



Rialto Antenna Description

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Last modified by:

Scott Vance

Date:

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Approved by:

[Approved by]

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1 Antenna Overview

The antenna consists of a flexfilm (copper) conductor placed above a ground plane. It is positioned on the outside of the device near the right temple of the wearer.

1.1 Antenna Design

The antenna is a PIFA (Planar Inverted F-type Antenna). It consists of a flex film element connected to the PCB with two spring connectors.

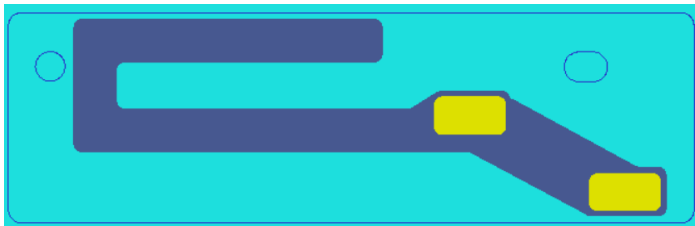


Figure 1 - CAD image of antenna flex

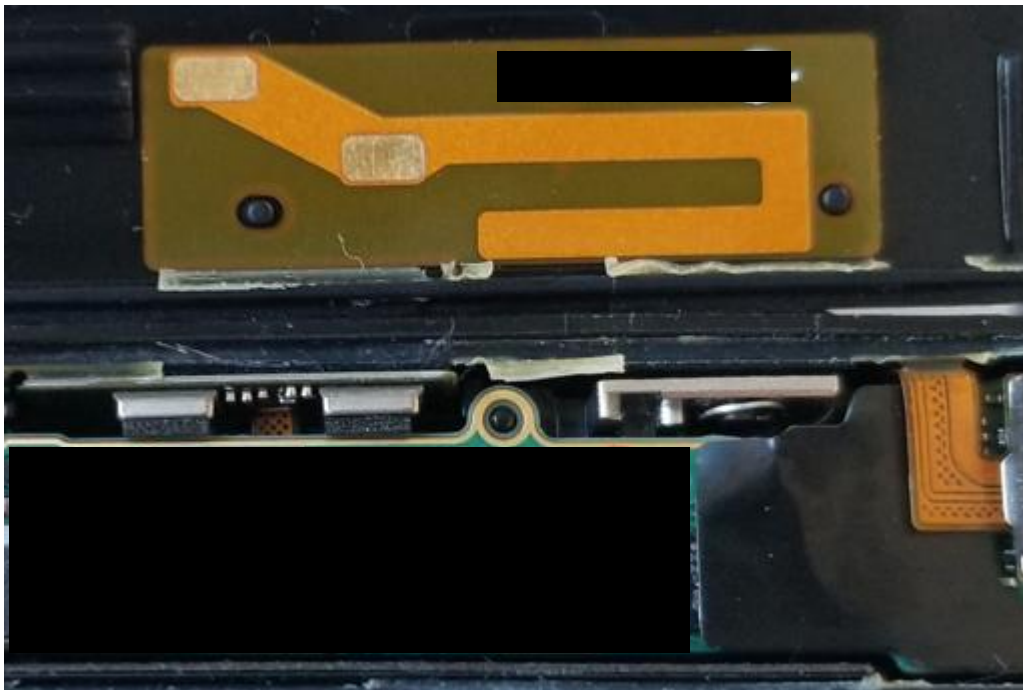


Figure 2 - Antenna Flex (top) and PCB showing spring connectors (feed and ground)

The antenna is matched with a single shunt component.

1.2 Antenna Position

The antenna is positioned on the outside of the right temple of the wearer.



Figure 3 - Antenna positioning in the device

2 Electrical Parameters

2.1 Frequency

The antenna frequency range goes from 2.400 to 2.480 GHz.

2.2 Gain

Peak gain has a maximum value of 2.66 dBi for the frequencies verified.

Table 1 - Antenna Gain vs. Frequency

Frequency (MHz)	Gain
2400	2,28
2410	2,24
2420	2,59
2430	2,66
2440	2,13
2450	1,94
2460	1,93
2470	1,84
2480	1,59

2.3 EIRP

Peak EIRP from production quality samples was measured as follows:

Table 2 - Peak EIRP

	2404	2440	2478
Peak EIRP (highest of 5 samples)	6.84 dBm	7.39 dBm	6.44 dBm
Peak EIRP (typical production unit)	5,87 dBm	6,56 dBm	5,95 dBm

These values are well below the 20 dBm peak EIRP requirement outlined in ETSI EN 300 328.

2.4 Radiation Patterns (passive)

Representative elevation cuts for the center of the frequency band (2440 MHz) are shown below. These patterns were measured using a fixture with a cable loss of 0.7 dB. Patterns shown do not include compensation for this conducted loss.

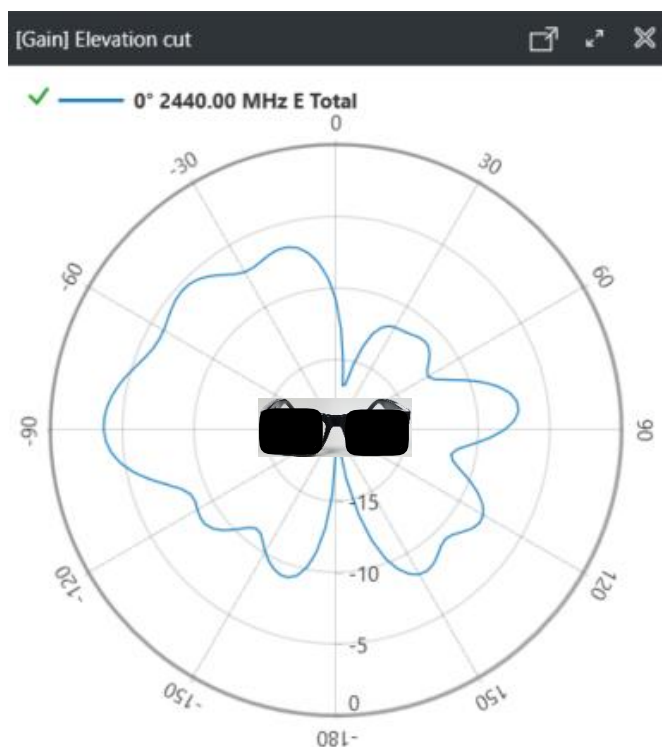


Figure 4 - Elevation Cut: $\Phi = 0$

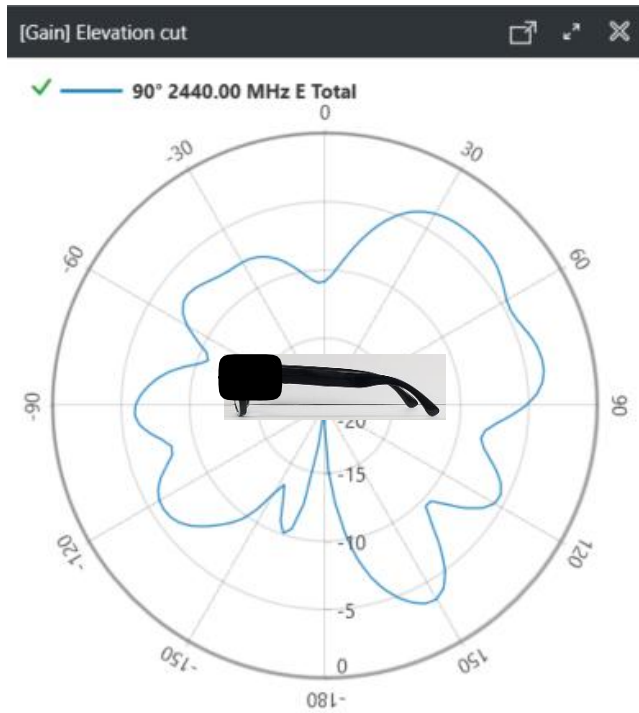


Figure 5 - Elevation Cut, $\Phi = 90$

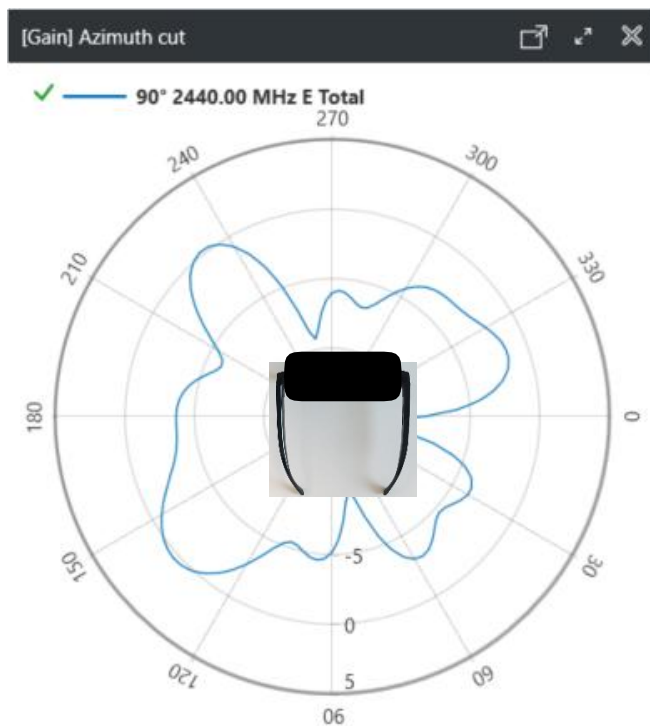


Figure 6 - Azimuth cut, $\Theta = 0$

2.5 Radiation Patterns (Active EIRP)

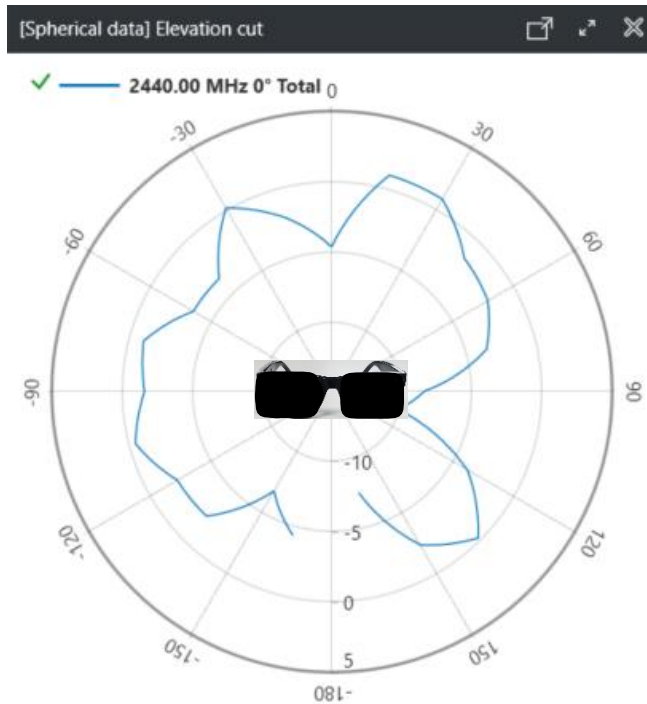


Figure 7 - Elevation Cut: $\Phi = 0$

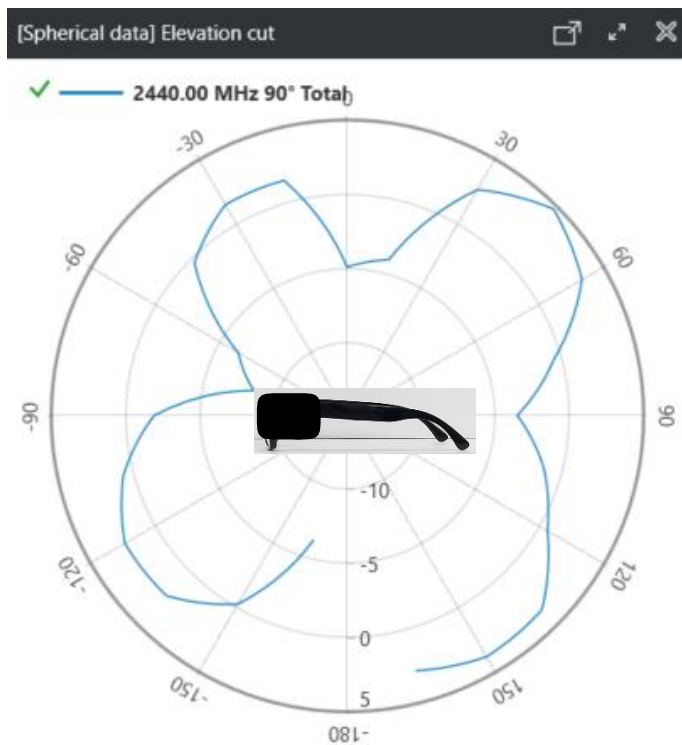


Figure 8 - Elevation Cut, $\Phi = 90$

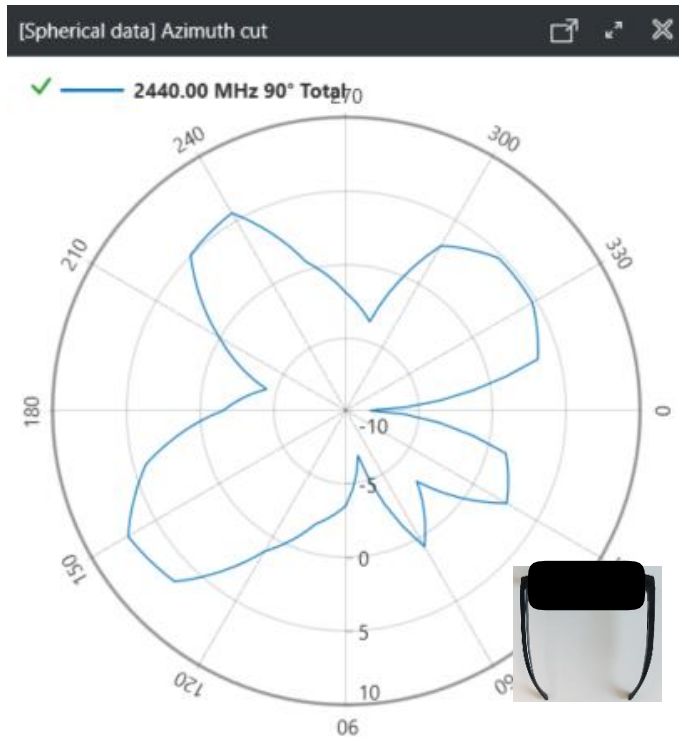


Figure 9 - Azimuth cut, $\Theta = 0$

2.6 Production Variation

The product has several different colour and style variants. In addition to this, there is natural production spread due to conducted differences (chip variations) and mechanical tolerances. All of these combine to give radiated performance variations of at least approximately ± 1 dB.

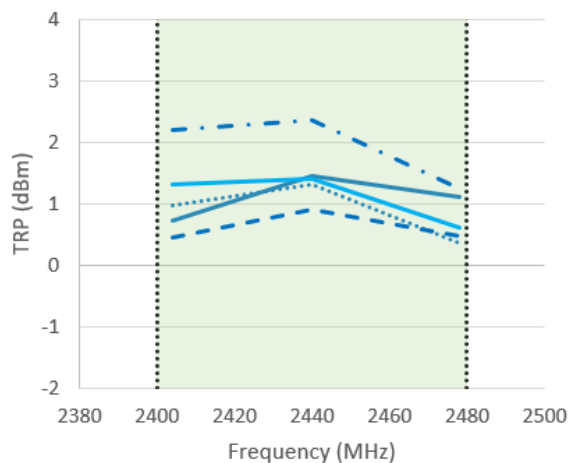


Figure 10 - TRP of 5 representative units including different styles and colour variants

3 Testing Details

3.1 Equipment & tools

The following equipment was used for verification:

- 1) Active and passive measurements: MVG SG-24L chamber. Application SW version 24.3.2. Annual calibration performed 2025.06.05.
- 2) Standard cables and other lab equipment as required.

Calibration and labelling requirements of all instruments at Sigma Connectivity AB are defined in “Calibration Procedure for Electronic and Mechanical Instruments” and “Calibration Procedure for Measurement Systems” as defined in Sigma Connectivity Management System.

3.2 Premises

Verification was performed at the main site of Sigma Connectivity:

Mobilvägen 10, in Lund Sweden
Antenna lab (Floor: 3, Wing: 1A, Left)

Passive verification was conducted on Oct 16, 2025.
Active testing was conducted between Sept 19 and Oct 15, 2025.

3.3 Responsibilities & personnel involved

Role	Name
Tester [Area]	Scott Vance [Antenna]
Project Manager	James Berresford
Engineering Manager [Area]	Jonas Brorson [HW, Radio, and Antenna]
Quality Assurance	Johan Hellfalk [Quality Manager]

Review and Approval of documents according to Sigma internal process “Review and approval process”.

3.4 Protocols for design verification

The following test protocols were used in verification:

Test Protocol No	Test Protocol
SCDC-1715298472-2316	Wavestudio User Manual [SG24L Chamber measurements]

3.5 Definitions and abbreviations

DUT: Device under test

MVG SG-24 Chamber: An anechoic chamber used for RF antenna verification. This is a multi-probe system which allows for relatively quick measurements of 3D radiation patterns.

Tolerance	Designation	from 0.5 up to 3	over 3 up to 6	over 6 up to 30	over 30 up to 120	over 120 up to 400
Permissible deviations for ranges of lengths in millimeters of shorter side of the angle concerned						
Designation		fine	medium	coarse	fine	medium
ISO 2768-1		M1	M1.2	M1.4	M1.6	M1.6
Threads		Screw	Screw	Screw	Screw	Screw
ISO 2768-1		5H	6H / 6g	6H / 6g	6H / 6g	6H

NOTES (UNLESS OTHERWISE SPECIFIED):

A. SEE FABNOTES FOR DETAILED LAYER CONSTRUCTION & MATERIALS. THIS ASSOCIATED 2D DRAWING SHALL BE USED FOR GEOMETRIC TOLERANCES. UNLESS OTHERWISE SPECIFIED, A DEFAULT TOLERANCE ACCORDING TO THE DEGREE SPECIFIED OF ISO 2768-1 *fine* SHALL BE APPLIED.

B. INTERPRET GEOMETRIC DIMENSIONING & TOLERANCING (GD&T) PER ASME Y14.5-2018.

C. DENOTES A FIRST ARTICLE INSPECTION DIMENSION. DENOTES A CRITICAL TO QUALITY DIMENSION. DENOTES A CPK DIMENSION. () DENOTES A REFERENCE DIMENSION. DENOTES A DRAWING REVISION EDIT.

D. GENERAL TOLERANCES UNLESS OTHERWISE SPECIFIED:

PCB/FPC OUTLINE: ± 0.13 mm
PCB/FPC THICKNESS: $\pm 10\%$ OF THICKNESS
THROUGH HOLE : ± 0.075 mm
SLOT WIDTH: ± 0.1 mm
THROUGH HOLE/SLOT TO PCB EDGE: ± 0.13 mm
COMPONENT PLACEMENT FROM DATUM: ± 0.15 mm
WARPAGE: $\pm 0.75\%$

E. FLEX BENDING TESTING TO BE DONE AT 90DEG BASED ON INDICATED LOCATION AND DIAMETER. RED SOLID LINES INDICATE BENDING TOWARDS VIEWER. BLUE DASHED LINES INDICATE BENDING AWAY FROM VIEWER.

F. STRAIGHT EDGES TO HAVE STRAIGHTNESS TOLERANCE OF 0.05mm PER 25 mm, NOT TO EXCEED 0.15mm OVER ENTIRE LENGTH.

G. ALL TOOLING AND FIXTURES USED TO MAKE THIS PART SHALL BE APPROVED BY ESSILORLUXOTTICA.

H. DIES, SPECIAL PUNCHES, OR OTHER UNIQUE TOOLING REQUIRED TO MAKE THIS PART TO BE PROPERTY OF ESSILORLUXOTTICA, AND SHALL BE PERMANENTLY MARKED WITH PART NUMBER, REVISION, AND DATE.

I. VENDOR SHALL USE THE ESSILORLUXOTTICA FAI TEMPLATE TO PREPARE DIMENSIONAL MEASUREMENT REPORTS.

J. ALL DIMENSIONAL WAIVER REQUESTS TO BE PROVIDED USING ESSILORLUXOTTICA WAIVER TEMPLATE LT-SP-FM-053.

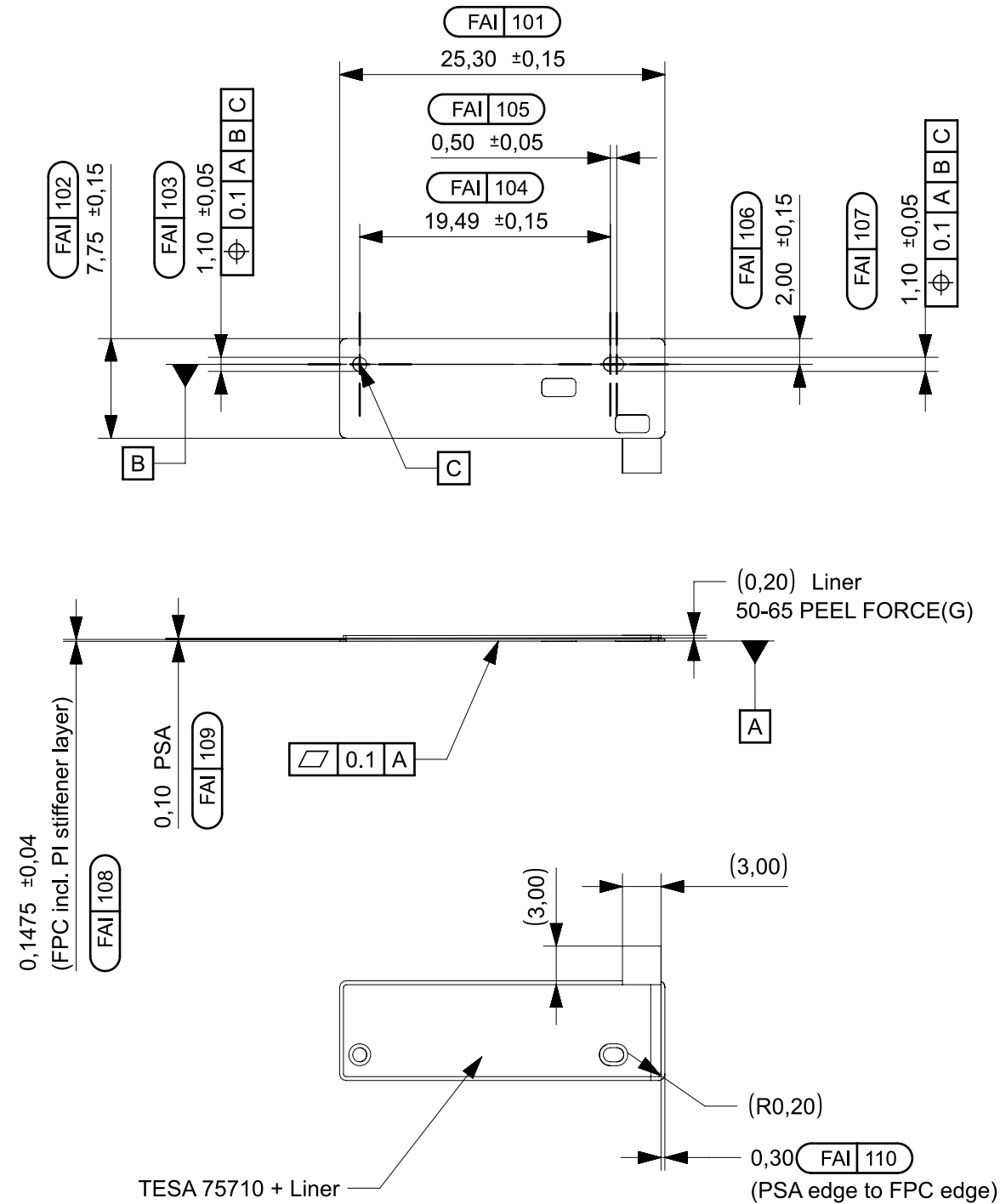
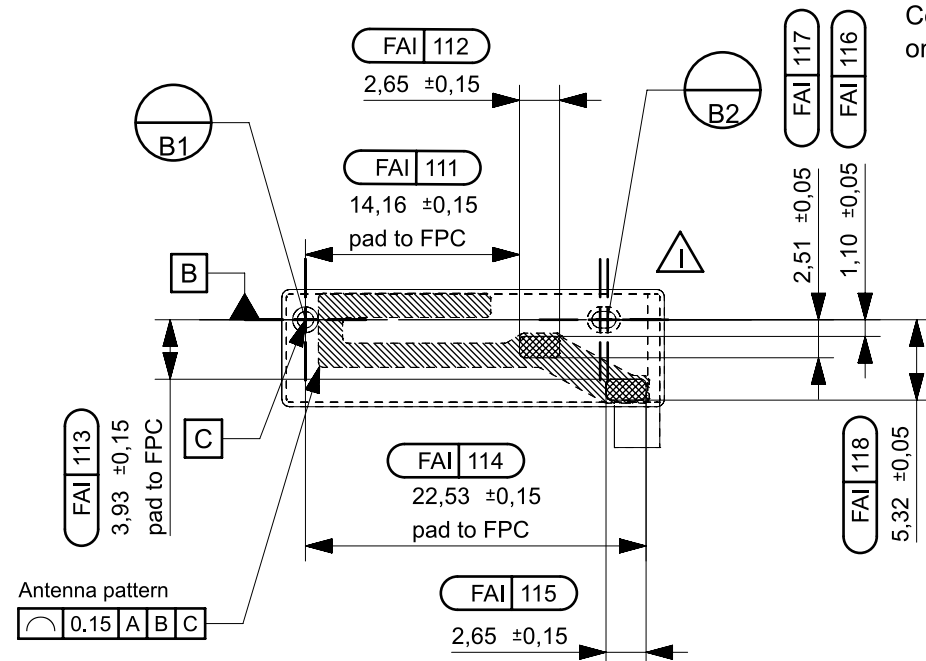
K. PARTS MUST BE PACKAGED TO PREVENT DAMAGE, DEFORMATION, OR CONTAMINATION DURING SHIPPING AND HANDLING. PACKAGING SHALL BE APPROVED BY ESSILORLUXOTTICA OR ITS DESIGNEES. SUPPLIER BEARS FULL RESPONSIBILITY FOR DAMAGE, DEFORMATION, OR CONTAMINATION RESULTING FROM INADEQUATE PACKAGING.

L. ALL MATERIALS SPECIFIED ON THIS DRAWING MUST COMPLY WITH THE FOLLOWING ENVIRONMENTAL REGULATIONS:

RoHS 2 DIRECTIVE (2011/65/EU)
HALOGEN FREE: IEC 61249-2-21
REACH REGULATION (EC) No 1907/2006
CALIFORNIA PROP 65
NO MATERIAL CHANGES ARE ALLOWED WITH

M. A CERTIFICATE OF COMPLIANCE (COC) FOR THE MATERIAL SPECIFIED SHALL ACCOMPANY EACH SHIPMENT. THIS CERTIFICATE SIGNIFIES THE COMPLIANCE OF THE SHIPPED PRODUCTS TO THE SPECIFICATION. CERTIFICATE SHALL INCLUDE BASE PART NUMBER AND DASH NUMBER, MATERIAL DESIGNATION, DATE OF PART MANUFACTURE, PURCHASE ORDER NUMBER, PART QUANTITY OF SHIPMENT AND A STATEMENT OF CONFORMANCE OF THE SHIPPED PRODUCT TO THE SPECIFICATION. CERTIFICATE OF COMPLIANCE SHALL BE SIGNED BY THE QUALITY MANAGER, OR EQUIVALENT.

 Note: No copper layer allowed outside antenna pattern.
Component markings shall be placed on silk screen.



I	Antenna pattern updated		PRAS		
H	Moved guide holes 1.6mm up				
G	Updated Antenna pattern and FPC		STNI		
F	Updated Antenna pattern, FPC and PSA stackup		DAON		
E	Corrected according to Tristar feedback		DAON		
D	Change PSA thickness		JNYN		
C	Increase pad size		JNYN		
B	Change thickness on FPC and tape, modify copper pattern		JNYN		
A	PRELIMINARY RELEASE		-	-	-
Rev.	Revision Description	Requested by:	Designed by:	Approval Date:	Approved by:
First Model:				Dimensions without tolerance indication have accuracy degree according to ISO 2768-1. Threads (M1.00 M1.20 M1.40 M1.60) without tolerance indication are in accordance with ISO11381	
Hardness : -					
Material : -					
Description : RL,ANTENNA FPCA, ANT3,TEMPLE RIGHT,P1		Technical Department of: TRISTAR		Degree of accuracy : fine	
Technical Code : 1EB24002100		Drawing n° : D-054814		Designed by : Nyman Johan	
		Revision : I		Date : 2025/06/19	
				Approved by : -	
				Size : A3	
				1st Angle Proj.	