# RADIO TEST REPORT

| | | |
|---|---|---|
| **Product** | : | Tire Pressure Monitoring System |
| **Model Name** | : | AI SENSOR |
| **FCC ID** | : | W55AISDB3N4 |
| **Test Regulation** | : | FCC 47 CFR Part 15 Subpart C (Section 15.231) |
| **Received Date** | : | 2023/5/29 |
| **Test Date** | : | 2023/6/12 ~ 2023/6/16 |
| **Issued Date** | : | 2023/7/3 |
| **Applicant** | : | Oro Technology Co., Ltd.<br>3F, No.29, 21st Road, Industrial Park, Taichung 408, Taiwan |
| **Issued By** | : | Underwriters Laboratories Taiwan Co., Ltd.<br>Building B and Building E, No. 372-7, Sec. 4, Zhongxing Rd.,<br>Zhudong Township, Hsinchu County, Taiwan |

Testing Laboratory
3398

**The results reported herein have been performed in accordance with the laboratory's terms of accreditation. This report shall not be reproduced except in full without the written approval of the Laboratory. The results in this report are responsible of the test sample(s) provided by the client only and are not to be used to indicate applicability to other similar products.**

# REVISION HISTORY

## Original Test Report No.: 4790838020-US-R0-V0

| Revision | Test report No. | Date | Page revised | Contents |
|---|---|---|---|---|
| Original | 4790838020-US-R0-V0 | 2023/7/3 | - | Initial issue |

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# 1. Attestation of Test Results

| | |
|---|---|
| **APPLICANT:** | Oro Technology Co., Ltd.<br>3F, No.29, 21st Road, Industrial Park, Taichung 408, Taiwan |
| **MANUFACTURER:** | Oro Technology Co., Ltd.<br>3F, No.29, 21st Road, Industrial Park, Taichung 408, Taiwan |
| **EUT DESCRIPTION:** | Tire Pressure Monitoring System |
| **BRAND:** | ORO |
| **MODEL:** | AI SENSOR |
| **SAMPLE STAGE:** | Design Verification Test sample |
| **DATE of TESTED:** | 2023/6/12 ~ 2023/6/16 |

**APPLICABLE STANDARDS**

| STANDARD | Test Results |
|---|---|
| FCC 47 CFR PART 15 Subpart C (Section 15.231) | PASS |

Underwriters Laboratories Taiwan Co., Ltd. tested the above equipment in accordance with the requirements set forth in the above standards. All indications of Pass/Fail in this report are opinions expressed by Underwriters Laboratories Taiwan Co., Ltd. based on interpretations and/or observations of test results. The test results show that the equipment tested is capable of demonstrating compliance with the requirements as documented in this report.

**Note:** The results documented in this report apply only to the tested sample, under the conditions and modes of operation as described herein. This document may not be altered or revised in any way unless done so by Underwriters Laboratories Taiwan Co., Ltd. and all revisions are duly noted in the revisions section. Any alteration of this document not carried out by Underwriters Laboratories Taiwan Co., Ltd. will constitute fraud and shall nullify the document. This report must not be used by the client to claim product certification, approval, or endorsement by NVLAP, NIST, any agency of the Federal Government, or any agency of any government.

Prepared By:

Sally Lu Date : 2023/7/3
Project Handler

Approved and Authorized By:

Kent Liu Date : 2023/7/3
Senior Laboratory Engineer

## 2. Summary of Test Results

| Summary of Test Results | | |
|---|---|---|
| **FCC Clause** | **Test Items** | **Result** |
| 15.209 / 15.231(b) | Radiated Emissions | PASS |
| 15.231(c) | Emission Bandwidth Test | PASS |
| 15.231(a) | Deactivation Time Measurement | PASS |

# 3. Facilities and Accreditation

| | |
|---|---|
| **Test Location** | Underwriters Laboratories Taiwan Co., Ltd. |
| **Address** | Building B and Building E, No. 372-7, Sec. 4, Zhongxing Rd., Zhudong Township, Hsinchu County, Taiwan |
| **Accreditation Certificate** | Underwriters Laboratories Taiwan Co., Ltd. is accredited by TAF, Laboratory Code 3398. |

# 4. Measurement Uncertainty

For statement of conformity, Simple acceptance (Section 4.3.4 of ISO Guide 115) was applied as decision rule for measurement in this test report.

The following uncertainties have been calculated to provide a confidence level of 95 % using a coverage factor k=2.

Determining compliance based on the results of the compliance measurement, not considering measurement instrumentation uncertainty.

| Measurement | Frequency | Uncertainty |
|---|---|---|
| Conducted disturbance at mains terminals ports | 150kHz ~ 30MHz | ±3.1 dB |
| RF Conducted | 9 kHz - 40GHz | ±2.3 dB |
| Radiated disturbance below 30MHz | 9 kHz - 30 MHz | ±3.2 dB |
| Radiated disturbance below 1 GHz | 30MHz ~ 1GHz | ±6.1 dB |
| Radiated disturbance above 1 GHz | 1GHz ~ 40GHz | ±5.1 dB |

# 5. Equipment under Test

## 5.1. Description of EUT

| | |
|---|---|
| **Product** | Tire Pressure Monitoring System |
| **Brand Name** | ORO |
| **Model Name** | AI SENSOR |
| **Operating Frequency** | 315 MHz<br>433.92 MHz |
| **Modulation** | 315 MHz: ASK<br>433.92 MHz: FSK |
| **Transfer Rate** | 9600 bps |
| **Number of Channel** | 2 |
| **Maximum Output Power** | 315 MHz: 68.44 dBuV/m<br>433.92 MHz: 74.88 dBuV/m |
| **Normal Voltage** | 3Vdc from battery |
| **Sample ID** | 6121411 & 6121412 |
| **Software Version** | Continuous transmission by powering on |

Note:

1. The EUT contains following accessory devices:

| Product | Brand | Model | Description |
|---|---|---|---|
| Valve | ORO | S02VA00014 | - |

2. The EUT could be supplied with rechargeable battery as the following table:

| Brand Name | Model | Description |
|---|---|---|
| Murata | CR2050W | 3V Lithium battery |

3. The above EUT information is declared by manufacturer and for more detailed features description, please refer the manufacturer's or user's manual, the laboratory shall not be held responsible.

## 5.2. Channel List

2 channels are provided to this EUT:

| Channel | Frequency (MHz) |
|---|---|
| 1 | 315 |

| Channel | Frequency (MHz) |
|---|---|
| 1 | 433.92 |

## 5.3. Test Condition

| Test Item | Test Site No. | Environmental Condition | Input Power | Test Date | Tested by |
|---|---|---|---|---|---|
| Antenna Port Conducted Measurement | SR4 | 22~25°C/ 56~61%RH | 3Vdc | 2023/06/12~ 2023/06/16 | Jubo Shen |
| Radiated Spurious Emission | 966-2 | 22~25°C/ 56~61%RH | 3Vdc | 2023/06/12~ 2023/06/16 | Jubo Shen |

FCC Test Firm Registration Number: 498077

### Sample Calculation:

Radiated Spurious Emission:

- Where relevant, the follow sample calculation is provided:
  Result Value (dBuV/m) = Reading Value (dBuV) + Correction Factor (dB/m).
  Correction Factor (dB/m) = Antenna Factor (dB/m) + Cable Loss (dB) - Preamp Factor (dB).
  Example: Result Value (34.5dBuV/m) = Reading Value (40.1dBuV) + Antenna Factor (18.7dB/m) + Cable Loss (4.2dB) - Preamp Factor (28.5dB).

AC power Line Conducted Emission:

- Where relevant, the follow sample calculation is provided:
  Result Value (dBuV) = Reading Value (dBuV) + Correction Factor (dB).
  Correction Factor (dB) = Insertion loss(dB) + Cable loss(dB).
  Example: Result Value (53.7dBuV) = Reading Value (35.1dBuV) + Insertion loss(18.1dB) + Cable loss(0.5dB).

## 5.4. Description of Available Antennas

| Ant. No. | Transmitter Circuit | Brand Name | Model Name | Ant. Type | Maximum Gain (dBi) |
|---|---|---|---|---|---|
| 1 | Chain (0) | ORO | M02AN00004 | Monopole | 315MHz: -20.89<br>433MHz: -19.90 |

Note: The above antenna information was provided from customer and for more detailed features description, please refer the manufacturer's specification or user's manual, the laboratory shall not be held responsible.

## 5.5. Test Mode Applicability and Tested Channel Detail

- The fundamental of the EUT was investigated in three orthogonal axes X-Y/Y-Z/X-Z, it was determined that Y-Z plane was worst-case. Therefore, all final radiated testing was performed with the EUT in Y-Z plane.
- The EUT has 3Vdc power source from battery. The test data of the 3Vdc was recorded in this report.
- For below 30MHz testing, investigation was done on three antenna orientations (parallel, perpendicular, and ground-parallel), parallel and perpendicular are the worst orientations, therefore testing was performed on these two orientations only.
- Pre-Scan has been conducted to determine the worst-case mode from all possible combinations between available modulations, data rates and antenna ports (if EUT with antenna diversity architecture).

**315MHz**

| Test Item | Modulation Type | Available Channel | Test Channel | Data Rate |
|---|---|---|---|---|
| Radiated Emissions | ASK | 1 | 1 | 9600 bps |
| Radiated Emissions (Below 1GHz) | ASK | 1 | 1 | 9600 bps |
| Antenna Port Conducted Measurement | ASK | 1 | 1 | 9600 bps |

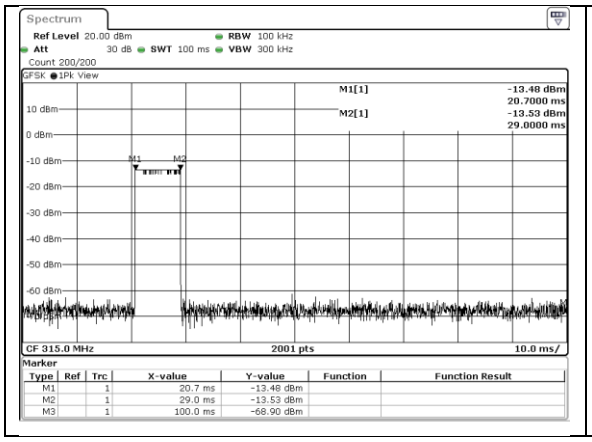
**433.92MHz**

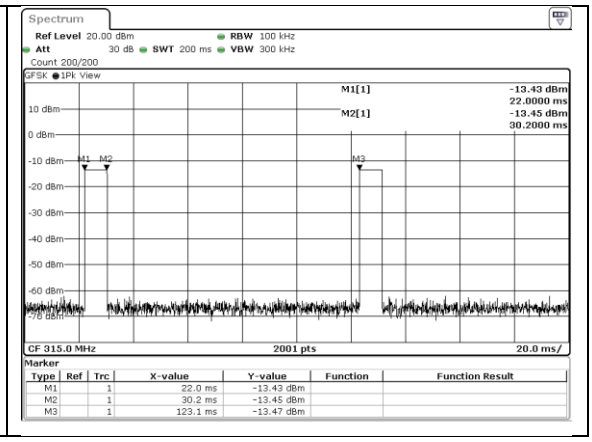
| Test Item | Modulation Type | Available Channel | Test Channel | Data Rate |
|---|---|---|---|---|
| Radiated Emissions | FSK | 1 | 1 | 9600 bps |
| Radiated Emissions (Below 1GHz) | FSK | 1 | 1 | 9600 bps |
| Antenna Port Conducted Measurement | FSK | 1 | 1 | 9600 bps |

## 5.6. Duty Cycle of Test Signal

| Mode | TX on (ms) | TX on+off (ms) | Duty Cycle (%) | Duty Cycle Correction Factor (dB) |
|---|---|---|---|---|
| 315MHz | 8.300 | 100.000 | 8.30% | -21.62 |

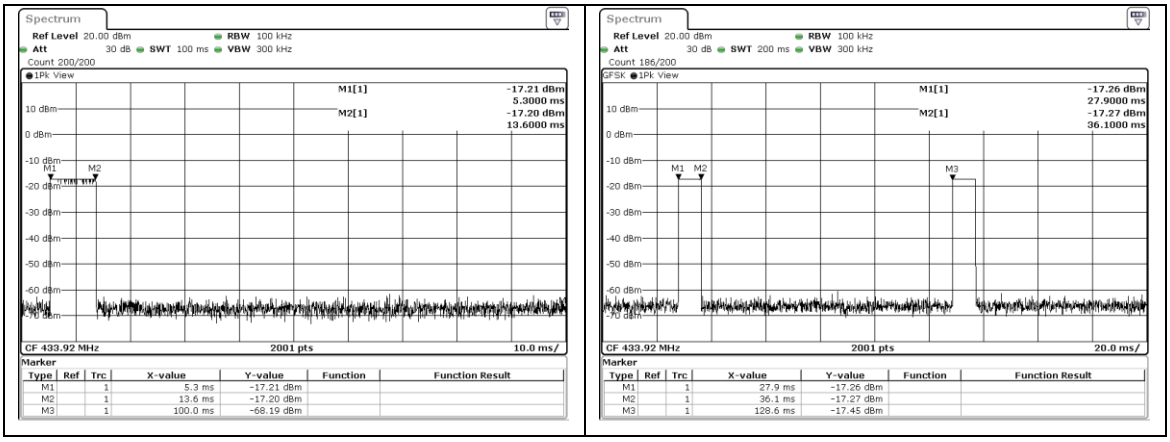
AVG factor = 20*Log (duty cycle in 100ms) = 20*Log(0.083) = -21.62 dB
Duty Cycle Correction Factor for Emission AVG Factor = -21.62 dB
Because= -21.62 less than -20, so Duty Cycle Correction Factor = -20 dB
AVG= Peak + duty cycle correction factor
AVG= Peak -20 dB



| Mode | TX on (ms) | TX on+off (ms) | Duty Cycle (%) | Duty Cycle Correction Factor (dB) |
|---|---|---|---|---|
| 433.92MHz | 8.300 | 100.000 | 8.30% | -21.62 |

AVG factor = 20*Log (duty cycle in 100ms) = 20*Log(0.083) = -21.62 dB
Duty Cycle Correction Factor for Emission AVG Factor = -21.62 dB
Because= -21.62 less than -20, so Duty Cycle Correction Factor = -20 dB
AVG= Peak + duty cycle correction factor
AVG= Peak -20 dB



# 6. Test Equipment

| Test Equipment List | | | | | |
|---|---|---|---|---|---|
| **Equipment** | **Manufacturer** | **Model No.** | **Serial No.** | **Cal. Date** | **Expired date** |
| **Radiated Spurious Emission** | | | | | |
| Spectrum Analyzer | Keysight | N9010A | MY56070827 | 2023/4/7 | 2024/4/6 |
| EMI Test Receiver | Rohde & Schwarz | ESR7 | 101754 | 2022/12/13 | 2023/12/12 |
| Loop Antenna | ETS lindgren | 6502 | 00213440 | 2023/1/4 | 2024/1/3 |
| Trilog-Broadband Antenna with 5dB Attenuator | Schwarzbeck & EMCI | VULB 9168 & N-6-05 | 774 & AT-N0538 | 2023/2/13 | 2024/2/12 |
| Horn Antenna (1-18 GHz) | Schwarzbeck | BBHA 9120 D | 01690 | 2022/12/21 | 2023/12/20 |
| Preamplifier (30-1000 MHz) | EMCI | EMC330E | 980405 | 2023/6/7 | 2024/6/6 |
| Preamplifier (1-18 GHz) | EMCI | EMC051835BE | 980406 | 2023/2/17 | 2024/2/16 |
| Cables | Hanyitek | K1K50-UP0264-K1K50-2500 | 170214-4 & 170425-2 | 2022/12/1 | 2023/11/30 |

| UL Software | | |
|---|---|---|
| **Description** | **Name** | **Version** |
| Radiated measurement | e3 | 6.191211 (V6) |
| Conducted measurement | RF-Conducted-FCC 15247 | ver 1.0 |

# 7. Description of Test Setup

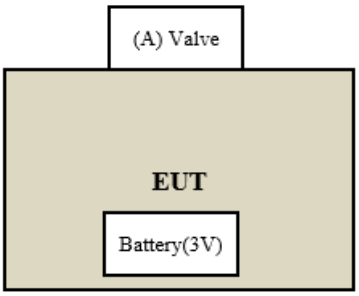
## Support Equipment

| ID | Equipment | Brand Name | Model Name | S/N | Remark |
|---|---|---|---|---|---|
| A | Valve | ORO | S02VA00014 | NA | Provide by client |

## Test Setup

Continuous transmission by powering on.

## Setup Diagram for Test




**Under Table**

**Remote Site**

# 8. Test Results

## 8.1. Radiated Spurious Emission

**Requirements**

Limits of Radiated Emission Measurement

| Fundamental Frequency (MHz) | Field Strength of Fundamental | | Field Strength of Spurious | |
|---|---|---|---|---|
| | uV/meter | dBuV/meter | uV/meter | dBuV/meter |
| 40.66 ~ 40.70 | 2250 | 67.04 | 225 | 48.04 |
| 70 ~ 130 | 1250 | 61.94 | 125 | 41.94 |
| 130 ~ 174 | 1250 ~ 3750 | 61.94 ~ 71.48 | 125 ~ 375 | 41.94 ~ 51.48 |
| 174 ~ 260 | 3750 | 71.48 | 375 | 51.48 |
| 260 ~ 470 | 3750 ~ 12500 | 71.48 ~ 81.94 | 375 ~ 1250 | 51.48 ~ 61.94 |
| Above 470 | 12500 | 81.94 | 1250 | 61.94 |

Note:
1. Where F is the frequency in MHz, the formula for calculating the maximum permitted fundamental field strengths are as follows: for the band 130-174 MHz, uV/m at 3 meters = 56.81818(F)-6136.3636; for the band 260-470 MHz, uV/m at 3 meters = 41.6667(F)-7083.3333. The maximum permitted unwanted emission level is 20 dB below the maximum permitted fundamental level.
2. The above field strength limits are specified at a distance of 3meters. The tighter limits apply at the band edges.

Radiated emissions which fall in the restricted bands must comply with the radiated emission limits specified as below table. Other emissions shall be at least 20dB below the highest level of the desired power:

| Frequency(MHz) | Field strength (microvolts/meter) | Measurement distance (meters) |
|---|---|---|
| 0.009-0.490 | 2400/F(kHz) | 300 |
| 0.490-1.705 | 24000/F(kHz) | 30 |
| 1.705-30.0 | 30 | 30 |
| 30-88 | 100 | 3 |
| 88-216 | 150 | 3 |
| 216-960 | 200 | 3 |
| Above 960 | 500 | 3 |

Note:
1. The lower limit shall apply at the transition frequencies.
2. Emission level (dBuV/m) = 20 log Emission level (uV/m).
3. For frequencies above 1000MHz, the field strength limits are based on average detector, however, the peak field strength of any emission shall not exceed the maximum permitted average limits, specified above by more than 20dB under any condition of modulation.

## Test Procedures

[For 9 kHz ~ 30 MHz]

a. The EUT was placed on the top of a rotating table 0.8 meters above the ground at a 3 meter chamber room. The table was rotated 360 degrees to determine the position of the highest radiation.
b. The EUT was set 3 meters away from the interference-receiving antenna, which was mounted on the top of a variable-height antenna tower.
c. Parallel, perpendicular, and ground-parallel orientations of the antenna are set to make the measurement.
d. For each suspected emission, the EUT was arranged to its worst case and the rotatable table was turned from 0 degrees to 360 degrees to find the maximum reading.
e. For measurement below 30MHz, the initial step in collecting conducted emission data is a spectrum analyzer peak detector mode pre-scanning the measurement frequency range. Significant peaks are then marked and then Quasi Peak detector mode re-measured. If the emission level of the EUT measured by the peak detector is lower than the applicable limit, the peak emission level will be reported. Otherwise, the emission measurement will be repeated using the quasi-peak detector and reported.

NOTE:
1. The resolution bandwidth and video bandwidth of test receiver/spectrum analyzer is 9kHz at frequency below 30MHz.

[For above 30 MHz]

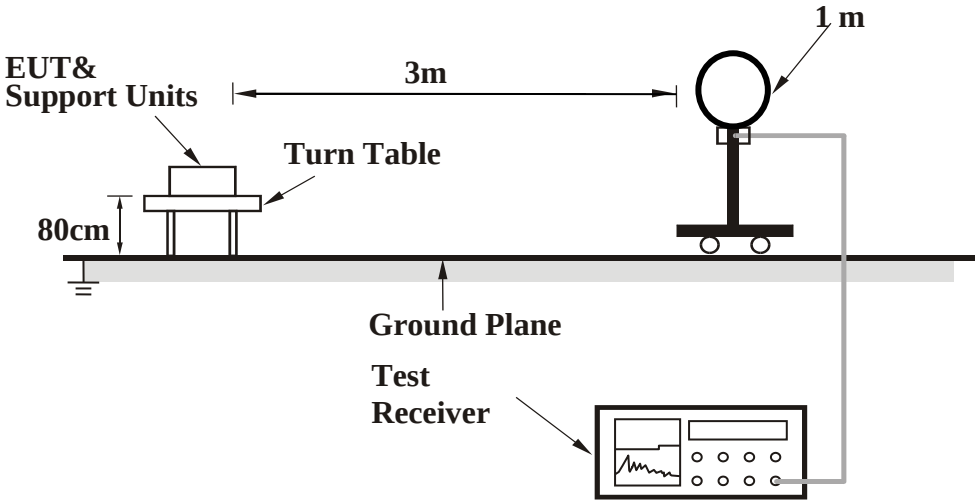
a. The EUT was placed on the top of a rotating table 0.8 meters (for 30MHz ~ 1GHz) / 1.5 meters (for above 1GHz) above the ground at 3 meter chamber room for test. The table was rotated 360 degrees to determine the position of the highest radiation.
b. The EUT was set 3 meters away from the interference-receiving antenna, which was mounted on the top of a variable-height antenna tower.
c. The height of antenna is varied from one meter to four meters above the ground to determine the maximum value of the field strength. Both horizontal and vertical polarizations of the antenna are set to make the measurement.
d. For each suspected emission, the EUT was arranged to its worst case and then the antenna was tuned to heights from 1 meter to 4 meters and the rotatable table was turned from 0 degrees to 360 degrees to find the maximum reading.
e. For measurement below 1GHz, the initial step in collecting conducted emission data is a spectrum analyzer peak detector mode pre-scanning the measurement frequency range. Significant peaks are then marked and then Quasi Peak detector mode re-measured. If the emission level of the EUT measured by the peak detector is lower than the applicable limit, the peak emission level will be reported. Otherwise, the emission measurement will be repeated using the quasi-peak detector and reported.
f. The test-receiver system was set to peak and average detects function and specified bandwidth with maximum hold mode when the test frequency is above 1 GHz. If the peak reading value also meets average limit, measurement with the average detector is unnecessary.

Note:

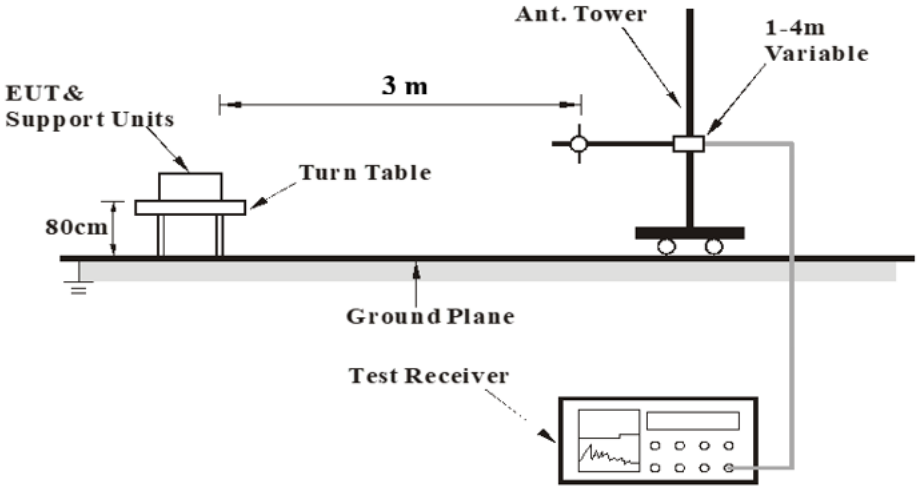
a. The resolution bandwidth and video bandwidth of test receiver/spectrum analyzer is 120kHz for Quasi-peak detection (QP) at frequency below 1GHz.
b. The resolution bandwidth of test receiver/spectrum analyzer is 1 MHz and the video bandwidth is 3 MHz for Peak detection (PK) at frequency above 1GHz.
c. The resolution bandwidth of test receiver/spectrum analyzer is 1MHz and the video bandwidth is ≥ 1/T (Duty cycle < 98%) or 10Hz (Duty cycle ≥ 98%) for Average detection (AV) at frequency above 1GHz.
d. All modes of operation were investigated (includes all external accessories) and the worst-case emissions are reported, the other emission levels were low against the limit.
e. Test data of Result value (dBuV/m) = Reading value (dBuV/m) + Correction Factor (dB/m).
f. Test data of Margin(dB) = Result value (dBuV/m) - Limit value (dBuV/m).
g. Test data of Correction Factor (dB/m) = Antenna Factor (dBuV/m) + Cable Loss (dB) - Preamp Factor (dB).
h. Test data of Notation "@" = Fundamental Frequency
i. Test data of Notation " * " = The peak result under 20 dB above and complies with AVG limit, AVG result is deemed to comply with AVG limit.

## Test Setup

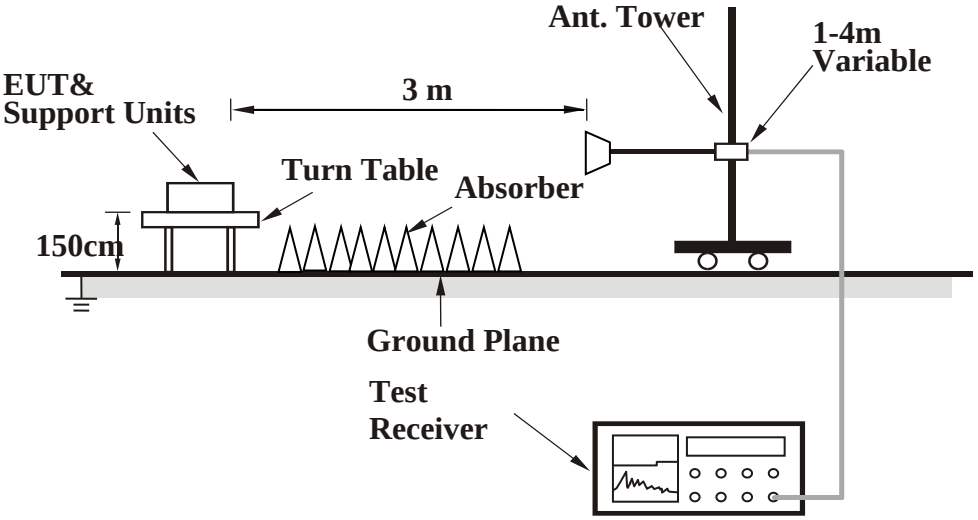
<Frequency Range 9 kHz ~ 30 MHz>



<Frequency Range 30 MHz ~ 1 GHz >




<Frequency Range above 1 GHz>




For the actual test configuration, please refer to the Setup Configurations.

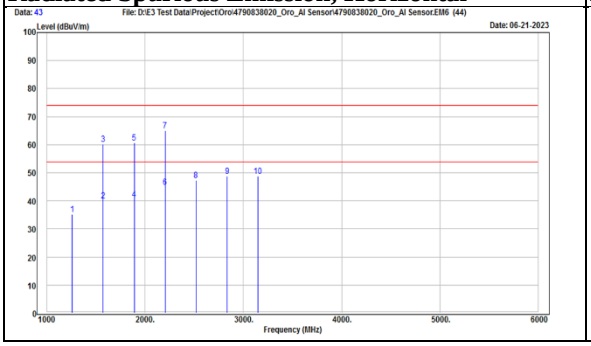
## Test Data

### Above 1 GHz

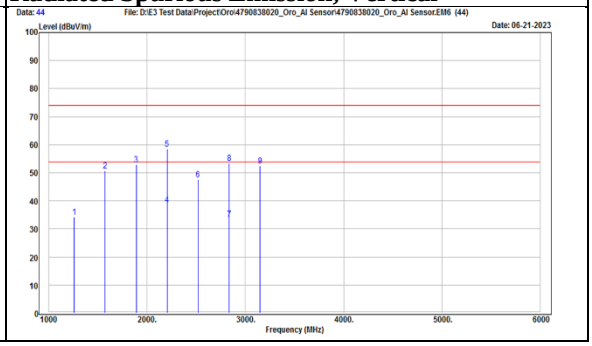
| Mode | ASK(315MHz) | Channel | 1 |
|---|---|---|---|

| Polarization | Notation | Frequency (MHz) | Reading (dBuV) | Correct (dB/m) | Result (dBuV/m) | Limit (dBuV/m) | Margin (dB) | Remark |
|---|---|---|---|---|---|---|---|---|
| Horizontal | * | 1260 | 44.03 | -8.82 | 35.21 | 74 | -38.79 | PK |
| | | 1575 | 68.33 | -8.25 | 60.08 | 74 | -13.92 | PK |
| | | 1575 | 48.33 | -8.25 | 40.08 | 54 | -13.92 | AVG |
| | | 1890 | 67.45 | -6.87 | 60.58 | 74 | -13.42 | PK |
| | | 1890 | 47.45 | -6.87 | 40.58 | 54 | -13.42 | AVG |
| | | 2205 | 69.36 | -4.4 | 64.96 | 74 | -9.04 | PK |
| | | 2205 | 49.36 | -4.4 | 44.96 | 54 | -9.04 | AVG |
| | * | 2520 | 51.73 | -4.3 | 47.43 | 74 | -26.57 | PK |
| | * | 2835 | 51.88 | -3 | 48.88 | 74 | -25.12 | PK |
| | * | 3150 | 50.66 | -1.76 | 48.9 | 74 | -25.1 | PK |
| Vertical | * | 1260 | 43.14 | -8.82 | 34.32 | 74 | -39.68 | PK |
| | * | 1575 | 59.05 | -8.25 | 50.8 | 74 | -23.2 | PK |
| | * | 1890 | 59.84 | -6.87 | 52.97 | 74 | -21.03 | PK |
| | | 2205 | 62.88 | -4.4 | 58.48 | 74 | -15.52 | PK |
| | | 2205 | 42.88 | -4.4 | 38.48 | 54 | -15.52 | AVG |
| | * | 2520 | 51.94 | -4.3 | 47.64 | 74 | -26.36 | PK |
| | | 2835 | 56.4 | -3 | 53.4 | 74 | -20.6 | PK |
| | | 2835 | 36.4 | -3 | 33.4 | 54 | -20.6 | AVG |
| | * | 3150 | 54.1 | -1.76 | 52.34 | 74 | -21.66 | PK |

**TX, ASK(315MHz) (Ch 1)**
**Radiated Spurious Emission, Horizontal**



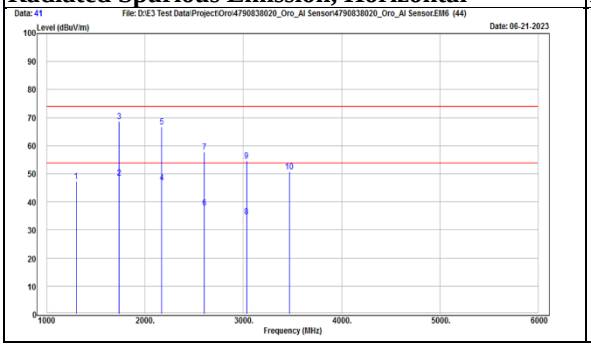

**TX, ASK(315MHz) (Ch 1)**
**Radiated Spurious Emission, Vertical**



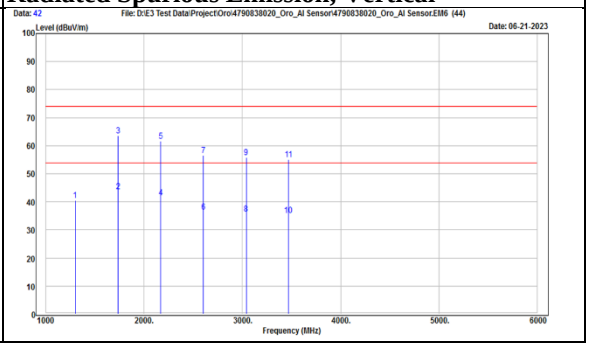
| Mode | FSK(433.92MHz) | Channel | 1 |
|---|---|---|---|

| Polarization | Notation | Frequency (MHz) | Reading (dBuV) | Correct (dB/m) | Result (dBuV/m) | Limit (dBuV/m) | Margin (dB) | Remark |
|---|---|---|---|---|---|---|---|---|
| Horizontal | * | 1301.76 | 55.87 | -8.55 | 47.32 | 74 | -26.68 | PK |
| | | 1735.68 | 76.43 | -7.85 | 68.58 | 74 | -5.42 | PK |
| | | 1735.68 | 56.43 | -7.85 | 48.58 | 54 | -5.42 | AVG |
| | | 2169.6 | 71.39 | -4.6 | 66.79 | 74 | -7.21 | PK |
| | | 2169.6 | 51.39 | -4.6 | 46.79 | 54 | -7.21 | AVG |
| | | 2605 | 61.81 | -4 | 57.81 | 74 | -16.19 | PK |
| | | 2605 | 41.81 | -4 | 37.81 | 54 | -16.19 | AVG |
| | | 3035 | 56.69 | -2.05 | 54.64 | 74 | -19.36 | PK |
| | | 3035 | 36.69 | -2.05 | 34.64 | 54 | -19.36 | AVG |
| | | 3470 | 52.59 | -1.88 | 50.71 | 74 | -23.29 | PK |
| Vertical | * | 1301.76 | 49.07 | -8.55 | 40.52 | 74 | -33.48 | PK |
| | | 1735.68 | 71.46 | -7.85 | 63.61 | 74 | -10.39 | PK |
| | | 1735.68 | 51.46 | -7.85 | 43.61 | 54 | -10.39 | AVG |
| | | 2169.6 | 66.17 | -4.6 | 61.57 | 74 | -12.43 | PK |
| | | 2169.6 | 46.17 | -4.6 | 41.57 | 54 | -12.43 | AVG |
| | | 2605 | 60.5 | -4 | 56.5 | 74 | -17.5 | PK |
| | | 2605 | 40.5 | -4 | 36.5 | 54 | -17.5 | AVG |
| | | 3040 | 57.75 | -2.04 | 55.71 | 74 | -18.29 | PK |
| | | 3040 | 37.75 | -2.04 | 35.71 | 54 | -18.29 | AVG |
| | | 3470 | 56.98 | -1.88 | 55.1 | 74 | -18.9 | PK |
| | | 3470 | 36.98 | -1.88 | 35.1 | 54 | -18.9 | AVG |

**TX, FSK(433.92MHz) (Ch 1)**
**Radiated Spurious Emission, Horizontal**




**TX, FSK(433.92MHz) (Ch 1)**
**Radiated Spurious Emission, Vertical**

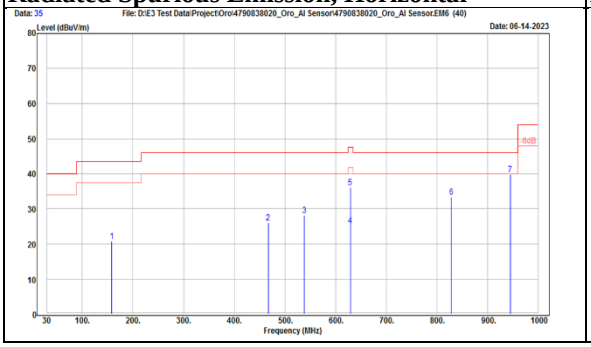


## Below 1 GHz

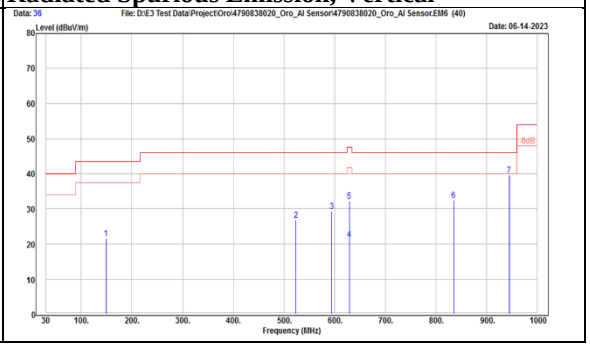
| Mode | ASK(315MHz) | Channel | 1 |
|---|---|---|---|

| Polarization | Notation | Frequency (MHz) | Reading (dBuV) | Correct (dB/m) | Result (dBuV/m) | Limit (dBuV/m) | Margin (dB) | Remark |
|---|---|---|---|---|---|---|---|---|
| Horizontal | | 158.04 | 41.12 | -20.35 | 20.77 | 43.5 | -22.73 | PK |
| | | 467.47 | 40.41 | -14.32 | 26.09 | 46 | -19.91 | PK |
| | | 538.28 | 41.13 | -13.03 | 28.1 | 46 | -17.9 | PK |
| | | 629.46 | 46.85 | -10.68 | 36.17 | 47.66 | -11.49 | PK |
| | | 629.46 | 35.85 | -10.68 | 25.17 | 47.66 | -22.49 | AVG |
| | | 828.31 | 40.68 | -7.26 | 33.42 | 46 | -12.58 | PK |
| | | 944.71 | 45.1 | -5.35 | 39.75 | 46 | -6.25 | PK |
| Vertical | | 149.31 | 42.13 | -20.66 | 21.47 | 43.5 | -22.03 | PK |
| | | 523.73 | 40.18 | -13.29 | 26.89 | 46 | -19.11 | PK |
| | | 594.54 | 40.76 | -11.37 | 29.39 | 46 | -16.61 | PK |
| | | 629.46 | 43.01 | -10.68 | 32.33 | 47.66 | -15.33 | PK |
| | | 629.46 | 32.01 | -10.68 | 21.33 | 47.66 | -26.33 | AVG |
| | | 835.1 | 39.63 | -7.12 | 32.51 | 46 | -13.49 | PK |
| | | 944.71 | 45.02 | -5.35 | 39.67 | 46 | -6.33 | PK |

**TX, ASK(315MHz) (Ch 1)**
**Radiated Spurious Emission, Horizontal**



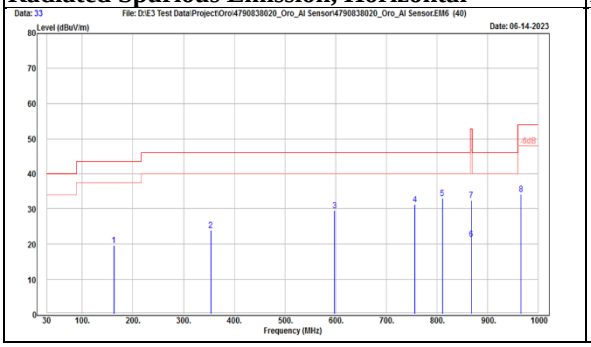

**TX, ASK(315MHz) (Ch 1)**
**Radiated Spurious Emission, Vertical**



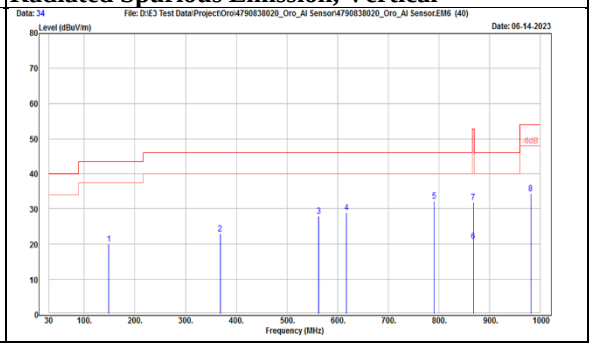
| Mode | FSK(433.92MHz) | Channel | 1 |
|---|---|---|---|

| Polarization | Notation | Frequency (MHz) | Reading (dBuV) | Correct (dB/m) | Result (dBuV/m) | Limit (dBuV/m) | Margin (dB) | Remark |
|---|---|---|---|---|---|---|---|---|
| Horizontal | | 162.89 | 36.98 | -17.33 | 19.65 | 43.5 | -23.85 | PK |
| | | 353.98 | 38.84 | -14.99 | 23.85 | 46 | -22.15 | PK |
| | | 598.42 | 37.65 | -8.13 | 29.52 | 46 | -16.48 | PK |
| | | 756.53 | 36.19 | -4.93 | 31.26 | 46 | -14.74 | PK |
| | | 810.85 | 37.37 | -4.41 | 32.96 | 46 | -13.04 | PK |
| | | 868.08 | 36.11 | -3.69 | 32.42 | 52.87 | -20.45 | PK |
| | | 868.08 | 25.11 | -3.69 | 21.42 | 52.87 | -31.45 | AVG |
| | | 966.05 | 36.41 | -2.17 | 34.24 | 54 | -19.76 | PK |
| Vertical | | 148.34 | 37.79 | -17.73 | 20.06 | 43.5 | -23.44 | PK |
| | | 368.53 | 37.3 | -14.4 | 22.9 | 46 | -23.1 | PK |
| | | 562.53 | 37.27 | -9.4 | 27.87 | 46 | -18.13 | PK |
| | | 617.82 | 36.66 | -7.7 | 28.96 | 46 | -17.04 | PK |
| | | 790.48 | 36.78 | -4.64 | 32.14 | 46 | -13.86 | PK |
| | | 868.08 | 35.56 | -3.69 | 31.87 | 52.87 | -21 | PK |
| | | 868.08 | 24.56 | -3.69 | 20.87 | 52.87 | -32 | AVG |
| | | 981.57 | 36.5 | -2.19 | 34.31 | 54 | -19.69 | PK |

**TX, FSK(433.92MHz) (Ch 1)**
**Radiated Spurious Emission, Horizontal**



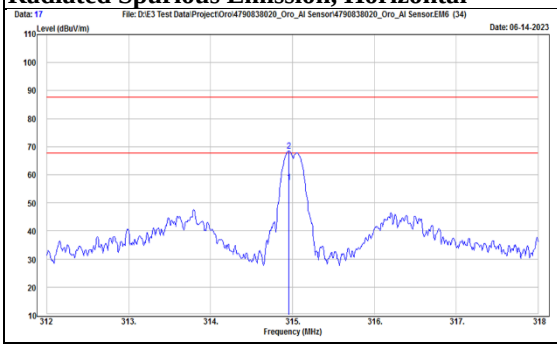

**TX, FSK(433.92MHz) (Ch 1)**
**Radiated Spurious Emission, Vertical**



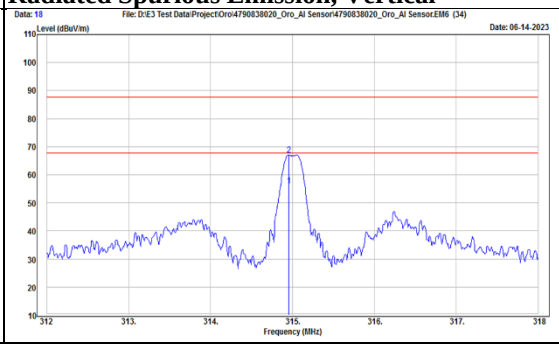
| Mode | Fundamental ASK(315MHz) | Channel | 1 |
|---|---|---|---|

| Polarization | Notation | Frequency (MHz) | Reading (dBuV) | Correct (dB/m) | Result (dBuV/m) | Limit (dBuV/m) | Margin (dB) | Remark |
|---|---|---|---|---|---|---|---|---|
| Horizontal | | 315 | 87.16 | -18.72 | 68.44 | 87.66 | -19.22 | PK |
| | | 315 | 76.16 | -18.72 | 57.44 | 67.66 | -10.22 | AVG |
| Vertical | | 315 | 85.85 | -18.72 | 67.13 | 87.66 | -20.53 | PK |
| | | 315 | 74.85 | -18.72 | 56.13 | 67.66 | -11.53 | AVG |

**TX, Fundamental ASK(315MHz) (Ch 1)**
**Radiated Spurious Emission, Horizontal**



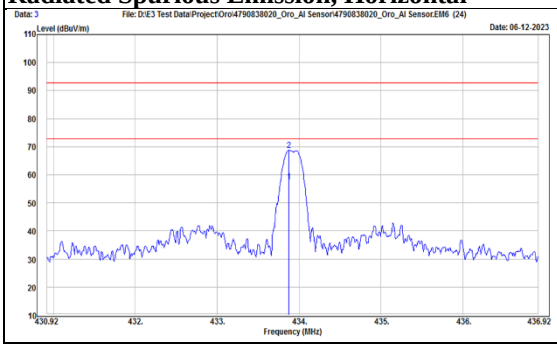

**TX, Fundamental ASK(315MHz) (Ch 1)**
**Radiated Spurious Emission, Vertical**



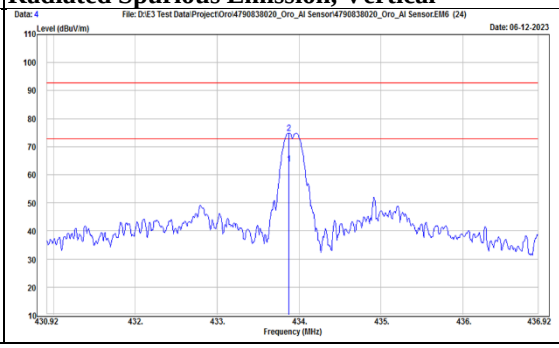
| Mode | Fundamental FSK(433.92MHz) | Channel | 1 |
|---|---|---|---|

| Polarization | Notation | Frequency (MHz) | Reading (dBuV) | Correct (dB/m) | Result (dBuV/m) | Limit (dBuV/m) | Margin (dB) | Remark |
|---|---|---|---|---|---|---|---|---|
| Horizontal | | 433.92 | 73.95 | -5.27 | 68.68 | 92.87 | -24.19 | PK |
| | | 433.92 | 62.95 | -5.27 | 57.68 | 72.87 | -15.19 | AVG |
| Vertical | | 433.92 | 80.15 | -5.27 | 74.88 | 92.87 | -17.99 | PK |
| | | 433.92 | 69.15 | -5.27 | 63.88 | 72.87 | -8.99 | AVG |

**TX, Fundamental FSK(433.92MHz) (Ch 1)**
**Radiated Spurious Emission, Horizontal**




**TX, Fundamental FSK(433.92MHz) (Ch 1)**
**Radiated Spurious Emission, Vertical**




## 9 kHz ~ 30 MHz Data:

For 9 kHz to 30 MHz radiated emission have performed all modes of operation were investigated. The amplitude of spurious emissions attenuated more than 20 dB below the permissible value is not required to be report.

No non-compliance noted:

**KDB 414788 D01 OATS and Chamber Correlation Justification**

- Base on FCC 15.31 (f) (2): measurements may be performed at a distance closer than that specified in the regulations; however, an attempt should be made to avoid making measurements in the near field.

- OATs and chamber correlation testing had been performed and chamber measured test results is the worst case test result.

Although these tests were performed other than open area test site, adequate comparison measurements were confirmed against 30m open area test site. Therefore sufficient tests were made to demonstrate that the alternative site produces results that correlate with the ones of tests made in an open field based on KDB 414788.

## 8.2. 20dB Bandwidth Measurement

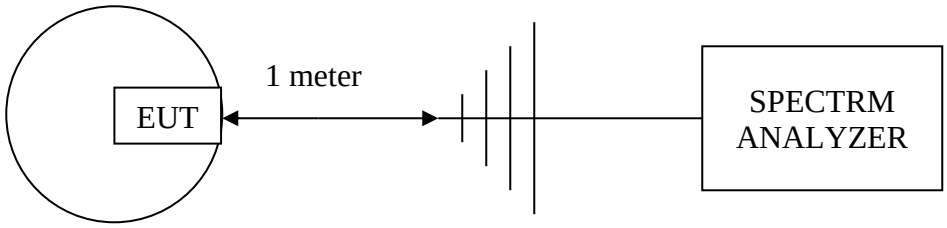
### Requirements

Limits of 20dB Bandwidth Measurement

The bandwidth of the emission shall be no wider than 0.25% of the center frequency for device operating above 70 MHz and below 900 MHz.

| Fundamental Frequency (MHz) | Limit of Emission Bandwidth (kHz) |
|---|---|
| 315 | 787.5 |
| 433.92 | 1084.80 |

### Test Setup




### Test Instruments

Refer to section 6 to get information of above instrument.

### Test Procedure

a. The EUT was placed on the turn table.
b. The signal was coupled to the spectrum analyzer through an antenna.
c. Set the resolution bandwidth to 3 kHz and video bandwidth to 10 kHz then select Peak function to scan the channel frequency.
d. The emission bandwidth was measured and recorded.

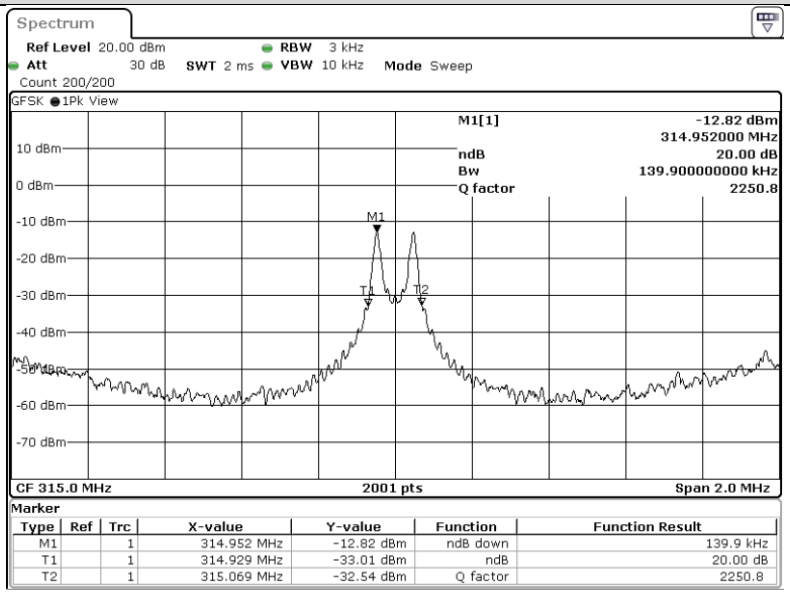
### Deviation from Test Standard

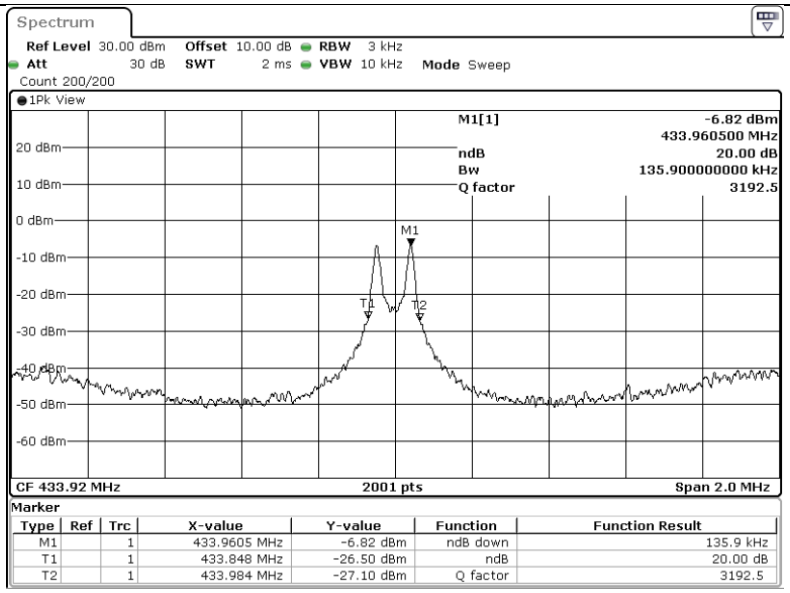
No deviation.

## Test Data

| Channel | Frequency (MHz) | 20dB Bandwidth (kHz) | Maximum Limit (kHz) | Pass / Fail |
|---|---|---|---|---|
| 1 | 315 | 139.9 | 787.5 | PASS |
| 1 | 433.92 | 139.9 | 1084.80 | PASS |

**SPECTRUM PLOT OF VALUE**



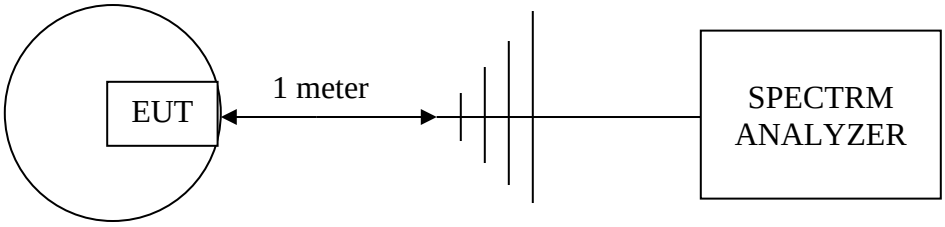
## 8.3. Deactivation Time Measurement

**Requirements**

Limits of Deactivation Time Measurement

(1) A transmitter activated automatically shall cease transmission within 5 seconds after activation.
(2) For automatically limiting operation that the duration of each transmission shall not be greater than one second and the silent period between transmissions shall be at least 30 times the duration of the transmission but in no case less than 10 seconds.

**Test Setup**




**Test Instruments**

Refer to section 6 to get information of above instrument.

**Test Procedure**

a. The EUT was placed on the turning table.

b. The signal was coupled to the spectrum analyzer through an antenna.

c. Set the resolution bandwidth to 100kHz and video bandwidth to 100kHz. The spectrum analyser was turned to the centre frequency of the transmitter's and the analyser's marker function was used to determine the duration of transmission.

d. The transmission duration was measured and recorded.

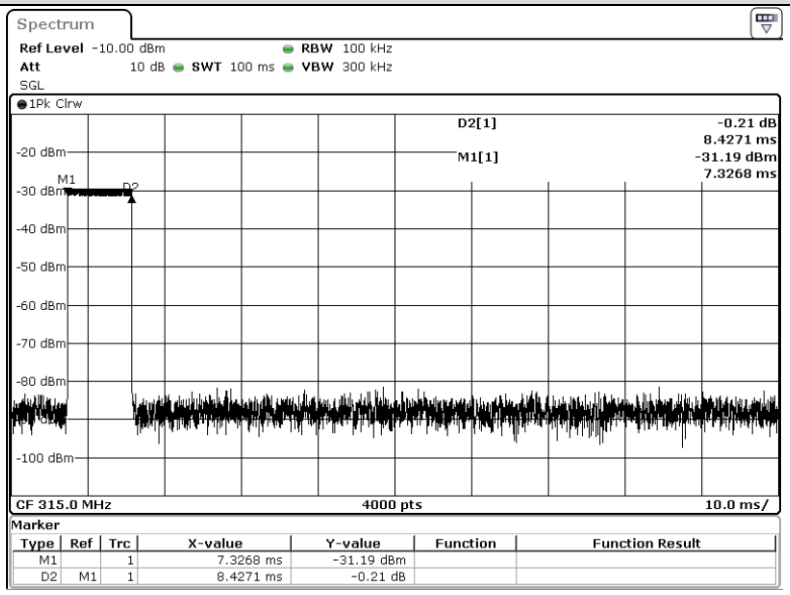
**Deviation from Test Standard**

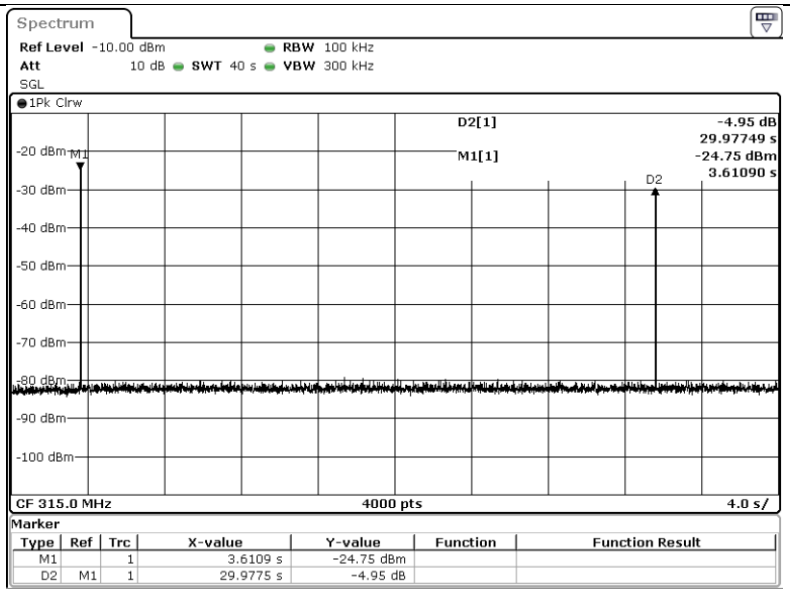
No deviation.

## Test Data

| Frequency (MHz) | Tx on time (ms) | Tx on time Limit (s) | Idle time (s) | Idle time Limit (s) | Pass/Fail |
|---|---|---|---|---|---|
| 315 | 8.43 | <1 | 29.98 | 10 | PASS |

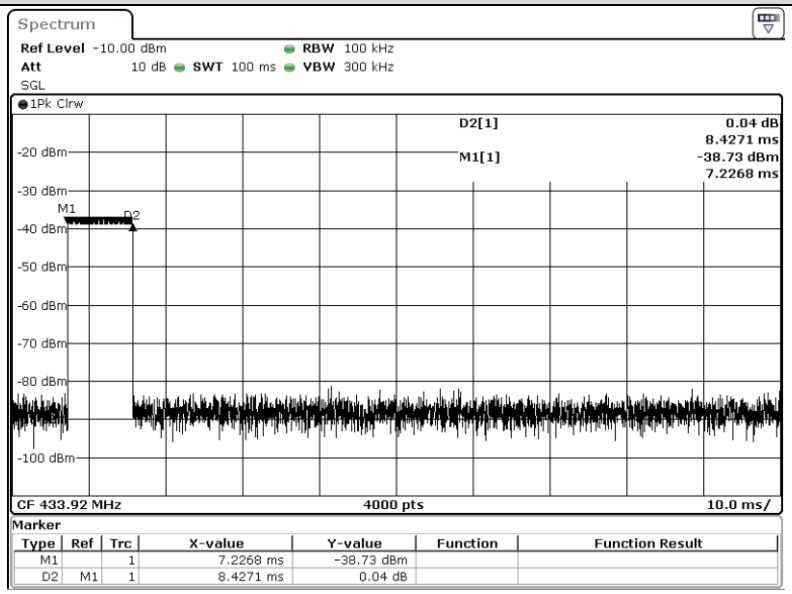
**SPECTRUM PLOT OF VALUE**

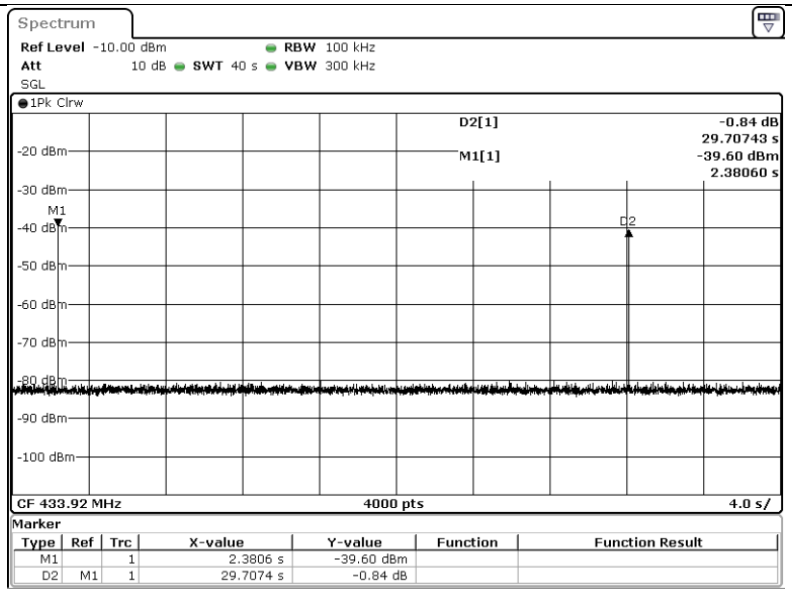


| Frequency (MHz) | Tx on time (ms) | Tx on time Limit (s) | Idle time (s) | Idle time Limit (s) | Pass/Fail |
|---|---|---|---|---|---|
| 433.92 | 8.42 | <1 | 29.70 | 10 | PASS |

**SPECTRUM PLOT OF VALUE**




# END OF REPORT