# FCC Part 15C Measurement and Test Report

For

Shenzhen Daiku technology Co., LTD

# FCC ID:2BCKX-GT4PLUS

FCC Rule(s):	FCC Part 15.247			
Product Description:	Smart Watch			
Tested Model:	<u>GT4PLUS</u>			
Report No.:	BSL240404175006RF			
Tested Date:	<u>Apr.11~Sep.09,2024</u>			
Issued Date:	<u>Sep.09,2024</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>	tilens		
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# **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.:	GT4PLUS
Test Model No:	GT4PLUS
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

Operation	Frequency eac	h of channe	l				
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, GT4PLUS, 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	
	Pi/4 QPSK	CH1	2402	
2		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	$\pm 0.42$ dB		
Occupied Bandwidth	Conducted	$\pm 1.5\%$		
Power Spectral Density	Conducted	$\pm 1.8$ dB		
Conducted Spurious Emission	Conducted	±2.17dB		
Conducted Emissions	Conducted	$\pm 2.88$ 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 (c		
Limit:	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:	Reference Plane			
Tasé nga akura	Remark E.U.T LISN: Line impedence Stabilization Network Test table - 0.8m	EMI Receiver		
Test procedure:	<ol> <li>The E.U.T and simulators are connected to the main power through a line impedance stabilization network (L.I.S.N.). This provides a 50ohm/50uH coupling impedance for the measuring equipment.</li> <li>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).</li> <li>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.</li> </ol>			
Test Instruments:	Refer to section 1.7 for details			
	Refer to section 1.2 for details			
Test mode:	Refer to section 1.2 for details	;		

#### 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	-0.58		
GFSK	Middle	-0.76	30.00	Pass
	Highest	-0.59		
	Lowest	-1.13		
Pi/4QPSK	Middle	-1.34	20.97	Pass
	Highest	-1.17		
	Lowest	-3.27		
8DPSK	Middle	-3.41	20.97	Pass
	Highest	-3.19		

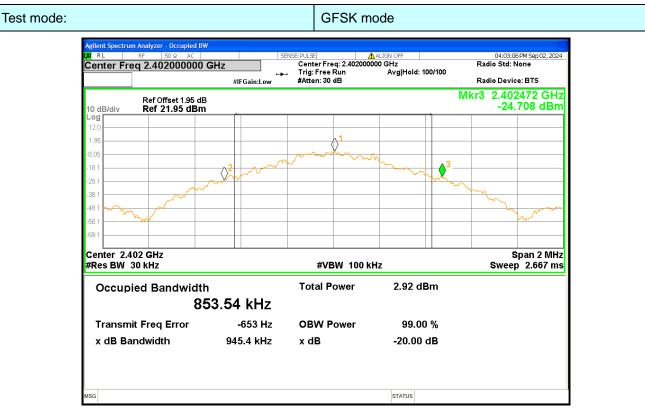
# 6. 20dB Emission Bandwidth

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	0.945	
GFSK	Middle	0.951	Pass
	Highest	0.953	
	Lowest	1.319	
Pi/4QPSK	Middle	1.317	Pass
	Highest	1.315	
	Lowest	1.296	
8DPSK	Middle	1.305	Pass
	Highest	1.287	

#### Test plot as follows:



#### Lowest channel



Middle channel

RL RF 50Ω AC			ALIGN OFF	04:04:28 PM Sep 02, 202 Radio Std: None
enter Freq 2.441000000		Center Freq: 2.4410000 Trig: Free Run #Atten: 30 dB	Avg Hold: 100/100	Radio Std: None Radio Device: BTS
	#IFGain:Low	#Atten: 30 dB		
Ref Offset 1.95 dB dB/div Ref 21.95 dBm				Mkr3 2.441472 GH -26.588 dBr
2.0				
95		1		
15		And American		
1		Vary ~~~~	w 3-	
.1	2 mm		- Mar	
.1				May
1				
.1				- Mark
.1				
enter 2.441 GHz				Span 2 MH
Res BW 30 kHz		#VBW 100 ki	Hz	Sweep 2.667 m
Occupied Bandwidth	ו	Total Power	2.46 dBm	
86	62.89 kHz			
Transmit Freq Error	-3.531 kHz	OBW Power	99.00 %	
x dB Bandwidth	951.3 kHz	x dB	-20.00 dB	

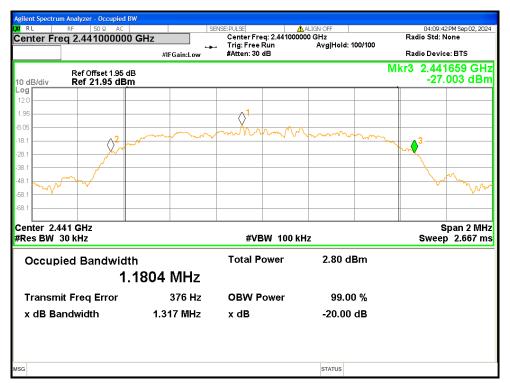
Highest channel

#### Test mode:

#### Pi/4QPSK mode



#### Lowest channel



Middle channel

Center Freq 2.48000000 GHz #IFGain:Low #Geodfiset 1.94 dB Ref Offset 1.94 dB 10 dB/div Ref 21.94 dBm 194 406 19 194 194 194 194 194 194 194		Analyzer - Occupied B				
AvglHold: 100/100         Radio Device: BTS         Mkr3       2.480658 G         10 dB/div       Ref 21.94 dB       -26.921 dl         11.9       -1       -1       -26.921 dl         11.9       -2       -26.921 dl       -26.921 dl         11.9       -2       -2       -2       -2         11.9       -2       -2       -2       -2       -2         11.9       -2       -2       -2       -2       -2       -2         11.9       -2						04:11:43 PM Sep 02, 2024
Ref Offset 1.94 dB         Mkr3 2.480658 G           10 dB/div         Ref 21.94 dBm           119         1           194         1           806         1           48.1         2           48.1         2           48.1         4           48.1         4           48.1         4           48.1         4           48.1         4           48.1         4           48.1         4           48.1         4           48.1         4           48.1         4           48.1         4           48.1         5           48.1         5           48.1         5           48.1         5           48.1         5           48.1         5           48.1         5           48.1         5           48.1         5           48.1         5           48.1         5           48.1         5           48.1         5           48.1         5           48.1         5           5	Center Fred	1 2.40000000		. Trig: Free Run	Avg Hold: 100/100	
Note: Unset: 1.94 dB    26.921 dI       Log    26.921 dI       11.9			#IFGain:Low	#Atten: 30 dB		
Log 11.9 1						Mkr3 2.480658 GHz -26.921 dBm
194 806 -181 -281 -81 -681 -Center 2.48 GHz #Res BW 30 kHz 		Rei 21.94 ubii				
806	11.9					
-18.1 -28.1 -38.1 -48.1 -48.1 -68.1 -7	1.94			1		
-281         -481 <td< td=""><td>-8.06</td><td></td><td></td><td>man</td><td></td><td></td></td<>	-8.06			man		
331     -481       -481       -681 <td< td=""><td>-18.1</td><td><math>-\sqrt{2}</math></td><td></td><td></td><td>to de attant</td><td>× <sup>3</sup></td></td<>	-18.1	$-\sqrt{2}$			to de attant	× <sup>3</sup>
48.1         48.1         44.1           -68.1         -68.1         -68.1           -68.1         -68.1         -68.1           -68.1         -68.1         -68.1           -68.1         -68.1         -68.1           -68.1         -68.1         -69.1           -68.1         -69.1         -69.1           -68.1         -69.1         -69.1           -68.1         -69.1         -69.1           -68.1         -69.1         -69.1           -68.1         -69.1         -69.1           -68.1         -69.1         -69.1           -68.1         -69.1         -69.1           -68.1         -69.1         -69.1           -68.1         -69.1         -69.1           -68.1         -69.1         -69.1           -68.1         -69.1         -69.1           -68.1         -69.1         -69.1           -69.1         -69.1         -69.1           -69.1         -69.1         -69.1           -69.1         -69.1         -69.1           -69.1         -69.1         -69.1           -69.1         -69.1         -69.1           -6	-28.1					
-58.1     -68.1     -68.1     -68.1       -68.1     -68.1     -68.1       Center 2.48 GHz     Span 2 N       #Res BW 30 kHz     Sweep 2.667	-38.1					
-68.1 Center 2.48 GHz Span 2 M #Res BW 30 kHz #VBW 100 kHz Sweep 2.667	-48.1	mm				- Whyn
Center 2.48 GHz Span 2 M #Res BW 30 kHz \$\$\$ \$\$ \$\$ \$\$ \$\$ \$\$ \$\$ \$\$ \$\$ \$\$ \$\$ \$\$ \$	-58.1					
#Res BW 30 kHz #VBW 100 kHz Sweep 2.667	-68.1					
#Res BW 30 kHz #VBW 100 kHz Sweep 2.667	Center 2.48	GHz				Span 2 MHz
				#VBW 100 k	Hz	Sweep 2.667 ms
Occupied Bandwidth Total Power 3.01 dBm	Occupie	ed Bandwidt	h	Total Power	3.01 dBm	
1.1807 MHz	-	1.	1807 MHz			
Transmit Freq Error 803 Hz OBW Power 99.00 %	Transmit	Freq Error	803 Hz	OBW Power	99.00 %	
x dB Bandwidth 1.315 MHz x dB -20.00 dB	x dB Ban	dwidth	1.315 MHz	x dB	-20.00 dB	
MSG STATUS	MSG				STATUS	

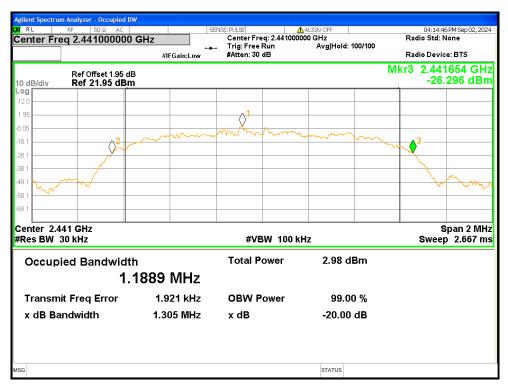
Highest channel

#### Test mode:

8DPSK mode



#### Lowest channel



Middle channel

Center Freq 2.480000000 GHz       Radio Std: None         Center Freq 2.480000000 GHz       Radio Std: None         Tig: Free Run       Avg Held: 100/100         Mkr3 2.4800646 GH         Offset 1.94 dB       Mkr3 2.480646 GH         Center Freq 2.48000000 GHz       Radio Std: None         Ref Offset 1.94 dB       Mkr3 2.480646 GH         Center 2.48 GHz       Mkr3 2.480646 GH         19       1<	Agilent Spectrum Analyzer - Occupied BW X/ RL RF 50 Ω AC		ENSE:PULSE	ALIGN OFF	04:16:59 PM Sep 02, 2024
Ref Offset 1.94 dB     Mkr3     2.480646       119     1     1     1       139     1     1     1       140     1     1     1       139     1     1     1       141     1     1     1       151     1     1     1       152     1     1     1       153     1     1     1       154     1     1     1       161     1     1     1       161     1     1     1       161     1     1     1       162     1     1     1       163     1     1     1       164     1     1     1       164     1     1     1       165     1     1     1       166     1     1     1       166     1     1     1       168     1     1     1       178     1     1     1       184     1     1     1       195     1     1     1       196     1     1     1       197     1     1     1       198					
Ref Offset 1.94 dBm       Mkr3 2.480646 GF         119       -25.753 dB         139       -25.753 dB         140       -25.753 dB         150       -25.753 dB         151       -25.753 dB         152       -25.753 dB         153       -25.753 dB         154       -25.753 dB         155       -25.753 dB         154       -25.753 dB         155       -25.753 dB         154       -25.753 dB         155       -25.753 dB         154       -25.753 dB         154				Avg Hold: 100/100	
10 dB/div       Ref 21.94 dBm       -25.753 dB         113       -25.753 dB       -25.753 dB         113       -25.753 dB       -25.753 dB         113       -25.753 dB       -25.753 dB         114       -25.753 dB       -25.753 dB         115       -25.753 dB       -25.753 dB         116       -25.753 dB       -25.753 dB         118       -25.753 dB       -25.753 dB         119       -25.753 dB       -25.753 dB         119       -25.753 dB       -25.753 dB         119       -25.753 dB       -25.753 dB         111       -25.753 dB       -25.753 dB         119       -25.753 dB       -25.753 dB         1281       -25.753 dB       -25.753 dB         1282       #VBW 100 kHz       Span 2 MB         System       -25.753 dB       -25.753 dB         1283       MB       -20.00 dB         1283       MHz       X dB       -20.00 dB		#IFGain:Low	#Atten: 30 dB		
Image: And Provide Line       Image: And Provide Line         Image: And Provide Line       Image: And Provide Line <th>Ref Offset 1.94 dB</th> <th>5</th> <th></th> <th></th> <th></th>	Ref Offset 1.94 dB	5			
113 134 136 137 138 139 139 139 139 139 139 139 139					-25.753 dBm
14 14 14 14 14 14 14 14 14 14					
ele ele ele ele ele ele ele ele			1		
101       1			↓ <u></u>		
221 221 221 221 221 221 221 221			muchikan	mann	• 3
381     481     481     481     481     481     481     481     481     481     481     481     580     580     200     580     200     200     700 <td></td> <td></td> <td></td> <td>, , , , , , , , , , , , , , , , , , ,</td> <td></td>				, , , , , , , , , , , , , , , , , , ,	
481     484     484     484     484     484     484     484     59an 2 Million       Center 2.48 GHz #Res BW 30 kHz     #VBW 100 kHz     Span 2 Million     Span 2 Million       Occupied Bandwidth 1.1817 MHz     Total Power     3.05 dBm       Transmit Freq Error     2.148 kHz     OBW Power     99.00 %       x dB Bandwidth     1.287 MHz     x dB     -20.00 dB					
68.1     V     V     V       Center 2.48 GHz #Res BW 30 kHz     Span 2 MH       Cocupied Bandwidth     Total Power     3.05 dBm       1.1817 MHz     Transmit Freq Error     2.148 kHz     OBW Power     99.00 %       x dB Bandwidth     1.287 MHz     x dB     -20.00 dB					1 m
68.1     Center 2.48 GHz     Span 2 Mi       #Res BW 30 kHz     #VBW 100 kHz     Sweep 2.667 m       Occupied Bandwidth     Total Power     3.05 dBm       1.1817 MHz     Transmit Freq Error     2.148 kHz       OBW Power     99.00 %       x dB Bandwidth     1.287 MHz     x dB	Max				A www
Center 2.48 GHz     Span 2 Mi       #Res BW 30 kHz     #VBW 100 kHz     Sweep 2.667 m       Occupied Bandwidth     Total Power     3.05 dBm       1.1817 MHz     Transmit Freq Error     2.148 kHz     OBW Power     99.00 %       x dB Bandwidth     1.287 MHz     x dB     -20.00 dB					
#Res BW 30 kHz     #VBW 100 kHz     Sweep 2.667 n       Occupied Bandwidth     Total Power     3.05 dBm       1.1817 MHz     1.1817 MHz       Transmit Freq Error     2.148 kHz     OBW Power     99.00 %       x dB Bandwidth     1.287 MHz     x dB     -20.00 dB	-68.1				
Occupied Bandwidth Total Power 3.05 dBm 1.1817 MHz Transmit Freq Error 2.148 kHz OBW Power 99.00 % x dB Bandwidth 1.287 MHz x dB -20.00 dB	Center 2.48 GHz				Span 2 MHz
1.1817 MHz         Transmit Freq Error       2.148 kHz       OBW Power       99.00 %         x dB Bandwidth       1.287 MHz       x dB       -20.00 dB	#Res BW 30 kHz		#VBW 100 k	Hz	Sweep 2.667 ms
<b>1.1817 MHz</b> Transmit Freq Error 2.148 kHz OBW Power 99.00 % x dB Bandwidth 1.287 MHz x dB -20.00 dB	Occupied Bandwidth	า	Total Power	3.05 dBm	
x dB Bandwidth 1.287 MHz x dB -20.00 dB	1.1	1817 MHz			
	Transmit Freq Error	2.148 kHz	OBW Power	99.00 %	
	x dB Bandwidth	1 287 MHz	v dB	-20 00 dB	
JSG STATIS		1.207 10112		-20.00 00	
	ISG			STATUS	

Highest channel

# 7. Carrier Frequencies Separation

Test Requirement:	FCC Part15 C Section 15.247 (a)(1)	
Test Method:	ANSI C63.10:2013	
Receiver setup:	RBW=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	0.63	Pass
GFSK	Middle	0.828	0.634	Pass
	Highest	0.998	0.635	Pass
	Lowest	1.094	0.879	Pass
Pi/4QPSK	Middle	0.902	0.878	Pass
	Highest	0.976	0.877	Pass
	Lowest	1.096	0.864	Pass
8DPSK	Middle	1.066	0.87	Pass
	Highest	1.174	0.858	Pass

Note: According to section 7.4

Mode	20dB bandwidth (kHz)	Limit (kHz)
wode	(worse case)	(Carrier Frequencies Separation)
GFSK	945.00	630
Pi/4QPSK	1315.00	877
8DSK	1287.00	858

### Test plot as follows:

#### Only show the worst case



#### Pi/4QPSK

RF	50Ω AC	SE	NSE:PULSE	🔥 ALIGN OFF	04:22:09 PM Sep 02
er Freq 2.40	02500000 GHz	Z PNO: Wide IFGain:Low	Trig: Free Run #Atten: 30 dB	#Avg Type: RMS Avg Hold:>100/100	TRACE 1 2 3 TYPE M WW DET P N N
	set 1.95 dB 9.00 dBm				Mkr1 2.401 912 C -6.050 d
	1				
	m	mm	~	- And	mm
www		¥	mon	~~~~	- When
ter 2.402500	GHz				Span 2.000
s BW 30 kHz	×	#VB	W 100 kHz	FUNCTION WIDTH	/eep 2.133 ms (1001 FUNCTION VALUE
N 1 f N 1 f	2.401 912 2.402 996		dBm		TONCHON VALUE

8DPSK

RF	50 Ω AC	SEN	SE:PULSE	ALIGN OFF		04:44:30 PM Sep 02, 2
ter Freq 2.4	479500000 GH	Z PNO: Wide IFGain:Low	Trig: Free Run #Atten: 30 dB	#Avg Type: RM Avg Hold≫100/		TRACE 1 2 3 TYPE MWWR DET P N N
	ffset 1.94 dB 20.00 dBm				Mkr1	2.478 840 G -5.990 dE
	. 1				0.2	
	- 1 m				X	
~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~						~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~
ter 2.479500	) GHz					Span 2.000 N
s BW 30 kH:	2	#VBV	V 100 kHz		Sweep 2	.133 ms (1001
MODE TRC SCL N 1 f N 1 f	× 2.478 840 2.480 014			FUNCTION WIDTH	FUNCT	ON VALUE

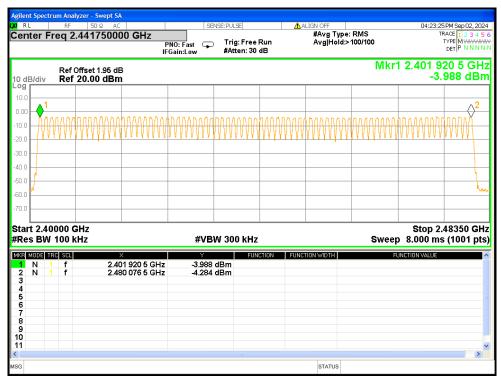
# 8. Hopping Channel Number

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

gilent Spect	rum Analyzer	- Swept SA								
(IRL		50 Ω AC		9	SENSE:PULSE		🛕 ALIGN OF		04	:40:58 PM Sep 02, 2024
Center F	req 2.44	175000	F	PNO: Fast G Gain:Low		ree Run :: 30 dB		g Type: RMS  Hold:>100/100		TRACE 12345 TYPE MWWWW DET PNNNN
10 dB/div		et 1.95 dB 00 dBm						N	/lkr1 2.40	1 586 5 GHz -7.284 dBm
10.0										
0.00	AAMAAAA		AMA AAN	Indahad	Anhand	marr	14 ALANA MAK	WALLAND	AUVERVER	white have 2
10.0		10010		W TO BE TO A TO A TO A				11111111111111111111111111111111111111		A An L
80.0										
40.0										
50.0										
50.0										
70.0										
	0000 GHz / 100 kHz			#VI	300 I	<b>Hz</b>		Si		p 2.48350 GH: ms (1001 pts
IKR MODE T	IRC SCL	X		Y		FUNCTION	FUNCTION WID	DTH	FUNCTION VA	LUE
1 N 2 N 3	1 f 1 f		586 5 GHz 410 5 GHz		4 dBm 4 dBm					
6										
4 5 6 7 8 9										
9 10 11										
										>
								ATUS		

# **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)	71	(ms)	(ms)	(ms)	
		DH1	2.904	310.728		
GFSK	2441	DH3	2.904	307.824	400	PASS
		DH5	2.904	313.632		
		DH1	2.909	325.808		
π/4-DQPSK	2441	DH3	2.909	325.808	400	PASS
		DH5	2.907	328.491		
		DH1	2.908	284.984		
8DPSK	2441	DH3	2.908	316.972	400	PASS
		DH5	2.91	276.45		

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

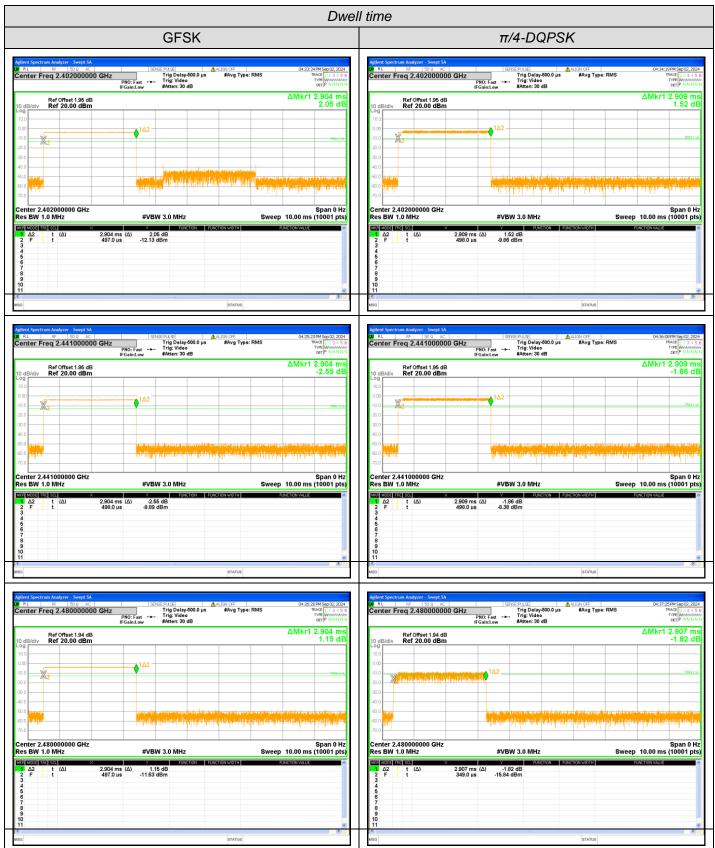
Test channel: 2402MHz/2441MHz/2480MHz as blow

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:

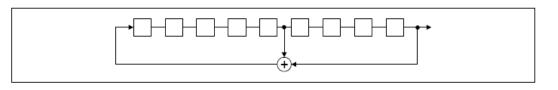
Frequency hopping systems shall have hopping channel carrier frequencies separated by a minimum of 25 kHz or the 20 dB bandwidth of the hopping channel, whichever is greater.

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 been tested.					
Limit:	Frequency	Limit (dBuV/m @3m)	Remark			
	Above 1GHz	54.00	Average Value			
		74.00	Peak Value			

# Test plot as follows:

#### GFSK Mode:

Test channel:

Lowest channel

Agiler LXI R		ectrur	<mark>n Ana</mark> RE	lyzer - Swept SA 50 Ω AC				1				04:00:1	70M Car 02, 2024
		Fre		.35600000	F	NO: Fast		Free Ru n: 30 dB		LIGN OFF #Avg Type Avg Hold:		т	7PM Sep 02, 2024 RACE 1 2 3 4 5 6 TYPE MWWWWW DET P N N N N N
10 d Log	B/div			Offset 1.95 dB 20.00 dBm		Gam.com							02 2 GHz 727 dBm
10.0	$\vdash$												
0.00	⊢												
-10.C	⊢												
-20.0													-24.26 dBm
-30.C	$\vdash$												
-40.C	$\vdash$												A4 A3
-50.C													
-60.0 -70.0	Mar pet	L <sub>Mat</sub> eloj	3604-01×-	and the marked and the second	en inder der beiden scher der s Ster der scher der sch	aled advise consideration	alead Constitution	englister.	dave bed frank te way be	ann-fall an chan chine	Alifiation	ipdus/eduardines/	
Sta #Re						#VE	W 300	kHz			Swee		.40600 GHz s (1001 pts)
	MODE	TRC	_	X		Y Y		FUNCTIO	IN FUNCT	TION WIDTH	ŀ	UNCTION VALUE	~
1 2 3 4 5 6 7 8 9 10 11 €	N N N		f f f		2.402 2 GHz 2.400 0 GHz 2.400 0 GHz 2.397 2 GHz	-56.300 -56.300 -56.085	dBm						×
MSG										STATUS			

RL	RF	50 Ω AC		SEI	NSE:PULSE	🛕 ALIGN OFF			58 PM Sep 02, 20
enter F	req 2	.35600000	PI	NO: Fast 🔸	Trig: Free Run #Atten: 30 dB	#Avg T) Avg Ho	/pe: RMS ld: 2000/2000		TYPE MWWW DET P N N N
) dB/div		Offset 1.95 dE 20.00 dBm						Mkr1 2.4 -3	104 0 GH .488 dBi
.00									
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0.0									-23.59 0
).0									
0.0									
0.0									<u></u> 2
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0.0									
tart 2.3								Otem 2	10600 01
Res BW				#VB	W 300 kHz		Swe	ep 9.600 m	.40600 GH s (1001 pt
KR MODE T		>	2.404 0 GHz	Y -3.488	FUNCTION	N FUNCTION WIDTH		FUNCTION VALUE	
1 N 2 N	1 f 1 f		2.400 0 GHz	-57.736	dBm				
3 N 4 N	1 f 1 f		2.390 0 GHz 2.376 3 GHz	-57.920 -55.169					
5 6									
7									
8 9									
0									

## Test channel: Highest channel

RL	RF 50	DΩ AC	SENSE:PUL	SE	ALIGN OFF		04:06:2	1 PM Sep 02, 20
enter F	req 2.526			j: Free Run ten: 30 dB	#Avg Typ Avg Hold			TYPE MWWW DET PNNN
dB/div	Ref Offset Ref 20.0						Mkr1 2.4 -3.	79 8 GH 869 dB
1.0								
10 <b>- 6</b>	1							
٥Lľ								
								-24.17
		4						
	$0^2$	<mark>4</mark>						
0 <mark>41″</mark>	Wymall	manner provident	and the second sec	Mar Handward	Mannahar Marina	mummhous	mahanna	manus
0								
	'600 GHz 100 kHz		#VBW 30	0 kHz		Swee	Stop 2. p 9.600 ms	.57600 G s (1001 p
MODE TR		×	Y	FUNCTION	FUNCTION WIDTH		FUNCTION VALUE	
N 1 N 1	f f	2.479 8 GHz 2.483 5 GHz	-3.869 dBm -58.538 dBm					
N 1	f	2.500 0 GHz	-58.356 dBm					
N 1	f	2.489 4 GHz	-55.915 dBm					
					STATUS			

RL	RF 50 Ω	AC	SENSE:PUL	SE	ALIGN OFF		04:27:4	5 PM Sep 02, 20
enter F	req 2.52600	PN		j: Free Run ten: 30 dB	#Avg Type Avg Hold:	: RMS 2000/2000		RACE 1 2 3 4 TYPE MWWW DET P N N N
) dB/div	Ref Offset 1. Ref 20.00						Mkr1 2.4 -3.	79 1 GH 891 dB
0.0								
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.0								
	7600 GHz / 100 kHz		#VBW 30	0 kHz		Swee	Stop 2. p 9.600 m	57600 G s (1001 p
			× 1	FUNCTION	FUNCTION WIDTH	7	UNCTION VALUE	
R MODE T		Х						
R MODE T N N	1 f 1 f 1 f	2.479 1 GHz 2.483 5 GHz 2.500 0 GHz	-3.891 dBm -57.185 dBm -57.046 dBm -54 974 dBm					
R MODE T N N N	1 f 1 f	2.479 1 GHz 2.483 5 GHz	-57.185 dBm					
R MODE T N N N N N	1 f 1 f 1 f	2.479 1 GHz 2.483 5 GHz 2.500 0 GHz	-57.185 dBm -57.046 dBm					
	1 f 1 f 1 f	2.479 1 GHz 2.483 5 GHz 2.500 0 GHz	-57.185 dBm -57.046 dBm					
B MODE T N 2 N 3 N 4 N 5 5 5 5 5 5 5 5 5 5 5 5 5 5 5 5 5 5 5	1 f 1 f 1 f	2.479 1 GHz 2.483 5 GHz 2.500 0 GHz	-57.185 dBm -57.046 dBm					
R MODE T N 2 N 3 N	1 f 1 f 1 f	2.479 1 GHz 2.483 5 GHz 2.500 0 GHz	-57.185 dBm -57.046 dBm					

## Pi/4QPSK Mode:

#### Test channel:

#### Lowest channel

		lyzer - Swept SA								
RL	RF	50 Ω AC		SEN	ISE:PULSE	<u>∧</u> A	LIGN OFF AVG Type	DMC		PM Sep 02, 202
enter F	req 2	.356000000	PNO	0: Fast ↔→ ain:Low	Trig: Free   #Atten: 30		Avg Hold:			TYPE MWWWW DET P N N N N
	Def	Offset 1.95 dB							Mkr1 2.4	02 0 GH
0 dB/div		20.00 dBm							-3.	687 dBr
10.0										
0.00										1
0.0										X
20.0										
0.0										-28.75 dt
0.0										
0.0										
		mulumation	المحصور وحالا	مد معاد م	. A start a sector	المراجعة فكأم ومعقو				
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0.0										
tart 2.3										40600 GH
Res BW		KHZ		#VB\	N 300 kHz				p 9.600 ms	: (1001 pt
Krimode t <mark>1</mark> N	IRC SCL	× 2/	102 0 GHz	-3.687		CTION FUNC	TION WIDTH	F	UNCTION VALUE	
2 N	1 f	2.4	100 0 GHz	-55.454	dBm					
3 N 4 N	1 f 1 f		100 0 GHz 100 0 GHz	-55.454						
5 6										
7										
8 9										
0										
G							STATUS			

RL	RF	50 Ω AC		SENS	E:PULSE		🛕 ALIGN OFF			I3 PM Sep 02, 20
enter F	req 2.3	56000000 G	i <b>Hz</b> PNO: F IFGain:		Trig: Free #Atten: 30			Type: RMS old: 2000/2000	1	TYPE MWWWW DET PNNN
0 dB/div		fset 1.95 dB 0.00 dBm							Mkr1 2.4 -4	02 1 GI .017 dB
0.0										
.00										<b>≬</b> 1
0.0										<u></u>
0.0										-28.97
0.0										
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0.0										
	0600 GH / 100 kH			#VBW	/ 300 kHz	 :		Swee	Stop 2 p 9.600 m	.40600 G s (1001 p
KR MODE	TRC SCL	× 2.40	2 1 GHz	-4.017 d		ICTION	FUNCTION WIDTH		FUNCTION VALUE	
2 N 3 N	1 f 1 f		0 0 GHz 0 0 GHz	-56.405 d -58.323 d						
4 N	i f		7 2 GHz	-55.657 d						
5										
5										
7										
7 3 9										
6 7 8 9 0 1										>

## Test channel: Highest channel

RL	RF	50 Ω AC	SENS	E:PULSE	ALIGN OFF		04:11:53	M Sep 02, 20
enter F	req 2.52	6000000 GHz	PNO: Fast ↔ IFGain:Low	Trig: Free Run #Atten: 30 dB	#Avg Tyj Avg Hold	e: RMS I: 100/100	т	ICE 1 2 3 4 1 PE MWWW DET P N N N
dB/div		et 1.94 dB 00 dBm					Mkr1 2.48 -5.6	0 0 GH 81 dB
0.0								
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u <mark>Á</mark>								
.0								-23.60
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.0		and the short for several sector of	NU. AP NAME AND A PARTY	Colling and an and an and an and an		e de color alla data de la	ander of a state point of a set	ing to here a
	7600 GHz 100 kHz		#VBW	/ 300 kHz		Swe	Stop 2.5 ep 9.600 ms	
R MODE T		× 2.480 0 GH;	z -5.681 d	FUNCTION	FUNCTION WIDTH		FUNCTION VALUE	
	1 f 1 f	2.480 0 GH	z -59.793 d	Bm				
N N								
N N N	1 f 1 f	2.500 0 GH: 2.486 0 GH:						
N N N	1 f							
N N N	1 f							
N N N	1 f							
N N N	1 f							>

	RF	50 Ω AC	SENSE	EPULSE	ALIGN OFF		04:38:50	) PM Sep 02, 2
nter Fr	req 2.520			Trig: Free Run #Atten: 30 dB	#Avg Typ Avg Hold	e: RMS : 2000/2000	TF	TYPE MWWW DET P N N I
dB/div	Ref Offse Ref 20.0						Mkr1 2.4 -4.	78 9 G 488 dE
í —								
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) —								
	600 GHz 100 kHz		#VBW	300 kHz		Sweel	Stop 2. p 9.600 ms	
es BW	100 kHz	×	Y	FUNCTION	FUNCTION WIDTH			
es BW	100 kHz	× 2.478 9 GHz 2.483 5 GHz	#VBW	FUNCTION	FUNCTION WIDTH		p 9.600 ms	
MODE TF N 1 N 1 N 1 N 1	100 kHz f f f	2.478 9 GHz 2.483 5 GHz 2.500 0 GHz	-4.488 dE -56.468 dE -57.673 dE	FUNCTION 3m 3m 3m	FUNCTION WIDTH		p 9.600 ms	
es BW MODE IT N 1 N 1	100 kHz f f	2.478 9 GHz 2.483 5 GHz	-4.488 dE -56.468 dE	FUNCTION 3m 3m 3m	FUNCTION WIDTH		p 9.600 ms	57600 G ; (1001 p
MODE TF N 1 N 1 N 1 N 1	100 kHz f f f	2.478 9 GHz 2.483 5 GHz 2.500 0 GHz	-4.488 dE -56.468 dE -57.673 dE	FUNCTION 3m 3m 3m	FUNCTION WIDTH		p 9.600 ms	
NODE TE N 1 N 1 N 1 N 1	100 kHz f f f	2.478 9 GHz 2.483 5 GHz 2.500 0 GHz	-4.488 dE -56.468 dE -57.673 dE	FUNCTION 3m 3m 3m	FUNCTION WIDTH		p 9.600 ms	
NODE TE N 1 N 1 N 1 N 1	100 kHz f f f	2.478 9 GHz 2.483 5 GHz 2.500 0 GHz	-4.488 dE -56.468 dE -57.673 dE	FUNCTION 3m 3m 3m	FUNCTION WIDTH		p 9.600 ms	
MODE TF N 1 N 1 N 1 N 1	100 kHz f f f	2.478 9 GHz 2.483 5 GHz 2.500 0 GHz	-4.488 dE -56.468 dE -57.673 dE	FUNCTION 3m 3m 3m	FUNCTION WIDTH		p 9.600 ms	

#### 8DPSK Mode:

Test channel:

Lowest channel

RL	RF	50 Ω AC		SE	NSE:PULSE	<u>A</u> A	LIGN OFF		04:13:06 PM Sep 02,3
enter F	req 2.3	35600000	Р	NO: Fast 🔸	Trig: Free R #Atten: 30 d		#Avg Type: Avg Hold: 1		TRACE 1 2 3 TYPE MWWM DET P N N
dB/div		ffset 1.95 dE 20.00 dBm						N	1kr1 2.401 9 G -4.356 dE
0.0									
									A
									-25.6
.0									
.0									
.0							<del>4</del>		
.0 <mark>shasaw</mark>	ertistikernet	place alongues a	and the second	Call March Carlo C	encylene langester	danstation	anterationation	undersynderschaterspillete	warden warden w
.0									
	0600 GI / 100 ki			#VB	W 300 kHz			Sweep	Stop 2.40600 G 9.600 ms (1001 p
R MODE 1 N 2 N 3 N	TRC SCL 1 f 1 f 1 f		2.401 9 GHz 2.400 0 GHz 2.400 0 GHz	-4.356 -57.215 -57.215	dBm	IION FUNC	TION WIDTH	FUN	CTION VALUE
	1 f		2.364 8 GHz	-55.890					



## Test channel: Highest channel

RL	RF	50 Ω AC		SEM	ISE:PULSE		ALIGN OFF		04:17:09	PM Sep 02, 20
enter Fi	req 2.52	6000000		Fast ↔→ :Low	Trig: Free F #Atten: 30 d		#Avg Type Avg Hold:			ACE 1 2 3 4 TYPE MWWW DET P N N N
dB/div		et 1.94 dB .00 dBm							Mkr1 2.4 -3.	80 0 GH 285 dB
.0										
0	1									
ol_A										
										-23.61
										-23.01
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- L.,			A start of all the start		alter hat sleep u.e.	للبار محمور بالمراه	مر بالمعامل م	Human		Part No Antonia
	- more way (	A and the delay wells	w. wardenest or			The second s				
	'600 GHz								Stop 2.	57600 G
es BW	100 kHz	!		#VB۱	N 300 kHz			Sweep	9.600 ms	(1001 p
MODE TR		×		Y		TION FUNC	TION WIDTH	FL	INCTION VALUE	
N 1 N 1	f		80 0 GHz 83 5 GHz	-3.285 -58.398						
N 1	f		00 0 GHz	-58.874						
N 1	Т	2.4	91 4 GHz	-56.071	авт					

L	RF	50 Ω AC		SEN	SE:PULSE	A	LIGN OFF		04:46:0	03 PM Sep 02
		52600000	)0 GHz P	NO: Fast 🔸	Trig: Free Ru #Atten: 30 dB		#Avg Type Avg Hold:	: RMS 2000/2000		TYPE MWW DET P N N
IB/div		fset 1.94 dE 0.00 dBm							Mkr1 2.4	.998 d
1										
(man										
										-23.
	~2	4	a <b>?</b>							
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	′600 GH 100 kH			#VBV	V 300 kHz			Swee	Stop 2 p 9.600 m	2.57600 s (1001
MODE T	RC SCL		×	Y	FUNCTIO	N FUNCT	TION WIDTH		FUNCTION VALUE	
	f		2.476 2 GHz 2.483 5 GHz	-4.998 ( -57.661 (						
N 1 N 1	T		2.500 0 GHz	-57.890 (						
N N N	f			-54 907 /	1Bm					
N 1 N 1			2.488 4 GHz	-54.807 (	1Bm					
N N N	f			-54.807 (	1Bm					
N N N	f			-54.807 (	iBm					
N N N	f			-54.807 (	iBm					
N N N	f			-54.807 (	iBm					

# Bandedge (Conducted)

Lowest Channel:

trum Analyzer - Swept SA 07:16:06 PM Sep 04, 2024 TRACE 1 2 3 4 5 6 TYPE MWWWW DET P N N N N RL SENSE:PULSE 🛕 AL Center Freq 2.356000000 GHz #Avg Type: RMS Avg|Hold: 100/100 Trig: Free Run #Atten: 30 dB PNO: Fast IFGain:Low Mkr1 2.402 1 GHz -1.121 dBm Ref Offset 1.95 dB Ref 20.00 dBm 10 dB/div Log 0.0 10.0 20.0 30.0  $\sqrt{3}$ 40.0 50. 60. 70.0 Start 2.30600 GHz #Res BW 1.0 MHz Stop 2.40600 GHz Sweep 1.000 ms (1001 pts) #VBW 3.0 MHz 
 MXS
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 FUNCTION FUNCTION WIDTH INCTIONA -1.121 dBm -43.185 dBm -43.185 dBm -39.677 dBm 2.402 1 GHz 2.400 0 GHz 2.400 0 GHz 2.398 3 GHz > STATUS SG

ilent Spectrum Analyzer - S RL RF 50			A 414011 077		07.01.01.01.0
RL RF 50 enter Freq 2.3560	DOOOOO GHz	SENSE:PULSE	≘Run Avg[Hol	/pe: RMS Id: 2000/2000	07:21:24 PM Sep 04, 20 TRACE 1 2 3 4 5 TYPE MWWW DET P N N N
Ref Offset 7 dB/div Ref 20.00				N	lkr1 2.405 1 GH -1.072 dBi
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tart 2.30600 GHz Res BW 1.0 MHz		#VBW 3.0 MH	Z	Sweep	Stop 2.40600 GH 1.000 ms (1001 pt
KR MODE TRC SCL	X		NCTION FUNCTION WIDTH	FUN	CTION VALUE
1 N 1 f 2 N 1 f 3 N 1 f 4 N 1 f	2.405 1 GHz 2.400 0 GHz 2.390 0 GHz 2.378 5 GHz	-1.072 dBm -44.714 dBm -47.236 dBm -45.798 dBm			
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**GFSK Mode** 

## High Channel:

GFSK Mode

RL	RE	50 Ω AC	0	ENSE:PULSE	ALIGN OFF		07:18:02 PM Sep 04, 20
		26000000 GHz			n Avg H	Type: RMS old: 100/100	TRACE 1 2 3 4 TYPE MWWW DET P N N N
dB/div		et 1.94 dB .00 dBm					Mkr1 2.480 1 GF -2.618 dB
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es BW	'600 GHz 1.0 MHz		#VI	BW 3.0 MHz			Stop 2.57600 G p 1.000 ms (1001 p
MODE TR	RC SCL	× 2.480 1 (	CU- 2.64	FUNCTI 8 dBm	DN FUNCTION WIDTH	1	FUNCTION VALUE
NI 4		2.483 5 (	GHz -49.38	2 dBm			
N 1 N 1	f			0 dBm			
N 1 N 1	f	2.500 0 0					
N 1		2.500 0 0 2.484 0 0		2 dBm			
N 1 N 1	f						
N 1 N 1	f						
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N 1 N 1	f						

L	RF	50 Ω A	C		SENSE:F	ULSE		<b>≜</b> ALI	GN OFF		0'	7:21:55 PM Sep 04, 2
iter F	req 2	.5260000		PNO: Fast IFGain:Low		rig: Free R Atten: 30 d			#Avg Type Avg Hold:			TRACE 1 2 3 4 TYPE MWWW DET P N N N
IB/div		Offset 1.94 d 20.00 dBr									Mkr1	2.476 1 GI -2.585 dB
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rt 2.47 es BW				Ŧ	#VBW 3	.0 MHz				Sw		op 2.57600 <b>G</b> 0 ms (1001 p
MODE T			×		Y	FUNC	TION	FUNCTIO	IN WIDTH		FUNCTION V	ALUE
N 1 N 1	f f		2.476 1 GH 2.483 5 GH	z -48	.585 dBr .138 dBr	1						
N 1 N 1	f f		2.500 0 GH 2.483 7 GH		.446 dBr .383 dBr							

Channel	Mode	Detector	Frequency(MHz)	Level(dBm)	Delta(dB)
Low	Hop off	Peak	2402.10	-1.12	
			2400.00	-43.18	42.06
	Hop on		2405.10	-1.07	
			2400.00	-44.71	43.64
			2390.00	-47.23	46.16
			2378.50	-45.79	44.72
High	Hop off		2480.10	-2.61	
			2483.50	-49.38	46.77
			2484.40	-41.92	39.31
			2500.00	-49.49	46.88
	Hop on		2475.10	-2.58	
			2483.50	-48.13	45.55
			2483.70	-39.38	36.8
			2500.00	-47.44	44.86

Test channel:	Lowest
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Peak value:

Frequency (MHz)	Fundamental (dBuV/m)	Delta (dB)	Level (dBuV/m)	Limit Line (dBuV/m)	Over Limit (dB)	Polarization
2400.00	87.35	42.06	45.29	74.00	-28.71	Vertical
2400.00	86.54	42.06	44.48	74.00	-29.52	Horizontal

Test channel:	Highest
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Peak value:

Frequency (MHz)	Fundamental (dBuV/m)	Delta (dB)	Level (dBuV/m)	Limit Line (dBuV/m)	Over Limit (dB)	Polarization
2483.50	85.37	36.80	48.57	74.00	-25.43	Vertical
2483.50	85.14	36.80	48.34	74.00	-25.66	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.

Lowest

RL	RF			SE	NSE:PULSE	<u>A</u> A	ALIGN OFF			55 PM Sep 02, 2
enter	Freq	13.265000	P	NO: Fast ↔→ Gain:Low	Trig: Free F #Atten: 20 d		#Avg Type: Avg Hold: 1			TRACE 1 2 3 4 TYPE MWMM DET P N N N
) dB/di		f Offset 1.95 d f <b>11.95 dBr</b>							Mkr1 2.4 -4	101 7 GI .314 dB
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05		/								
8.1										-23.70
1										-23.70
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u		$\bigcirc$	<sup>3</sup> /4	<mark>_5</mark>					والمطالب والمراجع	and the state of
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	0 MHz W 100	kHz		#VB	W 300 kHz			Swee	stoj p 2.530 s	o 26.50 G (30001 p
R MODE	TRC SC	1	× 2.401 7 GHz	Y -4.314	fund	TION FUNC	TION WIDTH	ŀ	UNCTION VALUE	
N	1 f		26.454 1 GHz	-53.175	dBm					
N N	1 f 1 f		4.803 4 GHz 7.400 1 GHz	-61.484 -65.533	dBm					
5 N	1 f		9.731 3 GHz	-65.649	dBm					
•										
1										

Middle

RL			iO Ω AC		9	ENSE:PULSE		🔥 🕰	LIGN OFF		04	:05:06 PM Sep 02, 2
enter	Frec	13.26	5000000	Р	NO: Fast ↔ Gain:Low				#Avg Ty Avg Hol			TRACE 1 2 3 4 TYPE MWWW DET P N N N
) dB/div			t 1.95 dB 15 dBm								Mkr1	2.441 4 GI -4.431 dB
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tart 30 Res B					#VI	3W 300 KI	Hz			Sv		itop 26.50 G 0 s (30001 p
R MODE			×		Y		FUNCTION	FUNCT	ION WIDTH		FUNCTION VA	LUE
1 N 2 N		f f		41 4 GHz 61 2 GHz		1 dBm 6 dBm						
3 N 4 N		f f		82 0 GHz 99 2 GHz		7 dBm 7 dBm						
5 N		f		99 2 GHZ 07 7 GHZ		1 dBm						
5 7												
3												
3 9												
8 9 0 1												

Highest

RL	RF	50 Ω AC		SE	NSE:PULSE	4	ALIGN OFF			58 PM Sep 02, 20
enter F	req ′	13.265000	PI	NO: Fast 🔸	Trig: Free #Atten: 20		#Avg Type Avg Hold:			TRACE 1 2 3 4 TYPE MWWW DET P N N N
) dB/div		Offset 1.94 di 11.94 dBm								480 2 GH .370 dB
94		1								
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art 30 M Res BW		kHz		#VB	W 300 kHz			Swe	Sto ep 2.530 s	p 26.50 G s (30001 p
R MODE T	RC SCL		× 2.480 2 GHz	-4.370	dBm	ICTION FU	NCTION WIDTH		FUNCTION VALUE	
2 N 1 3 N 1	f		26.453 2 GHz 4.960 5 GHz	-52.903 -65.467						
N 1	f		7.474 2 GHz	-65.217	dBm					
;	T		9.794 8 GHz	-66.165	авт					
7 3										
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										>

## Radiated Emission Method

Test Requirement:	FCC Part15 C Se	ection 15.209	)							
Test Method:	ANSI C63.10:2013									
Test Frequency Range:	30MHz to 25GHz									
Test site:	Measurement Distance: 3m									
Receiver setup:	Frequency Detector RBW VBW Remark									
	30MHz-1GHz	Quasi-peak	x 120KHz	300KHz	Quasi-peak Value					
	Above 1GHz	Peak	1MHz	3MHz	Peak Value					
	Above IGHZ	Average	1MHz	3MHz	Average Value					
Limit:	Frequer	ю	Limit (dBuV	/m @3m)	Remark					
	30MHz-88	MHz	40.0	)	Quasi-peak Value					
	88MHz-216	6MHz	43.5	5	Quasi-peak Value					
	216MHz-96	216MHz-960MHz 46.0			Quasi-peak Value					
	960MHz-1	)	Quasi-peak Value							
	Above 10	247	54.0	)	Average Value					
			74.0	)	Peak Value					
Test setup:	Below 1GHz			$-\frac{1}{2}$ Antenna- $1 \dots 4m > -\frac{1}{2}$ Preampli	fier-					

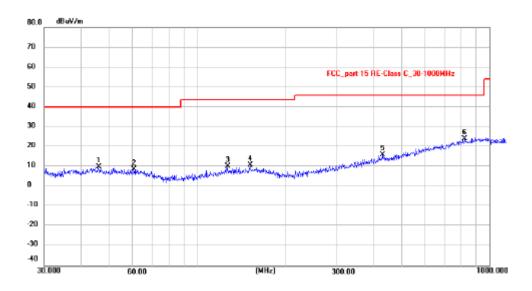
	< 3m >+'       Test Antenna+       Im       <
Test Procedure:	<ol> <li>The EUT was placed on the top of a rotating table (0.8 meters below 1G and 1.5 meters above 1G) above the ground at a 3 meter camber. The table was rotated 360 degrees to determine the position of the highest radiation.</li> <li>The 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:

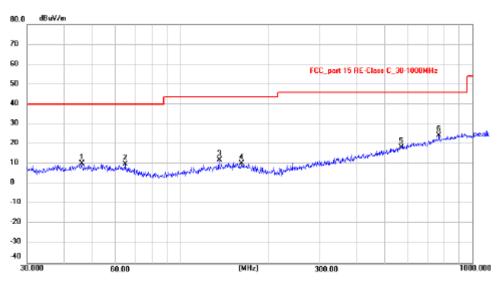
#### Vertical:



No.	Frequency (MHz)	Reading (dBuV)	Factor (dB/m)	Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Detector
1	46.0164	26.32	-16.49	9.83	40.00	-30.17	peak
2	60.7044	25.97	-17.15	8.82	40.00	-31.18	peak
3	127.2176	27.53	-17.40	10.13	43.50	-33.37	peak
4	152.1297	26.65	-15.92	10.73	43.50	-32.77	peak
5	431.0316	28.05	-12.20	15.85	46.00	-30.15	peak
6 *	824.5968	28.36	-4.41	23.95	46.00	-22.05	peak

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

#### Horizontal:



No.	Frequency (MHz)	Reading (dBuV)	Factor (dB/m)	Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Detector
1	46.1779	26.74	-16.49	10.25	40.00	-29.75	peak
2	64.8865	27.77	-17.83	9.94	40.00	-30.06	peak
3	135.9822	29.09	-16.94	12.15	43.50	-31.35	peak
4	162.0414	26.28	-15.98	10.30	43.50	-33.20	peak
5	570.6100	26.98	-8.70	18.28	46.00	-27.72	peak
6 *	768.7481	29.42	-5.05	24.37	46.00	-21.63	peak

\*: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	87.35	-	-	Vertical
4804	40.24	74.00	-33.76	Vertical
7206	38.53	74.00	-35.48	Vertical
9608	31.50	74.00	-42.50	Vertical
2402	86.84	-	-	Horizontal
4804	40.53	74.00	-33.47	Horizontal
7206	37.51	74.00	-36.49	Horizontal
9608	31.47	74.00	-42.53	Horizontal

#### Average value:

Frequency (MHz)	Level (dBuV/m)	Limit Line (dBuV/m)	Over Limit (dB)	Polarization
2402	86.47	-	-	Vertical
4804	38.50	54.00	-15.5	Vertical
7206	36.71	54.00	-17.29	Vertical
9608	30.4	54.00	-23.6	Vertical
2402	86.41	-	-	Horizontal
4804	37.46	54.00	-16.54	Horizontal
7206	36.07	54.00	-17.93	Horizontal
9608	30.27	54.00	-23.73	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	86.37	-	-	Vertical
4882	40.13	74.00	-33.87	Vertical
7323	37.68	74.00	-36.32	Vertical
9764	31.48	74.00	-42.52	Vertical
2442	86.34	-	-	Horizontal
4882	40.71	74.00	-33.29	Horizontal
7323	7323 37.28		-36.72	Horizontal
9764	31.43	74.00	-42.57	Horizontal

#### Average value:

Frequency (MHz)	Level (dBuV/m)	Limit Line (dBuV/m)	Over Limit (dB)	Polarization
2442	85.24	-	-	Vertical
4882	38.71	54.00	-15.29	Vertical
7323	36.81	54.00	-17.19	Vertical
9764	30.63	54.00	-23.37	Vertical
2442	85.41	-	-	Horizontal
4882	37.33	54.00	-16.67	Horizontal
7323	35.64	54.00	-18.36	Horizontal
9764	30.64	54.00	-23.36	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	85.37	-	-	Vertical
4960	40.04	74.00	-33.96	Vertical
7440	37.67	74.00	-36.33	Vertical
9920	31.64	74.00	-42.36	Vertical
2480	85.14	-	-	Horizontal
4960	39.25	74.00	-34.75	Horizontal
7440	37.40	74.00	-36.60	Horizontal
9920	31.46	74.00	-42.54	Horizontal

#### Average value:

Frequency (MHz)	Level (dBuV/m)	Limit Line (dBuV/m)	Over Limit (dB)	Polarization
2480	84.32	-	-	Vertical
4960	38.54	54.00	-15.46	Vertical
7440	35.41	54.00	-18.59	Vertical
9920	30.46	54.00	-23.54	Vertical
2480	84.34	-	-	Horizontal
4960	37.41	54.00	-16.59	Horizontal
7440	35.71	54.00	-18.29	Horizontal
9920	30.14	54.00	-23.86	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-----