Technical Service Bulletin 030328
IOX / DCX Troubleshooting Table

This service bulletin provides a troubleshooting table for the Comark IOX and DCX series of UHF television transmitter. The information contained in this table is the compilation of inputs from Comark customer service representatives, field service engineers, design engineers, and customers. If you would like to make an addition or correction to this table, please send your information to the Comark Customer Service department via e-mail to csfeedback@comarktv.com

Symptom	Problem / Solution
	480VAC Three Phase Power
"Soft Start" failure prevents application of high voltage.	Missing phase in 480V feed to beam supply primary. Trace three-phase voltages back from beam supply disconnect with voltmeter to find where missing leg disappears. Possible partial failure of CB3 motorized breaker. Check for presence of three-phase 480V at output terminals of CB3 when closed. Replace CB3 as necessary. Possible failure of HV rotary switch or outdoor disconnect. Check for 480V at output terminals of suspected device. Replace faulty components as necessary. To prevent damage to CB3 breaker, HV rotary switch, step-start contactors, and other 480V devices, check tightness of terminal connections at regular intervals as part of a preventative maintenance program.
Beam voltage OK when HV is isolated, but sags significantly (>5kV) when IOT is connected. Possible positive grid current alarms or severe distortion of transmitted waveform.	Missing phase in 480V feed to beam supply primary. Trace three-phase voltages back from beam supply disconnect with voltmeter to find where missing leg disappears. Possible partial failure of CB3 motorized breaker. Check for presence of three-phase 480V at output terminals of CB3 when closed. Replace CB3 as necessary. Possible failure of HV rotary switch or outdoor disconnect. Check for 480V at output terminals of suspected device. Replace faulty components as necessary.
Beam voltage is 2/3 of nominal value e.g. 22kV instead of 33kV.	Missing phase in 480V feed to beam supply primary. Trace three-phase voltages back from beam supply disconnect with voltmeter to find where missing leg disappears. Possible partial failure of CB3 motorized breaker. Check for presence of three-phase 480V at output terminals of CB3 when closed. Replace CB3 as necessary. Possible failure of HV rotary switch or outdoor disconnect. Check for 480V at output terminals of suspected device. Replace faulty components as necessary.
Beam voltage is unstable, bi-stable (jumping between two values).	Possible high voltage breakdown of 60 ohm filter resistors in HV beam supply. Extinguish high voltage and inspect beam supply resistors. Replace resistors as necessary.
Beam will not come on due to cabinet interlock alarm, yet all safety devices connected to cabinet interlock line are in proper positions.	Possible over-temperature condition in step-start resistors. Step start resistor temperature sensor is also part of cabinet interlock line. Condition typically occurs after frequent HV on-off cycles in a short period of time. Allow step start resistors to cool down for ten minutes. Interlock will clear itself as resistors cool. Step-start overheating may also be due to open phase leg on K32 step start contactor. Remove 480V and connect voltmeter across contactor terminals for one phase. Reapply 480V and read voltage drop across contactor while engaged. Repeat measurement for all three phases. Look for non-zero voltage drop on one phase leg. Replace K32 as necessary. Note: other devices in cabinet interlock line are HVPS door, HVPS ground hook, HVPS oil level switch, HV key interlock system.
High voltage is stable in beam mode but drops out with cabinet interlock alarm after	Possible over-temperature condition in step start resistors due to high resistance condition in one or more legs of K32 step start contactor. Step start resistor temperature sensor is also part of cabinet interlock line. Remove 480V and connect voltmeter across contactor

several minutes in RF mode.	terminals for one phase. Reapply 480V and read voltage drop across contactor while engaged. Repeat measurement for all three phases. Look for non-zero voltage drop on one phase leg. Replace K32 as necessary.
Amber three phase power alarm. HPA controller screen displays “waiting for three phase” message.	Possible three-phrase power problem. Check status of HVPS ON/OFF switch on AC distribution panel on HPA cabinet. Check for 277V line-neutral on all three phases with voltmeter at AC input to transmitter. Check for signs of incorrect phase rotation if there has been a recent AC blackout Possible jammed three phase detector relay contacts. If three phase power is OK from previous step, place temporary jumper across terminals TB1 - 8,9 on three phase detector. If three phase alarm clears, replace three phase detector. Possible absence of +24V from HPA controller power supply. Remove HPA front panel and check status of +24V LED on HPA power supply card (far right). Check continuity of small green pico fuses at rear of card. Replace fuses as necessary. Remove HPA power supply card and measure resistance between ground and second-from-bottom pin on right side. Resistance should be at least 235 ohms. If resistance is less than this value, +24V line is shorted somewhere in HPA cabinet. Locate and eliminate short before replacing fuses and reinstalling card. Fuse failure is sometimes caused by damage to HPA controller card 452117-01, in turn caused by a destructive failure of one or more snubber networks 452251-01, 452252-01 on relays in HPA relay panel assembly. Be sure to indicate software revision level of board when obtaining replacement HPA controller board (e.g. v2.12, v3.01). Does not apply to 451144-01 type HPA controllers. Early vintage IOX transmitters should be checked for presence of snubber networks on relays K2, K10-12, K15-18. Contact Comark if snubber networks not present.
Loud humming coming from 480V contactor(s) in rear of HPA cabinet.	Contactor faulty. Unit must be replaced.
Ratcheting or machine-gun sound coming from step-start relays during turn-on.	Intermittent activation of step-start relays. Possible intermittent contacts in step start time delay relay K31-pins 1, 2 or auxiliary contacts on K1-pins 43, 44. Determine and eliminate source of intermittent contacts. Replace faulty components as necessary.
Pumps trip thermal protection on motor starters. Each pump runs approx. 20 seconds and shuts off.	Three-phase electrical problems. Verify 480V phase-phase voltage on all legs of feed to transmitter / pumps. Check balance of current draw on all three phases will clamp on ammeter. For certain three-phase imbalances, the pump thermal protections sometimes prove to be more sensitive than the three-phase detector relay.
Control System	
HPA control panel buttons intermittent or insensitive. Buttons must be pressed very hard to register command. Condition worsens with time.	Contact Comark for a replacement unit PN 452103-02. Be prepared to provide panel serial number, revision level of panel and HPA brain (CPU) board. (CPU code and Front Panel code.) Does not apply to 451144-01 type HPA controller (non LCD screen version).

HPA controller(s) do not respond or respond very slowly (>1 min) to beam ON command or RF ON command from system controller in exciter cabinet.	Possible incorrect RF system pattern. Any HPA not called for in the current RF system pattern will not respond to an ON command from the system controller. The determination of the current pattern is based on the position read back of the RF system switches, NOT on the commands issued by the pattern select buttons. Therefore, an HPA not called for in a given pattern will have its control inhibited, even if that pattern were entered by manually actuating the RF system switches one at a time. This effect does not occur when an HPA controller is in internal control mode. Possible partial logic/communications freeze-up of PLC controller in system cabinet. Recycling power to system controller in exciter cabinet will restore proper operation to control system. A permanent solution may be had by upgrading to a 452117-01 HPA CPU card with code version 3.10 or later. Contact Comark for further details. Does not apply to 451144-01 type HPA controllers (non-screen).
HPA falls to stop mode after brief AC interruption (~5 sec)	Software bug in HPA controller, which manifests itself only under certain external conditions. Problem is non-existent at many sites, but evident at small minority of sites. Cause of

and fails to respond to commands from exciter cabinet or remote control. External HPA control can be re-established by cycling HPA controller from external to internal to external mode.	variability from site to site unknown. A permanent solution may be had by upgrading to a 452117-01 HPA CPU card with code version 3.10 or later. Contact Comark for further details. Does not apply to 451144-01 type HPA controllers (non-screen).
RF output from cabinet disappears as HPA is steered to magic tee reject load. HPA controller spontaneously drops from RF mode to standby mode.	This is normal. IOX/DCX system controller will inhibit RF output of any HPA not called for by current RF system pattern. The determination of current pattern is based on position read back of RF system switches, NOT on commands issued by pattern select buttons. Therefore, an HPA not called for in a given pattern will have its drive inhibited, even if that pattern were entered by manually actuating the RF system switches one at a time. This effect does not occur when an HPA controller is in internal control mode.
Transmitter system drops to standby mode five seconds after being switched from local to remote control.	Failsafe interlock not satisfied. Remote control panel input IN15 must have +24V applied to satisfy failsafe interlock.
Control system behaves erratically. (erroneous faults that will not clear, blower will not come on, control freeze-up)	Possible failure of 452117-01 HPA brain (CPU) board. Verify failure by swapping board with known good unit from spares or other HPA in multi-tube systems. Contact Comark for replacement board. Be sure to indicate software revision level of board when obtaining replacement HPA controller board (e.g. v2.12, v3.01). Does not apply to 451144-01 type HPA controllers (non-screen).
High voltage isolation relay will not remain in position, instantly relaxes when HV connect/isolate button is released.	Incorrect selection of HV isolation relay type in HPA controller configuration. Consult Service Bulletin 040704 for more information on configuration of HPA controller backplane and selection of correct HV isolation relay type.
HPA controller screen indicates NOVRAM errors or failure.	Possible absence of +/- 12V from HPA controller power supply. Remove HPA front panel and check status of +/- 12V LEDs on HPA power supply card (far right). Check continuity of small green pico fuses at rear of card. Replace fuses as necessary. Check for failure of power supply itself. Does not apply to 451144-01 type HPA controllers (non-screen). Possible failure of HPA controller backplane board. Consult Service Bulletin 040704 for more information on troubleshooting / replacing backplane board. Does not apply to 451144-01 type HPA controllers (non-screen).
HPA controller screen indicates “anti-fault.”	HPA control system has observed a condition inconsistent with current operating state (e.g. RF forward power reading while transmitter is only in start mode). Anti-faults are typically due to stuck / malfunctioning sensors. The most common anti-fault is due to a stuck vane on an airflow sensor, thereby registering airflow even when blower is extinguished. Does not apply to 451144-01 type HPA controllers (non-screen).
Any of following conditions after installation of new HPA controller backplane: HV isolation relay fails to stay engaged. FBI supply fails to turn on in start mode. Out of tolerance alarm for filament, beam, bias, or other operating parameter even though levels are correct.	HPA controller backplane has not been programmed correctly. Tube type, HV contactor type, FBI supply type must all be programmed upon installation of a new HPA controller backplane. Requires special password. Contact Comark for more details. Does not apply to 451144-01 type HPA controllers (non-screen).
LCD screen on HPA controller is to too bright, too dark.	Possible misadjustment of screen contrast control. Locate the contrast trimpot on the display driver PCB (**R6**). Use this trimpot to adjust LCD screen contrast. Replace LCD screen or front panel if satisfactory adjustment is not possible.
Multimeter selector button on HPA metering bridge does not work properly. Multimeter remains stuck on top metering selection.	Possible damage to K3 on 450226 Multimeter PCB Assy. Lift HPA metering bridge and inspect K3 for crushed pins or partial ejection from socket. K3 is easily crushed by downward pressure applied to HPA metering bridge. Avoid stepping on HPA metering bridge when on top of HPA cabinet. Remove alignment tabs for pins 4, 5 on orange connector at TB-1 to minimize crush hazard.
Panel View screen on	Possible corrupted programming in system controller. Restore screen programming from

(millennium-style) system controller dark except for "type 633 error" message.	memory via Panel View Screen. Contact Comark for procedure.
Input IN12 does not reset HPA alarms on remote I/O block.	Typographical error on certain versions of remote control pinout listings. HPA fault reset may be on input IN11 with system fault reset on input IN12. Documentation incorrectly shows IN12 as system/HPA fault reset and IN11 as unused. Contact Comark if doubts remain.
Incandescent bulbs in system controller frequently burn out.	Replace incandescent bulbs with LED replacements. Suitable replacements are as follows: (upper white buttons) = LEDtronics FF200-21W-028B (lower buttons) = LEDtronics GF200-21W-028B (lower keypad) = LEDtronics BPF120-OUY-028V This entry applies only to non-millennium system controllers (non-Panel View).
High Voltage Arcs & Crowbars	
Crowbar fires upon application of high voltage.	Arc has occurred in high voltage circuit. Isolate high voltage from IOT by activating HV ISOLATED mode and repeat test. Consult table entries below.
Crowbar immediately and consistently fires upon application of high voltage, does not fire in HV ISOLATED mode.	Possible high voltage arc to ground through solid material such as HV wires, IOT input cavity, or AC isolation transformer to FBI supply. Inspect red HV wire for pinhole burns, especially where wire outer surface makes contact with cabinet ground. Once short circuit develops in solid material, damage is irreversible and crowbars occur immediately. If transmitter withstands HV for even a second, even once, before crowbarring, arcing is most likely across air (corona) or a vacuum (inside IOT). Consult section on arcs through air or vacuum, immediately below. Note: An immediate and consistent arc that is absent upon cold turn on, but appears after 15 -30 minutes of warm up time, is characteristic of a insulation breakdown in the AC isolation transformer to the FBI supply. Swap transformers between cabinets in multi-tube transmitters or test HV standoff with a hipot test set to confirm failure. Consult Service Bulletin 030614 for more information on troubleshooting with a hipot test set.
Crowbar fires after random period of time between 2 sec - 30 minutes after application of high voltage, does not fire in HV ISOLATED mode.	High voltage arc to ground through air or vacuum. Arc may be internal or external to IOT e.g. in the junction box or high voltage compartment. Inspect all HV circuits for oxidation due to corona or carbon marks due to arcing. Look for any sharp edges liable to create corona. Clean dust from all HV standoffs and bushings. Test HV circuits with hipot test set for leakage current and corona. Consult Service Bulletin 030614 for more information on troubleshooting with a hipot test set. It is also possible to have a crowbar falsely triggered by the induced current from a static electric discharge from the HV wire outer jacket to ground. (jacket arc). This type of arc will leave no traces and does not permanently damage the HV wire. Jacket arcs are mostly likely to occur wherever the HV wire approaches, but does not touch, ground – especially if there is a sharp protrusion (screw head, cabinet seam, etc.) in the vicinity. Re-route HV wiring as necessary to eliminate arcing. Crowbar frequency increasing during dry weather or other climatic changes is a sign of arcing external to the IOT due to corona or jacket arcing. Raise bias voltage to most negative setting and reapply beam without RF drive. If high voltage holds with full negative bias, crowbars are most likely internal to IOT. Slowly bring bias voltage more positive until normal idle current is re-established. Re-apply RF drive. Read table entry concerning arcs internal to IOT, immediately below. If arcing continues despite full negative bias setting, lower beam voltage to lowest setting and reapply high voltage. If high voltage holds with lowest beam voltage setting, arcing is probably due to corona, jacket arcs, or a spuriously firing crowbar. Re-inspect all HV circuits external to IOT for source of arcing. Test HV circuits with hipot test set for leakage current and corona. Consult Service Bulletin 030614 for more information on troubleshooting with a hipot test set. If arcing continues despite full negative bias setting and lowest beam voltage setting, test HV standoff of IOT and AC isolation transformer with hipot test set. Replace isolation transformer, IOT input cavity, or IOT itself, as necessary. Consult Service Bulletin 030614 for more information on troubleshooting with a hipot test set.
Crowbar fires after application	High voltage arc to ground through vacuum inside IOT. The presence of ion current after arc

of high voltage, does not fire in HV ISOLATED mode. Arc known to be internal to the IOT.	event serves as a good confirmation that arc is internal to IOT. Note: an ion current reading of as low as 5uA may cause an immediate crowbar upon application of high voltage. Do not attempt to re-apply high voltage until the ion current reading has fallen back to zero. Note: certain brands of IOT do not have an ion pump and therefore do not produce an ion current reading. Arcing inside IOT may be due to the following causes: ➢ Excessive RF drive (or excessive sync stretch in an analog transmitter)...especially in an aging tube with marginal cathode emission. ➢ Excessive IOT filament voltage (often accompanied by negative bias current). ➢ Sudden change in tube operating power level in older tube (tube has acquired "memory" of previous power level). This condition usually clears within a day at the new power level. ➢ Transient overdrive conditions caused by intermittent RF connections, disconnection of AGC feedback cable, or other drive level instability. ➢ Brand new tube is clearing internal burrs, surface irregularities (first month of operation). Attempt to "nurse" IOT back to normal by raising bias voltage to most negative setting, lowering beam supply to lowest tap setting, and reapplying beam without RF drive. If high voltage holds, gradually bring IOT back to normal operating parameters by lowering bias voltage five volts and/or raising beam voltage one tap setting every ten minutes until normal levels are re-established. Activate RF at 10% power and increase power 10% every ten minutes until 100% operation is restored. If arcing continues despite full negative bias setting and lowest beam voltage setting, test HV standoff of IOT. Replace IOT input cavity, or IOT itself, as necessary. Consult Service Bulletin 030614 for more information on troubleshooting with a hipot test set.
Crowbar immediately and consistently fires upon application of high voltage, even in HV ISOLATED mode.	Probable spuriously firing crowbar. Clean dust from crowbar assembly legs, large external resistors on side of crowbar assembly and repeat test. If crowbar continues to fire, measure thyratron filament voltage with voltmeter at base of tube (carefully set aside crowbar cover without disconnecting fan to do this). Filaments should be 6.3V +/- 0.2V. Move tap on isolation transformer in LV compartment to adjust filament voltage, as necessary. Consult Service Bulletins 030605 and 46744354-194 for further details. Possible insufficient high voltage rise-time due to damaged filter resistors and/or capacitors in HV beam supply. Crowbar will spontaneously fire if high voltage ramps up too quickly. Inspect beam supply filter components for signs of damage. Check output signal for excessive 120 Hz ripple (field rate) for confirmation of diagnosis on IOX (analog) transmitters. Replace filter capacitors as necessary. If beam supply shows no signs of damage and crowbar continues to spuriously fire with a filament voltage < 6.3V, thyratron tube should be replaced.
Instant trip of CB3 motorized breaker upon application of beam mode command. Crowbar does not fire.	Possible arc inside transmitter and malfunctioning crowbar. Attempt to establish high voltage with HV isolate relay in HV ISOLATED position. Attempt to establish high voltage with HV-lead disconnected before crowbar (remove J3 from crowbar and suspend in HV compartment away from all metal surfaces). If high voltage is established, in either case, without trip of CB3 breaker, first determine why crowbar is not firing, then search for cause of arc. If high voltage does not hold with J3 disconnected from crowbar, search for possible short circuit in HV conduit leading to transmitter. Disconnect HV- and HV+ return wires at beam supply and attempt to establish high voltage. If CB3 breaker still fires, consult entry on beam supply short circuit, below. If CB3 breaker does not fire, replace HV wires in conduit to HPA cabinet. Possible short circuit in beam supply. Visually inspect components inside beam supply. Search for arc marks or creepage along fiberglass resistor support board. Individually isolate HV filter capacitors and attempt to re-establish high voltage. Remove diode transpack from oil tank and verify diode action with multimeter (one-way conduction). Replace fiberglass resistor board, shorted HV cap, diode transpack or other damaged components as

	necessary.
After arc event(s), IOT Idle current is checked and found to be very low (<200mA). Note: idle current is the beam current with RF drive extinguished.	Possible low beam voltage due to missing phase / damage to CB3 motorized breaker, rotary switch, or other three-phase component. If beam voltage is low, trace three-phase voltages back from beam supply disconnect with voltmeter to find where missing leg disappears. Possible cathode emission temporarily disrupted by full dissipation of arc inside tube due to malfunctioning crowbar. Test operation of crowbar with high voltage isolated from tube and verify crowbar failure. Determine and eliminate source of crowbar malfunction. Consult Service Bulletin 990611 for more information on crowbar test procedures. IOT cathode emission should eventually recover and idle current return to normal after several hours or days of operation in beam-only mode. Contact tube manufacturer for recommended cathode re-activation procedure. Never apply RF to the IOT while it is in this reduced emission condition.
After arc event(s), IOT Idle current is normal but gain (output power) is very low, sync is excessively compressed in NTSC Tx.	Tube cathode emission temporarily disrupted by full dissipation of arc inside tube due to malfunctioning crowbar. Test operation of crowbar with high voltage isolated from tube and verify crowbar failure. Determine and eliminate source of crowbar malfunction. Consult Service Bulletin 990611 for more information on crowbar test procedures. IOT cathode emission should eventually recover and idle current return to normal after several hours or days of operation in beam-only mode. Contact tube manufacturer for recommended cathode re-activation procedure. Never apply RF to the IOT while it is in this reduced emission condition.
Crowbar events frequently interrupt AC power to entire transmitter and/or entire building.	Possible incorrect setting or failure of CB3 motorized breaker. Verify trip setting on CB3 breaker body is set to MIN while any other breakers upstream in AC system are set to MAX (where applicable). Verify that CB3 breaker and motorized actuator are not jammed or otherwise physically damaged. Replace CB3 as necessary. Possible use of incorrect fuses or magnetic breakers in building AC distribution system. Comark specifies BUSS FRS-R type fuses for main Tx feed and each HPA branch feed to prevent spurious AC trips during crowbars. Contact Comark or original installation AC distribution diagram for more details.
Ticking or snapping sound coming from high voltage compartment at regular intervals. Crowbar does not fire and transmitter operates normally.	Static electric discharge from the HV wire outer jacket to ground (jacket arc). This type of arc will leave no traces and does not permanently damage the HV wire. Typically, this type of arc will trigger and fire the crowbar, but this is not universally true depending on the location and size of the discharge. Jacket arcs are mostly likely to occur wherever the HV wire approaches, but does not touch, ground – especially if there is a sharp protrusion (screw head, cabinet seam, etc.) in the vicinity. Re-route HV wiring as necessary to eliminate arcing. Clean dust from all HV standoffs and bushings.
Crowbar only partially discharges HV upon test firing. HV drops, but not completely to zero (< 5kV).	Thyratron tube does not have sufficient internal gas to fully conduct arc to ground. Possible thyratron filament voltage too low. Measure thyratron filament voltage with voltmeter at base of tube (carefully set aside crowbar cover without disconnecting fan to do this). Filaments should be 6.3V +/- 0.2V. Move tap on isolation transformer in LV compartment to adjust filament voltage, as necessary. Consult Service Bulletins 030605 and 46744354-194 for further details. Possible faulty thyratron or thyratron at end-of-life. If filament voltage OK and problem persists, replace thyratron tube.
Crowbar does not fire in response to test button.	Possible thyratron filament voltage too low. Measure thyratron filament voltage with voltmeter at base of tube (carefully set aside crowbar cover without disconnecting fan to do this). Filaments should be 6.3V +/- 0.2V. Move tap on isolation transformer in LV compartment to adjust filament voltage, as necessary. Consult Service Bulletin 030605 for further details. Possible faulty triggering circuits in crowbar, especially U5 thyristor on crowbar low voltage board or T2 toroid on crowbar high voltage board. Attempt to test fire crowbar in start mode with HV compartment door open. NOT TRIGGERED LED on far right of upper HV section should extinguish as test fire command is received. If LED does not change state, trace EXT trigger circuit in crowbar LV and HV PC boards. Replace faulty components. If filament voltage OK and trigger command being received, replace thyratron tube.

Crowbar triggers and fires in response to test button (as evidenced by voltage falling rapidly to zero), but crowbar counter does not advance.	Possible failure of HPA brain (CPU) board. Verify failure by swapping board with known good unit from spares or other HPA in multi-tube systems. Contact Comark for replacement 452117-01 board. Be sure to indicate software revision level of board when obtaining replacement (e.g. v2.12, v3.01). Does not apply to 451144-01 type HPA controllers (non-screen).
Crowbar will not report ready status: one or several green LEDs are extinguished on crowbar HV section (upper section).	Problem with high voltage PCB (upper section) of crowbar, possibly latch-up of U5, U6, or U7 ICs on crowbar high voltage board. Remove cover to HV section and touch chips with fingertip as crowbar warms up. A latched-up chip will be extremely hot to the touch. Chips U5, U6, U7 should all be replaced with retrofit daughter boards. (as of 10/2003) Check for presence of U5 and U6/U7 retrofit daughter boards on HV board. Obtain Comark Service Bulletin 020709 describing retrofit. Consult Service Bulletin 46744354-194 for further details.
Crowbar will not report ready status: All LEDs on HV section (upper section) crowbar are on.	Possible intermittent connection. Break Molex connections and inspect for partially recessed pins. Check crowbar ready status input to HPA controller at connector A7J4 - 10 (rear of HPA controller) for presence of +24V relative to ground. Place jumper between pins P1 - 3, 4 on crowbar Molex plug. If problem disappears, problem is low voltage PCB (lower section) of crowbar, possibly failure of U12 IC. Replace faulty component or PCB (see SB46744354-194 page 4). NOTE: If crowbar assembly revision (451227-01) is prior to REV G review SB020709. If problem remains, place jumper between pins A7J4 - 9, 10 at rear of HPA controller. If problem disappears, problem is intermittent connection in HPA harness. If problem remains, replace HPA controller CPU card.
Crowbar requires full 10 minute warm-up period after intermittent AC interruption.	Possible failure of C14 capacitor on crowbar low voltage board. Replace faulty component.
Crowbar counter advances hundreds of counts after crowbar assembly is replaced.	Spurious crowbar counting due to crowbar assembly being disconnected while HPA controller is still powered up. Always remove power to both crowbar assembly and HPA controller using front panel CROWBAR and CONTROL POWER breakers whenever crowbar assembly is replaced / serviced.
High voltage drops out with crowbar triggered alarm. Crowbar does not fire and motorized breaker does not trip.	Intermittent connection in crowbar NOT TRIGGERED line. Consult schematics 451262 and 450349 in crowbar chapter (8) in HPA manual. Check for intermittent connection in NOT TRIGGERED fiber optic cable between upper and lower sections or J1 Molex connector. Trace logic signal through HV and LV PCBs. Any interruption of the NOT TRIGGERED signal will cause this condition. Check for presence of U5 retrofit daughter board in U5 socket on HV board. Obtain Comark Service Bulletin 020709 describing retrofit. Consult Service Bulletin 46744354-194 for further details.
Instantaneous body, beam, or positive grid current alarm upon application of high voltage.	Possible grid neutralization problems with Comark IOT. Consult manufacturer instructions for proper adjustment of neutralization circuits
IOT Focus and Body Current	
Body current alarm. Crowbar does not fire. Motorized breaker does not trip.	Possible grounding of IOT collector or collector return lead. Check for grounded metal objects touching collector. Check integrity of video bypass capacitors from collector to ground. Note: does not apply to tubes with grounded collectors. Possible arc in beam supply. Occasionally, in the case of mild short circuits in the beam supply, the body circuit will alarm before the motorized breaker trips. Visually inspect components inside beam supply. Search for arc marks or creepage along fiberglass resistor support board. Search for moisture or other paths to ground in HV air compartment of beam supply. Replace damaged components as necessary. Possible arc internal to beam supply capacitors or C1 in high voltage compartment (white 0.1 uF cap) due to intermittent connection. When a capacitor develops an intermittent connection, high voltage will (internally) flash across broken connection, thereby causing an inrush transient (body current alarm), but voltage across capacitor quickly stabilizes, thereby

	preventing a total HV collapse (crowbar). Replace suspected capacitors to prove diagnosis. Possible transient trip at turn-on due to inrush current in C1 in high voltage compartment (white 0.1 uF cap). C1 is not required for ATSC service and may be removed in all DCX transmitters. C1 is required in most IOX transmitters for video line-rate filtering and may not be removed. Problem is extremely rare in IOX transmitters, but may be alleviated by re-routing C1 ground wire to HV+ line returning to beam supply.
Tube withstands high voltage w/ normal idle current, but trips on excessive body current (only) when RF is applied. Crowbar does not fire.	Possible improper video bypassing of collector. Check integrity of video bypass capacitors connected between IOT collector and ground. Turn off HV and discharge collector before performing check as a safety precaution. Possible problem with magnetic focusing circuit. Check for proper focus current and focus voltage.
Focus current or focus voltage erratic, unstable.	Possible dried out or burst electrolytic capacitors. Replace electrolytic capacitors in supply. Possible faulty regulator chip IC1. Replace IC1.
Whistling sound (like tea kettle) coming from collector.	Localized boiling of coolant inside IOT collector water jacket due to excessive focus current or insufficient cooling. Lower focus current. Check for adequate cooling flow to collector. Disassemble & clean or replace clogged cooling system components, as necessary.
RF Output Level and IOT Tuning	
Beam on, RF mode on, but no RF at output. All LEDs on driver status panel either red or extinguished.	Failure of driver power supply in HPA cabinet. Check for presence of AC at power supply input. Check status of circuit breaker on AC distribution panel. Check for proper operation of internal power supply fan. Temporary relief for faulty fan may be had by adding external fan. Check power supply output unloaded with voltmeter. Either isolate bad (shorted) load or replace faulty power supply unit.
Output power level is unstable, bi-stable. Power drops in level and exciter output is raised to compensate. Gain returns suddenly causing forward overpower alarm	Cold solder joint or other intermittent connection in drive stage. Check coaxial drive cables for recessed or misaligned inner pins. Mechanically vibrate drive cables, IPA splitter plate, IPA combiner plate, and observe effect on output power level. If suspected, diassamble IPA combiner or splitter plates and inspect for signs of damage or cracked solder joints.
Little or no output power from IOT. High power from circulator reject port at IOT input. Poor null of input return loss for IOT.	Possible incorrect input tuning. Attempt to tune IOT according to Service Bulletin 030528 or 030615. If IOT input will not tune correctly, possible damaged input connector to IOT inside input cavity. IOT input cavity must be replaced.
IOT tuning very sensitive to mechanical shock, especially input return loss.	Input drive cable or coupling loop loose inside input cavity. Repair may be possible on-site with partial cavity disassembly. Contact Comark or tube manufacturer.
Transmitter metering circuits sensitive to opening and closing of HPA doors. Metering indications change more than 5% according to door position.	Possible RF leak from IOT due to poorly seated cavities and / or missing finger stock. Check IOT cavities for proper mechanical seating. Measure ambient radiated power with ANSI-type radiation meter. Ensure that radiation level is below ANSI standard.
Each HPA cabinet has flat frequency response when measured individually, but combined system response is tilted.	Incorrect intercabinet RF phasing. Intercabinet phasing off by 15 or more RF wavelengths. Add or subtract drive cable length to one HPA cabinet to improve frequency response.
HPA cabinet phasing trombone or RF attenuator at end of adjustment range.	Re-center adjustment range by adding N-barrel(s) to drive path opposite phasing trombone (i.e. path with attenuator) or N-attenuator pads to drive path opposite attenuator (i.e. path with trombone). Consult system RF flow diagram to determine proper location of pads or barrels.

Rippling of IOT swept response (greater than +/- 0.5dB). Ripples do not change in frequency as IOT is retuned.	VSWR at IOT output or on RF sample cable to analyzer. Add 6dB attenuator pads on each end of sample cable. Check VSWR performance of RF dummy loads. Note changes in frequency response as tube output is steered from combiner reject load to system test load (where applicable). Also, verify integrity of ballast load at input to balanced RF mask filter (where applicable). It is normal to see VSWR ripples less than +/- 0.5dB in amplitude.
Drive power higher than normal, beam current and output power lower than normal.	Possible mistuning of IOT input cavity and input tuner (where applicable). Retune IOT as necessary. Consult Service Bulletin 030528 or 030615 for more details.
Drive power and beam current higher than normal, output power lower than normal.	Possible mistuning of IOT output cavities. This is especially true for NTSC/PAL, where almost all of energy is concentrated at vision carrier frequency. A frequency rolloff at vision carrier will have a profound effect on measured IOT gain and efficiency. Retune IOT as necessary. Consult Service Bulletin 030528 or 030615 for more details.
Output power and beam current drop after first minute of operation.	Possible loose stackpole resistor. Check mechanical tightness of stackpole resistors in HV compartment. Replace fiberglass center rod as necessary. Consult Service Bulletin 030331 for more details.
Output power drops 20-30% on one HPA. Drive power also reduced by similar value. Remaining HPAs at full power.	Possible failed IPA amplifier. Check driver status panel for alarm indications or extinguished LEDs. Disconnect feed to single IPA amplifier at RF splitter plate, record drop in power, and reconnect feed. Test each IPA amplifier in turn with this procedure. If particular IPA causes little or no drop in power, amplifier may require replacement. Kill RF drive while making/breaking each RF connection as a safety precaution. Cold solder joint or other intermittent connection in drive stage. Check coaxial drive cables for recessed or misaligned inner pins. Mechanically vibrate drive cables, IPA splitter plate, IPA combiner plate, and observe effect on output power level. If suspected, diassamble IPA combiner or splitter plates and inspect for signs of damage or cracked solder joints.
Arc Detectors (output cavities)	
Transmitter fails to come ready for beam mode due to blinking arc detector alarm.	Arc detector has failed auto-test during transmitter warm up. Possible faulty arc detector photocell or burned out test bulb (inside output cavity). Test arc detector functioning with arc detect test button on HPA control panel. If arc detectors fail test (blinking red LED), remove photocell and bulb assembly from output cavity and repeat test. If bulb does not light during test, replace bulb. If no voltage is reaching bulb during test, verify wiring to bulb, verify HPA controller fuses, and replace HPA brain board as necessary. If bulb is lighting during test, replace arc detector photocell. The HPA controller records the results of the last arc detector test in memory. Issue following commands on HPA LCD control screen to access stored arc detector test results: **Information Access > System Operations > HPA Maintenance > Messages > Arc test**. Screen will display three numbers: OFF resistance, ON resistance, and threshold resistance. For a properly operating photocell and bulb combination, the OFF resistance should be > 2 Megohm and the ON resistance ~ 1kohm. Does not apply to 451144-01 type HPA controllers (non-screen).
Transmitter drops to start mode from operating state due to arc detector alarm.	Arcing in output cavities due to one of following causes: ➢ Damaged or loose finger stock in output cavities. Disassemble and inspect output cavities for visible signs of arcing and damage. Inspect RF output stack for damaged watchband spring bullets. ➢ Dust, moisture, or other foreign contaminants in output cavities. Disassemble and clean output cavities. ➢ Excessive aural ratio (NTSC/PAL only). Check aural ratio with spectrum analyzer. Aural carrier must be at least 10dB below peak visual carrier. Adjust aural ratio with exciter potentiometer B4-17 as necessary. ➢ Incorrect output tuning response (typically too narrow). Check output tuning response. Retune as necessary. Consult Service Bulletin 030528 or 030615 for further details.

	➢ Undesired second harmonic mode in RF output stack. Check for presence of high second or other harmonic levels at IOT output directional coupler. Offsetting cavity tuning doors or changing orientation of low pass filter may solve problem. Contact Comark for procedures. Possible spurious trip of arc detector due to incorrect threshold in HPA controller. The HPA controller determines the arc detector trip point based on photocell performance during the self test routine executed when the HPA enters standby mode. If the self-test has been performed with a malfunctioning arc detector photocell or bulb, the trip point setting may not have adequate margin for normal operational variances. Possible spurious trip of arc detector photocell caused by fluorescence (glowing) of output window ceramic due to electron bombardment. Very rare problem. NEVER attempt to view output ceramic while tube is operating (X-ray hazard). Contact tube manufacturer for further instructions.
Transmitter fails to come ready for beam mode due to yellow arc detector interlock alarm.	Arc detector interlock loop interrupted. Check integrity of arc detector connections, magnet cart focus coil connection, input cavity lid position (where applicable), tube socket sensor position (where applicable).
Reverse Power	
Sudden reverse power alarm. Multiple HPAs trip simultaneously in multi-tube system. Body current alarm may also be present.	Arc or dead short in RF output system. Infinite VSWR at IOT output gap disrupts normal operation and causes beam to scatter, thereby also causing excessive body current. Switch transmitter to dummy load to determine if arcing is occurring in antenna & tower transmission line or in transmitter RF system. Inspect transmission line for localized hot spots. Disassemble and inspect any suspect areas of transmission line for internal damage. If search for damaged component unsuccessful, disconnect HPA reverse power RF sample cable(s) and allow transmitter to operate into arc for five seconds. Listen for origin of arcs. Disassemble RF output system and inspect for damaged components.
Sudden reverse power alarm on single HPA cabinet. Body current alarm may also be present.	Arc or dead short in RF output system. Infinite VSWR at IOT output gap disrupts normal operation and causes beam to scatter, thereby also causing excessive body current. Inspect HPA output stack and coaxial line for localized hot spots. Disassemble and inspect any suspect areas of transmission line for internal damage. Concentrate search on watchband spring bullets, loose bullets, and the harmonic filter. If search for damaged component unsuccessful, disconnect HPA reverse power RF sample cable and allow transmitter to operate into arc for five seconds. Listen for origin of arcs. Disassemble RF output system and inspect for damaged components.
Reverse power readings do not agree between HPA and system power meters.	Assuming meter calibrations have not been disturbed, some reverse power meter disagreement is normal, especially in analog IOX transmitters. This is because the majority of the power in an analog (NTSC/PAL) signal is concentrated at the visual carrier frequency. Accordingly, the reflected power reading depends heavily on the VSWR level at the visual carrier frequency, which is very “location-dependent” in an RF system. It is possible for one HPA to have a VSWR null at the visual carrier frequency while another HPA has a maximum. It is also typical for these nulls & maxima to change frequency as the RF system pattern is changed. As long as all reflected power readings are below 2%, there is no reason for concern.
Filament, Bias, and Ion (FBI) Supply	
Bias current alarm. Bias current is negative.	Contamination of IOT grid with emissive material boiled off cathode. Filament voltage too high. Slightly reduce IOT filament voltage. Report problem to tube manufacturer before taking action.
Bias current alarm. Bias current is positive.	IOT grid being driven positive due to RF overdrive at input. Find and eliminate cause of RF overdrive. Check output tuning response (too wide response = lower gain). Crowbar may also fire in extreme cases of transient overdrive. Lower drive power to 75%. If positive grid current remains, imminent IOT failure due to internal structural damage is probable. Contact tube manufacturer for further instructions and to line up replacement IOT. If positive grid current is instantaneous upon application of high voltage: possible grid neutralization problems with Comark IOT. Consult manufacturer instructions for proper

	adjustment of neutralization circuit.
Bias supply folds back to zero, acts erratically upon application of filament voltage or beam voltage.	Possible faulty bias supply, especially type #46745360 FBI supply (millennium). Replace faulty supply. Always check filament voltage (E2V, L3) or current (Comark, CPI) calibrations upon installation of a new FBI supply. Consult Service Bulletin 030524 for more details. Possible IOT grid shorted to filaments inside tube. Simultaneous disruption in filament voltage, filament current, or grid current is good indication that problem is IOT and not power supply. IOT must be replaced.
As drive power is increased, HPA output power (and beam current) hits a maximum then starts to decrease. Bias voltage increases as drive is further increased.	Possible faulty bias supply. Supply not able to draw positive grid current (sink electrons), thereby causing grid voltage to creep negative and pinch off tube as drive power is increased. Troubleshoot grid supply or replace faulty FBI supply.
Transmitter spontaneously shuts down filaments and returns to cooling mode. Filament overvoltage alarm with excessive filament current or filament voltage otherwise erratic, unstable. Ratio of filament voltage to current is normal but absolute levels are too high or too low.	Possible filament supply problem. Type #405343-03 FBI supply: possible faulty regulator chip IC1 or electrolytic capacitors. Replace IC1 and/or electrolytic capacitors in supply. Type #46745360 FBI supply (millennium): replace faulty supply. Always check filament voltage (E2V, L3) or current (Comark, CPI) calibrations upon installation of a new FBI supply. Consult Service Bulletin 030524 for more details. Verify correct operation of filament supply by using IOT focus coil as filament dummy load. Use heavy gauge wires and spare focus coil connector to connect filament supply output across focus coil input on magnet cart (polarity not important). If spare focus connector not available, use butt splices snugly slid over male focus input pins. FBI supply should run in start mode for approximately three minutes until Tx shuts down for lack of focus current. During this time, it should be possible to verify that filament supply is not operating correctly. If filament operates correctly into dummy load, consult entry on IOT filament failure, below. Ready-made focus-as-filament load adapter cables are available from Comark. Request part numbers 453234-01 (Comark IOT) 453235-01 (EEV & L3 IOT).
Transmitter spontaneously shuts down filaments and returns to cooling mode. Filament voltage is incorrect while filament current is OK or vice versa. Ratio of filament voltage to current is abnormal.	Possible partial failure of tube filaments. Verify correct operation of filament supply by using IOT focus coil as filament dummy load. Use heavy gauge wires and spare focus coil connector to connect filament supply output across focus coil input on magnet cart (polarity not important). If spare focus connector not available, use butt splices snugly slid over male focus input pins. FBI supply should run in start mode for approximately three minutes until Tx shuts down for lack of focus current. During this time, it should be possible to verify that filament supply is operating correctly, thereby indicating IOT filament failure. IOT must be replaced. Ready-made focus-as-filament load adapter cables are available from Comark. Request part numbers 453234-01 (Comark IOT) 453235-01 (EEV & L3 IOT).
Excessive filament voltage with little or no filament current.	Filament circuit open due to either disconnected lead or burned out IOT filaments. Reconnect lead if disconnected. Replace tube if filaments burned out. Consult entry above concerning abnormal filament voltage to filament current ratio.
Filament voltage drops approximately 0.3V after a crowbar event.	This entry applies only to type #46745360 FBI supplies (millennium) rev. C or lower. FBI internal control has been disrupted by crowbar surge. Recycling AC power to HPA controller will send a reset command to the FBI supply and eliminate discrepancy. Do NOT attempt to raise the filament voltage setting 0.3V to compensate. If transmitter should recycle for other reasons, filaments will jump to higher setting.
Filament current folds back as RF output power is increased. Filament voltage remains essentially constant.	Unwanted RF or video current appearing across filament supply terminals causing metering error or inappropriate foldback of power supply regulator. Check video bypass capacitors in input cavity. Add snap-on ferrite chokes to filament & bias leads coming from IOT input cavity. Applies mostly to type 405343-03 FBI supplies (non-millennium).
Filaments very slow to come to full voltage upon start up. Eventually results in filament undervoltage alarm.	This entry applies only to type #405343-03 FBI supplies (non-millennium). Possible misadjustment of current limiting potentiometer R4 on filament regulator PCB. Current limiting threshold must be set to maximum for filaments to properly turn on.

	This problem is most likely to surface after installation of a new / repaired filament supply.
Ion voltage alarm. Ion pump voltage sagging or absent.	Ion pump power supply defective. Unit must be replaced. Some temporary relief for sagging ion voltage may be had by increasing ion pump voltage adjustment.
Steady ion current indication that does not diminish with time (over 3+ hours).	Possible piece of charged debris stuck to ion pump electrode inside ion pump. Gently tap on ion pump chamber with metal object (with ion pump off) to dislodge debris.
Sudden spikes of ion voltage and/or ion current.	Possible failure of ion supply. Disconnect ION lead from FBI supply to IOT. If trips persist, replace faulty FBI supply.
High ion current indication or spurious ion current trips after replacement of Spellman ion power supply in type 405343-03 (non-millennium) FBI supply.	Type 453225-01 ion power supply retrofit requires a .01 ceramic disc bypassing capacitor across ion current metering shunt resistor R3 on ion regulator PCB. Consult Service Bulletin 040706 for more details.
FILAMENT/BIAS/ION breaker trips on AC distribution panel.	Possible internal failure of FBI supply. Observe filament, grid bias, and ion currents for signs of excessive current draw. If none found, replace faulty FBI supply.
Filament, bias, or ion voltage and/or current reading(s) incorrect (>10% error). Impossible to calibrate meters because reading(s) are frozen, do not track correctly.	Possible failure of fiber optic transmitter inside FBI supply. For type #405343-03 FBI supplies, swap lid with another FBI to see if problem follows FO xmtr (mounted on lid). Replace entire FBI supply for type 46745360 (millennium) FBI supply
FO loop alarm.	Possible damage to fiber optic cable between FBI supply and control system. Check FO cable integrity, looking for kinks or excessive bends. Remove FO cable from socket at receive end at check for presence of red glow. Verify that FO cable connectors are fully inserted in their respective sockets. Possible no AC power to FBI supply. Verify presence of appropriate AC input voltage(s) at input to FBI supply. Eliminate cause of AC power interruption. Verify FILAMENT / BIAS / ION breaker is in ON position. Ensure that all relays on relay distribution panel are firmly in sockets. If cables are OK and FBI supply is receiving power, replace FO transmitter card (405307-01) for type 405343-01 (non-millennium) FBI supply. Replace entire FBI supply for type 46745360 (millennium) FBI supply. If problem persists, contact Comark for possible HPA controller backplane replacement.
Air and Liquid Cooling	
Cabinet airflow or cavity airflow alarm upon restarting transmitter. Blowers appear to be functioning correctly.	Vane of airflow switch mechanically stuck. Carefully tap body of switch to dislodge vane. If problem persists, remove switch cover and inspect switch. Be careful to not short circuit voltage to switch. This may cause power supply fuses in HPA controller to open. Do not squeeze sheet metal cover to switch as this will crush cover and cause a short circuit condition.
Cavity blower operation intermittent. Blower stops while transmitter is operating.	Possible failure of low-level driver relays, especially auxiliary contacts on three-phase power monitor. Check three-phase power monitor for proper threshold setting and green OK LED. Tap on three-phase power monitor to clear stuck contacts for temporary relief. Replace intermittent relay as necessary.
Solid metallic / black particles are seen flowing in glycol through flow meter sight glass.	Possible deterioration of IOT collector. Contact IOT manufacturer immediately.
Glycol in cooling system changes color, loses color.	Chemical changes in glycol, which may or may not require cooling system flushing. Test pH and corrosion properties of glycol and obtain second opinion from glycol vendor and/or IOT manufacturer. Glycol properties should be tested and cooling system flushed at regular intervals as part of maintenance program. Consult transmitter Operator's Manual for more information on cooling system procedures. Use only Comark-approved liquid coolants. Never use industrial grade ethylene glycol.

	Serious damage to transmitter may result.
HPA flow meter indicates full liquid cooling flow to tube even with valve closed.	Flow meter mechanically stuck due to dried / crusted glycol. Disassemble switch and clean with denatured alcohol. Check proper operation of flow meter and flow meter interlock at regular maintenance intervals. This is important to prevent switch jamming: a potentially dangerous condition that can lead to IOT destruction, should the flow be interrupted and the flow switch fail to activate the alarm.
DCX (ATSC) only	
Inability to achieve proper reduction of adjacent channel sidebands through precorrection.	Incorrect nonlinear (LUT) precorrection. Run LUT precorrection routine using ADAPT Control software to improve sideband suppression. Consult Service Bulletin 040126 for more details. If adjacent channel sideband suppression is only slightly out of spec (< 2 dBs) after several (> 5) iterations of LUT routine: ➢ Possible incorrect alignment of CUDC module upconverter and downconverter sections. For exciters equipped *with* OLDC module, check CUDC alignment by issuing command **Compute > OLDC > Rejection** and **Compute > OLMC > Quality**. “Rejection” reading returned should be greater than 50dB. “Modulator Adjustment” reading returned should be less than 1%. If returned reading exceed recommended values, consult entry on “CUDC requires alignment.” For exciters *without* OLDC module, check for presence of spurious LO carrier at exact center of channel on spectrum display. ➢ Verify that beam voltage is correct and HVPS is on correct tap (more beam voltage = less peak compression). ➢ Verify that IOT output tuning is correct (wider tuning = less peak compression). Consult Service Bulletin 030615 for more details. Pay special attention to input return loss tuning, and trim input return loss tuning while IOT is operating at 100% power. ➢ Check filament voltage (or current), especially if filament voltage recently reduced for filament management purposes (Insufficient filament voltage = increased peak compression) ➢ Check system output power calibration (true power too high?). ➢ Check that all driver amps report OK status (green LED) on driver status panel. (excessive peak compression due to missing amplifiers?). ➢ Check that all exciter parameters are correct by issuing commands **Get > CUDC > All** in ADAPT Control software and comparing settings with those recorded at time of proof of performance. ➢ Reset correction and attempt LUT correction again. Caution: transmitter power will most likely jump upwards when LUT correction is reset or bypassed. If adjacent channel sideband suppression is significantly out of spec after several (> 5) iterations of LUT routine or steps above did not resolve problem: ➢ Possible low gain or soft failure of amplifying stage Connect correction feedback sample cable to output of each IOT, each drive stage, and calculate peak to average ratio by issuing commands **Correction Commands > Feed Back** in ADAPT Control software. Observe and record "peak power factor" parameter at output of each stage. Divide peak power factor by 1000 to get peak to average ratio in dBs (e.g 9450 = 9.45 dB). Compare to readings made while transmitter was last operating in spec. Look for a stage with an excessive drop in peak to average ratio. Note: the random nature of the 8-VSB signal causes the peak power factor result to vary slightly each time the calculation is performed. It may be desirable to average five consecutive readings or use an external real-time 8-VSB test set with averaging to increase reading accuracy. ➢ Possible incorrect setting of DAP power boost (clipping) function. Check power boost setting by issuing following commands in ADAPT Control software: **Get > Power Boost > Status**. Power boost should be set to OFF, or possibly "table number 5".

	Change power boost setting as necessary by issuing commands: **Set > Power Boost > Off**. ➢ Possible corruption of precorrection routine due to poor RF sample feedback. Check RF sample arriving at exciter for proper frequency response using spectrum analyzer. Issue commands **Correction Commands > Feed Back** in ADAPT Control software to check I and Q feedback levels. The “max I” and “max q” values reported should be approximately 24000. Adjust RF feedback level into exciter, as necessary. ➢ Possible error in test equipment due to input signal overload. Add attenuators to RF sample input to test equipment. Consult test equipment manual for further instructions. Perform independent verification of signal quality with Comark Scout monitoring software or by issuing commands **Compute > Shoulder Level > Feedback** in ADAPT Control software. “Shoulder level” reading returned will approximately equal the adjacent channel sideband level as reference to the in-band pedestal level (-37dB = FCC spec). ➢ Possible failure of one or more exciter modules. Verify proper exciter operation by checking quality of exciter output at connector J23 with all corrections cleared **(Correction Commands > Clear Linear and Clear Nonlinear)**. Adjacent channel sideband level should be less than -50dB and SNR less than 35dB as viewed on appropriate test equipment or Comark Scout software. Signal quality may also be measured by looping exciter output back to DAP feedback input (Loop J23 back to J16 (or J50 w/ OLDC) on ADAPT backplane and pad accordingly to obtain max I and max Q levels = 24000). If no test equipment available, check output signal quality by issuing commands **Compute > Shoulder Level > Feedback** and **Compute > Filter Ripple** in ADAPT Control software. With all correctors cleared, “Shoulder Level” value returned should be greater 40dB. “Filter Ripple” value returned should be less than 20 cdB. If these values are not possible, consult entry on “CUDC requires alignment,” below. If satisfactory performance is still not possible after a successful CUDC alignment, contact Comark for possible module replacement. ➢ Possible convergence problems in precorrection routine poor SNR in feedback sample (poor ALE linear correction). Verify that signal to noise ratio at feedback sample point is at least –27dB. To achieve excellent LUT results, ALE correction (i.e. SNR) must be acceptable and vice versa. It may be necessary to perform ALE and LUT correction in alternation until this goal is obtained. If this is not possible, attempt nonlinear LUT correction with RF sample cable before channel mask filter (with ALE cleared), save LUT correction, and proceed to perfect ALE correction. ➢ Possible convergence problems in precorrection routine due to presence of strong adjacent channel signal. Attempt nonlinear correction with RF sample cable before channel combiner. ➢ Possible failure of video bypass capacitor in IOT input cavity. Physically inspect bypass capacitor for signs of damage. Location of bypass capacitor will vary according to IOT make and model, but is always in close proximity to the IOT grid. Replace damaged capacitor as necessary. Contact tube manufacturer for further instructions.
Inability to achieve acceptable EVM (SNR) numbers through precorrection.	Consult Service Bulletin 040126 for more details. Possible incorrect alignment of CUDC module upconverter and downconverter sections. For exciters equipped *with* OLDC module, check CUDC alignment by issuing command **Compute > OLDC > Rejection** and **Compute > OLMC > Quality**. “Rejection” reading returned should be greater than 50dB. “Modulator Adjustment” reading returned should be less than 1%. If returned reading exceeds recommended values, consult entry on “CUDC requires alignment.” For exciters *without* OLDC module, check for presence of spurious LO carrier at exact center of channel on spectrum display. Possible corruption of precorrection routine due to poor RF sample feedback. Check RF sample arriving at exciter for proper frequency response using spectrum analyzer. Issue commands **Correction Commands > Feed Back** in ADAPT Control software to check I and Q feedback levels. The “max I” and “max q” values reported should be approximately 24000. Adjust RF feedback level into exciter, as necessary, to obtain reading close to 24000. Possible error in test equipment due to input signal overload or poor quality RF sample. Add attenuators to RF sample input to test equipment. Consult test equipment manual for further

	instructions. Perform independent verification of signal quality with Comark Scout monitoring software or by issuing commands **Compute > Filter Ripple** in ADAPT Control software. A "Filter Ripple" reading of 20 cdB or less generally indicates good transmitter SNR. Possible convergence problems in precorrection routine due to high adjacent channel sidebands in feedback signal (poor LUT nonlinear correction). Verify that adjacent channel sideband level at feedback sample point is at least –37 dB below in-band signal. To achieve excellent ALE results, LUT correction (sidebands) must be acceptable and vice versa. It may be necessary to perform ALE and LUT correction in alternation until this goal is obtained. Possible convergence problems in precorrection routine due to presence of strong adjacent channel signal. Attempt linear correction while adjacent channel transmitter is extinguished and save correction settings. Operate in fixed correction mode. Possible failure of one or more exciter modules. Verify proper exciter operation by checking quality of exciter output at connector J23 with all corrections cleared **(Correction Commands > Clear Linear and Clear Nonlinear)**. Adjacent channel sideband level should be less than –50dB and SNR less than 35dB as viewed on appropriate test equipment or Comark Scout software. Signal quality may also be measured by looping exciter output back to DAP feedback input (Loop J23 back to J16 (or J50 w/ OLDC) on ADAPT backplane and pad accordingly to obtain max I and max Q levels = 24000). If no test equipment available, check output signal quality by issuing commands **Compute > Shoulder Level > Feedback** and **Compute > Filter Ripple** in ADAPT Control software. With all correctors cleared, "Shoulder Level" value returned should be greater 40dB. "Filter Ripple" value returned should be less than 20 cdB. If these values are not possible, consult entry on "CUDC requires alignment," below. If satisfactory performance is still not possible after a successful CUDC alignment, contact Comark for possible module replacement.
CUDC requires alignment. Modulator Adjustment parameter is greater than 1% or OLDC Rejection parameter is less than 50dB, thereby indicating that CUDC requires alignment. Presence of spurious LO carrier in exact center of RF channel, thereby indicating that CUDC requires alignment.	The I and Q baseband signals passing through the upconverter and downconverter sections of the CUDC module must be properly balanced and have no DC offset for proper modulation/demodulation to occur. Extreme misadjustment of the I and Q offsets in the modulator section will cause a spurious LO carrier to appear in the exact center of the RF channel. Extreme misadjustment of the I and Q offsets in the demodulator section will prevent the automatic precorrection routines from operating properly. The adjustment of the I and Q offsets must be performed manually in those exciters not equipped with the OLDC module. The CUDC may be aligned automatically in those exciters equipped with the OLDC module by invoking the OLDC and OLMC routines in ADAPT Control software. **Never, under any circumstances, adjust the factory-preset manual offset potentiometers available at the front of the CUDC module.** ➢ For manual adjustment of modulator offsets, issue following commands in ADAPT Control software: **Set > CUDC > I Mod Offset** and **Q Mod Offset**. Iteratively adjust I and Q offset levels to achieve an acceptable null of LO carrier on spectrum display. ➢ For automatic adjustment of modulator offsets, issue following commands in ADAPT Control software: **Correction commands > New OLDC** and **New OLMC**. Software will adjust offsets automatically. If OLDC or OLMC fail to converge on an acceptable result, use manual adjustment procedure to achieve coarse result, and re-run OLDC & OLMC for fine-tuning. Running an iteration of linear (ALE) correction **(Correction Commands > New Linear)** may also help OLMC to converge to an acceptable level of modulator adjustment.
Picture locked (freeze-frame) or macro-blocking in decoded signal.	Possible loss of MPEG lock in 8VSB module due to incoming MPEG signal problems. Check status of data LED on 8VSB module indicating presence MPEG lock. Reset 8VSB module by interrupting incoming MPEG stream. Remove cable from J9 on ADAPT backplane or break incoming signal connection at other point in SMPTE-310 chain. If MPEG stream resets after connection is broken and re-established, contact Comark to obtain retrofit P/N 46745569 - SMPTE310M Lock Detection Upgrade Kit. If lock is not re-established, verify MPEG signal integrity by decoding SMPTE-310 stream with professional ATSC decoder/analyzer (with direct SMPTE-310 input). Consult Service Bulletin 030424 for more information on checking SMPTE-310 stream integrity. Possible problems in receiver/decoder due to poor transmitted EVM (SNR). Check transmitted EVM with vector signal analyzer or 8-VSB test set. As a general rule, SN ratios less than 20dB can have a negative impact on reception. SN ratios approaching 15dB will

	prevent all reception. Consult table entry on EVM problems, above.
No picture in decoded signal	Possible problems in incoming data stream. Disconnect incoming transport stream from J9 at rear of exciter and connect to test equipment with SMPTE-310 / MPEG decode capabilities. If stream does not decode properly, check encoder/multiplexer settings such as PSIP tables and data frequency. Reprogram MPEG equipment as necessary until successful decode results. Comark offers customer support for MPEG processing equipment. Contact Comark at 1-800-345-9295. If stream decodes properly, reconnect to J9 and check for presence of data light on user interface module. If light is on (yellow), remove 8VSB module and check backplane connector for J9 with high-powered flashlight for crushed “inner” pin. If pin is crushed, replace exciter backplane. If data light on user module is off, problem may be due to poor transmitted EVM (SNR). Check transmitted EVM with vector signal analyzer or 8-VSB test set. As a general rule, SN ratios less than 20dB can have a negative impact on reception. SN ratios approaching 15dB will prevent all reception. Consult table entry on EVM problems, above.
Precorrection routine introduces tilt / ripple into in-band signal.	Poor quality RF feedback due to VSWR on RF sample cable. Check frequency response of feedback signal on cable with spectrum analyzer. Possible corruption of precorrection routine due to poor RF sample feedback. Check RF sample arriving at exciter for proper frequency response using spectrum analyzer. Issue commands **Correction Commands > Feed Back** in ADAPT Control software to check I and Q feedback levels. The “max I” and “max q” values reported should be approximately 24000. Adjust RF feedback level into exciter, as necessary.
Low or no RF power output from exciter.	Possible failure of CUDC or RF preamp of ADAPT exciter. Measure RF output at output of CUDC module (J15) and RF preamp (J23) with average power meter. Output of CUDC should be approximately -10dBm. Output of RF amp should be between +7 and +17dBm, depending on the transmitter vintage. Check signal quality at these points with spectrum analyzer or other test gear. Front panel LED on CUDC should be orange (MGC mode) or green (AGC mode)l; a red LED indicates a failure. Front panel LED on RF preamp should be solid green; a blinking green or extinguished LED indicates failure. Consult ADAPT User's Guide for further details. Replace faulty ADAPT modules, as necessary. Possible failure of LO synthesizer module. Check for presence of red unlocked indicator on front of module. Output of LO synthesizer should be approximately +10 dBm at the channel center frequency when measured at output of mini-coaxial jumper W1 (or LO sample BNC on OLDC daughter board w/ OLDC). Consult ADAPT User's Guide for further details. Replace faulty module, as necessary. Note: it is a good idea to record readings at J15, J22, J23, and W1 while transmitter is operating correctly to have a reference should problems develop in the future. Possible incorrect LO frequency. RF output may be present, but on wrong channel. Check for correct LO frequency using spectrum analyzer and/or frequency counter connected to mini-coaxial jumper W1 (or LO sample BNC on OLDC daughter board w/ OLDC). The LO frequency should be the center channel frequency. The LO frequency is programmed at the factory, but may be changed in the field with special software permissions. Contact Comark for more details. This problem is most likely to surface after the replacement of an LO module. Possible exciter preamplifier temperature shutdown. Check green LED on exciter preamplifier module. Check operation of cooling fan tray, as necessary. Possible exciter turned off. Verify exciter status by checking green RF DRIVE LED on user interface module. Switch exciter to local LCL mode with RF DRIVE switch in UP position to force exciter on for testing purposes. Force exciter on via software by issuing following commands in ADAPT Control software: **Set > CUDC > RF On.**
Inability to raise or lower power.	Possible saturated digital power control. Check MGC and AGC power levels using ADAPT Control software by issuing commands **Get > CUDC > All**. If AGC or MGC level is above 128, lower power level setting using **Drive Commands > Lower Power** commands. Remove attenuators from elsewhere in drive chain to restore power to 100%. Possible incorrect usage of adaptive correction, endless correction loop. Exciter will not respond to power level commands while running correction routines. Adaptive correction system is designed to remain inactive until certain distortion thresholds are exceeded and

	then run correction routines only until the thresholds are again met. If thresholds are not correctly set or cannot be met due to a failure in the amplifier chain, exciter will run endlessly in adaptive mode, thereby locking out external control. Most users avoid this possibility by activating adaptive correction only as needed to touch up performance and leaving exciter correction in fixed mode the rest of the time. Possible problem with exciter user interface module. Place user interface module in LCL (local) mode via front panel switch. Attempt to raise and lower power with front panel pushbuttons. If power level does not respond, check status of user interface module communication with rest of exciter (DAP module) by observing PLL indicator on front panel. If PLL indicator is blinking, communications have been lost. Re-seat user interface module. Check revision level of U501 chip in user interface module. U501 must be revC or higher for those exciters equipped with DAP code version 5.0.3 or higher. Older boards may be upgraded by obtaining new revC U501 from Comark. Contact Comark for more information. This problem is most likely to surface when replacing an older (pre-2002) DAP module with version 3.4.6 (or lower) code with a new replacement module. Issue commands **Software > Get Soft Release Version** in ADAPT Control to check DAP code version level. Possible incorrect remote control set up. Switch exciter to local (LCL) mode and attempt to control power locally on user interface card. If problem disappears, check set up of remote control. Typically due to a power raise or lower command being latched by remote control, thereby causing exciter to stay stuck at upper or lower extreme of power adjustment range. Possible corruption of exciter control system state. Recycle AC power to unit to see if power level and performance return to correct levels.
Exciter power drops to zero and DAP module LED turns red after running in adaptive correction mode for an extended period of time.	The exact cause of this problem is unknown. Frequency of problem is also unknown: most users activate adaptive correction only as needed to touch up performance and leave exciter correction in fixed mode the rest of the time. Power may be restored by clearing ALE and LUT correctors and re-attempting correction.
Non-linear LUT correction converges on a solution with asymmetrical adjacent channel sidebands.	Incorrect "correction level" parameter setting. Readjust correction level parameter to slightly different value by issuing the following commands in ADAPT Control software: **Set > DAP > Correction Level** = *old number +/- 10*. Clear LUT corrector and reattempt correction. Caution: Power level will most likely jump upwards as LUT corrector is cleared.
Power level drops excessively >25% as nonlinear (LUT) corrector converges on solution.	"Correction level" parameter setting too high. Readjust correction level parameter to 195 by issuing the following commands in ADAPT Control software: **Set > DAP > Correction Level** = 195. Clear LUT corrector and reattempt nonlinear correction. Caution: Power level will most likely jump upwards as LUT corrector is cleared.
Reception is normal but spectrum analyzer reveals presence of fine spectral lines clustered around pilot at 60Hz multiples	Partial failure of power supply section of exciter preamp module. Replace exciter preamp module. Probability of this failure is increased if preamp module runs hot. For increased reliability, all ADAPT exciters should have their perforated top and bottom covers permanently removed. Consult Service Bulletin 030413 for more details. **This is extremely important and may significantly affect long-term exciter reliability.**
Exciter changes AGC / MGC modes, loses LUT and/or ALE correction, or changes power level after brief AC power interruption.	Possible conflicting switch setting between local and remote control. Switch settings on user interface card in exciter MUST match the desired operating state, even when the exciter is being controlled remotely by the transmitter control system. Ensure that the DRIVE, AGC OFF, ADP/FXD, LUT, and AGC switches are in the correct positions on the user interface card. Possible failure to save correction settings. Be sure to save correction settings, either via the user interface module or **Copy > current_cs restart_cs** commands in ADAPT Control software, once acceptable transmitter performance has been obtained. Possible incorrect exciter software revision level. Save correction settings function was not supported in exciter software revisions below 5.03. Issue commands **Software > Get Soft Release Version** in ADAPT Control software to check exciter software revision level. If software revision is 3.4.6 or lower, contact Comark for upgrade to newer software level. Possible incorrect remote control set up. Use voltmeter to check status of remote control lines in TB1 in system cabinet. Look for a line that is accidentally shorted to ground or otherwise miswired. Check set up of remote control.

	Possible corruption of exciter control system state. Recycle AC power to unit to see if power level and performance return to correct levels.
Exciter runs well when first turned on, but performance deteriorates rapidly after warm-up period.	Possible failure of one or more fans in exciter cooling fan pack. Inspect fans for proper operation. Change fan pack fuse or replace affected fans as necessary.
Exciter runs hot, especially RF preamp module.	Top and bottom covers not removed. For increased reliability, all ADAPT exciters should have their perforated top and bottom covers permanently removed. Consult Service Bulletin 030413 for more details. **This is extremely important and may significantly affect long-term exciter reliability.** Possible failure of one or more fans in exciter cooling fan pack. Inspect fans for proper operation. Change fan pack fuse or replace affected fans as necessary.
ADAPT software indicates OLDC board failed or not present on boot-up. Exciter still outputs power, but OLDC and OLMC routines do not work correctly.	This entry applies only to ADAPT exciters with the OLDC module installed. Possible incorrect OLDC frequency programmed in DAP module. Check OLDC frequency using ADAPT Control software by issuing commands **Get > OLDC > Frequency** or **Set > Send Command >** *get synthe* (typed in). OLDC frequency should match channel center frequency. The OLDC frequency must match the LO frequency for the OLDC module to be recognized. If problem persists, check for correct LO frequency using spectrum analyzer and/or frequency counter connected to mini-coaxial jumper W1. The LO frequency should be the center channel frequency. The LO frequency is programmed at the factory, but may be changed in the field with special software permissions. Contact Comark for more details. This problem is most likely to surface after the replacement of a DAP module.
ADAPT exciter will not communicate with ADAPT Control software.	Possible incorrect serial cable. Cable must be null modem format (transmit and receive pins inverted). Straight pin-out extender cable will not work. Obtain proper cable type or null modem adapter. Possible incorrect settings in ADAPT Control software. Proper settings are: Computer Baud = 9600, ADAPT Baud = 9600, Receive Data = True. Change settings and issue **Comm Ports > Open Link** command to attempt connection.
ADAPT Control software displays garbage font in Received data window after Scout monitor software quits.	DAP module not properly reset when Scout software closed. Typically occurs when Scout is not properly closed (i.e. Ctrl-Alt-Del or End Task used). Re-launch Scout application and close using EXIT button on control panel.
Unstoppable scrolling in Data Received window with ADAPT Control software.	Adaptive / Fixed status out of sync in DAP module vs. ADAPT Control software. In ADAPT Control software issue commands **Comm Ports > Receive Data > False**, **Correction Commands > Non-Linear Fixed** and **Linear Fixed**, **Comm Ports > Receive Data > False**.
No control of transmitter with WebGUI software.	Possible incorrect selection of mode(s) of operation in transmitter. Ensure that ADAPT exciter(s) are in remote (REM) mode on user interface card. Ensure that HPA controller(s) are in external mode. Ensure that exciter cabinet controller is in remote mode. Ensure that Web GUI is enabled (IN 9 held high +24V) on remote I/O block. Possible incorrect configuration of remote PC or terminal server. Consult WebGUI manual for configuration information.
No ADAPT status indicated on WebGUI software.	Possible wrong settings of jumpers TB504 through TB507 in user interface module. Jumpers TB504 and TB505 should be in positions 1 and 2. Exciter A in a two-exciter system should have jumpers TB506 and TB507 in positions 1 and 2. Exciter B in a two-exciter system should have jumpers TB506 and TB507 in positions 2 and 3. Note: exciter A vs. B addressing is hard coded with external resistors in user interface modules revB and lower.
Unable to run / establish connection with SCOUT signal monitoring software.	Possible incompatible operating system on PC. Operating system must be Windows NT4, Windows 2000, or Windows XP if Windows 2000 compatibility mode is selected. Processor speed should be >400MHz. Obtain suitable PC. Possible incorrect configuration of SCOUT. Check settings under **CONFIGURE SCOUT**

	menu. Proper settings are STANDARD = ATSC, COM PORT = appropriate com port on PC, COM SPEED = 9600, DATA SPEED = 57600. Possible incorrect serial cable. Cable must be null modem format (transmit and receive pins inverted). Straight pin-out extender cable will not work. Obtain proper cable type or null modem adapter. Consult SCOUT Software User's Guide P/N 46744205-108 for more details.
SNR or EVM performance drops slightly after opening SCOUT and allowing it to perform its "calibration."	This is normal. The SCOUT "calibration" is, in fact, the OLMC and OLDC routines internal to the ADAPT exciter. Since ALE and LUT corrections were previously optimized with certain OLMC & OLDC settings, re-optimizing OLMC and OLDC settings may cause ALE (SNR) results to shift slightly. Re-running ALE and LUT routines after last SCOUT "calibration" and saving corrections will eliminate this discrepancy.
HPA output power meter readings continually bounce over 10%-20% range.	Limitation of early DCX systems addressed by the DCX power monitor retrofit 46749185.02. Check for presence of retrofit "horseshoe" daughter board on rear of HPA controller. Consult Service Bulletin 010904 for more details.
Power readings on through-line type wattmeter do not agree with readings from average power meter, seem too high.	Traditional through-line power meters cannot be used to give a correct absolute power reading with an 8-VSB signal. They can, however, still be used to give relative readings…to null of reject load power, etc. Power readings from a traditional NTSC through-line type meter will be exaggerated by approximately 30%-50%.
IOX (Analog) only	
Exciter output power low or unstable.	Remove remote power control panel from circuit (BNC barrel from input to output) to eliminate it as possible source of problem. Replace power control panel if exciter output returns with panel bypassed. Troubleshoot exciter with spectrum analyzer. Consult Service Bulletin 040720 for edited exciter block diagram showing nominal levels at various sample points. Note that schematics in 040720 do not show remote power control panel inserted in IF W507 path.
Moire effect observed on video monitor. 920kHz intermodulation component observed on spectrum analyzer (in analog mode) with modulated ramp video signal. Disappears when sound carrier extinguished.	Intermodulation between video, chroma, and sound signals due to shift in IOT transfer curve and/or incorrect adjustment of linearity and ICPM correctors on B1 module. Ensure that IOT transfer curve has not shifted due to tube aging by measuring idle current (beam current with no RF drive). Adjust bias voltage, as necessary, to return idle current to original value recorded during proof. If intermodulation persists, readjust linearity and ICPM correctors to minimize 920 kHz intermodulation product using modulated ramp video signal. Consult Service Bulletin 030602 for more details.
System aural power metering unstable. Aural power reading fluctuates according to picture chroma level.	Mistuned notch filter in aural RF sample line. Visual carrier RF being detected by aural metering detector. Check tuning of visual notch filter using spectrum analyzer. Retune as necessary to establish maximum notch at visual carrier while maintaining minimum attenuation of aural carrier. Applies principally to type 604540-01 filters (406/586). An improved replacement filter 608335-01 with higher Q factor is now available to provide improved aural metering stability and freedom from tuning drift. Contact Comark for further details.
Prominent smeared corner on 0-100IRE video pedestal transition. Problem disappears when sound carrier is extinguished.	High frequency intermodulation products due to incorrect adjustment of transmitter precorrections. First ensure that 920kHz intermodulation has been properly suppressed. Then readjust B3 ICPM corrector to minimize problem. Check aural carrier corrections afterwards. Readjust as necessary. Consult Service Bulletins 030602 and 030604 for more details.
Prominent symmetrical humped (or dimpled) response within first +/- 1MHz from vision carrier when performing RF sweep.	Possible incorrect adjustment (overuse) of linearity or ICPM precorrection. Bypass correctors on exciter B1 module to see if problem disappears. If so, look for a corrector threshold that has been dialed "all the way through" (too far clockwise to have any effect). All correction thresholds not currently in use should be dialed fully counterclockwise. Always use minimum amount of correction necessary to accomplish goal. Consult Service Bulletin 030602 for more details.
Prominent overshoot horn or	Possible incorrect adjustment (overuse) of differential gain adjustment. Bypass correctors on

sagging corner on 0-100IRE video pedestal transition and/or mini-overshoots/sags at the corners of a monochromatic stairsteps. Problem remains when sound carrier is extinguished.	exciter B2 module to see if problem disappears. If so, look for a corrector threshold that has been dialed "all the way through" (too far clockwise to have any effect). All correction thresholds not currently in use should be dialed fully counterclockwise. Always use minimum amount of correction necessary to accomplish goal. Note: If CR23 - CR26 diode orientation and jumper E6 settings are incorrect, differential gain correctors will remain fully activated even when corrector is switched off, thereby causing this problem. Consult Service Bulletin 030603 for more details.
Peak power level fluctuates according to APL of incoming video.	Incorrect adjustment of AGC clamp timing in exciter. Possible failure of IC MN1 in B1 module AGC circuit. Consult Service Bulletin 030531 for more details.
Sync and blanking level sag during vertical interval. Appears as upward bump during vertical interval on waveform monitor while viewing field rate.	Possible poor HVDC filtering due to failed capacitor or open resistor in HV power supply. Visually Inspect beam supply for bulging filter capacitors, damaged resistors. Possible poor HV filtering due to failed video bypass capacitor(s) in IOT junction box or tube socket. Check integrity of video bypass capacitor. Location of video bypass cap varies according to tube make and model. Contact Comark or tube manufacturer for more details. Possible partial power supply failure in exciter or other low power RF stage. Check signal quality at driver output sample and exciter output sample to determine origin of vertical interval sag.
Prominent 360Hz ripple in signal when viewed in field rate on waveform monitor	Possible ripple on DC beam voltage due to failure of one or more beam supply filter components. Visually Inspect beam supply for bulging filter capacitors, damaged resistors, or shorted lightning arrestor. Replace faulty components as necessary.
Power slowly creeps upward / varies despite AGC being activated. Power variations not dependent on APL/video content. Inability to lower power to 100% with B1 - R366 control.	Instability in AGC feedback sample. AGC feedback is too low, thereby causing exciter to excessively boost its output. Check integrity of AGC feedback sample cables. Check aural carrier reject filter FL1 (FL2) in system phasing drawer in exciter cabinet. Verify frequency response of filter with spectrum analyzer and sweep generator. Retune filter, as necessary, to maximize aural carrier rejection relative to visual carrier. Filter may be bypassed for extended periods of time with a 1 dB or 2 dB BNC attenuator. However, this will allow the aural signal to pass through the AGC system. AGC will still function, but visual power level will change slightly as aural carrier is activated / extinguished, thereby potentially causing inaccuracies during power meter calibrations. Check AGC detected feedback voltage at AGC test point in B1 module. Trace backwards from test point to locate instability. Consult Service Bulletin 030531 for more details.
Transmitter spontaneously rejects exciter and switches to backup exciter, even though rejected exciter appears to produce full power.	Exciter switching occurs when any of three conditions occurs: exciter reports RF fault (red LED on front panel) because AGC sample from transmitter is too low in comparison to B1-R402 trip setting, transmitter system forward power is too low compared to UMD-R19 trip setting, or transmitter system aural power is too low compared to UMD-R81 trip setting. Normal operating conditions for trip LEDs on UMD are OFF-ON-OFF from top to bottom. (i.e. aural *above* trip threshold, reflected *below* trip threshold, forward *above* trip threshold). Locate unsatisfied trip threshold and readjust to eliminate unwanted exciter switching.
Exciter displays red RF Fault LED on front panel, even though transmitter is producing 100% power.	Possible insufficient AGC sample due to mistuning of aural carrier reject filter FL1 (FL2) in system phasing drawer in exciter cabinet. Verify frequency response of filter with spectrum analyzer and sweep generator. Retune filter, as necessary, to maximize aural carrier rejection relative to visual carrier. Filter may be bypassed for extended periods of time with a 1 dB or 2 dB BNC attenuator. However, this will allow the aural signal to pass through the AGC system. AGC will still function, but visual power level will change slightly as aural carrier is activated / extinguished, thereby potentially causing inaccuracies during power meter calibrations.
Signal dropouts on certain portions of NTSC waveform. Appears as white or black smearing on video monitor.	Tube "glitching" caused by spurious multipactor resonance at IOT ceramic output window. Can be destructive to tube if not eliminated. Adjusting focus current may eliminate problem. Very rare problem.
Output power drops to zero	This is normal. The digitally controlled RF attenuator automatically resets to minimum each

whenever AC power is interrupted to remote power control panel while in manual gain control mode.	time AC power is lost as a safety precaution. Press raise power button to return transmitter output power to desired level.
Combiner reject power varies wildly over 10-15 minute period in parallel exciter configuration.	Possible unstable intercabinet phasing due to dead SAW filter oven. The transit phase through the SAW filter is very much dependent on the filter temperature (Hence, the need for a temperature stabilized oven). Physically check SAW filter oven for signs of warmth. Replace heater transistor or drive circuitry, as necessary.
System controller fails to switch away from a failed oscillator in parallel system. No failure reported.	This entry applies only to parallel "P" systems with redundant (external precision) IF and LO oscillators. Easily remedied design logic flaw: LO and IF alarms are both open collectors tied to same input of PLC controller (logic OR). OK condition reported even if one oscillator has failed. Disconnect IF alarm open collector line. Allow traditional P switching chassis to sense and switch IF oscillators.

At Comark, we are constantly striving to improve the satisfaction of both our new and existing customers. Please do not hesitate to contact Comark Customer Service with any questions you may have concerning the contents of this service bulletin.

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