

1. SCOPE

Free TV Operational Practice OP 54 is a guideline to the minimum requirements for industry standard television coverage of major “long distance” sporting events involving a combination of multiple fixed and mobile cameras and the infrastructure required for comprehensive TV coverage. Typical of such events are marathon, triathlon, road cycling, street parades and similar large scale, large area events.

OP 54 provides an indication of infrastructure for an outside broadcast production using contemporary production techniques which meet current broadcast television presentation requirements.

This Operational Practice has been developed by the Free TV Australia Project Group - Outside Broadcasts, it's intention being to maximise television and radio production potential and productivity at venues and the avoidance of costly omissions at planning and construction stages.

TVOB coverage of large area sporting events has progressed with the general availability of super and ultra slow motion (slo-mo) cameras along with wireless (RF) and other specialty cameras. These and further ongoing developments, both technical and production oriented require space and infrastructure requirements and impose stringent requirements on lighting specifications for events that have evening and night phases of competition.

2. TYPICAL COVERAGE

The marathon is run over a course of approximately 42 km and typically involves fixed camera cover at key vantage points, but relies totally on wireless cameras for full start to finish coverage.

Triathlon events are typically held within a defined precinct which offers scope for distance running, swimming and road cycling. The precinct area can typically be in the order of 20 hectares, with road distances of 5 to 10 km.

Cycle road races can be held in confined area precincts as for triathlon, or open road events over hundreds of kilometres.

3. CAMERAS

Total camera requirements for a specific event are determined by the geographic features of the course and the TV coverage criteria for the event.

Fixed cameras are deployed at the start and finish areas and at key vantage points along the course. Wireless cameras provide continuity of cover over the entire course, in most cases being relayed back to the central production facility via helicopter or light plane relay platforms. Camera configuration for a typical event can be in the order of:

- | | |
|---|-------------|
| ▪ Fixed cameras covering start / finish / key locations | 10 – 20 |
| ▪ Crane/jib mounted cameras at start and finish | typically 2 |
| ▪ Portable cameras | 4 |
| ▪ Helicopter mounted cameras | 1 - 2 |
| ▪ Wireless cameras (motorbike/car) with aerial relay | Typically 4 |

3.1 Camera positions

Camera positions are determined by the director and producer of the television coverage and are subject to the particular requirements of the event.

Cameras at start and finish are typically mounted on purpose built scaffolds and camera platforms.

A typical working platform for a single camera is in the order of 1.8-2.0 metres wide and 2.5—3.0 metres deep. Height is determined in survey.

Camera platforms and scaffolds are to comply with relevant work-safe requirements.

Platforms are required to be highly rigid to allow for stable operation when using large scale zoom lens equipped cameras.

3.2 Portable cabled cameras

Portable (small format) cabled cameras are utilised in allocated zones at the start and finish areas for interview and hosting operations. These cameras are used in “fixed” zones where space is at a premium and do not generally move out of their allocated zones.

See Clause 7: Radio Frequency (RF) Spectrum management

3.3 Portable wireless cameras

Portable cabled cameras are utilised at start and finish areas for interview and close up cover of competitors.

Microwave frequency planning for portable wireless cameras is to be co-ordinated with other licensed users operating in the event precinct, or in the near vicinity to minimise risk of mutual interference between the TVOB and other legitimate microwave link operators (eg News ENG services). On major events, it is essential to implement an overall frequency management strategy involving statutory regulatory authority control.

3.4 Mobile camera platforms (Vehicle-based)

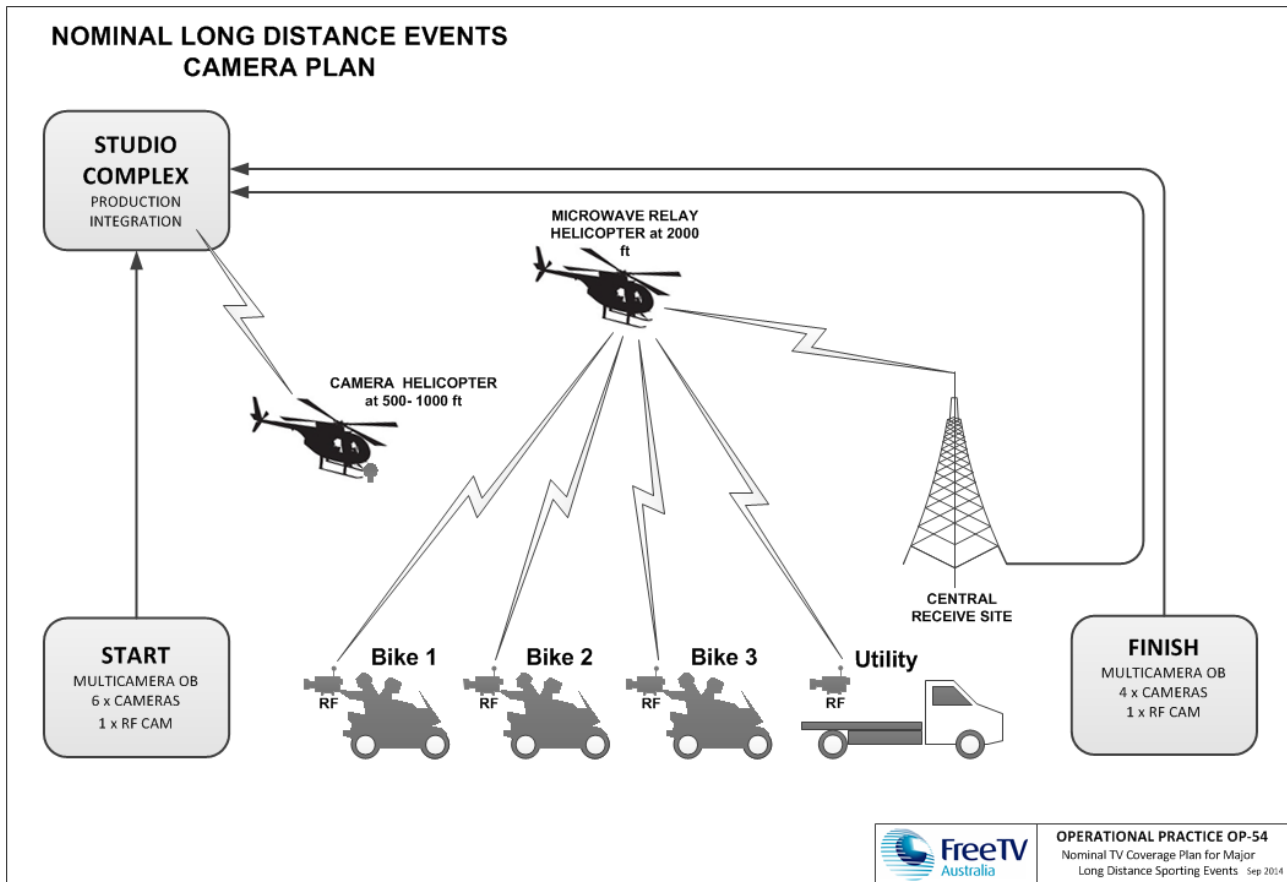
A gyro mounted camera on a flat bed vehicle or motorcycle is often used as the lead vehicle. This camera is relayed back via the various aerial relay platforms in place for the event.

3.5 Special mobile cameras

Continuous start to finish cover of major distance events is highly dependent on reliable helicopter mounted cameras and helicopter or light plane relay of motor bike and vehicle cameras.

3.5.1 Helicopter cameras

A number of camera systems have been developed for helicopter mounted camera systems, with nearly all systems using stabilised lenses and/or remote controlled gyro-ball cameras. Backhaul to the main technical control area is typically by 2.0 and 2.5 GHz microwave with auto tracking directional transmit and receive antennae. Camera equipped helicopters generally operate at altitudes between 500 and 1000 feet (approx 150 to 300 metres).



Nominal TV Coverage Plan for Major Long Distance Sporting Events

3.5.2 Motorcycle cameras

Motorcycle mounted cameras are typically hand held units operated by the pillion rider on the bike. Stabilised lenses are used in nearly all instances.

Backhaul is typically via 2.0 microwave link relay via a helicopter microwave relay platform.

A clear overhead sight line from the motorcycle uplink to the helicopter relay platform is required. Where tree canopy obstructs clear line for the up link, ground based receivers can be deployed for "gap fill" service.

Helicopter microwave relay platforms typically operate at altitudes of 2000 to 5000 feet (approx 600 to 1500 metres).

On extreme long distance operations (e.g. motor rally) airborne microwave repeaters may sometimes be used. For this operation, the helicopter platform transmits in turn to a microwave relay equipped light aircraft circling at approx 10000 feet altitude and transmitting to a ground based receiver site with Telco, satellite or OB terrestrial microwave connectivity to a main control centre.

This technique is particularly appropriate for remote areas where the broad-beam transmit characteristic of the aircraft down link antenna does not cause restrictive interference to any normal service ENG operations in the wide area of the aircraft down link pattern.

3.5.3 Helicopter and light aircraft facilities

Helicopter and light aircraft operations are an essential requirement for long distance TVOB operations. Flight paths and operation zones are to be planned in accordance with Civil Aviation Safety Authority (CASA) flight operations regulations. On long distance events it is important to have a comprehensive refuelling schedule which may also include an additional helicopter.

Temporary helipads to be established in the event zone are to be approved to comply with local council and CASA regulations. Light aircraft will use the nearest available airstrip.

Temporary on-site refuelling facilities are to comply with fire safety and environmental protection (fuel spillage) regulations.

4. AUDIO

Commentary facilities are to be provided at the main control centre, and as required at key locations along the event route for International broadcasters who are covering the event.

Hosting positions for 3-4 hosts is also typically required at the main control centre with smaller on camera facilities as required by broadcasters at key locations.

5. WIRELESS MICROPHONES

Wireless microphones are extensively used for TV and radio interviews. Wireless microphones frequency co-ordination is required on a venue by venue basis to avoid interference with TV operations, radio broadcasters, venue officials, public address announcers, entertainment, and other legitimate users of wireless microphone equipment.

See Clause 7: Radio Frequency (RF) Spectrum management.

6. COMMUNICATIONS

Voice communications between the main control centre, the TV studio complex and secondary OB units is usually via Telco circuits.

Voice communications between the main control centre and microwave wireless cameras, motor bike cameras, portable wireless cameras, helicopter cameras and helicopter microwave relay platforms shall be primarily via UHF duplex radio telephone equipment.

7. RADIO FREQUENCY (RF) SPECTRUM MANAGEMENT

Extensive use of the RF spectrum is necessary for comprehensive TVOB cover of long distance events.

Allocation of frequency bands is generally as follows:

2.0 & 2.2 GHz microwave bands:

- Portable wireless camera
- Specialty POV cameras
- Helicopter / aerial downlinks in the 2GHz band ONLY

For specific information on use and coordination of ENG / TOB in the 2 and 2.2GHz bands refer to:

OP63 Spectrum usage for ENG and TVOB Operations in the Brisbane / Gold Coast / Sunshine Coast Area

OP64 Spectrum usage for ENG and TVOB Operations in the Sydney / Canberra / Newcastle / Illawarra Area

OP65 Spectrum usage for ENG and TVOB Operations in the Melbourne Area

OP66 Spectrum usage for ENG and TVOB Operations in the Adelaide Area

OP67 Spectrum usage for ENG and TVOB Operations in the Hobart Area

OP68 Spectrum usage for ENG and TVOB Operations in the Darwin Area

OP69 Spectrum usage for ENG and TVOB Operations in the Rural and Remote Areas

- 7 / 8 GHz microwave band Medium haul point to point back haul links
- 13 GHz microwave band Short haul point to point back haul and local interconnect links
- 470 – 520 MHz band Duplex Radio Telephone (RT) voice, telemetry and data communications

- 520- 694, 1790-1800 MHz band Wireless microphone operations
- Aggregate RF systems requirements can be in the order of 12 x 2.5 GHz channels, 4 to 6 x 7 / 8 GHz channels, 4 to 6 x 13 GHz channels, 10 x UHF duplex RT frequencies and 30 to 40 x wireless microphone frequencies for major events.

RF spectrum usage is strictly controlled, and specific channel allocations are generally licensed to individual commercial entities. Temporary use of multiple frequencies as is required for operations on the major event scale require frequency co-ordination with established license holders and special licensing for the complete RF requirements for the period of the event.

It is essential that a rigid frequency management procedure be implemented on a venue basis to ensure non interference between services within the precinct involved in TVOB origination, including authorised unilateral operators, and for other licensed users (ENG etc.) operating in near proximity to the OB precinct.

Frequency allocation and usage regulations are becoming increasingly rigid and restricted.

Wireless microphone frequency management is the prerogative of the event promoter and venue management, along with TVOB operators who all need to be fully involved in channel allocations from the early planning stage of a project.

Microwave and UHF frequencies are licensed but may be subject to frequency sharing arrangements. Co-ordination between users, including news services not directly involved in the event telecast, but licensed to operate in proximity of the event precinct is an essential prerequisite for event RF spectrum planning.

Major events involving multiple operators of RF services require overall coordination to be under statutory authority control of use / misuse of RF spectrum assets.

8. LIGHTING

Television standard lighting is to be provided at start, finish and each stage of an event along with tunnels and undercover areas that are encountered en route.

(Reference should be made to FREE TV AUSTRALIA OP 31: *Lighting Requirements for Television.*)

A brief summary of lighting standards is as follows:-

8.1 International standard for TV venues

- Lighting level (E_v) toward main cameras: 1400 lux (average)
- Lighting level toward other directions: 1000 lux
- Lighting level toward USM / SSM cameras: 1800 lux (within defined zones, slo mo replay zones (SRZ)
- Colour temperature (TK): 4000K to 6500K, but within 500K at individual venues: preferred value 5600K.
- Colouring rendering index R_a : ≥ 90
- Maximum GR for main TV cameras < 40
- 50 Hz mains flicker: minimise flicker by cross aiming and spreading floodlights equally over the three phases:
 $\leq 10\%$ flicker for ≤ 600 fps
 $\leq 3\%$ flicker for $\leq 1,000$ fps.

8.2 Professional standard

- E_v toward main cameras 1000 lux (average)
- E_v toward other directions 800 lux
- Colour temperature 4000K to 6500K, but within 500K at individual venues:, preferred 5600K but within 500K at individual venues
- Colour rendering index R_a Minimum requirement R_a 85, $R_a > 90$ preferred
- Maximum GR for main TV cameras: < 40
- 50 Hz mains flicker minimise flicker by cross aiming and spreading floodlights equally over the three phases

Note: Whilst satisfactory picture quality can be achieved at the minimum lighting levels stated, restrictions are placed on full usage of zoom lenses and focusing becomes quite difficult for camera operators on BCU (big close up) camera angles. Super Slo-mo cameras cannot perform satisfactorily below Professional standard lighting.

9. MAIN TECHNICAL CONTROL CENTRE

The main technical control centre is the co-ordination centre for all cameras covering the event. The facility can be located in a TV studio complex providing comprehensive microwave receive capacity and Telco connectivity, or through a purpose configured major OB complex in an Outside

Broadcast compound located at a key location (typically start or finish) on the event route. Local cabled cameras would connect directly to the control centre, along with switched output of sub control OB units located at other key areas and connected to the main OB via Telco or OB microwave links.

A purpose configured microwave receive location would be constructed at the main control centre for integration of aerial down links and point to point microwave backhaul.

10. OUTSIDE BROADCAST COMPOUND

10.1 General

A level hardstand area for outside broadcast control units (OB Units) parking is required for the main technical control centre.

The OB van compound should be fenced off from public access for security of TV operations and for public safety.

Major outside broadcast vehicles are semi trailer units built to Australian road transport regulations. Venue vehicle access and load bearing capacity needs to comply with maximum vehicle dimension and weight specifications. Typical requirements are 22.0 metres combined trailer and prime mover length, maximum height of 4.3 metres, and 8.5 tonne per axle loading.

Access to and egress from the OB compound needs to cater for the turning circle and overhead clearance requirements of maximum dimension articulated vehicles.

Special attention to overhead obstructions is necessary where ramps or uneven road surfaces are involved.

Typical hardstand area is in the order of 500 square metres either 25 metres x 20 metres or 50 metres x 10 metres, rectangular.

Generator hardstand should be incorporated in the OB compound (see below).

Provision is to be made to site a satellite uplink vehicle within the compound, adjacent to the compound or within the venue area with suitable cable/fibre connectivity and local 32A 3 phase power outlets x 3 as a minimum. Clear line of sight to the north eastern sky for the majority of Australian broadcasters and to the western sky for a number of international broadcasters is a location requirement.

Should the OB Compound be situated within an enclosed space (underground or under a grandstand for instance) adequate ventilation is to be provided so as to comply with relevant safe work practice regulations as outlined by each State's regulatory body Code of Practice. Air conditioning units on OB vans and portable sheds give off a considerable amount of heat which needs to be removed from the area and this along with any exhaust fumes from generators and vehicles (buses, delivery vehicles, fork lift trucks etc), needs to be taken into account when designing ventilation systems.

An additional area of nominal 300 square metres should be available for international unilateral OB operators.

10.2 Personnel amenities

Crewing on major TVOB operations can exceed 200 staff.
Adequate personnel services need to be provided in the OB compound.

These amenities should include:

- Toilet facilities, separate male and female facilities
- Sewer connection, town water connection
- Lighting for personnel movement
- Drainage contours such as to minimise “ponding” during heavy rainfalls
- Food preparation area and catering area
- First Aid facility
- Regular cleaning and rubbish removal services

10.3 Secondary OB compounds

Secondary OB compounds may be specified at key locations along the event route.
General requirements are as per the main compound, with a space provision of 200 square metres typical.

Power requirements for secondary compounds would be in the order of 120 Amps three phase with provision for location of a 125 kVA to 175 kVA standby generator, along with the provision for satellite uplink as per the main compound.

11. POWER

11.1 Typical requirements

Typical power requirement is for 250 Ampere per phase three phase supply adjacent to the outside broadcast vehicles hardstand area. Power should be available via powerlock connectors, with OB facilitators providing their own distribution equipment as required.
General purpose 15A outlets to be provided for overnight use.

11.2 Heavy neutral currents

The high level of use of switch mode power supplies in TVOB technical equipment has resulted in high neutral current drain in three phase mains supplies. High current neutral connections should be specified for mains power installations planned for TVOB compounds.

11.3 Circuit breakers and safety

Where mains power supplies are protected by residual current devices (RCDs) trip current of the source RCD should be adjustable, to be set to a higher trip current level than the main OB van circuit breaker, such that the OB van main circuit breaker serves as the prime safety switch for the TVOB operation.

TVOB mains supplies are to be separately protected from other electrical supplies servicing the venue.

Power reticulation ex the OB van to operational areas is to be RCD protected in accordance with Work Safety requirements.

Three phase, minimum 32A rated interconnect cables (5 pin connectors) are to be installed between the OB Compound and major operational areas—close by.

11.4 Local and standby generators

Generator hardstand should be incorporated in the OB compound and should be adjacent to the mains power connect point.

Sourcing of generators is a TVOB responsibility. Generators are to be silenced to EPA requirements and are to be sited to obviate exhaust fume exposure to TVOB staff and patrons.

For indoor/undercover compounds provision is to be made to extract exhaust fumes . If this is not possible or the generator hardstand cannot be within the OB van compound interconnect cabling specified to full electrical load (250 Amps / phase, three phase) is required to be installed between the generator site and the OB Compound.

12. CABLING

Simple access is required for cabling from the outside broadcast vehicle hardstand areas to the camera platforms, commentary facilities, on camera positions, to the microwave receive facility and to all other operations areas, TV cable installations are site specific and need to be planned on an individual basis, but provision needs to be made for cable routes which provide ease of access, do not compromise venue aesthetics and do not present risk to workers or public.

Wherever possible, ground level cable paths clear of public traffic areas are preferred. Where cables need to be routed below ground level open cable troughs with easily removable and replaceable cover plates are the preferred option. Where cables need to be routed above traffic area open cable trays with cantilever mounting from below allow for simple cable runs with “lift in” installation possible.

Cable conduits are not recommended for temporary cable installs, but where there is no other option conduits should be a minimum 150mm diameter with draw wire installed any curves or bends to be no greater than 30 degrees. A minimum of 4 x conduits should be available in order to separate signal cables from power cables, and to allow for (inevitable) future expansion.

13. BACKHAUL

13.1 General

TVOB transmission to studio base can be via telecommunications circuits, satellite uplink or local microwave radio transmission.

An area within the compound is required for the location of various circuit provider’s equipment and services, (fibre interfaces, PSTN, data etc.) This area to have local power as required by the service providers and adequate space for their equipment. Modern equipment has seen the need for small air conditioning plants being used on the equipment housings so facility for water runoff needs to be considered.

13.2. Microwave link platform

A Microwave tower, typically of scaffold construction is required for installation of microwave receivers for helicopter down links, point to point contribution links and for microwave backhaul to the broadcast studio complex.

UHF communications antenna systems would also locate on the microwave tower.

The platform is to be sited to allow clear line of sight radio transmission to the TV studios or to a suitable intermediate relay site. Structures need to comply with relevant OH&S regulations.

14. SAFETY

All personnel working on TVOBs are to be familiar with and to comply with relevant OH&S regulations.

A site specific risk assessment is to be undertaken by venue management and TVOB operations management during planning stages of the event.

TVOB personnel are to be inducted as to venue and TVOB safety requirements prior to commencement of duties.

Scaffolding, camera tracks, aerial cabling and other constructions are to be installed by suitably licensed persons.

Camera cranes, scissor lifts, fork lifts and other mobile work platforms are to be operated by licensed persons.

Electrical installations are to be undertaken by licensed persons, and tested and tagged in compliance with statutory regulations.

Temporary TV cable installations are to comply with site hazard reduction policies.

As safety regulations can vary subject to individual state government regulations, applicable requirements need to be determined on a site by site basis.
