



# FCC RADIO TEST REPORT

FCC ID	:	E2K-P152G006
Equipment	:	Portable Computer
Brand Name	:	DELL
Model Name	:	P152G
Applicant	:	DELL Inc. One Dell Way, Round Rock, TX 78682, USA
Manufacturer	:	DELL Inc. One Dell Way, Round Rock, TX 78682, USA
Standard	:	FCC Part 15 Subpart C §15.247

The product was received on Aug. 23, 2022 and testing was performed from Sep. 07, 2022 to Oct. 03, 2022. 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.

Lunis Wu

Approved by: Louis Wu

Sporton International Inc. Wensan Laboratory

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Report Template No.: BU5-FR15CBT Version 2.4

Page Number: 1 of 48Issue Date: Oct. 17, 2022Report Version: 01



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# History of this test report

Report No.	Version	Description	Issue Date
FR270404A	01	Initial issue of report	Oct. 17, 2022



# Summary of Test Result

Report Clause	Ref Std. Clause	Test Items	Result (PASS/FAIL)	Remark
3.1	15.247(a)(1)	Number of Channels	Pass	-
3.2	15.247(a)(1)	Hopping Channel Separation	Pass	-
3.3	15.247(a)(1)	Dwell Time of Each Channel	Pass	-
3.4	15.247(a)(1)	20dB Bandwidth	Pass	-
3.4	2.1049	99% Occupied Bandwidth	Reporting only	-
3.5	15.247(b)(1) 15.247(b)(4)	Peak Output Power	Pass	-
3.6	15.247(d)	Conducted Band Edges	Pass	-
3.7	15.247(d)	Conducted Spurious Emission	Pass	-
3.8	15.247(d)	Radiated Band Edges and Radiated Spurious Emission	Pass	6.95 dB under the limit at 32.910 MHz
3.9	15.207	AC Conducted Emission	Pass	8.42 dB under the limit at 0.168 MHz
3.10	15.203	Antenna Requirement	Pass	-

#### Declaration of Conformity:

- 1. The test results (PASS/FAIL) with all measurement uncertainty excluded are presented in accordance with the regulation limits or requirements declared by manufacturers.
  - It's means measurement values may risk exceeding the limit of regulation standards, if measurement uncertainty is include in test results.
- 2. The measurement uncertainty please refer to report "Uncertainty of Evaluation".

#### Comments and Explanations:

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

#### Reviewed by: Sheng Kuo Report Producer: Doris Chen



# **1** General Description

# **1.1 Product Feature of Equipment Under Test**

Bluetooth, Wi-Fi 2.4GHz 802.11b/g/n/ac/ax and Wi-Fi 5GHz 802.11a/n/ac/ax.

Product Feature			
Sample 1		EUT with AWAN Antenna	
Sample 2		EUT with Hong-Bo Antenna	
		WLAN	
Antonno Tuno		<aux.>: PIFA Antenna</aux.>	
Antenna Type		<main>: PIFA Antenna</main>	
		Bluetooth: PIFA Antenna	
Antenna Information			
Manufacturer		Hong-Bo	
	Antenna Type	PIFA Antenna	
Vendor 1	Part Number	260-24414(DC33002QK0L)	
	Peak gain (dBi)	Aux. Antenna:	
	Feak gaill (UDI)	2.97	
	Manufacturer	AWAN	
	Antenna Type	PIFA Antenna	
Vendor 2	Part Number	AYP6Y-200052(DC33002QR0L)	
	Poak dain (dRi)	Aux. Antenna:	
		2.95	

**Remark:** The EUT's information above is declared by manufacturer. Please refer to Comments and Explanations in report summary.

# **1.2 Modification of EUT**

No modifications made to the EUT during the testing.



# 1.3 Testing Location

Test Site	Sporton International Inc. EMC & Wireless Communications Laboratory			
Test Site Location         No.52, Huaya 1st Rd., Guishan Dist., Taoyuan City 333, Taiwan (R.O.C.)           TEL: +886-3-327-3456           FAX: +886-3-328-4978				
Test Site No.	Sporton Site No.			
Test Site NO.	CO05-HY(TAF Code: 1190)			
Remark	The AC Conducted Emission test item subcontracted to Sporton International Inc. EMC & Wireless Communications Laboratory.			

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

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			
Sporton Site No.           TH05-HY, 03CH20-HY			

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

FCC designation No.: TW1190 and TW3786

# **1.4 Applicable Standards**

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

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

#### Remark:

- 1. All the test items were validated and recorded in accordance with the standards without any modification during the testing.
- 2. The TAF code is not including all the FCC KDB listed without accreditation.

# 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	-	-



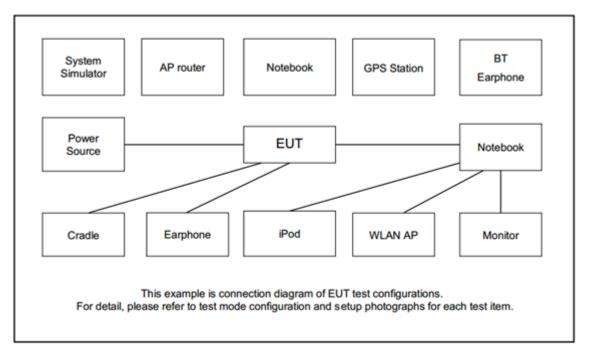
# 2.2 Test Mode

- 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). 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.

Summary table of Test Cases						
Test Item	Data Rate / Modulation					
	Bluetooth BR 1Mbps GFSK	Bluetooth EDR 2Mbps <i>π</i> /4-DQPSK	Bluetooth EDR 3Mbps 8-DPSK			
Conducted	Mode 1: CH00_2402 MHz	Mode 4: CH00_2402 MHz	Mode 7: CH00_2402 MHz			
Test Cases	Mode 2: CH39_2441 MHz	Mode 5: CH39_2441 MHz	Mode 8: CH39_2441 MHz			
	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	Mode 1 :Bluetooth Link + WLAN (2.4GHz) Link + Adapter + USB HD*2 +					
Emission	Earphone for Sample 1					
	Remark: For Radiated Test Cases, the worst mode data rate 1Mbps was reported only since the					
•	highest RF output power in the preliminary tests. The conducted spurious emissions and					
	conducted band edge measurement for other data rates were not worse than 1Mbps, and no other significantly frequencies found in conducted spurious emission.					



# 2.3 Connection Diagram of Test System



# 2.4 Support Unit used in test configuration and system

ltem	Equipment	Brand Name	Model Name	FCC ID	Data Cable	Power Cord
1.	Bluetooth Earphone	Sony Ericsson	MW600	PY700A2029	N/A	N/A
2.	WLAN AP	ASUS	RT-AC66U	MSQ-RTAC66U	N/A	Unshielded, 1.8 m
3.	iPod Earphone	Apple	N/A	Verification	Unshielded, 1.0 m	N/A
4.	USB HD	ADATA	HV620S-1T	FCC DoC	Shielded, 1.0m	N/A
5.	SD Card	SanDisk	MicroSD HC	FCC DoC	N/A	N/A
6.	Notebook	Dell	Latitude 3400	FCC DoC	N/A	AC I/P: Unshielded, 1.2 m DC O/P: Shielded, 1.8 m



# 2.5 EUT Operation Test Setup

The RF test items, utility "QRCT 4.0.00206.0" was installed in EUT which was programmed in order to make the EUT get into the engineering modes to provide channel selection, power level, data rate and the application type and for continuous transmitting signals.

# 2.6 Measurement Results Explanation Example

#### For all conducted test items:

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

Example:

The spectrum analyzer offset is derived from RF cable loss and attenuator factor.

Offset = RF cable loss + attenuator factor.

Following shows an offset computation example with cable loss 4.2 dB and 10 dB attenuator.

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

= 4.2 + 10 = 14.2 (dB)



# 3 Test Result

# 3.1 Number of Channel Measurement

#### 3.1.1 Limits of Number of Hopping Frequency

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

#### 3.1.2 Measuring Instruments

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

#### 3.1.3 Test Procedure

- 1. The testing follows ANSI C63.10-2013 clause 7.8.3.
- 2. The RF output of EUT is connected to the spectrum analyzer by RF cable and attenuator. The path loss is compensated to the results for each measurement.
- 3. Set the maximum power setting and enable the EUT to transmit continuously.
- 4. Enable the EUT hopping function.
- Use the following spectrum analyzer settings: Span = the frequency band of operation;
   RBW = 300 kHz; 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



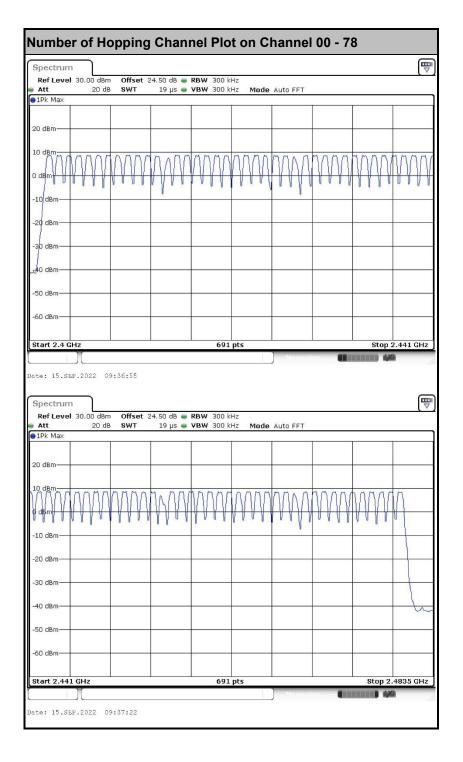
Spectrum Analyzer

EUT



### 3.1.5 Test Result of Number of Hopping Frequency

Please refer to Appendix A.



# **3.2 Hopping Channel Separation Measurement**

#### 3.2.1 Limit of Hopping Channel Separation

Frequency hopping systems operating in the 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.

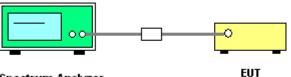
#### 3.2.2 Measuring Instruments

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

#### 3.2.3 Test Procedures

- 1. The testing follows ANSI C63.10-2013 clause 7.8.2.
- 2. The RF output of EUT is connected to the spectrum analyzer by RF cable and attenuator. The path loss is compensated to the results for each measurement.
- 3. Set the maximum power setting and enable the EUT to transmit continuously.
- 4. Enable the EUT hopping function.
- Use the following spectrum analyzer settings:
   Span = wide enough to capture the peaks of two adjacent channels;
   RBW = 300 kHz; 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



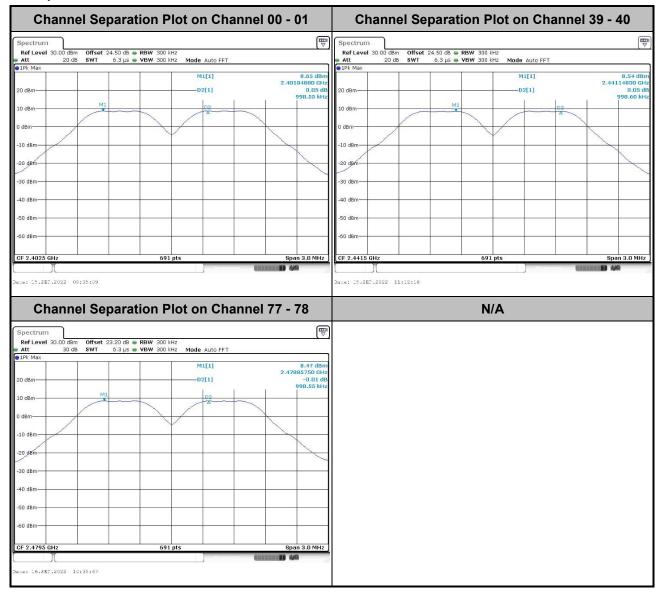
Spectrum Analyzer

### 3.2.5 Test Result of Hopping Channel Separation

Please refer to Appendix A.



#### <1Mbps>



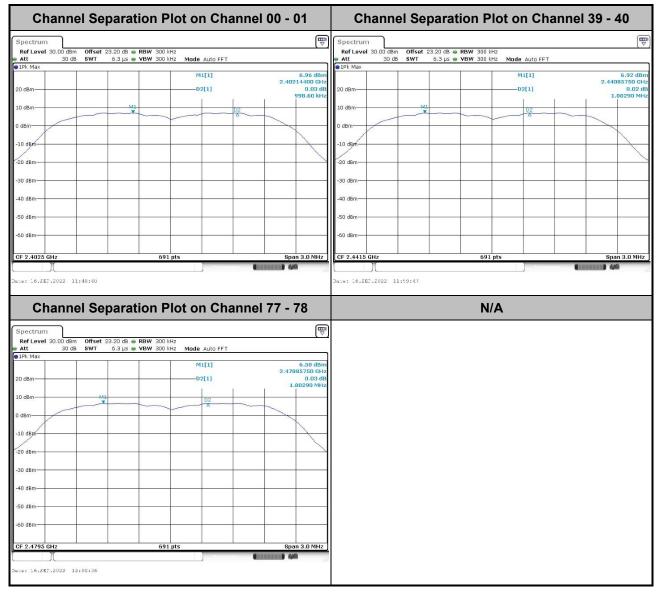


#### <2Mbps>

Channel Sepa	ration Plot on Chanr	nel 00 - 01	Channel Separation Plot on Channel 39 - 40
Spectrum			
Att 30 dB SWT 6.3	0 dB 👄 RBW 300 kHz 3 µs 🖷 VBW 300 kHz 🛛 Mode Auto FFT		Ref Level         30.00 dBm         Offset         23.20 dB         RBW         300 kHz           Att         30 dB         SWT         6.3 µs         VBW         300 kHz         Mode         Auto FFT
20 dBm	M1[1] D2[1]	6.94 dBm 2.40186180 GHz 0.04 dB 998.55 KHz	2 2.44100070 C 2 20 dBm
10 dBm		998.33 KH2	10 dBm 10 dBm10 dBm10 dBm
10 dBm			0 dBm -10 dBm
20 dBm-			20 dBm
30 dBm			- 30 dBm
50 dBm			-50 dBm
-60 dBm	691 pts	Span 3.0 MHz	-60 dBm         -60 dBm <t< td=""></t<>
Channel Sepa	ration Plot on Chanr	nel 77 - 78	Date: 16.5ET.2022 11:35:54
Spectrum			9
Att 30 dB SWT 6.3	0 dB 👄 RBW 300 kHz 3 µs 🖶 VBW 300 kHz 🛛 Mode Auto FFT		
91Pk Max 20 dBm	M1[1] D2[1]	6.47 dBm 2.47885750 GHz 0.02 dB 1.00290 MHz	2
0 dBm M1			-
10 dgm			
20 dBm			
40 dBm			-
50 dBm			1
CF 2.4795 GHz	691 pts	Span 3.0 MHz )	
nte: 16.5E7.2022 11:40:20	Metanophig	(IIIIIII) 44	



#### <3Mbps>





## 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.

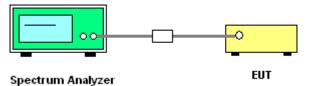
#### 3.3.2 Measuring Instruments

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

#### 3.3.3 Test Procedures

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

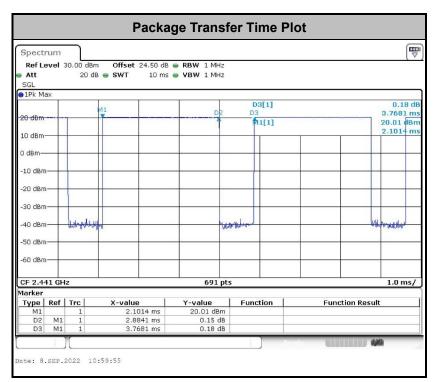
#### 3.3.4 Test Setup



#### 3.3.5 Test Result of Dwell Time

Please refer to Appendix A.





#### Remark:

**1.** In normal mode, hopping rate is 1600 hops/s with 6 slots 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  $(0.4 \times 20)$  (s), Hops Over Occupancy Time comes to  $(800 / 6 / 20) \times (0.4 \times 20) = 53.33$  hops.

3. Dwell Time(s) = Hops Over Occupancy Time (hops) x Package Transfer Time

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### 3.4 20dB and 99% Bandwidth Measurement

#### 3.4.1 Limit of 20dB and 99% Bandwidth

Reporting only

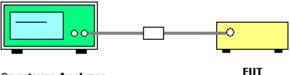
#### 3.4.2 Measuring Instruments

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

#### 3.4.3 Test Procedures

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

#### 3.4.4 Test Setup



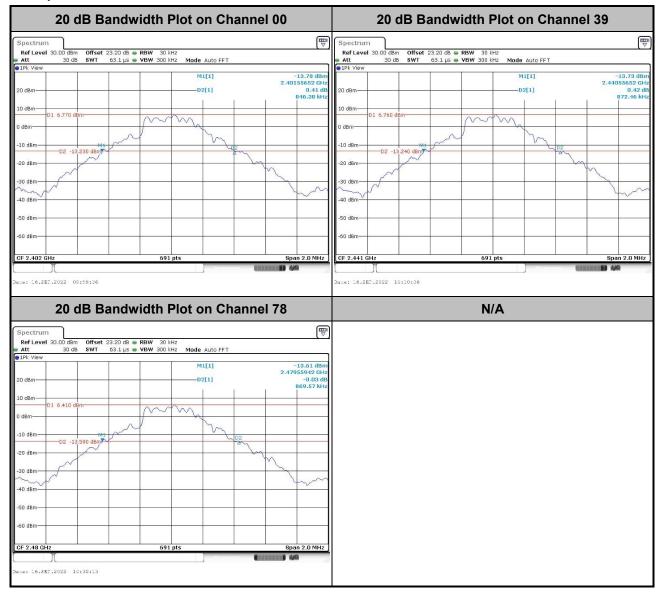
Spectrum Analyzer

### 3.4.5 Test Result of 20dB Bandwidth

Please refer to Appendix A.

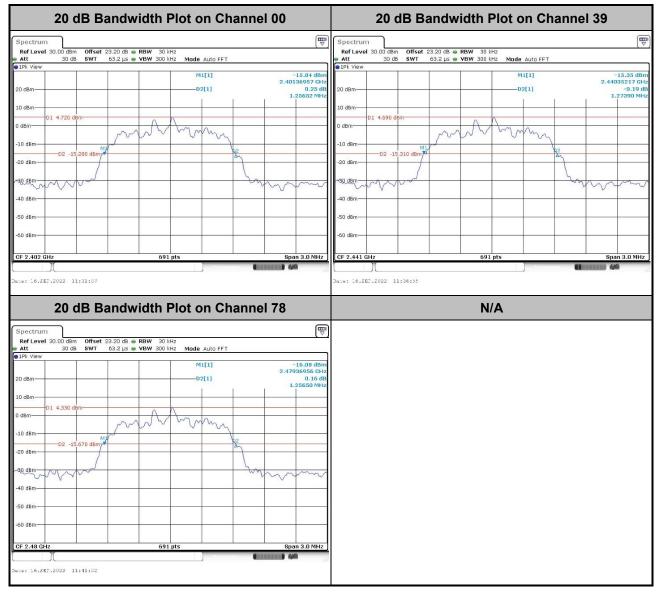


#### <1Mbps>



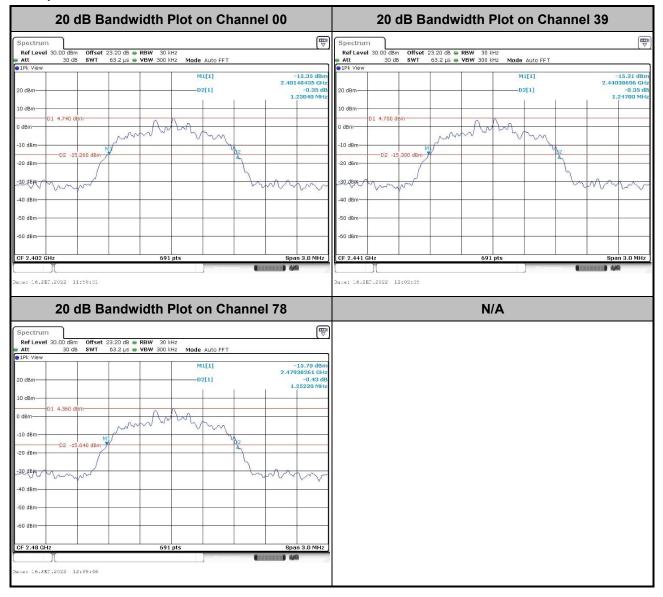


#### <2Mbps>





#### <3Mbps>

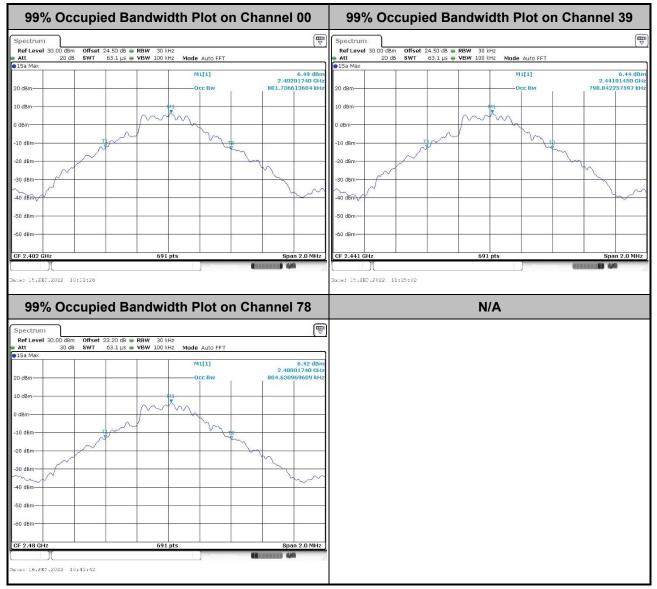




#### 3.4.6 Test Result of 99% Occupied Bandwidth

Please refer to Appendix A.

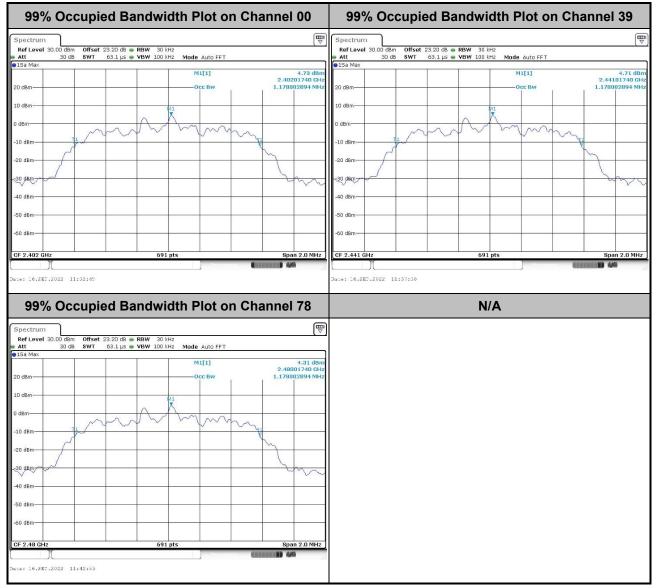
#### <1Mbps>



Note: The occupied channel bandwidth is maintained within the band of operation for all of the modulations.



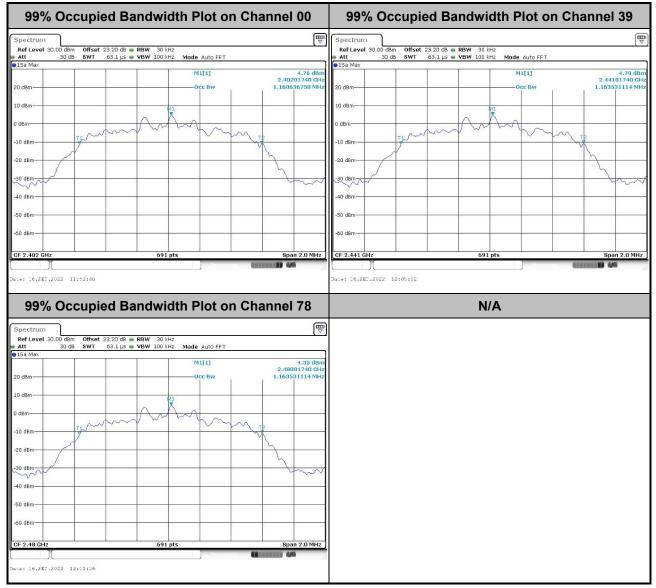
#### <2Mbps>



Note: The occupied channel bandwidth is maintained within the band of operation for all of the modulations.



#### <3Mbps>



Note: The occupied channel bandwidth is maintained within the band of operation for all of the modulations.



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

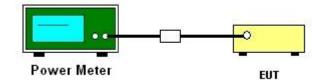
#### 3.5.2 Measuring Instruments

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

#### 3.5.3 Test Procedures

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

#### 3.5.4 Test Setup



#### 3.5.5 Test Result of Peak Output Power

Please refer to Appendix A.

#### 3.5.6 Test Result of Average Output Power (Reporting Only)

Please refer to Appendix A.



# 3.6 Conducted Band Edges Measurement

#### 3.6.1 Limit of Band Edges

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

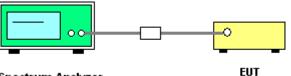
#### 3.6.2 Measuring Instruments

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

#### 3.6.3 Test Procedures

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

#### 3.6.4 Test Setup



Spectrum Analyzer



# 3.6.5 Test Result of Conducted Band Edges

#### <1Mbps>

Low Band Edge Plot on Channel 00	High Band Edge Plot on Channel 78
Spectrum         (♥)           Ref Level 30.00 dBm         Offset 24.50 dB ● RBW 100 kHz         (♥)           Att         20 dB         SWT         19 µs         VBW 300 kHz         Mode Auto FFT           ● IPk Max         M1[1]         -43.50 dBm         -43.50 dBm	Spectrum         Image: Constraint of the sector of t
20 dBm 10 dBm 0 dBm -10 dBm -20 dBm -20 dBm -30 dBm -30 dBm -40 dBm -40 dBm	20 dBm 10 dBm 0 dBm -10 dBm -20 dBm -20 dBm -20 dBm -30 dBm -40 dBm -40 dBm
-50 dBm -50 dBm -50 dBm F1 Start 2.395 GHz Stop 2.405 GHz Comparison Stop 2.405 GHz Comparison Stop 2.405 GHz Comparison Stop 2.405 GHz Comparison Comparison Stop 2.405 GHz Comparison	-50 dBm -50 dBm -50 dBm -50 dBm F1 Start 2.4775 GHz Stop 2.4895 GHz Darser 15.5EE.2022 10:04:01

#### <2Mbps>

Low Band Edge Plot on Channel 00	High Band Edge Plot on Channel 78			
Spectrum         mm           Ref Level 30.00 dBm         Offset 23.20 dB ● RBW 100 kHz           ● Att         30 dB           SWT         19 µs           ● TPk View	Spectrum           Ref Level 30.00 dBm         Offset 23.20 dB • RBW 100 kHz           4tt         30 dB • SWT         19 µS • VBW 300 kHz           Mode         Auto FFT			
10 dbm 01 6.510 dbm 0 db	20 dBm         -32.96 d           10 dBm         2.4892060           0 dBm         -01 6.140 dBm           -10 dBm         -02 -13.860 dBm           -20 dBm         -02 -13.860 dBm           -30 dBm         -02 -13.860 dBm           -30 dBm         -02 -13.860 dBm           -30 dBm         -02 -13.860 dBm			
FI	-50 dBm F1 Start 2.4775 GHz 691 pts Stop 2.4895 G 			



#### <3Mbps>

Low Band Edge Plot on Channel 00	High Band Edge Plot on Channel 78			
Spectrum         W           Ref Level 30.00 dBm         Offset 23.20 dB	Spectrum         Image: Constraint of the sector of th			
-50 dBm	-50 dBm			



# 3.6.6 Test Result of Conducted Hopping Mode Band Edges

<1Mbps>

Hopping Mode Low Band Edge Plot	Hopping Mode High Band Edge Plot			
Spectrum         The second secon	Ref Level 30.00 dBm         Offset 24.50 dB         RBW 100 kHz           Att         20 dB         SWT         19 µs         VBW 300 kHz           M1/L         0 dB         WT         19 µs         VBW 300 kHz			
-60 dBm F1 Stop 2.405 GHz	-60 dBm         F1           Start 2.4775 GHz         691 pts			

#### <2Mbps>

Hopping Mode Low Band Edge Plot	Hopping Mode High Band Edge Plot				
Spectrum         Image: Constraint of the sector of t	Spectrum         Image: Constraint of the sector of t				
Att 30 dB SWT 19 µs • VBW 300 kHz Mode Auto FFT     Prk Max	Att SU OB SWI 19 µs VBW SUU KHZ MODE AUTO FFT				
20 dBm	20 dBm M1[1] -33.39 dBm 2.4869910 GHz				
10 dBm	10 dBm				
0 dBm	0, 5.9.0 dbm d'dbm/y				
-10 dBm	-10 dBm				
-30 dBm	-30 dBm // // // // // ///				
40 dBm	40 dBm				
-50 dBm	-50 d8m				
-60 dBm F1	-50 dBm				
Start 2.395 GHz 691 pts Stop 2.405 GHz	Start 2.4775 GHz 691 pts Stop 2.4895 GHz				
Newson (Internet) 4/2	Networks 🗰 👬				
Date: 16.587.2022 11:32:06	Dwnw: 16.8E0.2022 11:42:07				

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FAX : 886-3-327-0855	Issue Date	: Oct. 17, 2022
Report Template No.: BU5-FR15CBT Version 2.4	Report Version	: 01



#### <3Mbps>

Hopping Mode Low Band Edge Plot				Hopping Mode High Band Edge Plot					
Spectrum           Ref Level 30.00 dBm         Offset 23.20 dB           • Att         30 dB         SWT         19 μs           • IPk Max	RBW 100 kHz     VBW 300 kHz     Mode Auto FFT     M1[1]	-33.29 dBm 2.3969460 GHz	Spectrum Ref Level 3 Att 1Pk Max	30.00 dBm Offset 2 30 dB SWT	3.20 dB <b>● RBW</b> 19 µs <b>● VBW</b>	300 kHz Mod	le Auto FFT M1[1]	2	-33.53 dBm 4881190 GHz
20 dBm 10 dBm 0 dBm -10 dBm -10 dBm -20 dBm -20 dBm -30 dBm -50 dBm -50 dBm -50 dBm -50 dBm			20 dBm 10 dBm 0 0 0 0 0 0 0 0 0 0 0 0 0	1 6.160 dem 	Muran				Mt
Start 2.395 GHz	691 pts	A49	Start 2.4775	GHz		F1 691 pts	Measuojino	Stop (AAAAAAA)	2.4895 GHz

# 3.7 Conducted Spurious Emission Measurement

#### 3.7.1 Limit of Spurious Emission Measurement

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

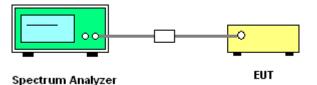
#### 3.7.2 Measuring Instruments

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

#### 3.7.3 Test Procedure

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

#### 3.7.4 Test Setup





# 3.7.5 Test Result of Conducted Spurious Emission

#### <1Mbps>

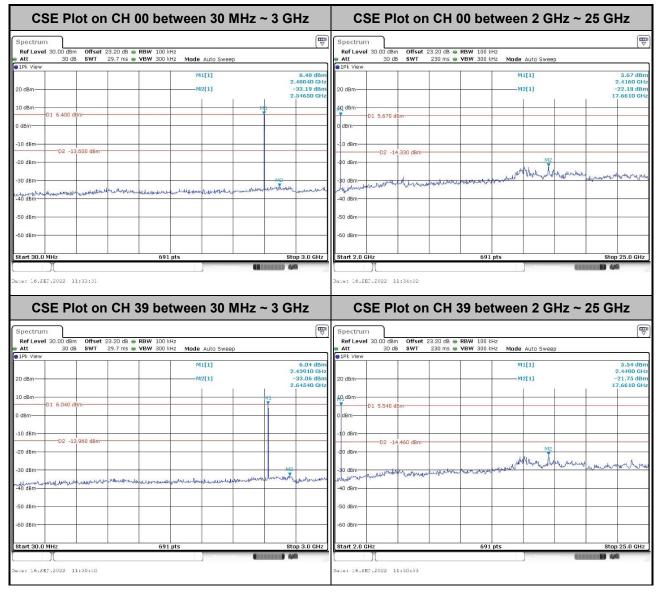
CSE Plot on CH	CSE Plot on CH 00 between 30 MHz ~ 3 GHz			CSE Plot on CH 00 between 2 GHz ~ 25 GHz			
Spectrum			Spectrum		[ Ţ		
	B 👄 RBW 100 kHz Is 🖷 VBW 300 kHz 🛛 Mode Auto Sweep		Ref Level 30.00 dBm Offset Att 20 dB SWT	24.50 dB   RBW 100 kHz 230 ms   VBW 300 kHz  Mode Auto St	weep		
●1Pk View			e 1Pk View				
	M1[1]	8.21 dBm 2.40040 GHz		M1[1]	8.34 dBm 2.4160 GHz		
20 dBm	M2[1]	-43.29 dBm 2.72710 GHz	20 dBm		-39.31 dBm 6.2110 GHz		
10 dBm D1 8.210 dBm		Mi	10 dBm D1 8.340 dBm				
0 dBm-			0 dBm				
o dall			o dom				
-10 dBm D2 -11.790 dBm			-10 dBm-D2 -11.660 dBm-				
-20 dBm			-20 dBm				
-30 dBm-			-30 dBm				
-40 dBm		412			. 184. 6 ul. 6		
by and the second s	the Lupinon hard second shall be a superior and	on a deallow and a hard a start and a start and a start	-50 dBm	e human and and and with the	and a second more and and a second		
-50 UBIN			-50 UBIN				
-60 dBm-			-60 dBm-				
Start 30.0 MHz	691 pts	Stop 3.0 GHz	Start 2.0 GHz	691 pts	Stop 25.0 GHz		
	H 39 between 30 M	1Hz ~ 3 GHz	Date: 15.5ET.2022 10:10:43	n CH 39 between 2	GHz ~ 25 GHz		
Spectrum		1Hz ~ 3 GHz ( ( )	CSE Plot or		GHz ~ 25 GHz (\vec{w}		
CSE Plot on CF	H 39 between 30 M		CSE Plot or Spectrum Ref Level 30.00 dBm Offset Att 30 dB SWT	n CH 39 between 2 23.20 db • RBW 100 kHz 230 ms • VBW 300 kHz Mode Auto St			
CSE Plot on CH	B <b>e RBW</b> 100 kHz	(₩) 8.63 dBm	CSE Plot or	23.20 dB <b>BRBW</b> 100 kHz	veep 7.91 dBm		
CSE Plot on CF	B • RBW 100 kHz S • VBW 300 kHz Mode Auto Sweep	(₩ 8.63 dBm 2.43910 GHz -33.26 dBm	CSE Plot or Spectrum Ref Level 30.00 dBm Offset Att 30 dB SWT	23.20 dB • RBW 100 kHz 230 ms • VBW 300 kHz Mode Auto St	veep 7.91 dBm 2.4400 GHz -24.03 dBm		
CSE Plot on CF	B • RBW 100 kHz • VBW 300 kHz Mode Auto Sweep M1[1]	(₩ ▼ 8.63 dBm 2.43910 GHz	CSE Plot or Spectrum Ref Level 30.00 dBm offset att 30 dB SWT 20 dBm 20 dBm	23.20 dB • RBW 100 kHz 230 ms • VBW 300 kHz Mode Auto St M1[1]	₩eep 7.91 dBm 2.4490 GHz		
CSE Plot on CF           Spectrum           Ref Level 30.00 dbm           Offset 23.20 db           Stat           30 db           Strip           View           20 dbm	B • RBW 100 kHz • VBW 300 kHz Mode Auto Sweep M1[1]	(₩ 8.63 dBm 2.43910 GHz -33.26 dBm	CSE Plot or Spectrum Ref Level 30.00 dBm Offset 30 dB SWT 9 DF View	23.20 dB • RBW 100 kHz 230 ms • VBW 300 kHz Mode Auto St M1[1]	veep 7.91 dBm 2.4400 GHz -24.03 dBm		
CSE Plot on Ch           Spectrum           Ref Level 30.00 dbm         Offset 23.20 db           att 30 db         SWT 29.7 ms           apple View         20 dbm           20 dbm         01.8.630 dbm	B • RBW 100 kHz • VBW 300 kHz Mode Auto Sweep M1[1]	(₩ 8.63 dBm 2.43910 GHz -33.26 dBm	CSE Plot or Ref Level 30.00 dBm Offset Att 30 dB SWT PJPk View 20 dBm	23.20 dB • RBW 100 kHz 230 ms • VBW 300 kHz Mode Auto St M1[1]	veep 7.91 dBm 2.4400 GHz -24.03 dBm		
CSE Plot on CH           Spectrum           Ref Level 30.00 dbm           30 db           91Pk View           20 dbm           10 dbm           01 8.630 dbm	B • RBW 100 kHz • VBW 300 kHz Mode Auto Sweep M1[1]	(₩ 8.63 dBm 2.43910 GHz -33.26 dBm	CSE Plot or Spectrum Ref Level 30.00 dBm Offset att 30.06 sWT DIPL View 20 dBm 01 7.910 dBm 0 dBm	23.20 dB • RBW 100 kHz 230 ms • VBW 300 kHz Mode Auto St M1[1]	veep 7.91 dBm 2.4400 GHz -24.03 dBm		
CSE Plot on CF           Spectrum           Ref Level 30.00 dbm           30 db           910F View           20 dBm           10 dBm           01 8.630 dBm           0 dBm           0 dBm           0 dBm           0 dBm	B • RBW 100 kHz • VBW 300 kHz Mode Auto Sweep M1[1]	(₩ 8.63 dBm 2.43910 GHz -33.26 dBm	Spectrum         Offset           Ref Level 30.00 dBm         Offset           9 Att         30 db         SWT           9 IPL View         20 dBm         01 7.010 dBm           0 dBm         01 7.010 dBm         0 dBm           -10 dBm         -02 -12.090 dBm         -12.090 dBm	23.20 dB • RBW 100 kHz 230 ms • VBW 300 kHz Mode Auto St M1[1]	veep 7.91 dBm 2.4400 GHz -24.03 dBm		
CSE Plot on CH           Spectrum           Ref Level 30.00 dbm           30 db           91Pk View           20 dbm           10 dbm           01 8.630 dbm	B • RBW 100 kHz • VBW 300 kHz Mode Auto Sweep M1[1]	(₩ 8.63 dBm 2.43910 GHz -33.26 dBm	CSE Plot or Spectrum Ref Level 30.00 dBm Offset att 30.06 sWT DIPL View 20 dBm 01 7.910 dBm 0 dBm	23.20 dB • RBW 100 kHz 230 ms • VBW 300 kHz Mode Auto Sv MI[1] MI[1] MI[1]			
CSE Plot on CH           Spectrum           Ref Level 30.00 dbm           30 db           91Pk View           20 dBm           10 dBm           01 8.630 dBm           0 dBm	B • RBW 100 kHz • VBW 300 kHz Mode Auto Sweep M1[1]	€.63 dBm 2.4910 GHz -33.26 dBm 2.64540 GHz 11 MC	Spectrum         Offset           Ref Level 30.00 dBm         Offset           9 Att         30 dB         SWT           9 IPL View         20 dBm         0           40 dBm         01 7.910 dBm         0           -10 dBm         -02 -12.090 dBm         -20 dBm	23.20 dB   RBW 100 kHz 230 ms VBW 300 kHz Mode Auto Sv M1[1] M2[1]	veep 7.91 dbm 2.4490 dt∔ -24.03 dbm		
CSE Plot on CH           Spectrum           Ref Level 30.00 dbm           0 db           91PL View           20 dbm           10 dbm           01 8.630 dbm           00 dbm           00 dbm           00 dbm           00 dbm           00 dbm           01 8.630 dbm           00 dbm	B • RBW 100 KHz S • VBW 300 KHz Mode Auto Sweep M1[1] 	(₩ 8.63 dBm 2.43910 GHz -33.26 dBm	CSE Plot or           Spectrum           Ref Level 30.00 dBm           9 dB           9 1Pk View           20 dBm           10 dBm           01 7.910 dBm           0 dBm           10 dBm           0 dBm           20 dBm           0 dBm           10 dBm           -10 dBm           -20 dBm           -30 dBm	23.20 dB   RBW 100 kHz 230 ms VBW 300 kHz Mode Auto Sv M1[1] M2[1]	veep 7.91 dbm 2.4490 GHz -24.03 dbm 15.9970 GHz		
CSE Plot on CH           Spectrum           RefLevel 30.00 dbm           Att           30 db           SWT           29,7 ms           JDR. View           20 dbm           10.dbm           01 8.630 dbm           20 dbm           10.dbm           02 -11.370 dbm           20 dbm	8 • RBW 100 HH2 s • VBW 300 HH2 Mode Auto Sweep M1[1] 	8.63 dBm 2.4910 GHz -33.26 dBm 2.64540 GHz M1	Spectrum         Offset           Ref Level 30.00 dBm         Offset           9 Att         30 dB         SWT           9 IPL View         20 dBm         0           40 dBm         01 7.910 dBm         0           -10 dBm         -02 -12.090 dBm         -20 dBm	23.20 dB   RBW 100 kHz 230 ms VBW 300 kHz Mode Auto Sv M1[1] M2[1]	veep 7.91 dbm 2.4490 GHz -24.03 dbm 15.9970 GHz		
CSE Plot on CH           Spectrum           RefLevel 30.00 dbm           0 dbm           0 dbm           20 dbm           10 dbm           01 8.630 dbm           20 dbm           20 dbm           10 dbm           02 - 11.370 dbm           20 dbm	8 • RBW 100 HH2 s • VBW 300 HH2 Mode Auto Sweep M1[1] 	8.63 dBm 2.4910 GHz -33.26 dBm 2.64540 GHz M1	CSE Plot or           Spectrum           Ref Level 30.00 dBm           9 dB           9 1Pk View           20 dBm           10 dBm           01 7.910 dBm           0 dBm           10 dBm           0 dBm           20 dBm           0 dBm           10 dBm           -10 dBm           -20 dBm           -30 dBm	23.20 dB   RBW 100 kHz 230 ms VBW 300 kHz Mode Auto Sv M1[1] M2[1]	Veep 7.91 dBm 2.4490 GHz -24.03 dBm 15.0970 GHz		
CSE Plot on Ch           Spectrum           Ref Level 30.00 dbm           30 db           90 dbm           10 dbm           01 8.630 dbm           0 dbm           20 dbm           10 dbm           02 -11.370 dbm           20 dbm           50 dbm           50 dbm	8 • RBW 100 HH2 s • VBW 300 HH2 Mode Auto Sweep M1[1] 	8.63 dBm 2.4910 GHz -33.26 dBm 2.64540 GHz M1	CSE Plot or           Spectrum           Ref Level 30.00 dBm           9 JPk View           20 dBm           10 dBm           0 dBm           -10 dBm           -20 dBm           -30 dBm           -30 dBm           -30 dBm           -50 dBm	23.20 dB   RBW 100 kHz 230 ms VBW 300 kHz Mode Auto Sv M1[1] M2[1]			
CSE Plot on CH           Spectrum           Ref Level 30.00 dbm           30.db           91PF View           20 dBm           10 dBm           01 8.630 dbm           10 dBm           02 -11.370 dBm           20 dBm	8 • RBW 100 HH2 s • VBW 300 HH2 Mode Auto Sweep M1[1] 	8.63 dBm 2.4910 GHz -33.26 dBm 2.64540 GHz M1	CSE Plot or           Spectrum           Ref Level 30.00 dBm         Offset           • Att         30 db         SWT           • DPk View         20 dBm         0           • D dBm         01 7.910 dBm         0           • D dBm         02 -12.090 dBm           • -20 dBm         -30 dBm         -40 dBm	23.20 dB   RBW 100 kHz 230 ms VBW 300 kHz Mode Auto Sv M1[1] M2[1]			
CSE Plot on Ch           Spectrum           Ref Level 30.00 dBm           30 dB           SWT           29,7 ms           30 dB           30 dB           SWT           29,7 ms           30 dB           SWT           29,7 ms           30 dB           30 dB           0 dBm           10 dBm           01 8,630 dBm           0 dBm           -20 dBm           -30 dBm           -30 dBm           -50 dBm	8 • RBW 100 HH2 s • VBW 300 HH2 Mode Auto Sweep M1[1] 	8.63 dBm 2.4910 GHz -33.26 dBm 2.64540 GHz M1	CSE Plot or           Spectrum           Ref Level 30.00 dBm           9 JPk View           20 dBm           10 dBm           0 dBm           -10 dBm           -20 dBm           -30 dBm           -30 dBm           -30 dBm           -50 dBm	23.20 dB   RBW 100 kHz 230 ms VBW 300 kHz Mode Auto Sv M1[1] M2[1]			
CSE Plot on CH           Spectrum           Ref Level 30.00 dbm         Offset 23.20 db           Jab db         SWT         29.7 mc           Jab db         Jab db         SWT           Jab db         Ol 8.630 dbm         Jab db           Jab db         Ol 8.630 dbm         Jab db	B RBW 100 KHz S VBW 300 KHz MI[1] MI	8.63 dBm 2.4910 GHz -33.26 dBm 2.64540 GHz //1	CSE Plot or           Spectrum           Ref Level 30.00 dBm           offset           • Att           • DPk View           • D dBm           • D dBm	23.20 dB • RBW 100 kHz 230 ms • VBW 300 kHz Mode Auto Sv MI[1] M2[1]	veep 7.91 dBn 2.490 GH 15.8970 GH 15.8970 GH		



CSE Plot on CH 78 bet	ween 30 MHz ~ 3 (	GHz CS	E Plot on CH 7	8 between 2 0	GHz ~ 25 GHz
Spectrum           Ref Level 30.00 dBm         Offset 23.20 dB         RBW 100 kH           Att         30 dB         SWT         29.7 ms         VBW 300 kH		Ref Level	30.00 dBm Offset 23.20 dB	XBW 100 kHz XBW 300 kHz Mode Auto Sw	een
	M1[1] M2[1]	0 dBm	-02 -12,360 dBm	M1[1] M2[1]	7.64 dBm 2.4890 CHz -22.21 dBm 17.6610 GHz
Start 30.0 MHz 691 g	nts		Hz 5.2022 10:52:02	691 pts	Stop 25.0 GHz



#### <2Mbps>

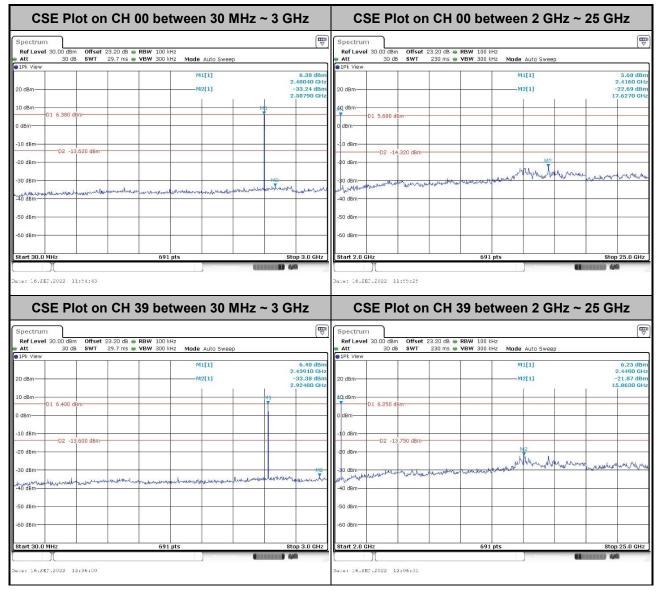




CSE Plot on CH 78 betweer	30 MHz ~ 3 GHz	CSE Plot on	CH 78 between 2 0	GHz ~ 25 GHz
e 1Pk View	Auto Sweep	Spectrum Ref Level 30.00 dBm Offset 3 Att 30 dB SWT P1Pk View	23.20 dB • RBW 100 kHz 230 ms • VBW 300 kHz Mode Auto Sw	*
20 dBm         M1           10 dBm         01 6.070 dBm           0 dBm         01 6.070 dBm           -10 dBm         0           -20 dBm         00 dBm           -30 dBm         00 dBm	2.51220 GHz	20 dBm 01 5.460 dBm 0 1 5.460 dBm 0 dBm 0 dBm 0 1 5.460 dBm 0 2 -14 540 dBm 0 2 -14 540 dBm 0 2 -10 dB	. Mar.	5.46 dBn 2.480 CH2 -22.23 dBn 17.6270 CH2 17.6270 CH2
40 dBm	Stop 3.0 GHz	-40 dBm-	691 pts	Stop 25.0 GHz



#### <3Mbps>





CSE Plot on CH	78 between 30 MHz	z ~ 3 GHz	CSE Plo	t on CH 78 b	etween 2 GH	z ~ 25 GHz
Spectrum           Ref Level 30.00 dBm         Offset 23.20 dB           Att         30 dB         SWT         29.7 ms           IPk View         State         30 dB         SWT         29.7 ms	VBW 300 kHz Mode Auto Sweep			Offset 23.20 dB   RBW 10 SWT 230 ms   VBW 30	00 kHz Mode Auto Sweep	
20 dBm 10 dBm 01 5.760 dBm 0 dBm -10 dBm -20 dBm -20 dBm -20 dBm -30 dBm -30 dBm -50 dBm	M1[1] M2	2.50360 GHz	20 dBm 20 dBm 0 dBm 10 dBm -10 dBm -20 dBm -20 dBm -20 dBm -30 dBm -50 dBm -40 dBm		MI[1] 	1,72 dbm 2,480 dHz -22,49 dbm 17,6270 dHz 17,6270 dHz 17,6270 dHz 17,6270 dHz
-60 dBm	691 pts		-60 dBm		i91 pts	Stop 25.0 GHz

# 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

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



## 3.8.3 Test Procedures

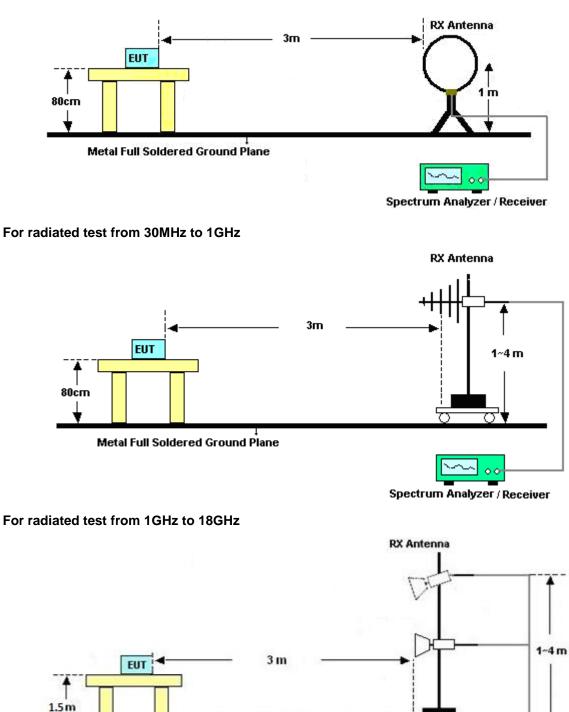
- 1. The EUT is placed on a turntable with 0.8 meter for frequency below 1 GHz and 1.5 meter for frequency above 1 GHz respectively above ground.
- 2. The EUT is set 3 meters away from the receiving antenna, which is mounted on the top of a variable height antenna tower.
- 3. For each suspected emission,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

Note: The average levels are 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 test below 30MHz

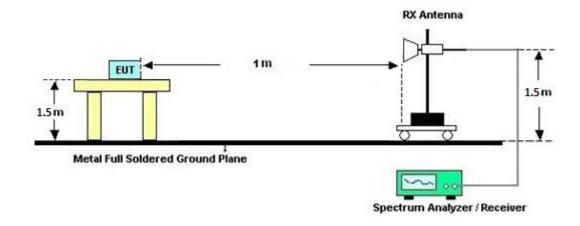


Metal Full Soldered Ground Plane

Spectrum Analyzer / Receiver



#### For radiated test above 18GHz



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

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

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

## 3.8.6 Test Result of Radiated Spurious at Band Edges

Please refer to Appendix C and D.

### 3.8.7 Duty Cycle

Please refer to Appendix E.

# 3.8.8 Test Result of Radiated Spurious Emission (30MHz ~ 10<sup>th</sup> Harmonic)

Please refer to Appendix C and D.



# 3.9 AC Conducted Emission Measurement

## 3.9.1 Limit of AC Conducted Emission

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

Frequency of emission (MHz)	Conducted	limit (dBµV)
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

\*Decreases with the logarithm of the frequency.

### 3.9.2 Measuring Instruments

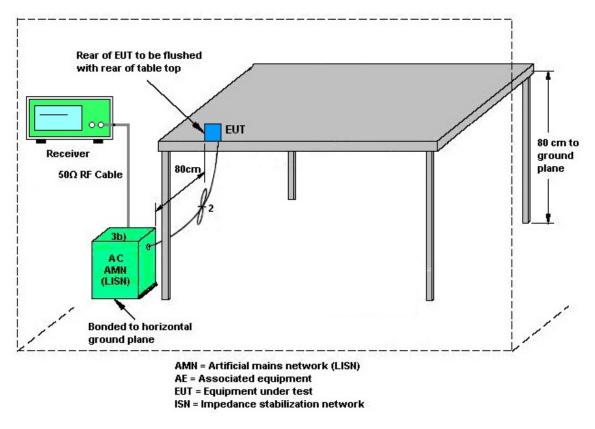
Please refer to the measuring equipment list in this test report.

## 3.9.3 Test Procedures

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



# 3.9.4 Test Setup



# 3.9.5 Test Result of AC Conducted Emission

Please refer to Appendix B.



# 3.10 Antenna Requirements

# 3.10.1 Standard Applicable

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

# 3.10.2 Antenna Anti-Replacement Construction

An embedded-in antenna design is used.



# 4 List of Measuring Equipment

Instrument	Brand Name	Model No.	Serial No.	Characteristics	Calibration Date	Test Date	Due Date	Remark
AC Power Source	ChainTek	APC-1000W	N/A	N/A	N/A	Sep. 07, 2022	N/A	Conduction (CO05-HY)
EMI Test Receiver	Rohde & Schwarz	ESR3	102388	9kHz~3.6GHz	Dec. 01, 2021	Sep. 07, 2022	Nov. 30, 2022	Conduction (CO05-HY)
Hygrometer	Testo	608-H1	34913912	N/A	Nov. 17, 2021	Sep. 07, 2022	Nov. 16, 2022	Conduction (CO05-HY)
LISN	Rohde & Schwarz	ENV216	100081	9kHz~30MHz	Nov. 16, 2021	Sep. 07, 2022	Nov. 15, 2022	Conduction (CO05-HY)
Software	Rohde & Schwarz	EMC32	N/A	N/A	N/A	Sep. 07, 2022	N/A	Conduction (CO05-HY)
Pulse Limiter	SCHWARZBE CK	VTSD 9561-F N	00691	N/A	Aug. 01, 2022	Sep. 07, 2022	Jul. 31, 2023	Conduction (CO05-HY)
LISN Cable	MVE	RG-400	260260	N/A	Dec. 30, 2021	Sep. 07, 2022	Dec. 29, 2022	Conduction (CO05-HY)
EMI Test Receicver	Keysight	N9010B	MY60240520	10Hz~44GHz	Dec. 23, 2021	Sep. 22, 2022~ Oct. 03, 2022	Dec. 22, 2022	Radiation (03CH20-HY)
Preamplifier	COM-POWER	PAM-103	18020201	1MHz-1000MHz	Jan. 03, 2022	Sep. 22, 2022~ Oct. 03, 2022	Jan. 02, 2023	Radiation (03CH20-HY)
Amplifier	EMCI	EMC118A45SE	980792	N/A	Nov. 15, 2021	Sep. 22, 2022~ Oct. 03, 2022	Nov. 14, 2022	Radiation (03CH20-HY)
Preamplifier	EMEC	EM18G40G	060801	18GHz~40GHz	Jun. 28, 2022	Sep. 22, 2022~ Oct. 03, 2022	Jun. 27, 2023	Radiation (03CH20-HY)
Loop Antenna	Rohde & Schwarz	HFH2-Z2	100315	9 kHz~30 MHz	Jan. 07, 2022	Sep. 22, 2022~ Oct. 03, 2022	Jan. 06, 2023	Radiation (03CH20-HY)
Bilog Antenna	TESEQ	CBL 6111D&00802N 1D01N-06	55606 & 08	30MHz~1GHz	Oct. 17, 2021	Sep. 22, 2022~ Oct. 03, 2022	Oct. 16, 2022	Radiation (03CH20-HY)
Horn Antenna	SCHWARZBE CK	BBHA 9120 D	02360	1GHz~18GHz	Nov. 02, 2021	Sep. 22, 2022~ Oct. 03, 2022	Nov. 01, 2022	Radiation (03CH20-HY)
SHF-EHF Horn Antenna	SCHWARZBE CK	BBHA9170	00994	18GHz-40GHz	Nov. 04, 2021	Sep. 22, 2022~ Oct. 03, 2022	Nov. 03, 2022	Radiation (03CH20-HY)
Hygrometer	TECPEL	DTM-303B	TP140325	N/A	Aug. 15, 2022	Sep. 22, 2022~ Oct. 03, 2022	Aug. 14, 2023	Radiation (03CH20-HY)
RF Cable	HUBER + SUHNER	SUCOFLEX 102	519229/2,8040 15/2,804027/2	N/A	Jan. 19, 2022	Sep. 22, 2022~ Oct. 03, 2022	Jan. 18, 2023	Radiation (03CH20-HY)
Software	Audix	E3 6.2009-8-24	RK-002156	N/A	N/A	Sep. 22, 2022~ Oct. 03, 2022	N/A	Radiation (03CH20-HY)
Antenna Mast	EMEC	AM-BS-4500-B	N/A	1m~4m	N/A	Sep. 22, 2022~ Oct. 03, 2022	N/A	Radiation (03CH20-HY)
Turn Table	EMEC	TT2000	N/A	0~360 Degree	N/A	Sep. 22, 2022~ Oct. 03, 2022	N/A	Radiation (03CH20-HY)
Controller	EMEC	EM1000	N/A	Control Turn table & Ant Mast	N/A	Sep. 22, 2022~ Oct. 03, 2022	N/A	Radiation (03CH20-HY)



Instrument	Brand Name	Model No.	Serial No.	Characteristics	Calibration Date	Test Date	Due Date	Remark
Hygrometer	TECPEL	DTM-303A	TP201996	N/A	Nov. 16, 2021	Sep. 08, 2022~ Sep. 16, 2022	Nov. 15, 2022	Conducted (TH05-HY)
Power Meter	Anritsu	ML2495A	0932001	N/A	Sep. 30, 2021	Sep. 08, 2022~ Sep. 16, 2022	Sep. 29, 2022	Conducted (TH05-HY)
Power Sensor	Anritsu	MA2411B	0846202	300MHz~40GHz	Sep. 30, 2021	Sep. 08, 2022~ Sep. 16, 2022	Sep. 29, 2022	Conducted (TH05-HY)
Power Sensor	DARE	RPR3006W	15I00041SNO 10 (NO:248)	10MHz~6GHz	Dec. 29, 2021	Sep. 08, 2022~ Sep. 16, 2022	Dec. 28, 2022	Conducted (TH05-HY)
Signal Analyzer	Rohde & Schwarz	FSV40	101905	10Hz - 40GHz	Aug. 03, 2022	Sep. 08, 2022~ Sep. 16, 2022	Aug. 02, 2023	Conducted (TH05-HY)



# 5 Uncertainty of Evaluation

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

Measuring Uncertainty for a Level of Confidence	3.1 dB
of 95% (U = 2Uc(y))	3. I UB

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

Measuring Uncertainty for a Level of Confidence	5.9 dB
of 95% (U = 2Uc(y))	5.9 UB

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

Measuring Uncertainty for a Level of Confidence	5.2 dB
of 95% (U = 2Uc(y))	5.2 00

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

Measuring Uncertainty for a Level of Confidence	5.7 dB
of 95% (U = 2Uc(y))	

Report Number : FR270404

# Appendix A. Test Result of Conducted Test Items

Test Engineer:	ERIC WU	Temperature:	21~25	°C
Test Date:	2022/9/8-2022/9/16	Relative Humidity:	51~54	%

			20dB	and 99	% Occup	-	<u>SULTS DATA</u> Ith and Hopping	Channel Separ	ation
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	0.846	0.802	0.999	0.5643	Pass
DH	1Mbps	1	39	2441	0.872	0.799	0.999	0.5816	Pass
DH	1Mbps	1	78	2480	0.870	0.805	0.999	0.5797	Pass
2DH	2Mbps	1	0	2402	1.257	1.178	0.999 0.8377		Pass
2DH	2Mbps	1	39	2441	1.274	1.178	1.003	0.8493	Pass
2DH	2Mbps	1	78	2480	1.257	1.178	1.003	0.8377	Pass
3DH	3Mbps	1	0	2402	1.230	1.161	0.999	0.8203	Pass
3DH	3Mbps	1	39	2441	1.248	1.164	1.003	0.8319	Pass
3DH	3Mbps	1	78	2480	1.252	1.164	1.003	0.8348	Pass

	<u>TEST RESULTS DATA</u> Dwell Time								
	Mod.	Hopping Channel Number Rate		•	Dwell Time (sec)	Limits (sec)	Pass/Fail		
ſ	DH5	79	106.670	2.88	0.31	0.4	Pass		
ľ	DH5 (AFH)	20	53.330	2.88	0.15	0.4	Pass		

	<u>TEST RESULTS DATA</u> Peak Power Table									
DH	CH.	NTX	Peak Power (dBm)	Power Limit (dBm)	Test Result	Setting				
	0	1	9.45	30.00	Pass					
DH1	39	1	9.35	30.00	Pass	9.0				
	78	1	9.22	30.00	Pass					
	0	1	8.56	20.97	Pass					
2DH1	39	1	8.48	20.97	Pass	9.0				
	78	1	8.32	20.97	Pass					
	0	1	8.76	20.97	Pass					
3DH1	39	1	8.67	20.97	Pass	9.0				
	78	1	8.50	20.97	Pass					

				Ave	TEST RESULTS DATA Average Power Table (Reporting Only)											
DH	CH.	NTX	Average Power (dBm)	Duty Factor (dB)												
	0	1	9.24	5.25												
DH1	39	1	9.12	5.25												
	78	1	8.99	5.25												
	0	1	7.09	5.15												
2DH1	39	1	7.03	5.15												
	78	1	6.83	5.15												
	0	1	7.10	5.15												
3DH1	39	1	7.03	5.15												
	78	1	6.85	5.15												

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

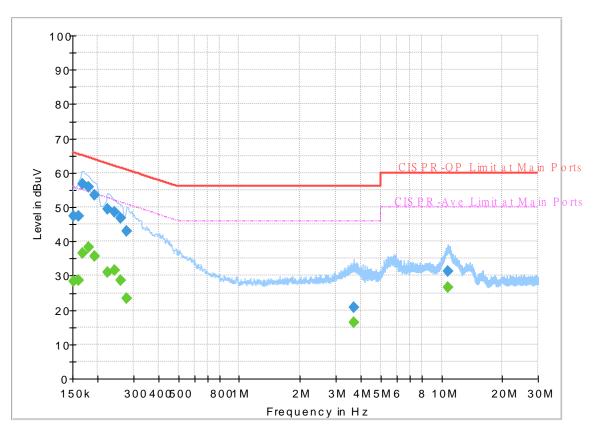


# Appendix B. AC Conducted Emission Test Results

Toot Engineer	Tom Loo	Temperature :	<b>23~26</b> ℃
Test Engineer :	Tom Lee	Relative Humidity :	45~55%

# **EUT Information**

Report NO : Test Mode : Test Voltage : Phase : 270404 Mode 1 120Vac/60Hz Line



#### FullSpectrum

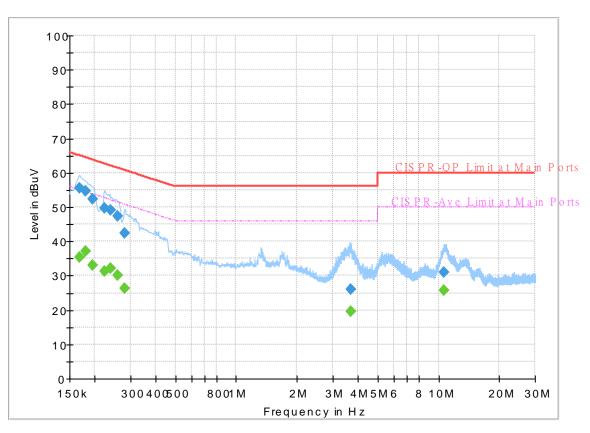
# Final\_Result

Frequency	QuasiPeak	CAverage	Limit	Margin	Line	Filter	Corr.
(MHz)	(dBuV)	(dBuV)	(dBuV)	(dB)			(dB)
0.152250		28.47	55.88	27.41	L1	OFF	19.8
0.152250	47.32		65.88	18.56	L1	OFF	19.8
0.161250		28.79	55.40	26.61	L1	OFF	19.8
0.161250	47.50		65.40	17.90	L1	OFF	19.8
0.168000		36.50	55.06	18.56	L1	OFF	19.8
0.168000	56.64		65.06	8.42	L1	OFF	19.8
0.179250		38.38	54.52	16.14	L1	OFF	19.8
0.179250	55.95		64.52	8.57	L1	OFF	19.8
0.192750		35.61	53.92	18.31	L1	OFF	19.8
0.192750	53.50		63.92	10.42	L1	OFF	19.8
0.224250		30.96	52.66	21.70	L1	OFF	19.8
0.224250	49.49		62.66	13.17	L1	OFF	19.8
0.242250		31.56	52.02	20.46	L1	OFF	19.8
0.242250	48.65		62.02	13.37	L1	OFF	19.8
0.260250		28.67	51.42	22.75	L1	OFF	19.8
0.260250	46.64		61.42	14.78	L1	OFF	19.8
0.278250		23.42	50.87	27.45	L1	OFF	19.8
0.278250	42.88		60.87	17.99	L1	OFF	19.8
3.689250		16.42	46.00	29.58	L1	OFF	19.8
3.689250	20.74		56.00	35.26	L1	OFF	19.8
10.738500		26.59	50.00	23.41	L1	OFF	20.0

10.738500	31.27		60.00	28.73	L1	OFF	20.0
-----------	-------	--	-------	-------	----	-----	------

# **EUT Information**

Report NO : Test Mode : Test Voltage : Phase : 270404 Mode 1 120Vac/60Hz Neutral



#### Full Spectrum

# Final\_Result

Frequency (MHz)	QuasiPeak (dBuV)	CAverage (dBuV)	Limit (dBuV)	Margin (dB)	Line	Filter	Corr. (dB)
0.168000		35.50	55.06	19.56	N	OFF	19.8
0.168000	55.46		65.06	9.60	Ν	OFF	19.8
0.179250		37.23	54.52	17.29	Ν	OFF	19.8
0.179250	54.76		64.52	9.76	Ν	OFF	19.8
0.195000		33.03	53.82	20.79	Ν	OFF	19.8
0.195000	52.26		63.82	11.56	Ν	OFF	19.8
0.224250		31.33	52.66	21.33	Ν	OFF	19.8
0.224250	49.69		62.66	12.97	Ν	OFF	19.8
0.240000		32.10	52.10	20.00	Ν	OFF	19.8
0.240000	49.23		62.10	12.87	Ν	OFF	19.8
0.258000		30.20	51.50	21.30	Ν	OFF	19.8
0.258000	47.41		61.50	14.09	Ν	OFF	19.8
0.280500		26.28	50.80	24.52	Ν	OFF	19.8
0.280500	42.48		60.80	18.32	Ν	OFF	19.8
3.684750		19.70	46.00	26.30	Ν	OFF	19.8
3.684750	26.15		56.00	29.85	Ν	OFF	19.8
10.686750		25.85	50.00	24.15	Ν	OFF	20.0
10.686750	30.86		60.00	29.14	Ν	OFF	20.0



# Appendix C. Radiated Spurious Emission

Test Engineer :	JC Liang and Leo Li	Temperature :	18~20°C
rest Engineer .		Relative Humidity :	66~70%

<Sample 1 >

#### 2.4GHz 2400~2483.5MHz

				E	BT (Band B	Edge @	3m)						
BT	Note	Frequency	Level	Over	Limit	Read	Antenna	Path	Preamp	Ant	Table	Peak	Pol.
				Limit	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)
	*	2480	104.66	-	-	104.53	27.62	8.82	36.31	146	243	Ρ	н
	*	2480	79.87	-	-	-	-	-	-	-	-	А	Н
		2483.52	49.94	-24.06	74	49.79	27.63	8.83	36.31	146	243	Ρ	Н
		2483.52	25.15	-28.85	54	-	-	-	-	-	-	А	Н
													Н
ВТ СН 78													Н
2480MHz	*	2480	101.26	-	-	101.13	27.62	8.82	36.31	310	101	Р	V
	*	2480	76.47	-	-	-	-	-	-	-	-	А	V
		2483.56	46.09	-27.91	74	45.94	27.63	8.83	36.31	310	101	Р	V
		2483.56	21.3	-32.7	54	-	-	-	-	-	-	Α	V
													V
													V
Remark		o other spurious results are PA		eak and	Average lim	it line.							



### 2.4GHz 2400~2483.5MHz

BT (Harmonic @ 3m)												ſ	-
ВТ	Note	Frequency	Level	Over	Limit	Read	Antenna	Path	Preamp	Ant	Table	Peak	Pol.
				Limit	Line	Level	Factor	Loss	Factor	Pos	Pos	Avg.	
		(MHz)	(dBµV/m)	( dB )	(dBµV/m)		(dB/m)	( dB )	(dB)	( cm )	(deg)	(P/A)	-
		4960	43.84	-30.16	74	35.53	32.94	13.03	37.66	-	-	Ρ	Н
		4960	19.05	-34.95	54	-	-	-	-	-	-	Α	Н
		7440	47.54	-26.46	74	33.74	36.52	15.91	38.63	-	-	Ρ	Н
		7440	22.75	-31.25	54	-	-	-	-	-	-	А	Н
													Н
													Н
													Н
													Н
													Н
													Н
													Н
BT													Н
CH 78		4960	44.95	-29.05	74	36.64	32.94	13.03	37.66	-	-	Р	V
2480MHz		4960	20.16	-33.84	54	-	-	-	-	-	-	А	V
		7440	47.22	-26.78	74	33.42	36.52	15.91	38.63	-	-	Р	V
		7440	22.43	-31.57	54	-	-	-	-	-	-	А	V
													V
													V
													V
													V
													V
													V
													V
													V
	1. No	o other spurious	s found.										•
	<ol> <li>No other spurious found.</li> <li>All results are PASS against Peak and Average limit line.</li> </ol>												
Remark		e emission pos					ission found	d with suf	ficient mar	gin agai	inst limit	line or	noise
		or only.				-				- 0			
	1	-											



## <Sample 2 >

#### 2.4GHz 2400~2483.5MHz

# BT (Band Edge @ 3m)

ВТ	Note	Frequency	Level	Over	Limit	Read	Antenna	Path	Preamp	Ant	Table	Peak	Pol.
				Limit	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)
		2380.455	42.87	-31.13	74	43.29	27.22	8.63	36.27	305	113	Ρ	Н
		2380.455	18.08	-35.92	54	-	-	-	-	-	-	А	Н
	*	2402	104.43	-	-	104.73	27.31	8.67	36.28	305	113	Ρ	Н
	*	2402	79.64	-	-	-	-	-	-	-	-	А	Н
BT CH00													н
		2388.54	39.88	-34.12	74	40.25	27.25	8.65	36.27	308	106	Р	H V
2402MHz		2388.54	15.09	-38.91	54	-	-	-	-	-	-	А	V
	*	2402	101.31	-	-	101.61	27.31	8.67	36.28	308	106	Ρ	V
	*	2402	76.52	-	-	-	-	-	-	-	-	А	V
													V
		2332.54	39.55	-34.45	74	40.15	27.1	8.55	36.25	303	113	Р	V H
		2332.54	14.76	-39.24	54	-	-	-	-	-	-	A	н
	*	2441	104.43	-	-	104.51	27.46	8.75	36.29	303	113	Р	Н
	*	2441	79.64	-	-	-	-	-	-	-	-	А	н
		2491.88	40.89	-33.11	74	40.7	27.67	8.84	36.32	303	113	Ρ	Н
ВТ СН 39		2491.88	16.1	-37.9	54	-	-	-	-	-	-	А	Н
сп зэ 2441MHz		2321.9	41.45	-32.55	74	42.06	27.1	8.53	36.24	308	106	Ρ	V
244110112		2321.9	16.66	-37.34	54	-	-	I	-	-	-	А	V
	*	2441	102.34	-	-	102.42	27.46	8.75	36.29	308	106	Ρ	V
	*	2441	77.55	-	-	-	-	-	-	-	-	А	V
		2491.25	39.77	-34.23	74	39.58	27.67	8.84	36.32	308	106	Р	V
		2491.25	14.98	-39.02	54	-	-	-	-	-	-	А	V



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	*	2480	105.3	-	-	105.17	27.62	8.82	36.31	300	108	Р	Н	
	*	2480	80.51	-	-	-	-	-	-	-	-	А	Н	
		2483.68	54.19	-19.81	74	54.04	27.63	8.83	36.31	300	108	Ρ	Н	
		2483.68	29.4	-24.6	54	-	-	-	-	-	-	А	Н	
DT													Н	
ВТ СН 78													н	
2480MHz	*	2480	103.13	-	-	103	27.62	8.82	36.31	300	100	Р	V	
2400111172	*	2480	78.34	-	-	-	-	-	-	-	-	А	V	
		2483.64	52.35	-21.65	74	52.2	27.63	8.83	36.31	300	100	Р	V	
		2483.64	27.56	-26.44	54	-	-	-	-	-	-	А	V	
													V	
													V	
Remark	<ol> <li>No other spurious found.</li> <li>All results are PASS against Peak and Average limit line.</li> </ol>													





#### 2.4GHz 2400~2483.5MHz

	Г			•	or (⊓armo			F	F	F	F	1	r
BT	Note	Frequency	Level	Over	Limit	Read	Antenna	Path	Preamp	Ant	Table	Peak	Pol.
				Limit	Line	Level	Factor	Loss	Factor	Pos	Pos	Avg.	
		(MHz)	( dBµV/m )		( dBµV/m )	(dBµV)	(dB/m)	( dB )	(dB)	( cm )	(deg)		
		4804	42.84	-31.16	74	34.93	32.4	13.05	37.54	-	-	Р	Н
		4804	18.05	-35.95	54	-	-	-	-	-	-	А	Н
													Н
													Н
													Н
													Н
													Н
													Н
ВТ СН 00													Н
													Н
													H
		4804	44.17	-29.83	74	36.26	32.4	13.05	37.54	-	-	Р	H V
2402MHz		4804	19.38	-34.62	54	-	-	-	-	-	_	A	V
													V
													V
													V
													V
													V
													V
													V
													V
													V
													V

#### BT (Harmonic @ 3m)



#### Report No. : FR270404A

ВТ	Note	Frequency	Level	Over	Limit	Read	Antenna	Path	Preamp	Ant	Table	Peak	Pol.
		(MHz)	(dBµV/m)	Limit (dB)	Line ( dBµV/m )	Level (dBµV)	Factor (dB/m)	Loss (dB)	Factor (dB)	Pos ( cm )	Pos (deg)	Avg. (P/A)	(H/V)
		4882	42.9	-31.1	74	34.93	32.53	13.04	37.6	-	-	P	Н
		4882	18.11	-35.89	54	-	-	-	-	-	-	Α	Н
		7323	47.31	-26.69	74	33.06	36.9	15.88	38.53	-	-	Р	Н
		7323	22.52	-31.48	54	-	-	-	-	-	-	А	Н
													Н
													Н
													Н
													Н
													Н
													Н
вт													Н
CH 39													Н
2441MHz		4882	44.35	-29.65	74	36.38	32.53	13.04	37.6	-	-	Р	V
		4882	19.56	-34.44	54	-	-	-	-	-	-	A	V
		7323	47.47	-26.53	74	33.22	36.9	15.88	38.53	-	-	Р	V
		7323	22.68	-31.32	54	-	-	-	-	-	-	Α	V
													V
													V
													V
													V
													V
													V
													V
													V



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BT         (MHz)         Limit (dB)//m         Line (dB)//m         Level (dB/m)         Factor (dB/m)         Loss (dB)         Factor (dB/m)         Pos (dB)         Pos (dB)           4960         44.5         -29.5         74         36.19         32.94         13.03         37.66         -           4960         19.71         -34.29         54         - <t< th=""><th>Peak P</th><th>Table</th><th>Ant</th><th>Preamp</th><th>Path</th><th>Antenna</th><th>Read</th><th>Limit</th><th>Over</th><th>Level</th><th>Frequency</th><th>Note</th><th>BT</th></t<>	Peak P	Table	Ant	Preamp	Path	Antenna	Read	Limit	Over	Level	Frequency	Note	BT
BT         4960         44.5         -29.5         74         36.19         32.94         13.03         37.66         -         -           4960         19.71         -34.29         54         -	Avg.	1	Pos	Factor	Loss	Factor	Level	Line	Limit				
BT         4960         19.71         -34.29         54         -	(P/A) (H	(deg)	( cm )	(dB)	( dB )	( dB/m )	( $dB\mu V$ )	( dBµV/m )	( dB )	( dBµV/m )	(MHz)		
BT         T440         46.11         -27.89         74         32.31         36.52         15.91         38.63         -         -           Image: Second S	P ł	-	-	37.66	13.03	32.94	36.19	74	-29.5	44.5	4960		
BT         T440         21.32         -32.68         54         -	A ł	-	-	-	-	-	-	54	-34.29	19.71	4960		
BT         H         H         I	Ρŀ	-	-	38.63	15.91	36.52	32.31	74	-27.89	46.11	7440		
CH 78         4960         43.89         -30.11         74         35.58         32.94         13.03         37.66         -         -           4960         19.1         -34.9         54         - </td <td>A ł</td> <td>-</td> <td>-</td> <td>-</td> <td>-</td> <td>-</td> <td>-</td> <td>54</td> <td>-32.68</td> <td>21.32</td> <td>7440</td> <td></td> <td></td>	A ł	-	-	-	-	-	-	54	-32.68	21.32	7440		
CH 78         4960         43.89         -30.11         74         35.58         32.94         13.03         37.66         -         -           2480MHz         4960         19.1         -34.9         54         -         <	ł												
CH 78         4960         43.89         -30.11         74         35.58         32.94         13.03         37.66         -         -           2480MHz         4960         19.1         -34.9         54         -         <	ł												
CH 78         4960         43.89         -30.11         74         35.58         32.94         13.03         37.66         -         -           2480MHz         4960         19.1         -34.9         54         -         <	ł												
CH 78         4960         43.89         -30.11         74         35.58         32.94         13.03         37.66         -         -           4960         19.1         -34.9         54         - </td <td>ŀ</td> <td></td> <td> </td> <td></td> <td></td> <td></td> <td></td> <td></td> <td> </td> <td></td> <td></td> <td></td> <td></td>	ŀ												
CH 78         4960         43.89         -30.11         74         35.58         32.94         13.03         37.66         -         -           4960         19.1         -34.9         54         - </td <td>ŀ</td> <td></td> <td>  </td> <td></td> <td></td> <td></td> <td></td> <td></td> <td> </td> <td></td> <td></td> <td></td> <td></td>	ŀ												
CH 78         4960         43.89         -30.11         74         35.58         32.94         13.03         37.66         -         -           4960         19.1         -34.9         54         - </td <td>ŀ</td> <td></td> <td>  </td> <td></td> <td></td> <td></td> <td></td> <td></td> <td> </td> <td></td> <td></td> <td></td> <td></td>	ŀ												
CH 78         4960         43.89         -30.11         74         35.58         32.94         13.03         37.66         -         -           2480MHz         4960         19.1         -34.9         54         -         <	H												вт
2480MHz         4960         19.1         -34.9         54         -	ł												
7440 46.06 -27.94 74 32.26 36.52 15.91 38.63	P \	-	-	37.66	13.03	32.94	35.58						
	A \	-	-		-			54					
7440       21.27       -32.73       54       -	P \	-	-	38.63	15.91	36.52	32.26	74	-27.94	46.06	7440		
Image: Second	A \	-	-	-	-	-	-	54	-32.73	21.27	7440		
	``												
	\ \												
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	\								 				
	N				L				L				
1. No other spurious found.									Deel				
<ol> <li>All results are PASS against Peak and Average limit line.</li> <li>Remark</li> <li>3. The emission position marked as "-" means no suspected emission found with sufficient margin against li</li> </ol>	it line er	agingt lim	orain cr	ufficient	und with a	mission fou							Remark
<ol> <li>The emission position marked as "-" means no suspected emission found with sufficient margin against li noise floor only.</li> </ol>	t line of	yainst iim	argin ag	unicient m	na with S	mission iou	specied el	means no su	u as -				



### Emission above 18GHz

вт			2.4GHz BT (SHF)										
	Note	Frequency	Level	Over	Limit	Read	Antenna	Path	Preamp	Ant	Table	Peak	Pol.
				Limit	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)
_		24930	42.18	-31.82	74	36.02	39.63	19.67	53.14	-	-	Р	Н
													Н
													Н
-													Н
_													Н
													Н
_													Н
_													н
_													Н
-													Н
2.4GHz													Н
BT													Н
SHF		24818	42.37	-31.63	74	36.36	39.67	19.55	53.21	-	-	Р	V
••••													V
													V
-													V
_													V
_													V
_													V
_													V
_													v
_													
_													V
-													V
													V
		o other spuriou											
Remark		results are PA											
3		e emission po	sition marked	as "-" m	eans no susp	pected em	ission found	d with suf	ficient mar	gin agai	inst limit	line or	noise
	flo	or only.											

#### 2.4GHz BT (SHF)



### Emission below 1GHz

					2.4GHz								
BT	Note	Frequency	Level	Over	Limit	Read	Antenna	Path	Preamp	Ant	Table	Peak	Pol.
				Limit	Line	Level	Factor	Loss	Factor	Pos		Avg.	(110.0)
		<b>( MHz )</b> 30.97	(dBµV/m) 24.63	(dB) -15.37	<b>( dBμV/m )</b> 40	( <b>dBµV)</b> 35.07	(dB/m) 23.9	(dB) 1.32	(dB) 35.66	( cm )	( deg )	( <b>P/A)</b> P	( <b>H/V)</b> H
		94.99	23.26	-20.24	43.5	41.67	15.13	2.03	35.57	-	-	ч Р	H
		118.27	23.20	-20.24	43.5	39.91	17.41	2.03	35.52		-	P	н
										-			
		259.89	26.54	-19.46	46	38.56	20.09	3.15	35.26	-	-	P	H
		323.91	27.7	-18.3	46	39.67	19.63	3.48	35.08	-	-	P	H
		736.16	35.59	-10.41	46	36.79	27.49	5.11	33.8	-	-	Р	Н
													Н
													Н
													Н
													Н
2.4GHz													Н
BT													Н
LF		32.91	33.05	-6.95	40	44.52	22.84	1.34	35.65	-	-	Р	V
		91.11	26.44	-17.06	43.5	45.38	14.64	2	35.58	-	-	Р	V
		194.9	21.33	-22.17	43.5	39.14	14.82	2.76	35.39	-	-	Р	V
		336.52	26.5	-19.5	46	37.99	20.01	3.54	35.04	-	-	Р	V
		711.91	38.01	-7.99	46	40.37	26.5	5.03	33.89	-	-	Р	V
		903	35.94	-10.06	46	34.61	28.76	5.68	33.11	-	-	Ρ	V
													V
													V
													V
													V
													V
													V
	1. No	o other spuriou	s found.		<u> </u>	l	I		1	1	1	1	L
<b>_</b> .	2. All	results are PA	.SS against li	mit line.									
Remark	3. Th	e emission po	sition marked	as "-" m	ieans no sus	pected err	nission foun	d and em	ission leve	el has at	least 60	lB ma	rgin
	ag	ainst limit or er	mission is noi	ise floor	only.								
	1												

# 2.4GHz BT (LF)



# 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 <b>over limit</b> line.
P/A	Peak or Average
H/V	Horizontal or Vertical



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

BT	Note	Frequency	Level	Over	Limit	Read	Antenna	Path	Preamp	Ant	Table	Peak	Pol.
				Limit	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 00 2402MHz		2390	55.45	-18.55	74	54.51	32.22	4.58	35.86	103	308	Ρ	н

- 1. Path Loss(dB) = Cable loss(dB) + Filter loss(dB) + Attenuator loss(dB)
- 2. Level(dB $\mu$ V/m) =

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

3. Over  $Limit(dB) = Level(dB\mu V/m) - Limit Line(dB\mu V/m)$ 

#### For Peak Limit @ 2390MHz:

- 1. Level(dB $\mu$ V/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)
- $= 55.45(dB\mu V/m) 74(dB\mu V/m)$
- = -18.55(dB)

Peak measured complies with the limit line, so test result is "PASS".



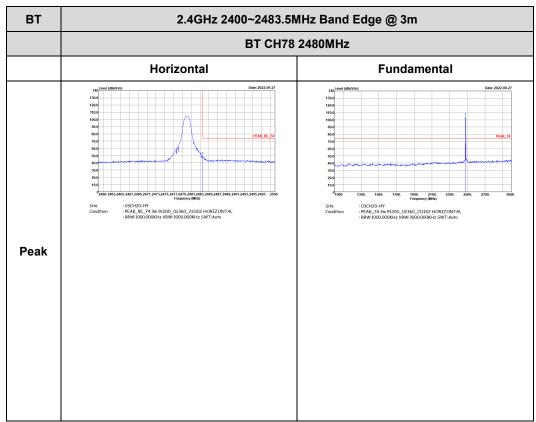
# **Appendix D. Radiated Spurious Emission Plots**

Toot Engineer :		Temperature :	18~20°C
Test Engineer :	JC Liang and Leo Li	Relative Humidity :	66~70%

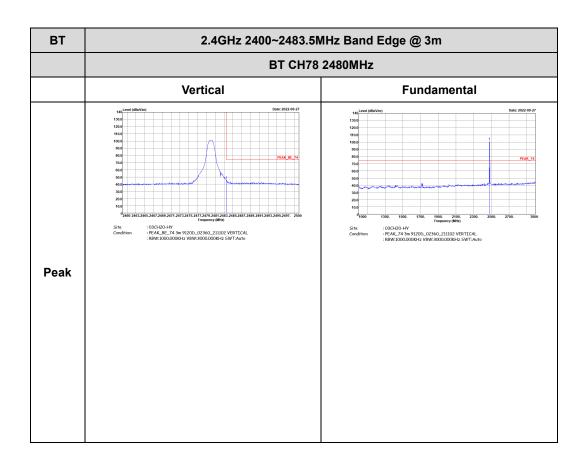
<Sample 1 >

## 2.4GHz 2400~2483.5MHz

#### BT (Band Edge @ 3m)



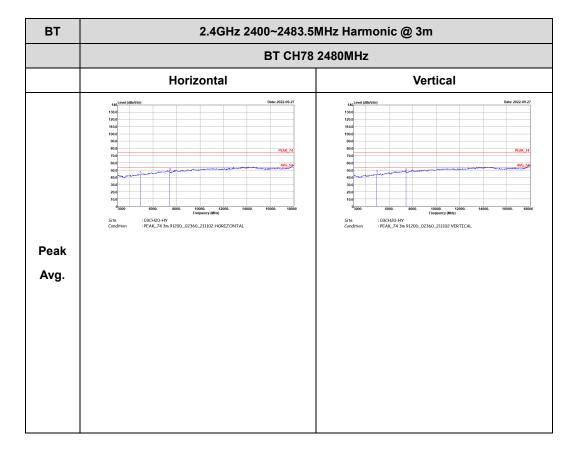




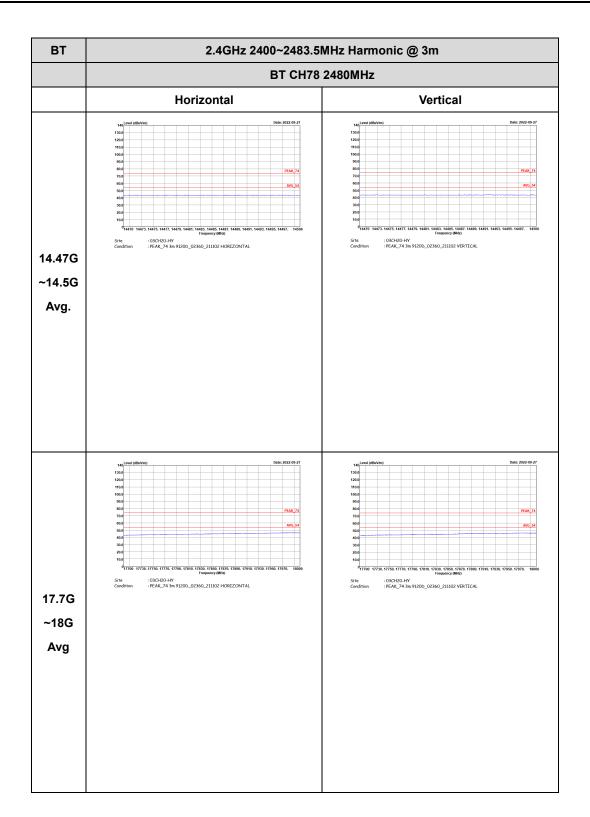


### 2.4GHz 2400~2483.5MHz

# BT (Harmonic @ 3m)





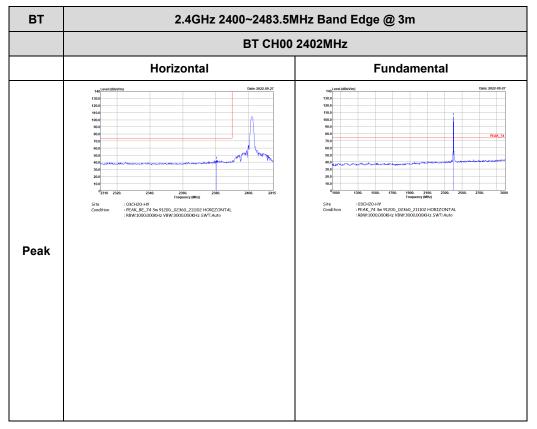




<Sample 2 >

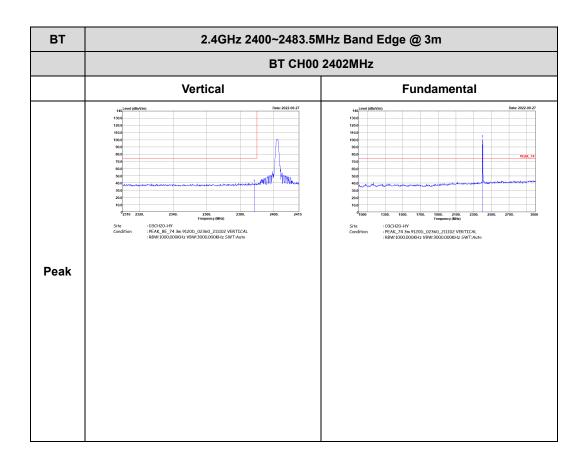
#### 2.4GHz 2400~2483.5MHz

## BT (Band Edge @ 3m)

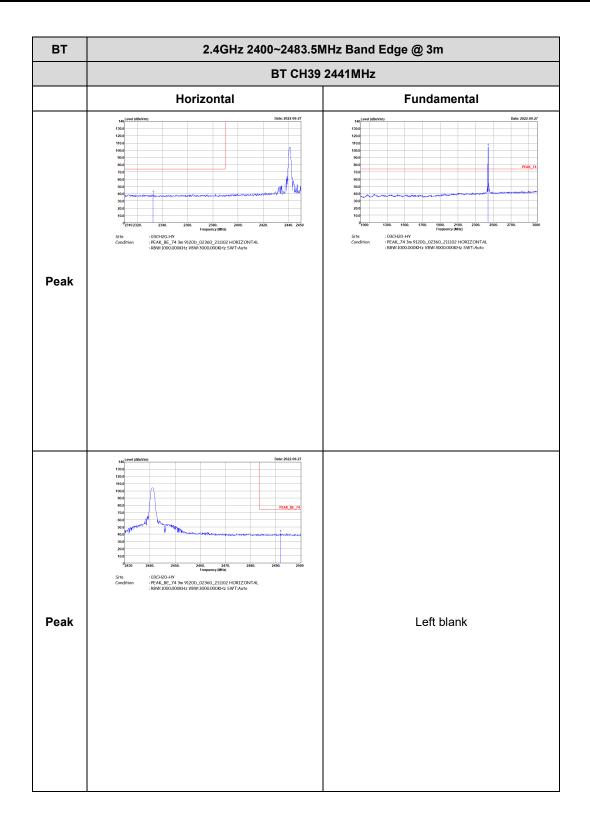




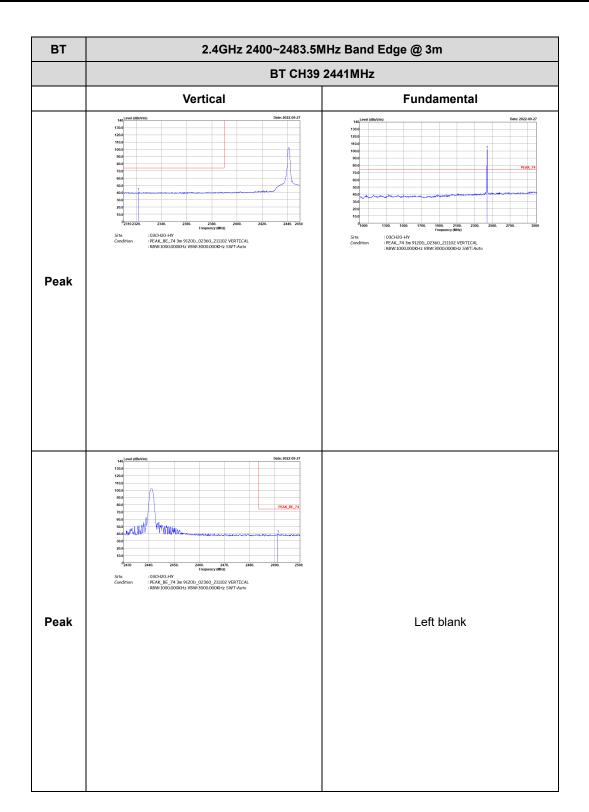




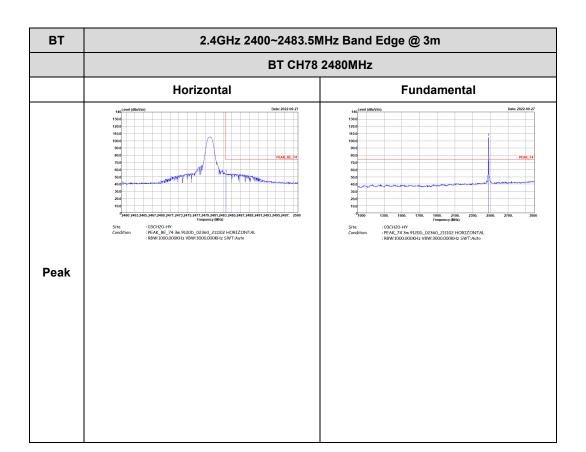




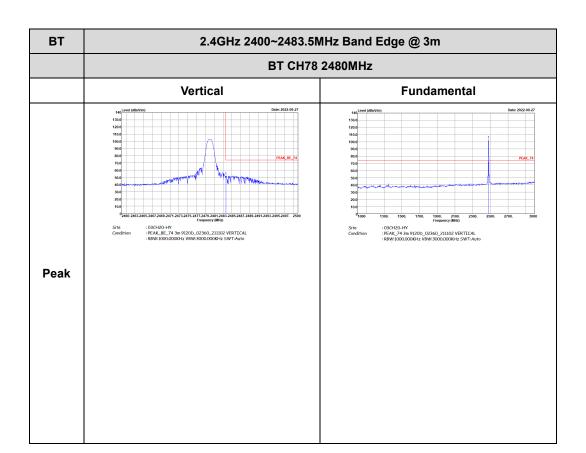








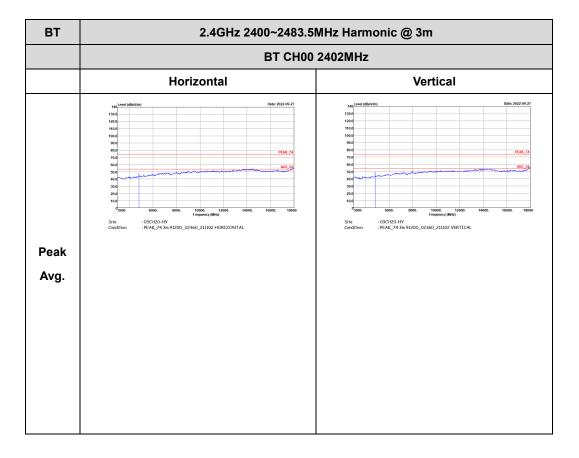


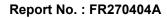




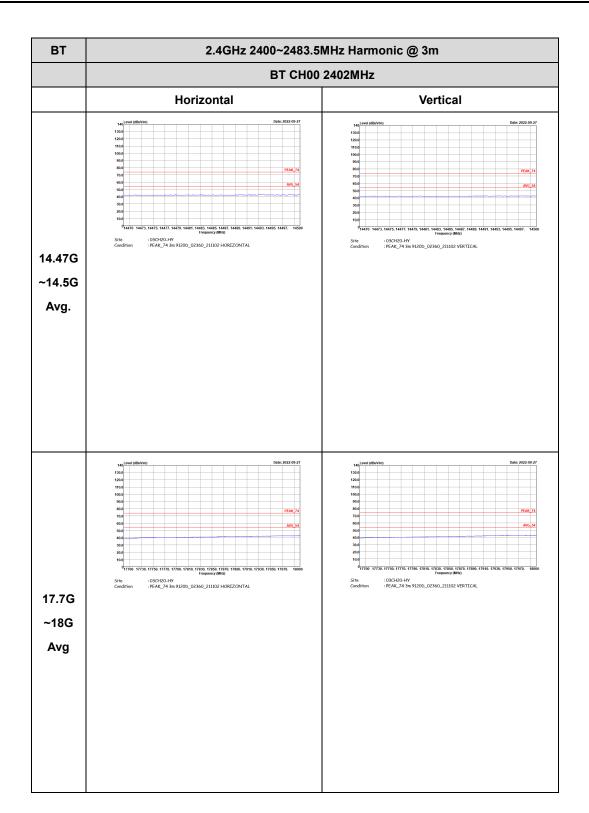
# 2.4GHz 2400~2483.5MHz

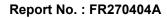
# BT (Harmonic @ 3m)



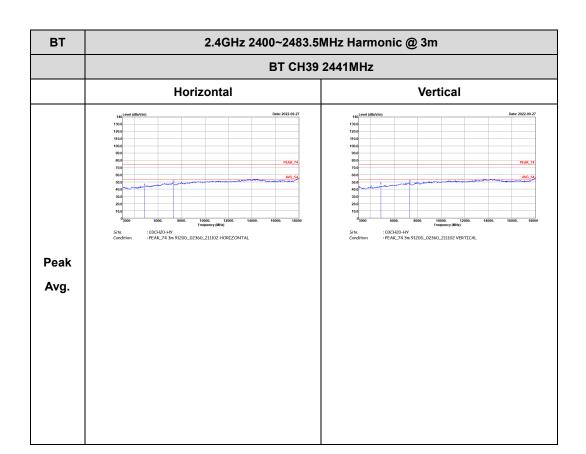




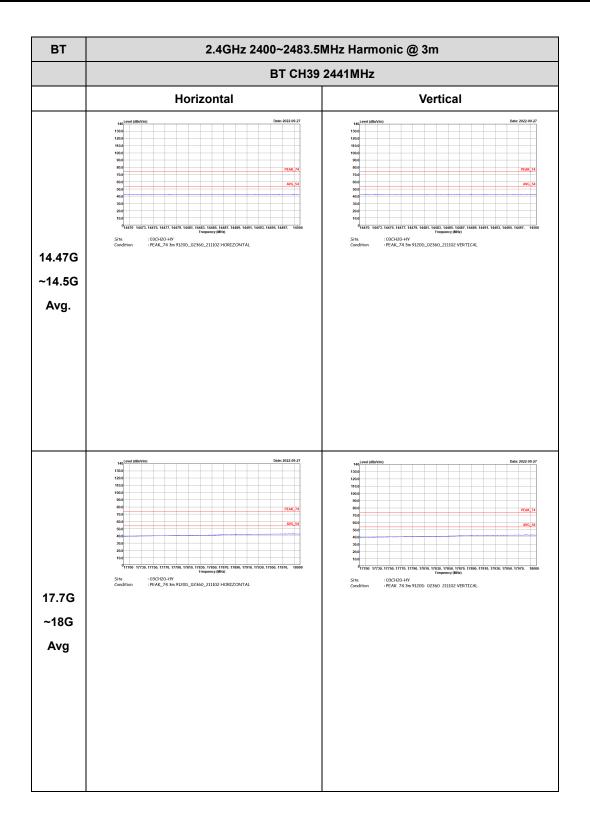


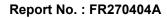




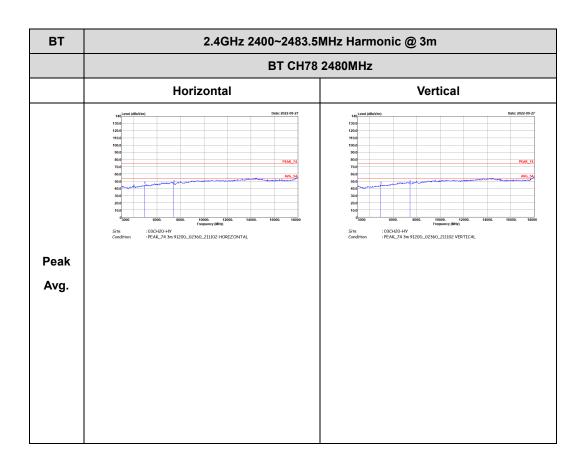




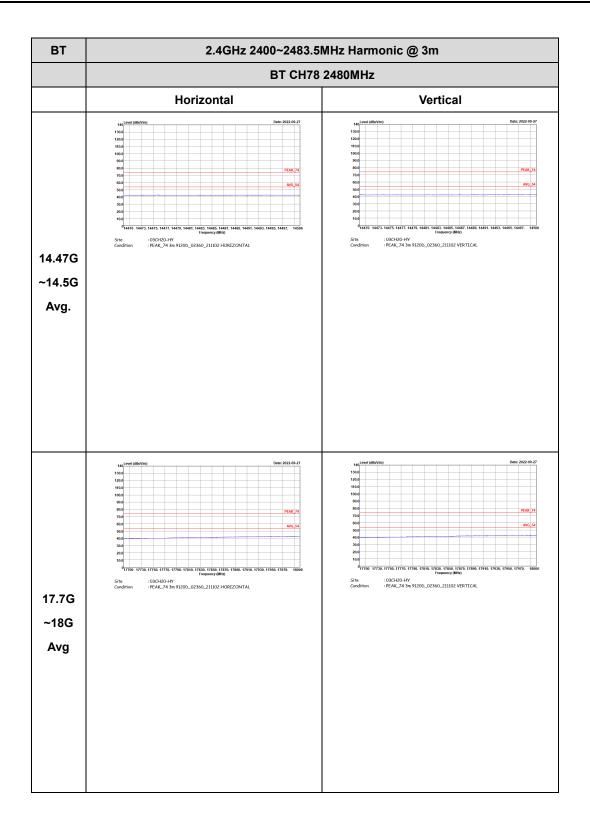






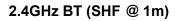


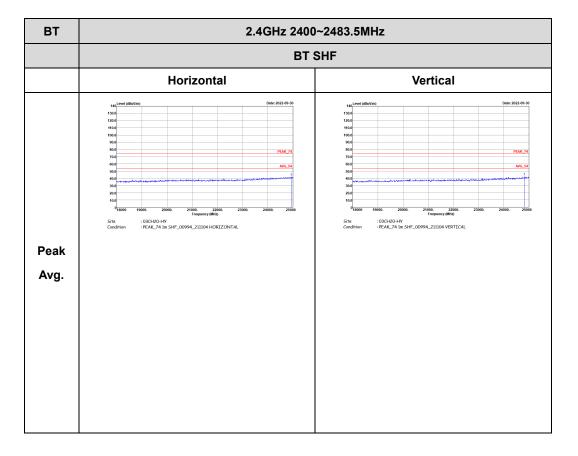






## Emission above 18GHz

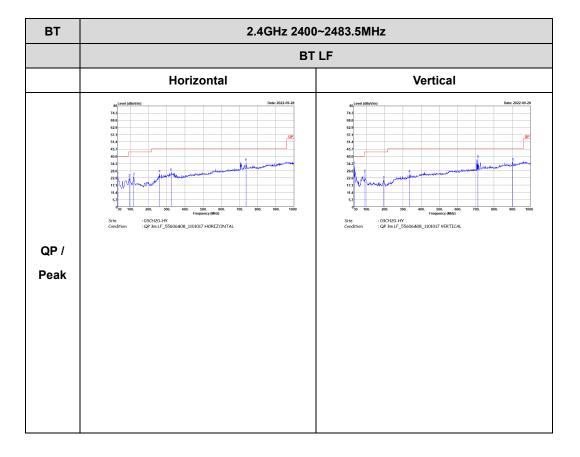






## Emission below 1GHz







# Appendix E. Duty Cycle Plots

# <Sample 1 >



#### 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. DH5 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,

 $20 \times log(5.76 \text{ ms}/100 \text{ ms}) = -24.79 \text{ dB}$ 



## <Sample 2 >

DH5 on time (One Pulse) Plot on Ch	on time (Count Pulses) Plot on Channel 39					
Specifium Analyzer 1         Impail 2500         Alter: 20.08         PNO Fact (and c) fact (b) (c) (c) (c) (c) (c) (c) (c) (c) (c) (c	Marker     Marker       Stelet     Marker       Marker 3/     -       Marker Arme     Settinga       3/5000 mm     Settinga       Normal     PK search       Orten     Marker -       Other     Content       Orten     Marker -       Other     Content       Orten     Content       Orten     Content       Orten     Content       Orten     Content       Orten     Content	Spectrum Analyzer 1 Swept 6A KEVSIGHT input R7 KL Control Control Control Societarian 1 5 Control 10 dB 1 7 7 7 7 7 7 7 7 7 7	50 Ω Atten: 20 dB PNO: Fast orr Gate: Off	Aduji Tope Dever (1936]         2 3 4 5 0           Aduji Tope Dever (1936]         2 3 4 5 0           Tope Dever (1936]         9 3 18 16 18           Multi Carl (1974)         Merrice (1974)           Multi Carl (1974)         102.31 dByV           Aduji Adul (1974)         102.31 dByV           Adul (1974)         102.31 dByV           Adul (1974)         102.31 dByV	Marker Select Marker	Restings Settings Peak Search Config Properties Marker-+ Counter
≗ ■ つ /² ■ ? sep 27, 3022	On	Center 2.441000000 GHz Res BW 1.0 MHz	Video BW 50 MHz 7, 2022		Search On Off	

#### Note:

- 1. Worst case Duty cycle = on time/100 milliseconds = 2 \* 2.88 / 100 = 5.76 %
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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:

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 $20 \times log(5.76 \text{ ms}/100 \text{ ms}) = -24.79 \text{ dB}$