

**Final**

## Pointing Accuracy & Auto TX Shut-off

Model Name: Intellian v80G

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Intellian Technologies, Inc.*Confidential and Intellian proprietary*

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## 1. Introduction

The FCC regulation, 47 C.F.R § 25.222 (a) (1) (iii) states that: all emissions from the ESV (Earth Station on Vessel) shall automatically cease within 100 milliseconds if the angle between the orbital location of the target satellite and the axis of the main lobe of the ESV antenna exceeds 0.5 °, and transmission will not resume until such angle is less than 0.2 °.

This document presents a proposal for insuring that Intellian V80G antennas, when used in a two way satellite transmission environment, will accurately point at the target satellite. If the antenna should become miss-pointed by exceeding 0.5° from the axis of the main lobe of the target satellite, the system will provide a signal to immediately cease the transmitter to prevent interference with adjacent satellite transmissions, and the transmission will not resume until such angle is less than 0.2°, thus meeting the requirements of the foregoing FCC regulation.

## 2. Back Ground

Intellian V80G antenna systems employs closed loop servo systems to keep the antenna pointed accurately at the satellite. The closed loop servo system includes highly accurate sensors continuously to monitor the antenna's position in inertial space. In the normal operation, the servo mechanism keeps the antenna pointing within  $\pm 0.1^\circ$  degrees RMS and the pointing accuracy is approximately 0.2° peak. However there always exists the possibility that unexpected conditions will cause the antenna to deviate outside this normal operation.

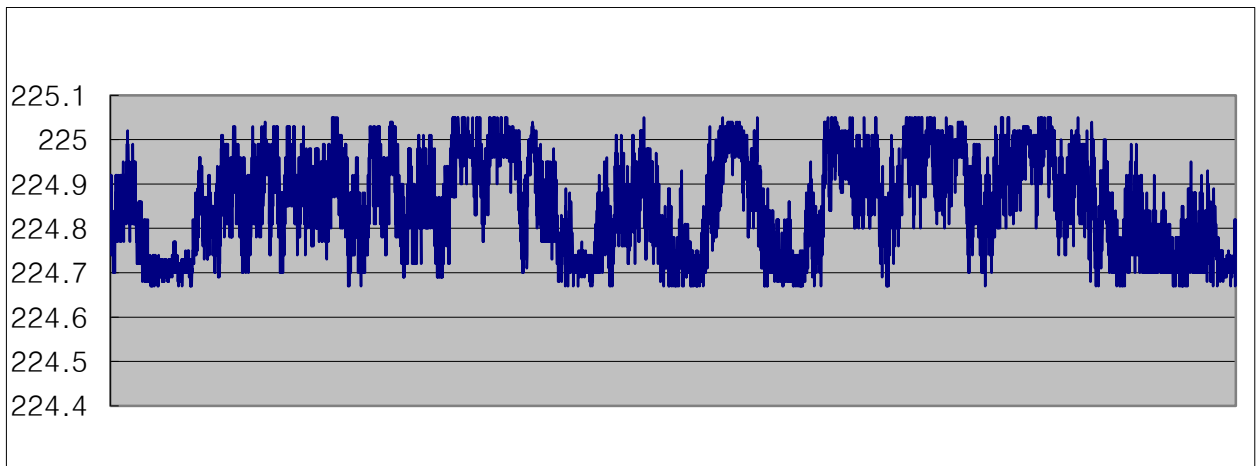
*Examples of some possible conditions are:*

- Unexpected mechanical disturbance from an external source.
- Mechanical malfunction.
- Ship motions beyond the pedestal specifications which cause very large accelerations on the axes.
- Failure of one or more drive motors.
- Sensor malfunction (Rate Sensors, GPS, Gyrocompass).

### 3. Antenna Pointing Accuracy

At all times, the antenna control unit (ACU) continually monitors the antenna position as part of the normal servo loop operation of the antenna and compares a running average of the measured azimuth and elevation to the desired azimuth and elevation positions. If the antenna becomes miss-pointed by exceeding 0.5° from the axis of the main lobe of the target satellite, then the ACU will send a “cease transmissions” signal by providing a TX MUTE instruction to the below-deck satellite modem within 100 milliseconds. The ACU will suppress the signal until the off-axis angle is within 0.2° of the target satellite.

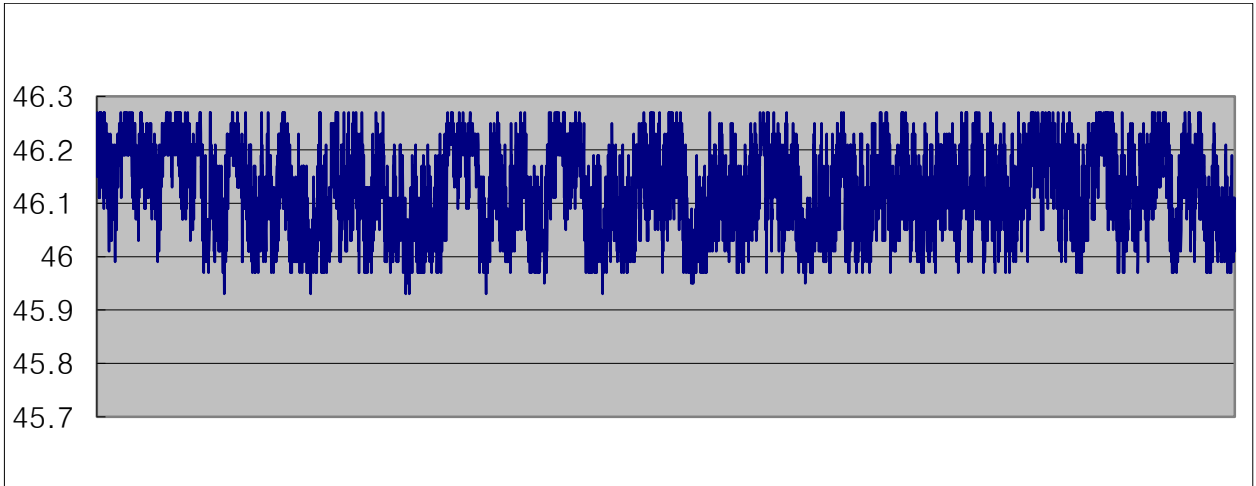
#### 3.1. Azimuth Stability Accuracy Test



Max. Azimuth Angle	225.05°
Min. Azimuth Angle	224.68°
MAX-MIN Angle	0.37°
Average Angle	224.85°
Number of Data	4,434
Percentage of Data Within ± 0.2°	4,434 (100.0%)

- During the tracking period, the variation of the AZ angle was within ±0.185°
- Conformance rate within the standard spec of ±0.2° was 100.0%

### 3.2. Elevation Stability Accuracy Test



Max. Azimuth Angle	46.27°
Min. Azimuth Angle	45.93°
MAX-MIN Angle	0.34°
Average Angle	46.12°
Number of Data	4,437
Percentage of Data Within $\pm 0.2^\circ$	4,437 (100.0%)

- During the tracking period, the variation of the AZ angle was  $\pm 0.17^\circ$
- Conformance rate within the standard spec of  $\pm 0.2^\circ$  was 100.0%

## 4. Auto Tx Shut-off

Below is the expected system and error detector performance

Feature	Performance
Normal operation system pointing error	0.05° RMS, +/-0.1° Peak
Nominal error detector limit	<0.5°
Response time (from pointing error occurs to Tx-off)	Less than 100 milliseconds

Event	Time to go from Tx-on to Tx-off	Comment
Antenna position deviation > 0.5°	<60 msec	Delay caused by master clock.
GPS-error	<60 msec	Will re-activate when GPS error is cleared.
HEADING-error	<60 msec	Will re-activate as the external heading sensor error is cleared.
Correction vector > 0.5°	<60 msec	The antenna control unit can detect the antenna's position with a resolution of 10ms and can react within 10ms of the antenna being disturbed from boresight
Go to parking position or shutdown	10 msec	
Satellite signal lock lost	<100 msec	The external mute is used if the modem cannot comply with the <100msec.