

GLOBALINK

April 7, 2004
File: 07-1-7 Spectra Lux
04.032

Mr. Bob Bernstein
Spectra Lux
11825 120th Avenue NE
Kirkland, WA 98034

Dear Mr. Bernstein:

Bob

A POA and AOA Phase 3 Avionics Qualification Policy (AQP) test for the ACSS/Spectra Lux CMS-1000 ACARS configuration (software PN 4550-5101-A00) was completed on March 29, 2004. This configuration supported POA and AOA. An engineering summary is attached for your review.

AQP problems found during testing:

1. Failed Handoff: When the avionics attempted a handoff and failed, it continued on the original link with the N(s) and N(r) numbers reset. It recovers properly with a FRMR and UA XID exchange.
2. Media Advisories: The avionics incorrectly sent media advisories after a POA/AOA retune.
3. AOA to POA Autotune: If an AOA to POA autotune message was received in the middle of a multiblock downlink, the avionics gets confused. It sent one INFO frame after the DISC and the multiblock was sent in the wrong order on POA.
4. Crisscross Uplink ACK: When sending a Q0 label link test downlink, the avionics completes the scenario properly but then disconnects from the ground station for no reason. (See Test Description 4.4.13.1.2)
5. AOA Crisscross Uplink Acknowledgment: When the CMU receives an uplink block, which does not positively ACK a preceding link test, the avionics retransmitted the downlink block with an embedded ACK after VAT7. The CMU should immediately ACK the uplink block with an ACK message. The downlink block is retransmitted only when VAT7 expires. Reference 618 11.3.3.3 and Test Description 4.4.13.1.1.



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ARINC PHASE 3 AQP TEST RESULTS/DATA

Test ID: 04.032

OOOI EVENTS

DESCRIPTION	REQUIREMENT	Y/N
Message Sequencing	Messages are downlinked in a logical order according to airline documentation	P
Message Buffering	Messages are buffered when not acknowledged and retransmitted when radio contact resumes	P
Timers	OFF/ON events are delayed approximately 10 seconds	P
Filters	IN/OUT events are delayed approximately 2 seconds	P
Source	Source of OOOI events	DISCRETES
	If Digital 429, list peripheral (s):	
OOOI Labels	MU Uses Standard QA-QV OOOI Labels or unique ON/OFF with Dept. & Dest.	P

COMMENTS:

RETRANSMISSION INTERVAL

DESCRIPTION	REQUIREMENTS	DATA: Time Between Transmissions (Second						
Retransmissions	Downlinks are retransmitted 3 - 5 times at randomly spaced intervals from 10 to 25 seconds before NOCOMM is displayed	Test#Xmission	1&2	2&3	3&4	4&5	5&6	P/F
		1	17	14	19	14	0	P
		2	18	24	24	0	27	P
		3	12	18	14	19	0	P
		4	15	19	14	19	0	P

PREKEY TIME

DESCRIPTION	REQUIREMENTS	DATA
Unmodulated Carrier Transmission Time	1 millisecond max.	0
Prekey	85 milliseconds max.	85
Programmable Prekey	Is prekey programmable?	N

COMMENTS:

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6. Nested Higher Priority Multiblock Uplinks: The avionics did not support nested reception of higher priority multiblock uplinks. In this case, a high priority message, such as an autotune or an ATIS report, interrupting other messages would be properly received and presented to the crew. The interrupted message was split and displayed in two separate parts. This condition does not comply with AEEC specification 618 and may impact the customer.
7. Current Overload Reset: When the avionics warmed up, it was repeatedly reset by the over current protection circuit.
8. Manual Frequency: After COMM is lost on the manually entered frequency, the unit fell back to a base frequency with permission to send. It should fall back to scan the base frequencies.
9. Buffered Media Advisory: If the avionics happens to hear the AOA available squitter before the SA EV message is sent, it is buffered and sent on AOA.
10. Co-Channel Interference: This MU/radio configuration did not pass the uplink success test in the co-channel environment (AEEC 618-4, Section 4.4.7.) This performance is not ideal, will cause some degree of network-impact, and will result in added RF utilization charges.
11. POA Spectral Mask: Spectral emissions were high. The radio transmitted a spectral spread that measured about 15 dB too high from 3200 Hz and farther from the center frequency. (See ARINC 716).
12. Mode 2 Transmitter Power: One radio transmitted 8 watts and the other transmitted about 12 watts. Fifteen watts is required.
13. Mode 2 Adjacent Channel Rejection: Avionics did not pass adjacent channel rejection at 137 and 137.075 MHz. The interference was lowered 44 and 50 dB below spec before the receiver could receive messages. (See Test Description 4.1.2)
14. Mode 2 In-Band Intermodulation: The avionics cannot decode any messages in the presence of in-band intermodulation. (See Test Description 4.1.8)
15. Mode 2 Co-channel Interference: A BER of at least 10^{-3} is required with a co-channel interference signal 20 dB below the desired signal. The avionics passed the BER with interference of 32 dB below the desired signal. (See Test Description 4.1.9)
16. Mode 2 First Adjacent Channel: First adjacent channel emissions are about 3 dB high. (See Test Description 4.2.6)

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17. Mode 2 Persistence: Persistence is not enabled in Mode 2.
18. Mystery NAK: In AOA, the CMU sent a NAK message after the crisscross acknowledgment test scenario (see AQP test 4.4.13.1.2).
19. Dedicated Transceiver Advisory: In AOA, the CMU required an ACK for the F3 label dedicated transceiver advisory. The F3 is a send and forget message.

Based on the problems identified in the Phase 3 test report, the CMS-1000 has shown significant improvement, but does not meet the minimum AQP requirements for normal, unrestricted use on the network. However, the CMS-1000 is authorized a **network-impacting waiver for limited flight testing and certification purposes only**. We require that all identified issues be corrected prior to release to a customer. An additional AQP will be required to validate the corrections have been properly made.

Thank you for your cooperation. Participation in the AQP process will help ensure that your avionics and the ACARS® system operate reliably and efficiently. Please contact us if you have any questions regarding this letter or the attached reports.

Sincerely,



Stephen R. Leger
Director, AQP Services

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ARINC PHASE 3 AQP
TEST RESULTS/DATA

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OOOI EVENTS

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Source	Source of OOOI events	DISCRETES
	If Digital 429, list peripheral (s):	
OOOI Labels	MU Uses Standard QA-QV OOOI Labels or unique ON/OFF with Dept. & Dest.	P

COMMENTS:

RETRANSMISSION INTERVAL

DESCRIPTION	REQUIREMENTS	DATA: Time Between Transmissions (Second)
Retransmissions	Downlinks are retransmitted 3 - 5 times at randomly spaced intervals from 10 to 25 seconds before NOCOMM is displayed	Test# \ Xmission 1&2 2&3 3&4 4&5 5&6 P/F
		1 17 14 19 14 0 P
		2 18 24 24 0 27 P
		3 12 18 14 19 0 P
		4 15 19 14 19 0 P

PREKEY TIME

DESCRIPTION	REQUIREMENTS	DATA
Unmodulated Carrier Transmission Time	1 millisecond max.	0
Prekey	85 milliseconds max.	85
Programmable Prekey	Is prekey programmable?	N

COMMENTS:

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MISCELLANEOUS

DESCRIPTION	REQUIREMENT	DATA (P/F)
Protocol and	Avionics utilizes UBI/DBI protocol	☐ P
Embedded ACKs	If yes, protocol works correctly	☐ P
	Downlink retransmissions contain the same MSN before and after a NOCOMM condition.	☐ P
	Avionics processes uplink with the same MSN & UBI within 10 minutes as a duplicate uplink	☐ P
	An embedded ACK to an uplink is changed to an embedded NAK in subsequent downlink retransmissions.	☐ P
	Avionics properly handles embedded ACKs in uplink messages.	☐ P
	Avionics provides embedded ACKs in downlink messages.	☐ P

COMMENTS:

U/L & D/L	Avionics accepts and prints multiblock messages.	☐ P
Multiblock	Avionics accepts and displays multiblock messages.	☐ P
Processing	"INCOMPLETE MESSAGE" advisory given when subsequent blocks not received in 1.5 minutes.	☐ P
	If part of a multiblock downlink has been acknowledged, and the avionics goes NOCOMM, the entire multiblock message is resent when COM is regained.	☐ P

COMMENTS:

Tracker Message	Tracker Message interval (minutes).	10:00
	Intervals are at 10 minutes and only in the absence of other downlinks.	☐ P
	NOT sent while the aircraft is on the ground.	☐ P
	Tracker Messages are not queued while the avionics is in voice mode.	☐
	Tracker Timer reset by uplink ACK to a downlink.	☐ P

COMMENTS:

Contact Message	Contact Message interval.	240
	Sent only if no uplink traffic is heard for a defined period of time.	☐ P
	NOT sent while the aircraft is on the ground.	☐ P
	Contact/Tracker used on alternate (autotune) frequency?	☐ P

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CHANNEL ACCESS

DESCRIPTION	REQUIREMENT	DATA (P/F)
Channel Access Algorithm	Will not transmit while receiving a 1200 Hz MSK modulated signal.	☐ P
	Will not transmit while receiving a 2400 Hz MSK modulated signal.	☐ P
	Will not transmit while receiving a random (1200/2400) MSK modulated signal.	☐ P
	Will not transmit while receiving actual traffic with 75 ms prekey.	☐ P
	Must check for channel occupancy before transmitting an ACK to an uplink.	☐ P
Carrier Sense Multiple Access	The avionics implements a non-persistent CSMA algorithm.	☐ P
COMMENTS:		

AGENCY CODE, REGISTRATION NUMBER, AND FLIGHT NUMBER

DESCRIPTION	REQUIREMENT	DATA
Default Agency	Enter the default agency code source and list the agency code.	APM
Agency Code Chars.	Will the avionics accept numeric characters for the agency code?	☐ Y
Default Reg#	Enter the default registration source and list the registration number.	APM
Flight Number	Flight numbers less than four characters are padded with leading zeros.	☐ P
	Will the avionics accept alpha characters for the flight number.	☐ P
AN/FI Address	Avionics supports both AN and FI addressing	☐ P
COMMENTS:		

ARINC EUROPEAN BASE FREQUENCY - 136.925 MHz

Is 136.925 present and enabled in scan table?	☐ N
Are tracker messages enabled on 136.925?	☐
Are contact messages enabled on 136.925?	☐
Does the avionics respond properly when autotune received while on 136.925?	☐

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MULTI-MEDIA FUNCTIONS

DESCRIPTION	REQUIREMENT	DATA
Preferred Media & Simultaneous Media	MU uses VHF as preferred media and only communicates via SATCOM/HFDL when VHF is unavailable or when responding to an unsolicited SATCOM/HFDL U/L. MU always attempts to complete on media where originated.	☐
Multiblock D/L Handling	The MU correctly handles Multiblock retransmission when changing media. Entire message is retransmitted. Original MSN is retained.	☐
VHF to SATCOM/HF	The avionics completes failed VHF transmissions on SATCOM/HF Media and alerts the crew of the VHF NOCOMM conditions. Avionics sends downlinks via SATCOM/HF when in Voice Mode (if available).	☐
SATCOM/HF to VHF Transitions	The avionics monitors the available VHF frequencies and attempts to re-establish the VHF media (label QO, SA, etc.)	☐
Automatic Link Establishment	MU automatically sends a QO downlink (followed by SA) via SATCOM whenever the SDU logs on. Same as VHF & HF.	☐
UBI/DBI Handling	The MU correctly maintains separate and independent UBI/DBI's for the VHF, SATCOM, and HF links.	☐

622/623 PROTOCOL & FUNCTIONS

D/L Message Format	ATS messages are downlinked in proper format.	☐
U/L Message Format	Uplinks are checked for ATS format compliance.	☐
CRC	Downlinks contain proper CRC values.	☐
	Uplinks are tested for proper CRC values.	☐
	U/L messages w/o CRC or improper CRC are rejected.	☐
	Avionics accepts U/L's with or without ending CR/LF chars.	☐
ATS U/L Response	MU provides readback responses where appropriate (i.e., PDC Accept/Reject)	☐
Multiblock ATS Messages	MU properly handles multiblock ATS messages	☐
Multiblock Prioritization	Avionics supports nesting of higher priority single block uplinks.	☐
	Avionics supports nesting of higher priority multiblock uplinks.	☐

COMMENTS: SPLITS LOWER PRIORITY MESSAGE INTO 2 PARTS

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STUCK CARRIER

Stuck Transmitter Avionics does not exhibit any stuck transmitter as a result of power cycling or related testing. ☐

COMMENTS:

AUTOTUNE FUNCTIONS

DESCRIPTION	REQUIREMENT	DATA		
		Label	#	P/F
ACK to Command	Avionics provides ACK to autotune command before changing frequency.			☐ P
Channel Changeover	Avionics changes to frequency specified by Autotune command.			☐ P
Link Tests on New Frequency	Avionics immediately conducts at least 3 Link Tests on the new frequency	☐ Q0	☐ 5	☐ P
Return to Base Frequency and Conduct Link Test	Avionics returns to the base freq. and immediately conducts at least 3 Tests to re-establish communication	☐ Q0	☐ 5	☐ P
Autotune to an Autotune	If the avionics was autotuned and a subsequent autotune is received, the avionics will correctly retune and return to the base frequency if unable to establish or maintain communication.			☐ P
Power Interruption	Avionics recalls last autotuned freq. if 115VAC power is interrupted (> 1 min) and 28VDC is retained			☐
	For how long will MU recall last autofreq with both 115VAC and 28 VDC removed?			☐ P

COMMENTS: Frequency Tuning Will the avionics tune between 118.000 MHz and 136.975 MHz? ☐ Y

Frequency Table	Location	Frequency	Scan		Trackers		Contacts	
			Y/N	Time	Y/N	Time	Y/N	Time
		131.550	Y	2-10				
		0.000						
		0.000						
		0.000						
		0.000						
		0.000						
		0.000						
		0.000						
		0.000						
		0.000						

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ARINC PHASE 3 AQP TEST RESULTS/DATA				Test ID: 04.032
MU TO TRANSMITTER/RECEIVER AUDIO LEVELS				
DESCRIPTION	REQUIREMENT			
Audio Output Level	0.00 Vpk	0.00 Vrms	1.0 Vrms +/- 2%	☐
Audio Rx Level to MU	0.00 Vpk	0.00 Vrms	1.0 Vrms +/- 2%	☐
AM Modulation	Verify when using newly updated transceiver or when audio levels above are out of tolerance			☐
% Output Modulation	%	> 85 %		☐
COMMENTS:				
SUMMARY OF TEST RESULTS				
<i>A POA and AOA Phase 3 Avionics Qualification Policy (AQP) test for the ACSS/Spectra Lsx CMS-1000 ACARS configuration (software PN 4550-5101-A00) was completed on March 29, 2004. This configuration supported POA and AOA. An engineering summary is attached for your review.</i> <i>AQP problems found during testing:</i> <i>1. Failed Handoff: When the avionics attempted a handoff and failed, it continued on the original link with the N(s) and N(r) numbers reset. It recovers properly with a FRMR and UA XID exchange.</i> <i>2. Media Advisories: The avionics incorrectly sent media advisories after a POA/AOA return.</i> <i>3. AOA to POA Autotune: If an AOA to POA autotune message was received in the middle of a multiblock downlink, the avionics gets confused. It sent one INFO frame after the DISC and the multiblock was sent in the wrong order on POA.</i> <i>4. Criss Cross Uplink ACK: When sending a Q0 label link test downlink, the avionics completes the scenario properly but then disconnects from the ground station for no reason. (See Test Description 4.4.13.1.2)</i> <i>5. AOA Criss-Cross Uplink Acknowledgment: When the CMU receives an uplink block, which does not positively ACK a preceding link test, the avionics retransmitted the downlink block with an embedded ACK after VAT7. The CMU should immediately ACK the uplink block with an ACK message. The downlink block is retransmitted only when VAT7 expires. Reference 618 11.3.3.3 and Test Description 4.4.13.1.1.</i> <i>6. Nested Higher Priority Multiblock Uplinks: The avionics did not support nested reception of higher priority multiblock uplinks. In this case, a high priority message, such as an autotune or an ATIS report, interrupting other messages would be properly received and presented to the crew. The interrupted message was split and displayed in two separate parts. This condition does not comply with AEEC </i>				
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specification 618 and may impact the customer.

- 7. Current Overload Reset: When the avionics warmed up, it was repeatedly reset by the over current protection circuit.*
- 8. Manual Frequency: After COMM is lost on the manually entered frequency, the unit fell back to a base frequency with permission to send. It should fall back to scan the base frequencies.*
- 9. Buffered Media Advisory: If the avionics happens to hear the AOA available squitter before the SA EV message is sent, it is buffered and sent on AOA.*
- 10. Co-Channel Interference: This MU/radio configuration did not pass the uplink success test in the co-channel environment (AEEC 618-4, Section 4.4.7.) This performance is not ideal, will cause some degree of network-impact, and will result in added RF utilization charges.*
- 11. POA Spectral Mask: Spectral emissions were high. The radio transmitted a spectral spread that measured about 15 dB too high from 3200 Hz and farther from the center frequency. (See ARINC 716).*
- 12. Mode 2 Transmitter Power: One radio transmitted 8 watts and the other transmitted about 12 watts. 15 watts is required.*
- 13. Mode 2 Adjacent Channel Rejection: Avionics did not pass adjacent channel rejection at 137 and 137.075 MHz. The interference was lowered 44 and 50 dB below spec before the receiver could receive messages. (See Test Description 4.1.2)*
- 14. Mode 2 In-Band Intermodulation: The avionics cannot decode any messages in the presence of in-band intermodulation. (See Test Description 4.1.8)*
- 15. Mode 2 Co-channel Interference: A BER of at least 10^{-3} is required with a co-channel interference signal 20 dB below the desired signal. The avionics passed the BER with interference of 32 dB below the desired signal. (See Test Description 4.1.9)*
- 16. Mode 2 First Adjacent Channel: First adjacent channel emissions are about 3 dB high. (See Test Description 4.2.6)*
- 17. Mode 2 Persistence: Persistence is not enabled in Mode 2.*
- 18. Mystery NAK: In AOA, the CMU sent a NAK message after the criss-cross acknowledgment test scenario (see AQP test 4.4.13.1.2).*
- 19. Dedicated Transceiver Advisory: In AOA, the CMU required an ACK for the F3 label dedicated*

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transceiver advisory. The F3 is a send and forget message.

Based on the problems identified in the Phase 3 test report, the CMS-1000 has shown significant improvement, but does not meet the minimum AQP requirements for normal, unrestricted use on the network. However, the CMS-1000 is authorized a network-impacting waiver for limited flight testing and certification purposes only. We require that all identified issues be corrected prior to release to a customer. An additional AQP will be required to validate the corrections have been properly made.

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DOWNLINK SUCCESS RATIO TESTS

Calibration (loss) factor: dB

Attenuation offset required to cause a -20dBm RF Level @ ground station receiver input

Downlink prekey used: ms (typically 75-85 ms)

Downlink success ratio data

Attenuator Setting (dB)	RF Level at GSC RX (dBm)	# Downlinks Sent	# Downlinks Acknowledged	Resultant Downlink Success (%)
	-20			
	-30			
	-40			
	-50			
	-60			
	-70			
	-80			
	-90			
	-95			
	-100			
	-105			
	-110			
	-115			

Downlink success requirement: 98% or better
at reception levels from -20 to -100dBm.☐

COMMENTS:

ARINC PHASE 3 AQP TEST RESULTS/DATA

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UPLINK SUCCESS RATIO TESTS

Calibration (loss) factor: 2332 dB

Attenuation offset required to cause a -20dBm RF Level @ ground station receiver input

Uplink prekey used: 80 ms (typically 75-85 ms)

Uplink success ratio data

Attenuator Setting (dB)	RF Level at GSC RX (dBm)	# Uplinks Sent	# Uplinks Acknowledged	Resultant Uplink Success (%)
	-20	100	100	100
	-30	100	100	100
	-40	100	98	98
	-50	100	100	100
	-60	100	100	100
	-70	100	100	100
	-80	100	99	99
	-90	100	100	100
	-95	100	100	100
	-100	100	96	96
	-105	100	83	83
	-110	100	4	4
	-115	100	0	0

Uplink success requirement: 98% or better
(with 75ms of prekey) at reception levels from -20 to -100 dBm.

Co-Channel Compliant

Desired Leads Desired Lags COMMENTS: