

## EXHIBIT NUMBER 1

### TCAS MODULATION SIGNAL DESCRIPTION

The TCAS transmitter output consist of pulse groups whose attributes are defined by RTCA DO-185A. Transmissions fall into two categories – TCAS to ATCRBS transmissions and TCAS to Mode S transmissions.

#### TCAS to ATCRBS Transmissions

TCAS to ATCRBS transmissions employ the “Mode-C-Only All-Call” format which consists of three pulses P1, P3, and P4. This shall normally be preceded by an ATCRBS “whisper-shout” suppression pulse designated S1.

The amplitude of P3 shall be within 0.5 dB of the amplitude of P1 and the amplitude of P4 shall be within 0.5 dB of the amplitude of P3. The amplitude of S1 is variable as specified in RTCA DO-185A and typically is 2 or 3 dB less than the amplitude of P1.

All pulses have pulse duration's of 0.8 +/- 0.05 microseconds, rise times between 0.05 and 0.1 microseconds. The rise and decay times are allowed to be less than this provided the side band radiation does not exceed the spectral limits specified in RTCA DO-185A.

The pulse spacings are S1 to P1: 2 +/- 0.1 microseconds, P1 to P3: 21 +/- 0.1 microseconds, and P3 to P4: 2 +/- 0.04 microseconds.

#### TCAS to Mode S Transmissions

TCAS to Mode S Transmissions consist of a P1 and P2 pulse and either a short or long P6 pulse.

Pulse shapes are given in microseconds as:

| Pulse Designator | Pulse Duration | Duration Tolerance | Rise Min | Time Max | Decay Min | Time Max |
|------------------|----------------|--------------------|----------|----------|-----------|----------|
| P1, P2           | 0.8            | 0.05               | 0.05     | 0.1      | 0.05      | 0.2      |
| P6 (short)       | 16.25          | 0.125              | 0.05     | 0.1      | 0.05      | 0.2      |
| P6 (long)        | 30.25          | 0.125              | 0.05     | 0.1      | 0.05      | 0.2      |

The short and long P6 pulses have internal modulation consisting of possible 180-degree phase reversals of the carrier at designated times. The first phase reversal is the sync phase reversal and is always present. The presence or absence of subsequent phase reversals indicates a one or zero in the transmitted code respectively. The duration of the phase reversal shall be less than 0.08 microseconds as measured between the 10 degree and 170 degree points of the phase transition. The interval between the 80 percent points of the amplitude transient associated with the phase reversal shall be less than 0.08 microseconds. The tolerance of the 0 and 180 degree phase relationships shall be less than 5 degrees. The 90 degree points of each data phase reversal shall occur at a time  $N \pm 0.25 \pm 0.02$  microseconds after the 90 degree point of the sync phase reversal, where N is greater than or equal to two.

The spacing from P1 to P2 shall be  $2 \pm 0.04$  microseconds between leading edges. The spacing from the leading edge of P2 to the 90 degree point of the sync phase reversal of P6 shall be  $2.75 \pm 0.04$  microseconds. The leading edge of P6 shall occur  $1.25 \pm 0.04$  microseconds before the sync phase reversal.

The radiated amplitudes of P2 and the initial first microsecond of P6 shall be greater than the radiated amplitude of P1 minus 0.25 dB. The maximum envelope amplitude variation between successive phase modulation chips in P6 shall be less than 0.25 dB.