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# FCC 15.247 & RSS-247
# 900 MHz Test Report

## for

## FUTABA Corporation

## 1080 YabutsukaChosei-son Chosei-gun, Chiba-ken, 299-4395 Japan.

| | | |
|---|---|---|
| **Product Name** | **:** | **RECEIVER** |
| **Model Name** | **:** | **R9001SB** |
| **Brand** | | **Futaba** |
| **FCC ID** | **:** | **AZPR9001SB** |
| **IC** | **:** | **2914D-R9001SB** |

| | | |
|---|---|---|
| **Prepared by:** | **:** | **AUDIX Technology Corporation, EMC Department** |

Testing Laboratory
1724

TESTING
NVLAP LAB CODE 200077-0

The test report is based on a single evaluation of one sample of the above-mentioned products. It does not imply an assessment of the whole production and does not permit the use of the test lab logo.
The report must not be used by the client to claim product certification, approval, or endorsement by NVLAP, NIST, or any agency of the U.S. Government.



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# TEST REPORT

| | | |
|---|---|---|
| Applicant | : | FUTABA Corporation |
| Manufacturer | : | FUTABA Corporation |
| EUT Description | | |
| (1) Product | : | RECEIVER |
| (2) Model | : | R9001SB |
| (3) Brand | : | Futaba |
| (4) Power Supply | : | DC 4.0V-8.4V |

Applicable Standards:

Title 47 CFR FCC Part 15 Subpart C
RSS-Gen (Issue 5), Amendment 2, February 2021
RSS-247 (Issue 3), August 2023

***Audix Technology Corp.*** tested the equipment mentioned in accordance with the requirements set forth in the above standards. Test results indicate that the equipment tested is capable of demonstrating compliance with the requirements as documented within this report.
***Audix Technology Corp.*** does not assume responsibility for any conclusions and generalizations drawn from the test results with regard to other specimens and samples.

Date of Report: 2024. 01. 17

Reviewed by: Annie Yu (Annie Yu/Administrator)

Approved by: Johnny Hsueh (Johnny Hsueh/Section Manager)



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# 1. REVISION RECORD OF TEST REPORT

| Edition No | Issued Date | Revision Summary | Report Number |
|---|---|---|---|
| 0 | 2024. 01. 17 | Original Report | EM-F230632 |



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# 2. SUMMARY OF TEST RESULTS

| Rule | | Description | Results |
|---|---|---|---|
| **FCC** | **IC** | | |
| 15.207 | RSS-Gen §8.8 | Conducted Emission | **N/A, Note 3** |
| 15.247(d)/15.205 | RSS-Gen §8.9<br>RSS-247 §5.5 | Radiated Band Edge and Radiated Spurious Emission | **PASS** |
| 15.247(a)(1)(i) | RSS-247 §5.1(C) | 20dB Bandwidth | **PASS** |
| 15.247(a)(1)(i) | RSS-247 §5.1(C) | Carrier Frequency Separation | **PASS** |
| 15.247(a)(1)(i) | RSS-247 §5.1(C) | Time of Occupancy | **PASS** |
| 15.247(a)(1)(i) | RSS-247 §5.1(C) | Number of Hopping Channels | **PASS** |
| 15.247(b)(2) | RSS-247 §5.4(a) | Maximum Peak Output Power | **PASS** |
| 15.247(d) | RSS-247 §5.5 | Conducted Band Edges and Conducted Spurious Emission | **PASS** |
| 15.203 | --- | Antenna Requirement | **Compliance** |

Note: 1. Decision rule according to the limit of the test standard chapter, the test value is lower than the limit specified in the test chapter, and it is judged as Pass.
2. The uncertainties value is not used in determining the result.
3. The EUT only employs battery power for operation, so it is unnecessary to test.



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# 3. GENERAL INFORMATION

## 3.1. Description of Application

| | |
|---|---|
| Applicant | FUTABA Corporation<br>1080 Yabutsuka Chosei-mura Chosei-gun Chiba-ken, 299-4395 Japan. |
| Manufacturer | FUTABA Corporation<br>1080 Yabutsuka Chosei-mura Chosei-gun Chiba-ken, 299-4395 Japan. |
| Product | RECEIVER |
| Model | R9001SB |
| Brand | Futaba |



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## 3.2. Description of EUT

| | |
|---|---|
| Test Model | R9001SB |
| Serial Number | N/A |
| Power Rating | DC 4.0V-8.4V |
| Software Version | N/A |
| RF Features | 2GFSK (FHSS) |
| Transmit Type | 2T2R (Diversity) |
| Test Sample | Sample No. 01 / Test Item: RSE, RF Conducted / Firmware: N/A |
| Sample Status | Trial sample |
| Date of Receipt | 2023. 10. 16 |
| Date of Test | 2023. 11. 30 ~ 2024. 01. 17 |
| Interface Ports of EUT | None |
| Accessories Supplied | None |

Pursuant ISO 17025:2017 section 7.8.2, ***Audix Technology Corp.*** does not assume responsibility for all EUT's information including RF features, transmit type, antenna information…etc are provided by customer.

## 3.3. Reference Test Guidance

ANSI C63.10:2013

## 3.4. Antenna Information

| No. | Antenna Type | | Manufacture | Antenna Part Number | Frequency (MHz) | Max Gain (dBi) |
|---|---|---|---|---|---|---|
| 1. | ANT A | Flex type | Molex | 2111400100 | 902-928 | 1.0 |
| | ANT B | Flex type | Molex | 2111400100 | 902-928 | 1.0 |



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## 3.5. EUT Specifications Assessed in Current Report

| Mode | Fundamental Range (MHz) | Channel Number | Modulation | Data Rate (kbps) |
|---|---|---|---|---|
| FHSS | 904.6-925.4 | 53 | 2GFSK | 140 |

| Channel List | | | | | | | |
|---|---|---|---|---|---|---|---|
| Channel Number | Frequency (MHz) | Channel Number | Frequency (MHz) | Channel Number | Frequency (MHz) | Channel Number | Frequency (MHz) |
| 1 | 904.6 | 16 | 910.6 | 31 | 916.6 | 46 | 922.6 |
| 2 | 905.0 | 17 | 911.0 | 32 | 917.0 | 47 | 923.0 |
| 3 | 905.4 | 18 | 911.4 | 33 | 917.4 | 48 | 923.4 |
| 4 | 905.8 | 19 | 911.8 | 34 | 917.8 | 49 | 923.8 |
| 5 | 906.2 | 20 | 912.2 | 35 | 918.2 | 50 | 924.2 |
| 6 | 906.6 | 21 | 912.6 | 36 | 918.6 | 51 | 924.6 |
| 7 | 907.0 | 22 | 913.0 | 37 | 919.0 | 52 | 925.0 |
| 8 | 907.4 | 23 | 913.4 | 38 | 919.4 | 53 | 925.4 |
| 9 | 907.8 | 24 | 913.8 | 39 | 919.8 | | |
| 10 | 908.2 | 25 | 914.2 | 40 | 920.2 | | |
| 11 | 908.6 | 26 | 914.6 | 41 | 920.6 | | |
| 12 | 909.0 | 27 | 915.0 | 42 | 921.0 | | |
| 13 | 909.4 | 28 | 915.4 | 43 | 921.4 | | |
| 14 | 909.8 | 29 | 915.8 | 44 | 921.8 | | |
| 15 | 910.2 | 30 | 916.2 | 45 | 922.2 | | |

## 3.6. Description of Key Components

None



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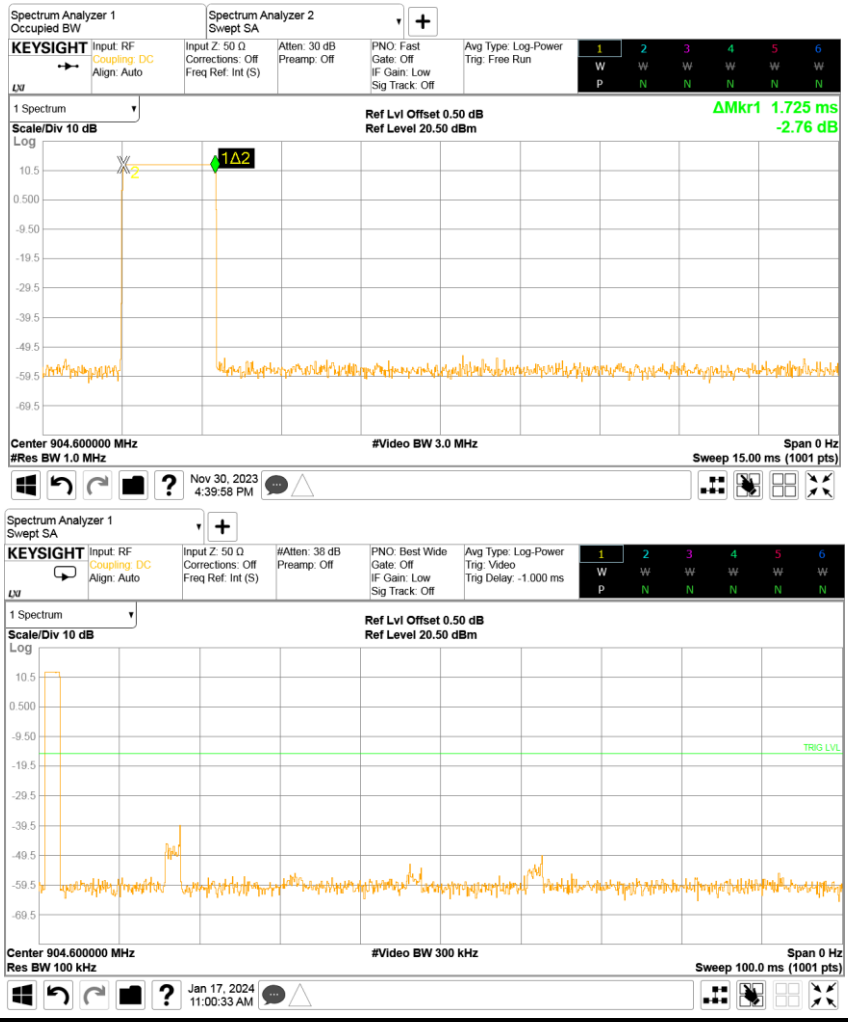
## 3.7. Test Configuration

| Mode | Frequency (MHz) | $TX_{on}$ (ms) | $TX_{on+off}$ (ms) | Duty Cycle Correction Factor (dB) |
|---|---|---|---|---|
| FHSS (ANT A) | 904.6 | 1.725 | 100 | -35.26 |
| FHSS (ANT B) | 904.6 | 1.725 | 100 | -35.26 |

Note: Duty Cycle Correction Factor (DCCF)= 20log (TXon/TX on+off)。

"TX on + off" means the period of the pulse train or 100ms if the pulse train length is greater than 100ms.

| Mode | Frequency (MHz) | $TX_{on}$ (ms) |
|---|---|---|
| FHSS (ANT A) | 904.6 |  |





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| Mode | Frequency (MHz) | TXon (ms) |
|---|---|---|
| FHSS (ANT B) | 904.6 | |





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| Item | | ANT Port | Test Channel |
|---|---|---|---|
| Radiated Test Case | Radiated Spurious Emission (30MHz~1GHz) | ANT A | 1 |
| | | ANT B | 1 |

| Item | | ANT Port | Test Channel |
|---|---|---|---|
| Radiated Test Case | Radiated Band Edge Note | ANT A | 1/53 |
| | | ANT B | 1/53 |
| | Radiated Spurious Emission Note | ANT A | 1/27/53 |
| | | ANT B | 1/27/53 |
| Conducted Test Case | 20dB Bandwidth | ANT A | 1/27/53 |
| | | ANT B | 1/27/53 |
| | Carrier Frequency Separation | ANT A | 1/27/53 |
| | | ANT B | 1/27/53 |
| | Time of Occupancy | ANT A | 1/27/53 |
| | | ANT B | 1/27/53 |
| | Number of Hopping Channels | ANT A | 27 |
| | | ANT B | 27 |
| | Maximum Peak Output Power | ANT A | 1/27/53 |
| | | ANT B | 1/27/53 |
| | Band Edges | ANT A | 1/53 |
| | | ANT B | 1/53 |
| | Spurious Emission | ANT A | 1/27/53 |
| | | ANT B | 1/27/53 |

Note 1: ☐Mobile Device ■Portable Device
and 3 axis were assessed. The worst scenario for Radiated Spurious Emission as follow: ■Lie ☐Side ☐Stand

Note 2: Low, mid, and high channels were measured, only the worst channel of each modulation was presented in this report.

## 3.8. Output Power Setting

| Mode | Centre Frequency (MHz) | Power Setting |
|---|---|---|
| 2GFSK | 904.6 | Default |
| | 915.0 | Default |
| | 925.4 | Default |



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## 3.9. Tested Supporting System List

### 3.9.1. Support Peripheral Unit

| No. | Product | Brand | Model No. | Serial No. | Approval |
|---|---|---|---|---|---|
| 1. | Battery (DC 6.0V) | Futaba | HT5F1800B | N/A | N/A |
| 2. | Test Jig | Futaba | CIU-3 | N/A | N/A |
| 3. | Notebook PC | Dynabook | CS40L-HB | 51144079H | N/A |

### 3.9.2. Cable Lists

| No. | Cable Description Of The Above Support Units |
|---|---|
| 1. | Power Wire: Unshielded, Detachable, 0.1m*2 |
| 2. | Signal Cable: Unshielded, Detachable, 0.2m |
| 3. | Adapter: BSY, M/N BSY065T1902103 D,<br>DC Cord：Shielded, Undetachable, 1.8m, Bonded a ferrite core<br>AC Power Cord：Unshielded, Detachable, 1.5m |

## 3.10. Setup Configuration

### 3.10.1. EUT Configuration for Radiated Emission

### 3.10.2. EUT Configuration for RF Conducted Test Items

## 3.11. Operating Condition of EUT

Test program “Futaba Term” is used for enabling EUT RF function under continue transmitting and choosing channel.



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## 3.12.Description of Test Facility

| | |
|---|---|
| Name of Test Firm | Audix Technology Corporation / EMC Department<br>No. 491, Zhongfu Rd., Linkou Dist., New Taipei City 244, Taiwan<br>Tel: +886-2-26092133<br>Fax: +886-2-26099303<br>Website : www.audixtech.com<br>Contact e-mail: attemc_report@audixtech.com |
| Accreditations | The laboratory is accredited by following organizations under ISO/IEC 17025:2017<br>(1) NVLAP(USA)<br>NVLAP Lab Code 200077-0<br>(2) TAF(Taiwan)<br>No. 1724 |
| Test Facilities | FCC OET Designation Number under APEC MRA by NCC is : TW1724<br>ISED CAB Identifier Number under APEC TEL MRA by NCC is TW1724<br>(1) No.1 3m Semi Anechoic Chamber |



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## 3.13.Measurement Uncertainty

The measurement uncertainty levels have been estimated as specified in ETSI TR 100 028-2001

| Test Items/Facilities | | | Frequency Range | Uncertainty |
|---|---|---|---|---|
| Conduction Test | ☐ | No. 7 Shielded Room | 9kHz-150kHz | ±3.7dB |
| | | | 150kHz-30MHz | ±3.4dB |
| | ☐ | No. 8 Shielded Room | 9kHz-150kHz | ±3.7dB |
| | | | 150kHz-30MHz | ±3.5dB |
| Radiation Test | ☒ | No.1 3m Semi Anechoic Chamber | 30MHz-200MHz, 3m, Horizontal | ±3.6dB |
| | | | 200MHz-1000MHz, 3m, Horizontal | ±4.3dB |
| | | | 30MHz-200MHz, 3m, Vertical | ±4.4dB |
| | | | 200MHz-1000MHz, 3m, Vertical | ±4.8dB |
| | | | 1GHz-6GHz, 3m | ±4.8dB |
| | | | 6GHz-18GHz, 3m | ±4.5dB |
| | ☐ | No.3 3m Semi Anechoic Chamber | 30MHz-200MHz, 3m, Horizontal | ±4.0dB |
| | | | 200MHz-1000MHz, 3m, Horizontal | ±4.4dB |
| | | | 30MHz-200MHz, 3m, Vertical | ±4.7dB |
| | | | 200MHz-1000MHz, 3m, Vertical | ±4.5dB |
| | | | 1GHz-6GHz, 3m | ±4.8dB |
| | | | 6GHz-18GHz, 3m | ±4.5dB |
| | ☐ | No.4 3m Semi Anechoic Chamber | 30MHz-200MHz, 3m, Horizontal | ±4.3dB |
| | | | 200MHz-1000MHz, 3m, Horizontal | ±4.2dB |
| | | | 30MHz-200MHz, 3m, Vertical | ±4.8dB |
| | | | 200MHz-1000MHz, 3m, Vertical | ±4.7dB |
| | | | 1GHz-6GHz, 3m | ±4.6dB |
| | | | 6GHz-18GHz, 3m | ±4.4dB |
| | ☐ | No.5 3m Semi Anechoic Chamber | 30MHz-200MHz, 3m, Horizontal | ±4.6dB |
| | | | 200MHz-1000MHz, 3m, Horizontal | ±4.4dB |
| | | | 30MHz-200MHz, 3m, Vertical | ±4.5dB |
| | | | 200MHz-1000MHz, 3m, Vertical | ±4.9dB |
| | | | 1GHz-6GHz, 3m | ±4.9dB |
| | | | 6GHz-18GHz, 3m | ±4.6dB |
| | Radiated emissions (18GHz-40GHz) | | 18GHz-40GHz, 3m | ±3.4dB |

Remark：Uncertainty = $ku_c(y)$



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| Test Item | Uncertainty |
|---|---|
| 20dB Bandwidth | ±0.2kHz |
| 99% Occupied Bandwidth | ±0.38% |
| Carrier Frequency Separation | ±0.2kHz |
| Time of Occupancy | ±0.03sec |
| Maximum peak Output power | ± 0.52dB |
| Conducted Emission Limitations | ± 0.13dB |



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# 4. MEASUREMENT EQUIPMENTLIST

## 4.1. Radiated Emission Measurement

| Item | Type | Manufacturer | Model No. | Serial No. | Cal. Date | Cal. Interval |
|---|---|---|---|---|---|---|
| 1. | Spectrum Analyzer | Agilent | N9010A-526 | MY53400071 | 2023.08.16 | 1 Year |
| 2. | Test Receiver | R&S | ESCS30 | 100338 | 2023.06.20 | 1 Year |
| 3. | Amplifier | HP | 8447D | 2944A06305 | 2022.12.29 | 1 Year |
| 4. | Microwave Preamplifier | HP | 8449B | 3008A01284 | 2023.06.06 | 1 Year |
| 5. | Bilog Antenna | TESEQ | CBL6112D | 33821 | 2023.09.30 | 1 Year |
| 6. | Double-Ridged Waveguide Horn | EMCO | 3115 | 9112-3775 | 2023.05.04 | 1 Year |
| 7. | High-Pass Filter | Woken | WFIL-H1200-12000F | WRG19WC2B4 | 2023.05.03 | 1 Year |
| 8. | Coaxial Cable | MIYAZAKI | 5D2W | RE-11 | 2023.01.07 | 1 Year |
| 9. | Coaxial Cable | HUBER+ SUHNER | SUCOFLEX 106 | RE-14 | 2023.01.07 | 1 Year |
| 10. | Digital Thermo-Hygro Meter | iMax | HTC-1 | No.1 3m A/C | 2023.04.13 | 1 Year |
| 11. | Test Software | Audix | e3 | V9 18621a | N.C.R. | N.C.R. |

## 4.2. RF Conducted Measurement

| Item | Type | Manufacturer | Model No. | Serial No. | Cal. Date | Cal. Interval |
|---|---|---|---|---|---|---|
| 1. | Spectrum Analyzer | Keysight | N9020B | MY57120357 | 2023.02.22 | 1 Year |
| 2. | Digital Thermo-Hygro Meter | iMax | HTC-1 | RF-03 | 2023.04.13 | 1 Year |



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# 5. CONDUCTED EMISSION

【The EUT only employs uses DC power for operation, no conductive emission limits are required according to FCC Part 15 Section §15.207 and RSS-Gen §8.8】



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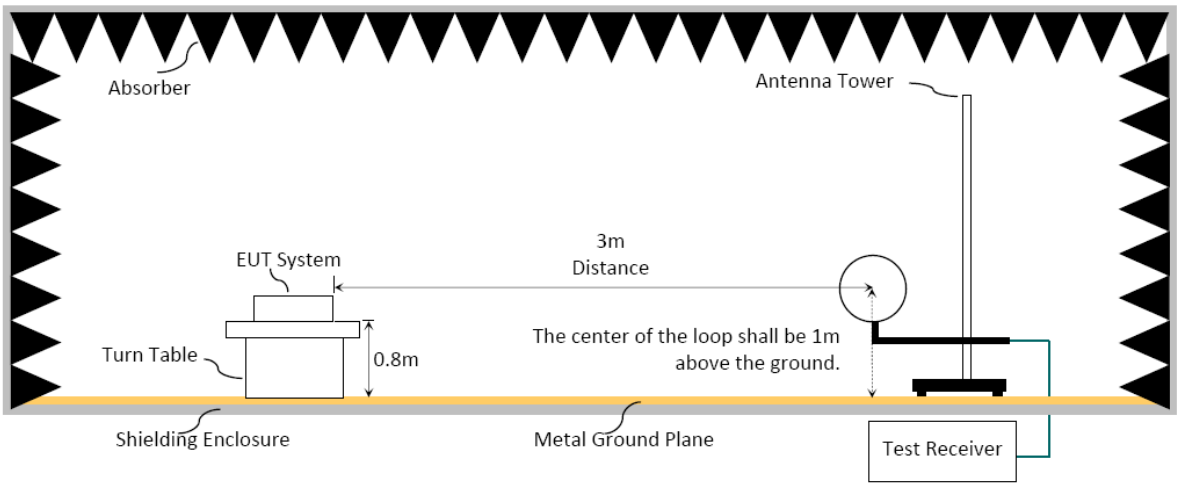
# 6. RADIATED EMISSION

## 6.1. Block Diagram of Test Setup

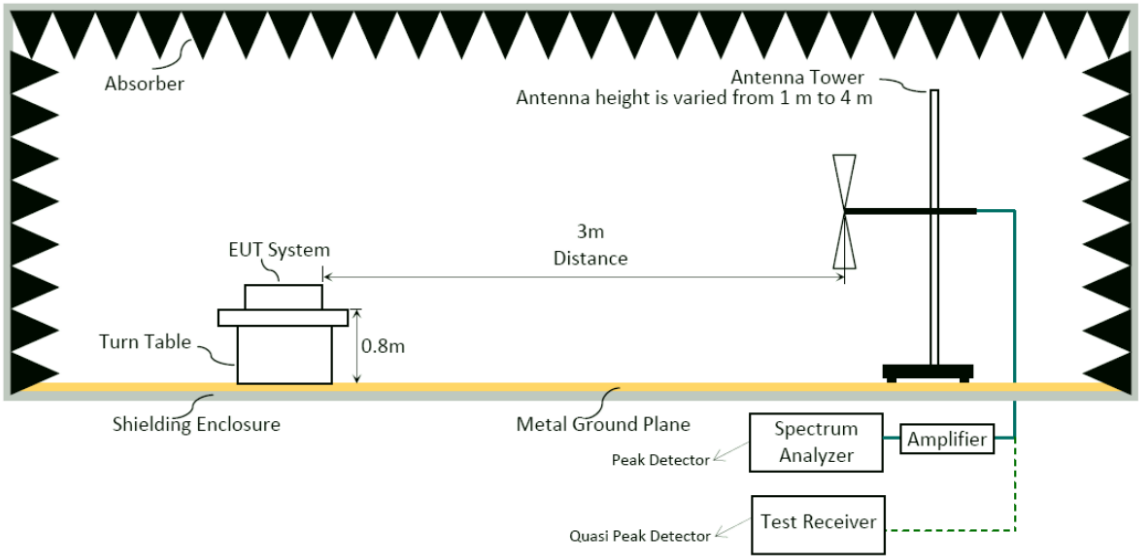
### 6.1.1. Block Diagram of EUT

Indicated as section 3.10

### 6.1.2. Setup Diagram for 9kHz-30MHz




### 6.1.3. Setup Diagram for 30-1000MHz



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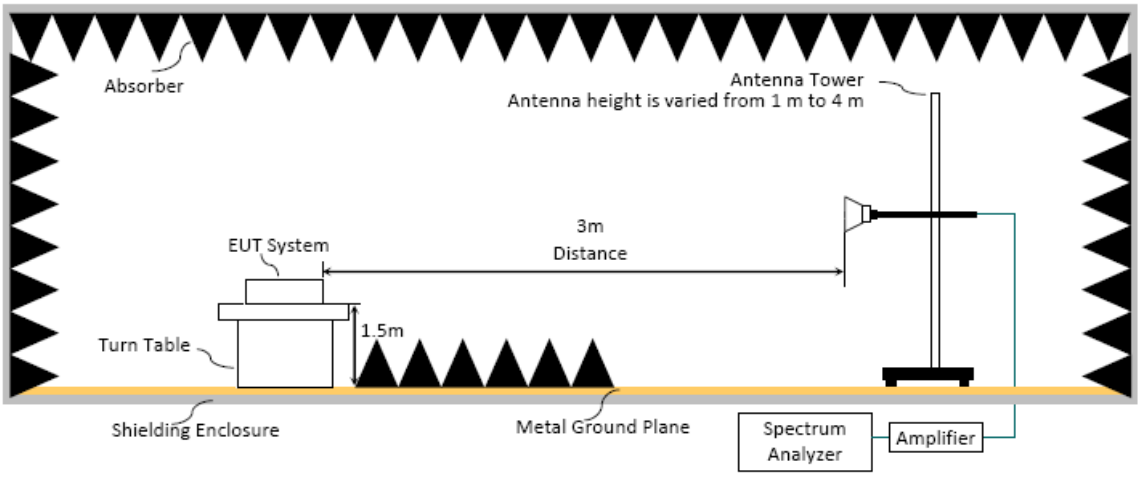
6.1.4. Setup Diagram for above 1GHz




## 6.2. Radiated Emission Limits

In any 100kHz bandwidth outside the frequency band, the radio frequency power produced by the intentional radiator shall be at least 20dB below that in the 100kHz bandwidth within the band that contains the highest level. In addition, radiated emissions which fall in restricted bands, as defined in Section 15.205/ RSS-Gen Section 8.10 table 6, must also comply with the radiated emission limits specified as below.

| Frequency (MHz) | Distance(m) | Limits | |
|---|---|---|---|
| | | dBμV/m | μV/m |
| 0.009 - 0.490 | 300 | 67.6-20 log f(kHz) | 2400/f kHz |
| 0.490 - 1.705 | 30 | 87.6-20 log f(kHz) | 24000/f kHz |
| 1.705 - 30 | 30 | 29.5 | 30 |
| 30 - 88 | 3 | 40.0 | 100 |
| 88- 216 | 3 | 43.5 | 150 |
| 216- 960 | 3 | 46.0 | 200 |
| Above 960 | 3 | 54.0 | 500 |
| Above 1000 | 3 | 74.0 dBμV/m (Peak)<br>54.0 dBμV/m (Average) | |

Remark：(1) dBμV/m = 20 log (μV/m)
(2) The tighter limit applies to the edge between two frequency bands.
(3) Distance refers to the distance in meters between the measuring instrument antenna and the closed point of any part of the device or system.
(4) Fundamental and emission fall within operation band are exempted from this section.
(5) Pursuant to ANSI C63.10: 6.6.4.3, if the maximized peak measured value complies with the average limit, then it is unnecessary to perform an average measurement.



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## 6.3. Test Procedure

**Frequency Range 9kHz~30MHz:**
The EUT setup on the turntable which has 0.8 m height to the ground. The turn table rotated 360 degrees and antenna fixed to 1 m to find the maximum emission level.
In order to find the maximum emission, all of the interface cables were manipulated according to ANSI C63.10-2013 regulation.

(1) RBW = 9kHz with peak and average detector.
(2) Detector: average and peak (9kHz-490kHz)
Q.P. (490kHz-30MHz)

**Frequency Range 30MHzto 10th harmonic (up to 10 GHz):**
The EUT setup on the turn table which has 80cm (for 30-1000MHz) and 1.5m (for above 1GHz) height to the ground. The turn table rotated 360 degrees and antenna varied from 1 m to 4 m to find the maximum emission level. Both horizontal and vertical polarization are required. In order to find the maximum emission, all of the interface cables were manipulated according to ANSI C63.10-2013 regulation.

**Frequency below 1GHz:**
Spectrum Analyzer is used for pre-testing with following setting:
(1)RBW = 120KHz
(2)VBW ≥ 3 x RBW.
(3)Detector = Peak.
(4)Sweep time = auto.
(5)Trace mode = max hold.
(6)Allow sweeps to continue until the trace stabilizes.
Note 1: When peak-detected value is lower than limit that the measurement using theQ.P. detector is not required, otherwise using Q.P. for final measurement.
Note 2: When the radiated emissions limits are expressed in terms of the average value of the emissions, and pulsed operation is employed, the measurement field strength shall be determined by averaging over one complete pulse train, including blanking intervals, as long as the pulse train does not exceed 0.1 seconds.

**Frequency above 1GHz to 10th harmonic (up to 10 GHz):**
**Peak Detector:**
(1)RBW = 1MHz
(2)VBW ≥ 3 x RBW.
(3)Detector = Peak.
(4)Sweep time = auto.
(5)Trace mode = max hold.
(6)Allow sweeps to continue until the trace stabilizes.
Note: When peak-detected value is lower than limit that the measurement using the average detector is not required, otherwise using average detector for final measurement.


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**Average Detector:**

☐**Option 1:**

(1)RBW = 1MHz
(2)VBW ≥ 1/ T
(3)Detector = Peak.
(4)Sweep time = auto.
(5)Trace mode = max hold.
(6)Allow sweeps to continue until the trace stabilizes.

■**Option 2:**

Average Emission Level= Peak Emission Level+ D.C.C.F.

## 6.4. Measurement Result Explanation

■Peak Emission Level(dBμV/m)=Antenna Factor(dB/m) + Cable Loss (dB)– Preamp Gain (dB)+ Reading(dBμV).

☐Average Emission Level(dBμV/m)= Antenna Factor(dB/m) + Cable Loss (dB)– Preamp Gain (dB)+ Reading(dBμV).

■Average Emission Level(dBμV/m)= Peak Emission Level(dBμV/m)+ DCCF(dB)
Duty Cycle Correction Factor (DCCF)(dB)= 20log($TX_{on}/TX_{on+off}$) presented in section 3.7.

☐ERP(dBm)= Peak Emission Level(dBμV/m) -95.2dB-2.14dB

## 6.5. Test Results

Please refer to Appendix A.



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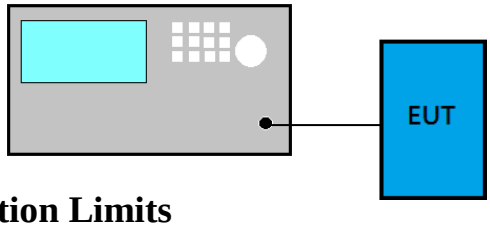
# 7. 20dB/OCCUPIED BANDWIDTH

## 7.1. Block Diagram of Test Setup




## 7.2. Specification Limits

For frequency hopping systems operating in the 902–928 MHz band: if the 20 dB bandwidth of the hopping channel is less than 250 kHz, the system shall use at least 50 hopping frequencies and the average time of occupancy on any frequency shall not be greater than 0.4 seconds within a 20 second period; if the 20 dB bandwidth of the hopping channel is 250 kHz or greater, the system shall use at least 25 hopping frequencies and the average time of occupancy on any frequency shall not be greater than 0.4 seconds within a 10 second period. The maximum allowed 20 dB bandwidth of the hopping channel is 500 kHz.

## 7.3. Test Procedure

Following measurement procedure is reference to ANSI C63.10:2013:

**For 20dB Bandwidth**

(1) Set Span range 2~5 times the OBW
(2) Set RBW close to1% to 5% of OBW.
(3) Set VBW≥3xRBW.
(4) Detector = Peak.
(5) Trace mode = Max hold.
(6) Sweep = Auto couple.
(7) Allow the trace to stabilize.
(8) Setting channel bandwidth function x dB to -20 dB to record the final bandwidth.

**For 99% Occupied Bandwidth**

(9) Set Span range 1.5~5 times the OBW
(10) Set RBW = 1% to 5% of OBW.
(11) Set VBW≥3xRBW.
(12) Detector = Peak.
(13) Trace mode = Max hold
(14) Sweep = Auto couple.
(15) Allow the trace to stabilize.

## 7.4. Test Results

Please refer to Appendix A



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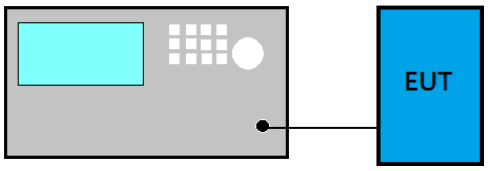
# 8. CARRIER FREQUENCY SEPARATION

## 8.1. Block Diagram of Test Setup




## 8.2. Specification Limits

For frequency hopping systems operating in the 902–928 MHz band: if the 20 dB bandwidth of the hopping channel is less than 250 kHz, the system shall use at least 50 hopping frequencies and the average time of occupancy on any frequency shall not be greater than 0.4 seconds within a 20 second period; if the 20 dB bandwidth of the hopping channel is 250 kHz or greater, the system shall use at least 25 hopping frequencies and the average time of occupancy on any frequency shall not be greater than 0.4 seconds within a 10 second period. The maximum allowed 20 dB bandwidth of the hopping channel is 500 kHz.

## 8.3. Test Procedure

Following measurement procedure is reference to ANSI C63.10:2013:

(1) Span = Wide enough to capture the peaks of two adjacent channels
(2) RBW: Start with the RBW set to approximately 30% of the channel spacing; adjust as necessary to best identify the center of each individual channel.
(3) VBW≥ RBW
(4) Sweep = Auto
(5) Detector function = Peak
(6) Trace = Max hold
(7) Allow the trace to stabilize.

## 8.4. Test Results

Please refer to Appendix A



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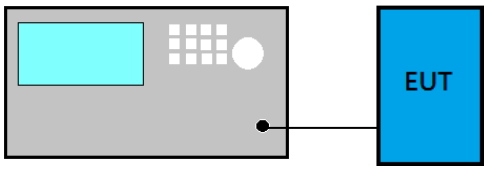
# 9. TIME OF OCCUPANCY

## 9.1. Block Diagram of Test Setup




## 9.2. Specification Limits

For frequency hopping systems operating in the 902–928 MHz band: if the 20 dB bandwidth of the hopping channel is less than 250 kHz, the system shall use at least 50 hopping frequencies and the average time of occupancy on any frequency shall not be greater than 0.4 seconds within a 20 second period; if the 20 dB bandwidth of the hopping channel is 250 kHz or greater, the system shall use at least 25 hopping frequencies and the average time of occupancy on any frequency shall not be greater than 0.4 seconds within a 10 second period. The maximum allowed 20 dB bandwidth of the hopping channel is 500 kHz.

## 9.3. Test Procedure

Following measurement procedure is reference to ANSI C63.10:2013:

(1) Span: Zero span, centered on a hopping channel.
(2) RBW shall be ≤ channel spacing and where possible RBW should be set >> 1/T, where T is the expected dwell time per channel.
(3) Sweep: As necessary to capture the entire dwell time per hopping channel; where possible use a video trigger and trigger delay so that the transmitted signal starts a little to the right of the start of the plot. The trigger level might need slight adjustment to prevent triggering when the system hops on an adjacent channel; a second plot might be needed with a longer sweep time to show two successive hops on a channel.
(4) Detector function = Peak
(5) Trace = Max hold

## 9.4. Test Results

Please refer to Appendix A



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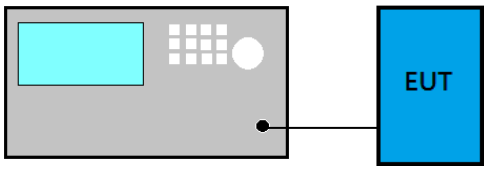
# 10. NUMBER OF HOPPING CHANNELS

## 10.1. Block Diagram of Test Setup




## 10.2. Specification Limits

For frequency hopping systems operating in the 902–928 MHz band: if the 20 dB bandwidth of the hopping channel is less than 250 kHz, the system shall use at least 50 hopping frequencies and the average time of occupancy on any frequency shall not be greater than 0.4 seconds within a 20 second period; if the 20 dB bandwidth of the hopping channel is 250 kHz or greater, the system shall use at least 25 hopping frequencies and the average time of occupancy on any frequency shall not be greater than 0.4 seconds within a 10 second period. The maximum allowed 20 dB bandwidth of the hopping channel is 500 kHz.

## 10.3. Test Procedure

Following measurement procedure is reference to ANSI C63.10:2013:

(1) Span: The frequency band of operation. Depending on the number of channels the device supports, it may be necessary to divide the frequency range of operation across multiple spans, to allow the individual channels to be clearly seen.
(2) RBW: To identify clearly the individual channels, set the RBW to less than 30% of the channel spacing or the 20 dB bandwidth, whichever is smaller.
(3) VBW ≥ RBW
(4) Sweep = Auto
(5) Detector function = Peak
(6) Trace = m=Max hold
(7) Allow the trace to stabilize.

## 10.4. Test Results

Please refer to Appendix A



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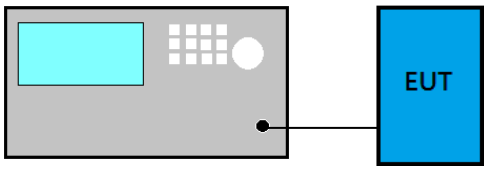
# 11. MAXIMUM PEAK OUTPUT POWER

## 11.1. Block Diagram of Test Setup




## 11.2. Specification Limits

The Limits of maximum Peak Output Power for frequency hopping systems in 902–928 MHz is: 1 watt for systems employing at least 50 hopping channels; and 0.25 watts for systems employing less than 50 hopping channels, but at least 25 hopping channels, as permitted under paragraph (a)(1)(i)of 15.247.

## 11.3. Test Procedure

Following measurement procedure is reference to ANSI C63.10:2013:

(a) Use the following spectrum analyzer settings

(1) Span: Approximately five times the 20 dB bandwidth, centered on a hopping channel.
(2) RBW > 20 dB bandwidth of the emission being measured.
(3) VBW ≥ RBW
(4) Sweep: Auto
(5) Detector function: Peak
(6) Trace: Max hold

(b) Allow trace to stabilize.

(c) Use the marker-to-peak function to set the marker to the peak of the emission.

## 11.4. Test Results

Please refer to Appendix A



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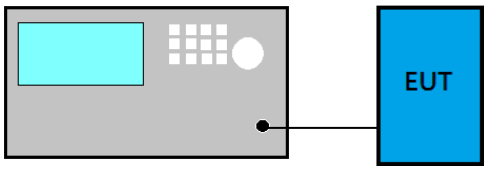
# 12. EMISSION LIMITATIONS

## 12.1. Block Diagram of Test Setup




## 12.2. Specification Limits

In any 100kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20dB below that in the 100kHz bandwidth within the band that contains the highest level of the desired power, based on either an RF conducted or a radiated measurement. If the transmitter complies with the conducted power limits based on the use of RMS averaging over a time interval, that the required attenuation shall be 30 dB instead of 20 dB.
Attenuation below the general limits specified in Section 15.209(a)/ RSS-Gen Section 8.9 table 4 is not required. In addition, radiated emissions which fall in restricted bands, as defined in Section 15.205(a)/RSS-Gen Section 8.10 table 6, must also comply with the radiated emission limits specified in Section 15.209(a)/RSS-Gen Section 8.9 table 4. (See Section 15.205(c)).

## 12.3. Test Procedure

Following measurement procedure is reference to ANSI C63.10:2013:

(1) Set span wide enough to capture the peak level of the in-band emission and all spurious emissions; up to $10^{th}$ harmonic.
(2) RBW = 100 kHz
(3) VBW ≥ RBW
(4) Sweep = Auto
(5) Detector function = Peak
(6) Trace = Max hold

## 12.4. Test Results

Please refer to Appendix A



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# 13. DEVIATION TO TEST SPECIFICATIONS

【NONE】



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# APPENDIX A

## TEST DATA AND PLOTS

(Model: R9001SB)



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# A.1 RADIATED EMISSION

| | | | |
|---|---|---|---|
| Test Date | 2023/12/05 | Temp./Hum. | 22℃/54% |
| Test Voltage | DC 6.0V (Via Battery) | Tested By | Hua Wu |

A.1.1 Emissions within Restricted Frequency Bands

A.2.1.1 Frequency 9kHz~30MHz

**The emissions (9kHz~30MHz) not reported for there is no emission be found.**

A.2.1.2 Frequency Below 1 GHz

**ANT A**

| Mode | FHSS | Frequency | TX 904.6MHz |
|---|---|---|---|

Antenna at Horizontal Polarization

| Emission Frequency (MHz) | Antenna Factor (dB/m) | Cable Loss (dB) | Preamp Gain (dB) | Read Level (dBμV) | Emission Level (dBμV/m) | Limits (dBμV/m) | Margin (dB) | Detector |
|---|---|---|---|---|---|---|---|---|
| 30.000 | 23.95 | 1.20 | 26.52 | 30.28 | 28.91 | 40.00 | 11.09 | Peak |
| 101.942 | 16.84 | 2.32 | 26.30 | 34.10 | 26.96 | 43.50 | 16.54 | Peak |
| 301.600 | 18.96 | 4.38 | 25.68 | 30.80 | 28.46 | 46.00 | 17.54 | Peak |
| 378.392 | 21.05 | 5.29 | 26.35 | 32.15 | 32.14 | 46.00 | 13.86 | Peak |
| 487.517 | 22.96 | 6.30 | 27.09 | 32.26 | 34.43 | 46.00 | 11.57 | Peak |
| 612.000 | 24.38 | 6.83 | 27.41 | 31.78 | 35.58 | 46.00 | 10.42 | Peak |

Antenna at Vertical Polarization

| Emission Frequency (MHz) | Antenna Factor (dB/m) | Cable Loss (dB) | Preamp Gain (dB) | Read Level (dBμV) | Emission Level (dBμV/m) | Limits (dBμV/m) | Margin (dB) | Detector |
|---|---|---|---|---|---|---|---|---|
| 34.850 | 22.21 | 1.30 | 26.51 | 34.26 | 31.25 | 40.00 | 8.75 | Peak |
| 128.617 | 17.56 | 2.63 | 26.13 | 32.72 | 26.78 | 43.50 | 16.72 | Peak |
| 333.933 | 19.89 | 4.79 | 25.98 | 31.60 | 30.30 | 46.00 | 15.70 | Peak |
| 408.300 | 21.71 | 5.59 | 26.57 | 32.30 | 33.03 | 46.00 | 12.97 | Peak |
| 510.958 | 23.27 | 6.44 | 27.19 | 32.05 | 34.58 | 46.00 | 11.42 | Peak |
| 604.725 | 24.35 | 6.79 | 27.41 | 32.34 | 36.06 | 46.00 | 9.94 | Peak |



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## ANT B

| Mode | FHSS | Frequency | TX 904.6MHz |
|---|---|---|---|

Antenna at Horizontal Polarization

| Emission Frequency (MHz) | Antenna Factor (dB/m) | Cable Loss (dB) | Preamp Gain (dB) | Read Level (dBμV) | Emission Level (dBμV/m) | Limits (dBμV/m) | Margin (dB) | Detector |
|---|---|---|---|---|---|---|---|---|
| 33.233 | 22.77 | 1.27 | 26.52 | 33.11 | 30.62 | 40.00 | 9.38 | Peak |
| 101.942 | 16.84 | 2.32 | 26.30 | 34.21 | 27.08 | 43.50 | 16.42 | Peak |
| 296.750 | 18.87 | 4.33 | 25.66 | 30.73 | 28.26 | 46.00 | 17.74 | Peak |
| 378.392 | 21.05 | 5.29 | 26.35 | 31.87 | 31.86 | 46.00 | 14.14 | Peak |
| 462.458 | 22.59 | 6.09 | 26.93 | 31.97 | 33.71 | 46.00 | 12.29 | Peak |
| 546.525 | 23.72 | 6.58 | 27.28 | 32.08 | 35.09 | 46.00 | 10.91 | Peak |

Antenna at Vertical Polarization

| Emission Frequency (MHz) | Antenna Factor (dB/m) | Cable Loss (dB) | Preamp Gain (dB) | Read Level (dBμV) | Emission Level (dBμV/m) | Limits (dBμV/m) | Margin (dB) | Detector |
|---|---|---|---|---|---|---|---|---|
| 34.850 | 22.21 | 1.30 | 26.51 | 35.23 | 32.22 | 40.00 | 7.78 | Peak |
| 101.942 | 16.84 | 2.32 | 26.30 | 33.11 | 25.98 | 43.50 | 17.52 | Peak |
| 293.517 | 18.82 | 4.30 | 25.67 | 31.60 | 29.05 | 46.00 | 16.95 | Peak |
| 409.108 | 21.72 | 5.60 | 26.58 | 32.13 | 32.87 | 46.00 | 13.13 | Peak |
| 478.625 | 22.83 | 6.23 | 27.03 | 32.10 | 34.12 | 46.00 | 11.88 | Peak |
| 536.825 | 23.60 | 6.54 | 27.26 | 32.68 | 35.57 | 46.00 | 10.43 | Peak |



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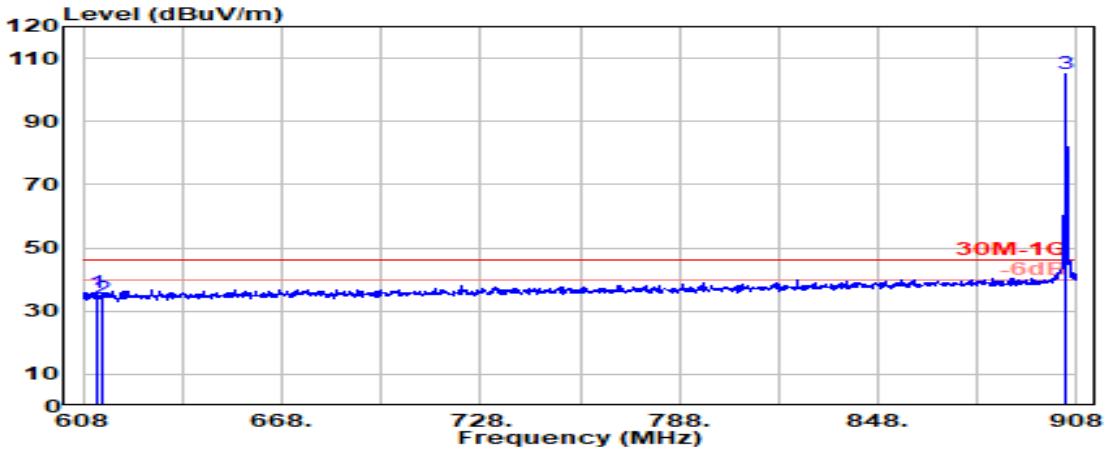
A.2.1.3 Frequency Above 1 GHz to 10th harmonics

**Band Edge:**

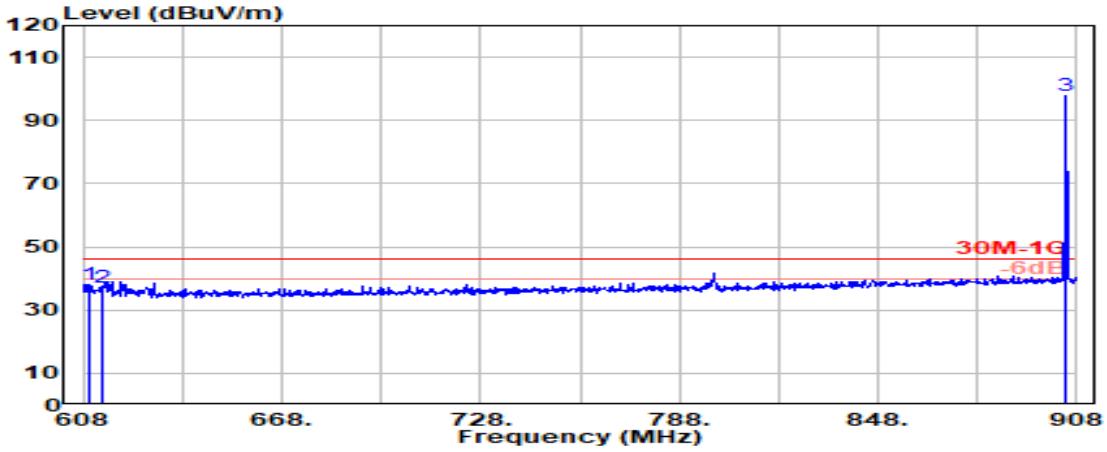
**ANT A**

| Mode | FHSS | Frequency | TX 904.6MHz |
|---|---|---|---|




Antenna at Horizontal Polarization

| | Emission Frequency (MHz) | Antenna Factor (dB/m) | Cable Loss (dB) | Preamp Gain (dB) | Read Level (dBμV) | Emission Level (dBμV/m) | Limits (dBμV/m) | Margin (dB) | Detector |
|---|---|---|---|---|---|---|---|---|---|
| | 612.250 | 24.38 | 6.83 | 27.41 | 32.16 | 35.96 | 46.00 | 10.04 | Peak |
| | 614.000 | 24.39 | 6.84 | 27.41 | 30.33 | 34.15 | 46.00 | 11.85 | Peak |
| @ | 904.500 | 26.28 | 8.75 | 27.03 | 96.88 | 104.87 | --- | --- | Peak |




Antenna at Vertical Polarization

| | Emission Frequency (MHz) | Antenna Factor (dB/m) | Cable Loss (dB) | Preamp Gain (dB) | Read Level (dBμV) | Emission Level (dBμV/m) | Limits (dBμV/m) | Margin (dB) | Detector |
|---|---|---|---|---|---|---|---|---|---|
| | 610.250 | 24.37 | 6.82 | 27.41 | 34.35 | 38.13 | 46.00 | 7.87 | Peak |
| | 614.000 | 24.39 | 6.84 | 27.41 | 33.13 | 36.95 | 46.00 | 9.05 | Peak |
| @ | 904.500 | 26.28 | 8.75 | 27.03 | 89.86 | 97.85 | --- | --- | Peak |

Remark: The "@" means fundamental frequency, it is ignored in this section.



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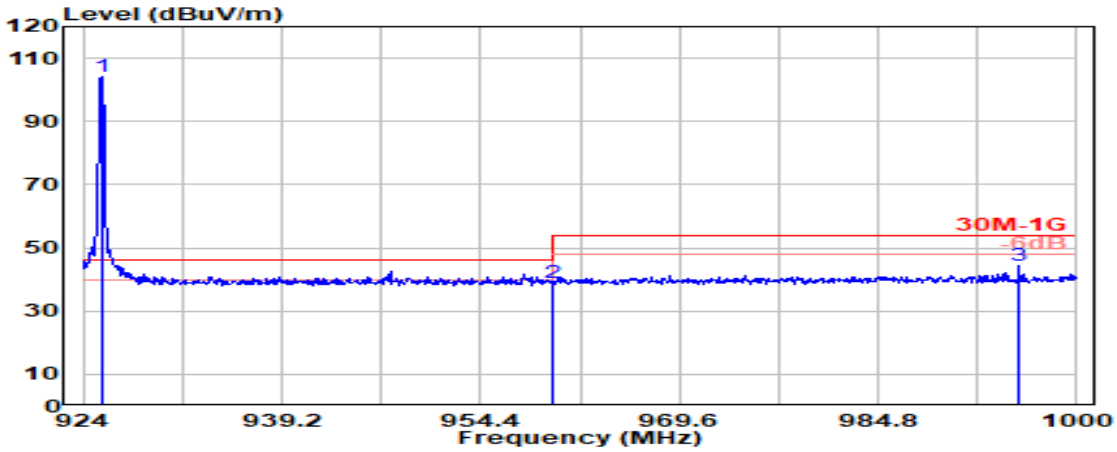
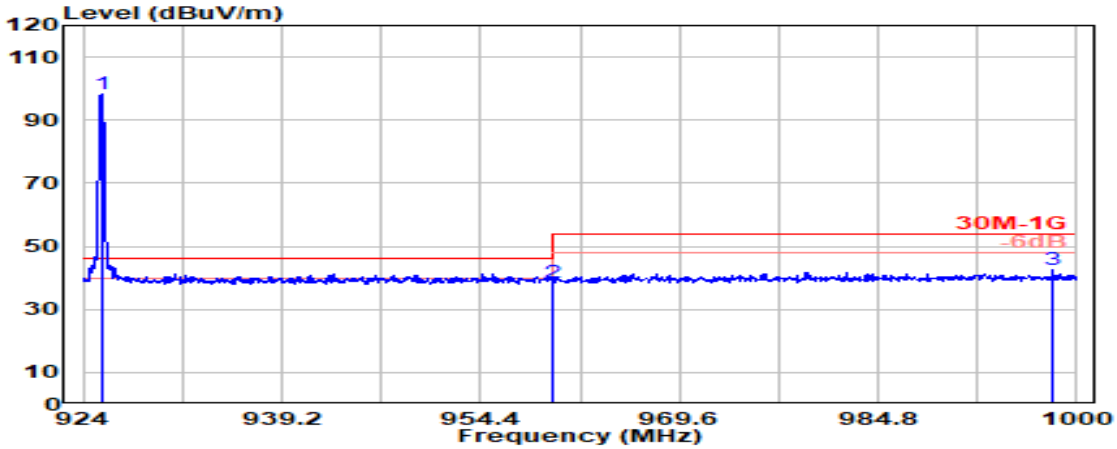
| Mode | FHSS | Frequency | TX 925.4MHz |
|---|---|---|---|




Antenna at Horizontal Polarization

| | Emission Frequency (MHz) | Antenna Factor (dB/m) | Cable Loss (dB) | Preamp Gain (dB) | Read Level (dBμV) | Emission Level (dBμV/m) | Limits (dBμV/m) | Margin (dB) | Detector |
|---|---|---|---|---|---|---|---|---|---|
| @ | 925.393 | 26.42 | 8.87 | 26.97 | 95.96 | 104.28 | --- | --- | Peak |
| | 960.000 | 26.66 | 9.06 | 26.87 | 30.13 | 38.97 | 46.00 | 7.03 | Peak |
| | 995.567 | 26.93 | 9.25 | 26.77 | 35.05 | 44.46 | 46.00 | 1.54 | Peak |




Antenna at Vertical Polarization

| | Emission Frequency (MHz) | Antenna Factor (dB/m) | Cable Loss (dB) | Preamp Gain (dB) | Read Level (dBμV) | Emission Level (dBμV/m) | Limits (dBμV/m) | Margin (dB) | Detector |
|---|---|---|---|---|---|---|---|---|---|
| @ | 925.393 | 26.42 | 8.87 | 26.97 | 89.91 | 98.23 | --- | --- | Peak |
| | 960.000 | 26.66 | 9.06 | 26.87 | 29.87 | 38.72 | 46.00 | 7.28 | Peak |
| | 998.163 | 26.94 | 9.26 | 26.76 | 33.23 | 42.67 | 46.00 | 3.33 | Peak |

Remark: The "@" means fundamental frequency, it is ignored in this section.



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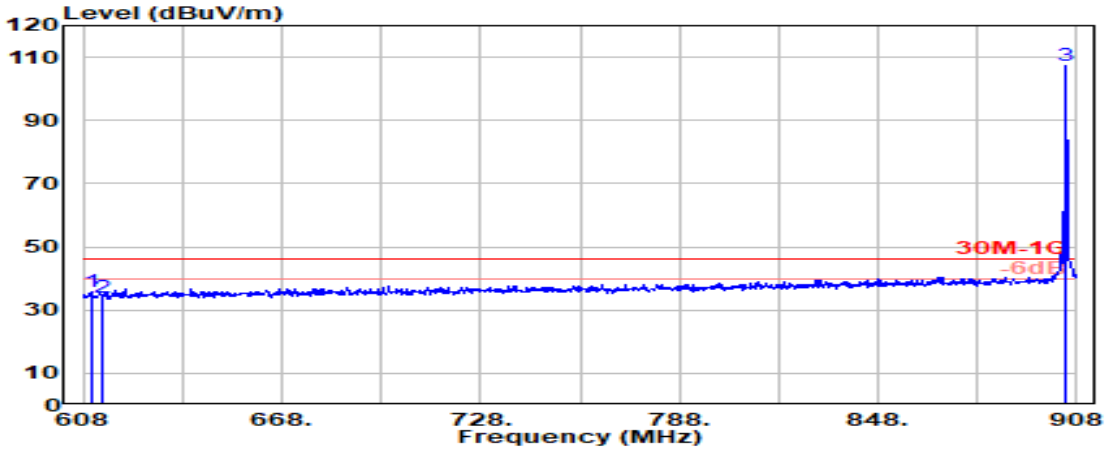
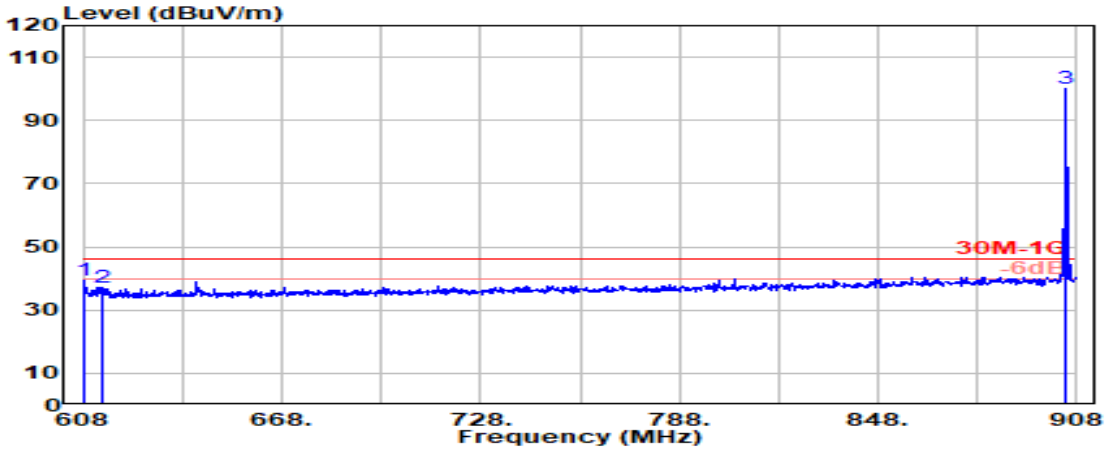
## ANT B

| Mode | FHSS | Frequency | TX 904.6MHz |
|---|---|---|---|




Antenna at Horizontal Polarization

| | Emission Frequency (MHz) | Antenna Factor (dB/m) | Cable Loss (dB) | Preamp Gain (dB) | Read Level (dBμV) | Emission Level (dBμV/m) | Limits (dBμV/m) | Margin (dB) | Detector |
|---|---|---|---|---|---|---|---|---|---|
| | 610.750 | 24.37 | 6.82 | 27.41 | 31.83 | 35.62 | 46.00 | 10.38 | Peak |
| | 614.000 | 24.39 | 6.84 | 27.41 | 30.17 | 33.99 | 46.00 | 12.01 | Peak |
| @ | 904.500 | 26.28 | 8.75 | 27.03 | 99.16 | 107.15 | --- | --- | Peak |




Antenna at Vertical Polarization

| | Emission Frequency (MHz) | Antenna Factor (dB/m) | Cable Loss (dB) | Preamp Gain (dB) | Read Level (dBμV) | Emission Level (dBμV/m) | Limits (dBμV/m) | Margin (dB) | Detector |
|---|---|---|---|---|---|---|---|---|---|
| | 608.250 | 24.36 | 6.81 | 27.41 | 35.74 | 39.50 | 46.00 | 6.50 | Peak |
| | 614.000 | 24.39 | 6.84 | 27.41 | 33.31 | 37.13 | 46.00 | 8.87 | Peak |
| @ | 904.750 | 26.28 | 8.75 | 27.03 | 92.00 | 99.99 | --- | --- | Peak |

Remark: The "@" means fundamental frequency, it is ignored in this section.



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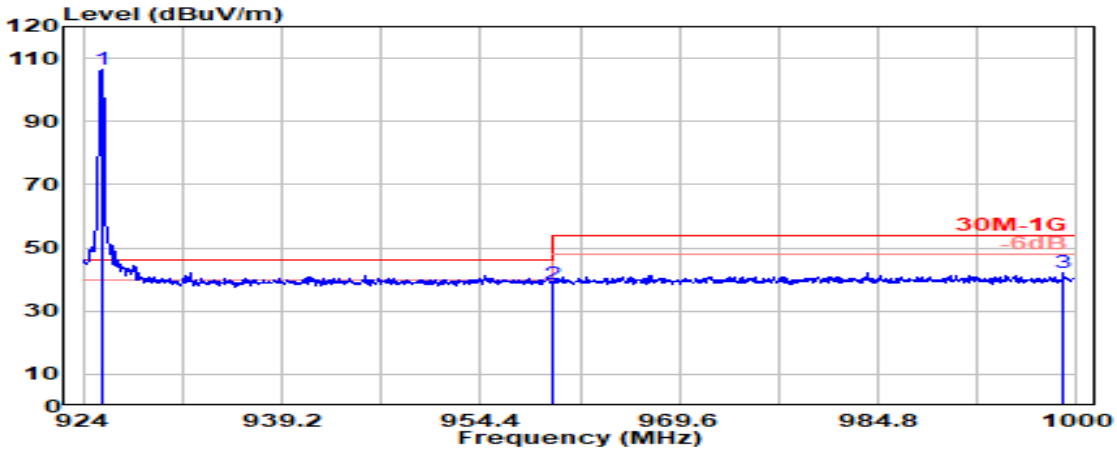
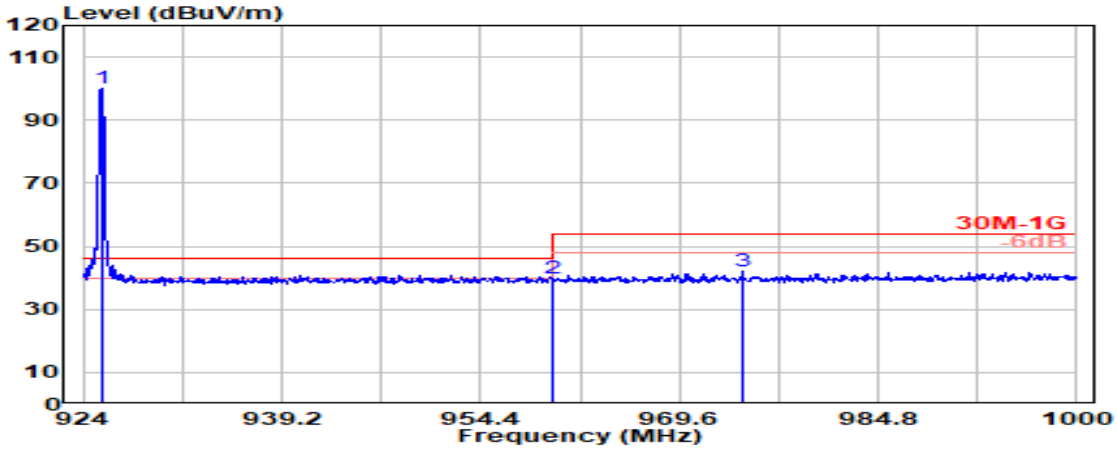
| Mode | FHSS | Frequency | TX 925.4MHz |
|---|---|---|---|




Antenna at Horizontal Polarization

| | Emission Frequency (MHz) | Antenna Factor (dB/m) | Cable Loss (dB) | Preamp Gain (dB) | Read Level (dBμV) | Emission Level (dBμV/m) | Limits (dBμV/m) | Margin (dB) | Detector |
|---|---|---|---|---|---|---|---|---|---|
| @ | 925.393 | 26.42 | 8.87 | 26.97 | 97.98 | 106.30 | --- | --- | Peak |
| | 960.000 | 26.66 | 9.06 | 26.87 | 29.58 | 38.43 | 46.00 | 7.57 | Peak |
| | 998.987 | 26.95 | 9.26 | 26.76 | 32.80 | 42.24 | 46.00 | 3.76 | Peak |




Antenna at Vertical Polarization

| | Emission Frequency (MHz) | Antenna Factor (dB/m) | Cable Loss (dB) | Preamp Gain (dB) | Read Level (dBμV) | Emission Level (dBμV/m) | Limits (dBμV/m) | Margin (dB) | Detector |
|---|---|---|---|---|---|---|---|---|---|
| @ | 925.393 | 26.42 | 8.87 | 26.97 | 91.55 | 99.87 | --- | --- | Peak |
| | 960.000 | 26.66 | 9.06 | 26.87 | 31.11 | 39.95 | 46.00 | 6.05 | Peak |
| | 974.477 | 26.77 | 9.14 | 26.83 | 32.84 | 41.92 | 46.00 | 4.08 | Peak |

Remark: The "@" means fundamental frequency, it is ignored in this section.



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A.1.2 Emissions outside the frequency band:

The emissions (up to 25GHz) not reported for there is no emission be found.

**ANT A**

| Mode | FHSS | Frequency | TX 904.6MHz |
|---|---|---|---|

Antenna at Horizontal Polarization

| Emission Frequency (MHz) | Antenna Factor (dB/m) | Cable Loss (dB) | Preamp Gain (dB) | Read Level (dBμV) | Emission Level (dBμV/m) | Limits (dBμV/m) | Margin (dB) | Detector |
|---|---|---|---|---|---|---|---|---|
| 1809.200 | 26.54 | 4.77 | 40.03 | 57.89 | 49.17 | 74.00 | 24.83 | Peak |
| 2713.800 | 28.88 | 6.38 | 39.98 | 59.33 | 54.61 | 74.00 | 19.39 | Peak |

| Emission Frequency (MHz) | Peak Emission Level (dBμV/m) | Duty Cycle Correction Factor (dB) | Average Emission Level (dBμV/m) | Limits (dBμV/m) | Margin (dB) | Remark |
|---|---|---|---|---|---|---|
| 1809.200 | 49.17 | -35.26 | 13.91 | 54.00 | 40.09 | Average |
| 2713.800 | 54.61 | -35.26 | 19.35 | 54.00 | 34.65 | Average |

Antenna at Vertical Polarization

| Emission Frequency (MHz) | Antenna Factor (dB/m) | Cable Loss (dB) | Preamp Gain (dB) | Read Level (dBμV) | Emission Level (dBμV/m) | Limits (dBμV/m) | Margin (dB) | Detector |
|---|---|---|---|---|---|---|---|---|
| 1809.200 | 26.54 | 4.77 | 40.03 | 53.45 | 44.73 | 74.00 | 29.27 | Peak |
| 2713.800 | 28.88 | 6.38 | 39.98 | 55.14 | 50.42 | 74.00 | 23.58 | Peak |

| Emission Frequency (MHz) | Peak Emission Level (dBμV/m) | Duty Cycle Correction Factor (dB) | Average Emission Level (dBμV/m) | Limits (dBμV/m) | Margin (dB) | Remark |
|---|---|---|---|---|---|---|
| 1809.200 | 44.73 | -35.26 | 9.47 | 54.00 | 44.53 | Average |
| 2713.800 | 50.42 | -35.26 | 15.16 | 54.00 | 38.84 | Average |



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| Mode | FHSS | Frequency | TX 915.0MHz |
|---|---|---|---|

Antenna at Horizontal Polarization

| Emission Frequency (MHz) | Antenna Factor (dB/m) | Cable Loss (dB) | Preamp Gain (dB) | Read Level (dBμV) | Emission Level (dBμV/m) | Limits (dBμV/m) | Margin (dB) | Detector |
|---|---|---|---|---|---|---|---|---|
| 1830.000 | 26.79 | 4.80 | 40.03 | 56.88 | 48.45 | 74.00 | 25.55 | Peak |
| 2745.000 | 28.81 | 6.46 | 39.99 | 59.96 | 55.23 | 74.00 | 18.77 | Peak |

| Emission Frequency (MHz) | Peak Emission Level (dBμV/m) | Duty Cycle Correction Factor (dB) | Average Emission Level (dBμV/m) | Limits (dBμV/m) | Margin (dB) | Remark |
|---|---|---|---|---|---|---|
| 1830.000 | 48.45 | -35.26 | 13.19 | 54.00 | 40.81 | Average |
| 2745.000 | 55.23 | -35.26 | 19.97 | 54.00 | 34.03 | Average |

Antenna at Vertical Polarization

| Emission Frequency (MHz) | Antenna Factor (dB/m) | Cable Loss (dB) | Preamp Gain (dB) | Read Level (dBμV) | Emission Level (dBμV/m) | Limits (dBμV/m) | Margin (dB) | Detector |
|---|---|---|---|---|---|---|---|---|
| 1830.000 | 26.79 | 4.80 | 40.03 | 57.25 | 48.82 | 74.00 | 25.18 | Peak |
| 2745.000 | 28.81 | 6.46 | 39.99 | 57.84 | 53.12 | 74.00 | 20.88 | Peak |

| Emission Frequency (MHz) | Peak Emission Level (dBμV/m) | Duty Cycle Correction Factor (dB) | Average Emission Level (dBμV/m) | Limits (dBμV/m) | Margin (dB) | Remark |
|---|---|---|---|---|---|---|
| 1830.000 | 48.82 | -35.26 | 13.56 | 54.00 | 40.44 | Average |
| 2745.000 | 53.12 | -35.26 | 17.86 | 54.00 | 36.14 | Average |



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| Mode | FHSS | Frequency | TX 925.4MHz |
|---|---|---|---|

Antenna at Horizontal Polarization

| Emission Frequency (MHz) | Antenna Factor (dB/m) | Cable Loss (dB) | Preamp Gain (dB) | Read Level (dBμV) | Emission Level (dBμV/m) | Limits (dBμV/m) | Margin (dB) | Detector |
|---|---|---|---|---|---|---|---|---|
| 1850.800 | 27.10 | 4.84 | 40.02 | 52.84 | 44.77 | 74.00 | 29.23 | Peak |
| 2776.200 | 28.89 | 6.52 | 40.00 | 61.18 | 56.59 | 74.00 | 17.41 | Peak |

| Emission Frequency (MHz) | Peak Emission Level (dBμV/m) | Duty Cycle Correction Factor (dB) | Average Emission Level (dBμV/m) | Limits (dBμV/m) | Margin (dB) | Remark |
|---|---|---|---|---|---|---|
| 1850.800 | 44.77 | -35.26 | 9.51 | 54.00 | 44.49 | Average |
| 2776.200 | 56.59 | -35.26 | 21.33 | 54.00 | 32.67 | Average |

Antenna at Vertical Polarization

| Emission Frequency (MHz) | Antenna Factor (dB/m) | Cable Loss (dB) | Preamp Gain (dB) | Read Level (dBμV) | Emission Level (dBμV/m) | Limits (dBμV/m) | Margin (dB) | Detector |
|---|---|---|---|---|---|---|---|---|
| 1850.800 | 27.10 | 4.84 | 40.02 | 54.29 | 46.22 | 74.00 | 27.78 | Peak |
| 2776.200 | 28.89 | 6.52 | 40.00 | 58.56 | 53.97 | 74.00 | 20.03 | Peak |

| Emission Frequency (MHz) | Peak Emission Level (dBμV/m) | Duty Cycle Correction Factor (dB) | Average Emission Level (dBμV/m) | Limits (dBμV/m) | Margin (dB) | Remark |
|---|---|---|---|---|---|---|
| 1850.800 | 46.22 | -35.26 | 10.96 | 54.00 | 43.04 | Average |
| 2776.200 | 53.97 | -35.26 | 18.71 | 54.00 | 35.29 | Average |



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## ANT B

| Mode | FHSS | Frequency | TX 904.6MHz |
|---|---|---|---|

Antenna at Horizontal Polarization

| Emission Frequency (MHz) | Antenna Factor (dB/m) | Cable Loss (dB) | Preamp Gain (dB) | Read Level (dBμV) | Emission Level (dBμV/m) | Limits (dBμV/m) | Margin (dB) | Detector |
|---|---|---|---|---|---|---|---|---|
| 1809.200 | 26.54 | 4.77 | 40.03 | 61.46 | 52.74 | 74.00 | 21.26 | Peak |
| 2713.800 | 28.88 | 6.38 | 39.98 | 58.89 | 54.17 | 74.00 | 19.83 | Peak |

| Emission Frequency (MHz) | Peak Emission Level (dBμV/m) | Duty Cycle Correction Factor (dB) | Average Emission Level (dBμV/m) | Limits (dBμV/m) | Margin (dB) | Remark |
|---|---|---|---|---|---|---|
| 1809.200 | 52.74 | -35.26 | 17.48 | 54.00 | 36.52 | Average |
| 2713.800 | 54.17 | -35.26 | 18.91 | 54.00 | 35.09 | Average |

Antenna at Vertical Polarization

| Emission Frequency (MHz) | Antenna Factor (dB/m) | Cable Loss (dB) | Preamp Gain (dB) | Read Level (dBμV) | Emission Level (dBμV/m) | Limits (dBμV/m) | Margin (dB) | Detector |
|---|---|---|---|---|---|---|---|---|
| 1809.200 | 26.54 | 4.77 | 40.03 | 56.76 | 48.05 | 74.00 | 25.95 | Peak |
| 2713.800 | 28.88 | 6.38 | 39.98 | 54.22 | 49.50 | 74.00 | 24.50 | Peak |

| Emission Frequency (MHz) | Peak Emission Level (dBμV/m) | Duty Cycle Correction Factor (dB) | Average Emission Level (dBμV/m) | Limits (dBμV/m) | Margin (dB) | Remark |
|---|---|---|---|---|---|---|
| 1809.200 | 48.05 | -35.26 | 12.79 | 54.00 | 41.21 | Average |
| 2713.800 | 49.50 | -35.26 | 14.24 | 54.00 | 39.76 | Average |



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| Mode | FHSS | Frequency | TX 915.0MHz |
|---|---|---|---|

Antenna at Horizontal Polarization

| Emission Frequency (MHz) | Antenna Factor (dB/m) | Cable Loss (dB) | Preamp Gain (dB) | Read Level (dBμV) | Emission Level (dBμV/m) | Limits (dBμV/m) | Margin (dB) | Detector |
|---|---|---|---|---|---|---|---|---|
| 1830.000 | 26.79 | 4.80 | 40.03 | 59.76 | 51.33 | 74.00 | 22.67 | Peak |
| 2745.000 | 28.81 | 6.46 | 39.99 | 60.00 | 55.28 | 74.00 | 18.72 | Peak |

| Emission Frequency (MHz) | Peak Emission Level (dBμV/m) | Duty Cycle Correction Factor (dB) | Average Emission Level (dBμV/m) | Limits (dBμV/m) | Margin (dB) | Remark |
|---|---|---|---|---|---|---|
| 1830.000 | 51.33 | -35.26 | 16.07 | 54.00 | 37.93 | Average |
| 2745.000 | 55.28 | -35.26 | 20.02 | 54.00 | 33.98 | Average |

Antenna at Vertical Polarization

| Emission Frequency (MHz) | Antenna Factor (dB/m) | Cable Loss (dB) | Preamp Gain (dB) | Read Level (dBμV) | Emission Level (dBμV/m) | Limits (dBμV/m) | Margin (dB) | Detector |
|---|---|---|---|---|---|---|---|---|
| 1830.000 | 26.79 | 4.80 | 40.03 | 56.88 | 48.45 | 74.00 | 25.55 | Peak |
| 2745.000 | 28.81 | 6.46 | 39.99 | 57.37 | 52.65 | 74.00 | 21.35 | Peak |

| Emission Frequency (MHz) | Peak Emission Level (dBμV/m) | Duty Cycle Correction Factor (dB) | Average Emission Level (dBμV/m) | Limits (dBμV/m) | Margin (dB) | Remark |
|---|---|---|---|---|---|---|
| 1830.000 | 48.45 | -35.26 | 13.19 | 54.00 | 40.81 | Average |
| 2745.000 | 52.65 | -35.26 | 17.39 | 54.00 | 36.61 | Average |



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| Mode | FHSS | Frequency | TX 925.4MHz |
|---|---|---|---|

Antenna at Horizontal Polarization

| Emission Frequency (MHz) | Antenna Factor (dB/m) | Cable Loss (dB) | Preamp Gain (dB) | Read Level (dBμV) | Emission Level (dBμV/m) | Limits (dBμV/m) | Margin (dB) | Detector |
|---|---|---|---|---|---|---|---|---|
| 1850.800 | 27.10 | 4.84 | 40.02 | 55.79 | 47.72 | 74.00 | 26.28 | Peak |
| 2776.200 | 28.89 | 6.52 | 40.00 | 61.89 | 57.30 | 74.00 | 16.70 | Peak |

| Emission Frequency (MHz) | Peak Emission Level (dBμV/m) | Duty Cycle Correction Factor (dB) | Average Emission Level (dBμV/m) | Limits (dBμV/m) | Margin (dB) | Remark |
|---|---|---|---|---|---|---|
| 1850.800 | 47.72 | -35.26 | 12.46 | 54.00 | 41.54 | Average |
| 2776.200 | 57.30 | -35.26 | 22.04 | 54.00 | 31.96 | Average |

Antenna at Vertical Polarization

| Emission Frequency (MHz) | Antenna Factor (dB/m) | Cable Loss (dB) | Preamp Gain (dB) | Read Level (dBμV) | Emission Level (dBμV/m) | Limits (dBμV/m) | Margin (dB) | Detector |
|---|---|---|---|---|---|---|---|---|
| 1850.800 | 27.10 | 4.84 | 40.02 | 55.83 | 47.75 | 74.00 | 26.25 | Peak |
| 2776.200 | 28.89 | 6.52 | 40.00 | 58.69 | 54.11 | 74.00 | 19.89 | Peak |

| Emission Frequency (MHz) | Peak Emission Level (dBμV/m) | Duty Cycle Correction Factor (dB) | Average Emission Level (dBμV/m) | Limits (dBμV/m) | Margin (dB) | Remark |
|---|---|---|---|---|---|---|
| 1850.800 | 47.75 | -35.26 | 12.49 | 54.00 | 41.51 | Average |
| 2776.200 | 54.11 | -35.26 | 18.85 | 54.00 | 35.15 | Average |

A.1.3 Emissions in Non-restricted Frequency Bands:

All emission levels below the FCC 15.209(a)/RSS-Gen Section 8.9 table 4 general radiated emissions limits is not required.



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# A.2 20dB/OCCUPIED BANDWIDTH

| | | | |
|---|---|---|---|
| Test Date | 2023/11/30 | Temp./Hum. | 25℃/52% |
| Cable Loss | 0.50dB | Tested By | Hua Wu |
| Test Voltage | DC 6.0V (Via Battery) | | |

A.2.1 Emission Bandwidth Result

| Mode | ANT | Centre Frequency (MHz) | 20 dB Bandwidth (MHz) | 99% Bandwidth (MHz) |
|---|---|---|---|---|
| FHSS | ANT A | 904.6 | 0.1698 | 0.14785 |
| | | 915.0 | 0.1703 | 0.14839 |
| | | 925.4 | 0.1702 | 0.14779 |
| FHSS | ANT B | 904.6 | 0.1702 | 0.14740 |
| | | 915.0 | 0.1692 | 0.14770 |
| | | 925.4 | 0.1694 | 0.14768 |



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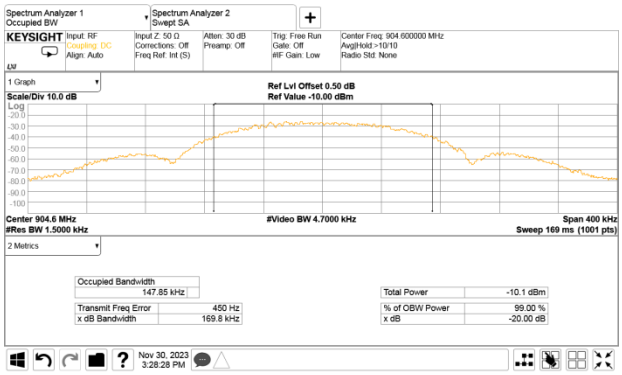
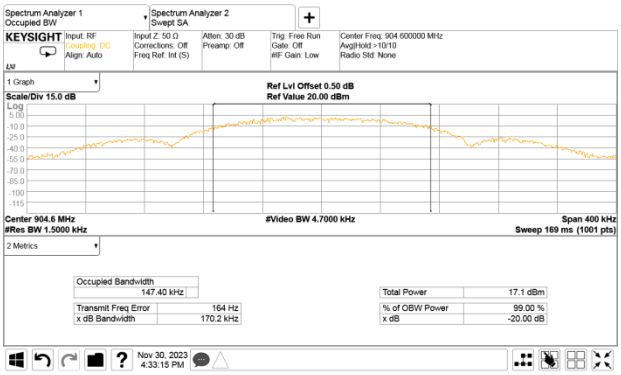
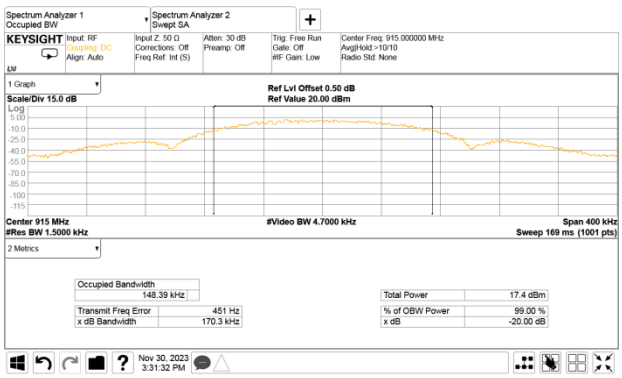
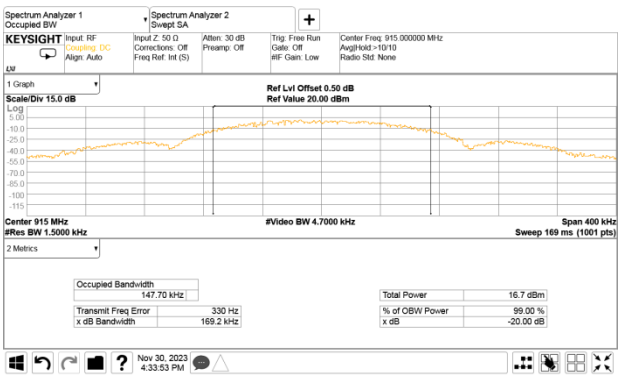
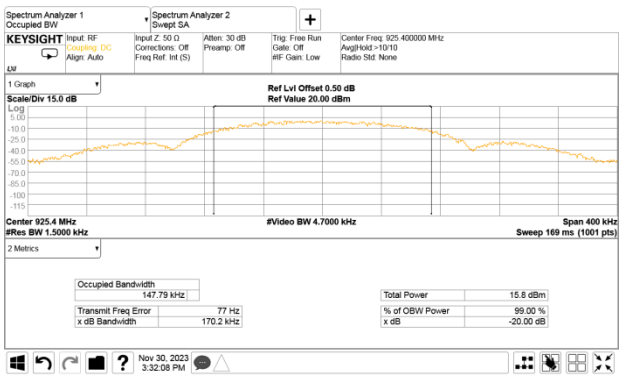
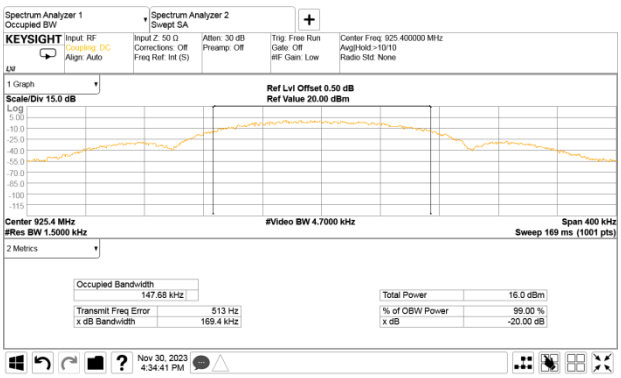
## A.2.2 Measurement Plots

| FHSS | |
|---|---|
| ANT A | ANT B |
|  |  |
|  |  |
|  |  |



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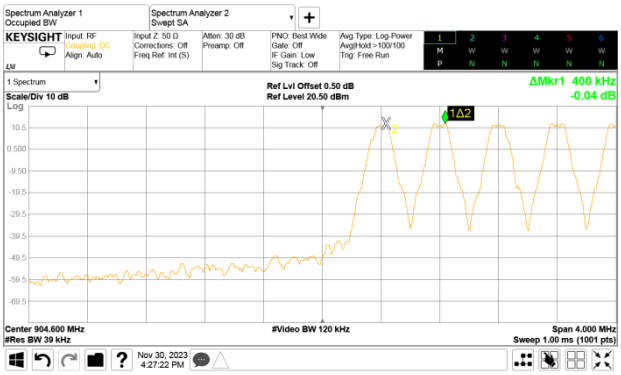
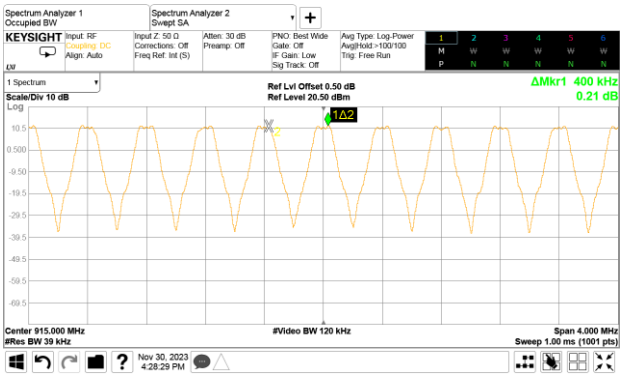
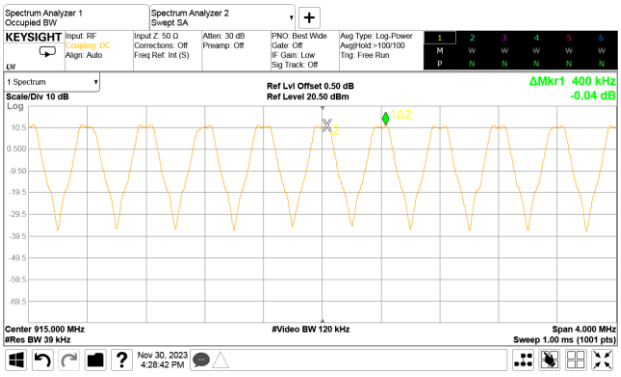
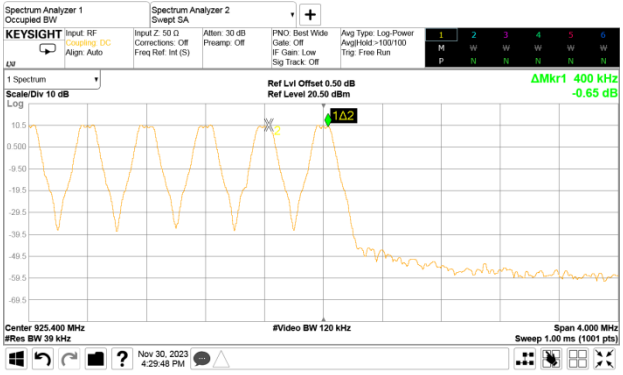
# A.3 CARRIER FREQUENCY SEPARATION

| | | | |
|---|---|---|---|
| Test Date | 2023/11/30 | Temp./Hum. | 25℃/52% |
| Cable Loss | 0.50dB | Tested By | Hua Wu |
| Test Voltage | DC 6.0V (Via Battery) | | |

| FHSS | |
|---|---|
| ANT A | |
| 904.6MHz | 915.0MHz<br>adjacent channel of left carrier frequency |
|  |  |
| 915.0MHz<br>adjacent channel of right carrier frequency | 925.4MHz |
|  |  |

Limit: The max 20 dB Bandwidth: 0.1703MHz



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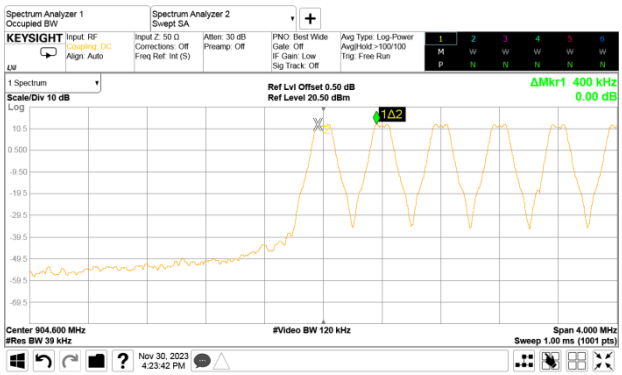
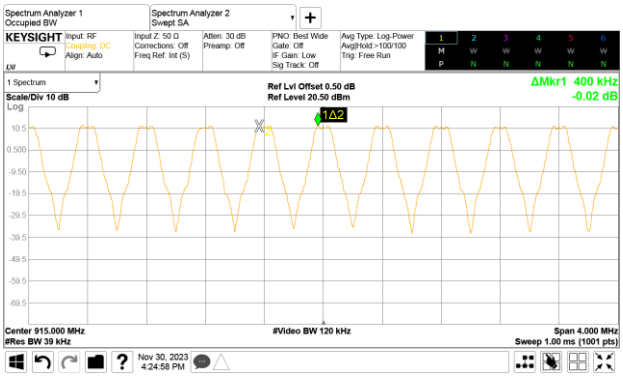
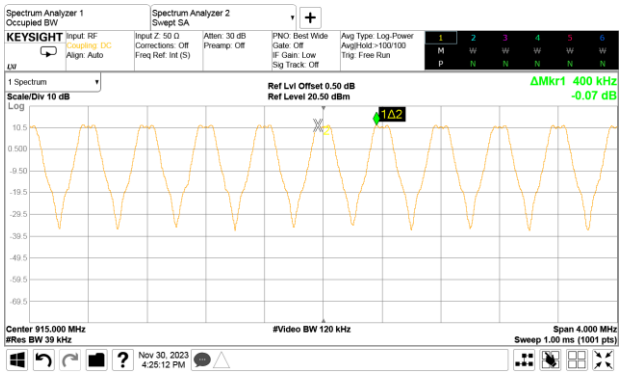
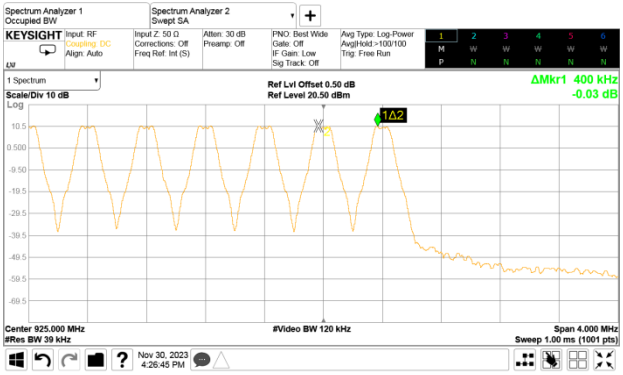
| FHSS | |
|---|---|
| ANT B | |
| 904.6MHz | 915.0MHz<br>adjacent channel of left carrier frequency |
|  |  |
| 915.0MHz<br>adjacent channel of right carrier frequency | 925.4MHz |
|  |  |

Limit: The max 20 dB Bandwidth: 0.1702MHz



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# A.4 TIME OF OCCUPANCY

| | | | |
|---|---|---|---|
| Test Date | 2023/11/30 | Temp./Hum. | 25℃/52% |
| Cable Loss | 0.50dB | Tested By | Hua Wu |
| Test Voltage | DC 6.0V (Via Battery) | | |

## A.4.1 Time of Occupancy

ANT A

| Mode | Centre Frequency (MHz) | Each second appearance transmission | Time of Occupancy (ms) | Maximum accumulated Time of Occupancy (ms) | Limit (ms) |
|---|---|---|---|---|---|
| 2GFSK | 904.60 | 1 | 1.725 | 34.500 | <400 |
| | 915.00 | 1 | 1.725 | 34.500 | <400 |
| | 925.40 | 1 | 1.725 | 34.500 | <400 |

Observation Period: 20

**Centre Frequency: 2403.25MHz**
For each second of **1** transmission appearance,the longest time of occupancy is
**1** channels* **20** * **1.725** ms= **34.500** ms (<400ms)
**Centre Frequency: 2425.00MHz**
For each second of **1** transmission appearance,the longest time of occupancy is
**1** channels* **20** * **1.725** ms= **34.500** ms (<400ms)
**Centre Frequency: 2447.50MHz**
For each second of **1** transmission appearance,the longest time of occupancy is
**1** channels* **20** * **1.725** ms= **34.500** ms (<400ms)

ANT B

| Mode | Centre Frequency (MHz) | Each second appearance transmission | Time of Occupancy (ms) | Maximum accumulated Time of Occupancy (ms) | Limit (ms) |
|---|---|---|---|---|---|
| 2GFSK | 904.60 | 1 | 1.725 | 34.500 | <400 |
| | 915.00 | 1 | 1.725 | 34.500 | <400 |
| | 925.40 | 1 | 1.725 | 34.500 | <400 |

Observation Period: 20

**Centre Frequency: 2403.25MHz**
For each second of **1** transmission appearance,the longest time of occupancy is
**1** channels* **20** * **1.725** ms= **34.500** ms (<400ms)
**Centre Frequency: 2425.00MHz**
For each second of **1** transmission appearance,the longest time of occupancy is
**1** channels* **20** * **1.725** ms= **34.500** ms (<400ms)
**Centre Frequency: 2447.50MHz**
For each second of **1** transmission appearance,the longest time of occupancy is
**1** channels* **20** * **1.725** ms= **34.500** ms (<400ms)


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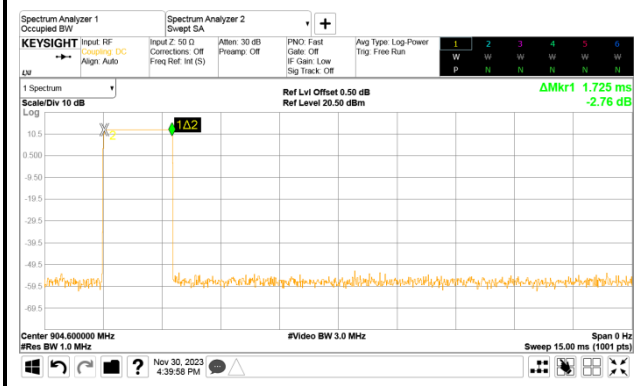
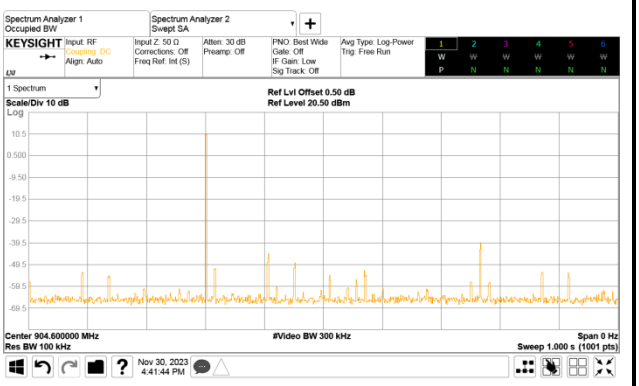
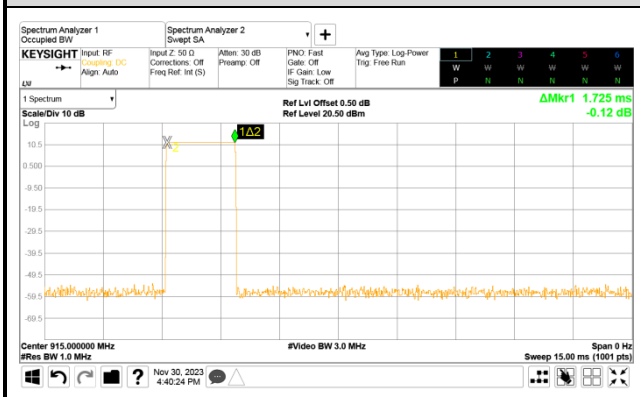
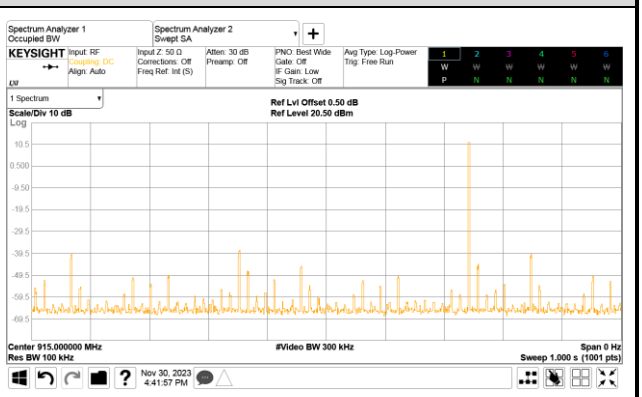
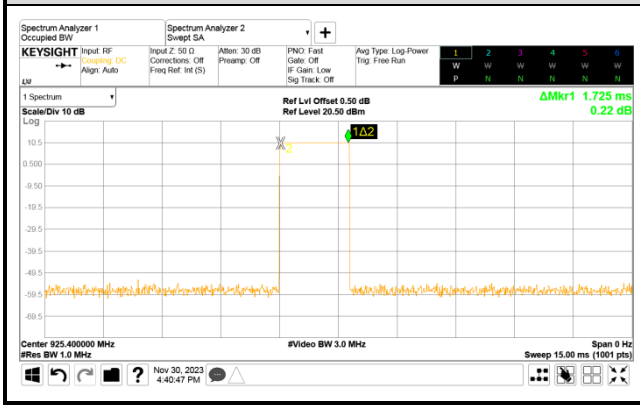
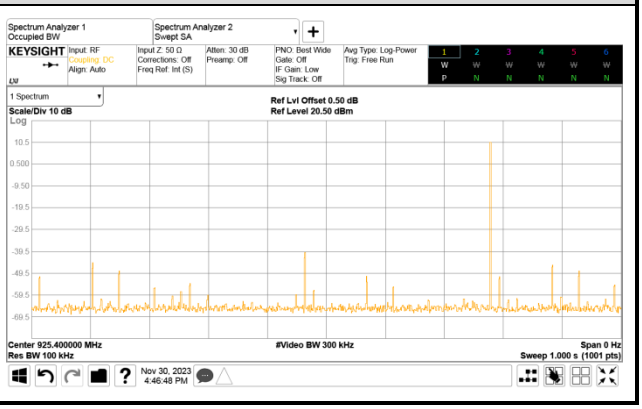
## A.4.2 Measurement Plots

| FHSS | |
|---|---|
| ANT A | |
| 904.6MHz | |
|  |  |
| 915.0MHz | |
|  |  |
| 925.4MHz | |
|  |  |



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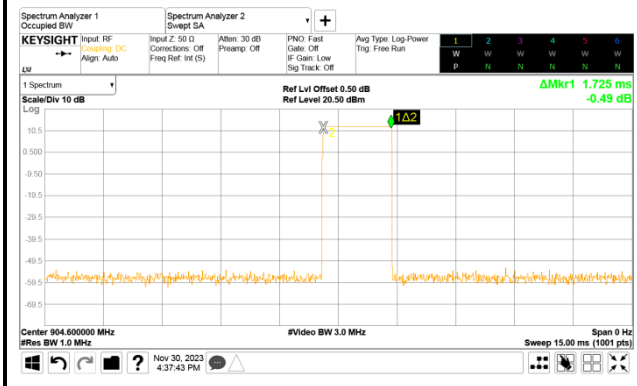
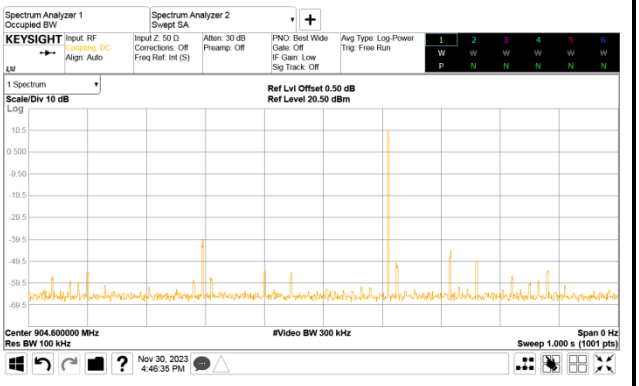
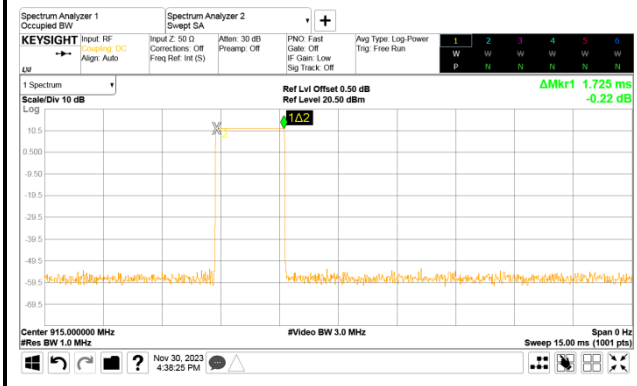
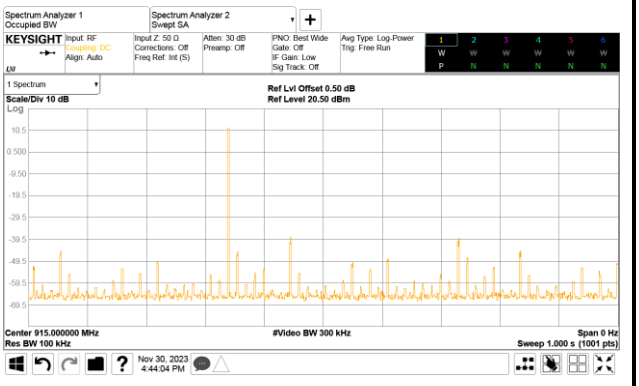
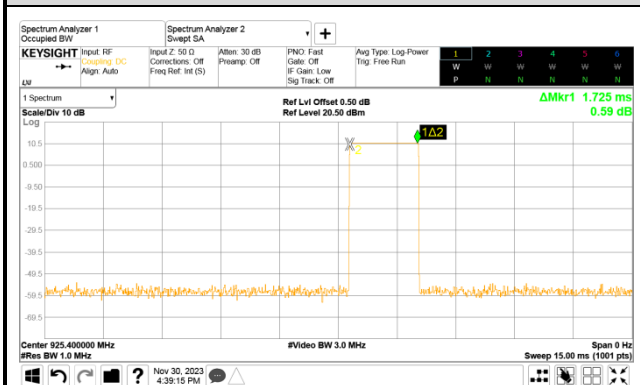
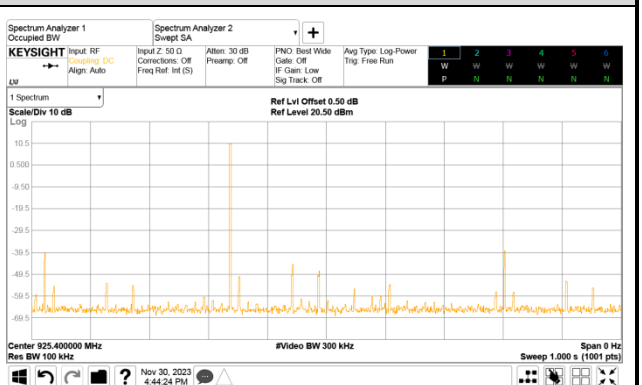
| FHSS | |
|---|---|
| ANT B | |
| 904.6MHz | |
|  |  |
| 915.0MHz | |
|  |  |
| 925.4MHz | |
|  |  |



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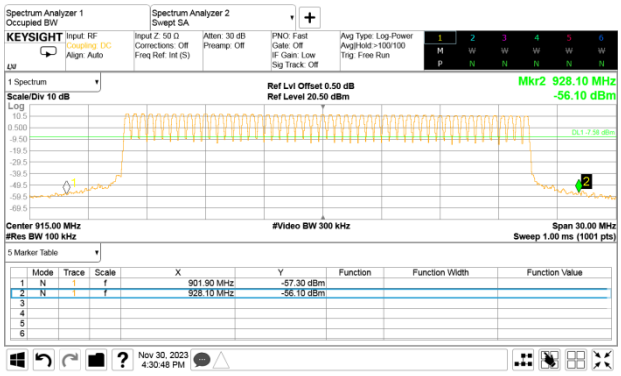
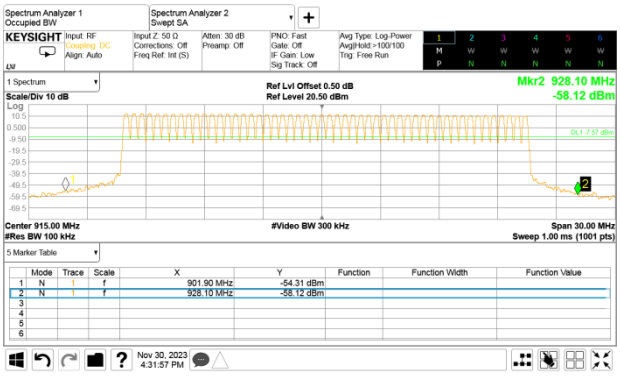
# A.5 NUMBER OF HOPPING CHANNELS

| | | | |
|---|---|---|---|
| Test Date | 2023/11/30 | Temp./Hum. | 25℃/52% |
| Cable Loss | 0.50dB | Tested By | Hua Wu |
| Test Voltage | DC 6.0V (Via Battery) | | |

| FHSS | |
|---|---|
| ANT A | ANT B |
|  |  |
| The number hopping channel is 53. | The number hopping channel is 53. |



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# A.6 MAXIMUM PEAK OUTPUT POWER

| | | | |
|---|---|---|---|
| Test Date | 2023/11/30 | Temp./Hum. | 25℃/52% |
| Cable Loss | 0.50dB | Tested By | Hua Wu |
| Test Voltage | DC 6.0V (Via Battery) | | |

A.6.1 Maximum Peak Output Power

| Mode | ANT | Centre Frequency (MHz) | Peak Output Power | | Limit |
|---|---|---|---|---|---|
| | | | dBm | W | |
| FHSS | ANT A | 904.6 | 12.54 | 0.017947 | 30dBm (1.0W) |
| | | 915.0 | 11.62 | 0.014521 | |
| | | 925.4 | 10.57 | 0.011402 | |
| | ANT B | 904.6 | 12.53 | 0.017906 | 30dBm (1.0W) |
| | | 915.0 | 11.70 | 0.014791 | |
| | | 925.4 | 10.64 | 0.011588 | |



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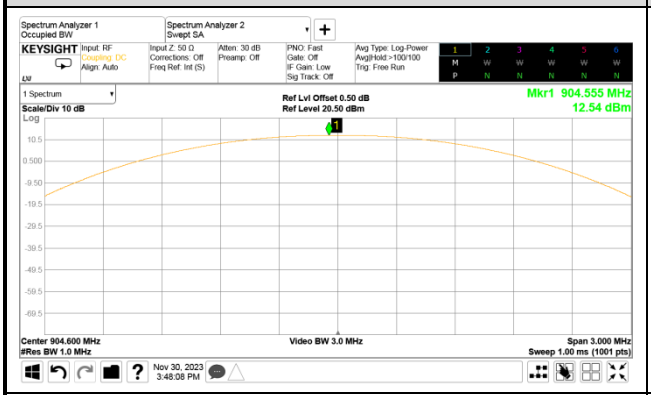
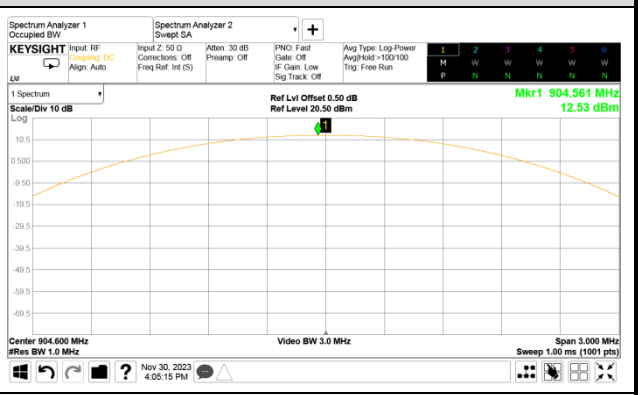
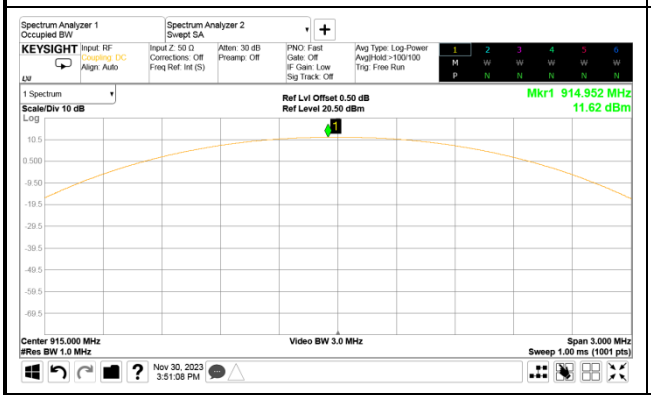
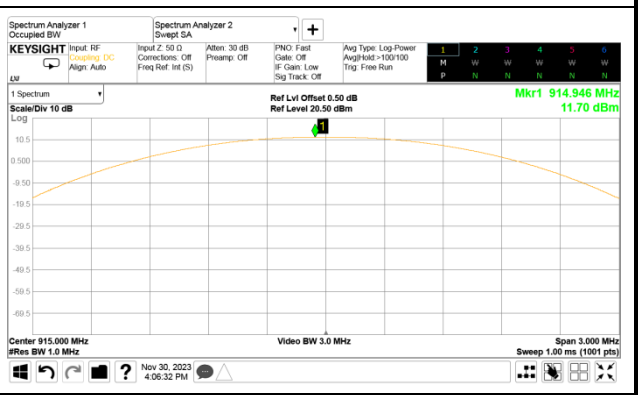
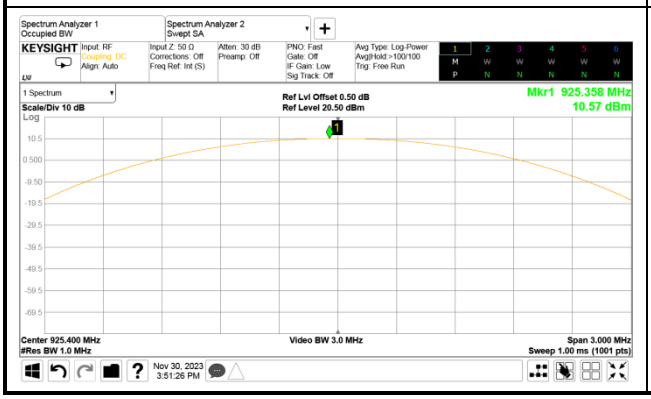
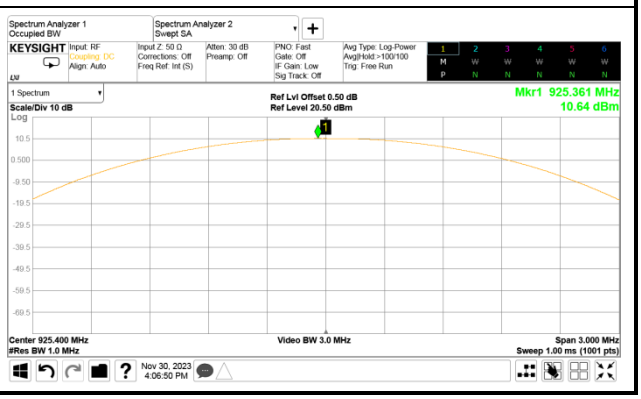
## A.6.2 Measurement Plots

| FHSS | |
|---|---|
| ANT A | ANT B |
|  |  |
|  |  |
|  |  |



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# A.7 EMISSION LIMITATIONS MEASUREMENT

## A.7.1 Band Edge

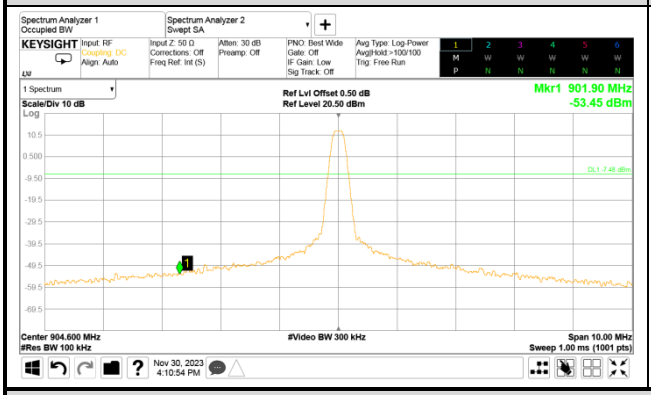
| | | | |
|---|---|---|---|
| Test Date | 2023/11/30 | Temp./Hum. | 25℃/52% |
| Cable Loss | 0.50dB | Tested By | Hua Wu |
| Test Voltage | DC 6.0V (Via Battery) | | |

FHSS

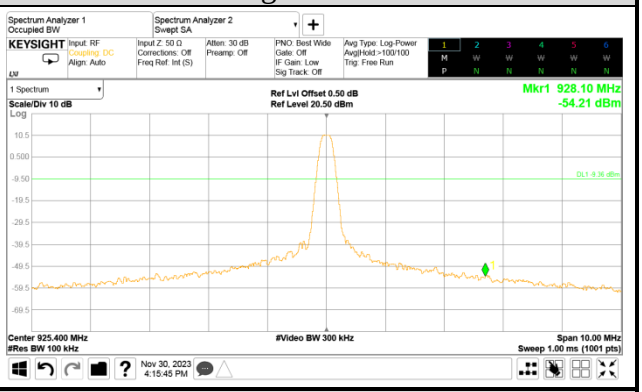
ANT A

Single Channel

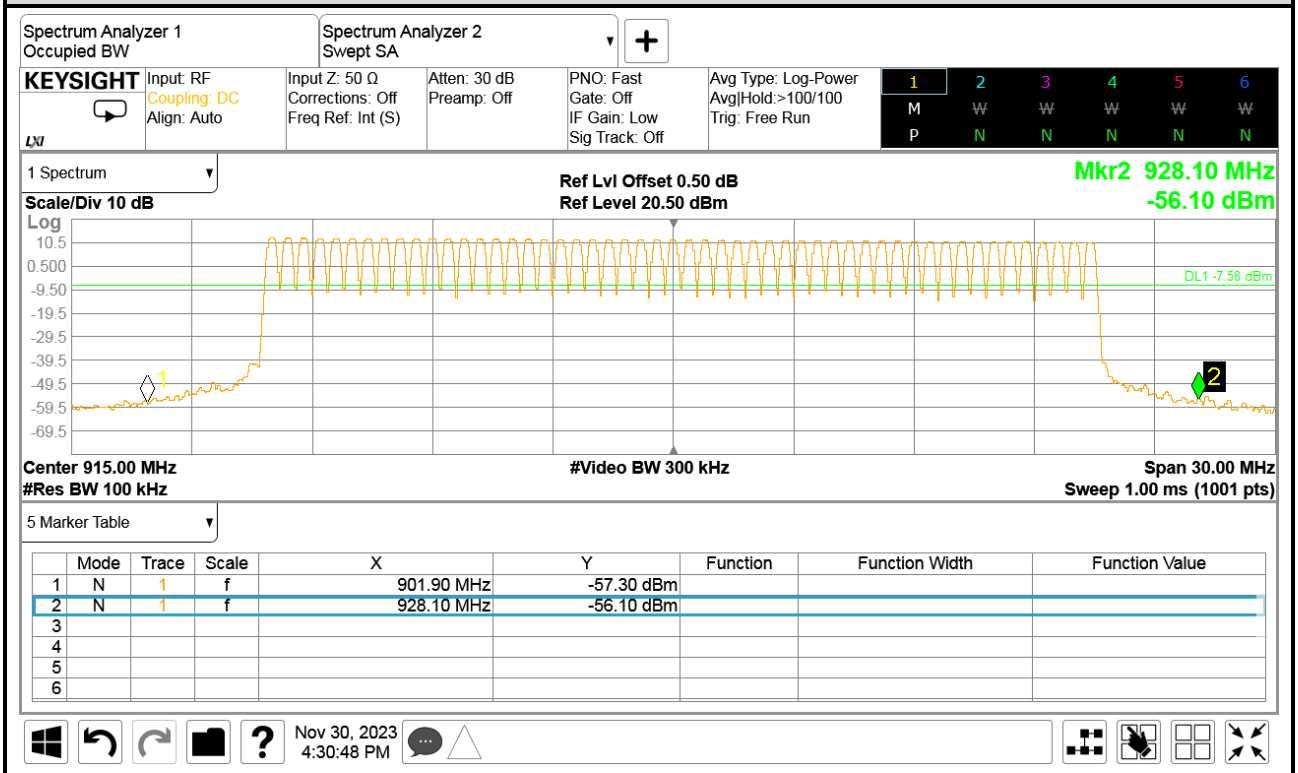
Low channel




High channel




Hopping Mode



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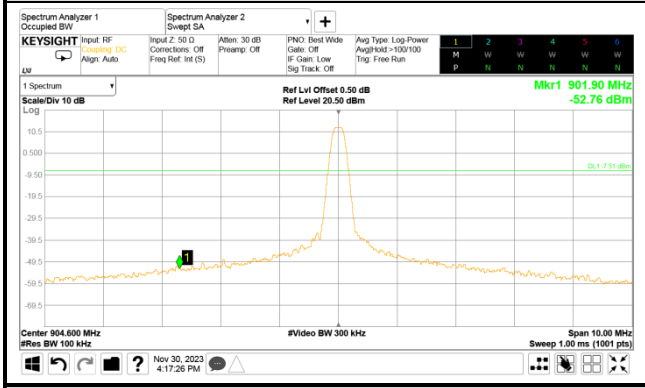
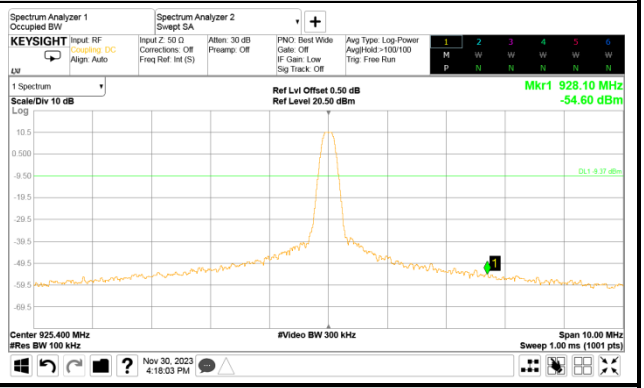
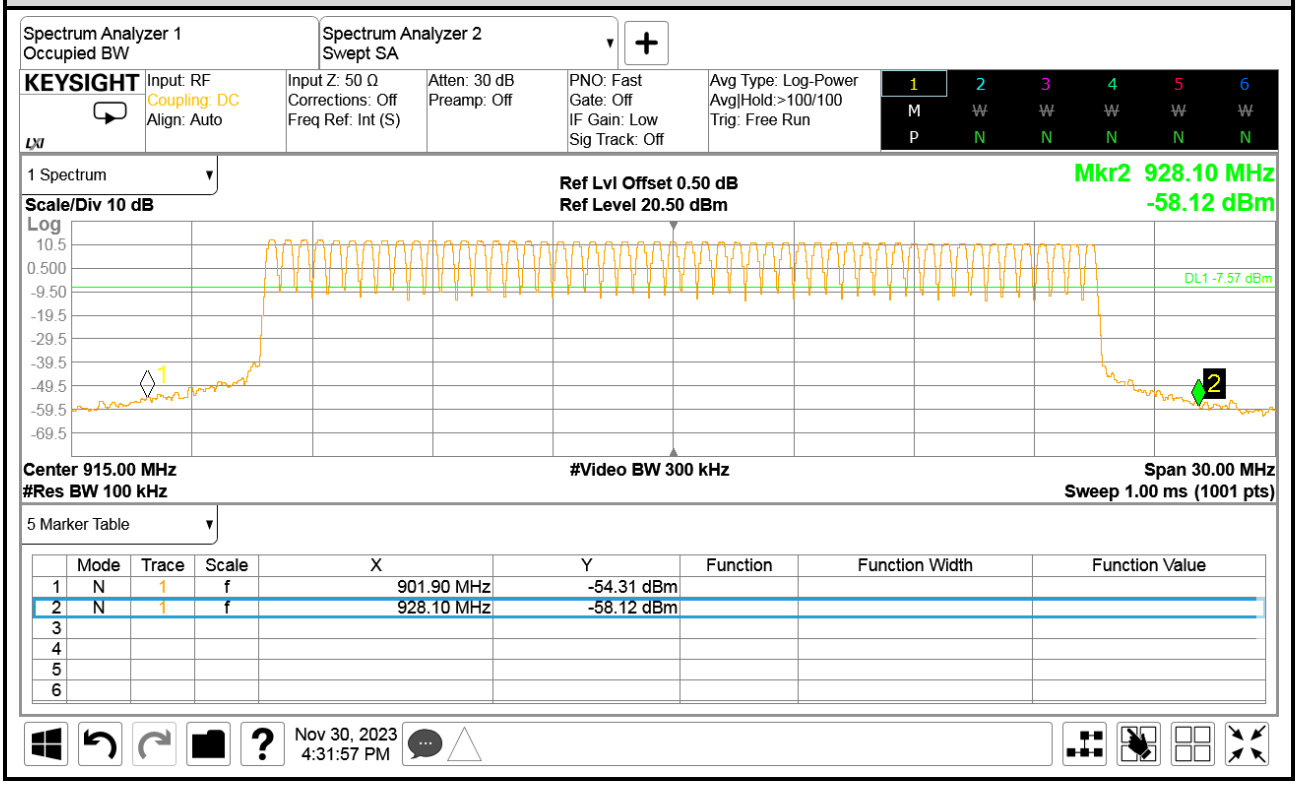
| FHSS | |
|---|---|
| ANT B | |
| Single Channel | |
| Low channel | High channel |




## Hopping Mode




| | Mode | Trace | Scale | X | Y | Function | Function Width | Function Value |
|---|---|---|---|---|---|---|---|---|
| 1 | N | 1 | f | 901.90 MHz | -54.31 dBm | | | |
| 2 | N | 1 | f | 928.10 MHz | -58.12 dBm | | | |
| 3 | | | | | | | | |
| 4 | | | | | | | | |
| 5 | | | | | | | | |
| 6 | | | | | | | | |



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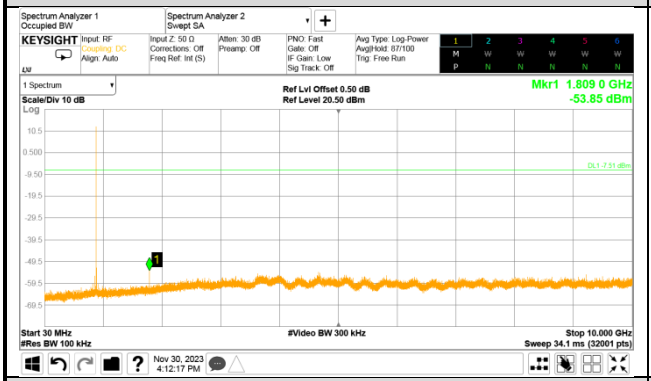
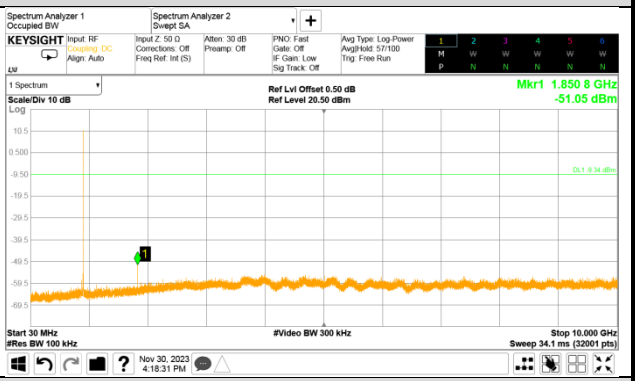
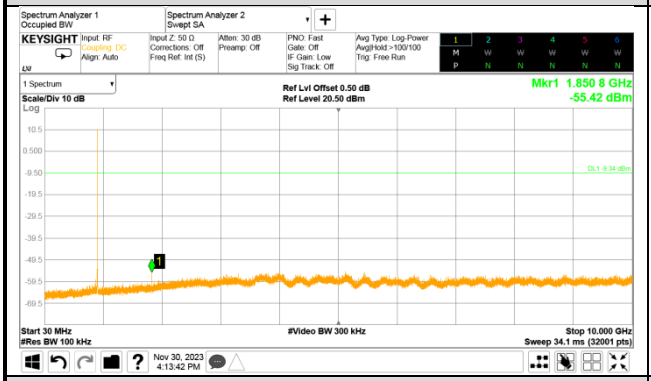
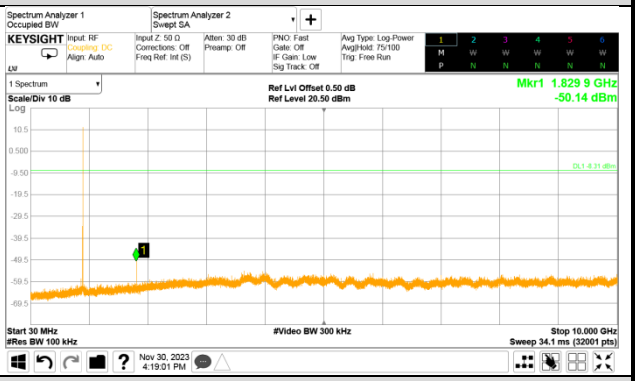
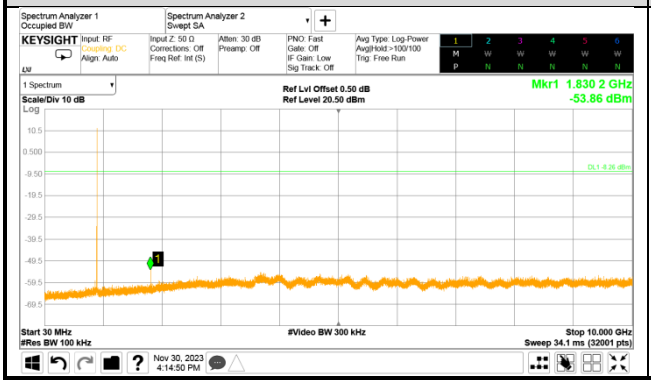
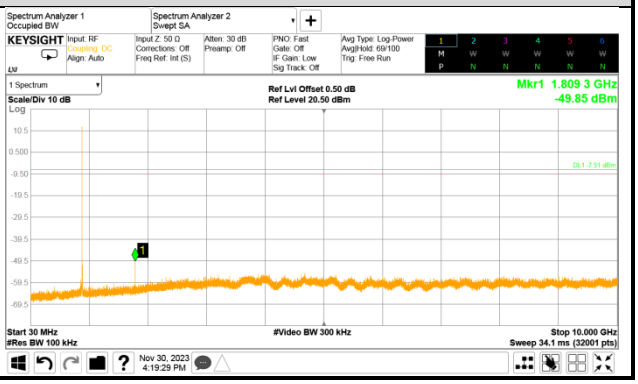
## A.7.2 Spurious Emission

| | | | |
|---|---|---|---|
| Test Date | 2023/11/30 | Temp./Hum. | 25℃/52% |
| Cable Loss | 0.50dB | Tested By | Hua Wu |
| Test Voltage | DC 6.0V (Via Battery) | | |

| FHSS | |
|---|---|
| ANT A | ANT B |
| 904.6MHz | 904.6MHz |
| 30MHz –25GHz | 30MHz –25GHz |
|  |  |
| 915.0MHz | 915.0MHz |
| 30MHz –25GHz | 30MHz –25GHz |
|  |  |
| 925.4MHz | 925.4MHz |
| 30MHz –25GHz | 30MHz –25GHz |
|  |  |



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# APPENDIX B

## TEST PHOTOGRAPHS

(Model: R9001SB)



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