

FEDERATION OF COMMUNICATION SERVICES BUSINESS RADIO

Resilience Levels in Business Radio Systems The FCS 5-Level Resilience Assessment Scheme

MATRIX ONLY – V1.0

Part of a Federation of Communication Services (FCS) Code of
Practice

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FCS 5-Level Resilience Assessment Scheme

	Level 1	Level 2 Level 1 and:	Level 3 Level 2 and:	Level 4 Level 3 and:	Level 5 Level 4 and:	Audited Level
Infrastructure Location	<ul style="list-style-type: none"> No Special arrangements. 	<ul style="list-style-type: none"> Location not susceptible to flood / earthquake and/or other natural phenomena. Protected against rain, damp, dust etc. 	<ul style="list-style-type: none"> Measures taken against damage from fire in location. Equipment is placed where there is little chance of damage from normal other activity. 	<ul style="list-style-type: none"> Environment is controlled in temperature and has good ventilation. Measures taken against damage from fire in location or in a related location (E.g. the floor below). 	<ul style="list-style-type: none"> Equipment is housed in dedicated environmentally-controlled, specialised location. 	
Physical Security	<ul style="list-style-type: none"> Located in a room within premises that are locked. Suitable arrangements made to ensure access to sites with other users' equipment co-located in it. 	<ul style="list-style-type: none"> Located in a locked room inside a secure office building or externally in a locked metal cabin. 	<ul style="list-style-type: none"> Located in a secure metalized area with border fencing etc. where possible/permitted. 	<ul style="list-style-type: none"> Located in a secure area under surveillance 	<ul style="list-style-type: none"> Secure location under 24 Hr surveillance with close-proximate security 	
Power Continuity	<ul style="list-style-type: none"> No special arrangements. 	<ul style="list-style-type: none"> Simple power back-up system offering at least 15 minutes' continuity of full service. Back-up system is safe and in suitable environment. 	<ul style="list-style-type: none"> Back-up system offering at least 60 minutes' continuity of full service. This back up scheme fitted with an alarm system. 	<ul style="list-style-type: none"> Back-up system offering at least 8 hours' continuation of full service. This back up scheme fitted with an automatic alarm system alerting the maintenance organization who have the capability to extend service up to 2 days. 	<ul style="list-style-type: none"> Battery/generator backup system offering at least 24 hours continuation of full service¹. This back up scheme fitted with an automatic system notifying the maintenance organization that has the capability to extend service indefinitely (days). 	
Surges / Lightning	<ul style="list-style-type: none"> No special arrangements. Note that the FCS advise against having no protection at all. 	<ul style="list-style-type: none"> Lightning rod protection on the antenna support structure (e.g. mast/tower) to BS EN/IEC 62305 with adequate route to earth/ground achieving a 10Ω (or less) impedance to ground forming a separate discharge path to ground than that of the electrical safety earth. 	<ul style="list-style-type: none"> RF lightning protection device to BS EN/IEC 62305 on the antenna coax feeder prior to cable entry into cabinet. Let-thro energy of the SPD should be below the maximum input level of the radio. Position the device to minimise discharge energy proximity to equipment, earth 	<ul style="list-style-type: none"> RF lightning protection device to BS EN/IEC 62305 on the antenna coax feeder cable positioned outside the Radio cabinet with low impedance connection to earth/ ground. Surge protection on AC/DC power lines with appropriate fuse and isolation switch placed within 0.5m of ground earthing terminal. For 	<ul style="list-style-type: none"> Enhanced performance RF lightning protection device capable of handling multiple strikes with no maintenance for min 10yr period (BS EN/IEC 62305) on the antenna coax feeder cable with adequate route to earth/ ground. Surge protection on AC/DC power lines with appropriate fuse and isolation switch placed within 0.5m of ground earthing terminal. For multi- 	

¹ Note: Impending changes in some regulations may require this to be increased to 7 days.

			connected with adequate route to earth/ ground via low impedance connection (sub-10Ω).	multi-phase supplies – protection should be connected from each phase to N. For installations without N-G termination close to enclosure an additional high isolation protection should be used. <ul style="list-style-type: none"> Incoming Data cables protected prior to radio entry (BS EN/IEC 62305) with adequate route to earth/ ground. 	phase supplies – protection should be connected from each phase to N. For installations without N-G termination close to enclosure an additional high isolation protection should be used. Alarm monitoring on AC/DC surge protection connected to remote status indicator. <ul style="list-style-type: none"> Surge protection on other incoming lines such as interconnect cables and other signaling lines to a rating consistent with protection from all probable input spikes and surges. 	
Site Installation / Wiring Note that FCS1331 provides important advice on Site engineering.	<ul style="list-style-type: none"> Out of the box assembly and place into service. No special Site Engineering measures. 	<ul style="list-style-type: none"> Neat wiring with all cables or wires identified and not assembled such that they are under any mechanical stress/strain. Infrastructure elements properly fixed in position to avoid vibration or undue flexing. Antenna positioned and aligned to provide the desired coverage. Antenna to be of the correct type for the desired application (coverage prediction required). 	<ul style="list-style-type: none"> Antenna mounted on mast using best practice mounting arrangements (see FCS 1331 relevant parts). Mast wiring assembled to best practice standard. Full analysis of co-location effects such as inter-mod etc. 	<ul style="list-style-type: none"> Mast Arrangements (including variations of beam direction of backhaul links) assembled on mast to maintain operation in storms etc. (E.g. wind speed gusts of 200mph). 	<ul style="list-style-type: none"> Full application of FCS 1331. 	
Equipment Reliability	<ul style="list-style-type: none"> No figures available. 	<ul style="list-style-type: none"> At least some key infrastructure elements and ancillary units have reliability / MTTF / MTBF figures indicating a compatible level of reliability. 	<ul style="list-style-type: none"> All radio transceivers and power units have reliability / MTTF / MTBF figures indicating adequate reliability in relation to the customer's needs. 	<ul style="list-style-type: none"> Terminal units have reliability figures from the manufacturer indicating a suitable field lifetime. 	<ul style="list-style-type: none"> The terminal operational life expectancy is greater than 7 years. 	
OTA Modulation / Protocol	<ul style="list-style-type: none"> Any. 	<ul style="list-style-type: none"> A reliable standard with no known resilience shortcomings. 	<ul style="list-style-type: none"> Reliable standard with widely recognized robust performance. 	<ul style="list-style-type: none"> Standard with quoted reliability and/or error recover figures that meet the need. 	<ul style="list-style-type: none"> Reliability and/or recovery figures exceed the stated requirement by x10. 	
Points of Failure	<ul style="list-style-type: none"> No special measures. 	<ul style="list-style-type: none"> Most critical areas of system identified. 	<ul style="list-style-type: none"> High quality units chosen for identified points of failure. 	<ul style="list-style-type: none"> System dimensioned to improve behaviour at the critical points. The most critical areas have arrangements in 	<ul style="list-style-type: none"> Full redundancy with no single point of failure, well-dimensioned system. Backhaul is provisioned such that a common fault 	

				the event of failure to maintain some level of service	will not cause a widespread outage.	
Control Over System	<ul style="list-style-type: none"> No special arrangements. 	<ul style="list-style-type: none"> Customer has a responsible person identified. 	<ul style="list-style-type: none"> A comprehensive suite of SLAs for all third-party services has been obtained. 	<ul style="list-style-type: none"> Real influence on actual third-party performance has been secured. Technical and Management roles have been clarified. 	<ul style="list-style-type: none"> All system elements and sub-systems are completely under the management and technical control of the customer or the identified operator. 	
Cyber Security	<ul style="list-style-type: none"> No special arrangements. 	<ul style="list-style-type: none"> All computers are fully provisioned with a reputable and fully up-to-date protection package. All passwords are strong. 	<ul style="list-style-type: none"> All equipment and externals are password protected from cyber-attack. Operational policies for regular changing of passwords (at least 6-monthly). 	<ul style="list-style-type: none"> Equipment and externals monitored for suspicious behavior. All cyber events logged and investigated by competent staff. 16-character random string keys. Changed frequently. Keys at both ends changed frequently. Secure Key management system. Adoption of Recognised and credible Cyber Protection policies² 	<ul style="list-style-type: none"> Policies in place that protect key staff from efforts to obtain access details and key equipment from them. Systems protected to only allow traffic from known & trusted sources. Access to system closely controlled to prevent manual introduction of threats. Adoption of recognized and credible assessment scheme³ 	
Radio Interference Hazard	<ul style="list-style-type: none"> No special arrangements other than ensuring conformity to any relevant WT Act licence that has been issued by Ofcom. 	<ul style="list-style-type: none"> Radiocommunications known to be operating within the relevant area checked and operating channels chosen accordingly. Full link-budget analysis conducted and placed on file. Appropriate antenna that meets the operational need and does not radiate unwanted power inappropriately chosen and fitted. 	<ul style="list-style-type: none"> Noise floor assessed on site and power budgets chosen accordingly. Near-neighbour transmitters identified and appropriate filtering and/or protection added. 	<ul style="list-style-type: none"> Regular liaison with enforcement authorities to assist the detection and termination of all types of illegal transmissions from other systems that cause harmful interference. Maintenance programme that examines all aspects of inbound and outbound interference. 	<ul style="list-style-type: none"> Regular and frequent (at least daily and preferably fully dynamic) monitoring of interference/noise floor situation to ensure nothing changes. If it does the necessary remedial action is undertaken immediately. 	
Maintenance / Repair Schedule	<ul style="list-style-type: none"> No defined maintenance schedule. 	<ul style="list-style-type: none"> Arrangements for quick-response maintenance in place and relevant persons defined and 	<ul style="list-style-type: none"> Formal Maintenance schedule established to replace identified vulnerable areas of system. 	<ul style="list-style-type: none"> Formal maintenance schedule operating exclusively at times when users will see no degradation of service 	<ul style="list-style-type: none"> Predictive full maintenance system providing assurance of uninterrupted use for the customer. 	

² Example: GCHQ - <https://www.ncsc.gov.uk/guidance/10-steps-cyber-security>

³ Example: <https://www.itgovernance.co.uk/cyber-essentials-scheme>

		<p>contact details readily available.</p> <ul style="list-style-type: none"> • Maintenance programme has defined response times including an agreed MTR for critical elements. 		<p>(E.g. in out-of-hours periods) or by installing temporary equipment.</p> <ul style="list-style-type: none"> • Remote fault recognition and identification system in place. 		
Calculated Availability (within stated operating hours)	<ul style="list-style-type: none"> • No specification provided. 	<ul style="list-style-type: none"> • Comparison to other similar systems indicates a 'good level of availability' is to be expected. 	<ul style="list-style-type: none"> • Numeric analysis of system to provide a theoretical predicted availability figure. 	<ul style="list-style-type: none"> • Call logging or active monitoring system providing actual availability performance. 	<ul style="list-style-type: none"> • Full diagnostic call performance package fitted and working. 	
Over-loading	<ul style="list-style-type: none"> • No special arrangements. 	<ul style="list-style-type: none"> • System dimensioned sufficiently to give confidence that over-loading is rare (discussed with user). 	<ul style="list-style-type: none"> • Measures taken to ensure that none of the elements within the system completely cease to support calls or crash on over-load. <p>Overload warnings automatically issued.</p>	<ul style="list-style-type: none"> • System enhancements included that provide for graceful decline as over-load conditions become more severe. • Strategies in place to ensure that a minimum level of operation retained for critical communications. 	<ul style="list-style-type: none"> • Full analysis of loading characteristics in continuous operation to allow necessary modifications and enhancements of capability where necessary to reduce over-loading conditions. 	
					Average FCS Resilience Level Achieved ⁴	
					Minimum Resilience level achieved for any parameter ⁵	

⁴ This is an OPTIONAL entry that may be considered useful by some users. It does not form part of the Resilience Assessment

⁵ This may be considered useful in some limited situations. It does not form part of the Resilience Scheme