

1 Part Description/Summary

Flexible Antenna for 2.4 GHz and 5 GHz

2 Specifications

- **Frequency Range:**
 - 2.4 GHz – 2.485 GHz
 - 5.15 GHz – 5.85 GHz
 - 5.925 GHz – 7.125 GHz
- **Polarization:**
 - Linear
- **RF Power:**
 - 2 Watts
- **Impedance with matching:**
 - 50 Ohms

- **Electrical Requirements:**

Frequency Range	2.4 GHz – 2.485 GHz	5.15 GHz – 5.85 GHz	5.925 GHz – 7.125 GHz
Peak Gain (Max.)	3.0dBi	4.0 dBi	5.5dBi
Average Total Efficiency	>60%	>71%	>56%

- **Antenna Type:**
 - Flex
- **Mechanical:**
 - Connector: U.FL compatible plug (female socket)
 - Flex size: 42 mm x 12 mm x 0.2 mm maximum (not including solder area)
 - Cable: OD 1.13 mm, Length 100 mm
 - Adhesive backing
- **Environmental:**
 - Operating Temperature with matching: -40 to 80 degrees C
- **RoHS Compliance:** RoHS 3 (2015/863/EU Directive)

3 Approved Manufacturers

Suppliers and suppliers part numbers must be approved by Creation Design Services Engineering. Approved suppliers and supplier part numbers are listed below:

- **Molex**
 - **Part Number: 1461530100**
 - **Manufacturers Drawing**

CONTROLLED DOCUMENT

CREATION TECHNOLOGIES

Apr 12, 2022

Confidential

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CREATION DESIGN SERVICES
Component Specification

Antenna, 2.4 GHz/5 GHz

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PRODUCT SPECIFICATION

TITLE


WIFI 6E FLEX CABLE BALANCE ANTENNA

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<u>DOCUMENT NUMBER:</u> PS-1461530100	<u>CREATED / REVISED BY:</u> Kang Cheng 2020/08/31	<u>CHECKED BY:</u> Cooper Zhou 2020/08/31	<u>APPROVED BY:</u> Stary Song 2020/08/31

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PRODUCT SPECIFICATION

WIFI 6E FLEX CABLE BALANCE ANTENNA

1.0 SCOPE

This Product Specification covers the mechanical, electrical and environmental performances specification for WiFi 6E flex cable balance antenna.

2.0 PRODUCT DESCRIPTION

2.1 PRODUCT NAME AND SERIES NUMBER (S)

Product name: WiFi 6E flex cable balance antenna
Series Number: 146153 Series

2.2 DESCRIPTION

Series 146153 is a balanced, dipole-type, high efficiency antenna for 2.4/5/6 GHz applications, including WiFi 6E, Bluetooth, Zigbee and others. This antenna is made from poly flexible material with small size 35*9*0.1mm and has double-sided adhesive tape for easy "peel and stick" mounting. This balanced antenna with ground plane independent design offers various cable length options for ease of integration into various devices.


2.3 FEATURES

- 2400~2500MHz, 5150~5850MHz, 5925~7125MHz, linear polarization
- Ground plane independent, balanced dual band antenna
- Flex size 35 x 9 x 0.1mm (not contain solder area)
- IPEX MHF (U.FL compatible) connector (Such as MHF1/MHF4)
- Cable OD 1.13mm, 6 standard length options (50/100/150/200/250/300mm)
- Cable and connector can be customized



Molex 146153 SERIES 3D VIEW

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CREATION DESIGN SERVICES
Component Specification

Antenna, 2.4 GHz/5 GHz

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PRODUCT SPECIFICATION

3.0 GENERAL SPECIFICATION

Product name	WIFI 6E FLEX CABLE BALANCE ANTENNA		
Part number	146153		
Frequency	2.4GHz-2.5GHz	5.15GHz-5.85GHz	5.925GHz-7.125GHz
Polarization	Linear		
Operating with matching	-40°C to 85°C		
Storage with matching	-40°C to 85°C		
RF Power	2 Watts		
Impedance with matching	50 Ohms		
Antenna type	Flex		
Connector type	146153 0XXX	146153 1XXX	
	Compatible MHF1	Compatible MHF4	
User Implementation type	Adhesive 3M9077		
Cable diameter	Ø1.13mm		
Cable length	50 mm (P/N for 1461530050/1461531050)		
	100 mm (P/N for 1461530100/1461531100)		
	150 mm (P/N for 1461530150/1461531150)		
	200 mm (P/N for 1461530200/1461531200)		
	250 mm (P/N for 1461530250/1461531250)		
	300 mm (P/N for 1461530300/1461531300)		

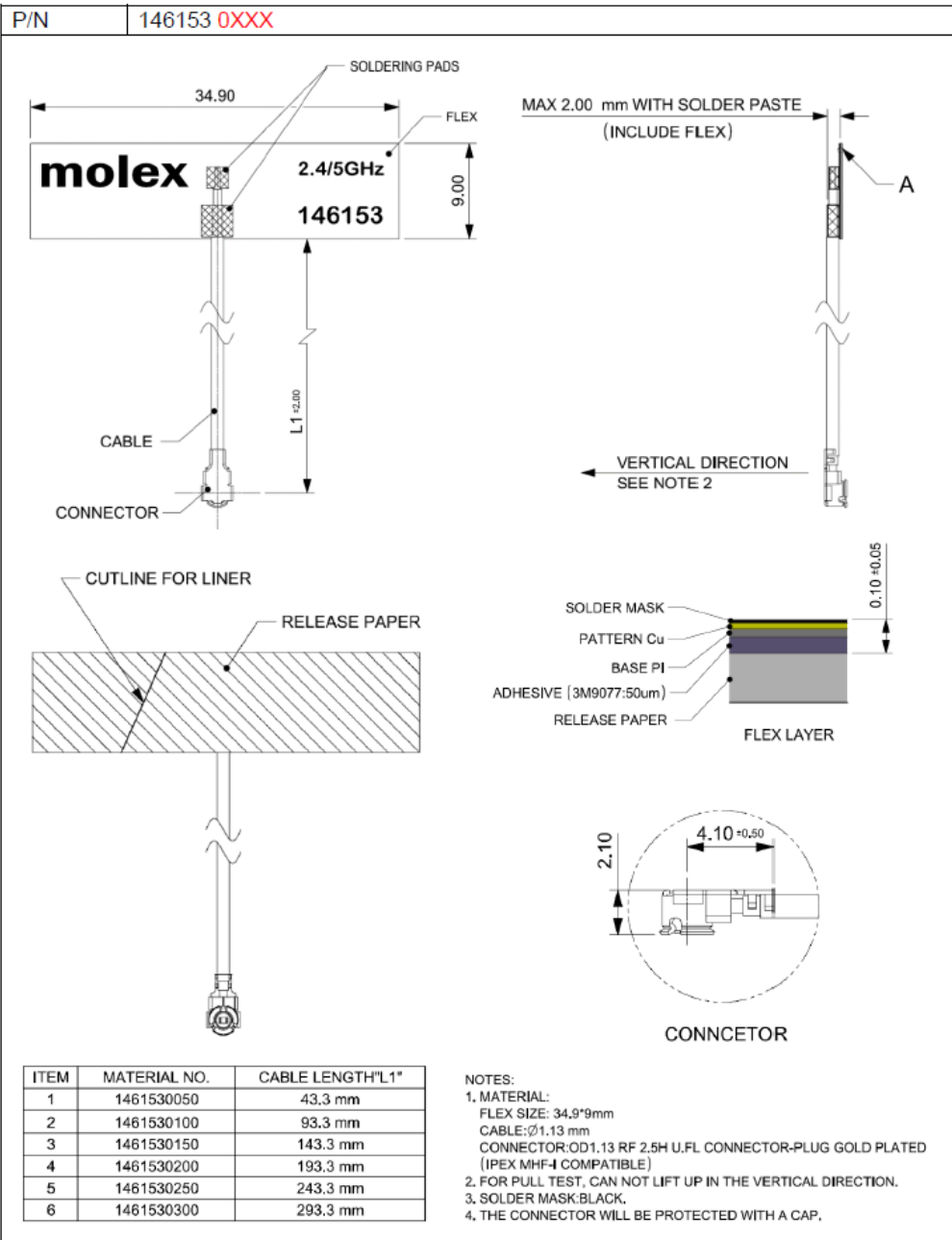
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4.0 PRODUCT STRUCTURE INFORMATION

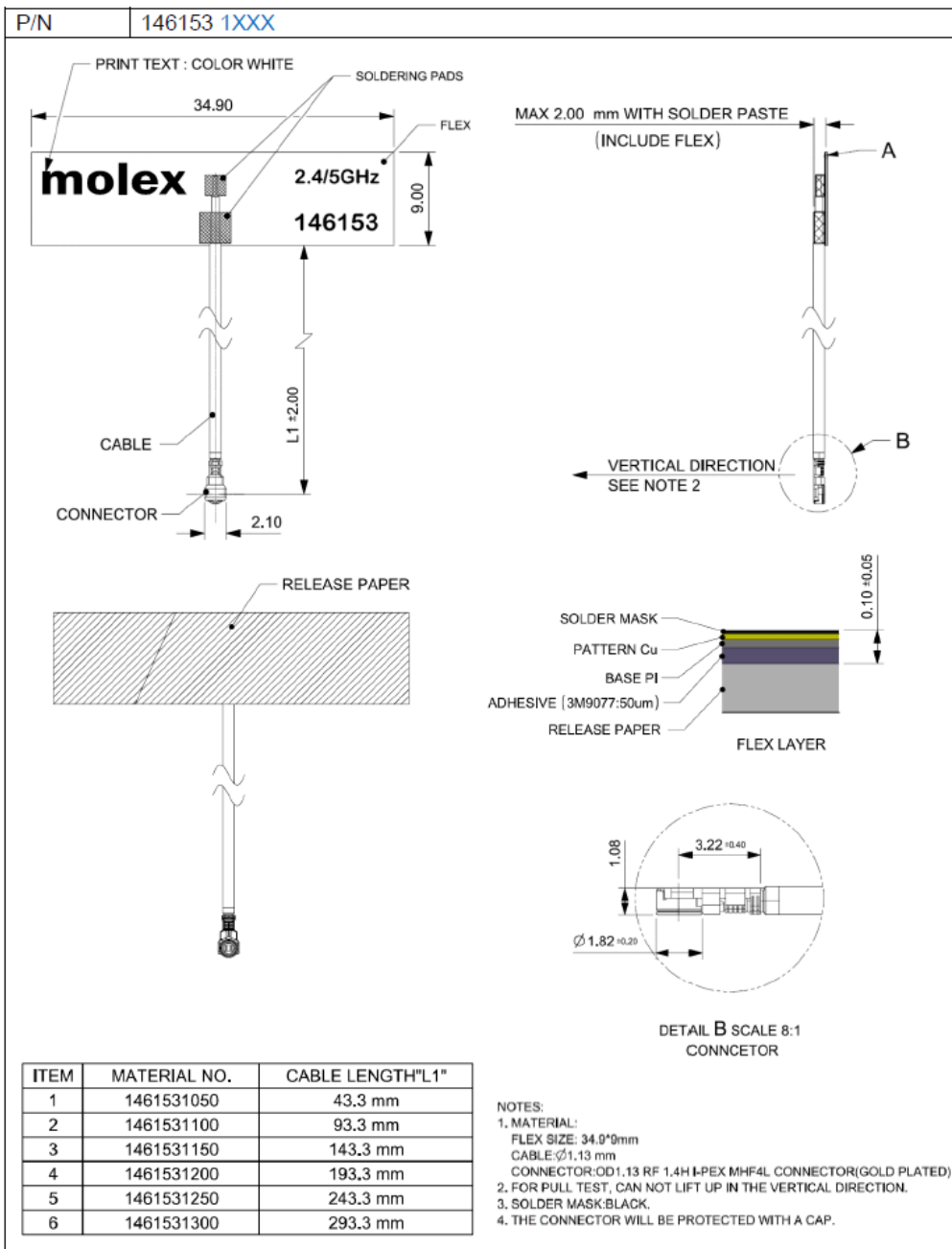


Mechanical Structure Information for 1461530XXX

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Mechanical Structure Information for 1461531XXX

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PRODUCT SPECIFICATION

5.0 APPLICABLE DOCUMENTS

DOCUMENT	NUMBER	DESCRIPTION
Sale Drawing (SD)	SD-1461530050	Mechanical Dimension of the product
	SD-1461531050	
Application Guide (AS)	AS-1461530100	Antenna Application and surrounding
Packing Drawing (PK)	PK-1461530100	Product packaging specifications

6.0 ANTENNA SPECIFICATION

All measurements are done of the antenna mounted on a PC/ABS material block of 1.5 mm thickness with VNA Agilent E5071C and Over-The-Air (OTA) chamber. All measurements in this document are done with the part no.1461530100 for different cable length.

6.1 ELECTRICAL REQUIREMENT

6.1.1 ELECTRICAL REQUIREMENTS FOR CABLE LENGTH 50mm			
P/N	1461530050		
Frequency Range	2.4GHz-2.5GHz	5.15GHz-5.85GHz	5.925-7.125GHz
Peak Gain (Max)	3.2dBi	4.25dBi	5.8dBi
Average Total efficiency	>78%	>79%	>75%
Return Loss	< -10 dB	< -10 dB	< -10 dB

6.1.2 ELECTRICAL REQUIREMENTS FOR CABLE LENGTH 100mm			
P/N	1461530100		
Frequency Range	2.4GHz-2.5GHz	5.15GHz-5.85GHz	5.925-7.125GHz
Peak Gain (Max)	3.0dBi	4.0dBi	5.5dBi
Average Total efficiency	>75%	>75%	>70%
Return Loss	< -10 dB	< -10 dB	< -10 dB

6.1.3 ELECTRICAL REQUIREMENTS FOR CABLE LENGTH 150mm			
P/N	1461530150		
Frequency Range	2.4GHz-2.5GHz	5.15GHz-5.85GHz	5.925-7.125GHz
Peak Gain (Max)	2.8dBi	3.7dBi	5.2dBi
Average Total efficiency	>72%	>70%	>65%
Return Loss	< -10 dB	< -10 dB	< -10 dB

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6.1.4 ELECTRICAL REQUIREMENTS FOR CABLE LENGTH 200mm			
P/N	1461530200		
Frequency Range	2.4GHz-2.5GHz	5.15GHz-5.85GHz	5.925-7.125GHz
Peak Gain (Max)	2.6dBi	3.5dBi	4.8dBi
Average Total efficiency	>69%	>66%	>60%
Return Loss	< -10 dB	< -10 dB	< -10 dB

6.1.5 ELECTRICAL REQUIREMENTS FOR CABLE LENGTH 250mm			
P/N	1461530250		
Frequency Range	2.4GHz-2.5GHz	5.15GHz-5.85GHz	5.925-7.125GHz
Peak Gain (Max)	2.4dBi	3.2dBi	4.5dBi
Average Total efficiency	>66%	>63%	>56%
Return Loss	< -10 dB	< -10 dB	< -10 dB

6.1.6 ELECTRICAL REQUIREMENTS FOR CABLE LENGTH 300mm			
P/N	1461530300		
Frequency Range	2.4GHz-2.5GHz	5.15GHz-5.85GHz	5.925-7.125GHz
Peak Gain (Max)	2.2dBi	2.8dBi	4.2dBi
Average Total efficiency	>63%	>59%	>51%
Return Loss	< -10 dB	< -10 dB	< -10 dB

Note that the above antenna performance is measured with just the antenna mounted on a PC/ABS block to similar a free-space condition. When implement into the system, the frequency resonant might be off-tune due to the loading of surrounding components especially metal plane. This off-tune can be compensated through matching. Although module manufacturers specify a peak gain limit, it is based on free-space conditions. The peak gain will be degraded by 1 to 2dBi in the actual implementation as the radiation pattern will change due to the surround components. As such, during selection of antenna, you can select one with high peak gain to compensate for the loss. Molex can offer assistant to choose the best location and best tuning in-order to meet this peak gain requirement.

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6.2 CABLE LOSS

DESCRIPTION	TEST CONDITION	REQUIREMENTS		
Frequency Range	2 GHz~7.125GHz	2.0GHz~3.0GHz	5GHz~6GHz	6GHz~7.125GHz
Attenuation	1m cable measured by VNA5071C	≤3.5dB/m	≤5.5dB/m	≤6.5dB/m

Balance antenna resonance is insensitive to cable's length, but the cable's loss will affect the total efficiency.

7.0 MECHANICAL SPECIFICATION

All measurements in this document are done with the part no.1461530100 for different cable length.

DESCRIPTION	TEST CONDITION	TEST RESULT
Pull Test	1. Test machine: Max intelligent load tester 2. Stick the flex antenna on a plastic board, pull cable in axial direction.	Pull force >8N
Un-mating force (connector)	Solder the receptacle connector to the test board, then place the board and plug on push-on/pull-off machine, and repeat mating and un-mating 30 cycles at a speed 25±3mm/min. along the mating axis.	Un-mating force : 0.5 kgf min

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8.0 ENVIRONMENTAL SPECIFICATION

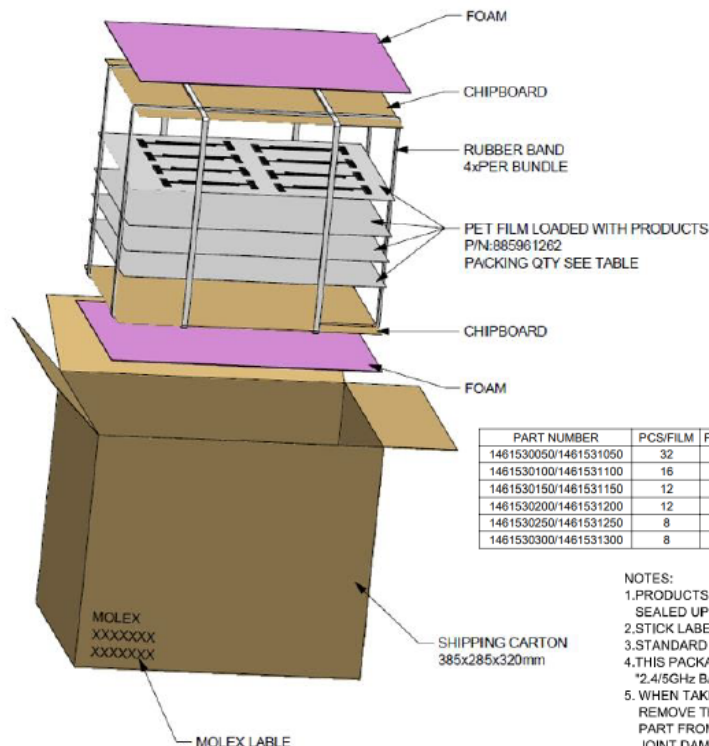
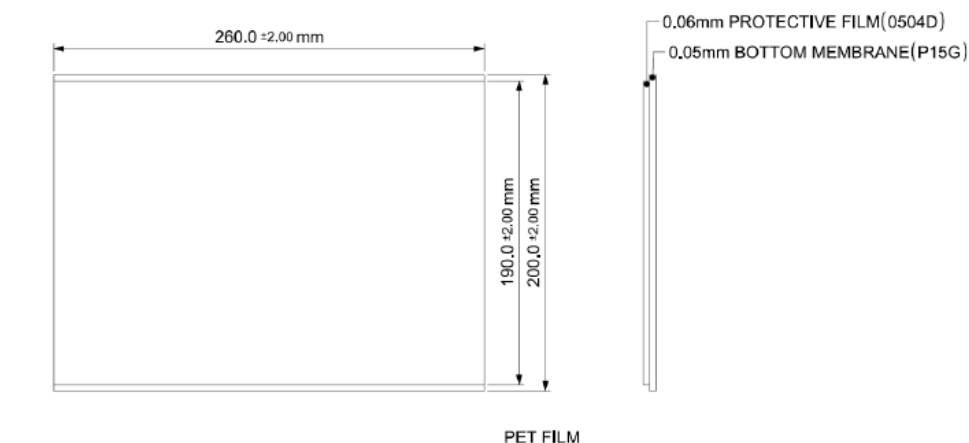
DESCRIPTION	SPECIFICATION
Temperature /Humidity cycling	<ol style="list-style-type: none"> 1.The device under test is kept for 30 mins in an environment with a temperature of -40 °C. 2. Kept for 4 Hours in an environment with a temperature of 85 °C. 3. Kept for 2 Hours in an environment with a temperature of 125 °C. 4. The cycle is repeated until a total of 40 cycles have been completed. Hereafter the conditions are stabilized at room temperature. Transfer temperature 8°C per min. 5. Parts should meet RF spec before and after test. 6. No cosmetic problem (No soldering problem; No adhesion problem of glue.)
Temperature Shock	<ol style="list-style-type: none"> 1.The device under test at -40 °C-125 °C by 100 cycles, Dwell of 30 mins, transition time between Dwell 30 secs (~ 61 mins / cycle) and each item should be measured after exposing them in normal temperature and humidity for 24 h. 2. Parts should meet RF spec before and after test. 3. No cosmetic problem (No soldering problem; No adhesion problem of glue) .
High Temperature	<ol style="list-style-type: none"> 1.Temperature:125°C, time:1008 hours 2.There is no substantial obstruction to air flow across and around the samples, and the samples are not touching each other 3. Parts should meet RF spec before and after test. 4. No cosmetic problem (No soldering problem; No adhesion problem of glue) .
Salt mist test	<ol style="list-style-type: none"> 1. The device under test is exposed to a spray of a 5% (by volume) resolution of NACL in water for 2 hours. Thereafter the device under test is left for 1 week in room temperature at a relative humidity of 95%. The cycle is repeated until a total of 2 cycles have been completed. Here after the conditions are stabilized at room temperature. 2. Parts should meet RF spec before and after test. 3. No visible corrosion. Discoloration accept.

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PRODUCT SPECIFICATION

9.0 PACKING




PART NUMBER	PCS/FILM	FILM/BUNDLE	BUNDLE/CARTON	QTY/CARTON
1461530050/1461531050	32	40	4	5120PCS
1461530100/1461531100	16	40	5	3200PCS
1461530150/1461531150	12	40	5	2400PCS
1461530200/1461531200	12	40	5	2400PCS
1461530250/1461531250	8	40	5	1600PCS
1461530300/1461531300	8	40	5	1600PCS

NOTES:

- 1.PRODUCTS MUST BE PACKED IN CARTONS AND SEALED UP WITH TAPE.
- 2.STICK LABEL WITH PART NUMBER AND DATE CODE
- 3.STANDARD PACKAGING QUANTITY:SEE TABLE
- 4.THIS PACKAGING SPECIFICATION TO BE USED FOR "2.4/5GHz BALANCE FLEX ANTENNA".
5. WHEN TAKING PRODUCT FROM PET FILM, PLEASE REMOVE THE COVER TAPE FIRST, THEN PICK UP THE PART FROM FLEX NOT THE CABLE, TO AVOID SOLDER JOINT DAMAGE.

PACKAGING INFORMATION FOR 146153 Series

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10.0 CHANGE HISTORY

CHANGE HISTORY		
REV	DATA	DESCRIPTION
F	2020/07/09	Add 6-7.125GHz Frequency Range
F1	2020/08/31	Optimized Part 6.1 Peak Gain
F2	2021/09/06	Updated General Specification Text

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- *Linx Technologies*
 - *Part Number: ANT-W63-FPC2-UFL-100*
 - *Manufacturers Drawing*

Datasheet



ANT-W63-FPC2-UFL-100 Flexible Embedded WiFi 6 Antenna

The Linx W63-FPC2 antenna is a flexible embedded multiband antenna offering excellent performance for WiFi 6E applications in the 6 GHz band (5.925 GHz to 7.125 GHz) plus 2.4 GHz and 5 GHz WiFi/WLAN for WiFi 5 and WiFi 6 solutions.

The W63-FPC2 provides a ground plane independent dipole embedded antenna solution comparable in performance to an external antenna. The flexibility and adhesive backing makes the W63-FPC2 antenna easy to mount in unique and custom enclosures, while enabling an environmentally sealed enclosure and protection from tampering or accidental antenna damage.

Connection is made to the radio via a 100 mm (3.94 in) long, 1.13 mm coaxial cable terminated in a U.FL-type plug (female socket) connector.



Features

- 2.4 GHz, 5 GHz and 6 GHz WiFi/WLAN bands
- Ground plane independent dipole antenna
- Compact, low-profile
 - 42.0 mm x 12.0 mm x 0.2 mm
- U.FL-type plug (female socket) Compatible with MHF1, AMC, UMCC
- Adhesive backing permanently adheres to non-metal enclosures using 3M 467MP™/200MP adhesive
- Flexible to fit in challenging enclosures

Applications

- Complete WiFi/WLAN coverage
 - 802.11b/g
 - WiFi 4 (802.11n)
 - WiFi 5 (802.11ac)
 - WiFi 6 (802.11ax)
 - WiFi 6E (802.11ax)
- U-NII bands 1-4 and 5-8 (proposed)
- 2.4 GHz ISM applications
 - Bluetooth®
 - ZigBee®
- Internet of Things (IoT) devices
- Smart Home networking
- Sensing and remote monitoring

Ordering Information

Part Number	Description
ANT-W63-FPC2-UFL-100	Antenna with 100 mm of 1.13 mm coaxial cable and U.FL-type plug (female socket)

Available from Linx Technologies and select distributors and representatives.

ANT-W63-FPC2-UFL-100

Datasheet

Electrical Specifications

ANT-W63-FPC2-UFL	ISM/WIFI	U-NII 1-4	U-NII 5-8*
Frequency Range	2400 MHz to 2485 MHz	5150 MHz to 5850 MHz	5925 MHz to 7125 MHz
VSWR (max.)	2.4	1.4	2.4
Peak Gain (dBi)	3.2	7.7	8.4
Average Gain (dBi)	-2.3	-1.6	-2.9
Efficiency (%)	61	72	57
Polarization	Linear		
Radiation	Omnidirectional		
Max Power	2 W		
Wavelength	1/2-wave		
Electrical Type	Dipole		
Impedance	50 Ω		
Connection	U.FL-type plug (female socket) on 100 mm (3.94 in) of 1.13 mm coaxial cable.		
Weight	0.6 g (0.02 oz)		
Dimensions	42.0 mm x 12.0 mm x 0.2 mm (1.65 in x 0.47 in x 0.01 in)		
Operating Temp. Range	-40 °C to +80 °C		

*Proposed

Product Dimensions

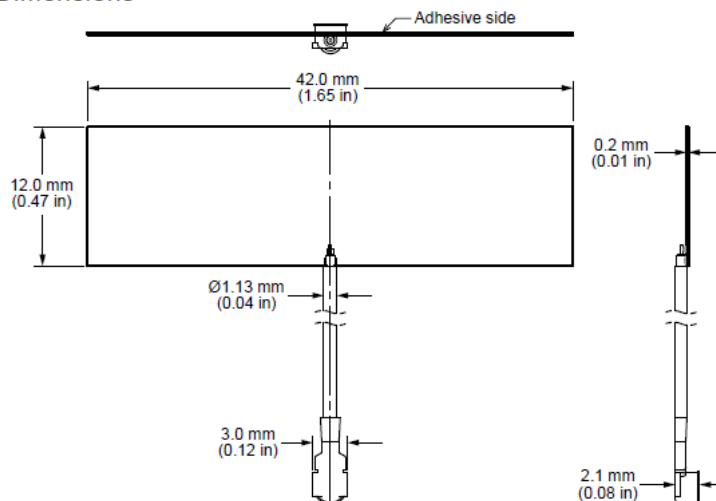


Figure 1. ANT-W63-FPC2-UFL-100 Dimensions

Antenna Mounting

The ANT-W63-FPC2-UFL-100 is a flexible, adhesive backed antenna that allows it to be permanently installed onto non-metallic surfaces. The adhesive backing is 3M 467MP™/200MP, which provides outstanding adhesion to high surface energy plastics. The adhesive delivers excellent shear strength to resist slippage and edge lifting, but can be repositioned temporarily to allow for repositioning. This adhesive is highly resistant to solvents, humidity and moisture, as well as heat up to 204 °C (400 °F) for short periods.

The antenna should never be bent to the point of creating a crease or allowing the angle of the bend to fall below 90 degrees (i.e. become acute) as this will impair function and may cause permanent damage.

Datasheet

ANT-W63-FPC2-UFL-100

VSWR

Figure 2 provides the voltage standing wave ratio (VSWR) across the antenna bandwidth. VSWR describes the power reflected from the antenna back to the radio. A lower VSWR value indicates better antenna performance at a given frequency. Reflected power is also shown on the right-side vertical axis as a gauge of the percentage of transmitter power reflected back from the antenna.

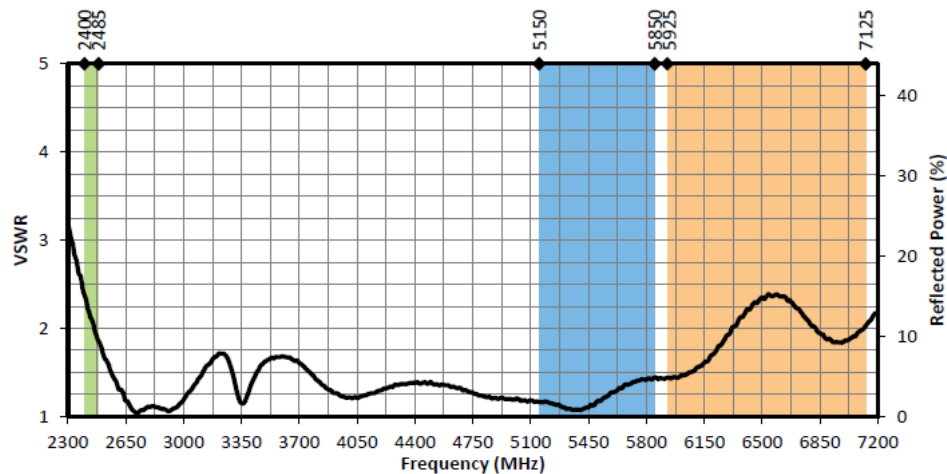


Figure 2. W63-FPC2 Antenna VSWR with Frequency Band Highlights

Return Loss

Return loss (Figure 3), represents the loss in power at the antenna due to reflected signals. Like VSWR, a lower return loss value indicates better antenna performance at a given frequency.

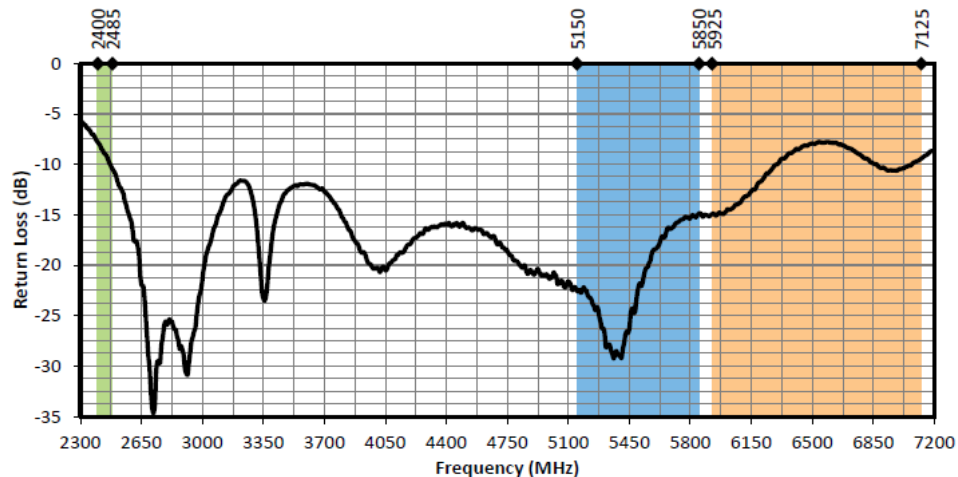


Figure 3. W63-FPC2 Antenna Return Loss with Frequency Band Highlights

ANT-W63-FPC2-UFL-100

Datasheet

Peak Gain

The peak gain across the antenna bandwidth is shown in Figure 4. Peak gain represents the maximum antenna input power concentration across 3-dimensional space, and therefore peak performance, at a given frequency, but does not consider any directionality in the gain pattern.

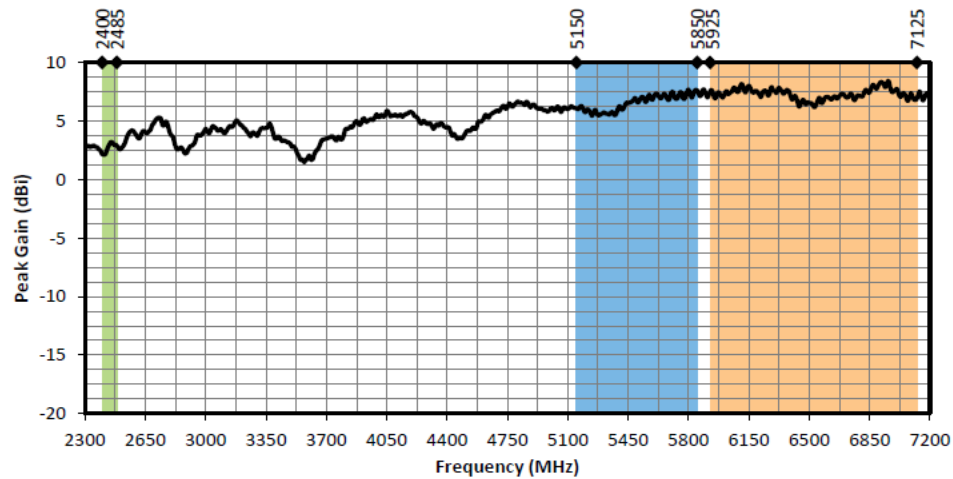


Figure 4. W63-FPC2 Antenna Peak Gain with Frequency Band Highlights

Average Gain

Average gain (Figure 5), is the average of all antenna gain in 3-dimensional space at each frequency, providing an indication of overall performance without expressing antenna directionality.

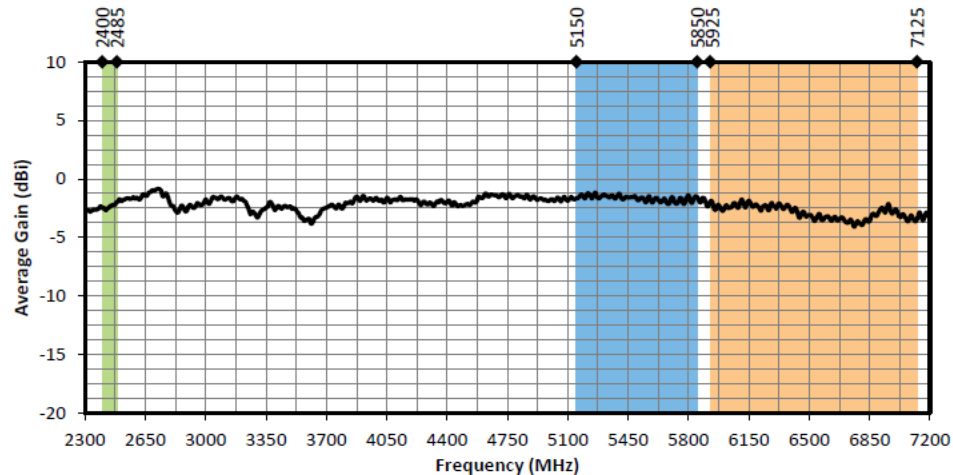


Figure 5. W63-FPC2 Antenna Average Gain with Frequency Band Highlights

Datasheet

ANT-W63-FPC2-UFL-100

Radiation Efficiency

Radiation efficiency (Figure 6), shows the ratio of power delivered to the antenna relative to the power radiated at the antenna, expressed as a percentage, where a higher percentage indicates better performance at a given frequency.

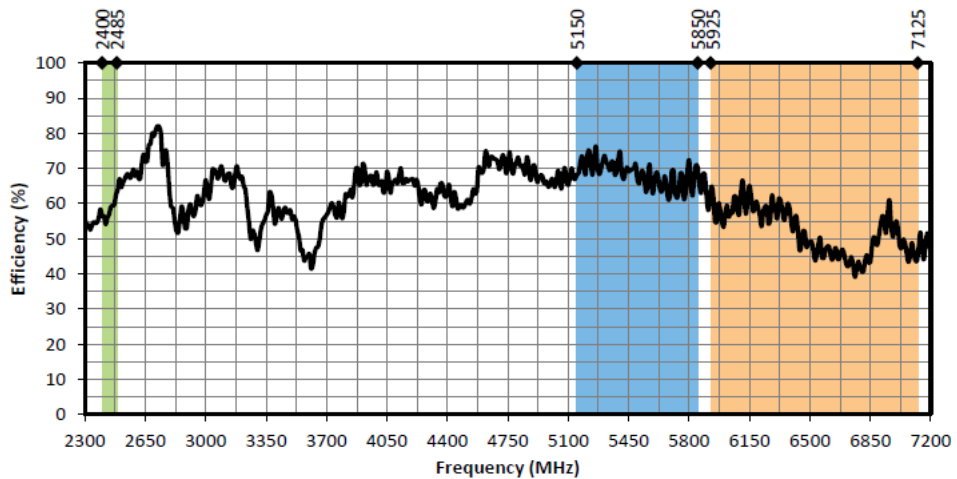


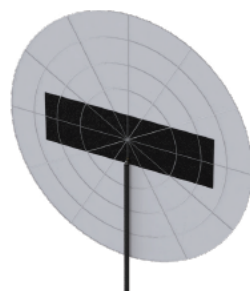
Figure 6. W63-FPC2 Antenna Radiation Efficiency with Frequency Band Highlights

ANT-W63-FPC2-UFL-100

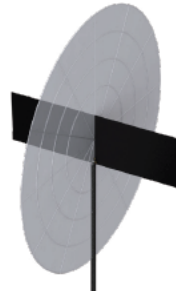
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Radiation Patterns

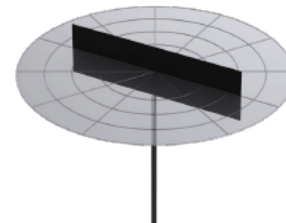
Radiation patterns provide information about the directionality and 3-dimensional gain performance of the antenna by plotting gain at specific frequencies in three orthogonal planes. Antenna radiation patterns (Figure 7), are shown using polar plots covering 360 degrees. The antenna graphic above the plots provides reference to the plane of the column of plots below it. Note: when viewed with typical PDF viewing software, zooming into radiation patterns is possible to reveal fine detail.



XZ-Plane Gain

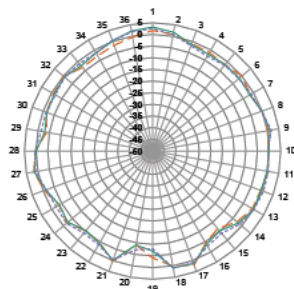


YZ-Plane Gain

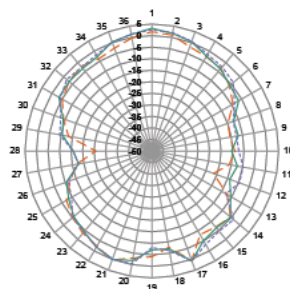


XY-Plane Gain

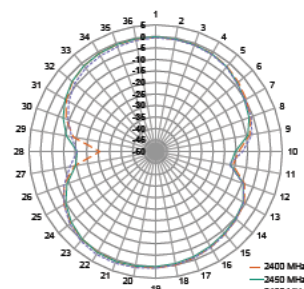
2400 MHz to 2485 MHz (2450 MHz)



XZ-Plane Gain

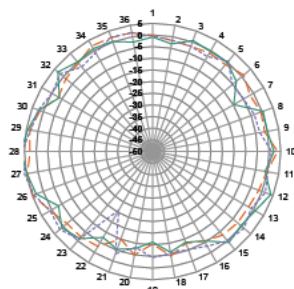


YZ-Plane Gain

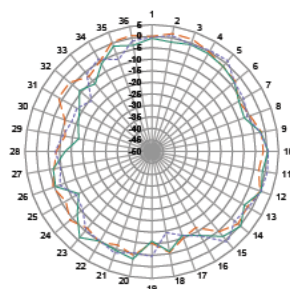


XY-Plane Gain

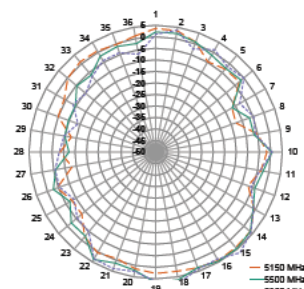
5150 MHz to 5850 MHz (5500 MHz)




XZ-Plane Gain



YZ-Plane Gain



XY-Plane Gain

	CREATION DESIGN SERVICES <i>Component Specification</i>		
	Antenna, 2.4 GHz/5 GHz	PART NUMBER:	19005-0222
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Revision History

ECO	Revision	Date	Description	Author
101121	A0	4/8/2022	Initial release	D. Miller