



Test Report to

ITU-R M.1176

Echomax Active-X Radar Target Enhancer

4th January 2010

OPERATIONAL TEST REPORT



Product: Echomax Active-X Radar Target Enhancer Page: 2 of 29

Serial No: N/A

Date: 4/1/2010

Report compiled by: David Sheekey

Test Report: OPP003

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1. Introduction

This test report covers the requirements for Echomax Active-X X-band active radar target enhancer as specified in ITU-R M.1176(1995).

The equipment was tested at the radar test range of QinetiQ Ltd., (Funtington). Supplementary testing was carried out in the facility of Coverise Limited.

Testing was carried out by Coverise Ltd. on behalf of the Active-X manufacturer:-

Aquamate Products Ltd., Changers Farm, Bardfield End Green, Thaxted, Dunmow, Essex CM6 3PX

1.1. Product Description

The equipment covered by this report comprised of the Active-X Radar Target Enhancer (RTE) and its associated terminal connection box. The Active-X consists of a receiving antenna, amplifier and transmitting antenna. The Active-X RTE is designed to enhance the determination of position of small targets by shipborne X-band radars used in the band 9300 – 9500MHz.

Some requirements of ITU-R M.1176 require testing of individual components, e.g. the antenna.

The intended operating voltage for the EUT is 10.8V to 15.6V DC. In all applicable tests the RTE power supply was provided by a 12V DC laboratory power supply.

1.2. Test Locations

Testing was carried out at the following sites

QinetiQ, Common Road, Funtington, Chichester, PO18 9PD

Tel: +44 (0) 2392 335000

and

Coverise Ltd, Unit 4 Ocivan Way, Margate, Kent CT9 4NN

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Report compiled by: David Sheekey

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Tel: +44 (0)1843 282930

Report prepared by: *DC Sheekey* Date: 4/1/2010

Report checked by: *Steph Kennedy* Date: 4/1/2010

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2. Test Summary

ITU-R M.1176 Annex 1	Test Description	Result
1	Polarization	PASS
1	Beamwidth; 360° horizontal within $\pm 3\text{dB}$	PASS
1	Beamwidth; $\pm 15^\circ$ vertical to $\pm 3\text{dB}$	PASS
2	Broadband over frequency band 9300 to 9500MHz	PASS
	Amplification; minimum 50dB including antenna gain	PASS
	Output form	PASS
	e.i.r.p. at limiting level	PASS

Table 1: ITU-R M.1176 Test Summary

2.1. Test Result

The supplied test sample of the Echomax Active-X Radar Target Enhancer successfully passed the series of tests outlined above. This demonstrates the operational performance of the Active-X Radar Target Enhancer.

2.2. Test Acknowledgment

Testing in the anechoic chamber at QinetiQ Ltd (Funtington) was carried out by Steve Luke of Qinetiq in the presence of Simon Nolan from Coverise.

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3. Test Equipment Used

QinetiQ Funtington Calibrated RCS Anechoic Measurement Chamber and associated test equipment.

No.	Test Equipment	Manufacturer	Model No.	Serial No.
NAV1307	Anechoic Chamber	MPE	-	SN: C1162-D1
NAV2043	Spectrum Analyser	Rohde & Schwarz	FSP	SN: 100404
NAV2045	Horn Antenna	Rohde & Schwarz	HF906	SN: 100287
C002	N-Type Cable 10m	Teledyne	-	-
C012	N-Type Cable 3m	Teledyne	-	-
	6200 Scalar Analyser	Marconi	6200	SN
	20dB Attenuator (26GHz)	Hewlett Packard	8493C-20	n/a

Table 2: Pulse length, Power Emissions, Amplifier Gain, Test Equipment

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Excitation Signal Generation / EUT monitoring – All Tests				
No.	Test Equipment	Manufacturer	Model No.	Serial No.
	Pulse Generator	Lyons Instruments	PG-2E	SN: 5176
NAV2043	Spectrum Analyser	Rohde & Schwarz	FSP	SN: 100404
-	9.4 GHz Signal Source	Coverise Ltd	-	-
-	6dB Attenuator	HP	8473B	SN: 04917
	Microwave Switch	HP	33144A	SN: 04284
	Switch Driver	HP	33190B	SN: 02187
-	Waveguide to Coax Transition	FMI	-	-
-	Waveguide to Coax Transition	FMI	-	-
	PSU	WEIR	460	SN: 731012
	PSU	Navico	PSU1208	SN: KF0540
	Horn Antenna X-Band	Plessey	3102	SN: 0001
	Horn Antenna X-Band	Plessey	3102	SN: 0002

Table 3: General Equipment Used for Excitation Signal and Monitoring EUT

4. Operation Test Results

Operation tests are in accordance with Annex 1.

4.1. Annex 1, Item 1: Antenna performance

4.1.1. Test Method

Testing was carried out in the Funtington calibrated anechoic test chamber on 6/8/2009.

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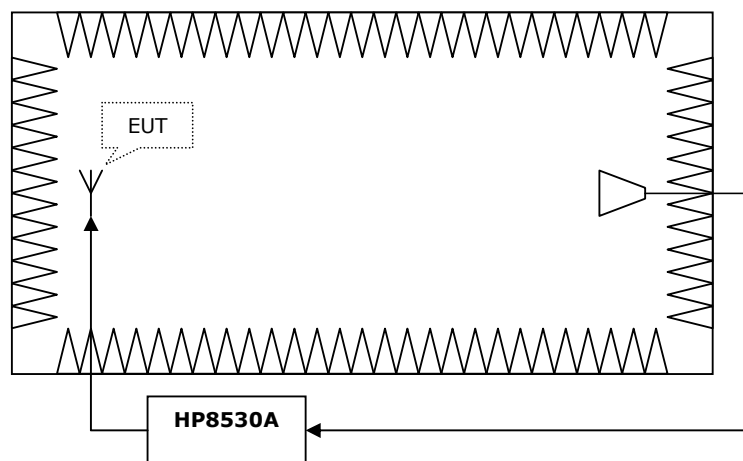
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A single antenna assembly was mounted on the rotating test fixture and the performance of measured.

The antenna was fed with a test signal at 9400MHz and the horizontally polarised measurement antenna in the chamber connected to a Hewlett Packard HP8530A microwave receiver. Calibration is carried out using a standard gain horn prior to measuring the antenna under test.

The test fixture is automatically rotated through $\pm 180^\circ$ and measurements of the output level taken every 0.5° .



Photographs of the test layout are shown in Figure 1, page 14.

4.1.2. Equipment Used

Refer to section 3.1.

4.1.3. Results

Plot 1, page 17, shows the measurement result is within the $\pm 3\text{dB}$ of the average output in the horizontal plane.

Plot 2, page 18 shows the measurement result in within the $\pm 3\text{dB}$ limit in the vertical plane.

The EUT complies with the antenna performance requirements of ITU-R
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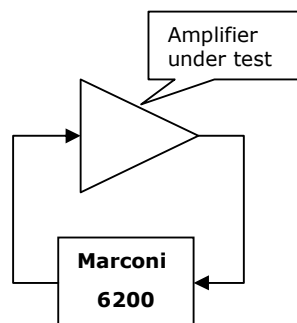
M.1176 in the X-Band.

4.2. Annex 1, Item 2: Broadband over the frequency range

4.2.1. Test Method

Testing was carried out in the premises of Coverise Ltd on 10/6/2009.

The EUT amplifier was connected to a Marconi 6200 microwave scalar analyser and powered from a bench power supply. The gain and saturated amplifier output power were measured and recorded over a frequency range 9300 to 9500MHz.



TA photograph of the test layout is shown in Figure 2, page 15.

4.2.2. Results

The results are shown in plot 3, page 19. The lower trace shows the unsaturated amplifier gain over the frequency range 9000 – 9700MHz.

The unsaturated amplifier gain over the frequency range 9300 – 9500MHz is between 51.54dB and 53.56dB.

The amplifier in the Active-X meets the requirement of ITU-R M.1176; Annex 1 to be broadband over the range 9300MHz to 9500MHz.

4.3. Annex 1, Item 2: Amplification

4.3.1. Test Method

The test method in 4.2 was used to determine the gain of the amplifier. The gain of the antennas used was determined in 4.1.

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4.3.2. Equipment Used

Refer to section 3.1 Tables 2 and 3.

4.3.3. Results

Minimum unsaturated amplifier gain in the band 9300-9500MHz was measured at 51.54dB. Added to the gain of the antennas of 3.78dBi (minimum) each, the overall system gain including antennas is 57.18dB (worst case).

The unit complies with the amplifier gain requirements of ITU-R M.1176; Annex 1.

4.4. Annex 1, Item 2: Output form

4.4.1. Test Method

Testing was carried out at the Coverise R&D Facility in accordance with ISO8729-2 Clause 7.3.9 on 22/6/2009.

The EUT was set-up inside the Coverise anechoic chamber at 0° of heel and connected to a power supply. A test pulse was generated at 9.34GHz by gating the output of the Marconi 6200 microwave test set through a microwave switch, which is gated by a pulse generated by the Lyons PG2E Pulse generator. This was fed to a test antenna as the source. This pulse was then measured with the EUT switched off and on. (To maintain similar levels during the test, the antennas were moved closer together during the EUT off test) The test pulses were received on a R&S FSP spectrum analyser. The length of the pulse with the EUT on and off was recorded.

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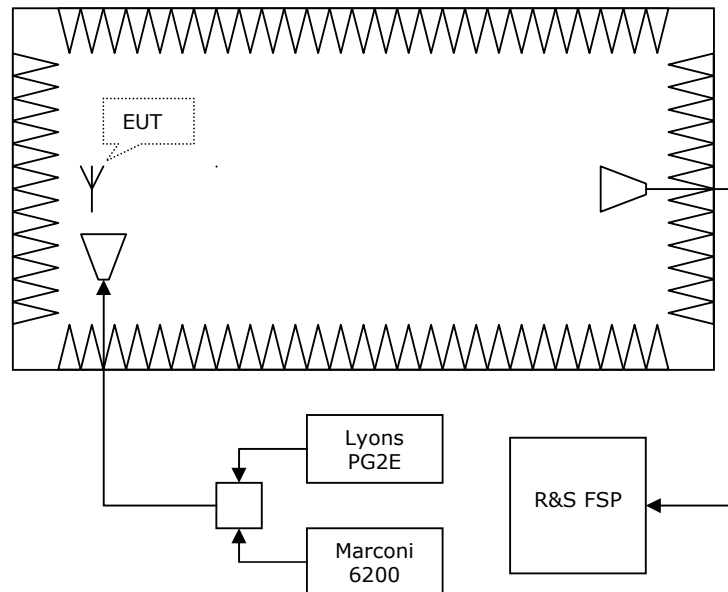
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The test layout is shown in Figure 3, page 16.

4.4.2. Equipment Used

Refer to section 3.1 Tables 2 and 3.

4.4.3. Results

Plots 4 and 5 on page 20 show the measurement scans with the EUT switched on and off. The pulse length was the similar under both conditions. (Measurement of the two plots shows a difference in pulse length of approximately 5ns at the -10dB points.)

The EUT complies with the requirements of ITU-R M.1176; Annex 1

4.5. Annex 1, Item 2: e.i.r.p. at limiting level

4.5.1. Test Method

Testing was carried out as described in 4.2.

4.5.2. Equipment Used

Refer to section 3.1 Tables 2 and 3.

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4.5.3. Results

Plot 3, **page Error! Bookmark not defined.**, shows the measurement plot of the EUT amplifier gain and saturated output power. The EUT saturated output power maximum was measured at 26.4dB. Therefore, when connected to the antenna with maximum gain of 5.0dB (from plot 1), this gives a maximum e.i.r.p 29.4dBm. (= 0.87Watts)

The EUT complies with the requirements of ITU-R M.1176; Annex 1 for e.i.r.p. at limiting level.

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Annex A: Photographs

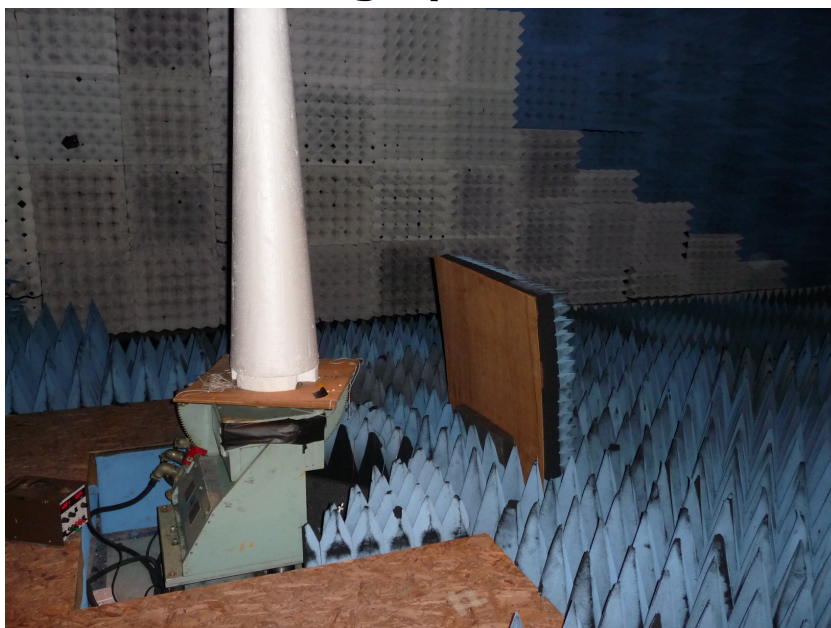


Figure 1: QinetiQ Funtington Calibrated Chamber test set up.

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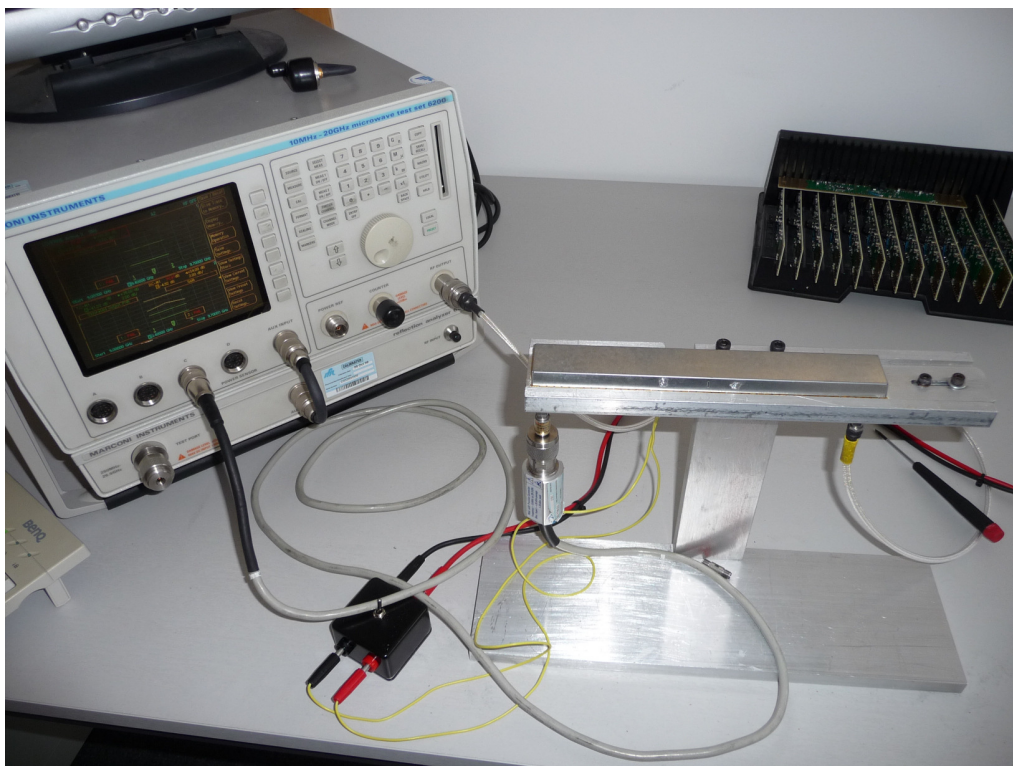


Figure 2: Gain & Saturated Power measurement system

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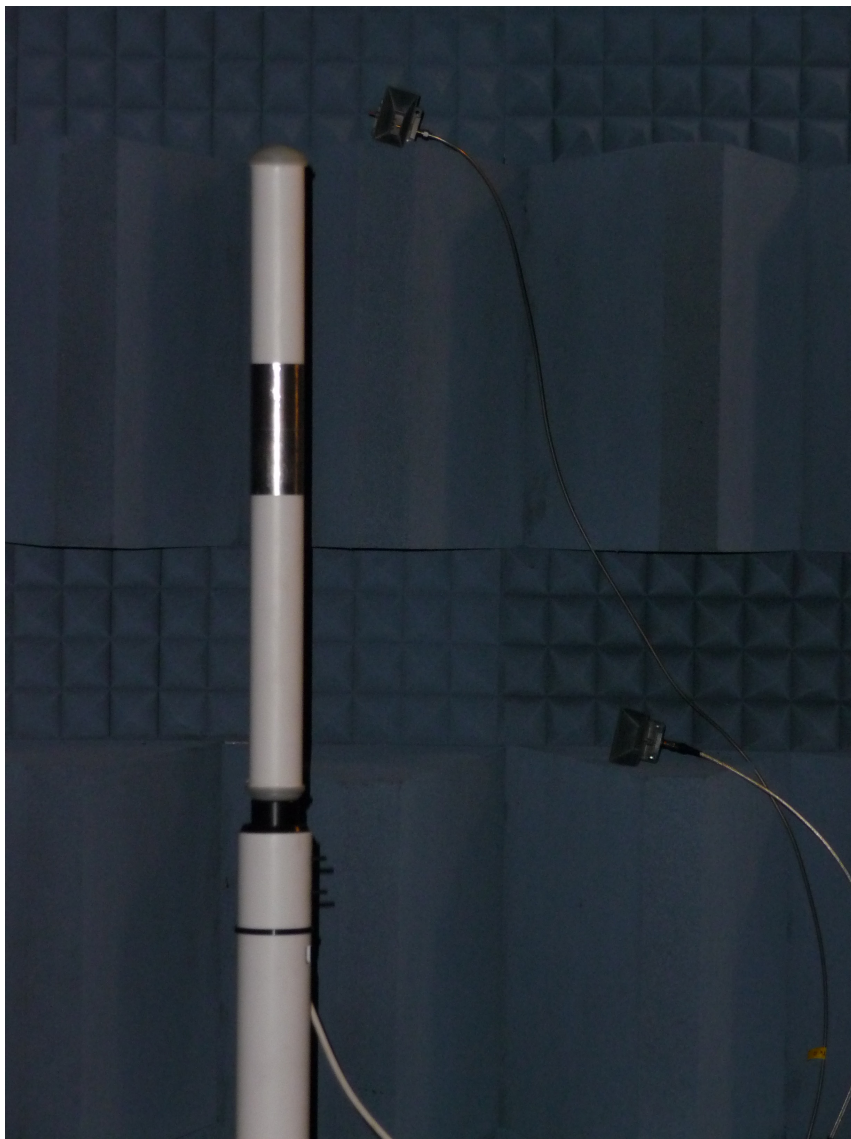


Figure 3: Pulse length test in Anechoic Chamber at Coverise Ltd.

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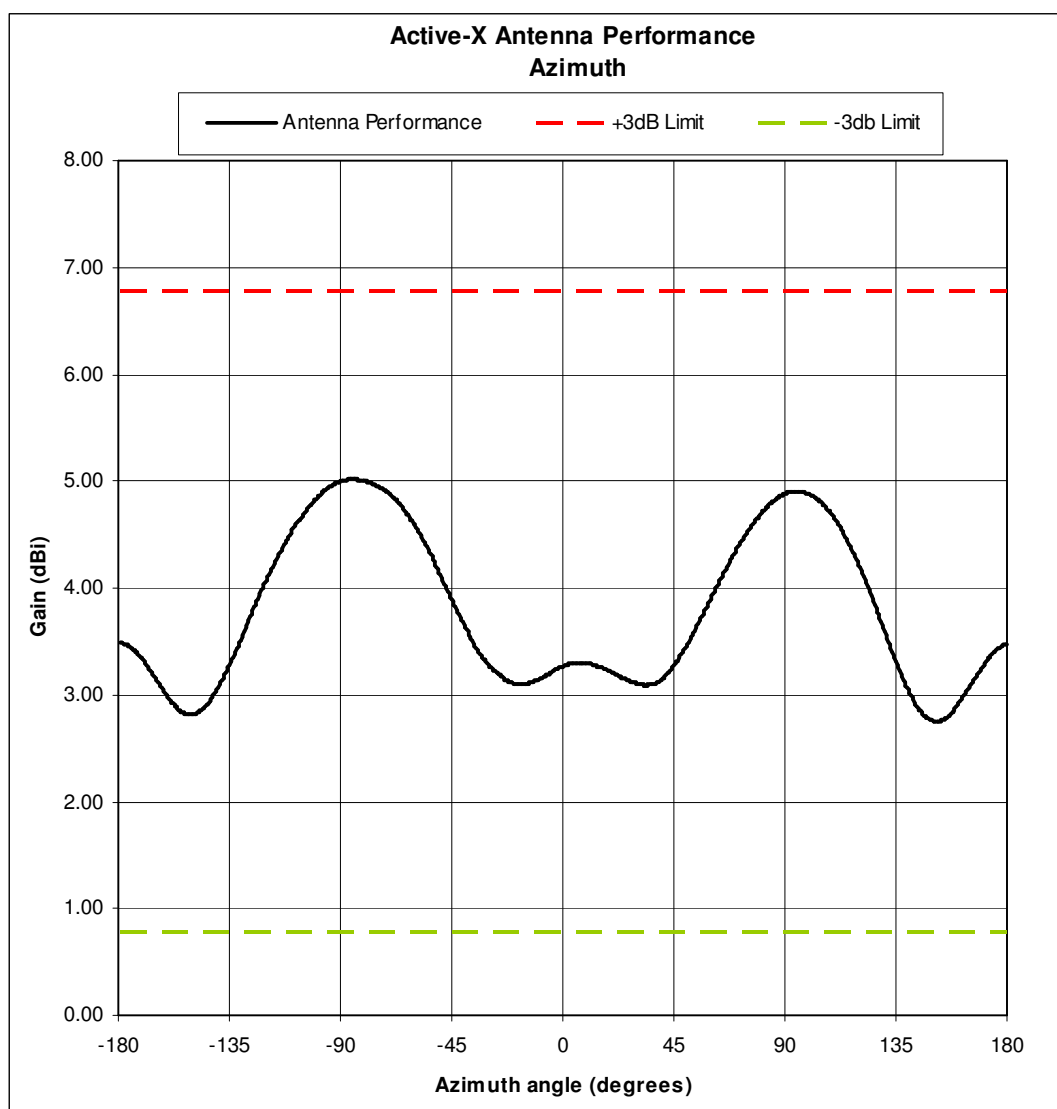
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Annex B: Results of Performance Tests



Plot 1: Antenna gain in horizontal plane

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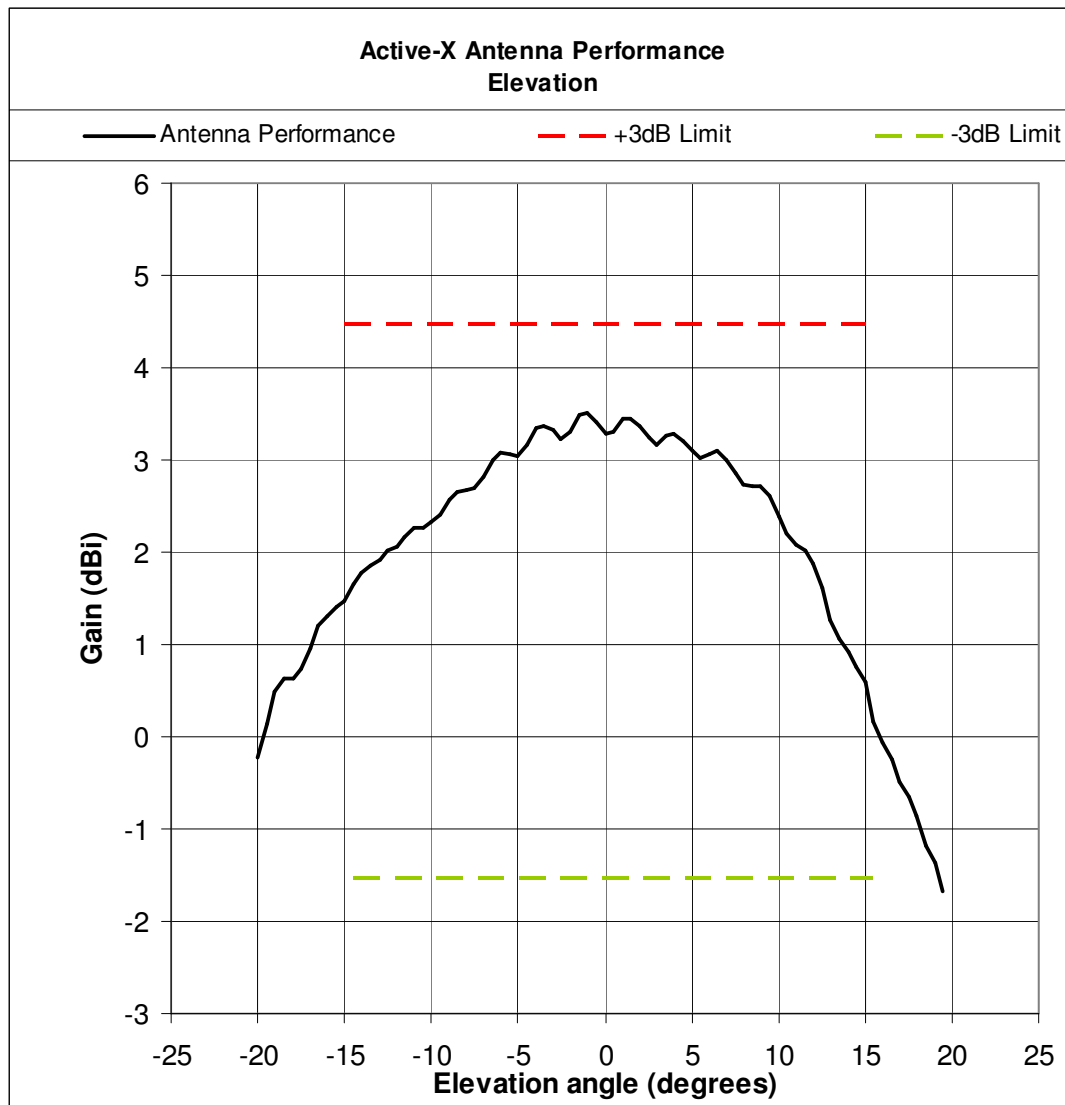
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Plot 2: Antenna Performance in Vertical Plane

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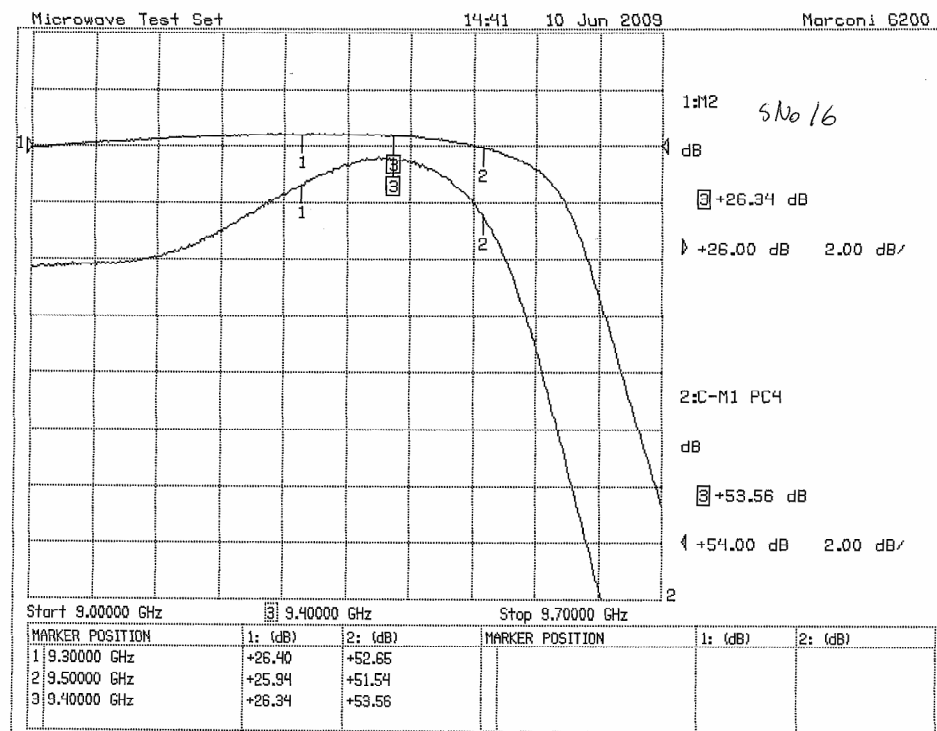
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Plot 3: Amplifier Gain versus Frequency

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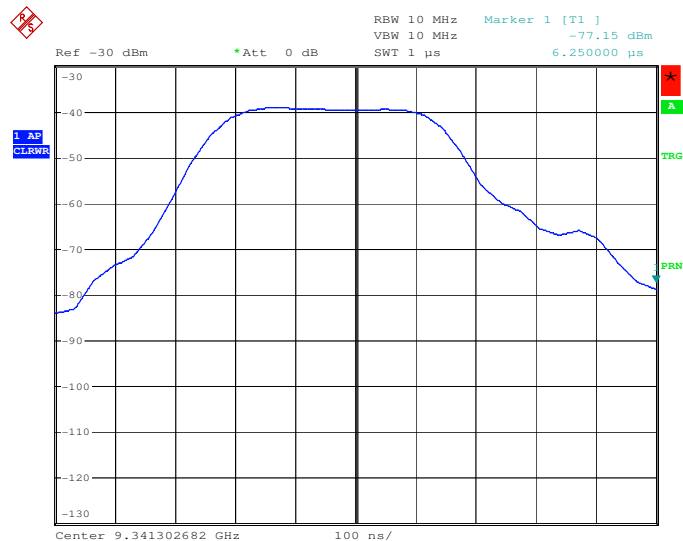
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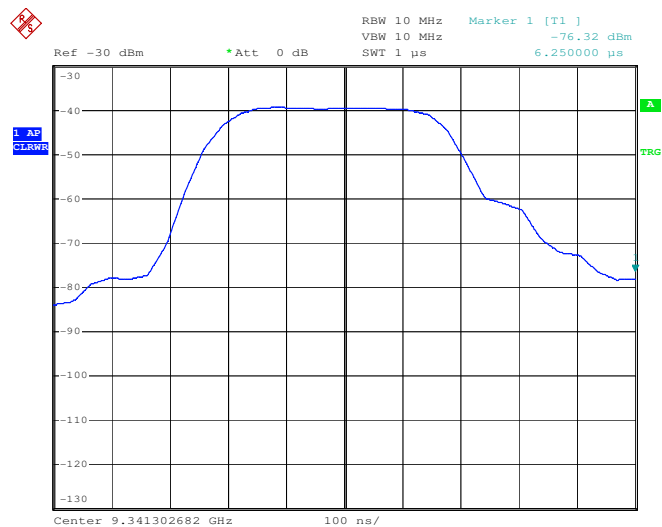
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Date: 22.JUN.2009 16:40:35

Plot 4: Spectrum Analyser Pulse length Active-X Off



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Plot 5: Spectrum Analyser Pulse length Active-X On