



Shared Spectrum Company Memo

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Date: February 24, 2020
Subject: APCS Flight Test Description

1.0 Introduction

This memo describes the APCS flight test. The goal of the flight test is to demonstrate the APCS ducting communications technology.

The link distance should be significantly longer than is presently possible with current air-to-air links.

2.0 Demonstration Description

2.1. Introduction

The UAV altitudes should be at altitudes with high ducting probability. This altitude range is the surface to 2500 meters.

Most non-ducting links fail at the radio horizon distance. The radio horizon distance at 2500 meters altitude is 178 km. Thus, the air-to-air link distance should be 356 km.

The free space path loss at 356 km and 1755 MHz is 148 dB. We assume that ducting reduces this loss by 20 dB. Thus, the radio needs to close a link with at least 128 dB of loss.

Table 1 shows the maximum link loss for different signal bandwidths, with a 1 W TX power, and an assumed 15 dB SNR required for demodulation. With a 25 kHz bandwidth, a 135 dB of propagation loss is feasible. This is a margin of 8 dB compared to the above 128 dB of loss.

Table 1. Maximum Radio Link Loss

Parameter	10 kHz BW	25 kHz BW	100 kHz BW	1 MHz BW
Transmit Power (dBm)	30.0	30.0	30.0	30.0
Transmit Antenna Gain (dBi)	0.0	0.0	0.0	0.0
Effective Isotropic Radiated Power (EIRP) (dBm)	30.0	30.0	30.0	30.0
Signal Bandwidth (MHz)	0.01	0.025	0.1	1
Receiver Noise Figure (dB)	10.0	10.0	10.0	10.0
Receiver Noise Power (dBm)	-124.0	-120.0	-114.0	-104.0
Receive Antenna Gain (dBi)	0.0	0.0	0.0	0.0
Required SNR (dB)	15.0	15.0	15.0	15.0
Maximum Propagation Loss (dB)	139.0	135.0	129.0	119.0



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2.2. Location

The system will be tested at two locations:

Location 1: Within 5 km of the SSC offices on the ground.

Location 2: Within 5 km of Manassas Airport, VA on the ground.

Location 3: The airplanes will fly along the east coast. One airplane will fly as far south as Chincoteague, VA. The other airplane will fly as far north as Beaufort, NC. This location will test at altitudes up to 2500 m.



Figure 1. Planned demonstration location.

2.3. Altitude of Transmitters

Locations 1 and 2: Antenna height of 2 meters.

Location 3: The airplanes will fly in circles at each location. They will change altitude from near the surface to 2500 meters in a coordinated manner. The altitudes of each airplane should be the same at each moment.

2.4. Power

One watt of TX power.



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2.5. Bandwidth

25 kHz.

2.6. Emission Type

BPSK or QPSK modulation.

2.7. Antenna Gain

0 dBi

2.8. Antenna Type

Omni-directional.

2.9. Number of Frequencies

Ten frequencies.

2.10. Manufacturer and the model number of the transmitter

Shared Spectrum Company, model = APCS