FCC Part 15C Measurement and Test Report

For

Shenzhen Daiku technology Co., LTD

FCC ID:2BCKX-DK68

FCC Rule(s):	FCC Part 15.247			
Product Description:	Smart Watch			
Tested Model:	<u>DK68</u>			
Report No.:	BSL240404175010RF			
Tested Date:	<u>May 18~29, 2024</u>			
Issued Date:	<u>May 29, 2024</u>			
Tested By:	Cindy Zheng / Engineer	Cindy theng		
Reviewed By:	Haley Wen / EMC Manager	Cindy zheng Haley wen		
Approved & Authorized By:	<u>Mike Mo / PSQ Manager</u>	Silens		
Prepared By:				
BSI	- Testing Co.,LTD.			
1/F, Building B, Xinshidai GR Park, Shiyan Street,				
Bao'an District, Shenzhen, ShiyanStreet, Bao'an District,				
Shenzhen,Guangdong,518052,People's Republic of China				
Tel: 400-882-9628 Fax: 86- 755-26508703				

TABLE OF CONTENTS

1. GENERAL INFORMATION	3
1.1 PRODUCT DESCRIPTION FOR EQUIPMENT UNDER TEST (EUT)	3
1.2 EUT SETUP AND TEST MODE	
1.3 TEST STANDARDS	
1.4 TEST METHODOLOGY	
1.5 TEST FACILITY	
1.6 Measurement Uncertainty	
-	
3. RF EXPOSURE	1
3.1 Standard Applicable	7
3.2 Test Result	7
4. ANTENNA REQUIREMENT	3
4.1 Standard Applicable	
4.2 EVALUATION INFORMATION	3
5. CONDUCTED EMISSIONS)
6. 20DB EMISSION BANDWIDTH11	L
7. CARRIER FREQUENCIES SEPARATION	
8. HOPPING CHANNEL NUMBER	L
9. DWELL TIME	ŀ
10. PSEUDORANDOM FREQUENCY HOPPING SEQUENCE	7
11. BAND EDGE	3
12. SPURIOUS EMISSION	3

1. GENERAL INFORMATION

1.1 Product Description for Equipment Under Test (EUT)

Applicant:	Shenzhen Daiku technology Co., LTD
Address of applicant:	605-606, Building E, Longjing Science Park, 339 Bulong Road, Longgang District, Shenzhen
Manufacturer:	Shenzhen Daiku technology Co., LTD
Address of manufacturer:	605-606, Building E, Longjing Science Park, 339 Bulong Road, Longgang District, Shenzhen
Product Name:	Smart Watch
Model No.:	DK68
Test Model No:	DK68
Quantity of tested samples	1
Serial No.:	N/A
Operation Frequency:	2402MHz~2480MHz
Channel numbers:	79
Channel separation:	1MHz
Modulation type:	GFSK,Pi/4 QPSK,8DPSK
Antenna Type:	Cable Antenna
Antenna gain:	1.49dBi
Power supply:	DC 3.7V by battery

•	Frequency eac					<u>г</u>	
Channel	Frequency	Channel	Frequency	Channel	Frequency	Channel	Frequency
1	2402MHz	21	2422MHz	41	2442MHz	61	2462MHz
2	2403MHz	22	2423MHz	42	2443MHz	62	2463MHz
3	2404MHz	23	2424MHz	43	2444MHz	63	2464MHz
4	2405MHz	24	2425MHz	44	2445MHz	64	2465MHz
5	2406MHz	25	2426MHz	45	2446MHz	65	2466MHz
6	2407MHz	26	2427MHz	46	2447MHz	66	2467MHz
7	2408MHz	27	2428MHz	47	2448MHz	67	2468MHz
8	2409MHz	28	2429MHz	48	2449MHz	68	2469MHz
9	2410MHz	29	2430MHz	49	2450MHz	69	2470MHz
10	2411MHz	30	2431MHz	50	2451MHz	70	2471MHz
11	2412MHz	31	2432MHz	51	2452MHz	71	2472MHz
12	2413MHz	32	2433MHz	52	2453MHz	72	2473MHz
13	2414MHz	33	2434MHz	53	2454MHz	73	2474MHz
14	2415MHz	34	2435MHz	54	2455MHz	74	2475MHz
15	2416MHz	35	2436MHz	55	2456MHz	75	2476MHz
16	2417MHz	36	2437MHz	56	2457MHz	76	2477MHz
17	2418MHz	37	2438MHz	57	2458MHz	77	2478MHz
18	2419MHz	38	2439MHz	58	2459MHz	78	2479MHz
19	2420MHz	39	2440MHz	59	2460MHz	79	2480MHz
20	2421MHz	40	2441MHz	60	2461MHz		

Note:

In section 15.31(m), regards to the operating frequency range over 10 MHz, the Lowest frequency, the middle frequency, and the highest frequency of channel were selected to perform the test.

EUT Cable List and Details

Cable Description	Length (M)	Shielded/Unshielded	With Core/Without Core
/	/	/	/

Auxiliary Equipment List and Details

Description	Manufacturer	Model	Serial Number
Notebook	Lenovo	Lenovo B490	BSTSZEMC-77

Special Cable List and Details

Cable Description	Length (M)	Shielded/Unshielded	With Core/Without Core
/	/	/	/

1.2 EUT Setup and Test Mode

The EUT was operated in the engineering mode to fix the Tx frequency that was for the purpose of the measurements. All testing shall be performed under maximum output power condition, and to measure its highest possible emissions level, more detailed description as follows: During the test, pre-scan F18m, F18, DK68, and found the F18m model which it is worse case model.

Test Mode List				
Test Mode	Description	Channel	Frequency (MHz)	
		CH1	2402	
1	GFSK,	CH40	2441	
		CH79	2480	
		CH1	2402	
2	Pi/4 QPSK	CH40	2441	
		CH79	2480	
		CH1	2402	
3	8DPSK	CH40	2441	
		CH79	2480	

1.3 Test Standards

The following report accordance with FCC Part 15, Subpart C, and section 15.203, 15.205, 15.207, 15.209 and 15.247 of the Federal Communication Commissions rules.

1.4 Test Methodology

All measurements contained in this report were conducted with ANSI C63.10-2013, American National Standard for Testing Unlicensed Wireless Devices, and ANSI C63.4-2014, American National Standard for Methods of Measurement of Radio-Noise Emissions from Low-Voltage Electrical and Electronic Equipment in the range of 9 kHz to 40 GHz.

1.5 Test Facility

BSL Testing Co.,LTD.

1/F, Building B, Xinshidai GR Park, Shiyan Street, Bao'an District, Shenzhen, ShiyanStreet, Bao'an District, Shenzhen, Guangdong, 518052, People's Republic of China

FCC Test Firm Registration Number: 562200 Designation Number: CN1338

Tel: 400-882-9628 Fax: 86-755-26508703

1.6 Measurement Uncertainty

Measurement uncertainty		
Parameter	Conditions	Uncertainty
RF Output Power	Conducted	± 0.42 dB
Occupied Bandwidth	Conducted	$\pm 1.5\%$
Power Spectral Density	Conducted	± 1.8 dB
Conducted Spurious Emission	Conducted	±2.17dB
Conducted Emissions	Conducted	± 2.88 dB
Transmitter Spurious Emissions	Radiated	±5.1dB

1.7 Test Equipment List and Details

Description	Manufacturer	Model	Serial No.	Cal Date	Due. Date
Communication Tester	Rohde & Schwarz	CMW500	100358	2023-10-27	2024-10-26
Spectrum Analyzer	R&S	FSP40	100550	2023-10-27	2024-10-26
Test Receiver	R&S	ESCI7	US47140102	2023-10-27	2024-10-26
Signal Generator	HP	83630B	3844A01028	2023-10-27	2024-10-26
Test Receiver	R&S	ESPI-3	100180	2023-10-27	2024-10-26
Amplifier	Agilent	8449B	4035A00116	2023-10-27	2024-10-26
Amplifier	HP	8447E	2945A02770	2023-10-27	2024-10-26
Signal Generator	IFR	2023A	202307/242	2023-10-27	2024-10-26
Broadband Antenna	SCHAFFNER	2774	2774	2023-10-27	2024-10-26
Biconical and log periodic antennas	ELECTRO-METRI CS	EM-6917B-1	171	2023-10-27	2024-10-26
Horn Antenna	R&S	HF906	100253	2023-10-27	2024-10-26
Horn Antenna	EM	EM-6961	6462	2023-10-27	2024-10-26
LISN	R&S	ESH3-Z5	100196	2023-10-27	2024-10-26
LISN	COM-POWER	LI-115	02027	2023-10-27	2024-10-26
3m Semi-Anechoic Chamber	Chengyu Electron	9 (L)*6 (W)* 6 (H)	BSL086	2023-10-27	2024-10-26
Horn Antenna	A-INFOMW	LB-180400KF	BSL088	2023-10-27	2024-10-26
20dB Attenuator	ICPROBING	IATS1	BSL1003	2023-10-27	2024-10-26
POWER DIVIDER	Mini-circuits	PD-2SF-0010	N/A	2023-10-27	2024-10-26
POWER DIVIDER	Mini-circuits	PD-2SF-0010	N/A	2023-10-27	2024-10-26
Loop Antenna	Schwarz beck	FMZB 1516	9773	2023-10-27	2024-10-26
Antenna Tower	SKET	BK-4AT-BS	N/A	N/A	N/A

3. RF Exposure

3.1 Standard Applicable

According to § 1.1307 and § 2.1093, the portable transmitter must comply the RF exposure requirements.

3.2 Test Result

This product complied with the requirement of the RF exposure, please see the RF Exposure Report.

4. Antenna Requirement

4.1 Standard Applicable

According to FCC Part 15.203, an intentional radiator shall be designed to ensure that no antenna other than that furnished by the responsible party shall be used with the device. 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 provisions of this section.

4.2 Evaluation Information

This product has a PCB antenna(1.49dBi), fulfill the requirement of this section.

5. Conducted Emissions

Test Requirement:	FCC Part15 C Section 15.207		
Test Method:	ANSI C63.10:2013		
Test Frequency Range:	150KHz to 30MHz		
Class / Severity:	Class B		
Receiver setup:	RBW=9KHz, VBW=30KHz, Sv	weep time=auto	
Limit:		Limit (d	IBuV)
	Frequency range (MHz)	Quasi-peak	Average
	0.15-0.5	66 to 56*	56 to 46*
	0.5-5	56	46
	5-30	60	50
	* Decreases with the logarithm	n of the frequency.	
Test setup: Test procedure:	Reference Plane LISN 40cm 80cm Filter AC power Equipment E.U.T Test table/Insulation plane Remark E.U.T Equipment Under Test LISN: Line Impedence Stabilization Network Test table height=0.8m		
	 line impedance stabilization network (L.I.S.N.). This provides a 50ohm/50uH coupling impedance for the measuring equipment. 2. The peripheral devices are also connected to the main power through a LISN that provides a 50ohm/50uH coupling impedance with 50ohm termination. (Please refer to the block diagram of the test setup and photographs). 3. Both sides of A.C. line are checked for maximum conducted interference. In order to find the maximum emission, the relative positions of equipment and all of the interface cables must be changed according to ANSI C63.10:2013 on conducted measurement. 		
Test Instruments:	Refer to section 1.7 for details		
Test mode:	Refer to section 1.2 for details		
Test results:	Pass		

The equipment is battery powered, so do not test this item

Notes:

- 1. An initial pre-scan was performed on the line and neutral lines with peak detector.
- 2. Quasi-Peak and Average measurement were performed at the frequencies with maximized peak emission.
- 3. Final Level =Receiver Read level + LISN Factor + Cable Loss

6. Conducted Peak Output Power

Test Requirement:	FCC Part15 C Section 15.247 (b)(3)	
Test Method:	ANSI C63.10:2013	
Limit:	30dBm(for GFSK),20.97dBm(for EDR)	
Test setup:	Power Meter E.U.T Non-Conducted Table Ground Reference Plane	
Test Instruments:	Refer to section 1.7 for details	
Test mode:	Refer to section 1.2 for details	
Test results:	Pass	

Measurement Data:

Mode	Test channel	Peak Output Power (dBm)	Limit (dBm)	Result
	Lowest	1.1		
GFSK	Middle	0.54	30.00	Pass
	Highest	0.3		
	Lowest	1.03		
Pi/4QPSK	Middle	0.59	20.97	Pass
	Highest	-0.4		
	Lowest	-1.25		
8DPSK	Middle	-0.66	20.97	Pass
	Highest	-0.32		

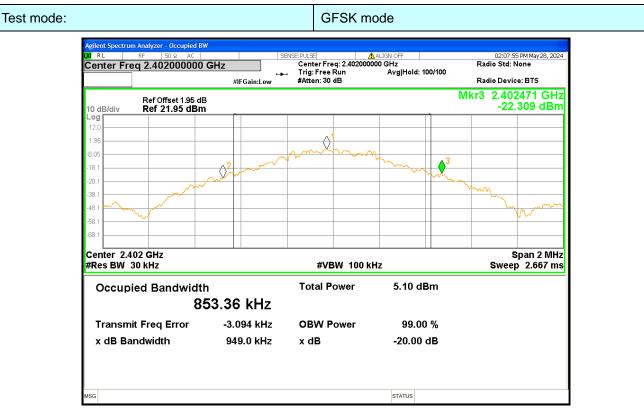
6. 20dB Emission Bandwidth

Test Requirement:	FCC Part15 C Section 15.247 (a)(2)	
Test Method:	ANSI C63.10:2013	
Limit:	N/A	
Test setup:	Spectrum Analyzer E.U.T Non-Conducted Table Ground Reference Plane	
Test Instruments:	Refer to section 1.7 for details	
Test mode:	Refer to section 1.2 for details	
Test results:	Pass	

Measurement Data:

Mode	Test channel	20dB Emission Bandwidth (MHz)	Result
	Lowest	0.949	
GFSK	Middle	0.94	Pass
	Highest	0.95	
	Lowest	1.282	
Pi/4QPSK	Middle	1.316	Pass
	Highest	1.316	
	Lowest	1.304	
8DPSK	Middle	1.28	Pass
	Highest	1.316	

Test plot as follows:



Lowest channel



Middle channel



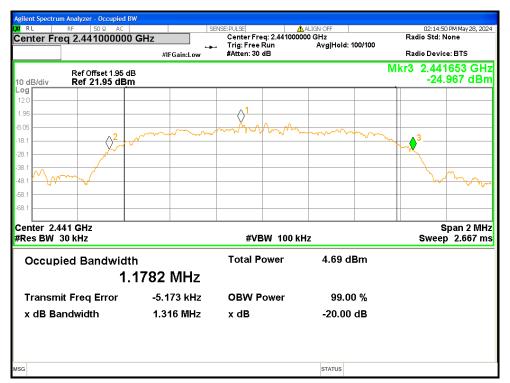
Highest channel

Test mode:

Pi/4QPSK mode

	n Analyzer - Occupied	I BW							
Center Fre	RF 50 Ω AC	0 GHz		Center Fre	q: 2.40200000			02:13:0 Radio Std: N	1 PM May 28, 2024 Jone
		#IFGain:L		Trig: Free #Atten: 30		Avg Hold: 1	100/100	Radio Devid	e: BTS
10 dB/div	Ref Offset 1.95 Ref 21.95 dE						N		2638 GHz 247 dBm
Log 12.0									
1.95) <mark>1</mark>				
-8.05			~~~~~	m	handron	mm	nn	▲3	
-18.1	-2^2								
-28.1									
-38.1	\sim								ma
-40.1									6 Mm
-68.1									
Center 2.4	02 CH-							<u> </u>	span 2 MHz
#Res BW 3				#VB	W 100 kH	z			5 2.667 ms
Occupi	ed Bandwic	ith		Total P	ower	5.36 dl	Bm		
	1	.1754 M⊢	z						
Transmi	it Freq Error	-3.403 k	Hz	OBW P	ower	99.00	0%		
x dB Ba	ndwidth	1.282 M	Hz	x dB		-20.00	dB		
MSG						STATUS			

Lowest channel



Middle channel

RL RF 50 Q AC			ALIGN OFF	02:16:27 PM May 28, 20
enter Freq 2.48000000		Center Freq: 2.4800000 Trig: Free Run	00 GHz Avg Hold: 100/100	Radio Std: None
	#IFGain:Low	#Atten: 30 dB	Avgineia, loorioo	Radio Device: BTS
Ref Offset 1.94 d dB/div Ref 21.94 dBr				Mkr3 2.480654 GF -25.809 dB
.9				
94		1		
16		Ann		
.1		The company	man por	∽ 3
1				
1				
1 mm				- ma
1				
.1				
enter 2.48 GHz				Span 2 Mi
Res BW 30 kHz		#VBW 100 ki	Hz	Sweep 2.667 n
Occupied Bandwidt	h	Total Power	3.78 dBm	
	1787 MHz			
Transmit Freq Error	-4.113 kHz	OBW Power	99.00 %	
x dB Bandwidth	1.316 MHz	x dB	-20.00 dB	

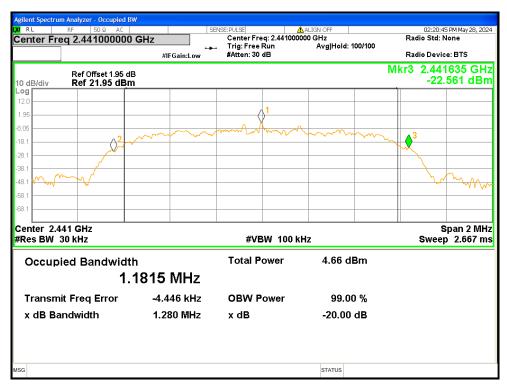
Highest channel

Test mode:

8DPSK mode



Lowest channel



Middle channel

Agilent Spectrum Analyzer - Occupied BV		ENSE:PULSE	ALIGN OFF	02:21:48 PM May 28, 2024
Center Freq 2.480000000		Center Freq: 2.480000	000 GHz	Radio Std: None
	#IFGain:Low	Trig: Free Run #Atten: 30 dB	Avg Hold: 100/100	Radio Device: BTS
				Mkr3 2.480654 GHz
Ref Offset 1.94 dE 10 dB/div Ref 21.94 dBm				-25.862 dBm
Log				
11.9		. 1		
1.94				
-8.06	mm	m. M. M. M.	how	• • 3
-18.1	~			
-28.1				
-38.1				
-48.1				M M M
-58.1				
-68.1				
Center 2.48 GHz				Span 2 MHz
#Res BW 30 kHz		#VBW 100 k	Hz	Sweep 2.667 ms
Occupied Bandwidth	י ו	Total Power	3.98 dBm	
	1730 MHz			
1.				
Transmit Freq Error	-4.038 kHz	OBW Power	99.00 %	
x dB Bandwidth	1.316 MHz	x dB	-20.00 dB	
			20100 02	
MSG			STATUS	

Highest channel

7. Carrier Frequencies Separation

Test Requirement: Test Method: Receiver setup:	FCC Part15 C Section 15.247 (a)(1)ANSI C63.10:2013RBW=20KHz, VBW=62KHz, detector=Peak	
Limit:	0.025MHz or 2/3 of the 20dB bandwidth (whichever is greater)	
Test setup:	Spectrum Analyzer E.U.T Non-Conducted Table Ground Reference Plane	
Test Instruments:	Refer to section 1.7 for details	
Test mode:	Refer to section 1.2 for details	
Test results:	Pass	

Measurement Data:

Mode	Test channel	Carrier Frequencies Separation (MHz)	Limit (MHz)	Result
	Lowest	1.084	0.627	Pass
GFSK	Middle	1.02	0.627	Pass
	Highest	0.984	0.627	Pass
	Lowest	0.896	0.855	Pass
Pi/4QPSK	Middle	0.99	0.855	Pass
	Highest	0.988	0.855	Pass
	Lowest	1.096	0.853	Pass
8DPSK	Middle	0.982	0.853	Pass
	Highest	0.89	0.853	Pass

Note: According to section 7.4

Mode	20dB bandwidth (kHz)	Limit (kHz)
WOUE	(worse case)	(Carrier Frequencies Separation)
GFSK	940.00	627
Pi/4QPSK	1282.00	855
8DSK	1280.00	853

Test plot as follows:

Only show the worst case



Pi/4QPSK

	50 Ω AC	SENSE:P	ULSE	ALIGN OFF	02:31:55 PM May 28, 3
ter Freq 2.402	PNC): Wide 🖵 T ain:Low #/	rig: Free Run Atten: 30 dB	#Avg Type: RMS Avg Hold:>100/100	DET P NNI
Ref Offse B/div Ref 20.0					Mkr1 2.402 014 G -3.865 dE
				02	
		~ ~			
~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~		man 1	······································		and and the new
nter 2.402500 G	Hz				Span 2.000 M
s BW 30 kHz		#VBW 1			Sweep 2.133 ms (1001 p
MODE TRC SCL N 1 f N 1 f	× 2.402 014 GHz 2.402 910 GHz	3.865 dBn -3.900 dBn	1	FUNCTION WIDTH	FUNCTION VALUE

8DPSK

. RF 5	OΩ AC	SENSE:	PULSE	ALIGN OFF		03:47:49 PM May 28, 2
ter Freq 2.441	PNO		Frig: Free Run Atten: 30 dB	#Avg Type: F Avg Hold:>1		TRACE 1 2 3 4 TYPE MWW DET P N N N
Ref Offset B/div Ref 20.0					Mkr	1 2.441 014 GI -4.484 dB
	1					
mon	www.www.	~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~	www	a martin	Am	m
nter 2.441500 GH	lz					Span 2.000 M
s BW 30 kHz		#VBW 1	100 kHz		Sweep	2.133 ms (1001 p
Mode TRC SCL N 1 f N 1 f	× 2.441 014 GHz 2.441 996 GHz	≚ -4.484 dВı -3.734 dВı	m	FUNCTION WIDTH	FUNC	TION VALUE
						3

# 8. Hopping Channel Number

Test Requirement:	FCC Part15 C Section 15.247 (a)(1)	
Test Method:	ANSI C63.10:2013	
Receiver setup:	RBW=100kHz, VBW=300kHz, Frequency range=2400MHz-2483.5MHz,	
	Detector=Peak	
Limit:	15 channels	
Test setup:	Spectrum Analyzer E.U.T Non-Conducted Table Ground Reference Plane	
Test Instruments:	Refer to section 1.7 for details	
Test mode:	Refer to section 1.2 for details	
Test results:	Pass	

#### Measurement Data:

Mode	Hopping channel numbers	Limit	Result
GFSK	79	15	Pass
Pi/4QPSK	79	15	Pass
8DPSK	79	15	Pass

GFSK
------



#### Pi/4QPSK



#### 8DPSK

RL	RF	50 Ω AC			SENSE:PU	LSE	🔥 AL	.IGN OFF		03:45:31	7 PM May 28, 20
enter F	req 2	.44175000	00 GHz	PNO: Fast IFGain:Low		g: Free Run tten: 30 dB	· <u> </u>	#Avg Type Avg Hold>		т	RACE 1 2 3 4 TYPE MWWW DET P N N N
dB/div		offset 1.95 di 20.00 dBm							Mkr	2.401 9 -4.	20 5 GH 707 dB
.0											2
	MANA	MAAAA	'Wwwy	VWWW	www	vmm	www	MAAA	www	ᡃᠬᠰ᠕ᢣ᠕ᠰ	mm
∘⊬—											4
	0000 G / 100 k			#	VBW 30	0 kHz			Sweep	Stop 2. 8.000 ms	48350 Gi \$ (1001 pi
MODE I N N	IRC SCL 1 f 1 f	2.40	× 01 920 5 G 30 160 0 G		707 dBm 113 dBm	FUNCTION	FUNCT	ION WIDTH	FL	INCTION VALUE	
		2.4	50 100 0 0								
5 6 7 8 9 0 1											

# **9.** Dwell Time

Test Requirement:	FCC Part15 C Section 15.247 (a)(1)
Test Method:	ANSI C63.10:2013
Receiver setup:	RBW=1MHz, VBW=1MHz, Span=0Hz, Detector=Peak
Limit:	0.4 Second
Test setup:	Spectrum Analyzer E.U.T Non-Conducted Table Ground Reference Plane
Test Instruments:	Refer to section 1.7 for details
Test mode:	Refer to section 1.2 for details
Test results:	Pass

#### Measurement Data:

Mode	Frequency	Burst Type	Pulse Width	Dwell Time	Limit	Verdict
	(MHz)		(ms)	(ms)	(ms)	
		DH1	2.905	296.31		
GFSK	2441	DH3	2.905	305.025	400	PASS
		DH5	2.905	305.025		
		DH1	2.913	291.3		
π/4-DQPSK	2441	DH3	2.91	349.2	400	PASS
		DH5	2.91	331.74		
		DH1	2.891	289.1		
8DPSK	2441	DH3	2.911	264.901	400	PASS
		DH5	2.909	328.717		

The test period: T= 0.4 Second/Channel x 79 Channel = 31.6 s

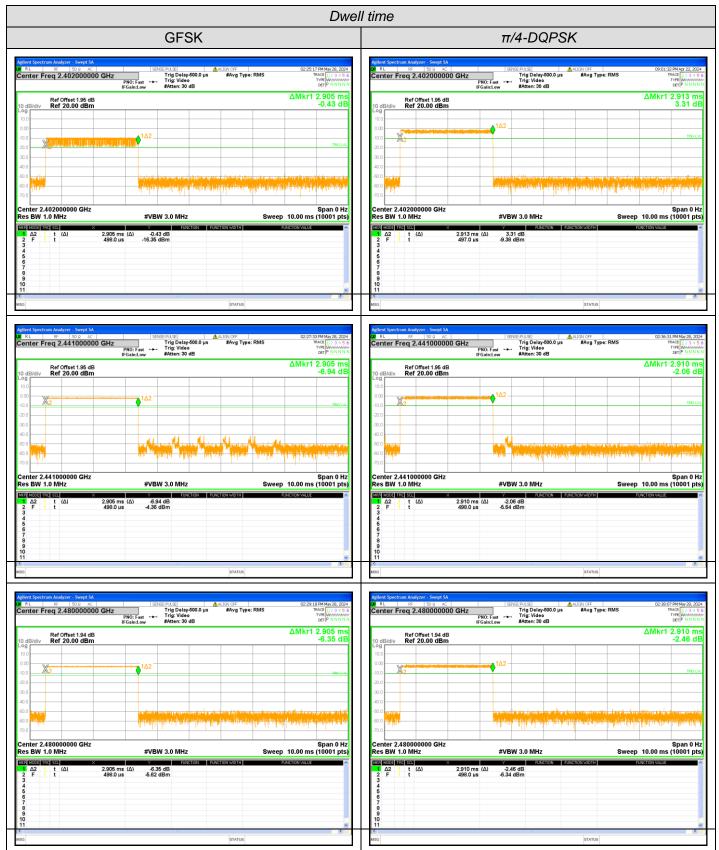
Test channel: 2402MHz/2441MHz/2480MHz as blow

DH1 time slot= Pulse time (ms)*(1600/ (2*79))*31.6

DH3 time slot= Pulse time (ms)*(1600/ (4*79))*31.6

DH5 time slot= Pulse time (ms)*(1600/ (6*79))*31.6

#### Test plot as follows:



# BSL Testing Co.,LTD.



# **10. Pseudorandom Frequency Hopping Sequence**

#### Test Requirement:

#### FCC Part15 C Section 15.247 (a)(1) requirement:

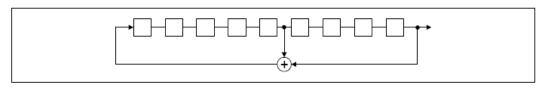
Frequency hopping systems shall have hopping channel carrier frequencies separated by a minimum of 25 kHz or the 20 dB bandwidth of the hopping channel, whichever is greater.

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. The system shall hop to channel frequencies that are selected at the system hopping rate from a Pseudorandom ordered list of hopping frequencies. Each frequency must be used equally on the average by each transmitter. The system receivers shall have input bandwidths that match the hopping channel bandwidths of their corresponding transmitters and shall shift frequencies in synchronization with the transmitted signals.

#### EUT Pseudorandom Frequency Hopping Sequence

The pseudorandom sequence may be generated in a nine-stage shift register whose 5th and 9th stage outputs are added in a modulo-two addition stage. And the result is fed back to the input of the first stage. The sequence begins with the first ONE of 9 consecutive ONEs; i.e. the shift register is initialized with nine ones.

- Number of shift register stages: 9
- Length of pseudo-random sequence:  $2^9 1 = 511$  bits
- Longest sequence of zeros: 8 (non-inverted signal)



Linear Feedback Shift Register for Generation of the PRBS sequence

An example of Pseudorandom Frequency Hopping Sequence as follow:

	0	2	4	6	62	64	7	8	1	73 75 77
Γ							1			
					1					

Each frequency used equally on the average by each transmitter.

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.

# **11. Band Edge**

#### Conducted Emission Method

Test Requirement:	FCC Part15 C Section 15.247 (d)
Test Method:	ANSI C63.10:2013
Receiver setup:	RBW=100kHz, VBW=300kHz, Detector=Peak
Limit:	In any 100 kHz bandwidth outside the frequency band in which the spread spectrum intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power, based on either an RF conducted or a radiated measurement.
Test setup:	Spectrum Analyzer E.U.T Non-Conducted Table Ground Reference Plane
Test Instruments:	Refer to section 1.7 for details
Test mode:	Refer to section 1.2 for details
Test results:	Pass

### Marker-Delta Method

Test Requirement:	FCC Part15 C Section 15.20	9 and 15.205				
Test Method:	ANSI C63.10:2013 section 6.10.6					
Test Frequency Range:	All restriction band have bee	en tested.				
Limit:	Frequency	Limit (dBuV/m @3m)	Remark			
	Above 1GHz	54.00	Average Value			
	Above IGHZ	74.00	Peak Value			

## Test plot as follows:

#### GFSK Mode:

Test channel:

Lowest channel

		ctrum	Analyz	er - Swept SA									
LXI R			RF	50 Ω AC		SE	NSE:PULSE		<u>A</u> A	LIGN OFF			8 PM May 28, 2024
Cer	nter	Fred	ן 2.3 ן	56000000	Р	NO: Fast 🔸		Free Run n: 30 dB		#Avg Typ Avg Hold		23	TYPE MWWWWW DET PNNNNN
10 d	B/div			fset 1.95 dB 0.00 dBm									02 0 GHz 413 dBm
Log 10.0			0										
0.00	1												
-10.0	1												Å
-20.0	T			0								0	21 SE dBm
-30.0													
-40.0													
-40.0							∧ <mark>4</mark>						
-60.0	1	and and the	alas	the state of the second	and an all and the los	and have made and	hamphone	mah minter	- American	When show of the	normalinate	- norther marked and the	work he
-70.0													
-70.0				2									
		3060 W 10				#VB	W 300	kHz			Sw	Stop 2 eep 9.600 m	.40600 GHz s (1001 pts)
MKR	MODE	TRC S	SCL	×		Y		FUNCTION	FUNCT	ION WIDTH		FUNCTION VALUE	~
1	NN		f f		.402 0 GHz .400 0 GHz	-1.413 -56,764							
23	N		f		.400 0 GHz	-56.764							
4	N		f		.346 3 GHz	-56.705							
5													(III)
6 7													
8 9													
9 10													
11													~
<													
MSG										STATUS			



# Test channel:

Highest channel
-----------------

R L RF	50 Ω AC	SENSE:P	ULSE	ALIGN OFF		02:11:43 PM May 28, 202
enter Freq 2.			rig: Free Run Atten: 30 dB	#Avg Type: F Avg Hold: 10		TRACE 12345 TYPE MWWWW DET PNNNN
	ffset 1.94 dB 20.00 dBm				MI	kr1 2.480 0 GH -0.038 dBr
	0				2	
		-				
1.0					5	-20.52 d
.0						
.0		s			2	
	mon the mark the production of the start of the	mound	mounded	Marmannen	amonganan	antra adaption and an
1.0					2	
art 2.47600 G les BW 100 kl		#VBW 3	00 kHz		Sweep 9	Stop 2.57600 GH 9.600 ms (1001 pt
R MODE TRC SCL	× 2.480 0 GHz	Y -0.038 dBm		FUNCTION WIDTH	FUNC	ION VALUE
N 1 F 2 N 1 F 3 N 1 F 4 N 1 F	2.480 0 GHz 2.483 5 GHz 2.500 0 GHz 2.483 7 GHz	-57.843 dBn -57.613 dBn -56.219 dBn	1			
r 3 9						
)						

mter F	RF 50	OΩ AC	SENSE:PUL	.SE	ALIGN OFF		02:30:42 F	M May 28, 20
anner F	req 2.526			g: Free Run ten: 30 dB	#Avg Type Avg Hold:		T)	CE 1 2 3 4 PE MWWW ET P N N N
dB/div	Ref Offset Ref 20.0						Mkr1 2.48 -2.8	0 0 GH 63 dB
	1							
.0								-23.151
.0						_		
.0	$\wedge^2$				De la			
.0	hatter	monadore allowers	gaylethaqueesta offers have	ecclosoftwyllwyrodiwygyd	W Montprince la comente	na an an an Andrea	and the second second second	nightformentation
art 2.47	7600 GHz						Stop 2.5	7600 GI
	100 kHz		#VBW 30				9.600 ms	1001 p
es BW		X	Y ID	FUNCTION	FUNCTION WIDTH	F	JNCTION VALUE	
R MODE T	RC SCL	2.480 0 GHz	-2.863 dBm					
r Mode t N N N	f f f	2.483 5 GHz 2.500 0 GHz	-57.020 dBm -57.773 dBm					
N N N N N	f	2.483 5 GHz	-57.020 dBm					
R MODE T N N N N	f f f	2.483 5 GHz 2.500 0 GHz	-57.020 dBm -57.773 dBm					
R MODE T N N N N	f f f	2.483 5 GHz 2.500 0 GHz	-57.020 dBm -57.773 dBm					

### Pi/4QPSK Mode:

### Test channel:

#### Lowest channel

RL R	F 50 Ω AC	SENSE:P	ULSE	ALIGN OFF	02:13:12 PM May 28, 20
enter Freq	2.356000000 GHz		rig: Free Run Atten: 30 dB	#Avg Type: RMS Avg Hold: 100/10	
	f Offset 1.95 dB ef 20.00 dBm				Mkr1 2.402 0 GH -1.575 dBi
9 1.0					
					(\)
.0					Δ
.0					-20.14 0
.0					
.0					
.0					13
O Tastellanatathan	and a destruction and the destruction of the second	some and some south all the	helimosania	mb some about the march	- and a serie produce of a series of the ser
art 2.30600 Res BW 100		#VBW 3	00 kHz		Stop 2.40600 GF Sweep 9.600 ms (1001 pt
R MODE TRC SC		Y Hz -1.575 dBn		FUNCTION WIDTH	FUNCTION VALUE
N f					
N 1 f					

Ref Offset 1.95 dB         Mkr1 2.40           0 dB/div         Ref 20.00 dBm           100	ACE 1 2 3 4 TYPE M WWW DET P N N N
Ref 20.00 dBm         -2.           0 dB/div         Ref 20.00 dBm           0 dB/div         -2.           0 dB/div         -2	
100 100 100 100 100 100 100 100	05 1 GH 007 dB
0.0         0.0         0.0         0.0         0.0         0.0         0.0         0.0         0.0         0.0         0.0         0.0         0.0         0.0         0.0         0.0         0.0         0.0         0.0         0.0         0.0         0.0         0.0         0.0         0.0         0.0         0.0         0.0         0.0         0.0         0.0         0.0         0.0         0.0         0.0         0.0         0.0         0.0         0.0         0.0         0.0         0.0         0.0         0.0         0.0         0.0         0.0         0.0         0.0         0.0         0.0         0.0         0.0         0.0         0.0         0.0         0.0         0.0         0.0         0.0         0.0         0.0         0.0         0.0         0.0         0.0         0.0         0.0         0.0         0.0         0.0         0.0         0.0         0.0         0.0         0.0         0.0         0.0         0.0         0.0         0.0         0.0         0.0         0.0         0.0         0.0         0.0         0.0         0.0         0.0         0.0         0.0         0.0         0.0         0.0         0.0         0.0 <th></th>	
200         200         200         200         200         200         200         200         200         200         200         200         200         200         200         200         200         200         200         200         200         200         200         200         200         200         200         200         200         200         200         200         200         200         200         200         200         200         200         200         200         200         200         200         200         200         200         200         200         200         200         200         200         200         200         200         200         200         200         200         200         200         200         200         200         200         200         200         200         200         200         200         200         200         200         200         200         200         200         200         200         200         200         200         200         200         200         200         200         200         200         200         200         200         200         200         200 <td></td>	
000         4         3           000         4         3           000         4         3           000         4         3           000         4         3           000         4         3           000         4         3           000         4         3           000         4         4           000         4         4           000         4         4           000         6         5           000         6         4           000         6         5           000         6         2.405 1 GHz           2         1         6           000         6         2.400 0 GHz           2         1         6           0         1         5           0         1         1	M
0         4         3           0         4         3           0         4         3           0         4         3           0         4         4           0         4         3           0         4         3           0         4         4           0         4         4           0         4         4           0         4         4           0         4         4           0         4         4           0         4         4           0         4         4           0         4         4           0         4         4           0         4         4           0         4         4           0         4         4           0         4         5           0         4         4         4           0         4         4         4           0         4         4         5         5           0         4         4         4         4         4	-21.88.0
Image: set in the set	
Image: Stop 2 /	
Image: Second state state         Stop 2.           Image: Second state         #VBW 300 kHz         Sweep 9.600 ms           Image: Second state         #VBW 300 kHz         Sweep 9.600 ms           Image: Second state         #VBW 300 kHz         Function width	$\langle \rangle^2$
Art 2.30600 GHz         Stop 2.           Res BW 100 kHz         #VBW 300 kHz         Sweep 9.600 ms           R Model FRC Sci         X         Y         FUNCTION WIDTH         FUNCTION VALUE           N         f         2.405 1 GHz         -2.007 dBm         FUNCTION WIDTH         FUNCTION VALUE           N         f         2.400 0 GHz         -56.201 dBm         FUNCTION WIDTH         FUNCTION VALUE	errol of
Res BW 100 kHz         #VBW 300 kHz         Sweep         9.600 ms           Image: TRC SCL         X         Y         FUNCTION         FUNCTION WIDTH         FUNCTION WIDTH           Image: N         1         f         2.405 1 GHz         -2.007 dBm         Function         Function width         Function width           2         N         1         f         2.400 0 GHz         -56.201 dBm         Function width         Function width	1
N 1 f 2.405 1 GHz -2.007 dBm 2 N 1 f 2.400 0 GHz -56.201 dBm	40600 GI (1001 pi
3 N 1 f 2.390 0 GHz -57.091 dBm	
1 N 1 f 2.346 4 GHz -50.143 dBm	
	>

### Test channel: Highest channel

	RF	50 Ω AC	SENSE:PUL	SE	ALIGN OFF			M May 28, 202
enter	Freq 2.52			g: Free Run sen: 30 dB	#Avg Type Avg Hold:		TY	CE 1 2 3 4 5 PE MWWWW ET P NNNN
) dB/div		et 1.94 dB 00 dBm				1	Vkr1 2.48 -4.0	0 0 GH 05 dBi
	<u>^1</u>							
in la	Ă							
								-24.04 c
.0		n4 .					a	
			manyoupperpire		and the second		mellinsonality	La chante o
.0	manuf road	or development of the second states of the second s	grand and the grand for the	where have been and the second	1. Martine Manual Construction	P. Bill Control of the second second	-ger White White Products	insertion Advance
.0	2	2	5				a	
	47600 GHz N 100 kHz		#VBW 30	0 kHz		Sweep	Stop 2.5 9.600 ms	
	TRC SCL	×	Y	FUNCTION	FUNCTION WIDTH	131	INCTION VALUE	
I MODE	1 f	2.480 0 GHz 2.483 5 GHz	-4.005 dBm -58.258 dBm					
N			-58.592 dBm					
N N N	1 f 1 f	2.500 0 GHz						
N N N		2.500 0 GHz 2.496 5 GHz	-55.706 dBm					
N N N N	1 f							
	1 f							
N N N	1 f							
N N N	1 f							

	RF 5	50 Ω AC	· · · · · · · · · · · · · · · · · · ·	SEN	VSE:PULSE		ALIGN OFF			) PM May 28, 2
nter F	req 2.526	600000	P	'NO: Fast ↔→ Gain:Low	Trig: Free #Atten: 30		#Avg Type Avg Hold:2		TF	TYPE MWAA DET P N N N
B/div	Ref Offsel Ref 20.0								Mkr1 2.4 -2.	78 0 G 786 dE
LAAM									0	1
				-						-22.95
	$\langle \rangle^2$	$\wedge^4$	$\wedge^3$							
	Vertransen	whenam	a wood er ander	miline water	holomatrian	whether hat so	an we make the second	in Advantation when	aramenand	mound
-				C				1	9	
									<b>Ot</b> en 0	57600 G
	600 GHz			#\/B)	M 300 PH	7		Swoo	510p Z.	/1000 0
es BW	100 kHz			#VB\	W 300 kH				p 9.600 ms	57000 G (1001 p
es BW Mode II	100 kHz		2.478 0 GHz	Y -2.786	FU dBm		UNCTION WIDTH		p 9.600 ms	57000 Q
N N N N	100 kHz f f f		2.483 5 GHz 2.500 0 GHz	-2.786 -56.530 -56.813	fu dBm dBm dBm		UNCTION WIDTH		p 9.600 ms	; (1001 p
es BW Mode M N N	100 kHz f f		2.483 5 GHz	-2.786 -56.530	fu dBm dBm dBm		UNCTION WIDTH		p 9.600 ms	; (1001 p
N N N N	100 kHz f f f		2.483 5 GHz 2.500 0 GHz	-2.786 -56.530 -56.813	fu dBm dBm dBm		UNCTION WIDTH		p 9.600 ms	; (1001 p
N N N N	100 kHz f f f		2.483 5 GHz 2.500 0 GHz	-2.786 -56.530 -56.813	fu dBm dBm dBm		UNCTION WIDTH		p 9.600 ms	; (1001 p
N N N N	100 kHz f f f		2.483 5 GHz 2.500 0 GHz	-2.786 -56.530 -56.813	fu dBm dBm dBm		UNCTION WIDTH		p 9.600 ms	; (1001 p

#### 8DPSK Mode:

Test channel:

Lowest channel

Ref Offset 1.95 dB       0 dB/div     Ref 20.00 dBm       9	Stop 2.40600 G
Beldiv         Ref 20.00 dBm           B         B           B         B           B         B           B         B           B         B           B         B           B         B           B         B           B         B           B         B           B         B           B         B           B         B           B         B           B         B           B         B           B         B           B         B           B         B           B         B           B         B           B         B           B         B           B         B           B         B           B         B           B         B           B         B           B         B           B         B           B         B           B         B           B         B           B         B           B	-1.700 dB
00     00       00     00       00     00       00     00       00     00       00     00       00     00       00     00       00     00       00     00       00     00       00     00       00     00       00     00       00     00       00     00       00     00       00     00       00     00       00     00       00     00       00     00       00     00       00     00       00     00       00     00       00     00       00     00       00     00       00     00       00     00       00     00       00     00       00     00       00     00       00     00       00     00       00     00       00     00       00     00       00     00       00     00       00     00       00	Stop 2.40600 G
art 2.30600 GHz Res BW 100 kHz #VBW 300   R MODE TRC SCL X Y	Stop 2.40600 G
	Stop 2.40600 G
art 2.30600 GHz es BW 100 kHz #VBW 300   MODE TRC SCL × Y	Stop 2.40600 G
	Stop 2.40600 G
۲         ۲         ۲         ۲         ۲         ۲         ۲         1         1         1         1         1         1         1         1         1         1         1         1         1         1         1         1         1         1         1         1         1         1         1         1         1         1         1         1         1         1         1         1         1         1         1         1         1         1         1         1         1         1         1         1         1         1         1         1         1         1         1         1         1         1         1         1         1         1         1         1         1         1         1         1         1         1         1         1         1         1         1         1         1         1         1         1         1         1         1         1         1         1         1         1         1         1         1         1         1         1         1         1         1         1         1         1         1         1         1         1	Stop 2.40600 G
۲۲ 2.30600 GHz es BW 100 kHz #VBW 300   MODE TRC SCL × ۲	Stop 2.40600 G
Art 2.30600 GHz es BW 100 kHz #VBW 300   MODE TRC SCL × Y	Stop 2.40600 G
rt 2.30600 GHz es BW 100 kHz #VBW 300   MODE TRC SGL X Y	Stop 2.40600 G
es BW 100 kHz #VBW 300   MODE TRC SCL X Y	Stop 2.40600 G
NODE TRC SCL X Y	
	kHz Sweep 9.600 ms (1001 p
	FUNCTION FUNCTION WIDTH FUNCTION VALUE
N 1 f 2.402 1 GHz -1.700 dBm N 1 f 2.400 0 GHz -56.099 dBm	
N 1 f 2.400 0 GHz -56.099 dBm N 1 f 2.346 5 GHz -51.096 dBm	
N 1 2.546 5 GHZ -51.056 dBm	



### Test channel: Highest channel

RL	RF 50 :	Ω AC	SENSE:PULS	E	ALIGN OFF			3 PM May 28, 20
enter F	req 2.5260		): Fast ↔ Trig in:Low #Att	: Free Run en: 30 dB	#Avg T _} Avg Hol	pe: RMS d: 100/100	TF	RACE 12345 TYPE M MAAAAAA DET P NNNN
0 dB/div	Ref Offset 1 Ref 20.00						Mkr1 2.4 -3.	80 2 GH 043 dBr
0.0				1			2	
	1							
0.0			6					
			6					-23.87 6
1.0								
0.0		2					2	0.
.0 +	$\wedge^2 \wedge^4$	3			24			
0.0	"When when the server	men providence marine	markenenenen	monorthan may	an Manada munor	Product and Annahr	whenhavennennen	momental
0.0		2					~	
art 2.47	'600 GHz						Stop 2.	57600 GH
Res BW	100 kHz		#VBW 300	) kHz		Swe	ep 9.600 ms	
R MODE T		×	Y	FUNCTION	FUNCTION WIDTH		FUNCTION VALUE	
1 N 2 N	f	2.480 2 GHz 2.483 5 GHz	-3.043 dBm -57.712 dBm					
3 N 1	f	2.500 0 GHz	-59.518 dBm					
4 N 5	f	2.486 0 GHz	-55.697 dBm					
5								
7 3								
9								
1								

	RF 50 Ω	AC	SENSE:PULS	8	ALIGN OFF			PM May 28, 21
enter Fi	req 2.526000	PN		: Free Run en: 30 dB	#Avg Typ Avg Hold	e: RMS : 2000/2000	T	CE 1 2 3 4 /PE MWWW DET P NNN
dB/div	Ref Offset 1.94 Ref 20.00 di						Mkr1 2.47 -4.2	8 0 GI 11 dB
0.0								
0 <b>1</b>								
0 mm								
.0								-22.71
0								
0							2	
	$10^2$	$>^4$ $>^3$			the settle setue			
0	Harden and and and	manuallamours	manumanon	muniterter	no Manano makelor	nonemalisation	or a manufacture and the second	and the second
o		0.						
							Stop 2.5	7600 G
art 2 47	7600 GHz							
	600 GHz 100 kHz		#VBW 300	) kHz		Swee	p 9.600 ms	(1001.b
es BW	100 kHz	×	Y	) kHz Function	FUNCTION WIDTH		ep 9.600 ms	(1001 p
es BW	100 kHz re sel	2.478 0 GHz	Y -4.211 dBm		FUNCTION WIDTH		-	(1001 p
MODE TF N 1 N 1 N 1	100 kHz FC SCL f f f	2.478 0 GHz 2.483 5 GHz 2.500 0 GHz	4.211 dBm -57.422 dBm -57.766 dBm		FUNCTION WIDTH		-	(1001 p
es BW NODE TF N 1 N 1 N 1	100 kHz FC SCL f f	2.478 0 GHz 2.483 5 GHz	4.211 dBm -57.422 dBm		FUNCTION WIDTH		-	(1001 p
es BW N 1 N 1 N 1	100 kHz FC SCL f f f	2.478 0 GHz 2.483 5 GHz 2.500 0 GHz	4.211 dBm -57.422 dBm -57.766 dBm		FUNCTION WIDTH		-	(1001 þ
es BW N 1 N 1 N 1	100 kHz FC SCL f f f	2.478 0 GHz 2.483 5 GHz 2.500 0 GHz	4.211 dBm -57.422 dBm -57.766 dBm		FUNCTION WIDTH		-	(1001 p
es BW 1 Mode TF N 1 N 1 N 1	100 kHz FC SCL f f f	2.478 0 GHz 2.483 5 GHz 2.500 0 GHz	4.211 dBm -57.422 dBm -57.766 dBm		FUNCTION WIDTH		-	
R MODE TF N 1 N 1 N 1 3 N 1	100 kHz FC SCL f f f	2.478 0 GHz 2.483 5 GHz 2.500 0 GHz	4.211 dBm -57.422 dBm -57.766 dBm		FUNCTION WIDTH		-	

### Bandedge (Conducted) Lowest Channel:

GFSK Mode

		alyzer - Swept SA								
IXI RL	RF			SEI	NSE:PULSE		ALIGN OFF	pe: RMS	05:53	56 PM May 27, 2024 TRACE 1 2 3 4 5 6
Center F	-req 4	2.35600000	Р	NO: Fast ↔ Gain:Low	Trig: Free #Atten: 30		Avg Hol	d: 100/100		TYPE MWWWWW DET P NNNNN
10 dB/div		Offset 1.95 dB f 20.00 dBm								402 3 GHz .108 dBm
Log										
10.0						1				1
0.00		+				-				
-10.0		-				-				+
-20.0						-		_		-21.09 dBm
-30.0						-				
-40.0		-								
-50.0 where	, Indana M	-	gane-portalization	+ Andrewalland	de Alamandunta	o bergates	malpulles syn	har manager	مەر يەرىمىيەلىرىغا بىلىپ	myland by
-60.0										
-70.0										
Start 2.3 #Res BW				#VB	N 3.0 MHz	z		Sw	Stop: eep 1.000 m	2.40600 <b>GH</b> z ns (1001 pts)
MKR MODE				Y		NCTION	FUNCTION WIDTH		FUNCTION VALUE	^
1 N 2 N	1 f		2.402 3 GHz 2.400 0 GHz	-1.108						
3 N	1 f		2.400 0 GHz	-44.222	dBm					
2 N 3 N 4 N 5 6 7 8 9	1 f		2.344 8 GHz	-50.590	dBm					
6										
8										
9 10										
11										~
MSG							STATUS			2
moo							314103			

	Ω AC	SENSE:PULSE		ALIGN OFF			3 PM May 27, 20
nter Freq 2.356	PNC	): Fast ↔→→ Trig: F in:Low #Atten	ree Run : 30 dB	#Avg Type: Avg Hold: 20			TYPE MWWWW DET P NNN
Ref Offset dB/div Ref 20.00						Mkr1 2.40 -1.	06 0 GH 088 dBi
.0						8	
00						1	~~~
.0	5 N					0	
0			-				-21.04 d
			A4			2	2
0 company shares	the work of the second second	how and the second s	monor	Molecomore den mont	and any man and a second	ware from theme	- S
0							
0						9	
art 2.30600 GHz					-		40600 GI
es BW 1.0 MHz		#VBW 3.0 M			-	0 1.000 ms	(1001 pi
8 MODE TRC SCL N 1 f N 1 f N 1 f N 1 f	× 2.406 0 GHz 2.400 0 GHz 2.390 0 GHz 2.356 2 GHz	-1.088 dBm -45.902 dBm -48.659 dBm -48.633 dBm	FUNCTION	FUNCTION WIDTH	Fl	UNCTION VALUE	

### High Channel:

GFSK Mode

RL	RF 50 Ω A	C I	SENSE:PUL	SE	ALIGN OFF		05:54:37 PM May 2	7, 20
enter Fre	q 2.5260000	PNC		g: Free Run ten: 30 dB		pe: RMS d: 100/100	TRACE 1 2 TYPE M W DET P N	LABALA
	Ref Offset 1.94 d Ref 20.00 dBr						Mkr1 2.479 9 0 -2.663 c	
9 1.0								
n 🔤 💧								
								2.64 0
	10	500						
	03	<u>3</u>			1 miles			
l hand in the second	milippinguestant and	and apply the allowed	and the state of the second	and a March March	mana Wasnessmark	wedda wedd ar an	unchenthy on the hours	the
) <u> </u>								
10.470	^^ <b>O</b> U-						040 57600	-
art 2.476 es BW 1			#VBW 3.0	MHz		Swee	Stop 2.57600 p 1.000 ms (1001	
MODE TRC		×	Y	FUNCTION	FUNCTION WIDTH		FUNCTION VALUE	
N 1	f	2.479 9 GHz 2.483 5 GHz	-2.663 dBm -46.776 dBm					
N 1	f	2.500 0 GHz	-49.375 dBm					
N 1	f	2.483 9 GHz	-46.352 dBm					
					STATUS		Ì	>

- RF	50 Q AC	SENSE:PU	LSE 🔬	ALIGN OFF	05:57:40 PM May 27, 2
ter Freq 2.5	26000000 GHz		g: Free Run tten: 30 dB	#Avg Type: RMS Avg Hold: 2000/2000	TRACE 1 2 3 4 TYPE M WWW DET P N N N
	set 1.94 dB ).00 dBm				Mkr1 2.480 1 GI -2.604 dB
	2				
					-22.61
$  \rangle^2$	$\wedge^4$ $\wedge^3$		· · · · · · · · · · · · · · · · · · ·		
Induran .	and man and marked and the second	north-showlessmantismeters	and a superior and a superior of the superior	Bushing and an and possible services	ะะะางมีสู่บับเขามาการใจกำรังระจบร่างการผ่
rt 2.47600 GH		#VBW 3.0	0 MHz	Sv	Stop 2.57600 G
MODE TRC SCL	×	Y	FUNCTION FUNC	CTION WIDTH	FUNCTION VALUE
N 1 f	2.480 1 GH 2.483 5 GH				
N 1 f	2.500 0 GH	lz -47.039 dBm			
N 1 f N 1 f					
	2.489 2 GH	12 -45.811 dBm			
N 1 f	2.489 2 GF	1z -45.811 aBm			
N 1 f	2.489 2 GF	12 -45.811 aBm			
N 1 f	2.489 2 GF	12 -40.811 GBM			

Channel	Mode	Detector	Frequency(MHz)	Level(dBm)	Delta(dB)
Low	Hop off	Peak	2402.30	-1.10	
			2400.00	-44.22	43.12
			2344.80	-50.59	49.49
	Hop on		2406.00	-1.08	
			2400.00	-45.90	44.82
			2390.00	-48.65	47.57
			2356.20	-48.63	47.55
High	Hop off		2479.90	-2.66	
			2483.50	-46.77	44.11
			2483.90	-46.35	43.69
			2500.00	-49.37	46.71
	Hop on		2480.10	-2.60	
			2483.50	-47.14	44.54
			2489.20	-45.81	43.21
			2500.00	-47.03	44.43

Test channel: Lowe	st
--------------------	----

Peak value:

Frequency (MHz)	Fundamental (dBuV/m)	Delta (dB)	Level (dBuV/m)	Limit Line (dBuV/m)	Over Limit (dB)	Polarization
2400.00	89.48	43.12	46.36	74.00	-27.64	Vertical
2400.00	88.67	43.12	45.55	74.00	-28.45	Horizontal

Test channel:	Highest

Peak value:

	uency Hz)	Fundamental (dBuV/m)	Delta (dB)	Level (dBuV/m)	Limit Line (dBuV/m)	Over Limit (dB)	Polarization
248	3.50	87.27	43.21	44.06	74.00	-29.94	Vertical
248	3.50	86.72	43.21	43.51	74.00	-30.49	Horizontal

Remark:

- 1. Final Level = Filed Strength of Fundamental Delta
- 2. During the test, pre-scan the GFSK, Pi/4QPSK, 8DPSK modulation, and found the GFSK modulation which it is worse case.
- 3. The average measurement was not performed when the peak measured data under the limit of average detection. If the readings given are average, peak measurement should also be supplied.

# **12. Spurious Emission**

# **Conducted Emission Method**

Test Requirement:	FCC Part15 C Section 15.247 (d)					
Test Method:	ANSI C63.10:2013					
Limit:	In any 100 kHz bandwidth outside the frequency band in which the spread spectrum intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power, based on either an RF conducted or a radiated measurement.					
Test setup:	Spectrum Analyzer E.U.T Non-Conducted Table Ground Reference Plane					
Test Instruments:	Refer to section 1.7 for details					
Test mode:	Refer to section 1.2 for details					
Test results:	Pass					

## Remark:

During the test, pre-scan the GFSK, Pi/4QPSK, 8DPSK modulation, and found the GFSK modulation which it is worse case.

Not recorded emission from 9 KHz to 30 MHz as emission level at least 20dBc lower than emission limit.

gilent Spectrum Analyzer - Swept SA RL RF 50Ω AC 02:08:49 PM May 28, 2024 TRACE 1 2 3 4 5 6 TYPE M WWWWW DET P N N N N N ALIGN OFF #Avg Type: RMS Avg|Hold: 10/10 Center Freq 13.265000000 GHz PNO: Fast ++ Trig: Free Run IFGain:Low #Atten: 20 dB Mkr1 2.401 7 GHz -1.881 dBm Ref Offset 1.95 dB Ref 11.95 dBm 10 dB/div 00 1.95 8.05 18.1  $\Diamond$ 28. 38. 48.1  $\langle \rangle^{5}$  $\Diamond^4$ 58 -58. 78. Start 30 MHz #Res BW 100 kHz Stop 26.50 GHz Sweep 2.530 s (30001 pts) #VBW 300 kHz MKR MODE TRC SCL FUNCTION FUNCTION WIDTH FUNCTION VALUE -1.881 dBm -32.997 dBm -32.997 dBm -61.343 dBm -62.052 dBm 2.401 7 GHz 4.804 3 GHz 4.804 3 GHz 7.206 0 GHz 9.607 7 GHz ZZZZZ 1 2 3 4 5 6 7 8 9 10 11 f f f > STATUS

Lowest

Middle

RL			RF 50			SE	NSE:PULSE	-	🗥 ALIGN O			02:10	10 PM May 28, 20
en	ter	Frec	13.26	5000000	PN	0: Fast ↔ ain:Low	Trig: Free #Atten: 20			g Type: RM jHold: 10/1			TRACE 1 2 3 4 TYPE MWMM DET P N N N
	3/div		ef Offset ef 11.9								2	Mkr1 2.	440 5 GH 0.007 dB
<b>og</b> 1.95			A1										
			Y										
3.05	-		1										
8.1	39			0								0	-22.22.0
8.1	2			$\langle \rangle^{4}$								0	
8.1													
8.1													
	2 <u></u>			8	04	_∧5	5				1.002	2	C 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1
8.1	-				$-\diamond$ +	$- \varphi$			Landa In	and the second second		and the state of the st	A Marchael
8.1	Harris	- Internet	and the street of	- Blass	and the start	- Alakak	A second s						
8.1				<u></u>									
		MHz N 10	z 0 kHz	-60		#VB	W 300 kH	z			Swee	Sto p 2.530 s	p 26.50 GI s (30001 p
KR I	MODE	TRC S	CL	×		Y	FU	NCTION	FUNCTION WI	DTH	FL	INCTION VALUE	
1	N		ŗ		05GHz	-3.007				1780 ·			
23	N N		F F		2 0 GHz 2 0 GHz	-31.536 -31.536							
4	N	1 1	F	7.32	23 4 GHz	-62.782	dBm						
5 6	N	1 1	f	9.76	53 9 GHz	-61.515	dBm						
о 7													
8 9 0													

Highest

RL		RF	50 Ω AC		SENSE:	PULSE	ALIGN OFF		02:12:29 PN	
ent	er l	req ′	13.265000000			Frig: Free Run Atten: 20 dB	#Avg Type Avg Hold:		TYP	E 1 2 3 4 5 E M WANNA T P N N N N
0 dB	/div		Offset 1.94 dB f <b>11.94 dB</b> m						Mkr1 2.480 -0.67	) 2 GH 71 dBr
.94 -	2	(	1							
.06										
8.1										-20.06.6
		_	3							-20.00 0
8.1			Y							
3.1		_								
3.1	a.	_	8 <u>8</u> 8	04	- 5				e e	
1			A	Y	5		مر بيار بن من الم		-	
3.1		L'III	and the second second	Margaret Margaret						
8,1	-								9. Vi.	
] tart	30	MHz							Stop 2	6 50 CL
		100	kHz		#VBW :	300 kHz		Swee	p 2.530 s (3	0001 pt
KR M	IODE	TRC SCL	×		Y	FUNCTION	FUNCTION WIDTH	FL	INCTION VALUE	
	N	1 f		30 2 GHz	-0.671 dB					
	N N	1 f		59 6 GHz 59 6 GHz	-32.274 dB					
4	N	1 f	7.43	39 8 GHz	-57.655 dB	m				
5	N	1 f	9.92	20 1 GHz	-62.959 dB	m				
o 7										
8										
9										
1										

# Radiated Emission Method

Test Requirement:	FCC Part15 C Section 15.209						
Test Method:	ANSI C63.10:2013						
Test Frequency Range:	30MHz to 25GHz						
Test site:	Measurement Distance: 3m						
Receiver setup:	Frequency	Detector	r RBW VBW		Remark		
	30MHz-1GHz	Quasi-pea	k 120KHz	300KHz	Quasi-peak Value		
	Above 1GHz	Peak	1MHz	3MHz	Peak Value		
	Above IGHZ	Average	1MHz	3MHz	Average Value		
Limit:	Frequen	юу	Limit (dBuV	′m @3m)	Remark		
	30MHz-88	MHz	40.0	)	Quasi-peak Value		
	88MHz-216	6MHz	43.5	5	Quasi-peak Value		
	216MHz-96	0MHz	46.0		Quasi-peak Value		
	960MHz-1	GHz	54.0		Quasi-peak Value		
	Above 10	24-7	54.0	)	Average Value		
		2112	74.0	)	Peak Value		
Test setup:	Below 1GHz	i		$-\frac{1}{2}$	fier-		

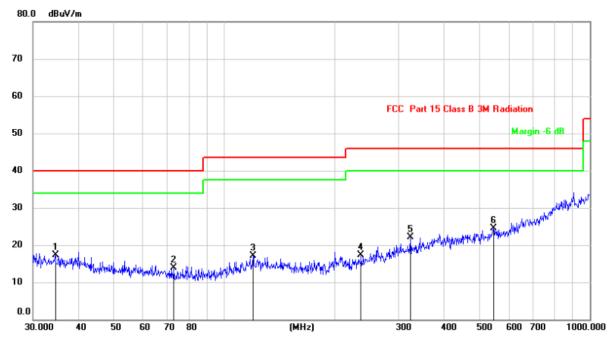
	Image: Simple state     Image: Simple state       Imag
Test Procedure:	<ol> <li>The EUT was placed on the top of a rotating table (0.8 meters below 1G and 1.5 meters above 1G) above the ground at a 3 meter camber. The table was rotated 360 degrees to determine the position of the highest radiation.</li> <li>The EUT was set 3 meters away from the interference-receiving antenna, which was mounted on the top of a variable-height antenna tower.</li> <li>The antenna height is varied from one meter to four meters above the ground to determine the maximum value of the field strength. Both horizontal and vertical polarizations of the antenna are set to make the measurement.</li> <li>For each suspected emission, the EUT was arranged to its worst case and then the antenna was tuned to heights from 1 meter to 4 meters and the rota table was turned from 0 degrees to 360 degrees to find the maximum reading.</li> <li>The test-receiver system was set to Peak Detect Function and Specified Bandwidth with Maximum Hold Mode.</li> <li>If the emission level of the EUT in peak mode was 10dB lower than the limit specified, then testing could be stopped and the peak values of the EUT would be reported. Otherwise the emissions that did not have 10dB margin would be re-tested one by one using peak, quasi-peak or average method as specified and then reported in a data sheet.</li> </ol>
Test Instruments:	Refer to section 1.7 for details
Test mode:	Refer to section 1.2 for details
Test results:	Pass

## Remark:

- 1. During the test, pre-scan the GFSK, Pi/4QPSK, 8DPSK modulation, and found the GFSK modulation which it is worse case.
- 2. Pre-scan all kind of the place mode (X-axis, Y-axis, Z-axis), and found the Y-axis which it is worse case.

# Measurement data:

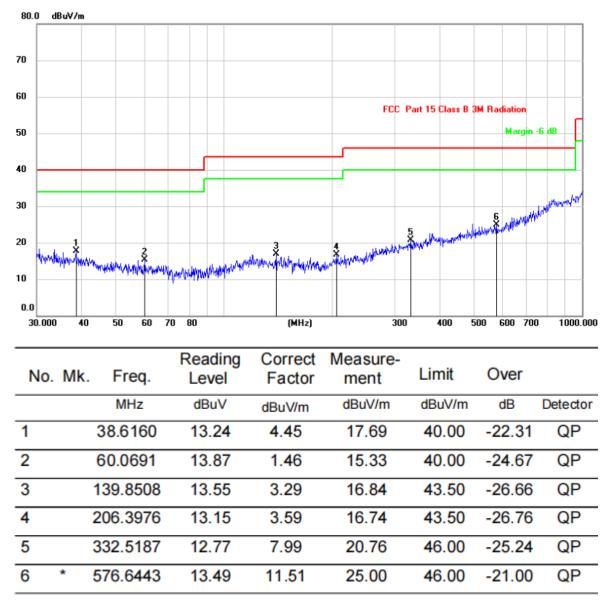
#### Vertical:



No.	Mk.	Freq.	Reading Level	Correct Factor	Measure- ment	Limit	Over	
		MHz	dBuV	dBuV/m	dBuV/m	dBuV/m	dB	Detector
1		34.5173	12.48	4.88	17.36	40.00	-22.64	QP
2		72.8466	12.87	1.08	13.95	40.00	-26.05	QP
3		119.8556	12.92	4.13	17.05	43.50	-26.45	QP
4		236.6447	13.14	4.16	17.30	46.00	-28.70	QP
5		323.3204	14.15	7.92	22.07	46.00	-23.93	QP
6	*	545.1826	12.96	11.62	24.58	46.00	-21.42	QP

*:Maximum data x:Over limit !:over margin

## Horizontal:



^{*:}Maximum data x:Over limit !:over margin

## Above 1GHz

Test channel:

Lowest

Peak value:

Frequency (MHz)	Level (dBuV/m)	Limit Line (dBuV/m)	Over Limit (dB)	Polarization
2402	89.48	-	-	Vertical
4804	40.15	74.00	-33.85	Vertical
7206	37.27	74.00	-36.73	Vertical
9608	31.29	74.00	-42.71	Vertical
2402	88.67	-	-	Horizontal
4804	39.34	74.00	-34.66	Horizontal
7206	37.18	74.00	-36.82	Horizontal
9608	31.59	74.00	-42.41	Horizontal

#### Average value:

Frequency (MHz)	Level (dBuV/m)	Limit Line (dBuV/m)	Over Limit (dB)	Polarization
2402	87.64	-	-	Vertical
4804	38.26	54.00	-15.74	Vertical
7206	35.19	54.00	-18.81	Vertical
9608	30.14	54.00	-23.86	Vertical
2402	86.73	-	-	Horizontal
4804	37.24	54.00	-16.76	Horizontal
7206	35.43	54.00	-18.57	Horizontal
9608	30.26	54.00	-23.74	Horizontal

Remark:

1. Final Level =Receiver Read level + Antenna Factor + Cable Loss – Preamplifier Factor

2. "*", means this data is the too weak instrument of signal is unable to test.

- 3. The emission from 9 kHz to 30MHz was pre tested and found the result was 20dB lower than the limit, and the permissible value has no need to be reported.
- 4. In frequency ranges 18 ~25GHz no any other harmonic emissions detected which are tested to compliance with the limit. No recording in the test report. No any other emissions level which are attenuated less than 20dB below the limit. No recording in the test report.

Middle

Peak value:

Frequency (MHz)	Level (dBuV/m)	Limit Line (dBuV/m)	Over Limit (dB)	Polarization
2442	87.93	-	-	Vertical
4882	39.57	74.00	-34.43	Vertical
7323	37.21	74.00	-36.79	Vertical
9764	31.27	74.00	-42.73	Vertical
2442	86.59	-	-	Horizontal
4882	39.41	74.00	-34.59	Horizontal
7323	37.47	74.00	-36.53	Horizontal
9764	31.36	74.00	-42.64	Horizontal

#### Average value:

Frequency (MHz)	Level (dBuV/m)	Limit Line (dBuV/m)	Over Limit (dB)	Polarization
2442	86.26	-	-	Vertical
4882	37.16	54.00	-16.84	Vertical
7323	35.41	54.00	-18.59	Vertical
9764	30.47	54.00	-23.53	Vertical
2442	85.47	-	-	Horizontal
4882	37.17	54.00	-16.83	Horizontal
7323	35.28	54.00	-18.72	Horizontal
9764	30.73	54.00	-23.27	Horizontal

Remark:

1. Final Level = Receiver Read level + Antenna Factor + Cable Loss – Preamplifier Factor

2. *"*", means this data is the too weak instrument of signal is unable to test.* 

- 3. The emission from 9 kHz to 30MHz was pre tested and found the result was 20dB lower than the limit, and the permissible value has no need to be reported.
- 4. In frequency ranges 18 ~25GHz no any other harmonic emissions detected which are tested to compliance with the limit. No recording in the test report. No any other emissions level which are attenuated less than 20dB below the limit. No recording in the test report.

Highest

Peak value:

Frequency (MHz)	Level (dBuV/m)	Limit Line (dBuV/m)	Over Limit (dB)	Polarization
2480	87.27	-	-	Vertical
4960	39.45	74.00	-34.55	Vertical
7440	36.91	74.00	-37.09	Vertical
9920	31.43	74.00	-42.57	Vertical
2480	86.72	-	-	Horizontal
4960	38.78	74.00	-35.22	Horizontal
7440	36.84	74.00	-37.16	Horizontal
9920	31.29	74.00	-42.71	Horizontal

#### Average value:

Frequency (MHz)	Level (dBuV/m)	Limit Line (dBuV/m)	Over Limit (dB)	Polarization
2480	85.61	-	-	Vertical
4960	37.81	54.00	-16.19	Vertical
7440	35.47	54.00	-18.53	Vertical
9920	30.35	54.00	-23.65	Vertical
2480	85.10	-	-	Horizontal
4960	37.24	54.00	-16.76	Horizontal
7440	35.16	54.00	-18.84	Horizontal
9920	30.43	54.00	-23.57	Horizontal

Remark:

1. Final Level =Receiver Read level + Antenna Factor + Cable Loss – Preamplifier Factor

2. "*", means this data is the too weak instrument of signal is unable to test.

- 3. The emission from 9 kHz to 30MHz was pre tested and found the result was 20dB lower than the limit, and the permissible value has no need to be reported.
- 4. In frequency ranges 18 ~25GHz no any other harmonic emissions detected which are tested to compliance with the limit. No recording in the test report. No any other emissions level which are attenuated less than 20dB below the limit. No recording in the test report.

-----End-----