# **FCC RF Test Report**

APPLICANT : Xiaomi Communications Co., Ltd.

**EQUIPMENT**: Mobile Phone

BRAND NAME : Redmi

MODEL NAME : 23090RA98G FCC ID : 2AFZZRA98G

STANDARD : FCC Part 15 Subpart C §15.247

CLASSIFICATION : (DSS) Spread Spectrum Transmitter

TEST DATE(S) : Aug. 08, 2023 ~ Aug. 19, 2023

We, Sporton International Inc. (ShenZhen), 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 of Sporton International Inc. (ShenZhen), the test report shall not be reproduced except in full.

JasonJia

Approved by: Jason Jia





Report No.: FR380206A

# Sporton International Inc. (ShenZhen)

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People's Republic of China

Sporton International Inc. (ShenZhen)

TEL: +86-755-8637-9589 FAX: +86-755-8637-9595 FCC ID: 2AFZZRA98G Page Number : 1 of 54
Report Issued Date : Sep. 15, 2023
Report Version : Rev. 01

# **TABLE OF CONTENTS**

RE	VISIO	N HISTORY	3
SU	MMAR	RY OF TEST RESULT	4
1	GENI	ERAL DESCRIPTION	5
	1.1	Applicant	5
	1.2	Manufacturer	5
	1.3	Product Feature of Equipment Under Test	5
	1.4	Product Specification of Equipment Under Test	5
	1.5	Modification of EUT	5
	1.6	Testing Location	6
	1.7	Test Software	6
	1.8	Applicable Standards	7
2	TEST	CONFIGURATION OF EQUIPMENT UNDER TEST	
	2.1	Carrier Frequency Channel	8
	2.2	Test Mode	
	2.3	Connection Diagram of Test System	10
	2.4	Support Unit used in test configuration and system	
	2.5	EUT Operation Test Setup	11
	2.6	Measurement Results Explanation Example	11
3	TEST	「 RESULT	12
	3.1	Number of Channel Measurement	
	3.2	Hopping Channel Separation Measurement	14
	3.3	Dwell Time Measurement	20
	3.4	20dB Bandwidth Measurement	22
	3.5	Output Power Measurement	28
	3.6	Conducted Band Edges Measurement	29
	3.7	Conducted Spurious Emission Measurement	36
	3.8	Radiated Band Edges and Spurious Emission Measurement	46
	3.9	AC Conducted Emission Measurement	50
	3.10	Antenna Requirements	52
4	LIST	OF MEASURING EQUIPMENT	53
5	MEA	SUREMENT UNCERTAINTY	54
ΑP	PEND	IX A. CONDUCTED TEST RESULTS	
ΑP	PEND	IX B. AC CONDUCTED EMISSION TEST RESULT	
ΑP	PEND	IX C. RADIATED SPURIOUS EMISSION	
ΑP	PEND	IX D. DUTY CYCLE PLOTS	
ΑP	PEND	IX E. SETUP PHOTOGRAPHS	

TEL: +86-755-8637-9589 FAX: +86-755-8637-9595 FCC ID: 2AFZZRA98G Page Number : 2 of 54
Report Issued Date : Sep. 15, 2023
Report Version : Rev. 01

Report No.: FR380206A

# **REVISION HISTORY**

REPORT NO.	VERSION	DESCRIPTION	ISSUED DATE
FR380206A	Rev. 01	Initial issue of report	Sep. 15, 2023

TEL: +86-755-8637-9589 FAX: +86-755-8637-9595 FCC ID: 2AFZZRA98G Page Number : 3 of 54
Report Issued Date : Sep. 15, 2023
Report Version : Rev. 01

Report Template No.: BU5-FR15CBT Version 2.0

Report No.: FR380206A

## **SUMMARY OF TEST RESULT**

Report Section	FCC Rule	Description	Limit	Result	Remark
3.1	15.247(a)(1)	Number of Channels	≥ 15Chs	Pass	-
3.2	15.247(a)(1)	Hopping Channel Separation	≥ 2/3 of 20dB BW	Pass	-
3.3	15.247(a)(1)	Dwell Time of Each Channel	≤ 0.4sec in 31.6sec period	Pass	-
3.4	15.247(a)(1)	20dB Bandwidth	-	Report only	-
3.4	- 99% Bandwidth		-	Report only	-
3.5	15.247(b)(1)	Peak Output Power	≤ 125 mW	Pass	-
3.6	15.247(d)	Conducted Band Edges	≤ 20dBc	Pass	-
3.7	3.7 Conducted Spurious Emission		≤ 20dBc	Pass	-
		Radiated Band Edges and Radiated Spurious Emission	15.209(a) & 15.247(d)	Pass	Under limit 11.90 dB at 30.00 MHz
3.9 15.207 AC Conducted Emission		15.207(a)	Pass	Under limit 10.09 dB at 0.15 MHz	
3.10	15.203 & 15.247(b)	Antenna Requirement	15.203 & 15.247(b)	Pass	-

#### **Conformity Assessment Condition:**

- 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.

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TEL: +86-755-8637-9589 FAX: +86-755-8637-9595 FCC ID: 2AFZZRA98G Page Number : 4 of 54
Report Issued Date : Sep. 15, 2023
Report Version : Rev. 01

Report No.: FR380206A

# 1 General Description

# 1.1 Applicant

Xiaomi Communications Co., Ltd.

#019, 9th Floor, Building 6, 33 Xi'erqi Middle Road, Haidian District, Beijing, China, 100085

Report No.: FR380206A

#### 1.2 Manufacturer

Xiaomi Communications Co., Ltd.

#019, 9th Floor, Building 6, 33 Xi'erqi Middle Road, Haidian District, Beijing, China, 100085

## 1.3 Product Feature of Equipment Under Test

Product Feature				
Equipment	Mobile Phone			
Brand Name	Redmi			
Model Name	23090RA98G			
FCC ID	2AFZZRA98G			
IMEI Code	Conducted: 864595060040940/864595060040957 Conduction: 864595060044389/864595060044397 Radiation: 864595060044249/864595060044256			
HW Version	1351N16UM0A01			
SW Version	MIUI 14			
EUT Stage	Identical Prototype			

**Remark:** The above EUT's information was declared by manufacturer. Please refer to the specifications or user's manual for more detailed description.

# 1.4 Product Specification of Equipment Under Test

Standards-related Product Specification				
Tx/Rx Frequency Range	2402 MHz ~ 2480 MHz			
Number of Channels	79			
Carrier Frequency of Each Channel	2402+n*1 MHz; n=0~78			
Maximum Output Power to Antenna	Bluetooth BR(1Mbps) : 15.37 dBm (0.0344 W) Bluetooth EDR (2Mbps) : 15.06 dBm (0.0321 W) Bluetooth EDR (3Mbps) : 15.08 dBm (0.0322 W)			
Antenna Type / Gain	PIFA Antenna type with gain -3.3 dBi			
Type of Modulation	Bluetooth BR (1Mbps) : GFSK Bluetooth EDR (2Mbps) :π/4-DQPSK Bluetooth EDR (3Mbps) : 8-DPSK			

## 1.5 Modification of EUT

No modifications are made to the EUT during all test items.

 Sporton International Inc. (ShenZhen)
 Page Number
 : 5 of 54

 TEL: +86-755-8637-9589
 Report Issued Date
 : Sep. 15, 2023

 FAX: +86-755-8637-9595
 Report Version
 : Rev. 01

FCC ID: 2AFZZRA98G Report Template No.: BU5-FR15CBT Version 2.0

# 1.6 Testing Location

Sporton International Inc. (Shenzhen) is accredited to ISO/IEC 17025:2017 by American Association for Laboratory Accreditation with Certificate Number 5145.01.

Test Firm	Sporton International Inc. (Shenzhen)					
Test Site Location	1/F, 2/F, Bldg 5, Shiling Industrial Zone, Xinwei Village, Xili, Nanshan, Shenzhen, 518055 People's Republic of China TEL: +86-755-86379589 FAX: +86-755-86379595					
Test Site No.	Sporton Site No.	FCC Designation No.	FCC Test Firm Registration No.			
	CO01-SZ TH01-SZ	CN1256	421272			

Test Firm	Sporton International Inc. (Shenzhen)				
Test Site Location	101, 1st Floor, Block B, Building 1, No. 2, Tengfeng 4th Road, Fenghuang Community, Fuyong Street, Baoan District, Shenzhen City, Guangdong Province 518103 People's Republic of China TEL: +86-755-86066985				
Test Site No.	Sporton Site No.	FCC Designation No.	FCC Test Firm  Registration No.		
	03CH04-SZ	CN1256	421272		

# 1.7 Test Software

Item	Site	Manufacturer	Name	Version
1.	CO01-KS	AUDIX	E3	6.2009-8-24
2.	03CH04-SZ	AUDIX	E3	6.2009-8-24

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TEL: +86-755-8637-9589 FAX: +86-755-8637-9595 FCC ID: 2AFZZRA98G Page Number : 6 of 54
Report Issued Date : Sep. 15, 2023
Report Version : Rev. 01

Report No.: FR380206A

# 1.8 Applicable Standards

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

- 47 CFR Part 15 Subpart C §15.247
- FCC KDB 558074 D01 15.247 Meas Guidance v05r02
- ANSI C63.10-2013

#### Remark:

- All test items were verified and recorded according to the standards and without any deviation during the test.
- 2. This EUT has also been tested and complied with the requirements of FCC Part 15, Subpart B, recorded in a separate test report.

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TEL: +86-755-8637-9589 FAX: +86-755-8637-9595 FCC ID: 2AFZZRA98G Page Number : 7 of 54
Report Issued Date : Sep. 15, 2023
Report Version : Rev. 01

Report No.: FR380206A

# 2 Test Configuration of Equipment Under Test

# 2.1 Carrier Frequency Channel

Frequency Band	Channel	Freq. (MHz)	Channel	Freq. (MHz)	Channel	Freq. (MHz)
	0	2402	27	2429	54	2456
	1	2403	28	2430	55	2457
	2	2404	29	2431	56	2458
	3	2405	30	2432	57	2459
	4	2406	31	2433	58	2460
	5	2407	32	2434	59	2461
	6	2408	33	2435	60	2462
	7	2409	34	2436	61	2463
	8	2410	35	2437	62	2464
	9	2411	36	2438	63	2465
	10	2412	37	2439	64	2466
	11	2413	38	2440	65	2467
	12	2414	39	2441	66	2468
2400-2483.5 MHz	13	2415	40	2442	67	2469
	14	2416	41	2443	68	2470
	15	2417	42	2444	69	2471
	16	2418	43	2445	70	2472
	17	2419	44	2446	71	2473
	18	2420	45	2447	72	2474
	19	2421	46	2448	73	2475
	20	2422	47	2449	74	2476
	21	2423	48	2450	75	2477
	22	2424	49	2451	76	2478
	23	2425	50	2452	77	2479
	24	2426	51	2453	78	2480
	25	2427	52	2454	-	-
	26	2428	53	2455	-	-

Sporton International Inc. (ShenZhen)

TEL: +86-755-8637-9589 FAX: +86-755-8637-9595 FCC ID: 2AFZZRA98G Page Number : 8 of 54
Report Issued Date : Sep. 15, 2023
Report Version : Rev. 01
Report Template No.: BU5-FR15CBT Version 2.0

Report No.: FR380206A

#### 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, pre-scanned in three orthogonal panels, X, Y, Z. The worst cases (X plane) were recorded in this report, and the worst mode of radiated spurious emissions is Bluetooth 1Mbps mode, and recorded 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							
	Data Rate / Modulation							
Test Item	Bluetooth BR 1Mbps	Bluetooth EDR 2Mbps	Bluetooth EDR 3Mbps					
	GFSK	π/4-DQPSK	8-DPSK					
Conducted	Mode 1: CH00_2402 MHz	Mode 4: CH00_2402 MHz	Mode 7: CH00_2402 MHz					
	Mode 2: CH39_2441 MHz	Mode 5: CH39_2441 MHz	Mode 8: CH39_2441 MHz					
Test Cases	Mode 3: CH78_2480 MHz	Mode 6: CH78_2480 MHz	Mode 9: CH78_2480 MHz					
		Bluetooth BR 1Mbps GFSK						
Radiated	Mode 1: CH00_2402 MHz							
Test Cases		Mode 2: CH39_2441 MHz						
		Mode 3: CH78_2480 MHz						
AC								
Conducted		duetooth Link + WLAN Link (2	2.4G) + USB Cable(Charging					
Emission	from Adapter) + Bat	tery 1 + Sample 1						

#### Remark:

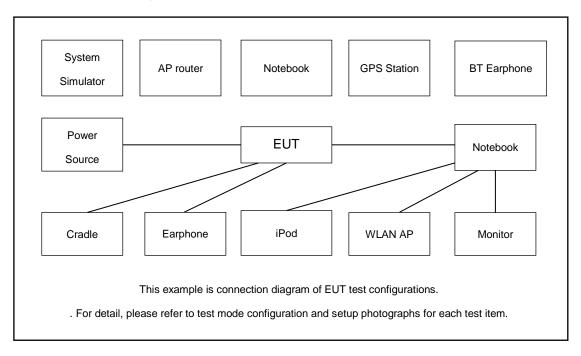
- 1. For radiated test cases, the worst mode data rate 1Mbps was reported only, because this data rate has the highest RF output power at preliminary tests, and no other significantly frequencies found in conducted spurious emission.
- 2. For Radiated Test Cases, The tests were performed with Adapter and USB Cable.

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TEL: +86-755-8637-9589 FAX: +86-755-8637-9595 FCC ID: 2AFZZRA98G Page Number : 9 of 54
Report Issued Date : Sep. 15, 2023
Report Version : Rev. 01

Report No.: FR380206A

# 2.3 Connection Diagram of Test System



# 2.4 Support Unit used in test configuration and system

Item	Equipment	Trade Name	Model Name	FCC ID	Data Cable	Power Cord
1.	System Simulator	Anritsu	MT8820C	N/A	N/A	Unshielded,1.8m
2.	System Simulator	Anritsu	MT8821C	N/A	N/A	Unshielded,1.8m
3.	WLAN AP	Dlink	DIR-820L	KA2IR820LA1	N/A	Unshielded,1.8m
4.	Bluetooth Earphone	Samsung	EO-MG900	PYAHS-107W	N/A	N/A

Sporton International Inc. (ShenZhen)

TEL: +86-755-8637-9589 FAX: +86-755-8637-9595 FCC ID: 2AFZZRA98G Page Number : 10 of 54
Report Issued Date : Sep. 15, 2023
Report Version : Rev. 01

Report No.: FR380206A

# 2.5 EUT Operation Test Setup

For Bluetooth function, the engineering test program was provided and enabled to make EUT connect with Bluetooth base station to continuous transmit.

For AC power line conducted emissions, the EUT was set to connect with the WLAN AP under large package sizes transmission.

# 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 1.3 dB and 10dB attenuator.

 $Offset(dB) = RF \ cable \ loss(dB) + attenuator \ factor(dB).$ = 1.3 + 10 = 11.3 (dB) Report No.: FR380206A

## 3 Test Result

#### 3.1 Number of Channel Measurement

## 3.1.1 Limits of Number of Hopping Frequency

Frequency hopping systems in the 2400-2483.5 MHz band shall use at least 15 channels.

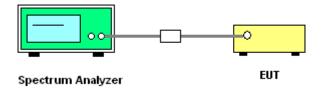
## 3.1.2 Measuring Instruments

The measuring equipment is listed in the section 4 of 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 was connected to the spectrum analyzer by RF cable and attenuator. The path loss was compensated to the results for each measurement.
- 3. Set to the maximum power setting and enable the EUT transmit continuously.
- 4. Enable the EUT hopping function.
- 5. Use the following spectrum analyzer settings: Span = the frequency band of operation; RBW = 300kHz; 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



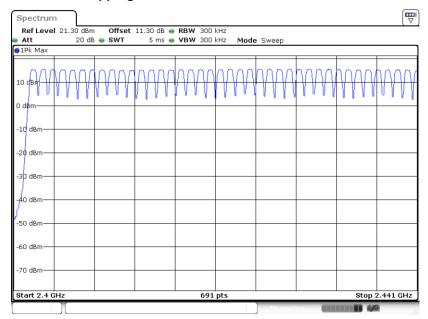
## 3.1.5 Test Result of Number of Hopping Frequency

Please refer to Appendix A.

TEL: +86-755-8637-9589 FAX: +86-755-8637-9595 FCC ID: 2AFZZRA98G Page Number : 12 of 54
Report Issued Date : Sep. 15, 2023
Report Version : Rev. 01

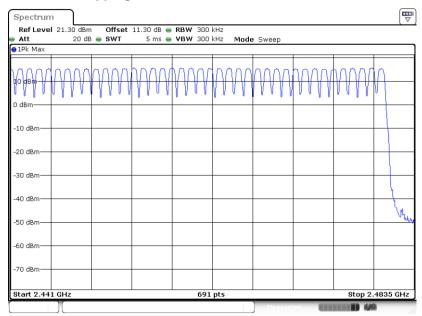
Report No.: FR380206A

## Number of Hopping Channel Plot on Channel 00 - 78



Date: 14.AUG.2023 20:43:45

#### Number of Hopping Channel Plot on Channel 00 - 78



Date: 14.AUG.2023 20:45:04

TEL: +86-755-8637-9589 FAX: +86-755-8637-9595 FCC ID: 2AFZZRA98G Page Number : 13 of 54
Report Issued Date : Sep. 15, 2023
Report Version : Rev. 01

Report No.: FR380206A

# 3.2 Hopping Channel Separation Measurement

## 3.2.1 Limit of Hopping Channel Separation

Frequency hopping systems operating in the 2400-2483.5 MHz band may have hopping channel carrier frequencies that are separated by 25 kHz or two-thirds of the 20 dB bandwidth of the hopping channel, whichever is greater.

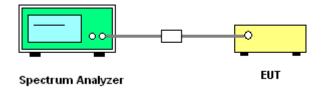
## 3.2.2 Measuring Instruments

The measuring equipment is listed in the section 4 of 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 was connected to the spectrum analyzer by RF cable and attenuator. The path loss was compensated to the results for each measurement.
- 3. Set to the maximum power setting and enable the EUT transmit continuously.
- 4. Enable the EUT hopping function.
- Use the following spectrum analyzer settings:
   Span = wide enough to capture the peaks of two adjacent channels;
   RBW = 300kHz; 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.

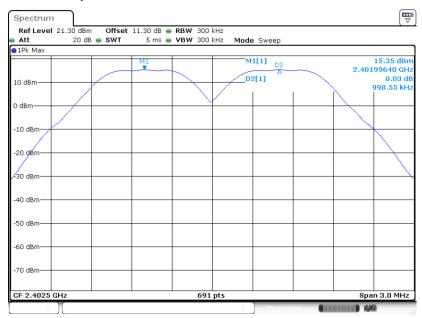
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TEL: +86-755-8637-9589 FAX: +86-755-8637-9595 FCC ID: 2AFZZRA98G Page Number : 14 of 54
Report Issued Date : Sep. 15, 2023
Report Version : Rev. 01

Report No.: FR380206A

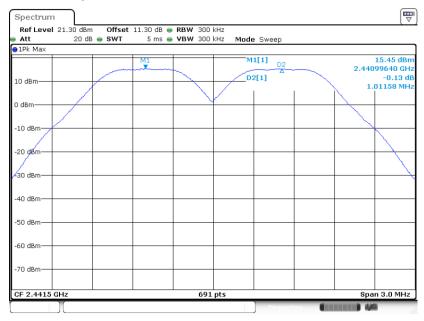
#### <1Mbps>

#### Channel Separation Plot on Channel 00 - 01



Date: 14.AUG.2023 20:29:30

#### Channel Separation Plot on Channel 39 - 40



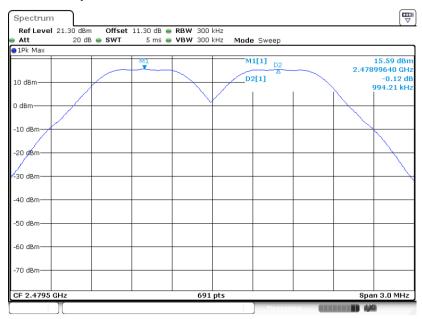
Date: 14.AUG.2023 20:38:27

Sporton International Inc. (ShenZhen)

TEL: +86-755-8637-9589 FAX: +86-755-8637-9595 FCC ID: 2AFZZRA98G Page Number : 15 of 54
Report Issued Date : Sep. 15, 2023
Report Version : Rev. 01

Report No.: FR380206A

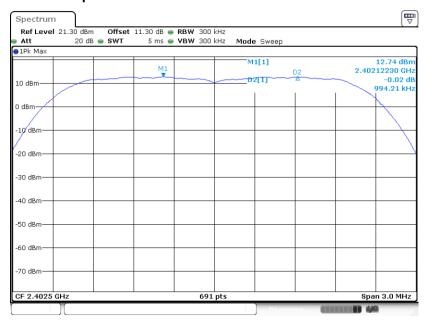
#### Channel Separation Plot on Channel 77 - 78



Date: 14.AUG.2023 20:42:04

#### <2Mbps>

## Channel Separation Plot on Channel 00 - 01



Date: 14.AUG.2023 20:51:42

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TEL: +86-755-8637-9589 FAX: +86-755-8637-9595 FCC ID: 2AFZZRA98G

: 16 of 54 Page Number Report Issued Date: Sep. 15, 2023 Report Version : Rev. 01

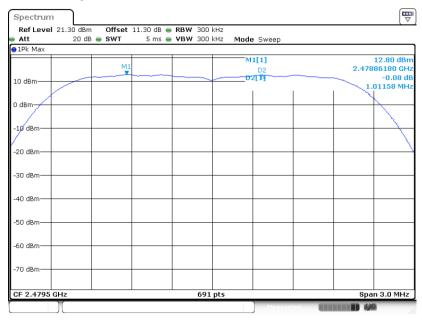
Report No.: FR380206A

#### Channel Separation Plot on Channel 39 - 40



Date: 14.AUG.2023 20:55:01

#### Channel Separation Plot on Channel 77 - 78



Date: 14.AUG.2023 20:58:03

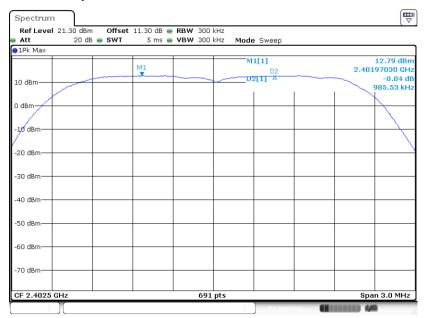
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TEL: +86-755-8637-9589 FAX: +86-755-8637-9595 FCC ID: 2AFZZRA98G Page Number : 17 of 54
Report Issued Date : Sep. 15, 2023
Report Version : Rev. 01

Report No.: FR380206A

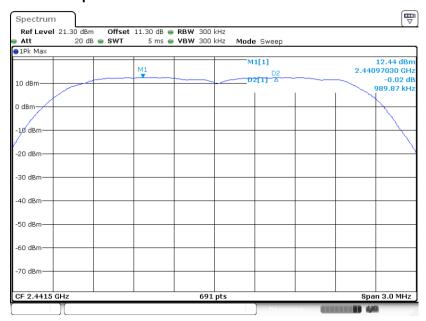
#### <3Mbps>

## Channel Separation Plot on Channel 00 - 01



Date: 14.AUG.2023 21:04:44

## Channel Separation Plot on Channel 39 - 40



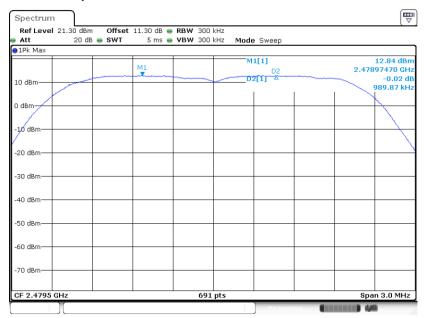
Date: 14.AUG.2023 21:08:21

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TEL: +86-755-8637-9589 FAX: +86-755-8637-9595 FCC ID: 2AFZZRA98G Page Number : 18 of 54
Report Issued Date : Sep. 15, 2023
Report Version : Rev. 01

Report No.: FR380206A

## Channel Separation Plot on Channel 77 - 78



Date: 14.AUG.2023 21:09:26

TEL: +86-755-8637-9589 FAX: +86-755-8637-9595 FCC ID: 2AFZZRA98G Page Number : 19 of 54
Report Issued Date : Sep. 15, 2023
Report Version : Rev. 01

Report No.: FR380206A

#### 3.3 Dwell Time Measurement

#### 3.3.1 Limit of Dwell Time

The average time of occupancy on any channel shall not be greater than 0.4 seconds within a period of 0.4 seconds multiplied by the number of hopping channels employed.

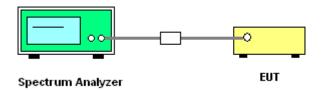
## 3.3.2 Measuring Instruments

The measuring equipment is listed in the section 4 of this test report.

#### 3.3.3 Test Procedures

- 1. The testing follows ANSI C63.10-2013 clause 7.8.4.
- The RF output of EUT was connected to the spectrum analyzer by RF cable and attenuator.
   The path loss was compensated to the results for each measurement.
- 3. Set to the maximum power setting and enable the EUT transmit continuously.
- 4. Enable the EUT hopping function.
- 5. Use the following spectrum analyzer settings: Span = zero span, centered on a hopping channel; RBW = 1 MHz; 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



TEL: +86-755-8637-9589 FAX: +86-755-8637-9595 FCC ID: 2AFZZRA98G Page Number : 20 of 54
Report Issued Date : Sep. 15, 2023
Report Version : Rev. 01

Report No.: FR380206A

#### 3.3.5 Test Result of Dwell Time

Please refer to Appendix A.

#### **Package Transfer Time Plot** Spectrum Offset 11.30 dB - RBW 1 MHz Att 30 dB . SWT 10 ms VBW 1 MHz ●1Pk Max D3[1] 20 dBm M1[1] 12.40 dBr 10 dBm 0 dBm -10 dBm -20 dBm -30 dBr -40 dBr WALLEY PORT hathanson. munus M -50 dBm CF 2.441 GHz 691 pts 1.0 ms/ Marker Type | Ref | Trc 1.7681 ms 2.8826 ms Y-value 12.40 dBm 0.70 dB -0.01 dB Function **Function Result** M1 3.7594 ms

Date: 9.AUG.2023 16:20:26

#### Remark:

In normal mode, hopping rate is 1600 hops/s with 6 slots (5 Transmit and 1 Receive slot)
in 79 hopping channels.

With channel hopping rate (1600 / 6 / 79) in Occupancy Time Limit  $(0.4 \times 79)$  (s), Hops Over Occupancy Time comes to  $(1600 / 6 / 79) \times (0.4 \times 79) = 106.67$  hops.

- 2. In AFH mode, hopping rate is 800 hops/s with 6 slots in 20 hopping channels.
  With channel hopping rate (800 / 6 / 20) in Occupancy Time Limit (0.4 x 20) (s),
  Hops Over Occupancy Time comes to (800 / 6 / 20) x (0.4 x 20) = 53.33 hops.
- 3. Dwell Time(s) = Hops Over Occupancy Time (hops) x Package Transfer Time

TEL: +86-755-8637-9589 FAX: +86-755-8637-9595 FCC ID: 2AFZZRA98G Page Number : 21 of 54
Report Issued Date : Sep. 15, 2023
Report Version : Rev. 01

Report No.: FR380206A

#### 3.4 20dB Bandwidth Measurement

#### 3.4.1 Limit of 20dB Bandwidth

Reporting only

#### 3.4.2 Measuring Instruments

The measuring equipment is listed in the section 4 of this test report.

#### 3.4.3 Test Procedures

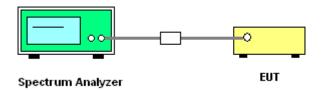
- 1. The testing follows ANSI C63.10-2013 clause 6.9.2 and 6.9.3.
- 2. The RF output of EUT was connected to the spectrum analyzer by RF cable and attenuator. The path loss was compensated to the results for each measurement.
- 3. Set to the maximum power setting and enable the EUT transmit continuously.
- 4. Use the following spectrum analyzer settings for 20dB Bandwidth measurement.
  Span = approximately 2 to 5 times the 20 dB bandwidth, centered on a hopping channel;
  the VBW is set to 3 times the RBW;

Sweep = auto; Detector function = peak;

Trace =  $\max$  hold.

5. 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.

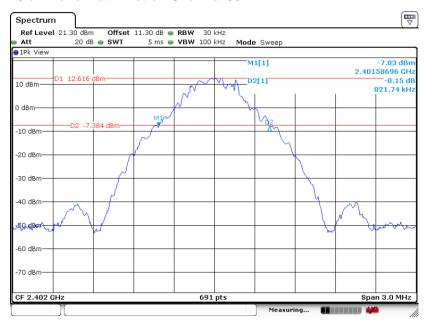
Sporton International Inc. (ShenZhen)

TEL: +86-755-8637-9589 FAX: +86-755-8637-9595 FCC ID: 2AFZZRA98G Page Number : 22 of 54
Report Issued Date : Sep. 15, 2023
Report Version : Rev. 01

Report No.: FR380206A

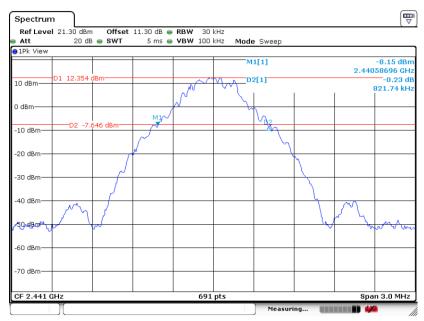
#### <1Mbps>

#### 20 dB Bandwidth Plot on Channel 00



Date: 14.AUG.2023 20:26:36

#### 20 dB Bandwidth Plot on Channel 39

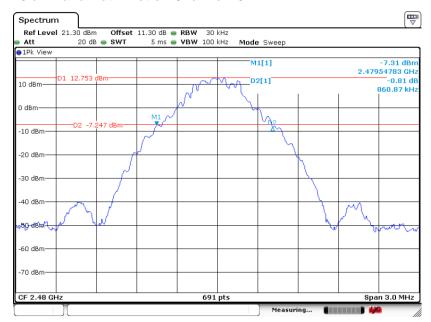


Date: 14.AUG.2023 20:36:15

TEL: +86-755-8637-9589 FAX: +86-755-8637-9595 FCC ID: 2AFZZRA98G Page Number : 23 of 54
Report Issued Date : Sep. 15, 2023
Report Version : Rev. 01

Report No.: FR380206A

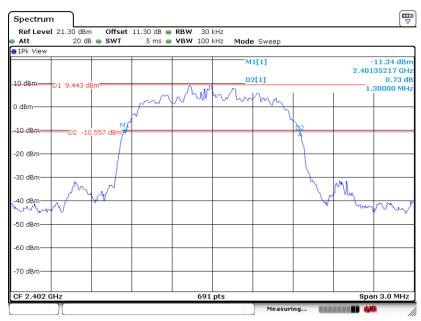
#### 20 dB Bandwidth Plot on Channel 78



Date: 14.AUG.2023 20:39:22

## <2Mbps>

#### 20 dB Bandwidth Plot on Channel 00



Date: 14.AUG.2023 20:49:50

TEL: +86-755-8637-9589 FAX: +86-755-8637-9595 FCC ID: 2AFZZRA98G Page Number : 24 of 54
Report Issued Date : Sep. 15, 2023
Report Version : Rev. 01

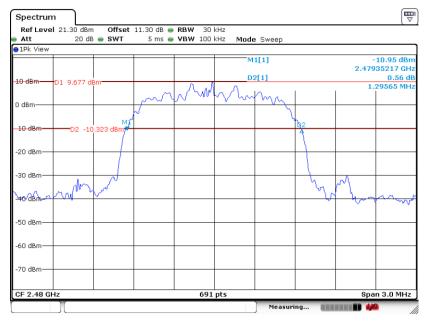
Report No.: FR380206A

#### 20 dB Bandwidth Plot on Channel 39



Date: 14.AUG.2023 20:53:12

#### 20 dB Bandwidth Plot on Channel 78



Date: 14.AUG.2023 20:58:58

TEL: +86-755-8637-9589 FAX: +86-755-8637-9595 FCC ID: 2AFZZRA98G Page Number : 25 of 54
Report Issued Date : Sep. 15, 2023
Report Version : Rev. 01

Report No.: FR380206A

#### <3Mbps>

#### 20 dB Bandwidth Plot on Channel 00



Date: 14.AUG.2023 21:02:40

#### 20 dB Bandwidth Plot on Channel 39



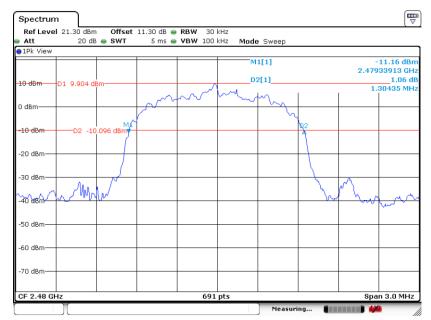
Date: 14.AUG.2023 21:05:49

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TEL: +86-755-8637-9589 FAX: +86-755-8637-9595 FCC ID: 2AFZZRA98G Page Number : 26 of 54
Report Issued Date : Sep. 15, 2023
Report Version : Rev. 01

Report No.: FR380206A

#### 20 dB Bandwidth Plot on Channel 78



Date: 14.AUG.2023 21:09:56

TEL: +86-755-8637-9589 FAX: +86-755-8637-9595 FCC ID: 2AFZZRA98G Page Number : 27 of 54
Report Issued Date : Sep. 15, 2023
Report Version : Rev. 01

Report No.: FR380206A

## 3.5 Output Power Measurement

## 3.5.1 Limit of Output Power

The maximum peak conducted output power of the intentional radiator shall not exceed the following: For frequency hopping systems operating in the 2400-2483.5 MHz band employing at least 75 non-overlapping hopping channels, and all frequency hopping systems in the 5725-5850 MHz band: 1 watt. For all other frequency hopping systems in the 2400-2483.5 MHz band 0.125 watts. The power limit for 1Mbps, 2Mbps, 3Mbps and AFH modes are 0.125 watts.

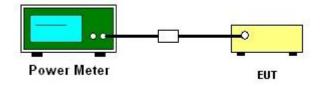
## 3.5.2 Measuring Instruments

The measuring equipment is listed in the section 4 of 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 was connected to the power meter by RF cable and attenuator. The path loss was compensated to the results for each measurement.
- 3. Set to the maximum power setting and enable the EUT 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.

Page Number : 28 of 54
Report Issued Date : Sep. 15, 2023
Report Version : Rev. 01

Report No.: FR380206A

# 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.

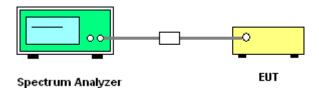
## 3.6.2 Measuring Instruments

The measuring equipment is listed in the section 4 of this test report.

#### 3.6.3 Test Procedures

- 1. The testing follows ANSI C63.10-2013 clause 7.8.6.
- 2. Set to the maximum power setting and enable the EUT transmit continuously.
- Set RBW = 100kHz, VBW = 300kHz. Band edge emissions must be at least 20 dB down from the highest emission level within the authorized band as measured with a 100kHz 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



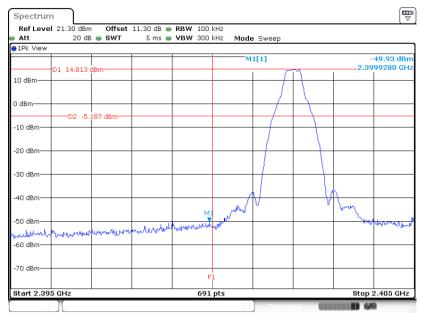
TEL: +86-755-8637-9589 FAX: +86-755-8637-9595 FCC ID: 2AFZZRA98G Page Number : 29 of 54
Report Issued Date : Sep. 15, 2023
Report Version : Rev. 01

Report No.: FR380206A

# 3.6.5 Test Result of Conducted Band Edges

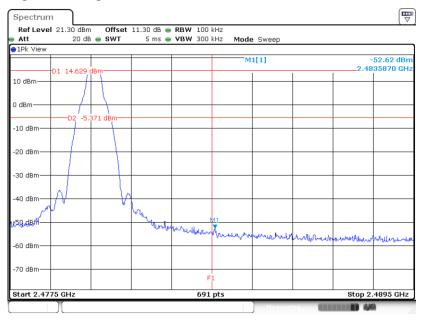
## <1Mbps>

#### Low Band Edge Plot on Channel 00



#### Date: 10.AUG.2023 01:23:04

## **High Band Edge Plot on Channel 78**



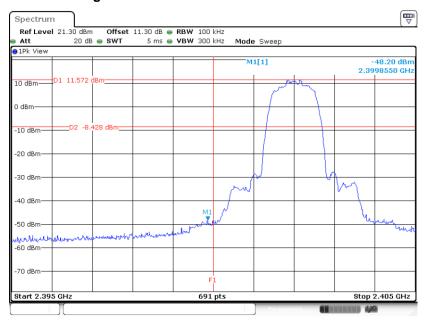
Date: 10.AUG.2023 01:25:22

TEL: +86-755-8637-9589 FAX: +86-755-8637-9595 FCC ID: 2AFZZRA98G Page Number : 30 of 54
Report Issued Date : Sep. 15, 2023
Report Version : Rev. 01

Report No.: FR380206A

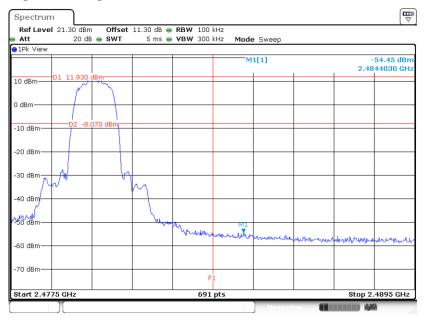
#### <2Mbps>

## Low Band Edge Plot on Channel 00



#### Date: 10.AUG.2023 01:31:56

#### **High Band Edge Plot on Channel 78**



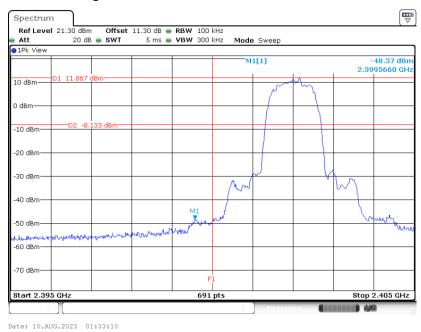
Date: 10.AUG.2023 01:30:54

TEL: +86-755-8637-9589 FAX: +86-755-8637-9595 FCC ID: 2AFZZRA98G Page Number : 31 of 54
Report Issued Date : Sep. 15, 2023
Report Version : Rev. 01

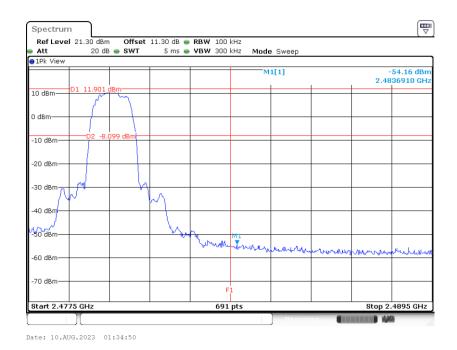
Report No.: FR380206A

#### <3Mbps>

## Low Band Edge Plot on Channel 00



#### **High Band Edge Plot on Channel 78**



Sporton International Inc. (ShenZhen)

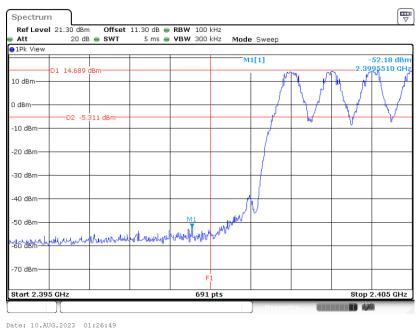
TEL: +86-755-8637-9589 FAX: +86-755-8637-9595 FCC ID: 2AFZZRA98G Page Number : 32 of 54
Report Issued Date : Sep. 15, 2023
Report Version : Rev. 01

Report No.: FR380206A

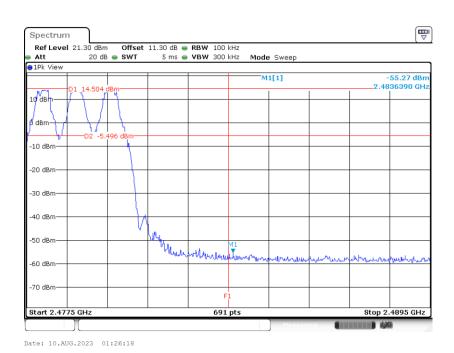
# 3.6.6 Test Result of Conducted Hopping Mode Band Edges

#### <1Mbps>

#### **Hopping Mode Low Band Edge Plot**



#### **Hopping Mode High Band Edge Plot**



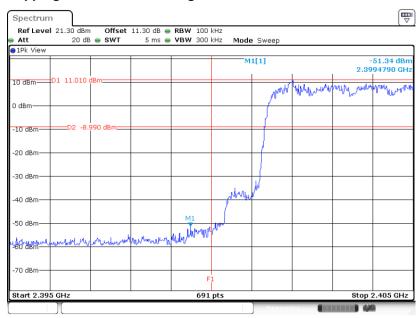
Sporton International Inc. (ShenZhen)

TEL: +86-755-8637-9589 FAX: +86-755-8637-9595 FCC ID: 2AFZZRA98G Page Number : 33 of 54
Report Issued Date : Sep. 15, 2023
Report Version : Rev. 01

Report No.: FR380206A

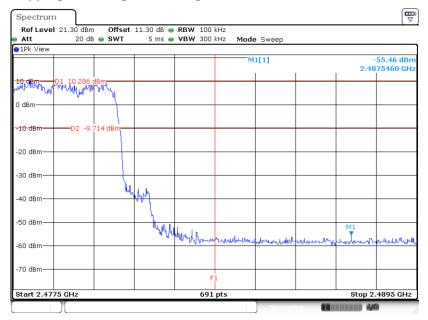
#### <2Mbps>

## **Hopping Mode Low Band Edge Plot**



#### Date: 10.AUG.2023 01:28:57

#### **Hopping Mode High Band Edge Plot**



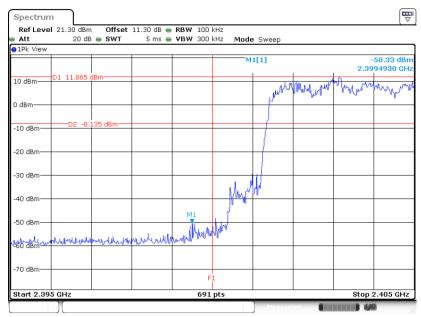
Date: 10.AUG.2023 01:30:17

TEL: +86-755-8637-9589 FAX: +86-755-8637-9595 FCC ID: 2AFZZRA98G Page Number : 34 of 54
Report Issued Date : Sep. 15, 2023
Report Version : Rev. 01

Report No.: FR380206A

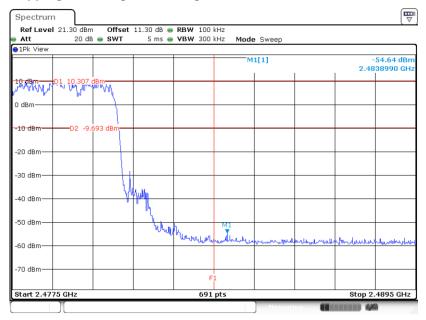
#### <3Mbps>

## **Hopping Mode Low Band Edge Plot**



#### Date: 10.AUG.2023 01:37:33

#### **Hopping Mode High Band Edge Plot**



Date: 10.AUG.2023 01:36:40

TEL: +86-755-8637-9589 FAX: +86-755-8637-9595 FCC ID: 2AFZZRA98G Page Number : 35 of 54
Report Issued Date : Sep. 15, 2023
Report Version : Rev. 01

Report No.: FR380206A

# 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.

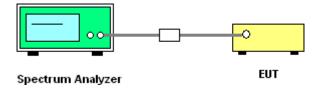
## 3.7.2 Measuring Instruments

The measuring equipment is listed in the section 4 of 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 was connected to the spectrum analyzer by RF cable and attenuator. The path loss was compensated to the results for each measurement.
- 3. Set to the maximum power setting and enable the EUT transmit continuously.
- 4. Set RBW = 100 kHz, VBW = 300kHz, scan up through 10th harmonic. All harmonics / spurs 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



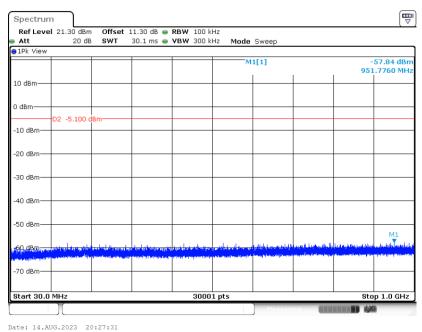
TEL: +86-755-8637-9589 FAX: +86-755-8637-9595 FCC ID: 2AFZZRA98G Page Number : 36 of 54
Report Issued Date : Sep. 15, 2023
Report Version : Rev. 01

Report No.: FR380206A

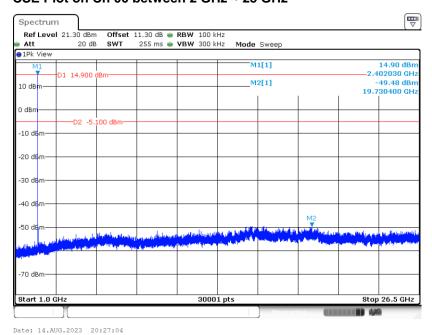
#### 3.7.5 Test Result of Conducted Spurious Emission

#### <1Mbps>

#### CSE Plot on Ch 00 between 30MHz ~ 3 GHz



#### CSE Plot on Ch 00 between 2 GHz ~ 25 GHz

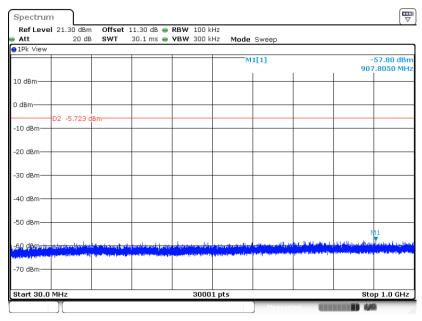


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TEL: +86-755-8637-9589 FAX: +86-755-8637-9595 FCC ID: 2AFZZRA98G Page Number : 37 of 54
Report Issued Date : Sep. 15, 2023
Report Version : Rev. 01

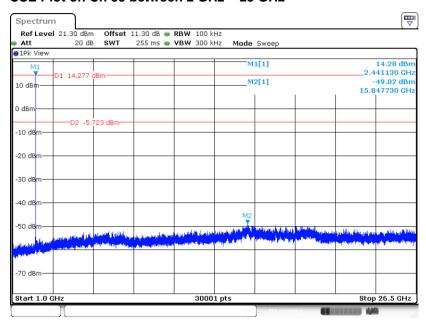
Report No.: FR380206A

#### CSE Plot on Ch 39 between 30MHz ~ 3 GHz



#### Date: 14.AUG.2023 20:37:12

#### CSE Plot on Ch 39 between 2 GHz ~ 25 GHz

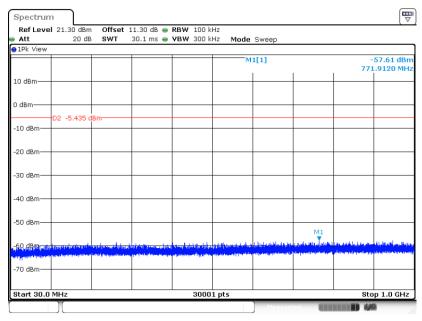


Date: 14.AUG.2023 20:36:43

TEL: +86-755-8637-9589 FAX: +86-755-8637-9595 FCC ID: 2AFZZRA98G Page Number : 38 of 54
Report Issued Date : Sep. 15, 2023
Report Version : Rev. 01

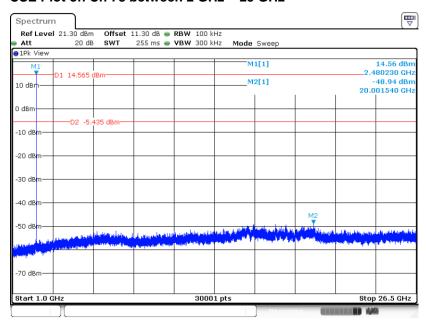
Report No.: FR380206A

#### CSE Plot on Ch 78 between 30MHz ~ 3 GHz



#### Date: 14.AUG.2023 20:40:22

#### CSE Plot on Ch 78 between 2 GHz ~ 25 GHz



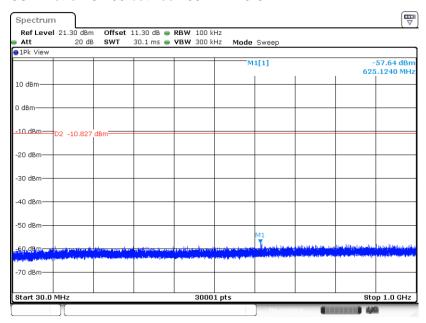
Date: 14.AUG.2023 20:39:55

TEL: +86-755-8637-9589 FAX: +86-755-8637-9595 FCC ID: 2AFZZRA98G Page Number : 39 of 54
Report Issued Date : Sep. 15, 2023
Report Version : Rev. 01

Report No.: FR380206A

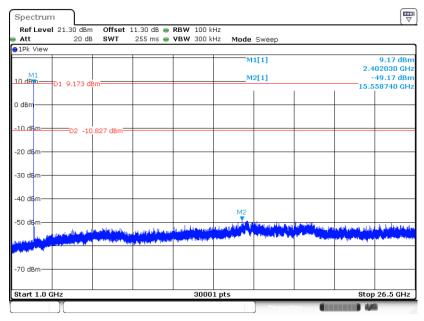
#### <2Mbps>

#### CSE Plot on Ch 00 between 30MHz ~ 3 GHz



#### Date: 14.AUG.2023 20:50:56

#### CSE Plot on Ch 00 between 2 GHz ~ 25 GHz

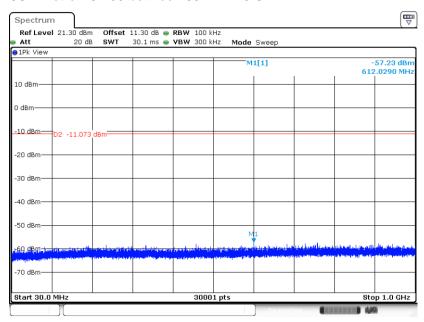


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TEL: +86-755-8637-9589 FAX: +86-755-8637-9595 FCC ID: 2AFZZRA98G Page Number : 40 of 54
Report Issued Date : Sep. 15, 2023
Report Version : Rev. 01

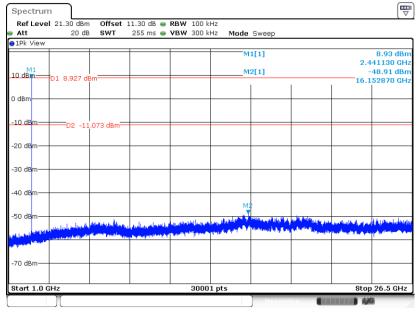
Report No.: FR380206A

#### CSE Plot on Ch 39 between 30MHz ~ 3 GHz



Date: 14.AUG.2023 20:54:07

#### CSE Plot on Ch 39 between 2 GHz ~ 25 GHz

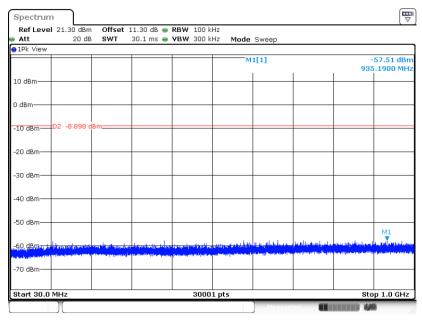


Date: 14.AUG.2023 20:53:41

TEL: +86-755-8637-9589 FAX: +86-755-8637-9595 FCC ID: 2AFZZRA98G Page Number : 41 of 54
Report Issued Date : Sep. 15, 2023
Report Version : Rev. 01

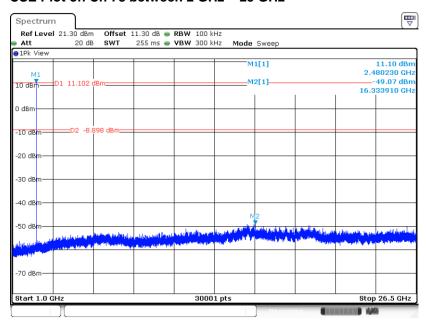
Report No.: FR380206A

#### CSE Plot on Ch 78 between 30MHz ~ 3 GHz



#### Date: 14.AUG.2023 21:00:59

#### CSE Plot on Ch 78 between 2 GHz ~ 25 GHz



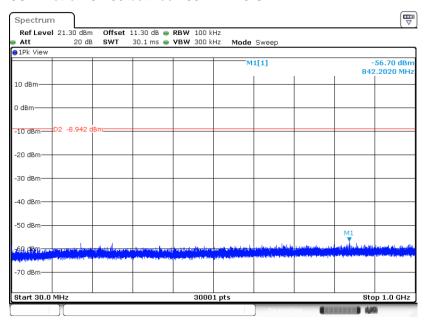
Date: 14.AUG.2023 21:00:30

TEL: +86-755-8637-9589 FAX: +86-755-8637-9595 FCC ID: 2AFZZRA98G Page Number : 42 of 54
Report Issued Date : Sep. 15, 2023
Report Version : Rev. 01

Report No.: FR380206A

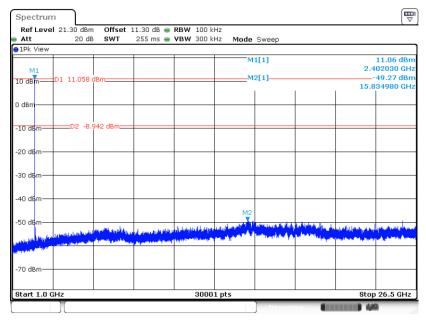
#### <3Mbps>

#### CSE Plot on Ch 00 between 30MHz ~ 3 GHz



Date: 14.AUG.2023 21:03:49

#### CSE Plot on Ch 00 between 2 GHz ~ 25 GHz

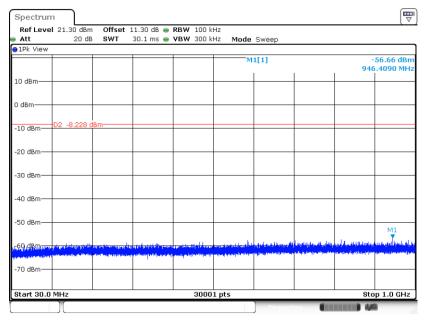


Date: 14.AUG.2023 21:03:22

TEL: +86-755-8637-9589 FAX: +86-755-8637-9595 FCC ID: 2AFZZRA98G Page Number : 43 of 54
Report Issued Date : Sep. 15, 2023
Report Version : Rev. 01

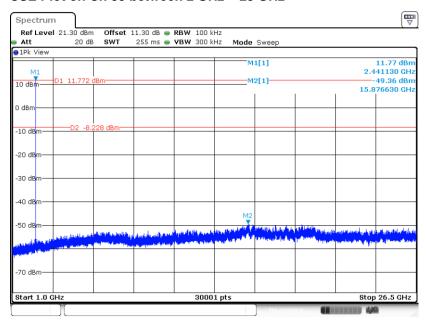
Report No.: FR380206A

#### CSE Plot on Ch 39 between 30MHz ~ 3 GHz



#### Date: 14.AUG.2023 21:06:43

#### CSE Plot on Ch 39 between 2 GHz ~ 25 GHz

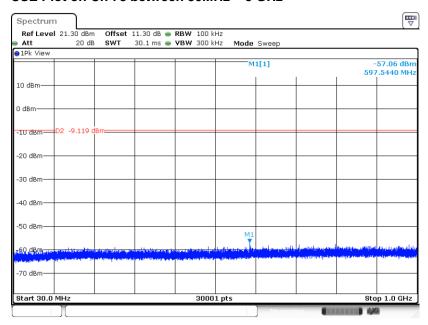


Date: 14.AUG.2023 21:06:17

TEL: +86-755-8637-9589 FAX: +86-755-8637-9595 FCC ID: 2AFZZRA98G Page Number : 44 of 54
Report Issued Date : Sep. 15, 2023
Report Version : Rev. 01

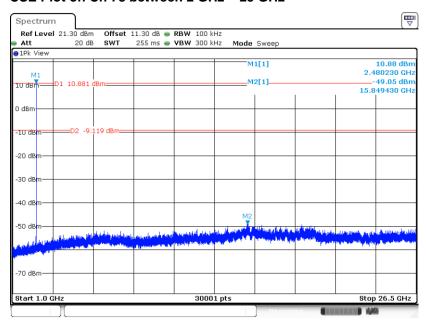
Report No.: FR380206A

#### CSE Plot on Ch 78 between 30MHz ~ 3 GHz



Date: 14.AUG.2023 21:11:02

#### CSE Plot on Ch 78 between 2 GHz ~ 25 GHz



Date: 14.AUG.2023 21:10:35

Sporton International Inc. (ShenZhen)

TEL: +86-755-8637-9589 FAX: +86-755-8637-9595 FCC ID: 2AFZZRA98G Page Number : 45 of 54
Report Issued Date : Sep. 15, 2023
Report Version : Rev. 01

Report No.: FR380206A

### 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	Field Strength	Measurement Distance
(MHz)	(microvolts/meter)	(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

The measuring equipment is listed in the section 4 of this test report.

Sporton International Inc. (ShenZhen)

TEL: +86-755-8637-9589 FAX: +86-755-8637-9595 FCC ID: 2AFZZRA98G Page Number : 46 of 54
Report Issued Date : Sep. 15, 2023
Report Version : Rev. 01

Report No.: FR380206A

#### 3.8.3 Test Procedures

- 1. The EUT was placed on a turntable with 0.8 meter for frequency below 1GHz and 1.5 meter for frequency above 1GHz respectively above ground.
- 2. The EUT was set 3 meters from the interference receiving antenna, which was mounted on the top of a variable height antenna tower.
- 3. For each suspected emission, the EUT was 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 to the maximum power setting and enable the EUT 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=1MHz for f>1GHz; 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.

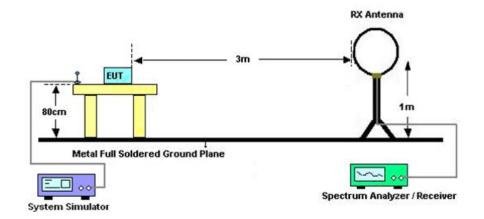
Average Emission Level = Peak Emission Level + 20\*log(Duty cycle)

- 6. Corrected Reading: Antenna Factor + Cable Loss + Read Level Preamp Factor = Level
- 7. For testing below 1GHz, if the emission level of the EUT in peak mode was 3 dB lower than the limit specified, then peak values of EUT will be reported, otherwise, the emissions will be repeated one by one using the CISPR quasi-peak method and reported.
- 8. For testing above 1GHz, the emission level of the EUT in peak mode was 20dB lower than peak limit (that means the emission level in average mode also complies with the limit in average mode), then peak values of EUT will be reported, otherwise, the emissions will be measured in average mode again and reported.

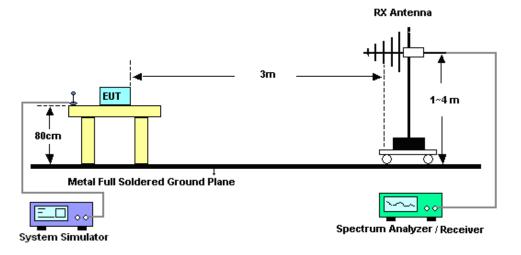
Note: The average levels were calculated from the peak level corrected with duty cycle correction factor (-24.79dB) derived from 20log (dwell time/100ms). This correction is only for signals that hop with the fundamental signal, such as band-edge and harmonic. Other spurious signals that are independent of the hopping signal would not use this correction.

#### 3.8.4 Test Setup

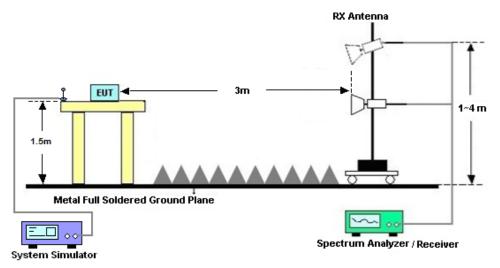
#### For radiated emissions below 30MHz



#### For radiated emissions from 30MHz to 1GHz



#### For radiated emissions above 1GHz



Sporton International Inc. (ShenZhen)

TEL: +86-755-8637-9589 FAX: +86-755-8637-9595 FCC ID: 2AFZZRA98G Page Number : 48 of 54
Report Issued Date : Sep. 15, 2023
Report Version : Rev. 01

Report No.: FR380206A

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

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

There is a comparison data of both open-field test site and semi-Anechoic chamber, and the result came out very similar.

#### 3.8.6 Test Result of Radiated Spurious at Band Edges

Please refer to Appendix C.

# 3.8.7 Test Result of Radiated Spurious Emission (30MHz ~ 10th Harmonic or 40GHz, whichever is lower)

Please refer to Appendix C.

#### 3.8.8 Duty cycle correction factor for average measurement

Please refer to Appendix D.

Sporton International Inc. (ShenZhen)

TEL: +86-755-8637-9589 FAX: +86-755-8637-9595 FCC ID: 2AFZZRA98G Page Number : 49 of 54
Report Issued Date : Sep. 15, 2023
Report Version : Rev. 01

Report No.: FR380206A

#### 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.

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

<sup>\*</sup>Decreases with the logarithm of the frequency.

#### 3.9.2 Measuring Instruments

The measuring equipment is listed in the section 4 of this test report.

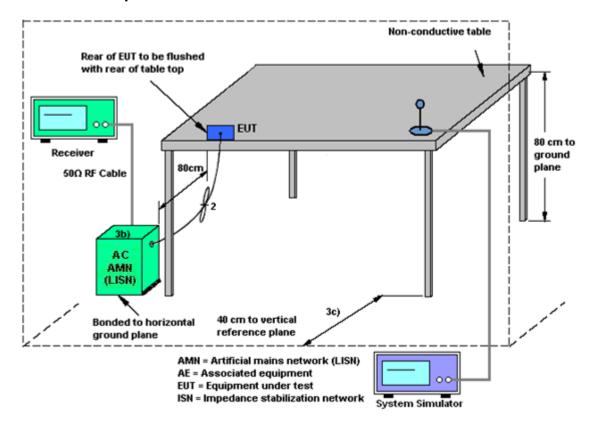
#### 3.9.3 Test Procedures

- The EUT was placed 0.4 meter from the conducting wall of the shielding room was 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 should be used.
- 6. Both sides of AC line were checked for maximum conducted interference.
- 7. The frequency range from 150 kHz to 30 MHz was searched.
- 8. Set the test-receiver system to Peak Detect Function and specified bandwidth (IF Bandwidth = 9kHz) with Maximum Hold Mode. Then measurement is also conducted by Average Detector and Quasi-Peak Detector Function respectively.

TEL: +86-755-8637-9589 FAX: +86-755-8637-9595 FCC ID: 2AFZZRA98G Page Number : 50 of 54
Report Issued Date : Sep. 15, 2023
Report Version : Rev. 01

Report No.: FR380206A

#### 3.9.4 Test Setup



#### 3.9.5 Test Result of AC Conducted Emission

Please refer to Appendix B.

Sporton International Inc. (ShenZhen)

TEL: +86-755-8637-9589 FAX: +86-755-8637-9595 FCC ID: 2AFZZRA98G Page Number : 51 of 54
Report Issued Date : Sep. 15, 2023
Report Version : Rev. 01

Report No.: FR380206A

### 3.10 Antenna Requirements

#### 3.10.1 Standard Applicable

If directional gain of transmitting antennas is greater than 6dBi, the power shall be reduced by the same level in dB comparing to gain minus 6dBi. 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.

#### 3.10.3 Antenna Gain

The antenna peak gain of EUT is less than 6 dBi. Therefore, it is not necessary to reduce maximum peak output power limit.

Sporton International Inc. (ShenZhen)

TEL: +86-755-8637-9589 FAX: +86-755-8637-9595 FCC ID: 2AFZZRA98G Page Number : 52 of 54
Report Issued Date : Sep. 15, 2023
Report Version : Rev. 01

Report No.: FR380206A

# 4 List of Measuring Equipment

In atmospant	Manufacturer	Madel Na	Carial Na	Chanastaniatica	Calibration	Toot Date	Due Dete	Domonic
Instrument	Manufacturer	Model No.	Serial No.	Characteristics	Date	Test Date	Due Date	Remark
Spectrum Analyzer	R&S	FSV40	101078	10Hz~40GHz	Apr. 06, 2023	Aug. 09, 2023~ Aug. 14, 2023	Apr. 05, 2024	Conducted (TH01-SZ)
Pulse Power Senor	Anritsu	MA2411B	1339473	30MHz~40GHz	Dec. 27, 2022	Aug. 09, 2023~ Aug. 14, 2023	Dec. 26, 2023	Conducted (TH01-SZ)
Power Meter	Anritsu	ML2495A	1542004	50MHz Bandwidth	Dec. 27, 2022	Aug. 09, 2023~ Aug. 14, 2023	Dec. 26, 2023	Conducted (TH01-SZ)
EMI Test Receiver	R&S	ESR7	101404	9kHz~7GHz	Oct. 19, 2022	Aug. 19, 2023	Oct. 18, 2023	Radiation (03CH04-SZ)
EXA Spectrum Analyzer	KEYSIGHT	N9010A	MY551502 13	10Hz~44GHz	Jul. 07, 2023	Aug. 19, 2023	Jul. 06, 2024	Radiation (03CH04-SZ)
Loop Antenna	R&S	HFH2-Z2	100354	9kHz~30MHz	Jun. 28, 2022	Aug. 19, 2023	Jun. 27, 2024	Radiation (03CH04-SZ)
Bilog Antenna	TeseQ	CBL6111D	41909	30MHz~1GHz	May 14, 2023	Aug. 19, 2023	May 13, 2024	Radiation (03CH04-SZ)
Double Ridge Horn Antenna	SCHWARZBE CK	BBHA9120D	9120D-147 4	1GHz~18GHz	Jul. 07, 2023	Aug. 19, 2023	Jul. 06, 2024	Radiation (03CH04-SZ)
Horn Antenna	SCHWARZBE CK	BBHA9170	9170#679	15GHz~40GHz	Jul. 08, 2023	Aug. 19, 2023	Jul. 07, 2024	Radiation (03CH04-SZ)
Amplifier	Burgeon	BPA-530	102211	0.01Hz ~3000MHz	Oct. 19, 2022	Aug. 19, 2023	Oct. 18, 2023	Radiation (03CH04-SZ)
HF Amplifier	MITEQ	AMF-7D-0010 1800-30-10P- R	1943528	1GHz~18GHz	Oct. 19, 2022	Aug. 19, 2023	Oct. 18, 2023	Radiation (03CH04-SZ)
HF Amplifier	MITEQ	TTA1840-35- HG	1871923	18GHz~40GHz	Jul. 07, 2023	Aug. 19, 2023	Jul. 06, 2024	Radiation (03CH04-SZ)
Amplifier	Agilent Technologies	83017A	MY572801 36	500MHz~26.5G Hz	Sep. 30, 2022	Aug. 19, 2023	Sep. 29, 2023	Radiation (03CH04-SZ)
AC Power Source	APC	AFV-S-600B	F11905001 9	N/A	Nov. 10, 2022	Aug. 19, 2023	Nov. 10, 2023	Radiation (03CH04-SZ)
Turn Table	EM	EM1000	N/A	0~360 degree	NCR	Aug. 19, 2023	NCR	Radiation (03CH04-SZ)
Antenna Mast	EM	EM1000	N/A	1 m~4 m	NCR	Aug. 19, 2023	NCR	Radiation (03CH04-SZ)
EMI Receiver	R&S	ESR7	101630	9kHz~7GHz;	Jul. 06, 2023	Aug. 08, 2023	Jul. 05, 2024	Conduction (CO01-SZ)
AC LISN	R&S	ENV216	100063	9kHz~30MHz	Sep. 15, 2022	Aug. 08, 2023	Sep. 14, 2023	Conduction (CO01-SZ)
AC LISN (for auxiliary equipment)	EMCO	3816/2SH	00103892	9kHz~30MHz	Oct. 17, 2022	Aug. 08, 2023	Oct. 16, 2023	Conduction (CO01-SZ)
AC Power Source	Chroma	61602	616020000 891	100Vac~250Vac	Jul. 07, 2023	Aug. 08, 2023	Jul. 06, 2024	Conduction (CO01-SZ)

NCR: No Calibration Required

Sporton International Inc. (ShenZhen)

TEL: +86-755-8637-9589 FAX: +86-755-8637-9595 FCC ID: 2AFZZRA98G Page Number : 53 of 54
Report Issued Date : Sep. 15, 2023
Report Version : Rev. 01

Report No.: FR380206A

### 5 Measurement Uncertainty

The measurement uncertainties shown below were calculated in accordance with the requirements of ANSI 63.10-2013. All the measurement uncertainty value were shown with a coverage K=2 to indicate 95% level of confidence. The measurement data show herein meets or exceeds the CISPR measurement uncertainty values specified in CISPR 16-4-2 and can be compared directly to specified limit to determine compliance.

#### **Uncertainty of Conducted Measurement**

Test Item	Uncertainty
Conducted Power	±1.34 dB
Conducted Emissions	±1.34 dB
Occupied Channel Bandwidth	±0.13 %

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

Measuring Uncertainty for a Level of Confidence	0 = 15
of 95% (U = 2Uc(y))	2.7dB

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

Measuring Uncertainty for a Level of Confidence	5.1dB
of 95% (U = 2Uc(y))	3.1 <b>u</b> b

#### <u>Uncertainty of Radiated Emission Measurement (1000 MHz ~ 18000 MHz)</u>

Measuring Uncertainty for a Level of Confidence	4.8dB
of 95% (U = 2Uc(y))	4.0UD

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

Measuring Uncertainty for a Level of Confidence of 95% (U = 2Uc(y))	5.1dB
---	-------

----- THE END -----

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TEL: +86-755-8637-9589 FAX: +86-755-8637-9595 FCC ID: 2AFZZRA98G Page Number : 54 of 54
Report Issued Date : Sep. 15, 2023
Report Version : Rev. 01

Report No.: FR380206A

# **Appendix A. Conducted Test Results**

Sporton International Inc. (ShenZhen)

TEL: +86-755-8637-9589 FAX: +86-755-8637-9595 FCC ID: 2AFZZRA98G Page Number

: A1 of A1

Report Number : FR380206A

#### Appendix A. Test Result of Conducted Test Items

Test Engineer:	Chen Ran	Temperature:	21~25	°C
Test Date:	2023/8/9~2023/8/14	Relative Humidity:	51~54	%

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

Mod.	Data Rate	NTX	CH.	Freq. (MHz)	20db BW (MHz)	99% Bandwidth (MHz)	Hopping Channel Separation Measurement (MHz)	Hopping Channel Separation Measurement Limit (MHz)	Pass/Fail
DH	1Mbps	1	0	2402	0.822	0.751	0.999	0.5478	Pass
DH	1Mbps	1	39	2441	0.822	0.751	1.012	0.5478	Pass
DH	1Mbps	1	78	2480	0.861	0.751	0.994	0.5739	Pass
2DH	2Mbps	1	0	2402	1.300	1.171	0.994	0.8667	Pass
2DH	2Mbps	1	39	2441	1.296	1.171	0.994	0.8638	Pass
2DH	2Mbps	1	78	2480	1.296	1.171	1.012	0.8638	Pass
3DH	3Mbps	1	0	2402	1.313	1.173	0.986	0.8754	Pass
3DH	3Mbps	1	39	2441	1.313	1.173	0.990	0.8754	Pass
3DH	3Mbps	1	78	2480	1.304	1.173	0.990	0.8696	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
Nomal	79	106.67	2.88	0.31	0.4	Pass
AFH	20	53.33	2.88	0.15	0.4	Pass

# TEST RESULTS DATA Peak Power Table

DH	CH.	NTX	Peak Power (dBm)	Power Limit (dBm)	Test Result
	0	1	15.37	20.97	Pass
DH5	39	1	15.07	20.97	Pass
	78	1	15.33	20.97	Pass
	0	1	15.06	20.97	Pass
2DH5	39	1	14.94	20.97	Pass
	78	1	14.95	20.97	Pass
	0	1	15.07	20.97	Pass
3DH5	39	1	14.98	20.97	Pass
	78	1	15.08	20.97	Pass

# TEST RESULTS DATA Average Power Table

#### (Reporting Only)

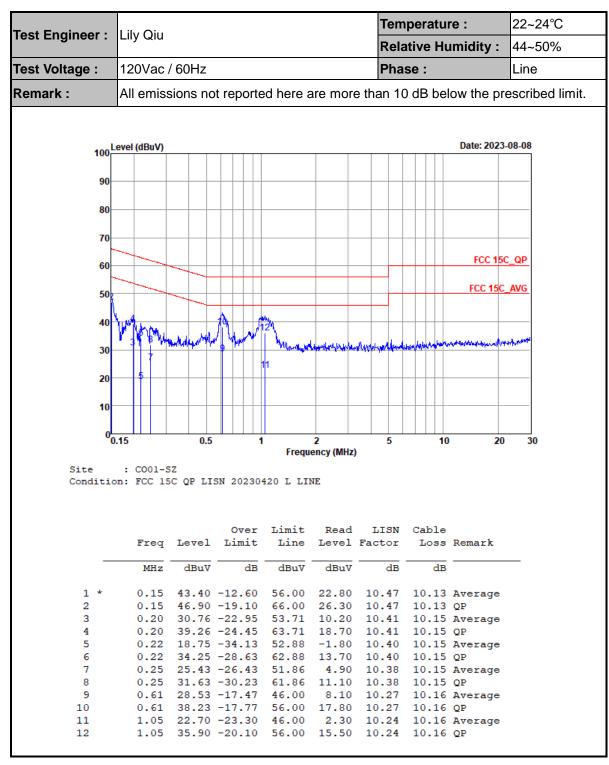
DH	CH.	NTX	Average Power (dBm)	Duty Factor (dB)
	0	1	15.20	1.16
DH5	39	1	15.00	1.16
	78	1	15.00	1.16
	0	1	12.70	1.14
2DH5	39	1	12.60	1.14
	78	1	12.60	1.14
	0	1	12.70	1.16
3DH5	39	1	12.60	1.16
	78	1	12.60	1.16

#### TEST RESULTS DATA

#### Number of Hopping Frequency

Number of Hopping (Channel)	Adaptive Frequency Hopping (Channel)	Limits (Channel)	Pass/Fail
79	20	> 15	Pass

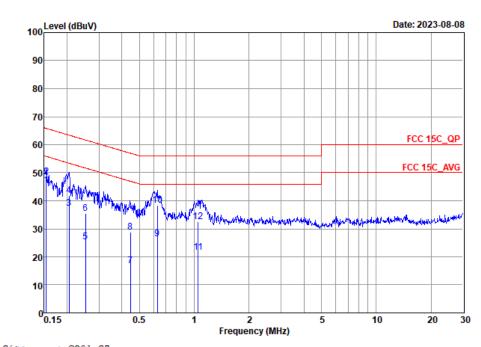
### **Appendix B. AC Conducted Emission Test Results**



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Toot Engineer	Lily Oiu	Temperature :	22~24°C
Test Engineer :		Relative Humidity :	44~50%
Test Voltage :	120Vac / 60Hz	Phase :	Neutral

Remark: All emissions not reported here are more than 10 dB below the prescribed limit.



Site : CO01-SZ Condition: FCC 15C\_QP LISN\_20230420\_N NEUTRAL

	:	Freq	Level	Over Limit	Limit Line	Read Level	LISN Factor	Cable Loss	Remark
		MHz	dBu∀	dB	dBu∀	dBuV	dB	dB	
_		0.15		-10.09	55.78	25.11	10.45	10.13	Average
2		0.15	48.59	-17.19	65.78	28.01	10.45	10.13	QP
3		0.21	37.30	-16.10	53.40	16.80	10.35	10.15	Average
4		0.21	41.80	-21.60	63.40	21.30	10.35	10.15	QP
5		0.25	25.37	-26.27	51.64	4.90	10.32	10.15	Average
6		0.25	35.47	-26.17	61.64	15.00	10.32	10.15	QP
7		0.45	16.89	-30.04	46.93	-3.50	10.23	10.16	Average
8		0.45	28.89	-28.04	56.93	8.50	10.23	10.16	QP
9		0.63	26.50	-19.50	46.00	6.10	10.24	10.16	Average
10		0.63	38.50	-17.50	56.00	18.10	10.24	10.16	QP
11		1.05	21.52	-24.48	46.00	1.11	10.25	10.16	Average
12		1.05	32.42	-23.58	56.00	12.01	10.25	10.16	QP

#### Note:

- 1. Level( $dB\mu V$ ) = Read Level( $dB\mu V$ ) + LISN Factor(dB) + Cable Loss(dB)
- 2. Over Limit(dB) = Level(dB $\mu$ V) Limit Line(dB $\mu$ V)

TEL: +86-755-8637-9589 FAX: +86-755-8637-9595 FCC ID: 2AFZZRA98G

# **Appendix C. Radiated Spurious Emission**

Test Engineer :	Wenbo Xiao	Relative Humidity :	50%
	vvendo XIao	Temperature :	20~22 ℃

# **Radiated Spurious Emission Test Modes**

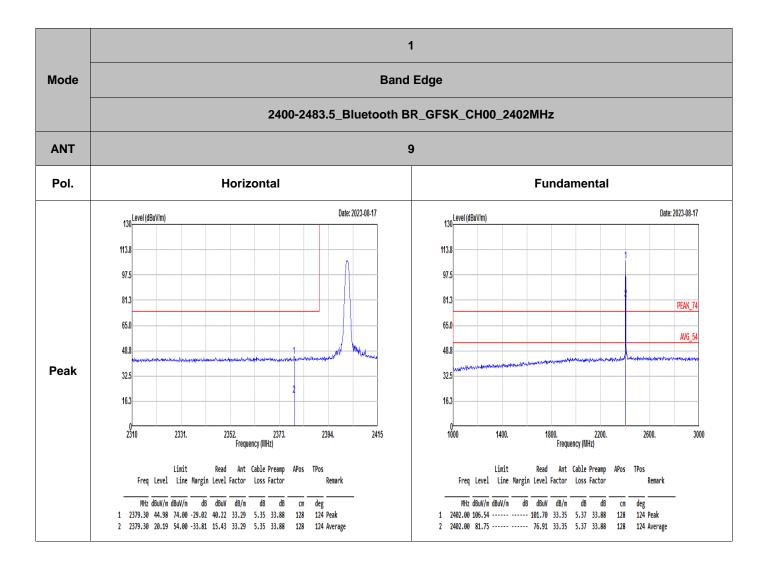
Mode	Band (MHz)	Antenna	Modulation	Channel	Frequency	Data Rate	Remark
Mode 1	2400-2483.5	9	Bluetooth BR_GFSK	00	2402	1DH5	-
Mode 2	2400-2483.5	9	Bluetooth BR_GFSK	39	2441	1DH5	-
Mode 3	2400-2483.5	9	Bluetooth BR_GFSK	78	2480	1DH5	-
Mode 4	2400-2483.5	9	Bluetooth BR_GFSK	78	2480	1DH5	-

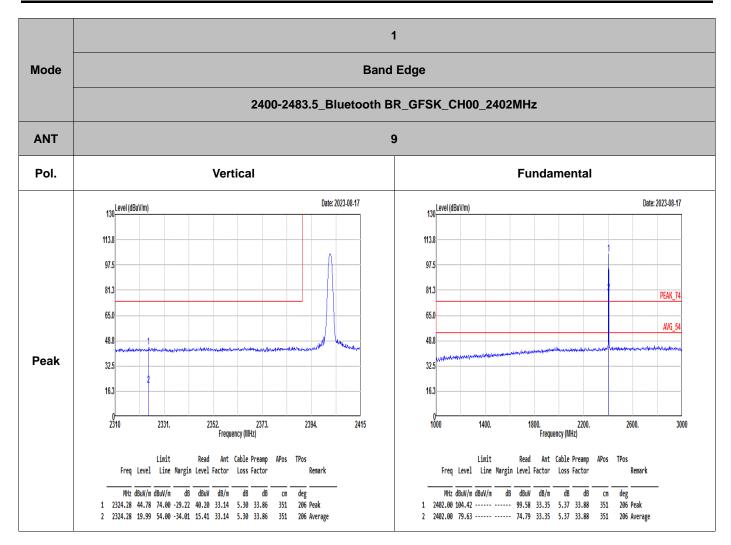
# Summary of each worse mode

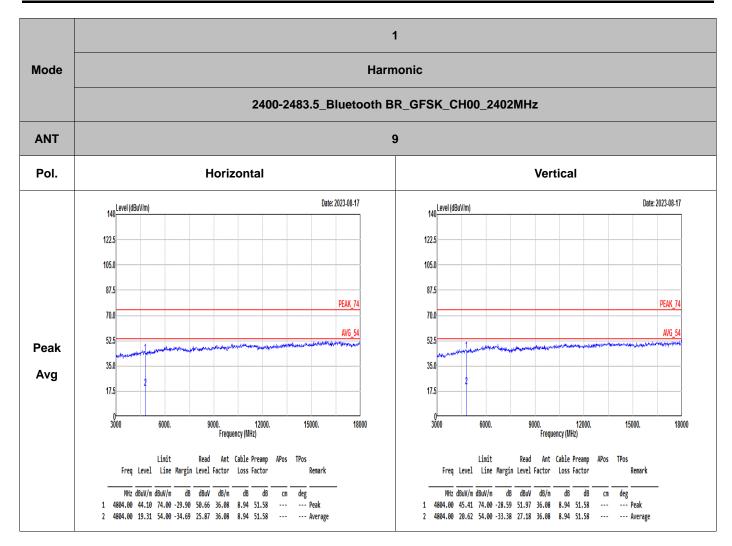
Mode	Modulation	Ch.	Freq.	Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Pol.	Peak Avg.	Result	Remark
1	Bluetooth BR_GFSK	00	2379.30	44.98	74.00	-29.02	Н	Peak	Pass	Band Edge
	Bluetooth BR_GFSK	00	4804.00	45.41	74.00	-28.59	V	Peak	Pass	Harmonic
2	Bluetooth BR_GFSK	39	-	-	-	-	-	-	-	Band Edge
	Bluetooth BR_GFSK	39	7323.00	45.64	74.00	-28.36	٧	Peak	Pass	Harmonic
2	Bluetooth BR_GFSK	78	2483.60	48.88	74.00	-25.12	Н	Peak	Pass	Band Edge
3	Bluetooth BR_GFSK	78	4960.00	46.68	74.00	-27.32	Н	Peak	Pass	Harmonic
4	Bluetooth BR_GFSK	78	30.00	28.10	40.00	-11.90	V	Peak	PASS	LF

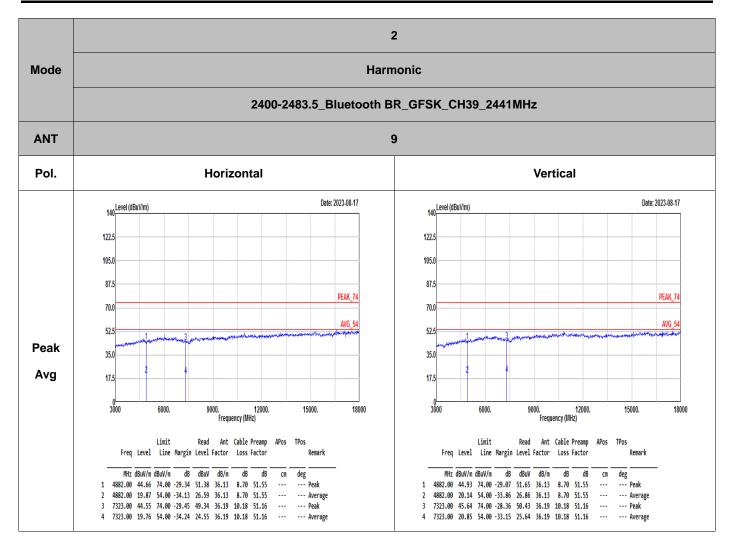
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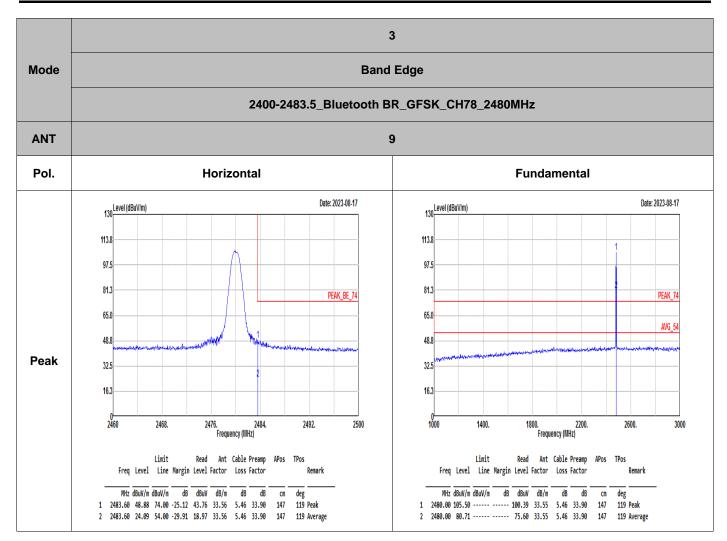
TEL: +86-755-8637-9589 FAX: +86-755-8637-9595 FCC ID: 2AFZZRA98G

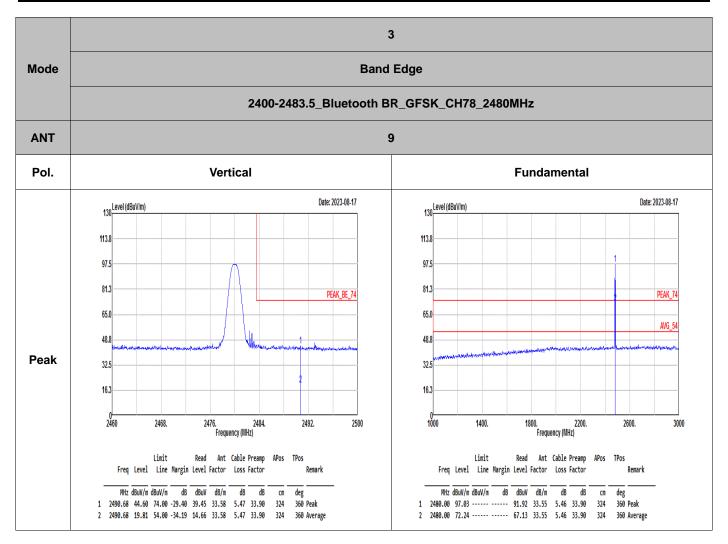


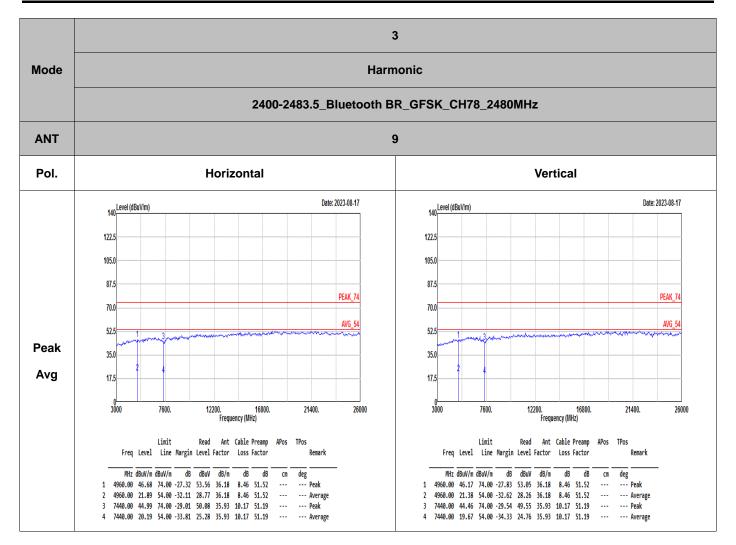


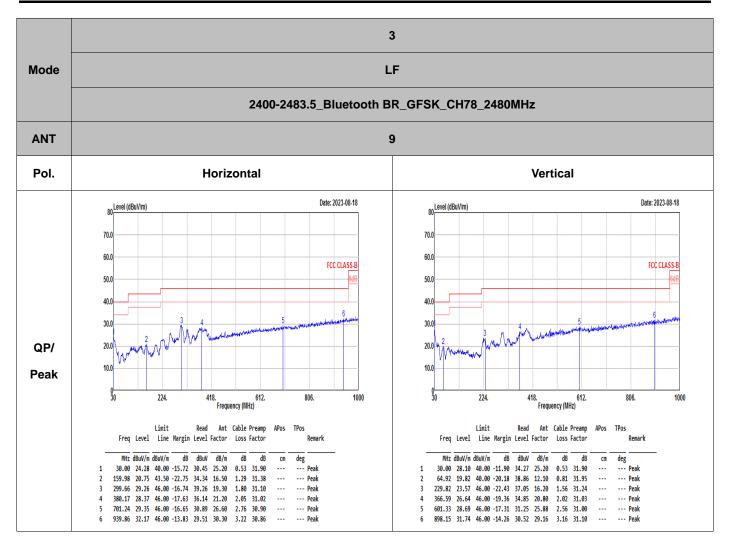










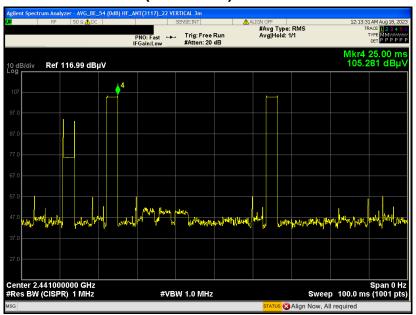


4 Mode LF 2400-2483.5\_Bluetooth BR\_GFSK\_CH78\_2480MHz **ANT** 9 Pol. Horizontal Vertical Date: 2023-08-18 Date: 2023-08-18 80 Level (dBuV/m) 80 Level (dBuV/m) 70.0 70.0 60.0 60.0 FCC CLASS-E FCC CLASS-B 50.0 50.0 30.0 30.0 QP/ 20.0 Peak 224. 806. 1000 224. 806. 1000 Ant Cable Preamp APos TPos Limit Read Ant Cable Preamp APos TPos Freq Level Line Margin Level Factor Loss Factor Freq Level Line Margin Level Factor Loss Factor MHz dBuV/m dBuV/m dB dBuV dB/m deg --- Peak --- Peak MHz dBuV/m dBuV/m dB dBuV dB/m deg --- Peak 30.00 24.28 40.00 -15.72 30.45 25.20 0.53 31.90 30.00 28.10 40.00 -11.90 34.27 25.20 0.53 31.90 159.98 20.75 43.50 -22.75 34.34 16.50 1.29 31.38 299.66 29.26 46.00 -16.74 39.26 19.30 1.80 31.10 64.92 19.82 40.00 -20.18 38.86 12.10 0.81 31.95 --- Peak --- Peak 229.82 23.57 46.00 -22.43 37.05 16.20 1.56 31.24 --- Peak 380.17 28.37 46.00 -17.63 36.14 21.20 366.59 26.64 46.00 -19.36 34.85 20.80 601.33 28.69 46.00 -17.31 31.25 25.88 2.56 31.00 898.15 31.74 46.00 -14.26 30.52 29.16 3.16 31.10 701.24 29.35 46.00 -16.65 30.89 26.60 2.76 30.90 939.86 32.17 46.00 -13.83 29.51 30.30 3.22 30.86 --- Peak

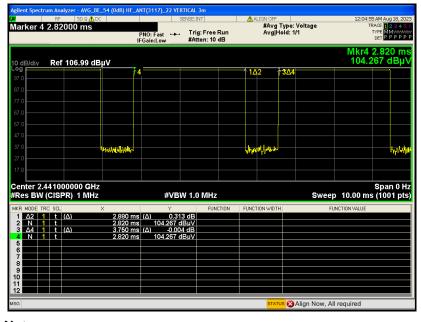
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# Appendix D. Duty Cycle Plots

#### 3DH5 on time (One Pulse) Plot on Channel 39



#### 3DH5 on time (Count Pulses) Plot on Channel 39



#### Note:

- 1. Worst case Duty cycle = on time/100 milliseconds =  $2 \times 2.88 / 100 = 5.76 \%$
- 2. Worst case Duty cycle correction factor = 20\*log(Duty cycle) = -24.79 dB
- 3. 3DH5 has the highest duty cycle worst case and is reported.

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