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Business Unit: Cobham Technical Services
Antenna & Electronic Systems

Report Title: # Measured Performance of the Newtec 75cm Ku Band Antenna

Serial No: SN0379163

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Client: Newtec Cy NV

Client Reference: PO: 4500037087 Dated 30.01.2014

Project Number: 61380
Document No: Newtec-75cm-KuBand-May2014-TR01-01
Issue: 1

Document Control: Commercial-in-Confidence

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14 May 2014
Ref. Newtec-75cm-KuBand-May2014-TR01-01

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1. Introduction

This document describes the far-field range measurements undertaken at Cobham Technical Services on the Newtec 75cm Ku band antenna. The system consists of a single offset 75cm reflector and a Ku band feed mounted on the feed arm which is supported off the main reflector.

The Test Plan and procedures undertaken at Cobham Technical Services are consistent with *IEEE Standard Test Procedures for Antennas ANSI/IEEE Std 149-1979*.

2. Objectives

The objectives of far-field range tests were to measure the radiation patterns of the antenna system at Ku band operating in linear polarisation. The gain of the antenna was calculated from the 3dB and 10 dB beamwidths and an estimate of the feed losses.

3. Testing Site

The antenna testing was undertaken on the 7th of May 2014 at the Cobham Technical Services outdoor far-field range located as follows:

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4. Electrical Specification

The electrical specification and measured values matrix for the antenna is given in Table 1. The summary for the range measurements is given in Sections 6.6 and 6.7 for the azimuth and elevation plane respectively.

Table 1: Specification and Measurement Matrix

Parameter	Specification	Measured Values
Frequency	Rx: 10.7 – 12.75 GHz Tx: 13.75 – 14.5 GHz	Rx: 10.7 - 12.75 GHz Tx: 13.75 – 14.5 GHz
Polarisation	Orthogonal Linear Tx to Rx	Orthogonal Linear Tx to Rx
Gain	Rx: >37.8 dBi at 11.7 GHz Tx: >39.0 dBi at 14.25 GHz	Rx: 37.9 dBi at 11.7 GHz Tx: 39.1 dBi at 14.25 GHz
Off-axis Co-polar Gain Tx Band	29-25log(θ) dBi $100\lambda/D^o<\theta\leq7^o$ 8 dBi $7^o<\theta\leq9.2^o$ 32-25log(θ) dBi $9.2^o<\theta\leq48^o$ -10 dBi $48^o<\theta\leq180^o$	Section 6.8 & 6.9 Pattern plots
Off-axis Cross-polar Gain Tx Band	19-25log(θ) dBi $1.8^o<\theta\leq7^o$ -2 dBi $7^o<\theta\leq9.2^o$	Section 6.8 & 6.9 Pattern plots
Cross- polar discrimination within -1dB of main beam	Rx: >25 dB Tx: >25 dB	Rx >22.9 dB Tx >23.5 dB
Cross-polar discrimination on axis – Tx Band	>30 dB	>30.8 dB

5. Quality Statement

Cobham Technical Services operates a Quality Management System that is registered by BSI as complying with BS EN ISO 9001:2000, including the TickIt requirements (registration number FM 01303). The company maintains other Quality Management System Accreditations and Certifications that are linked either to a specific market, technology or customer.

Our Quality Management System is defined in general terms by a Quality Manual and in detail by a series of Quality Procedures. These documents, and other relevant material, are provided to all staff via our Intranet. This Quality Management System is implemented so as to meet the specific contractual and technical requirements of each individual project.

The Quality Assurance Manager is responsible to the General Manager for defining the Quality Management System, maintaining it and, when needed, for continually improving the process and standards. The Quality Assurance Manager is also responsible for identifying quality problems and initiating effective solutions.

Individual project quality is devolved down from the Heads of Business Units to the Line Managers and, for day-to-day activities, to Project Managers. Quality Assurance Representatives are appointed from the engineering staff to give local quality support and provide links between their Business Units and the Quality Assurance Manager.

Copies of our Quality Manual and our ISO 9001 and other certificates are available from: http://www.cobham.com/about-cobham/aerospace-and-security/about-us/antenna-systems/about-us/technical-services/quality-assurance.aspx.

6. Far-Field Range Measurements

6.1 Far-Field Range Equipment List

The test equipment used for the far-field range measurements is listed in Table 2.

Table 2: Antenna Systems Far-Field Range Equipment List

Equipment Used	Serial No.	Calibration Due	Tick Box
For range testing of antenna assembly:			
Scientific Atlanta Positioner Az/El/Az 55150A-1	72AG	Indication Only	✓
Scientific Atlanta Positioner Polarisation 56060-18	489	Indication Only	✓
Flann Standard Gain Horn Model 17240-25-AD	134387	Indication Only	
Dell Computer with Midas Software	DTOHZOJ	Indication Only	✓
Agilent 20 GHz Lo Source 83623B	3844A01682	Jan 2015	✓
Agilent 50 GHz RF Source 83650B	3844A01529	Jan 2015	✓
Agilent Receiver 8530A	3901A00722	Jan 2015	✓
Agilent Test Mixer Module 85320A-H50	2944A00942	Jan 2015	✓
Agilent Test Mixer Module 18GHz	2944A00258	Jan 2015	✓
Agilent Ref Mixer Module 85320B	2944A00156	Jan 2015	✓
Agilent Lo/IF distribution Unit 85309A	3224A00707	Jan 2015	✓
Orbit Pos. Controller AL-4806-3A	91	Indication Only	✓
Orbit Pos. Controller AL-4906-3A	292	Indication Only	✓

6.2 Far-Field Range Measurement Uncertainties

Detailed surveys of the test range have been carried out in the most commonly used microwave bands that indicate co-polar reflectivity better than -50 dB and cross-polar isolations better than 55 dB.

Typical far field range measurements uncertainties are given in Table 3. The overall accuracy of the gain measurements undertaken using a commercial Standard Gain Horn is estimated to be ±0.32 dB.

Table 3: Far field Range measurement uncertainties

Parameter	Value
Mutual Coupling	0.0 dB
Tx Amplitude Taper (0.25 dB)	0.1 dB
Reflections (Elevated Range)	0.01 dB
Frequency Stability	0.01%
Power Level	< ± 0.05 dB
Standard Gain Horn	± 0.3 dB
Spacing Tx to AUT	0.01 dB
Tx isolation	0.01 dB
Total RSS (Root-Sum-Square)	0.32 dB

6.3 Measurements plan

The Test Plan for the far-field range measurements is given in Table 4. The elevation measurements were performed by moving the reflector up and down and at certain angles the effect of the range railings can be seen in increased sidelobe levels. In elevation the negative angles correspond to the region below the feed arm.

All the measurements were recorded as ASCII text files in amplitude (dB). The data was then processed in Excel spreadsheets and the recorded patterns are included in Sections 6.8 and 6.9.

Table 4: Far-Field Range Measurements Test Plan

					Pattern Number								
Angular scale degrees	Port	Pol	Cut	Component	Frequency GHz								
					10.7	10.95	11.7	12.5	12.75	13.75	14.0	14.25	14.5
±180°	Rx	V	Az	Co & Cross*	1	2	3	4	5				
±30°	Rx	V	Az	Co & Cross*	6	7	8	9	10				
±10°	Rx	V	Az	Co & Cross	11	12	13	14	15				
±10°	Rx	V	El	Co & Cross	16	17	18	19	20				
±180°	Rx	H	Az	Co & Cross*	21	22	23	24	25				
±30°	Rx	H	Az	Co & Cross*	26	27	28	29	30				
±10°	Rx	H	Az	Co & Cross	31	32	33	34	35				
±10°	Rx	H	El	Co & Cross	36	37	38	39	40				
±180°	Tx	V	Az	Co & Cross*						41	42	43	44
±30°	Tx	V	Az	Co & Cross*						45	46	47	48
±10°	Tx	V	Az	Co & Cross						49	50	51	52
±10°	Tx	V	El	Co & Cross						53	54	55	56
±180°	Tx	H	Az	Co & Cross*						57	58	59	60
±30°	Tx	H	Az	Co & Cross*						61	62	63	64
±10°	Tx	H	Az	Co & Cross						65	66	67	68
±10°	Tx	H	El	Co & Cross						69	70	71	72
±4°	Rx	V	Contour plot Co		73		74	75	76				
±4°	Rx	H	Contour plot Co		77		78	79	80				
±4°	Rx	V	Contour plot Cross		81		82	83	84				
±4°	Rx	H	Contour plot Cross		85		86	87	88				
±4°	Tx	V	Contour plot Co							89	90	91	92
±4°	Tx	H	Contour plot Co							93	94	95	96
±4°	Tx	V	Contour plot Cross							97	98	99	100
±4°	Tx	H	Contour plot Cross							101	102	103	104
Gain (Calculated)				Co	✓	✓	✓	✓	✓	✓	✓	✓	✓

* Cross-polar ±10°

6.4 Gain Calculations

The antenna gain was calculated using the 3dB and 10 dB measured beamwidths and an estimate of the feed losses. Table 5 and Table 6 summarise the gain calculations.

Table 5: Calculated Gain – Vertical Polarisation

Frequency GHz	3 dB Beamwidth deg		10 dB Beamwidth deg		Feed Losses dB	AUT Gain dBi
	Azimuth	Elevation	Azimuth	Elevation		
10.7	2.40	2.39	4.13	4.03	0.2	37.15
10.95	2.35	2.36	4.08	3.97	0.2	37.28
11.7	2.20	2.18	3.81	3.77	0.2	37.86
12.5	2.09	2.08	3.61	3.66	0.2	38.26
12.75	2.04	2.08	3.46	3.66	0.2	38.40
13.75	1.90	2.01	3.31	3.40	0.2	38.89
14.0	1.85	1.96	3.25	3.43	0.2	39.02
14.25	1.82	1.95	3.19	3.40	0.2	39.13
14.5	1.86	1.92	3.14	3.39	0.2	39.16

Table 6: Calculated Gain – Horizontal Polarisation

Frequency GHz	3 dB Beamwidth deg		10 dB Beamwidth deg		Feed Losses dB	AUT Gain dBi
	Azimuth	Elevation	Azimuth	Elevation		
10.7	2.38	2.36	4.09	4.09	0.2	37.19
10.95	2.32	2.31	3.99	4.00	0.2	37.39
11.7	2.20	2.18	3.76	3.70	0.2	37.94
12.5	2.10	2.03	3.67	3.51	0.2	38.35
12.75	2.08	1.96	3.62	3.42	0.2	38.54
13.75	2.00	1.87	3.45	3.23	0.2	38.95
14.0	1.99	1.83	3.43	3.23	0.2	39.02
14.25	2.01	1.82	3.44	3.16	0.2	39.06
14.5	1.96	1.84	3.44	3.24	0.2	39.03

6.5 Cross-polar Discrimination on Axis

The measured cross-polar discrimination on axis is given in **Figure 1** and **Figure 2** for vertical and horizontal polarisations respectively.

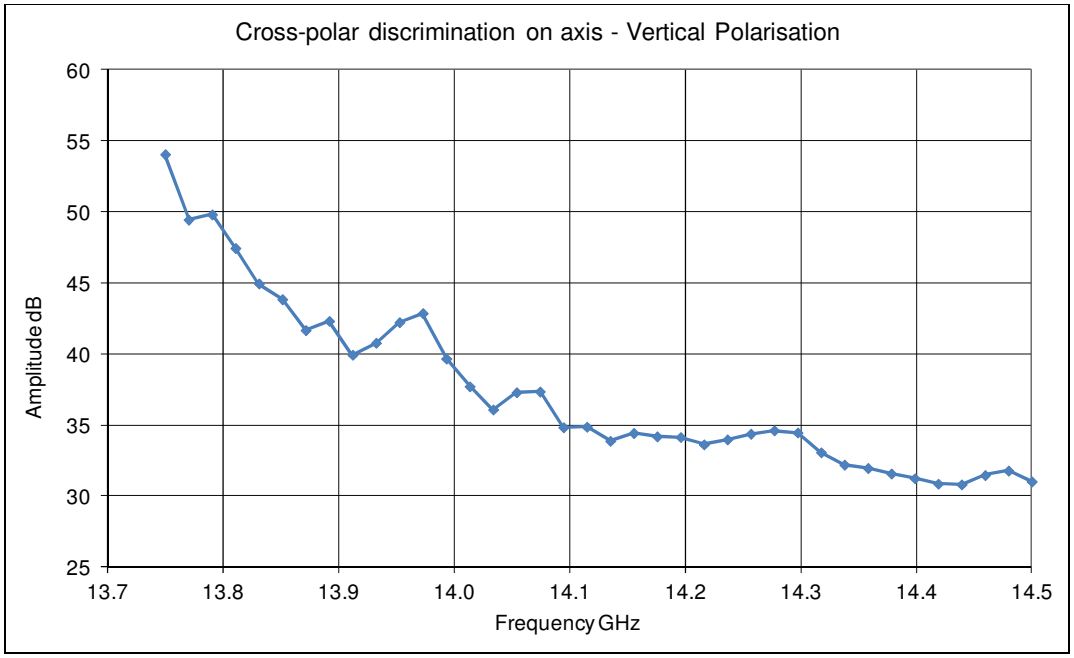


Figure 1: Measured cross-polar discrimination on axis – Vertical polarisation

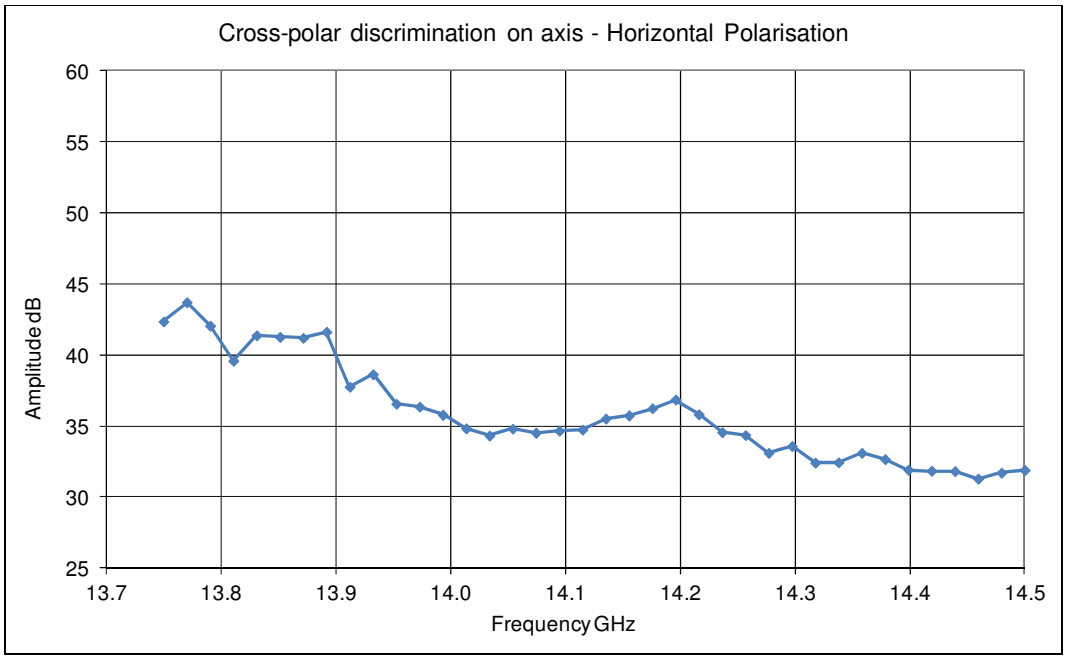
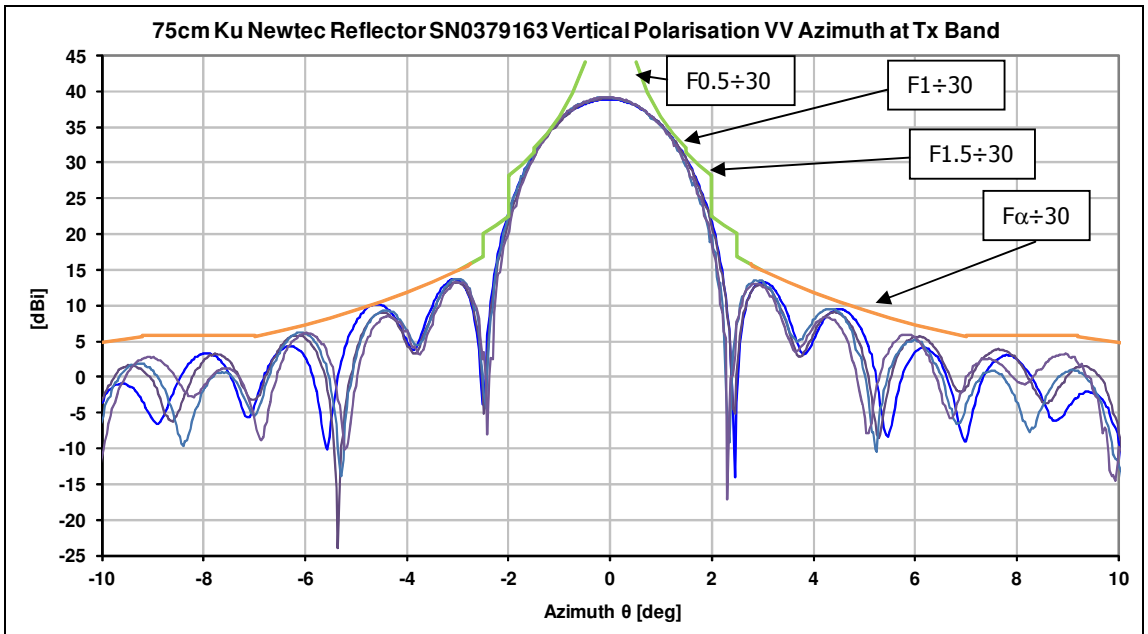


Figure 2: Measured cross-polar discrimination on axis – Horizontal polarisation

6.6 Summary of Azimuth Plane Range Measurements

The summary of the azimuth plane range measurements for the Tx band is given in **Figure 3** and **Figure 4** where all Tx frequencies are plotted for vertical and horizontal polarisation respectively. The sidelobe templates have been shifted up or down according to the F factors given in the figures. The F factors for the azimuth plane are also given in Table 7. In Table 7 positive numbers correspond to the pattern exceeding the sidelobe template and negative numbers correspond to the levels the patterns are below the templates.

The summary for the azimuth plane range measurements for both the Rx and Tx bands is given in Table 8. In Table 8 only the levels exceeding the sidelobe templates are given.

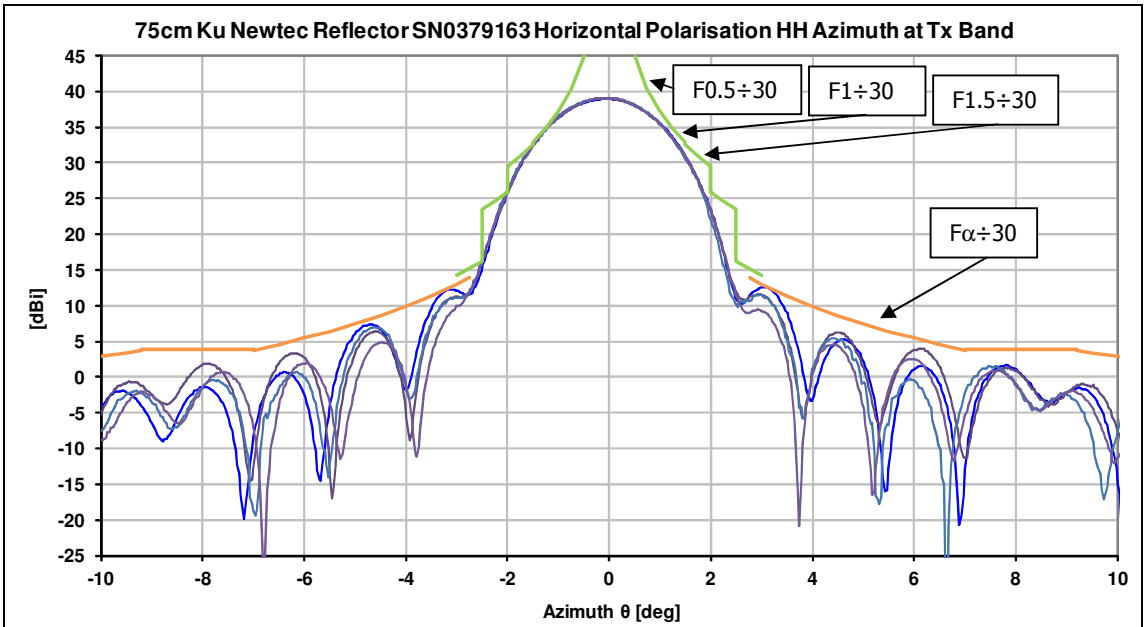


Frequency [GHz]	13.75	14	14.25	14.5
Gain [dBi]	38.89	39.02	39.13	39.16
Max -1dB Contour XPD [dB]	-23.5	-23.9	-23.8	-24.4
% over mask	9%	9%	9%	9%
Maximum out of spec [dB]				
α ÷ 9.2 [deg]	0.0	0.0	0.0	0.0
9.2 ÷ 48 [deg]	0.0	0.0	0.0	0.0
48 ÷ 180 [deg]	4.6	4.7	4.0	3.3

Frequency [GHz]	13.75	14	14.25	14.5
α [deg]	2.9	2.9	2.8	2.8
α ÷ 9.2 [deg]	-2.2	-3.4	-3.1	-3.4
0.5 ÷ 1 [deg]	6.7	6.6	6.9	7.0
1 ÷ 1.5 [deg]	7.4	7.2	7.5	7.2
1.5 ÷ 2 [deg]	6.7	6.2	6.8	6.0
2 ÷ 2.5 [deg]	1.0	-0.4	0.5	-1.9
2.5 ÷ 3 [deg]	-3.7	-3.9	-3.5	-4.0

Azimuth	
Fα÷30	-2.2
F0.5÷30	7.5
F1÷30	7.5
F1.5÷30	6.8
F2÷30	1.0
F2.5÷30	-2.2

Figure 3: Azimuth plane patterns summary – Vertical polarisation



Frequency [GHz]	13.75	14	14.25	14.5
Gain [dBi]	38.95	39.02	39.06	39.03
Max -1dB Contour XPD [dB]	-25.0	-24.5	-24.7	-24.7
% over mask	12%	11%	9%	8%
Maximum out of spec [dB]				
α ÷ 9.2 [deg]	0.0	0.0	0.0	0.0
9.2 ÷ 48 [deg]	0.0	0.0	1.0	0.0
48 ÷ 180 [deg]	8.6	7.8	7.1	6.8

Frequency [GHz]	13.75	14	14.25	14.5
α [deg]	2.9	2.9	2.8	2.8
α ÷ 9.2 [deg]	-4.1	-5.3	-5.4	-6.3
0.5 ÷ 1 [deg]	7.2	7.3	7.5	7.1
1 ÷ 1.5 [deg]	8.1	8.3	8.3	8.1
1.5 ÷ 2 [deg]	7.9	8.0	7.9	7.8
2 ÷ 2.5 [deg]	4.0	4.5	4.1	4.1
2.5 ÷ 3 [deg]	-4.2	-3.2	-3.2	-2.8

Azimuth	
Fα÷30	-4.1
F0.5÷30	8.3
F1÷30	8.3
F1.5÷30	8.0
F2÷30	4.5
F2.5÷30	-2.8

Figure 4: Azimuth plane patterns summary – Horizontal polarisation

Table 7: F Factors for the Azimuth Plane - Tx band

	F0.5°÷30°	F1.0°÷30°	F1.5°÷30°	F2.0°÷30°	F2.5°÷30°	Fα÷30°
Vpol (dB)	7.5	7.5	6.8	1.0	-2.2	-2.2
Hpol (dB)	8.3	8.3	8.0	4.5	-2.8	-4.1

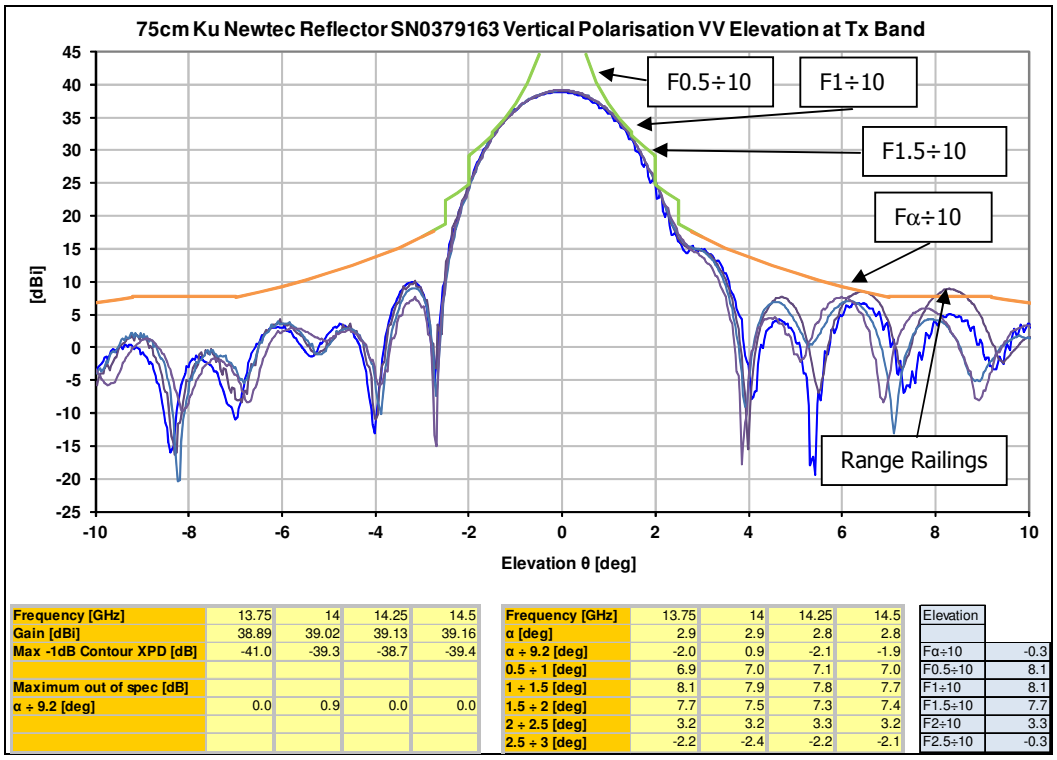
Table 8: Summary of Azimuth Plane Range Measurements

Frequency GHz	Pol	Gain dBi	XPD within -1 dB	% over mask α_{az}°-180°	Peak level above mask 29-25logθ						
					0.5°-1°	1°-1.5°	1.5°-2°	2°-2.5°	α_{az}°-9.2°	9.2°-48°	48°-180°
10.70	VV	37.15	23.6 dB	26%	6.1 dB	7.9 dB	8.0 dB	6.7 dB	0.0 dB	1.3 dB	13.2 dB
10.95	VV	37.28	24.3 dB	26%	6.1 dB	7.9 dB	8.0 dB	6.3 dB	0.0 dB	0.0 dB	12.2 dB
11.7	VV	37.86	23.7 dB	20%	6.3 dB	7.7 dB	7.6 dB	5.0 dB	0.0 dB	0.4 dB	10.2 dB
12.5	VV	38.26	23.7 dB	13%	6.5 dB	7.7 dB	7.2 dB	3.8 dB	0.0 dB	0.4 dB	7.0 dB
12.75	VV	38.40	24.0 dB	12%	6.5 dB	7.2 dB	6.9 dB	2.7 dB	0.0 dB	0.0 dB	5.2 dB
10.70	HH	37.19	22.9 dB	28%	6.0 dB	7.7 dB	7.8 dB	6.0 dB	0.0 dB	0.0 dB	11.9 dB
10.95	HH	37.39	23.3 dB	26%	6.1 dB	7.7 dB	7.6 dB	5.7 dB	0.0 dB	0.0 dB	11.6 dB
11.7	HH	37.94	23.7 dB	20%	6.4 dB	7.7 dB	7.6 dB	4.7 dB	0.0 dB	0.0 dB	11.2 dB
12.5	HH	38.35	25.2 dB	14%	6.7 dB	7.8 dB	7.7 dB	4.5 dB	0.0 dB	0.0 dB	10.0 dB
12.75	HH	38.54	25.2 dB	14%	7.0 dB	8.1 dB	7.9 dB	4.7 dB	0.0 dB	0.0 dB	9.9 dB
13.75	VV	38.89	23.5 dB	9%	6.7 dB	7.4 dB	6.7 dB	1.0 dB	0.0 dB	0.0 dB	4.6 dB
14.00	VV	39.02	23.9 dB	9%	6.6 dB	7.2 dB	6.2 dB	0.0 dB	0.0 dB	0.0 dB	4.7 dB
14.25	VV	39.13	23.8 dB	9%	6.9 dB	7.5 dB	6.8 dB	0.5 dB	0.0 dB	0.0 dB	4.0 dB
14.50	VV	39.16	24.4 dB	9%	7.0 dB	7.2 dB	6.0 dB	0.0 dB	0.0 dB	0.0 dB	3.3 dB
13.75	HH	38.95	25.0 dB	12%	7.2 dB	8.1 dB	7.9 dB	4.0 dB	0.0 dB	0.0 dB	8.6 dB
14.00	HH	39.02	24.5 dB	11%	7.3 dB	8.3 dB	8.0 dB	4.5 dB	0.0 dB	0.0 dB	7.8 dB
14.25	HH	39.06	24.7 dB	9%	7.5 dB	8.3 dB	7.9 dB	4.1 dB	0.0 dB	1.0 dB	7.1 dB
14.50	HH	39.03	24.7 dB	8%	7.1 dB	8.1 dB	7.8 dB	4.1 dB	0.0 dB	0.0 dB	6.8 dB

6.7 Summary of Elevation Plane Range Measurements

The summary of the elevation plane range measurements for the Tx band is given in **Figure 5** and **Figure 6** where all Tx frequencies are plotted for vertical and horizontal polarisation respectively. The sidelobe templates have been shifted up or down according to the F factors given in the figures. The F factors for the elevation plane cuts are also given in Table 9 for angles up to 7° to avoid including high sidelobes caused by the range railings when the antenna is moved up and down in elevation. In Table 9 positive numbers correspond to the pattern exceeding the sidelobe template and negative numbers correspond to the levels the patterns are below the templates.

The summary for the elevation plane range measurements for both the Rx and Tx bands is given in Table 10. In Table 10 only the levels exceeding the sidelobe templates are given.

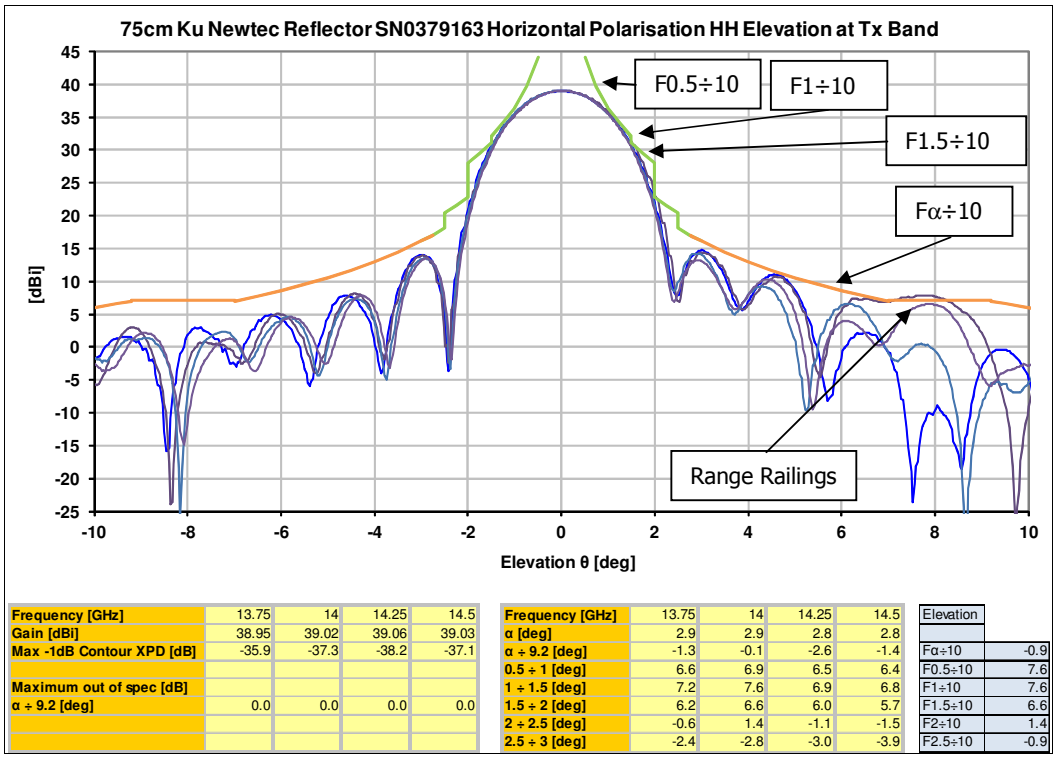


Frequency [GHz]	13.75	14	14.25	14.5
Gain [dBi]	38.89	39.02	39.13	39.16
Max -1dB Contour XPD [dB]	-41.0	-39.3	-38.7	-39.4
Maximum out of spec [dB]				
α ÷ 9.2 [deg]	0.0	0.9	0.0	0.0

Frequency [GHz]	13.75	14	14.25	14.5
α [deg]	2.9	2.9	2.8	2.8
α ÷ 9.2 [deg]	-2.0	0.9	-2.1	-1.9
0.5 ÷ 1 [deg]	6.9	7.0	7.1	7.0
1 ÷ 1.5 [deg]	8.1	7.9	7.8	7.7
1.5 ÷ 2 [deg]	7.7	7.5	7.3	7.4
2 ÷ 2.5 [deg]	3.2	3.2	3.3	3.2
2.5 ÷ 3 [deg]	-2.2	-2.4	-2.2	-2.1

Elevation	
Fα÷10	-0.3
F0.5÷10	8.1
F1÷10	8.1
F1.5÷10	7.7
F2÷10	3.3
F2.5÷10	-0.3

Figure 5: Elevation plane patterns summary – Vertical polarisation



Frequency [GHz]	13.75	14	14.25	14.5
Gain [dBi]	38.95	39.02	39.06	39.03
Max -1dB Contour XPD [dB]	-35.9	-37.3	-38.2	-37.1
Maximum out of spec [dB]				
α ÷ 9.2 [deg]	0.0	0.0	0.0	0.0

Frequency [GHz]	13.75	14	14.25	14.5
α [deg]	2.9	2.9	2.8	2.8
α ÷ 9.2 [deg]	-1.3	-0.1	-2.6	-1.4
0.5 ÷ 1 [deg]	6.6	6.9	6.5	6.4
1 ÷ 1.5 [deg]	7.2	7.6	6.9	6.8
1.5 ÷ 2 [deg]	6.2	6.6	6.0	5.7
2 ÷ 2.5 [deg]	-0.6	1.4	-1.1	-1.5
2.5 ÷ 3 [deg]	-2.4	-2.8	-3.0	-3.9

Elevation	
Fα÷10	-0.9
F0.5÷10	7.6
F1÷10	7.6
F1.5÷10	6.6
F2÷10	1.4
F2.5÷10	-0.9

Figure 6: Elevation plane patterns summary – Horizontal polarisation

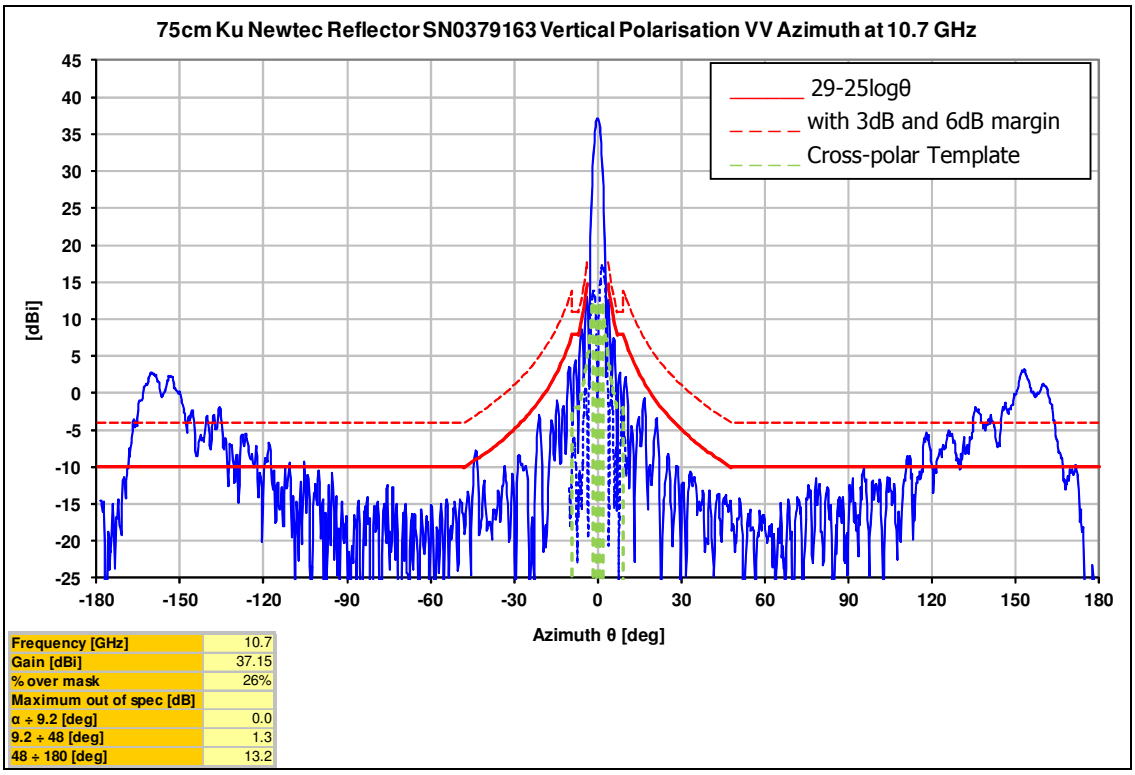
Table 9: F Factors for the Elevation Plane - Tx band

	F0.5°÷10°	F1.0°÷10°	F1.5°÷10°	F2.0°÷10°	F2.5°÷10°	Fα÷10°
Vpol (dB)	8.1	8.1	7.7	3.3	-0.3	-0.3
Hpol (dB)	7.6	7.6	6.6	1.4	-0.9	-0.9

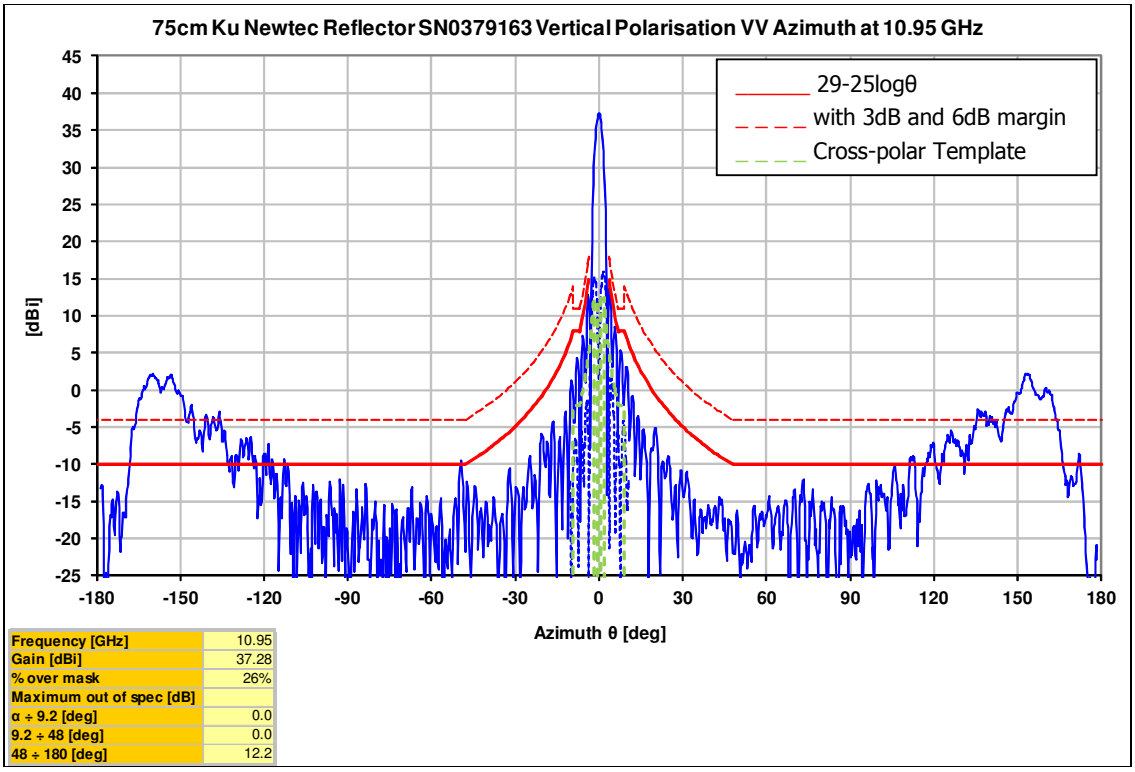
Table 10: Summary of Elevation Plane Range Measurements

Frequency GHz	Pol	Gain dBi	XPD within -1 dB	Peak level above mask 29-25logθ				
				1°-1.5°	1°-1.5°	1.5°-2°	2°-2.5°	α_{el}°-9.2°
10.70	VV	37.15	28.5 dB	5.9 dB	7.6 dB	7.6 dB	5.9 dB	2.5 dB
10.95	VV	37.28	33.8 dB	6.1 dB	7.8 dB	7.8 dB	5.9 dB	1.3 dB
11.7	VV	37.86	39.3 dB	6.3 dB	7.7 dB	7.5 dB	4.9 dB	0.5 dB
12.5	VV	38.26	48.5 dB	6.4 dB	7.5 dB	7.3 dB	4.2 dB	0.0 dB
12.75	VV	38.40	36.0 dB	6.8 dB	8.2 dB	8.0 dB	4.8 dB	0.0 dB
10.70	HH	37.19	22.4 dB	6.2 dB	8.1 dB	8.2 dB	7.8 dB	0.6 dB
10.95	HH	37.39	27.6 dB	6.3 dB	8.1 dB	8.2 dB	6.8 dB	0.0 dB
11.7	HH	37.94	37.0 dB	6.6 dB	8.1 dB	8.0 dB	5.4 dB	0.0 dB
12.5	HH	38.35	40.1 dB	6.7 dB	7.8 dB	7.6 dB	4.0 dB	0.0 dB
12.75	HH	38.54	33.3 dB	6.6 dB	7.6 dB	7.2 dB	3.3 dB	0.5 dB
13.75	VV	38.89	41.0 dB	6.9 dB	8.1 dB	7.7 dB	3.2 dB	0.0 dB
14.00	VV	39.02	39.3 dB	7.0 dB	7.9 dB	7.5 dB	3.2 dB	0.9 dB
14.25	VV	39.13	38.7 dB	7.1 dB	7.8 dB	7.3 dB	3.3 dB	0.0 dB
14.50	VV	39.16	39.4 dB	7.0 dB	7.7 dB	7.4 dB	3.2 dB	0.0 dB
13.75	HH	38.95	35.9 dB	6.6 dB	7.2 dB	6.2 dB	0.0 dB	0.0 dB
14.00	HH	39.02	37.3 dB	6.9 dB	7.6 dB	6.6 dB	1.4 dB	0.0 dB
14.25	HH	39.06	38.2 dB	6.5 dB	6.9 dB	6.0 dB	0.0 dB	0.0 dB
14.50	HH	39.03	37.1 dB	6.4 dB	6.8 dB	5.7 dB	0.0 dB	0.0 dB

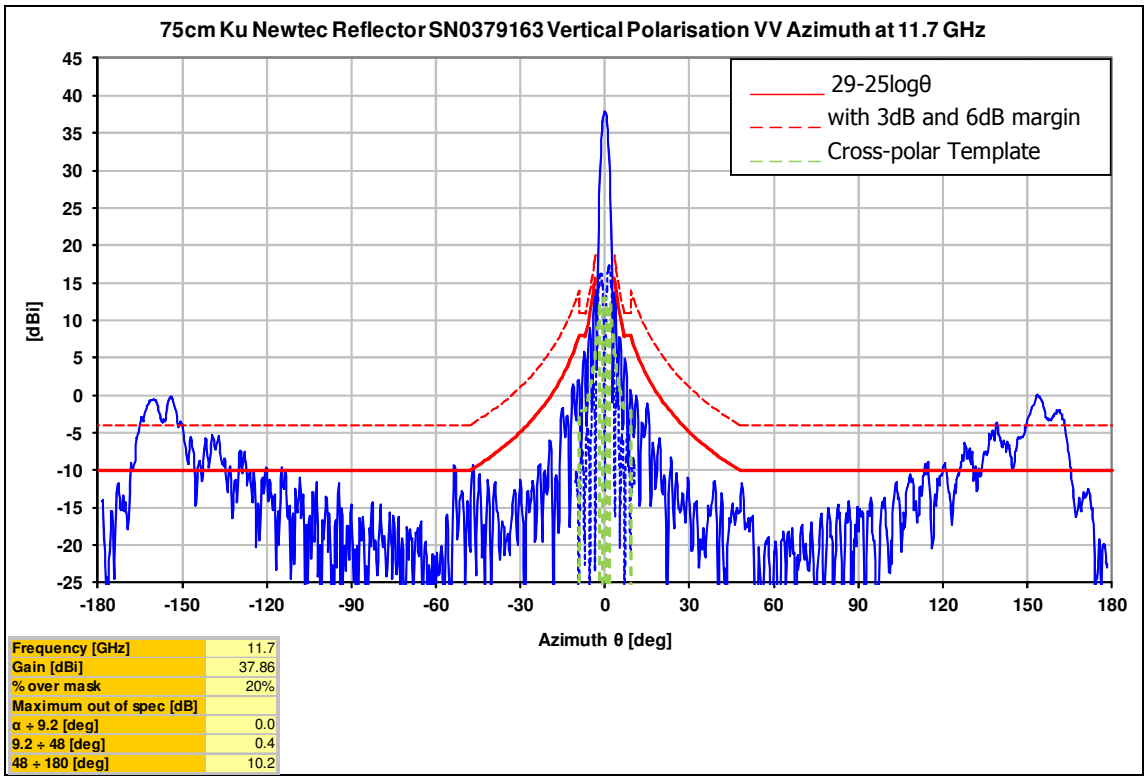
6.8 Measured Patterns – Rx Band



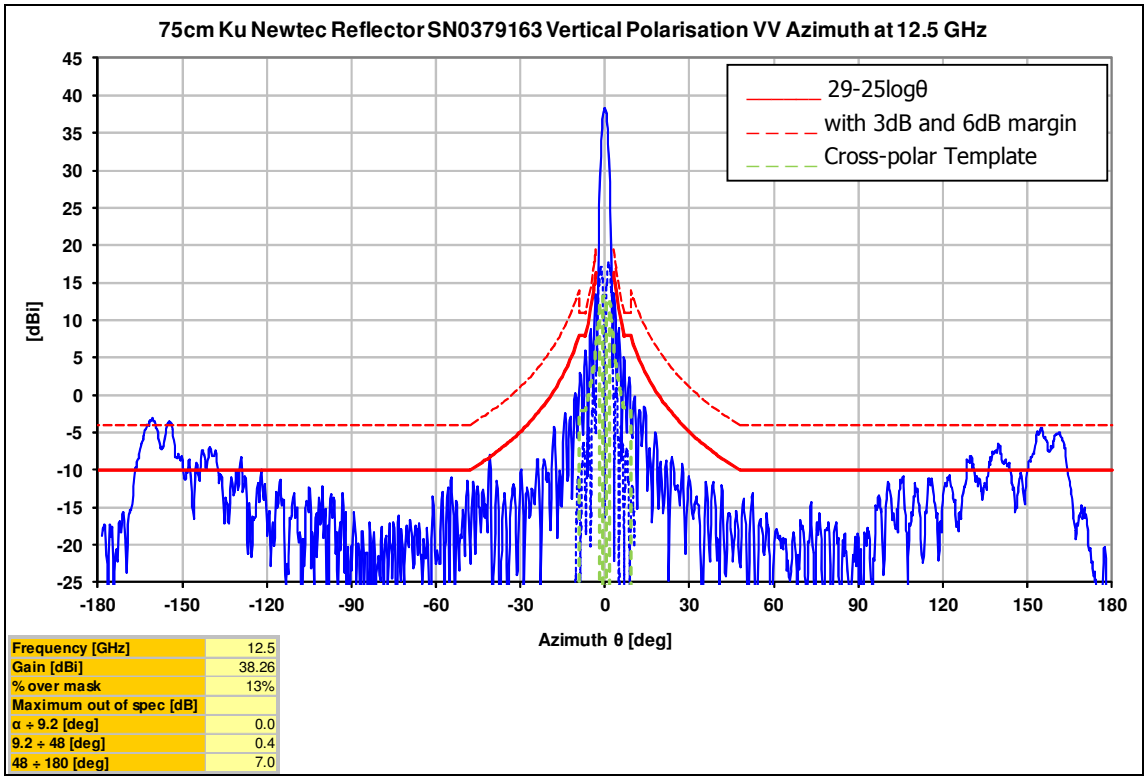
Frequency [GHz]	10.7
Gain [dBi]	37.15
% over mask	26%
Maximum out of spec [dB]	
α ÷ 9.2 [deg]	0.0
9.2 ÷ 48 [deg]	1.3
48 ÷ 180 [deg]	13.2



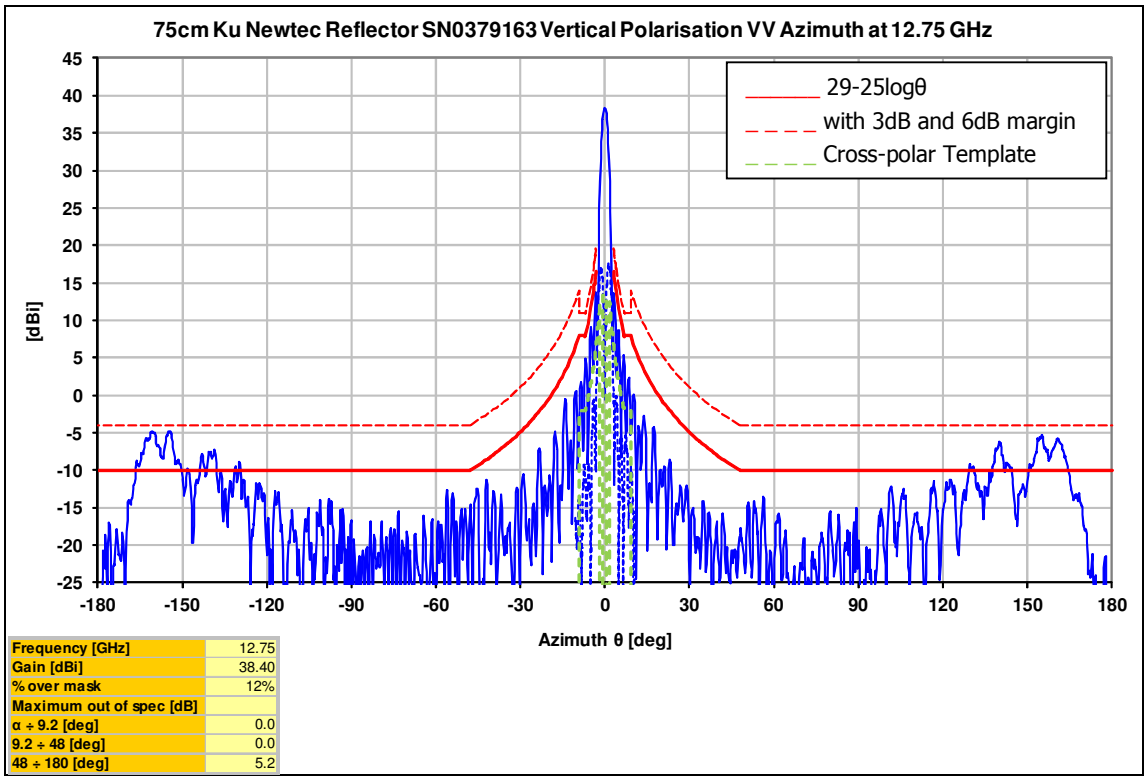
Frequency [GHz]	10.95
Gain [dBi]	37.28
% over mask	26%
Maximum out of spec [dB]	
α ÷ 9.2 [deg]	0.0
9.2 ÷ 48 [deg]	0.0
48 ÷ 180 [deg]	12.2



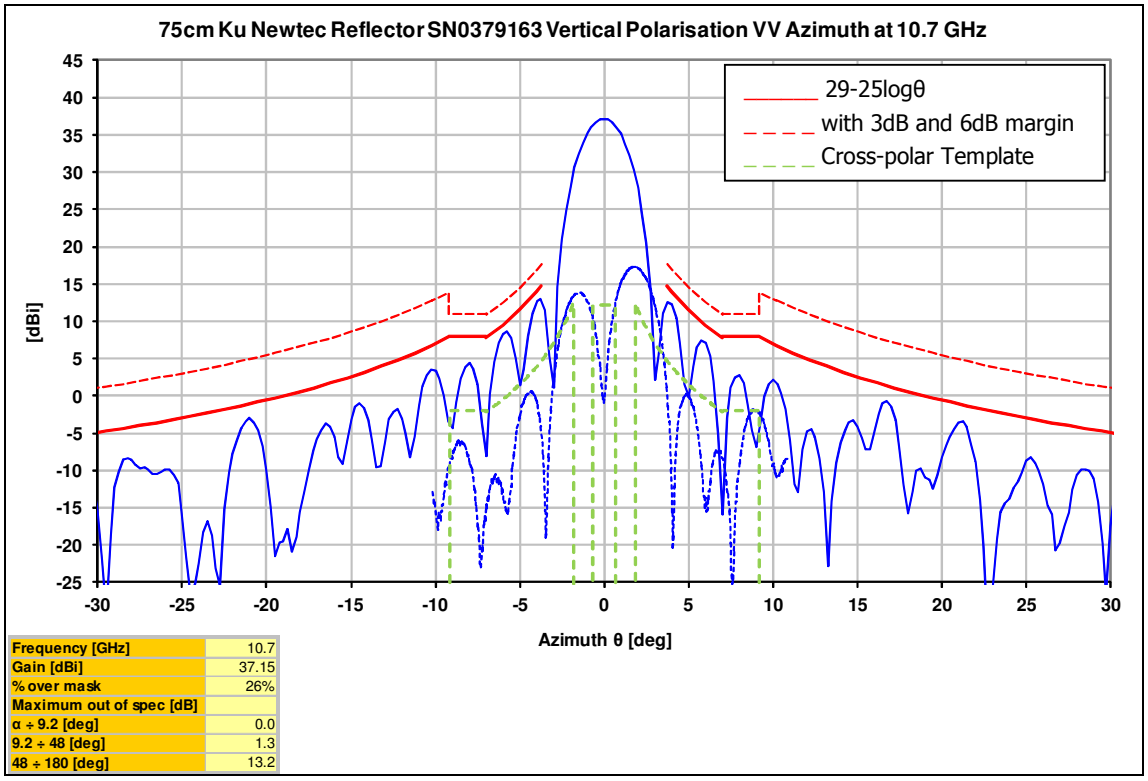
Frequency [GHz]	11.7
Gain [dBi]	37.86
% over mask	20%
Maximum out of spec [dB]	
α ÷ 9.2 [deg]	0.0
9.2 ÷ 48 [deg]	0.4
48 ÷ 180 [deg]	10.2



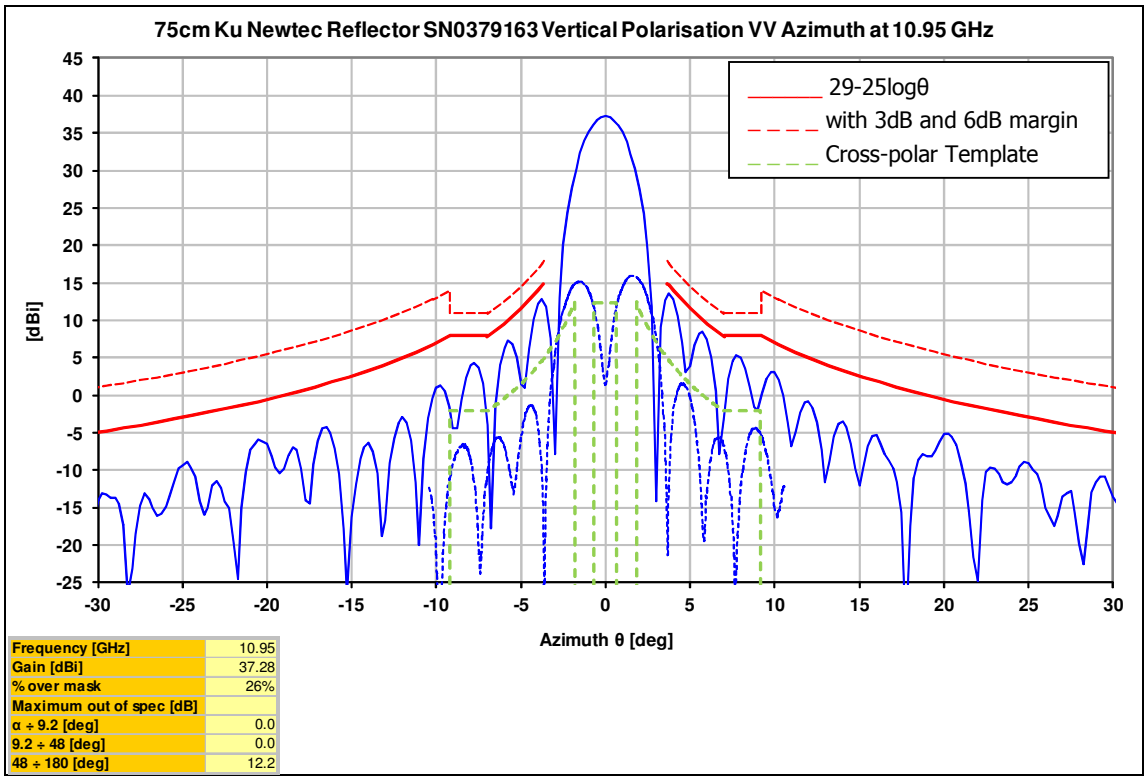
Frequency [GHz]	12.5
Gain [dBi]	38.26
% over mask	13%
Maximum out of spec [dB]	
α ÷ 9.2 [deg]	0.0
9.2 ÷ 48 [deg]	0.4
48 ÷ 180 [deg]	7.0



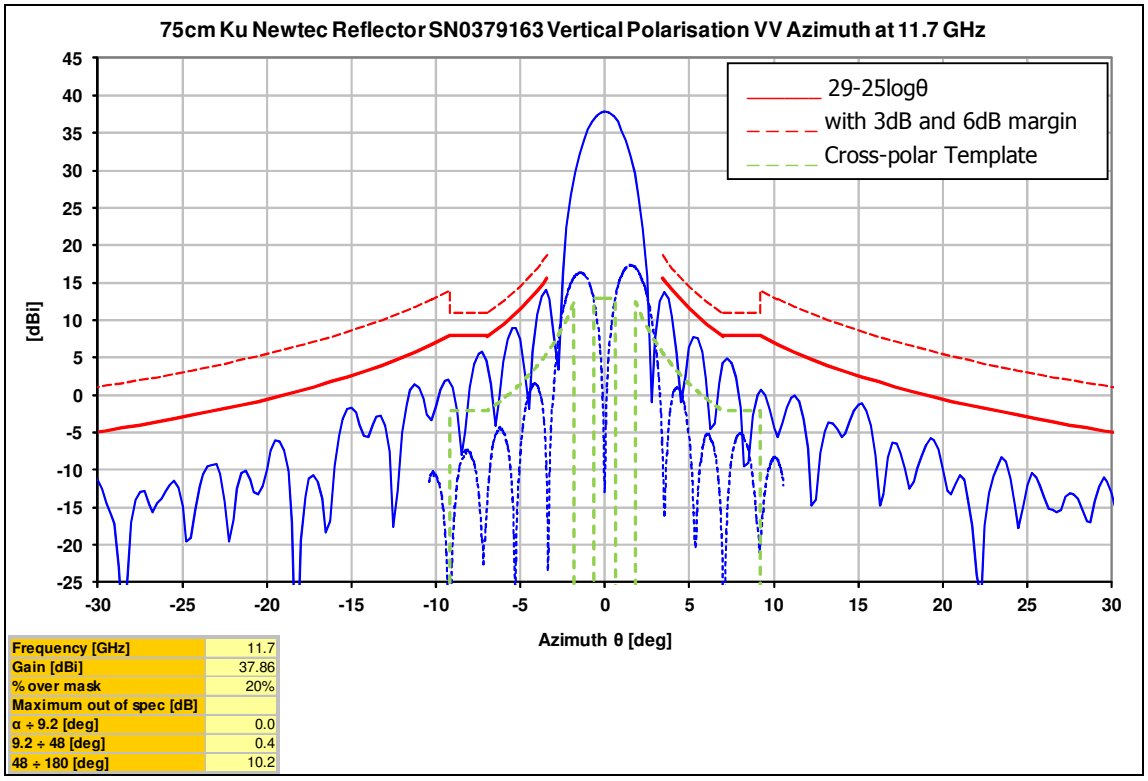
Frequency [GHz]	12.75
Gain [dBi]	38.40
% over mask	12%
Maximum out of spec [dB]	
α ÷ 9.2 [deg]	0.0
9.2 ÷ 48 [deg]	0.0
48 ÷ 180 [deg]	5.2



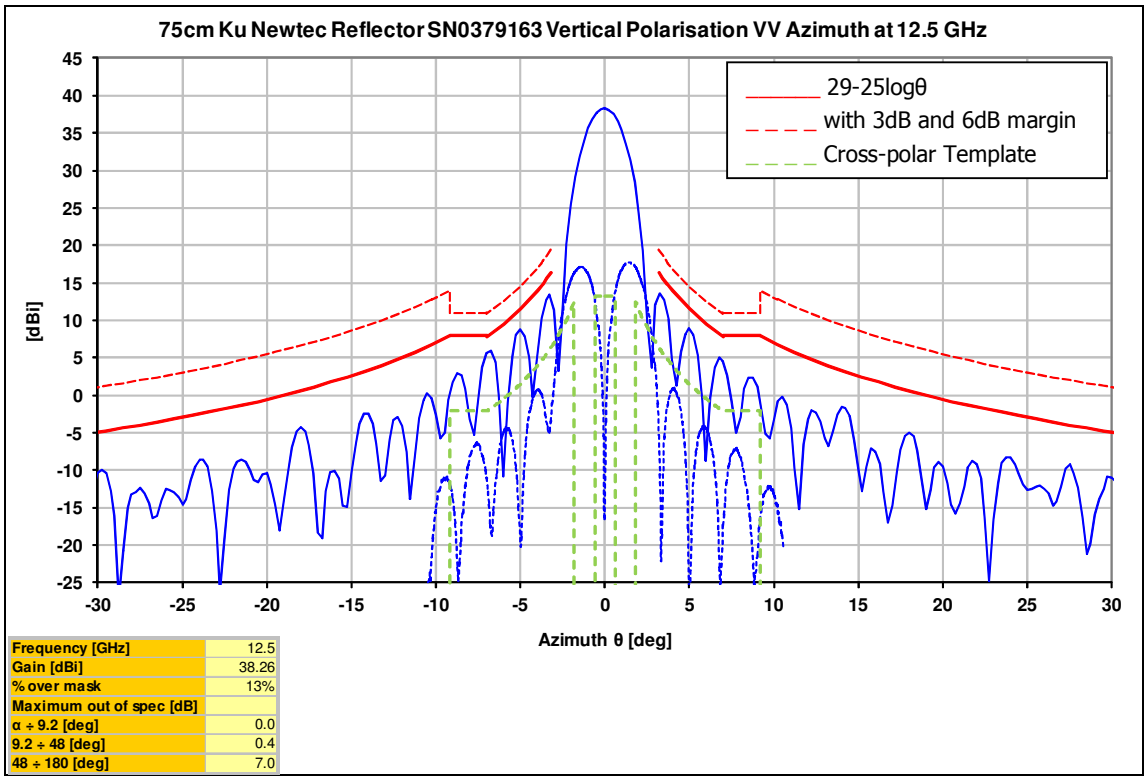
Frequency [GHz]	10.7
Gain [dBi]	37.15
% over mask	26%
Maximum out of spec [dB]	
α ÷ 9.2 [deg]	0.0
9.2 ÷ 48 [deg]	1.3
48 ÷ 180 [deg]	13.2



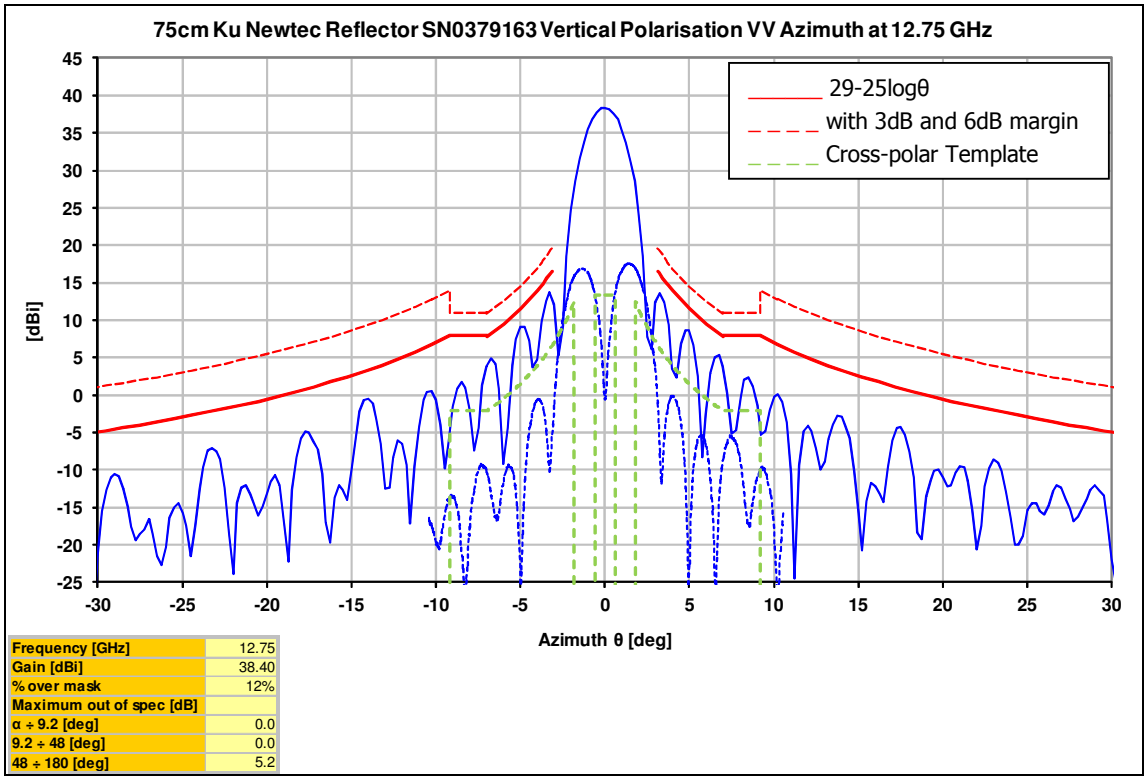
Frequency [GHz]	10.95
Gain [dBi]	37.28
% over mask	26%
Maximum out of spec [dB]	
α ÷ 9.2 [deg]	0.0
9.2 ÷ 48 [deg]	0.0
48 ÷ 180 [deg]	12.2



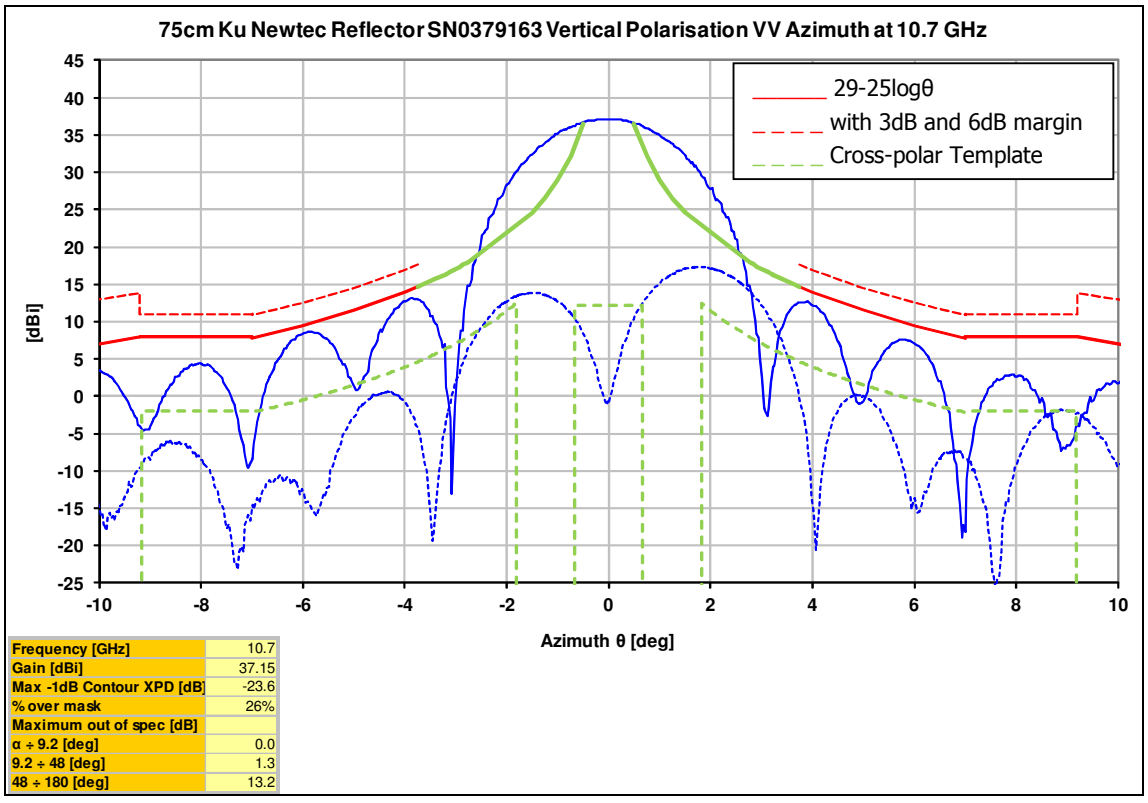
Frequency [GHz]	11.7
Gain [dBi]	37.86
% over mask	20%
Maximum out of spec [dB]	
α ÷ 9.2 [deg]	0.0
9.2 ÷ 48 [deg]	0.4
48 ÷ 180 [deg]	10.2



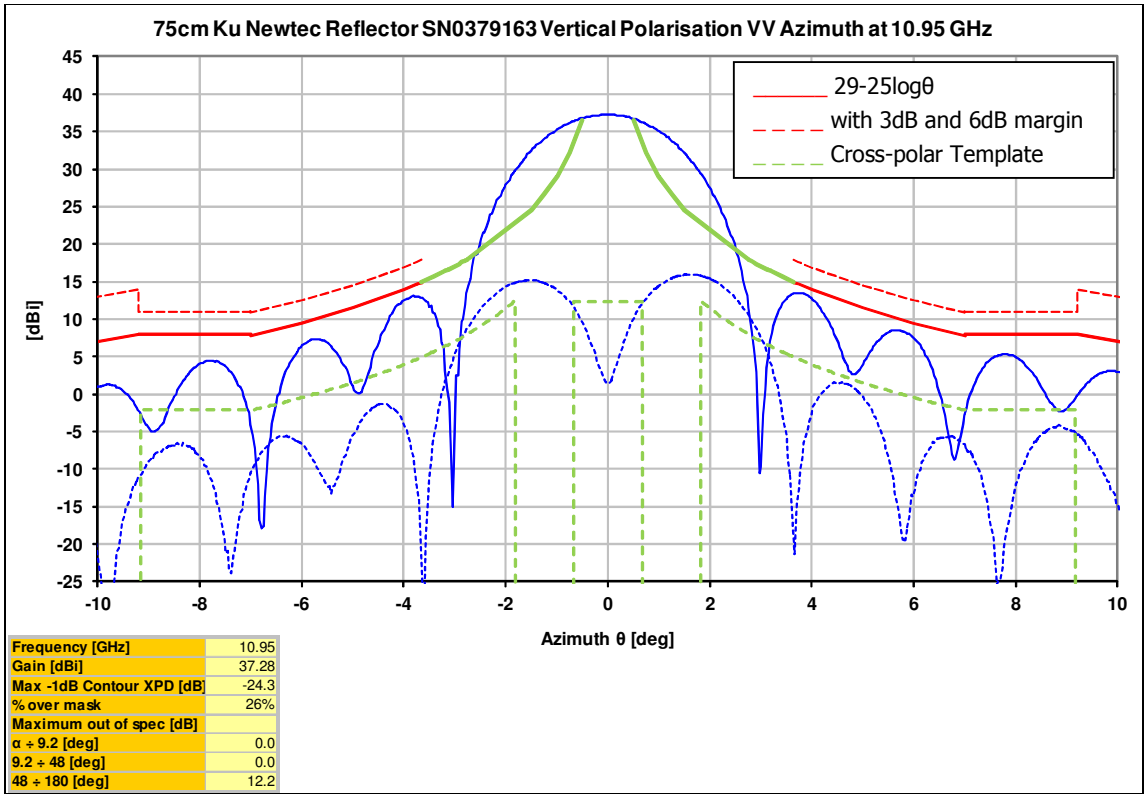
Frequency [GHz]	12.5
Gain [dBi]	38.26
% over mask	13%
Maximum out of spec [dB]	
α ÷ 9.2 [deg]	0.0
9.2 ÷ 48 [deg]	0.4
48 ÷ 180 [deg]	7.0



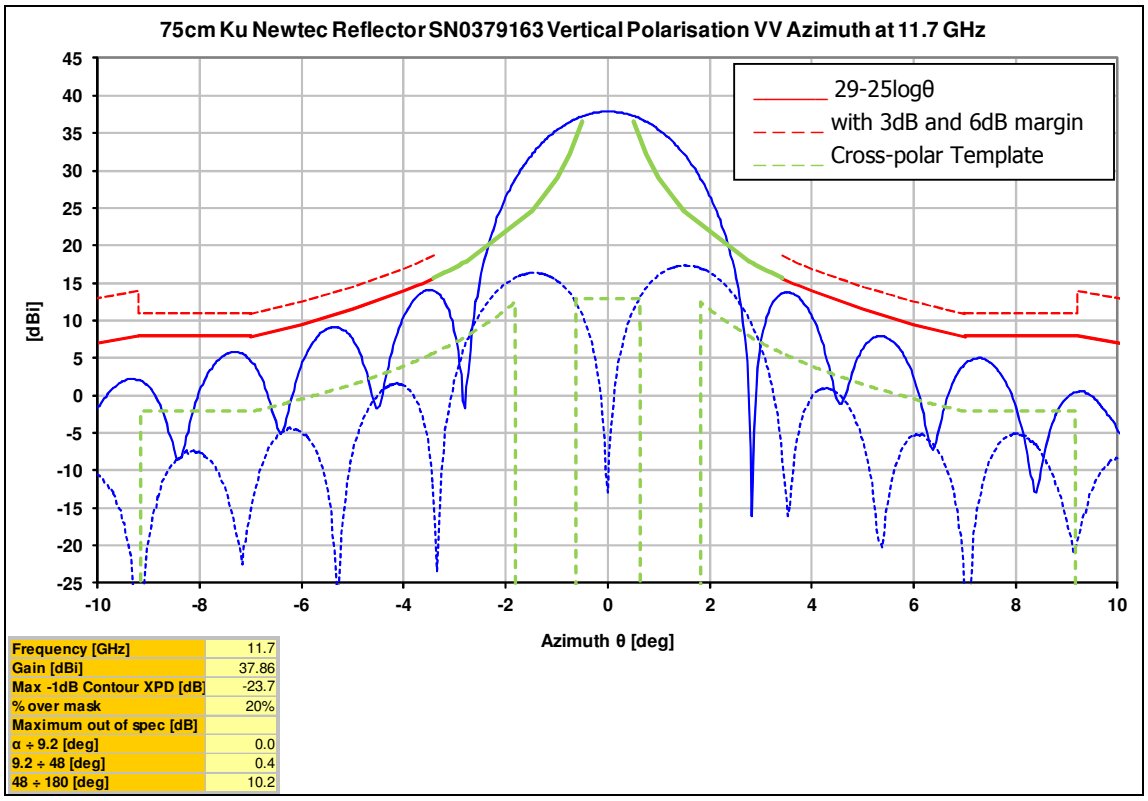
Frequency [GHz]	12.75
Gain [dBi]	38.40
% over mask	12%
Maximum out of spec [dB]	
α ÷ 9.2 [deg]	0.0
9.2 ÷ 48 [deg]	0.0
48 ÷ 180 [deg]	5.2



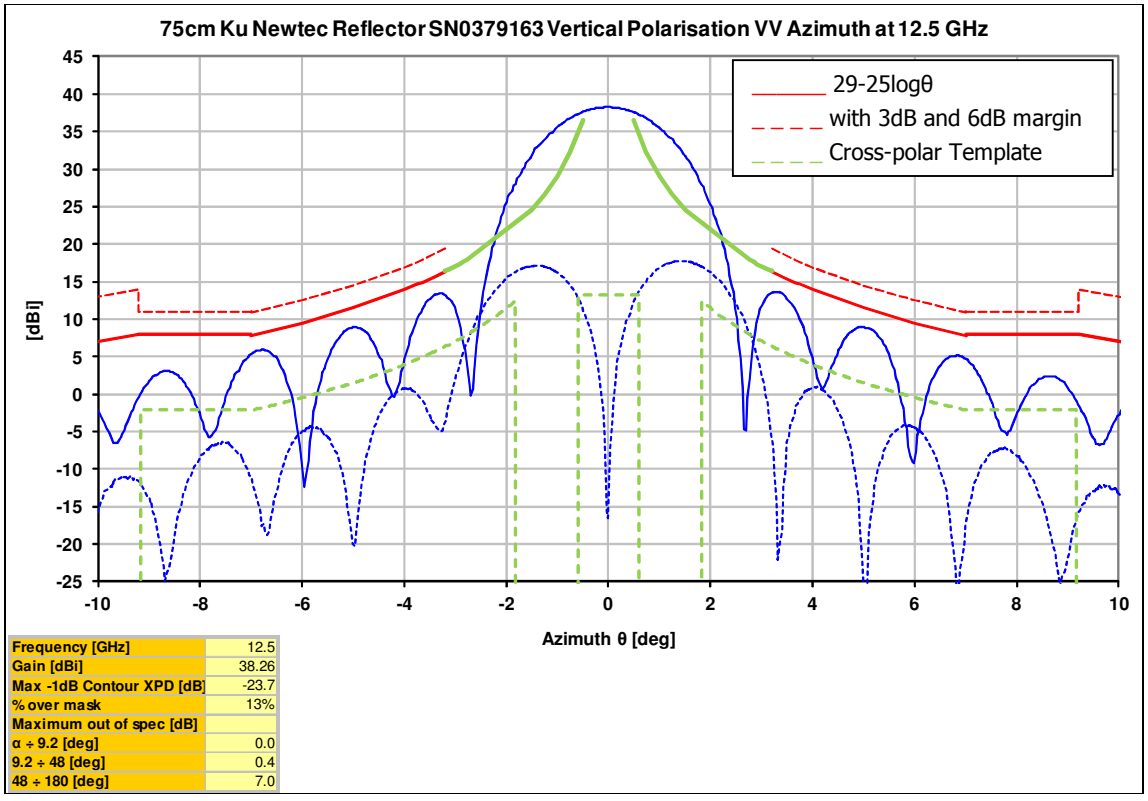
Frequency [GHz]	10.7
Gain [dBi]	37.15
Max -1dB Contour XPD [dB]	-23.6
% over mask	26%
Maximum out of spec [dB]	
α ÷ 9.2 [deg]	0.0
9.2 ÷ 48 [deg]	1.3
48 ÷ 180 [deg]	13.2



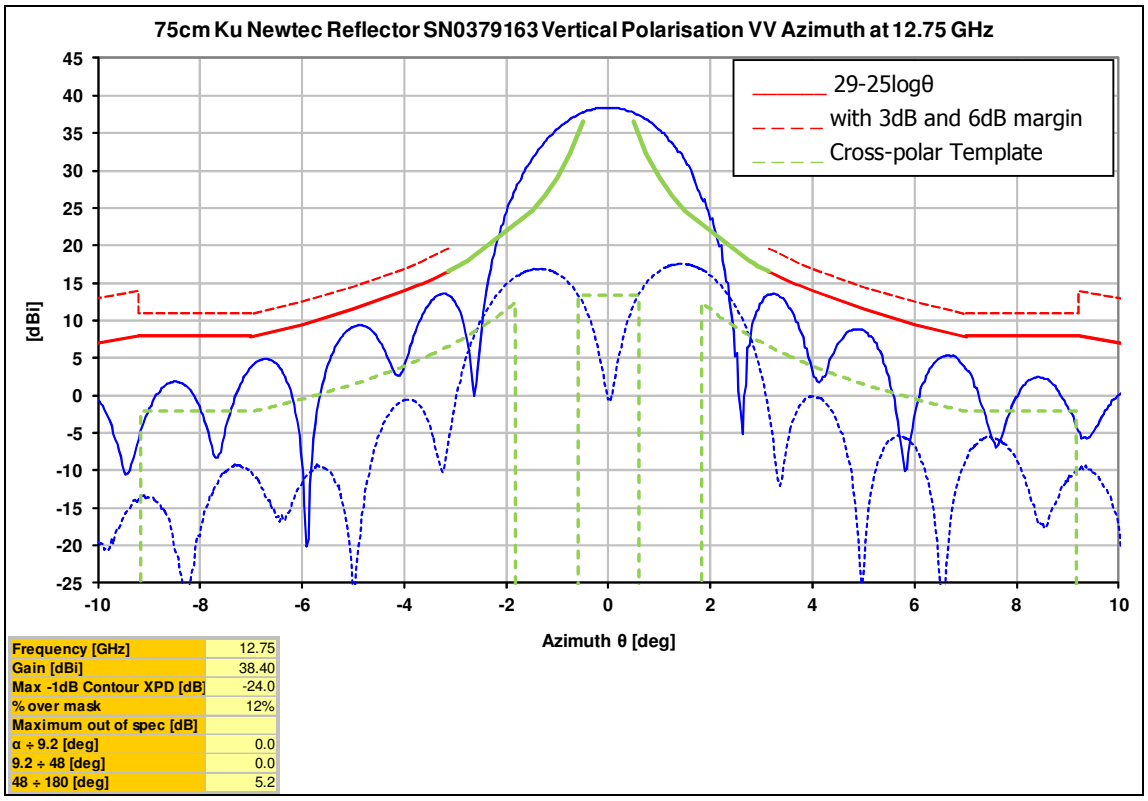
Frequency [GHz]	10.95
Gain [dBi]	37.28
Max -1dB Contour XPD [dB]	-24.3
% over mask	26%
Maximum out of spec [dB]	
α ÷ 9.2 [deg]	0.0
9.2 ÷ 48 [deg]	0.0
48 ÷ 180 [deg]	12.2



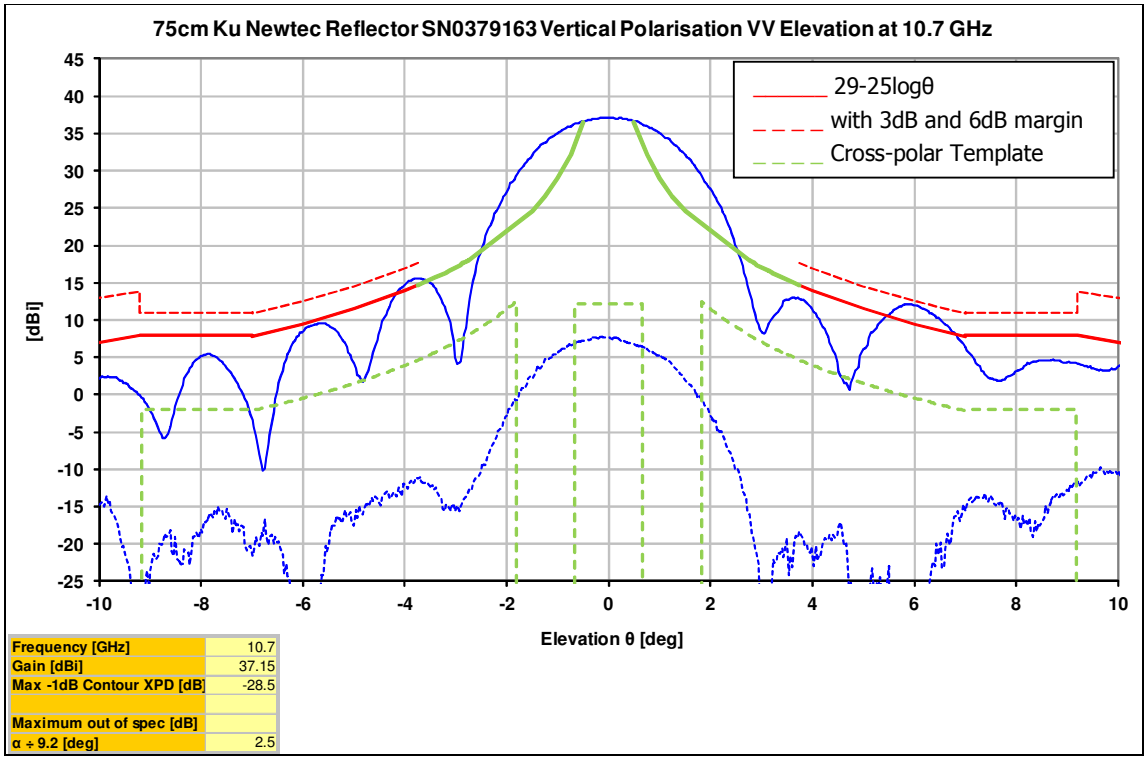
Frequency [GHz]	11.7
Gain [dBi]	37.86
Max -1dB Contour XPD [dB]	-23.7
% over mask	20%
Maximum out of spec [dB]	
α ÷ 9.2 [deg]	0.0
9.2 ÷ 48 [deg]	0.4
48 ÷ 180 [deg]	10.2



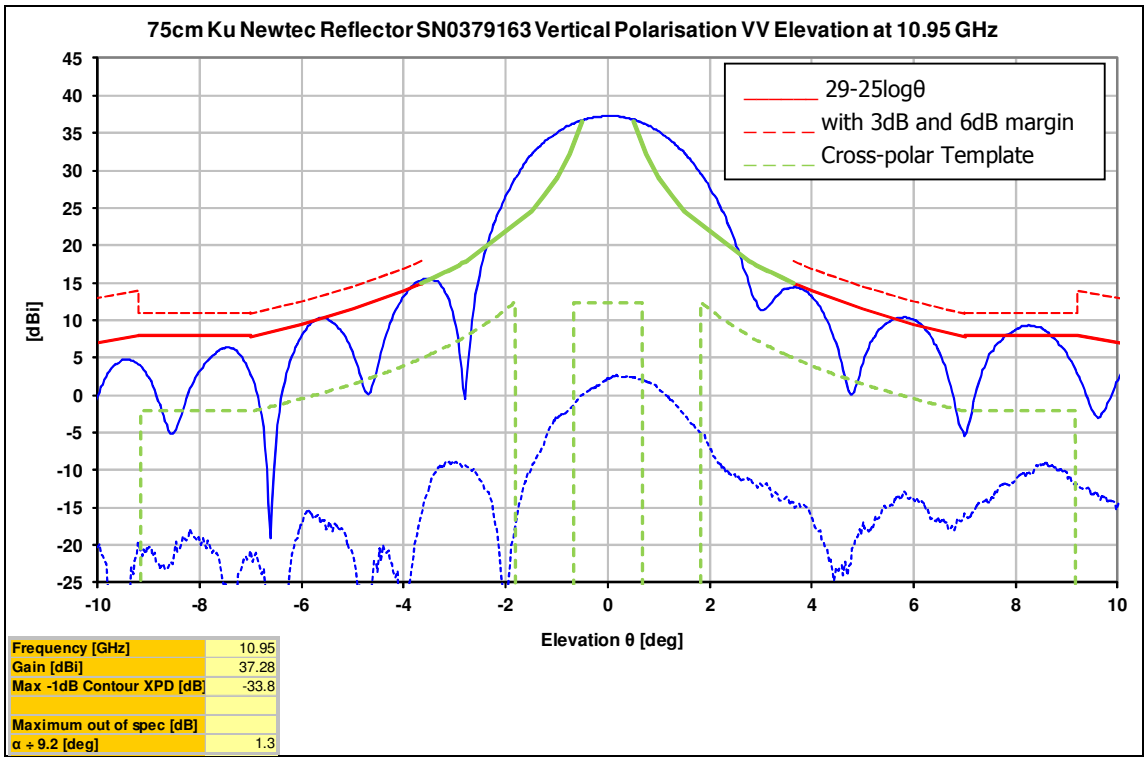
Frequency [GHz]	12.5
Gain [dBi]	38.26
Max -1dB Contour XPD [dB]	-23.7
% over mask	13%
Maximum out of spec [dB]	
α ÷ 9.2 [deg]	0.0
9.2 ÷ 48 [deg]	0.4
48 ÷ 180 [deg]	7.0



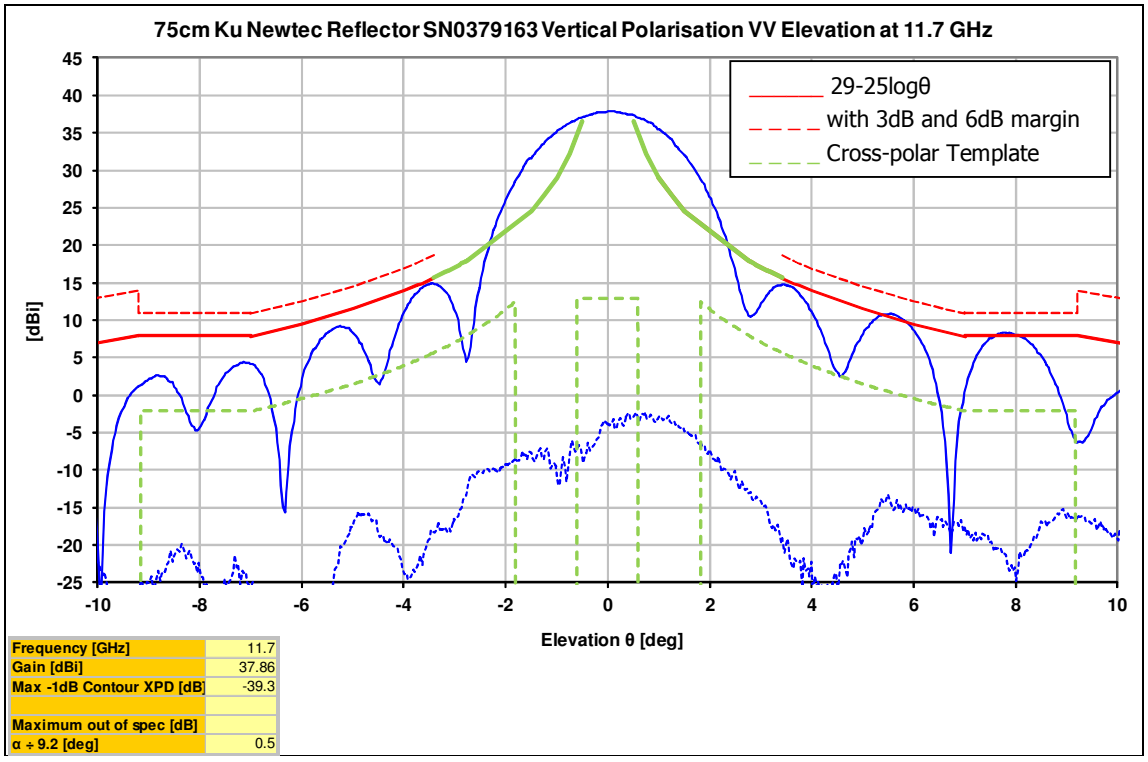
Frequency [GHz]	12.75
Gain [dBi]	38.40
Max -1dB Contour XPD [dB]	-24.0
% over mask	12%
Maximum out of spec [dB]	
α ÷ 9.2 [deg]	0.0
9.2 ÷ 48 [deg]	0.0
48 ÷ 180 [deg]	5.2



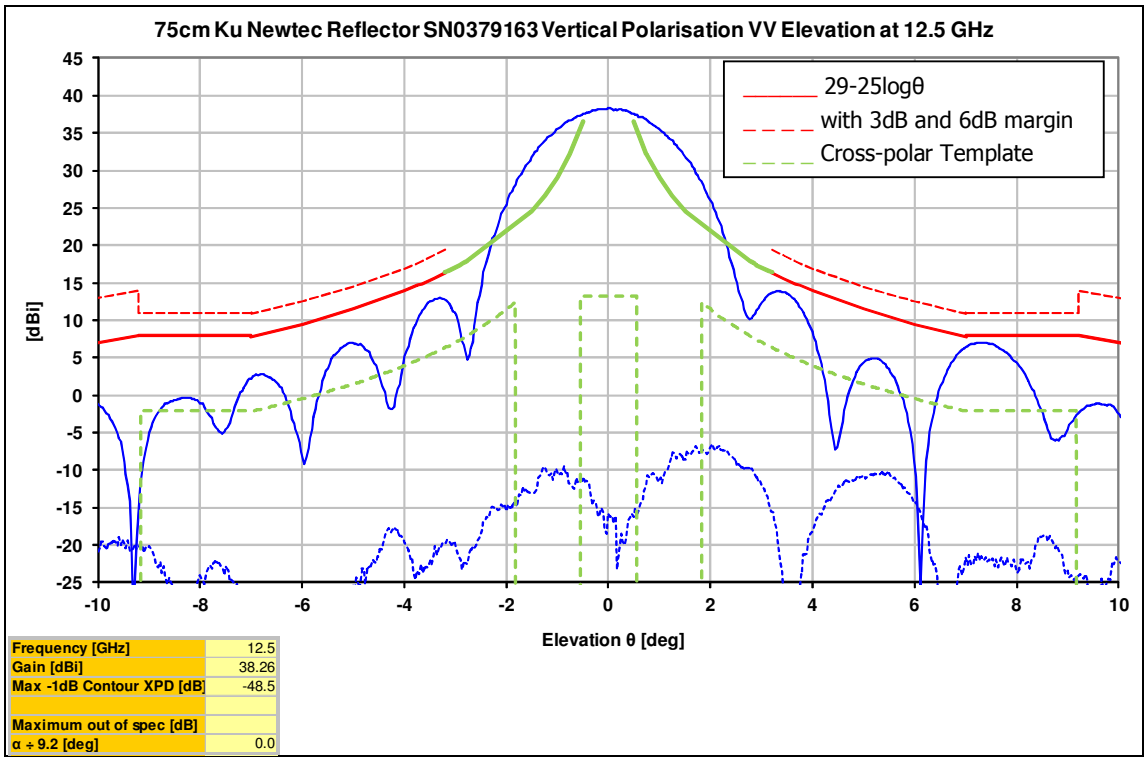
Frequency [GHz]	10.7
Gain [dBi]	37.15
Max -1dB Contour XPD [dB]	-28.5
Maximum out of spec [dB]	
α ÷ 9.2 [deg]	2.5



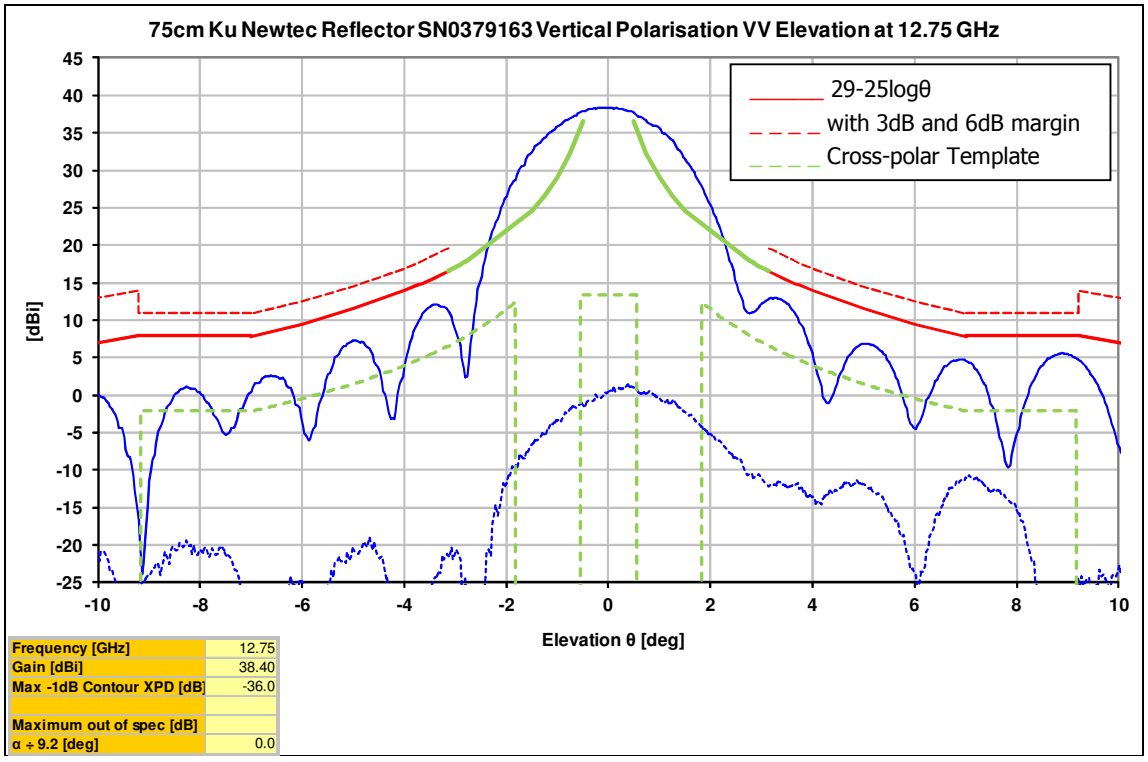
Frequency [GHz]	10.95
Gain [dBi]	37.28
Max -1dB Contour XPD [dB]	-33.8
Maximum out of spec [dB]	
α ÷ 9.2 [deg]	1.3



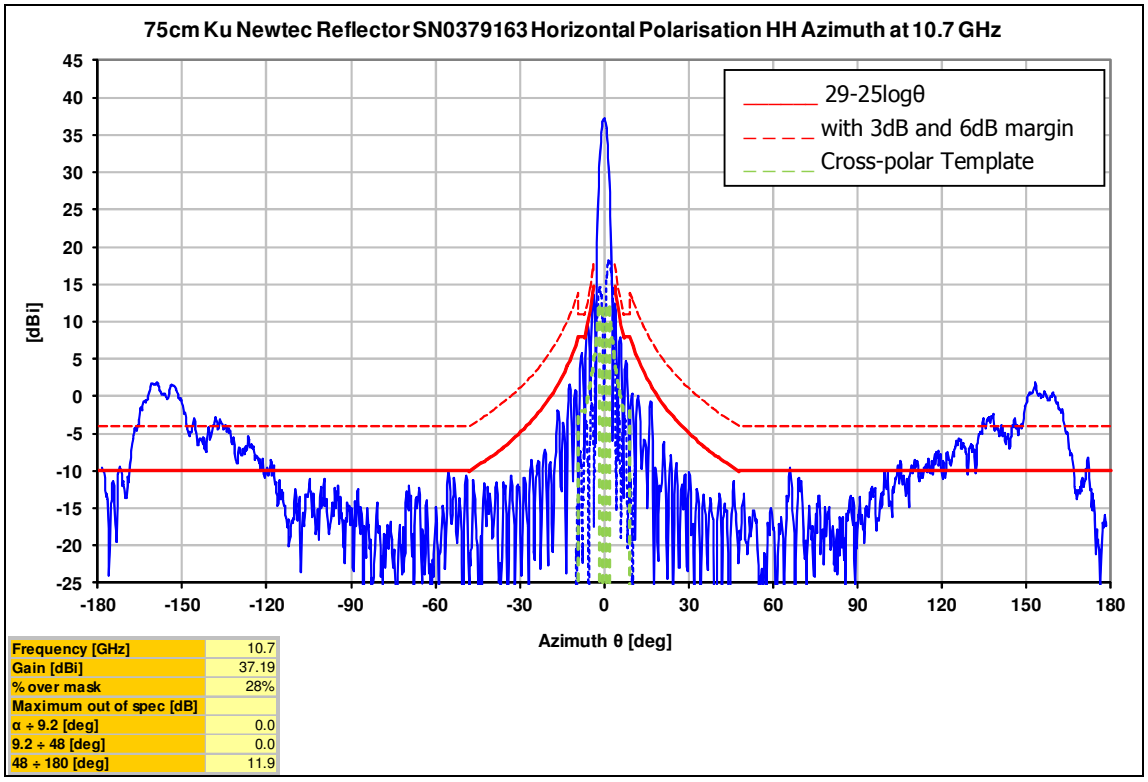
Frequency [GHz]	11.7
Gain [dBi]	37.86
Max -1dB Contour XPD [dB]	-39.3
Maximum out of spec [dB]	
α ÷ 9.2 [deg]	0.5



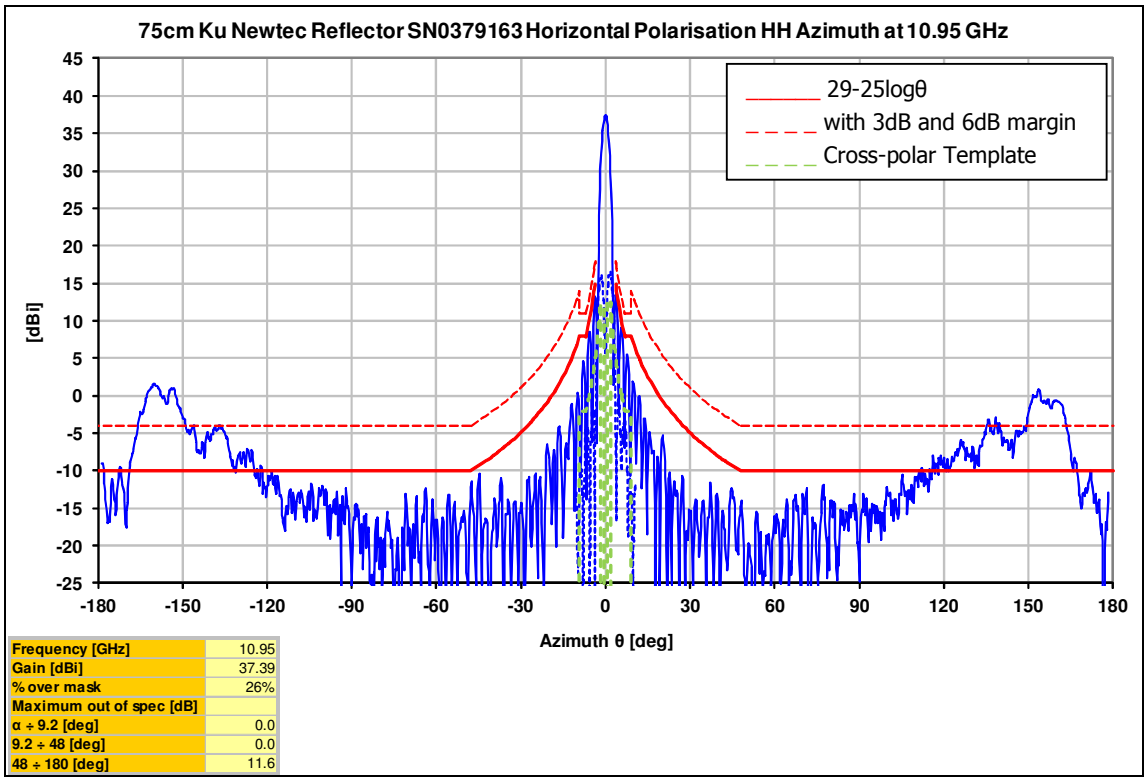
Frequency [GHz]	12.5
Gain [dBi]	38.26
Max -1dB Contour XPD [dB]	-48.5
Maximum out of spec [dB]	
α ÷ 9.2 [deg]	0.0



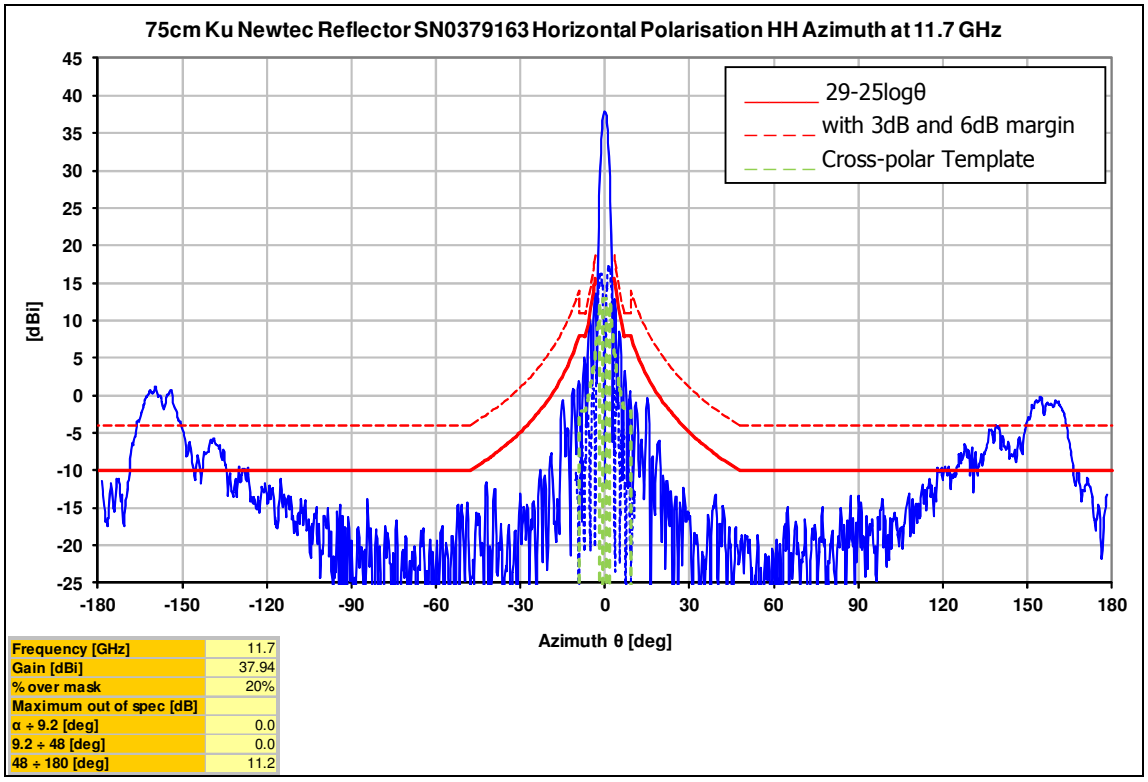
Frequency [GHz]	12.75
Gain [dBi]	38.40
Max -1dB Contour XPD [dB]	-36.0
Maximum out of spec [dB]	
α ÷ 9.2 [deg]	0.0



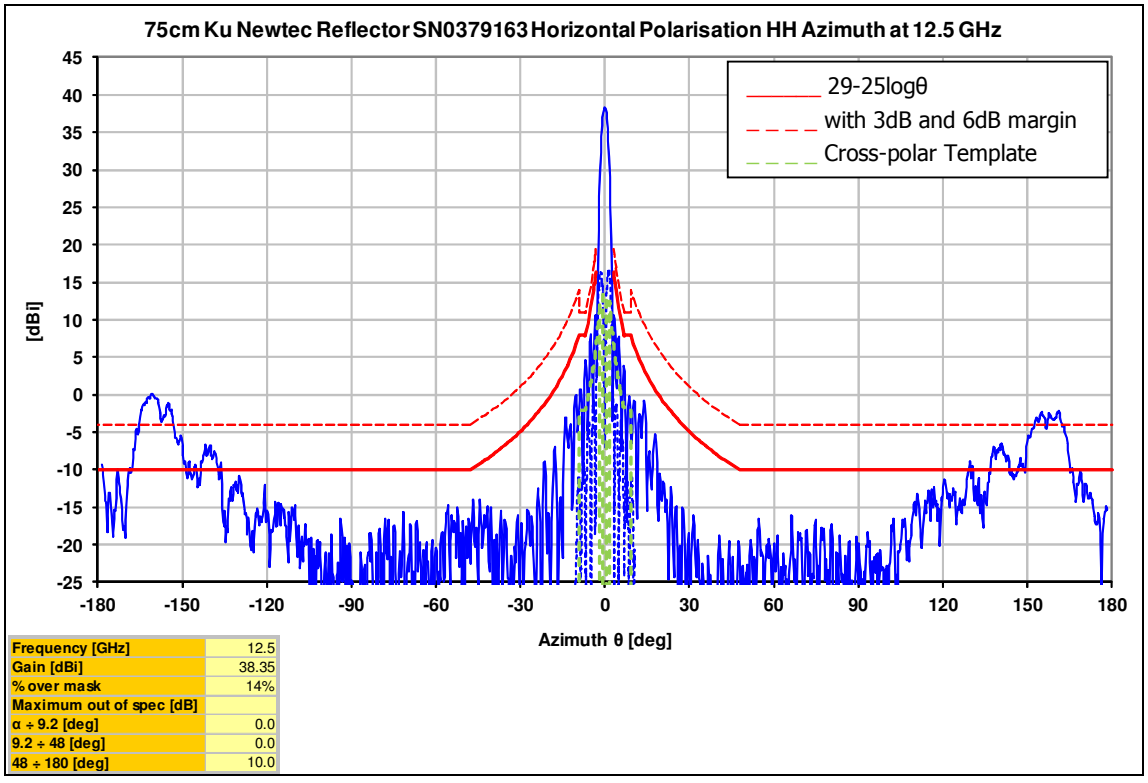
Frequency [GHz]	10.7
Gain [dBi]	37.19
% over mask	28%
Maximum out of spec [dB]	
α ÷ 9.2 [deg]	0.0
9.2 ÷ 48 [deg]	0.0
48 ÷ 180 [deg]	11.9



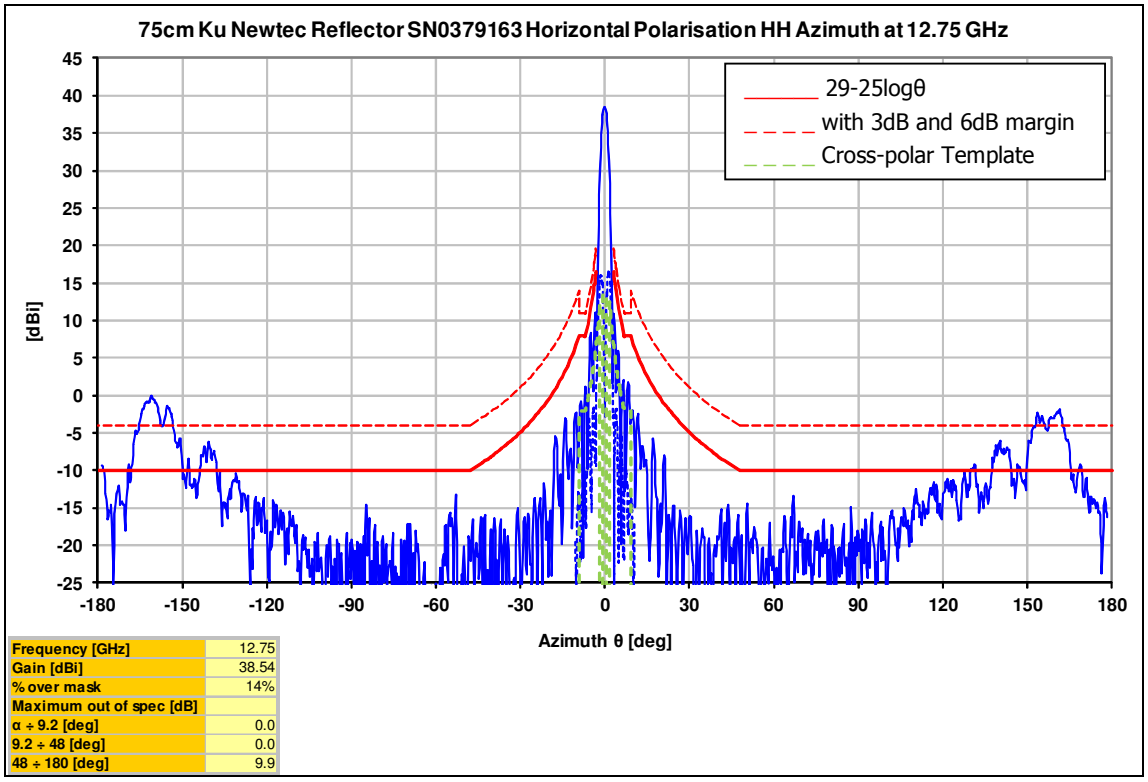
Frequency [GHz]	10.95
Gain [dBi]	37.39
% over mask	26%
Maximum out of spec [dB]	
α ÷ 9.2 [deg]	0.0
9.2 ÷ 48 [deg]	0.0
48 ÷ 180 [deg]	11.6



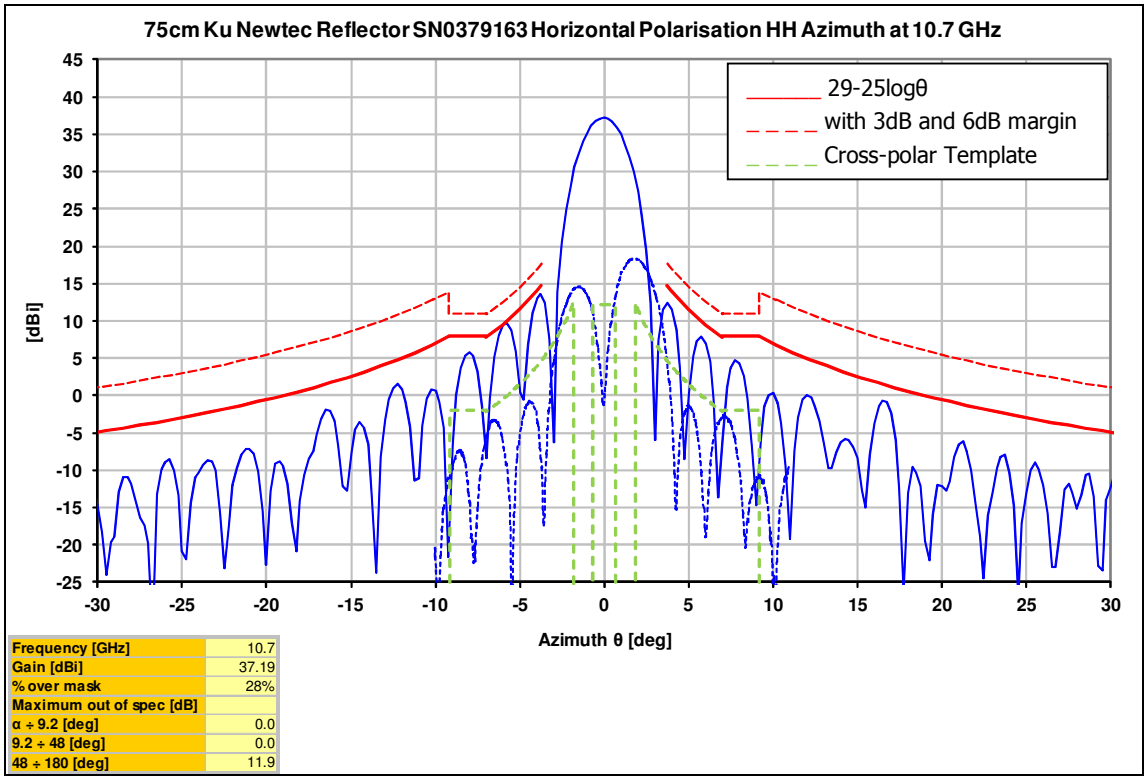
Frequency [GHz]	11.7
Gain [dBi]	37.94
% over mask	20%
Maximum out of spec [dB]	
α ÷ 9.2 [deg]	0.0
9.2 ÷ 48 [deg]	0.0
48 ÷ 180 [deg]	11.2



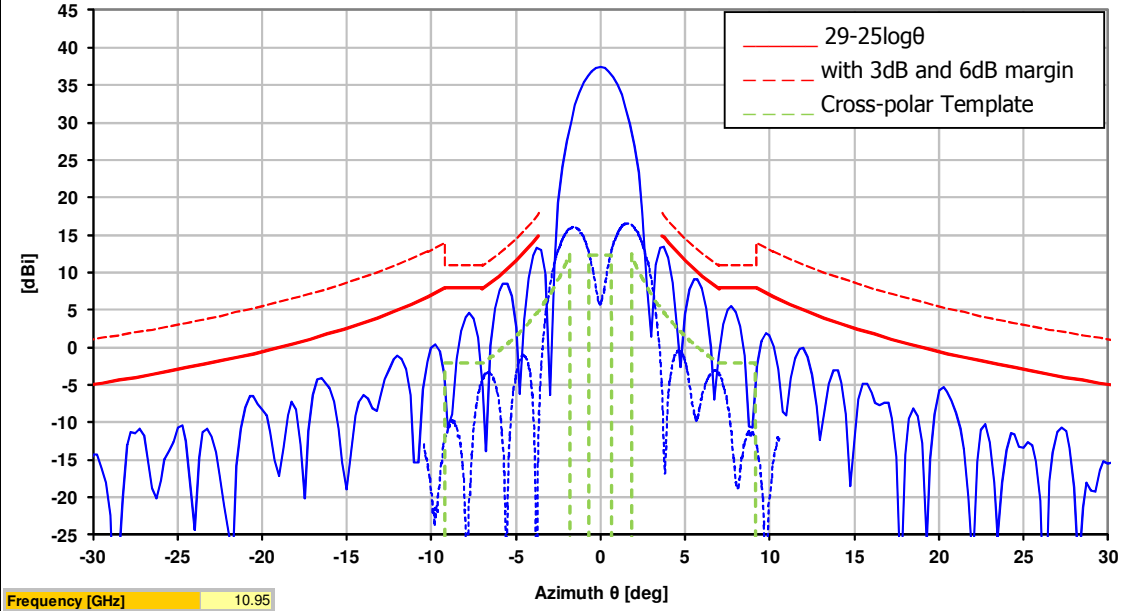
Frequency [GHz]	12.5
Gain [dBi]	38.35
% over mask	14%
Maximum out of spec [dB]	
α ÷ 9.2 [deg]	0.0
9.2 ÷ 48 [deg]	0.0
48 ÷ 180 [deg]	10.0



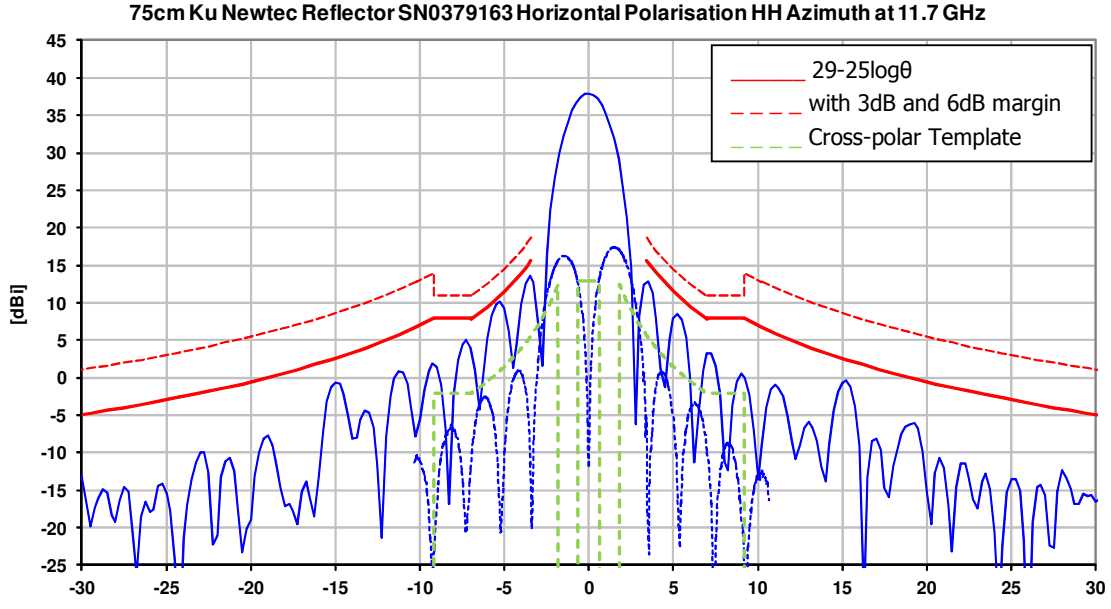
Frequency [GHz]	12.75
Gain [dBi]	38.54
% over mask	14%
Maximum out of spec [dB]	
α ÷ 9.2 [deg]	0.0
9.2 ÷ 48 [deg]	0.0
48 ÷ 180 [deg]	9.9



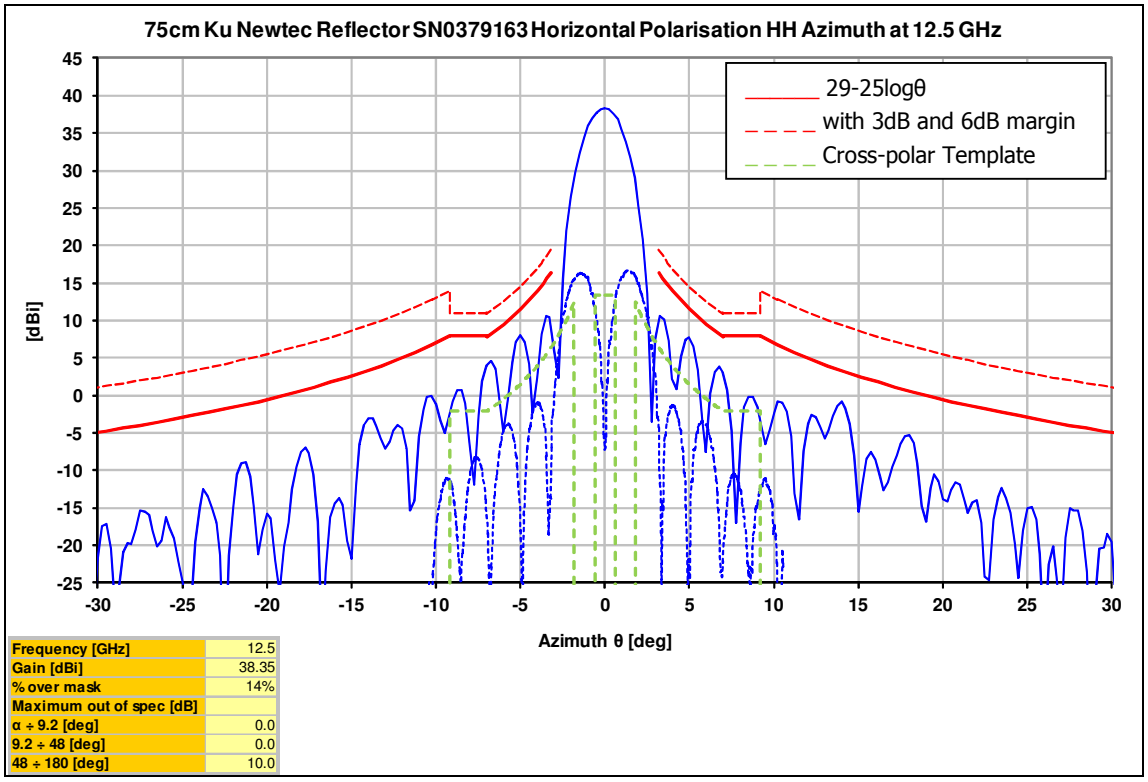
Frequency [GHz]	10.7
Gain [dBi]	37.19
% over mask	28%
Maximum out of spec [dB]	
α ÷ 9.2 [deg]	0.0
9.2 ÷ 48 [deg]	0.0
48 ÷ 180 [deg]	11.9



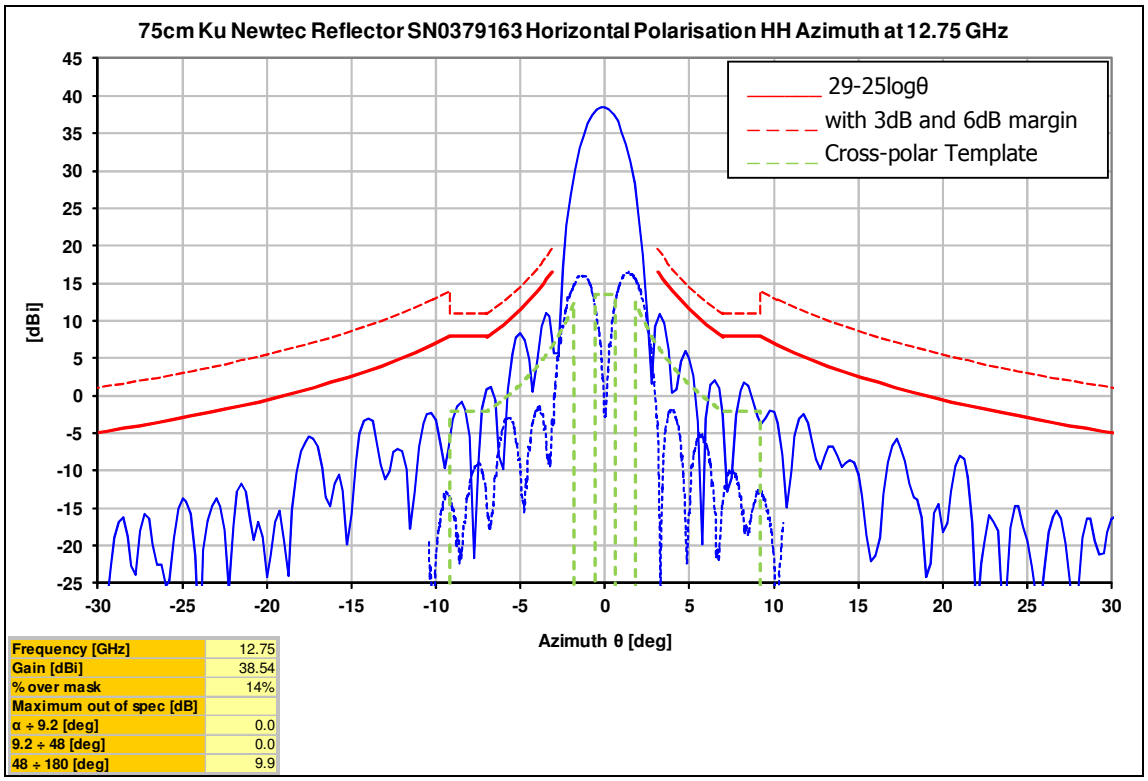
Frequency [GHz]	10.95
Gain [dBi]	37.39
% over mask	26%
Maximum out of spec [dB]	
α ÷ 9.2 [deg]	0.0
9.2 ÷ 48 [deg]	0.0
48 ÷ 180 [deg]	11.6



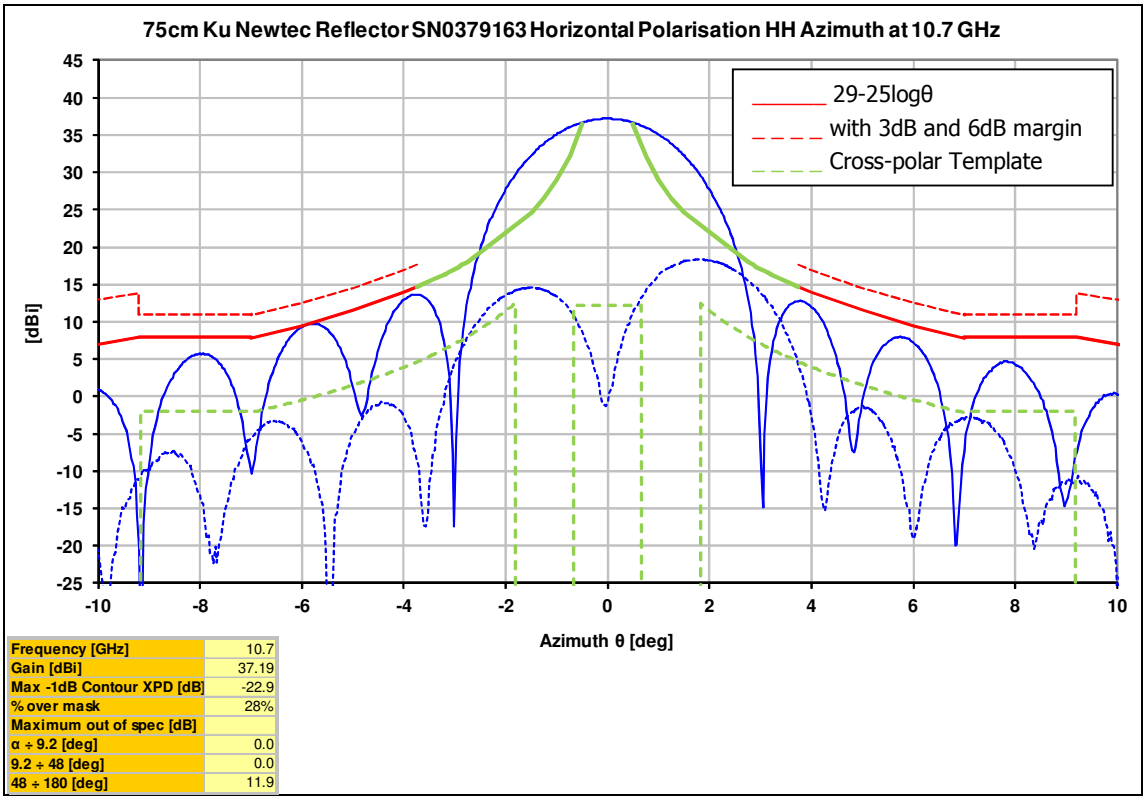
Frequency [GHz]	11.7
Gain [dBi]	37.94
% over mask	20%
Maximum out of spec [dB]	
α ÷ 9.2 [deg]	0.0
9.2 ÷ 48 [deg]	0.0
48 ÷ 180 [deg]	11.2



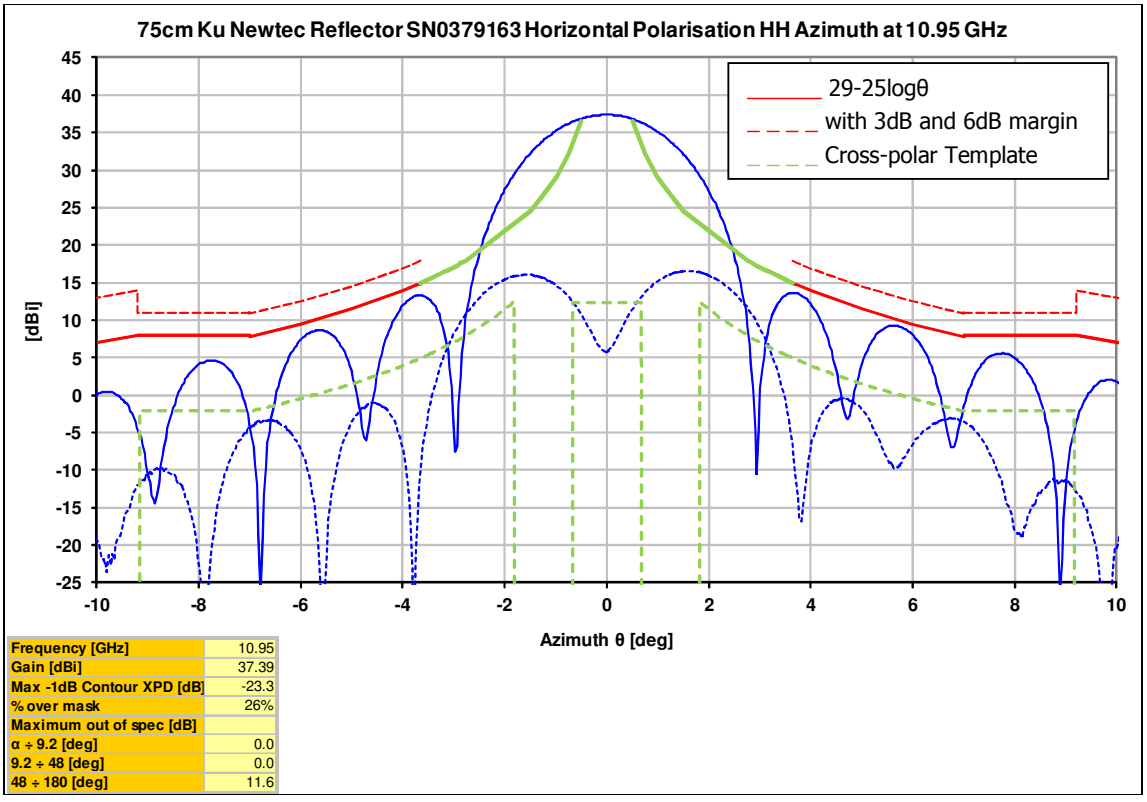
Frequency [GHz]	12.5
Gain [dBi]	38.35
% over mask	14%
Maximum out of spec [dB]	
α ÷ 9.2 [deg]	0.0
9.2 ÷ 48 [deg]	0.0
48 ÷ 180 [deg]	10.0



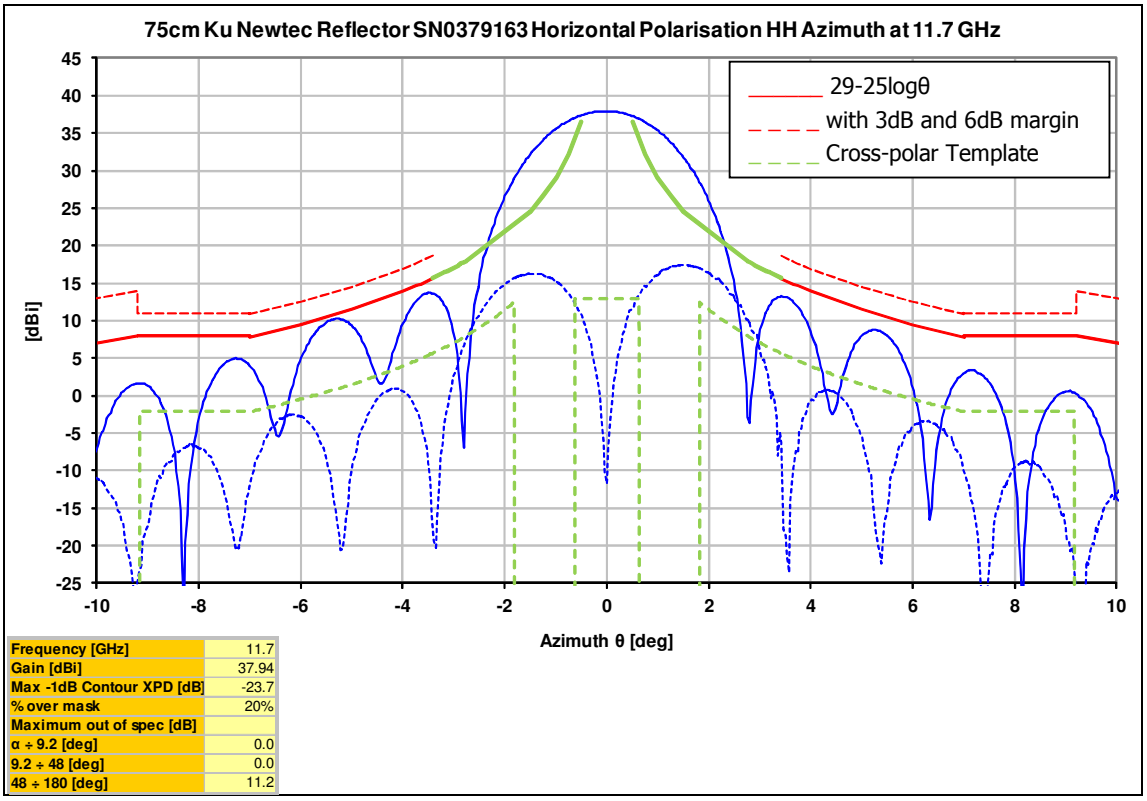
Frequency [GHz]	12.75
Gain [dBi]	38.54
% over mask	14%
Maximum out of spec [dB]	
α ÷ 9.2 [deg]	0.0
9.2 ÷ 48 [deg]	0.0
48 ÷ 180 [deg]	9.9



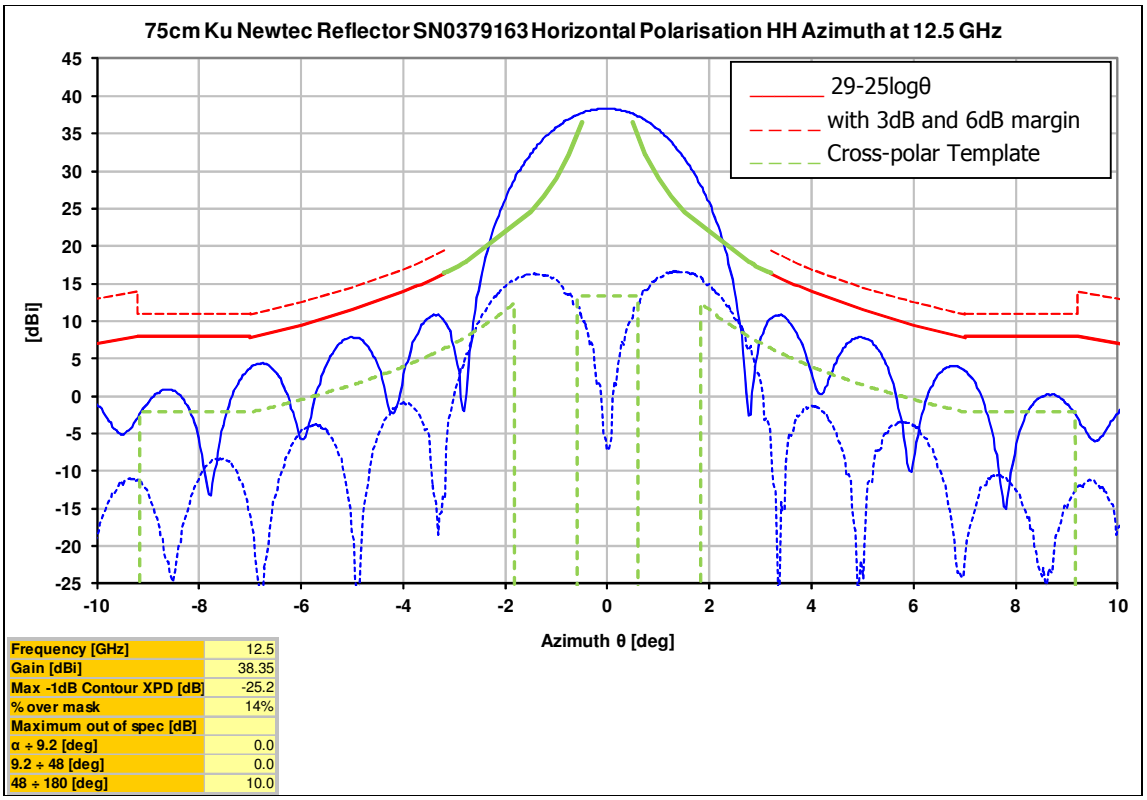
Frequency [GHz]	10.7
Gain [dBi]	37.19
Max -1dB Contour XPD [dB]	-22.9
% over mask	28%
Maximum out of spec [dB]	
α ÷ 9.2 [deg]	0.0
9.2 ÷ 48 [deg]	0.0
48 ÷ 180 [deg]	11.9



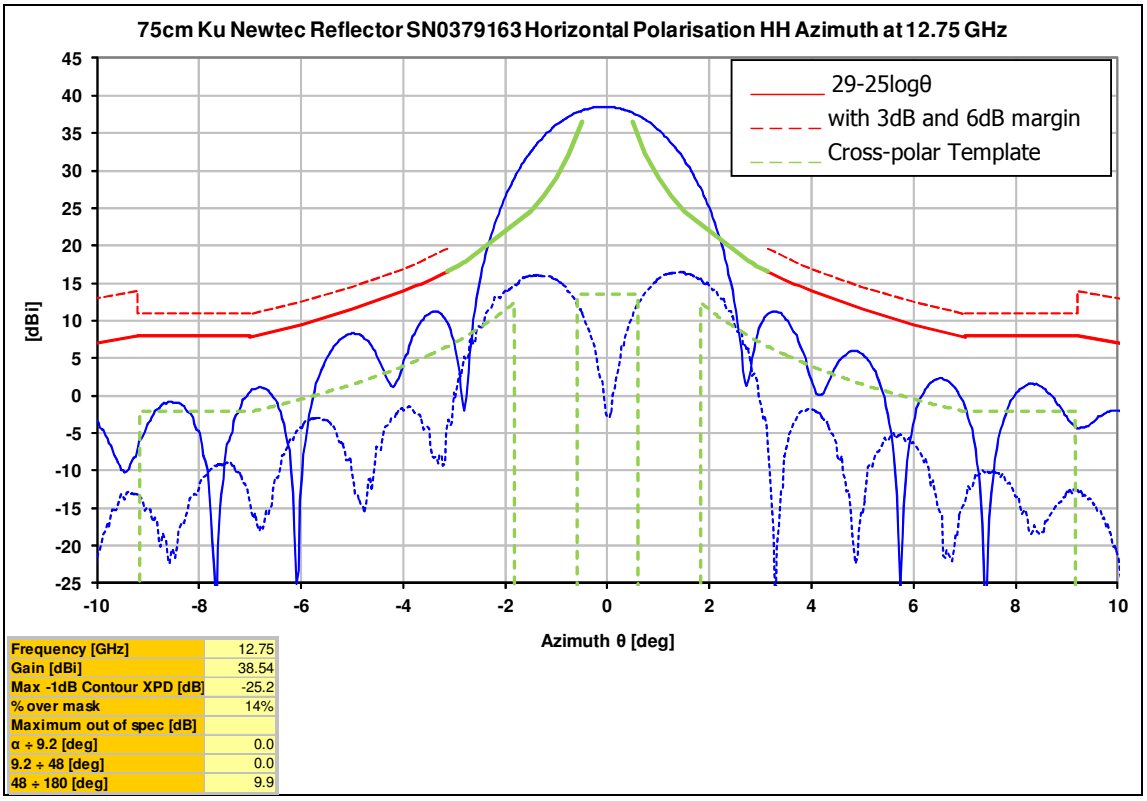
Frequency [GHz]	10.95
Gain [dBi]	37.39
Max -1dB Contour XPD [dB]	-23.3
% over mask	26%
Maximum out of spec [dB]	
α ÷ 9.2 [deg]	0.0
9.2 ÷ 48 [deg]	0.0
48 ÷ 180 [deg]	11.6



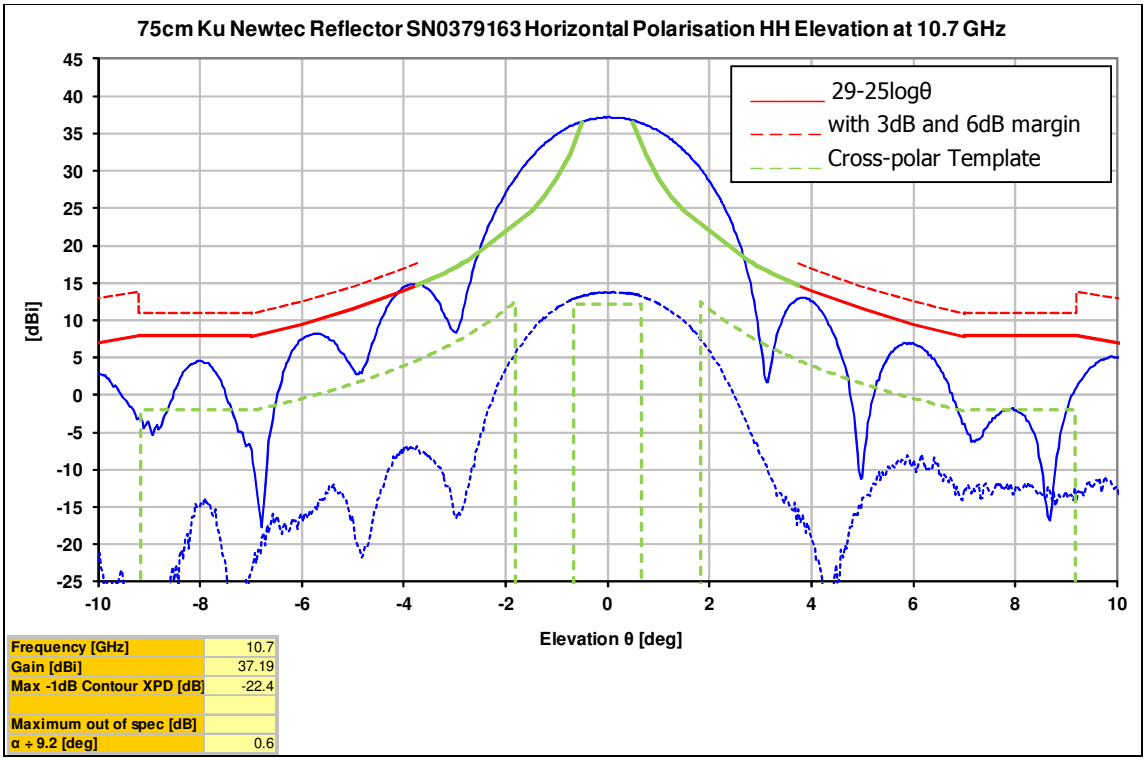
Frequency [GHz]	11.7
Gain [dBi]	37.94
Max -1dB Contour XPD [dB]	-23.7
% over mask	20%
Maximum out of spec [dB]	
α ÷ 9.2 [deg]	0.0
9.2 ÷ 48 [deg]	0.0
48 ÷ 180 [deg]	11.2



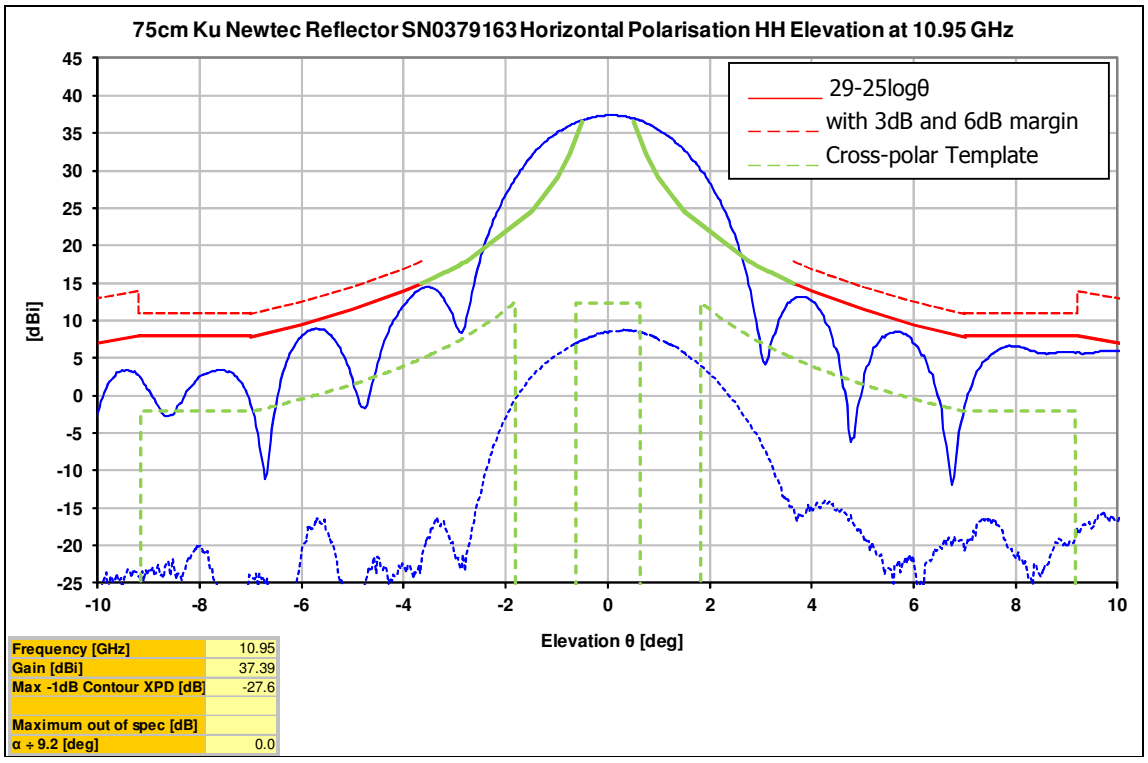
Frequency [GHz]	12.5
Gain [dBi]	38.35
Max -1dB Contour XPD [dB]	-25.2
% over mask	14%
Maximum out of spec [dB]	
α ÷ 9.2 [deg]	0.0
9.2 ÷ 48 [deg]	0.0
48 ÷ 180 [deg]	10.0



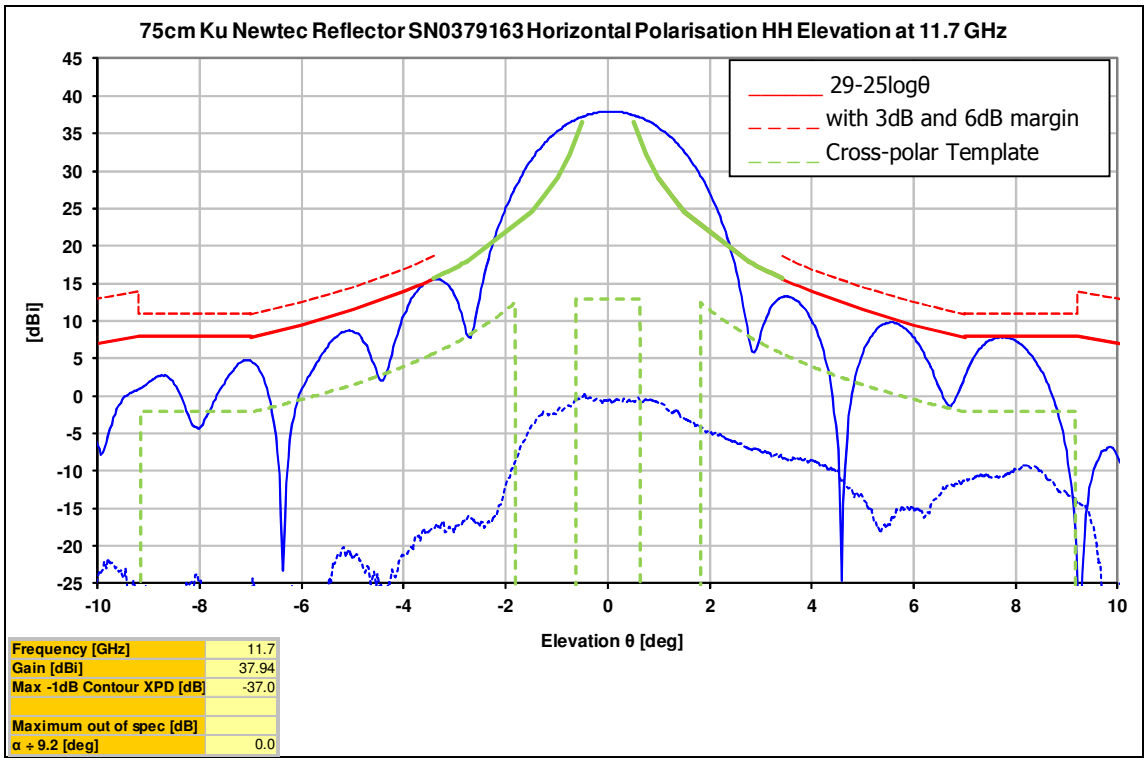
Frequency [GHz]	12.75
Gain [dBi]	38.54
Max -1dB Contour XPD [dB]	-25.2
% over mask	14%
Maximum out of spec [dB]	
α ÷ 9.2 [deg]	0.0
9.2 ÷ 48 [deg]	0.0
48 ÷ 180 [deg]	9.9



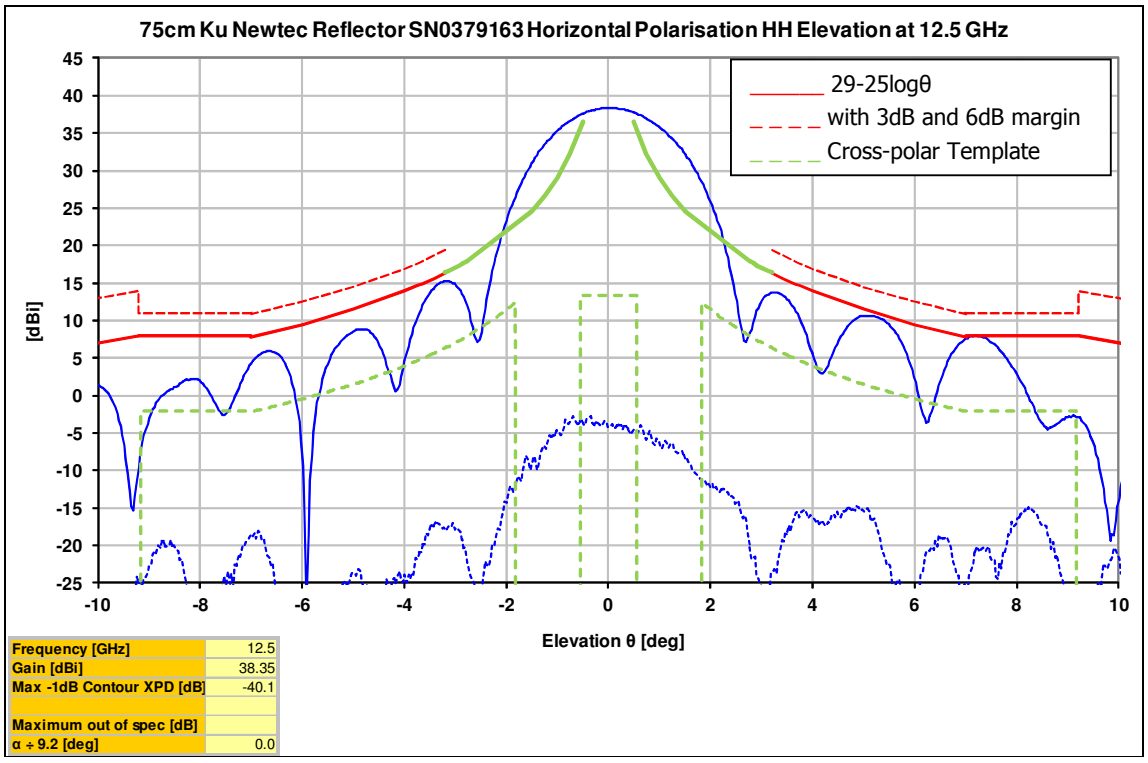
Frequency [GHz]	10.7
Gain [dBi]	37.19
Max -1dB Contour XPD [dB]	-22.4
Maximum out of spec [dB]	
α ÷ 9.2 [deg]	0.6



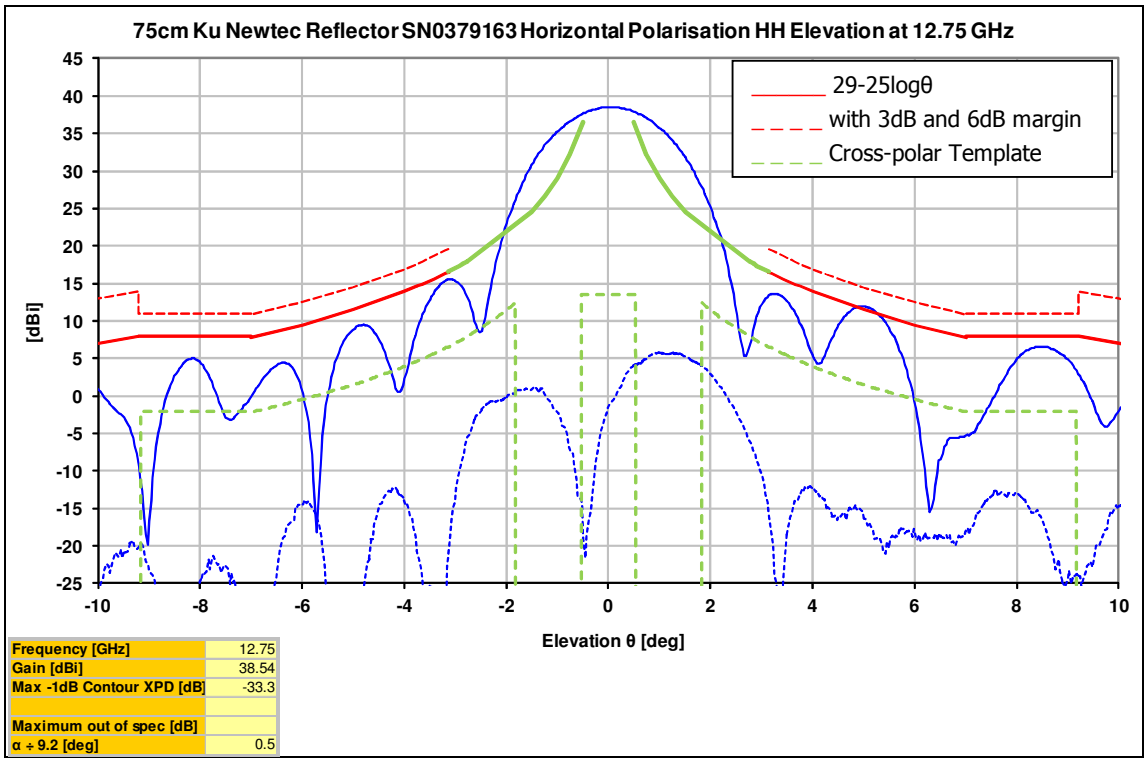
Frequency [GHz]	10.95
Gain [dBi]	37.39
Max -1dB Contour XPD [dB]	-27.6
Maximum out of spec [dB]	
α ÷ 9.2 [deg]	0.0



Frequency [GHz]	11.7
Gain [dBi]	37.94
Max -1dB Contour XPD [dB]	-37.0
Maximum out of spec [dB]	
α ÷ 9.2 [deg]	0.0

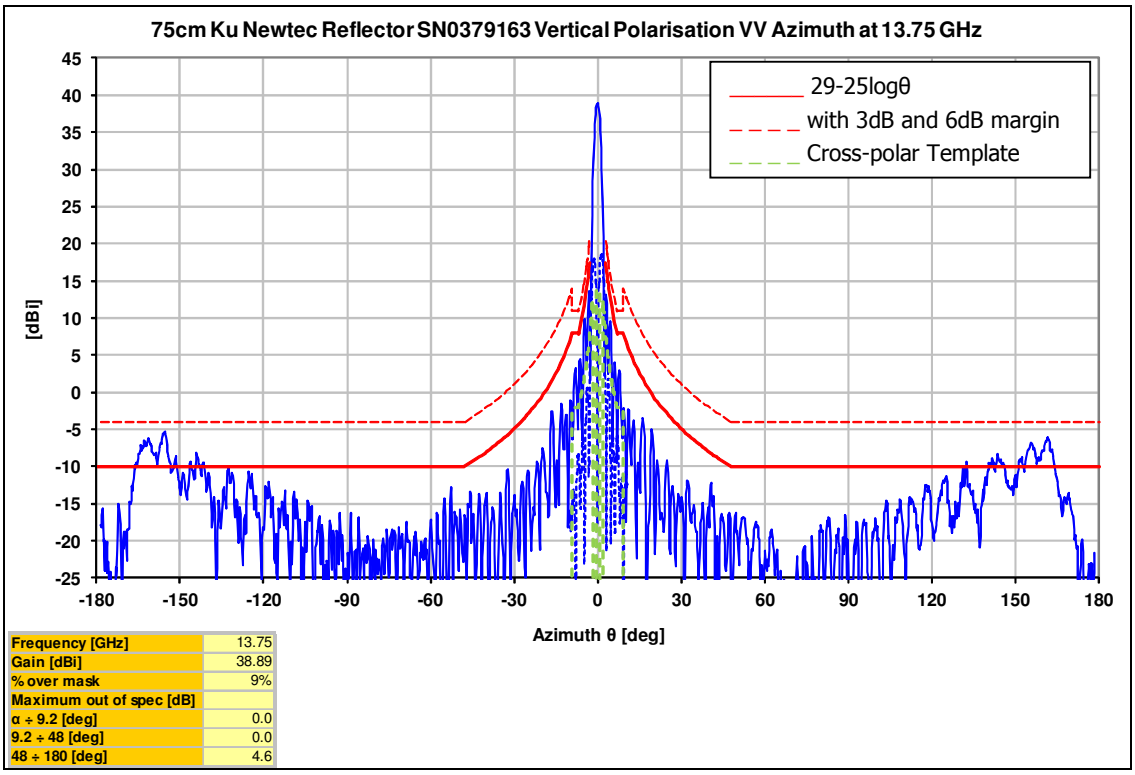


Frequency [GHz]	12.5
Gain [dBi]	38.35
Max -1dB Contour XPD [dB]	-40.1
Maximum out of spec [dB]	
α ÷ 9.2 [deg]	0.0

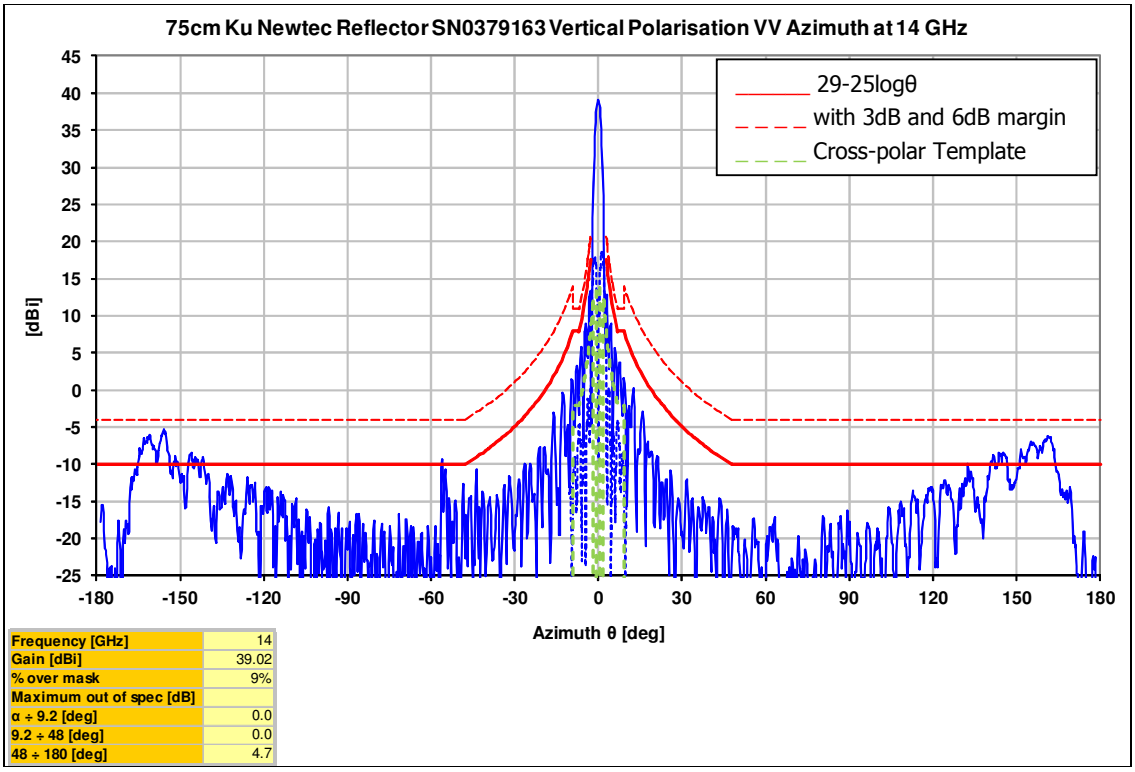


Frequency [GHz]	12.75
Gain [dBi]	38.54
Max -1dB Contour XPD [dB]	-33.3
Maximum out of spec [dB]	
α ÷ 9.2 [deg]	0.5

6.9 Measured Patterns – Tx Band



Frequency [GHz]	13.75
Gain [dBi]	38.89
% over mask	9%
Maximum out of spec [dB]	
α ÷ 9.2 [deg]	0.0
9.2 ÷ 48 [deg]	0.0
48 ÷ 180 [deg]	4.6



Frequency [GHz]	14
Gain [dBi]	39.02
% over mask	9%
Maximum out of spec [dB]	
α ÷ 9.2 [deg]	0.0
9.2 ÷ 48 [deg]	0.0
48 ÷ 180 [deg]	4.7