The University of Tasmania Ceduna Antenna: Feed Horn Design and Performance near 22 GHz

1. Summary

This short report outlines the design of a proposed horn for Ceduna for operation over the frequency range, 16 to 25 GHz. Also, shown are the computed results for the cross-polarisation introduced when the existing horn is attached to its aperture.

2. Design Principle

The specification of a useable horn for operation near 22 GHz has been made possible by the available space behind the existing horn after removal of the sections of horn having an inside diameter of up to 246.5 mm. With a flare semi-angle of 8.7°, the phase-error factor Δ is 0.7, adequate for wideband constant-beam operation. Also, the phase-centre will be close to the apex of the horn, and hence the focus.

The horn has the following parameters:

Semi-angle:	8.7°	
Slot parameters:	pitch:	4.5 mm
	slot width:	3.1 mm
	flange width:	1.4 mm
Slot depths:	input:	6.0 mm
	transition (depth) over	23 slots
	remainder of horn:	3.5 mm
Diameters:	input:	14.0 mm
	output:	246.5 mm
No. of slots:	168	

Fig.1 shows an outline drawing of the horn.

3. Predicted Performance

Radiation patterns were computed by C. Granet of CTIP. The return loss and peak side-lobe levels are shown below. The beamwidths for frequencies at 20 GHz and above remain constant at -20 dB at ± 10°. At 16 GHz the intensity level is -17.5 dB.

Predicted Performance of Horn (no extension)

Frequency (GHz)	Return Loss (dB)	Cross-polar peak (dB)
16.0	17	-35
20.0	27	-47
23.0	32	-36
25.0	44	-35

Fig.2 shows the cross-polar results plotted for this horn, and an earlier design for coverage to 23 GHz only. Also shown for both cases are the cross-polar levels when lengths of the existing horn are added, where the total number of added slots is about 40. Additional calculations were carried out at a frequency of 23 GHz for the proposed design for additional horn lengths corresponding to 80, 160 and 240 slots. The results show only a small increase in cross-polarisation with length.

The calculations at 25 GHz show that the cross-polarisation is considerably higher with the existing horn attached and may lead to reduced performance. Operation above 25 GHz is not recommended.

4. *Conclusion*

The design and predicted patterns show that the proposed horn, when attached to the existing horn, should give good performance between 16 and 23 GHz, with reduced performance at 25 GHz.

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CEDUNA HORN: 16 - 25 GHz

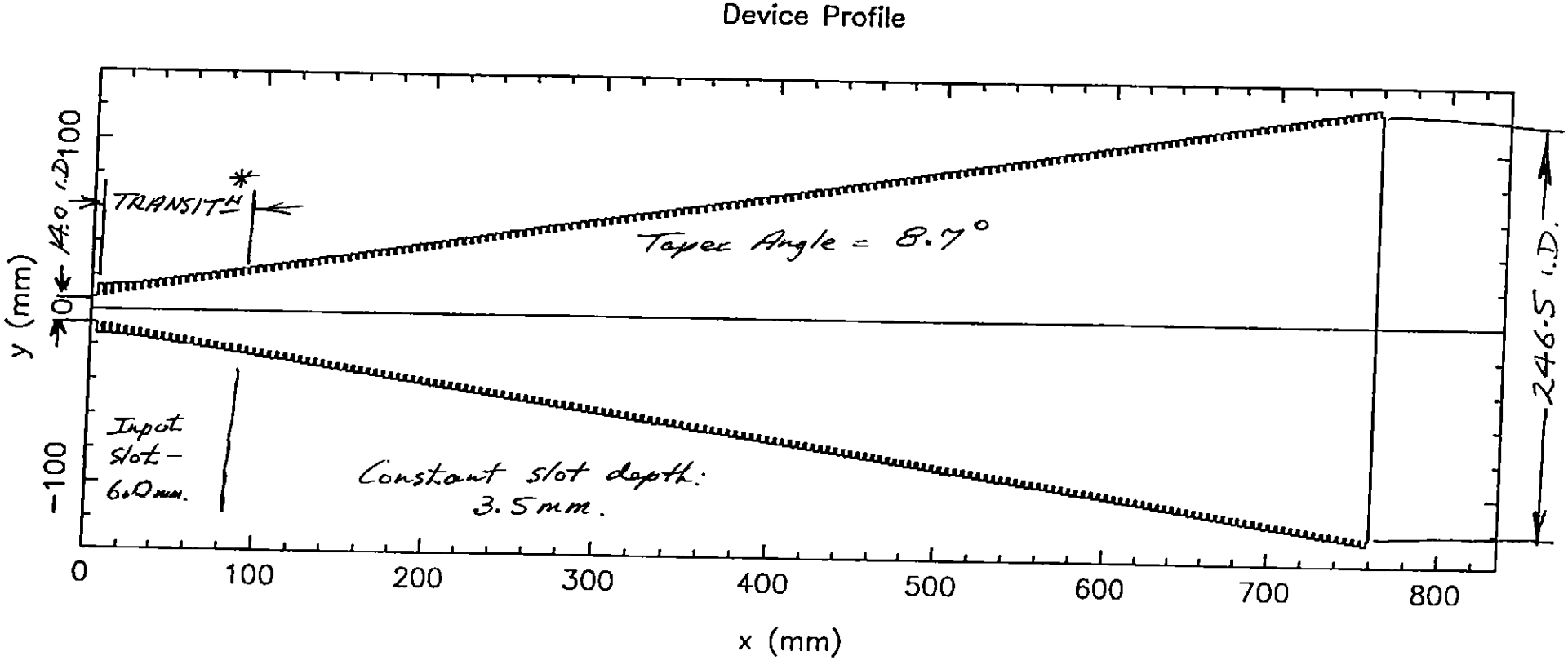

FIG. 1.

- Pitch = 4.5 mm
- Slot width = 3.1 mm
- Flange " = 1.4mm
- # slots = 168
- Transition: slot depth reduction, 6.0 to 3.5mm

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CEDUNA HORN : EFFECT OF LENGTH OF EXISTING HORN ON OPERATION FROM 16-25 GHz (Computed: C. Granet).

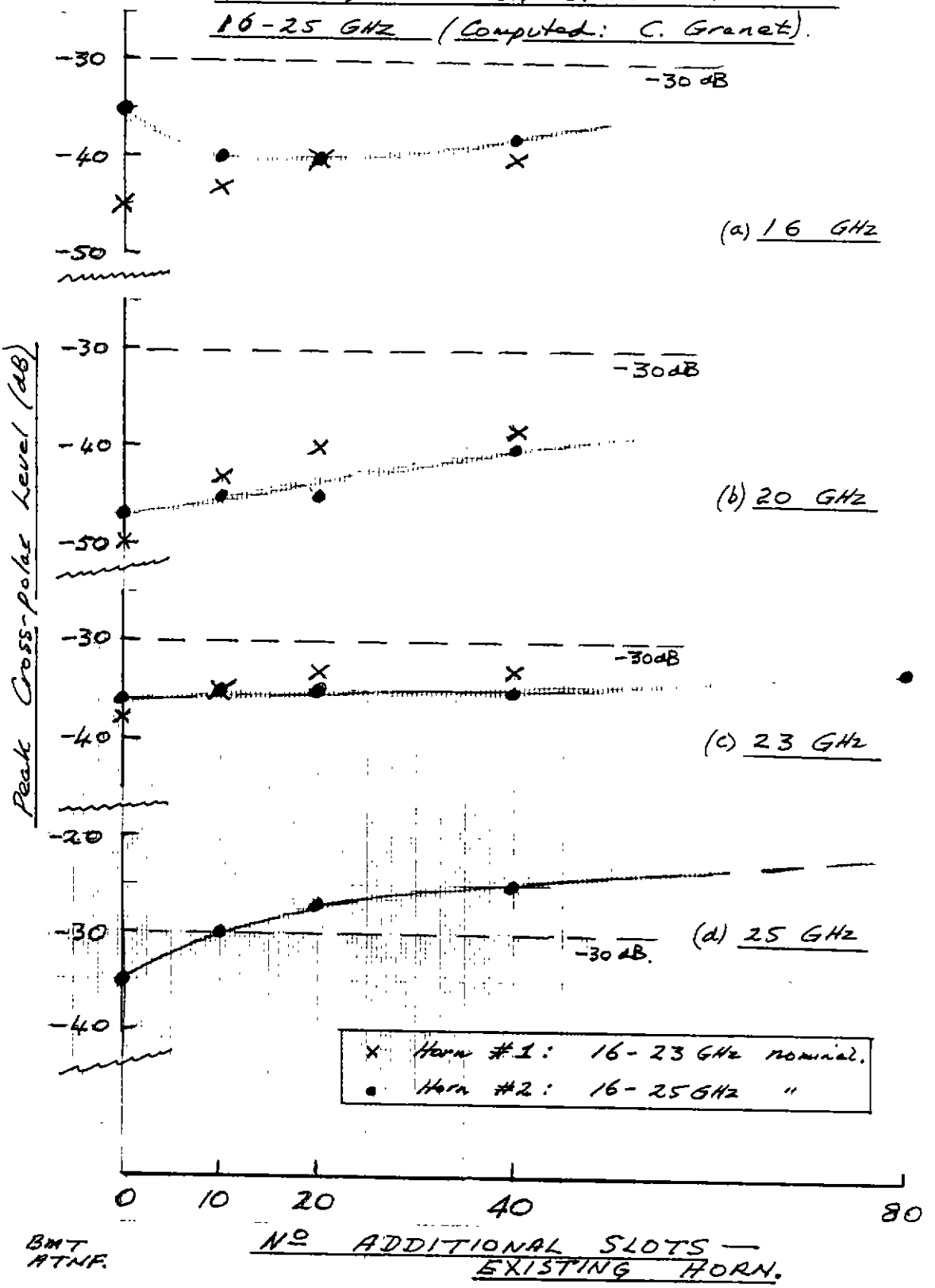

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FIG. 2.