

 Project No:
 TM-2406000277P

 Report No.:
 TMWK2407002364KR



FCC ID: PANBA550T

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RADIO TEST REPORT FCC 47 CFR PART 15 SUBPART C

Test Standard	FCC Part 15.247
Product name	Triple source to BT5.3 LE Audio Transmitter
Brand Name	CC&C
Model No.	BA-550T
Test Result	Pass
Statements of Conformity	Determination of compliance is based on the results of the compliance measurement, not taking into account measurement instrumentation uncertainty.

The test Result was tested by Compliance Certification Services Inc. The test data, data evaluation, test procedures, and equipment configurations shown in this report were given in ANSI C63.10: 2013 and compliance standards.

The test results of this report relate only to the tested sample (EUT) identified in this report.

The test Report of full or partial shall not copy. Without written approval of Compliance Certification Services Inc.(Wugu Laboratory)

Approved by:

sehni. Hu

Sehni Hu Supervisor

Unless otherwise stated the results shown in this test report refer only to the sample(s) tested and such sample(s) are retained for 90 days only.

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Revision History

Rev.	Issue Date	Revisions	Effect Page	Revised By
00	August 8, 2024	Initial Issue	ALL	Peggy Tsai
01	August 23, 2024	See the following Note Rev. (01)	P.4, 6, 10, 11	Peggy Tsai
02	September 10, 2024	See the following Note Rev. (02)	P.4	Peggy Tsai
03	September 25, 2024	See the following Note Rev. (03)	P.6	Peggy Tsai

Note: Rev. (01)

1. Modify power operation in section 1.1.

2. Modify antenna information in section 1.4.

3. Modify support and EUT accessories equipment in section 1.8.

4. Modify test set up diagram in section 1.9.

Rev. (02)

1. Added EUT Serial # in section 1.1.

Rev. (03)

1. Modify Antenna Type in section 1.4.



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1. GENERAL INFORMATION

1.1 EUT INFORMATION

Applicant	CC&C Technologies, Inc. 8F, No.150, Jian Yi Rd, Zhonghe District, New Taipei City, 235, Taiwan
Manufacturer	CC&C Technologies, Inc. 8F, No.150, Jian Yi Rd, Zhonghe District, New Taipei City, 235, Taiwan
Equipment	Triple source to BT5.3 LE Audio Transmitter
Model No.	BA-550T
Model Discrepancy	N/A
Trade Name	CC&C
Received Date	June 28, 2024
Date of Test	July 16 ~ 26, 2024
Power Operation	 Powered from Host System: DC 5V Powered from Battery: DC 3.7V, 250mAh, 0.93Wh (Model No.: 502030)
EUT Serial #	Radiated: 000272F14FD1 BA-550T Conducted: 000272F14FD2 BA-550T
HW Version	0A
FW Version	01

Remark:

1. For more details, please refer to the User's manual of the EUT.

2. Disclaimer: Antenna information is provided by the applicant, test results of this report are applicable to the sample EUT received.



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1.2 INFORMATION ABOUT THE FHSS CHARACTERISTICS

1.2.1 Pseudorandom Frequency Hopping Sequence

The channel is represented by a pseudo-random hopping sequence hopping through the 79 RF channels. The hopping sequence is unique for the piconet and is determined by the Bluetooth device address of the master; the phase in the hopping sequence is determined by the Bluetooth clock of the master. The channel is divided into time slots where each slot corresponds to an RF hop frequency. Consecutive hops correspond to different RF hop frequencies. The nominal hop rate is 1 600 hops/s.

1.2.2 Equal Hopping Frequency Use

The channels of this system will be used equally over the long-term distribution of the hopsets.

1.2.3 Example of a 79 hopping sequence in data mode:

02, 05, 31, 24, 20, 10, 43, 36, 30, 23, 40, 06, 21, 50, 44, 09, 71, 78, 01, 13, 73, 07, 70, 72, 35, 62, 42, 11, 41, 08, 16, 29, 60, 15, 34, 61, 58, 04, 67, 12, 22, 53, 57, 18, 27, 76, 39, 32, 17, 77, 52, 33, 56, 46, 37, 47, 64, 49, 45, 38, 69, 14, 51, 26, 79, 19, 28, 65, 75, 54, 48, 03, 25, 66, 05, 16, 68, 74, 59, 63, 55

1.2.4 System Receiver Input Bandwidth

Each channel bandwidth is 1MHz.

The system receivers have input bandwidths that match the hopping channel bandwidths of their corresponding transmitters and shift frequencies in synchronization with the transmitted signals.

1.2.5 Equipment Description

The Rx input bandwidths shift frequencies in synchronization with the transmitted signals.

In accordance with the Bluetooth Industry Standard, the system is designed to comply with all of the regulations in standard when the transmitter is presented with a continuous data (or information) system.

In accordance with the Bluetooth Industry Standard, the system does not coordinate it channels selection/ hopping sequence with other frequency hopping systems for the express purpose of avoiding the simultaneous occupancy of individual hopping frequencies by multiple transmitters.



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1.3 EUT CHANNEL INFORMATION

Frequency Range	2402MHz-2480MHz
Modulation Type	 GFSK for BDR-1Mbps π/4-DQPSK for EDR-2Mbps 8DPSK for EDR-3Mbps
Number of channel	79 Channels

Remark:

Refer as ANSI C63.10: 2013 clause 5.6.1 Table 4 for test channels

Number of frequencies to be tested				
Frequency range in which device operates	Number of frequencies	Location in frequency range of operation		
1 MHz or less	1	Middle		
1 MHz to 10 MHz	2	1 near top and 1 near bottom		
🛛 More than 10 MHz	3	1 near top, 1 near middle, and 1 near bottom		

1.4 ANTENNA INFORMATION

Antenna Type	🗌 PIFA 🗌 PCB 🗌 Dipole 🔀 embedded antenna
Antenna Gain	Gain: 3.2 dBi
Antenna Trade / Model	LYNwave / ALA120-051026-00
Antenna Connector	IPEX

Notes:

1. The antenna(s) of the EUT are permanently attached and there are no provisions for connection to an external antenna. So the EUT complies with the requirements of §15.203.



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1.5 MEASUREMENT UNCERTAINTY

PARAMETER	UNCERTAINTY
AC Powerline Conducted Emission	± 2.213 dB
Channel Bandwidth	± 2.7 %
RF output power (Power Meter + Power sensor)	± 0.243 dB
Power Spectral density	± 2.739 dB
Conducted Bandedge	± 2.739 dB
Conducted Spurious Emission	± 2.742 dB
Radiated Emission_9kHz-30MHz	± 3.761 dB
Radiated Emission_30MHz-200MHz	± 3.473 dB
Radiated Emission_200MHz-1GHz	± 3.946 dB
Radiated Emission_1GHz-6GHz	± 4.797 dB
Radiated Emission_6GHz-18GHz	± 4.803 dB
Radiated Emission_18GHz-26GHz	± 3.459 dB
Radiated Emission_26GHz-40GHz	± 3.297 dB

Remark:

1. This uncertainty represents an expanded uncertainty expressed at approximately the 95% confidence level using a coverage factor of k=2

2. ISO/IEC 17025 requires that an estimate of the measurement uncertainties associated with the emissions test results be included in the report.

1.6 FACILITIES AND TEST LOCATION

All measurement facilities used to collect the measurement data are located at

No.11, Wugong 6th Rd., Wugu Dist., New Taipei City, Taiwan.

CAB identifier: TW1309

Test site	Test Engineer	Remark
AC Conduction Room	Ben Yang	-
Radiation	Tony Chao、Ray Li	-
RF Conducted	Marco Chan	-

Remark: The lab has been recognized as the FCC accredited lab. under the KDB 974614 D01 and is listed in the FCC pubic Access Link (PAL) database, FCC Registration No. :444940, the FCC Designation No.:TW1309



1.7 INSTRUMENT CALIBRATION

Conducted_FCC/NCC/IC(AII)						
Name of Equipment	Manufacturer	Model	Serial Number	Calibration Date	Calibration Due	
Power Sensor	Anritsu	MA2411B	1726104	2024-04-16	2025-04-15	
Power Sensor	Anritsu	MA2412B	1726107	2024-04-16	2025-04-15	
Power Meter	Anritsu	ML2496A	1804001	2024-04-16	2025-04-15	
EXA Signal Analyzer	Keysight	N9010B	MY55460167	2024-01-03	2025-01-02	
Software	Radio Test Software Ver. 21					

966A_Radiated					
Name of Equipment	Manufacturer	Model	Serial Number	Calibration Date	Calibration Due
Signal Analyzer	KEYSIGHT	N9010A	MY52220817	2024-03-15	2025-03-14
Thermo-Hygro Meter	WISEWIND	1206	D07	2023-12-08	2024-12-07
Active Loop Antenna	SCHWARZBEC K	FMZB 1513-60	1513-60-028	2023-12-13	2024-12-12
Bi-Log Antenna	Sunol Sciences	JB3	A030105	2024-07-12	2025-07-11
Preamplifier	EMEC	EM330	060609	2024-02-21	2025-02-20
Cable	Huber+Suhner	104PEA	20995+21000+ 182330	2024-02-21	2025-02-20
Horn Antenna	ETC	MCTD 1209	DRH13M02003	2023-12-28	2024-12-27
Preamplifier	HP	8449B	3008A00965	2023-12-22	2024-12-21
Cable	EMCI	EMC101G	221213+221011 +221012	2023-10-17	2024-10-16
Attenuator	Mini-Circuits	BW-S9W5	BWS9W5-09- 966A-01	2024-02-07	2025-02-06
High Pass Filters	Titan Microwave	T04H30001800 070S01	22011402-4	2024-06-12	2025-06-13
Horn Antenna	SCHWARZBEC K	BBHA9170	1047	2023-12-13	2024-12-12
Pre-Amplifier	EMCI	EMC184045SE	980860	2023-12-12	2024-12-11
Turn Table	CCS	CC-T-1F	N/A	N.C.R	N.C.R
Controller	CCS	CC-C-1F	N/A	N.C.R	N.C.R
Antenna Tower	CCS	CC-A-1F	N/A	N.C.R	N.C.R
Software e3 V9-210616c					

Remark:

1. Each piece of equipment is scheduled for calibration once a year.

2. N.C.R. = No Calibration Required.



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AC Mains Conduction						
Name of Equipment	Manufacturer	Model	Serial Number	Calibration Date	Calibration Due	
EMI Test Receiver	R&S	ESCI	100064	2024-06-14	2025-06-13	
LISN	TESEQ	LN2-16N	22012	2024-02-29	2025-02-27	
Cable	Woken	SFL402	185A	2024-07-08	2025-07-07	
Software			e3 V6-110812			

Remark:

1. Each piece of equipment is scheduled for calibration once a year.

2. N.C.R. = No Calibration Required.



1.8 SUPPORT AND EUT ACCESSORIES EQUIPMENT

	EUT Accessories Equipment						
No.	No. Equipment Brand Model Series No. FCC ID IC						
	N/A						

Support Equipment (Conducted)						
No. Equipment Brand Model Series No. FCC						
1	NB(B)	Lenovo	T470	N/A	N/A	
А	Type-C Cable	Dong Guan YCD Electronic Co., Itd	37G1E6300-00	N/A	N/A	
В	4 PIN Test Kit	CC&C	BA-550T TEST BOARD	N/A	N/A	

Support Equipment (Conduction)						
No.	Equipment	Brand	Model	Series No.	FCC ID	
1	NB(D)	Lenovo	ThinkPad X260	N/A	N/A	
2	Adapter	Lenovo	ADLX45DLC3A	N/A	N/A	
А	Type-C Cable	Dong Guan YCD Electronic Co., Itd	37G1E6300-00	N/A	N/A	
В	4 PIN Test Kit	CC&C	BA-550T TEST BOARD	N/A	N/A	

Support Equipment (RSE)						
No. Equipment Brand Model				Series No.	FCC ID	
1	NB(D)	Lenovo	ThinkPad X260	N/A	N/A	
2	Adapter	Lenovo	ADLX45DLC3A	N/A	N/A	
3	USB Cable	DTAudio	8024025	N/A	N/A	
А	Type-C Cable	Dong Guan YCD Electronic Co., Itd	37G1E6300-00	N/A	N/A	
В	4 PIN Test Kit	CC&C	BA-550T TEST BOARD	N/A	N/A	



1.9 TEST SET UP DIAGRAM



1.10 TEST PROGRAM

The EUT connection corresponds to the surrounding fixture control board. This EUT uses "BlueTest3" software to set the frequency, modulation, and power to allow the sample to continuously transmit (including frequency hopping mode).

1.11 TEST METHODOLOGY AND APPLIED STANDARDS

The test methodology, setups and results comply with all requirements in accordance with ANSI C63.10:2013, FCC Part 2, FCC Part 15.247, KDB 558074.



2. TEST SUMMERY

FCC Standard Section	Report Section	Test Item	Result
15.203	1.3	Antenna Requirement	Pass
15.207(a)	4.1	AC Conducted Emission	Pass
15.247(a)(1)	4.2	20 dB Bandwidth	Pass
-	4.2	Occupied Bandwidth (99%)	Pass
15.247(b)(1)	4.3	Output Power Measurement	Pass
15.247(a)(1)	4.4	Frequency Separation	Pass
15.247(a)(1)(iii)	4.5	Number of Hopping	Pass
15.247(d)	4.6	Conducted Band Edge	Pass
15.247(d)	4.6	Conducted Spurious Emission	Pass
15.247(a)(1)(iii)	4.7	Time of Occupancy	Pass
15.247(d) 15.205, 15.209	4.8	Radiation Band Edge	Pass
15.247(d) 15.205, 15.209	4.8	Radiation Spurious Emission	Pass



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3. DESCRIPTION OF TEST MODES

3.1 THE WORST MODE OF OPERATING CONDITION

Operation mode	GFSK for BDR-1Mbps (DH5) π/4-DQPSK for 2Mbps (2DH5) 8DPSK for EDR-3Mbps (3DH5)
Test Channel Frequencies	GFSK for BDR-1Mbps: 1.Lowest Channel: 2402MHz 2.Middle Channel: 2441MHz 3.Highest Channel: 2480MHz π/4-DQPSK for 2Mbps: 1.Lowest Channel: 2402MHz 2.Middle Channel: 2480MHz 3.Highest Channel: 2480MHz 8DPSK for EDR-3Mbps: 1.Lowest Channel: 2402MHz 2.Middle Channel: 2401MHz
	3.Highest Channel: 2480MHz

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Remark:

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1. EUT pre-scanned data rate of output power for each mode, the worst data rate were recorded in this report.

2. The system support GFSK , $\pi/4$ DQPSK ,8DPSK , the $\pi/4$ DQPSK were reduced since the identical parameters with 8dpsk. In the following test items, number of hopping, conducted bandedge, radiated band edge and spurious emissions.



3.2 THE WORST MODE OF MEASUREMENT

AC Power Line Conducted Emission				
Test ConditionAC Power line conducted emission for line and neutral				
Power supply Mode Mode 1: EUT Power by Host System				
Worst Mode 🛛 Mode 1 🗌 Mode 2 🗌 Mode 3 🗌 Mode 4				

Radiated Emission Measurement Above 1G					
Test Condition	Test Condition Radiated Emission Above 1G				
Power supply Mode	Mode 1: EUT power by Host System				
Worst Mode I Mode 1 Mode 2 Mode 3 Mode 4					
Worst Position Placed in fixed position. Placed in fixed position at X-Plane (E2-Plane) Placed in fixed position at Y-Plane (E1-Plane) Placed in fixed position at Z-Plane (H-Plane)					

Radiated Emission Measurement Below 1G					
Test Condition Radiated Emission Below 1G					
Power supply Mode	Mode 1: EUT power by Host System				
Worst Mode Mode 1 Mode 2 Mode 3 Mode 4					

Remark:

1. The worst mode was record in this test report.

2. AC power line conducted emission were performed the EUT transmit at the highest output power channel as worse case.

3. EUT pre-scanned in three axis ,X,Y, Z and two polarity, for radiated measurement. The worst case(Z-Plane) were recorded in this report.



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3.3 EUT DUTY CYCLE

Temperature:	23.1 ℃	Test date:	July 16, 2024
Humidity:	55% RH	Tested by:	Marco Chan

	Duty Cycle (%) = Ton / (Ton+Toff)	Duty Factor (dB) =10*log (1/Duty Cycle)	1/T (kHz)	VBW setting (kHz)
DH1	30.80	5.11	2.60	3.00
DH3	65.60	1.83	0.61	1.00
DH5	77.20	1.12	0.35	1.00
2DH1	31.20	5.06	2.56	3.00
2DH3	65.60	1.83	0.61	1.00
2DH5	76.80	1.15	0.35	1.00
3DH1	30.80	5.11	2.60	3.00
3DH3	65.60	1.83	0.61	1.00
3DH5	77.20	1.12	0.35	1.00





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4. TEST RESULT

4.1 AC POWER LINE CONDUCTED EMISSION

4.1.1 Test Limit

According to §15.207(a),

Frequency Range	Limits(dBµV)		
(MHz)	Quasi-peak	Average	
0.15 to 0.50	66 to 56*	56 to 46*	
0.50 to 5	56	46	
5 to 30	60	50	

* Decreases with the logarithm of the frequency.

4.1.2 Test Procedure

Test method Refer as ANSI C63.10: 2013 clause 6.2,

- 1. The EUT was placed on a non-conducted table, which is 0.8m above horizontal ground plane and 0.4m above vertical ground plane.
- 2. EUT connected to the line impedance stabilization network (LISN)
- 3. Receiver set RBW of 9kHz and Detector Peak, and note as quasi-peak and average.
- 4. Maximum procedure was performed on the six highest emissions to ensure EUT compliance.
- 5. Recorded Line for Neutral and Line.

4.1.3 Test Setup





4.1.4 Test Result



Note: 1. Actual FS= Spectrum Read Level + Factor Note: 2. Margin= Actual FS - Limit



Report No.:	TMWK24070	02364KR			Pa Re	ge: 20 / 76 ev.: 03
Project No Operation Moo Test Chamber Probe Note	: TM-2406 de : BT : Conduct : NEUTRA :	6000277P ion AL	Test D Temp Engin Test V	Date ./Humi. eer /oltage	: 2024 : 23.4 : Ben : AC 1	-07-23 °C / 54% Yang 20V/60Hz
80 Level (dBuV)						
70 60						
50 40 30	Mugarmania	away and the second	Mary	112 M	rdywym dwr dynw	M.
20						
0.15 0.2°	0.5	1 2 Frequer	ncy (MHz)	5	10	20 30
Freq.	Detector Mode	Spectrum Read Level	Factor	Actual FS	Limit	Margin
MHz	PK/QP/AV	dBµV	dB	dBµV	dBµV	dB
0.176	QP	46.18	0.25	46.43	64.65	-18.22
0.176	Average	35.64	0.25	35.89	54.65	-18.76
0.232	QP	39.29	0.36	39.65	62.39	-22.74
0.232	Average	31.24	0.30	31.00	52.39	-20.79
0.344	QP Avorago	32.12 25.22	0.30	32.47 25.67	59.11 40.11	-20.04
0.344		20.02	0.35	20.07	49.11 56.00	-23.44
1.570		30.04	0.15	33.62	16 00	-17.21
1 936	OP	39.07	0.15	39.23	56.00	-16 77
1 936	Average	33.01	0.16	33 17	46.00	-12 83
5.040	QP	28.83	0.24	29.07	60.00	-30.93
5.040	Average	21.83	0.24	22.07	50.00	-27.93

Note: 1. Actual FS= Spectrum Read Level + Factor Note: 2. Margin= Actual FS - Limit



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4.2 20dB BANDWIDTH AND OCCUPIED BANDWIDTH (99%)

4.2.1 Test Limit

According to §15.247(a) (1),

<u>20 dB Bandwidth</u> : For reporting purposes only.

Occupied Bandwidth(99%) : For reporting purposes only.

4.2.2 Test Procedure

Test method Refer as ANSI C63.10: 2013 clause 7.8.7,

- 1. The EUT RF output connected to the spectrum analyzer by RF cable.
- 2. Setting maximum power transmit of EUT
- 3. SA set RBW = 30kHz, VBW = 100kHz and Detector = Peak, to measurement 20 dB Bandwidth and 99% Bandwidth.
- 4. Measure and record the result of 20 dB Bandwidth and 99% Bandwidth. in the test report.

4.2.3 Test Setup

Refer to section 1.9.



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4.2.4 Test Result

Temperature:	23.1 ℃	Test date:	July 16, 2024
Humidity:	55% RH	Tested by:	Marco Chan

20dB BANDWIDTH

GFSK

СН	20 dB BW (MHz)	2/3 BW (MHz)
Low	0.9617	0.64
Mid	0.9650	0.64
High	0.9632	0.64

$\pi/4$ -DQPSK

	20 dB BW	2/3 BW	
СП	(MHz)	(MHz)	
Low	1.337	0.89	
Mid	1.333	0.89	
High	1.336	0.89	

8-DPSK

СЦ	20 dB BW	2/3 BW	
СП	(MHz)	(MHz)	
Low	1.314	0.88	
Mid	1.313	0.88	
High	1.314	0.88	



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BANDWIDTH 99%

GFSK

СН	99% BW (MHz)
Low	0.87593
Mid	0.87637
High	0.87792

π/4-DQPSK

СН	99% BW (MHz)
Low	1.1875
Mid	1.1872
High	1.1879

8-DPSK

сц	99% BW
СП	(MHz)
Low	1.1894
Mid	1.1908
High	1.1903



Test Data 20dB BANDWIDTH



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BANDWIDTH 99%



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4.3 OUTPUT POWER MEASUREMENT

4.3.1 Test Limit

According to §15.247(a)(1),

Peak output power :

<u>FCC</u>

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.

Average output power : For reporting purposes only.

4.3.2 Test Procedure

- 1. The EUT RF output connected to the power meter by RF cable.
- 2. Setting maximum power transmit of EUT.
- 3. The path loss was compensated to the results for each measurement.
- 4. Measure and record the result of Peak output power and Average output power. in the test report.

4.3.3 Test Setup

Refer to section 1.9.



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4.3.4 Test Result

Temperature:	23.1 ℃	Test date:	July 16, 2024
Humidity:	55% RH	Tested by:	Marco Chan

Peak & Average output power :

1M BR mode (Peak):

СН	Freq. (MHz)	Power Setting	Peak Output Power (dBm)	Output Power (mW)	Limit (mW)
Low	2402	6	6.72	4.699	125
Mid	2441	7	6.64	4.613	125
High	2480	7	6.65	4.624	125

2M EDR mode (Peak):

СН	Freq. (MHz)	Power Setting	Peak Output Power (dBm)	Output Power (mW)	Limit (mW)
Low	2402	10	9.41	8.730	125
Mid	2441	10	9.30	8.511	125
High	2480	10	9.24	8.395	125

3M EDR mode (Peak):

СН	Freq. (MHz)	Power Setting	Peak Output Power (dBm)	Output Power (mW)	Limit (mW)
Low	2402	10	9.92	9.817	125
Mid	2441	10	9.79	9.528	125
High	2480	10	9.75	9.441	125

IM BR	mode	(Average)	:

СН	Freq. (MHz)	Power Setting	Avg. Output Power (dBm)	Output Power (mW)	Limit (mW)
Low	2402	6	6.68	4.660	125
Mid	2441	7	6.61	4.585	125
High	2480	7	6.64	4.617	125

2M EDR mode (Average):

СН	Freq. (MHz)	Power Setting	Avg. Output Power (dBm)	Output Power (mW)	Limit (mW)
Low	2402	10	6.86	4.849	125
Mid	2441	10	6.78	4.760	125
High	2480	10	6.80	4.782	125

3M EDR mode (Average):

СН	Freq. (MHz)	Power Setting	Avg. Output Power (dBm)	Output Power (mW)	Limit (mW)
Low	2402	10	6.90	4.902	125
Mid	2441	10	6.79	4.780	125
High	2480	10	6.81	4.802	125

Note: Measured by power meter, cable loss + Duty cycle factor has been offseted to the power meter for Avg. power and cable loss has been offseted for Peak power measurement.



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4.4 FREQUENCY SEPARATION

4.4.1 Test Limit

According to \$15.247(a)(1),

Alternatively, 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, provided the systems operate with an output power no greater than 125 mW.

Limit > two-thirds of the 20 dB bandwidth

4.4.2 Test Procedure

- 1. Place the EUT on the table and set it in transmitting mode.
- 2. EUT RF output port connected to the SA by RF cable.
- 3. Set the spectrum analyzer as RBW = 300kHz, VBW = 910kHz, Sweep = auto. Max hold, mark 3 peaks of hopping channel and record the 3 peaks frequency

4.4.3 Test Setup

Refer to section 1.9.



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4.4.4 Test Result

Temperature:	23.1 ℃	Test date:	July 16, 2024
Humidity:	55% RH	Tested by:	Marco Chan

Test mode: GFSK_BDR-1Mbps mode / 2402-2480 MHz					
Channel	Frequency (MHz)	Channel Separation (MHz)	Channel Separation Limits (MHz)	Result	
Low	2402	1.000	0.64	PASS	
Mid	2441	1.000	0.64	PASS	
High	2480	1.000	0.64	PASS	

Test mode: π/4-DQPSK_2Mbps mode / 2402-2480 MHz					
Channel	Frequency (MHz)	Channel Separation (MHz)	Channel Separation Limits (MHz)	Result	
Low	2402	1.000	0.89	PASS	
Mid	2441	1.000	0.89	PASS	
High	2480	1.000	0.89	PASS	

Test mode: 8DPSK_EDR-3Mbps mode / 2402-2480 MHz					
Channel	Frequency (MHz)	Channel Separation (MHz)	Channel Separation Limits (MHz)	Result	
Low	2402	1.000	0.88	PASS	
Mid	2441	1.000	0.88	PASS	
High	2480	1.000	0.88	PASS	



Test Data

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Call ? Jul 16, 2024

1

Report No.: TMWK2407002364KR

8DPSK_3M_DH5_CH0CH1CH2 Ö uency I0 GHz Log X う (* **1** ? Jul 16, 2024 🗩 8DPSK 3M DH5 CH38CH39CH40 Ö Frequency + **KEYSIGH** Х AUTO TUNE BW 910 kH 1.00 ms Call ? Jul 16, 2024 M H 8DPSK_3M_DH5_CH76CH77CH78 Ö + Freque) GHz 10 dB X eep 1.00 ms (100

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4.5 NUMBER OF HOPPING

4.5.1 Test Limit

According to §15.247(a)(1)(iii),

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

4.5.2 Test Procedure

Test method Refer as ANSI C63.10: 2013 clause 7.8.3

1. Place the EUT on the table and set it in transmitting mode.

2. EUT RF output port connected to the SA by RF cable.

3. Set spectrum analyzer Start Freq. = 2400 MHz, Stop Freq. = 2441 MHz, RBW=300KHz, VBW =910kHz for left half.

4. Set spectrum analyzer Start Freq. = 2441 MHz, Stop Freq. = 2483.5 MHz, RBW=300KHz, VBW =910kHz for right half.

5. Max hold, view and count how many channel in the band.

4.5.3 Test Setup

Refer to section 1.9.

4.5.4 Test Result

Temperature:	23.1 ℃	Test date:	July 16, 2024
Humidity:	55% RH	Tested by:	Marco Chan

Number of Hopping					
Mode	Frequency (MHz)	Hopping Channel Number	Hopping Channel Number Limits	Result	
BDR-1Mbps	2402-2480	79	15	Deee	
EDR-3Mbps	2402-2480	79	15	F855	



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<u>Test Data</u>





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4.6 CONDUCTED BANDEDGE AND SPURIOUS EMISSION

4.6.1 Test Limit

According to §15.247(d),

Limit -20 dBc

4.6.2 Test Procedure

1. EUT RF output port connected to the SA by RF cable, and the path loss was compensated to result.

2. SA setting, RBW=100kHz, VBW=300kHz, Detector=Peak, Trace mode = max hold, SWT = Auto.

3. The Band Edge at 2.4GHz and 2.4835GHz are investigated with both hopping "ON" and "OFF" modes ".

4.6.3 Test Setup

Refer to section 1.9.

4.6.4 Test Result

Temperature:	23.1 ℃	Test date:	July 16, 2024
Humidity:	55% RH	Tested by:	Marco Chan



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Test Data

Band Edge

Band Edge_GFSK_1M_DH5_2402MHz





Hopping mode Hopping Band Edge_GFSK_1M_DH5_2402MHz

Swept SA	zeri	+					Frequency	
KEYSIGHT RL →→	Input: RF Coupling: DC Align: Auto	Input Z: 50 Ω Corrections: Off Freq Ref: Int (S)	#Atten: 30 dB Preamp: Off	PNO: Fast Gate: Off IF Gain: Low Sig Track: Off	Awg Type: Log-Power Trig: Free Run	123456 M WWWWW PNNNNN	Center Frequency 2.365000000 GHz Span	Settings
1 Spectrum Scale/Div 10 d	, B		Ref Lvi Offset 0. Ref Level 20.00	50 dB dBm	Mkr2 2.4	00 00 GHz 53.42 dBm	110.000000 MHz Swept Span	
10.0 0.00							Zero Span Full Span	
-20.0							Start Freq 2.310000000 GHz	
-40.0 -50.0 -60.0			n de palente construinción que	ogaanna dawwoo	22		Stop Freq 2.420000000 GHz	
-70 0 Center 2.3650	GHz		#Video BW 300	kHz	Sugar 10	ipan 110.0 MHz	AUTO TUNE	
5 Marker Table	1	7	, and the second s		5466p 10.	niis (1001 pts)	11.000000 MHz	
1 N 2 N 3	1 f 1 f	X 2.413 95 GHz 2.400 00 GHz	Y 6.470 dBm -53.42 dBm	Function Fi	unction Width Fur	iction value	Freq Offset 0 Hz	
4 5 6							X Axis Scale Log Lin	
1 5		? Jul 16, 2024 4:51:11 AM	ÐA		.:: 🕅	X	Signal Track (Span Zoom)	

Hopping Band Edge_GFSK_1M_DH5_2480MHz

Spectr Swept	um Anal SA	yzer 1	· 1	+					C Frequency	
KEY: RL	Sight ++-	linput: F Couplir Align: /	8F ng:DC Nuto	Input Z: 50 Ω Corrections: Off Freq Ref: Int (S)	#Atten: 30 dB Preamp: Off	PNO: Fast Gate: Off IF Gain: Low Sig Track: Off	Avg Type: Log- Trig: Free Run	Power 123456 MWWWWW PNNNNN	Center Frequency 2.487500000 GHz	Settings
1 Spec Scale Log	trum Div 10 (1B A 1	•		Ref Lvi Offset 0.1 Ref Level 20.00 d	50 dB JBm	Mkr3	2.485 600 GHz -55.46 dBm	Span 25.0000000 MHz Swept Span Zero Span	
10.0 0.00 -10.0	vv	ŶĄ	M					0L1 12-61 dBm	Full Span	
-20.0 -30.0				4					Start Freq 2.475000000 GHz	
-40.0 -50.0 -60.0				Jon malun	ne sa	and the state			Stop Freq 2.500000000 GHz	
-70.0 Cente	r 2.4875	0 GHz			#Video BW 300	kHz		Span 25.00 MHz	AUTO TUNE	
5 Mark	er Table	KHZ	۲				Swee	p 2.40 ms (1001 pts)	2.500000 MHz	
	Mode	Trace	Scale	х	Y	Function	Function Width	Function Value	Man	
1	Ν			2.477 000 GHz	6.389 dBm				Eron Offent	
2	N	1	f	2.483 500 GHz	-56.22 dBm					
3	N	1	1	2.485 600 GHz	-55.46 dBm				URZ	
4 5 6									X Axis Scale Log Lin	
H	ょ	3		Jul 16, 2024 4:53:00 AM	ÐA			N - X	Signal Track	

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Spurious Emission



Spurious Emission_GFSK_1M_DH5_2480MHz







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Frea



Spurious Emission 8DPSK 3M DH5 2402MHz

Swep	t SA	·	- 'L							-	Frequency	
KEY RL	'SIGH1 +→-	Input: Coupli Align:	RF ng: DC Auto	Input Z: 50 Ω Corrections: Off Freq Ref: Int (S)	#Atten: 30 dB Preamp: Off	PNO:Fast Gate:Off IF Gain:Low Sig Track:Off	Avg Type: Log Trig: Free Run		123456 MWWWWW PNNNNN	Center F 12.5150	requency 00000 GHz	Settings
1 Spe	ctrum		•	,	Ref LvI Offset 0.	50 dB	M	(r 4 24	.463 GHz	5pan 24.9700	000 GHz	
Scale Log	/Div 10	lB ∧1			Ref Level 20.00	dBm		-5	3.57 dBm	Swe Zero	pt Span Span	
0.00									Di 1 45 32 dBm	FL	ll Span	
-20.0 -30.0										Start Fre 30.0000	A OD MHz	
-40.0 -50.0 -60.0								un en luis		Stop Fre 25.0000	A 00000 GHz	
-70.0	r 42 52	04.4			#Video BW 200	1019		904	24 07 OUT	AUT	TO TUNE	
#Res	BW 100	kHz			#VIGEO BW 300	ND2	Swee	p~2.39 s	s (24971 pts)	CF Step		
5 Mar	ker Table									2.49700	0000 GHz	
	Mode	Trace	Scale	x	Y	Function	Function Width	Funct	ion Value	Auto Man		
1	N		1	2.402 GHz	3.685 dBm					Frea Offs	et	
2	N		1	4.804 GHZ	-58.11 dBm					0 Hz		
4	N	1	-	24 463 GHz	-53.57 dBm							
5				24.400 0112						X Axis Si Log Lin	ale	
	۲	6		Jul 16, 2024 4:44:59 AM	ÐA					Signal Tr (Span Zoo	ack m)	

Spurious Emission_8DPSK_3M_DH5_2441MHz

Specti Swept	'um Ana 'SA	lyzer 1	•	Ð						Ö	Frequency	- 12
KEY RL DJ	SIGHT ++-	Coupli Align: J	&F ng: DC Auto	Input Z: 50 Ω Corrections: Off Freq Ref: Int (S)	#Atten: 30 dB Preamp: Off	PNO: Fast Gate: Off IF Gain: Low Sig Track: Of	Avg Type: Log Trig: Free Rui f	p-Power ר	1 2 3 4 5 6 M WWWWW P N N N N N	Center Fr 12.51500	equency 0000 GHz	Settings
1 Spei Scale	trum Div 10	dB	•		Ref Lvl Offset 0.5 Ref Level 20.00 c	50 dB dBm	М	kr4 23 -5	.634 GHz 3.41 dBm	24.97000 Swej	00 GHz t Span	
10.0 0.00		_								Zero Ful	Span I Span	
-20.0									DL1 -16.45 dBm	Start Free 30.00000	0 MHz	
-40.0 -50.0 -60.0		-	~ 2 ²	³					4	Stop Freq 25.00000	0000 GHz	
-70.0 Cente	r 12.52	GHz			#Video BW 300	kHz	Sum	Spi	an 24.97 GHz	AUT	D TUNE	
5 Mark	ker Table		•				01161	JP 1.00	5 (2457 T pt3)	2.497000 Auto	000 GHz	
	Mode	Trace	Scale	х	Y	Function	Function Width	Funct	ion Value	Man		
	N		f	2.441 GHz	3.519 dBm					Free Offe		
2	N		1	4.882 GHz	-59.77 dBm					0 H7	~	
3	N	1	4	23 634 GHz	-59.71 dBm				_	0.14		
56				20.004 0112						X Axis Sc Log Lin	ale	
	ょ	3	12	Jul 16, 2024 4:46:34 AM	ÐA		.:			Signal Tra	ick m)	

Spurious Emission_8DPSK_3M_DH5_2480MHz



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4.7 TIME OF OCCUPANCY (DWELL TIME)

4.7.1 Test Limit

According to §15.247(a)(1)(iii),

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.

4.7.2 Test Procedure

1. EUT RF output port connected to the SA by RF cable.

2. Set center frequency of spectrum analyzer = operating frequency.

3. Set the spectrum analyzer as RBW=1MHz, VBW=3MHz, Sweep = 5 ms ~15ms(Depends on signal characteristics)

4.7.3 Test Setup

Refer to section 1.9.



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4.7.4 Test Result

Temperature:	23.1 ℃	Test date:	July 16, 2024
Humidity:	55% RH	Tested by:	Marco Chan

GFSK (1Mbps)

Channel	PACKET TYPE	Measurement Result (ms)	Limit (ms)
	DH1	123.20	400
Mid	DH3	262.40	400
	DH5	308.80	400

π/4 DQPSK (2Mbps)

Channel	PACKET TYPE	Measurement Result (ms)	Limit (ms)
	2DH1	124.80	400
Mid	2DH3	262.40	400
	2DH5	307.20	400

8-DPSK (3Mbps)

Channel	PACKET TYPE	Measurement Result (ms)	Limit (ms)
	3DH1	123.20	400
Mid	3DH3	262.40	400
	3DH5	308.80	400



Report No.:	TMWK2407002364KR

GFSK (1Mbps):

CH Mid	DH1 time slot	=	0.385 *	(1600/2/79)	*	31.6	=	123.20 (ms)
	DH3 time slot	=	1.640 *	(1600/4/79)	*	31.6	=	262.40 (ms)
	DH5 time slot	=	2.895 *	(1600/6/79)	*	31.6	=	308.80 (ms)

π/4 -DQPSK (2Mbps):

CH Mid	2DH1 time slot	=	0.390 *	(1600/2/79)	*	31.6	=	124.80 (ms)
	2DH3 time slot	=	1.640 *	(1600/4/79)	*	31.6	=	262.40 (ms)
	2DH5 time slot	=	2.880 *	(1600/6/79)	*	31.6	=	307.20 (ms)

8-DPSK (3Mbps):

CH Mid	3DH1 time slot	=	0.385 *	(1600/2/79)	*	31.6	=	123.20 (ms)
	3DH3 time slot	=	1.640 *	(1600/4/79)	*	31.6	=	262.40 (ms)
	3DH5 time slot	=	2.895 *	(1600/6/79)	*	31.6	=	308.80 (ms)

A period time = 0.4 (s) * 79 = 31.6 (s)



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	GFSK (1Mbps) for Al	FH Mode	
Hopping Channel Number	PACKET TYPE	Measurement Result (ms)	Limit (ms)
20	DH5	154.40	400
	π/4 DQPSK (2Mbps) for	AFH Mode	
Hopping Channel Number	PACKET TYPE	Measurement Result (ms)	Limit (ms)
20	2DH5	153.60	400
	8-DPSK (3Mbps) for A	FH Mode	
Hopping Channel Number	PACKET TYPE	Measurement Result (ms)	Limit (ms)
20	3DH5	154.40	400

GFSK (1Mbps):

DH5 time slot	=	2.895	(ms)	*	(800/6/20)	* 8 =	154.40	(ms)
π/4 -DQPSK (2MI	ops):							
2DH5 time slot	=	2.880	(ms)	*	(800/6/20)	* 8 =	153.60	(ms)
8-DPSK (3Mbps):								
3DH5 time slot	=	2.895	(ms)	*	(800/6/20)	* 8 =	154.40	(ms)

Note: Based on normal hopping, the DH5 type has worse results than DH1, so only DH5 is recorded.