Technical Service Bulletin 040127

DCX Paragon Troubleshooting Table

This service bulletin provides an initial troubleshooting table for the Comark DCX Paragon series of UHF television transmitter. The information contained in this first revision table is largely an adaptation of the material contained in the DCX troubleshooting table for those areas of transmitter operation where the two models are similar. It is expected that this table will undergo rapid revisions and updating as more Paragon transmitters are installed in the months ahead. Please check the Comark website for future revisions.

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 swikcsfeedback@Comarktv.com

Symptom	Problem / Solution
480VAC Three Phase Power	
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 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 failure of HV rotary switch or outdoor disconnect. Check for 480V at output terminals of suspected device. Replace faulty components as necessary.
Amber AC mains alarm. HPA controller screen displays MSG_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.
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	
Large quantities of spurious alarms.	Check in HPA manual (chapter 4) to determine if spurious alarms are all related to a certain IOM module. If so, examine status LEDs on IOM module in question for possible alarm indication. Consult HPA manual for info on how to interpret LEDs on IOM modules. Remove covers to IOM module(s) and inspect for proper alignment and installation. Replace IOM module as necessary. IOT/C IOM: If spurious alarms are all related to IOT/C IOM (coolant, HV skirt, arc detect, power limits, etc.) problem may be due to RF leak from IOT or mistuned input nulling control (CEA tubes). Contact Comark for instructions on measuring ambient radiation levels and possible measures to eliminate tube RF leakage. Review L3 tuning procedures for adjustment of input nulling control and make necessary adjustments. Possible momentary AC interruption. It takes a full two seconds of power outage to register a three phase power failure. Shorter duration failures may cause filament, bias, focus alarms without an actual three phase alarm being registered.
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. 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.
LCD screen on HPA controller is to too bright, too dark.	Possible misadjustment of screen contrast control. Locate contrast trimpot on display driver PCB. Adjust LCD screen contrast. Replace LCD screen or front panel if satisfactory adjustment not possible.
Panel View screen on (millennium-style) system controller dark except for “type 633 error” message.	Possible corrupted programming in system controller. Restore screen programming from 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.
High Voltage Arcs	
Arc immediately and consistently upon application of high voltage, does not occur 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 arcs occur immediately. If transmitter withstands HV for even a second, even once, before arcing, arc 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.
Arcs after random period of time between 2 sec - 30 minutes after application of high voltage, does not fire in	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.

HV ISOLATED mode.	Test HV circuits with hipot test set for leakage current and corona. It is also possible to have a arc 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. Arc 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, arcs 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 arc. Re-inspect all HV circuits external to IOT for source of arcing. Test HV circuits with hipot test set for leakage current and corona. 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.
Arcs after application of high voltage, does not arc in HV ISOLATED mode. Arc known to be internal to the IOT.	High voltage arc to ground through vacuum inside IOT. The presence of ion current after arc 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 arc 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...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.
Arc immediately and consistently upon application of high voltage, even in HV ISOLATED mode.	Possible short circuit in beam supply. Visually inspect components inside beam supply. Search for arc marks or creepage along fiberglass resistor support boards. Individually isolate HV filter capacitors and attempt to re-establish high voltage. Remove diode transpacks 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 cathode emission temporarily disrupted by full dissipation of arc inside tube due to malfunctioning SAT protection. Test operation of SAT with high voltage isolated from tube. Determine and eliminate source of SAT malfunction. 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.	Possible cathode emission temporarily disrupted by full dissipation of arc inside tube due to malfunctioning SAT protection. Test operation of SAT with high voltage isolated from tube. Determine and eliminate source of SAT malfunction. 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.
Ticking or snapping sound coming from high voltage compartment at regular intervals. Arc 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 SAT, 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.
IOT Focus and Body Current	
Body current alarm. SAT does not fire.	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. Visually inspect components inside beam supply. Search for arc marks or creepage along fiberglass resistor support boards. 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 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 (arc). Replace suspected capacitors to prove diagnosis.
Tube withstands high voltage w/ normal idle current, but trips on excessive body current (only) when RF is applied. SAT 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.	Replace faulty focus supply.
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.	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, disassemble 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 040124. 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 040124 for more details.

Drive power and beam current higher than normal, output power lower than normal.	Possible mistuning of IOT output cavities. Retune IOT as necessary. Consult Service Bulletin 040124 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, disassemble 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. Consult Service Bulletin 040128 for information on troubleshooting arc detector photocells. For a properly operating photocell and bulb combination, the OFF resistance should be > 2 Megohm and the ON resistance ~ 1kohm.
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. ➢ Incorrect output tuning response (typically too narrow). Check output tuning response. Retune as necessary. Consult Service Bulletin 040124 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 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. Possible faulty photocell. Consult Service Bulletin 040128 for information on troubleshooting arc detector photocells. For a properly operating photocell and bulb combination, the OFF resistance should be > 2 Megohm and the ON resistance ~ 1kohm.
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	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

present.	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.
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). Arc 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.
Bias supply folds back to zero, acts erratically upon application of filament voltage or beam voltage.	Possible faulty bias supply. Replace faulty supply. Always check filament voltage (E2V, L3) or current (Comark, CPI) calibrations upon installation of a new FBI supply. Consult Service Bulletin 031211 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. Replace faulty supply. Always check filament voltage (E2V, L3) or current (Thales, CPI) calibrations upon installation of a new FBI supply. Consult Service Bulletin 031211 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 (Thales 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 (Thales 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.

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.
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. Excessive draw can be caused by severe waveform distortion on AC mains. Check quality of incoming AC mains with oscilloscope. Eliminate external source of AC waveform distortion. 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. Replace 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 FBI supply.
Air and Liquid Cooling	
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.
Oil leaking in and around tube collector.	Check bleeder valve located just below primary output cavity on body of tube, just above collector. Contact tube manufacturer (L3) for special tightening tool and further instructions.
ADAPT Exciter	

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 04124 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 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. 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. 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. 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 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	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 >**

and OLMC routines do not work correctly.	**Send Command >** *get synthe* (typed in). OLDC frequency should match channel center frequency. If not, issue the commands **Set > Send command >** *set synthe 000000000* (typed in, where nine digit number is exact channel center frequency in hertz). A click should be heard as the setting changes 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 TEST OL port on OLDC daughter board. 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.
Power readings on through-	Traditional through-line power meters cannot be used to give a correct absolute power

line type wattmeter do not agree with readings from average power meter, seem too high.	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%.

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.

Comark Communications
104 Feeding Hills Road
Southwick, MA 01077 U.S.A.
(800) 345-9295
http://www.comarktv.com