

Prepared by COL	Approved by ASU	Date (last revision) 2003-08-29	Doc. No. AE030058	Rev A
Distribution EA				

Antenna Concept for Calexico II, mini-PCI

1 Summary and conclusions

1.1 Summary of results

		Freq., GHz	Return Loss, dB	Eff., %
2.39 - 2.49 GHz Band		2.39	-9,8	81
		2.44	-10,2	74
		2.49	-10,1	76
4.90 - 5.90 GHz Band		4.90	-15,7	68,0
		5.47	-11,3	58,0
		5.90	-12,7	57,0

1.2 Conclusions

- The proposed antenna system includes 2 identical antennas with dimension 27 x 12 x 1 mm each.
- The measured Return Loss (VSWR) at the input port for each antenna element is in general not greater than -10 dB over the specified frequency bands.
- Nominal gain is between 0 and 1dBi.
- Each antenna element has close to omni directional pattern coverage.
- The 2 antennas are designed to handle both Vertical and Horizontal polarization. In real applications due to multipath properties of the radio channel both polarizations are important to receive.
- The small antenna dimensions allow flexible spacing for better antenna diversity.
- Impedance matching network is not needed.

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1.3 Summary of Intel evaluation criteria and our achievements

Intel Criteria	Results	Our Achievements
Antenna Efficiency	OK	~73% at 2.39 - 2.49 GHz ~61% at 4.9 - 5.9 GHz
Return Loss (≤ -10 dB)	OK	Not greater than -10dB for both bands
Gain _{nom} > -2dBi	OK	Nominal gain between 0 to 1 dBi
VSWR < 2.0:1	OK	Coherent with return loss
Cable length < 18 inches and connector Hirose U.FL	OK	Antenna dimension 27 x 12 x 1 mm, cable length can be adjusted to customer specification, connector Hirose U.FL
	OK	Impedance matching network is not needed.

2 Test object

The proposed antenna system includes 2 identical antennas printed on a PCB with dimensions of 27 x 12 x 1 mm. They are horizontally mounted on to of the LCD screen of a laptop mock-up.

The antennas are soldered with standard 50Ohm cable and SMA connector to allow 3D radiation, return loss and isolation performance measurements.

3 Measurements

The return loss and isolation measurements are during the evaluation work measured with a network analyser, Agilent ENA E5071A in free space. The 3D-radiation pattern is measured in GigaAnt's anechoic chamber, which is the ORBIT F/R 3D Nearfield chamber. The network analyser connected to the anechoic chamber is an Agilent 8753 ES.

Measurements done:

- 3D measurements – 2.39 to 2.49 GHz and 4.9 to 5.9 GHz bands; total field plots; vertical and horizontal polarization plots.
- XY, XZ, YZ cuts for the same bands; total field plots; vertical and horizontal polarization plots
- Total antenna efficiency
- Return Loss
- Isolation

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4 Results

4.1 Antenna efficiency and 3D pattern (total field) for the 2.39 – 2.49 GHZ Band

File name	Freq [GHz]	Efficiency [%]	Return loss [dB]
Intel175	2.39	81	-9,8
176	2.44	74	-10,2
177	2.49	76	-10,1

Table 1. Antenna Efficiency

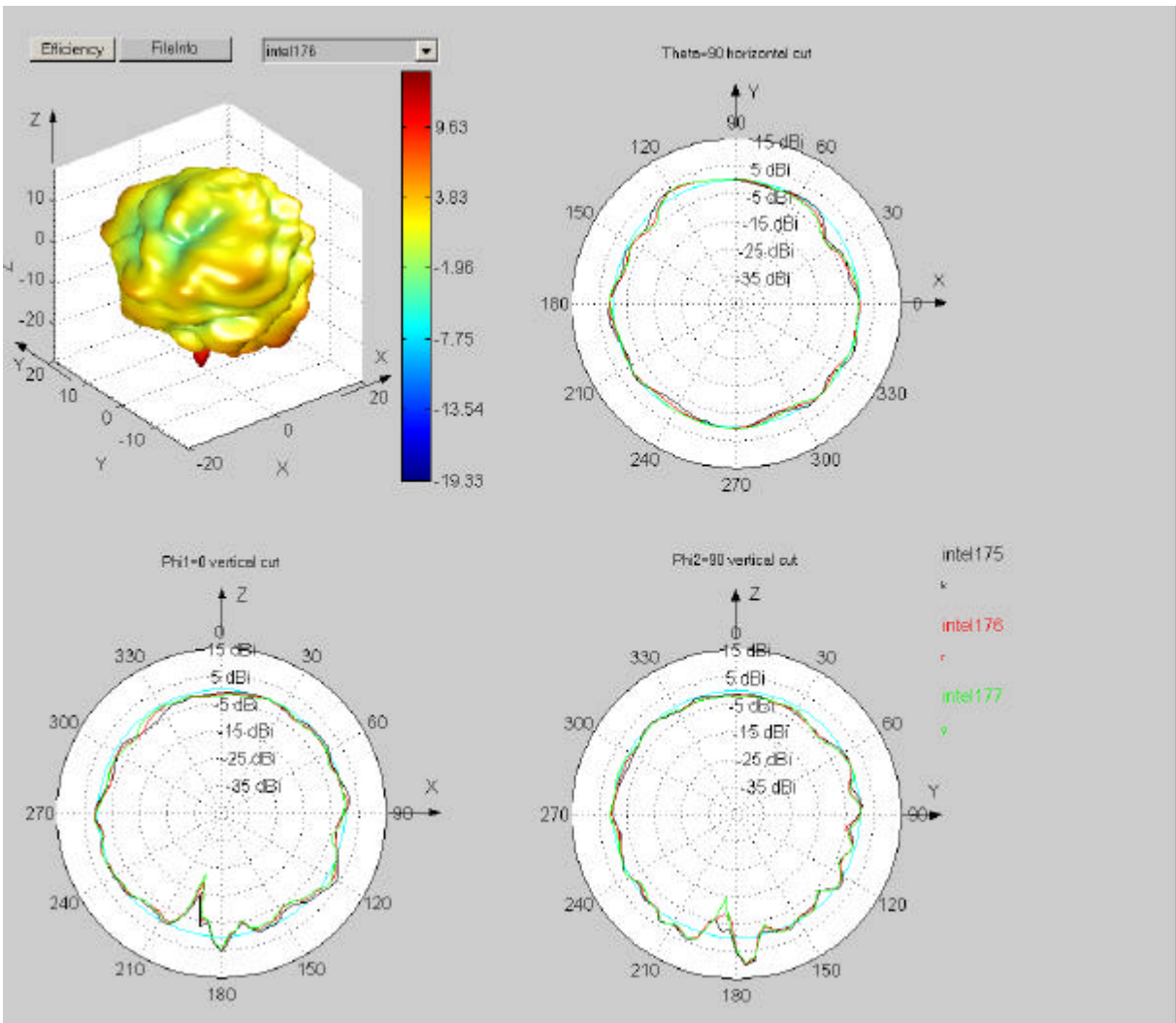


Figure 1 Polar plots show 2.4, 2.45 and 2.5 GHz. The 3D pattern corresponds to 2.45 GHz

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4.2 Antenna efficiency and 3D pattern (total field) for the 4.9 GHz – 5.9 GHz band

File name	Freq [GHz]	Efficiency [%]	Return loss [dB]
Intel21	5.1	68	-15,7
25	5.47	58	-11,3
27	5.9	57	-12,7

Table 2. Antenna Efficiency

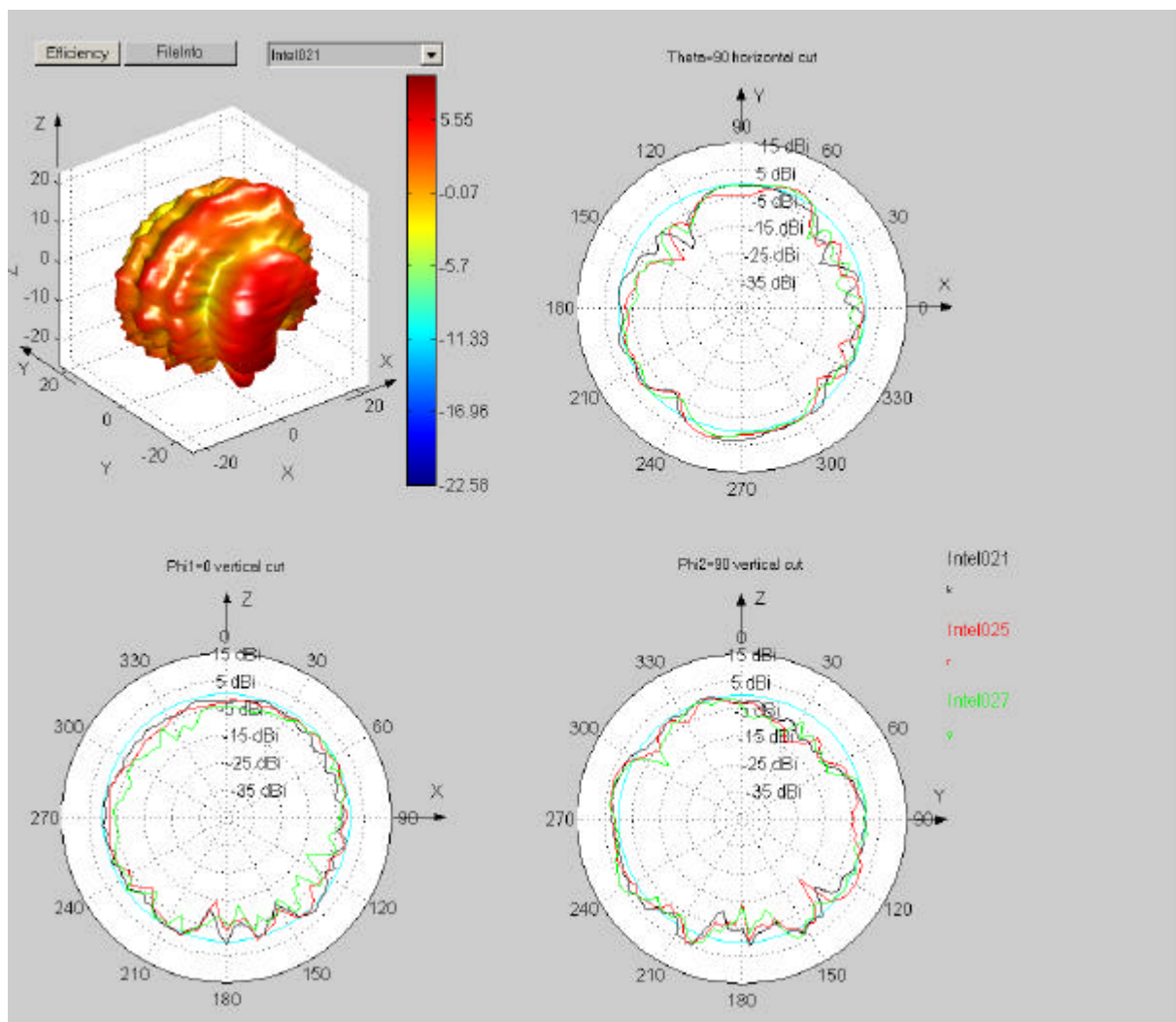


Figure 2 Polar plots show 5.1, 5.47 and 5.9 GHz. The 3D pattern corresponds to 5.1 GHz

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4.3 Return Loss plot

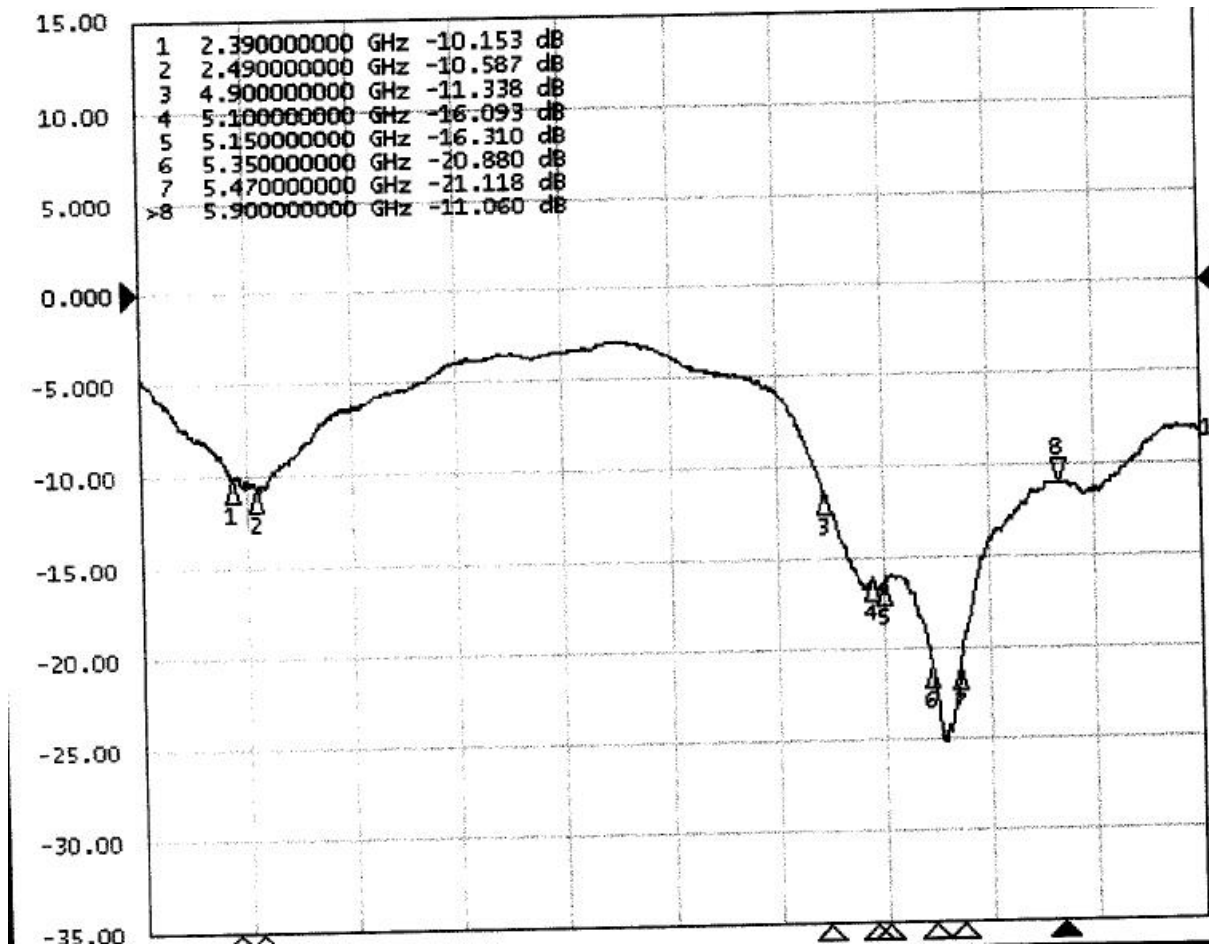


Figure 3 S11 plot

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4.4 Measured Isolation

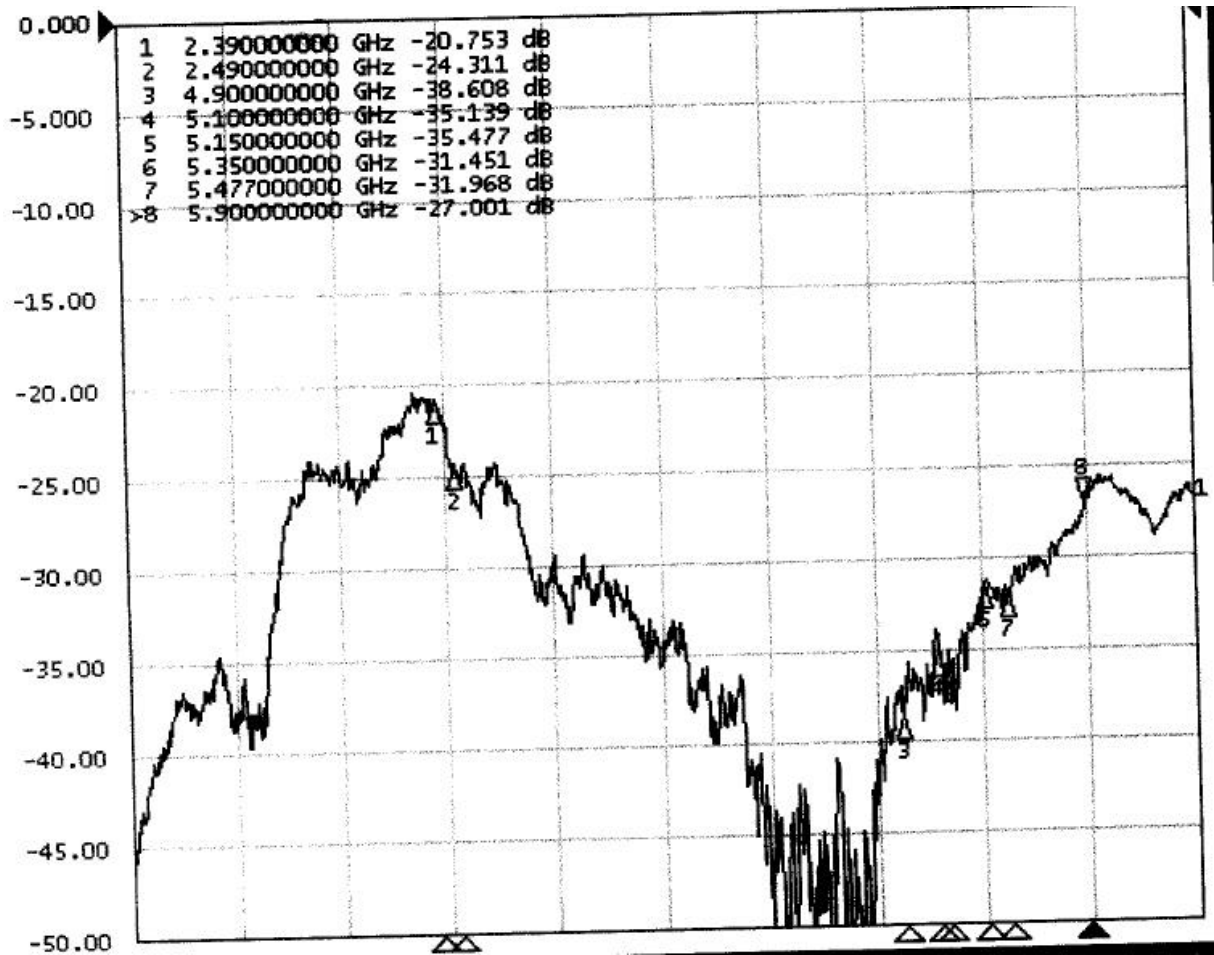


Figure 4 S21 plot – antenna 1 is connected to port 1 of the NA and antenna 2 o port 2.

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5 Enclosures

5.1 2.39 – 2.49 GHz Band

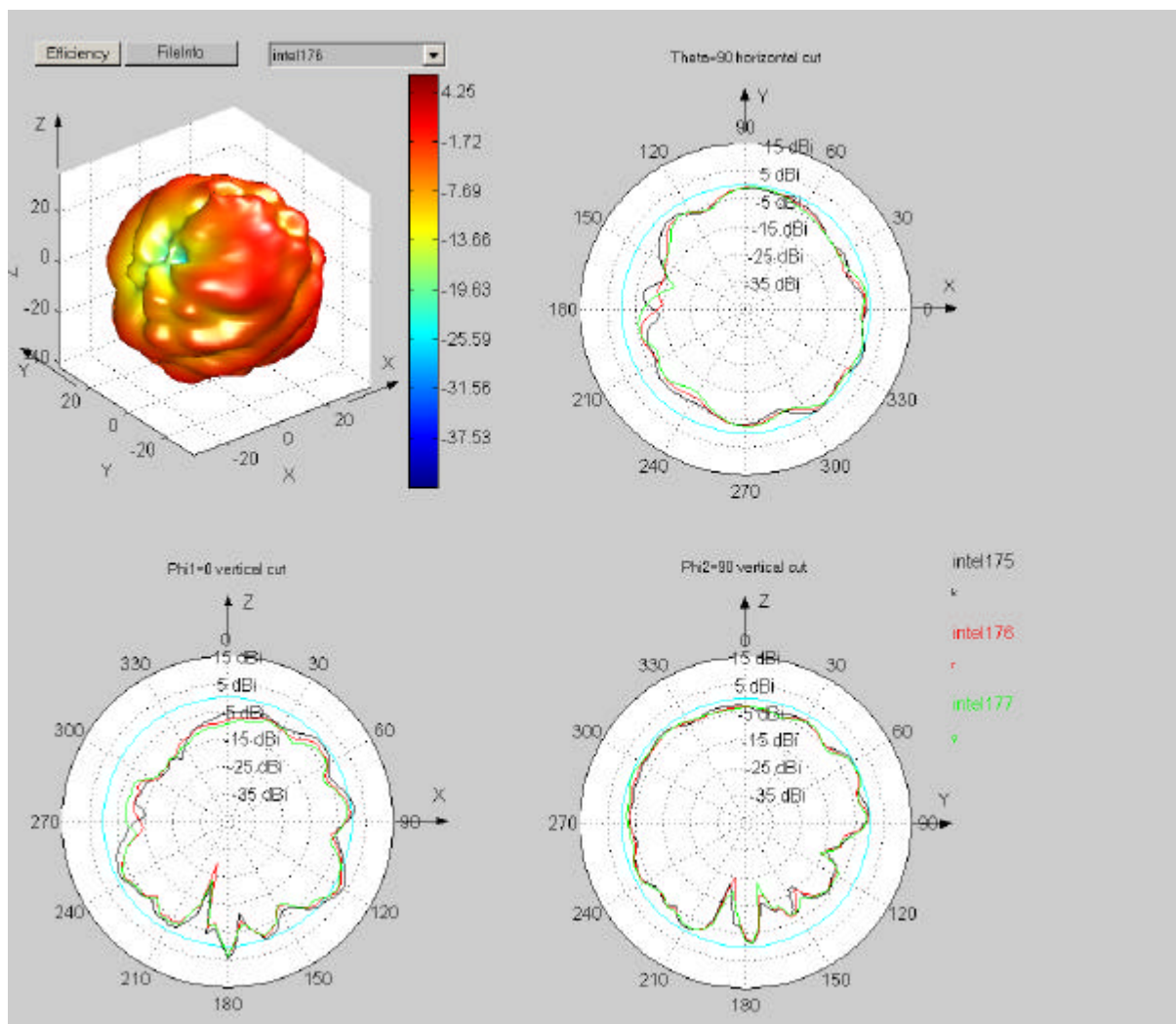


Figure 5 Vertical Polarization; polar plots show 2.4, 2.45 and 2.5 GHz. The 3D pattern corresponds to 2.45 GHz

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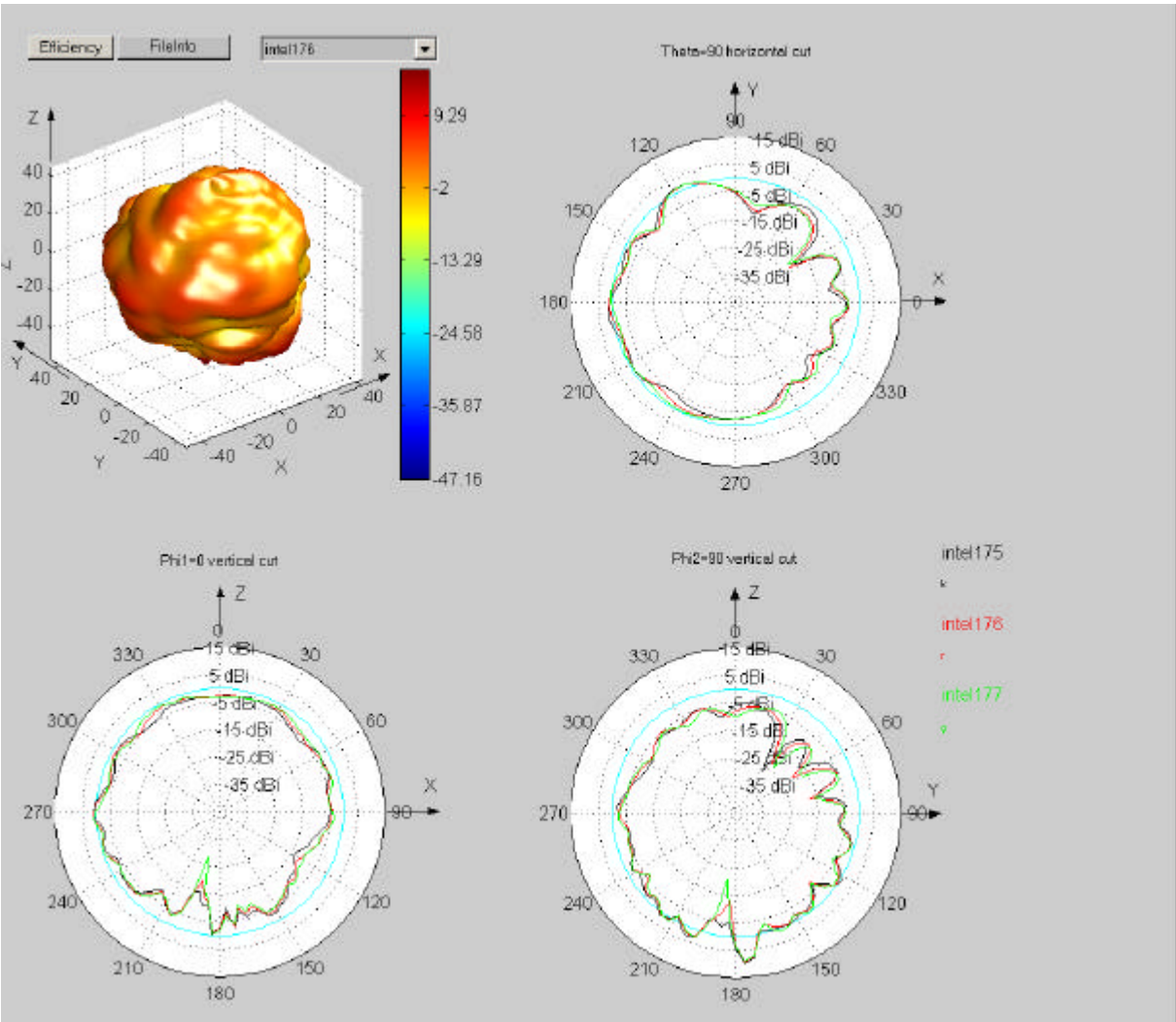


Figure 6 Horizontal Polarization; polar plots show 2.4, 2.45 and 2.5 GHz. The 3D pattern corresponds to 2.45 GHz

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5.2 4.9 GHz – 5.9 GHz Band

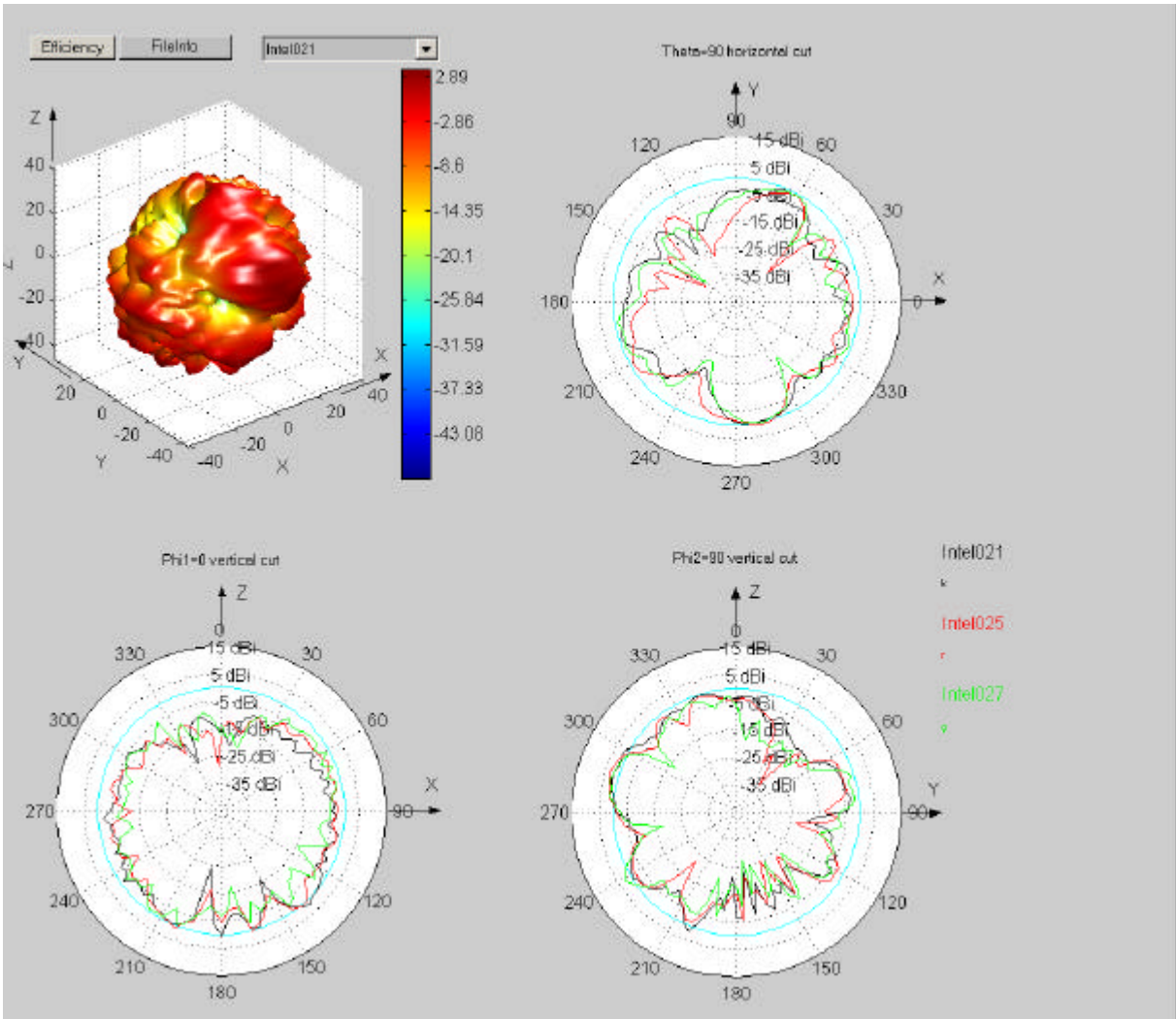


Figure 7 Vertical Polarization; polar plots show 5.1, 5.47 and 5.9 GHz. The 3D pattern corresponds to 5.1 GHz

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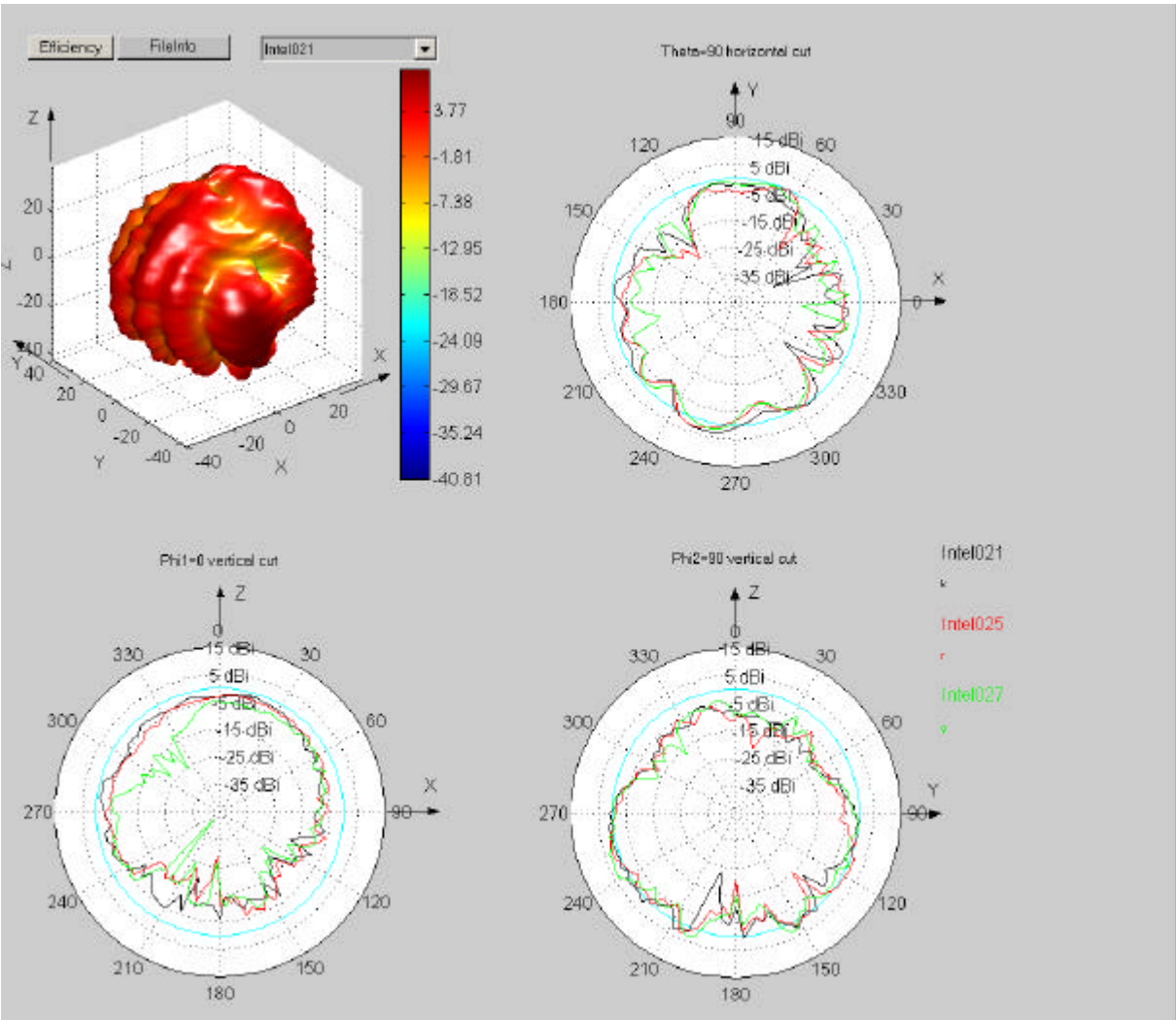


Figure 8 Horizontal Polarization; polar plots show 5.1, 5.47 and 5.9 GHz. The 3D pattern corresponds to 5.1 GHz

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5.3 Single Antenna Element

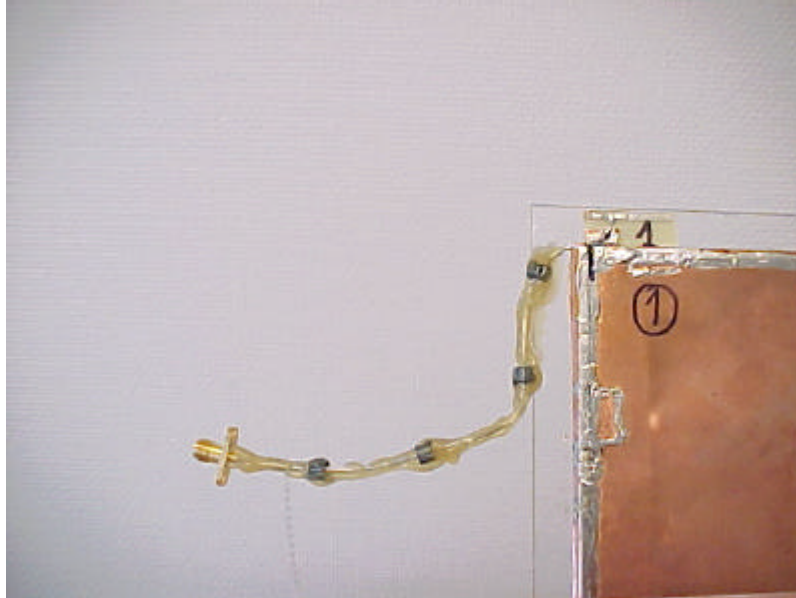


Figure 9 Single test object

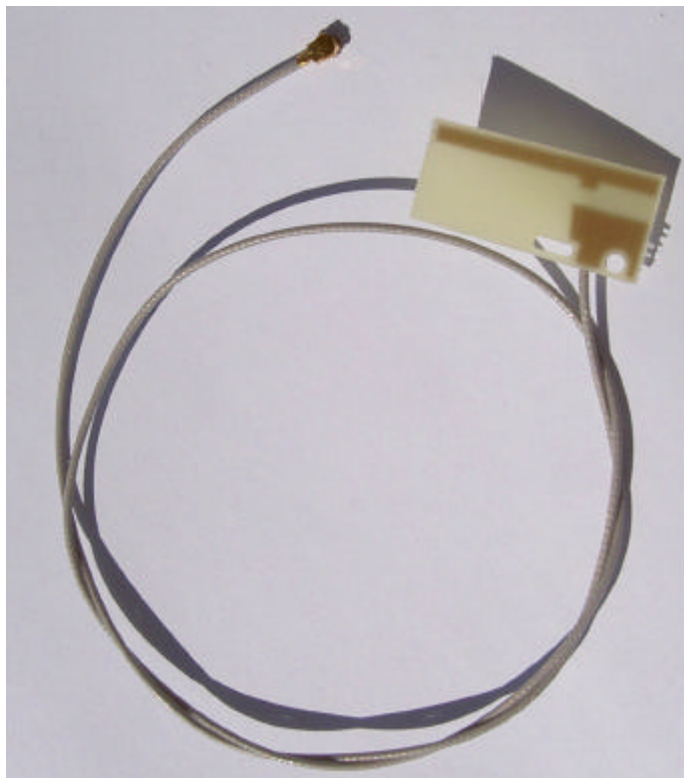


Figure 10 Antenna in original and production design