

AERONAUTICAL SURVEILLANCE SYSTEMS PANEL (ASP)
TSG MEETING

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Contribution for the ASP report on Task 5

Brief Report on Signal Environment Studies in Japan

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SUMMARY

This paper is a brief report on the signal environment investigation in Japan.

The WG meeting in Brussels on April 2007 tasks TSG members to provide this information to draft the ASP report on its task five including the investigation on signal environment in 1030/1090 MHz channel.

References

- 1) K. Carpenter: "REPORT OF THE MEETING", SCRSP/JWG-3, Montreal, 5 May 2006
- 2) S. Ozeki: "1030 MHz signal measurement in Japan", SCRSP/WG-A IP/A/1-18, presented in Rio de Janeiro, April. 2001
- 3) S. Ozeki, et. al.: "Effect of transponder decoder performance on the 1090 MHz signal environment", SCRSP/WG-A5-WP173, May, 2003
- 4) S. Ozeki: "Transponder Anomalies Observed with Airborne Waveform Measurement", SCRSP/WG-A IP/A/6-220, presented in Honolulu, October. 2003
- 5) S. Ozeki: "Reply failure to low power interrogations", SCRSP/WG-A IP/A/8-14, presented in Gold coast, April. 2005
- 6) TSG: "WG-A discussions on Reply failure to low power interrogations", SCRSP/WG-B IP/B/9-13, presented in Paris, October. 2005
- 7) S. Ozeki: "Impact of ATC transponder transmission to onboard GPS-L5 signal environment", SCRSP/WG-A IP/A/10-18, presented in Montreal, May. 2006
- 8) S. Ozeki, T. Otsuyama: "Signal Environment Measurement with Long Time Waveform Recorder", ASP/WG, ASP01-026, presented in Kobe, November, 2006
- 9) S. Ozeki, T. Otsuyama: "Measurement for Reply Signal Quality with Wideband Waveform Recorder", ASP/WG, ASP02-027, presented in Brussels, April, 2007

1. Introduction

1.1 The list of tasks for ASP was also revised by the ANC. The list includes the task on signal environment as follows.

CSN-9601 CNS-9701 CNS-7901	5) Report on the radio frequency (RF) pollution problem associated with the use of 1 030 and 1 090 MHz frequencies.	2008-6-30
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1.2 The investigations in this area have been reported to WGs and TSG by organizations including US FAA, DFS, UK NATS and JCAB. In 1990's of later SICASP era, the investigations have been mainly focused onto three issues, i.e., the evaluation of ACAS interference limitation algorithm, the performance estimation of mode S extended squitter as surveillance data link, and the performance estimation of SSR in future environment with assuming the applications of squitter and mode S data link.

1.3 Authors have kept providing the information on signal environment investigation in Japan since early '90s under the coordination with SICASP/SCRSP WG activities. Early measurement for signal environment in 1090MHz band provides an experimental basis to support the statistical performance estimation with the Poisson distribution model for asynchronous interference to mode S extended squitter. Recently, the purpose of signal environment investigation in Japan covers study areas including the error source of signal environment estimation and the effect to its adjacent bands.

1.4 This paper is the response to following action item to support TSG.

Action ASP02-10: Roland to provide a paper outlining the structure of the report on Task 5 to the TSG. The TSG should also consider WP/ASP02-17 when working on this Task.

2. Draft report on signal environment measurement

2.1 Authors suggest for including the sections in appendix A for this paper into the draft section 4.2 of report. The sections describe current activities for signal environment investigation in Japan.

2.2 Authors provide those sections as the starting point of drafting the report. Authors also suggest that above sections should be adjusted to follow the context of report. Authors are open to add diagrams and expressions for measured data, if they are required to fit the sections into the context.

3. Conclusion

3.1 TSG members are invited to note the information in this paper. It will support TSG to carry out the action item on report related to the task five including signal environment investigation in 1030/1090 MHz band.

Appendix. Draft contribution for the section 4.2 of report

ENRI is carrying out the flight measurement to measure the signal environment including 1030/1090 MHz band in Japan. The results have been reported to WGs and TSG with pointing out the potential error sources for signal environment estimation. Additional flight measurement for 1090 MHz band is scheduled in 2007 to compare the signal environment with that in past. Also, new equipments for measurement are under development.

The signal environment in 1030MHz band has been measured by flight experiment for representative airspace in Japan. The airborne measurement for 1090 MHz band has been done in 2005 and the data will be compared with new data to be measured in 2007 and later.

The measured results have been discussed in WG and TSG to find the error source for signal environment estimation by simulations. For example, multipath echoes of interrogation signals are observed to increase the transponder reply in less than 10 NM from SSR. Another example is the unexpected response of ATC transponder to low power interrogation signal close to its MTL. The transponder may fail to discriminate the signal modes to reply, if the interrogation signal level is about MTL or bit less. In addition, the effect of military interrogator is not negligible for signal environment in this band by their signal count and by their mobility. Provided information will be used for the signal environment estimation and its error analysis in future.

The waveform data for signal environment measurement is also applied to measure the quality of signals in this band. The time-frequency analysis helps to pick up the signals out of ICAO specifications.

Recently, the frequency band under measurement by ENRI extended to cover that of GPS-L5. The transmissions of onboard ATC transponder were observed in GPS-L5 band. The power level of interference to GPS signal is not negligible. On the other hand, the duty ratio of ATC transponder transmission is expected to be negligible in current Japanese environment. The future issue will be the signal environment estimation with assuming operational scenario in future.

