

## <u>TITLE</u>

## WIFI 6E FLEX CABLE BALANCE ANTENNA

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The Molex website: https://www.molex.com Molex, LLC 2222 Wellington Court Lisle, USA

| REVISION: | ECR/ECN INFORMATION:    | TITLE:                |                    |              | SHEET No.             |
|-----------|-------------------------|-----------------------|--------------------|--------------|-----------------------|
| F2        | <u>EC No:</u> 676655    |                       | BLE FLEX BALANCE A |              | <b>1</b> of <b>12</b> |
| ГΖ        | <u>DATE:</u> 2022/12/19 | PRODUCT SPECIFICATION |                    |              |                       |
| DOCUMEN   | T NUMBER:               | CREATED / REVISED BY: | CHECKED BY:        | <u>APPR(</u> | OVED BY:              |
| PS        | -1461530100             | Kang Cheng            | Cooper Zhou        | Hora         | ace Ma                |



## 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 OD1.13mm, 6 standard length options (50/100/150/200/250/300mm)
- Cable and connector can be customized

|                               | Molex 146153 SERIE    | S 3D VIEW          |       |                       |
|-------------------------------|-----------------------|--------------------|-------|-----------------------|
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| PS-1461530100                 | Kang Cheng            | Cooper Zhou        | Hora  | ace Ma                |

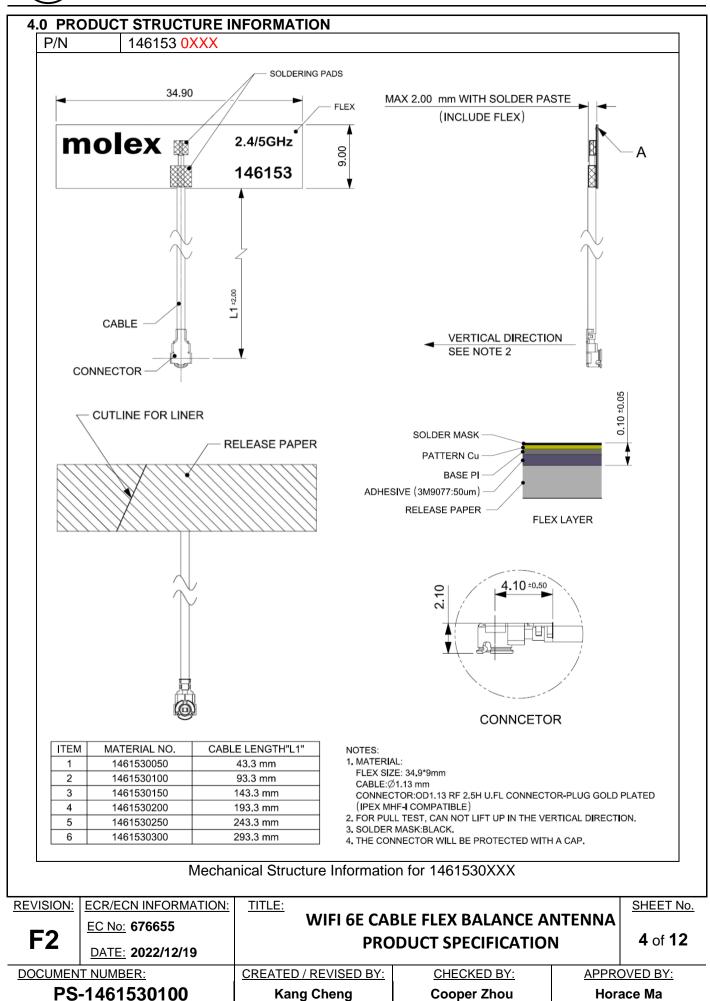


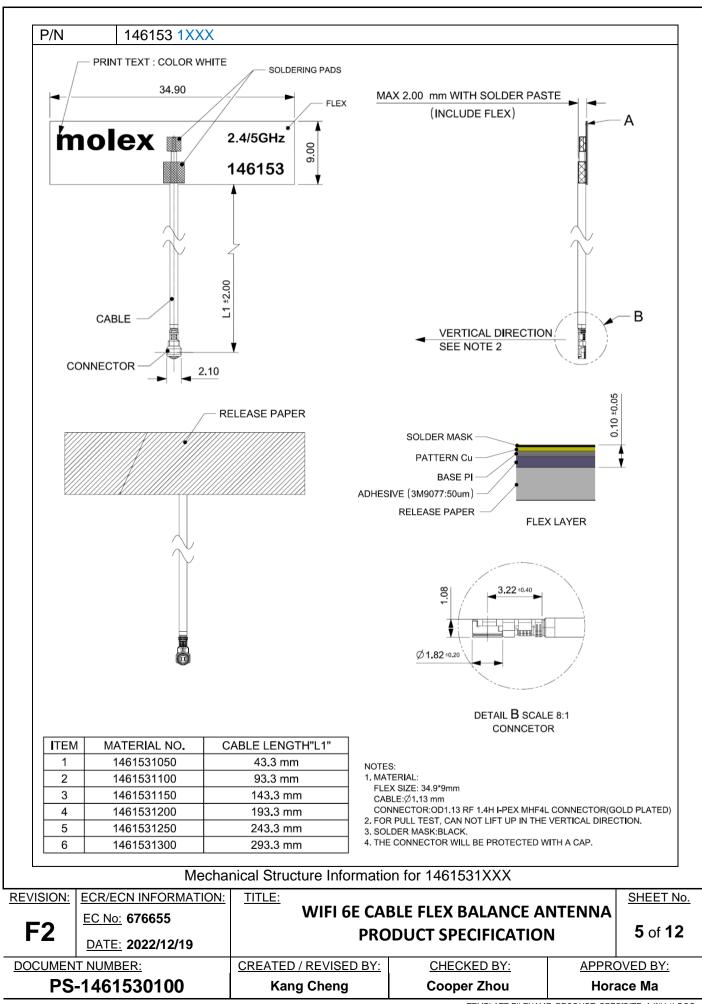
### 3.0 GENERAL SPECIFICATION

| Product name             | WIFI 6E FLE                            | X CABLE B | WIFI 6E FLEX CABLE BALANCE ANTENNA |             |  |
|--------------------------|--|-----------|------------------------------------|-------------|--|
| Part number              |  | 14615     | 53                                 |             |  |
| Frequency                |  |           | 5.925GHz-<br>7.125GHz              |             |  |
| Polarization             |  | Linear    |                                    |             |  |
| Operating with matching  | -40℃ to 85℃                            |           |                                    |             |  |
| Storage with matching    |  | -40°C to  | 85℃                                |             |  |
| RF Power                 |  | 2 Wat     | tts                                |             |  |
| mpedance with matching   |  | 50 Oh     | ms                                 |             |  |
| Antenna type             |  | Flex      | (                                  |             |  |
| Connector type           | 146153 0XX                             | Х         | 14                                 | 146153 1XXX |  |
| Connector type           | Compatible MHF1 Compatible MH          |           | patible MHF4                       |             |  |
| User Implementation type | Adhesive 3M9077                        |           |                                    |             |  |
| Cable diameter           | Ø1.13mm                                |           |                                    |             |  |
|                          | 50 mm (P/N for 1461530050/1461531050)  |           |                                    |             |  |
|                          | 100 mm (P/N for 1461530100/1461531100) |           |                                    |             |  |
|                          | 150 mm (P/N for 1461530150/1461531150) |           |                                    |             |  |
| Cable length             | 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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### 5.0 APPLICABLE DOCUMENTS

| DOCUMENT               | NUMBER        | DESCRIPTION                         |
|------------------------|---------------|-------------------------------------|
| Solo Drowing (SD)      | SD-1461530050 | Machanical Dimension of the product |
| Sale Drawing (SD)      | SD-1461531050 | Mechanical Dimension of the product |
| 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 LENGHTH 50mm |  |  |  |  |  |
|--|--|--|--|--|--|
| P/N  | 1461530050                                   |  |  |  |  |
| Frequency Range                                      | 2.4GHz-2.5GHz 5.15GHz-5.85GHz 5.925-7.125GHz |  |  |  |  |
| Average Total efficiency                             | >78% >75% >76%                               |  |  |  |  |
| Return Loss  | < -10 dB                                     |  |  |  |  |

| 6.1.2 ELECTRICAL REQUIREMENTS FOR CABLE LENGHTH 100mm |                |                 |                |  |
|---|----------------|-----------------|----------------|--|
| P/N   | 1461530100     |                 |                |  |
| Frequency Range                                       | 2.4GHz-2.5GHz  | 5.15GHz-5.85GHz | 5.925-7.125GHz |  |
| Average Total efficiency                              | >75% >70% >70% |                 |                |  |
| Return Loss   | < -10 dB       |                 |                |  |

| 6.1.3 ELECTRICAL REQUIREMENTS FOR CABLE LENGHTH 150mm |                |                 |                |  |
|---|----------------|-----------------|----------------|--|
| P/N   | 1461530150     |                 |                |  |
| Frequency Range                                       | 2.4GHz-2.5GHz  | 5.15GHz-5.85GHz | 5.925-7.125GHz |  |
| Average Total efficiency                              | >72% >66% >65% |                 |                |  |
| Return Loss < -10 dB                                  |                |                 |                |  |

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| 6.1.4 ELECTRICAL REQUIREMENTS FOR CABLE LENGHTH 200mm |                |                 |                |  |
|---|----------------|-----------------|----------------|--|
| P/N   | 1461530200     |                 |                |  |
| Frequency Range                                       | 2.4GHz-2.5GHz  | 5.15GHz-5.85GHz | 5.925-7.125GHz |  |
| Average Total efficiency                              | >69% >62% >60% |                 |                |  |
| Return Loss   | < -10 dB       |                 |                |  |

| 6.1.5 ELECTRICAL REQUIREMENTS FOR CABLE LENGHTH 250mm |                |                 |                |  |
|---|----------------|-----------------|----------------|--|
| P/N   | 1461530250     |                 |                |  |
| Frequency Range                                       | 2.4GHz-2.5GHz  | 5.15GHz-5.85GHz | 5.925-7.125GHz |  |
| Average Total efficiency                              | >66% >58% >55% |                 |                |  |
| Return Loss < -10 dB                                  |                |                 |                |  |

| 6.1.6 ELECTRICAL REQUIREMENTS FOR CABLE LENGHTH 300mm |  |  |  |  |
|---|--|--|--|--|
| P/N   | 1461530300                                   |  |  |  |
| Frequency Range                                       | 2.4GHz-2.5GHz 5.15GHz-5.85GHz 5.925-7.125GHz |  |  |  |
| Average Total efficiency                              | >63% >55% >50%                               |  |  |  |
| Return Loss   | < -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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| F2                                       | DATE: 2022/12/19     | PRODUCT SPECIFICATION                      |                                    |  | 7 of 12                   |  |
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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~7.125G<br>Hz |  |
| Attenuation                | 1m cable measured by<br>VNA5071C | ≤3.5dB/m      | ≤5dB/m    | ≤6.5dB/m          |  |

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

### 6.2.1 PEAK GAIN AT 2.4-2.5GHZ BAND

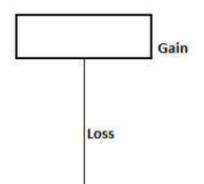


### 6.2.2 PEAK GAIN AT 5.15-5.25GHZ BAND

| Gain                           | Length Ga             | in (dBi) | Loss (dB)   | Total (dBi | )                     |
|--------------------------------|-----------------------|----------|-------------|------------|-----------------------|
|                                | 50mm                  | 3.4      | 0.25        | 3.15       |                       |
|                                | 100mm                 | 3.4      | 0.5         | 2.9        |                       |
|                                | 150mm                 | 3.4      | 0.75        | 2.65       |                       |
| Loss                           | 200mm                 | 3.4      | 1           | 2.4        |                       |
|                                | 250mm                 | 3.4      | 1.25        | 2.15       |                       |
| 1                              | 300mm                 | 3.4      | 1.5         | 1.9        |                       |
|                                |                       |          |             |            |                       |
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| PS-1461530100                  | Kang Cheng            | Co       | oper Zhou   | Hora       | ace Ma                |

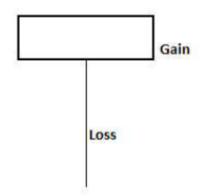


## 6.2.3 PEAK GAIN AT 5.25-5.35GHZ BAND



| Length | Gain (dBi) | Loss (dB) | Total (dBi) |
|--------|------------|-----------|-------------|
| 50mm   | 3          | 0.25      | 2.75        |
| 100mm  | 3          | 0.5       | 2.5         |
| 150mm  | 3          | 0.75      | 2.25        |
| 200mm  | 3          | 1         | 2           |
| 250mm  | 3          | 1.25      | 1.75        |
| 300mm  | 3          | 1.5       | 1.5         |

### 6.2.4 PEAK GAIN AT 5.47-5.725GHZ BAND



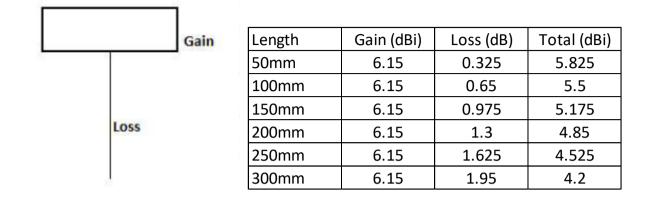
| Length | Gain (dBi) | Loss (dB) | Total (dBi) |
|--------|------------|-----------|-------------|
| 50mm   | 4.5        | 0.25      | 4.25        |
| 100mm  | 4.5        | 0.5       | 4           |
| 150mm  | 4.5        | 0.75      | 3.75        |
| 200mm  | 4.5        | 1         | 3.5         |
| 250mm  | 4.5        | 1.25      | 3.25        |
| 300mm  | 4.5        | 1.5       | 3           |

### 6.2.5 PEAK GAIN AT 5.725-5.85GHZ BAND

| Gain                           | Length Ga             | in (dBi) | Loss (dB)   | Total (dBi | )                     |
|--------------------------------|-----------------------|----------|-------------|------------|-----------------------|
|                                | 50mm                  | 4.1      | 0.25        | 3.85       |                       |
|                                | 100mm                 | 4.1      | 0.5         | 3.6        |                       |
|                                | 150mm                 | 4.1      | 0.75        | 3.35       |                       |
| Loss                           | 200mm                 | 4.1      | 1           | 3.1        |                       |
|                                | 250mm                 | 4.1      | 1.25        | 2.85       |                       |
|                                | 300mm                 | 4.1      | 1.5         | 2.6        |                       |
|                                |                       |          |             |            |                       |
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## 6.2.6 PEAK GAIN AT 5.925-7.125GHZ BAND



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

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### 8.0 ENVIRONMENTAL SPECIFICATION

| DESCRIPTION                                      | SPECIFICATION   |
|--|---|
|  | 1.The device under test is kept for 30 mins in an environment with a temperature of -40 $^{\circ}$ C.   |
|  | 2. Kept for 4 Hours in an environment with a temperature of 85 $^\circ\!\mathrm{C}$ .   |
| <b>T</b> aana ana taona 11 ka asia ka asia ka as | 3. Kept for 2 Hours in an environment with a temperature of 125 $^\circ\!\!\mathbb{C}.$   |
| Temperature /Humidity cycling                    | 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                                | 1.The device under test at -40 °C-125 °C by 100 cycles, Dwell<br>of 30 mins, transition time between Dwell 30 secs (~ 61 mins<br>/ cycle) and each item should be measured after exposing<br>them in normal temperature and humidity for 24 h.  |
| Temperature Shock                                | 2. Parts should meet RF spec before and after test.   |
|  | 3. No cosmetic problem (No soldering problem; No adhesion problem of glue).   |
|  | 1.Temperature:125°C, time:1008 hours  |
| High Temperature                                 | 2. There is no substantial obstruction to air flow across and around the samples, and the samples are not touching each other   |
| 5  | 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                                   | 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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| PS-1461530100    |                         | Kang Cheng            | Kang Cheng Cooper Zhou Ho                                   |      | ace Ma    |  |



PS-1461530100

## PRODUCT SPECIFICATION

#### 9.0 PACKING 0.06mm PROTECTIVE FILM(0504D) 260.0 ±2.00 mm 0.05mm BOTTOM MEMBRANE(P15G) 190.0 ±2.00 mm 200.0 ±2.00 mm PET FILM FOAM CHIPBOARD RUBBER BAND **4xPER BUNDLE** PET FILM LOADED WITH PRODUCTS P/N:885961262 PACKING QTY SEE TABLE CHIPBOARD FOAM PART NUMBER PCS/FILM FILM/BUNDLE BUNDLE/CARTON QTY/CARTON 1461530050/1461531050 32 40 5120PCS 1461530100/1461531100 16 40 3200PCS 5 1461530150/1461531150 12 40 2400PCS 5 1461530200/1461531200 12 40 2400PCS 5 1461530250/1461531250 8 40 5 1600PCS 1461530300/1461531300 8 40 1600PCS 5 NOTES: 1.PRODUCTS MUST BE PACKED IN CARTONS AND SEALED UP WITH TAPE. MOLEX 2.STICK LABEL WITH PART NUMBER AND DATE CODE XXXXXXX SHIPPING CARTON 3.STANDARD PACKAGING QUANTITY:SEE TABLE XXXXXXX 385x285x320mm 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 MOLEX LABLE JOINT DAMAGE. PACKAGING INFORMATION FOR 146153 Series **REVISION:** ECR/ECN INFORMATION: TITLE: SHEET No. WIFI 6E CABLE FLEX BALANCE ANTENNA EC No: 676655 **F2** 12 of 12 **PRODUCT SPECIFICATION** DATE: 2022/12/19 DOCUMENT NUMBER: CREATED / REVISED BY: APPROVED BY: CHECKED BY:

Kang Cheng

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## 4.5 RADIATION PATTERN

All measurements in this document are done with a cable length of 100mm.

