Demonstration of Compliance with Section 25.222 Criteria

In response to Section 25.222(a) and (b) of the FCC's Rules, C5 Communications, LLC. ("C5") provides the following information with respect to the Ku-band ESV remote antenna specified in this application (Sea Tel Model No. 4003-7):

1. 25.222(a)(1) — (3). Off-Axis EIRP Spectral Density

The Ku-band ESV remote antenna specified in this application meets the off-axis ETRP spectral density requirements for co-polarized signals emitted from the ESV in the plane of the geostationary satellite orbit as it appears at a particular earth station location as required in Sections 25.222(a)(1) — (3). Figures 1 - 3 attached hereto contain measured test data that demonstrates that the off-axis spectral density requirements are satisfied for all relevant angles provided that the transmit power density at the antenna input does not exceed -14 dBW/4 kHz of occupied bandwidth as required.

2. 25.222(a)(4) - Off-Axis Spurious Emissions

The proposed ESV remote antenna meets the cross-polarized power spectral density limits defined in Section 25.222(a)(4). Figures 1-3 attached hereto demonstrates this compliance.

3. 25.222(a)(5) - Non-Circular ESV Antennas

The ESV remote specified in this application uses circular antennas or, if slightly asymmetric, the antenna performance power spectral density requirements are met in the minor axis (see also Figure 1-3).

4. 25.222(a)(6) & (7) - Pointing Error and Auto-Shut Off

C5 uses stabilized antenna systems for ESVs that operate with ±0.2° pointing accuracy of the exact position of the satellite through which the ESV is communicating. There are only a few exceptional conditions, described below, under which the antenna could be mispointed by more than 0.5°. Even under these highly unusual conditions, the ESV antenna controller can detect within 100 milliseconds if the pointing error should ever exceed 0.5°and cease transmissions in 70 milliseconds. The controller would then suppress transmissions until the pointing accuracy is within±0.2°.

The stabilized antenna systems used by C5 employ closed-loop servo systems and highly accurate sensors to continuously monitor the antenna's position in inertial space. When operating properly, the servo mechanism will keep the antenna pointing within ±0.1° RMS, 0.2° peak. See Figures 4-6 attached hereto.

There always exists the possibility that unforeseen conditions can cause the antenna to be mispointed outside of these specifications. Examples of some of these possible conditions are:

- Unexpected mechanical disturbance from an external source;
- Operation in an unbalanced mechanical configuration;
- Operation subjected to tangential accelerations beyond the pedestal specifications (e.g., extremely heavy sea conditions);
- Failure of one or more sensors; or
- Failure of one or more drive motors.

Even under any of the failure conditions cited above, the antenna controller can detect a pointing error that exceeds 0.5° within 100 ms and cease transmissions immediately. As noted above, the controller will not allow transmissions to resume until the pointing error has diminished to within ± 0.2°.

The sensors mounted on the antenna measure antenna position with a resolution of better than 0.01°. The key to robust systems operation and reliable error reporting is that the antenna position data is processed before being used to drive an error comparator. In addition to antenna position, many sources of data are available to the system to make a robust decision about the accuracy of the antenna pointing. They are:

- Satellite modem synch lock;
- Short-term integrated rate sensor antenna position;
- Long-term accelerometer and heading reference sensors readings;
- AGC level data; and
- Calculated azimuth and elevation positions based on ship latitude, longitude and desired satellite longitude.

If for any reason the satellite modem should lose synch with the satellite down-link, the system will cease transmission immediately, regardless of the pointing accuracy, and not re-transmit until it has re-synchronized with the satellite and the pointing accuracy is within ±0.2°.

At all times the antenna controller compares a running average of the measured azimuth and elevation to the desired azimuth and elevation positions. If the results exceed the 0.5° threshold, then transmissions will cease immediately and not resume until the pointing accuracy is within±0.20.

The threshold detection algorithm has been used successfully for more than 10 years to insure that the stabilized antenna system is operating within the desired limits.

In addition, new software has recently been developed to continuously monitor the instantaneous pedestal pointing error and will trip an error flag whenever an unexpected event occurs that causes the pointing error to exceed 0.5 degrees. This flag will not clear until the pedestal error remains below 0.2 degrees for a period of S seconds. The state of this flag is used as an additional logic input to the existing "Transmit Mute" function of the Sea Tel below decks controller. By connecting the "Transmit Mute Output" of the

Sea Tel below decks controller to the "Mute Input" of the satellite modem, the provisions of Section 25.222(a)(7) are satisfied.

5. 25.222(a)(8) - Point of Contact.

C5 maintains a Network Operations Center ("NOC") at 1305 Industrial Park Road, Shenandoah in Mount Jackson, Virginia on a 24-hours-a-day, 365-days-a-year basis. All systems of C5's clients are monitored and their emissions are controlled from the NOC. Any client will be able to obtain information about its system and problem resolution by calling the personnel on-duty in the NOC at +1(832) 495-4853. An appropriate regulatory authority can also call the NOC to inquire about potential interference. If it is determined that the interference is coming from a system under C5's control, the on-duty personnel can cease emissions from that unit immediately.

There are standard escalation procedures in place for all types of incidents that the on-duty personnel use to notify and involve the appropriate C5 staff members to resolve a problem. In the most extreme cases, C5's Chief Operations Officer will be called in to take charge of the situation and resolve the problem.

6. 25.222(a)(9) - Excessive Radiation

C5's ESVs do not exceed the radiation guidelines of Section 1.1310 of the FCC's Rules, as demonstrated by the RF Compliance Assessment attached hereto.

7. 25.222(a)(10) - Geographic Area

C5's ESVs will operate in the Gulf of Mexico within the parameters of the frequency coordinations. These ESVs operate in and out of Coastal U.S waters, in and out of US Ports in Mississippi (Pascagoula), Louisiana(New Orleans) and Texas (Houston, Freeport, Corpus Christi, Port Arthur). Some transit direct routes to Venezuela and Mexico from and to the previous ports. At no time will these ESVs venture in areas closer than 150km of Puerto Rico nor St. Croix, Virgin Islands.

8. 25.222(b)(1)(i-iv) – Density Charts and Tables

C5 Attaches Figures 1-6 to meet these requirements.

9. 25.222(c)(1-3) – Operating Requirements

C5's ESV's will operate under these guidelines and rules.

10. 25.222(d-e) - Proximities, NASA TDRSS and Radio Observatory

At no time will C5's ESVs be or pass in areas closer than 150km of Puerto Rico nor St. Croix, Virgin Islands.

Certification of Peter G. Blaney, Sea Tel, Inc

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I, Peter G. Blaney, Vice President for Engineering for Sea Tel, Inc("Sea Tel"), hereby certify:

1. that the statements contained in the foregoing paragraphs 1-4 above are true and correct, and that Sea Tel maintains all relevant test data, available upon request, to verify these statements; and

2. that the ESV antenna proposed herein (Sea Tel Model 4003-7) conforms to the gain pattern criteria of Section 25.209(a) and (b) of the FCC's Rules, and, that combined with the input power density entered in Schedule B of the instant application, demonstrates that the off-axis ETRP spectral density envelope set forth in Sections 25.22l(a)(l) through (a)(4) will be met.

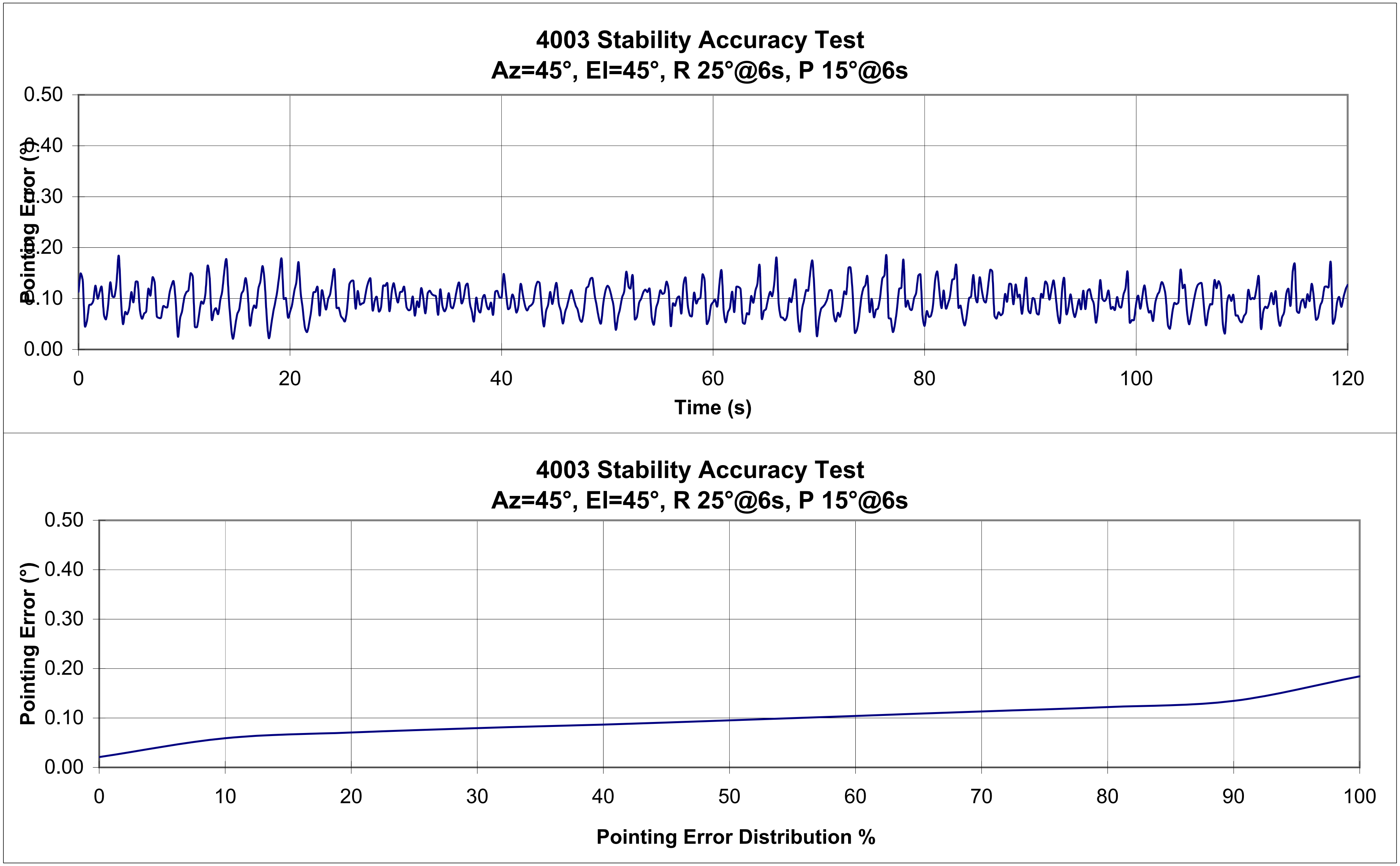
Executed on 9/30/05________ By: ______________/s/____________________

Peter G. Blaney
Vice President, Engineering
Sea Tel, Inc

EMISSIONS DESIGNATOR

QPSK, 1/2 FEC, 384 KBPS, CONCATENATED CODE
14000.0000 - 14500.0000 MHz 842KG7W

Figure 5



Ave Err (°) 0.097 RMS Err (°) 0.101 Max Err (°) 0.184

Figure 4

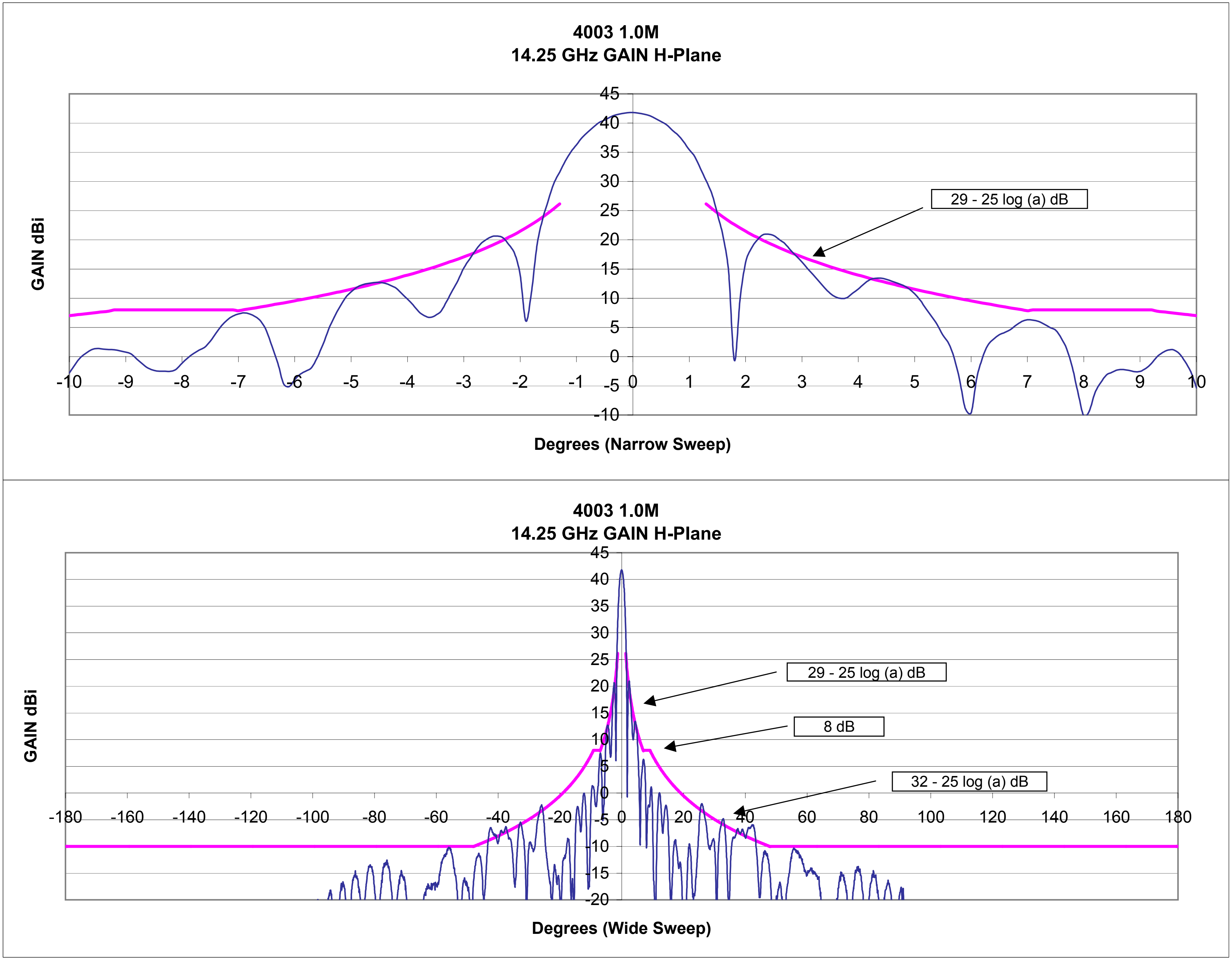
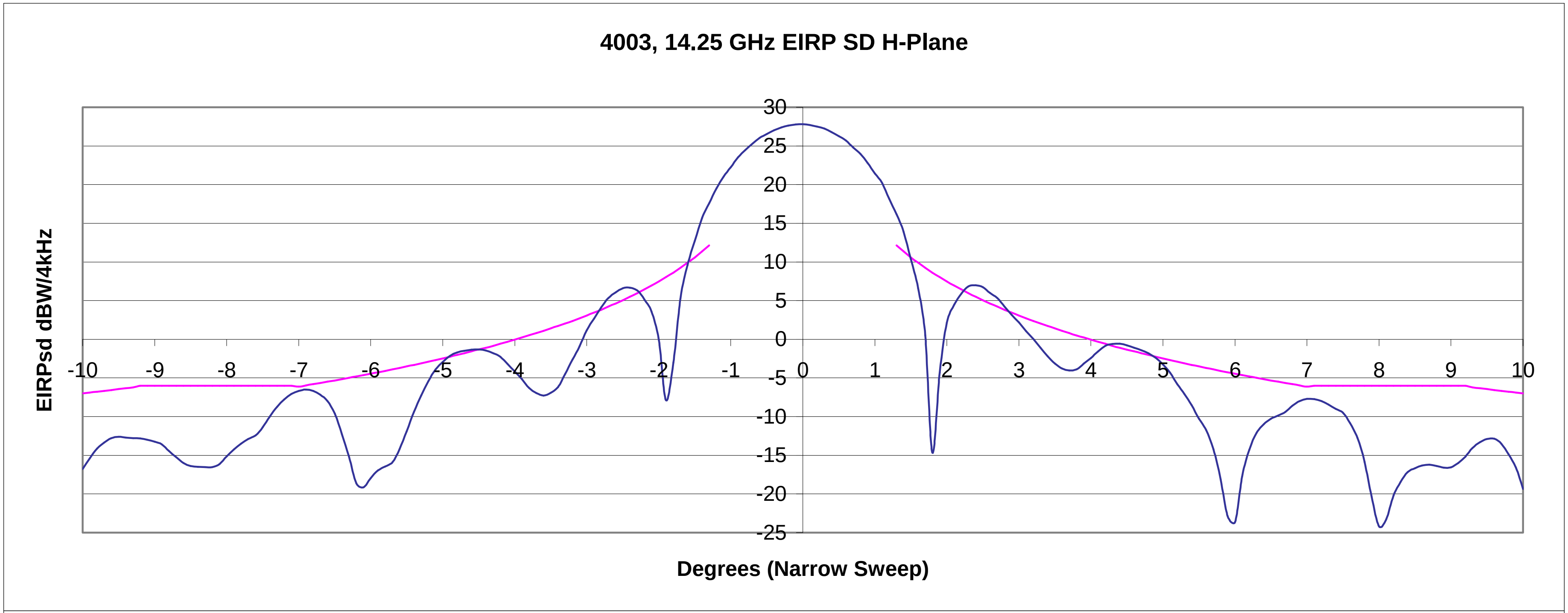

4003 1.0M
14.25 GHz GAIN H-Plane
GAIN dBi
Degrees (Narrow Sweep)
29 - 25 log (a) dB
4003 1.0M
14.25 GHz GAIN H-Plane
GAIN dBi
Degrees (Wide Sweep)
29 - 25 log (a) dB
8 dB
32 - 25 log (a) dB

Figure 3


4003, 14.25 GHz EIRP SD H-Plane
EIRPsd dBW/4kHz
30
25
20
15
10
5
0
-5
-10
-15
-20
-25
-10
-9
-8
-7
-6
-5
-4
-3
-2
-1
0
1
2
3
4
5
6
7
8
9
10
Degrees (Narrow Sweep)

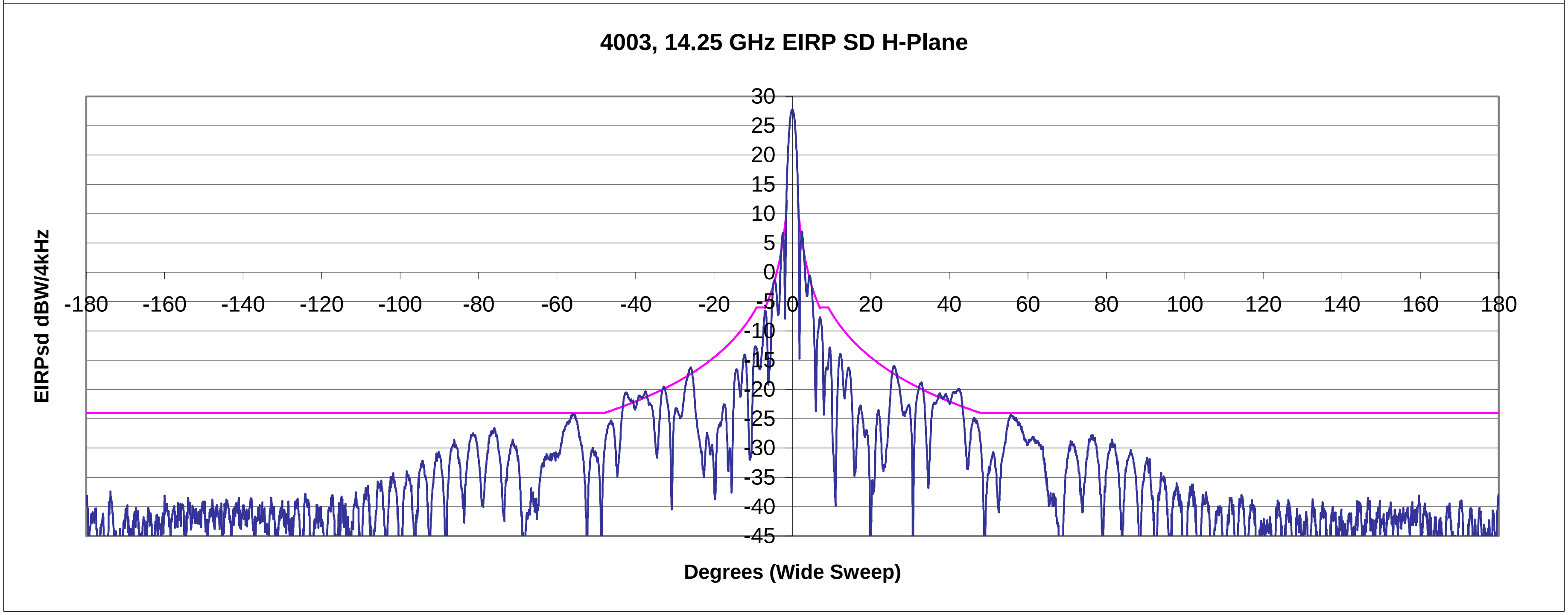
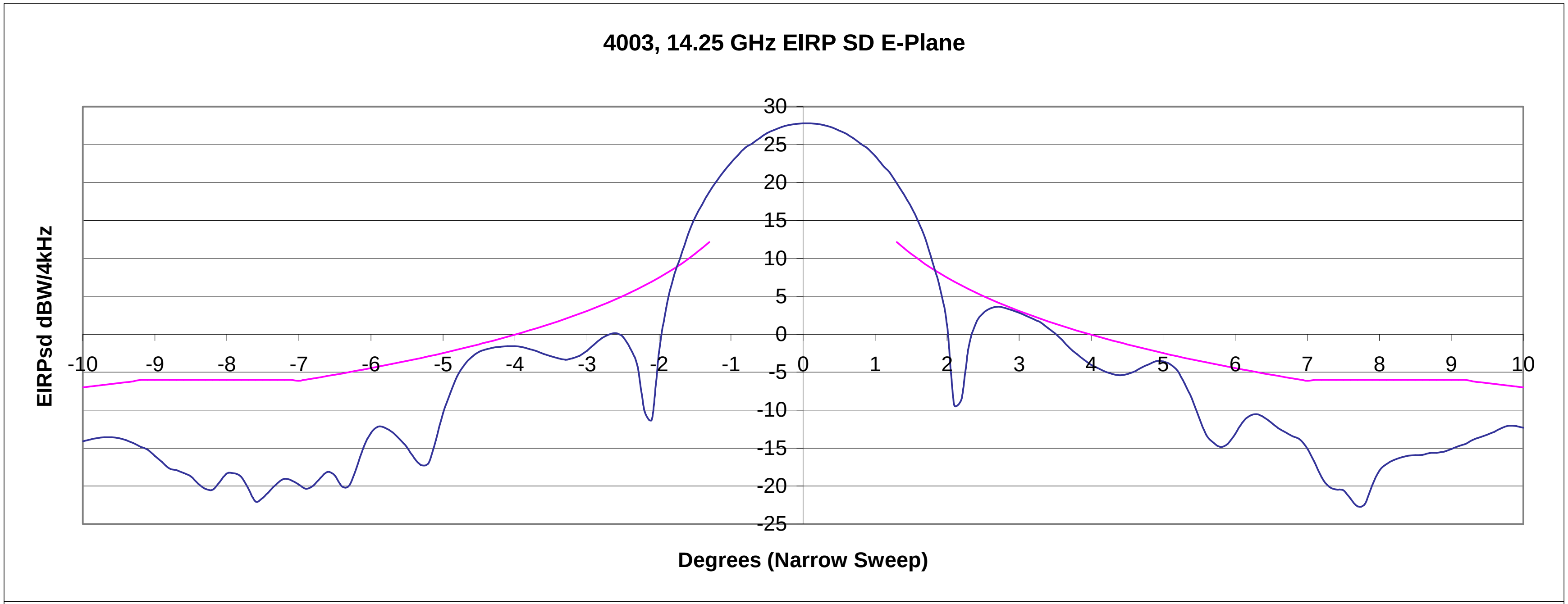

4003, 14.25 GHz EIRP SD H-Plane
EIRPsd dBW/4kHz
30
25
20
15
10
5
0
-5
-10
-15
-20
-25
-30
-35
-40
-45
-180
-160
-140
-120
-100
-80
-60
-40
-20
0
20
40
60
80
100
120
140
160
180
Degrees (Wide Sweep)

Figure 3


4003, 14.25 GHz EIRP SD E-Plane
EIRPsd dBW/4kHz
Degrees (Narrow Sweep)

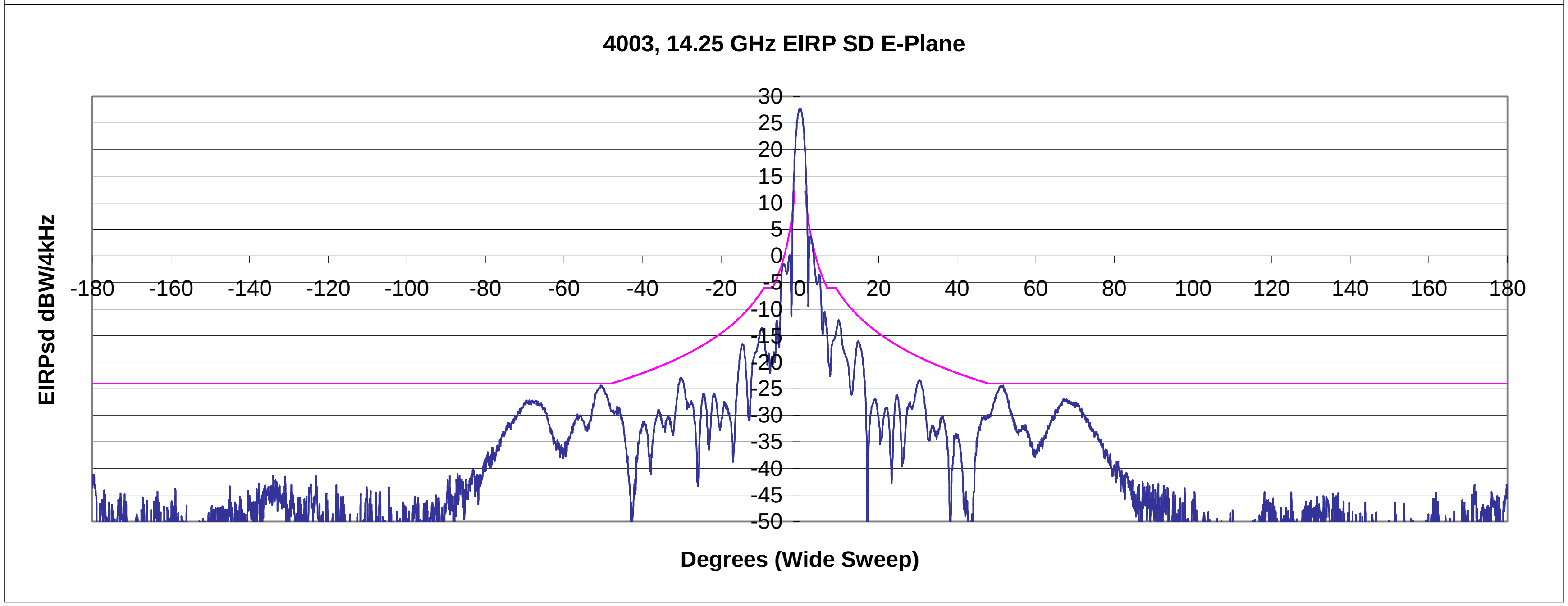
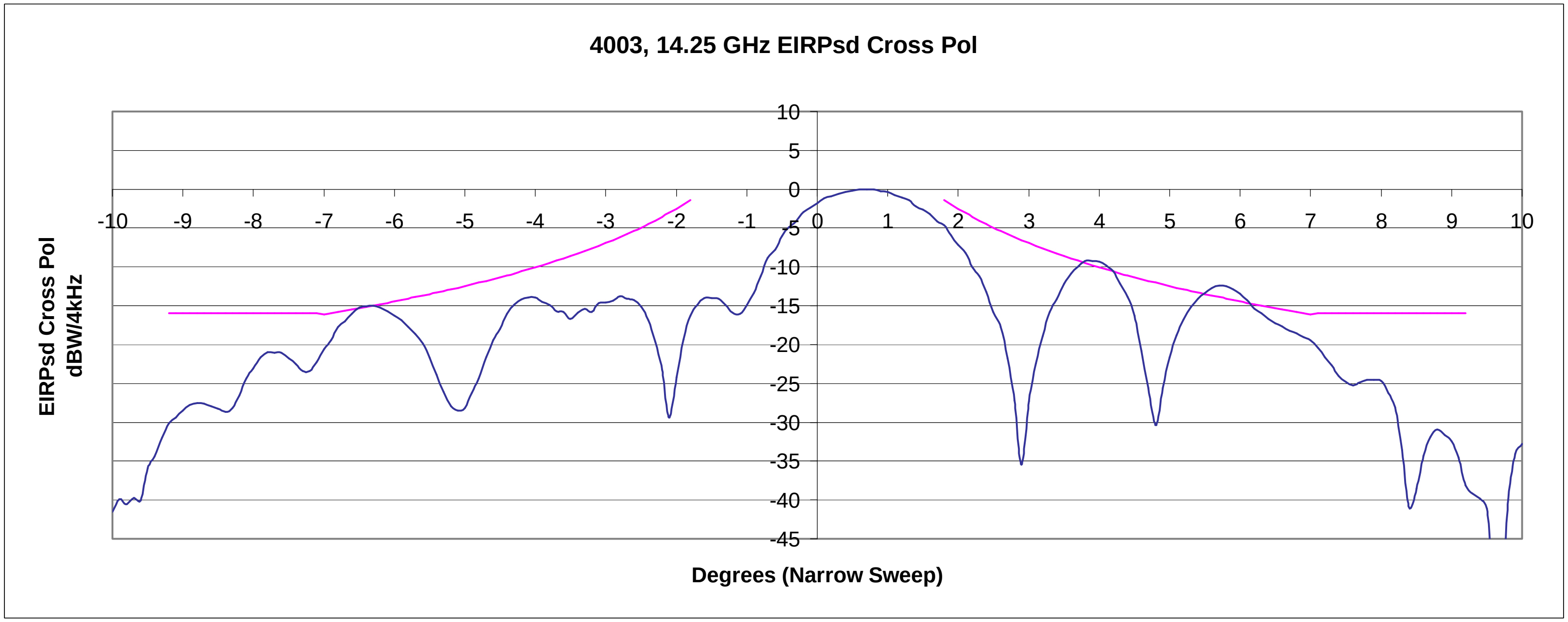
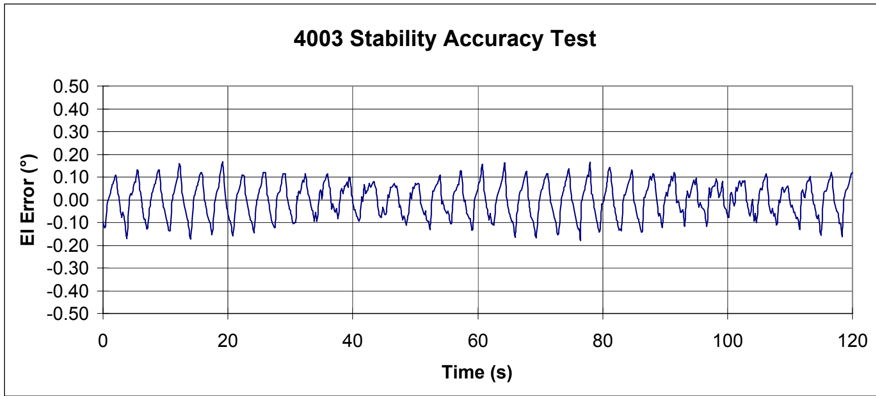

4003, 14.25 GHz EIRP SD E-Plane
EIRPsd dBW/4kHz
Degrees (Wide Sweep)

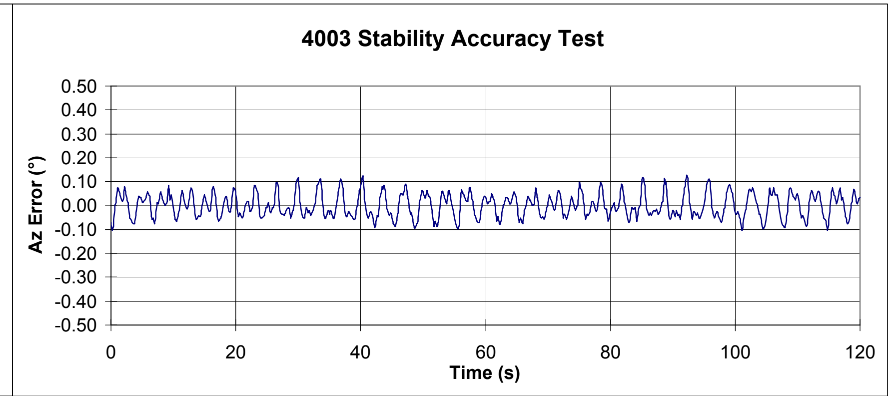
Figure 1

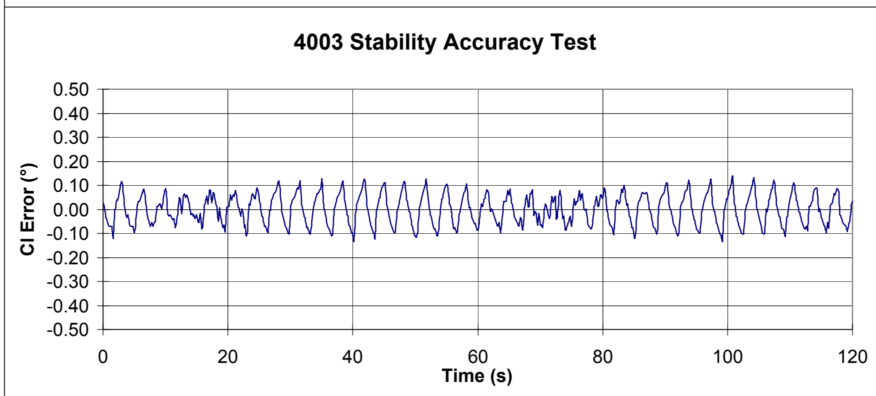


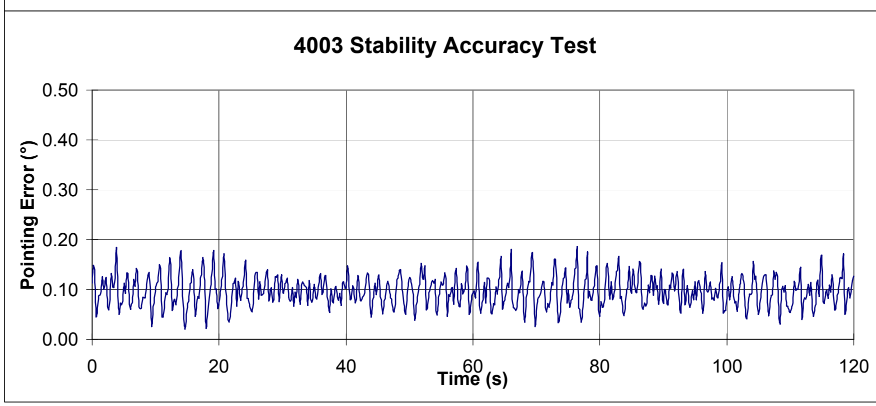
4003, 14.25 GHz EIRPsd Cross Pol
EIRPsd Cross Pol
dBW/4kHz
10
5
0
-5
-10
-15
-20
-25
-30
-35
-40
-45
-10
-9
-8
-7
-6
-5
-4
-3
-2
-1
0
1
2
3
4
5
6
7
8
9
10
Degrees (Narrow Sweep)

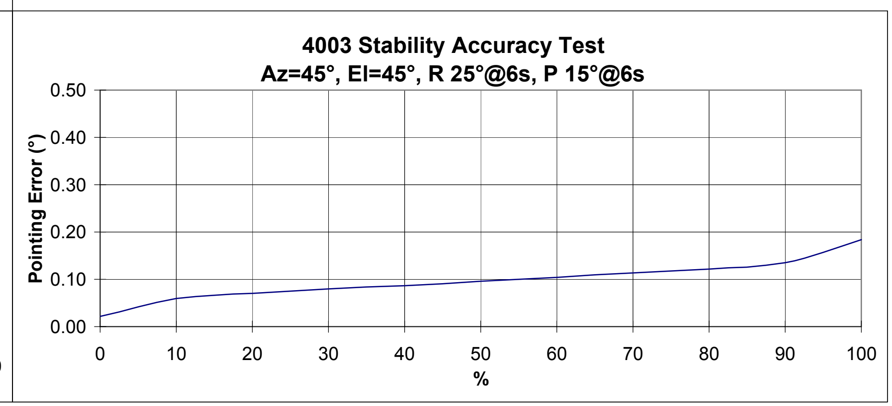
Figure 6











Ave Err (°) 0.097 RMS Err (°) 0.101 Max Err (°) 0.184

FCC RF COMPLIANCE ASSESSMENT

Prepared for

C5 COMMUNICATIONS

1.0-METER VSAT OPERATION

The following is an assessment of compliance with applicable FCC limits for maximum permissible exposure (MPE) for very small aperture terminals (VSATs) operated by C5 Communications (C5).

As will be explained, the results of the assessment apply to Ku-band VSAT operations whose antenna diameters are no smaller than 1.0 meters and whose antenna input power is up to 8 watts. In all cases, immediate access to the antennas is limited to C5's personnel who apply standard RF safety procedures. The MPE limit that applies is the one for "controlled" (occupational) exposure.

Based on the results of the mathematical analysis of potential RF exposure levels, the limited access to the areas of interest, and the application of standard RF safety procedures, it is our expert conclusion that C5's VSAT operations are in compliance with the FCC regulations and applicable MPE limits.

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The sections that follow provide all the necessary background underlying the analysis and our conclusion regarding compliance.

Operational Data

The relevant data for the subject operation is summarized as follows:

Transmitting Frequency Bands:	14.0 — 14.5 GHz
Antenna Type:	Aperture
Antenna Dimension (Diameter):	1.03 meters
Max Power Input to Antenna (at flange):	8 watts

Applicable MPE Limit

For frequencies above 1.5 GHz, the applicable FCC MPE limit for acceptable, continuous exposure of the general population is 1.0 milliwatt per square centimeter (mW/cm2), and for “controlled” occupational exposure, the limit is 5.0 mW/cm2.

Immediate access to C5’s VSATs is restricted to trained C5 personnel, and thus the latter limit applies.

FCC Models and Calculations

FCC Bulletin OET 65 provides standardized formulas for calculating the power density in both of the areas of possible interest here: (1) directly in front of the antenna, at the face and farther away but still in the main beam; and (2) to the side of the antenna. Each area of interest will be addressed in the subsections below.

Note that in each of the models, the parameters of interest focus on determining the power density at various locations around the antenna. Specifically, the antenna parameters of interest are the power input and the antenna diameter.

In this case, all C5 VSAT operations of interest use an antenna diameter of 1.03 meters, and the maximum antenna input power in either frequency band is 8 watts. Additionally, all C5 VSAT installations are atop a pedestal, 6ft in height above surrounding decks, placing the antenna radiation center at over 8ft above surrounding decks. Therefore, a single compliance assessment can be applied to all of C5’s VSAT operations satisfying these criteria.

Potential Exposure Levels Directly in Front of the Antenna

Before proceeding to these calculations, it is relevant to note that potential exposure in the areas in front of the antenna — whether at the surface of the antenna or in the extended main beam — is obviated by standard practices involving RF safety and RF design. As mentioned earlier, immediate access to the antennas is limited to C5’s trained personnel; if work needs to be performed on the antennas, it is standard RF safety practice to remove the input power. That basically prevents any exposure issue right at the face of the antenna. Potential exposure in the extended beam of the antenna is obviated by sound engineering practice; the beam of each VSAT requires a clear, unobstructed view of the satellite(s) with which it communicates. Proper engineering and positioning of the antenna prevents the beam from being obstructed by any nearby object, including human beings. Thus, the “potential” exposure in these areas is never “actual”. However, the results of these calculations do serve as confirmation of the need for standard safety procedures, and also serve as a reference point for calculations of RF levels to the side of the antennas.

According to Bulletin CET 65, the applicable formula for power density (S) at the antennae surface is as follows:

$$S = \frac{4P}{A}$$

where P represents the antenna input power and A is the surface area of the antenna.

In this case, with 8 watts maximum input power and an antenna diameter of 1.03 meters, the power density at the antenna surface is 3.84 mW/cm2, which does NOT exceed the FCC occupational MPE limit of 5 for this frequency. Though RF safety procedures should always be observed when work needs to be performed in this area, there exists no FCC requirement in this situation.

The formula for near-field, on-axis power density in front of the antenna is as follows:

$$S = 16 * e * P / (pi * D2)$$

where "e" represents the antenna illumination efficiency and D is the antenna diameter. In this case, when we apply an illumination efficiency of 0.65, the result of the calculation is 2.496 mW/cm2, which also does NOT exceed the occupational MPE limit of 5 for these frequencies. As described earlier, though, the need for an unobstructed view to the satellites and sound engineering design obviates concern over actual exposure in this area. The calculated result here, however, is used in the analysis of potential exposure to the immediate side of the antenna, which is addressed in the subsection that follows.

Potential Exposure Levels to the Side of the Antenna.

It is well founded that the near-field power density drops off dramatically outside the imaginary cylinder extending from the surface along the axis of the main beam of an aperture antenna.

According to Bulletin OET 65, if the point of interest is at least one antenna diameter removed from the center of the main beam, the power density at that point would be at least a factor of 100 lower than the value calculated for the equivalent distance in the main beam.

The previous calculation (for immediately in front of the antenna) demonstrated that the power density there is 3.84 mW/cm2, which is equivalent to 76.8 percent of the limit. At a distance of one antenna diameter (1.03 meters) to the side of the antenna, the FCC model says that the RF level would be no more than 0.02496 mW/cm2, equivalent to about .49 percent of the occupational limit and 2.4 percent of the General Population limits.

Compliance Conclusion

Based on the results of the calculations alone, and when considered along with access restrictions and standard safety procedures, it is our conclusion that the operation of C5's Ku-band 1.03 meter VSATs satisfy the compliance requirements in the FCC regulations.

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Bellaire, Texas 77401
Tel: 713-668-8085