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Photos (6) : Ralph@Larmann.com

The Eurovision Song Contest

– a cult show with Sennheiser microphones

Every year in the spring, the eyes of the member states of the growing Eurovision television community watch as the winner of the annual Eurovision Song Contest gets chosen in a spectacular live show. And every year, the respective host broadcaster is faced with a big expansion in technological requirements – and the ambition to outdo the previous show.

The Eurovision Song Contest has become a display of superlatives, with a trend towards ever more breathtaking productions. In 2008 host broadcaster RTS of Serbia covered a show on a scale never seen before, with an unprecedented forty-three countries taking part, meaning that for the first time in the song contest's history, two semi-finals had to be organised to determine the finalists.

A few weeks before the actual contest, a Sennheiser team was on site to install the audio technology together with RTS. "The stage and lighting technology in the ultra-modern Belgrade Arena was even more lavish than in previous years," divulged Sennheiser's RF expert Klaus Willemsen. "Unfortunately, what looks great on the TV screen is a potential source of interference for the audio transmission. We were only able to finalise the radio frequencies for the wireless mikes and the monitoring systems when the lighting technology was in place."

"Radio interference caused by LEDs in the huge video walls and by dimmers and digitally synchronised lights can be found across the whole spectrum from medium wave to gigahertz," Willemsen continued. "For microphone and moni-



toring frequencies, we had to search for areas where there were as few active 'disrupters' as possible. The Wireless Systems Manager software was a great help, as it allowed all device parameters to be picked up quickly – and adapted as the situation required."

For the 2008 edition of the song contest, the very latest wireless technology was used in the Belgrade Arena: EM 3732 twin receivers for the wireless mikes, SR 350 IEM G2 twin transmitters, and new high-performance transmitter combiners for the artists' monitoring systems. "RTS had 48 microphone channels available for artists," said Klaus Willemsen. "Depending on individual preferences and the type of stage show, some used SKM 5200 handheld transmitters, while others preferred SK 5212 bodypack transmitters with HSP 4 headset mikes. An additional 12 channels were reserved for wireless monitoring."

During the semi-finals and final, the radio spectrum was continually monitored to bypass or eliminate new disturbances and interference. "At every

Eurovision Song Contest, you have the odd ENG team which turns on a wireless microphone for a quick interview. This is where we have to be quick, too," smiles Klaus Willemsen. "Such a team is located and asked to switch off their equipment. For other types of interference, we also have replacement equipment on other frequencies in place for the live shows to eliminate all glitches."

So the contests are not just exciting for the artists and TV audiences in their millions – they represent a particular challenge for the broadcasters and their technical teams.

Microphone and monitor technology used in Belgrade:

- 27 x SKM 5200 handheld transmitters with dynamic MD 5235 capsules
- 27 x SK 5212 bodypack transmitters with HSP 4 headset mikes
- 30 x EM 3732 COM twin receivers with command function
- 12 x SR 350 IEM G2 twin transmitters
- 24 x EK 3253 monitoring receivers
- Various antennas, boosters, splitters and combiners



Klaus Willemsen

The Eurovision Song Contest

The European Broadcasting Union, formed in 1950, launched the first Eurovision Song Contest in 1956. At a time when television was not yet a standard household commodity, the "Grand Prix Eurovision de la Chanson" was a true technological challenge, as the live show was to be transmitted simultaneously to all participating countries. The first contest had seven participating countries only: Belgium, France, Germany, Italy, Luxembourg, the Netherlands and Switzerland. Each country had two songs competing for the title; the charming first song contest winner was Lys Assia from host country Switzerland. The Eurovision community has grown since, and the 2008 song contest in Belgrade saw 43 countries taking part – with just one song each of course. In order to determine the 25 finalists, two semi-finals had to be held. The Eurovision Song Contest is today's biggest live event, placing ever-increasing demands on the audio and RF wireless technology used.



Monitor engineer Horst Hartmann (left)

The wireless microphone receivers and monitoring transmitters (top)

Working in RF congested environments

Wireless microphones are usually just one element in complex technical set-ups. The more important the show, the greater the quantity of technical equipment that will inevitably be utilised in an effort to try and ensure a spectacular event. In spite of the fact that many of these devices are inadvertent sources of heavy RF interference, wireless microphones are still expected to deliver a perfect signal. Potential sources of interference for radio microphones and wireless monitoring systems include large dimmed lighting installations, PC networks and the armada of walkie-talkies used by the security staff, engineers and roadies. Individually each of these potential interference sources may not pose any problems, however the cumulative effect of so many individual sources of radio energy being brought together in random com-

binations can, and frequently does, create a hostile RF environment. For example, large LED displays create breathtaking stage sets for artists – but can also make conditions very difficult for the sound engineer. These video walls contain hundreds of thousands of pulsed LEDs, creating broadband interference, which reaches far into the UHF range used by wireless microphones.

In such RF congested environments, a thorough spectrum scan prior to assigning the transmission frequencies is of vital importance. These scans should be conducted when all the lighting technology is in place, and when the frequencies for walkie-talkies and the transmission frequencies for OB teams have been fixed. If there are only a few frequencies available, and if these are to be used near powerful sources of inter-

ference, RF wireless systems with a high intermodulation resistance should be used.

The correct antenna position is essential too. For example, the receiving antennas for the wireless mics should be positioned as far away from the source of any unwanted signal as possible. Directional antennas can turn an (almost) blind eye towards the interference. The transmitter antennas for wireless monitoring systems should be positioned as closely to the artist as possible. This will ensure that a sufficient amount of radiated power reaches the antennas of their bodypack receivers, which are usually in a less than ideal position, i.e. in front of an LED wall and shaded by the body.

During the event or show itself, the RF spectrum should be monitored

continuously to locate and eliminate any new source of interference, such as an OB team reporting from the show or event. Keep spare microphone systems on other clear frequencies ready for use so that if interference occurs, and the source cannot be located and removed immediately, systems can be quickly swapped out.



Great sound on all channels

Tears of joy, angry outbursts and general bitchiness – reality TV is often a showcase for high drama. While broadcasters dream of the high ratings this ‘in’ genre can achieve, there are drawbacks when it comes to production: cameramen and sound engineers can’t allow themselves to relax for a second – if these emotions aren’t recorded in sufficiently good quality, they’re lost forever.

This was a job that Gregg Kita and his lads were really looking forward to... the company of pretty women and filming in Los Angeles and New York. The reality show “She’s Got The Look” gives attractive women over 35 the chance to win a coveted modelling contract. Kita, a sound engineer who’s been in the audio business for 14 years and really loves his job, was in charge of ensuring great quality sound. The 39-year-old and his company RGear Worldwide have already been responsible for a whole host of reality TV shows and know the particular challenges this genre presents; on the one hand protagonists are

working unpaid with a storyline that almost writes itself and on the other, situations are liable to change in a split second. And that’s not to mention the sound carpet produced by several people chattering simultaneously along with associated distracting background noises!

It was no different here. When Bahia, Celeste, Karin, Melissa, Paula, Roxanne and Tanya chatted amongst themselves in the model loft about their problem areas, it was hard for the human ear to follow the conversation. But successfully mixing sound separately and cleanly in situations like this is considered the height of genius among the sound engineering fraternity. This is why the primary requirement for good sound delivery is excellent microphones. Gregg Kita relies on “Quality, Made in Germany”. Sennheiser’s MKE *platinum* is minute but can really come into its own on stage in musicals thanks to its great dynamic range. Paula suddenly shouting “I did it” into the mic wasn’t a problem.





Having been in the audio business for 14 years, Gregg Kita set up his AV rental company, RGear Worldwide, three years ago.

"I prefer Sennheiser because the equipment is very robust and I hardly ever have any issues with quality. It's easy to use and is flexible enough to be adapted for different locations and tasks. Especially in environments with heavy RF usage, the Sennheiser gear gives me the flexibility to work around occupied frequencies quickly and easily. It provides very stable RF links even in heavily congested environments and large multi-channel set-ups."

This mini model from Sennheiser can really cut it when it comes to being discrete. With a cable diameter of just a millimetre, it's even hard to detect on scantily clad supermodels. The same applies to the accompanying SK 5212 bodypack transmitter. This little box with dimensions no greater than 53 by 60 millimetres doesn't add bulk – even during the contestants' bikini competition.

No let-up for anyone during filming

With this kind of production you can't repeat takes: an angry outburst from Bahia, tears from Paula – everything's genuine, nothing's fake. There was little time to take a break. To allow post-production to be as streamlined as possible, Kita and his team had to mix practically everything on site. "A job like that takes concentration, skill and experience. The technology is just a tool that must do its job," says Kita, describing the atmosphere on set. So as not to miss any action – even a secret binge on sweets – the film crew followed the models' every move with six cameras simultaneously. A portable audio mixer receiving input from five Sennheiser

EK 3241 receivers was linked to each piece of kit. All these devices could easily be packed in the sound engineers' audio bag, enabling the sound pros to easily mix several channels without frantic toggling. Nothing was lost if, during hectic daily production, the unit manager suddenly decided that Melissa's latest comment just had to be captured on tape. Sennheiser's EK 500 receivers ensured such spontaneous decisions weren't a problem, with the production team always getting the current sound from the portable mixers. For this, Kita had linked the audio mixers to SK 500 bodypack transmitters. "A set-up like this made subsequent post-production easier and the production team were able to react more quickly," explained the sound pro.

Never one to take chances, Gregg Kita had even included a back-up: a hard disk recorder to store all the tracks from the entire shoot in their original state. A venomous comment in the background, a tip whispered into the ear of an ally – anything that escaped the sound engineer's immediate attention in the flurry of activity, was recorded here in its unadulterated form.



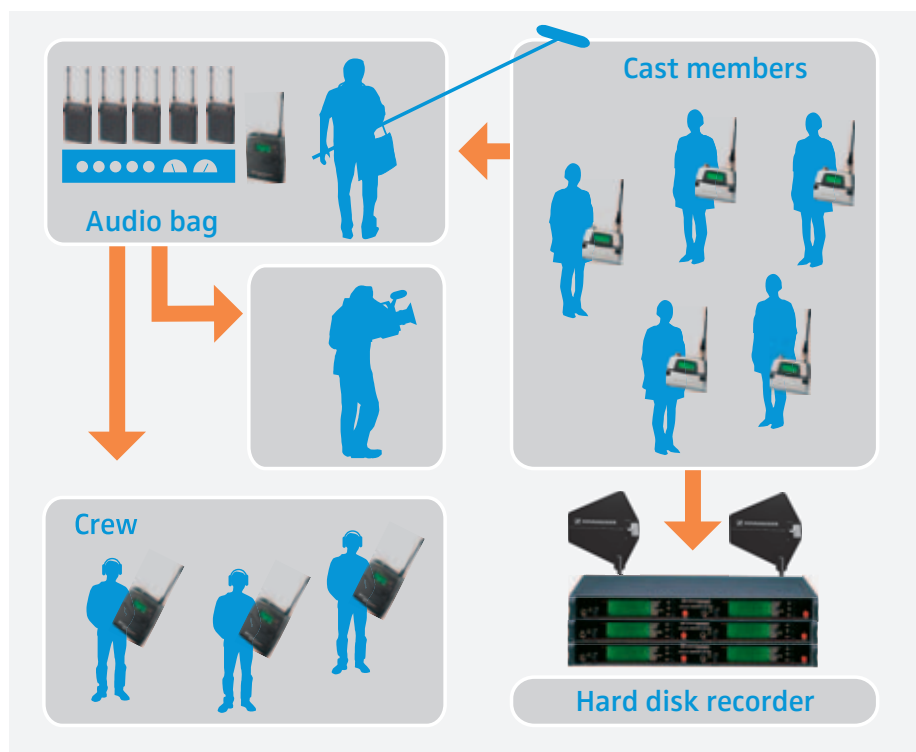
The hard disk recorder received the audio from eight rack-mount EM 3532 receivers. A standard item of equipment across numerous theatre and broadcast applications, these are extremely easy to use. The robust piece of kit contains two highly selective, tunable UHF receivers – an essential feature in the dense frequency spectrum of New York. “In this city it’s hard to find a clear gap in the ether. With Sennheiser equipment, a touch of the button is enough for the quality to be perfect,” says Kita, explaining the choice behind his favourite tools.



Audio equipment supplied by RGear Worldwide for “She’s Got The Look”:

- 30 x SK 5212 bodypack transmitters
- 25 x EK 3241 camera receivers
- 8 x EM 3532 rack-mount receivers
- 1 x ASA 3000 active antenna splitter
- 7 x SK 500 bodypack transmitters
- 12 x EK 500 bodypack receivers
- 30 x MKE *platinum* clip-on microphones

Things came to a head for viewers in the fifth episode of “She’s Got The Look” when just Karin, Tanya, Hope, Bahia and Celeste were left in the running. A sigh of relief from the sound engineers: no more scenes with screeching fans, and manageable audio sources – in the end just tears of joy from Tanya. After the last take, Gregg Kita is pleased with how things went: “Not just my team but also the Sennheiser devices worked together brilliantly. It made our job so much easier.” His team would just have liked to have had a little more time to admire the models, but it’s time for Kita to move on.



No handicap with Sennheiser Wireless technology

Ontario-based RF Wireless Systems Inc. has supplied radio systems for audio and video transmission to the Skins golf tournament for sixteen years. Scott Nickerson, head engineer for wireless audio, said: "Sennheiser wireless technology is the first choice for us in audio, not just because of its famously reliable transmitters and receivers, but also because of the support we get from the Sennheiser team. They know how important rapid support is when you're out in the field doing live work."

There are arguably plenty of sports that offer more spectator appeal than golf. However there is one golf tournament which offers a real treat and a genuinely unique experience. At the Telus Skins Game Golf Tournament in Canada, players are equipped with wireless microphones enabling them to involve the TV audience as they consider their tactics – and let slip exactly how they're feeling too – giving the public an exciting opportunity to experience the tournament 'shoulder-to-shoulder' with the golf pros.

As a spectator, all you'd normally hear is the commentary and the click of the ball as it drops into the hole on the green; but Canada's RF specialists from RF Wireless Systems Inc. have given TV viewers of the Telus Skins Game Golf Tournament the opportunity to see their

favourite players in a completely new light. All the golfers are kitted out with wireless mics so spectators can hear exactly what's going on – from their concentrated breathing and explanations about what's going to happen next, all the way to letting an expletive slip out or giving a shout of elation when the ball is holed. It's a fabulous way for the TV audience to experience their players 'up close and personal' and get caught up in the golfers' excitement.

Sennheiser wireless technology has played a key role during the tournament in Canada. With a prize of US\$10,000 per hole to play for and five of the best world-class golfers competing, every player had to focus hard and produce an outstanding performance. It was therefore crucial for the golfers to have a compact transmitter; they certainly

The speedy team from RF Wireless Systems Inc., with the antenna crane in the background.



wouldn't want to be impeded by a large bodypack transmitter when teeing off. The compact SK 5012 (61 x 53 x 17 mm) with MKE 2 Gold clip-on mics did just the job.

The receivers for the bodypack transmitters were transported in a golf cart accompanying the players around the course. The cart had A 12 AD "roof antennas" and EM 3532 twin receivers at the rear, with signals transmitted via a mixing desk to an SK 250 long-range bodypack transmitter. Its signal in turn was picked up high above the golf course trees by an antenna crane which then fed the audio signal straight to the OB vehicle. Transmitters and receivers from the 3000 and 5000 series were used for their high transmission reliability and low RF noise, ensuring clear transmission of the golfers' activities.



Scott Nickerson's audio golf cart, with Sennheiser antennas on the roof and Sennheiser twin receivers in the back.

Telus Skins Game golf tournament

The sixteenth Telus Skins Game golf tournament took place last summer. Played on a different golf course in Canada each year, it involves five big professional golfing names coming together to compete. The event's been even more popular since the five golfers have been coming from five different countries. And the stakes are high. The Skins Game is a variation on the standard tournament, where the hole is won by the player with the lowest score. If a hole is tied, the value of the hole is carried over until just one player wins a hole again, thus increasing the chances of a huge amount of money accumulating in the jackpot.

Esplanade provides patrons with optimum sound



On-site training: the Sound Team of Esplanade with Robin Shuttleworth (6th from left) and Sennheiser RF expert Klaus Willemsen (5th from left)

The distinctive spiky outlines of “Esplanade – Theatres on the Bay” rise up over Marina Bay, Singapore’s new city centre area. Just a few years after its opening, Esplanade has not only become an architectural icon of Singapore, it is also one of the busiest arts centres in the world, welcoming more than eight million people who enjoy the wide range of performing arts genres the venue has to offer. Helping to enhance the audience experience at Esplanade is Sennheiser audio equipment.

Esplanade has become an integral part of the arts scene – not only in Asia but also throughout the world. “With the eclectic range of programmes presented at Esplanade, we do our best to keep up with the latest trends in the professional audio industry, and try to maintain that standard,” explained Robin Shuttleworth, Technical Manager of Sound at Esplanade. Therefore, the arts centre is continually updating its equipment and has become the first venue to use Sennheiser’s latest professional receiver, the EM 3732 twin receiver. Esplanade’s concert hall has a particularly low noise figure, as its room-in-a-room design blocks out virtually any noise from outside. This also means that reference-class audio systems are a must, as any compromise in audio quality would be clearly audible for the audience.

In total, the Esplanade system comprises twenty-eight EM 3732 and EM 3732 COM receivers, with the 56 channels combined with handheld SKM 5200 transmitters and SK 5212 bodypack transmitters. A 20-channel evolution wireless ew 500 system has also been installed, together with a 16-channel evolution wireless monitoring system. All systems are controlled and supervised remotely by PC using the *Wireless Systems Manager* software.

One of the challenges for the RF wireless systems was the radio traffic in the bay. The Port of Singapore is the busiest harbour in the world in terms of shipping tonnage, with hundreds of container ships travelling through or anchoring in the bay. Their radio traffic and radar systems – but also the many powerful TV transmitters in Singapore – create heavy RF interference for wireless applications. Therefore, precise frequency selection is vital to circumvent these sources of disturbance. In addition, the antenna sites for the receivers and monitoring transmitters need to be carefully chosen to avoid any conflict. A 5000-CP circularly polarised antennas were used throughout, as they avoid field strength gaps and deliver a higher signal strength and a more stable signal than other antennas. Due to its operating principle, the A 5000-CP is able to receive both polarisations, where con-



Photo: Stockphotography.co.uk

ventional rod antennas are only able to “see” one. What is more, the housings of the receivers and transmitters are extremely well shielded, ensuring that the electronics do not pick up interfering RF signals.

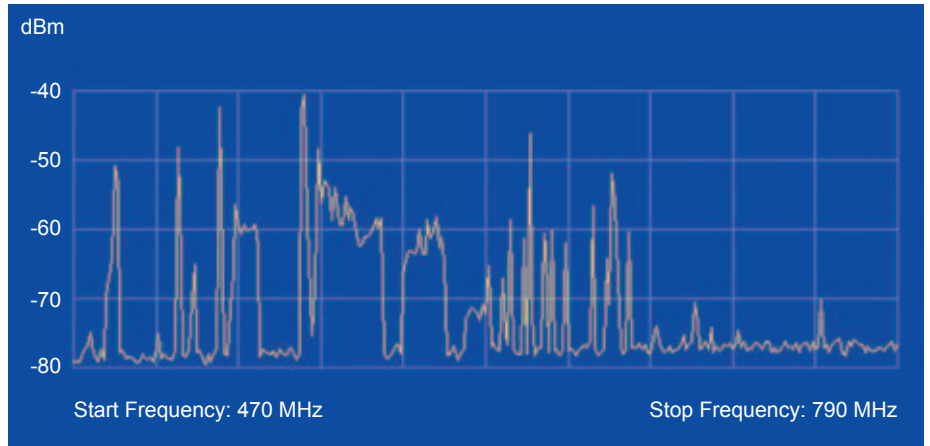
As Esplanade has productions running in all auditoriums, outdoor areas and also the rehearsal rooms, the rack-mount receivers and monitoring transmitters are housed in mobile wheeled racks that can quickly be brought to where they are needed. The systems’ integrated antenna splitters make set-up all the more flexible: up to eight EM 3732s can easily be daisy-chained without the need for an external splitter.

The new systems have allowed Robin Shuttleworth to offer his artists and production clients the latest technology: “Sennheiser over the years has proven to be the leader in RF wireless technology; they have years of research and development experience within their particular field, and it comes as no surprise to find their products as the

preferred choice in many musical and drama productions. Audiences at Esplanade will be able to continue to enjoy top-quality sound.”



For Robin Shuttleworth, Technical Manager of Sound at Esplanade, wireless technology is “one of the most important aspects of the live sound business”.



Frequency scan for Singapore, 470 to 790 MHz

Wireless equipment used by Esplanade – Theatres on the Bay:

- 28 x EM 3732 and EM 3732 COM receivers
- 56 x SK 5212 bodypack transmitters
- 26 x SKM 5200 handheld transmitters
- 10 x AD 3700 active directional antennas
- 2 x A 3700 active omni-directional antennas
- 10 x EM 550 G2 receivers
- 20 x SK 500 G2 bodypack transmitters
- 20 x SKM 935 G2 handheld transmitters
- 8 x SKP 500 G2 plug-on transmitters
- 2 x NET 1 network systems
- 6 x A 12 AD active directional antennas
- 16 x ew 300 IEM G2 wireless monitoring systems
- 2 x AC 3000 antenna combiners
- 4 x A 5000-CP circularly polarised antennas





Viewed from the East, West and South the 3,970 metre high Eiger resembles every other mountain in the Alps. Its North face, however, makes it a legend: an unforgiving wall of rock and ice projecting almost 2,000 metres out of the ground, responsible for the death of 60 climbers in the last 70 years. In 1999, in order to capture the myth of this “Killer Face” Swiss Television broadcast a 30-hour long live ascent. And audio specialist Sennheiser brought optimal sound to the project.

The North Face of the Eiger has always commanded reverence and respect. During the first serious attempt at climbing it in 1934, there were countless onlookers who followed the event through telescopes from their hotels on Kleine Scheidegg. It is as if the mountain was created for the adventure of a live transmission! And the challenge for Swiss Television was to deliver

impressive pictures and crystal-clear sound. To achieve this, the broadcaster had to rewrite the rules on camera and transmission technology. The subject: *four people enter into combat with a*

Echoes in the North Face of the Eiger

mountain. With minimal voice-over commentary, the unfiltered emotions of the mountaineers are there for all to hear; they gasp, swear and struggle.

With Ralf Dujmovits, Evelyne Binsack, Hansruedi Gertsch and Stephan Siegrist Swiss Television found four experienced mountain climbers who were prepared to let us share every step of their adventure. Together with Sennheiser the broadcaster developed special helmets

Peter Flückiger:

“Our aim was to achieve studio sound quality for the outside broadcast, i.e. full voices and full background sound. That was our prerequisite. We also had this objective in mind for other long-running programmes, and so developed the wireless transmission in studio quality together with Sennheiser.”

which not only offered the mountaineers the necessary protection, but also contained a mini-camera, a studio-quality microphone, a loudspeaker and a dipole antenna integrated into the headgear: a lot of technology but nevertheless comfortable to wear. Even more important was safety: “Initially, we had planned to issue the mountaineers with walkie-talkies or mobile phones in order to be able to co-ordinate a rescue in an emergency. However, the equipment’s weight and above all its range turned out to be a problem. We therefore decided that our Sennheiser audio systems were to double as emergency communication equipment, meaning that transmission reliability was critical,” explained Peter Flückiger, audio and communications specialist at *tv productioncenter zürich ag (tpc)*.

Abseiling without cables

Sennheiser also had a few audio extras for the mountaineers’ rucksacks: in addition to essentials such as snacks and a sleeping bag, there was room for a small transmitter and receiver. Flückiger and his team opted for the sturdy and reliable EK 3052 bodypack receiver – the predecessor of the EK 3253 – and the SK 250 bodypack transmitter. The additional technology in the luggage hardly affected the weight as the equipment is normally used across the world in live shows and musicals and only weighs a few grams. Unlike the live shows however, here on the mountain the receiver was over five kilometres away. But due to the good radiation properties of the helmet antenna, the sound engineers were even able to reduce the transmission power in order to save energy.

While the climbers were fighting their way through the North Face the production centre had settled in on the adjacent mountain, Männlichen. From the high plateau of this popular hiking resort the crew not only captured the signals from the helmet cameras by means of a parabolic antenna, but also the images from the ten video positions directly on the mountain. These were

achieved by using a helicopter to abseil the cameramen along with mountain guides and equipment down from vertiginous heights. With extensive practice in the Grindel mountains the men had prepared well for the task and had become a committed rope team. Here too Sennheiser’s equipment ensured that there was clear communication between them all.

The meticulous planning and the extensive trials also paid off for the sound engineers: choice of frequency, antenna locations and the equipment itself could be optimally adapted to all adversities. One of these was the North Face of the Eiger itself: the mountain acts like a gigantic parabolic dish and captures everything moving around in the frequency bands. “We could even hear the Frankfurt Airport radio,” said Flückiger.

The conquering of the summit was witnessed by the television world: a relatively straightforward climb up to the North face, the Schwierige Riss (‘The Challenging Ravine’), Evelyne’s small tumble shortly after the second ice field, the dreaded Weiße Spinne (‘White Spider’) – the viewers remained spellbound in front of the television, followed every step, not even switching off during the ad breaks. They witnessed climbers standing on rocky ledges simply ignoring the 1000 metre drop just one step away. Moments of recovery and rest for the mountaineers – pure adrenaline for the viewers at home. The closer the climbers finally came to the summit, the more relaxed the mood of the production team became. Flückiger: “The moment the climbers reached the summit was also the absolute high point for the technical crew below. The elation was indescribable.”



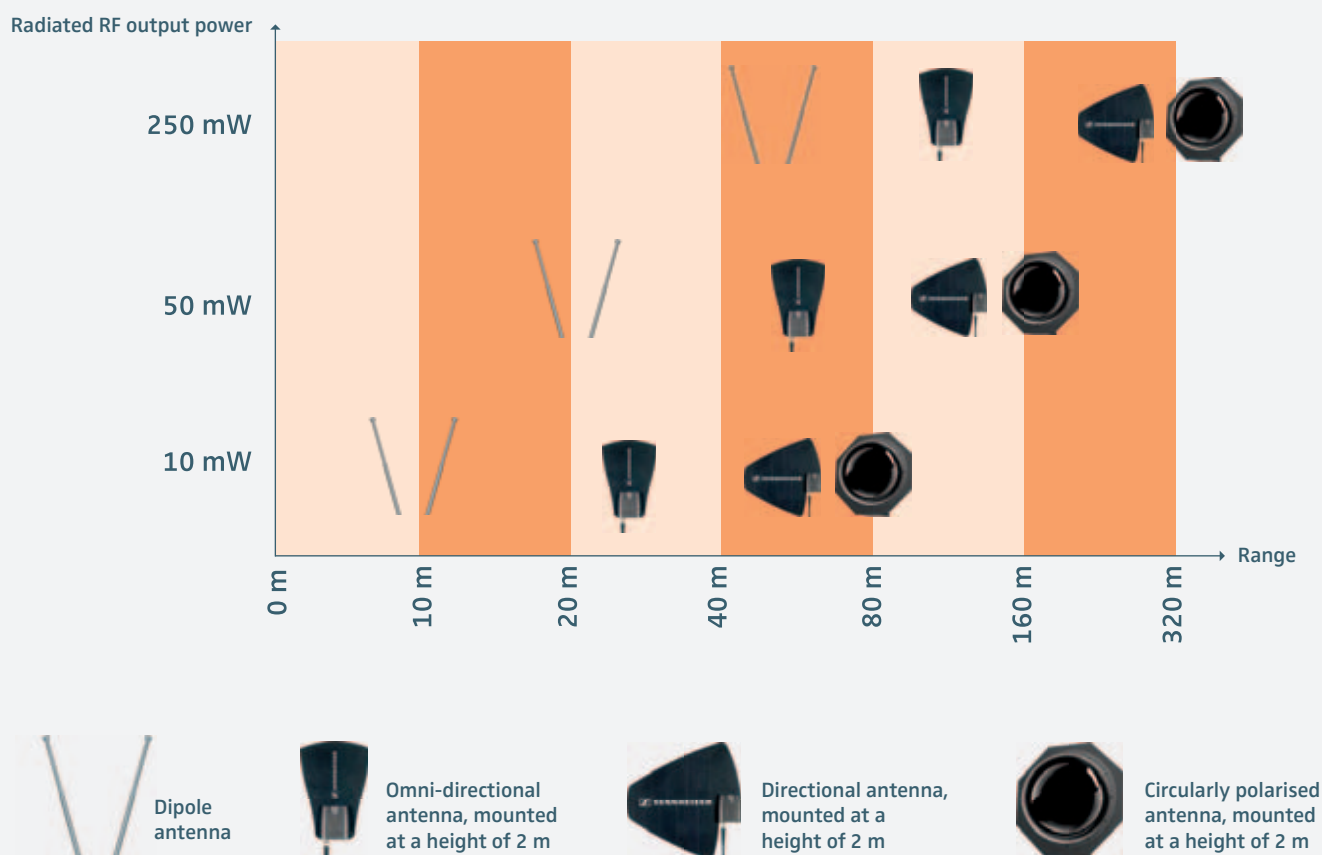
Maximising range and transmission reliability

The range of a wireless microphone system depends on many factors. First of all, there is the environment in which the system is operating. There may be interference from other signal sources in the vicinity, or transmission and receiving antennas may get shaded. The weather also plays its part. While these factors can rarely be controlled, the choice of equipment can: self-noise of individual components, dynamic range, radiated RF output power and intermodulation behaviour all influence range and reliability. Last but not least, the type

and position of the antennas will influence the performance of an RF wireless system. Choosing a suitable antenna type is crucial. With standard telescopic antennas plugged into the receiver, a reliable long range transmission is not possible, even when the output power is increased. Remote antennas are the solution: make sure that the antennas are in a direct line of sight with the transmitters. If the signal to be received is coming from one direction only, it is worthwhile employing directional antennas – this will further increase the gain. Putting the

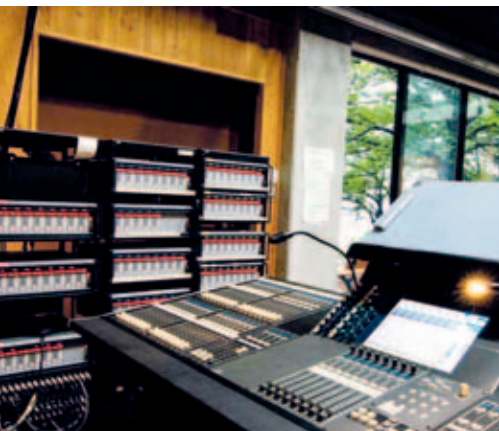
antennas in a very exposed position – as was the case for the climb of the Eiger, where the transmitter antennas were integrated into the mountaineers' helmets – will significantly increase the range, in this case to more than five kilometres.

The below graphics show the relation between range, radiated RF output power and antenna type:



Relation between antenna type, radiated RF output power and range

Professional from the very first rehearsal



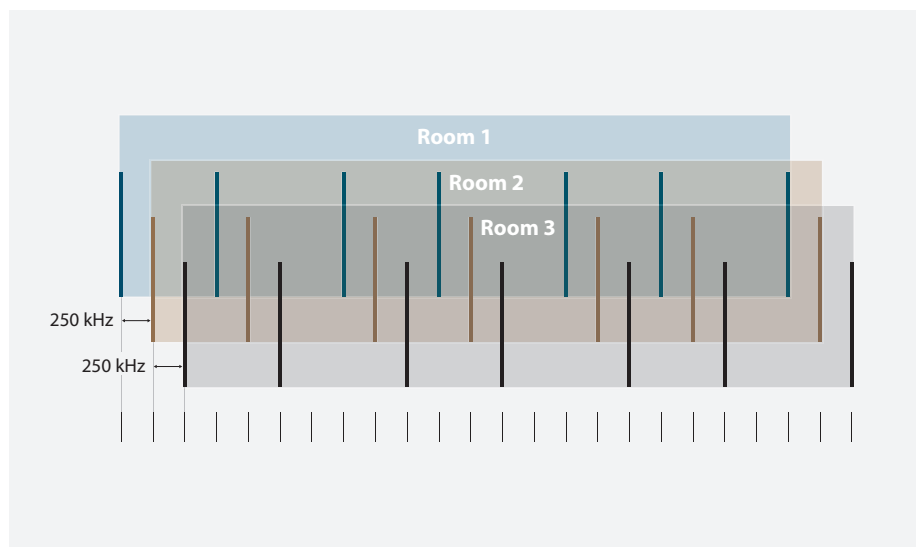
The Shiki rehearsal studios, the world's largest theatre rehearsal facilities

With five theatres in Tokyo alone, four in the rest of Japan and four additional rented theaters, the Shiki Theatre Company not only holds the record as the country's largest theatre company, it also has the world's largest rehearsal facility: the Shiki Arts Centre. Since July 2006 musicals and plays have been honed to perfection on its three rehearsal stages, fully fitted with state-of-the-art sound systems, before going on to thrill audiences in theatres across the country.

Large glass façades radiate light and a friendly ambiance in the training studios. Choreography is rehearsed and spectacular costumes for lavish musicals wait to be used. But it's not just the actors and singers who are perfecting their scenes: make-up artists and sound and lighting engineers also work on making the experience memorable for audiences. How can make-up be applied so the microphone is invisible? How can two actors in a musical sing to one another without causing phasing and cancellation problems for the sound engineer?

The first-class audio technology at the Shiki Arts Centre holds the answers to these questions. A technical challenge is that Japan has stricter licencing regulations than anywhere else in the world, in all there's just 22.5 MHz available for wireless microphones. Also, owing to the Arts Centre's glass façades and simple brick walls, there's very low RF attenuation between each of the three rehearsal stages, which are located side by side. 22.5 MHz is usually enough for around 20 wireless channels – too few for large musicals and far too few when all three stages are being used for rehearsals. The fact that the Shiki Arts Centre can now operate with 84 channels is down to excellent teamwork between the Shiki technical crew and Sennheiser's engineers.

To resolve the channel problem they chose a transmitter variant specially conceived for Japan transmitting with just 10 mW. Because output power is only reduced to 10 mW right in front of the transmitter antenna, the transmitter



"Intermeshed" frequency distribution (principle with seven frequencies per room)

causes far less intermodulation, so that more frequencies can be accommodated within the narrow frequency range. Specifically for the Shiki Arts Centre, antenna boosters for the EM 1046 receivers were limited to 4.5 MHz so that interfering frequencies could be suppressed effectively through this narrow-band filter. Also, the EM 1046 receiver system uses steep-edge filters, which ensure that signals can still be received with a high selectivity even when the spectrum is quite congested.

For the individual rehearsal stages, transmission frequencies were “intermeshed”: the frequencies were chosen such that they had the same basic fre-

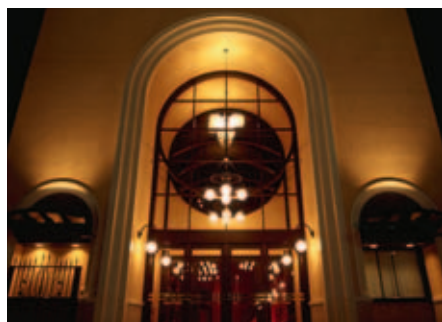
quency grid but were shifted by a certain amount for each room. The combination of these measures ensured that the low RF attenuation between the rooms was sufficient to screen the rehearsal stages from one another. With cleverly devised wireless technology like this, the Shiki Theatre Company can run rehearsals at full pace – and give Japanese audiences some wonderful stage shows.

Equipment used:

- 84 x SK 5012 bodypack transmitters
- 84 x EM 1046 RX rack-mount receiver modules
- 12 x AB 1036 antenna boosters



Dentsu Shiki theater [Umi]
Photo: Chihiro Hiraki



Jiyu theater
Photo: Takashi Uehara



Shiki theater [Haru] [Aki]
Photo: Ken Arai



Cats theater
Photo: Takeshi Arai

