FCC CO-LOCATION RADIO TEST REPORT

FCC ID	:	**APYHRO00331**
Equipment	:	**Smart phone**
Brand Name	:	**SHARP**
Model Name	:	**APYHRO00331**
Applicant	:	**SHARP CORPORATION** **1 Takumi-cho, Sakai-ku, Sakai City, Osaka 590-8522, Japan**
Manufacturer	:	**SHARP CORPORATION** **1 Takumi-cho, Sakai-ku, Sakai City, Osaka 590-8522, Japan**
Standard	:	**FCC Part 15 Subpart C §15.247** **FCC Part 15 Subpart E §15.407**

The product was received on Mar. 20, 2024 and testing was performed from Mar. 29, 2024 to Apr. 17, 2024. We, Sporton International Inc. Wensan Laboratory, 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 Inc. Wensan Laboratory, the test report shall not be reproduced except in full.

Louis Wu

Approved by: Louis Wu

Sporton International Inc. Wensan Laboratory
No.58, Aly. 75, Ln. 564, Wenhua 3rd, Rd., Guishan Dist., Taoyuan City 333010, Taiwan (R.O.C.)

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History of this test report

Report No.	Version	Description	Issue Date
FR3D2225G	01	Initial issue of report	May 09, 2024

Summary of Test Result

Report Clause	Ref Std. Clause	Test Items	Result (PASS/FAIL)	Remark
3.1	15.407(b)	Unwanted Emissions	Pass	3.40 dB under the limit at 5467.47 MHz
3.2	15.203 15.407(a)	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.

Reviewed by: Keven Cheng

Report Producer: Ming Chen

1 General Description

1.1 Product Feature of Equipment Under Test

Product Feature	
General Specs	GSM/ WCDMA/LTE, Bluetooth, Wi-Fi 2.4GHz 802.11b/g/n/ac, Wi-Fi 5GHz 802.11a/n/ac, NFC, and GNSS**.**
Antenna Type	WLAN: Loop Antenna Bluetooth: Loop Antenna GPS / Glonass / BDS / Galileo: PIFA Antenna NFC: Loop Antenna

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

Item	Main		2nd Source			
	Main Sample		Sample 2		Sample 3	
	Vendor	Model Number	Vendor	Model Number	Vendor	Model Number
Memory	SAMSUNG	SA05P91D010	Hynix	SA0QG9G5010	Micron	SA0D81SF010
PA	QORVO	SA07048B020 (QM77048B)	QORVO	SA077048020 (QM77048)	QORVO	SA077048020 (QM77048)
FPC_USB	PBH	MESX314004A	SUNFLEX	MESX114012A	SUNFLEX	MESX114012A
FPC_AJ	PBH	MESX314003A	SUNFLEX	MESX114013A	SUNFLEX	MESX114013A
FPC_Main	PBH	MESX414001A	SUNFLEX	MESX414011A	SUNFLEX	MESX414011A
FPC_SPK	AKM	MESX414004A	SUNFLEX	MESX114015A	SUNFLEX	MESX114015A
FPC_Side_Key	PBH	MESX414002A	AKM	MESX414012A	AKM	MESX414012A
FPC_flashlight	PBH	MESX414003A	SUNFLEX	MESX414013A	SUNFLEX	MESX414013A
rear housing	DY	MESX461130A	COXON	MESX461131A	COXON	MESX461131A
Battery	SCUD	BPSX400001S (SX4)	EVE	BPSX400002S (X4)	EVE	BPSX400002S (X4)
Display	DJN	SLX1462BX00	CPT	SLX65WM2X00	CPT	SLX65WM2X00
Camera 50M	Shinetech	S0CNN72B000	Union Image	S0C50A350A0	Union Image	S0C50A350A0
Camera 8M	Shinetech	S0CF891B060	Union Image	S0C8F357060	Union Image	S0C8F357060
E-compass	MEMSIC	SA0C56030A0	QST	SA0C6308130	QST	SA0C6308130
DPDT	MAXSCEND	SA08546C020	CANAANTEK	SA01122N080	CANAANTEK	SA01122N080
Switch	MAXSCEND	SA08621E080	Richwave	SA086102080	Richwave	SA086102080
P-sensor	EMINENT	SA0MN789080	Sensortek	SA033562020	Sensortek	SA033562020
G- sensor	TDK	SA042670020	Bosch	SA0MI320020	Bosch	SA0MI320020

1.2 Modification of EUT

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

1.3 Testing Location

Test Site	Sporton International Inc. Wensan Laboratory
Test Site Location	No.58, Aly. 75, Ln. 564, Wenhua 3rd, Rd., Guishan Dist., Taoyuan City 333010, Taiwan (R.O.C.) TEL: +886-3-327-0868 FAX: +886-3-327-0855
Test Site No.	**Sporton Site No.**
	03CH15-HY

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

FCC designation No.: TW3786

1.4 Applicable Standards

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

- FCC Part 15 Subpart E
- FCC Part 15 Subpart C §15.247
- FCC KDB Publication No. 558074 D01 15.247 Meas Guidance v05r02
- FCC KDB 789033 D02 General UNII Test Procedures New Rules v02r01.
- FCC KDB 414788 D01 Radiated Test Site v01r01.
- FCC KDB 662911 D01 Multiple Transmitter Output v02r01.
- ANSI C63.10-2013

Remark:

1. All test items were verified and recorded according to the standards and without any deviation during the test.
2. The TAF code is not including all the FCC KDB listed without accreditation.
3. 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

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: 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.

2.1 Carrier Frequency and Channel

2400-2483.5 MHz		5500-5720 MHz	
Bluetooth		802.11a	
Channel	Freq. (MHz)	Channel	Freq. (MHz)
78	2480	100	5500

2.2 Test Mode

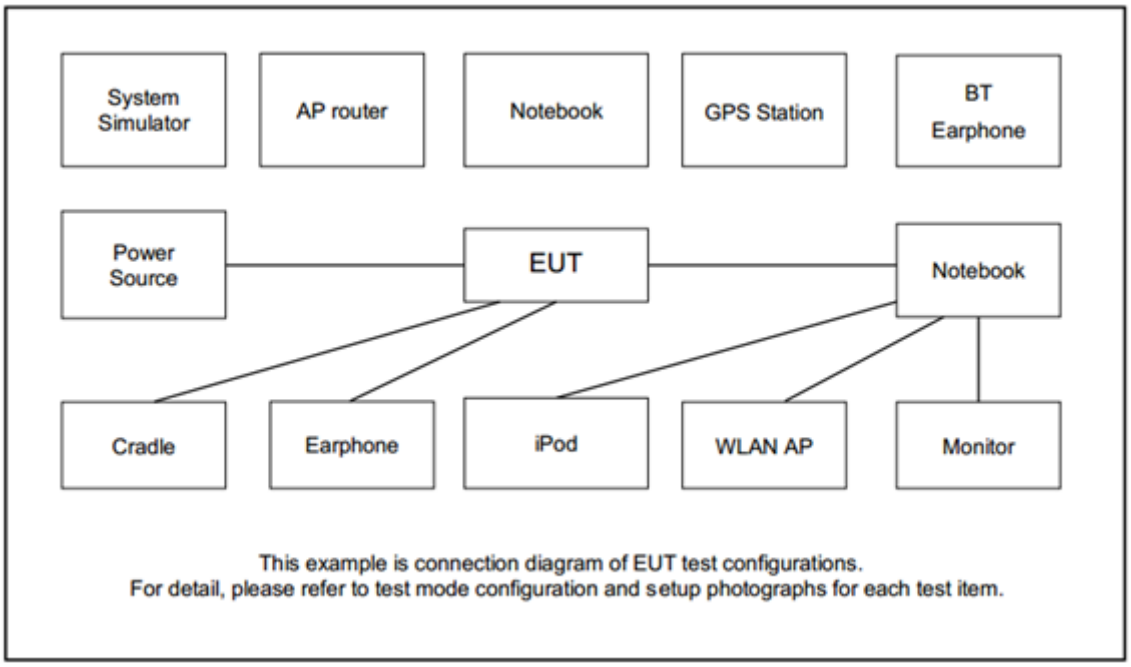
Final test modes are considering the modulation and worse data rates as below table.

<Co-Location>

Test Mode	Modulation	Data Rate
Mode 1	Bluetooth TX + WLAN 5GHz 802.11a TX	π/4-DQPSK + MCS0

Remark: For Radiated Test Cases, the tests were performed with Battery 1 and Main Sample.

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.	Earphone	NOKIA	WH-108	N/A	Unshielded, 1.5 m	N/A

2.5 EUT Operation Test Setup

The RF test items, make the EUT (SW: A3130) get into the engineering modes to provide channel selection, power level, data rate and the application type and for continuous transmitting signals.

3 Test Result

3.1 Unwanted Emissions Measurement

This section is to measure unwanted emissions through radiated measurement for band edge spurious emissions and out of band emissions measurement.

3.1.1 Limit of Unwanted Emissions

(1) Unwanted spurious emissions fallen in restricted bands shall comply with the general field strength limits as below table:

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

Note: The following formula is used to convert the EIRP to field strength.

$$E=\frac{1000000\sqrt{30P}}{3}$$ μV/m, where P is the eirp (Watts)

EIRP (dBm)	Field Strength at 3m (dBμV/m)
- 27	68.3

(2) KDB789033 D02 v02r01 G)2)c)

(i) Sections 15.407(b)(1-3) specifies the unwanted emissions limit for the U-NII-1 and U-NII-2 bands. As specified, emissions above 1000 MHz that are outside of the restricted bands are subject to a peak emission limit of −27 dBm/MHz.

(ii) Section 15.407(b)(4) specifies the unwanted emissions limit for the U-NII-3 band. A band emissions mask is specified in Section 15.407(b)(4)(i). The emission limits are based on the use of a peak detector.

3.1.2 Measuring Instruments

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

3.1.3 Test Procedures

1. The testing follows FCC KDB 789033 D02 General UNII Test Procedures New Rules v02r01. Section G) Unwanted emissions measurement.

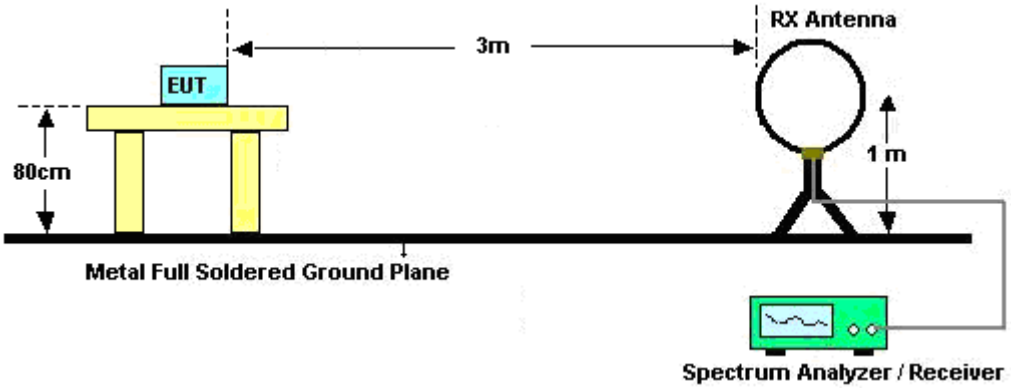
   (1) Procedure for Unwanted Emissions Measurements Below 1000MHz
   - RBW = 120 kHz
   - VBW = 300 kHz
   - Detector = Peak
   - Trace mode = max hold

   (2) Procedure for Peak Unwanted Emissions Measurements Above 1000 MHz
   - RBW = 1 MHz
   - VBW ≥ 3 MHz
   - Detector = Peak
   - Sweep time = auto
   - Trace mode = max hold

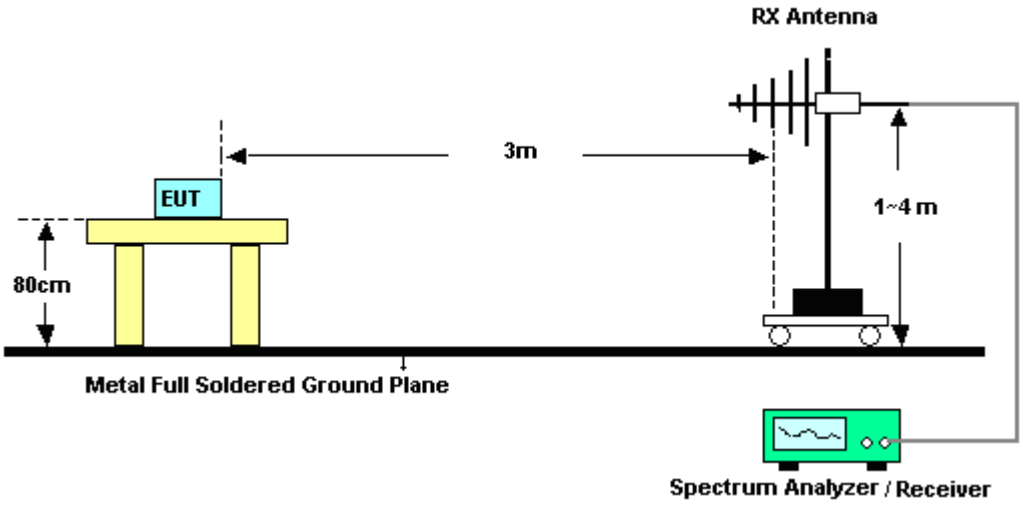
   (3) Procedures for Average Unwanted Emissions Measurements Above 1000MHz
   - RBW = 1 MHz
   - VBW = 10 Hz, when duty cycle is no less than 98 percent.
   - VBW ≥ 1/T, when duty cycle is less than 98 percent where T is the minimum transmission duration over which the transmitter is on and is transmitting at its maximum power control level for the tested mode of operation.
2. 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.
3. The EUT is set 3 meters away from the receiving antenna which is mounted on the top of a variable height antenna tower.
4. The antenna is a broadband antenna and its height is adjusted between one meter and four meters above ground to find the maximum value of the field strength for both horizontal polarization and vertical polarization of the antenna.
5. For each suspected emission, the EUT is arranged to its worst case and then adjust the antenna tower (from 1 m to 4 m) and turntable (from 0 degree to 360 degrees) to find the maximum reading.
6. 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 “-“.
7. 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 “-“.

3.1.4 Test Setup

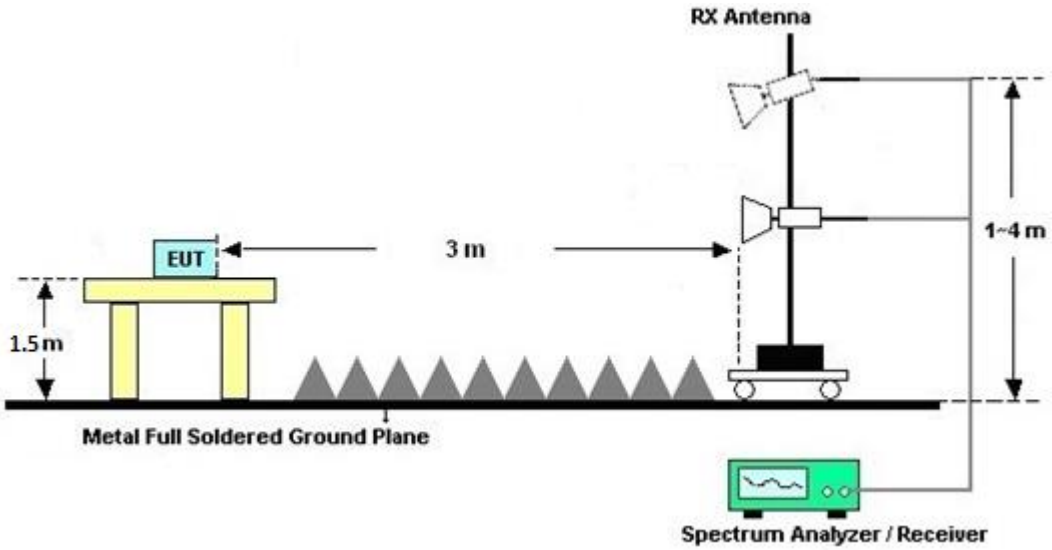
For radiated emissions below 30MHz



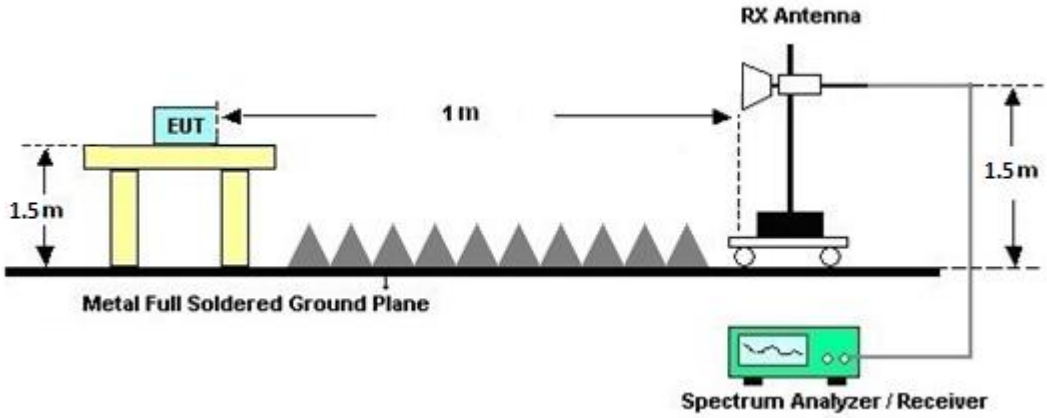
For radiated emissions from 30MHz to 1GHz



For radiated test from 1GHz to 18GHz



For radiated test above 18GHz



3.1.5 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 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 came out very similar.

3.1.6 Test Result of Radiated Spurious at Band Edges

Please refer to Appendix A and B.

3.1.7 Duty Cycle

Please refer to Appendix C.

3.1.8 Test Result of Radiated Spurious Emissions (30MHz ~ 10th Harmonic)

Please refer to Appendix A and B.

3.2 Antenna Requirements

3.2.1 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.

3.2.2 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	Rohde & Schwarz	HFH2-Z2	100488	9 kHz~30 MHz	Sep. 12, 2023	Mar. 29, 2024~ Apr. 17, 2024	Sep. 11, 2024	Radiation (03CH15-HY)
Bilog Antenna	TESEQ	CBL 6111D & 00800N1D01N-06	41912 & 05	30MHz~1GHz	Feb. 04, 2024	Mar. 29, 2024~ Apr. 17, 2024	Feb. 03, 2025	Radiation (03CH15-HY)
Horn Antenna	SCHWARZBECK	BBHA 9120 D	9120D-02294	1GHz~18GHz	Jun. 30, 2023	Mar. 29, 2024~ Apr. 17, 2024	Jun. 29, 2024	Radiation (03CH15-HY)
SHF-EHF Horn Antenna	SCHWARZBECK	BBHA 9170	1223	18GHz~40GHz	Jul. 10, 2023	Mar. 29, 2024~ Apr. 17, 2024	Jul. 09, 2024	Radiation (03CH15-HY)
Amplifier	SONOMA	310N	363440	9kHz~1GHz	Dec. 25, 2023	Mar. 29, 2024~ Apr. 17, 2024	Dec. 24, 2024	Radiation (03CH15-HY)
Preamplifier	EMEC	EM01G18G	060837	1GHz~18GHz	Feb. 15, 2024	Mar. 29, 2024~ Apr. 17, 2024	Feb. 14, 2025	Radiation (03CH15-HY)
Preamplifier	EM Electronics	EM01G18G	060802	1GHz~18GHz	Feb. 29, 2024	Mar. 29, 2024~ Apr. 17, 2024	Feb. 28, 2025	Radiation (03CH15-HY)
Preamplifier	EMEC	EM18G40G	060801	18GHz~40GHz	Jun. 27, 2023	Mar. 29, 2024~ Apr. 17, 2024	Jun. 26, 2024	Radiation (03CH15-HY)
EMI Test Receiver	Keysight	N9038A(MXE)	MY53290045	20MHz~8.4GHz	Oct. 06, 2023	Mar. 29, 2024~ Apr. 17, 2024	Oct. 05, 2024	Radiation (03CH15-HY
Spectrum Analyzer	Keysight	N9010B	MY60241058	10Hz~44GHz	Jul. 06, 2023	Mar. 29, 2024~ Apr. 17, 2024	Jul. 05, 2024	Radiation (03CH15-HY)
Antenna Mast	ChainTek	MBS-520-1	N/A	1m~4m	N/A	Mar. 29, 2024~ Apr. 17, 2024	N/A	Radiation (03CH15-HY)
Turn Table	ChainTek	T-200-S-1	N/A	0~360 Degree	N/A	Mar. 29, 2024~ Apr. 17, 2024	N/A	Radiation (03CH15-HY)
Software	Audix	E3 6.2009-8-24(k5)	RK-000451	N/A	N/A	Mar. 29, 2024~ Apr. 17, 2024	N/A	Radiation (03CH15-HY)
RF Cable	HUBER + SUHNER	SUCOFLEX 104, 102E	MY582185/4, 519228/2,803 950/2	N/A	Jun. 13, 2023	Mar. 29, 2024~ Apr. 17, 2024	Jun. 12, 2024	Radiation (03CH15-HY)
RF Cable	HUBER + SUHNER	SUCOFLEX 102	804011/2,804 012/2	18-40G	Jan. 02, 2024	Mar. 29, 2024~ Apr. 17, 2024	Jan. 01, 2025	Radiation (03CH15-HY)
Filter	Wainwright	WLJ4-1000-1530-6000-40ST	SN4	1.53GHz Low Pass Filter	Jun. 14, 2023	Mar. 29, 2024~ Apr. 17, 2024	Jun. 13, 2024	Radiation (03CH15-HY)
Filter	Wainwright	WHKX12-2700-3000-18000-60ST	SN4	3GHz High Pass Filter	Jun. 14, 2023	Mar. 29, 2024~ Apr. 17, 2024	Jun. 13, 2024	Radiation (03CH15-HY)
Hygrometer	TECPEL	DTM-302	SN4	N/A	Jul. 26, 2023	Mar. 29, 2024~ Apr. 17, 2024	Jul. 25, 2024	Radiation (03CH15-HY)

5 Measurement Uncertainty

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

Measuring Uncertainty for a Level of Confidence of 95% (U = 2Uc(y))	**6.3 dB**

Uncertainty of Radiated Emission Measurement (1000 MHz ~ 6000 MHz)

Measuring Uncertainty for a Level of Confidence of 95% (U = 2Uc(y))	**4.5 dB**

Uncertainty of Radiated Emission Measurement (6000 MHz ~ 18000 MHz)

Measuring Uncertainty for a Level of Confidence of 95% (U = 2Uc(y))	**5.5 dB**

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

Measuring Uncertainty for a Level of Confidence of 95% (U = 2Uc(y))	**5.4 dB**

Appendix A. Radiated Spurious Emission

Test Engineer :	Daniel Lee, Quentin Liu and Bigshow Wang	Temperature :	21.0~23.4°C
		Relative Humidity :	47~58%

2.4GHz 2400~2483.5MHz +Band 3 - 5350~5725MHz

BT (Band edge @ 3m)

BT	Note	Frequency	Level	Margin	Limit	Read	Antenna	Path	Preamp	Ant	Table	Peak	Pol.
Ant					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)
BT CH 78 2480MHz	*	2480	103.73	-	-	106.76	27.72	5.71	36.46	100	299	P	H
	*	2480	78.94	-	-	-	-	-	-	-	-	A	H
		2487.6	51.62	-22.38	74	54.61	27.75	5.72	36.46	100	299	P	H
		2487.6	26.83	-27.17	54	-	-	-	-	-	-	A	H
													H
													H
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													H
													H
													H
	*	2480	104.17	-	-	107.2	27.72	5.71	36.46	246	277	P	V
	*	2480	79.38	-	-	-	-	-	-	-	-	A	V
		2487.44	51.69	-22.31	74	54.68	27.75	5.72	36.46	246	277	P	V
		2487.44	26.9	-27.1	54	-	-	-	-	-	-	A	V
													V
													V
													V
													V
													V
													V
													V

Remark

1. No other spurious found.
2. All results are PASS against limit line.

2.4GHz 2400~2483.5MHz +Band 3 - 5350~5725MHz

WIFI 802.11a (Band edge @ 3m)

WIFI Ant.	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)
11a CH 100 5500MHz		5457.95	60.48	-13.52	74	55.06	32.8	8.91	36.29	100	44	P	H
		5467.47	64.8	-3.4	68.2	59.37	32.8	8.92	36.29	100	44	P	H
		5459.65	49.88	-4.12	54	44.45	32.8	8.92	36.29	100	44	A	H
	*	5500	108.84	-	-	103.36	32.8	8.96	36.28	100	44	P	H
	*	5500	101.93	-	-	96.45	32.8	8.96	36.28	100	44	A	H
													H
													H
													H
													H
													H
													H
													H
		5458.63	55.89	-18.11	74	50.47	32.8	8.91	36.29	200	310	P	V
		5469.85	59.15	-9.05	68.2	53.71	32.8	8.93	36.29	200	310	P	V
		5459.82	45.23	-8.77	54	39.8	32.8	8.92	36.29	200	310	A	V
	*	5500	103.13	-	-	97.65	32.8	8.96	36.28	200	310	P	V
	*	5500	96.14	-	-	90.66	32.8	8.96	36.28	200	310	A	V
													V
													V
													V
													V
													V
													V
													V

Remark

1. No other spurious found.
2. All results are PASS against limit line.

2.4GHz 2400~2483.5MHz +Band 3 - 5350~5725MHz

Bluetooth _Tx _Ch78 + 802.11a_Tx_Ch100 (Harmonic @ 3m)

	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)
		4960	58.98	-15.02	74	53.72	33	8.63	36.37	100	299	P	H
		4960	34.19	-19.81	54	-	-	-	-	-	-	A	H
		7440	43.65	-30.35	74	56.56	36.12	10.95	59.98	-	-	P	H
		7440	18.86	-35.14	54	-	-	-	-	-	-	A	H
		11000	45.18	-28.82	74	52.15	38.8	12.91	58.68	-	-	P	H
		16500	45.78	-22.42	68.2	51.23	37.6	16.2	59.25	-	-	P	H
													H
													H
													H
BT													H
Ch78													H
+													H
802.11a		4960	60.04	-13.96	74	54.78	33	8.63	36.37	287	176	P	V
CH 100		4960	35.25	-18.75	54	-	-	-	-	-	-	A	V
5500MHz		7440	43.01	-30.99	74	55.92	36.12	10.95	59.98	-	-	P	V
		7440	18.22	-35.78	54	-	-	-	-	-	-	A	V
		11000	45.05	-28.95	74	52.02	38.8	12.91	58.68	-	-	P	V
		16500	45.04	-23.16	68.2	50.49	37.6	16.2	59.25	-	-	P	V
													V
													V
													V
													V
													V
													V

Remark

1. No other spurious found.
2. All results are PASS against limit line.
3. The emission position marked as "-" means no suspected emission found with sufficient margin against limit line or noise floor only.

Emission above 18GHz

Bluetooth _Tx _Ch78 + 802.11a_Tx_Ch100 (SHF @ 1m)

	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)
		39541	47.01	-26.99	74	58.45	45.31	-0.3	56.45	-	-	P	H
													H
													H
													H
													H
													H
													H
													H
													H
BT													H
Ch78													H
+													H
11a		39379	46.79	-27.21	74	58.64	45.08	-0.36	56.57	-	-	P	V
Ch100													V
SHF													V
													V
													V
													V
													V
													V
													V
													V
													V
													V
													V
													V

Remark

1. No other spurious found.
2. All results are PASS against limit line.
3. The emission position marked as "-" means no suspected emission found with sufficient margin against limit line or noise floor only.

Emission below 1GHz

Bluetooth _Tx_Ch78 + 802.11a_Tx_Ch100 (LF @ 3m)

	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)
BT Ch78 2480MHz + 802.11a CH 100 5500MHz LF		30.18	24.51	-15.49	40	31.53	24.58	0.72	32.32	-	-	P	H
		78.42	31.31	-8.69	40	49.15	13.35	1.17	32.36	-	-	P	H
		110.1	36.88	-6.62	43.5	51.07	16.83	1.33	32.35	-	-	P	H
		267.2	32.04	-13.96	46	43.13	19.22	2.07	32.38	-	-	P	H
		708.8	32	-14	46	34.76	26.36	3.18	32.3	-	-	P	H
		843.2	31.71	-14.29	46	31.85	28.24	3.46	31.84	-	-	P	H
													H
													H
													H
													H
													H
													H
		51.96	28.79	-11.21	40	46.55	13.75	0.95	32.46	-	-	P	V
		80.04	28.76	-11.24	40	46.45	13.55	1.18	32.42	-	-	P	V
		108.12	30.48	-13.02	43.5	44.88	16.7	1.33	32.43	-	-	P	V
		561.6	28.88	-17.12	46	32.57	25.85	2.9	32.44	-	-	P	V
		717.6	37.53	-8.47	46	40.38	26.23	3.2	32.28	-	-	P	V
		956.8	31.41	-14.59	46	28.81	29.8	3.76	30.96	-	-	P	V
													V
													V
													V
													V
													V
													V

Remark

1. No other spurious found.
2. All results are PASS against limit line.
3. The emission position marked as “-” means no suspected emission found and emission level has at least 6dB margin against limit or emission is noise floor only.

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:

WIFI	Note	Frequency	Level	Over	Limit	Read	Antenna	Path	Preamp	Ant	Table	Peak	Pol.
Ant.				Limit	Line	Level	Factor	Loss	Factor	Pos	Pos	Avg.	
0+1		(MHz)	(dBμV/m)	(dB)	(dBμV/m)	(dBμV)	(dB/m)	(dB)	(dB)	(cm)	(deg)	(P/A)	(H/V)
802.11b CH 01 2412MHz		2390	55.45	-18.55	74	54.51	32.22	4.58	35.86	103	308	P	H
		2390	43.54	-10.46	54	42.6	32.22	4.58	35.86	103	308	A	H

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

For Peak Limit @ 2390MHz:

1. Level(dBμV/m)

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

= 32.22(dB/m) + 4.58(dB) + 54.51(dBμV) – 35.86 (dB)

= 55.45 (dBμV/m)

2. Over Limit(dB)

= Level(dBμV/m) – Limit Line(dBμV/m)

= 55.45(dBμV/m) – 74(dBμV/m)

= -18.55(dB)

For Average Limit @ 2390MHz:

1. Level(dBμV/m)

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

= 32.22(dB/m) + 4.58(dB) + 42.6(dBμV) – 35.86 (dB)

= 43.54 (dBμV/m)

2. Over Limit(dB) = Level(dBμV/m) – Limit Line(dBμV/m)

= 43.54(dBμV/m) – 54(dBμV/m)

= -10.46(dB)

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

Appendix B. Radiated Spurious Emission

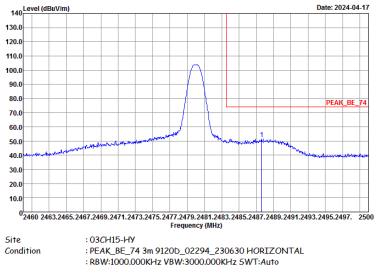
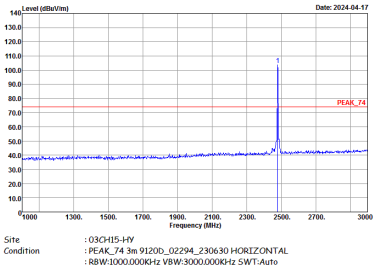
Test Engineer :	Daniel Lee, Quentin Liu and Bigshow Wang	**Temperature :**	21.0~23.4°C
		Relative Humidity :	47~58%

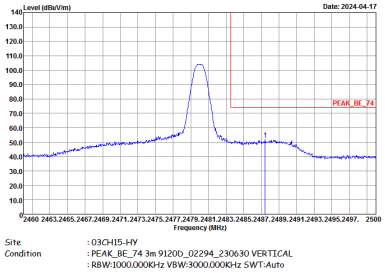
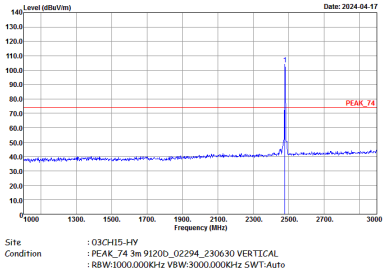
Note symbol

-L	**Low channel location**
-R	**High channel location**

2.4GHz 2400~2483.5MHz +Band 3 - 5350~5725MHz

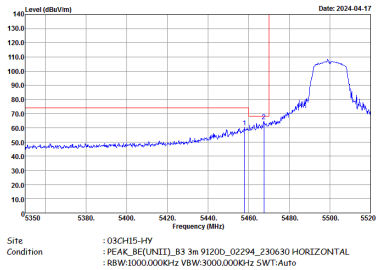
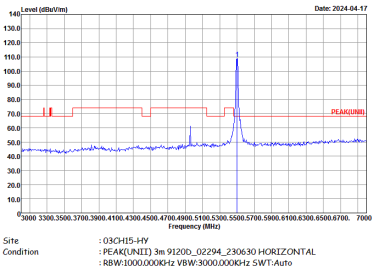
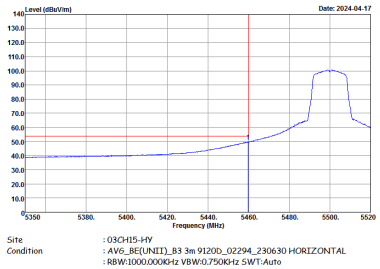
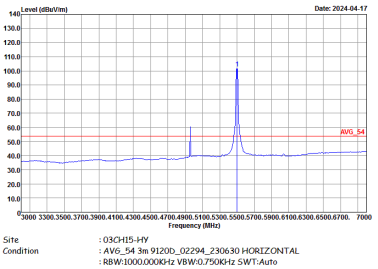
Bluetooth (Band Edge @ 3m)

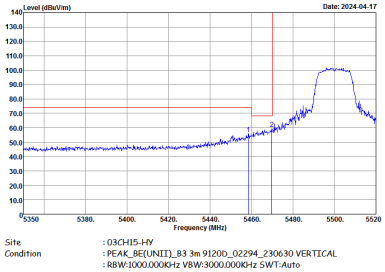
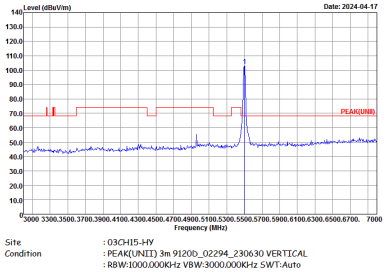
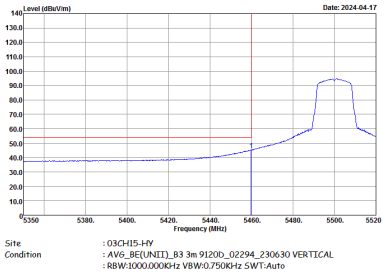
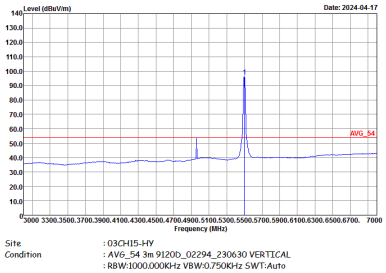
BT	2.4GHz 2400~2483.5MHz Band Edge @ 3m	
ANT	Bluetooth _Tx_Ch78 2480MHz - L	
	Horizontal	Fundamental
Peak		

BT	2.4GHz 2400~2483.5MHz Band Edge @ 3m	
ANT	Bluetooth _Tx_Ch78 2480MHz - R	
	Vertical	Fundamental
Peak		

2.4GHz 2400~2483.5MHz +Band 3 - 5350~5725MHz

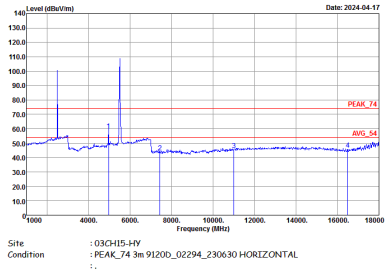
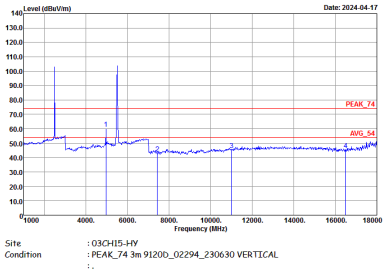
WIFI 802.11a (Band Edge @ 3m)

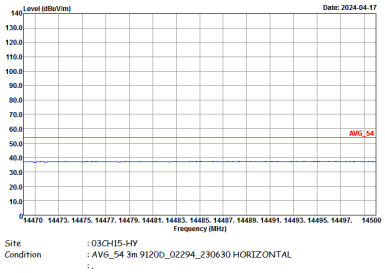
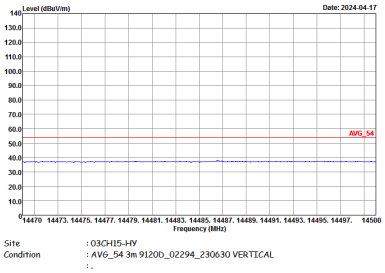
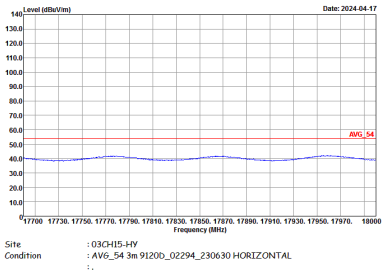
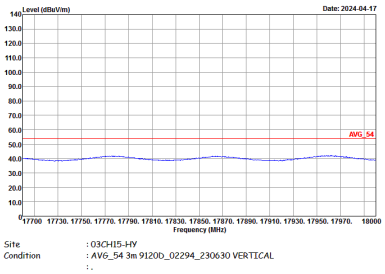
WIFI	Band 3 - 5350~5725MHz Band Edge @ 3m	
ANT	802.11a_Tx_Ch100 5500MHz	
	Horizontal	Fundamental
Peak		
Avg.		

WIFI	Band 3 - 5350~5725MHz Band Edge @ 3m	
ANT	802.11a_Tx_Ch100 5500MHz	
	Vertical	Fundamental
Peak		
Avg.		

2.4GHz 2400~2483.5MHz +Band 3 - 5350~5725MHz

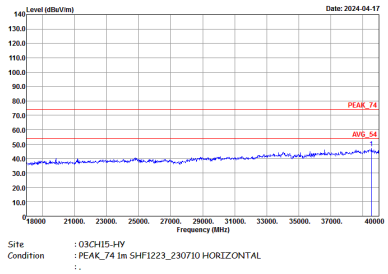
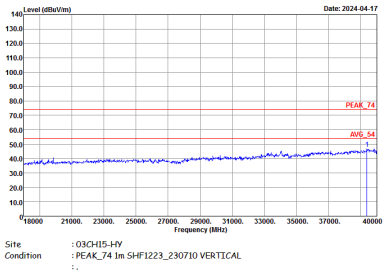
BLUETOOTH_Tx_Ch78+11a_Tx_Ch100 (Harmonic @ 3m)

	2.4GHz 2400~2483.5MHz +Band 3 - 5350~5725MHz Harmonic @ 3m	
	Bluetooth _Tx_Ch78 +1 1a_Tx_Ch100	
	Horizontal	Vertical
Peak Avg.		

	2.4GHz 2400~2483.5MHz +Band 3 - 5350~5725MHz Harmonic @ 3m	
	Bluetooth _Tx_Ch78 + 802.11a _Tx_Ch100	
	Horizontal	Vertical
14.47G ~14.5G Avg.		
17.7G ~18G Avg		

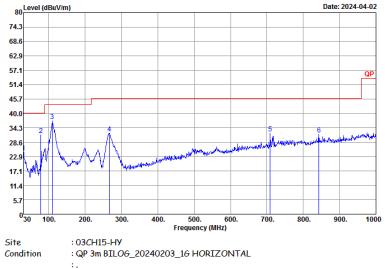
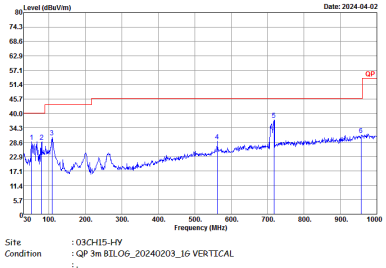
Emission above 1GHz

BLUETOOTH_Tx_Ch78+11a_Tx_Ch100 (SHF)

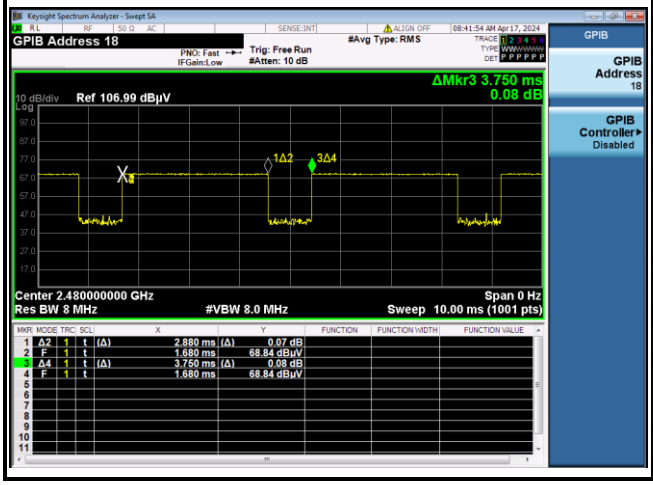
	2.4GHz 2400~2483.5MHz +Band 3 - 5350~5725MHz SHF @ 1m	
	Bluetooth _Tx_Ch78+11a_Tx_Ch100	
	Horizontal	Vertical
Peak Avg.		

Emission below 1GHz

Bluetooth _Tx_Ch78 + 802.11a_Tx_Ch100 (LF)

	2.4GHz 2400~2483.5MHz +Band 3 - 5350~5725MHz LF @ 3m	
	Bluetooth _Tx_Ch78 + 802.11a _Tx_Ch100	
	Horizontal	Vertical
QP / Peak		

Appendix C. Duty Cycle Plots

2DH5 on time (One Pulse) Plot on Channel 78	on time (Count Pulses) Plot on Channel 78
	

Note:

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

Duty Cycle Correction Factor Consideration for AFH mode:

Bluetooth normal hopping rate is 1600Hz and reduced to 800Hz in AFH mode; due to the reduced number of hopping frequencies, with the same packet configuration the dwell time in each channel frequency within 100msec period is longer in AFH mode than normal mode.

In AFH mode, the minimum hopping frequencies are 20, to get the longest dwell time DH5 packet is observed; the on time period to have DH5 packet completing one hopping sequence is

2.88 ms x 20 channels = 57.6 ms

There cannot be 2 complete hopping sequences within 100ms period, considering the random hopping behavior, maximum 2 hops can be possibly observed within the period. [100 ms / 57.6 ms] = 2 hops

Thus, the maximum possible ON time:

2.88 ms x 2 = 5.76 ms

Worst case Duty Cycle Correction factor, which is derived from the maximum possible ON time,

20 x log(5.76 ms/100 ms) = -24.79 dB

Band	Duty Cycle(%)	T(us)	1/T(kHz)	VBW Setting
5GHz 802.11a	97.89	1390	0.72	750Hz

5GHz 802.11a