

Antenna specification for approval

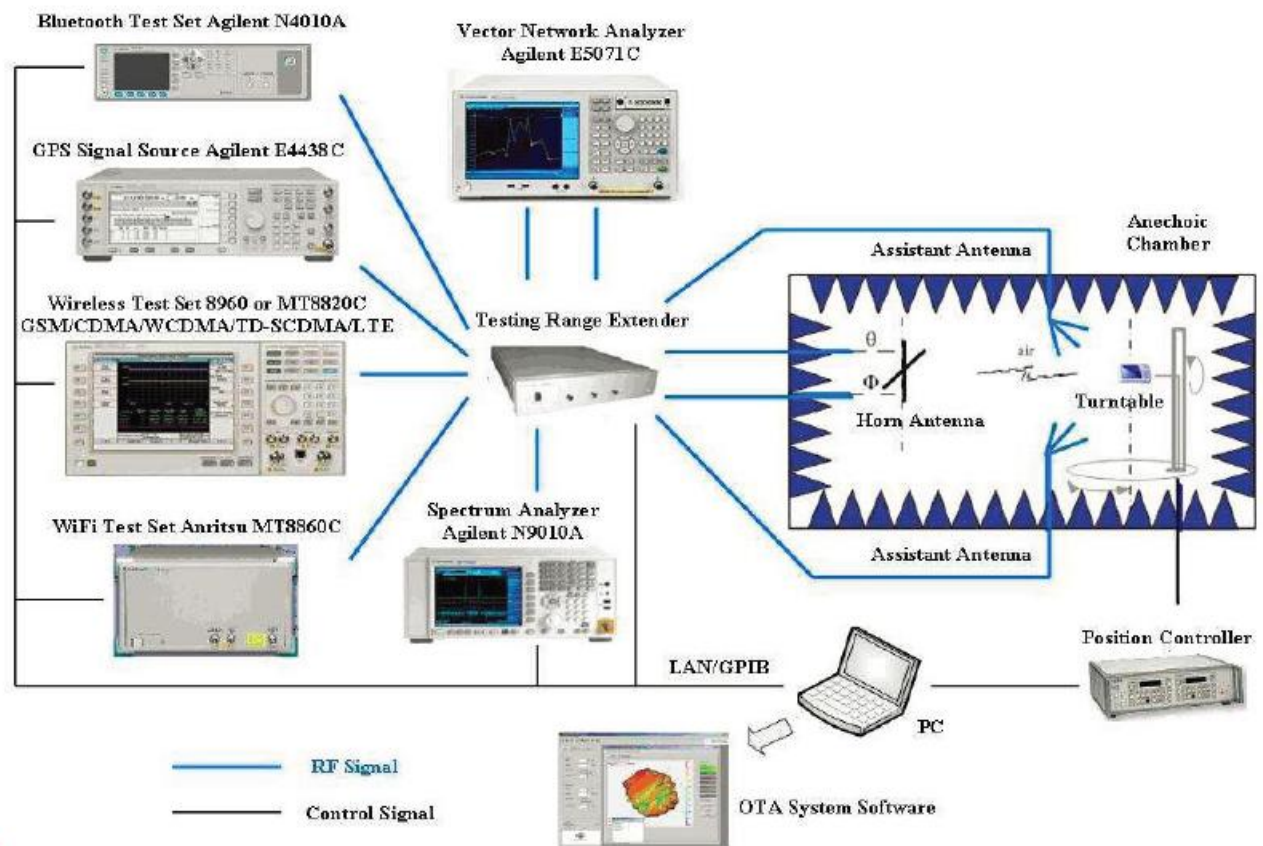
|                             |                               |                               |           |
|-----------------------------|-------------------------------|-------------------------------|-----------|
| Customer name               | Lightcomm Technology Co., Ltd |                               |           |
| Model                       | WIFI&BT&5Gwifi Antenna        |                               |           |
| Antenna frequency           | 2. 4GHZ&5GHz                  |                               |           |
| Antenna function            | WIFI&BT&5Gwifi Antenna        |                               |           |
| Antenna material            | FFC                           |                               |           |
| model                       | SF2299A-1B2-A                 |                               |           |
| Material number             | SF2299A-1B2-A                 |                               |           |
| Customer Part Number        |                               |                               |           |
| Ward accepted the signature |                               | Client acknowledges signature |           |
| structure                   |                               | Purchase                      |           |
| Document control            |                               | structure                     |           |
| radio frequency             |                               | engineering                   |           |
| To examine                  |                               | QC                            |           |
| Responsible Tingting Li     |                               | To examine                    |           |
| date<br>2024. 12. 07        | Seal area                     | date<br>2024. 12. 07          | Seal area |

| No. | Authentication No. | Material type      | issue Date | Remarks  |
|-----|--------------------|--------------------|------------|----------|
| 1   | A2230173541101001E | tinned copper wire | 2024-04-24 | one year |
| 2   | CANEC2227657302    | halogen            | 2024-12-28 | one year |
| 3   | CANEC2227657303    | back adhesive      | 2024-12-28 | one year |
| 4   | SHAEC23000346911   | FEP sheath         | 2024-01-13 | one year |
| 5   | SHAEC22004639301   | FEPinsulation      | 2024-12-15 | one year |
| 6   | SZXEC23001647204   | tin wire           | 2024-07-28 | one year |
| 7   | SZXEC23001647208   | tin bar            | 2024-07-28 | one year |
| 8   | ETR23701480        | printing ink       | 2024-07-13 | one year |
| 9   | A2230173918101001E | base material      | 2024-04-18 | one year |
| 10  | CANEC2227574118    | EVA foam           | 2024-01-03 | one year |
| 11  | A2230383826101003  | conductive cloth   | 2024-08-04 | one year |
| 12  | CANEC23002609908   | gold plating       | 2024-05-11 | one year |

# List

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## 一:Device support&testable antenna type



## 二:Overview.

### (1)Antenna performance

- 1.This approval sheet supports for CAR Car Multimedia Player project. FFC antennas include in this project. This report is for the performance of WIFI&BT antenna.
- 2.Antenna shape size: Meet the requirement of CAR Car Multimedia Player
- 3.Antenna band: 2.4GHz~5GHz
- 4.Antenna material: Antenna material meet the requirement of CAR Car Multimedia Player
- 5.Adhesive performance: Adhesive performance meet the requirement of CAR Car Multimedia Player
- 6.Antenna performance meet the spec below:

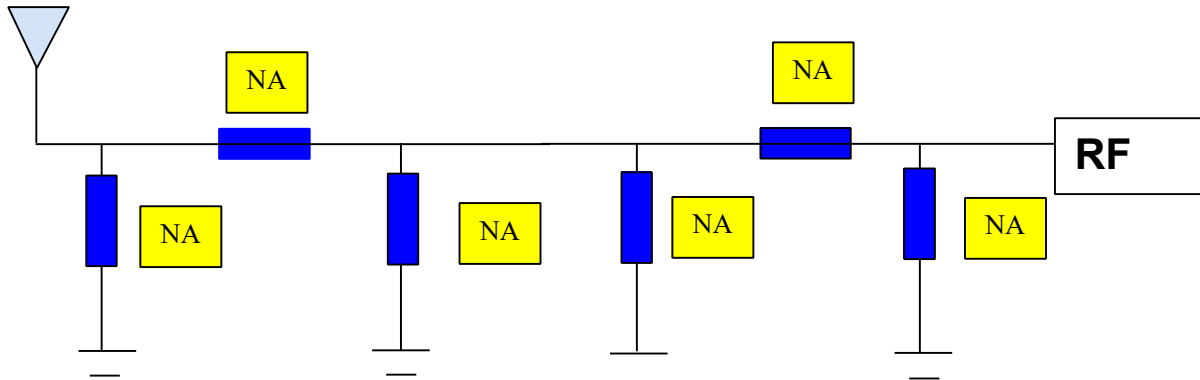
| Description            | 2.4GHz~5GHz               | Units |
|------------------------|---------------------------|-------|
| VSWR                   | $\leq 2.0$                |       |
| Average Antenna Gain   | $\geq -4.5$               | dB    |
|                        |                           |       |
| Feed Impedance         | 50 ohms                   |       |
| Operating Temperature  | -40 to +85 deg C          |       |
| Polarization / Azimuth | Linear / Omni-directional |       |

### (2)Mechanical Information

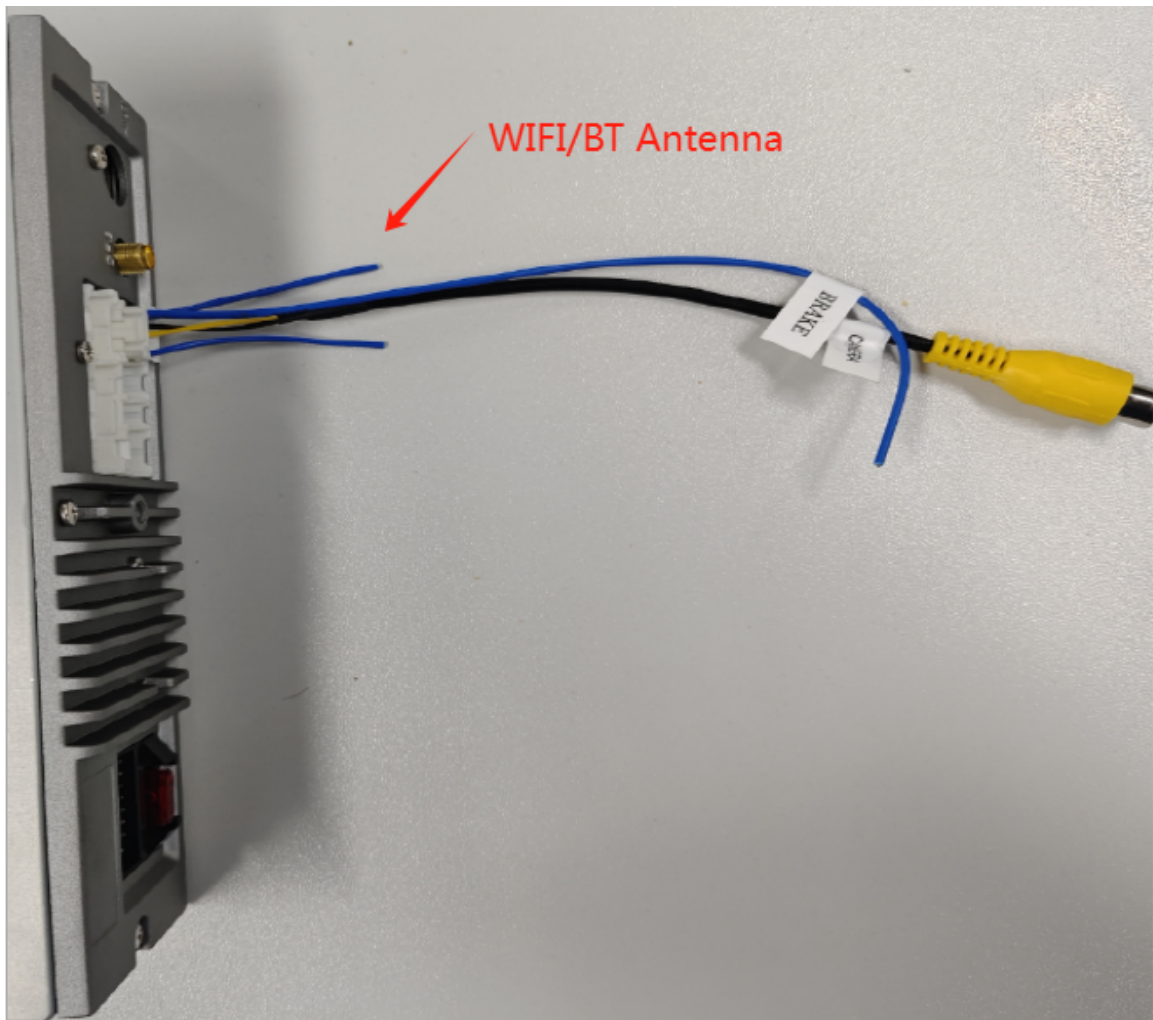
| Mechanical Dimension  |                  |
|-----------------------|------------------|
| Cable Length          | NA               |
| Description           | WIFI&BT antenna  |
| Material              | FFC              |
| Coaxial Cable         | NA               |
| Environmental         |                  |
| Operation Temperature | -40 to +85 deg C |
| Storage Temperature   | -40 to +85 deg C |

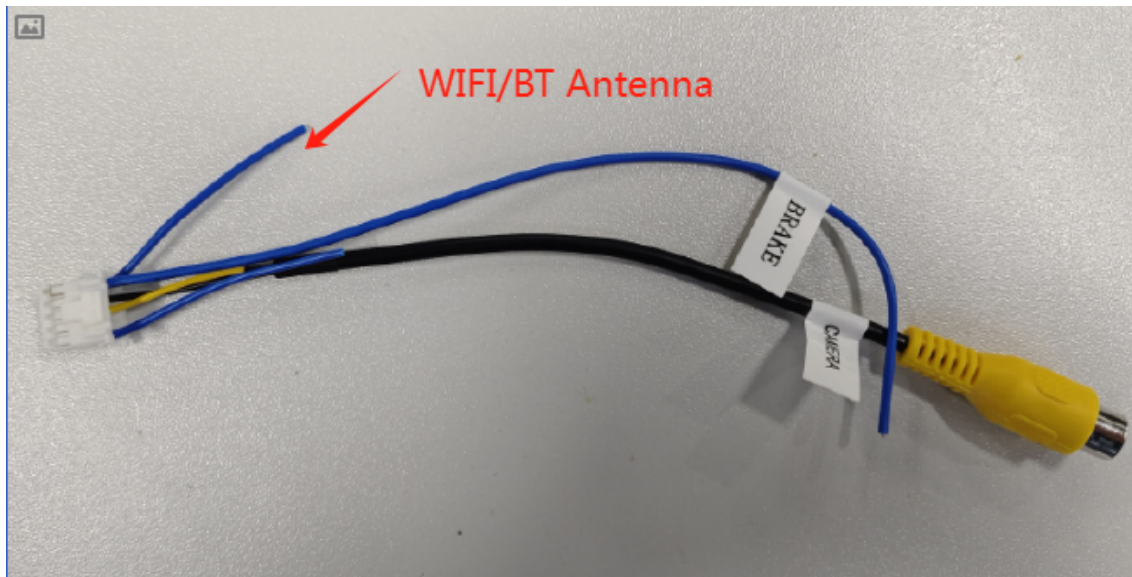
### 三: Matching circuit diagram&machine picture&antenna picture

#### (1) Matching circuit diagram

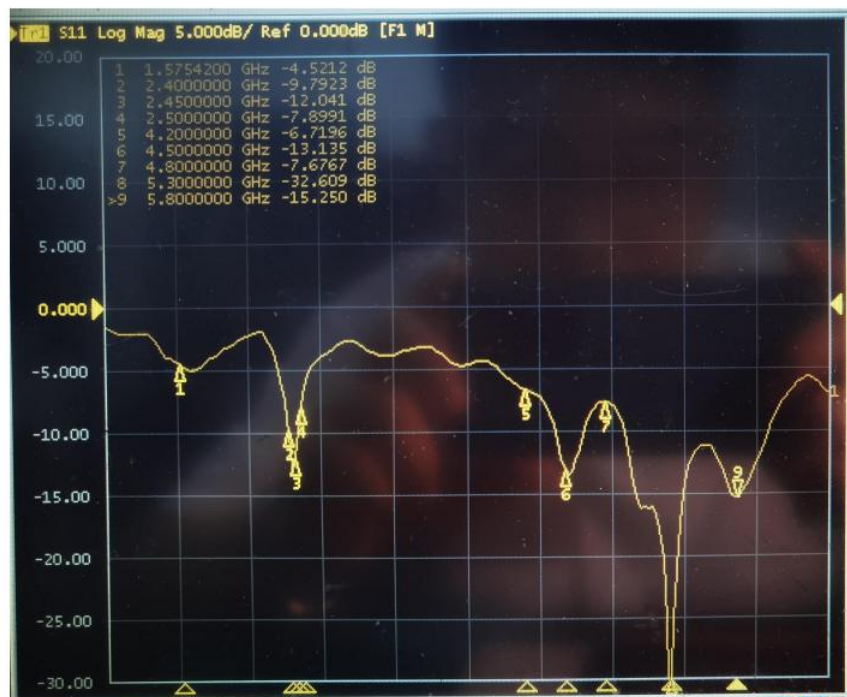


#### (2) machine picture&antenna picture





#### 四:Antenna standing wave ratio&antenna efficiency



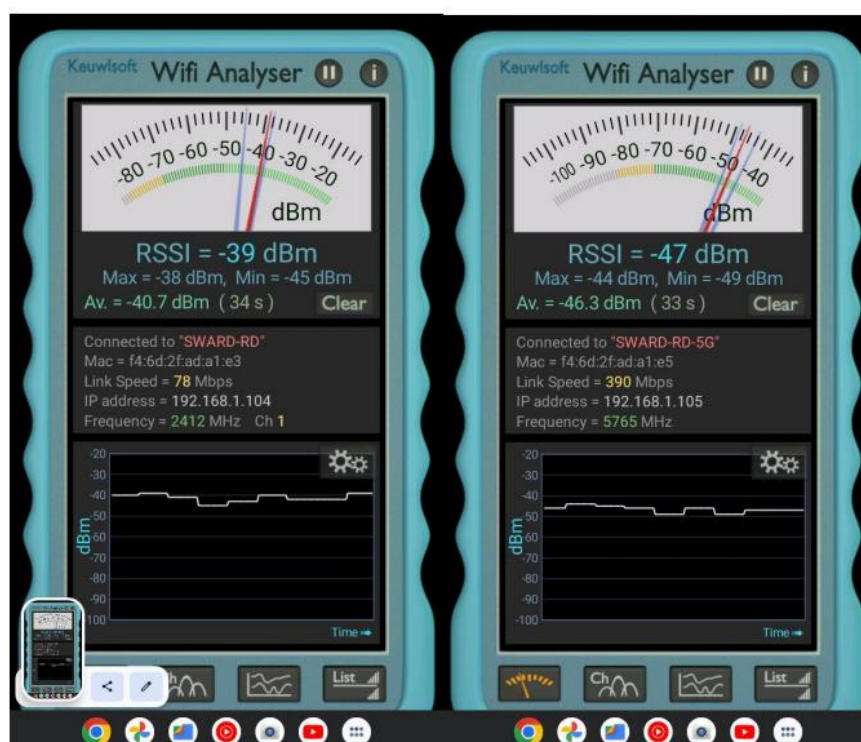
| Passive Test For 2.4G |          |           |            |            |         |         |          |          |                   |                 |           |           |
|-----------------------|----------|-----------|------------|------------|---------|---------|----------|----------|-------------------|-----------------|-----------|-----------|
| Freq (MHz)            | Effi (%) | Effi (dB) | Gain (dBi) | Gain (dBd) | UHS (%) | DHS (%) | Max (dB) | Min (dB) | Directivity (dBi) | Beamwidth (3dB) | AttH (dB) | AttV (dB) |
| 2400                  | 11.26    | -9.49     | -5.21      | -3.36      | 4.694   | 6.562   | -5.21    | -16.2    | 4.28              | 60              | 46.77     | 47.04     |
| 2410                  | 11.46    | -9.41     | -5.12      | -3.27      | 4.824   | 6.637   | -5.12    | -16.24   | 4.29              | 60              | 46.94     | 47.16     |
| 2420                  | 13.82    | -8.59     | -4.48      | -1.63      | 5.903   | 7.917   | -4.48    | -15.69   | 4.11              | 60              | 47.02     | 47.39     |
| 2430                  | 16.03    | -7.95     | -3.77      | -2.92      | 6.903   | 9.126   | -3.77    | -14.54   | 4.18              | 60              | 47.31     | 47.67     |
| 2440                  | 14.68    | -8.33     | -4.22      | -1.37      | 6.345   | 8.338   | -4.22    | -14.74   | 4.11              | 60              | 47.68     | 47.91     |
| 2450                  | 13.92    | -8.56     | -4.43      | -0.8       | 5.973   | 7.951   | -4.43    | -14.84   | 4.14              | 60              | 47.98     | 48.27     |
| 2460                  | 13.94    | -8.56     | -4.45      | -2.6       | 6       | 7.94    | -4.45    | -14.12   | 4.11              | 60              | 47.79     | 48.02     |
| 2470                  | 14.34    | -8.44     | -4.44      | -2.59      | 6.144   | 8.193   | -4.44    | -13.84   | 4                 | 60              | 47.6      | 47.7      |
| 2480                  | 16.13    | -7.92     | -4.1       | -2.25      | 6.909   | 9.225   | -4.1     | -13.49   | 3.82              | 60              | 47.93     | 48.05     |
| 2490                  | 18.72    | -7.28     | -3.46      | -2.61      | 7.969   | 10.753  | -3.46    | -13.02   | 3.81              | 60              | 48.1      | 47.95     |
| 2500                  | 20.86    | -6.81     | -3.04      | -1.19      | 8.822   | 12.036  | -3.04    | -12.74   | 3.77              | 60              | 48.13     | 48.09     |

| Passive Test For 5G |          |           |            |            |         |         |          |          |                   |                 |           |           |
|---------------------|----------|-----------|------------|------------|---------|---------|----------|----------|-------------------|-----------------|-----------|-----------|
| Freq (MHz)          | Effi (%) | Effi (dB) | Gain (dBi) | Gain (dBd) | UHS (%) | DHS (%) | Max (dB) | Min (dB) | Directivity (dBi) | Beamwidth (3dB) | AttH (dB) | AttV (dB) |
| 5050                | 25.7     | -5.9      | 0.45       | -2.7       | 16.321  | 9.377   | 0.45     | -13.79   | 6.35              | 30              | 57.87     | 57.75     |
| 5150                | 30.19    | -5.2      | 1.58       | -1.57      | 19.324  | 10.861  | 1.58     | -16.9    | 6.78              | 30              | 57.03     | 57.26     |
| 5250                | 27.36    | -5.63     | 0.83       | -2.32      | 17.24   | 10.119  | 0.83     | -19.54   | 6.46              | 60              | 56.42     | 56.34     |
| 5350                | 27.35    | -5.63     | 1.86       | -1.29      | 14.374  | 12.975  | 1.86     | -19.65   | 7.49              | 90              | 56.72     | 56.77     |
| 5450                | 32.72    | -4.85     | 3.31       | -1.16      | 13.748  | 18.97   | 3.31     | -19.22   | 8.16              | 90              | 56.86     | 57.62     |
| 5550                | 39.5     | -4.03     | 3.63       | -1         | 15.724  | 23.772  | 3.63     | -21.31   | 7.66              | 90              | 58.37     | 59.35     |
| 5650                | 33.96    | -4.69     | 2.06       | -2.09      | 15.499  | 18.46   | 2.06     | -18.96   | 6.75              | 90              | 59        | 59.74     |
| 5750                | 30.2     | -5.2      | 0.49       | -2.66      | 16.923  | 13.279  | 0.49     | -15.02   | 5.69              | 90              | 59.01     | 59.89     |
| 5850                | 30.88    | -5.1      | 0.37       | -2.78      | 18.951  | 11.926  | 0.37     | -14.95   | 5.47              | 60              | 60.11     | 60.72     |
| 5950                | 37.73    | -4.23     | 2.61       | -1.46      | 23.888  | 13.837  | 2.61     | -21.79   | 6.85              | 90              | 61.2      | 62.61     |

## WIFI Active data

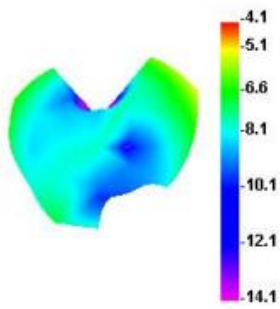
|                 |                  |        |        |                  |        |        |
|-----------------|------------------|--------|--------|------------------|--------|--------|
| Test            | 802.11b : 11Mbps |        |        |                  |        |        |
| Result          | 1                | 7      | 13     |                  |        |        |
| Frequency (MHz) | 2412             | 2442   | 2472   |                  |        |        |
| TRP (dBm)       | 11.16            | 12.25  | 12.38  |                  |        |        |
| TIS (dBm)       | -81.37           | -82.12 | -82.32 |                  |        |        |
| Test            | 802.11g : 54Mbps |        |        | 802.11a : 54Mbps |        |        |
| Result          | 1                | 7      | 13     | 36               | 64     | 165    |
| Frequency (MHz) | 2412             | 2442   | 2472   | 5180             | 5320   | 5825   |
| TRP (dBm)       | 10.5             | 10.27  | 10.58  | 12.21            | 11.05  | 12.62  |
| TIS (dBm)       | -69.56           | -70.34 | -69.51 | -71.87           | -72.21 | -73.72 |
| Test            | 802.11n : MCS7   |        |        | 802.11n : MCS7   |        |        |
| Result          | 1                | 7      | 13     | 36               | 64     | 165    |
| Frequency (MHz) | 2412             | 2442   | 2472   | 5180             | 5320   | 5825   |
| TRP (dBm)       | 10.35            | 11.12  | 10.19  | 12.34            | 11.28  | 12.7   |
| TIS (dBm)       | -65.21           | -66.59 | -65.11 | -69.38           | -69.66 | -69.17 |

## 五: Signal measurement:

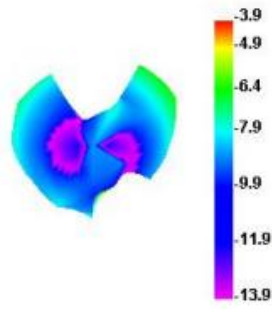


## 六:3D pattern

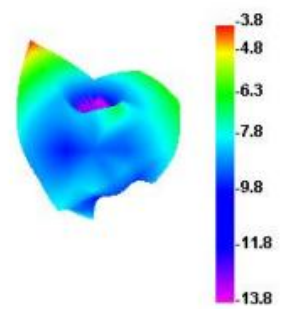
2400.000MHz



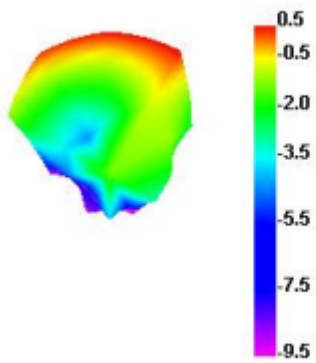
2450.000MHz



2500.000MHz



5050.000MHz



5550.000MHz

