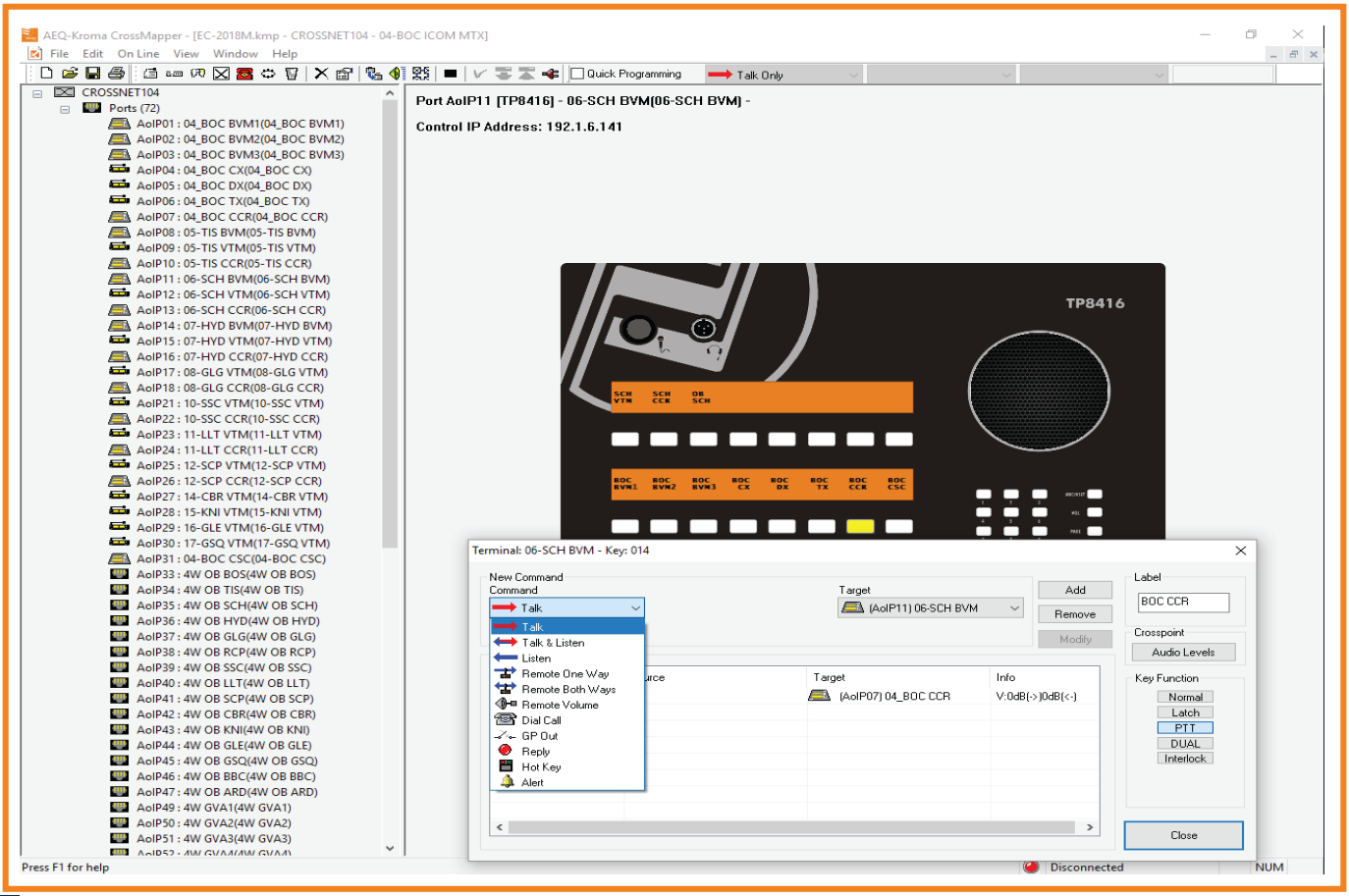
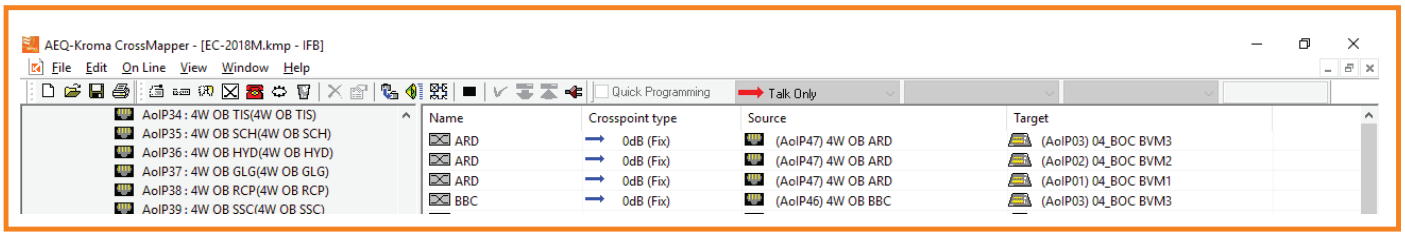


BC 2000D Setup matrix line configuration

The Intercom system planning was developed using the Crossmapper tool, assigning the required function to each panel's key, according to each intercom user needs. The application allows for the duplication and edition of the configurations in order to speed up the process.



Panel key basic configuration options



Configuring IFBs to provide the OBVan intercoms with access to the Production Quality Control panels, in order to solve issues.

Deployment, Start up and Operation

The deployment was carried out by the Host Broacaster's technical and engineering staff. A team of engineers was sent by AEQ in order to implement and operate the event. Three of them went to location A while a fourth traveled to location B. They provided support and collaborated at all times with the Host Broadcaster engineers.

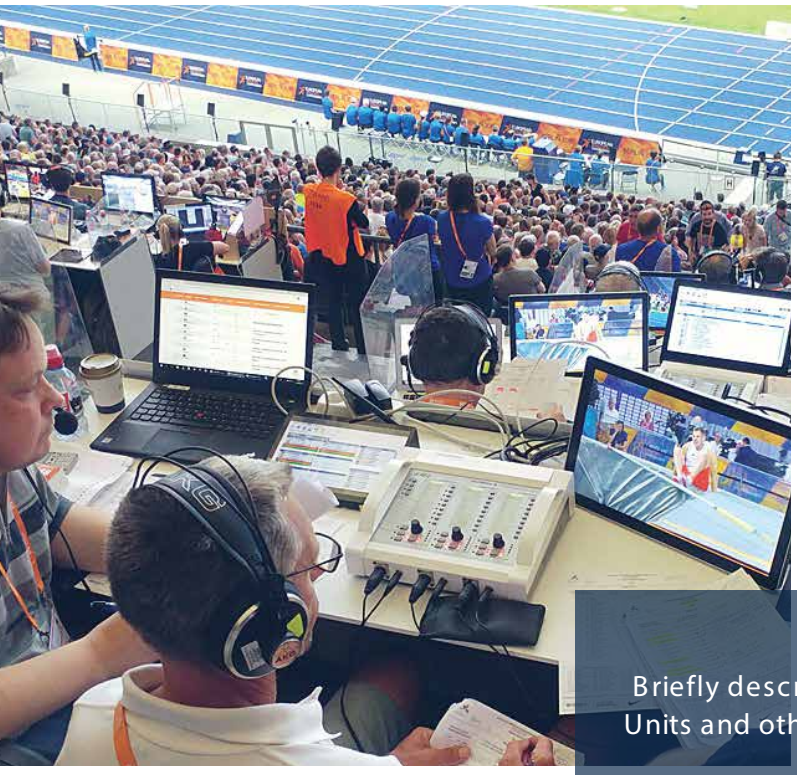
These AEQ engineers had to attend unexpected needs and requirements during the Startup phase and even during the operation itself. As they were couldn't be foreseen and planned in advance, these requests sometimes supposed great technical difficulty and a controlled implementation error chance.

7. CONCLUSION

The deployment simplicity, flexibility and scalability of Olympia 3 system, Netbox interfaces, BC 2000 D router and Crossnet / TP 8000 Intercom systems have been demonstrated in this very first implementation of a multi-venue sports event based on AEQ devices with Dante connectivity.

We want to acknowledge Dante Technical Support for the remote support provided, especially during the installation and start-up phases. The operation developed in a normal way with little issues that could be, in general, controlled. Several tips to be improved have been learnt that will hopefully help us reach more ambitious goals.

Video Quality Control at the Broadcast Operations Centre in B. Broadcast Monitors and Intercom System brand Kroma by AEQ



Briefly description of the deployment of Olympia 3 Commentator Units and other AEQ devices linked by AoIP with Dante protocol in a recent multi-venue event.

More than 75 positions of AoIP commentator units have been deployed in 15 venues.

For mixed zones where journalists interview athletes, the AEQ NETBOX 4 MH AoIP interfaces have been installed.

The trunk infrastructure consists in two Audio Routing Matrices BC2000D.

It was decided to centralize 30 AEQ Venus 3 audiocodecs to facilitate the distribution of the programs to the broadcasters affiliated.

For technical coordination a 104x104 CROSSNET Intercom system was installed.

Download here the broad application note with many technical and operational details!

Visit AEQ OLYMPIA 3 website:
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