

Mr. George Sakai
Federal Aviation Administration
Program Director for Spectrum Policy and Management, ASR-1
800 Independence Ave, SW
Washington, DC 20591

Subject: Coordination Letter between FAA and FCC for Goodrich TRC 899

Dear Mr. Sakai,

Goodrich Avionics Systems is seeking FCC equipment authorization for the TRC 899 collision avoidance system. In order to receive equipment authorization we need to write a letter informing the FAA of our intent to produce a piece of equipment that is authorized under FCC part 87. We request that you inform the FCC that the equipment that we intend to produce is acceptable to the FAA.

Goodrich is requesting FCC equipment authorization for our Skywatch TRC899 Aircraft Collision Avoidance system. The unit to be authorized is the Radio/ Transmitter/ Receiver Box called the TRC899. This product is governed by the FCC through technical standards outlined in part 87(aviation services) of Title 47. We have notified the FAA about our intentions to manufacture and sell this piece of equipment to avionics distributors and dealers. The FAA per TSO C197 will certify our system. This TSO is granted only after a unit has been designed and verified to comply with RTCA documents DO-197A, DO-160D and DO-178B.

RTCA DO-197A (Minimum Performance Standards For an Active Traffic Alert and Collision Avoidance System – Active TCAS I – For Revenue Passenger Operations) is a minimum operation standard for collision warning products for use on aircraft. DO-160D is the document describing the environmental tests to be run on the unit. DO-160D includes descriptions of the tests (that the FAA requires) to measure unintended radiation out of the unit through the panel and cables. DO-178B is a software standard that our unit is designed to comply with.

Our unit has been tested to the standards set forth in Title 47 part 87 subpart D. We have submitted data in accordance with Title 47 part 2.1033(c) on form 731. We have made tests and provided data in accordance with parts: 2.1046, 2.1047, 2.1049, 2.1051, 2.1053 and 2.1055.

The FCC equipment identification will be “PMY TRC899”. The antenna is a 4-pole directional antenna. Its transmit gain pattern is very similar to a standard monopole antenna. Its receiver gain pattern is also very similar to a standard monopole but it incorporates two outputs, which allow the direction of the received signal to be determined. The output power of the TRC899 is typically between 53 dBm and 55 dBm

and will never exceed 57 dBm (at the transmitting unit). This typically is connected to the antenna through cables of approximately 2 dB of loss so that the effective radiated output power is between 51 dBm and 53 dBm out of a monopole equivalent antenna.

The transmitter signal has characteristics as defined in DO-197A. This signal has a FCC emission designator of “ **PON**”. The transmitted signal is pulse-modulated bursts at $1030 \text{ MHz} \pm 200 \text{ KHz}$. There are three pulses sent out in each burst. Each RF pulse is 800 ns wide. The three pulses are sent out over a 23 usec interval. There is a maximum of 7 pulse bursts sent out every second. The amplitude of the pulses may be varied in level. The highest peak power out of the TRC is 500 (57 dBm) Watts. Each 800 nsec wide pulse has a risetime and falltime of approximately 100 nsec. The Bandwidth designator is “**20M0**”.

The FAA requires that every a DO-197A compliant system meet certain spectral requirements. Every unit that is manufactured is tested to ensure compliance with this specification. The specification is as follows:

The spectrum of an active TCAS I Mode –C interrogation shall not exceed the following:

<i>Frequency Difference (MHz from carrier)</i>	<i>Maximum Relative Power (dB down from peak)</i>
<i>Between 0.7 and 5</i>	<i>3</i>
<i>Between 5 and 20</i>	<i>20</i>
<i>Between 20 and 60</i>	<i>40</i>
<i>Over 60</i>	<i>60</i>

Attached in appendix A is the letter that we sent to the FAA informing them of our intent to certify and manufacture the TRC899. Attached in Appendix B is the revised letter of intent that we sent to the FAA.

Sincerely,

Brent Locher

Staff Engineer
Goodrich Avionics Systems

APPENDIX A – LETTER OF INTENT FOR SKYWATCH TRC899

February 26, 1999

Ms. Brenda S. Ocker
Federal Aviation Administration
Chicago ACO/Aircraft Certification Office
Systems & Equipment Branch, ACE-115c
2350 E. Devon Avenue, Room 323
Des Plaines, Illinois 60018

Subject: Letter of Intent for Skywatch II TRC899 (SKY899)

Dear Brenda;

This letter is to inform you of our intent to seek TSO authorization for the Skywatch II TRC899 Traffic Advisory System. The SKY899 is an active, traffic advisory system that assists the pilot in seeing and avoiding other aircraft. It will employ technologies currently being utilized in the TCAS791/791A Collision Avoidance System and the SKY497 Traffic Advisory System. The system will consist of three major components, a remote mounted Transmitter-Receiver-Computer (TRC), a display device, and a directional antenna. The system functionality is based on the current SKY497 design with the following modifications: The SKY899 will use the 52 dBm (nominal) peak RF transmitter power outlined in TSO C147, Traffic Advisory System Airborne Equipment. This will allow for increased range surveillance when compared to the SKY497. Therefore, we have increased the maximum display range to 15 nautical miles for this system. This system will also have the ability to receive and decode Automatic Dependent Surveillance-Broadcast (ADS-B) messages transmitted in the 1090 MHz Mode S extended message format. The TRC899 will also provide data, via an ARINC 429 interface, to a Mode S transponder or other system capable of transmitting Mode S extended squitter messages, for the purpose of transmitting own aircraft ADS-B information. The certification plan for the SKY899 is outlined in BFGoodrich Avionics Systems Document, *Certification Plan, Skywatch II*, BFGAS Part Number 016-11908-001. This document is included for your review.

Due to the use of the increased transmitter power, this system will fall under interference limiting requirements that were not applicable for the low power SKY497. As such it is our intent to follow the alternative approach outlined in the Interference Limiting Section of RTCA/DO-197A, *Minimum Operational Performance Standards For An Active Traffic Alert and Collision Avoidance System (Active TCAS I)*. The note under paragraph 2.2.6 *Interference Limiting*, states that "As an alternative to the above, an Active TCAS I may choose to transmit Mode S broadcast signals, in which case it would then appear to be an Active TCAS II and could therefore increase its power-rate limits to the limits specified for an Active TCAS II in RTCA DO-185." Since this note was omitted from Appendix I of Traffic Advisory System TSO C147, we will be seeking a deviation to allow for its use with a Traffic Advisory System. If the deviation is granted, we feel that an approach similar to that used in the SKY497, where we guarantee to stay below the minimum rate-power limits associated with a certain number of TCAS II aircraft, would justify

the elimination of the requirement to maintain a count of the number of TCAS II aircraft and thus remove the need for a 1030 MHz receiver in the system.

To receive further guidance and technical information on such an approach, we have initiated contact with Ron Sandholm of MIT Lincoln Labs. We will also discuss the technical details of this approach with Ed Glowacki, of the FAA Tech Center, or another appropriate source as directed by your office. We will further update and seek formal approval from you on this approach, based on the results of our discussions with Mr. Sandholm and the FAA Tech Center. All TSO test procedures will be documented in the Skywatch II TSO Test Plans and Procedures document and submitted for your review and approval prior to the beginning of certification testing. A milestone schedule is included in the Certification Plan document that is enclosed with this letter.

Sincerely,

Marnie Sablan
FAA Liaison

Enclosures: *Certification Plan, Skywatch II*, BFGAS Part Number 016-11908-001

APPENDIX B – REVISED LETTER OF INTENT FOR SKYWATCH TRC899

July 25, 2000

Ms. Brenda S. Ocker
Federal Aviation Administration
Chicago ACO/Aircraft Certification Office
Systems & Equipment Branch, ACE-115c
2350 E. Devon Avenue, Room 323
Des Plaines, Illinois 60018

Subject: Revised Letter of Intent for Skywatch II TRC899 (SKY899)

References: 1) BFGAS: CR-392 (2/26/1999), Letter of Intent for SkyWatch II TRC899
2) FAA: Response to CR-392 (9/21/1999)
3) BFGAS: CR-438 (2/11/2000), Request for Deviation, SKY II
4) FAA: E-Mail Response to CR-438 (3/24/2000)
5) BFGAS: E-Mail of 3/27/2000, Follow-up to our Request for Deviation, SkyWatch II
6) FAA: Response to Deviation Request (4/10/2000)

Dear Brenda;

This letter is to inform you of changes to the approach by which we intend to seek TSO authorization for the SkyWatch II, SKY899, Traffic Advisory System, as initially requested in reference 1) above. Our original approach, as described in reference items 3) and 5), sought deviation allowing the use of TCAS II Broadcast Interrogations to increase the system's output Power-Rate product as is allowed for TCAS I by RTCA/DO-197A. BFGoodrich was requesting the deviation because this provision had not been extended to Traffic Advisory Systems by TSO-C147, and we wanted the SKY899 to benefit from the higher Power-Rate product.

After review of your responses in reference items 4) and 6), we have decided to complete the development in strict accordance with TSO-C147 as a Traffic Advisory System. No deviation for increased Power-Rate product is requested. The remaining provisions of our original Letter of Intent, reference item 1) remain in effect, including the addition of processing for ADS-B 1090 MHz extended squitter messages.

Updated releases of our *Certification Plan for the SKY899*, BFGAS Doc. 016-11908-001, and our *Plan for Software Aspects of Certification*, BFGAS Doc. 016-11922-001, are enclosed with this letter which include our latest milestone schedule. As always, if you have any questions or need further information, please feel free to contact me. Thank you for your consideration and assistance in this matter.

Sincerely,

Marnie Sablan
FAA Liaison