加利电子（无锡）有限公司

地址: 无锡高新技术产业开发区锡士路 1 号
电话: 86-510-88665500
传真: 86-510-88665511

零件承认书

SPECIFICATION FOR APPROVAL

P/N of **Galtronics**	P/N of **Compal**
021020140-3909	**DC33000HD00**

APPROVED BY	SIGNATURE	DATE
Engineering Department Manager		09-5-8
Mechanical Engineer		2009-5-8
RF Engineer		2009.5.8
Customer Approval		

目 录

REV NO.	DATE	DESCRIPTION
S1	08-04-22	Initial Draft
S2	08-05-22	Changes of antenna peak and average gain values due to changes in antenna design
S3	08-08-19	Gain tables updated
S4	09-01-23	Efficiency and gain tables updated
S5	09-05-08	Cancel Transmit Composite Peak Gain
S6	09-05-08	Add 5350 – 5725 PEAK GAIN

DISTRIBUTION LIST: 1. 2.	3.	
APPROVED BY	**SIGNATURE**	**DATE**
Engineering Department Manager		
Mechanical Engineer Gary Wannagot		
RF Engineer Marin Stoytchev		
Approved By Customer (as required):		

Design Specification

2.4 GHz and 5 GHz Compact Balanced Antennas For Linksys DMC350 Digital Media Server

Galtronics P/N:

021020140-3909

Compal P/N:

DC33000HD00

CONTENTS

1.0 PURPOSE AND SCOPE;

The purpose of this document is to establish a ***design*** specification for the antenna product that Galtronics is producing for Linksys. Any changes or additions to this specification can affect schedule and/or cost of the product and should be negotiated between Galtronics and Linksys before being incorporated into the specification. Upon agreement of this specification Galtronics will make no changes without written approval from Linksys. Any changes requested by Linksys will be given to Galtronics with sufficient time frame to evaluate the cost impact and react as required. The development of this product within Galtronics is conducted according to the Design Control Procedure SOP-006E.

2.0 RELATED DOCUMENTS:

SOP006E	Product Launch Procedure (Design Control)
EN006E	Reliability Guidelines
EIA-STD-556	Outer Shipping Container Bar Code Label Standard

3.0 ABBREVIATIONS AND DEFINITIONS

Ω	Ohm
°	Degree
°C	Celsius (degrees Centigrade)
cm	Centimetre
g	Grams
GHz	Gigahertz
Hz	Hertz
kg	Kilograms
MHz	Megahertz
M	Metre
mm	Millimetre
N	Newton
PCB	Printed Circuit Board
RH	Relative Humidity
W	Watt

Design Specification: A preliminary target specification to guide the design process.
Product Specification: A final specification for the qualified product.

4.0 DESCRIPTIONS AND PART NUMBER;

4.1 DESCRIPTION

These antennas are referred to as Galtronics' Compact Balanced Antennas. The patent-pending design consist of single-piece high performance balanced antennas with coaxial cables. The cables are terminated with UFL-style connectors. Two antennas are installed per device. They will be denoted as Front Right antenna and Front Left antenna. Both antennas are a dual-band single-feed design. The antenna element is attached to a plastic carrier. The plastic carrier has snap fit mounting features allowing for attachment to and limited removal from the device.

4.2 PART NUMBER

Galtronics P/N	Compal P/N	Frequency Band(s)	Location in Wireless Router
021020140-3909	DC33000HD00	2.40 - 2.50 GHz 5.15 - 5.825 GHz	Front Right and Front Left

5.0 ELECTRICAL SPECIFICATIONS;

5.1 FREQUENCY BAND

Unlicensed ISM2400 Band: 2.4 – 2.5 GHz
Unlicensed ISM5400 Band: 5.15 – 5.825 GHz

5.2 IMPEDANCE - Nominal impedance: 50Ω

5.3 MATCHING REQUIREMENTS.

The compact balanced antennas do not require additional impedance matching circuitry.

5.4 VSWR REQUIREMENTS

5.4.1 VSWR Maximum

Maximum VSWR allowed is 2.0:1

5.4.2 TEST METHOD (ENGINEERING)

The antenna is tested while mounted in the wireless media server. The media server is positioned in free space. (Free space means the device is placed on a non-conductive surface away from any conductive objects.)

5.4.3 TEST METHOD (PRODUCTION)

In mass production it is not practical to use the device supplied by customer. Galtronics will designate reference antennas that meet VSWR requirements when installed in the wireless media server. The reference antennas will then be measured in free space on production test equipment. Production antennas will be measured on the same production test equipment, and are thereby correlated to the reference antennas.

5.5 EFFICIENCY

5.5.1 MINIMUM VALUES OF ANTENNA EFFICIENCY

The efficiency of the antennas shall be a minimum of 30%.

5.5.2 TEST METHOD (ENGINEERING)

The antennas are tested while mounted inside the wireless media server. The media server is then tested in an anechoic chamber in free space. The efficiency of each antenna is measured at a minimum of three frequency points across the band of interest. The antennas shall meet the minimum efficiency requirements.

5.6 ANTENNA GAIN VALUES

5.6.1 MINIMUM PEAK AND AVERAGE GAIN VALUES

The antennas shall meet the following minimum peak and average gain values:

	Azimuth Cut			
	Front Right Antenna		Front Left Antenna	
Frequency (GHz)	Power Sum Peak (dBi)	Power Sum Avg (dBi)	Power Sum Peak (dBi)	Power Sum Avg (dBi)
2.400	-1.50	-4.50	-1.50	-4.50
2.450	-2.00	-4.50	-1.50	-4.50
2.500	-1.00	-4.00	-1.00	-4.00

	Elevation Cut (Front to Back)			
	Front Right Antenna		Front Left Antenna	
Frequency (GHz)	Power Sum Peak (dBi)	Power Sum Avg (dBi)	Power Sum Peak (dBi)	Power Sum Avg (dBi)
2.400	-2.00	-5.50	0.00	-6.00
2.450	-2.00	-5.50	0.00	-6.00
2.500	-0.50	-5.00	0.00	-5.00

	Elevation Cut (Side to Side)			
	Front Right Antenna		Front Left Antenna	
Frequency (GHz)	Power Sum Peak (dBi)	Power Sum Avg (dBi)	Power Sum Peak (dBi)	Power Sum Avg (dBi)
2.400	-1.50	-5.50	-2.00	-6.50
2.450	-1.50	-5.50	-2.00	-6.00
2.500	-1.00	-5.50	-1.50	-5.50

	Azimuth Cut			
	Front Right Antenna		Front Left Antenna	
Frequency (GHz)	Power Sum Peak (dBi)	Power Sum Avg (dBi)	Power Sum Peak (dBi)	Power Sum Avg (dBi)
5.150	0.50	-4.00	1.50	-4.00
5.350	1.00	-3.50	1.50	-4.00
5.725	1.00	-3.50	2.50	-3.00
5.825	1.00	-3.50	2.50	-3.00

	Elevation Cut (Front to Back)			
	Front Right Antenna		Front Left Antenna	
Frequency (GHz)	Power Sum Peak (dBi)	Power Sum Avg (dBi)	Power Sum Peak (dBi)	Power Sum Avg (dBi)
5.150	2.50	-3.00	3.50	-2.00
5.350	3.50	-2.00	3.50	-1.50
5.725	0.50	-3.00	2.50	-4.00
5.825	-1.00	-4.50	1.00	-4.50

	Elevation Cut (Side to Side)			
	Front Right Antenna		Front Left Antenna	
Frequency (GHz)	Power Sum Peak (dBi)	Power Sum Avg (dBi)	Power Sum Peak (dBi)	Power Sum Avg (dBi)
5.150	2.50	-4.00	4.00	-4.00
5.350	3.50	-3.50	4.00	-4.00
5.725	1.00	-4.00	3.00	-3.00
5.825	0.00	-4.00	3.00	-3.00

5.6.2 INDIVIDUAL ANTENNA PEAK GAIN

The peak gain of individual antennas is as follows:

Frequency Band (MHz)	Typical Peak Gain (dBi)
2400 - 2500	
Peak Gain Left Front Antenna	1.6
Peak Gain Right Front Antenna	1.3
5150 - 5250	
Peak Gain Left Front Antenna	5.5
Peak Gain Right Front Antenna	4.7
5250 - 5350	
Peak Gain Left Front Antenna	5.5
Peak Gain Right Front Antenna	4.7
5350 - 5725	
Peak Gain Left Front Antenna	4.3
Peak Gain Right Front Antenna	3.6
5725 - 5825	
Peak Gain Left Front Antenna	4.5
Peak Gain Right Front Antenna	3.5

5.6.3 TEST METHOD (ENGINEERING)

The wireless router with antennas installed is mounted in an anechoic chamber in free space. The peak and average gain values are recorded for each antenna at the frequencies indicated.

The transmit composite gain is defined as the sum of the gain values of the TX antennas at each θ,ϕ-point in 3-D space. The maximum value of the resulting 3-D gain pattern provides the transmit composite peak gain.

6.0 MECHANICAL SPECIFICATIONS;

6.1 MECHANICAL CONFIGURATION

The appearance of the antennas is in accordance with drawing 021020140-3909.

6.2 CABLE PULL TEST

The antenna cable and solder joint shall withstand a 3 N axial pull force. The antenna element is fixed in an appropriate fixture and a 3 N axial force is slowly applied. The force is maintained for 10 seconds. There shall be no permanent damage to the antenna after the test.

7.0 ENVIRONMENTAL SPECIFICATIONS

7.1 OPERATING TEMPERATURE

Operating temperature range shall be 0° C to +60° C.

7.2 OPERATING HUMIDITY

Operating humidity range shall be 10% to 85%, non-condensing.

7.3 STORAGE TEMPERATURE

Storage temperature range shall be -20° C to +60° C.

7.2 STORAGE HUMIDITY

Storage humidity range shall be 5% to 90%, non-condensing.

8.0 QUALIFICATION

The mechanical and environmental tests mentioned above are performed according to the flow chart shown in Figure 1 below. The entire testing procedure will be conducted according to EN006E.

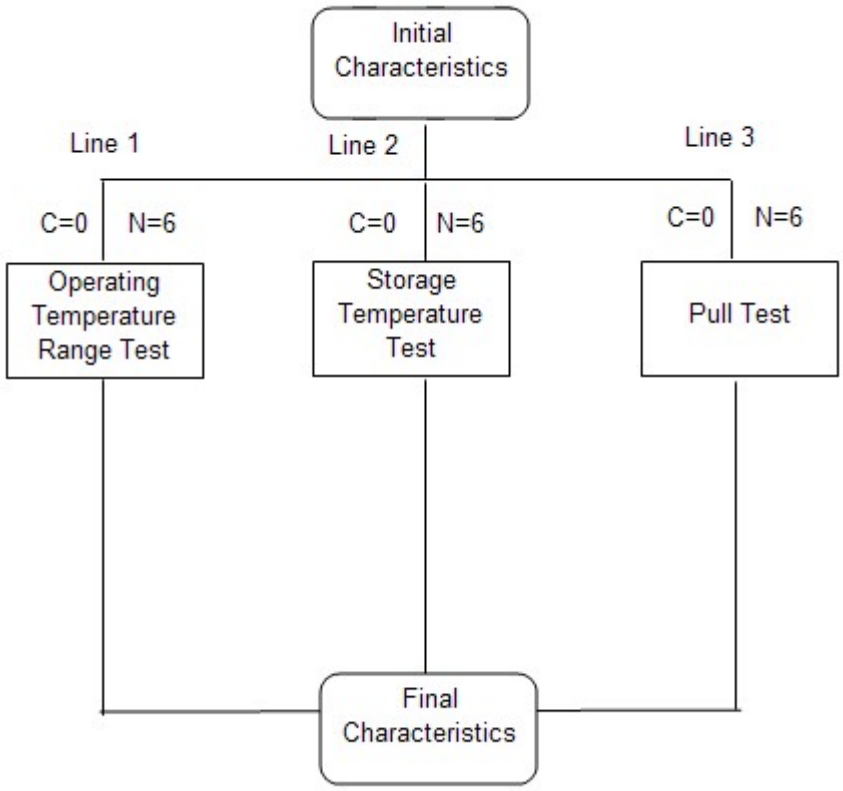

Figure 1. Property Verification Test Flow Chart
Note: n - sample size; c - allowable amount of critical failures

9.0 PACKAGING

021020140-3909 will be packed by PE package, 360 pcs antennas in one box

.

DWG No
021020140-3909

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DRAWING COVER SHEET

REV	DATE	ECO #	DESCRIPTION
S1	2008.11.19		FIRST RELEASE
S2	2009.3.20		Add label

APPLICABLE SPEC'S:

SURFACE FINISH, MICROMETERS, CLA (UNLESS STATED) 0.8

TOLERANCES UNLESS OTHERWISE SPECIFIED:

NO PLACE	(X)±1	TWO PLACE	(X.XX)±0.1
ONE PLACE	(X.X)±0.2	THREE PLACE	(X.XXX)±0.05

METRIC SCREW THREAD TO ISO STANDARDS 724, 2861, 965-1 AND 965-2 INCHES SCREW THREAD TO ANSI/ASME B1.1. ALL ANGLES TO BE 90° UNLESS OTHERWISE STATED. TOLERANCE ON ANGLES ±1/4°. ALL TOLERANCES APPLY AFTER FINISHING. MACHINE CORNER RADS, 0.25 MAX., TO BE FREE FROM BURRS, SHARP EDGES AND ALL FOREIGN MATERIALS. FLASH ALLOWANCE FOR PLASTIC MOLDED PARTS TO BE 0.1mm UNLESS OTHERWISE STATED. DIAMETER MUST BE CONCENTRIC WITHIN 0.08 T.I.R. ENVIRONMENTAL REQUIREMENTS: COMPLIANCE WITH GALTRONICS STANDARD "SUPPLIER ENVIRONMENTAL DECLARATION PROCEDURE" (SOPG002E).

INTERNAL DISTRIBUTION

- ☐ PROCESS
- ☐ PURCHASING
- ☐ PRODUCTION
- ☐ PLASTICS
- ☐ QUALITY
- ☐ INCOMING INSPECTION
- ☐ FINAL INSPECTION
- ☐ MARKETING

QUALITY ASSURANCE NOTES:

NO CHANGE SHALL BE ALLOWED ON PRODUCTION. MATERIAL WITHOUT PRIOR EXPLICIT WRITTEN APPROVAL BY GALTRONICS ENGINEERING AND PURCHASING DEPARTMENTS FOR SPECIAL REQUIREMENTS SEE FMI49

- ☒ XR PROCESS CONTROL CHART REQUIRED WITH EACH SHIPMENT
- ☐ CRITICAL DIMENSION AFFECTS FORM FIT OR FUNCTION

MATERIAL

FINISH

TITLE:

ANTENNA ASSY.
2.4 & 5 GHz

CHKD:

APRVD:

DATE: 2009-3-20

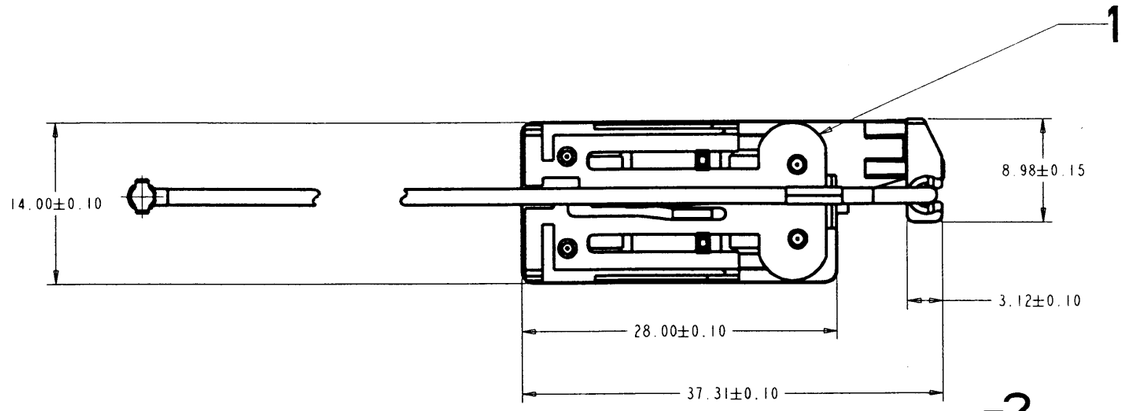
DWG. No.
021020140-3909

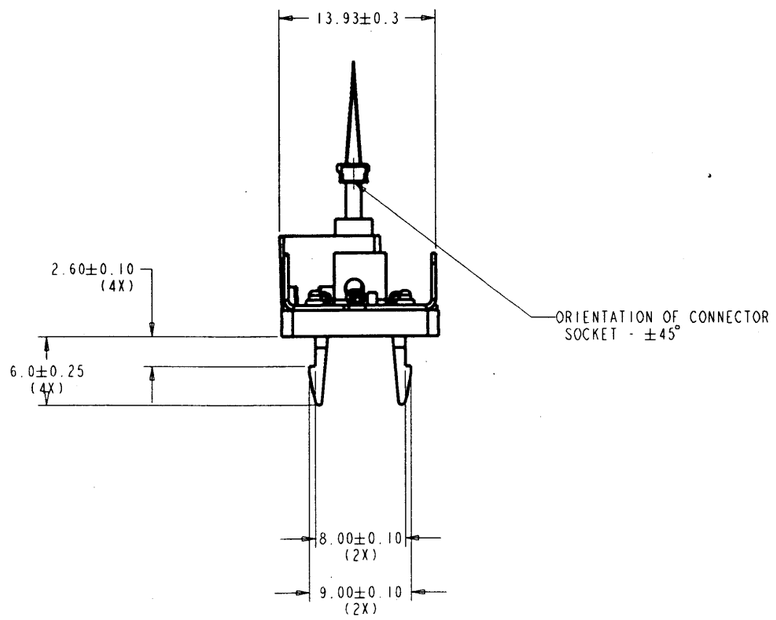
REV. S2

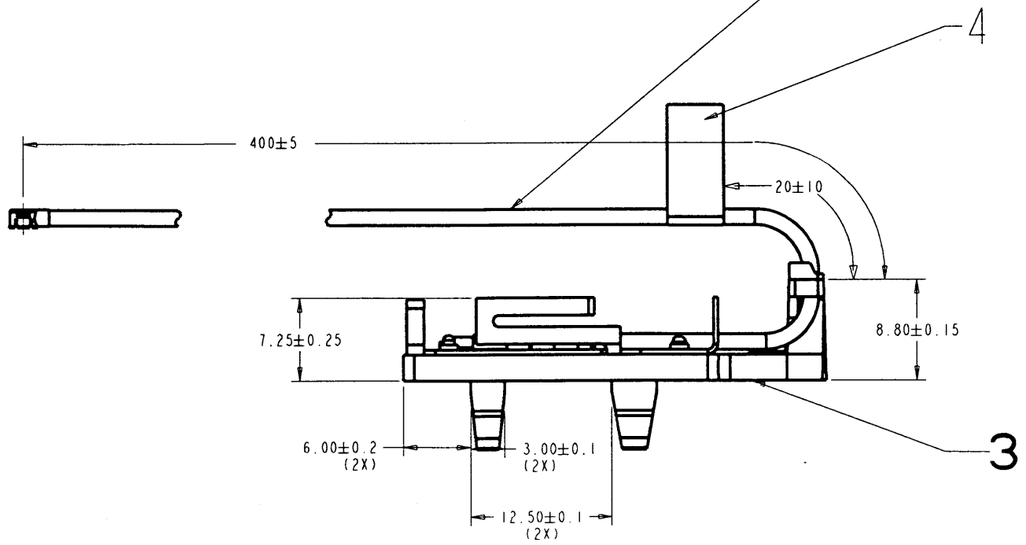
DWG. NO.: 021020140-3909 A1

ALL DIMENSIONS IN MILLIMETERS UNLESS OTHERWISE STATED. DO NOT SCALE - IF IN DOUBT, ASK!!

THIRD ANGLE PROJECTION







	DESCRIPTION	MATERIAL	FINISH	QTY
1	ELECTRICAL ELEMENT	STAINLESS STEEL, 304, 1/2 HARD. THICKNESS 0.4MM	PRE-PLATED NICKEL	1*
2	COAX CABLE W/UFL OR EQUIV CONNECTOR	CABLE Ø1.37	CABLE COLOR: GRAY LENGTH: 437mm OAL	1
3	CARRIER	POLYCARBONATE		1
4	Label			1

021020140-3909
PAGE 2 OF 2

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THIS PRINT IS GALTRONICS CONFIDENTIAL

ENGINEER	GAW	CHECKED	9-3-20
DRAWN	GAW	APPROVED	9-3-20
DATE	09-3-20	DATE	9-3-20

ANTENNA ASSY, 2.4 & 5 GHz

DWG. NO.: 021020140-3909 A1

52

Linksys Digital Media Center DMC350
Antenna Performance Report - Update

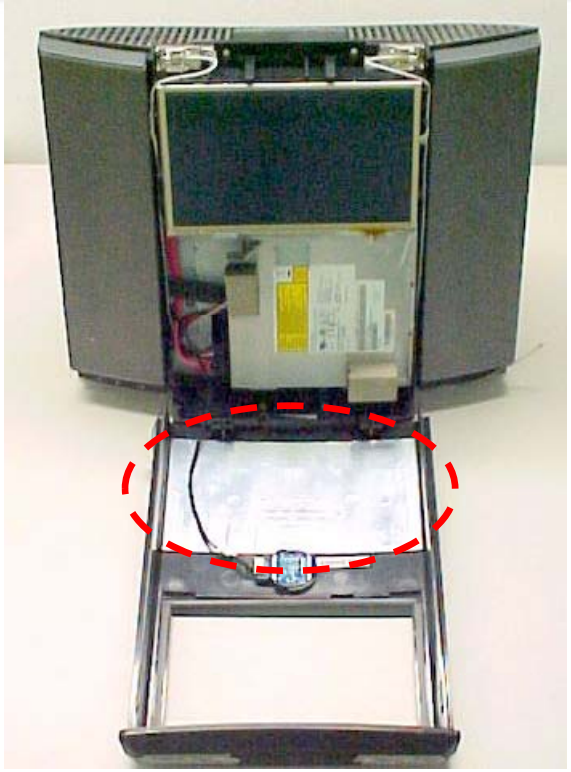
Galtronics Project #3909

Prepared by Marin Stoytchev
May 7, 2009

Overview

- In order to resolve EMI issues, Compal has made additional mechanical changes to product
- Updated unit was sent to Galtronics for a revision of the antenna specifications in modified device
- Galtronics tested the antennas integrated inside the modified device
- Results from tests are reported here

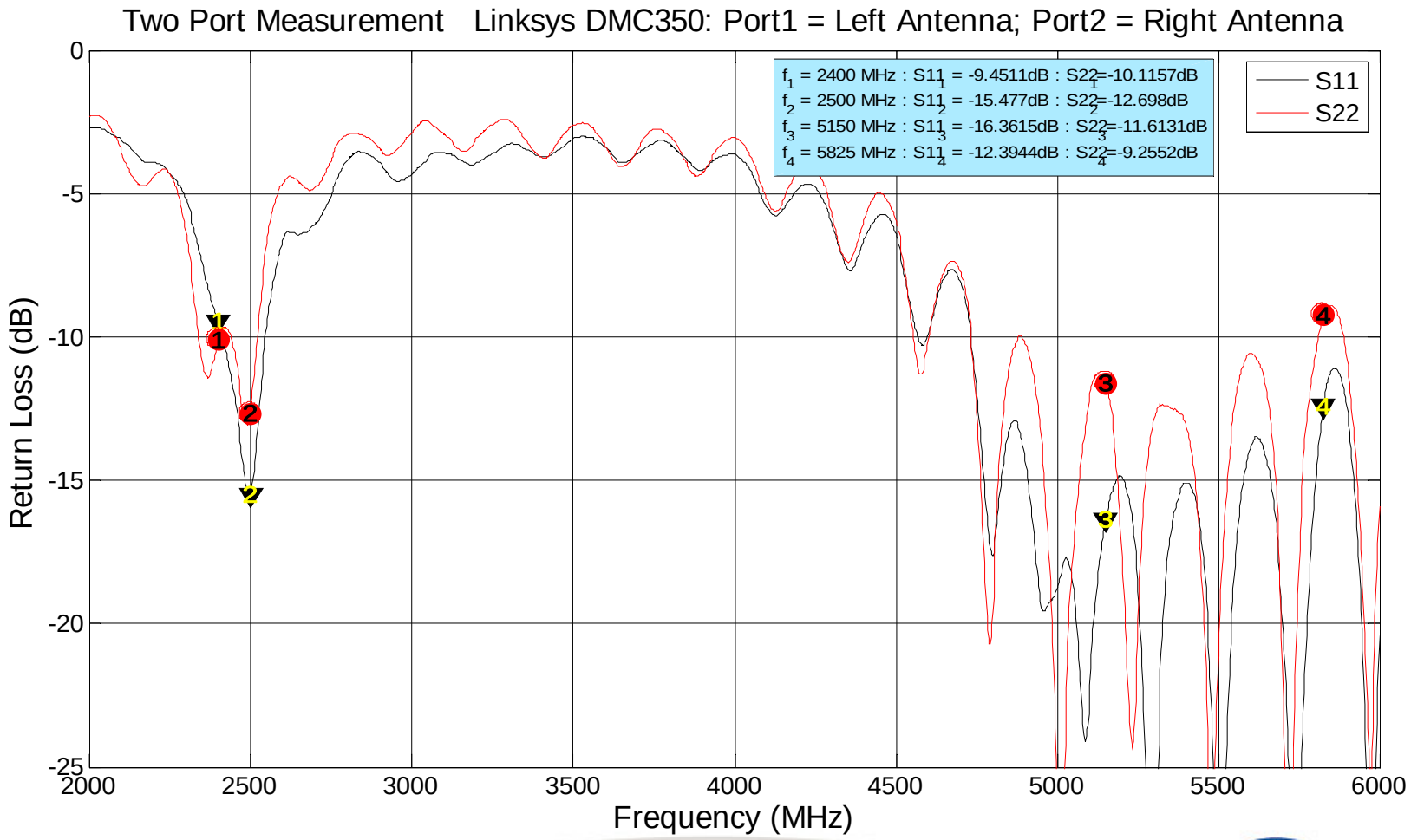
Changes to DMC350



- The only clearly visible change is added metal folio at the back of the front cover – it is not clear if there are additional changes in product
- Galtronics has tested the antennas integrated inside the modified device provided by Compal

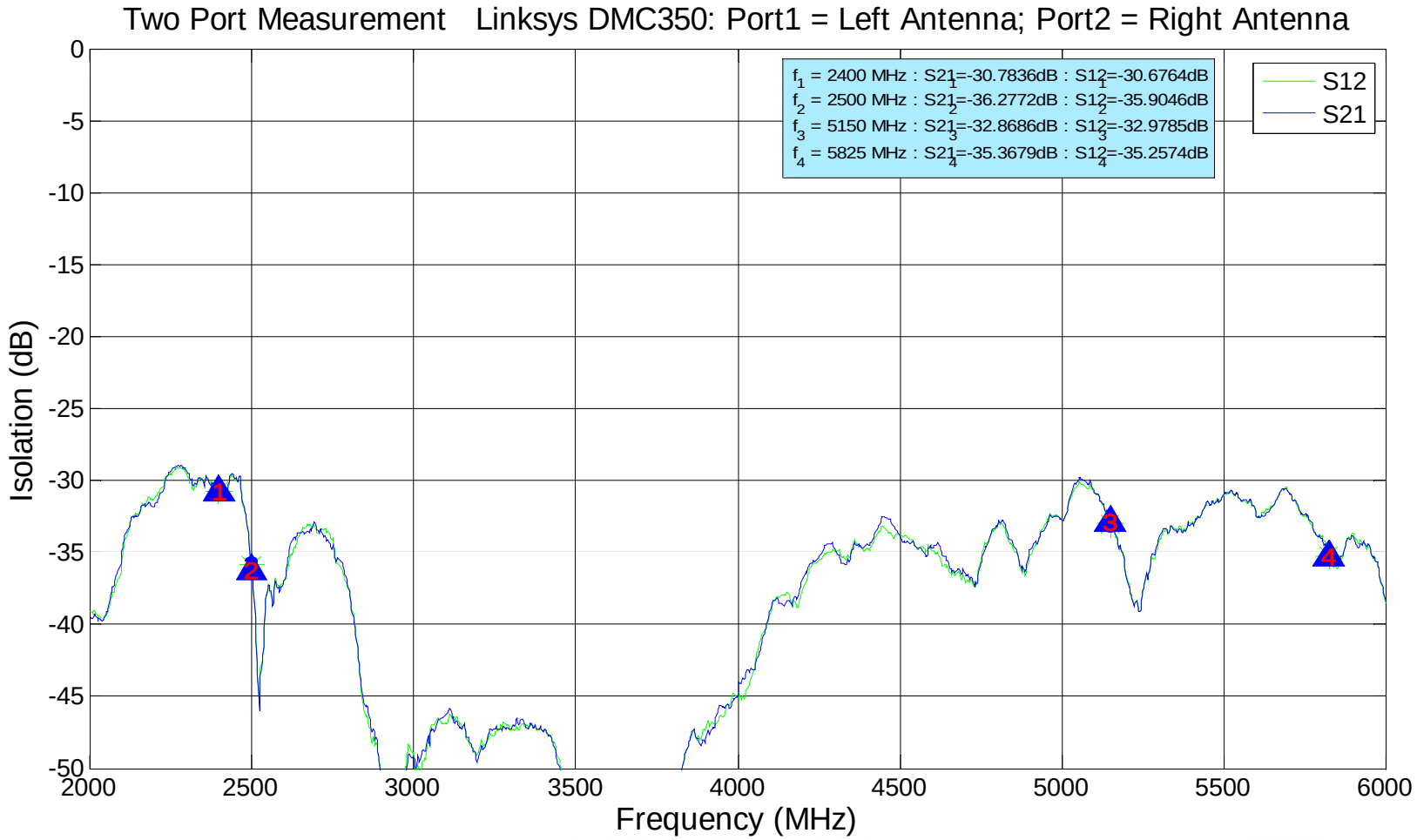
GALTRONICS

Return Loss: Left Front and Right Front Antennas



GALTRONICS

Isolation: Left Front and Right Front Antennas



Antenna Efficiency

Low Band

	Frequency (GHz)	Directivity	Peak Gain	S11	Terminal Efficiency
Left Antenna	2.400	5.33	0.70	-9.53	34.43%
	2.450	5.45	1.22	-11.44	37.78%
	2.500	5.30	1.53	-15.86	42.00%
	AVERAGE				**38.07%**

High Band

	Frequency (GHz)	Directivity	Peak Gain	S11	Terminal Efficiency
Left Antenna	5.150	8.12	5.12	-18.89	50.05%
	5.250	8.41	5.47	-16.27	50.76%
	5.350	7.30	4.22	-16.49	49.19%
	5.725	6.94	3.92	-20.01	49.89%
	5.825	7.75	4.44	-11.54	46.73%
	AVERAGE				**49.32%**

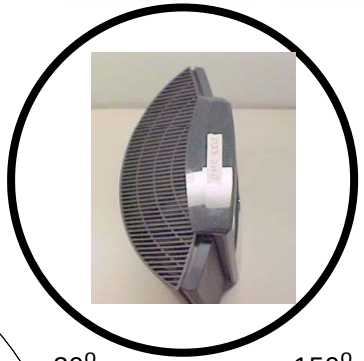
	Frequency (GHz)	Directivity	Peak Gain	S11	Terminal Efficiency
Right Antenna	2.400	5.25	0.84	-10.81	36.24%
	2.450	5.51	1.12	-10.20	36.45%
	2.500	5.30	1.28	-11.99	39.64%
	AVERAGE				**37.45%**

	Frequency (GHz)	Directivity	Peak Gain	S11	Terminal Efficiency
Right Antenna	5.150	6.83	3.75	-13.10	49.19%
	5.250	7.51	4.63	-25.94	51.56%
	5.350	6.75	3.56	-13.44	47.99%
	5.725	6.54	3.43	-27.56	48.85%
	5.825	6.89	3.23	-10.35	43.13%
	AVERAGE				**48.15%**

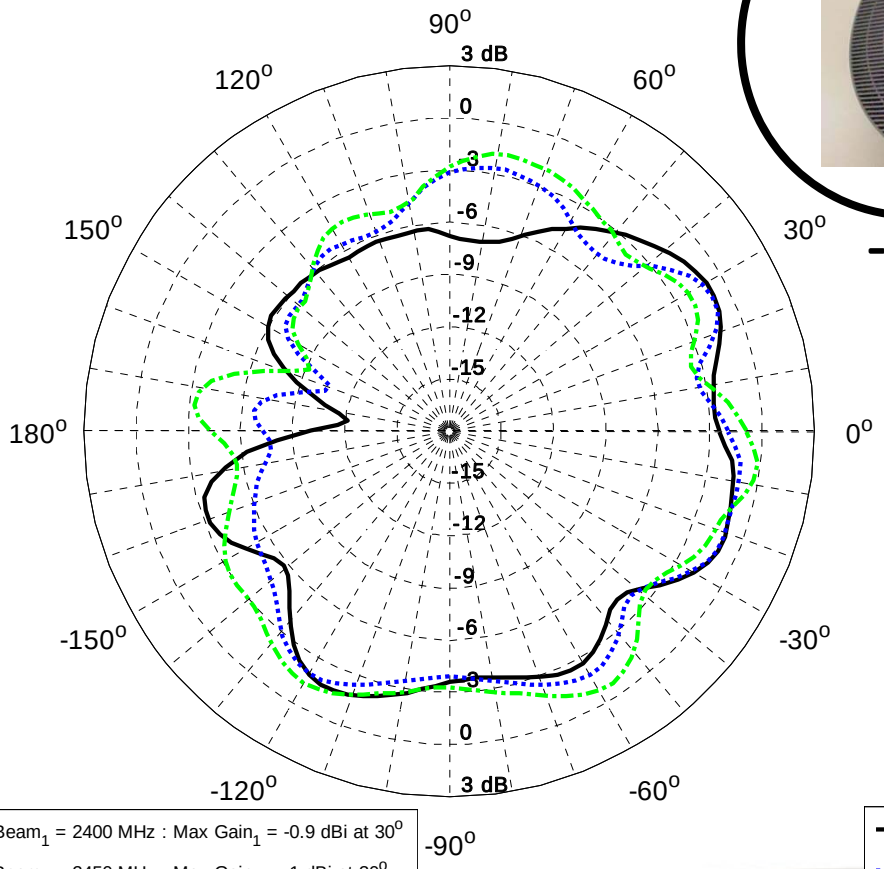
GALTRONICS

Antenna Patterns: Azimuth Cut – Low Band

Left Front



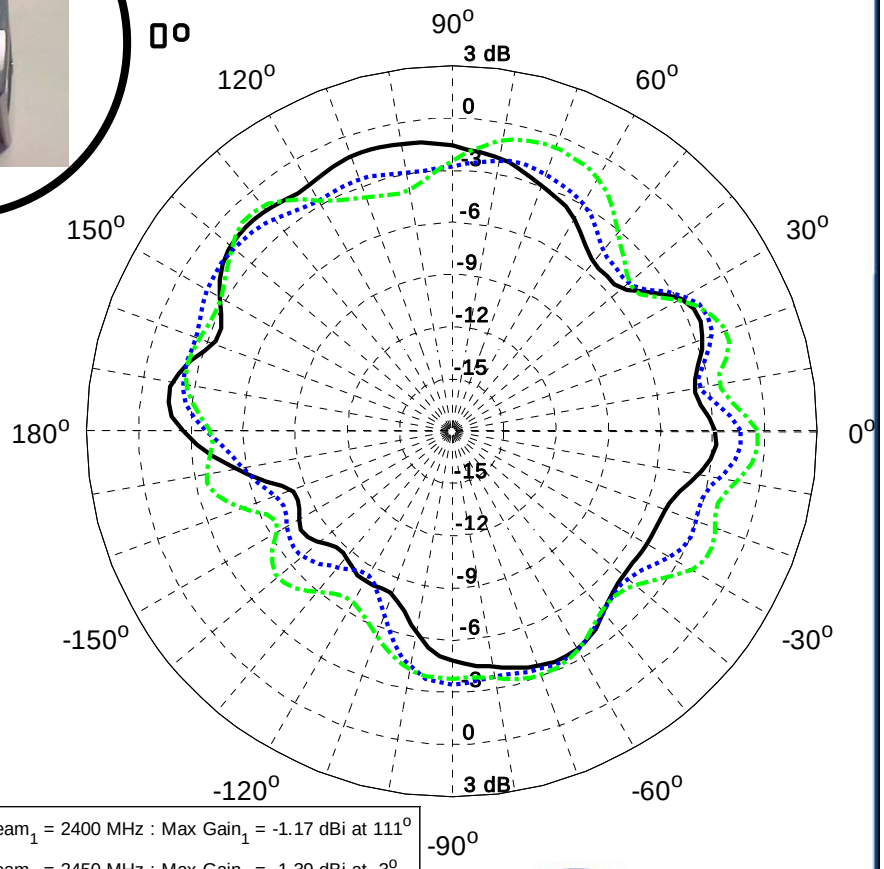
Right Front



Beam$_1$ = 2400 MHz : Max Gain$_1$ = -0.9 dBi at 30°

Beam$_2$ = 2450 MHz : Max Gain$_2$ = -1 dBi at 30°

Beam$_3$ = 2500 MHz : Max Gain$_3$ = -0.16 dBi at -6°



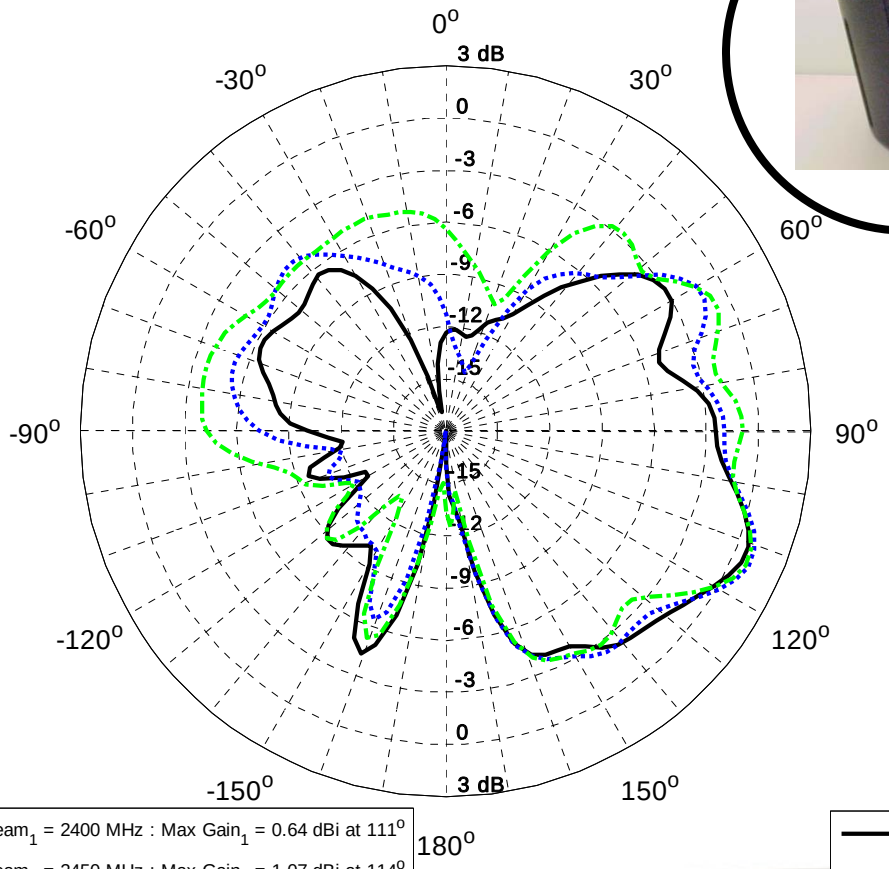
Beam$_1$ = 2400 MHz : Max Gain$_1$ = -1.17 dBi at 111°

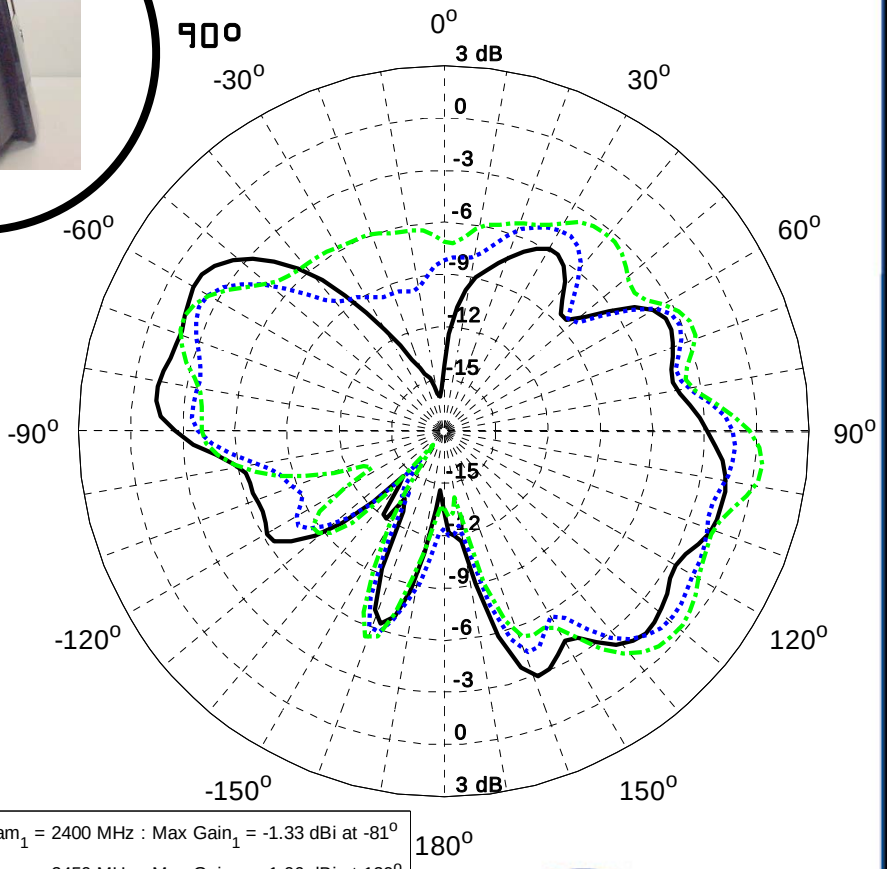
Beam$_2$ = 2450 MHz : Max Gain$_2$ = -1.39 dBi at -3°

Beam$_3$ = 2500 MHz : Max Gain$_3$ = -0.39 dBi at -3°

GALTRONICS

Antenna Patterns: Elevation Cut 1 (Front-to-Back) – Low Band

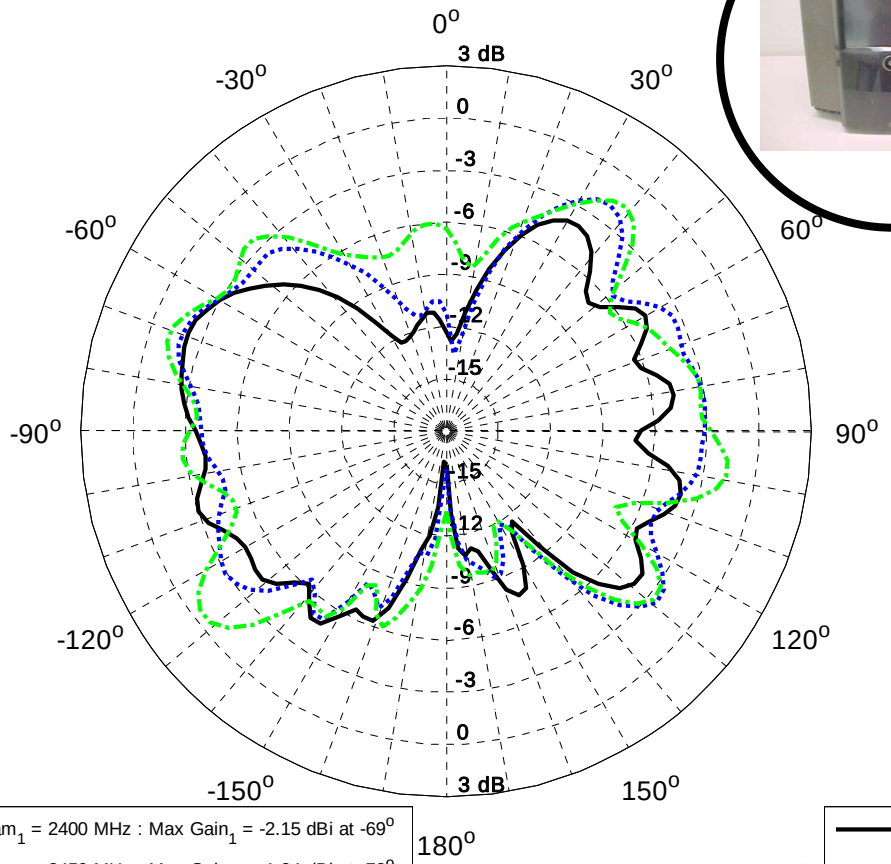




GALTRONICS

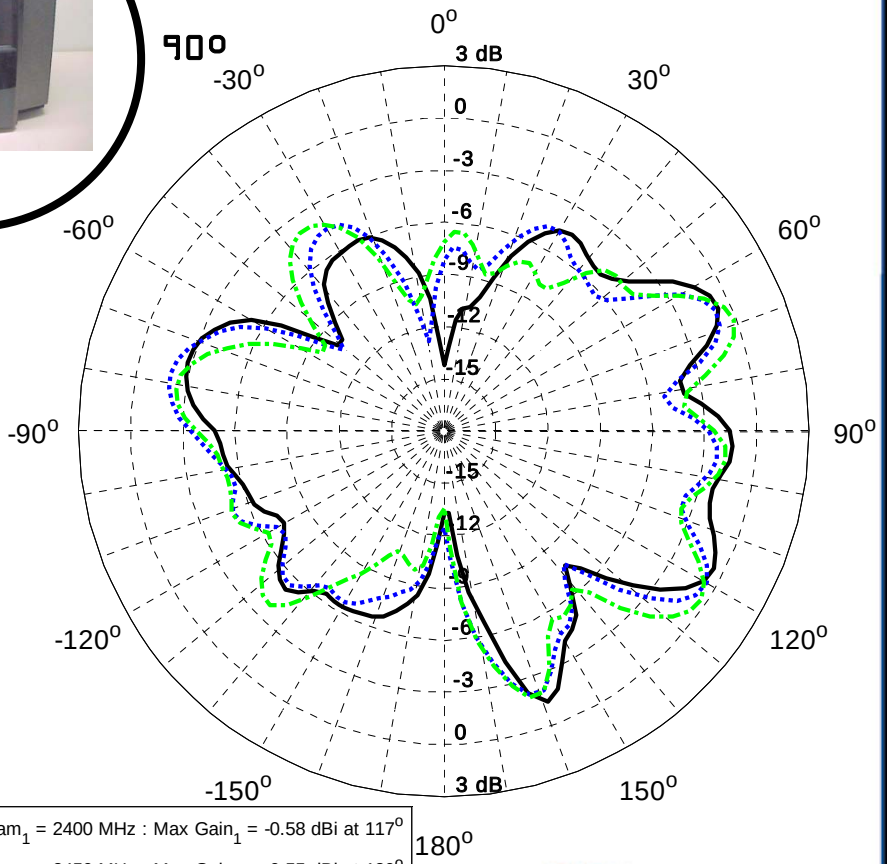
Antenna Patterns: Elevation Cut 2 (Side-to-Side) – Low Band

Left Front



Beam$_1$ = 2400 MHz : Max Gain$_1$ = -2.15 dBi at -69°
Beam$_2$ = 2450 MHz : Max Gain$_2$ = -1.84 dBi at -72°
Beam$_3$ = 2500 MHz : Max Gain$_3$ = -0.52 dBi at -126°

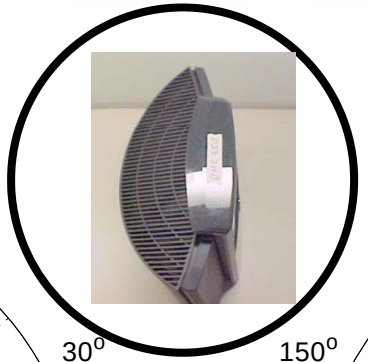
Right Front

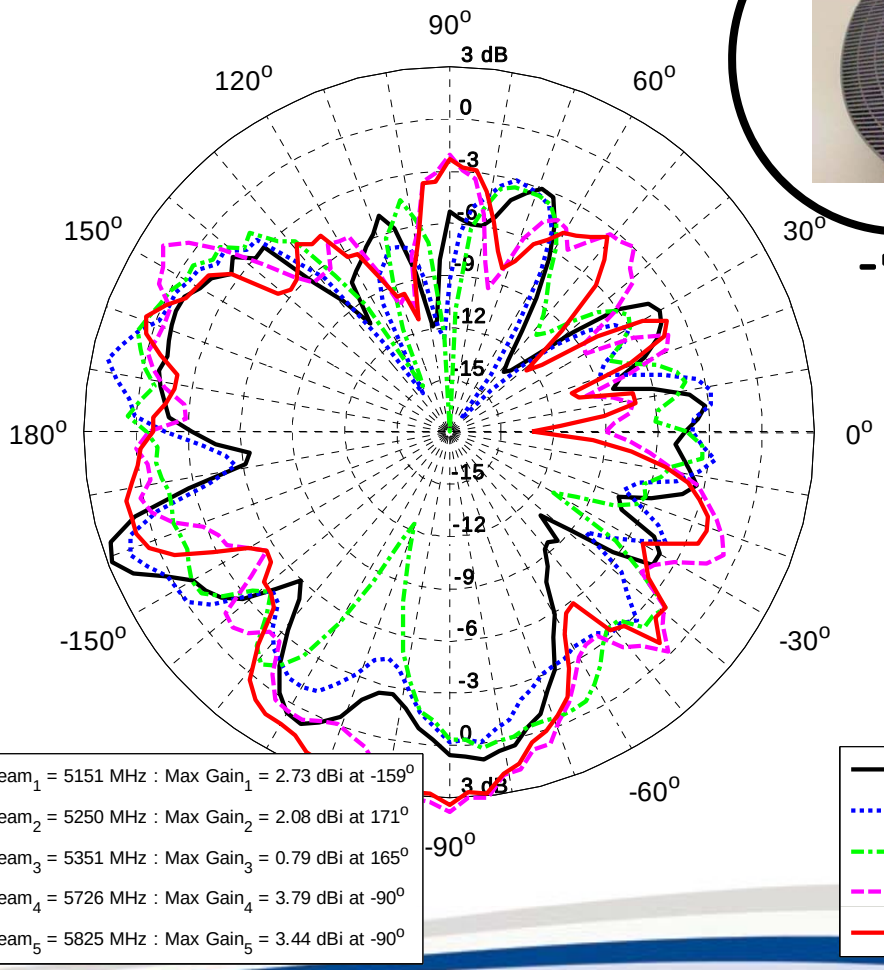


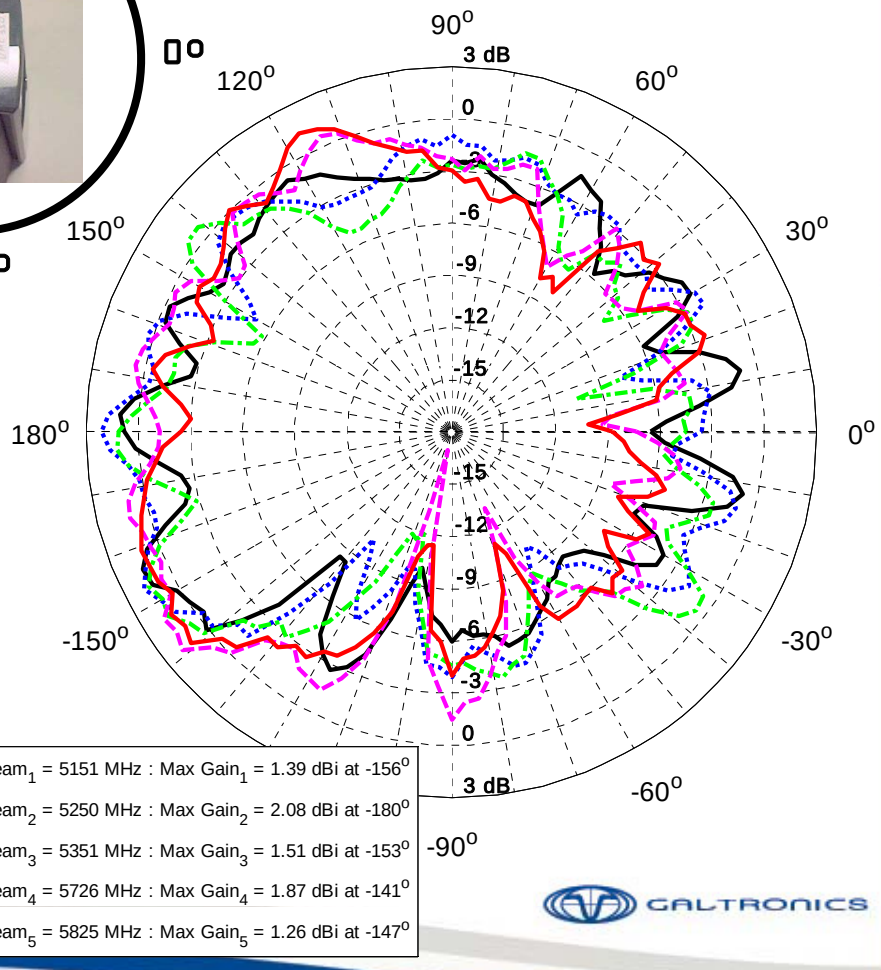
Beam$_1$ = 2400 MHz : Max Gain$_1$ = -0.58 dBi at 117°
Beam$_2$ = 2450 MHz : Max Gain$_2$ = -0.55 dBi at 120°
Beam$_3$ = 2500 MHz : Max Gain$_3$ = -0.13 dBi at 69°

GALTRONICS

Antenna Patterns: Azimuth Cut – High Band

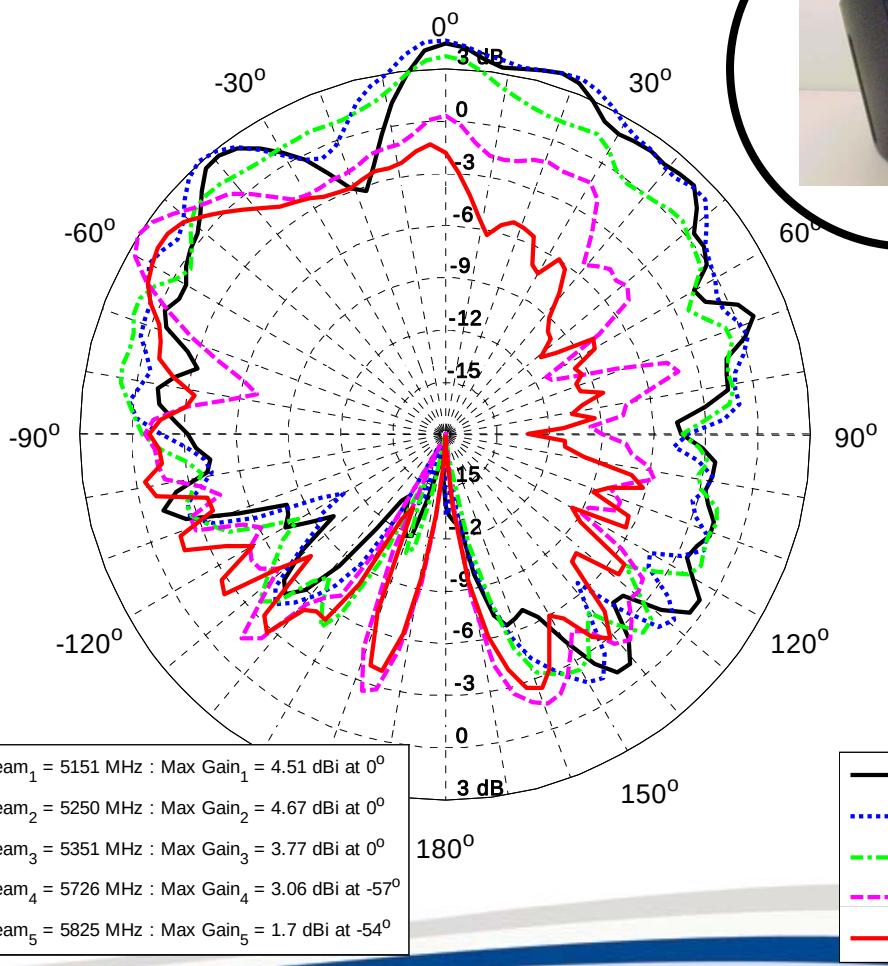


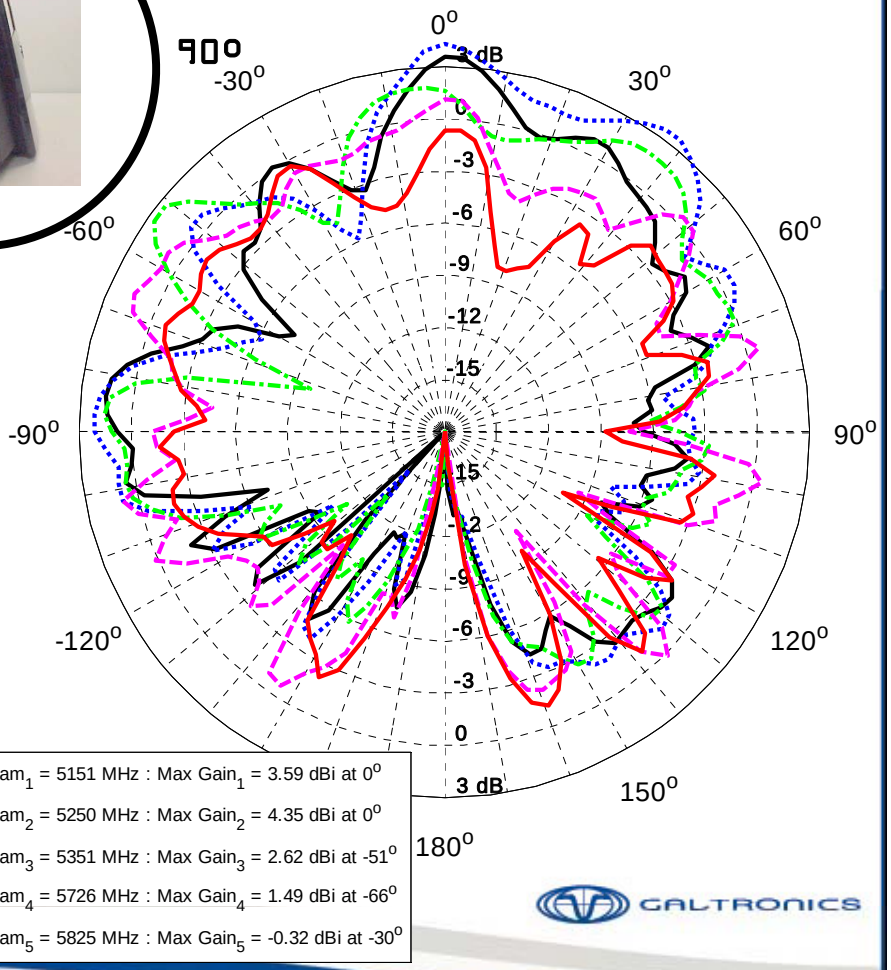




GALTRONICS

Antenna Patterns: Elevation Cut 1 (Front-to-Back) – High Band

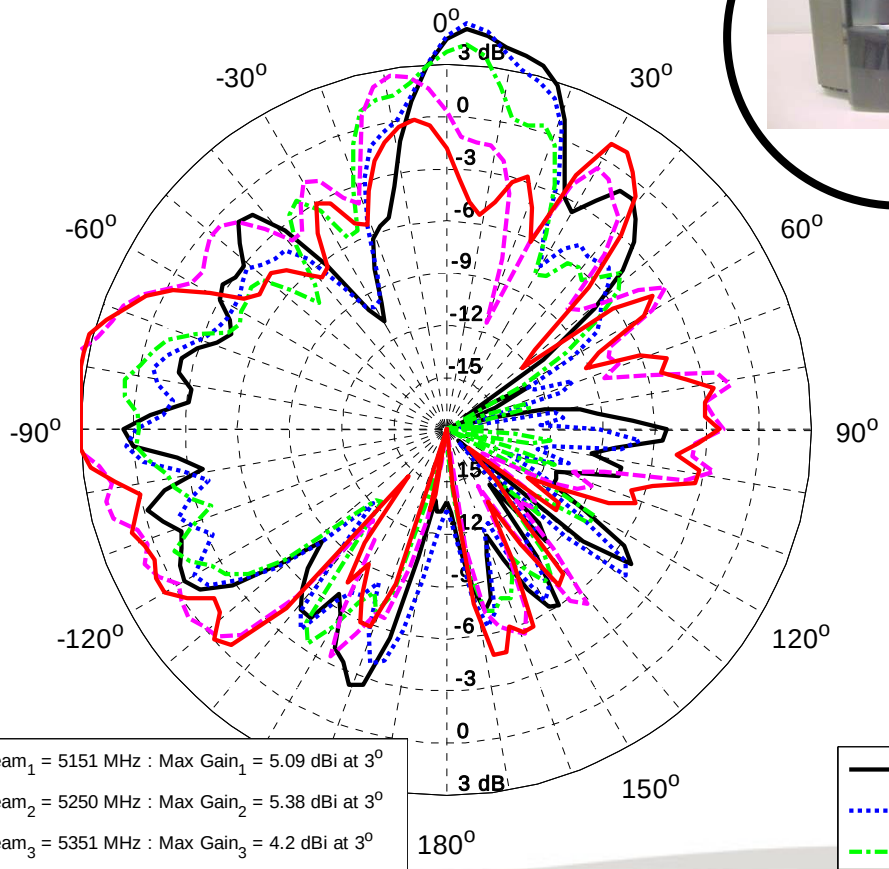




GALTRONICS

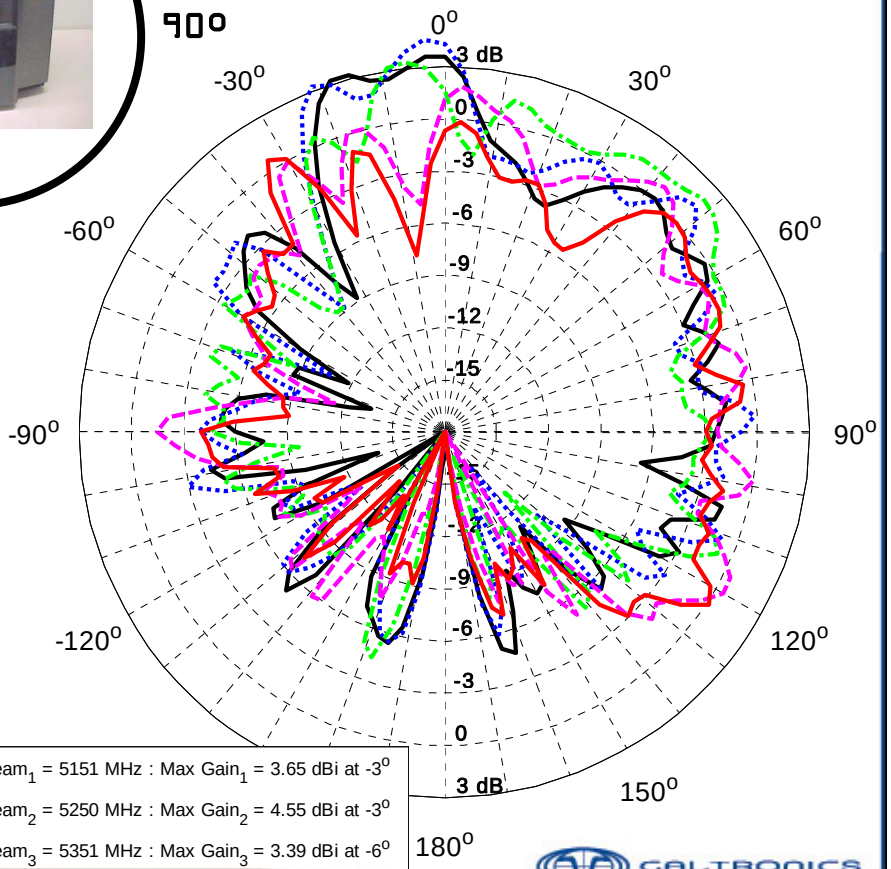
Antenna Patterns: Elevation Cut 2 (Side-to-Side) – High Band

Left Front



Beam$_1$ = 5151 MHz : Max Gain$_1$ = 5.09 dBi at 3°
Beam$_2$ = 5250 MHz : Max Gain$_2$ = 5.38 dBi at 3°
Beam$_3$ = 5351 MHz : Max Gain$_3$ = 4.2 dBi at 3°
Beam$_4$ = 5726 MHz : Max Gain$_4$ = 4.01 dBi at -81°
Beam$_5$ = 5825 MHz : Max Gain$_5$ = 3.94 dBi at -87°

Right Front



Beam$_1$ = 5151 MHz : Max Gain$_1$ = 3.65 dBi at -3°
Beam$_2$ = 5250 MHz : Max Gain$_2$ = 4.55 dBi at -3°
Beam$_3$ = 5351 MHz : Max Gain$_3$ = 3.39 dBi at -6°
Beam$_4$ = 5726 MHz : Max Gain$_4$ = 1.86 dBi at 3°
Beam$_5$ = 5825 MHz : Max Gain$_5$ = 0.62 dBi at -33°

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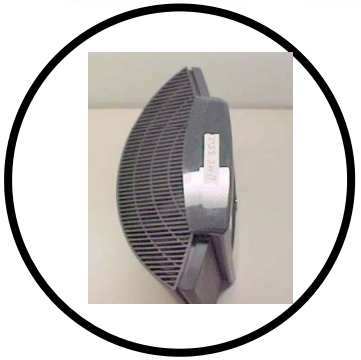
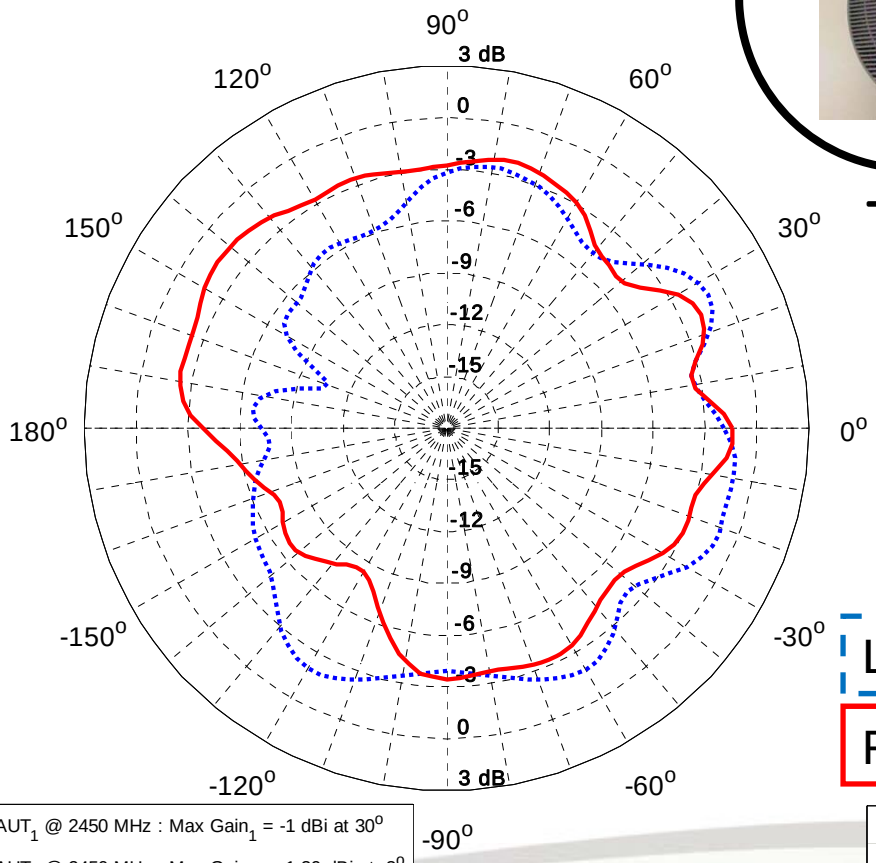
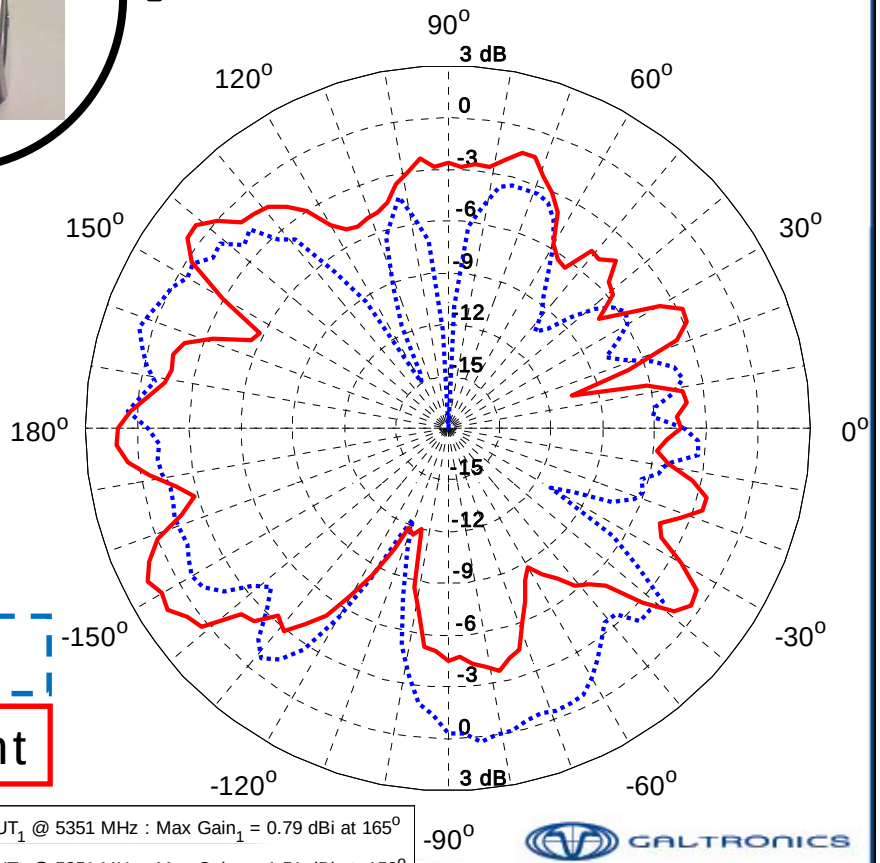
Antenna Patterns: Azimuth Cut – System Coverage



Low Band



High Band



Left

Right

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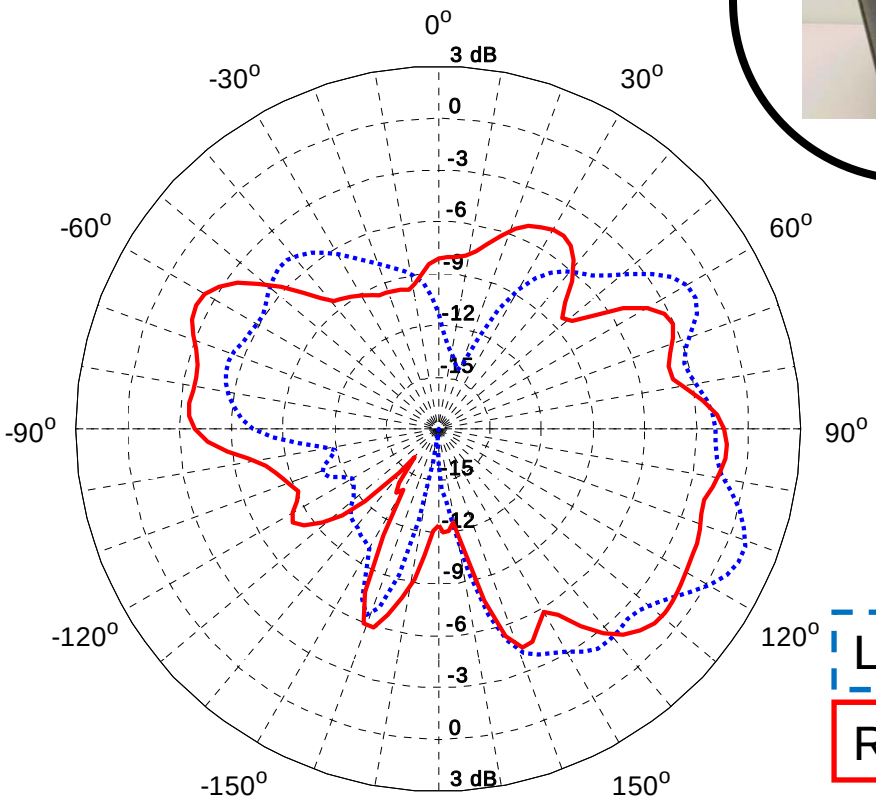
Antenna Patterns: Elevation Cut 1 (Front-to-Back) – System Coverage

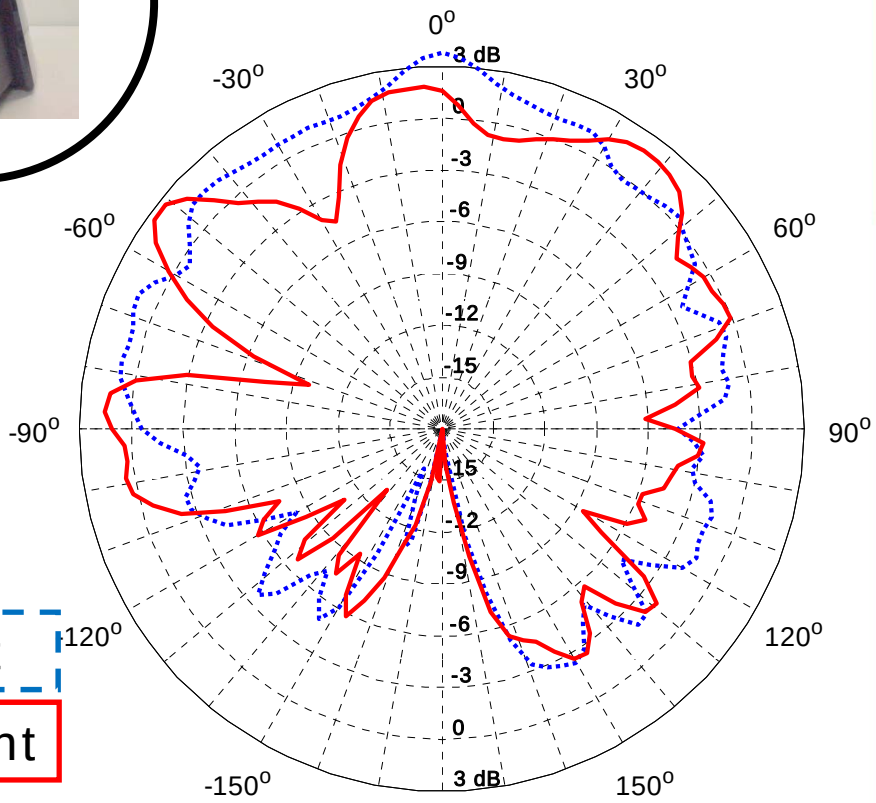
Low Band



AUT$_1$ = 2450 MHz : Max Gain$_1$ = 1.07 dBi at 114°

AUT$_2$ = 2450 MHz : Max Gain$_2$ = -1.06 dBi at 129°

High Band



AUT$_1$ = 5351 MHz : Max Gain$_1$ = 3.77 dBi at 0°

AUT$_2$ = 5351 MHz : Max Gain$_2$ = 2.62 dBi at -51°

Left

Right

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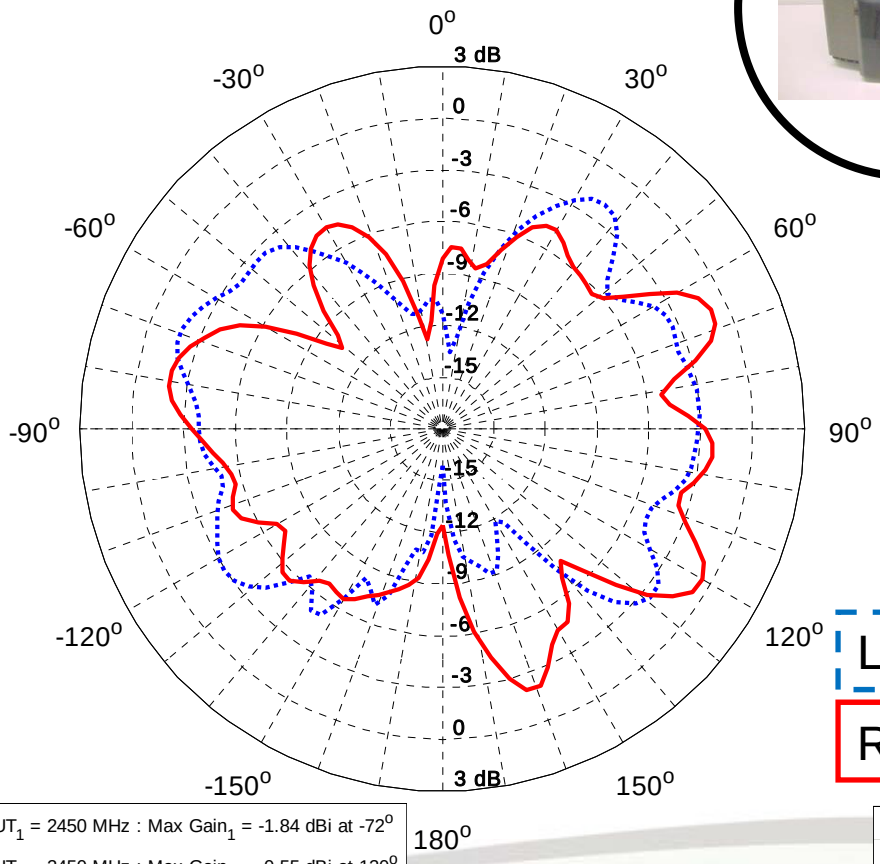
Antenna Patterns: Elevation Cut 2 (Side-to-Side) – System Coverage

Low Band



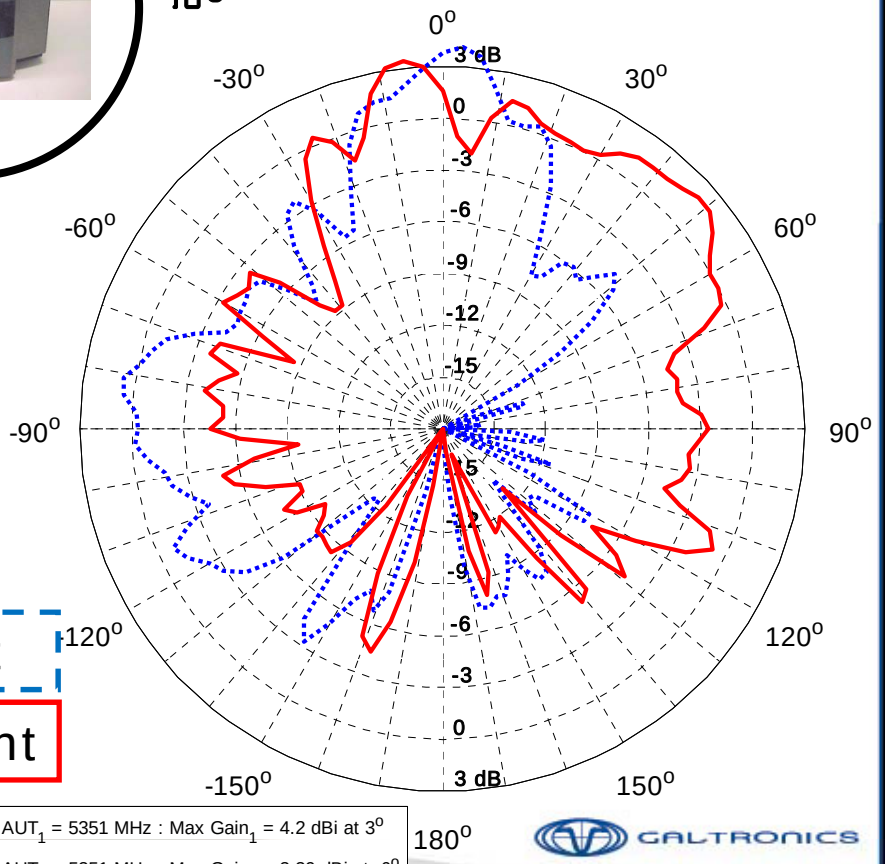
AUT$_1$ = 2450 MHz : Max Gain$_1$ = -1.84 dBi at -72°

AUT$_2$ = 2450 MHz : Max Gain$_2$ = -0.55 dBi at 120°

Left

Right

High Band



AUT$_1$ = 5351 MHz : Max Gain$_1$ = 4.2 dBi at 3°

AUT$_2$ = 5351 MHz : Max Gain$_2$ = 3.39 dBi at -6°

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Summary

Galtronics antennas for DMC350 were tested in latest housing with EMI shielding implemented by ODM. Test results show the following antenna characteristics

- Return Loss
  - Low band - good; High band - excellent
  - No significant changes from previous antenna tests
- Isolation
  - Excellent in both bands
  - No significant changes from previous antenna tests
- Efficiency
  - Low band: 30-40% - 6-8% reduction from previous values
  - High band: 40-50% - no reduction from previous values
- Antenna Patterns
  - Good 3-D pattern diversity in both bands
  - Patterns similar to those measured previously
  - Individual antenna gain does not exceed 2 dBi @ 2.4 GHz and 6 dBi @ 5 GHz

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