FCC RADIO TEST REPORT

FCC ID	:	**2AF77-H2221540**
Equipment	:	**Communication Device**
Brand Name	:	**blink**
Model Name	:	**BSM00500U**
Applicant	:	**Immedia Semiconductor LLC. 100 Riverpark Drive Suite 125, North Reading, MA, United States 01864**
Manufacturer	:	**Immedia Semiconductor LLC. 100 Riverpark Drive Suite 125, North Reading, MA, United States 01864**
Standard	:	**FCC Part 15 Subpart C §15.247**

The product was received on Aug. 07, 2023 and testing was performed from Aug. 08, 2023 to Feb. 12, 2024. We, Sporton International (USA) Inc., would like to declare that the tested sample has been evaluated in accordance with the test procedures and has been in compliance with the applicable technical standards.

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

Neil Kao

Approved by: Neil Kao

Sporton International (USA) Inc.
1175 Montague Expressway, Milpitas, CA 95035

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History of this test report

Report No.	Version	Description	Issue Date
FR230915002C	01	Initial issue of report	Mar. 11, 2024

Summary of Test Result

Report Clause	Ref Std. Clause	Test Items	Result (PASS/FAIL)	Remark
3.1	15.247(a)(1)	Number of Channels	Pass	-
3.2	15.247(a)(1)	Hopping Channel Separation	Pass	-
3.3	15.247(a)(1)	Dwell Time of Each Channel	Pass	-
3.4	15.247(a)(1)	20dB Bandwidth	Pass	-
3.4	2.1049	99% Occupied Bandwidth	Reporting only	-
3.5	15.247(b)(2)	Output Power	Pass	-
3.6	15.247(d)	Conducted Band Edges	Pass	-
3.7	15.247(d)	Conducted Spurious Emission	Pass	-
3.8	15.247(d)	Radiated Band Edges and Radiated Spurious Emission	Pass	4.25 dB under the limit at 835.10 MHz
3.9	15.207	AC Conducted Emission	Pass	21.66 dB under the limit at 1.96 MHz
3.10	15.203 15.247(b)	Antenna Requirement	Pass	-

Conformity Assessment Condition:

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

Disclaimer:

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

1 General Description

1.1 Product Feature of Equipment Under Test

Product Feature
General Specs Bluetooth-LE, Wi-Fi 2.4GHz 802.11b/g/n, SRD and 802.11ah. **Antenna Type** WLAN: Stamped Metal Antenna Bluetooth: Stamped Metal Antenna SRD: Stamped Metal Antenna 802.11ah: Stamped Metal Antenna

Antenna information		
902.4 MHz ~ 927.6 MHz	Peak Gain (dBi)	0.78

Remark: The EUT's information above is declared by manufacturer. Please refer to Disclaimer in report summary.

1.2 Modification of EUT

No modifications made to the EUT during the testing.

1.3 Testing Location

Test Site	Sporton International (USA) Inc.
Test Site Location	1175 Montague Expressway, Milpitas, CA 95035 TEL : 408 9043300
Test Site No.	**Sporton Site No.**
	03CH02-CA, CO01-CA, TH01-CA

Note: The test site complies with ANSI C63.4 2014 requirement.

FCC Designation No.: US1250

1.4 Applicable Standards

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

- FCC Part 15 Subpart C §15.247
- FCC KDB Publication No. 558074 D01 15.247 Meas Guidance v05r02
- FCC KDB 414788 D01 Radiated Test Site v01r01
- ANSI C63.10-2013

Remark:

1. All the test items were validated and recorded in accordance with the standards without any modification during the testing.
2. This EUT has also been tested and complied with the requirements of FCC Part 15, Subpart B, recorded in a separate test report.

2 Test Configuration of Equipment Under Test

2.1 Carrier Frequency Channel

Channel List	
The lowest channel	902.4MHz
The middle channel	915.2MHz
The highest channel	927.6MHz

2.2 Test Mode

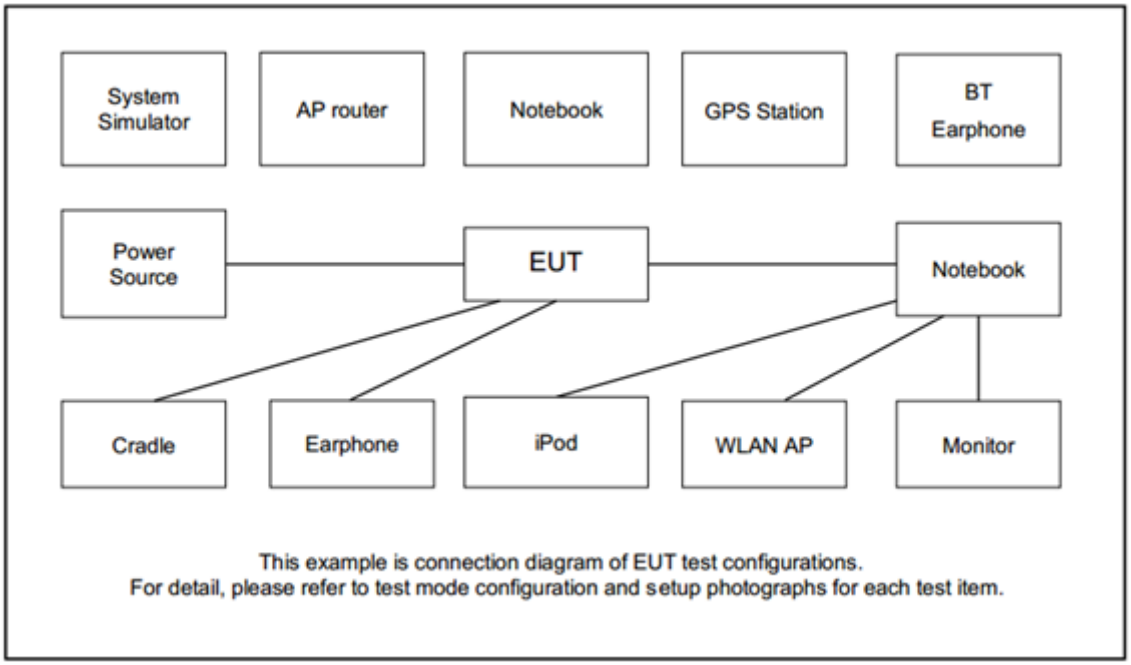
a. The EUT has been associated with peripherals and configuration operated in a manner tended to maximize its emission characteristics in a typical application. Frequency range investigated: conduction emission (150 kHz to 30 MHz), radiation emission (9 kHz to the 10th harmonic of the highest fundamental frequency or to 40 GHz, whichever is lower). For radiated measurement, the measured emission level of the EUT was maximized by rotating the EUT on a turntable, adjusting the orientation of the EUT and EUT antenna in three orthogonal axis (X: flat, Y: portrait, Z: landscape), and adjusting the measurement antenna orientation, following C63.10 exploratory test procedures and only the worst case emissions were reported in this report.

b. AC power line Conducted Emission was tested under maximum output power.

The following summary table is showing all test modes to demonstrate in compliance with the standard.

Summary table of Test Cases	
Test Item	**SRD/GFSK**
Conducted Test Cases	Mode 1: The lowest channel: 902.4MHz Mode 2: The middle channel: 915.2MHz Mode 3: The highest channel: 927.6MHz
Radiated Test Cases	Mode 1: The lowest channel: 902.4MHz Mode 2: The middle channel: 915.2MHz Mode 3: The highest channel: 927.6MHz
AC Conducted Emission	Mode 1 : SRD Tx + USB Cable (Charging from Adapter)

2.3 Connection Diagram of Test System



2.4 Support Unit used in test configuration and system

Item	Equipment	Brand Name	Model Name	FCC ID	Data Cable	Power Cord
1.	Adapter	Amazon	FANA7R	N/A	N/A	N/A
2.	USB Cable	Amazon	N/A	N/A	N/A	N/A
3.	Adapter	N/A	N/A	N/A	N/A	N/A

2.5 EUT Operation Test Setup

Writing commands onto the SD card, inserting the SD card into the EUT, and upon powering up, the EUT will automatically transmit signals.

2.6 Measurement Results Explanation Example

For all conducted test items:

The offset level is set in the spectrum analyzer to compensate the RF cable loss and attenuator factor between EUT conducted output port and spectrum analyzer. With the offset compensation, the spectrum analyzer reading level is exactly the EUT RF output level.

Example:
The spectrum analyzer offset is derived from RF cable loss and attenuator factor.
Offset = RF cable loss + attenuator factor.
Following shows an offset computation example with cable loss 4.2 dB and 10 dB attenuator.

Offset(dB) = RF cable loss(dB) + attenuator factor(dB).
= 4.2 + 10 = 14.2 (dB)

3 Test Result

3.1 Number of Channel Measurement

3.1.1 Limits of Number of Hopping Frequency

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; if the 20 dB bandwidth of the hopping channel is 250 kHz or greater, the system shall use at least 25 hopping frequencies.

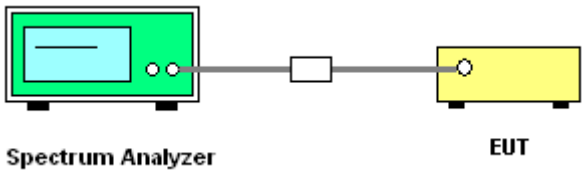
3.1.2 Measuring Instruments

Please refer to the measuring equipment list in this test report.

3.1.3 Test Procedure

1. The testing follows ANSI C63.10-2013 clause 7.8.3.
2. The RF output of EUT is connected to the spectrum analyzer by RF cable and attenuator. The path loss is compensated to the results for each measurement.
3. Set the maximum power setting and enable the EUT to transmit continuously.
4. Enable the EUT hopping function.
5. Use the following spectrum analyzer settings: Span = the frequency band of operation;
   RBW = 50kHz; VBW ≥ RBW; Sweep = auto; Detector function = peak; Trace = max hold.
6. The number of hopping frequency used is defined as the number of total channel.
7. Record the measurement data derived from spectrum analyzer.

3.1.4 Test Setup



3.1.5 Test Result of Number of Hopping Frequency

Please refer to Appendix A.

3.2 Hopping Channel Separation Measurement

3.2.1 Limit of Hopping Channel Separation

Frequency hopping systems operating in the 902 – 928 MHz band shall have hopping channel carrier frequencies separated by a minimum of 25 kHz or the 20 dB bandwidth of the hopping channel, whichever is greater.

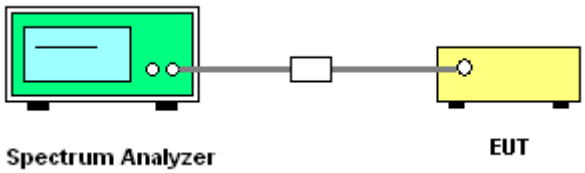
3.2.2 Measuring Instruments

Please refer to the measuring equipment list in this test report.

3.2.3 Test Procedures

1. The testing follows ANSI C63.10-2013 clause 7.8.2.
2. The RF output of EUT is connected to the spectrum analyzer by RF cable and attenuator. The path loss is compensated to the results for each measurement.
3. Set the maximum power setting and enable the EUT to transmit continuously.
4. Enable the EUT hopping function.
5. Use the following spectrum analyzer settings:
   Span = wide enough to capture the peaks of two adjacent channels;
   RBW = 100kHz for; VBW ≥ RBW; Sweep = auto; Detector function = peak; Trace = max hold.
6. Measure and record the results in the test report.

3.2.4 Test Setup



3.2.5 Test Result of Hopping Channel Separation

Please refer to Appendix A.

3.3 Dwell Time Measurement

3.3.1 Limit of Dwell Time

If the 20 dB bandwidth of the hopping channel is less than 250 kHz, 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 average time of occupancy on any frequency shall not be greater than 0.4 seconds within a 10 second period.

3.3.2 Measuring Instruments

Please refer to the measuring equipment list in this test report.

3.3.3 Test Procedures

1. The testing follows ANSI C63.10-2013 clause 7.8.4.
2. The RF output of EUT is connected to the spectrum analyzer by RF cable and attenuator. The path loss is compensated to the results for each measurement.
3. Set the maximum power setting and enable the EUT to transmit continuously.
4. Enable the EUT hopping function.
5. Use the following spectrum analyzer settings: Span = zero span, centered on a hopping channel; RBW = 100 KHz; VBW ≥ RBW; Sweep = as necessary to capture the entire dwell time per hopping channel; Detector function = peak; Trace = max hold.
6. Measure and record the results in the test report.

3.3.4 Test Setup

3.3.5 Test Result of Dwell Time

Please refer to Appendix A.

3.4 20dB and 99% Bandwidth Measurement

3.4.1 Limit of 20dB and 99% Bandwidth

The maximum allowed 20 dB bandwidth of the hopping channel is 500 kHz.

99% Bandwidth is reporting only.

3.4.2 Measuring Instruments

Please refer to the measuring equipment list in this test report.

3.4.3 Test Procedures

1. The testing follows ANSI C63.10-2013 clause 6.9.2 and 6.9.3.
2. The RF output of EUT is connected to the spectrum analyzer by RF cable and attenuator. The path loss is compensated to the results for each measurement.
3. Set the maximum power setting and enable the EUT to transmit continuously.
4. Use the following spectrum analyzer settings for 20 dB Bandwidth measurement.
   Span = approximately 2 to 5 times the 20 dB bandwidth, centered on a hopping channel;
   RBW ≥ 1% of the 20 dB bandwidth; VBW ≥ RBW; Sweep = auto; Detector function = peak;
   Trace = max hold.
5. Use the following spectrum analyzer settings for 99 % Bandwidth measurement.
   Span = approximately 1.5 to 5 times the 99% bandwidth, centered on a hopping channel;
   RBW ≥ 1-5% of the 99% bandwidth; VBW ≥ 3 * RBW; Sweep = auto; Detector function = peak;
   Trace = max hold.
6. Measure and record the results in the test report.

3.4.4 Test Setup

3.4.5 Test Result of 20dB Bandwidth

Please refer to Appendix A.

3.4.6 Test Result of 99% Occupied Bandwidth

Please refer to Appendix A.

3.5 Output Power Measurement

3.5.1 Limit of Output Power

For frequency hopping systems operating in the 902-928 MHz band: 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 this section.

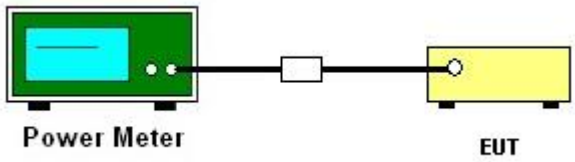
3.5.2 Measuring Instruments

Please refer to the measuring equipment list in this test report.

3.5.3 Test Procedures

1. The testing follows ANSI C63.10-2013 clause 7.8.5.
2. The RF output of EUT is connected to the power meter by RF cable and attenuator. The path loss is compensated to the results for each measurement.
3. Set the maximum power setting and enable the EUT to transmit continuously.
4. Measure the conducted output power with cable loss and record the results in the test report.
5. Measure and record the results in the test report.

3.5.4 Test Setup



3.5.5 Test Result of Peak Output Power

Please refer to Appendix A.

3.5.6 Test Result of Average Output Power (Reporting Only)

Please refer to Appendix A.

3.6 Conducted Band Edges Measurement

3.6.1 Limit of Band Edges

In any 100 kHz bandwidth outside the intentional radiation frequency band, the radio frequency power shall be at least 20 dB below the highest level of the radiated power. In addition, radiated emissions which fall in the restricted bands must also comply with the radiated emission limits.

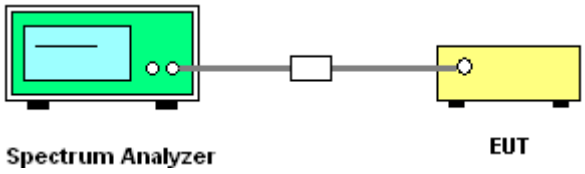
3.6.2 Measuring Instruments

Please refer to the measuring equipment list in this test report.

3.6.3 Test Procedures

1. The testing follows ANSI C63.10-2013 clause 7.8.6.
2. Set the maximum power setting and enable the EUT to transmit continuously.
3. Set RBW = 100 kHz, VBW = 300 kHz. Band edge emissions must be at least 20 dB down from the highest emission level within the authorized band as measured with a 100 kHz RBW. The attenuation shall be 30 dB instead of 20 dB when RMS conducted output power procedure is used.
4. Enable hopping function of the EUT and then repeat step 2 and 3.
5. Measure and record the results in the test report.

3.6.4 Test Setup



3.6.5 Test Result of Conducted Band Edges

Please refer to Appendix A.

3.6.6 Test Result of Conducted Hopping Mode Band Edges

Please refer to Appendix A.

3.7 Conducted Spurious Emission Measurement

3.7.1 Limit of Spurious Emission Measurement

In any 100 kHz bandwidth outside the intentional radiation frequency band, the radio frequency power shall be at least 20 dB below the highest level of the radiated power. In addition, radiated emissions which fall in the restricted bands must also comply with the radiated emission limits.

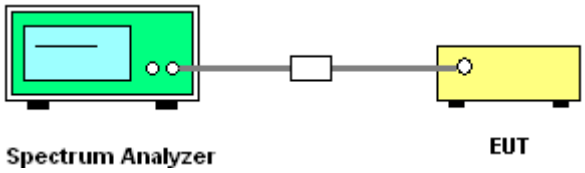
3.7.2 Measuring Instruments

Please refer to the measuring equipment list in this test report.

3.7.3 Test Procedure

1. The testing follows ANSI C63.10-2013 clause 7.8.8.
2. The RF output of EUT is connected to the spectrum analyzer by RF cable and attenuator. The path loss is compensated to the results for each measurement.
3. Set the maximum power setting and enable the EUT to transmit continuously.
4. Set RBW = 100 kHz, VBW = 300 kHz, scan up through 10th harmonic. All harmonics / spurious must be at least 20 dB down from the highest emission level within the authorized band as measured with a 100 kHz RBW.
5. Measure and record the results in the test report.
6. The RF fundamental frequency should be excluded against the limit line in the operating frequency band.

3.7.4 Test Setup



3.7.5 Test Result of Conducted Spurious Emission

Please refer to Appendix A.

3.8 Radiated Band Edges and Spurious Emission Measurement

3.8.1 Limit of Radiated Band Edges and Spurious Emission

In any 100 kHz bandwidth outside the intentional radiator frequency band, all harmonics / spurious must be at least 20 dB below the highest emission level within the authorized band. In addition, radiated emissions which fall in the restricted bands must also comply with the limits as below.

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

3.8.2 Measuring Instruments

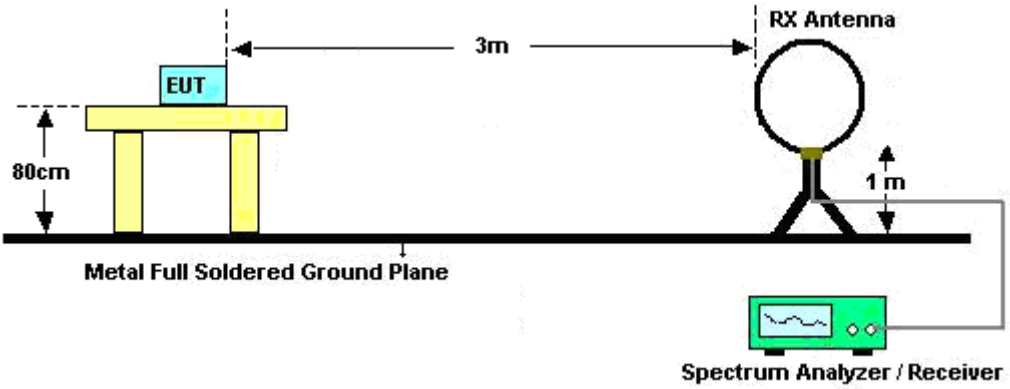
Please refer to the measuring equipment list in this test report.

3.8.3 Test Procedures

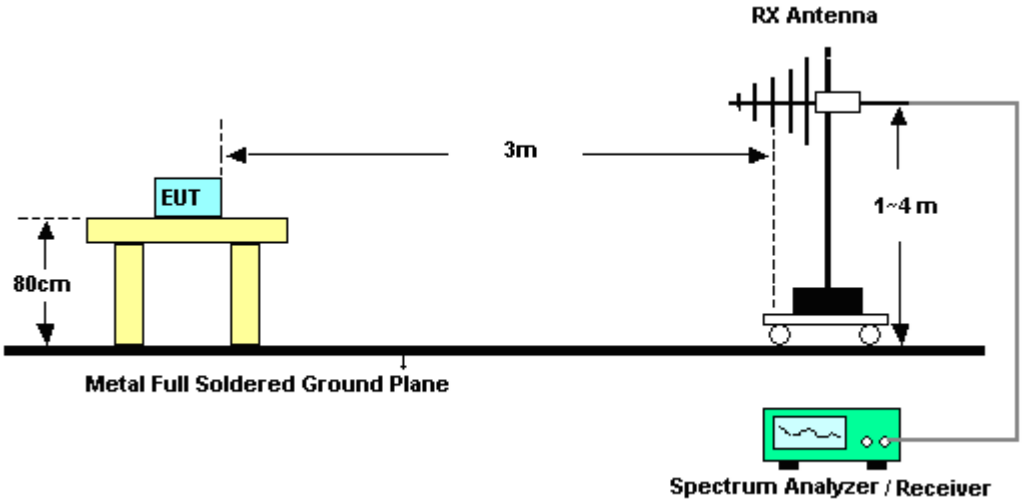
1. The EUT is placed on a turntable with 0.8 meter for frequency below 1 GHz and 1.5 meter for frequency above 1 GHz respectively above ground.
2. The EUT is set 3 meters away from the receiving antenna, which is mounted on the top of a variable height antenna tower.
3. For each suspected emission, the EUT is arranged to its worst case and then tune the Antenna tower (from 1 m to 4 m) and turntable (from 0 degree to 360 degrees) to find the maximum reading. A pre-amp and a high pass filter are used for the test in order to get better signal level to comply with the guidelines.
4. Set the maximum power setting and enable the EUT to transmit continuously.
5. Use the following spectrum analyzer settings:
   (1) Span shall wide enough to fully capture the emission being measured;
   (2) Set RBW = 100 kHz for f < 1 GHz, RBW = 1 MHz for f>1 GHz ; VBW ≥ RBW; Sweep = auto; Detector function = peak; Trace = max hold for peak
   (3) For average measurement: use duty cycle correction factor method per 15.35(c).
   Duty cycle = On time/100 milliseconds
   On time = $N_1*L_1+N_2*L_2+...+N_{n-1}*LN_{n-1}+N_n*L_n$
   Where N_1 is number of type 1 pulses, L_1 is length of type 1 pulses, etc.
   Average Emission Level = Peak Emission Level + 20*log (Duty cycle)
6. Corrected Reading: Antenna Factor + Cable Loss + Read Level - Preamp Factor = Level
7. Radiated testing below 1 GHz is performed by adjusting the antenna tower from 1 m to 4 m and by rotating the turn table from 0 degree to 360 degrees to find the peak maximum hold reading. When there is no suspected emission found and the emission level is with at least 6 dB margin against QP limit line, the position is marked as "-".
8. Radiated testing above 1 GHz is performed by adjusting the antenna tower from 1 m to 4 m and by rotating the turn table from 0 degree to 360 degrees to find the peak maximum hold reading for scanning all frequencies. When there is no suspected emission found and the harmonic emission level is with at least 6 dB margin against average limit line, the position is marked as "-".

3.8.4 Test Setup

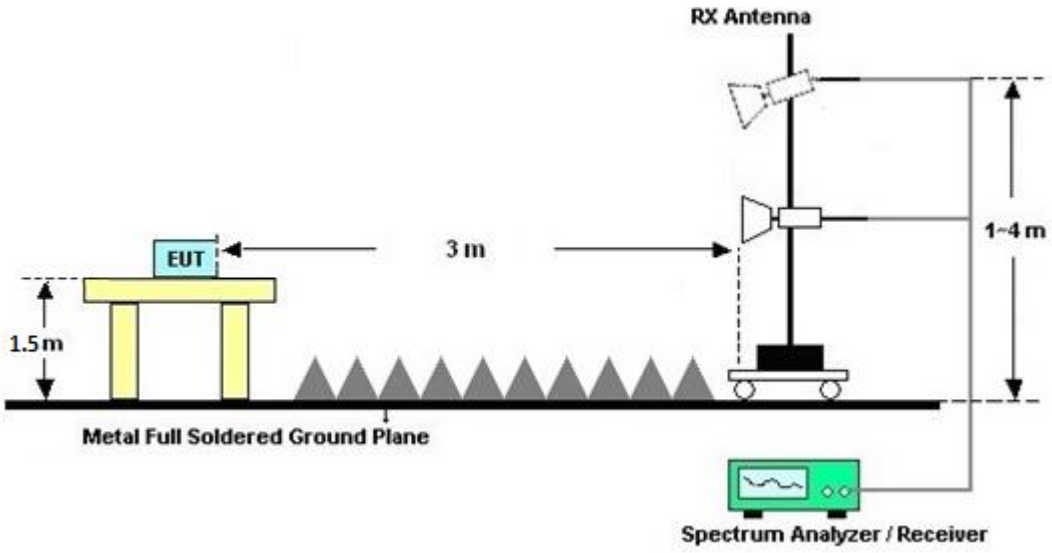
For radiated test below 30MHz



For radiated test from 30MHz to 1GHz



For radiated test above 1GHz



3.8.5 Test Results of Radiated Spurious Emissions (9 kHz ~ 30 MHz)

The low frequency, which starts from 9 kHz to 30 MHz, is pre-scanned and the result which is 20 dB lower than the limit line is not reported.

There is adequate comparison measurement of both open-field test site and alternative test site - semi-Anechoic chamber according to 414788 D01 Radiated Test Site v01r01, and the result comes out very similar.

3.8.6 Test Result of Radiated Spurious at Band Edges

Please refer to Appendix C and D.

3.8.7 Duty Cycle

Please refer to Appendix E.

3.8.8 Test Result of Radiated Spurious Emission (30MHz ~ 10th Harmonic)

Please refer to Appendix C and D.

3.9 AC Conducted Emission Measurement

3.9.1 Limit of AC Conducted Emission

For equipment that is designed to be connected to the public utility (AC) power line, the radio frequency voltage that is conducted back onto the AC power line on any frequency or frequencies within the band 150 kHz to 30 MHz shall not exceed the limits in the following table.

Frequency of emission (MHz)	Conducted limit (dBμV)	
	Quasi-peak	Average
0.15-0.5	66 to 56*	56 to 46*
0.5-5	56	46
5-30	60	50

*Decreases with the logarithm of the frequency.

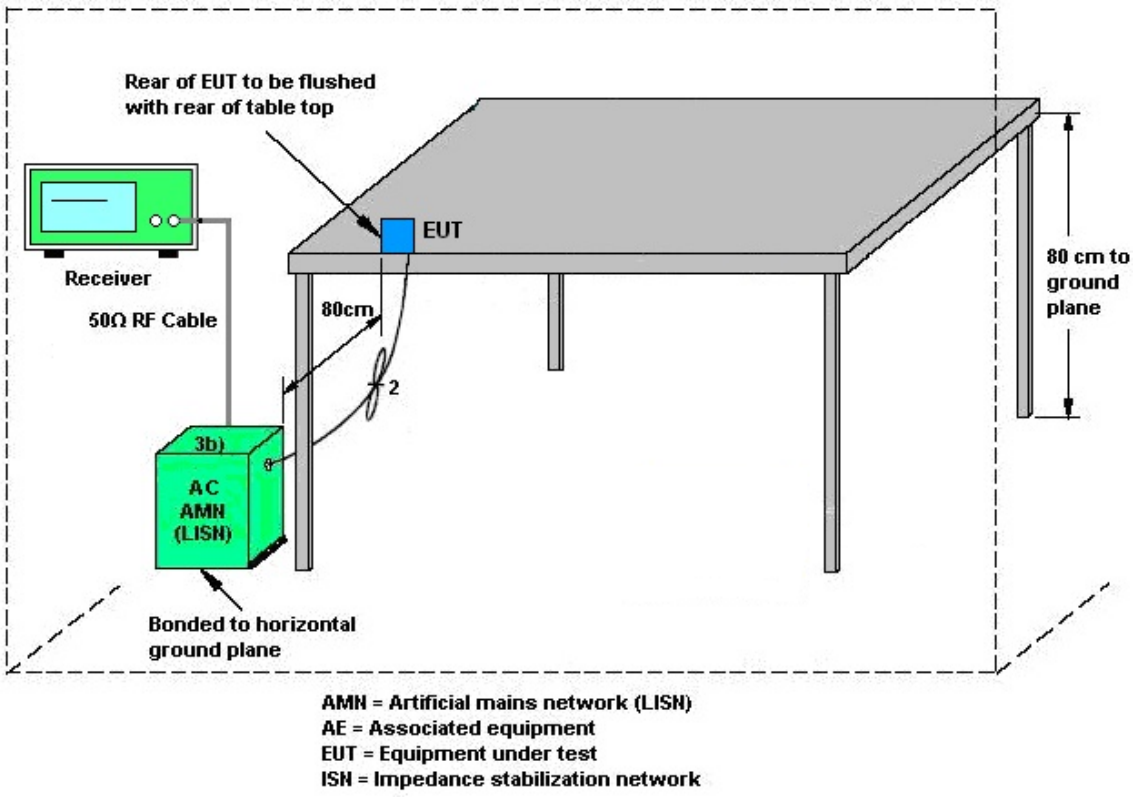
3.9.2 Measuring Instruments

Please refer to the measuring equipment list in this test report.

3.9.3 Test Procedures

1. The EUT is placed 0.4 meter away from the conducting wall of the shielding room, and is kept at least 80 centimeters from any other grounded conducting surface.
2. Connect EUT to the power mains through a line impedance stabilization network (LISN).
3. All the support units are connecting to the other LISN.
4. The LISN provides 50 ohm coupling impedance for the measuring instrument.
5. The FCC states that a 50 ohm, 50 microhenry LISN shall be used.
6. Both Line and Neutral shall be tested in order to find out the maximum conducted emission.
7. The frequency range from 150 kHz to 30 MHz is scanned.
8. Set the test-receiver system to Peak Detect Function and specified bandwidth (IF Bandwidth = 9 kHz) with Maximum Hold Mode. Then measurement is also conducted by Average Detector and Quasi-Peak Detector Function respectively.

3.9.4 Test Setup



AMN = Artificial mains network (LISN)
AE = Associated equipment
EUT = Equipment under test
ISN = Impedance stabilization network

3.9.5 Test Result of AC Conducted Emission

Please refer to Appendix B.

3.10 Antenna Requirements

3.10.1 Standard Applicable

The use of a permanently attached antenna or of an antenna that uses a unique coupling to the intentional radiator shall be considered sufficient to comply with the rule.

3.10.2 Antenna Anti-Replacement Construction

An embedded-in antenna design is used.

4 List of Measuring Equipment

Instrument	Brand Name	Model No.	Serial No.	Characteristics	Calibration Date	Test Date	Due Date	Remark
Loop Antenna	R&S	HFH2-Z2E	100840	9kHz~30MHz	Jun. 29, 2023	Aug. 08, 2023~ Aug. 09, 2023	Jun. 28, 2024	Radiation (03CH02-CA)
Bilog Antenna	TESEQ	6111D	54683	30MHz~1GHz	Nov. 01, 2022	Aug. 08, 2023~ Aug. 09, 2023	Oct. 31, 2023	Radiation (03CH02-CA)
Horn Antenna	SCHWARZBECK	BBHA 9120D	02140	1GHz~18GHz	Jan. 29, 2023	Aug. 08, 2023~ Aug. 09, 2023	Jan. 28, 2024	Radiation (03CH02-CA)
Amplifier	SONOMA	300N	372240	N/A	May 03, 2023	Aug. 08, 2023~ Aug. 09, 2023	May 02, 2024	Radiation (03CH02-CA)
Preamplifier	Keysight	83017A	MY53270323	1GHz~26.5GHz	May 04, 2023	Aug. 08, 2023~ Aug. 09, 2023	May 03, 2024	Radiation (03CH02-CA)
Preamplifier	E-instrument	ERA-100M-18G-56-01-A70	EC1900252	1GHz~18GHz	May 23, 2023	Aug. 08, 2023~ Aug. 09, 2023	May 22, 2024	Radiation (03CH02-CA)
RF Cable	HUBER+SUHNER	SUCOFLEX 102	804209/2, 802406/2, 802875/2, 802952/2	N/A	Nov. 14, 2022	Aug. 08, 2023~ Aug. 09, 2023	Nov. 13, 2023	Radiation (03CH02-CA)
High Pass Filter	Wainwright	WHKX12-900-1000-15000-60ST	SN2	1G~15G	Jun. 05, 2023	Aug. 08, 2023~ Aug. 09, 2023	Jun. 04, 2024	Radiation (03CH02-CA)
Filter	Wainwright	WLK12-1200-1272-11000-40SS	SN2	1.2GHz Low Pass Filter	Jun. 05, 2023	Aug. 08, 2023~ Aug. 09, 2023	Jun. 04, 2024	Radiation (03CH02-CA)
Hygrometer	TESEO	608-H1	45142602	N/A	Sep. 12, 2022	Aug. 08, 2023~ Aug. 09, 2023	Sep. 11, 2023	Radiation (03CH02-CA)
Controller	ChainTek	EM-1000	060876	NA	N/A	Aug. 08, 2023~ Aug. 09, 2023	N/A	Radiation (03CH02-CA)
Antenna Mast	ChainTek	MBS-520-1	N/A	1m~4m	N/A	Aug. 08, 2023~ Aug. 09, 2023	N/A	Radiation (03CH02-CA)
Turn Table	ChainTek	T-200-S-1	N/A	0~360 Degree	N/A	Aug. 08, 2023~ Aug. 09, 2023	N/A	Radiation (03CH02-CA)
Software	Audix	E3	N/A	N/A	N/A	Aug. 08, 2023~ Aug. 09, 2023	N/A	Radiation (03CH02-CA)
LISN	TESEQ	NNB51	47415	N/A	Jul. 31, 2023	Jan. 09, 2024	Jul. 30, 2024	Conduction (CO01-CA)
LISN	TESEQ	NNB51	47407	N/A	May 16, 2023	Jan. 09, 2024	May 15, 2024	Conduction (CO01-CA)
EMI Test Receiver	R&S	ESR7	102177	9kHz~7GHz	May 23, 2023	Jan. 09, 2024	May 22, 2024	Conduction (CO01-CA)
Pulse limiter with 10dB attenuation	R&S	VTSD 9561-F N	9561-F-N00412	N/A	Jun. 05, 2023	Jan. 09, 2024	Jun. 04, 2024	Conduction (CO01-CA)
Test Software	R&S	EMC32 V10.30.0	N/A	N/A	N/A	Jan. 05, 2024	N/A	Conduction (CO01-CA)
Hygrometer	Testo	608-H1	45141354	N/A	Jul. 26, 2023	Feb. 09, 2024~ Feb. 12, 2024	Jul. 25, 2024	Conducted (TH01-CA)
Power Sensor	Anritsu	MA2411B	1726149	10MHz-6GHz	May 11, 2023	Feb. 09, 2024~ Feb. 12, 2024	May 10, 2024	Conducted (TH01-CA)
Power Meter	Anritsu	ML2495A	1804004	N/A	May 11, 2023	Feb. 09, 2024~ Feb. 12, 2024	May 10, 2024	Conducted (TH01-CA)
Spectrum Analyzer	Rohde & Schwarz	FSV40	101545	10Hz-40GHz	May 03, 2023	Feb. 09, 2024~ Feb. 12, 2024	May 02, 2024	Conducted (TH01-CA)

5 Measurement Uncertainty

Uncertainty of Conducted Emission Measurement (150 kHz ~ 30 MHz)

Measuring Uncertainty for a Level of Confidence of 95% (U = 2Uc(y))	**2.70 dB**

Uncertainty of Radiated Emission Measurement (30 MHz ~ 1000 MHz)

Measuring Uncertainty for a Level of Confidence of 95% (U = 2Uc(y))	**4.50 dB**

Uncertainty of Radiated Emission Measurement (1000 MHz ~ 18000 MHz)

Measuring Uncertainty for a Level of Confidence of 95% (U = 2Uc(y))	**4.90 dB**

Uncertainty of Radiated Emission Measurement (18000 MHz ~ 40000 MHz)

Measuring Uncertainty for a Level of Confidence of 95% (U = 2Uc(y))	**5.20 dB**

Appendix A. Test Result of Conducted Test Items

Test Engineer:	Venkata Kondepudi	Temperature:	17.5~18.8	°C
Test Date:	2024/02/09~2024/02/12	Relative Humidity:	45.7~48.1	%

TEST RESULTS DATA
20dB and 99% Occupied Bandwidth and Hopping Channel Separation

Mod.	Data Rate	NTX	Freq. (MHz)	20db BW (MHz)	99% Bandwidth (MHz)	Hopping Channel Separation Measurement (MHz)	Hopping Channel Separation Measurement Limit (MHz)	Pass/Fail
GFSK	50 kbps	1	902.4	0.109	0.100	0.404	0.0726	Pass
GFSK	50 kbps	1	915.2	0.107	0.100	0.403	0.0713	Pass
GFSK	50 kbps	1	927.6	0.106	0.100	0.400	0.0706	Pass

TEST RESULTS DATA
Dwell Time

Mod.	Hopping Channel Number Rate	Hops Over Occupancy Time (hops)	Package Transfer Time (msec)	Dwell Time (sec)	Limits (sec)	Pass/Fail
GFSK	64	1.000	386.70	0.39	0.4	Pass

TEST RESULTS DATA
Peak Power Table

Mod.	Freq. (MHz)	NTX	Peak Power (dBm)	Power Limit (dBm)	Test Result
GFSK	902.4	1	14.36	30.00	Pass
	915.2	1	**14.37**	30.00	Pass
	927.6	1	14.36	30.00	Pass

TEST RESULTS DATA
Average Power Table
(Reporting Only)

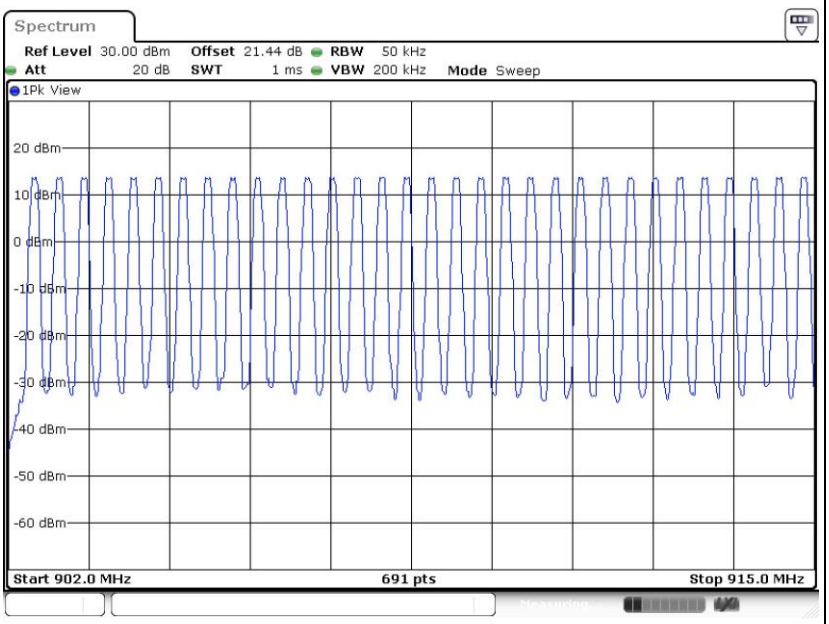
DH	CH.	NTX	Average Power (dBm)	Duty Factor (dB)
DH1	902.4	1	14.19	0.00
	915.2	1	**14.20**	0.00
	927.6	1	14.17	0.00

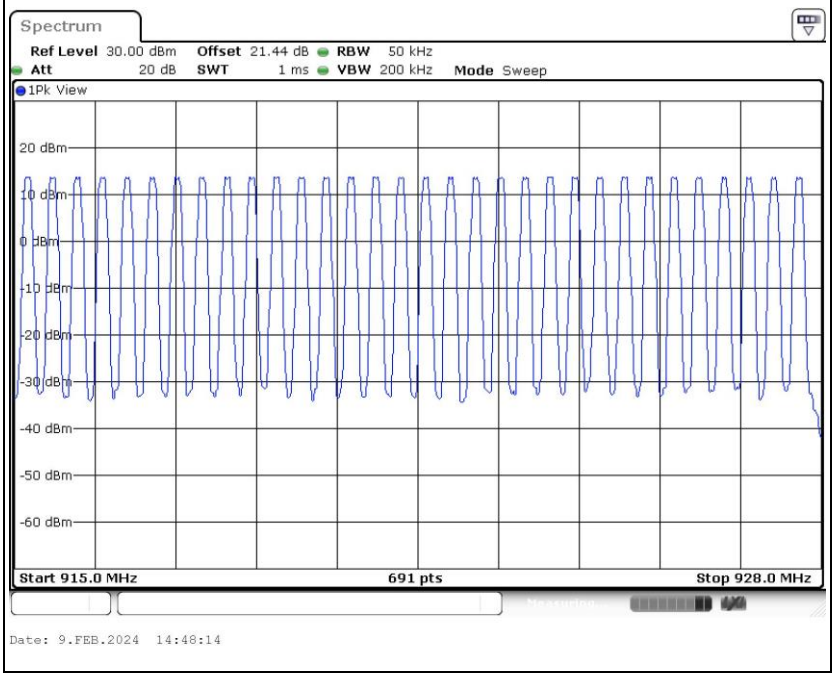
TEST RESULTS DATA
Number of Hopping Frequency

Number of Hopping (Channel)	Limits (Channel)	Pass/Fail
64	> 50	Pass

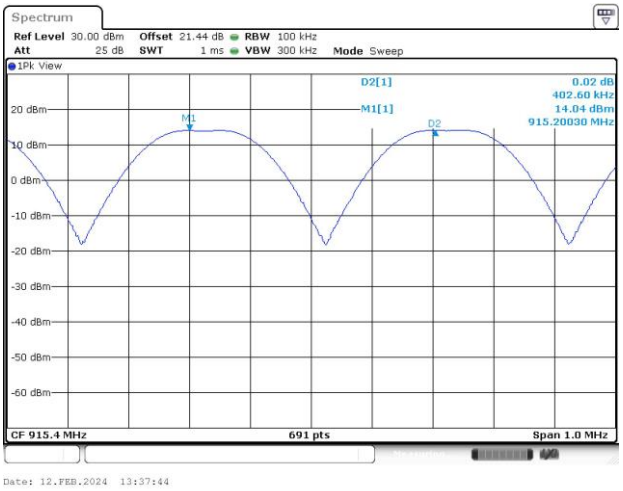
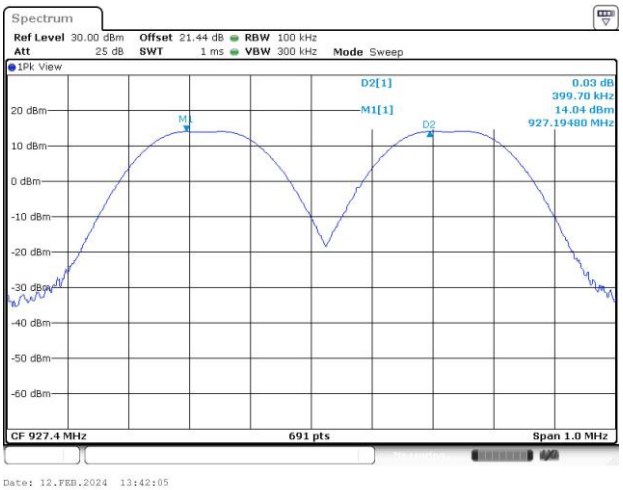
Number of Hopping Frequency

Number of Hopping Channel Plot on 902.4MHz - 927.6MHz

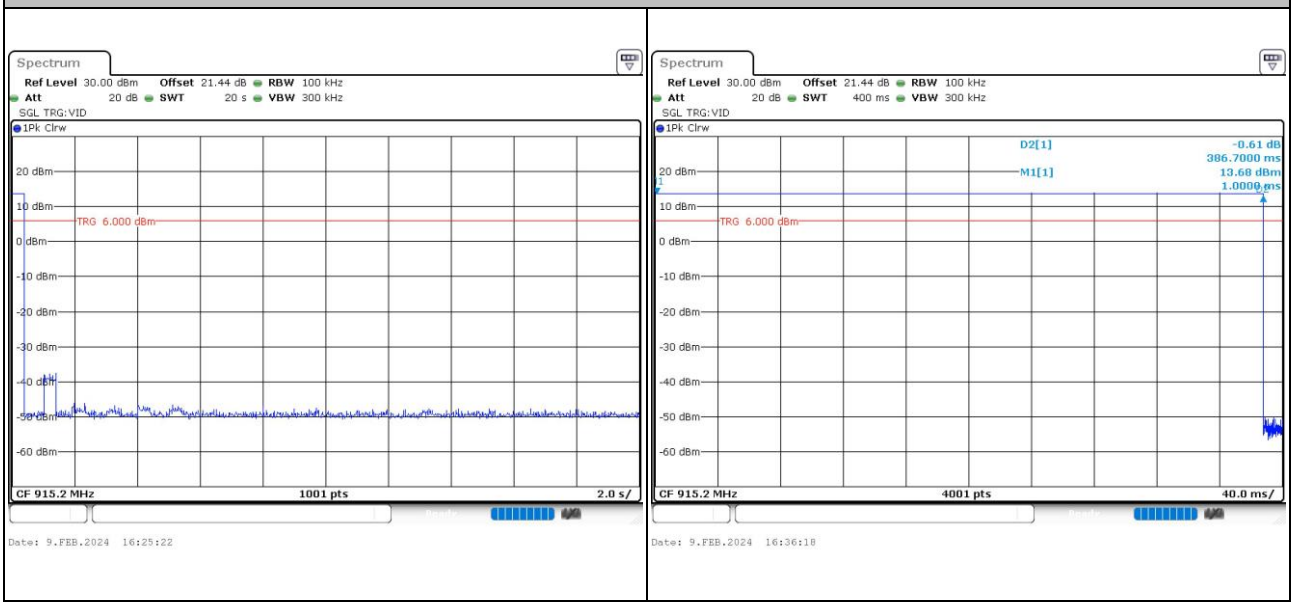




Hopping Channel Separation

<50kbps>	
Channel Separation Plot on 902.4MHz	**Channel Separation Plot on 915.2MHz**
	
Channel Separation Plot on 927.6MHz	
	

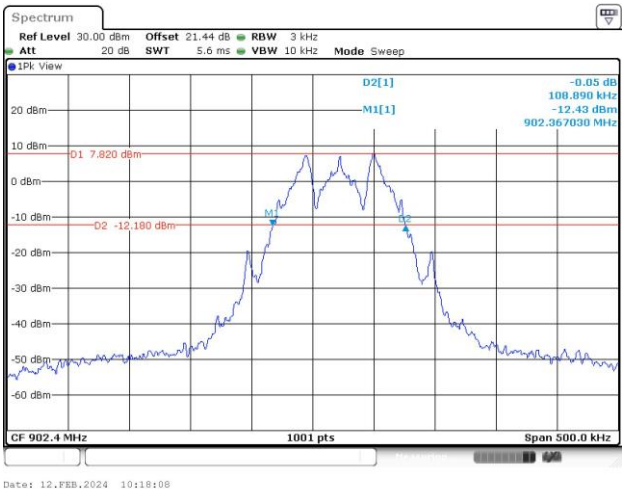
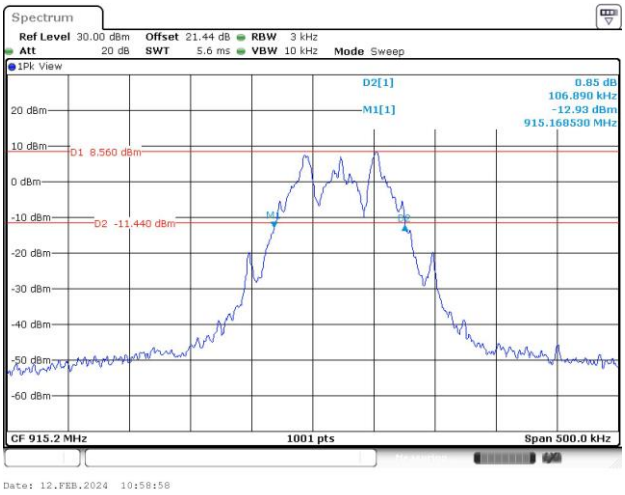
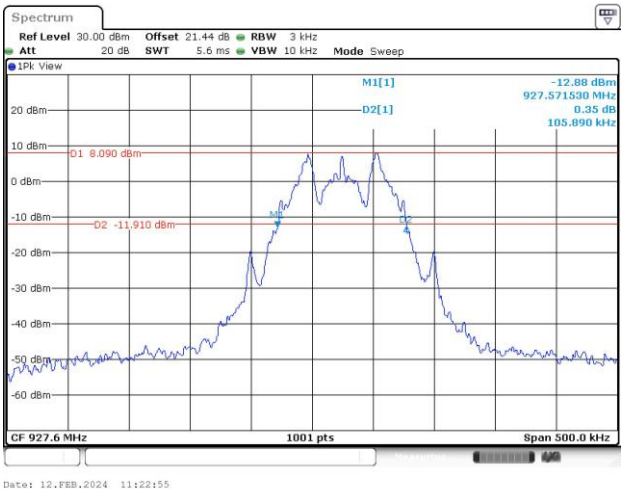
Dwell Time

Package Transfer Time Plot


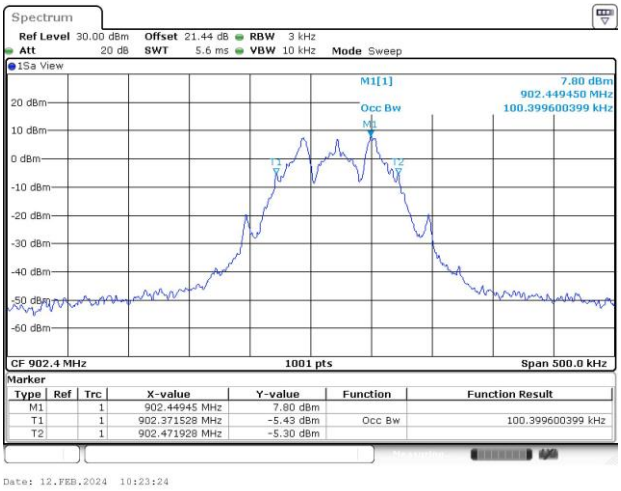
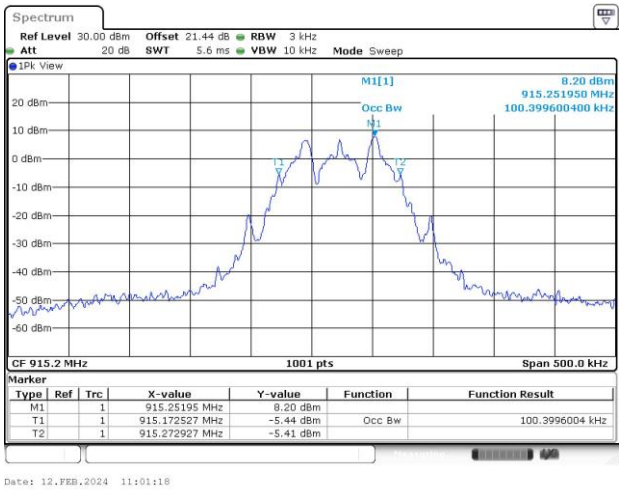
Remark: Dwell Time(s) = Hops Over Occupancy Time (hops) x Package Transfer Time

= 1 x0.3867s = 0.3867s

20dB Bandwidth

<50kbps>	
20 dB Bandwidth Plot on 902.4MHz	**20 dB Bandwidth Plot on 915.2MHz**
	
20 dB Bandwidth Plot on 927.6MHz	
	

99% Occupied Bandwidth

<table>
<tr><th colspan="2"><50kbps></th></tr>
<tr><th>99% Occupied Bandwidth on 902.4MHz</th><th>99% Occupied Bandwidth on 915.2MHz</th></tr>
<tr><td> 
</td><td> 
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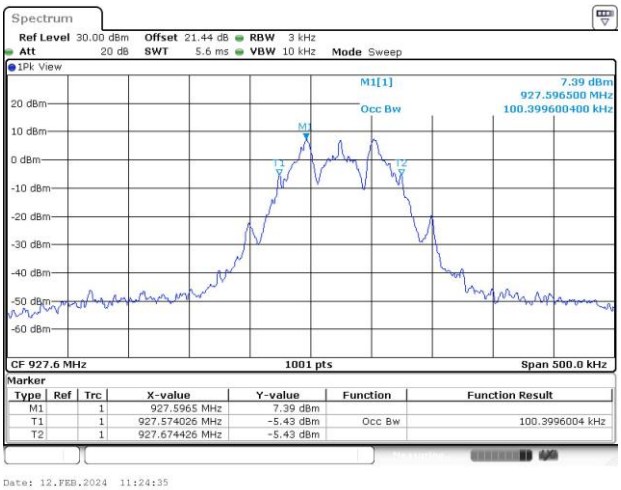
<tr><td> 
</td><td></td></tr>
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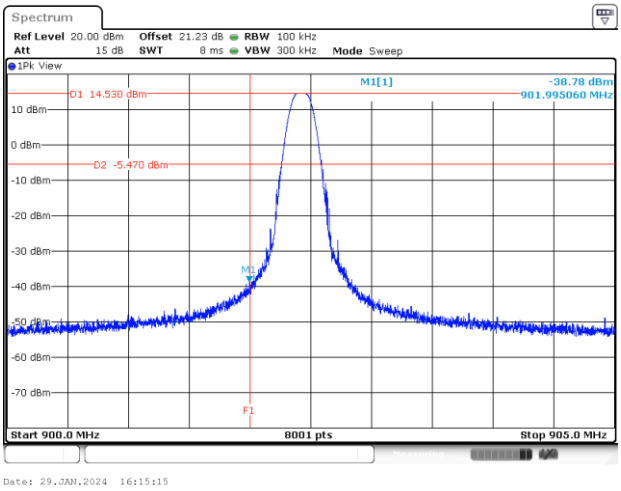
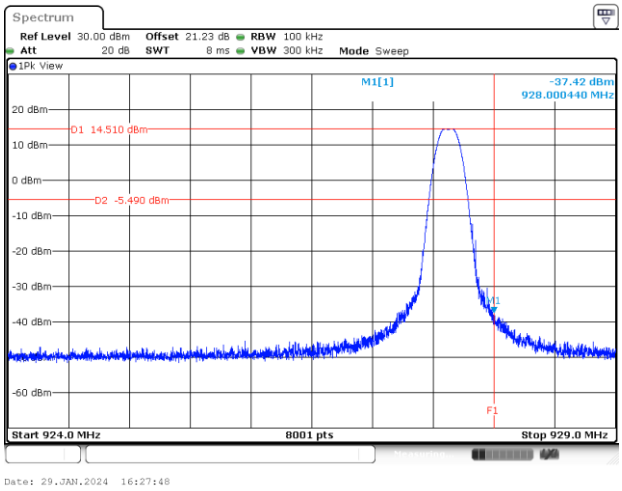
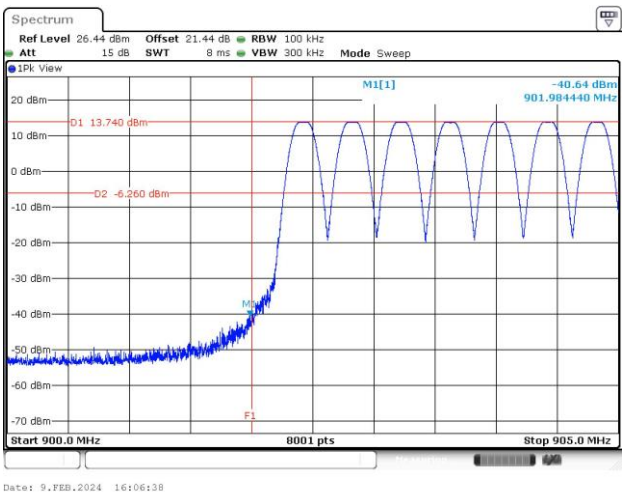
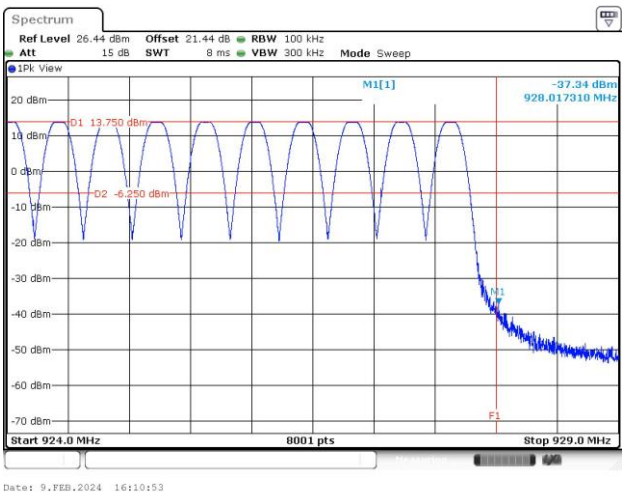
Note: The occupied channel bandwidth is maintained within the band of operation for all of the modulations.

Band Edges

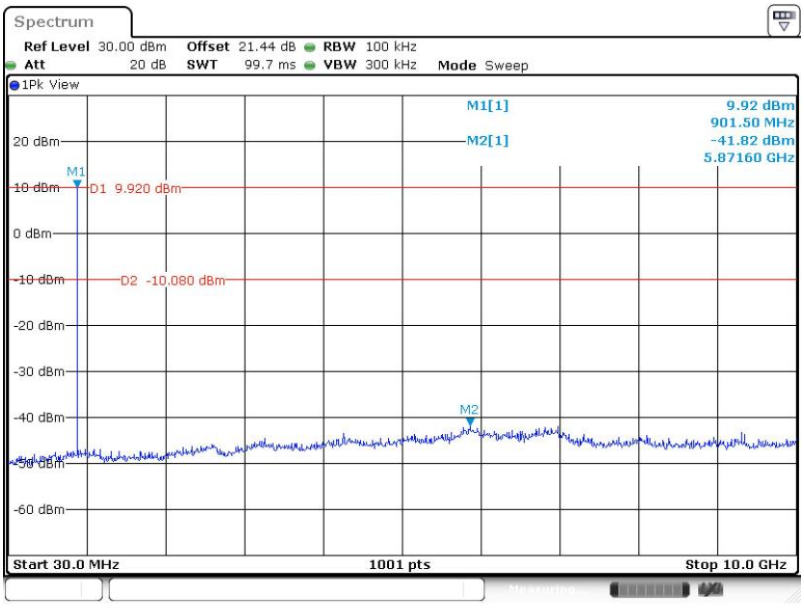
<50kbps>	
Low Band Edge Plot on 902.4MHz	**High Band Edge Plot on 927.6MHz**
	

Hopping Mode Band Edges

<50kbps>	
Hopping Mode Low Band Edge Plot	**Hopping Mode High Band Edge Plot**
	

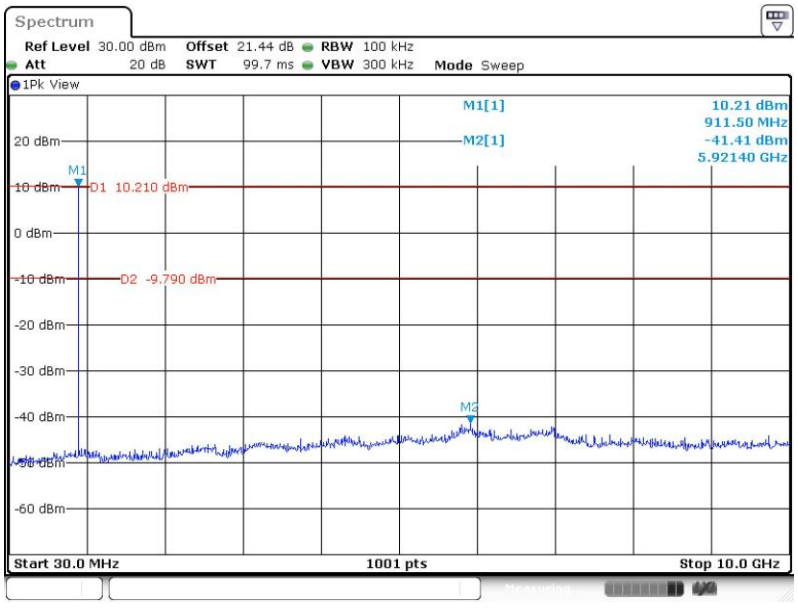
Spurious Emission

<50kbps>
CSE Plot on 902.4MHz between 30MHz ~ 10 GHz



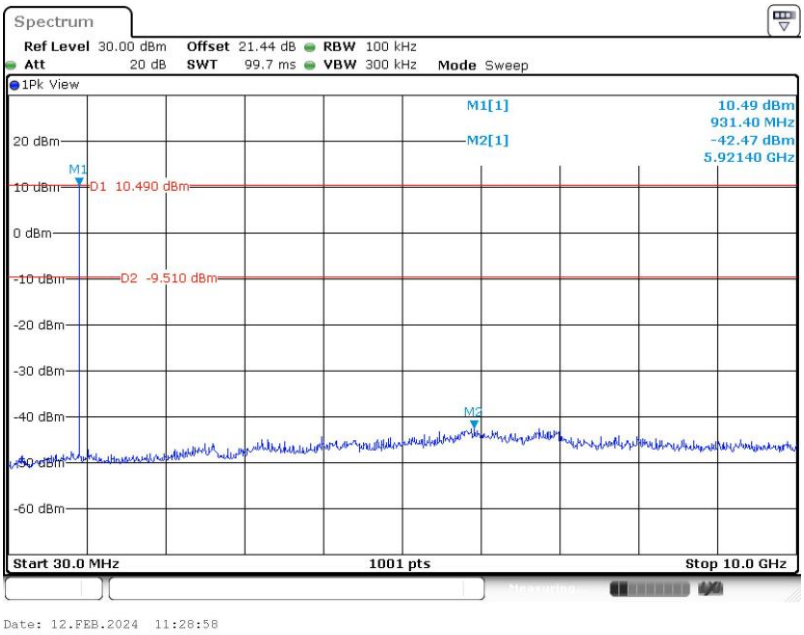
Date: 12.FEB.2024 10:32:21

CSE Plot on 915.2MHz between 30MHz ~ 10 GHz



Date: 12.FEB.2024 11:06:34

CSE Plot on 927.6MHz between 30MHz ~ 10 GHz



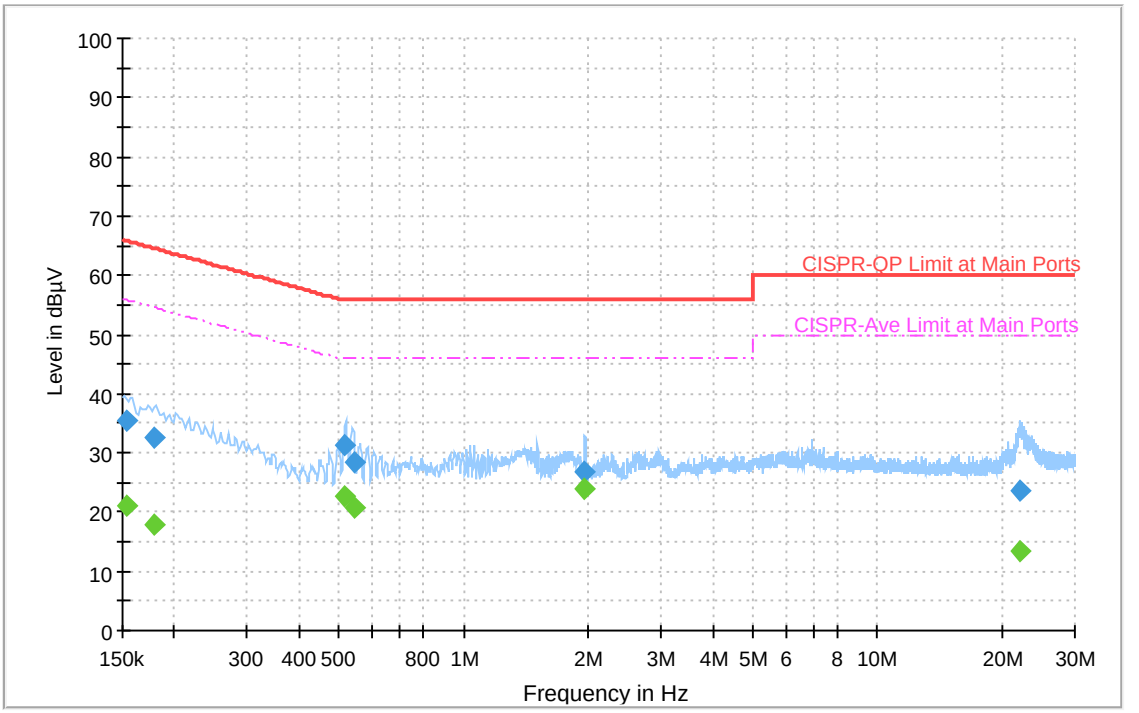
Appendix B. AC Conducted Emission Test Results

Test Engineer :	Leo Liu	**Temperature :**	20.5~22.6℃
		Relative Humidity :	39.7~42.3%

EUT Information

Test Site Location :	CO01-CA
Project	230915002
Power:	120Vac/60Hz
	Line

Full Spectrum



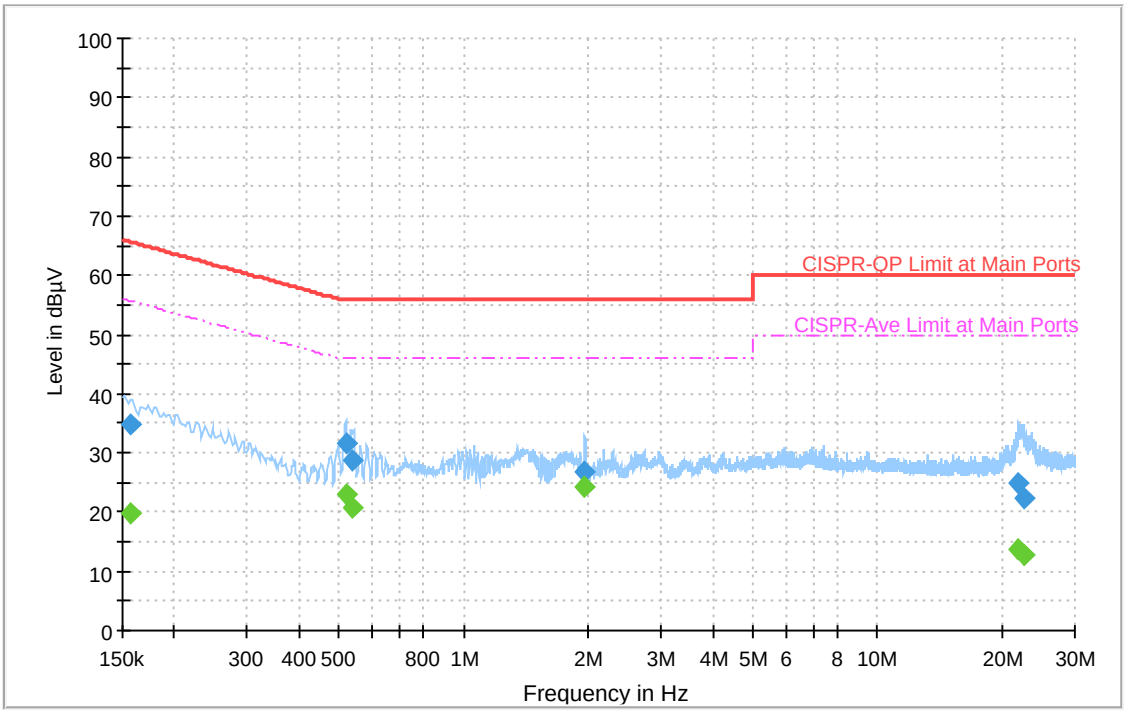
Final_Result

Frequency (MHz)	QuasiPeak (dBµV)	CAverage (dBµV)	Limit (dBµV)	Margin (dB)	Line	Filter	Corr. (dB)
0.152601	---	21.18	55.86	34.68	L1	OFF	20.2
0.152601	35.47	---	65.86	30.39	L1	OFF	20.2
0.179196	---	17.82	54.52	36.70	L1	OFF	20.3
0.179196	32.69	---	64.52	31.83	L1	OFF	20.3
0.518145	---	22.71	46.00	23.29	L1	OFF	20.3
0.518145	31.38	---	56.00	24.62	L1	OFF	20.3
0.541716	---	20.63	46.00	25.37	L1	OFF	20.3
0.541716	28.55	---	56.00	27.45	L1	OFF	20.3
1.964076	---	24.04	46.00	21.96	L1	OFF	20.3
1.964076	26.75	---	56.00	29.25	L1	OFF	20.3
22.102224	---	13.33	50.00	36.67	L1	OFF	21.2
22.102224	23.59	---	60.00	36.41	L1	OFF	21.2

EUT Information

Test Site Location :	CO01-CA
Project	230915002
Power:	120Vac/60Hz
	Neutral

Full Spectrum



Final_Result

Frequency (MHz)	QuasiPeak (dBµV)	CAverage (dBµV)	Limit (dBµV)	Margin (dB)	Line	Filter	Corr. (dB)
0.156498	34.88	---	65.65	30.77	N	OFF	20.2
0.156498	---	19.72	55.65	35.93	N	OFF	20.2
0.518928	31.54	---	56.00	24.46	N	OFF	20.2
0.518928	---	23.07	46.00	22.93	N	OFF	20.2
0.541302	28.65	---	56.00	27.35	N	OFF	20.2
0.541302	---	20.74	46.00	25.26	N	OFF	20.2
1.964508	26.91	---	56.00	29.09	N	OFF	20.3
1.964508	---	24.34	46.00	21.66	N	OFF	20.3
21.969267	24.95	---	60.00	35.05	N	OFF	21.2
21.969267	---	13.87	50.00	36.13	N	OFF	21.2
22.501185	22.37	---	60.00	37.63	N	OFF	21.2
22.501185	---	12.84	50.00	37.16	N	OFF	21.2

Appendix C. Radiated Spurious Emission

Test Engineer :	Thinh Hoang	**Temperature :**	20.8-23.6 °C
		Relative Humidity :	39.6-39.7%

SRD GFSK 902~928MHz

SRD GFSK 50Kbps (Band Edge @ 3m)

SRD GFSK	Note	Frequency	Level	Margin	Limit Line	Read Level	Antenna Factor	Path Loss	Preamp Factor	Ant Pos	Table Pos	Peak Avg.	Pol.
		(MHz)	(dBµV/m)	(dB)	(dBµV/m)	(dBµV)	(dB/m)	(dB)	(dB)	(cm)	(deg)	(P/A)	(H/V)
SRD GFSK 50Kbps 902.4MHz		31.94	31.12	-8.88	40	28.92	23.72	10.94	32.46	-	-	P	H
		213.33	29.51	-13.99	43.5	34.73	14.87	12.4	32.49	-	-	P	H
		344.28	30.48	-15.52	46	29.53	20.29	13.11	32.45	-	-	P	H
		445.16	34.54	-11.46	46	30.52	22.9	13.63	32.51	-	-	P	H
		564.47	36.13	-9.87	46	28.46	26.18	14	32.51	-	-	P	H
		702.21	38.89	-7.11	46	30.14	26.59	14.59	32.43	-	-	P	H
		835.1	41.75	-4.25	46	30.17	28.51	15.04	31.97	-	-	P	H
	*	902.4	113.97	-	-	101.11	29.15	15.23	31.52	100	350	P	H
		963.14	44.7	-9.3	54	28.85	31.4	15.39	30.94	-	-	P	H
													H
		36.79	30.02	-9.98	40	30.18	21.31	10.98	32.45	-	-	P	V
		117.3	31.68	-11.82	43.5	34.99	17.4	11.76	32.47	-	-	P	V
		283.17	31.65	-14.35	46	32.31	18.93	12.83	32.42	-	-	P	V
		445.16	33.64	-12.36	46	29.62	22.9	13.63	32.51	-	-	P	V
		552.83	35.91	-10.09	46	29.01	25.48	13.97	32.55	-	-	P	V
		643.04	38.22	-7.78	46	29.95	26.5	14.28	32.51	-	-	P	V
		785.63	40.4	-5.6	46	29.44	28.2	14.89	32.13	-	-	P	V
	*	902.4	107.86	-	-	95	29.15	15.23	31.52	100	131	P	V
		964.11	44.54	-9.46	54	28.68	31.4	15.39	30.93	-	-	P	V
													V

Remark

1. No other spurious found.
2. All results are PASS against limit line.
3. Non restricted band limit is radio frequency level down 20db

SRD GFSK	Note	Frequency (MHz)	Level (dBμV/m)	Margin (dB)	Limit Line (dBμV/m)	Read Level (dBμV)	Antenna Factor (dB/m)	Path Loss (dB)	Preamp Factor (dB)	Ant Pos (cm)	Table Pos (deg)	Peak Avg. (P/A)	Pol. (H/V)
		35.82	30.34	-9.66	40	29.99	21.83	10.97	32.45	-	-	P	H
		142.52	28.27	-15.23	43.5	31.22	17.5	11.98	32.43	-	-	P	H
		258.92	31.95	-14.05	46	31.76	19.93	12.67	32.41	-	-	P	H
		420.91	32.69	-13.31	46	29	22.74	13.49	32.54	-	-	P	H
		557.68	37.42	-8.58	46	30.09	25.86	13.99	32.52	-	-	P	H
		696.39	38.34	-7.66	46	29.71	26.5	14.56	32.43	-	-	P	H
		797.27	40.16	-5.84	46	29.06	28.31	14.9	32.11	-	-	P	H
	*	915.2	114.56	-	-	101.32	29.41	15.25	31.42	100	352	P	H
		971.87	44.45	-9.55	54	28.7	31.13	15.45	30.83	-	-	P	H
													H
SRD GFSK													H
50Kbps													H
915.2MHz		30.97	31.02	-8.98	40	28.43	24.13	10.92	32.46	-	-	P	V
		154.16	26.99	-16.51	43.5	30.57	16.78	12.05	32.41	-	-	P	V
		263.77	29.08	-16.92	46	28.76	20.02	12.7	32.4	-	-	P	V
		471.35	34.52	-11.48	46	29.82	23.45	13.74	32.49	-	-	P	V
		587.75	37.7	-8.3	46	30.26	25.89	14.07	32.52	-	-	P	V
		673.11	37.77	-8.23	46	29.34	26.4	14.43	32.4	-	-	P	V
		782.72	40.91	-5.09	46	30.02	28.15	14.88	32.14	-	-	P	V
	*	915.2	108.14	-	-	94.9	29.41	15.25	31.42	100	133	P	V
													V
													V
													V

Remark

1. No other spurious found.
2. All results are PASS against limit line.
3. Non restricted band limit is radio frequency level down 20db

SRD GFSK	Note	Frequency (MHz)	Level (dBµV/m)	Margin (dB)	Limit Line (dBµV/m)	Read Level (dBµV)	Antenna Factor (dB/m)	Path Loss (dB)	Preamp Factor (dB)	Ant Pos (cm)	Table Pos (deg)	Peak Avg. (P/A)	Pol. (H/V)
		34.85	29.42	-10.58	40	28.45	22.46	10.96	32.45	-	-	P	H
		137.67	29.36	-14.14	43.5	32.38	17.5	11.93	32.45	-	-	P	H
		259.89	32.39	-13.61	46	32.04	20.08	12.68	32.41	-	-	P	H
		445.16	34.9	-11.1	46	30.88	22.9	13.63	32.51	-	-	P	H
		567.38	36.45	-9.55	46	28.84	26.1	14.01	32.5	-	-	P	H
		712.88	37.7	-8.3	46	28.61	26.92	14.65	32.48	-	-	P	H
		841.89	41.04	-4.96	46	29.06	28.84	15.06	31.92	-	-	P	H
	*	927.6	114.58	-	-	100.78	29.85	15.28	31.33	100	352	P	H
													H
													H
													H
SRD GFSK 50Kbps 927.6MHz		970.9	44.82	-9.18	54	29.07	31.16	15.43	30.84	-	-	P	H
		34.85	30.2	-9.8	40	29.23	22.46	10.96	32.45	-	-	P	V
		117.3	32.4	-11.1	43.5	35.71	17.4	11.76	32.47	-	-	P	V
		258.92	31.29	-14.71	46	31.1	19.93	12.67	32.41	-	-	P	V
		365.62	31.21	-14.79	46	29.42	21.01	13.21	32.43	-	-	P	V
		500.45	34.04	-11.96	46	28.88	23.91	13.82	32.57	-	-	P	V
		708.03	38.59	-7.41	46	29.68	26.76	14.62	32.47	-	-	P	V
		833.16	40.8	-5.2	46	29.41	28.35	15.03	31.99	-	-	P	V
	*	927.6	109.37	-	-	95.57	29.85	15.28	31.33	100	20	P	V
		967.02	44.34	-9.66	54	28.49	31.32	15.41	30.88	-	-	P	V
													V
													V
													V

Remark

1. No other spurious found.
2. All results are PASS against limit line.
3. Non restricted band limit is radio frequency level down 20db

SRD GFSK 50Kbps (Harmonic @ 3m)

SRD GFSK	Note	Frequency (MHz)	Level (dBµV/m)	Margin (dB)	Limit Line (dBµV/m)	Read Level (dBµV)	Antenna Factor (dB/m)	Path Loss (dB)	Preamp Factor (dB)	Ant Pos (cm)	Table Pos (deg)	Peak Avg. (P/A)	Pol. (H/V)
SRD GFSK 50Kbps 902.4MHz		1804.8	37.31	-36.69	74	72.58	25.25	7.38	67.9	-	-	P	H
		6316.8	45.12	-28.88	74	61.48	34.51	13.29	64.16	-	-	P	H
													H
													H
													H
													H
		1801	35.25	-38.75	74	70.57	25.23	7.37	67.92	-	-	P	V
		6316.8	45.66	-28.34	74	62.02	34.51	13.29	64.16	-	-	P	V
													V
													V
													V
													V
SRD GFSK 50Kbps 915.2MHz		1828	37.04	-36.96	74	72.03	25.38	7.4	67.77	-	-	P	H
		6406.4	44.17	-29.83	74	61.04	34.7	13.42	64.99	-	-	P	H
		7321.6	46.02	-27.98	74	60.62	36.9	14.47	65.97	-	-	P	H
													H
													H
													H
													H
		1830.4	35.07	-38.93	74	70.03	25.39	7.41	67.76	-	-	P	V
		6406.4	43.93	-30.07	74	60.8	34.7	13.42	64.99	-	-	P	V
		7321.6	46.49	-27.51	74	61.09	36.9	14.47	65.97	-	-	P	V
													V
													V
													V
													V

SRD GFSK	Note	Frequency (MHz)	Level (dBµV/m)	Margin (dB)	Limit Line (dBµV/m)	Read Level (dBµV)	Antenna Factor (dB/m)	Path Loss (dB)	Preamp Factor (dB)	Ant Pos (cm)	Table Pos (deg)	Peak Avg. (P/A)	Pol. (H/V)
SRD GFSK 50Kbps 927.6MHz		1855.2	38.96	-35.04	74	73.54	25.58	7.45	67.61	-	-	P	H
		6493.2	47	-27	74	63.61	35	13.57	65.18	-	-	P	H
													H
													H
													H
													H
													H
		1855.2	35.98	-38.02	74	70.56	25.58	7.45	67.61	-	-	P	V
		6493.2	48.42	-25.58	74	65.03	35	13.57	65.18	-	-	P	V
													V
													V
													V
													V
													V

Remark

1. No other spurious found.
2. All results are PASS against Peak and Average limit line.
3. Non restricted band limit is radio frequency level down 20db

Note symbol

*	**Fundamental Frequency** which can be ignored. However, the level of any unwanted emissions shall not exceed the level of the fundamental frequency.
!	Test result is **over limit** line.
P/A	**P**eak or **A**verage
H/V	**H**orizontal or **V**ertical

A calculation example for radiated spurious emission is shown as below:

SRD GFSK	Note	Frequency	Level	Margin	Limit	Read	Antenna	Path	Preamp	Ant	Table	Peak	Pol.
					Line	Level	Factor	Loss	Factor	Pos	Pos	Avg.	
		(MHz)	(dBμV/m)	(dB)	(dBμV/m)	(dBμV)	(dB/m)	(dB)	(dB)	(cm)	(deg)	(P/A)	(H/V)
SRD GFSK 50Kbps		8119.8	49.02	-24.98	74	55.96	37.1	14.37	58.41	100	189	P	V
FHSS 902.2MHz		8119.8	44.97	-9.03	54	51.91	37.1	14.37	58.41	100	189	A	V

1. Path Loss(dB) = Cable loss(dB) + Filter loss(dB) + Attenuator loss(dB)
2. Level(dBμV/m) =

Antenna Factor(dB/m) + Path Loss(dB) + Read Level(dBμV) - Preamp Factor(dB)

3. Margin(dB) = Level(dBμV/m) – Limit Line(dBμV/m)

For Peak Limit @ 8119.8MHz:

1. Level(dBμV/m)

= Antenna Factor(dB/m) + Path Loss(dB) + Read Level(dBμV) - Preamp Factor(dB)

= 37.1(dB/m) + 14.37(dB) + 55.96(dBμV) – 58.41 (dB)

= 49.02 (dBμV/m)

2. Margin(dB)

= Level(dBμV/m) – Limit Line(dBμV/m)

= 49.02(dBμV/m) – 74(dBμV/m)

= -24.98(dB)

For Average Limit @ 8119.8MHz:

1. Level(dBμV/m)

= Antenna Factor(dB/m) + Path Loss(dB) + Read Level(dBμV) - Preamp Factor(dB)

= 37.1(dB/m) + 14.37(dB) +51.91(dBμV) – 58.41 (dB)

= 44.97 (dBμV/m)

2. Margin(dB)

= Level(dBμV/m) – Limit Line(dBμV/m)

= 44.97(dBμV/m) – 54(dBμV/m)

= -9.03(dB)

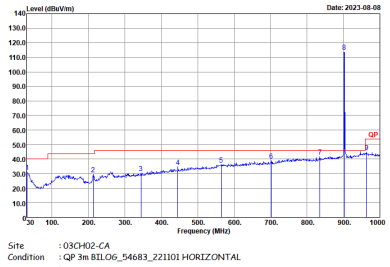
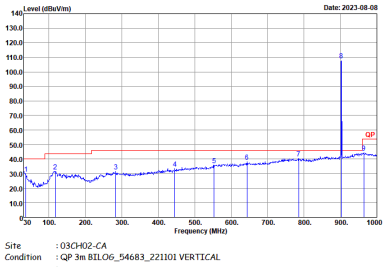
Both peak and average measured complies with the limit line, so test result is "PASS".

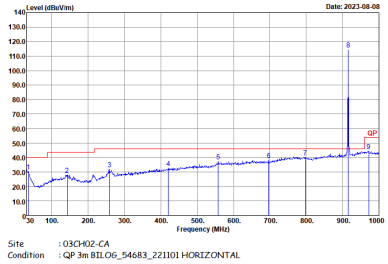
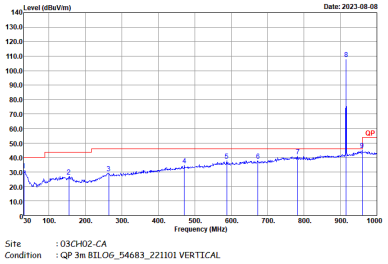
Appendix D. Radiated Spurious Emission Plots

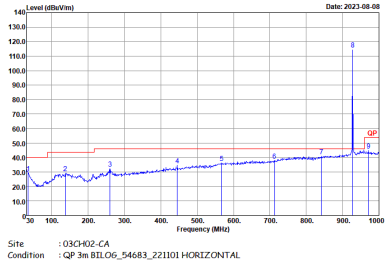
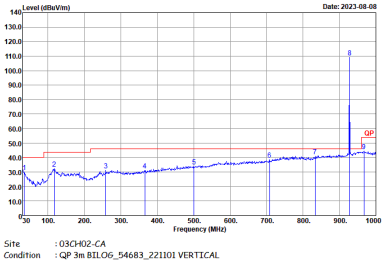
Test Engineer :	Thinh Hoang	**Temperature :**	20.8-23.6 °C
		Relative Humidity :	39.6-39.7%

SRD GFSK 902~928MHz

SRD GFSK 50Kbps FHSS (Band Edge @ 3m)

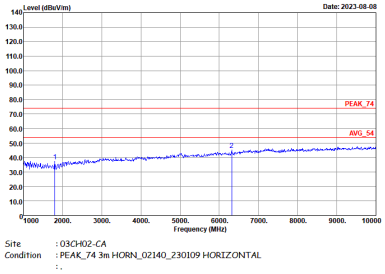
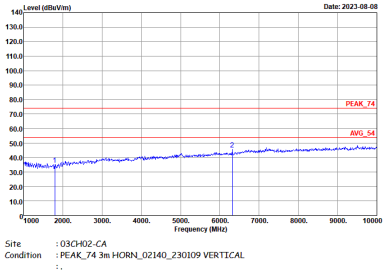
SRD GFSK	**SRD GFSK 902~928MHz**	
	SRD GFSK 50Kbps 902.4Mhz	
	Horizontal	**Vertical**
QP / Peak		

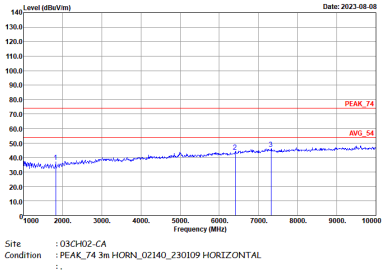
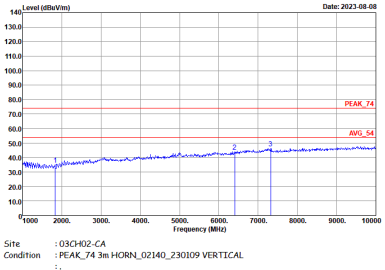
SRD GFSK	SRD GFSK 902~928MHz	
	SRD GFSK 50Kbps 915.2Mhz	
	Horizontal	Vertical
QP / Peak		

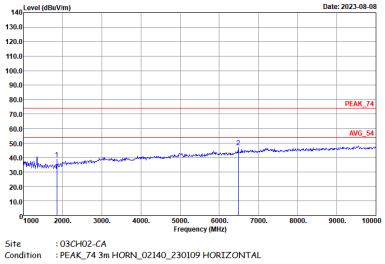
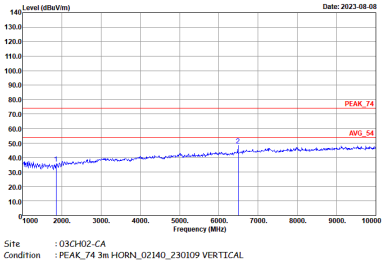
SRD GFSK	SRD GFSK 902~928MHz	
	SRD GFSK 50Kbps 927.6Mhz	
	Horizontal	Vertical
Peak Avg.		

SRD GFSK 902~928MHz

SRD GFSK 50Kbps FHSS (Harmonic @ 3m)

SRD GFSK	SRD GFSK 902~928MHz	
	SRD GFSK 50Kbps 902.4Mhz	
	Horizontal	Vertical
Peak Avg.		

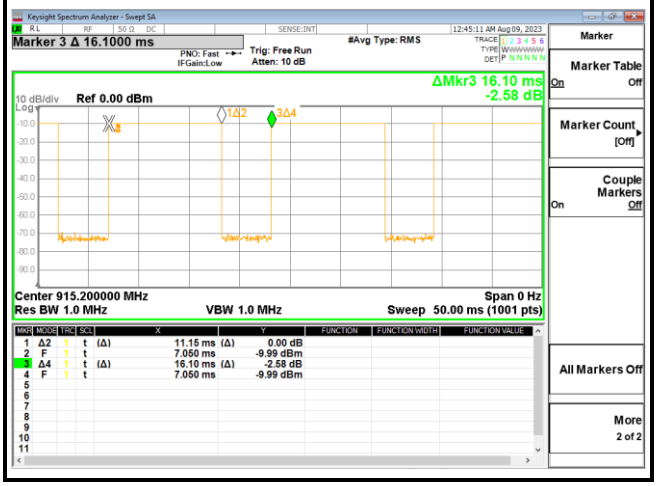
SRD GFSK	SRD GFSK 902~928MHz	
	SRD GFSK 50Kbps 915.2Mhz	
	Horizontal	Vertical
Peak Avg.		

SRD GFSK	SRD GFSK 902~928MHz	
	SRD GFSK 50Kbps 927.6Mhz	
	Horizontal	Vertical
Peak Avg.	 Site : 03CH02-CA Condition : PEAK_74 3m HORN_02140_230109 HORIZONTAL	 Site : 03CH02-CA Condition : PEAK_74 3m HORN_02140_230109 VERTICAL

Appendix E. Duty Cycle Plots

Band	Duty Cycle(%)	T(us)	1/T(kHz)	VBW Setting
SRD	69.25	11150	0.09	100Hz

SRD



————THE END————