



FCC RADIO TEST REPORT

FCC ID	:	TTUBEOPLAYEXR
Equipment	:	Bluetooth Earphone
Brand Name	:	Bang & Olufsen
Model Name	:	EX Earbud R
Applicant	:	Bang & Olufsen A/S
		Bang og Olufsen Allé 1, 7600 Struer, Denmark
Manufacturer	:	Bang & Olufsen A/S
		Bang og Olufsen Allé 1, 7600 Struer, Denmark
Standard	:	FCC Part 15 Subpart C §15.247

The product was received on Aug. 02, 2021 and testing was started from Aug. 11, 2021 and completed on Aug. 26, 2021. We, Sporton International Inc. EMC & Wireless Communications 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 of Sporton International Inc. EMC & Wireless Communications Laboratory, the test report shall not be reproduced except in full.

Louis Wu

Reviewed by: Louis Wu Sporton International Inc. EMC & Wireless Communications Laboratory No. 52, Huaya 1st Rd., Guishan Dist., Taoyuan City 333, Taiwan (R.O.C.)



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Appendix E. Setup Photographs



History of this test report

Report No.	Version	Description	Issued Date
FR180215-01A	01	Initial issue of report	Feb. 21, 2022
FR180215-01A	02	Revise appendix B and D	Mar. 01, 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)	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	Under limit 9.18 dB at 30.000 MHz
-	15.207	AC Conducted Emission	Not Required	-
3.9	15.203 & 15.247(b)	Antenna Requirement	Pass	-

Note: Not required means after assessing, test items are not necessary to carry out.

Declaration of Conformity:

The test results with all measurement uncertainty excluded are presented in accordance with the regulation limits or requirements declared by manufacturers.

Comments and Explanations:

The declared of product specification for EUT presented in the report are provided by the manufacturer, and the manufacturer takes all the responsibilities for the accuracy of product specification.

Reviewed by: Lewis Ho Report Producer: Vivian Hsu

1 General Description

1.1 Product Feature of Equipment Under Test

Bluetooth

P	Product Specification subjective to this standard
Sample 1	TI Sensor (DRV5032AJDMRR)
Sample 2	ABLIC Sensor (S-5716ANSL3-I4T1U)
Sample 3	ABLIC Sensor (S-5716ACDL3-I4T1U)
Sample 4	Rohm Sensor (BU52095GWZ-E2)
Antenna Type	monopole Antenna
	Antenna information

Antenna information2400 MHz ~ 2483.5 MHzPeak Gain (dBi)-2.2

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

	Specifi	cation of Accessory
Bottom 1	Brand Name	Varta
Battery 1	Model Name	CP1254 A4
Dettem: 0	Brand Name	VDL
Battery 2	Model Name	ZJ1254H
	Brand Name	Bang & Olufsen
USB Cable 1	Model Name	BHC568
	Manufacturer	Mingji
	Brand Name	Bang & Olufsen
USB Cable 2	Model Name	BHC568
	Manufacturer	Perfect Cable
Divete eth Fernheine (I.)	Brand Name	Bang & Olufsen
Bluetooth Earphone (L)	Model Name	EX Earbud L
Charging Case	Brand Name	Bang & Olufsen
Charging Case	Model Name	EX Charging case

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. 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. TH02-HY, 03CH07-HY

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

FCC designation No.: TW1190

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 C §15.247
- FCC KDB Publication No. 558074 D01 DTS Meas. Guidance v05r02
- FCC KDB 414788 D01 Radiated Test Site v01r01
- 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.

Test Configuration of Equipment Under Test 2

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

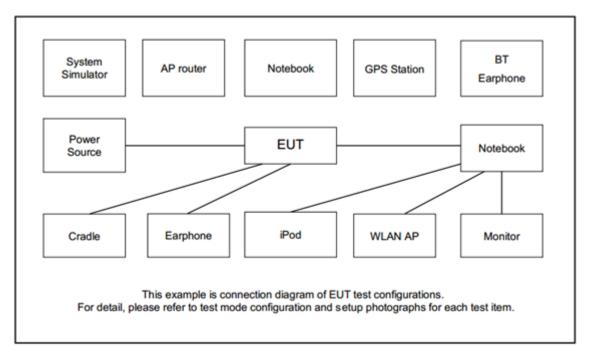
a. The EUT has been associated with peripherals and configuration operated in a manner tended to maximize its emission characteristics in a typical application. Frequency range investigated: radiation emission (9 kHz to the 10th harmonic of the highest fundamental frequency or to 40 GHz, whichever is 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 find Z plane as worst plane, and the worst mode of radiated spurious emissions is Bluetooth 3Mbps mode, and recorded in this report.

The following summary table is showing all test modes to demonstrate in compliance with the standard	١.

	Su	nmary table of Test Cases	5		
Test Item		Data Rate / Modulation			
	Bluetooth BR 1Mbps GFSK	Bluetooth EDR 2Mbps π /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		
	BI	uetooth EDR 3Mbps 8-DP	SK		
	<sample 1="" battery="" with=""></sample>				
Radiated	Mode 1: CH00_2402 MHz				
Test Cases	Mode 2: CH39_2441 MHz				
Test Cases	Mode 3: CH78_2480 MHz				
	<sample 1="" 2<="" battery="" th="" with=""><th>></th><th></th></sample>	>			
	Mode 1: CH78_2480 MHz				
highest conduc	diated Test Cases, the worst RF output power in the prel ted band edge measuremer r significantly frequencies fo	iminary tests. The conductent for other data rates were r	d spurious emissions and not worse than 3Mbps, and		



2.3 Connection Diagram of Test System



2.4 EUT Operation Test Setup

The RF test items, utility "Blue Test V_3.3.2" was installed in Notebook 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.

2.5 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.

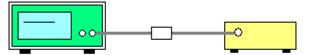
3.1.2 Measuring Instruments

See list of measuring equipment of this test report.

3.1.3 Test Procedure

- 1. The testing follows ANSI C63.10-2013 clause 7.8.3.
- 2. The RF output of EUT was connected to the spectrum analyzer by RF cable and attenuator. The path loss was compensated to the results for each measurement.
- 3. Set 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



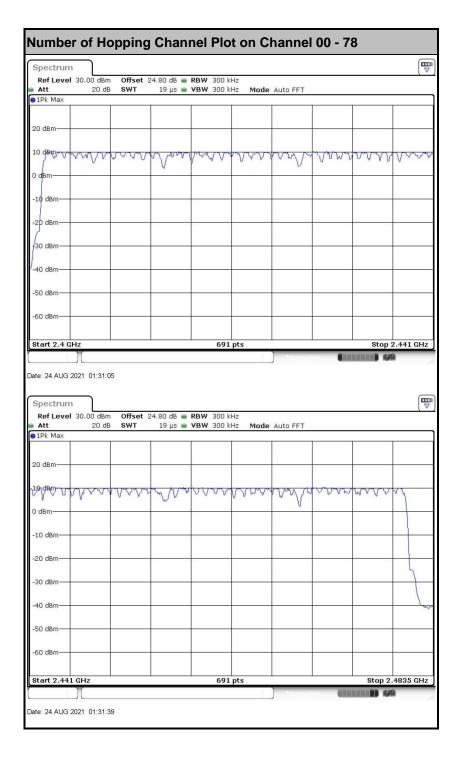
Spectrum Analyzer

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

See list of measuring equipment of this test report.

3.2.3 Test Procedures

- 1. The testing follows ANSI C63.10-2013 clause 7.8.2.
- 2. The RF output of EUT was connected to the spectrum analyzer by RF cable and attenuator. The path loss was compensated to the results for each measurement.
- 3. Set 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



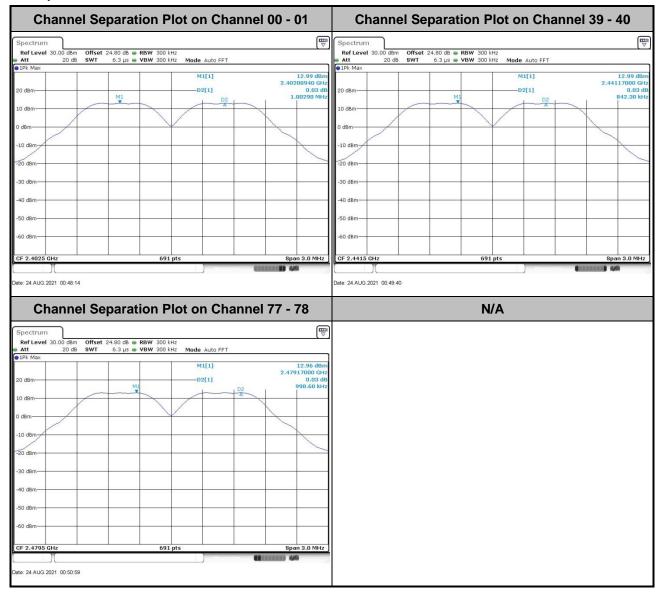
Spectrum Analyzer

3.2.5 Test Result of Hopping Channel Separation

Please refer to Appendix A.



<1Mbps>





<2Mbps>

Channel S	Separation Plot on C	hannel 00 - 01	Channel S	eparation Plot o	on Channe	l 39 - 40
Spectrum			Spectrum			E
RefLevel 30.00 dBm Off Att 20 dB SW	set 24.80 dB 👄 RBW 300 kHz /T 6.3 µs 👄 VBW 300 kHz Mode Auto F	× 4	Ref Level 30.00 dBm Offse Att 20 dB SWT	t 24.80 dB RBW 300 kHz 6.3 µs Mot	le Auto FFT	
●1Pk Max	M1[1]	10.09 dBm	● 1Pk Max		M1[1]	10.08 dBm
20 dBm-	D2[1]	2.40212660 GHz 0.04 dB	20 dBm		-D2[1]	2.44112660 GHz 0.02 dB
Constant P (19204-0)	MI	1.00290 MHz		M1	l be	1.00290 MHz
10 dBm			10 dBm			
0 dBm			0 dBm			
-10 dBm-			-10 dBm			
-20 dBm-			-20 dBm-			
-30 dBm-			-30 dBm			
-40 dBm			-40 dBm		_	-
-50 dBm			-50 dBm			
-60 dBm			-60 dBm			
CF 2.4025 GHz	691 pts	Span 3.0 MHz	CF 2.4415 GHz	691 pts		Span 3.0 MHz
Channel S	Separation Plot on C	hannel 77 - 78		N/A		
Spectrum						
Ref Level 30.00 dBm Off Att 20 dB SW	set 24.80 dB 👄 RBW 300 kHz /T 6.3 µs 👄 VBW 300 kHz Mode Auto F	FT				
●1Pk Max	M1[1]	10.03 dBm				
20 dBm	D2[1]	2.47912660 GHz 0.02 dB				
Constraint State C	M1	998.60 kHz				
10 dBm						
0 dBm						
-10 dBm						
-20 dBm-						
-30 dBm						
-40 dBm						
-50 dBm						
-60 dBm						
CF 2.4795 GHz	691 pts	Span 3.0 MHz				
		(111111) 4/A				
Date: 24.AUG.2021 00:55:22						



<3Mbps>

Channel Se	paration Plot on	Channel 00 - 01	Channel Separation Plot on Channel 39 - 40
Spectrum			
Att 20 dB SWT	24.80 dB e RBW 300 kHz 6.3 μs e VBW 300 kHz Mode Au	to FFT	Ref Level 30.00 dBm Offset 24.80 dB RBW 300 kHz Att 20 dB SWT 6.3 µs VBW 300 kHz Mode Auto FFT
●1Pk Max	M1[1	2.40200940 GHz	● 1Pk Max M1[1] 10.06 2.44100940
20 dBm-	D2[1]	864.00 kHz	20 dBm D2[1] 0.0 1.00290
10 dBm			
0 dBm			0 dBm
10 dBm			-10 /Bm
-20 dBm			-20 dBm-
30 dBm			-30 dBm
40 dBm			-40 dBm
50 dBm			-50 dBm
60 dBm			-60 dBm-
CF 2.4025 GHz	691 pts	Span 3.0 MHz	
		(1	СГ 2.4415 GHz 691 pts Span 3.0 / СГ 2.4415 GHz 691 pts ФФ Date: 24 AUG 2021 00.58 23
Channel Se	paration Plot on	Channel 77 - 78	Nexories (Internet) 44
Spectrum Ref Level 30.00 dBm Offset	paration Plot on	Channel 77 - 78	Date: 24 AUG 2021 00 58 23
Channel Se Spectrum Ref Level 30.00 dBm Offset Att 20 dB SWT	24.80 dB • RBW 300 kHz 6.3 µ5 • VBW 300 kHz Mode Au	Channel 77 - 78	Date: 24 AUG 2021 00 58 23
Channel Se Spectrum Ref Level 30.00 dBm Offset Att 20 dB SWT	paration Plot on	Channel 77 - 78	Date: 24 AUG 2021 00 58 23
Channel Se	24.80 dB • RBW 300 kHz 6.3 µs • VBW 300 kHz Mode Au	Channel 77 - 78	Date: 24 AUG 2021 00 58 23
Channel Se	24.80 dB RBW 300 kHz 6.3 µs VBW 300 kHz Mode Au	Channel 77 - 78	Date: 24 AUG 2021 00 58 23
Channel Se	24.80 dB RBW 300 kHz 6.3 µs VBW 300 kHz Mode Au	Channel 77 - 78	Date: 24 AUG 2021 00 58 23
Channel Se	24.80 dB RBW 300 kHz 6.3 µs VBW 300 kHz Mode Au	Channel 77 - 78	Date: 24 AUG 2021 00 58 23
Channel Se	24.80 dB RBW 300 kHz 6.3 µs VBW 300 kHz Mode Au	Channel 77 - 78	Date: 24 AUG 2021 00 58 23
Channel Se	24.80 dB RBW 300 kHz 6.3 µs VBW 300 kHz Mode Au	Channel 77 - 78	Date: 24 AUG 2021 00 58 23
Channel Se	24.80 dB RBW 300 kHz 6.3 µs VBW 300 kHz Mode Au	Channel 77 - 78	Date: 24 AUG 2021 00 58 23
Channel Se	24.80 dB RBW 300 kHz 6.3 µs VBW 300 kHz Mode Au	Channel 77 - 78	Date: 24 AUG 2021 00 58 23
Channel Se	24.80 dB RBW 300 kHz 6.3 µs VBW 300 kHz Mode Au	Channel 77 - 78	Date: 24 AUG 2021 00 58 23
Channel Se	24.80 dB RBW 300 kHz 6.3 µs VBW 300 kHz Mode Au	Channel 77 - 78	Date: 24 AUG 2021 00 58 23



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.

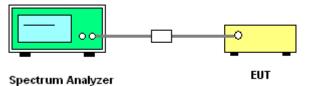
3.3.2 Measuring Instruments

See list of measuring equipment of this test report.

3.3.3 Test Procedures

- 1. The testing follows ANSI C63.10-2013 clause 7.8.4.
- The RF output of EUT was connected to the spectrum analyzer by RF cable and attenuator. The path loss was compensated to the results for each measurement.
- 3. Set 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.

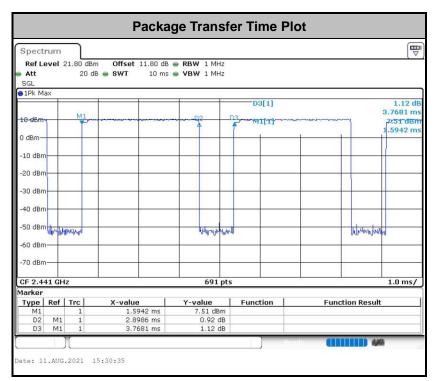
3.3.4 Test Setup



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 (0.4×79) (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 (0.4×20) (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



3.4 20dB and 99% Bandwidth Measurement

3.4.1 Limit of 20dB and 99% Bandwidth

Reporting only

3.4.2 Measuring Instruments

See list of measuring equipment of this test report.

3.4.3 Test Procedures

- 1. The testing follows ANSI C63.10-2013 clause 6.9.2 and 6.9.3.
- 2. The RF output of EUT was connected to the spectrum analyzer by RF cable and attenuator. The path loss was compensated to the results for each measurement.
- 3. Set 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



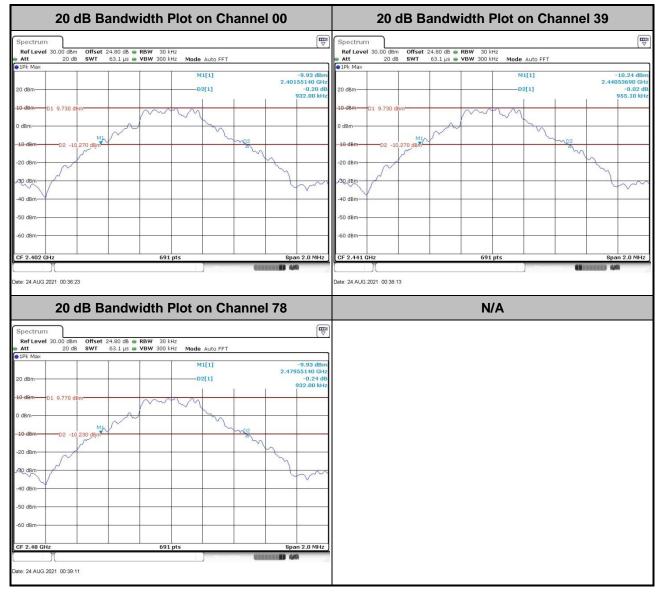
Spectrum Analyzer

3.4.5 Test Result of 20dB Bandwidth

Please refer to Appendix A.

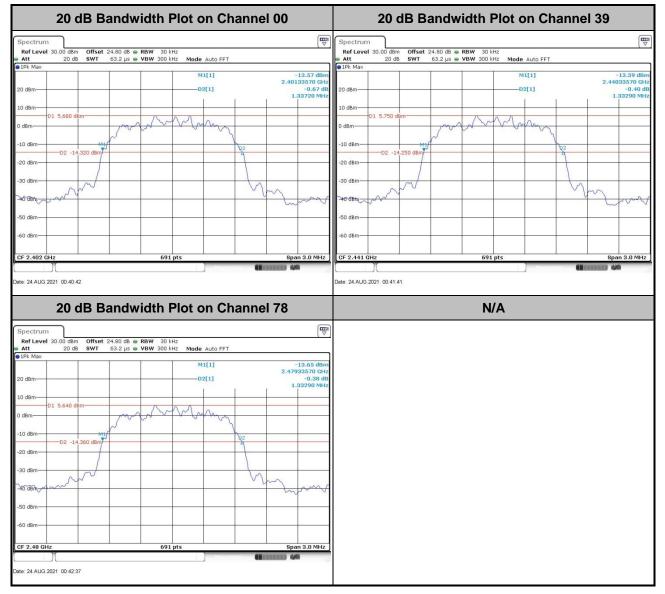


<1Mbps>



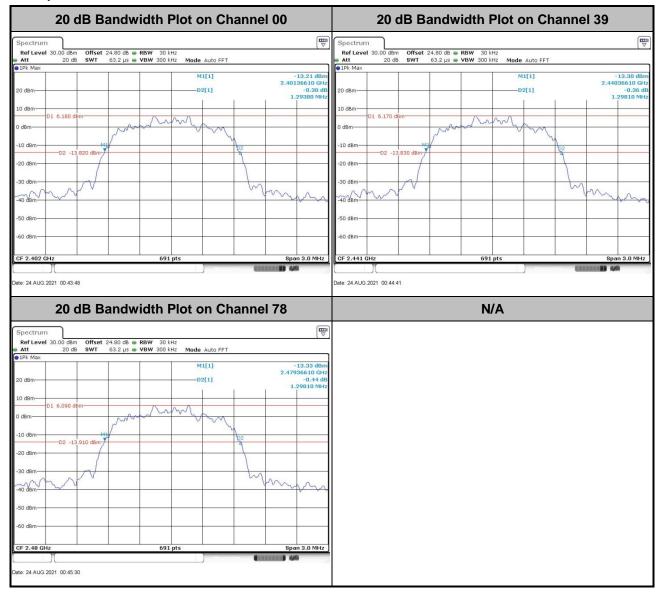


<2Mbps>





<3Mbps>

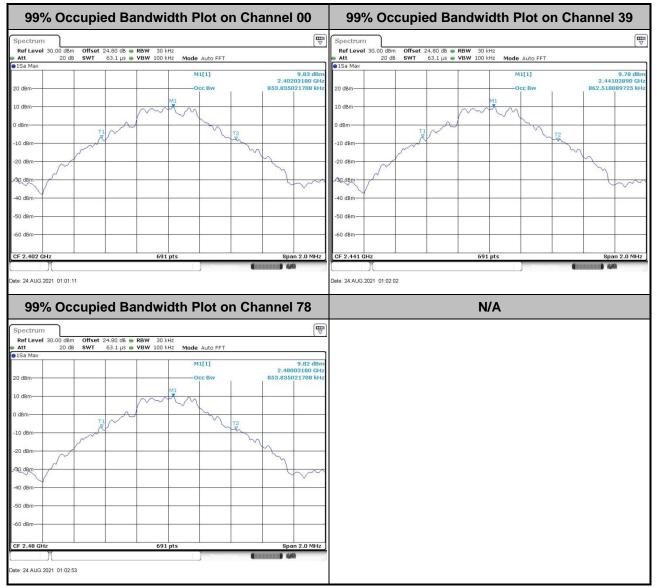




3.4.6 Test Result of 99% Occupied Bandwidth

Please refer to Appendix A.

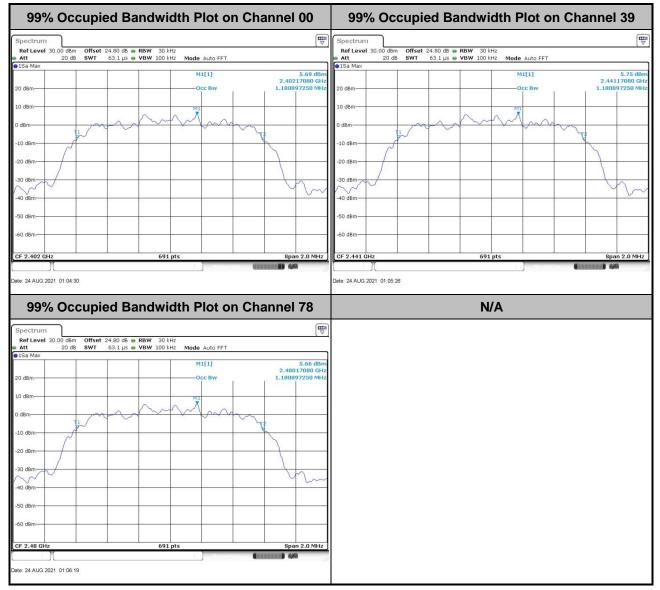
<1Mbps>



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



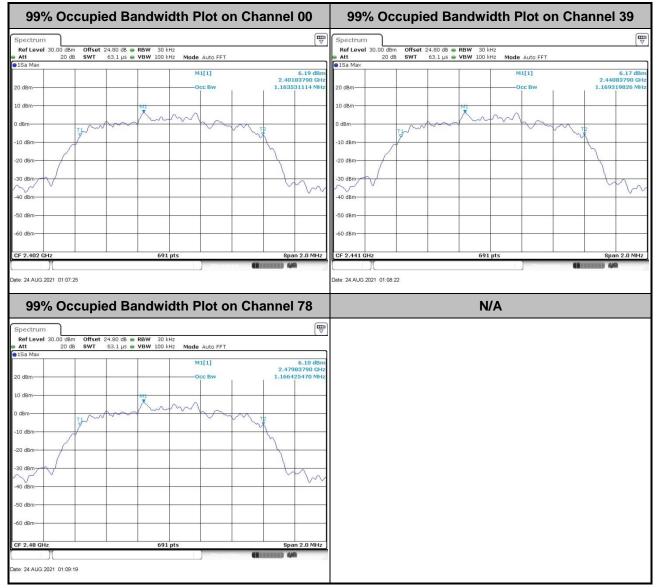
<2Mbps>



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.

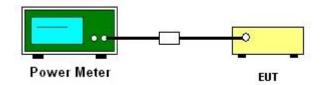
3.5.2 Measuring Instruments

See list of measuring equipment of this test report.

3.5.3 Test Procedures

- 1. The testing follows ANSI C63.10-2013 clause 7.8.5.
- 2. The RF output of EUT was connected to the power meter by RF cable and attenuator. The path loss was compensated to the results for each measurement.
- 3. Set 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.

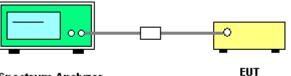
3.6.2 Measuring Instruments

See list of measuring equipment of 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

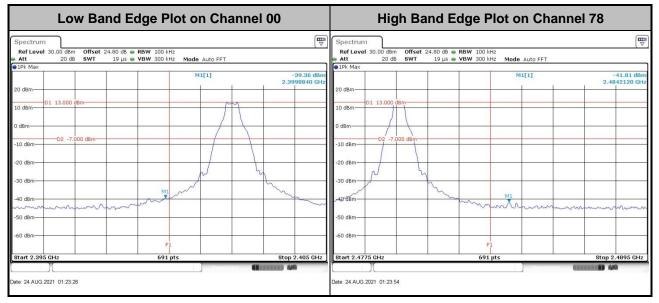


Spectrum Analyzer



3.6.5 Test Result of Conducted Band Edges

<1Mbps>



<2Mbps>

Low Band Edg	ge Plot on Channe	el 00	High Ba	and Edge Plot on Cha	annel 78
Spectrum Ref Level 30.00 dBm Offset 24.80 dB Att 20 dB SWT 19 µs VB IPk Max VB VB VB VB	W 300 kHz Mode Auto FFT		Spectrum Ref Level 30.00 dBm Offset Att 20 dB SWT P1Pk Max	24.80 dB • RBW 100 kHz 19 µs • VBW 300 kHz Mode Auto FFT	(m ⊽
20 dBm 01 9,960 dBm 01 9,960 dBm 01 9,960 dBm 02 -10.040 dBm 02 -10.040 dBm 02 -20 dBm 04 - 04 - 04 - 04 - 04 - 04 - 04 - 04			20 dBm 01 9.920 dBm 0 8 9.920 dBm		-43.01 dBm 2.4837950 GHz
-40 dBm	M1 Fi F1 691 pts	Stop 2.405 GHz	-40.d8m -50 d8m -60 d8m -60 d8m	FI 691 pts	Stop 2.4895 GHz



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Low Band Edge P	Low Band Edge Plot on Channel 00				dge Plot o	on Channe	el 78
Spectrum Ref Level 30.00 dBm Offset 24.80 dB RBW 100 kF Att 20 dB SWT 19 µs VBW 300 kF			Spectrum Ref Level 30.00 dB Att 20 d		RBW 100 kHz VBW 300 kHz Mod	e Auto FFT	
1Pk Max 20 dBm	M1[1]	-40.73 dBm 2.3995660 GHz	● 1Pk Max 20 dBm			M1[1]	-43.27 dBm 2.4854280 GHz
-10 dBm 01 10.060 dBm 01 0 dBm 01 0 dBm 02 -9.940 dBm 02 -9.940 dBm 02 -9.940 dBm 02 -9.940 dBm 030 dBm 04 -20			-10 dBm 01 10.050 0 dBm 02 -5 -20 dBm 02 -5 -30 dBm 02 -5	2 dBm 			
-40 dBm M1 -50 dBm50 dBm50 dBm50 dBm50 dBm	1	hann	-40.486		F1	Mi mananananananananananananananananananan	
Start 2.395 GHz 691	and the second se	Stop 2.405 GHz	Start 2.4775 GHz	-24	691 pts	Meximine	Stop 2.4895 GHz
Date: 24.AUG.2021 01:25:51			Date: 24.AUG.2021 01:26	.24			



3.6.6 Test Result of Conducted Hopping Mode Band Edges

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Hopping Mode Low Band Edge Plot	Hopping Mode High Band Edge Plot
Image: Spectrum Image: Spectrum Ref Level 30.00 dBm Offset 24.80 dB @ RBW 100 kHz Mode Auto FFT Image: Spectrum Image: Spectrum Image: Spectrum Image: Spectrum Image: Spectrum Image: Spectrum Image: Spectrum 20 dB m Image: Spectrum Image: Spectrum Image: Spectrum Image: Spectrum Image: Spectrum Image: Spectrum Image: Spectrum Image: Spectrum Image: Spectrum Image: Spectrum Image: Spectrum Image: Spectrum I	Image: Spectrum Image: Spe
-50 dBm	-50 dBm -60 dBm F1 Start 2.4775 GHz 691 pts Stop 2.4895 GHz
Start 2.395 GHz 691 pts Stop 2.405 GHz Date: 24 AUG 2021 01-27:56 Date: 24 AUG 2021 01-27:56 Date: 24 AUG 2021 01-27:56	Stort 2.47/5 GHz 691 pts Stop 2.4895 GHz Date: 24 AUG 2021 01:28:16 MA

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Hopping Mo	ode Low Band Edge Plot		Hopping Mod	le High Band E	dge Plot
Spectrum Ref Level 30.00 dBm Offset 24.80 dB Att 20 dB SWT 19 µs of PIPK Max	VBW 300 kHz Mode Auto FFT	Spectrum Ref Level 3 • Att • 1Pk Max		RBW 100 kHz VBW 300 kHz Mode Auto FFT M1[1]	(₩) -43.20 dBm
20 dBm -10 dBm 01 9.970 dBm 0 dBm -10 dBm 02 -10.030 dBm -20 dBm -30 dBm 40 dBm		52100 GHz 20 dBm 19 dBm 0 40 dBm -10 dBm -30 dBm -30 dBm -40 dBm	-D2 -10.030 dBm		2.4836040 GHz
-50 dBm -60 dBm -50	F1 691 pts Stop	-50 dBm -60 dBm 2:405 GHz Date: 24 AUG 20		F1 691 pts	Stop 2.4895 GHz



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Hopping Mode L	Hopping Mode Low Band Edge Plot				de High Ba	and Edge I	Plot
Spectrum Ref Level 30.00 dBm Offset 24.80 dB RBW 100 Att 20 dB SWT 19 us YBW 300) kHz) kHz Mode Auto FFT		Spectrum Ref Level 30.00 df Att 20		RBW 100 kHz VBW 300 kHz Mode	6.000 FFT	
Alt 20 db SW1 19 Js VSW 300 PPk Max 20 dbm	M1[1]	-43.11 dBm 2.3999570 GHz	20 dBm	20 2MI 13 hz		1[1]	-43.49 dBm 2.4851670 GHz
-10-d8m 01 10.080 d8m	mm	mmm	19.40m D1 10.08	D dem			
-10-d8m D2 -9.920 d8m			-10 dBmD2 -	9.920 dBm			
-30 dBm	m		-30 dBm	hing			
-40 dBm 			-40 dBm		· · · · · · · · · · · · · · · · · · ·	MI more	
-60 dBm	F1 D1 pts	Stop 2.405 GHz	-60 dBm		F1 691 pts		Stop 2.4895 GHz
Date: 24 AUG 2021 01:30:04	Nearning		Date: 24.AUG.2021 01:30):26		Nex ration.	ann 199

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.

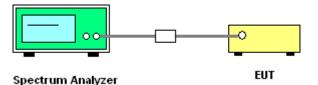
3.7.2 Measuring Instruments

See list of measuring equipment of this test report.

3.7.3 Test Procedure

- 1. The testing follows ANSI C63.10-2013 clause 7.8.8.
- 2. The RF output of EUT was connected to the spectrum analyzer by RF cable and attenuator. The path loss was compensated to the results for each measurement.
- 3. Set 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>

Att 20 dB SWT 29 1Pk View	.80 dB - RBW 100 kHz 9.7 ms - VBW 300 kHz Mode Auto Sweep		Spectrum		
Att 20 dB SWT 29 1Pk View			2		
1Pk View			Ref Level 30.00 dBm Offset Att 20 dB SWT	24.80 dB 🖷 RBW 100 kHz 230 ms 🖷 VBW 300 kHz 🛛 Mode Auto Sweep	
]	PlPk View		
	M1[1]	12.82 dBm 2.40040 GHz		M1[1]	12.57 dBn 2.4160 GH
0 dBm	M2[1]	-42.26 dBm M1 2.12100 GHz	20 dBm		-35.20 dBn 17.9270 GH:
0 dBm 01 12.820 dBm		M1 2.12100 GH2	D1 12.570 dBm-		17.9270 GH.
Jasm			TD OBM		
dBm			0 dBm		
D2 -7.180 dBm			D2 -7.430 dBm		
0 dBm			-10 dBm		
20 dBm			-20 dBm		
0 dBm			-30 dBm-	M2	
0 dBm			- 40 dBm	an and a second proper second and	more down that when we
	Marcan depresence and a second and a second	about all an an a second and the second			
0 dBm			-50 dBm		
0 dBm-			-60 dBm-		
art 30.0 MHz	691 pts	Stop 3.0 GHz	Start 2.0 GHz	691 pts	Stop 25.0 GHz
	2tearuring	(IIIIII) 4/9		- Meanuring	440 HI 100 H
	80 dB 🖷 RBW 100 kHz			24.80 dB 🖷 RBW 100 kHz	
Att 20 dB SWT 29 1Pk View	9.7 ms 🖶 VBW 300 kHz Mode Auto Sweep		Att 20 dB SWT 1Pk View	230 ms 🖷 VBW 300 kHz Mode Auto Sweep	
	M1[1]	12.87 dBm 2.43910 GHz		M1[1]	12.67 dBn 2.4490 GH:
D dBm	M2[1]	-41.41 dBm	20 dBm	-M2[1]	-34.20 dBn
01 12.870 dBm		M1 1.21840 GHz	D1 12.670 dBm		15.8630 GH:
dBm			10 dBm		
dBm			0 dBm		
D2 -7.130 dBm			D2 -7.330 dBm		
0 dBm			-10 dBm		
0 dBm			-20 dBm		
0 dBm			-30 dBm	M2	
0 dBm	M2		- 40 dBm	menerate manufactor and all the many allowed	which down the who we will as
	whether the manus and the second and the second second and the second se	unanteer mayar and market			
0 dBm			-50 dBm		
0 dBm			-60 dBm		
	691 pts	Stop 3.0 GHz	Start 2.0 GHz	691 pts	Stop 25.0 GHz
tart 30.0 MHz	uar hes	atop ato anz		091 pts	atop 20.0 GHz
tart 30.0 MHz	. Nexroting			Dat pt3	(111111) 4/A



Spectrum			Spectrum		E C
Ref Level 30.00 dBm Offset 24.80 dB Att 20 dB SWT 29.7 ms			Att 20 dB SWT	24.80 dB 👜 RBW 100 kHz 230 ms 🖶 VBW 300 kHz 🛛 Mode Auto Sw	veep
1Pk View 20 dBm 10 dBm 0 dBm 0 dBm -10 dBm -20 dBm -30 dBm	M1[1] 	12.53 dBm 2.48210 GHz -41.37 dBm M1 1.23990 GHz	10 ⁴ DPk View 20 dBm 10 dBm 01 11.830 dBm 0 dBm -10 dBm -20 dBm -20 dBm -20 dBm -20 dBm -20 dBm -20 dBm	MI[1] M2	11.83 dB 2.4830 dF -34.48 dB 17.8600 GF
40 dBm alulphonations all low on the shares have -50 dBm -60 dBm-	has been and the second of the	un migral a subscription of the	-40 dBm	- Analy and the same - a	
Start 30.0 MHz	691 pts	Stop 3.0 GHz	Start 2.0 GHz	691 pts	Stop 25.0 GH:



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	H 00 between 30 M	Hz ~ 3 GHz	CSE Plot on CH 00 between 2 GHz ~ 25 GHz				
Spectrum			Spectrum				
Ref Level 30.00 dBm Offset 24.80 d Att 20 dB SWT 29.7 m	dB 🖷 RBW 100 kHz ns 🖷 VBW 300 kHz 🛛 Mode Auto Sweep	()	RefLevel 30.00 dBm Off	fset 24.80 dB RBW 100 kHz 230 ms VBW 300 kHz	Node that Success	(.	
1Pk View			1Pk View	230 IIIS - YBW 300 KH2			
	M1[1]	9.63 dBm 2.40040 GHz			M1[1]	9.38 dBm 2.4160 GHz	
20 dBm	M2[1]	-42.27 dBm 2.99360 GHz	20 dBm-		M2[1]	-35.30 dBm 15.7630 GHz	
10 dBm D1 9.630 dBm		MI	M1 10 dBm D1 9.380 dBm				
0 dBm			0 dBm-				
10 dBm D2 -10.370 dBm			-10.620 d	Bm			
20 dBm			-20 dBm				
-30 dBm			-30 dBm		M2		
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neght drawan work has no on the within	and alour any have man build market and	man du bernon was madered	-40 dBm high war linde	www.washedbertalucations			
50 dBm-			-50 dBm				
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Start 30.0 MHz	691 pts	Stop 3.0 GHz	Start 2.0 GHz	691 pt	5	Stop 25.0 GHz	
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Spectrum			Spectrum				
Ref Level 30.00 dBm Offset 24.80 d	dB 🖷 RBW 100 kHz			fset 24.80 dB 🖷 RBW 100 kHz			
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Att 20 dB SWT 29.7 m 1Pk View	ns 🖷 VBW 300 kHz Mode Auto Sweep		Att 20 dB SW		Mode Auto Sweep	[•	
		9.83 dBm 2.43910 GHz	Att 20 dB SW		Mode Auto Sweep M1[1]	9.58 dBm 2.4490 GHz	
	ns 🖷 VBW 300 kHz Mode Auto Sweep	2.43910 GHz -42.12 dBm	Att 20 dB SW			9.58 dBm 2.4490 GHz -34.41 dBm	
1Pk View	M1[1]	2.43910 GHz	Att 20 dB SW IPk View 20 dBm M1		M1[1]	9.58 dBm 2.4490 GHz	
19k View 10 dBm 	M1[1]	2.43910 GHz -42.12 dBm	Att 20 dB SW 1Pk View 20 dBm 1		M1[1]	9.58 dBm 2.4490 GHz -34.41 dBm	
19k View 10 dBm 	M1[1]	2.43910 GHz -42.12 dBm	Att 20 dB SW IPk View 20 dBm M1		M1[1]	9.58 dBm 2.4490 GHz -34.41 dBm	
0 dBm 0-48m 01 9.830 dBm 048m	M1[1]	2.43910 GHz -42.12 dBm	Att 20 dB SW 1Pk View 20 dBm 1	// 230 ms • VBW 300 kHz	M1[1]	9,58 dBn 2.4490 GH: -34.41 dBn	
104 View 10-dBm 01 9.830 dBm 10-dBm -02 -10,170 dBm	M1[1]	2.43910 GHz -42.12 dBm	Att 20 dB SW DPk View D dBm D1 9.580 dBm D dBm D1 9.580 dBm D dBm D2 -10.420 dBm	// 230 ms • VBW 300 kHz	M1[1]	9.58 dBm 2.4490 GHz -34.41 dBm	
10 dBm 01 9.630 dBm 01 9.630 dBm	M1[1]	2.43910 GHz -42.12 dBm	Att 20 dB SW PIPk View 20 dBm M1 M1 J37 dBm 01 9.580 dBm	// 230 ms • VBW 300 kHz	M1[1]	9.58 dBm 2.4490 GHz -34.41 dBm	
10k View 20 dBm 01 9.830 dBm 0 dBm 02 -10,170 dBm 20 dBm 20 dBm	M1[1]	2.43910 GHz -42.12 dBm	Att 20 dB SW DPk View D dBm D1 9.580 dBm D dBm D1 9.580 dBm D dBm D2 -10.420 dBm	// 230 ms • VBW 300 kHz	M1[1]	9.58 dBm 2.4490 GHz -34.41 dBm	
104 Kiew 10 dBm 10 d	M1[1]	2,49910 GHz -42,12 dBm 2,95920 GHz M1 	Att 20 dB SW DPL View 20 dBm D1 9.580 dBm D1 9.580 dBm D dBm D2 -10.420 d -20 dBm -30 dBm	Image: rr 230 ms VBW 300 kHz Image: rr Image: rr Image: rr Image: rr Image: rr Image: rr Image: rr Image: rr Image: rr Image: rr Image: rr Image: rr	M1[1]	9.58 dBm 2.4490 GHz -34.41 dBm	
1Pk View 0 dBm 01 9.830 dBm 08m 01 9.830 dBm 09 dBm 02 -10,170 dBm 00 dB	Node Auto Sweep M1[1] -M2[1]	2.43910 GHz -42.12 dBm	Att 20 dB SW DPk View D dBm D1 9.580 dBm D dBm D2 -10.420 d dBm -30 dBm -30 dBm -30 dBm -40 d	// 230 ms • VBW 300 kHz	M1[1] M2[1]	9.58 dBn 2.4490 GH -34.41 dBn 17.8600 GH	
19/k View 20 dBm 01 9.830 dBm 0 dBm 0 dBm 0 dBm 02 -10,170 dBm 0 dBm 40 dBm 40 dBm	vBW 300 kHz Mode Auto Sweep M1[1] -M2[1]	2,49910 GHz -42,12 dBm 2,95920 GHz M1 	Att 20 dB SW DI PI- View DI dBm D1 9.580 dBm DI dBm D2 -10.420 d -20 dBm -0 dBm dBm dBm dBm dBm -30 dBm	Image: rr 230 ms VBW 300 kHz Image: rr Image: rr Image: rr Image: rr Image: rr Image: rr Image: rr Image: rr Image: rr Image: rr Image: rr Image: rr	M1[1] M2[1]	9.58 dBm 2.4490 GHz -34.41 dBm 17.8600 GHz	
10k View 20 dBm 01 9.830 dBm 0 dBm 10 dBm 20 dBm 20 dBm 20 dBm 30 dBm 50 dBm	vBW 300 kHz Mode Auto Sweep M1[1] -M2[1]	2,49910 GHz -42,12 dBm 2,95920 GHz M1 	Att 20 dB SW DPk View D dBm D1 9.580 dBm D dBm D2 -10.420 d dBm -30 dBm -30 dBm -30 dBm -40 d	Image: rr 230 ms VBW 300 kHz Image: rr Image: rr Image: rr Image: rr Image: rr Image: rr Image: rr Image: rr Image: rr Image: rr Image: rr Image: rr	M1[1] M2[1]	9.58 dBm 2.4490 GHz -34.41 dBm 17.8600 GHz	
1Pk View 0 dBm	vBW 300 kHz Mode Auto Sweep M1[1] -M2[1]	2,49910 GHz -42,12 dBm 2,95920 GHz M1 	Att 20 dB SW DPk View D dBm D dBm D dBm D 0 9,580 dBm D d	Image: rr 230 ms VBW 300 kHz Image: rr Image: rr Image: rr Image: rr Image: rr Image: rr Image: rr Image: rr Image: rr Image: rr Image: rr Image: rr	M1[1] M2[1]	9.58 dBm 2.4490 GHz -34.41 dBm 17.8600 GHz	
101: View 20 dBm 01 0.830 dBm 0 dBm 10-dBm 02 -10 170 dBm 20 dBm 40 dBm 40 dBm	vBW 300 kHz Mode Auto Sweep M1[1] -M2[1]	2.49910 GHz	Att 20 dB SW DPk View D dBm D dBm D dBm D 0 9,580 dBm D d	Image: rr 230 ms VBW 300 kHz Image: rr Image: rr Image: rr Image: rr Image: rr Image: rr Image: rr Image: rr Image: rr Image: rr Image: rr Image: rr		9.58 dBm 2.4490 GHz -34.41 dBm 17.8600 GHz	
19k View 20 dBm 01 9.830 dBm 0 dBm 02 -10 170 dBm 20 dBm 20 dBm 40 dBm 60 dBm 60 dBm	Node Auto Sweep M1[1] M2[1] M2[1] M2[1] M2[1] M2[1]	2,49910 GHz -42,12 dBm 2,95920 GHz M1 	Att 20 dB SW DPk View D dBm 01 9.580 dBm D dBm 02 -10.420 d dBm O dBm O dBm O dBm G0	Image: rr 230 ms VBW 300 kHz Image: rr Image: rr		9.58 dBm 2.4490 GH -34.41 dBm 17.8600 GH 17.8600 GH	



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Spectrum	[₩ Spectrum		
Ref Level 30.00 dBm Offset 24.80 dB RBW 100 kHz Att 20 dB SWT 29.7 ms VBW 300 kHz Mode	Ref Level 30.00 dBm Offse Auto Sweep Att 20 dB SWT	it 24.80 dB RBW 100 kHz 230 ms VBW 300 kHz Mode Auto Sweep	
PRC 2008 3W1 25.7 IIIS VBW 300 KH2 MDde 1	atto Sweep	230 ms • VBW 300 kHz Mode Adio Sweep	
20 dBm	2.47780 GHz	M1[1] M2[1]	8.38 dB) 2.4830 GF -35.02 dB) 16.1300 GF
10 dBm 01 9.750 dBm	M1 10 dBm D1 8.380 dBm		
0 dBm	0 dBm		
10-d8mD2 -10.250 dBm	-10 dBm	,	
-20 dBm	-40 dBm		
-30 dBm	-30 dBm	M2	
-40 dBm	mouture of the market ward and the second and the s	when we and the state of the state of the second	proceeding the here with
-50 dBm	-50 dBm		
-60 dBm	-60 dBm		
Start 30.0 MHz 691 pts	Stop 3.0 GHz Start 2.0 GHz	691 pts	Stop 25.0 GHz
	Nexuries III III III 440		AND 10 10 10 10 10 10 10 10 10 10 10 10 10



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Spectrum Ref Level 30.00 dBm Offset 24.80 dB 44 Att 20 dB 5WT 29.7 ms IPk View SWT 29.7 ms					25 GHz
Ref Level 30.00 dBm Offset 24.80 dB Att 20 dB SWT 29.7 ms		Spectrum			
		Ref Level 3			(•)
	VBW 300 KHZ Mode Auto Sweep	Att IPk View	20 dB SWT 230 ms 🖶 VBW 3	300 kHz Mode Auto Sweep	
	M1[1]	9.82 dBm 2.40040 GHz		M1[1]	8.47 dBm 2.4160 GHz
20 dBm	M2[1]	-41.86 dBm 20 dBm-		M2[1]	-34.92 dBm 15.7300 GHz
10 d8m D1 9.820 d8m		M1 M1			
		U.	1 8.470 dBm		
0 dBm		0 dBm			
-10-dBm-D2 -10,180 dBm-		-10 dBm-	D2 -11.530 dBm		
-20 dBm-		-20 dBm			
-30 dBm-		-30 dBm		M2	
-40 dBm		M2	mark	was a provent the last and proved	La mandamente work and
marken we weather washingthered	upper well and more more and and	M2 -40 dBm	much and der well the ward of the week	004.011	
-50 dBm		-50 dBm			
-60 dBm-		-60 dBm-			
Start 30.0 MHz	691 pts	Stop 3.0 GHz Start 2.0 GH	z	691 pts	Stop 25.0 GHz
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Spectrum Ref Level 30.00 dBm Offset 24.80 dB	39 between 30 MH	Z ~ 3 GHZ CS	30.00 dBm Offset 24.80 dB • RBW 3	100 kHz	- 25 GHz
Att 20 dB SWT 29.7 ms	VBW 300 kHz Mode Auto Sweep	👄 Att	20 dB SWT 230 ms 🖷 VBW 3	300 kHz Mode Auto Sweep	
e 1Pk View	M1[1]	9.83 dBm		M1[1]	8.62 dBm
20 dBm-	-M2[1]	2.43910 GHz -42.57 dBm 20 dBm			2.4490 GHz -35.19 dBm
		1.10670 GHz			19.3910 GHz
-10 d8m D1 9.830 d8m		19 dBm	1 8.620 dBm		
0 dBm		0 dBm			
10 dBm D2 -10.170 dBm		-10 dBm-	D2 -11.380 dBm		
-20 dBm		-20 dBm			+
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		-30 08/1		LARGEN M2	
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-50 dBm				601 sta	0447 05 0 01
-50 dBm	691 pts	Stop 3.0 GHz	Iz	691 pts	Stop 25.0 GHz
-50 dBm	691 pts		π	691 pts	Stop 25.0 GHz



Spectrum			Spectrum		
	B 👄 RBW 100 kHz			24.80 dB 🖷 RBW 100 kHz	
Att 20 dB SWT 29.7 m 1Pk View	is 🖷 VBW 300 kHz Mode Auto Sweep		Att 20 dB SWT	230 ms 🖶 VBW 300 kHz 🛛 Mode Auto Sweep	
20 dBm	M1[1] M2[1]	2.96350 GHz	20 dBm	M1[1] 	9.03 dBr 2.4830 GH -34.70 dBr 17.9270 GH
10 dBm D1 9.870 dBm		M1	M1 18 dBm D1 9.030 dBm		
0 dBm			0 dBm		
10 dBm D2 -10.130 dBm			-10.dBmD2 -10.970 dBm		
-20 dBm			-20 dBm		
-30 dBm			-30 dBm-	h m Migue LLN .	LMA
-40 dBm-	with harpon binan with more ward	where all monorally monorally		monto contraction of the	how he reverse have really
-50 dBm			-50 dBm		
-60 dBm			-60 dBm		
Start 30.0 MHz	691 pts	Stop 3.0 GHz	Start 2.0 GHz	691 pts	Stop 25.0 GHz
	Stearoring	44 CT		Steer order.	(IIIIIII) 4/9

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

See list of measuring equipment of this test report.



3.8.3 Test Procedures

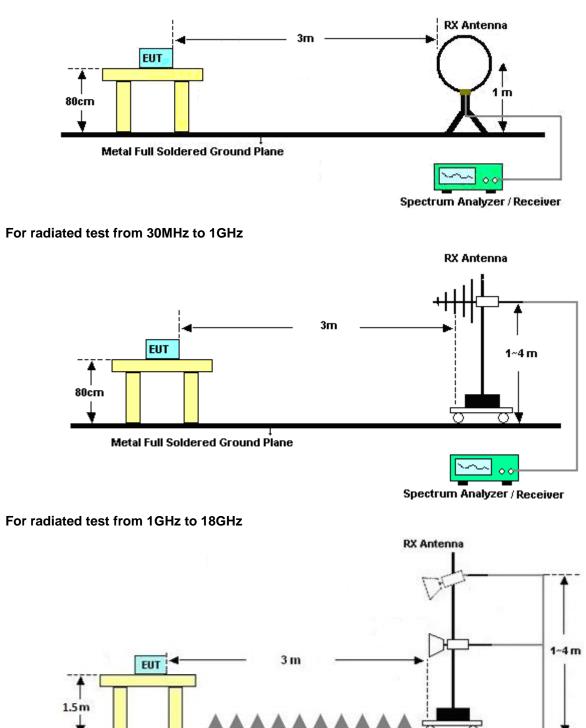
- 1. The EUT was placed on a turntable with 0.8 meter for frequency below 1 GHz and 1.5 meter for frequency above 1 GHz respectively above ground.
- 2. The EUT was set 3 meters from the interference receiving antenna, which was mounted on the top of a variable height antenna tower.
- 3. For each suspected emission, the EUT was arranged to its worst case and then tune the Antenna tower (from 1 m to 4 m) and turntable (from 0 degree to 360 degrees) to find the maximum reading. A pre-amp and a high pass filter are used for the test in order to get better signal level to comply with the guidelines.
- 4. Set 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 = N₁*L₁+N₂*L₂+...+N_{n-1}*LN_{n-1}+N_n*L_n Where N₁ is number of type 1 pulses, L₁ 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 were calculated from the peak level corrected with duty cycle correction factor (-24.79dB) derived from 20log (dwell time/100ms). This correction is only for signals that hop with the fundamental signal, such as band-edge and harmonic. Other spurious signals that are independent of the hopping signal would not use this correction.



3.8.4 Test Setup

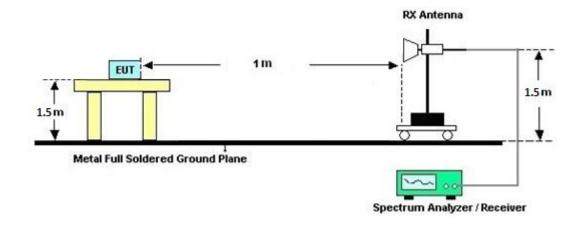
For radiated test below 30MHz



Metal Full Soldered Ground Plane



For radiated test above 18GHz



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

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

There is 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.

3.8.6 Test Result of Radiated Spurious at Band Edges

Please refer to Appendix B and C.

3.8.7 Duty Cycle

Please refer to Appendix D.

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

Please refer to Appendix B and C.



3.9 Antenna Requirements

3.9.1 Standard Applicable

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. 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.

3.9.2 Antenna Anti-Replacement Construction

An embedded-in antenna design is used.

3.9.3 Antenna Gain

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

List of Measuring Equipment 4

Instrument	Brand Name	Model No.	Serial No.	Characteristics	Calibration Date	Test Date	Due Date	Remark
Bilog Antenna	TESEQ	CBL 6111D & 00800N1D01N -06	35419 & 03	30MHz~1GHz	Apr. 28, 2021	Aug. 20, 2021~ Aug. 26, 2021	Apr. 27, 2022	Radiation (03CH07-HY)
Double Ridge Horn Antenna	ESCO	3117	00075962	1GHz ~ 18GHz	Dec. 01, 2020	Aug. 20, 2021~ Aug. 26, 2021	Nov. 30, 2021	Radiation (03CH07-HY)
Loop Antenna	Rohde & Schwarz	HFH2-Z2	100315	9 kHz~30 MHz	Jan. 04, 2021	Aug. 20, 2021~ Aug. 26, 2021	Jan. 03, 2022	Radiation (03CH07-HY)
Preamplifier	MITEQ	AMF-7D-0010 1800-30-10P	1590075	1GHz~18GHz	Apr. 22, 2021	Aug. 20, 2021~ Aug. 26, 2021	Apr. 21, 2022	Radiation (03CH07-HY)
Preamplifier	COM-POWER	PA-103A	161241	10MHz~1GHz	May 18, 2021	Aug. 20, 2021~ Aug. 26, 2021	May 17, 2022	Radiation (03CH07-HY)
Preamplifier	Agilent	8449B	3008A02362	1GHz~26.5GHz	Oct. 31, 2020	Aug. 20, 2021~ Aug. 26, 2021	Oct. 30, 2021	Radiation (03CH07-HY)
Preamplifier	EMEC	EM18G40G	0600789	18-40GHz	Jul. 23, 2021	Aug. 20, 2021~ Aug. 26, 2021	Jul. 22, 2022	Radiation (03CH07-HY)
Spectrum Analyzer	Agilent	N9030A	MY52350276	3Hz~44GHz	Jul. 22, 2021	Aug. 20, 2021~ Aug. 26, 2021	Jul. 21, 2022	Radiation (03CH07-HY)
Filter	Microwave	H1G013G1	SN477215	1GHz High Pass Filter	Oct. 31, 2020	Aug. 20, 2021~ Aug. 26, 2021	Oct. 30, 2021	Radiation (03CH07-HY)
RF Cable	HUBER + SUHNER	SUCOFLEX 104	MY15682-4	30MHz to 18GHz	Feb. 24, 2021	Aug. 20, 2021~ Aug. 26, 2021	Feb. 23, 2022	Radiation (03CH07-HY)
RF Cable	HUBER + SUHNER	SUCOFLEX 104	MY24971-4	9kHz to 18GHz	Feb. 24, 2021	Aug. 20, 2021~ Aug. 26, 2021	Feb. 23, 2022	Radiation (03CH07-HY)
RF Cable	HUBER + SUHNER	SUCOFLEX 104	MY28655-4	9kHz to 18GHz	Feb. 24, 2021	Aug. 20, 2021~ Aug. 26, 2021	Feb. 23, 2022	Radiation (03CH07-HY)
RF Cable	HUBER + SUHNER	SUCOFLEX 102	MY2858/2,80 1606/2	18GHz~40GHz	Feb. 24, 2021	Aug. 20, 2021~ Aug. 26, 2021	Feb. 23, 2022	Radiation (03CH07-HY)
RF Cable	HUBER + SUHNER	SUCOFLEX 126	532078/126E	30MHz~18GHz	Sep. 18, 2020	Aug. 20, 2021~ Aug. 26, 2021	Sep. 17, 2021	Radiation (03CH07-HY)
RF Cable	HUBER + SUHNER	SUCOFLEX 102	801606/2	9KHz ~ 40GHz	Apr. 03, 2021	Aug. 20, 2021~ Aug. 26, 2021	Apr. 02, 2022	Radiation (03CH07-HY)
Controller	EMEC	EM1000	N/A	Control Ant Mast	Apr. 28, 2021	Aug. 20, 2021~ Aug. 26, 2021	Apr. 27, 2022	Radiation (03CH07-HY)
Controller	MF	MF-7802	N/A	Control Turn table	N/A	Aug. 20, 2021~ Aug. 26, 2021	N/A	Radiation (03CH07-HY)
Antenna Mast	EMEC	AM-BS-4500E	N/A	Boresight mast 1M~4M	Apr. 28, 2021	Aug. 20, 2021~ Aug. 26, 2021	Apr. 27, 2022	Radiation (03CH07-HY)
Turn Table	ChainTek	Chaintek 3000	N/A	0~360 Degree	N/A	Aug. 20, 2021~ Aug. 26, 2021	N/A	Radiation (03CH07-HY)
Software	Audix	E3 6.2009-8-24	N/A	N/A	N/A	Aug. 20, 2021~ Aug. 26, 2021	N/A	Radiation (03CH07-HY)
USB Data Logger	TECPEL	TR-32	HE17XB2495	N/A	Mar. 09, 2021	Aug. 20, 2021~ Aug. 26, 2021	Mar. 08, 2022	Radiation (03CH07-HY)
SHF-EHF Horn Antenna	SCHWARZBE CK	BBHA 9170	BBHA917025 1	18GHz~40GHz	Dec. 02, 2020	Aug. 20, 2021~ Aug. 26, 2021	Dec. 01, 2021	Radiation (03CH07-HY)
Hygrometer	Testo	608-H1	34893241	N/A	Mar. 02, 2021	Aug. 11, 2021~ Aug. 24, 2021	Mar. 01, 2022	Conducted (TH02-HY)
Power Meter	Agilent	E4416A	GB41292344	N/A	Jan. 14, 2021	Aug. 11, 2021~ Aug. 24, 2021	Jan. 13, 2022	Conducted (TH02-HY)
Power Sensor	Agilent	E9327A	US40441548	50MHz~18GHz	Jan. 14, 2021	Aug. 11, 2021~ Aug. 24, 2021	Jan. 13, 2022	Conducted (TH02-HY)
Signal Analyzer	Rohde & Schwarz	FSV40	101397	10Hz~40GHz	Nov. 27, 2020	Aug. 11, 2021~ Aug. 24, 2021	Nov. 26, 2021	Conducted (TH02-HY)
Switch Box & RF Cable	EM Electronics	EMSW18SE	SW200302	N/A	Mar. 17, 2021	Aug. 11, 2021~ Aug. 24, 2021	Mar. 16, 2022	Conducted (TH02-HY)



5 Uncertainty of Evaluation

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

Measuring Uncertainty for a Level of Confidence	4.9 dB
of 95% (U = 2Uc(y))	4.9 dB

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

Measuring Uncertainty for a Level of Confidence	6.1 dB
of 95% (U = 2Uc(y))	0.1 UB

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

Measuring Uncertainty for a Level of Confidence	4.7 dB
of 95% (U = 2Uc(y))	4.7 UB

Report Number : FR180215-01A

Appendix A. Test Result of Conducted Test Items

Test Engineer:	Hank Hsu / Tommy Lee	Temperature:	22.5~25.9	°C
Test Date:	2021/8/11~2021/8/24	Relative Humidity:	45.1~58.7	%

<u>TEST RESULTS DATA</u> 20dB and 99% Occupied Bandwidth and Hopping Channel Separation									
Mod.	Data Rate	NTX	CH.	Freq. (MHz)	20db BW (MHz)	99% Bandwidth (MHz)	Hopping Channel Separation Measurement (MHz)	Hopping Channel Separation Measurement Limit (MHz)	Pass/Fail
DH	1Mbps	1	0	2402	0.932	0.853	1.002	0.6213	Pass
DH	1Mbps	1	39	2441	0.955	0.862	0.842	0.6367	Pass
DH	1Mbps	1	78	2480	0.932	0.853	0.998	0.6213	Pass
2DH	2Mbps	1	0	2402	1.337	1.180	1.002	0.8913	Pass
2DH	2Mbps	1	39	2441	1.332	1.180	1.002	0.8880	Pass
2DH	2Mbps	1	78	2480	1.332	1.180	0.998	0.8880	Pass
3DH	3Mbps	1	0	2402	1.293	1.163	0.864	0.8620	Pass
3DH	3Mbps	1	39	2441	1.298	1.169	1.002	0.8653	Pass
3DH	3Mbps	1	78	2480	1.298	1.166	0.998	0.8653	Pass

<u>TEST RESULTS DATA</u> Dwell Time									
Mod.	Hopping Channel Number Rate	Hops Over Occupancy Time(hops)	Package Transfer Time (msec)	Dwell Time (sec)	Limits (sec)	Pass/Fail			
Nomal	79	106.67	2.90	0.31	0.4	Pass			
AFH	20	53.33	2.90	0.15	0.4	Pass			

<u>TEST RESULTS DATA</u> Peak Power Table									
DH	CH.	NTX	Peak Power (dBm)	Power Limit (dBm)	Test Result				
	0	1	11.92	20.97	Pass				
DH1	39	1	11.87	20.97	Pass				
	78	1	11.94	20.97	Pass				
	0	1	11.65	20.97	Pass				
2DH1	39	1	11.56	20.97	Pass				
	78	1	11.63	20.97	Pass				
	0	1	12.26	20.97	Pass				
3DH1	39	1	12.23	20.97	Pass				
	78	1	12.27	20.97	Pass				

<u>TEST RESULTS DATA</u> <u>Average Power Table</u> (Reporting Only)							
DH	CH.	NTX	Average Power (dBm)	Duty Factor (dB)			
	0	1	11.88	5.15			
DH1	39	1	11.83	5.15			
	78	1	11.91	5.15			
	0	1	8.87	5.15			
2DH1	39	1	8.78	5.15			
	78	1	8.85	5.15			
	0	1	8.91	5.15			
3DH1	39	1	8.86	5.15			
	78	1	8.87	5.15			

		<u>TEST RE</u> Number of H	SULTS DA	
Number of Hopping (Channel)	Adaptive Frequency Hopping (Channel)	Limits (Channel)	Pass/Fail	
79	20	> 15	Pass	



Appendix B. Radiated Spurious Emission

Test Engineer :	Jesse Wang and Stan Hsieh	Temperature :	23.5~25.1°C
Test Engineer.	Jesse Wang and Starr I Sien	Relative Humidity :	51.3~55.5%

<Sample 1 with Battery 1>

2.4GHz 2400~2483.5MHz

					BT (Band E	age @	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)
		2389.59	48.45	-25.55	74	43.88	31.9	8.08	35.41	354	100	Р	Н
		2389.59	23.66	-30.34	54	-	-	-	-	-	-	А	Н
	*	2402	102.39	-	-	97.79	31.9	8.12	35.42	354	100	Р	Н
вт	*	2402	77.6	-	-	-	-	-	-	-	-	A	Н
СН00													Н
2402MHz		2375.625	44.23	-29.77	74	39.75	31.87	8.02	35.41	309	329	Р	V
		2375.625	19.44	-34.56	54	-	-	-	-	-	-	А	V
	*	2402	98.62	-	-	94.02	31.9	8.12	35.42	309	329	Р	V
	*	2402	73.83	-	-	-	-	-	-	-	-	А	V
													V
		2323.02	44.43	-29.57	74	40.23	31.77	7.82	35.39	340	101	Р	Н
		2323.02	19.64	-34.36	54	-	-	-	-	-	-	А	Н
	*	2441	103.2	-	-	98.26	32.2	8.18	35.44	340	101	Ρ	Н
	*	2441	78.41	-	-	-	-	-	-	-	-	А	Н
вт		2485.72	45.76	-28.24	74	40.5	32.47	8.24	35.45	340	101	Р	Н
CH 39		2485.72	20.97	-33.03	54	-	-	-	-	-	-	А	Н
2441MHz		2375.94	44.35	-29.65	74	39.87	31.87	8.02	35.41	315	154	Р	V
		2375.94	19.56	-34.44	54	-	-	-	-	-	-	А	V
	*	2441	101.38	-	-	96.44	32.2	8.18	35.44	315	154	Р	V
	*	2441	76.59	-	-	-	-	-	-	-	-	А	V
		2495.17	45.06	-28.94	74	39.67	32.6	8.25	35.46	315	154	Р	V
		2495.17	20.27	-33.73	54	-	-	-	-	-	-	А	V

BT (Band Edge @ 3m)



	*	2480	101.14	-	-	95.89	32.47	8.23	35.45	100	63	Р	Н
	*	2480	76.35	-	-	-	-	-	-	-	-	А	Н
		2483.8	52.83	-21.17	74	47.57	32.47	8.24	35.45	100	63	Р	Н
		2483.8	28.04	-25.96	54	-	-	-	-	-	-	А	Н
DT													Н
ВТ СН 78													Н
СП 76 2480MHz	*	2480	98.58	-	-	93.33	32.47	8.23	35.45	300	154	Р	V
2400141112	*	2480	73.79	-	-	-	-	-	-	-	-	А	V
		2483.64	50.26	-23.74	74	45	32.47	8.24	35.45	300	154	Ρ	V
		2483.64	25.47	-28.53	54	-	-	-	-	-	-	А	V
													V
													V
Remark		o other spurious I results are PA		Peak and	Average lir	nit line.							



2.4GHz 2400~2483.5MHz

вт	Nete	-	1				-	Deth	Due entre	A 1	Table	Peak	Del
ы	Note	Frequency	Level	Over Limit	Limit Line	Read Level	Antenna Factor	Path Loss	Preamp	Ant Pos	Table Pos	Peak Avg.	
		(MHz)	(dBµV/m)		(dBµV/m)		(dB/m)	(dB)	Factor (dB)	(cm)	(deg)		
		4804	42.79	-31.21	74	54.45	34	12.33	57.99	-	-	P	H
		4804	18	-36	54	-	-	-	-	-	-	А	Н
													Н
													Н
вт													Н
CH 00													Н
2402MHz		4804	43.19	-30.81	74	54.85	34	12.33	57.99	-	-	Ρ	V
		4804	18.4	-35.6	54	-	-	-	-	-	-	А	V
		4980	54.79	-19.21	74	65.85	34.2	12.52	57.78	100	159	Р	V
		4980	30	-24	54	-	-	-	-	-	-	А	V
													V
													V
		4882	42.94	-31.06	74	54.33	34.1	12.41	57.9	-	-	Ρ	Н
		4882	18.15	-35.85	54	-	-	-	-	-	-	А	Н
		7323	43.46	-30.54	74	51.08	35.6	14.7	57.92	-	-	Р	Н
		7323	18.67	-35.33	54	-	-	-	-	-	-	А	Н
вт													Н
CH 39													Н
2441MHz		4882	43.39	-30.61	74	54.78	34.1	12.41	57.9	-	-	Р	V
277 I WI IZ		4882	18.6	-35.4	54	-	-	-	-	-	-	А	V
		4980	55.11	-18.89	74	66.17	34.2	12.52	57.78	100	159	Р	V
		4980	30.32	-23.68	54	-	-	-	-	-	-	А	V
		7323	42.3	-31.7	74	49.92	35.6	14.7	57.92	-	-	Ρ	V
		7323	17.51	-36.49	54	-	-	-	-	-	-	А	V

BT (Harmonic @ 3m)



		4960	42.04	-31.96	74	53.15	34.2	12.5	57.81	-	-	Р	Н
		4960	17.25	-36.75	54	-	-	-	-	-	-	А	Н
		7440	43.22	-30.78	74	50.76	35.6	14.9	58.04	-	-	Ρ	н
		7440	18.43	-35.57	54	-	-	-	-	-	-	А	н
DT													Н
BT													н
		4960	42.21	-31.79	74	53.32	34.2	12.5	57.81	-	-	Р	V
2480MHz		4960	17.42	-36.58	54	-	-	-	-	-	-	А	V
		4980	54.76	-19.24	74	65.82	34.2	12.52	57.78	100	159	Ρ	V
		4980	29.97	-24.03	54	-	-	-	-	-	-	А	V
		7440	41.68	-32.32	74	49.22	35.6	14.9	58.04	-	-	Ρ	V
		7440	16.89	-37.11	54	-	-	-	-	-	-	А	V
	1.	No other spurious	s found.	<u> </u>					•	•	•		
Remark	2.	All results are PA	SS against	Peak and	Average lin	nit line.							
Nemark	3.	The emission pos	ition marke	d as "-" me	eans no sus	pected em	ssion foun	d with suff	icient mar	gin agai	nst limit	line or	noise
		floor only.											



Emission above 18GHz

					2.4GHz	BT (SHF	-)						
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)		(H/V)
		20940	35.94	-38.06	74	52.42	38.01	5.61	60.1	-	-	Р	Н
													Н
													н
													Н
													н
													н
													н
													Н
													Н
													Н
													н
2.4GHz													н
ВТ		24517	35.67	-38.33	74	47.91	39.07	6.76	58.07	-	_	Р	V
SHF		24317	55.07	-30.33	74	47.91	39.07	0.70	58.07	-	-	Г	V
													V
													V
													V
													V
													V
													V
													V
													V
													V
													V
	1. No	o other spuriou	s found.										
Remark	2. All	results are PA	SS against li	mit line.									
	3. Th	e emission pos	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	ļ	
		(MHz)	(dBµV/m)	Limit (dB)	Line (dBµV/m)	Level (dBµV)	Factor (dB/m)	Loss (dB)	Factor (dB)	Pos (cm)	Pos (deg)	Avg.	
		30.54	22.98	-17.02	40	27.92	24.17	0.92	30.03	-	-	P	н
		37.56	20.85	-19.15	40	29.02	20.73	1.12	30.02	-	-	Р	н
		106.95	18.39	-25.11	43.5	30.04	16.57	1.77	29.99	-	-	Р	н
		765.5	30.23	-15.77	46	27.85	27.73	4.3	29.65	-	-	Р	н
		860.7	31.64	-14.36	46	27.36	28.84	4.62	29.18	-	-	Р	Н
		953.8	33.09	-12.91	46	26.41	30.49	4.89	28.7	-	-	Р	н
													н
													Н
													Н
													Н
2.4GHz													н
вт		20	00.00	0.40	40	05.00	04.57		00.00			_	H
LF		30 45.39	30.82 20.53	-9.18 -19.47	40 40	35.38 32.64	24.57 16.69	0.9	30.03 30.01	-	-	P P	V V
		84.54	18.56	-21.44	40	33.09	13.89	1.58	30.01	-	-	P	V
		729.8	29.59	-16.41	40	28.17	26.93	4.21	29.72	_		P	V
		862.1	31.71	-14.29	46	27.39	28.87	4.62	29.12	-	-	' P	V
		959.4	33.54	-12.46	46	26.5	30.8	4.91	28.67	-	-	P	V
													V
													V
													V
													V
													V
													V
	1. No	o other spurious	s found.										
Remark		results are PA											
		e emission pos	ition marked	l as "-" m	eans no sus	pected em	ission found	d with suff	ficient mar	gin agai	nst limit	line or	[.] noise
	flo	or only.											

2.4GHz BT (LF)



<Sample 1 with Battery 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)
		2379.86	45.39	-28.61	74	40.89	31.87	8.04	35.41	100	89	Р	Н
		2379.86	20.6	-33.4	54	-	-	-	-	-	-	А	н
	*	2441	103.3	-	-	98.36	32.2	8.18	35.44	100	89	Р	Н
	*	2441	78.51	-	-	-	-	-	-	-	-	А	н
		2490.13	45.06	-28.94	74	39.66	32.6	8.25	35.45	100	89	Р	н
BT		2490.13	20.27	-33.73	54	-	-	-	-	-	-	А	н
CH 39 2441MHz		2349.2	43.92	-30.08	74	39.6	31.8	7.92	35.4	390	172	Р	V
244 (10112		2349.2	19.13	-34.87	54	-	-	-	-	-	-	А	V
	*	2441	100.23	-	-	95.29	32.2	8.18	35.44	390	172	Р	V
	*	2441	75.44	-	-	-	-	-	-	-	-	А	V
		2491.53	45.61	-28.39	74	40.21	32.6	8.25	35.45	390	172	Р	V
		2491.53	20.82	-33.18	54	-	-	-	-	-	-	А	V
	1. No	o other spurious	s found.										
Remark	2. All	results are PA	SS against F	eak and	Average lim	it line.							



ВТ	Note	Frequency	Level	Over	Limit	Read	Antenna	Path	Preamp	Ant	Table	Peak	Pol.
			(dBu)//m)	Limit	Line		Factor	Loss	Factor	Pos		Avg.	
		(MHz)	(dBµV/m)	(dB)	(dBµV/m)	(dBµV)	(dB/m)	(dB)	(dB)	(cm)	(deg)	(P/A)	
		4882	42.36	-31.64	74	53.75	34.1	12.41	57.9	-	-	Р	Н
		4882	17.57	-36.43	54	-	-	-	-	-	-	А	Н
		4980	45.58	-28.42	74	56.64	34.2	12.52	57.78	-	-	Р	н
		4980	20.79	-33.21	54	-	-	-	-	-	-	А	н
		7323	42.07	-31.93	74	49.69	35.6	14.7	57.92	-	-	Р	н
BT		7323	17.28	-36.72	54	-	-	-	-	-	-	А	н
CH 39		4882	43.1	-30.9	74	54.49	34.1	12.41	57.9	-	-	Р	V
2441MHz		4882	18.31	-35.69	54	-	-	-	-	-	-	А	V
		4980	50.91	-23.09	74	61.97	34.2	12.52	57.78	-	-	Ρ	V
		4980	26.12	-27.88	54	-	-	-	-	-	-	А	V
		7323	41.74	-32.26	74	49.36	35.6	14.7	57.92	-	-	Р	V
		7323	16.95	-37.05	54	-	-	-	-	-	-	А	V
	1. No	o other spurious	s found.										
Remark	2. All	results are PA	SS against F	eak and	Average lim	it line.							
	3. Th	e emission pos	ition marked	as "-" m	eans no sus	pected em	ission found	d with suff	icient mar	gin agai	nst limit	line or	noise
	flo	or only.											

2.4GHz 2400~2483.5MHz BT (Harmonic @ 3m)



Emission above 18GHz

					2.4GHz	BI (SHF	.)		-				
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)	
		23201	36.24	-37.76	74	50.14	38.8	6.3	59	-	-	Р	Н
													Н
													Н
													н
													Н
													н
													н
													Н
													н
													н
2.4GHz													Н
вт													Н
SHF		23194	37.11	-36.89	74	51.01	38.8	6.3	59	-	-	Р	V
													V
													V
													V
													V
													V
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			· ·										V
		o other spuriou											
Remark		results are PA							<i>.</i>				
		e emission pos	sition marked	as "-" m	eans no susp	pected em	ission found	a with suf	ficient mar	gin agai	nst limit	line or	noise
	flo	or only.											

2.4GHz BT (SHF)



Emission below 1GHz

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)		
		30	22.9	-17.1	40	27.46	24.57	0.9	30.03	-	-	Р	Н
		38.91	17.99	-22.01	40	26.88	20	1.13	30.02	-	-	Р	Н
		106.95	18.7	-24.8	43.5	30.35	16.57	1.77	29.99	-	-	Р	Н
		783.7	30.23	-15.77	46	27.67	27.83	4.35	29.62	-	-	Р	Н
		843.9	31.28	-14.72	46	27.43	28.56	4.58	29.29	-	-	Ρ	н
		955.9	33.93	-12.07	46	27.14	30.59	4.89	28.69	-	-	Ρ	н
													Н
													Н
													н
													н
													Н
2.4GHz													н
вт		30	30.29	-9.71	40	34.85	24.57	0.9	30.03	-	-	Р	V
LF		45.93	19.6	-20.4	40	32.02	16.38	1.21	30.01	-	-	Р	V
		91.02	19.19	-24.31	43.5	32.84	14.73	1.61	29.99	-	-	Р	V
		766.2	30.23	-15.77	46	27.85	27.73	4.3	29.65	-	-	Р	V
		889.4	31.85	-14.15	46	27.5	28.68	4.65	28.98	-	-	Р	V
		958	33.26	-12.74	46	26.33	30.71	4.9	28.68	-	-	Р	V
													V
													V
													V
													V
													V
													V
	1. No	o other spuriou	s found.		1		1		<u> </u>	<u> </u>	<u> </u>	I	I
		results are PA		mit line.									
Remark		e emission pos	-		eans no susi	pected em	ission found	d with suf	ficient mar	gin agai	inst limit	line oi	[.] nois
		or only.											

2 4GHz BT (I F)



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	Peak or Average
H/V	Horizontal or Vertical



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

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)
вт		2390	55.45	-18.55	74	54.51	32.22	4.58	35.86	103	308	Р	н
CH 00													
2402MHz		2390	43.54	-10.46	54	42.6	32.22	4.58	35.86	103	308	А	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 μ V/m) – Limit Line(dB μ V/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(dB μ V/m) Limit Line(dB μ V/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".



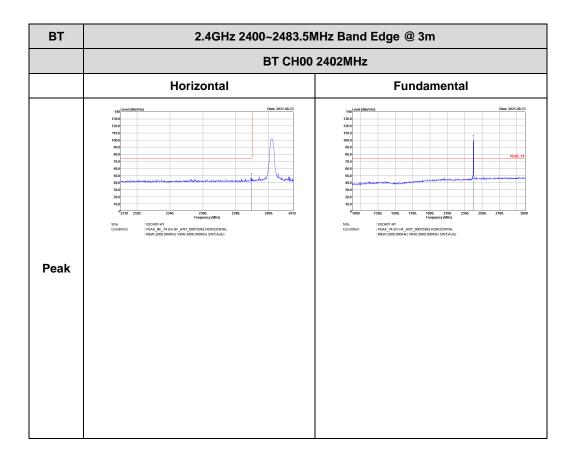
Appendix C. Radiated Spurious Emission Plots

Test Engineer :	Jesse Wang and Stan Hsieh	Temperature :	23.5~25.1°C
rest Engineer.		Relative Humidity :	51.3~55.5%

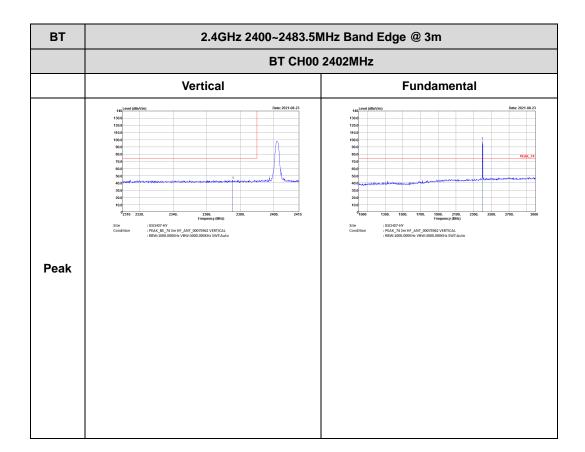
<Sample 1 with Battery 1>

2.4GHz 2400~2483.5MHz

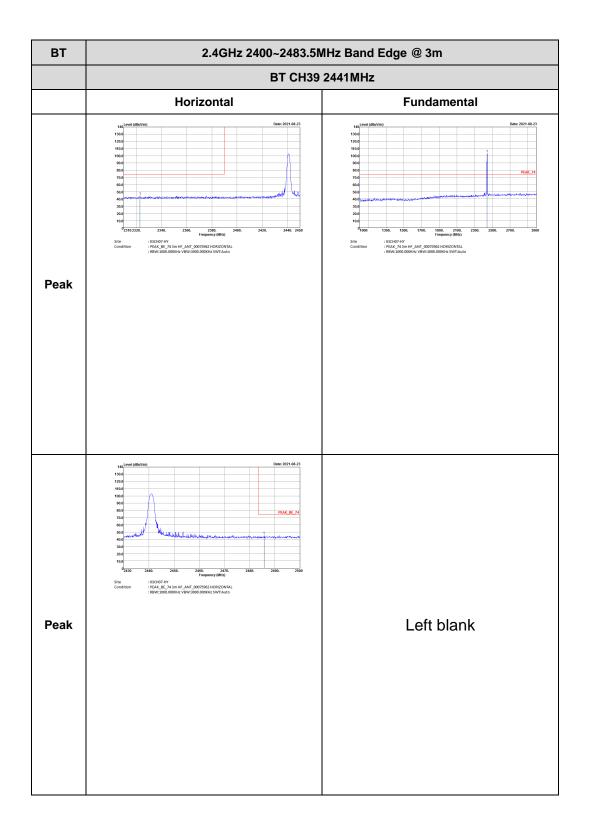
BT (Band Edge @ 3m)



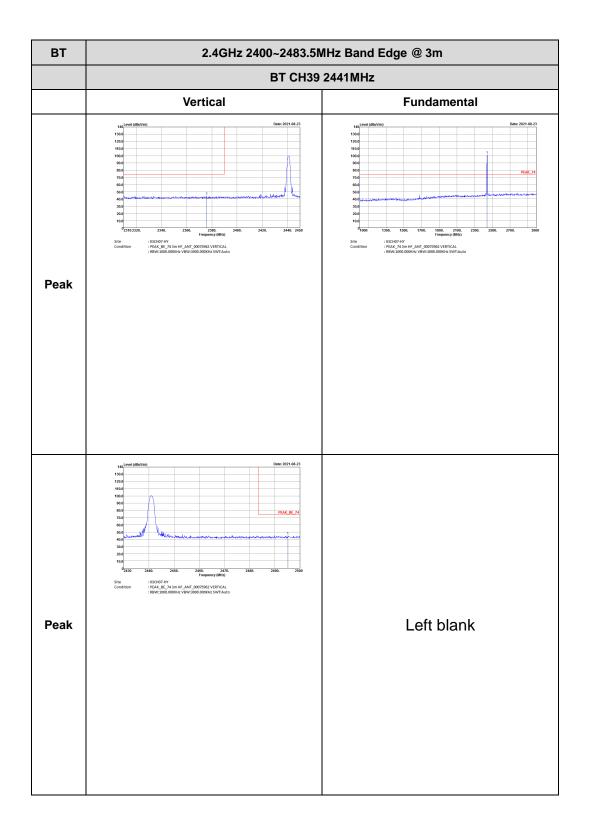




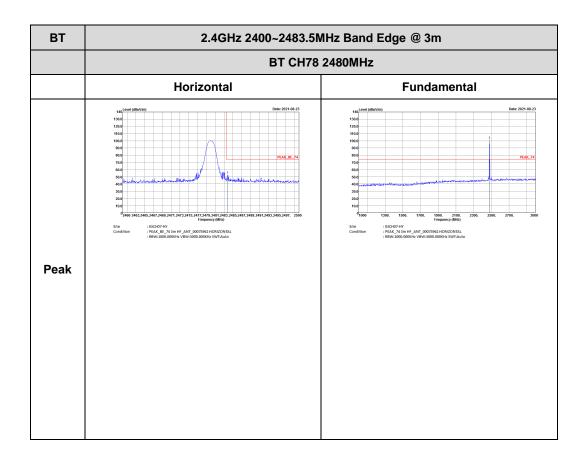




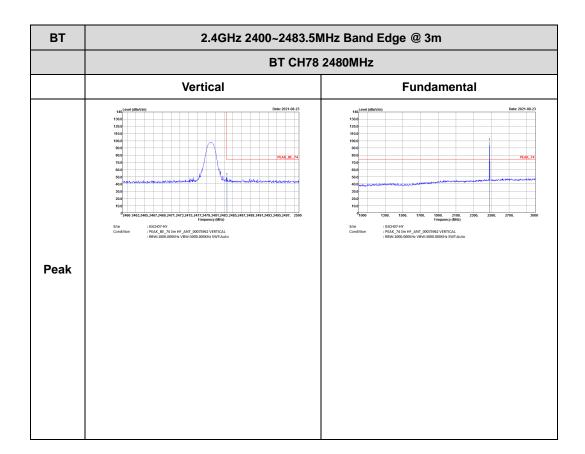






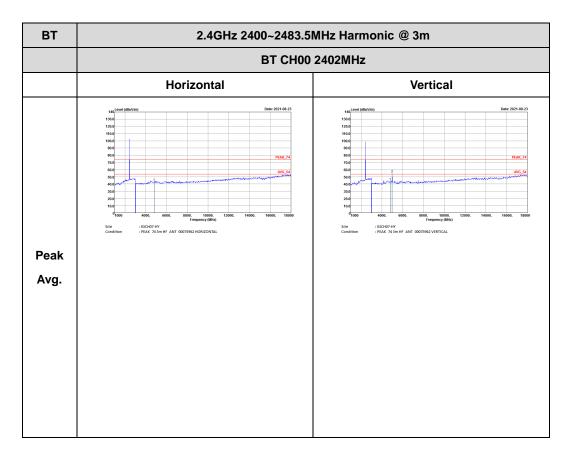






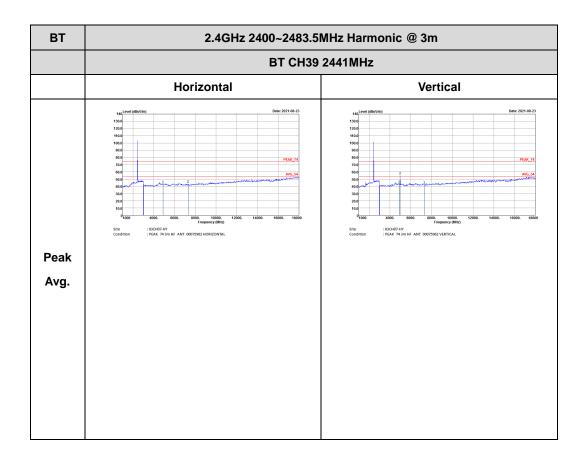


2.4GHz 2400~2483.5MHz

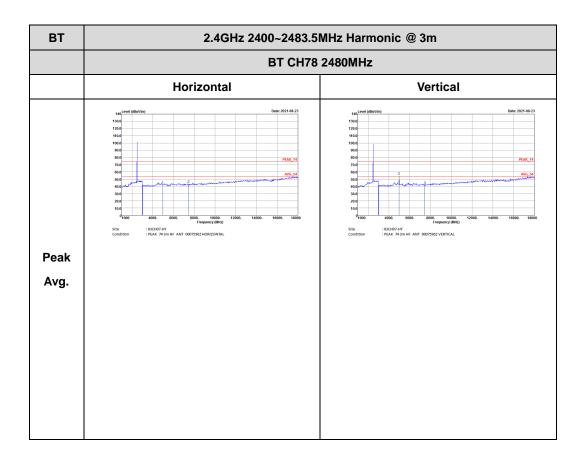


BT (Harmonic @ 3m)



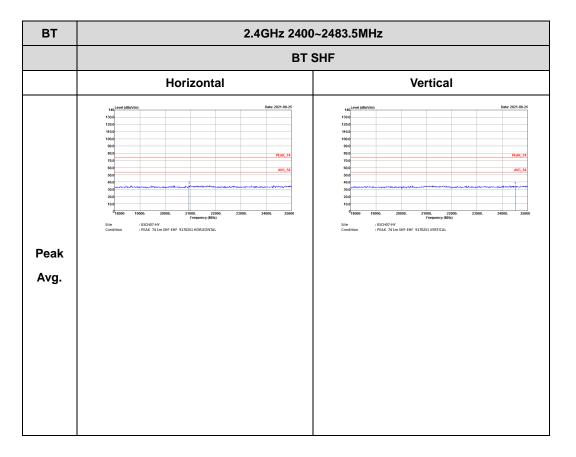








Emission above 18GHz

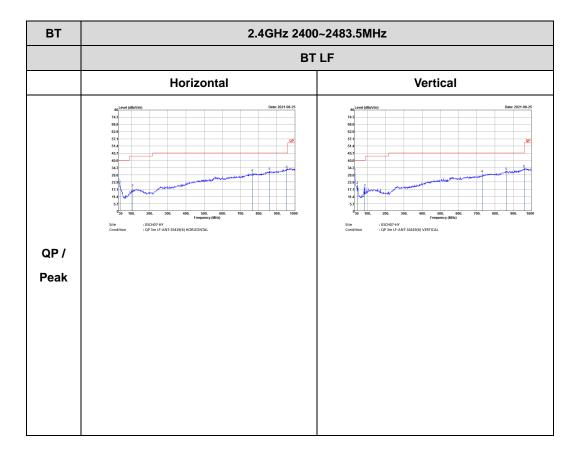


2.4GHz BT (SHF @ 1m)



Emission below 1GHz

2.4GHz BT (LF)

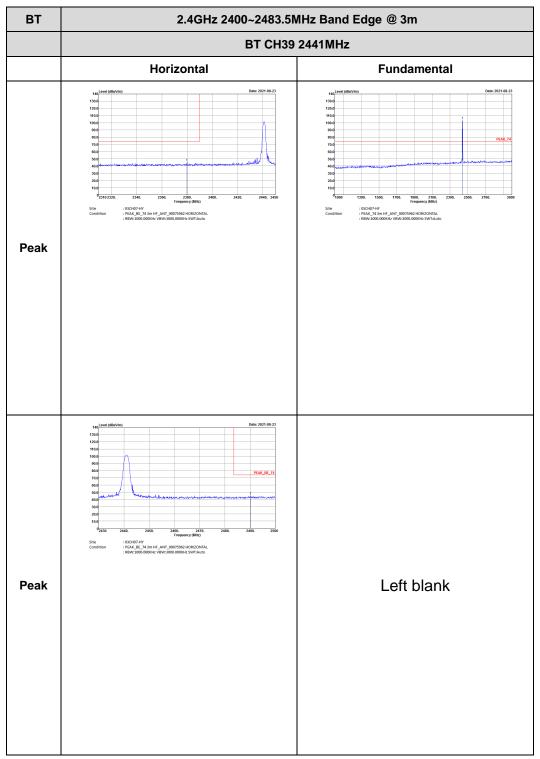




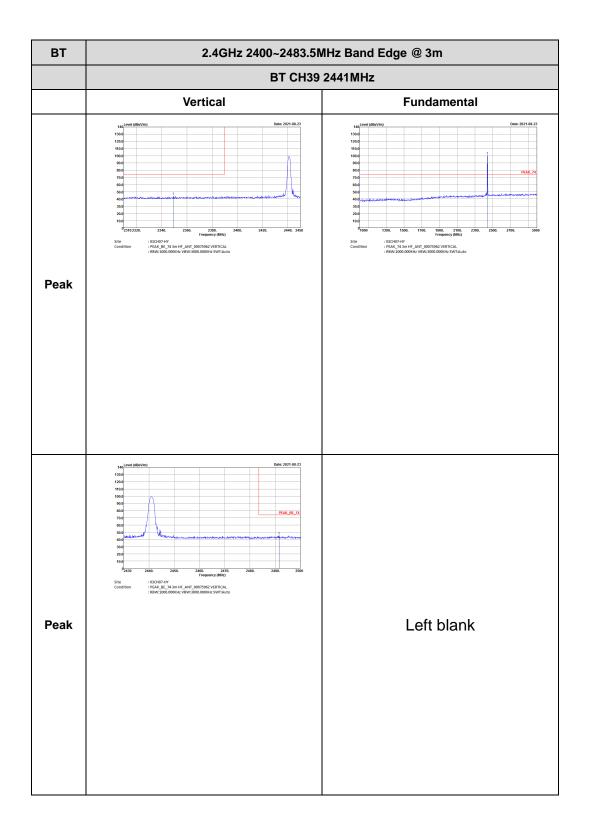
<Sample 1 with Battery 2>

2.4GHz 2400~2483.5MHz

BT (Band Edge @ 3m)

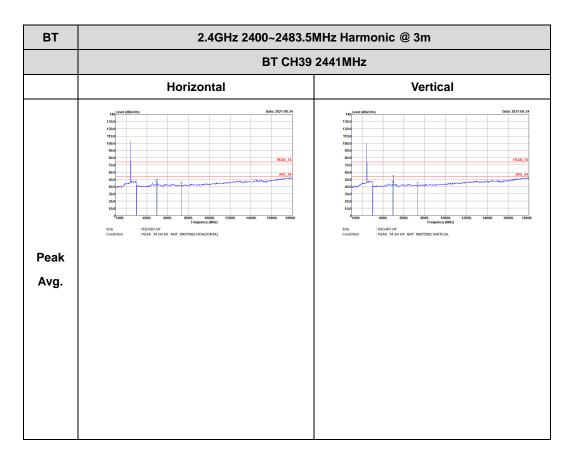








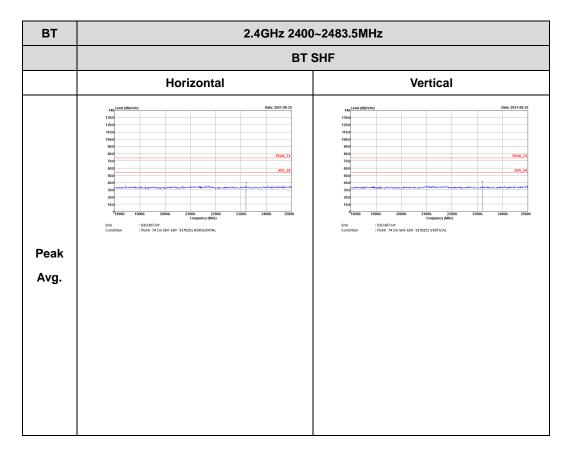
2.4GHz 2400~2483.5MHz



BT (Harmonic @ 3m)



Emission above 18GHz

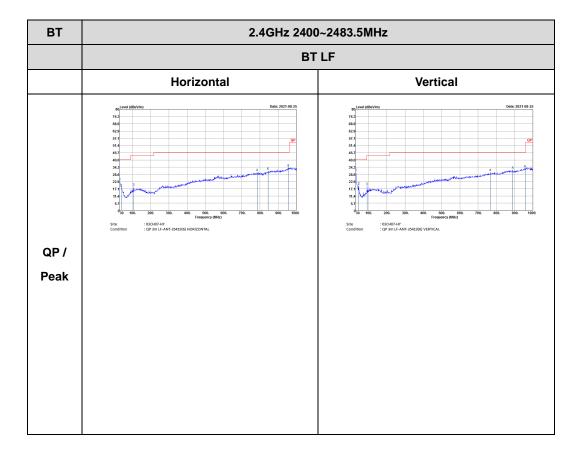


2.4GHz BT (SHF @ 1m)



Emission below 1GHz

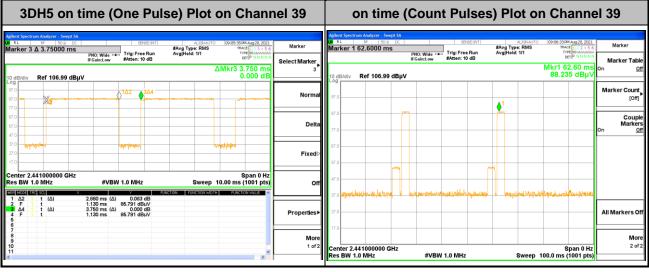
2.4GHz BT (LF)





Appendix D. Duty Cycle Plots

<Sample 1 with Battery 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. **3DH5** 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 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

<Sample 1 with Battery 2>

3DH5 on t	ime (One Pul	se) Plot on Cha	nnel 39	on time (Count Pulses) Plot on Channel 39
Agilent Spectrum Analyzer - Swept SA Qa RL RF S0 Ω DC Marker 3 Δ 3.75000 ms	SENSE-INT	ALIGNAUTO 09:38:07PM Aug23, #Avg Type: RMS TRACE 123 AvgHold: 1/1 TYPE MWW	Marker	Addred Spectrum Analyzer - Swyd XA. ■ RL #F ISD 2 DC SPECENT ALIONAUTO (09:99:23MA Agg23, 2021 Marker 1 40,1000 ms PHO: Widg +++ Trig: Free Run PHO: Widg +++ Trig: Free Run PHO: Widg +++ Trig: Free Run
10 dB/div Ref 116.99 dBµV	IFGain:Low #Atten: 20 dB	ΔMkr3 3.750 -0.018	Select Marker	Million Anter: 20 dB Might and the set of pointing Peak Criteria 10 dB/div Ref 116.99 dB/tV S7.461 dB/tV Peak Criteria
107 97.0	Δ ^{1Δ2} 3Δ4	etterstration of the second seco	Normal	107 Peak Table
87.0 77.0 67.0 57.0			Delta	Image: State
47.0 47.0 37.0 27.0	htterite the second sec	Willhaush	Fixed⊳	870
Center 2.441000000 GHz Res BW 1.0 MHz	#VBW 1.0 MHz	Span 0 Sweep 10.00 ms (1001		570 Pk-Pk Search
1 Δ2 1 t (Δ) 2 F 1 t 3 Δ4 1 t (Δ) 4 F 1 t 5	2.880 ms (Δ) 1.803 dB 240.0 μs 94.968 dBμV 3.760 ms (Δ) -0.018 dB 240.0 μs 94.968 dBμV		Properties►	270 agen
6 7 8 9 10			More 1 of 2	270 Mo Center 2.441000000 GHz Span 0 Hz 2 of
11 <			×	Res BW 1.0 MHz #VBW 1.0 MHz Sweep 100.0 ms (1001 pts)

Note:

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

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

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