



ICAO

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Coordination Group (SURICG/8)***Bangkok, Thailand, 6 – 9 June 2023*

Agenda Item 7: Report on surveillance ground system and avionics performance monitoring and improvement in compliance

## **A METHOD FOR ASSESSING RF INTERFERENCE BETWEEN PSR RADARS IN AN AIRPORT AREA**

(Presented by ROK, Republic of Korea)

### **SUMMARY**

A PSR radar system is the most powerful RF transmitter in an airport area while its receiver is the most sensitive. This paper shares the information of the case study on RF interference between PSR radars in Incheon airport and the analysis method about it.

## **1. INTRODUCTION**

1.1 In order to ensure the safety of air traffic control, the management of the radio frequency spectrum is important. Last year, the issue of 5G radio altimeter interference was a major concern for aviation industries worldwide. Even though, Radars could also be a source of RF interference cases at the airport area because it has the highest radiation power with sensitive receiver.

1.2 This paper presents a case study of PSR radar interference at the Incheon airport with related technical information about it and finally our own solution.

1.3 We go through the various technical and regulatory opinions on RF interference issues. ICAO has the DOC 9718(Handbook on Radio Frequency Spectrum Requirements for Civil Aviation). ITU-R recommendations M.1464 specifies the analysis procedure that address the methods to assess the potential for interference from radars.

## **2. DISCUSSION**

### **[The definition of terminology]**

2.1 **Victim radar:** An undesired signal from another RF transmitter saturates and affects its receiver LNA(low noise amplifier) resulting in a degradation of the radar detection performance.

2.2 **Aggressor radar:** Its RF signal affects and degrades a receiver on another radar

### **[Problem description]**

2.3 Because of the limitation to find an optimal location to install new radar, there are many cases where the lateral separation between PSR radars is not sufficient to avoid PSR interference. When designing a new project to build radars, there is no practical reference to the lateral and frequency separation of radars to minimize the interference between radars. For the design of ILS facility, DOC 9718 vol2 Table 3-9 clearly guides the separation distance between the ILS facility. But PSR separation distance is not supported in that document.

2.4 The frequency allocation process for new radars is administratively and technically complicated. Many ANSP operator normally conducts the new radar project based on the radar manufacturer's opinion about the interference between radars when there is an expected problem. This practice has the following limitations.

- A victim radar and an aggressor radar are not always the same because the receiver characteristics of the radar are different from those of another radar. So, the radar interference can be bi-directional or sometimes uni-directional.
- The radar manufacturer (contractor for new radar project) has a good understanding of their product but can not have detailed information about the RF receiver of another system.

#### **[PSR radar interference regulation at ITU-R M.1464]**

2.5 M.1464 provides guidance and procedures for determining the potential for interference between radars.

It states that:

The interference mechanism occurs when energy from the fundamental frequency of an undesired signal saturates the victim receiver front-end, resulting in gain compression of the desired signal sufficient to degrade receiver performance. Receiver front-end overload is typically a result of **inadequate RF selectivity in the front-end of the victim receiver**.

In general cases, a signal from another radars resulting in an Interference to Noise ratio below -6 dB is acceptable by the radar users for signals.

2.6 M.1464 provided the clear information about the radar interference. But from ANSP's point of view, there is very little thing to try to fix the interference when it happens. ANSP is not a manufacturer of radars, so cannot have complete information about RF specifications and no resource to re-design a radar. The M.1464 guideline for an Interference to Noise ratio -6 dB is too ideal to be applied at the real environment. Incheon airport area has 3 SMR, 1 TDWR, 3 PSR and several VST (Vessel traffic services) radars. In actual implementation, ANSP needs to carry out the new radar project while minimizing RF interference. It means that Interference to Noise ratio -6 dB can not be applied at the real airport environment.

#### **[The interference test procedure at Incheon airport as adapted version of ITU-R M.1464 procedures]**

2.7 ANSPs requires more simplified procedures to determine the radar interference. It should be practically ready for use. The simplified procedure should have the ability to assess the possible interference between existing radars and new radars starting to construct the new radar. Incheon airport simplified the M.1464 procedures to solve this issue for ANSPs. In this paper, ROK introduces "the simplified M.1464 procedures" and an example of the use case.

### Step#1 : Input parameter

Aggressor radar

- Peak power (dBm)
- Pulse width and repetition frequency (usecond, Hz)
- PSR antenna gain (dBi)

Victim radar

- PSR antenna gain (dBi)

Distance between the aggressor radar and victim radar : (meter)



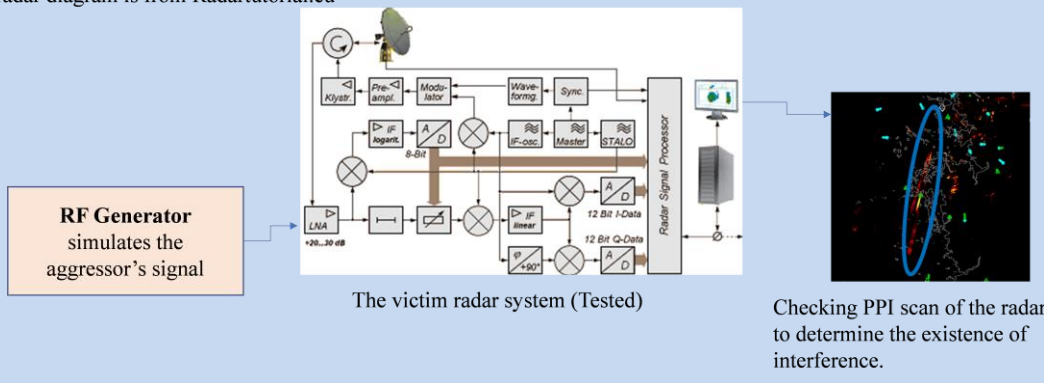
**Step#2: Calculate the strength of aggressor signal at the LNA input of victim radar**  
calculate the received power from an antenna at some distance given a transmission frequency and antenna gains using Friis equation (<https://www.pasternack.com/t-calculator-friis.aspx>)



### Step#3: Conduct the interference test at the LNA input of victim radar using RF generator.

When the victim radar is on the maintenance stop, the RF generator on the step#2 setting is connected to the LNA input. The decision regarding interference decided by checking the PPI video screen of the victim radar. The peak power setting of RF generator must be adjusted within the permitted max input power of LNA (Normally less than -10dBm)

radar diagram is from Radartutorial.eu



2.8 At Incheon Airport, the Shinbul A (installed in 2000) and Shinbul B radar (installed in 2017) are 167 meters away. Even though the frequencies of that are different, the PSR radar interference is observed. By using “the simplified M.1464 procedures”, we could check the more detailed information about the PSR interference. Based on our analysis, the new band pass filter is designed and adapted to the Shinbul B radar. Now, two PSR radars (Shinbul A&B) are fully operational at the same time without affecting another radar.

**[Conclusion]**

2.9 When ANSPs conduct a new radar project, the possibility of PSR radar interference should be carefully considered. “The simplified M.1464 procedures” could be used to determine the potential interference before starting the radar construction.

**3. ACTION BY THE MEETING**

3.1 The meeting is invited to:

- a) note the information contained in this paper; and
- b) discuss any relevant matter as appropriate

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