Report No. : FR3N2709AD





# **RADIO TEST REPORT**

| FCC ID       | : TLZ-CU5XX  |
|--------------|--|
| Equipment    | : Wireless MCU with Integrated Tri-radio Wi-Fi 6 +<br>BLE 5.3/802.15.4 LGA module, Wireless MCU with<br>Integrated Wi Fi 6 and Bluetooth Low Energy 5. 3<br>Module |
| Brand Name   | : AzureWave  |
| Model Name   | : AW-CU570, AW-CU598   |
| Applicant    | : AzureWave Technologies, Inc.<br>8F., No.94, Baozhong Rd. , Xindian Dist., New Taipei<br>City , Taiwan 231  |
| Manufacturer | : AzureWave Technologies, Inc.<br>8F., No.94, Baozhong Rd. , Xindian Dist., New Taipei<br>City , Taiwan 231  |
| Standard     | : 47 CFR FCC Part 15.247   |

The product was received on Dec. 12, 2023, and testing was started from Dec. 26, 2023 and completed on Jun. 14, 2024. We, Sporton International Inc. Hsinchu Laboratory, would like to declare that the tested sample has been evaluated in accordance with the procedures given in ANSI C63.10-2013 and shown compliance with the applicable technical standards.

The test results in this report apply exclusively to the tested model / sample. Without written approval of Sporton International Inc. Hsinchu Laboratory, the test report shall not be reproduced except in full.

Approved by: Rex Liao

Sporton International Inc. Hsinchu Laboratory No.8, Ln. 724, Bo'ai St., Zhubei City, Hsinchu County 302010, Taiwan (R.O.C.)

TEL : 886-3-656-9065 FAX : 886-3-656-9085 Report Template No.: CB-A10\_8 Ver1.3 Page Number : 1 of 30 Issued Date : Jun. 28, 2024 Report Version : 01



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#### Photographs of EUT v01



# History of this test report

| Report No. | Version | Description             | Issued Date   |
|------------|---------|-------------------------|---------------|
| FR3N2709AD | 01      | Initial issue of report | Jun. 28, 2024 |
|            |         |                         |               |
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|            |         |                         |               |



# Summary of Test Result

| Report<br>Clause | Ref Std.<br>Clause | Test Items                                     | Result<br>(PASS/FAIL) | Remark |
|------------------|--------------------|--|-----------------------|--------|
| 1.1.2            | 15.203             | Antenna Requirement                            | PASS                  | -      |
| 3.1              | 15.207             | AC Power-line Conducted Emissions              | PASS                  | -      |
| 4.1              | 15.247(a)          | DTS Bandwidth                                  | PASS                  | -      |
| 4.2              | 15.247(b)          | Maximum Conducted Output Power                 | PASS                  | -      |
| 4.3              | 15.247(e)          | Power Spectral Density                         | PASS                  | -      |
| 4.4              | 15.247(d)          | Emissions in Non-restricted Frequency<br>Bands | PASS                  | -      |
| 4.5              | 15.247(d)          | Emissions in Restricted Frequency Bands        | PASS                  | -      |

#### Conformity Assessment Condition:

- 1. The test results (PASS/FAIL) with all measurement uncertainty excluded are presented against the regulation limits or in accordance with the requirements stipulated by the applicant/manufacturer who shall bear all the risks of non-compliance that may potentially occur if measurement uncertainty is taken into account.
- 2. The measurement uncertainty please refer to each test result in the chapter "Measurement Uncertainty".

#### **Disclaimer:**

The product specifications of the EUT presented in the test report that may affect the test assessments are declared by the manufacturer who shall take full responsibility for the authenticity.

Reviewed by: Sam Chen Report Producer: Sophia Shiung



# **1** General Description

### 1.1 Information

#### 1.1.1 RF General Information

| Frequency Range | Mode   | Ch. Frequency (MHz) | Channel Number |
|-----------------|--------|---------------------|----------------|
| 2400–2483.5 MHz | Thread | 2405-2480           | 11-26 [16]     |

| Band          | Mode   | BWch (MHz) | Nant |
|---------------|--------|------------|------|
| 2.4-2.4835GHz | Thread | 3          | 1TX  |

Note:

• BWch is the nominal channel bandwidth.

• Thread uses a O-QPSK modulation.



#### 1.1.2 Antenna Information

| Ant. | Brand     | Model Name        | Antenna Type | Connector | Gain (dBi) |
|------|-----------|-------------------|--------------|-----------|------------|
| 1    | ARISTOTLE | RFA-27-C38H1-C198 | Dipole       | u.FL      |            |
| 2    | Molex     | 2128600011        | Dipole       | u.FL      | Note 1     |
| 3    | LYNwave   | 2570              | РСВ          | N/A       |            |

Note 1:

| Note 1 |             |           |           |        |             |           |           |        |
|--------|-------------|-----------|-----------|--------|-------------|-----------|-----------|--------|
| A      | Port        |           |           |        | Gain (dBi   | )         |           |        |
| Ant.   | WLAN 2.4GHz | WLAN 5GHz | Bluetooth | Thread | WLAN 2.4GHz | WLAN 5GHz | Bluetooth | Thread |
| 1      | -           | 1         | -         | -      | 3           | 5         | 3         | 3      |
| 2      | 1           | -         | 1         | 1      | Note 2      |           |           |        |
| 3      | 1           | 1         | 1         | 1      | 2.2         | 4.4       | 2.2       | 2.2    |

Note 2: The Ant. 2 has one RF cable (Brand: TE Connectivity / Model Name: Linx Connectivity / Remark: 11.5cm), and its gains are listed below.

| Ant  | Gain (dBi)    |             |           |           |        |  |  |
|------|---------------|-------------|-----------|-----------|--------|--|--|
| Ant. |               | WLAN 2.4GHz | WLAN 5GHz | Bluetooth | Thread |  |  |
|      | Max Peak Gain | 5.3         | 4.5       | 5.3       | 5.3    |  |  |
| 2    | Cable Loss    | 0.34        | 0.34      | 0.34      | 0.34   |  |  |
|      | Net Gain      | 4.96        | 4.16      | 4.96      | 4.96   |  |  |

Note 3: The above information was declared by manufacturer.

#### Note 4: For RF Conducted tests:

The Ant. 2 in WLAN 2.4GHz / Bluetooth / Thread and the Ant. 1 in WLAN 5GHz have higher gain than others in the same band. Therefore, they were selected to perform the test.

#### For AC Conduction and Radiated tests:

The EUT has two types of antenna. The antennas with higher gain in each band of each type were selected to test and their data were recorded in this report. Thus, Ant. 1 & Ant. 3 were selected to test WLAN 5GHz, and Ant. 2 & Ant. 3 were selected to test WLAN 2.4GHz / Bluetooth / Thread.

#### Note 5: For 2.4GHz function:

#### For IEEE 802.11 b/g/n/VHT/ax (1TX/1RX):

Only Port 1 can be used as transmitting/receiving antenna.

For 5GHz function:

#### For IEEE 802.11a/n/ac/ax (1TX/1RX):

Only Port 1 can be used as transmitting/receiving antenna.

#### For bluetooth function (1TX/1RX):

Only Port 1 can be used as transmitting/receiving antenna.

#### For Thread function (1TX/1RX):

Only Port 1 can be used as transmitting/receiving antenna.



#### 1.1.3 Mode Test Duty Cycle

| Mode         | DC | DCF<br>(dB) | Т<br>(s)       | VBW<br>(Hz)_1/T |
|--------------|----|-------------|----------------|-----------------|
| Thread_Nss 1 | 1  | 0           | n/a (DC>=0.98) | n/a (DC>=0.98)  |

Note:

• DC is Duty Cycle.

DCF is Duty Cycle Factor.

#### 1.1.4 EUT Operational Condition

| EUT Power Type        | From host system                    |  |  |
|-----------------------|-------------------------------------|--|--|
| Function              | Point-to-multipoint Depint-to-point |  |  |
| Test Software Version | DutApiMimoApApp 2.0.0.2             |  |  |

Note: The above information was declared by manufacturer.

#### 1.1.5 Table for Multiple Listing

The two EUTs are identical except for the difference listed below:

| EUT | Equipment Name                                   | Model Name | Thread Function |  |
|-----|--|------------|-----------------|--|
| 1   | Wireless MCU with Integrated Tri-radio Wi-Fi 6 + | AW-CU570   |                 |  |
| 1   | BLE 5.3/802.15.4 LGA module                      | AW-C0570   | v               |  |
| 2   | Wireless MCU with Integrated Wi Fi 6 and         |            | Y               |  |
| 2   | Bluetooth Low Energy 5. 3 Module                 | AW-CU598   | X               |  |

Note 1: From the above EUTs, EUT 1 (AW-CU570) was selected as representative EUT for the test and its data was recorded in this report.

Note 2: The above information was declared by manufacturer.



### **1.2 Applicable Standards**

According to the specifications of the manufacturer, the EUT must comply with the requirements of the following standards:

- 47 CFR FCC Part 15.247
- ANSI C63.10-2013

The following reference test guidance is not within the scope of accreditation of TAF.

- FCC KDB 558074 D01 v05r02
- FCC KDB 414788 D01 v01r01

### **1.3 Testing Location Information**

# Testing Location Information

Test Lab. : Sporton International Inc. Hsinchu LaboratoryHsinchuADD: No.8, Ln. 724, Bo'ai St., Zhubei City, Hsinchu County 302010, Taiwan (R.O.C.)(TAF: 3787)TEL: 886-3-656-9065FAX: 886-3-656-9085Test site Designation No. TW3787 with FCC.Conformity Assessment Body Identifier (CABID) TW3787 with ISED.

| Test Condition  | Test Site No. | Test Engineer | Test Environment<br>(°C / %) | Test Date                       |
|-----------------|---------------|---------------|------------------------------|---------------------------------|
| RF Conducted    | TH02-CB       | Mason Chan    | 21.1~22.8 / 63~67            | Dec. 28, 2023~<br>Mar. 01, 2024 |
| Radiated < 1GHz | 03CH01-CB     | Paul Hu       | 22.4-23.5 / 55-58            | Feb. 07, 2024~                  |
|                 | 03CH04-CB     | Faui Fu       | 21-22 / 56-59                | May 23, 2024                    |
| Radiated > 1GHz | 03CH01-CB     | Paul Hu       | 22.4~23.5 / 55~58            | Dec. 26, 2023~                  |
| Raulaleu > TGHZ | 03CH06-CB     | Faul Fu       | 21.9~22.8 / 56~58            | Feb. 29, 2024                   |
| AC Conduction   | CO01-CB       | Tim Chen      | 20~21 / 63~64                | Feb. 22, 2024~<br>Jun. 14, 2024 |



### **1.4 Measurement Uncertainty**

ISO/IEC 17025 requires that an estimate of the measurement uncertainties associated with the emissions test results be included in the report. The measurement uncertainties given below are based on a 95% confidence level (based on a coverage factor (k=2)

| Test Items                           | Uncertainty | Remark                   |
|--------------------------------------|-------------|--------------------------|
| Conducted Emission (150kHz ~ 30MHz)  | 3.4 dB      | Confidence levels of 95% |
| Radiated Emission (9kHz ~ 30MHz)     | 3.7 dB      | Confidence levels of 95% |
| Radiated Emission (30MHz ~ 1,000MHz) | 5.1 dB      | Confidence levels of 95% |
| Radiated Emission (1GHz ~ 18GHz)     | 4.1 dB      | Confidence levels of 95% |
| Radiated Emission (18GHz ~ 40GHz)    | 4.2 dB      | Confidence levels of 95% |
| Conducted Emission                   | 3.1 dB      | Confidence levels of 95% |
| Output Power Measurement             | 0.8 dB      | Confidence levels of 95% |
| Power Density Measurement            | 3.1 dB      | Confidence levels of 95% |
| Bandwidth Measurement                | 2.2%        | Confidence levels of 95% |



# 2 Test Configuration of EUT

### 2.1 Test Channel Mode

| Mode                 |
|----------------------|
| Thread_3MHz_Nss1_1TX |
| 2405MHz              |
| 2440MHz              |
| 2475MHz              |
| 2480MHz              |

# 2.2 The Worst Case Measurement Configuration

| Th                           | e Worst Case Mode for Following Conformance Tests                                       |  |  |
|------------------------------|---|--|--|
| Tests Item                   | AC power-line conducted emissions   |  |  |
| Condition                    | AC power-line conducted measurement for line and neutral<br>Test Voltage: 120Vac / 60Hz |  |  |
| Operating Mode               | CTX   |  |  |
| 1                            | EUT 1 + Ant. 2_Thread   |  |  |
| 2                            | EUT 1 + Ant. 2_Bluetooth  |  |  |
| 3                            | EUT 1 + Ant. 2_WLAN 2.4GHz  |  |  |
| 4                            | EUT 1 + Ant. 1_WLAN 5GHz  |  |  |
| 5                            | EUT 1 + Ant. 3_Thread   |  |  |
| 6                            | EUT 1 + Ant. 3_Bluetooth  |  |  |
| 7                            | EUT 1 + Ant. 3_WLAN 2.4GHz  |  |  |
| 8                            | EUT 1 + Ant. 3_WLAN 5GHz  |  |  |
| For operating, mode 6 is the | For operating, mode 6 is the worst case and it was recorded in this test report.        |  |  |

| Th             | The Worst Case Mode for Following Conformance Tests |  |  |
|----------------|---|--|--|
| Tests Item     | Maxi<br>Pow<br>Maxi                                 | Bandwidth<br>mum Conducted Output Power<br>er Spectral Density<br>mum Conducted Output Power<br>ssions in Non-restricted Frequency Bands |  |
| Test Condition | Cond  | Conducted measurement at transmit chains   |  |
| Test Mode      | 1 EUT 1 + Ant. 2                                    |  |  |



| Th                           | The Worst Case Mode for Following Conformance Tests   |  |  |
|------------------------------|---|--|--|
| Tests Item                   | Emissions in Restricted Frequency Bands   |  |  |
| Test Condition               | Radiated measurement<br>If EUT consist of multiple antenna assembly (multiple antenna are used in EUT<br>regardless of spatial multiplexing MIMO configuration), the radiated test should<br>be performed with highest antenna gain of each antenna type. |  |  |
|                              | СТХ   |  |  |
| Operating Mode < 1GHz        | The EUT was performed at X axis, Y axis and Z axis position in Radiated Emission test > 1GHz, and the worst case was found at Y axis. Thus, the measurement will follow this same test configuration.   |  |  |
| 1                            | EUT 1 in Y axis + Ant. 2_WLAN 2.4GHz  |  |  |
| 2                            | EUT 1 in Y axis + Ant. 2_Bluetooth  |  |  |
| 3                            | EUT 1 in Y axis + Ant. 2_Thread   |  |  |
| 4                            | EUT 1 in Y axis + Ant. 1_WLAN 5GHz  |  |  |
| 5                            | EUT 1 in Y axis + Ant. 3_WLAN 2.4GHz  |  |  |
| 6                            | EUT 1 in Y axis + Ant. 3_Bluetooth  |  |  |
| 7                            | EUT 1 in Y axis + Ant. 3_Thread   |  |  |
| 8                            | EUT 1 in Y axis + Ant. 3_WLAN 5GHz  |  |  |
| For operating, mode 2 is the | ne worst case and it was recorded in this test report.  |  |  |
|                              | СТХ   |  |  |
| Operating Mode > 1GHz        | The EUT was performed at X axis, Y axis and Z axis position, and the worst case was found at Y axis. Thus, the measurement will follow this same test configuration.  |  |  |
| 1                            | EUT 1 in Y axis + Ant. 2  |  |  |
| 2                            | EUT 1 in Y axis + Ant. 3  |  |  |

### 2.3 EUT Operation during Test

The EUT was programmed to be in continuously transmitting mode.

### 2.4 Accessories

N/A

### 2.5 Support Equipment

For AC Conduction:

| Support Equipment |           |            |            |        |
|-------------------|-----------|------------|------------|--------|
| No.               | Equipment | Brand Name | Model Name | FCC ID |
| А                 | Fixture   | AzureWave  | 2570-i4    | N/A    |
| В                 | NB        | DELL       | E6430      | N/A    |



#### For Radiated < 1GHz:

|     | Support Equipment |            |            |        |  |
|-----|-------------------|------------|------------|--------|--|
| No. | Equipment         | Brand Name | Model Name | FCC ID |  |
| А   | Fixture           | AzureWave  | 2570-i4    | N/A    |  |
| В   | DC Power Supply   | MOTECH     | LPS-305    | N/A    |  |

#### For Radiated > 1GHz:

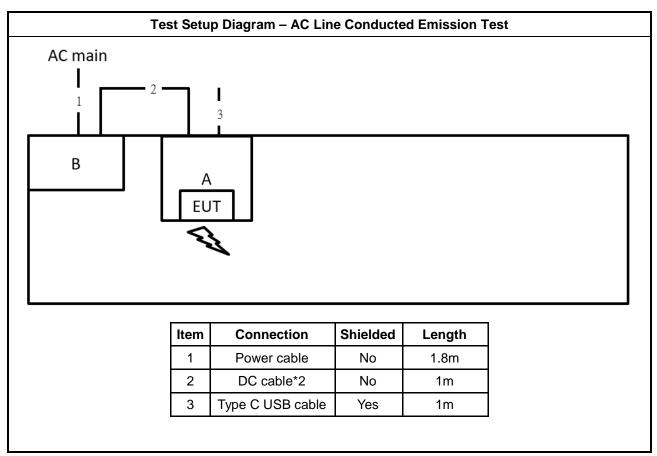
|     | Support Equipment                          |           |         |     |  |
|-----|--|-----------|---------|-----|--|
| No. | No. Equipment Brand Name Model Name FCC ID |           | FCC ID  |     |  |
| А   | Fixture                                    | AzureWave | 2570-i4 | N/A |  |
| В   | DC Power Supply                            | MOTECH    | LPS-305 | N/A |  |
| С   | NB   | DELL      | E4300   | N/A |  |

#### For RF Conducted:

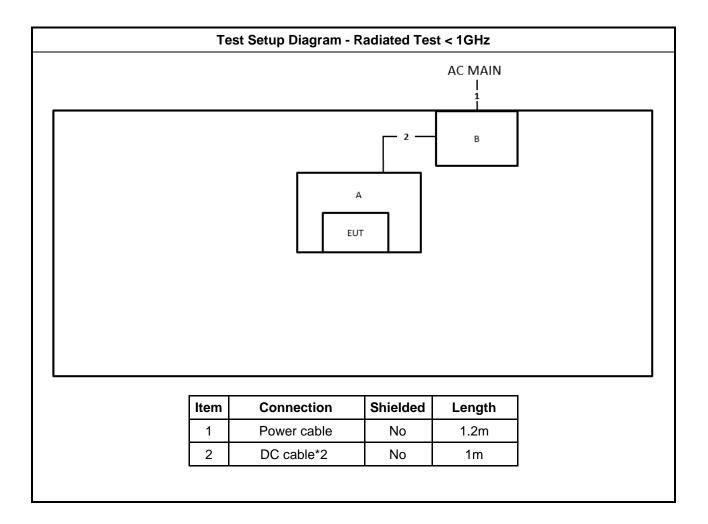
|     | Support Equipment                          |           |         |     |
|-----|--|-----------|---------|-----|
| No. | No. Equipment Brand Name Model Name FCC ID |           |         |     |
| А   | NB   | DELL      | E4300   | N/A |
| В   | Fixture                                    | AzureWave | 2570-i4 | N/A |



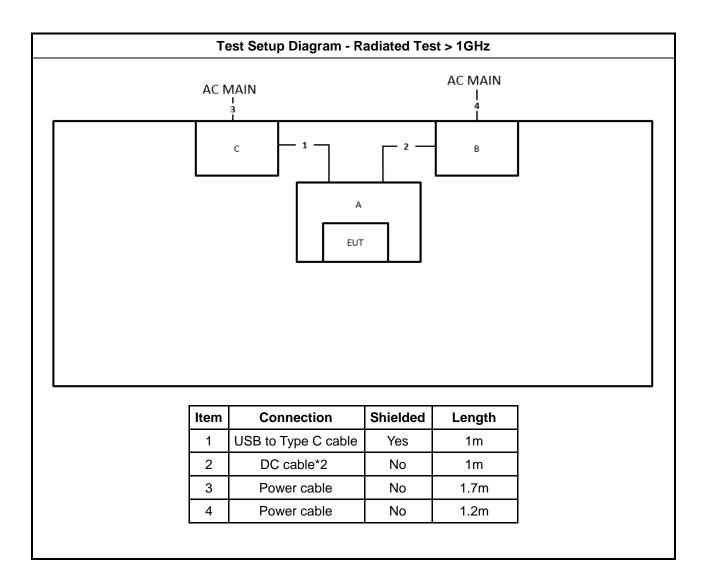
# 2.6 Test Setup Diagram













### 3 Test Result

### 3.1 AC Power-line Conducted Emissions

#### 3.1.1 AC Power-line Conducted Emissions Limit

| AC Power-line Conducted Emissions Limit                  |            |           |  |
|--|------------|-----------|--|
| Frequency Emission (MHz)                                 | Quasi-Peak | Average   |  |
| 0.15-0.5   | 66 - 56 *  | 56 - 46 * |  |
| 0.5-5  | 56         | 46        |  |
| 5-30   | 60         | 50        |  |
| Note 1: * Decreases with the logarithm of the frequency. |            |           |  |

5

### 3.1.2 Measuring Instruments

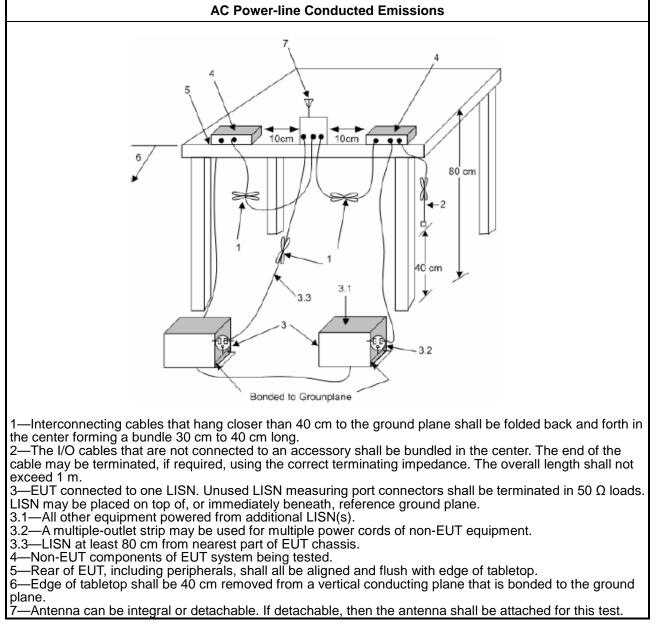
Refer a test equipment and calibration data table in this test report.

#### 3.1.3 Test Procedures

Test Method

• Refer as **ANSI C63.10-2013**, clause 6.2 for AC power-line conducted emissions.

### 3.1.4 Test Setup



#### 3.1.5 Measurement Results Calculation

The measured Level is calculated using:

- a. Corrected Reading: LISN Factor (LISN) + Attenuator (AT/AUX) + Cable Loss (CL) + Read Level (Raw) = Level
- b. Margin = -Limit + Level

#### 3.1.6 Test Result of AC Power-line Conducted Emissions

Refer as Appendix A



# 4 Transmitter Test Result – DTS

### 4.1 DTS Bandwidth

#### 4.1.1 6dB Bandwidth Limit

| 6dB Bandwidth Limit                           |
|---|
| Systems using digital modulation techniques:  |
| <ul> <li>6 dB bandwidth ≥ 500 kHz.</li> </ul> |

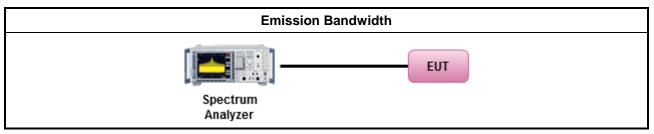
#### 4.1.2 Measuring Instruments

Refer a test equipment and calibration data table in this test report.

#### 4.1.3 Test Procedures

|  | Test Method  |   |  |  |  |  |  |  |
|--|--|---|--|--|--|--|--|--|
| •  | <ul> <li>For the emission bandwidth shall be measured using one of the options below:</li> </ul> |   |  |  |  |  |  |  |
| Refer as FCC KDB 558074, clause 8.2 & C63.10 clause 11.8.1 Option 1 for 6 dB ba measurement. |  |   |  |  |  |  |  |  |
|  |  | Refer as FCC KDB 558074, clause 8.2 & C63.10 clause 11.8.2 Option 2 for 6 dB bandwidth measurement. |  |  |  |  |  |  |
|  |  | Refer as ANSI C63.10, clause 6.9.1 for occupied bandwidth testing.                                  |  |  |  |  |  |  |

#### 4.1.4 Test Setup



### 4.1.5 Test Result of Emission Bandwidth

Refer as Appendix B



### 4.2 Maximum Conducted Output Power

#### 4.2.1 Maximum Conducted Output Power Limit

#### **Maximum Conducted Output Power Limit**

| I I $G_T X \ge 0$ (III), III POut $\ge 30$ (IIII) (I VV) |  | If $G_{TX} \le 6 \text{ dBi}$ , then $P_{Out} \le 30 \text{ dBm}$ (1 \ | N) |
|--|--|--|----|
|--|--|--|----|

| • | Point-to-multipoint systems | (P2M): If G <sub>TX</sub> > 6 dBi, t | hen $P_{Out} = 30 - (G_{TX} - 6) dBm$ |
|---|-----------------------------|--------------------------------------|---------------------------------------|
|---|-----------------------------|--------------------------------------|---------------------------------------|

- Point-to-point systems (P2P): If  $G_{TX} > 6$  dBi, then  $P_{Out} = 30 (G_{TX} 6)/3$  dBm
- Smart antenna system (SAS):
  - Single beam: If  $G_{TX} > 6$  dBi, then  $P_{Out} = 30 (G_{TX} 6)/3$  dBm
  - Overlap beam: If  $G_{TX} > 6 \text{ dBi}$ , then  $P_{Out} = 30 (G_{TX} 6)/3 \text{ dBm}$
  - Aggregate power on all beams: If  $G_{TX} > 6$  dBi, then  $P_{Out} = 30 (G_{TX} 6)/3 + 8$ dB dBm

 $P_{Out}$  = maximum peak conducted output power or maximum conducted output power in dBm,  $G_{TX}$  = the maximum transmitting antenna directional gain in dBi.

#### 4.2.2 Measuring Instruments

Refer a test equipment and calibration data table in this test report.

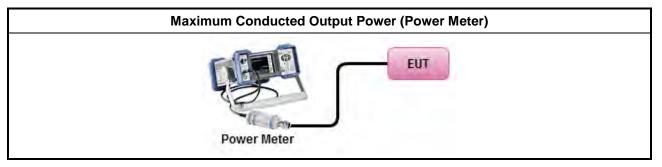
#### 4.2.3 Test Procedures

|  | Test Method  |  |  |  |  |  |  |
|--|--|--|--|--|--|--|--|
| •  | Maximum Peak Conducted Output Power  |  |  |  |  |  |  |
|  | Refer as FCC KDB 558074, clause 8.3.1.1 & C63.10 clause 11.9.1.1 (RBW ≥ EBW method).                                     |  |  |  |  |  |  |
|  | Refer as FCC KDB 558074, clause 8.3.1.3 & C63.10 clause 11.9.1.3 (peak power meter).                                     |  |  |  |  |  |  |
| •  | Maximum Conducted Output Power   |  |  |  |  |  |  |
|  | [duty cycle ≥ 98% or external video / power trigger]   |  |  |  |  |  |  |
|  | Refer as FCC KDB 558074, clause 8.3.2.2 & C63.10 clause 11.9.2.2.2 Method AVGSA-1.                                       |  |  |  |  |  |  |
| Refer as FCC KDB 558074, clause 8.3.2.2 & C63.10 clause 11.9.2.2.3 Method AVGSA (alternative)                  |  |  |  |  |  |  |  |
|  | duty cycle < 98% and average over on/off periods with duty factor  |  |  |  |  |  |  |
| Refer as FCC KDB 558074, clause 8.3.2.2 & C63.10 clause 11.9.2.2.4 Method AVGSA-2.                             |  |  |  |  |  |  |  |
| Refer as FCC KDB 558074, clause 8.3.2.2 & C63.10 clause 11.9.2.2.5 Method AVGS (alternative)                   |  |  |  |  |  |  |  |
|  | Refer as FCC KDB 558074, clause 8.3.2.2 & C63.10 clause 11.9.2.2.6 Method AVGSA-3  |  |  |  |  |  |  |
|  | Refer as FCC KDB 558074, clause 8.3.2.2 & C63.10 clause 11.9.2.2.7 Method AVGSA-3 (alternative)                          |  |  |  |  |  |  |
|  | Measurement using a power meter (PM)   |  |  |  |  |  |  |
| Refer as FCC KDB 558074, clause 8.3.2.3 & C63.10 clause 11.9.2.3.1 Method AVGPM (usin RF average power meter). |  |  |  |  |  |  |  |
|  | Refer as FCC KDB 558074, clause 8.3.2.3 & C63.10 clause 11.9.2.3.2 Method AVGPM-G (usin an gate RF average power meter). |  |  |  |  |  |  |
| TEI  | TEL: 886-3-656-9065 Page Number 19 of 30   |  |  |  |  |  |  |



| • | For conducted measurement.   |  |  |  |  |  |
|---|--|--|--|--|--|--|
|   | <ul> <li>If the EUT supports multiple transmit chains using options given below:<br/>Refer as FCC KDB 662911, In-band power measurements. Using the measure-and-sum<br/>approach, measured all transmit ports individually. Sum the power (in linear power units e.g., mW)<br/>of all ports for each individual sample and save them.</li> </ul> |  |  |  |  |  |
|   | <ul> <li>If multiple transmit chains, EIRP calculation could be following as methods:<br/>P<sub>total</sub> = P<sub>1</sub> + P<sub>2</sub> + + P<sub>n</sub><br/>(calculated in linear unit [mW] and transfer to log unit [dBm])<br/>EIRP<sub>total</sub> = P<sub>total</sub> + DG     </li> </ul>  |  |  |  |  |  |

### 4.2.4 Test Setup



### 4.2.5 Test Result of Maximum Conducted Output Power

Refer as Appendix C



### 4.3 **Power Spectral Density**

### 4.3.1 Power Spectral Density Limit

| Power Spectral Density Limit            |  |  |  |  |
|---|--|--|--|--|
| Power Spectral Density (PSD)≤8 dBm/3kHz |  |  |  |  |

#### 4.3.2 Measuring Instruments

Refer a test equipment and calibration data table in this test report.

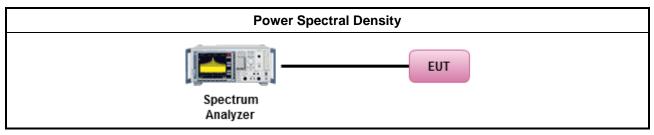
#### 4.3.3 Test Procedures

•

|   | Test Method  |   |  |  |  |  |  |  |
|---|--|---|--|--|--|--|--|--|
|   | Peak power spectral density procedures that the same method as used to determine the conducted output power. If maximum peak conducted output power was measured to demonstrate compliance to the output power limit, then the peak PSD procedure below (Method PKPSD) shall be used. If maximum conducted output power was measured to demonstrate compliance to the output power limit, then one of the average PSD procedures shall be used, as applicable based on the following criteria (the peak PSD procedure is also an acceptable option). |   |  |  |  |  |  |  |
|   | $\square$  | Refer as FCC KDB 558074, clause 8.4 & C63.10 clause 11.10 Method Max. PSD.  |  |  |  |  |  |  |
| • | For  | conducted measurement.  |  |  |  |  |  |  |
|   | •  | If The EUT supports multiple transmit chains using options given below:   |  |  |  |  |  |  |
|   |  | Option 1: Measure and sum the spectra across the outputs. Refer as FCC KDB 662911,<br>In-band power spectral density (PSD). Sample all transmit ports simultaneously using a<br>spectrum analyzer for each transmit port. Where the trace bin-by-bin of each transmit port<br>summing can be performed. (i.e., in the first spectral bin of output 1 is summed with that in the<br>first spectral bin of output 2 and that from the first spectral bin of output 3, and so on up to the<br>NTX output to obtain the value for the first frequency bin of the summed spectrum.). Add up<br>the amplitude (power) values for the different transmit chains and use this as the new data<br>trace. |  |  |  |  |  |  |
|   |  | Option 2: Measure and sum spectral maxima across the outputs. With this technique, spectra are measured at each output of the device at the required resolution bandwidth. The maximum value (peak) of each spectrum is determined. These maximum values are then summed mathematically in linear power units across the outputs. These operations shall be performed separately over frequency spans that have different out-of-band or spurious emission limits,  |  |  |  |  |  |  |
|   |  | Option 3: Measure and add 10 log(N) dB, where N is the number of transmit chains. Refer as FCC KDB 662911, In-band power spectral density (PSD). Performed at each transmit chains and each transmit chains shall be compared with the limit have been reduced with 10 log(N). Or each transmit chains shall be add 10 log(N) to compared with the limit.   |  |  |  |  |  |  |



### 4.3.4 Test Setup



#### 4.3.5 Test Result of Power Spectral Density

Refer as Appendix D



### 4.4 Emissions in Non-restricted Frequency Bands

#### 4.4.1 Emissions in Non-restricted Frequency Bands Limit

| Un-restricted Band Emissions Limit |            |  |  |  |  |
|------------------------------------|------------|--|--|--|--|
| RF output power procedure          | Limit (dB) |  |  |  |  |
| Peak output power procedure        | 20         |  |  |  |  |
| Average output power procedure     | 30         |  |  |  |  |

Note 1: If the peak output power procedure is used to measure the fundamental emission power to demonstrate compliance to requirements, then the peak conducted output power measured within any 100 kHz outside the authorized frequency band shall be attenuated by at least 20 dB relative to the maximum measured in-band peak PSD level.

Note 2: If the average output power procedure is used to measure the fundamental emission power to demonstrate compliance to requirements, then the power in any 100 kHz outside of the authorized frequency band shall be attenuated by at least 30 dB relative to the maximum measured in-band average PSD level.

#### 4.4.2 Measuring Instruments

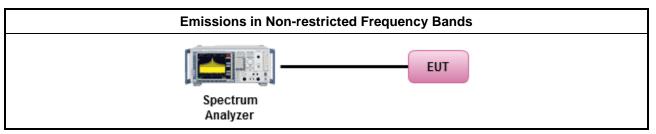
Refer a test equipment and calibration data table in this test report.

#### 4.4.3 Test Procedures

Test Method

Refer as FCC KDB 558074, clause 8.5 for unwanted emissions into non-restricted bands.

#### 4.4.4 Test Setup



#### 4.4.5 Test Result of Emissions in Non-restricted Frequency Bands

Refer as Appendix E



### 4.5 Emissions in Restricted Frequency Bands

#### 4.5.1 Emissions in Restricted Frequency Bands Limit

| Restricted Band Emissions Limit                     |                       |                         |                      |  |  |  |  |  |
|---|-----------------------|-------------------------|----------------------|--|--|--|--|--|
| Frequency Range (MHz)                               | Field Strength (uV/m) | Field Strength (dBuV/m) | Measure Distance (m) |  |  |  |  |  |
| 0.009~0.490 2400/F(kHz)                             |                       | 48.5 - 13.8             | 300                  |  |  |  |  |  |
| 0.490~1.705   | 24000/F(kHz)          | 33.8 - 23               | 30                   |  |  |  |  |  |
| 1.705~30.0  | 30                    | 29                      | 30                   |  |  |  |  |  |
| 30~88 100   |                       | 40                      | 3                    |  |  |  |  |  |
| 88~216  | 150                   | 43.5                    | 3                    |  |  |  |  |  |
| 216~960         200           Above 960         500 |                       | 46                      | 3                    |  |  |  |  |  |
|   |                       | 54                      | 3                    |  |  |  |  |  |

Note 1: Test distance for frequencies at or above 30 MHz, measurements may be performed at a distance other than the limit distance provided they are not performed in the near field and the emissions to be measured can be detected by the measurement equipment. When performing measurements at a distance other than that specified, the results shall be extrapolated to the specified distance using an extrapolation factor of 20 dB/decade (inverse of linear distance for field-strength measurements, inverse of linear distance-squared for power-density measurements).

Note 2: Test distance for frequencies at below 30 MHz, measurements may be performed at a distance closer than the EUT limit distance; however, an attempt should be made to avoid making measurements in the near field. When performing measurements below30 MHz at a closer distance than the limit distance, the results shall be extrapolated to the specified distance by either making measurements at a minimum of two or more distances on at least one radial to determine the proper extrapolation factor or by using the square of an inverse linear distance extrapolation factor (40 dB / decade). The test report shall specify the extrapolation method used to determine compliance of the EUT.

Note 3: Using the distance of 1m during the test for above 18 GHz, and the test value to correct for the distance factor at 3m.

#### 4.5.2 Measuring Instruments

Refer a test equipment and calibration data table in this test report.

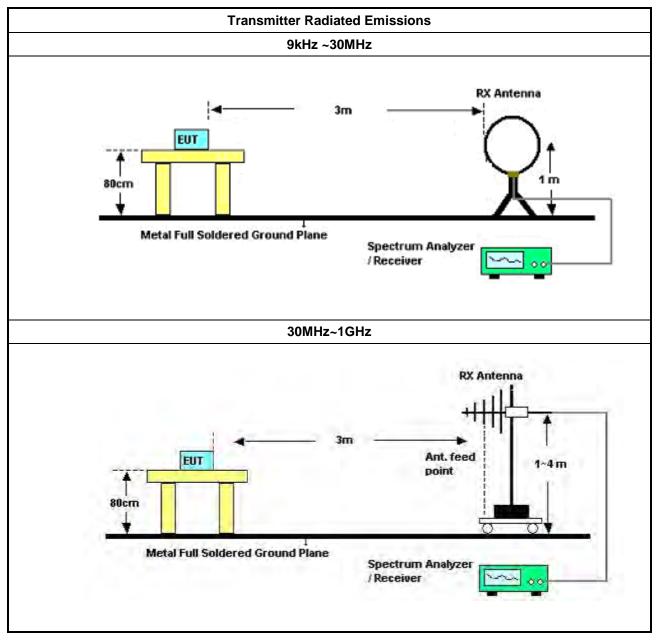


### 4.5.3 Test Procedures

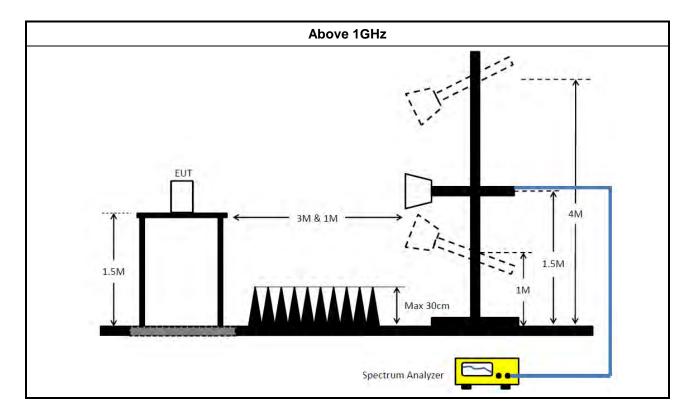
|   | Test Method  |  |  |  |  |  |  |
|---|--|--|--|--|--|--|--|
| • | The average emission levels shall be measured in [duty cycle $\geq$ 98 or duty factor].  |  |  |  |  |  |  |
| • | Refer as ANSI C63.10, clause 6.10.3 band-edge testing shall be performed at the lowest frequency channel and highest frequency channel within the allowed operating band.  |  |  |  |  |  |  |
| • | <ul> <li>For the transmitter unwanted emissions shall be measured using following options below:</li> </ul>  |  |  |  |  |  |  |
|   | <ul> <li>Refer as FCC KDB 558074, clause 8.6 for unwanted emissions into restricted bands.</li> </ul>  |  |  |  |  |  |  |
|   | Refer as FCC KDB 558074, clause 8.6 & C63.10 clause 11.12.2.5.1(trace averaging for duty cycle ≥98%).  |  |  |  |  |  |  |
|   | Refer as FCC KDB 558074, clause 8.6 & C63.10 clause 11.12.2.5.2(trace averaging + duty factor).  |  |  |  |  |  |  |
|   | ☑ Refer as FCC KDB 558074, clause 8.6 & C63.10 clause 11.12.2.5.3(Reduced VBW≥1/T).  |  |  |  |  |  |  |
|   | □ Refer as ANSI C63.10, clause 11.12.2.5.3 (Reduced VBW). VBW $\ge$ 1/T, where T is pulse time.  |  |  |  |  |  |  |
|   | Refer as ANSI C63.10, clause 7.5 average value of pulsed emissions.  |  |  |  |  |  |  |
|   | Refer as FCC KDB 558074, clause 8.6 & C63.10 clause 11.12.2.4 measurement procedure peak limit.  |  |  |  |  |  |  |
| • | For the transmitter band-edge emissions shall be measured using following options below:   |  |  |  |  |  |  |
|   | <ul> <li>Refer as FCC KDB 558074 clause 8.7 &amp; C63.10 clause 11.13.1, When the performing peak or<br/>average radiated measurements, emissions within 2 MHz of the authorized band edge may be<br/>measured using the marker-delta method described below.</li> </ul>   |  |  |  |  |  |  |
|   | <ul> <li>Refer as FCC KDB 558074, clause 8.7 (ANSI C63.10, clause 6.10.6) for marker-delta method for<br/>band-edge measurements.</li> </ul>   |  |  |  |  |  |  |
|   | <ul> <li>Refer as FCC KDB 558074, clause 8.7 for narrower resolution bandwidth (100kHz) using the band<br/>power and summing the spectral levels (i.e., 1 MHz).</li> </ul>   |  |  |  |  |  |  |
|   | <ul> <li>For conducted unwanted emissions into restricted bands (absolute emission limits).<br/>Devices with multiple transmit chains using options given below:         <ul> <li>(1) Measure and sum the spectra across the outputs or</li> <li>(2) Measure and add 10 log(N) dB</li> </ul> </li> </ul>   |  |  |  |  |  |  |
|   | <ul> <li>For FCC KDB 662911 The methodology described here may overestimate array gain, thereby<br/>resulting in apparent failures to satisfy the out-of-band limits even if the device is actually<br/>compliant. In such cases, compliance may be demonstrated by performing radiated tests around<br/>the frequencies at which the apparent failures occurred.</li> </ul> |  |  |  |  |  |  |



### 4.5.4 Test Setup







#### 4.5.5 Measurement Results Calculation

The measured Level is calculated using:

Corrected Reading: Antenna Factor + Čable Loss + Read Level - Preamp Factor (if applicable) = Level.

#### 4.5.6 Transmitter Radiated Unwanted Emissions (Below 30MHz)

All amplitude of spurious emissions that are attenuated by more than 20 dB below the permissible value has no need to be reported.

#### 4.5.7 Transmitter Radiated Unwanted Emissions

Refer as Appendix F



# 5 Test Equipment and Calibration Data

| Instrument                              | Brand         | Model No.          | Serial No.          | Characteristics   | Calibration<br>Date | Calibration<br>Due Date | Remark                   |
|---|---------------|--------------------|---------------------|-------------------|---------------------|-------------------------|--------------------------|
| EMI Receiver                            | Agilent       | N9038A             | MY52260140          | 9kHz ~ 8.4GHz     | May 18, 2023        | May 17, 2024            | Conduction<br>(CO01-CB)  |
| EMI Receiver                            | Agilent       | N9038A             | My52260123          | 9kHz ~ 8.4GHz     | Mar. 01, 2024       | Feb. 28, 2025           | Conduction<br>(CO01-CB)  |
| LISN                                    | Schwarzbeck   | NSLK 8127          | 8127478             | 9kHz ~ 30MHz      | Dec. 29, 2023       | Dec. 28, 2024           | Conduction<br>(CO01-CB)  |
| LISN                                    | Schwarzbeck   | NSLK 8127          | 8127647             | 9kHz ~ 30MHz      | Apr. 27, 2023       | Apr. 26, 2024           | Conduction<br>(CO01-CB)  |
| LISN                                    | Schwarzbeck   | NSLK 8127          | 8127647             | 9kHz ~ 30MHz      | Apr. 24, 2024       | Apr. 23, 2025           | Conduction<br>(CO01-CB)  |
| Pulse Limiter                           | Rohde&Schwarz | ESH3-Z2            | 100430              | 9kHz ~ 30MHz      | Feb. 08, 2024       | Feb. 07, 2025           | Conduction<br>(CO01-CB)  |
| COND Cable                              | Woken         | Cable              | Low<br>cable-CO01   | 9kHz ~ 30MHz      | Oct. 17, 2023       | Oct. 16, 2024           | Conduction<br>(CO01-CB)  |
| Software                                | SPORTON       | SENSE              | V5.10               | -                 | N.C.R.              | N.C.R.                  | Conduction<br>(CO01-CB)  |
| Loop Antenna                            | Teseq         | HLA 6121           | 65417               | 9kHz - 30MHz      | Oct. 13, 2023       | Oct. 12, 2024           | Radiation<br>(03CH01-CB) |
| 3m Semi<br>Anechoic<br>Chamber NSA      | TDK           | SAC-3M             | 03CH01-CB           | 30MHz ~ 1GHz      | Jan. 18, 2024       | Jan. 17, 2025           | Radiation<br>(03CH01-CB) |
| BILOG<br>ANTENNA with<br>6dB Attenuator | TESEQ & EMCI  | CBL6112D<br>N-6-06 | 37880 &<br>AT-N0609 | 20MHz ~ 2GHz      | Feb. 19, 2023       | Feb. 18, 2024           | Radiation<br>(03CH01-CB) |
| BILOG<br>ANTENNA with<br>6dB Attenuator | TESEQ & EMCI  | CBL6112D<br>N-6-06 | 37880 &<br>AT-N0609 | 20MHz ~ 2GHz      | Feb. 18, 2024       | Feb. 17, 2025           | Radiation<br>(03CH01-CB) |
| Pre-Amplifier                           | SGH           | SGH0301            | 20230109-2          | 10M~1GHz          | Jun. 23, 2023       | Jun. 22, 2024           | Radiation<br>(03CH01-CB) |
| Signal<br>Analyzer                      | R&S           | FSV3044            | 101437              | 10kHz ~ 44GHz     | Nov. 28, 2023       | Nov. 27, 2024           | Radiation<br>(03CH01-CB) |
| EMI Test<br>Receiver                    | R&S           | ESCS               | 826547/017          | 9kHz ~ 2.75GHz    | Jun. 13, 2023       | Jun. 12, 2024           | Radiation<br>(03CH01-CB) |
| RF Cable-low                            | Woken         | RG402              | Low<br>Cable-31+32  | 30MHz ~ 1GHz      | Nov. 06, 2023       | Nov. 05, 2024           | Radiation<br>(03CH01-CB) |
| 3m Semi<br>Anechoic<br>Chamber<br>VSWR  | трк           | SAC-3M             | 03CH01-CB           | 1GHz ~18GHz<br>3m | May 05, 2023        | May 04, 2024            | Radiation<br>(03CH01-CB) |
| Horn Antenna                            | SCHWARZBECK   | BBHA 9120 D        | BBHA<br>9120D-01816 | 1GHz~18GHz        | Dec. 20, 2023       | Dec. 19, 2024           | Radiation<br>(05CH01-CB) |
| Horn Antenna                            | Schwarzbeck   | BBHA 9170          | BBHA9170252         | 15GHz ~ 40GHz     | Sep. 04, 2023       | Sep. 03, 2024           | Radiation<br>(03CH01-CB) |

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#### Report No. : FR3N2709AD

| Instrument                               | Brand               | Model No.            | Serial No.          | Characteristics   | Calibration<br>Date | Calibration<br>Due Date | Remark                   |
|--|---------------------|----------------------|---------------------|-------------------|---------------------|-------------------------|--------------------------|
| Pre-Amplifier                            | Agilent             | 8449B                | 3008A02121          | 1GHz ~ 26.5GHz    | May 18, 2023        | May 17, 2024            | Radiation<br>(03CH01-CB) |
| Pre-Amplifier                            | SGH                 | SGH184               | 20221107-3          | 18GHz ~ 40GHz     | Nov. 24, 2023       | Nov. 23, 2024           | Radiation<br>(03CH01-CB) |
| RF Cable-high                            | Woken               | RG402                | High Cable-16       | 1GHz ~ 18GHz      | Nov. 06, 2023       | Nov. 05, 2024           | Radiation<br>(03CH01-CB) |
| RF Cable-high                            | Woken               | RG402                | High<br>Cable-16+17 | 1GHz ~ 18GHz      | Nov. 06, 2023       | Nov. 05, 2024           | Radiation<br>(03CH01-CB) |
| High Cable                               | Woken               | WCA0929M             | 40G#5+6             | 1GHz ~ 40GHz      | Dec. 06, 2023       | Dec. 05, 2024           | Radiation<br>(03CH01-CB) |
| High Cable                               | Woken               | WCA0929M             | 40G#5               | 1GHz ~ 40GHz      | Oct. 02, 2023       | Oct. 01, 2024           | Radiation<br>(03CH01-CB) |
| High Cable                               | Woken               | WCA0929M             | 40G#6               | 1GHz ~ 40GHz      | Oct. 02, 2023       | Oct. 01, 2024           | Radiation<br>(03CH01-CB) |
| Test Software                            | SPORTON             | SENSE                | V5.10               | -                 | N.C.R.              | N.C.R.                  | Radiation<br>(03CH01-CB) |
| Loop Antenna                             | Teseq               | HLA 6121             | 65417               | 9kHz - 30MHz      | Oct. 13, 2023       | Oct. 12, 2024           | Radiation<br>(03CH04-CB) |
| 3m Semi<br>Anechoic<br>Chamber NSA       | TDK                 | SAC-3M               | 03CH04-CB           | 30MHz ~ 1GHz      | Aug. 01, 2023       | Jul. 31, 2024           | Radiation<br>(03CH04-CB) |
| BILOG<br>ANTENNA with<br>6 dB attenuator | Schaffner &<br>EMCI | CBL6112B &<br>N-6-06 | 22021&AT-N06<br>07  | 30MHz ~ 1GHz      | Oct. 07, 2023       | Oct. 06, 2024           | Radiation<br>(03CH04-CB) |
| Pre-Amplifier                            | EMCI                | EMC330N              | 980391              | 20MHz ~ 3GHz      | May 23, 2023        | May 22, 2024            | Radiation<br>(03CH04-CB) |
| Pre-Amplifier                            | EMCI                | EMC330N              | 980391              | 20MHz ~ 3GHz      | May 22, 2024        | May 21, 2025            | Radiation<br>(03CH04-CB) |
| Spectrum<br>Analyzer                     | R&S                 | FSP40                | 100142              | 9kHz~40GHz        | Mar. 21, 2023       | Mar. 20, 2024           | Radiation<br>(03CH04-CB  |
| Spectrum<br>Analyzer                     | R&S                 | FSP40                | 100142              | 9kHz~40GHz        | Mar. 19, 2024       | Mar. 18, 2025           | Radiation<br>(03CH04-CB  |
| EMI Test<br>Receiver                     | R&S                 | ESCS                 | 826547/017          | 9kHz ~ 2.75GHz    | Jun. 13, 2023       | Jun. 12, 2024           | Radiation<br>(03CH04-CB) |
| RF Cable-low                             | Woken               | RG402                | Low<br>Cable-03+67  | 30MHz – 1GHz      | Oct. 02, 2023       | Oct. 01, 2024           | Radiation<br>(03CH04-CB) |
| Test Software                            | SPORTON             | SENSE                | V5.10               | -                 | N.C.R.              | N.C.R.                  | Radiation<br>(03CH04-CB) |
| 3m Semi<br>Anechoic<br>Chamber<br>VSWR   | трк                 | SAC-3M               | 03CH06-CB           | 1GHz ~18GHz<br>3m | Oct. 02, 2023       | Oct. 01, 2024           | Radiation<br>(03CH06-CB) |
| Horn Antenna                             | SCHWARZBECK         | BBHA9120D            | BBHA<br>9120D-1292  | 1GHz~18GHz        | Jul. 31, 2023       | Jul. 30, 2024           | Radiation<br>(03CH06-CB) |
| Horn Antenna                             | Schwarzbeck         | BBHA 9170            | BBHA9170252         | 15GHz ~ 40GHz     | Sep. 04, 2023       | Sep. 03, 2024           | Radiation<br>(03CH06-CB) |

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#### Report No. : FR3N2709AD

| Instrument           | Brand   | Model No. | Serial No.          | Characteristics     | Calibration<br>Date | Calibration<br>Due Date | Remark                   |
|----------------------|---------|-----------|---------------------|---------------------|---------------------|-------------------------|--------------------------|
| Pre-Amplifier        | Agilent | 83017A    | MY53270064          | 0.5GHz ~<br>26.5GHz | Aug. 01, 2023       | Jul. 31, 2024           | Radiation<br>(03CH06-CB) |
| Pre-Amplifier        | SGH     | SGH184    | 20221107-3          | 18GHz ~ 40GHz       | Nov. 24, 2023       | Nov. 23, 2024           | Radiation<br>(03CH06-CB) |
| Signal<br>Analyzer   | R&S     | FSV40     | 101904              | 9kHz ~ 40GHz        | Apr. 21, 2023       | Apr. 20, 2024           | Radiation<br>(03CH06-CB) |
| RF Cable-high        | Woken   | RG402     | High<br>Cable-05+68 | 1GHz~18GHz          | Oct. 02, 2023       | Oct. 01, 2024           | Radiation<br>(03CH06-CB) |
| High Cable           | Woken   | WCA0929M  | 40G#5+6             | 1GHz ~ 40GHz        | Dec. 06, 2023       | Dec. 05, 2024           | Radiation<br>(03CH06-CB) |
| High Cable           | Woken   | WCA0929M  | 40G#5               | 1GHz ~ 40GHz        | Oct. 02, 2023       | Oct. 01, 2024           | Radiation<br>(03CH06-CB) |
| High Cable           | Woken   | WCA0929M  | 40G#6               | 1GHz ~ 40GHz        | Oct. 02, 2023       | Oct. 01, 2024           | Radiation<br>(03CH06-CB) |
| Test Software        | SPORTON | SENSE     | V5.10               | -                   | N.C.R.              | N.C.R.                  | Radiation<br>(03CH06-CB) |
| Spectrum<br>analyzer | R&S     | FSV40     | 101027              | 9kHz~40GHz          | Aug. 14, 2023       | Aug. 13, 2024           | Conducted<br>(TH02-CB)   |
| Power Sensor         | Anritsu | MA2411B   | 1126203             | 300MHz~40GHz        | Oct. 19, 2023       | Oct. 18, 2024           | Conducted<br>(TH02-CB)   |
| Power Meter          | Anritsu | ML2495A   | 1210004             | 300MHz~40GHz        | Oct. 19, 2023       | Oct. 18, 2024           | Conducted<br>(TH02-CB)   |
| RF Cable-high        | Woken   | RG402     | High Cable-01       | 1GHz – 18GHz        | Oct. 02, 2023       | Oct. 01, 2024           | Conducted<br>(TH02-CB)   |
| RF Cable-high        | Woken   | RG402     | High Cable-02       | 1GHz – 18GHz        | Oct. 02, 2023       | Oct. 01, 2024           | Conducted<br>(TH02-CB)   |
| RF Cable-high        | Woken   | RG402     | High Cable-03       | 1GHz – 18GHz        | Oct. 02, 2023       | Oct. 01, 2024           | Conducted<br>(TH02-CB)   |
| RF Cable-high        | Woken   | RG402     | High Cable-04       | 1GHz – 18GHz        | Oct. 02, 2023       | Oct. 01, 2024           | Conducted<br>(TH02-CB)   |
| RF Cable-high        | Woken   | RG402     | High Cable-05       | 1GHz – 18GHz        | Oct. 02, 2023       | Oct. 01, 2024           | Conducted<br>(TH02-CB)   |
| Switch               | SPTCB   | SP-SWI    | SWI-02              | 1–26.5GHz           | Oct. 03, 2023       | Oct. 02, 2024           | Conducted<br>(TH02-CB)   |
| Test Software        | SPORTON | SENSE     | V5.10               | -                   | N.C.R.              | N.C.R.                  | Conducted<br>(TH02-CB)   |

Note: Calibration Interval of instruments listed above is one year.

NCR means Non-Calibration required.



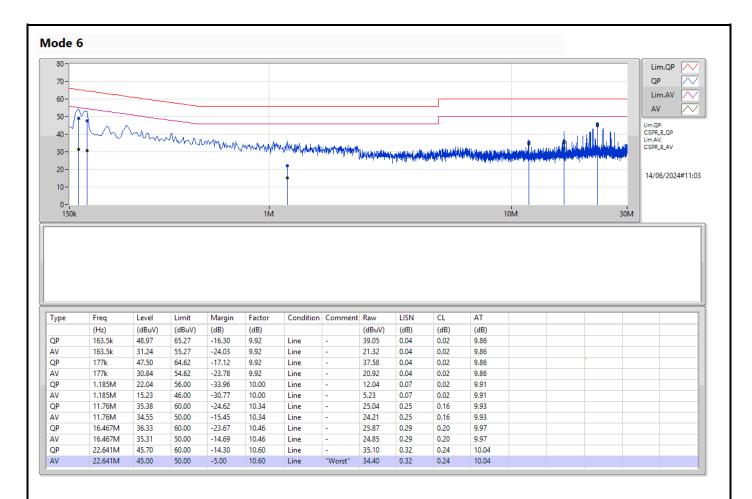
### Conducted Emissions at Powerline

### Appendix A

| Summary |        |      |         |        |        |        |           |
|---------|--------|------|---------|--------|--------|--------|-----------|
| Mode    | Result | Туре | Freq    | Level  | Limit  | Margin | Condition |
|         |        |      | (Hz)    | (dBuV) | (dBuV) | (dB)   |           |
| Mode 6  | Pass   | AV   | 22.641M | 45.00  | 50.00  | -5.00  | Line      |

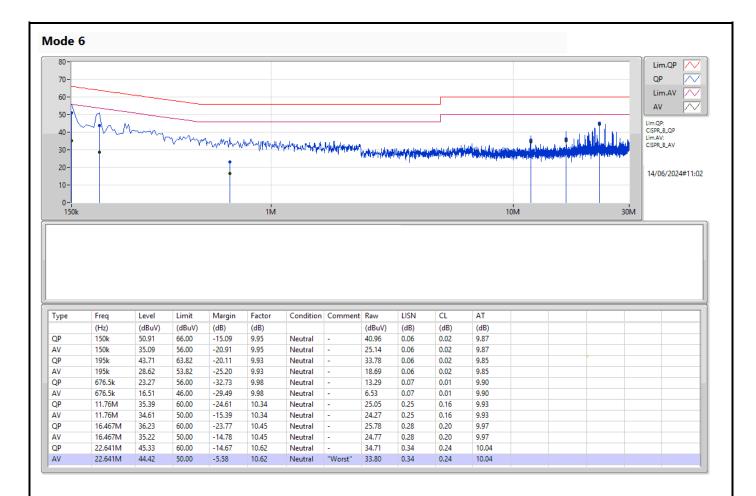














#### Summary

| Mode                 | Max-N dB<br>(Hz) | Max-OBW<br>(Hz) | ITU-Code | Min-N dB<br>(Hz) | Min-OBW<br>(Hz) |
|----------------------|------------------|-----------------|----------|------------------|-----------------|
| 2.4-2.4835GHz        | -                | -               | -        | -                | -               |
| Thread_3MHz_Nss1_1TX | 1.613M           | 2.38M           | 2M38D1D  | 1.556M           | 2.241M          |

 $\label{eq:max-NdB} Max\cdot N\, dB = Maximum 6dB \ down \ bandwidth; \ Max-OBW = Maximum 99\% \ occupied \ bandwidth; \ Min-OBW = Minimum 99\% \ occupied \ bandwidth; \ Minimum 99\%$ 



#### Result

| Mode                 | Result | Limit | Port 1-N dB | Port 1-OBW |
|----------------------|--------|-------|-------------|------------|
|                      |        | (Hz)  | (Hz)        | (Hz)       |
| Thread_3MHz_Nss1_1TX | -      | -     | -           | -          |
| 2405MHz              | Pass   | 500k  | 1.594M      | 2.38M      |
| 2440MHz              | Pass   | 500k  | 1.556M      | 2.358M     |
| 2475MHz              | Pass   | 500k  | 1.613M      | 2.241M     |
| 2480MHz              | Pass   | 500k  | 1.579M      | 2.256M     |

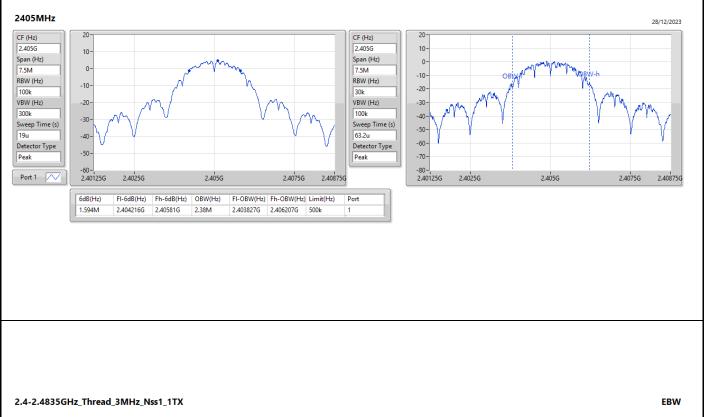
Port X-N dB = Port X 6dB down bandwidth; Port X-OBW = Port X 99% occupied bandwidth

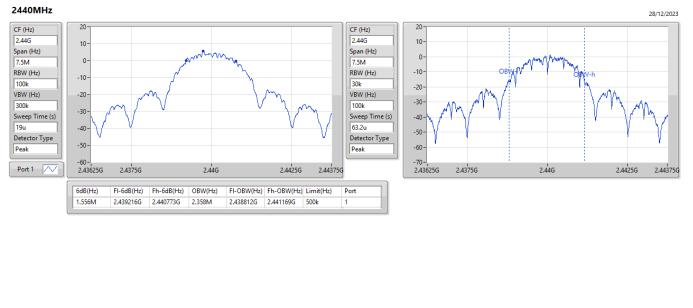


EBW



#### 2.4-2.4835GHz\_Thread\_3MHz\_Nss1\_1TX





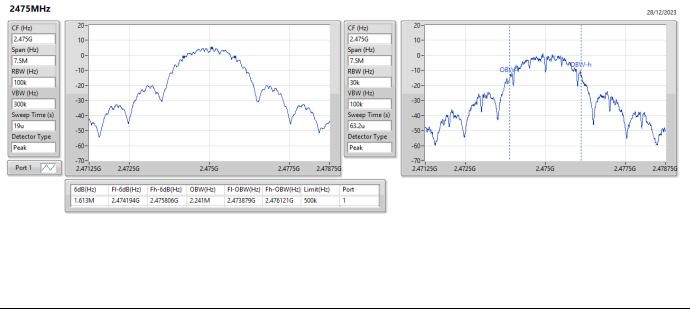




#### 2.4-2.4835GHz\_Thread\_3MHz\_Nss1\_1TX

EBW 28/12/2023

EBW



#### 2.4-2.4835GHz\_Thread\_3MHz\_Nss1\_1TX

2480MHz 28/12/2023 10-CF (Hz) CF (Hz) 2.48G 0. 2.48G -10 ywww. Span (Hz) Span (Hz) -10 -20 OB 7.5M 7.5M -20 RBW (Hz) RBW (Hz) -30 100k -30 30k VBW (Hz) VBW (Hz) -40 -40 300k 100k - 50 Sweep Time (s) -50-Sweep Time (s) 19u 63.2u -60 -60· Detector Type Detector Type -70 -70 Peak Peak -80-2.47625G -80-2.47625G Port 1 📈 2.4775G 2.48G 2.4775G 2.48G 2.48375G 2.4825G 2.48375G 2.4825G 6dB(Hz) FI-6dB(Hz) Fh-6dB(Hz) OBW(Hz) FI-OBW(Hz) Fh-OBW(Hz) Limit(Hz) Port 1.579M 2.479213G 2.480791G 2.256M 2.478872G 2.481128G 500k 1



### Average Power

# Appendix C

Summary

| Mode                 | Total Power<br>(dBm) | Total Power<br>(W) |
|----------------------|----------------------|--------------------|
| 2.4-2.4835GHz        | -                    | -                  |
| Thread_3MHz_Nss1_1TX | 9.91                 | 0.00979            |



### Average Power

# Appendix C

#### Result

| Mode                 | Result | DG    | Port 1 | Total Power | Power Limit |
|----------------------|--------|-------|--------|-------------|-------------|
|                      |        | (dBi) | (dBm)  | (dBm)       | (dBm)       |
| Thread_3MHz_Nss1_1TX | -      | -     | -      | -           | -           |
| 2405MHz              | Pass   | 4.96  | 9.67   | 9.67        | 30.00       |
| 2440MHz              | Pass   | 4.96  | 9.91   | 9.91        | 30.00       |
| 2475MHz              | Pass   | 4.96  | 9.46   | 9.46        | 30.00       |
| 2480MHz              | Pass   | 4.96  | -3.34  | -3.34       | 30.00       |

DG = Directional Gain; Port X = Port X output power



#### Summary

| Mode                 | PD        |
|----------------------|-----------|
|                      | (dBm/RBW) |
| 2.4-2.4835GHz        | -         |
| Thread_3MHz_Nss1_1TX | -7.26     |

RBW = 3kHz;

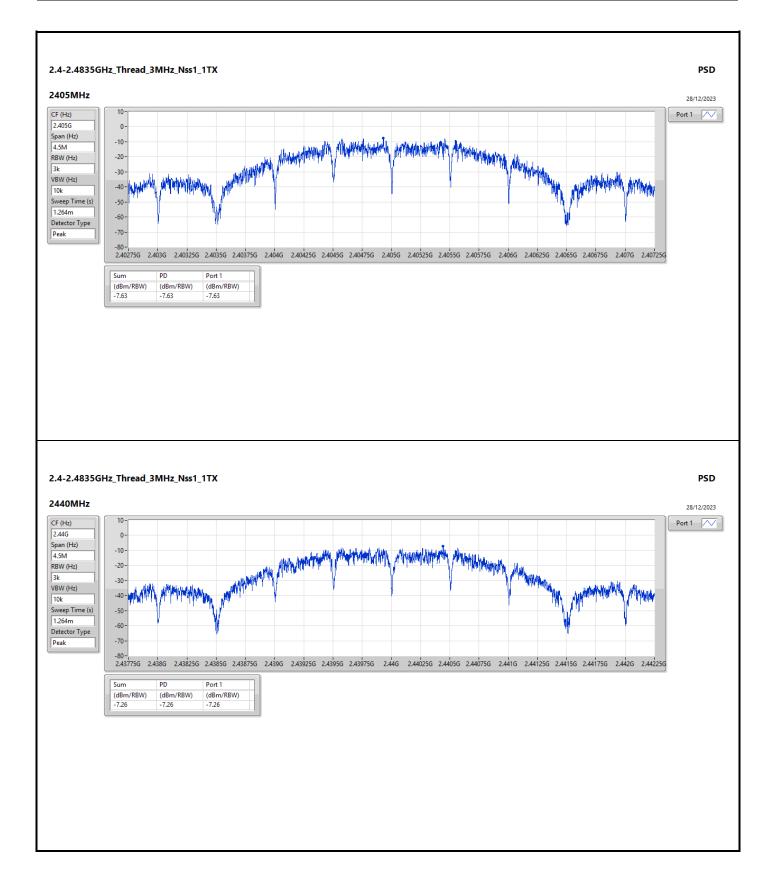


#### Result

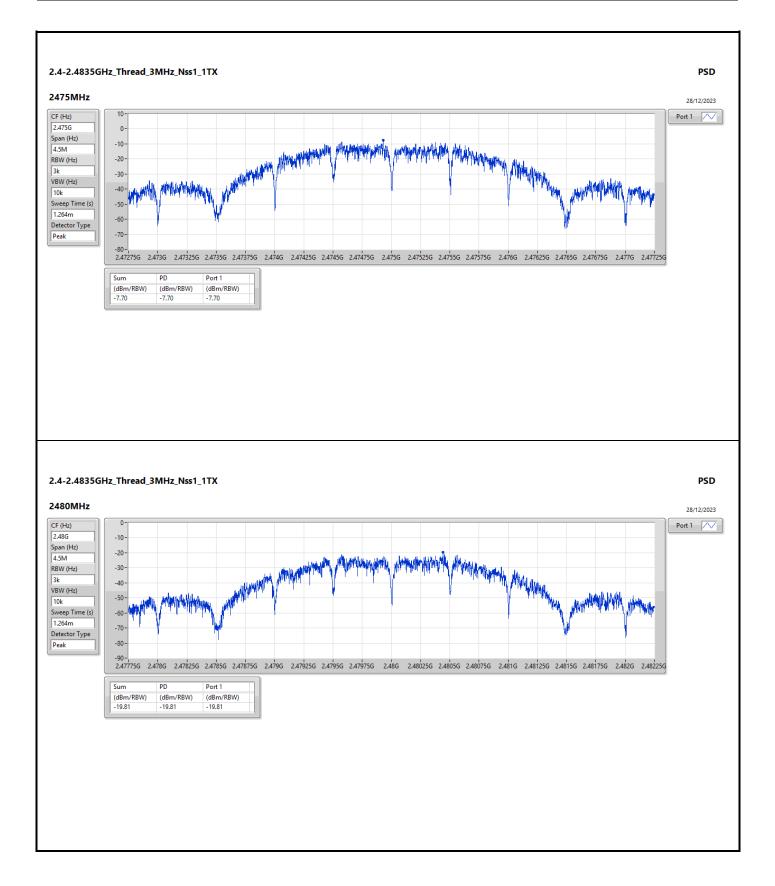
| Mode                 | Result | DG    | Port 1    | PD        | PD Limit  |
|----------------------|--------|-------|-----------|-----------|-----------|
|                      |        | (dBi) | (dBm/RBW) | (dBm/RBW) | (dBm/RBW) |
| Thread_3MHz_Nss1_1TX | -      | -     | -         | -         | -         |
| 2405MHz              | Pass   | 4.96  | -7.63     | -7.63     | 8.00      |
| 2440MHz              | Pass   | 4.96  | -7.26     | -7.26     | 8.00      |
| 2475MHz              | Pass   | 4.96  | -7.70     | -7.70     | 8.00      |
| 2480MHz              | Pass   | 4.96  | -19.81    | -19.81    | 8.00      |

DG = Directional Gain: RBW = 3kHz; PD = trace bin-by-bin of each transmits port summing can be performed maximum power density; Port X = Port X Power Density;











## CSE (NdB Down)

# Appendix E

#### Summary

| Mode                 | Result | Ref      | Ref   | Limit  | Freq    | Level  | Freq     | Level  | Freq | Level  | Freq      | Level  | Port |
|----------------------|--------|----------|-------|--------|---------|--------|----------|--------|------|--------|-----------|--------|------|
|                      |        | (Hz)     | (dBm) | (dBm)  | (Hz)    | (dBm)  | (Hz)     | (dBm)  | (Hz) | (dBm)  | (Hz)      | (dBm)  |      |
| 2.4-2.4835GHz        | -      | -        | -     | -      |         | -      | -        | -      | -    | -      | -         | -      | -    |
| Thread_3MHz_Nss1_1TX | Pass   | 2.44025G | 5.49  | -24.51 | 833.76M | -53.80 | 2.39995G | -36.02 | 2.4G | -36.24 | 16.42913G | -45.08 | 1    |



## CSE (NdB Down)

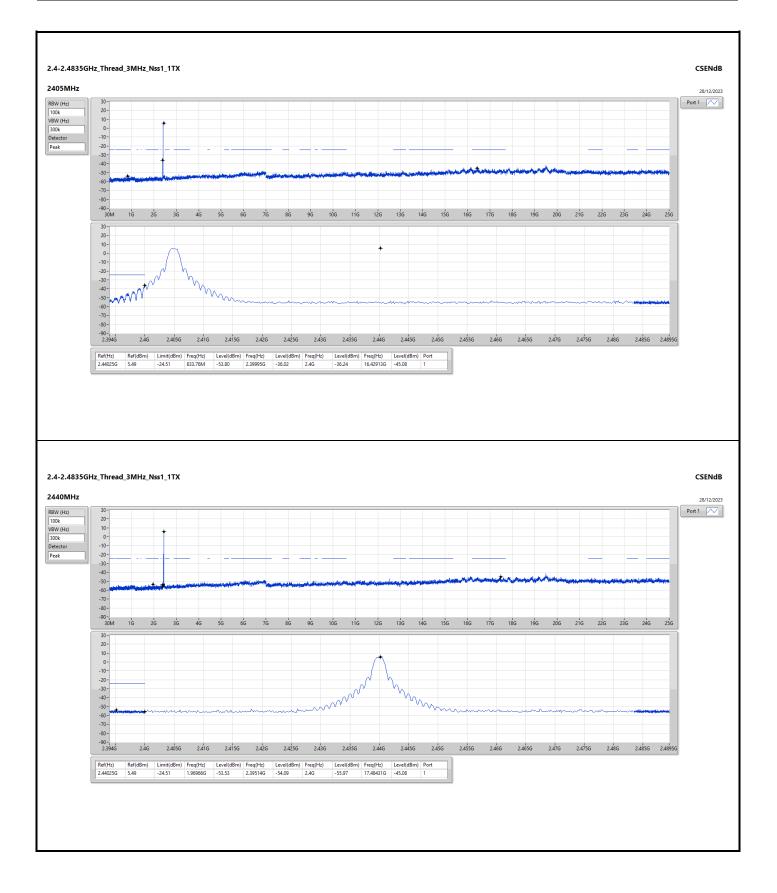
# Appendix E

#### Result

| Mode                 | Result | Ref      | Ref   | Limit  | Freq     | Level  | Freq     | Level  | Freq | Level  | Freq      | Level  | Port |
|----------------------|--------|----------|-------|--------|----------|--------|----------|--------|------|--------|-----------|--------|------|
|                      |        | (Hz)     | (dBm) | (dBm)  | (Hz)     | (dBm)  | (Hz)     | (dBm)  | (Hz) | (dBm)  | (Hz)      | (dBm)  |      |
| Thread_3MHz_Nss1_1TX | -      | -        | -     | -      | -        | -      | -        | -      | -    | -      | -         | -      | -    |
| 2405MHz              | Pass   | 2.44025G | 5.49  | -24.51 | 833.76M  | -53.80 | 2.39995G | -36.02 | 2.4G | -36.24 | 16.42913G | -45.08 | 1    |
| 2440MHz              | Pass   | 2.44025G | 5.49  | -24.51 | 1.96966G | -53.53 | 2.39514G | -54.09 | 2.4G | -55.97 | 17.48431G | -45.08 | 1    |
| 2475MHz              | Pass   | 2.44025G | 5.49  | -24.51 | 1.76636G | -54.10 | 2.39447G | -52.80 | 2.4G | -56.97 | 17.59967G | -45.67 | 1    |
| 2480MHz              | Pass   | 2.44025G | 5.49  | -24.51 | 1.9803G  | -54.33 | 2.39918G | -52.78 | 2.4G | -56.98 | 16.44601G | -44.92 | 1    |

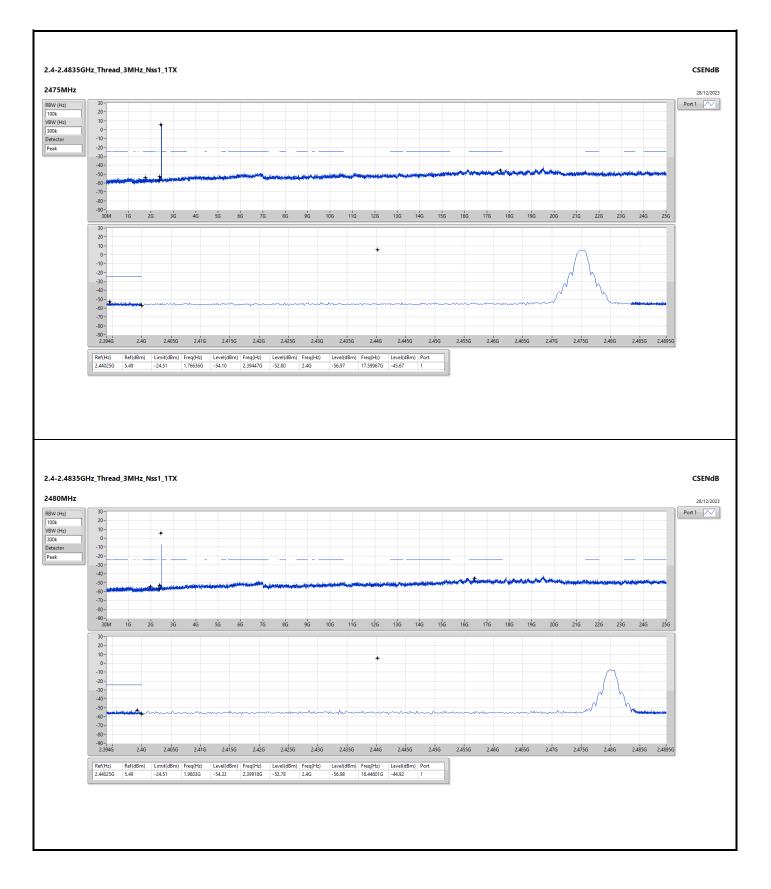


## Appendix E





### Appendix E





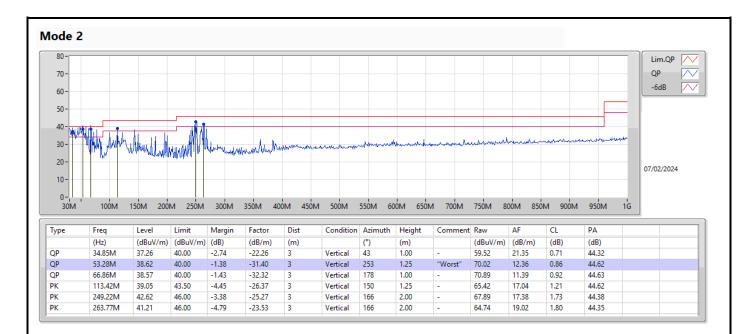
## Radiated Emissions below 1GHz

| Summary |        |      |        |          |          |        |           |
|---------|--------|------|--------|----------|----------|--------|-----------|
| Mode    | Result | Туре | Freq   | Level    | Limit    | Margin | Condition |
|         |        |      | (Hz)   | (dBuV/m) | (dBuV/m) | (dB)   |           |
| Mode 2  | Pass   | QP   | 53.28M | 38.62    | 40.00    | -1.38  | Vertical  |



### Radiated Emissions below 1GHz

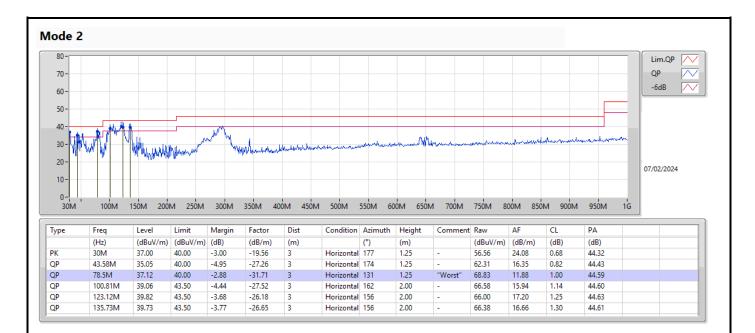
### Appendix F.1





### Radiated Emissions below 1GHz

### Appendix F.1





## RSE TX above 1GHz\_Dipole Antenna

# Appendix F.2

#### Summary

| eanninary     |        |      |         |          |          |        |      |           |         |        |          |
|---------------|--------|------|---------|----------|----------|--------|------|-----------|---------|--------|----------|
| Mode          | Result | Туре | Freq    | Level    | Limit    | Margin | Dist | Condition | Azimuth | Height | Comments |
|               |        |      | (Hz)    | (dBuV/m) | (dBuV/m) | (dB)   | (m)  |           | (°)     | (m)    |          |
| 2.4-2.4835GHz | -      | -    | -       | -        | -        |        | -    | -         | -       |        |          |
| Thread        | Pass   | AV   | 2.4835G | 48.35    | 54.00    | -5.65  | 3    | Vertical  | 39      | 1.90   |          |



2.405G

105.31

Inf

-Inf

72.94

3

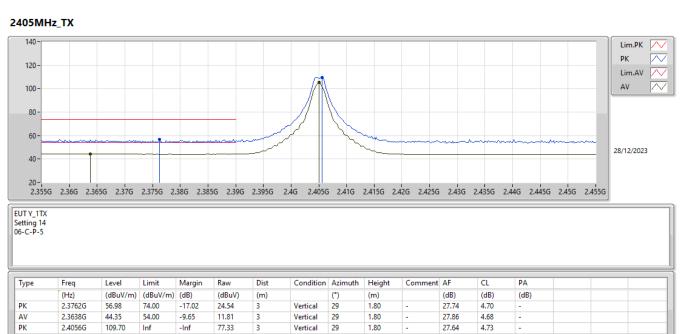
Vertical

29

1.80

### Appendix F.2

#### 2.4-2.4835GHz\_Thread



27.65



2.405G

95.40

Inf

-Inf

63.03

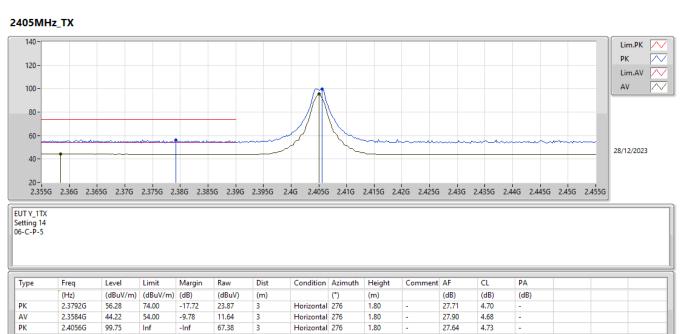
3

Horizontal 276

1.80

### Appendix F.2

#### 2.4-2.4835GHz\_Thread



27.65



4.81102G

39.19

54.00

-14.81

31.71

3

Vertical

10

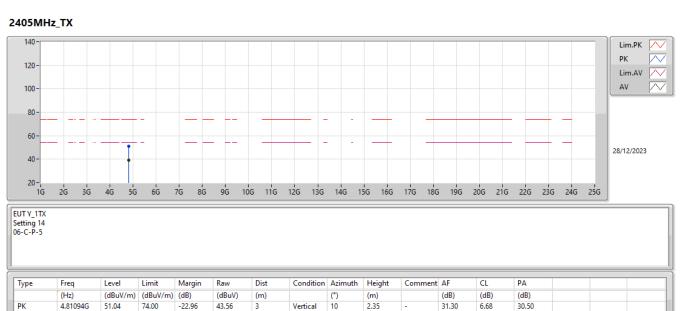
2.35

31.30

6.68

30.50

### Appendix F.2





4.80902G

44.10

54.00

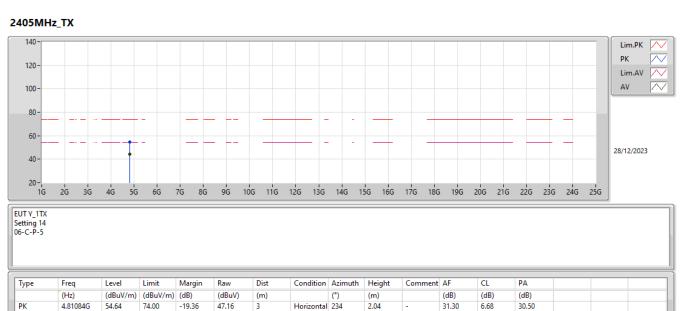
-9.90

36.62

3

### Appendix F.2

#### 2.4-2.4835GHz\_Thread



Horizontal 234

2.04

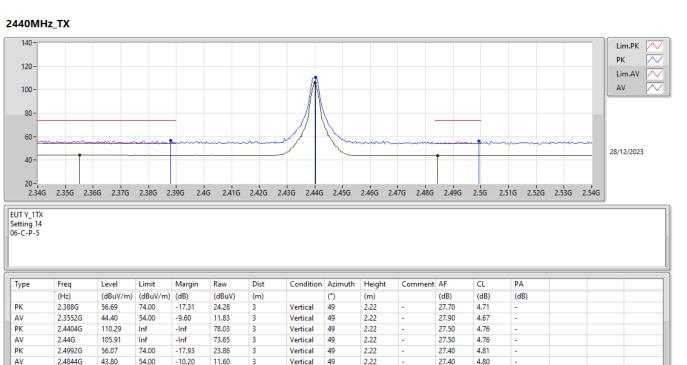
31.30

6.68



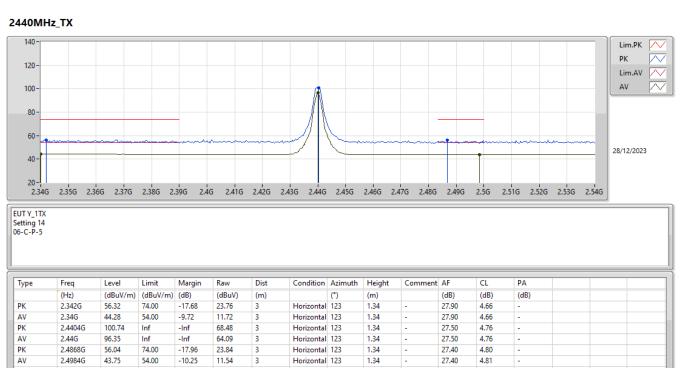
### Appendix F.2



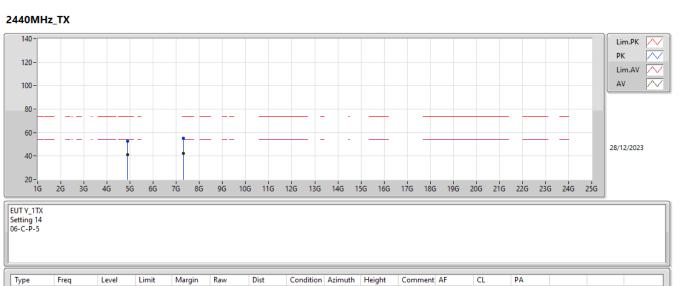




### Appendix F.2







| Туре | Freq     | Level    | Limit    | Margin | Raw    | Dist | Condition | Azimuth | Height | Comment | AF    | CL   | PA    |  |  |
|------|----------|----------|----------|--------|--------|------|-----------|---------|--------|---------|-------|------|-------|--|--|
|      | (Hz)     | (dBuV/m) | (dBuV/m) | (dB)   | (dBuV) | (m)  |           | (°)     | (m)    |         | (dB)  | (dB) | (dB)  |  |  |
| РК   | 4.88094G | 52.37    | 74.00    | -21.63 | 44.76  | 3    | Vertical  | 360     | 2.03   | -       | 31.30 | 6.74 | 30.43 |  |  |
| AV   | 4.88098G | 41.02    | 54.00    | -12.98 | 33.41  | 3    | Vertical  | 360     | 2.03   | -       | 31.30 | 6.74 | 30.43 |  |  |
| РК   | 7.32156G | 55.27    | 74.00    | -18.73 | 41.71  | 3    | Vertical  | 236     | 2.75   | -       | 36.60 | 8.34 | 31.38 |  |  |
| AV   | 7.31854G | 42.43    | 54.00    | -11.57 | 28.87  | 3    | Vertical  | 236     | 2.75   | -       | 36.60 | 8.34 | 31.38 |  |  |





| Ту | pe | Freq     | Level    | Limit    | Margin | Raw    | Dist | Condition  | Azimuth | Height | Comment | AF    | CL   | PA    |  |  |
|----|----|----------|----------|----------|--------|--------|------|------------|---------|--------|---------|-------|------|-------|--|--|
|    |    | (Hz)     | (dBuV/m) | (dBuV/m) | (dB)   | (dBuV) | (m)  |            | (°)     | (m)    |         | (dB)  | (dB) | (dB)  |  |  |
| PK |    | 4.87894G | 55.70    | 74.00    | -18.30 | 48.10  | 3    | Horizontal | 235     | 1.86   | -       | 31.30 | 6.74 | 30.44 |  |  |
| AV | 1  | 4.879G   | 46.01    | 54.00    | -7.99  | 38.41  | 3    | Horizontal | 235     | 1.86   | -       | 31.30 | 6.74 | 30.44 |  |  |
| PK |    | 7.31844G | 58.36    | 74.00    | -15.64 | 44.80  | 3    | Horizontal | 246     | 1.78   | -       | 36.60 | 8.34 | 31.38 |  |  |
| A٧ | 1  | 7.3186G  | 46.92    | 54.00    | -7.08  | 33.36  | 3    | Horizontal | 246     | 1.78   | -       | 36.60 | 8.34 | 31.38 |  |  |
| -  |    |          |          |          |        |        |      |            |         |        |         |       |      |       |  |  |



### Appendix F.2

#### 2.4-2.4835GHz\_Thread 2475MHz\_TX 140-Lim.PK РК 120-Lim.AV AV 100-80-<u>60</u>. 28/12/2023 40-20-2.425G 2.43G 2.435G 2.44G 2.445G 2.45G 2.45G 2.45G 2.46G 2.465G 2.47G 2.475G 2.48G 2.485G 2.49G 2.495G 2.5G 2.505G 2.51G 2.515G 2.52G 2.525G EUT Y\_1TX Setting 14 01-U-J-8 Туре Freq Level Limit Margin Raw Dist Condition Azimuth Height Comment AF CL PA (m) (Hz) (dBuV/m) (dBuV/m) (dB) (dBuV) (dB) (dB) (dB) (°) (m) PK 2.4746G 110.56 Inf -Inf 78.50 3 Vertical 329 1.70 27.45 4.61 AV 2.475G 106.98 Inf -Inf 74.92 3 Vertical 329 1.70 27.45 4.61 -РК 2.4846G 57.65 74.00 -16.35 25.55 3 Vertical 329 1.70 27.50 4.60 AV 2.4836G 1.70 27.50 44.13 54.00 -9.87 12.03 3 Vertical 329 4.60



2.4836G

43.75

54.00

-10.25

11.65

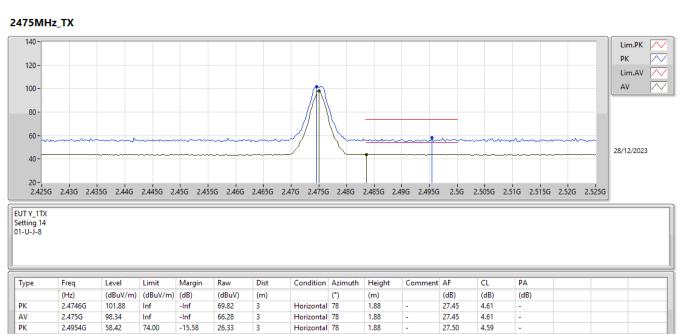
3

Horizontal 78

1.88

### Appendix F.2

#### 2.4-2.4835GHz\_Thread



27.50



2.4835G

48.35

54.00

-5.65

16.15

3

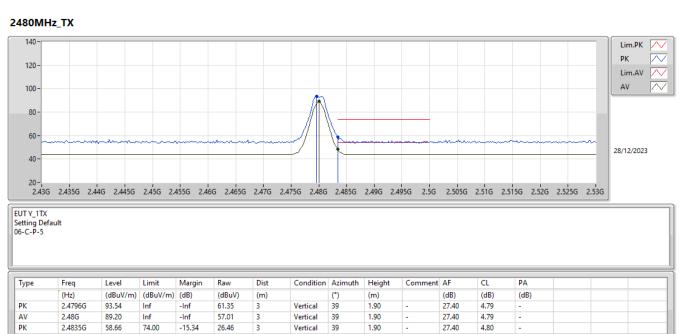
Vertical

39

1.90

### Appendix F.2

#### 2.4-2.4835GHz\_Thread



27.40



РК

AV

2.4858G

2.4835G

56.35

44.73

74.00

54.00

-17.65

-9.27

24.15

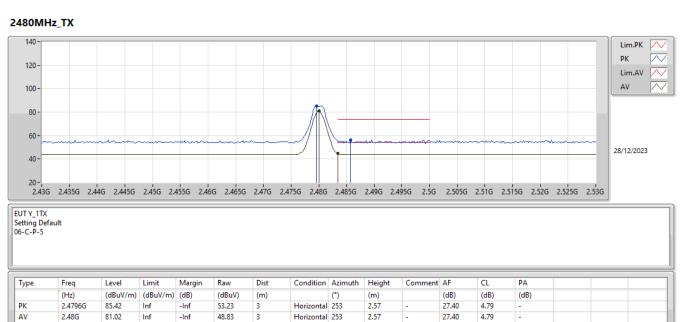
12.53

3

3

### Appendix F.2

#### 2.4-2.4835GHz\_Thread



Horizontal 253

Horizontal 253

2.57

2.57

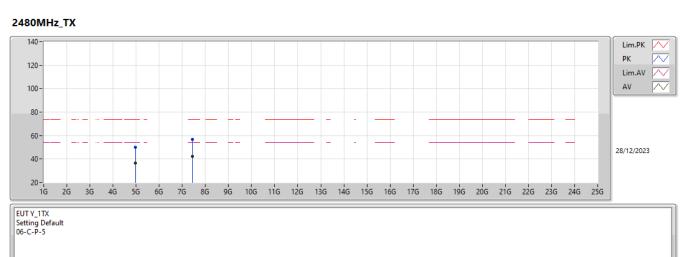
27.40

27.40

4.80



### Appendix F.2



| Туре | Freq     | Level    | Limit    | Margin | Raw    | Dist | Condition | Azimuth | Height | Comment | AF    | CL   | PA    |  |  |
|------|----------|----------|----------|--------|--------|------|-----------|---------|--------|---------|-------|------|-------|--|--|
|      | (Hz)     | (dBuV/m) | (dBuV/m) | (dB)   | (dBuV) | (m)  |           | (°)     | (m)    |         | (dB)  | (dB) | (dB)  |  |  |
| PK   | 4.95892G | 49.83    | 74.00    | -24.17 | 41.85  | 3    | Vertical  | 3       | 2.02   | -       | 31.54 | 6.81 | 30.37 |  |  |
| AV   | 4.959G   | 36.65    | 54.00    | -17.35 | 28.67  | 3    | Vertical  | 3       | 2.02   | -       | 31.54 | 6.81 | 30.37 |  |  |
| PK   | 7.4415G  | 56.74    | 74.00    | -17.26 | 42.92  | 3    | Vertical  | 195     | 3.00   | -       | 36.68 | 8.38 | 31.24 |  |  |
| AV   | 7.44134G | 42.44    | 54.00    | -11.56 | 28.62  | 3    | Vertical  | 195     | 3.00   | -       | 36.68 | 8.38 | 31.24 |  |  |





| Туре | Freq     | Level    | Limit    | Margin | Raw    | Dist | Condition  | Azimuth | Height | Comment | AF    | CL   | PA    |  |  |
|------|----------|----------|----------|--------|--------|------|------------|---------|--------|---------|-------|------|-------|--|--|
|      | (Hz)     | (dBuV/m) | (dBuV/m) | (dB)   | (dBuV) | (m)  |            | (°)     | (m)    |         | (dB)  | (dB) | (dB)  |  |  |
| РК   | 4.9608G  | 50.34    | 74.00    | -23.66 | 42.35  | 3    | Horizontal | 233     | 1.79   | -       | 31.54 | 6.81 | 30.36 |  |  |
| AV   | 4.95902G | 38.65    | 54.00    | -15.35 | 30.67  | 3    | Horizontal | 233     | 1.79   | -       | 31.54 | 6.81 | 30.37 |  |  |
| PK   | 7.4393G  | 56.15    | 74.00    | -17.85 | 42.33  | 3    | Horizontal | 248     | 1.69   | -       | 36.68 | 8.38 | 31.24 |  |  |
| AV   | 7.4384G  | 42.48    | 54.00    | -11.52 | 28.67  | 3    | Horizontal | 248     | 1.69   | -       | 36.68 | 8.37 | 31.24 |  |  |



### RSE TX above 1GHz\_PCB Antenna

# Appendix F.3

#### Summary

| canninary     |        |      |         |          |          |        |      |           |         |        |          |
|---------------|--------|------|---------|----------|----------|--------|------|-----------|---------|--------|----------|
| Mode          | Result | Туре | Freq    | Level    | Limit    | Margin | Dist | Condition | Azimuth | Height | Comments |
|               |        |      | (Hz)    | (dBuV/m) | (dBuV/m) | (dB)   | (m)  |           | (°)     | (m)    |          |
| 2.4-2.4835GHz | -      | -    | -       | -        | -        |        | -    | -         | -       |        | -        |
| Thread        | Pass   | AV   | 2.4835G | 48.18    | 54.00    | -5.82  | 3    | Vertical  | 72      | 2.86   | -        |



РК

AV

2.3574G

2.4046G

2.405G

44.99

99.66

104.07

54.00

Inf

Inf

-9.01

-Inf

-Inf

12.41

71.70

67.29

3

3

3

Vertical

Vertical

Vertical

225

225

225

1.80

1.80

1.80

27.90

27.65

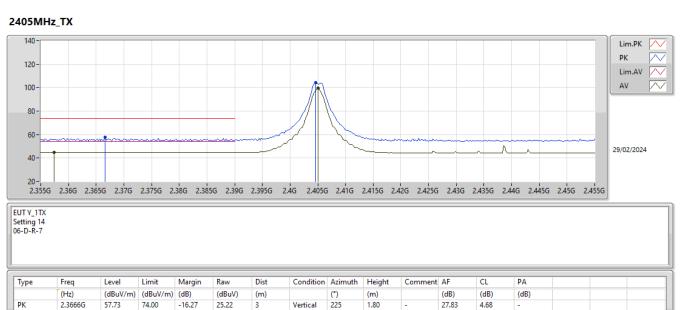
27.65

4.68

4.72

4.72

### Appendix F.3





РК

AV

2.4056G

2.405G

105.79

101.38

Inf

Inf

-Inf

-Inf

73.42

69.01

3

3

Horizontal 27

Horizontal 27

3.00

3.00

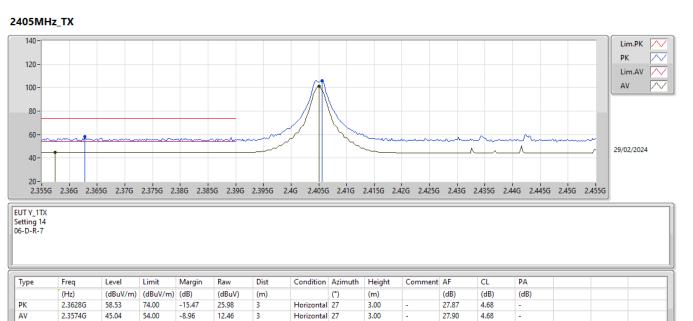
27.64

27.65

4.73

4.72

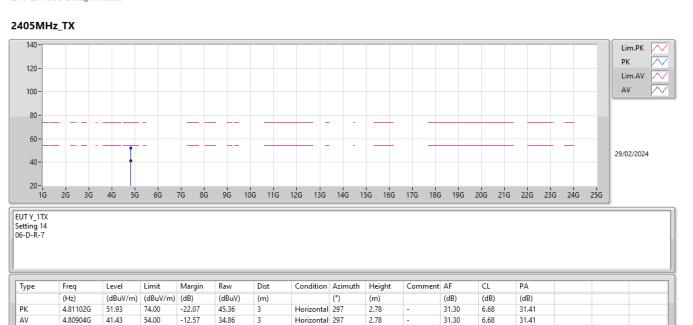
### Appendix F.3





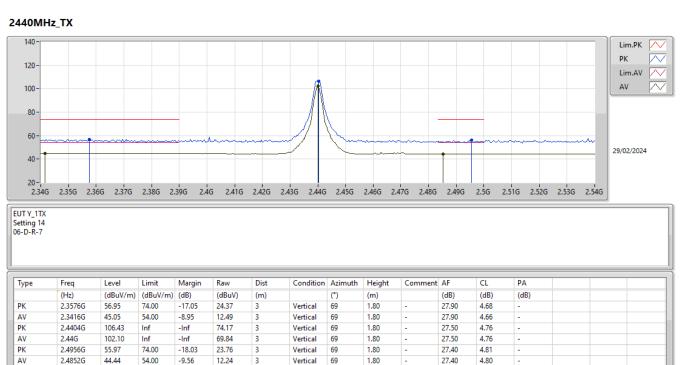






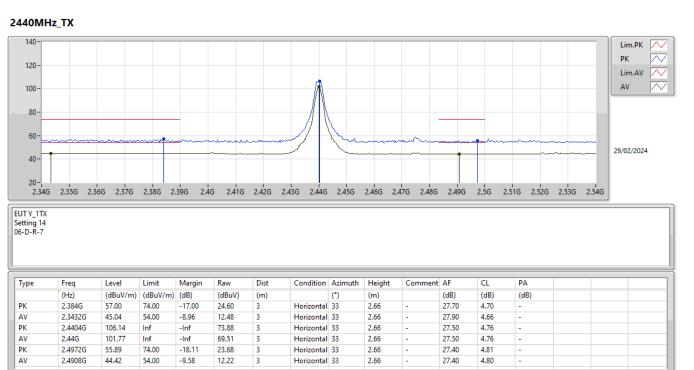


### Appendix F.3

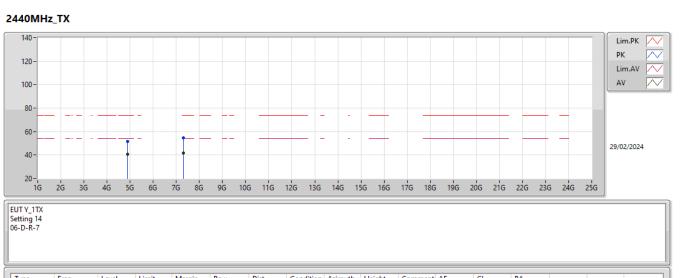




### Appendix F.3

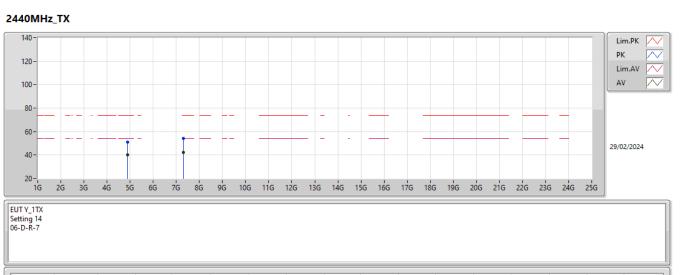






| Туре | Freq     | Level    | Limit    | Margin | Raw    | Dist | Condition | Azimuth | Height | Comment | AF    | CL   | PA    |  |  |
|------|----------|----------|----------|--------|--------|------|-----------|---------|--------|---------|-------|------|-------|--|--|
|      | (Hz)     | (dBuV/m) | (dBuV/m) | (dB)   | (dBuV) | (m)  |           | (°)     | (m)    |         | (dB)  | (dB) | (dB)  |  |  |
| РК   | 4.87892G | 51.46    | 74.00    | -22.54 | 44.78  | 3    | Vertical  | 321     | 2.90   | -       | 31.30 | 6.74 | 31.36 |  |  |
| AV   | 4.87898G | 40.50    | 54.00    | -13.50 | 33.82  | 3    | Vertical  | 321     | 2.90   | -       | 31.30 | 6.74 | 31.36 |  |  |
| РК   | 7.31832G | 54.48    | 74.00    | -19.52 | 42.15  | 3    | Vertical  | 335     | 3.00   | -       | 36.60 | 8.34 | 32.61 |  |  |
| AV   | 7.31862G | 41.74    | 54.00    | -12.26 | 29.41  | 3    | Vertical  | 335     | 3.00   | -       | 36.60 | 8.34 | 32.61 |  |  |

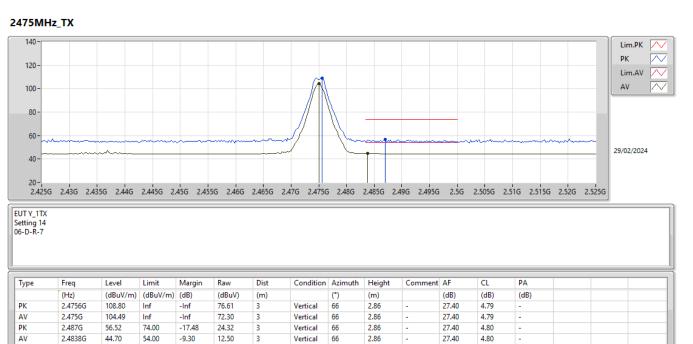




| Туре | Freq     | Level    | Limit    | Margin | Raw    | Dist | Condition  | Azimuth | Height | Comment | AF    | CL   | PA    |  |  |
|------|----------|----------|----------|--------|--------|------|------------|---------|--------|---------|-------|------|-------|--|--|
|      | (Hz)     | (dBuV/m) | (dBuV/m) | (dB)   | (dBuV) | (m)  |            | (°)     | (m)    |         | (dB)  | (dB) | (dB)  |  |  |
| РК   | 4.8809G  | 51.25    | 74.00    | -22.75 | 44.57  | 3    | Horizontal | 299     | 3.00   | -       | 31.30 | 6.74 | 31.36 |  |  |
| AV   | 4.87898G | 40.28    | 54.00    | -13.72 | 33.60  | 3    | Horizontal | 299     | 3.00   | -       | 31.30 | 6.74 | 31.36 |  |  |
| PK   | 7.3185G  | 54.25    | 74.00    | -19.75 | 41.92  | 3    | Horizontal | 30      | 1.01   | -       | 36.60 | 8.34 | 32.61 |  |  |
| AV   | 7.3185G  | 42.11    | 54.00    | -11.89 | 29.78  | 3    | Horizontal | 30      | 1.01   | -       | 36.60 | 8.34 | 32.61 |  |  |



### Appendix F.3





РК

AV

2.475G

2.4876G

2.4838G

102.08

56.52

44.48

Inf

74.00

54.00

-Inf

-17.48

-9.52

69.89

24.32

12.28

3

3

3

Horizontal 29

Horizontal 29

Horizontal 29

2.87

2.87

2.87

27.40

27.40

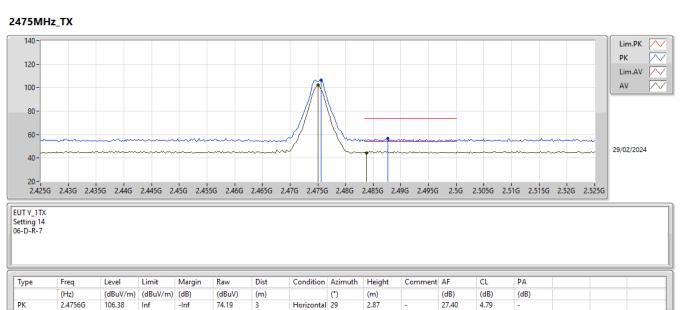
27.40

4.79

4.80

4.80

### Appendix F.3





2.4835G

48.18

54.00

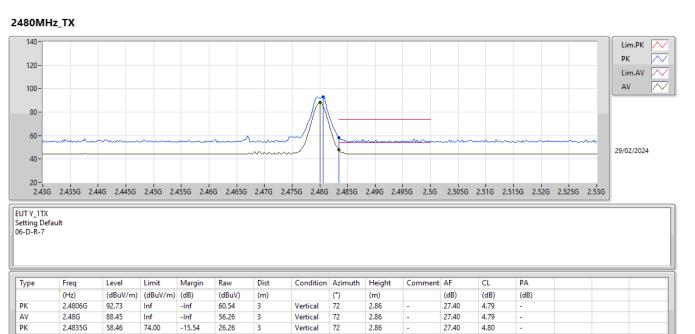
-5.82

15.98

3

### Appendix F.3

#### 2.4-2.4835GHz\_Thread



72

2.86

Vertical

27.40



2.4835G

47.20

54.00

-6.80

15.00

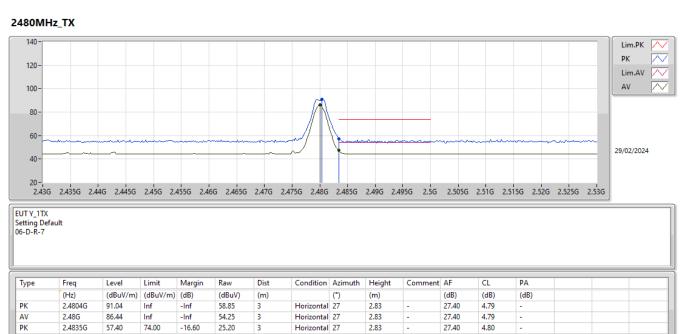
3

Horizontal 27

2.83

### Appendix F.3

#### 2.4-2.4835GHz\_Thread



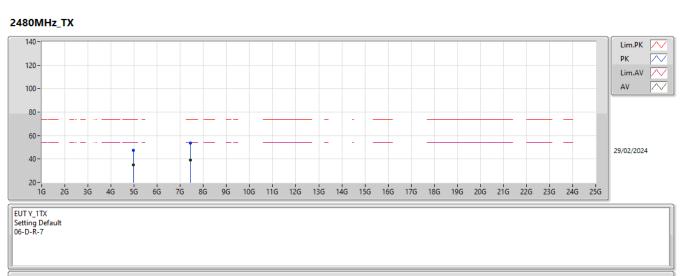
27.40





| Туре | Freq     | Level    | Limit    | Margin | Raw    | Dist | Condition | Azimuth | Height | Comment | AF    | CL   | PA    |  |  |
|------|----------|----------|----------|--------|--------|------|-----------|---------|--------|---------|-------|------|-------|--|--|
|      | (Hz)     | (dBuV/m) | (dBuV/m) | (dB)   | (dBuV) | (m)  |           | (°)     | (m)    |         | (dB)  | (dB) | (dB)  |  |  |
| РК   | 4.95892G | 47.71    | 74.00    | -26.29 | 40.67  | 3    | Vertical  | 321     | 3.00   | -       | 31.54 | 6.81 | 31.31 |  |  |
| AV   | 4.95904G | 35.68    | 54.00    | -18.32 | 28.64  | 3    | Vertical  | 321     | 3.00   | -       | 31.54 | 6.81 | 31.31 |  |  |
| PK   | 7.44654G | 53.58    | 74.00    | -20.42 | 41.30  | 3    | Vertical  | 185     | 2.96   | -       | 36.69 | 8.38 | 32.79 |  |  |
| AV   | 7.4415G  | 38.93    | 54.00    | -15.07 | 26.66  | 3    | Vertical  | 185     | 2.96   | -       | 36.68 | 8.38 | 32.79 |  |  |





| Туре | Freq     | Level    | Limit    | Margin | Raw    | Dist | Condition  | Azimuth | Height | Comment | AF    | CL   | PA    |  |  |
|------|----------|----------|----------|--------|--------|------|------------|---------|--------|---------|-------|------|-------|--|--|
|      | (Hz)     | (dBuV/m) | (dBuV/m) | (dB)   | (dBuV) | (m)  |            | (°)     | (m)    |         | (dB)  | (dB) | (dB)  |  |  |
| РК   | 4.95886G | 47.40    | 74.00    | -26.60 | 40.36  | 3    | Horizontal | 319     | 1.02   | -       | 31.54 | 6.81 | 31.31 |  |  |
| AV   | 4.95904G | 34.85    | 54.00    | -19.15 | 27.81  | 3    | Horizontal | 319     | 1.02   | -       | 31.54 | 6.81 | 31.31 |  |  |
| РК   | 7.44738G | 53.43    | 74.00    | -20.57 | 41.16  | 3    | Horizontal | 129     | 1.80   | -       | 36.69 | 8.38 | 32.80 |  |  |
| AV   | 7.44936G | 38.95    | 54.00    | -15.05 | 26.67  | 3    | Horizontal | 129     | 1.80   | -       | 36.70 | 8.38 | 32.80 |  |  |