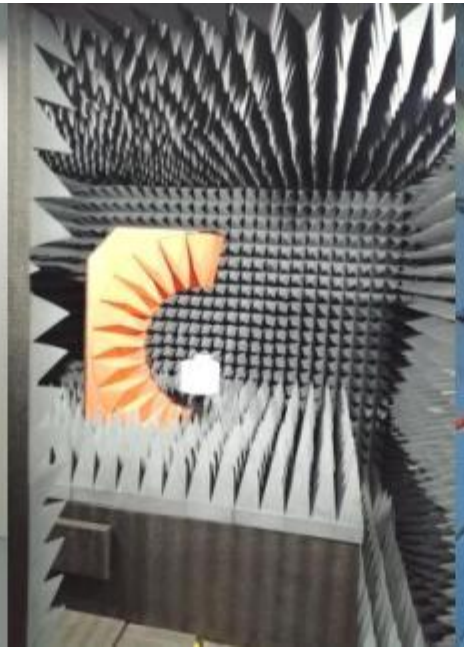
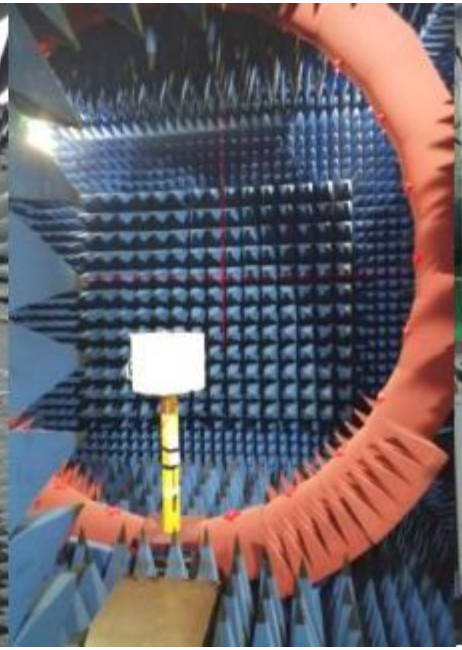
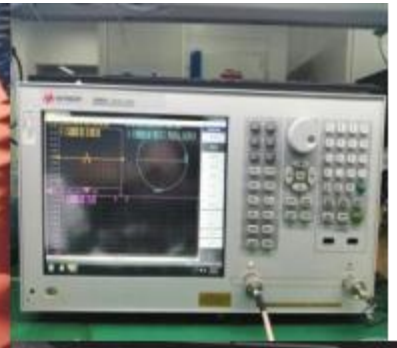
深圳市沃莱特电子有限公司
Shenzhen World Elite Electronic CO.,LTD.

D139 Antenna commissioning report

- This report is designed to better support the detailed process and summary done by collaborative customers.
- The ideas and methods of RF performance of all products in this report are customized developed by Vollet for this product.
- Do not broadcast the development report to third parties for your understanding and support.

Report version	Report time	Main matters of this report	Customer conclusion
V1	2024/11/5	New project commissioning	

Test system and equipment (4 * 4 * 3.5 TEM 24 multi-probe test system, 3 * 3 * 2.5 MVG 12 multi-probe test system, Agilent5071 Series Network analyzer, ED 5063 Series Network Analyzer, Agilent8960, RS-CMW 500)


Attached: antenna design and development process description and introduction

Stage one	Antenna performance was pre-assessed	According to the characteristics of different projects, suggest the most appropriate evaluation methods, including simulation review, drawing file review, hand board review, etc. As a very important link of antenna research and development, antenna review is carried out in the early stage of project approval, which is of great significance to the performance and realization of antenna in the later stage.
Stage 2	Antenna passive performance test	As an energy conversion and transmission device, its essence is passive device, and the parameters characterizing its own performance is passive parameters. In the missed commissioning stage, the transmission parameters and radiation parameters of the antenna itself are mainly tested, and the test parameters are mainly impedance, return loss, efficiency and gain, etc.
Stage 3	Active performance of the antenna test	In the case of the antenna confirmation passive parameter OK, the final use effect needs to be put into the product for performance confirmation. At this stage, what needs to be adjusted is the comprehensive performance of the whole system. The main attention parameters are power and sensitivity, which are the most intuitive active parameters to quantify the transmitting and receiving capability of the antenna.

Stage four	Wireless user experience test	For all wireless forms of electronic products, the user experience is the ultimate goal we need to achieve, which is also the users personal experience. So all of our early research and development is actually for the final stage of service.

Interpretation of common antenna parameters in the development report			
Category (measuring equipment)	Antenna parameters	paraphrase	
Antenna passive parameters (network analyzer)	Standing Bobby (VSWR)	Voltage standing wave ratio refers to the ratio of the standing wave belly voltage and the wave joint voltage amplitude, also known as the standing wave coefficient and the standing wave ratio. If the standing wave ratio is equal to 1, the impedance of the feeder and the antenna is perfectly matched. All the high frequency energy is radiated by the antenna without the energy reflection loss; If the standing wave ratio is infinite, it means the total reflection and the energy is not radiated at all.	VSWR≤3
	Echo loss (Return loss)	Echo loss is the ratio of the reflected wave power to the incident wave power of the transmission line port, which is expressed in logarithmic form in dB, generally negative value. Its absolute value can be called reflection loss.	|RL|≥6dB
	Impedance circle plot (SMITH CHART)	Smith diagram (impedance circle diagram) is a tool for effectively selecting and to calculate matching impedance in the design of HF and UHF circuits.	The closer the antenna working frequency band is to the 50 ohm point, the better it is
	Antenna efficiency (Effeciency)	Antenna efficiency refers to the ratio of the power radiated out by the antenna (that is, the power of the effective electromagnetic wave conversion part) and the active power input to the antenna.	Nonmetallic environment: Effeciency 35% metal ring Environment: Effeciency 20%
	Antenna gain (Gain)	Antenna gain is the ratio of the power density generated by the actual antenna and the ideal radiation unit at the same point in space under equal input power. It quantitatively describes the extent to which an antenna concentrates the input power on radiation, and the key parameters are micro-maximum gain, and the average gain of	According to the working frequency band and product characteristics

		the antenna is efficiency.	
	Antenna direction diagram (radiation pattern)	Antenna direction diagram refers to the relative field intensity (normalized mode value) of the radiation field changes with the direction at a certain distance from the antenna. It is usually represented by two perpendicular plane direction maps in the maximum radiation direction of the antenna.	According to the actual use experience needs

Active motherboard conduction parameters (comprehensive test Instrument + shielding box)	Emission power is TX Power (motherboard transmission lead)	The transmitting power of the main board is the source of the electromagnetic wave radiated by the antenna to space, and is the quantitative parameter to measure the transmitting capability of the radio frequency chip. Conduction test, also known as point test or closed-loop test, usually has a specific position on the motherboard as the calibration port, which is close to the antenna. It should be noted that if the calibration port is far from the antenna, the power ultimately transmitted to the antenna input port may vary greatly from the calibration port measurement.	CSM850/900：≥32.5 dBm DCS/PCS:≥29dBm DCMA/ TD- SCDMA：≥23 dBm WCDMA/ LTE：≥22.5 dBm WIFI and BT vary according to the specific system and rate
	receiving sensitivity RX Sensitivity (Main board conduction)	The conduction receiving sensitivity of the main board is the limit state of the antenna receiving the electromagnetic wave, which is the quantitative parameter of the RF chip without external interference and transmission loss. If the conduction sensitivity is low, then the receiving sensitivity of the whole machine OTA will not be high, other precautions with the conduction transmission power.	GSM/ CDMA/ TD/ WCDMA:≤-109 dBm LTE：≤-96 dBm@10 MHz
Antenna active parameters	Total Aerial radiation power (TRP)	The total radiation power of the antenna refers to the use of the dark room standard in the 3D microwave dark room The antenna probe collects the power value of the whole machine in various typical directions of 360°, and finally calculates the total radiation power of the project in all directions in space through the near field transfer and spherical integration, which is closely related to the antenna efficiency.	According to different product forms and customer requirements different

	Antenna total reception sensitivity (TIS)	Similar to TRP, TIS also refers to the use of dark chamber labels in the 3D microwave dark chamber The quasi-antenna probe collects the reception sensitivity of the whole machine in various typical directions of 360°, and finally calculates the total reception sensitivity of the project in all directions in the space through the near field transfer to far field and sphere integration. In the case of project approval, the efficiency is also positively correlated.	According to different product forms and customer requirements different

D139 Antenna Test

date: 2024/11/5

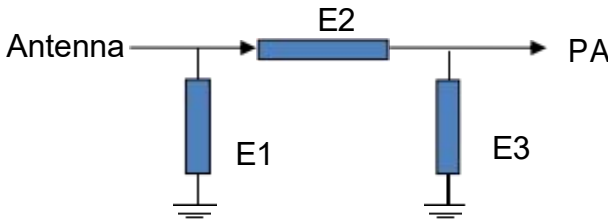
The main purpose of this report is to:

Report V1 optimized

The main conclusions of this report are as follows:

antenna	frequency range	material quality	performance requirement
BT	2400-2480 MHz	On board	

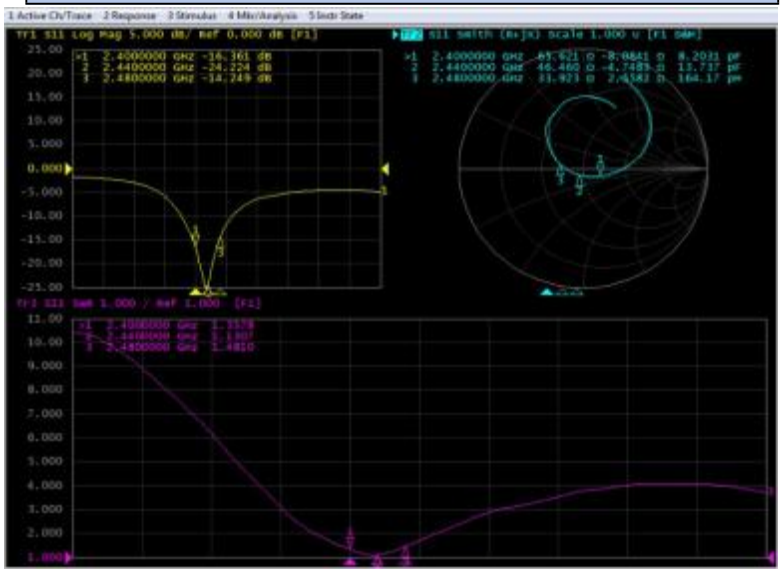
Antenna end matching circuit:



BT	
Element	
E1(0402)	
E2(0402)	3.3
E3(0402)	nH

Antenna passive S11 parameter test:

BT

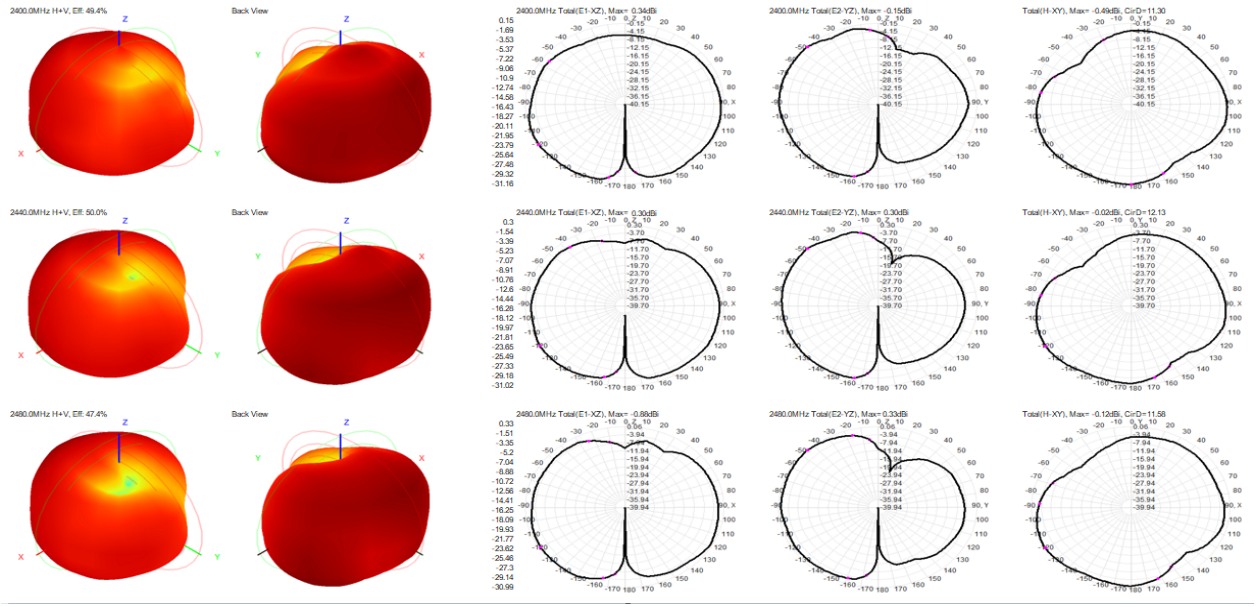


Freq (MHz)	2400	2440	2480
SWR	1.35	1.13	1.48
Log Mag	-16.36	-24.22	-14.25

Antenna passive efficiency and gain test:

BT		
Frequency (MHz)	Gain (dBi)	Efficiency (%)
2400	0.15	49.35
2410	0.23	49.71
2420	0.34	49.94
2430	0.27	50.13
2440	0.30	50.00
2450	0.33	50.06
2460	0.32	49.05
2470	0.24	48.21
2480	0.33	47.41
2490	0.21	46.74
2500	0.05	46.13

Antenna passive radiation direction diagram:



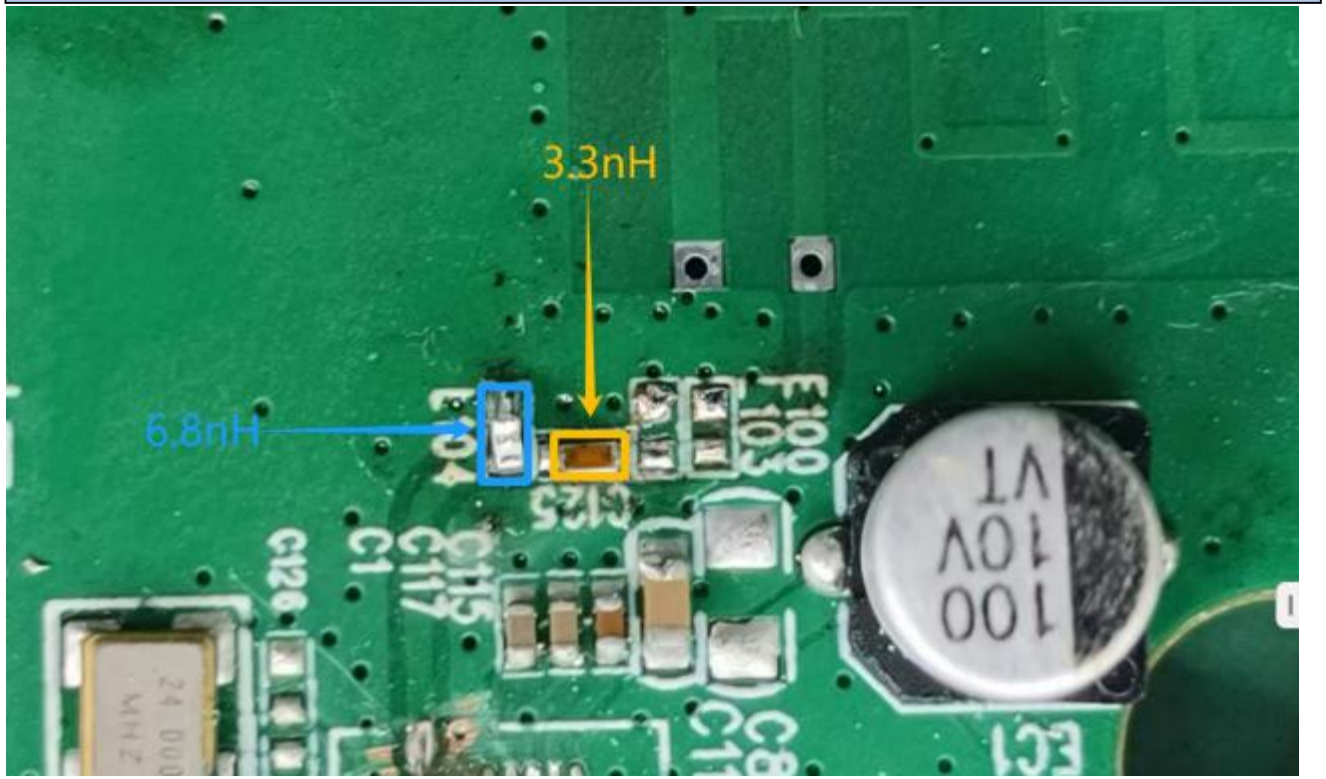
Antenna OTA test:

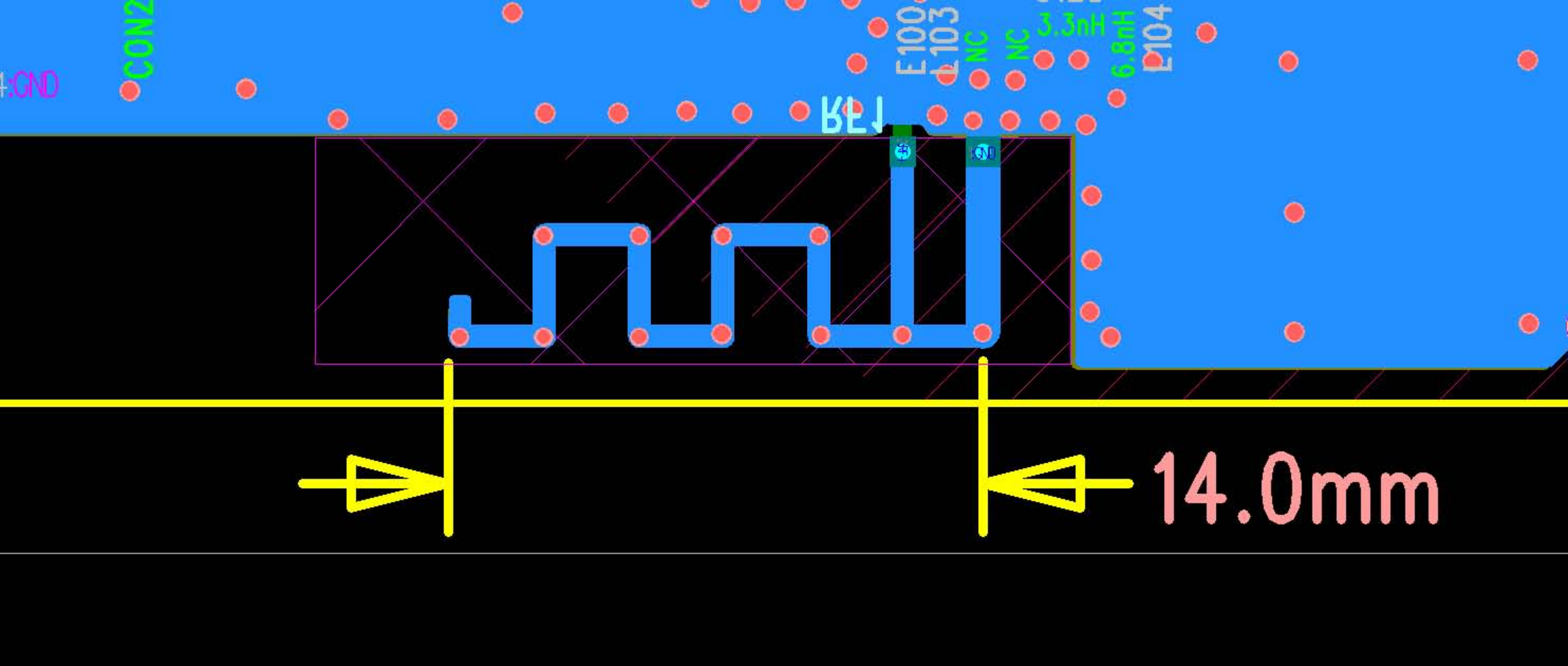
original		
Channels	TRP	TIS
0	-3.72	-89.49
39	-2.15	-88.22
78	-0.86	-89.1

After optimizing the match		
Channels	TRP	TIS
0	-0.6	-89.82
39	0.08	-90.1
78	-0.47	-90.26

Antenna position and matching picture:

BT




CON2
:GND
E100
L103
NC
NC
3.3nH
6.8nH
E104
14.0mm