

FCC TEST REPORT FCC ID:2A6NT-VGEA46 IC:28474-VGEA46

Report Number	ZKT-220718L5033-1
Date of Test	. Jul. 10, 2022 to Aug. 19, 2022
Date of issue	: Aug. 22, 2022
Total number of pages	69
Test Result	PASS
Testing Laboratory	Shenzhen ZKT Technology Co., Ltd.
Address	1/F, No. 101, Building B, No. 6, Tangwei Community Industrial Avenue, Fuhai Street, Bao'an District, Shenzhen, China
Applicant's name	: Cerwin-Vega, Inc
Address	3761 S. Hill Street Los Angeles, CA 90007
Manufacturer's name	: Cerwin-Vega, Inc
Address	3761 S. Hill Street Los Angeles, CA 90007
Test specification:	
Standard	FCC CFR Title 47 Part 15 Subpart C Section 15.247 RSS-247 Issue 2: February 2017 RSS-GEN, Issue 5: March 2019 ANSI C63.10:2013
Test procedure	: /
Non-standard test method	: N/A
Test Report Form No	TRF-EL-111_V0
Test Report Form(s) Originator	ZKT Testing
Master TRF	Dated: 2021-04-22
test (EUT) is in compliance with the identified in the report. This report shall not be reproduced e	en tested by ZKT, and the test results show that the equipment under e FCC requirements. And it is applicable only to the tested sample except in full, without the written approval of ZKT, this document may al only, and shall be noted in the revision of the document.
Product name	Subwoofer
Trademark	
Model/Type reference	VEGA4S-HUB, VEGA6S-HUB
Ratings	AC 100V-240V, 50/60Hz

Shenzhen ZKT Technolgy Co., Ltd.





Testing procedure and testing location:			
Testing Laboratory: Address	Shenzhen ZKT Technology Co., Ltd. 1/F, No. 101, Building B, No. 6, Tangwei Community Industrial Avenue, Fuhai Street, Bao'an District, Shenzhen, China		
Tested by (name + signature):	Alen He		
Reviewer (name + signature):	Joe. Lin.		
Approved (name + signature):	Lake Xie		





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Report No.	Version	Description	Approved
ZKT-220718L5033-1	Rev.01	Initial issue of report	Aug. 22, 2022





Test procedures according to the technical standards:

FCC Part15 (15.247) , Subpart C RSS-247 Issue 2: February 2017							
Standard Section	Test Item	Result	Remark				
15.203/15.247 (c) RSS-Gen 6.8	Antenna Requirement	PASS					
15.207 RSS-Gen 8.8	AC Power Line Conducted Emission	PASS					
15.247 (b)(1) RSS-247.5.4(4)	Conducted Peak Output Power	PASS					
15.247 (a)(1) RSS-247.5.1(2) RSS-Gen.6.7	20dB Occupied Bandwidth & 99% OCB	PASS					
15.247 (a)(1) RSS-247.5.1(4)	Carrier Frequencies Separation	PASS					
15.247 (a)(1)(iii) RSS-247.5.1(4)	Hopping Channel Number	PASS					
15.247 (a)(1)(iii) RSS-247.5.1(5)	Dwell Time	PASS					
15.205/15.209 RSS-Gen.6.13 RSS-Gen.8.10	Radiated Emission and Restricted Bandedge	PASS					
15.247(d) RSS-247 5.5	Conducted Unwanted emissions and Bandedge	PASS					

NOTE:

(1)" N/A" denotes test is not applicable in this Test Report







2.1 TEST FACILITY

Shenzhen ZKT Technology Co., Ltd. Add. : 1/F, No. 101, Building B, No. 6, Tangwei Community Industrial Avenue, Fuhai Street, Bao'an District, Shenzhen, China

FCC Test Firm Registration Number: 692225 Designation Number: CN1299 IC Registered No.: 27033 Test lab CAB identifier:CN0110

2.2 MEASUREMENT UNCERTAINTY

The reported uncertainty of measurement y ± U , where expended uncertainty U is based on a standard uncertainty multiplied by a coverage factor of $\,$ k=2 , providing a level of confidence of approximately 95 % $^{\circ}$

No.	Item	Uncertainty
1	Conducted Emission Test	±1.38dB
2	RF power conducted	±0.16dB
3	Spurious emissions conducted	±0.21dB
4	All emissions radiated(<1G)	±4.68dB
5	All emissions radiated(>1G)	±4.89dB
6	Temperature	±0.5°C
7	Humidity	±2%



3. GENERAL INFORMATION

3.1 GENERAL DESCRIPTION OF EUT

Product Name:	Subwoofer
Model No.:	VEGA6S-HUB
Sample ID:	ZKT220718L5033-1#
Serial No.:	VEGA4S-HUB
Model Different.:	VEGA4S and VEGA6S power boards are the same, and the power amplifier PCB board is the same. Differences: 1. Due to different power, VEGA4S is equipped with one less power amplifier IC than VEGA6S. 2. The sizes of wooden cases are different.
HVIN:	VEGA6S-HUB, VEGA4S-HUB
Hardware Version:	V1.0
Software Version:	V1.0
Sample(s) Status:	Engineer sample
Channel numbers:	79
Channel separation:	2402MHz~2480MHz
Modulation technology:	GFSK, π/4-DQPSK, 8-DPSK
Antenna Type:	PCB antenna
Antenna gain:	2.6dBi
Power supply:	AC 100V-240V, 50/60Hz

Operation	Frequency each	n of channel		· · · · ·			
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, and the selected channel see below:

Test channel	Frequency
The lowest channel	2402MHz
The middle channel	2441MHz
The Highest channel	2480MHz

3.2 Test Setup Configuration

Conducted Emission

AC Line EUT Radiated Emission AC Line EUT Conducted Spurious AC Line EUT

3.3 Support Equipment

The EUT has been tested as an independent unit together with other necessary accessories or support units. The following support units or accessories were used to form a representative test configuration during the tests.

Item	Equipment	Mfr/Brand	Model/Type No.	Series No.	Note
E-1	Subwoofer	CERWIN-VEGA	VEGA6S-HUB	N/A	EUT
AE	Notebook	lenovo	B40-80	MP07F6JD	AE

Item	Shielded Type	Ferrite Core	Length	Note

Note:

(1) The support equipment was authorized by Declaration of Confirmation.

(2) For detachable type I/O cable should be specified the length in cm in ^[]Length ^[] column.





Transmitting mode	Keep the EUT in continuously transmitting mode.				
Remark: During the test, the test voltage was tuned from 85% to 115% of the nominal rated sup voltage, and found that the worst case was under the nominal rated supply condition. So the rep just shows that condition's data.					

Test Software	FCC_V2.24_20200921
Power level setup	<7dBm





3.5 EQUIPMENTS LIST FOR ALL TEST ITEMS

Radiation & RF Conducted Test equipment

Item	Equipment	Manufacturer	Type No.	Serial No.	Last calibration	Calibrated until
1	Spectrum Analyzer (9kHz-26.5GHz)	KEYSIGHT	9020A	MY45109572	Sep. 21, 2021	Sep. 20, 2022
2	Spectrum Analyzer (1GHz-40GHz)	Agilent	E4446A	100363	Sep. 21, 2021	Sep. 20, 2022
3	Test Receiver (9kHz-7GHz)	R&S	ESCI7	101169	Sep. 21, 2021	Sep. 20, 2022
4	Bilog Antenna (30MHz-1400MHz)	Schwarzbeck	VULB9168	00877	Sep. 21, 2021	Sep. 20, 2022
5	Horn Antenna (1GHz-18GHz)	SCHWARZBEC K	BBHA9120D	1541	Sep. 21, 2021	Sep. 20, 2022
6	Horn Antenna (18GHz-40GHz)	A.H. System	SAS-574	588	Sep. 21, 2021	Sep. 20, 2022
7	Amplifier (30-1000MHz)	EM Electronics	EM330 Amplifier	N/A	Sep. 21, 2021	Sep. 20, 2022
8	Amplifier (1GHz-40GHz)	QUANJUDA	DLE-161	097	Sep. 21, 2021	Sep. 20, 2022
9	Loop Antenna (9KHz-30MHz)	SCHWARZBEC K	FMZB1519B	014	Sep. 21, 2021	Sep. 20, 2022
10	RF cables1 (9kHz-30MHz)	N/A	9kHz-30MHz	N/A	Sep. 21, 2021	Sep. 20, 2022
11	RF cables2 (30MHz-1GHz)	N/A	30MHz-1GHz	N/A	Sep. 21, 2021	Sep. 20, 2022
12	RF cables3 (1GHz-40GHz)	N/A	1GHz-40GHz	N/A	Sep. 21, 2021	Sep. 20, 2022
13	CMW500 Test	R&S	CMW500	106504	Sep. 21, 2021	Sep. 20, 2022
14	ESG Signal Generator	Agilent	E4421B	GB40051203	Sep. 21, 2021	Sep. 20, 2022
15	Signal Generator	Agilent	N5182A	MY47420215	Sep. 21, 2021	Sep. 20, 2022
16	Power Meter	Anritsu	ML2495A	N/A	Sep. 21, 2021	Sep. 20, 2022
17	D.C. Power Supply	LongWei	TPR-6405D	١	١	١
18	Software	Audix	E3	6.101223a	١	١

Conduction Test equipment

Item	Kind of Equipment	Manufacturer	Type No.	Serial No.	Last calibration	Calibrated until
1	LISN	R&S	ENV216	101471	Sep. 21, 2021	Sep. 20, 2022
2	LISN	CYBERTEK	EM5040A	E1850400149	Sep. 21, 2021	Sep. 20, 2022
3	Test Cable	N/A	C01	N/A	Sep. 21, 2021	Sep. 20, 2022
4	Test Cable	N/A	C02	N/A	Sep. 21, 2021	Sep. 20, 2022
5	EMI Test Receiver	R&S	ESRP3	101946	Sep. 21, 2021	Sep. 20, 2022
6	Absorbing Clamp	DZ	ZN23201	N/A	Sep. 21, 2021	Sep. 20, 2022
7	Software	Audix	E3	6.101223a	١	λ











4. EMC EMISSION TEST

4.1 Conducted emissions

Test Requirement:	FCC Part15 C Section 15.207& RSS-Gen [8.8]
Test Method:	ANSI C63.10:2013
Test Frequency Range:	150KHz to 30MHz
Receiver setup:	RBW=9KHz, VBW=30KHz, Sweep time=auto

4.1.1 POWER LINE CONDUCTED EMISSION Limits

FREQUENCY (MHz)	Limit (Standard	
	Quasi-peak	Average	Stanuaru
0.15 -0.5	66 - 56 *	56 - 46 *	FCC
0.50 -5.0	56.00	46.00	FCC
5.0 -30.0	60.00	50.00	FCC

Note:

(1) *Decreases with the logarithm of the frequency.

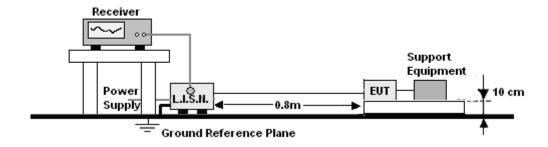
4.1.2 TEST PROCEDURE

- a. The EUT was placed 0.1 meters from the horizontal ground plane with EUT being connected to the power mains through a line impedance stabilization network (LISN). All other support equipments powered from additional LISN(s). The LISN provide 50 Ohm/ 50uH of coupling impedance for the measuring instrument.
- b. Interconnecting cables that hang closer than 40 cm to the ground plane shall be folded back and forth in the center forming a bundle 30 to 40 cm long.
- c. I/O cables that are not connected to a peripheral shall be bundled in the center. The end of the cable may be terminated, if required, using the correct terminating impedance. The overall length shall not exceed 1 m.
- d. LISN at least 80 cm from nearest part of EUT chassis.
- e. For the actual test configuration, please refer to the related Item -EUT Test Photos.

4.1.3 DEVIATION FROM TEST STANDARD No deviation







4.1.5 EUT OPERATING CONDITIONS

The EUT was configured for testing in a typical fashion (as a customer would normally use it). The EUT has been programmed to continuously transmit during test. This operating condition was tested and used to collect the included data.

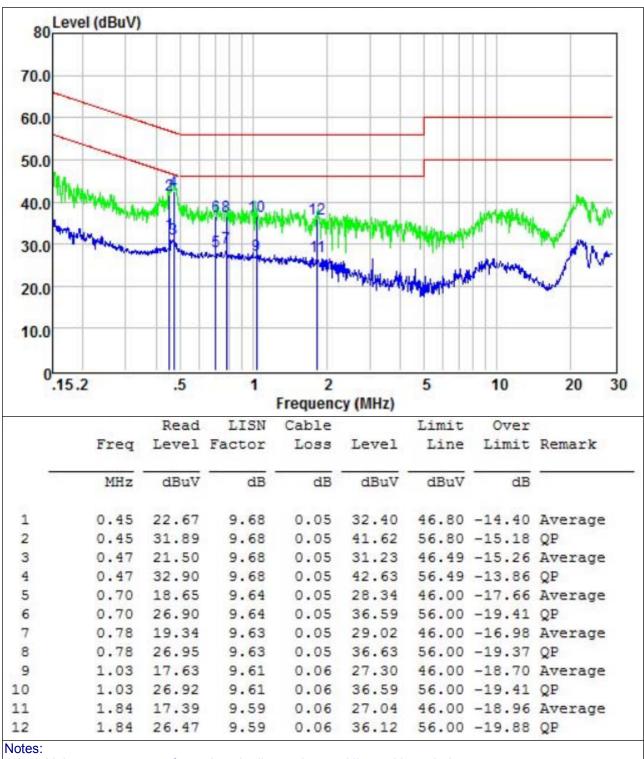
We pretest AC 120V and AC 230V, the worst voltage was AC 120V and the data recording in the report.





4.1.6 Test Result

Temperature :	26 ℃	Relative Humidity:	54%
Pressure :	101kPa	Phase :	L
Test Voltage :	AC 120V/60Hz		



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.Mesurement Level = Reading level + Correct Factor

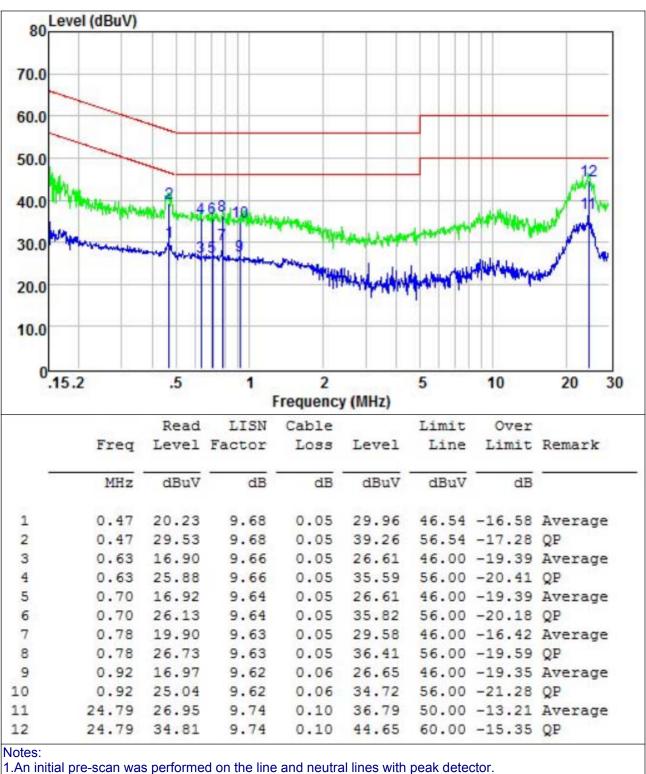
4.The test data shows only the worst case GFSK mode Shenzhen ZKT Technolgy Co., Ltd.

1/F, No. 101, Building B, No. 6, Tangwei Community Industrial Avenue, Fuhai Street, Bao'an District, Shenzhen, China





Temperature :	26 ℃	Relative Humidity:	54%
Pressure :	101kPa Phase :		Ν
Test Voltage :	AC 120V/60Hz		



2.Quasi-Peak and Average measurement were performed at the frequencies with maximized peak emission. 3.Mesurement Level = Reading level + Correct Factor

4. The test data shows only the worst case GFSK mode

Shenzhen ZKT Technolgy Co., Ltd.

1/F, No. 101, Building B, No. 6, Tangwei Community Industrial Avenue, Fuhai Street, Bao'an District, Shenzhen, China







4.2 Radiated emissions

Test Requirement:	FCC Part15 C Section 15.209 & RSS-247 [5.5]					
Test Method:	ANSI C63.10:2013					
Test Frequency Range:	9kHz to 25GHz					
Test site:	Measurement Distance: 3m					
Receiver setup:	Frequency	Detector	RBW	VBW	Value	
	9KHz-150KHz	Quasi-peak	200Hz	600Hz	Quasi-peak	
	150KHz-30MHz	Quasi-peak	9KHz	30KHz	Quasi-peak	
	30MHz-1GHz	Quasi-peak	100KHz	300KHz	Quasi-peak	
	Above 1GHz	Peak	1MHz	3MHz	Peak	
		Peak	1MHz	1/T	Average	

4.2.1 Radiated Emission Limits

Frequencies (MHz)	Field Strength (micorvolts/meter)	Measurement Distance (meters)
0.009~0.490	2400/F(KHz)	300
0.490~1.705	24000/F(KHz)	30
1.705~30.0	30	30
30~88	100	3
88~216	150	3
216~960	200	3
Above 960	500	3

LIMITS OF RADIATED EMISSION MEASUREMENT

FREQUENCY (MHz)	Limit (dBuV/m) (at 3M)		
	PEAK	AVERAGE	
Above 1000	74	54	

Notes:

- (1) The limit for radiated test was performed according to FCC PART 15C.
- (2) The tighter limit applies at the band edges.
- (3) Emission level (dBuV/m)=20log Emission level (uV/m).

4.2.2 TEST PROCEDURE

Below 1GHz test procedure as below:

- a. The EUT was placed on the top of a rotating table 0.1 meters above the ground at a 3 meter semi-anechoic camber. The table was rotated 360 degrees to determine the position of the highest radiation.
- b. The EUT was set 3 meters away from the interference-receiving antenna, which was mounted on the top of a variable-height antenna tower.
- c. 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.





- d. 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 (for the test frequency of below 30MHz, the antenna was tuned to heights 1 meter) and the rotatable table was turned from 0 degrees to 360 degrees to find the maximum reading.
- e. The test-receiver system was set to Peak Detect Function and Specified Bandwidth with Maximum Hold Mode.
- f. 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.

Above 1GHz test procedure as below:

- g. Different between above is the test site, change from Semi- Anechoic Chamber to fully Anechoic Chamber and change form table 0.8 metre to 1.5 metre(Above 18GHz the distance is 1 meter and table is 1.5 metre).
- h. Test the EUT in the lowest channel ,the middle channel ,the Highest channel

Note:

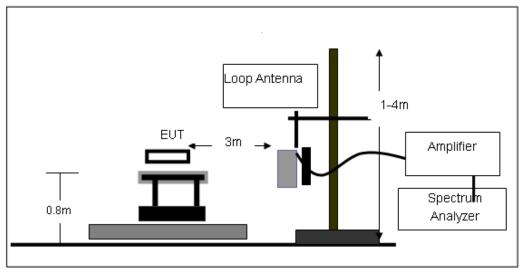
Both horizontal and vertical antenna polarities were tested and performed pretest to three orthogonal axis. The worst case emissions were reported

4.2.3 DEVIATION FROM TEST STANDARD

No deviation

4.2.4 TEST SETUP

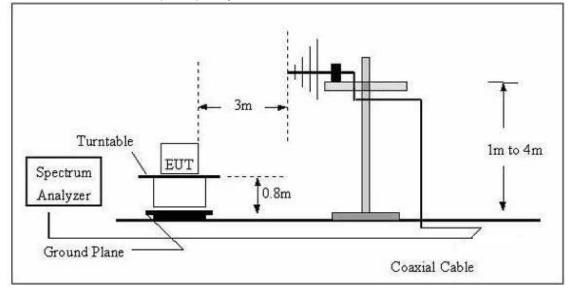
(A) Radiated Emission Test-Up Frequency Below 30MHz



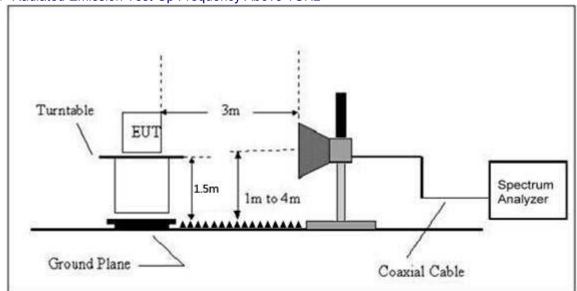




(B) Radiated Emission Test-Up Frequency 30MHz~1GHz



(C) Radiated Emission Test-Up Frequency Above 1GHz



4.2.5 EUT OPERATING CONDITIONS

The EUT tested system was configured as the statements of 2.4 Unless otherwise a special operating condition is specified in the follows during the testing.







4.2.6 TEST RESULTS

Between 9KHz – 30MHz

The emission from 9 kHz to 30MHz was pre-tested and found the result was 20dB lower than the limit, and according to 15.31(o) & RSS-Gen 6.13, the test result no need to reported.

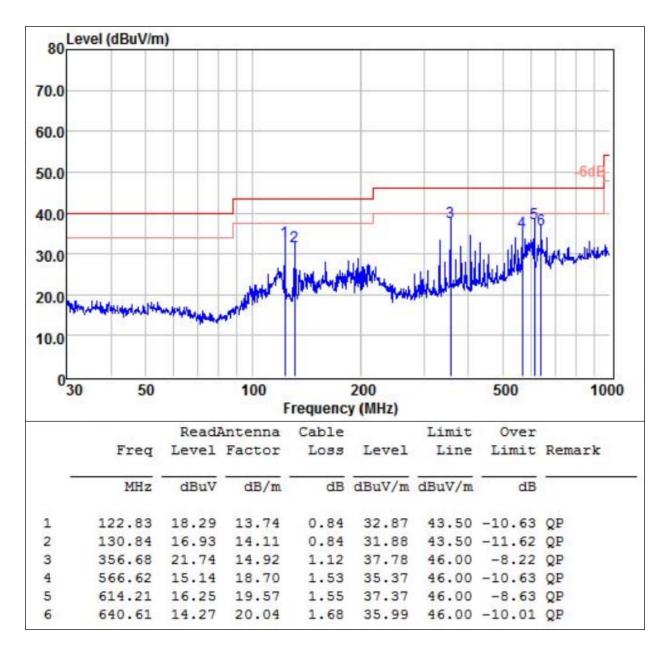






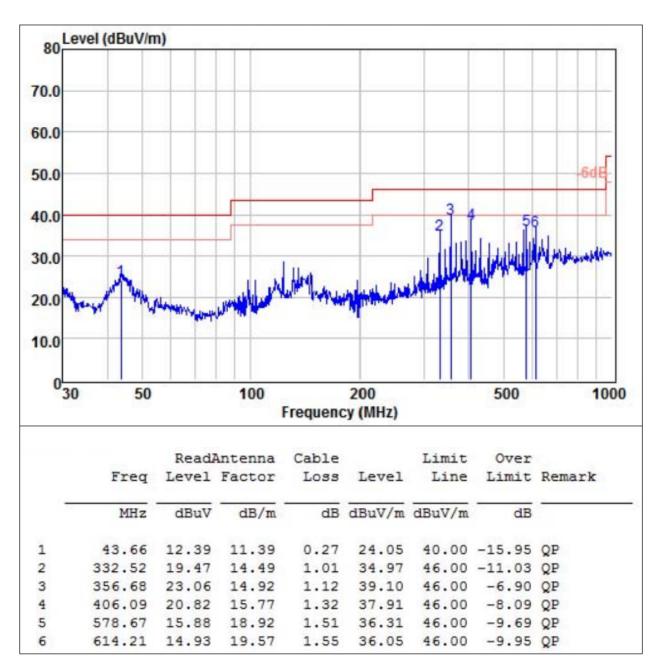
Between 30MHz - 1GHz

Temperature:	26 ℃	Relative Humidity:	54%
Pressure:	101 kPa	Polarization:	Horizontal
Test Voltage:	AC 120V/60Hz		





Temperature:	26 ℃	Relative Humidity:	54%
Pressure:	101kPa	Polarization:	Vertical
Test Voltage:	AC 120V/60Hz		



Remarks:

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

2. The emission levels of other frequencies are very lower than the limit and not show in test report.

3. The test data shows only the worst case GFSK mode









Above 1 GHz Test Results (GFSK Worst Case): 1GHz~25GHz

				(GFSK				
Polar	Frequency	Meter Reading	Pre-ampli fier	Cable Loss	Antenna Factor	Emission Level	Limits	Margin	Detector
(H/V)	(MHz)	(dBuV)	(dB)	(dB)	(dB)	(dBuV/m)	(dBuV/m)	(dB)	Туре
				Low Cha	nnel:2402M	Hz			
V	4804.00	55.81	30.55	5.77	24.66	55.69	74.00	-18.31	Pk
V	4804.00	46.73	30.55	5.77	24.66	46.61	54.00	-7.39	AV
V	7206.00	53.41	30.33	6.32	24.55	53.95	74.00	-20.05	Pk
V	7206.00	/	30.33	6.32	24.55	/	54.00	/	AV
V	9608.00	51.26	30.85	7.45	24.69	52.55	74.00	-21.45	Pk
V	9608.00	/	30.85	7.45	24.69	/	54.00	/	AV
V	12010.00	49.56	31.02	8.99	25.57	53.1	74.00	-20.9	Pk
V	12010.00	/	31.02	8.99	25.57	/	54.00	/	AV
Н	4804.00	56.32	30.55	5.77	24.66	56.2	74.00	-17.8	Pk
Н	4804.00	47.18	30.55	5.77	24.66	47.06	54.00	-6.94	AV
Н	7206.00	52.81	30.33	6.32	24.55	53.35	74.00	-20.65	Pk
Н	7206.00	/	30.33	6.32	24.55	/	54.00	/	AV
Н	9608.00	50.46	30.85	7.45	24.69	51.75	74.00	-22.25	Pk
Н	9608.00	/	30.85	7.45	24.69	/	54.00	/	AV
Н	12010.00	49.32	31.02	8.99	25.57	52.86	74.00	-21.14	Pk
Н	12010.00	/	31.02	8.99	25.57	/	54.00	1	AV

Polar	Frequency	Meter Reading	Pre-ampli fier	Cable Loss	Antenna Factor	Emission Level	Limits	Margin	Detector
(H/V)	(MHz)	(dBuV)	(dB)	(dB)	(dB)	(dBuV/m)	(dBuV/m)	(dB)	Туре
	•		N	Aiddle Ch	nannel:2441	MHz			
V	4882.00	55.21	30.55	5.77	24.66	55.09	74.00	-18.91	Pk
V	4882.00	45.16	30.55	5.77	24.66	45.04	54.00	-8.96	AV
V	7323.00	52.34	30.33	6.32	24.55	52.88	74.00	-21.12	Pk
V	7323.00	/	30.33	6.32	24.55	/	54.00	/	AV
V	9764.00	50.18	30.85	7.45	24.69	51.47	74.00	-22.53	Pk
V	9764.00	/	30.85	7.45	24.69	/	54.00	/	AV
V	12205.00	48.29	31.02	8.99	25.57	51.83	74.00	-22.17	Pk
V	12205.00	/	31.02	8.99	25.57	/	54.00	/	AV
Н	4882.00	55.62	30.55	5.77	24.66	55.5	74.00	-18.5	Pk
Н	4882.00	45.81	30.55	5.77	24.66	45.69	54.00	-8.31	AV
Н	7323.00	52.16	30.33	6.32	24.55	52.7	74.00	-21.3	Pk
Н	7323.00	/	30.33	6.32	24.55	/	54.00	/	AV
Н	9764.00	50.46	30.85	7.45	24.69	51.75	74.00	-22.25	Pk
Н	9764.00	/	30.85	7.45	24.69	/	54.00	/	AV
Н	12205.00	49.16	31.02	8.99	25.57	52.7	74.00	-21.3	Pk
Н	12205.00	/	31.02	8.99	25.57	/	54.00	/	AV



- 1	
69	
00	

Polar	Frequency	Meter Reading	Pre-ampli fier	Cable Loss	Antenna Factor	Emission Level	Limits	Margin	Detector
(H/V)	(MHz)	(dBuV)	(dB)	(dB)	(dB)	(dBuV/m)	(dBuV/m)	(dB)	Туре
		•		- ligh Cha	nnel:2480N	IHz			
V	4960.00	55.14	30.55	5.77	24.66	55.02	74.00	-18.98	Pk
V	4960.00	45.32	30.55	5.77	24.66	45.2	54.00	-8.8	AV
V	7440.00	52.91	30.33	6.32	24.55	53.45	74.00	-20.55	Pk
V	7440.00	/	30.33	6.32	24.55	/	54.00	/	AV
V	9920.00	50.29	30.85	7.45	24.69	51.58	74.00	-22.42	Pk
V	9920.00	/	30.85	7.45	24.69	/	54.00	/	AV
V	12400.00	48.37	31.02	8.99	25.57	51.91	74.00	-22.09	Pk
V	12400.00	/	31.02	8.99	25.57	/	54.00	/	AV
Н	4960.00	55.74	30.55	5.77	24.66	55.62	74.00	-18.38	Pk
Н	4960.00	45.31	30.55	5.77	24.66	45.19	54.00	-8.81	AV
Н	7440.00	52.81	30.33	6.32	24.55	53.35	74.00	-20.65	Pk
Н	7440.00	/	30.33	6.32	24.55	/	54.00	/	AV
Н	9920.00	51.06	30.85	7.45	24.69	52.35	74.00	-21.65	Pk
Н	9920.00	/	30.85	7.45	24.69	/	54.00	/	AV
Н	12400.00	49.35	31.02	8.99	25.57	52.89	74.00	-21.11	Pk
Н	12400.00	/	31.02	8.99	25.57	1	54.00	/	AV

Remark:

1. Emission Level = Meter Reading + Antenna Factor + Cable Loss – Pre-amplifier, Margin= Emission Level - Limit

2. If peak below the average limit, the average emission was no test.

3. The amplitude of spurious emissions which are attenuated by more than 20dB below the permissible value has no need to be reported.







5.1 Test Requirement:

Test Requirement:	FCC Part15 C Section 15.209 and 15.205							
Test Method:	ANSI C63.10: 2013							
Test Frequency Range:	All of the restrict bands were tested, only the worst band's (2310MHz to 2500MHz) data was showed.							
Test site:	Measurement Distance: 3m							
Receiver setup:	Frequency	Detector	RBW	VBW	Value			
	Above	Peak	1MHz	3MHz	Peak			
	1GHz	Average	1MHz	1/T	Average			

LIMITS OF RADIATED EMISSION MEASUREMENT (Above 1000MHz)

FREQUENCY (MHz)	Limit (dBuV/m) (at 3M)				
	PEAK	AVERAGE			
Above 1000	74	54			

Notes:

(1) The limit for radiated test was performed according to FCC PART 15C.

- (2) The tighter limit applies at the band edges.
- (3) Emission level (dBuV/m)=20log Emission level (uV/m).

Spectrum Parameter	Setting
Attenuation	Auto
Start Frequency	2300MHz
Stop Frequency	2520
RB / VB (emission in restricted band)	1 MHz / 1 MHz for Peak, 1 MHz / 1/T for Average

5.2 TEST PROCEDURE

Above 1GHz test procedure as below:

- a. 1. The EUT was placed on the top of a rotating table 1.5 meters above the ground at a 3 meter camber. The table was rotated 360 degrees to determine the position of the highest radiation.
- b. The EUT was set 3 meters away from the interference-receiving antenna, which was mounted on the top of a variable-height antenna tower.
- c. 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.
- d. 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.
- e. The test-receiver system was set to Peak Detect Function and Specified Bandwidth with Maximum Hold Mode.
- f. 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.
- g. Test the EUT in the lowest channel,the Highest channel Note:

Both horizontal and vertical antenna polarities were tested and performed pretest to three orthogonal axis. The worst case emissions were reported

Shenzhen ZKT Technolgy Co., Ltd.

1/F, No. 101, Building B, No. 6, Tangwei Community Industrial Avenue, Fuhai Street, Bao'an District, Shenzhen, China



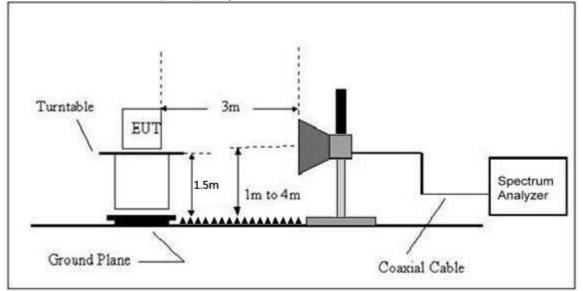




5.3 DEVIATION FROM TEST STANDARD No deviation

5.4 TEST SETUP

Radiated Emission Test-Up Frequency Above 1GHz



5.5 EUT OPERATING CONDITIONS

The EUT tested system was configured as the statements of 2.3 Unless otherwise a special operating condition is specified in the follows during the testing.







5.6 TEST RESULT

PASS

Remark: All modes of GFSK, $\pi/4$ DQPSK, 8DPSK were tested, only the worst result of GFSK was reported as below.

	Polar (H/V)	Frequenc y (MHz)	Meter Reading (dBuV)	Pre- amplifier (dB)	Cable Loss (dB)	Antenna Factor (dB/m)	Emission level (dBuV/m)	Limit (dBuV /m)	Detec tor Type	Result		
				Low	Channe	I: 2402MHz	2					
	Н	2390.00	54.39	30.22	4.85	23.98	53	74.00	PK	PASS		
	Н	2390.00	45.21	30.22	4.85	23.98	43.82	54.00	AV	PASS		
	Н	2400.00	53.29	30.22	4.85	23.98	51.9	74.00	PK	PASS		
	Н	2400.00	/	30.22	4.85	23.98	/	54.00	AV	PASS		
	V	2390.00	54.16	30.22	4.85	23.98	52.77	74.00	PK	PASS		
	V	2390.00	44.32	30.22	4.85	23.98	42.93	54.00	AV	PASS		
	V	2400.00	53.74	30.22	4.85	23.98	52.35	74.00	PK	PASS		
OFOR	V	2400.00	/	30.22	4.85	23.98	/	54.00	AV	PASS		
GFSK		High Channel: 2480MHz										
	Н	2483.50	54.36	30.22	4.85	23.98	52.97	74.00	PK	PASS		
	Н	2483.50	45.82	30.22	4.85	23.98	44.43	54.00	AV	PASS		
	Н	2500.00	53.08	30.22	4.85	23.98	51.69	74.00	PK	PASS		
	Н	2500.00	/	30.22	4.85	23.98	/	54.00	AV	PASS		
	V	2483.50	54.83	30.22	4.85	23.98	53.44	74.00	PK	PASS		
	V	2483.50	45.37	30.22	4.85	23.98	43.98	54.00	AV	PASS		
	V	2500.00	53.47	30.22	4.85	23.98	52.08	74.00	PK	PASS		
	V	2500.00	/	30.22	4.85	23.98	/	54.00	AV	PASS		







6. CONDUCTED BAND EDGE AND SPURIOUS EMISSION

Test Requirement:	FCC Part15 C Section 15.247 (d) & RSS-247 5.5
Test Method:	KDB558074 D0115.247 Meas Guidancev05r02 and RSS-Gen

6.1 Limit

Regulation 15.247 (d),In any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated 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, provided the transmitter demonstrates compliance with the peak conducted power limits. If the transmitter complies with the conducted power limits based on the use of RMS averaging over a time interval, as permitted under paragraph (b)(3) of this section, the attenuation required under this paragraph shall be 30 dB instead of 20 dB. Attenuation below the general limits specified in §15.209(a) is not required. In addition, radiated emissions which fall in the restricted bands, as defined in §15.205(a), must also comply with the radiated emission limits specified in §15.209(a) (see §15.205(c)).

6.2 Test Setup



6.3 Test procedure

Using the following spectrum analyzer setting:

- A) Set the RBW = 100KHz.
- B) Set the VBW = 300KHz.
- C) Sweep time = auto couple.
- D) Detector function = peak.
- E) Trace mode = max hold.
- F) Allow trace to fully stabilize.

6.4 DEVIATION FROM STANDARD

No deviation.







6.5 Test Result

Remark: Spurious Emission all modes of GFSK, $\pi/4$ DQPSK, 8DPSK were tested, only the worst result of GFSK

Lowest channel

was i	reported	as	bel	low
GFSI	K mode:			

Test channel:



CH:2402MHz



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1







🔤 Keysight Sp	ectrum Analyzer -	Swept SA									
🔀 Start Fre	RF 5	0Ω AC	-lz		SE:INT	Avg Type	ALIGN AUTO : Log-Pwr	TRA	M Jul 12, 2022	Fr	equency
	100000		PNO: Fast	Trig: Free Atten: 20		Avg Hold	: 58/100	TY D	PE MWWWWW ET P NNNNN		
			IFGain:Low	Atten: 20	ub		M	ce4 02 0	56 GHz		Auto Tune
10 dB/div	Ref 10.0	0 dBm					IVI		54 dBm		
Log	Kei 10.0	o ubiii		Y							
0.00											Center Freq
-10.0										13.00	0000000 GHz
-20.0		_							DL1 -22.19 dBm		
-30.0											Start Freq
-40.0									 ∳ ¹	1.00	0000000 GHz
-50.0							manilmonglas	and the states	mohendre		
-60.0 -60.0	Aurangener	www.hild.Ma	مهر بر مرسوم الأمي مرد المرسوم الأمي	manne	ممهليهم مريك المابر						Stop Freq
-70.0										25.00	0000000 GHz
-80.0										20.00	0000000000112
Start 1.0								Stop 2	5.00 GHz		OF Otem
	1.0 MHz		#VBV	V 3.0 MHz			Sweep 6		1001 pts)	2.40	CF Step 0000000 GHz
MKR MODE T		X		Y	FUNC		CTION WIDTH		ON VALUE	<u>Auto</u>	Man
1 N			.656 GHz	-46.754 dB				1011011			
2											Freq Offset
4									_		0 Hz
6											
8											Scale Type
9											
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<				m			1		•		
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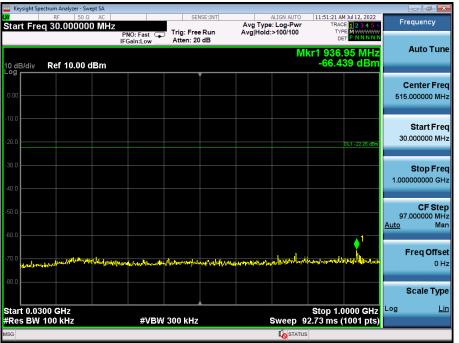
1MHz~25GHz



Middle channel







30MHz~1GHz



Keysight Spectrum Analyzer - Swept SA				- J ×
KF 50 Ω AC Start Freg 1.000000000 G	SENSE:INT	ALIGN AUTO Avg Type: Log-Pwr	11:51:46 AM Jul 12, 2022 TRACE 1 2 3 4 5 6	Frequency
10 dB/div Ref 10.00 dBm	PNO: Fast Trig: Free Run IFGain:Low Atten: 20 dB	Avg Hold: 52/100	1 21.184 GHz -47.877 dBm	Auto Tune
-10.0 -20.0			DL1 22.26 dBm	Center Freq 13.000000000 GHz
-30.0		A Warner and a start of the sta	1	Start Freq 1.000000000 GHz
-60.0				Stop Freq 25.000000000 GHz
Start 1.00 GHz #Res BW 1.0 MHz	#VBW 3.0 MHz	Sweep 60.	Stop 25.00 GHz 00 ms (1001 pts)	CF Step 2.400000000 GHz <u>Auto</u> Man
1 N 1 f 2 2 3 3 3 4 4 4 5 5 6 4 5 6 4	11.184 GHz -47.877 dBm		=	Freq Offset 0 Hz
7 8 9 10 11				Scale Type
MSG	III	I STATUS	•	

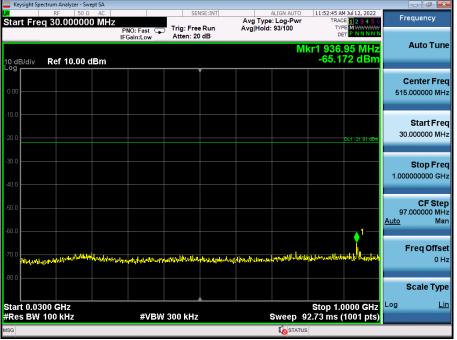
1GHz~25GHz



Highest channel



CH:2480MHz



30MHz~1GHz





Keysight Spectrum Analyzer - Swep					
ম⊧ 50 Ω tart Freg 1.0000000		SENSE:INT	ALIGN AUTO Avg Type: Log-Pwr	11:53:04 AM Jul 12, 2022 TRACE 1 2 3 4 5 6	Frequency
tart Freq 1.0000000	PNO: Fast IFGain:Low	Trig: Free Run Atten: 20 dB	Avg Hold: 43/100	TYPE NWWWW DET PNNNNN	
0 dB/div Ref 10.00 dl	Bm		MI	(r1 24.544 GHz -46.033 dBm	Auto Tun
•g 0.00 10.0 20.0				0L1 -21.91 dBm	Center Fre 13.000000000 GH
0.0				and the second s	Start Fre 1.000000000 G⊦
00.0	ander The full in particular production of the particular production of th	erendelingthe market and and produced			Stop Fre 25.000000000 G⊦
tart 1.00 GHz Res BW 1.0 MHz	#VI	BW 3.0 MHz		Stop 25.00 GHz 0.00 ms (1001 pts)	CF Ste 2.40000000 GH Auto Ma
KR MODE TRC SCL 1 N 1 f 2 - - - 3 - - - 4 - - - 5 - - - -	X 24.544 GHz	Y FU	NCTION FUNCTION WIDTH	FUNCTION VALUE	Freq Offse
6 7 8 9 9					Scale Typ
1					

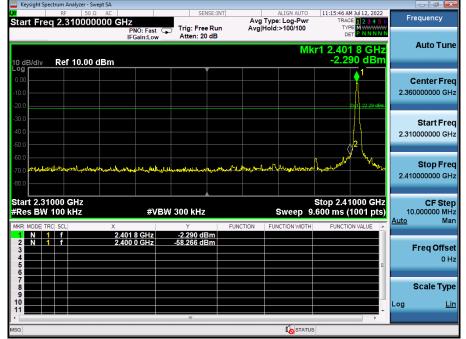
1GHz~25GHz

Conducted band edge Test result

Modulation		Frequency Band	Delta Peak to band emission (dBc)	>Limit (dBc)	Result
	Non honning	Left Band	55.98	20	Pass
OFOK	Non-hopping	Right Band	58.00	20	Pass
GFSK	henning	Left Band	57.75	20	Pass
	hopping	Right Band	60.09	20	Pass
	Non honning	Left Band	57.97	20	Pass
	Non-hopping	Right Band	60.29	20	Pass
π/4DQPSK	hanning	Left Band	57.27	20	Pass
	hopping	Right Band	57.70	20	Pass
	Non honning	Left Band	58.01	20	Pass
00001	Non-hopping	Right Band	60.20	20	Pass
8DPSK	henning	Left Band	58.34	20	Pass
	hopping	Right Band	60.21	20	Pass



GFSK No-hopping Band edge-left side

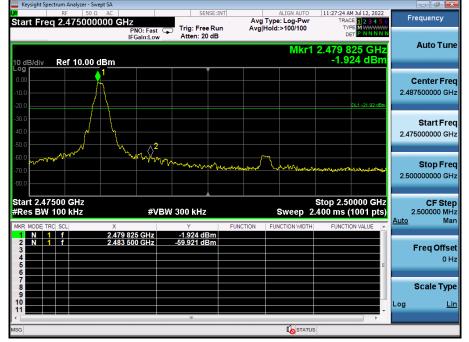


GFSK Hopping Band edge-left side

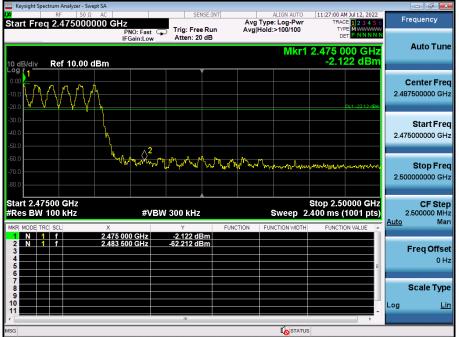
Keysight Spectrum Analyzer - Swept SA					- J ×
₩ RF 50 Ω AC Start Freq 2.310000000 G		SENSE:INT	ALIGN AUTO Avg Type: Log-Pwr	11:16:35 AM Jul 12, 2022 TRACE 1 2 3 4 5 6	Frequency
10 dB/div Ref 10.00 dBm	PNO: Fast	rig: Free Run Atten: 20 dB	Avg Hold:>100/100	TYPE MWWWW DET P N N N N r1 2.408 8 GHz -2.329 dBm	Auto Tune
-20.0					Center Freq 2.360000000 GHz
-30.0				2	Start Freq 2.310000000 GHz
-60.0 -70.0	harden and a second	~~~~	nmakon neuk kung		Stop Freq 2.410000000 GHz
Start 2.31000 GHz #Res BW 100 kHz	#VBW 30	10 kHz	Sweep 9	Stop 2.41000 GHz .600 ms (1001 pts)	CF Step 10.000000 MHz Auto Man
MKR MODE TRC SCL X	408 8 GHz -2	Y FUN 2.329 dBm	ICTION FUNCTION WIDTH	FUNCTION VALUE	<u>- nuro</u>
		0.075 dBm		E	Freq Offset 0 Hz
7 8 9					Scale Type
10					Log <u>Lin</u>
< [III	1	•	
ISG			I STATUS		



GFSK No-hopping Band edge-right side



GFSK Hopping Band edge-right side







$\pi/4\text{-}DQPSK$ No-hopping Band edge-left side

Keysight Spectrum Analyzer - Swept SA					- 7 ×
₩ RF 50 Ω AC Start Freq 2.310000000 Gł			ALIGN AUTO 11: e: Log-Pwr	18:29 AM Jul 12, 2022 TRACE 1 2 3 4 5 6	Frequency
10 dB/div Ref 10.00 dBm	PNO: Fast Trig: Free IFGain:Low Atten: 20	e Run Avg Hold	:>100/100 Mkr1 2	2.401 8 GHz	Auto Tune
10.0				0/1 -20.09 dBm	Center Freq 2.360000000 GHz
-30.0				2	Start Freq 2.310000000 GHz
-60.0 -70.0 4 h wa ya, ama baharin ang baharin -60.0	the print the ground of the second	and the second	uhandasha (hara	allow have	Stop Fred 2.410000000 GHz
Start 2.31000 GHz #Res BW 100 kHz	#VBW 300 kHz		Sweep 9.600	p 2.41000 GHz ms (1001 pts)	CF Step 10.000000 MH: <u>Auto</u> Mar
1 N 1 f 2.4	01 8 GHz -3.086 dE 00 0 GHz -61.060 dE	Bm			Freq Offse 0 H:
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ISG			I o status		

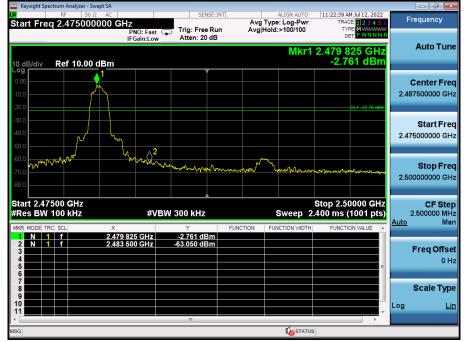
$\pi/4\text{-}DQPSK$ Hopping Band edge-left side

🔤 Keysight Sp		nalyzer - Swe									_	- # 🗙
	RF	50 Ω			SEN	SE:INT	ΑναΤν	ALIGN AUTO		H Jul 12, 2022	Fred	uency
Start Fre	eq Z.3	5100000		NO:Fast (Trig: Free	Run		Id:>100/100	TYP	E M WWWWW		
				Gain:Low	Atten: 20	dB	-		DE	P NNNN		
								Mk	r1 2.402	2 8 GHz	A	uto Tune
10 dB/div	Pef	10.00 d	Bm							25 dBm		
Log		10.00 0								<u> </u>		
0.00											Ce	nter Freq
-10.0										AMMAA	2.3600	00000 GHz
-20.0										011-22-29 dBm		
										021-22-29 dBm		
-30.0											5	Start Freq
-40.0											2 3100	00000 GHz
-50.0										2		
-60.0) 2		
								a the part of the hand and and a second s	phrman		5	Stop Freq
-70.0 -70.0	-William	adrat land the	bornoutortellar	with mailer	*****	Carles Mail No. North	arija aliyang di	~~~~				00000 GHz
-80.0											2.4100	
Start 2.3									Stop 2.41			CF Step
#Res BW	100	kHz		#VB	W 300 kHz			Sweep 9	.600 ms (1001 pts)		00000 MHz
MKR MODE T	RC SCL		х		Y	FUNC	TION F	UNCTION WIDTH	FUNCTIO	ON VALUE	<u>Auto</u>	Man
1 N *	1 f			8 GHz	-3.125 dB							
2 N	1 f		2.400	0 GHz	-60.392 dB	m					Fr	eq Offset
4												0 Hz
5										=		
7												
8											S	cale Type
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11										-	Log	Lin
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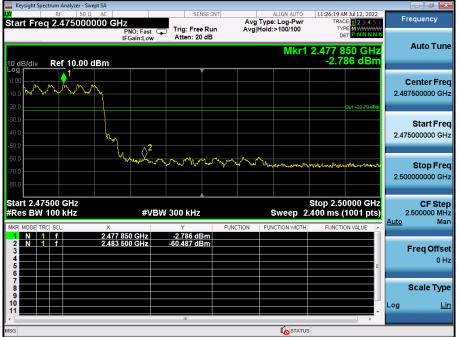




π/4-DQPSK No-hopping Band edge-right side



π /4-DQPSK Hopping Band edge-right side







8-DQPSK No-hopping Band edge-left side

Keysight Spectrum	n Analyzer - Swept SA					<u> </u>	
	RF 50 Ω AC		SENSE:		ALIGN AUTO	11:18:58 AM Jul 12, 2022	English
Start Freq 2	.310000000 GH	IZ			g Type: Log-Pwr	TRACE 1 2 3 4 5 6	Frequency
		PNO: Fast	Trig: Free Ru Atten: 20 dE		Hold:>100/100	DET P NNNN	
		IFGain:Low	Atten: 20 de	,		,	Auto Tur
					MK	r1 2.402 2 GHz	Autoru
0 dB/div 🛛 🛛	ef 10.00 dBm					-3.003 dBm	
.og						1	
0.00							Center Fre
0.0						<u>н А</u>	2.36000000 G
20.0						DI 4, 23.00 4Dm	
						011 20.00 (10)	
80.0							Start Fr
40.0							2.31000000 G
50.0						2	
50.0							
					any and have an	A water Yula	Stop Fre
70.0 And and a second	mently when the states	hali and a state of the state o	and survey and a second	and the second second	aliter der ferder halte	Marker 14	2.41000000 GI
30.0							
tart 2.3100						Stop 2.41000 GHz	CF Ste
Res BW 10	0 kHz	#VBW	300 kHz		Sweep 9	.600 ms (1001 pts)	10.000000 M
IKR MODE TRC S	CL X		Y	FUNCTION	FUNCTION WIDTH	FUNCTION VALUE	Auto M
1 N 1 1		02 2 GHz	-3.003 dBm				
2 N 1 1	f 2.4	00 0 GHz	-61.013 dBm				Freq Offs
4							01
5						E	
6							
8							Scale Typ
9							
10							Log <u>L</u>
			III			*	
G						3	
					N		

8-DQPSK Hopping Band edge-left side

Keysight Spectrum Analyzer - Swept SA					
RF 50Ω AC Start Freg 2.310000000 GH	lz	SENSE:INT	ALIGN AUTO Avg Type: Log-Pwr	11:20:01 AM Jul 12, 2022 TRACE 1 2 3 4 5 6	Frequency
10 dB/div Ref 10.00 dBm	PNO: Fast	rig: Free Run Atten: 20 dB	Avg Hold:>100/100	TYPE MWWWW DET P NNNNN r1 2.408 8 GHz -2.982 dBm	Auto Tune
				MAMAN	Center Free 2.360000000 GH
-30.0				Dt1-20.00 dDm	Start Free 2.310000000 GH
-60.0 -70.0	identariora dell'assance della	Andonewith and Marith	(generally and an all and the		Stop Free 2.410000000 GH:
Start 2.31000 GHz #Res BW 100 kHz	#VBW 30		Sweep 9	Stop 2.41000 GHz .600 ms (1001 pts)	CF Stej 10.000000 MH <u>Auto</u> Ma
1 N 1 f 2.4	08 8 GHz -2 00 0 GHz -61	2.982 dBm 1.326 dBm		E	Freq Offse 0 H
7 8 9 10 11					Scale Type Log <u>Li</u> i
<		m	K ostatus	3	

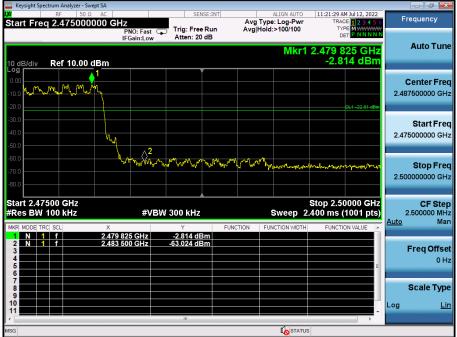




8-DQPSK No-hopping Band edge-right side



8-DQPSK Hopping Band edge-right side





7. 20DB BANDWIDTH & 99% BANDWIDTH

Test Requirement:	FCC Part15 C Section 15.247 (a)(1) & RSS-247.5.1(2) RSS-Gen 6.7
Test Method:	ANSI C63.10:2013and RSS-Gen

7.1 Test Setup



7.2 Limit

N/A

7.3 Test procedure

1. Set RBW = 30 kHz.

2. Set the video bandwidth (VBW) \ge 3 x RBW.

- 3. Detector = Peak.
- 4. Trace mode = max hold.
- 5. Sweep = auto couple.
- 6. Allow the trace to stabilize.

7. Measure the maximum width of the emission that is constrained by the frequencies associated with the two outermost amplitude points (upper and lower frequencies) that are attenuated by 6 dB relative to the maximum level measured in the fundamental emission.

7.4 DEVIATION FROM STANDARD

No deviation.







7.5 Test Result

Mode	Test channel	20dB Emission Bandwidth (MHz)	99% Emission Bandwidth (MHz)	Result
	Lowest	0.994	0.887	
GFSK	Middle	0.978	0.880	Pass
	Highest	0.973	0.881	
	Lowest	1.250	1.160	
π/4-DQPSK	Middle	1.248	1.157	Pass
	Highest	1.247	1.156	
	Lowest	1.224	1.147	
8-DPSK	Middle	1.224	1.145	Pass
	Highest	1.224	1.145	

Test plots

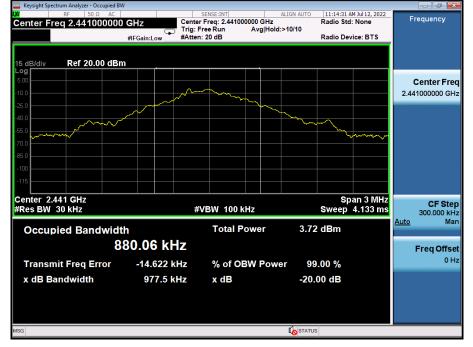
	GFS	SK Low Chanr	iei		
www.www.com analyzer - Occupied BW					
RF 50 Ω AC Center Freq 2.402000000 Gi #II	Z Center	Freq: 2.402000000 GHz ree Run Avg Hold:	ALIGN AUTO :>10/10	11:13:59 AM Jul 12, 2022 Radio Std: None Radio Device: BTS	Frequency
15 dB/div Ref 20.00 dBm					
5.00 -10.0 -25.0		~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~			Center Freq 2.402000000 GHz
-40.0				-^	
-70.0					
-115 Center 2.402 GHz				Span 3 MHz	
#Res BW 30 kHz Occupied Bandwidth	#V	/BW 100 kHz Total Power	3.86	Sweep 4.133 ms	CF Step 300.000 kHz <u>Auto</u> Man
887	.32 kHz				Freq Offset
Transmit Freq Error x dB Bandwidth	-16.522 kHz 993.6 kHz	% of OBW Powe x dB		.00 % 00 dB	0 H2
MSG			I STATUS		

GFSK Low Channel





GFSK Middle Channel



GFSK High Channel

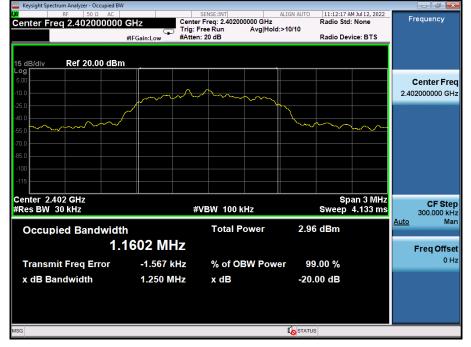




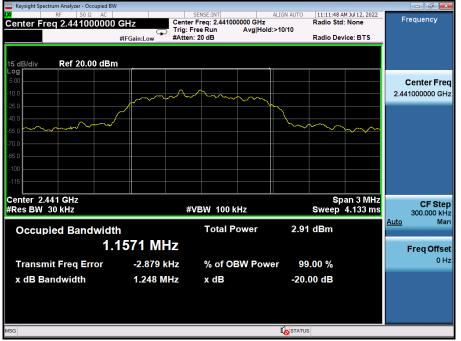




π/4-DQPSK Low Channel

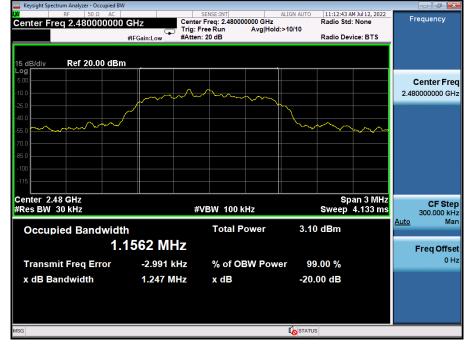


π/4-DQPSK Middle Channel





π/4-DQPSK High Channel



8-DPSK Low Channel



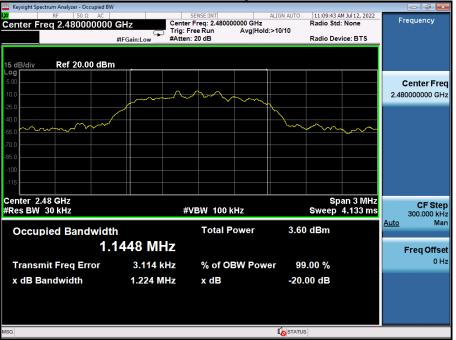




8-DPSK Middle Channel

Keysight Spectrum Analyzer - Occupied BW					- J - X
Center Freq 2.441000000		SENSE:INT r Freq: 2.441000000 GHz	R	11:10:48 AM Jul 12, 2022 adio Std: None	Frequency
		Free Run Avg Hol n: 20 dB		adio Device: BTS	
15 dB/div Ref 20.00 dBm					
5.00					Contor From
-10.0					Center Fred 2.441000000 GHz
-25.0	June -		<u> </u>		2.44 1000000 6112
-40.0					
-55.0				\sim	
-70.0					
-85.0					
-100					
-115					
Center 2.441 GHz				Span 3 MHz	
#Res BW 30 kHz	#	VBW 100 kHz	s	weep 4.133 ms	CF Step 300.000 kHz
Occupied Bandwidth		Total Power	3.38 d	Bm	<u>Auto</u> Mar
			0.00 0	Sill	
1.	1449 MHz				Freq Offset
Transmit Freq Error	4.096 kHz	% of OBW Pow	ver 99.0	0 %	0 Hz
x dB Bandwidth	1.224 MHz	x dB	-20.00	dB	
ISG			I STATUS		

8-DPSK High Channel







8. Maximum Peak Output Power

Test Requirement:	FCC Part15 C Section 15.247 (b)(1) & RSS-247.5.4(4)
Test Method:	ANSI C63.10:2013 and RSS-Gen
Limit:	20.97dBm(for GFSK), 20.97dBm(for EDR)

8.1 Block Diagram Of Test Setup



8.2 Limit

For frequency hopping systems operating in the 2400-2483.5 MHz band employing at least 75 non-overlapping hopping channels, and all frequency hopping systems in the 5725-5850 MHz band: 1 watt. For all other frequency hopping systems in the 2400-2483.5 MHz band: 0.125 watts.

8.3 Test procedure

- 1. Remove the antenna from the EUT and then connect a low RF cable from the antenna port to the spectrum.
- 2. Set the spectrum analyzer: RBW = 2MHz. VBW = 2MHz. Sweep = auto; Detector Function = Peak.
- 3. Keep the EUT in transmitting at lowest, medium and highest channel individually. Record the max value.

8.4 DEVIATION FROM STANDARD

No deviation.

8.5 Test Result

Mode	Test channel	Peak Output Power (dBm)	Limit (dBm)	Result
	Lowest	-2.460		
GFSK	Middle	-1.959	20.97	Pass
	Highest	-1.700		
	Lowest	-2.233		
π/4-DQPSK	Middle	-2.304	20.97	Pass
	Highest	-1.957		
	Lowest	-2.136		
8-DPSK	Middle	-2.196	20.97	Pass
	Highest	-1.861		

85







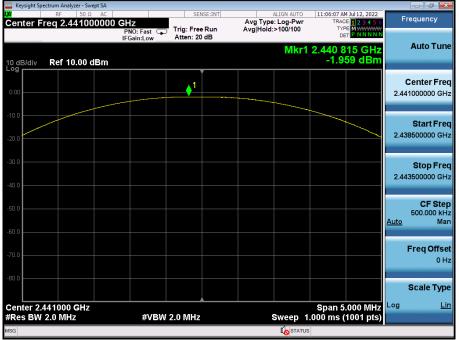


Test plots

GFSK Low Channel

SG						
	402000 GHz 2.0 MHz	#VBW 2	2.0 MHz	Sweep 1	Span 5.000 MHz .000 ms (1001 pts)	Log <u>Lir</u>
80.0						Scale Type
70.0						0 H:
						Freq Offse
60.0						<u>Auto</u> Mar
50.0						CF Step 500.000 kH
10.0						2.40400000 011
30.0						Stop Free 2.404500000 GH
20.0						Start Fred 2.399500000 GH;
10.0						
0.00						2.402000000 GH;
^{og}			.1			Center Fred
0 dB/div	Ref 10.00 dBm			WIKET	2.401 800 GHz -2.460 dBm	
		PNO: Fast IFGain:Low	Atten: 20 dB			Auto Tun
Center F	req 2.402000000	GHz	Trig: Free Run	Avg Type: Log-Pwr Avg Hold:>100/100	TRACE 1 2 3 4 5 6	Frequency
Keysight op	ectrum Analyzer - Swept SA RF 50 Ω AC		SENSE:INT	ALIGN AUTO	11:04:59 AM Jul 12, 2022	

GFSK Middle Channel



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1





GFSK High Channel



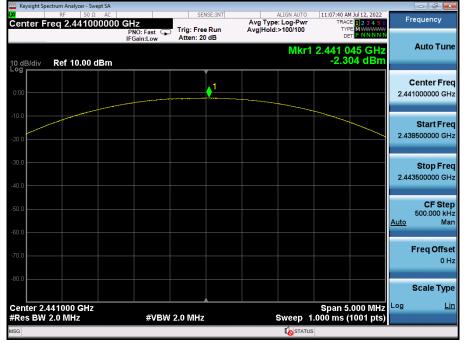
π/4-DQPSK Low Channel

Keysight Spectrum Analyzer - Swept SA				- 5 💌
X RF 50 Ω AC	SENSE:INT	ALIGN AUTO Avg Type: Log-Pwr	11:07:10 AM Jul 12, 2022 TRACE 1 2 3 4 5 6	Frequency
Center Freq 2.40200000	PNO: Fast Trig: Free Run IFGain:Low Atten: 20 dB	Avg Hold:>100/100		
10 dB/div Ref 10.00 dBm		Mkr1	2.402 040 GHz -2.233 dBm	Auto Tune
0.00	1			Center Freq 2.402000000 GHz
20 0				Start Freq 2.399500000 GHz
40.0				Stop Fred 2.404500000 GHz
so.o				CF Step 500.000 kH: <u>Auto</u> Mar
70.0				Freq Offse 0 H:
80.0				Scale Type
Center 2.402000 GHz #Res BW 2.0 MHz	#VBW 2.0 MHz	Sweep 1.	Span 5.000 MHz 000 ms (1001 pts)	Log <u>Lin</u>
ISG		STATUS		

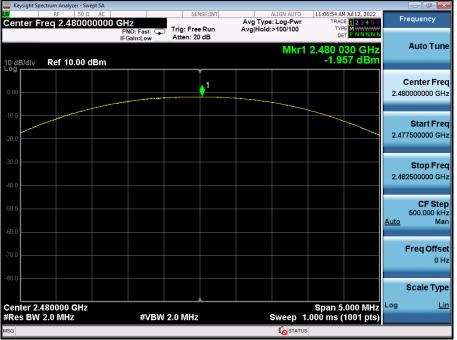




π/4-DQPSK Middle Channel



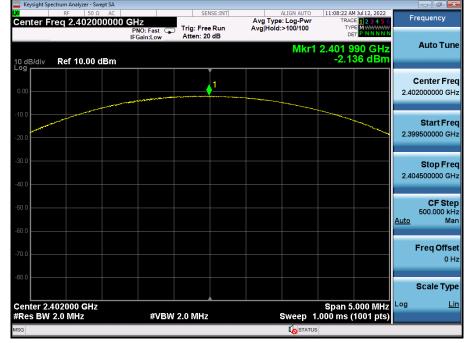
π/4-DQPSK High Channel







8-DPSK Low Channel



8-DPSK Middle Channel

Keysight Spectrum Analyzer - Swept SA					-
X RF 50 Ω AC Center Freq 2.44100000) GHz	SENSE:INT	ALIGN AUTO Avg Type: Log-Pwr	11:08:05 AM Jul 12, 2022 TRACE 1 2 3 4 5 6	Frequency
	PNO: East	Free Run :: 20 dB	Avg Hold:>100/100		Auto Tune
0 dB/div Ref 10.00 dBm				-2.196 dBm	
0.00		1			Center Fred 2.441000000 GHz
10.0					
20.0					Start Freq 2.438500000 GHz
30.0					Stop Fred
40.0					2.443500000 GH:
50.0					CF Step 500.000 kH <u>Auto</u> Mar
					Freq Offse
70.0					0 H:
80.0					Scale Type
Center 2.441000 GHz #Res BW 2.0 MHz	#VBW 2.0 M	Hz	Sweep	Span 5.000 MHz I.000 ms (1001 pts)	Log <u>Lin</u>
usg 🗼 File <3-1.png> saved			🚺 STATU	s	





8-DPSK High Channel





9. HOPPING CHANNEL SEPARATION

Test Requirement:	FCC Part15 C Section 15.247 (a)(1) & RSS-247.5.1(4)
Test Method:	ANSI C63.10:2013 and RSS-Gen
Receiver setup:	RBW=100KHz, VBW=300KHz, detector=Peak
Limit:	GFSK: 20dB bandwidth $\pi/4$ -DQPSK & 8DPSK: 0.025MHz or 2/3 of the 20dB bandwidth (whichever is greater)

9.1 Test Setup

EUT	SPECTRUM
	ANALYZER

9.2 Test procedure

1. Remove the antenna from the EUT and then connect a low RF cable from the antenna port

to the spectrum.

2. Set the spectrum analyzer: RBW = 100kHz. VBW = 300kHz , Span = 3.0MHz. Sweep = auto; Detector Function = Peak. Trace = Max hold.

3. Allow the trace to stabilize. Use the marker-delta function to determine the separation between the peaks of the adjacent channels. The limit is specified in one of the subparagraphs of this Section Submit this plot.

9.3 DEVIATION FROM STANDARD No deviation.







Modulation	Test Channel	Separation (MHz) Limit(MHz)		Result	
GFSK	GFSK Low		0.994	PASS	
GFSK	Middle	1.011	0.978	PASS	
GFSK	High	High 0.999 0.973		PASS	
π/4-DQPSK	Low	0.996	0.833	PASS	
π/4-DQPSK	Middle	0.990 0.832		PASS	
π/4-DQPSK	High	1.005 0.831		PASS	
8-DPSK	Low	0.996	0.816	PASS	
8-DPSK	Middle	0.999	0.816	PASS	
8-DPSK High		1.002	0.816	PASS	

Test plots GFSK Low Channel







GFSK Middle Channel



GFSK High Channel



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π/4-DQPSK Low Channel



π/4-DQPSK Middle Channel



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π/4-DQPSK High Channel



8-DPSK Low Channel



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8-DPSKMiddle Channel



8-DPSK High Channel



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Test Requirement:	FCC Part15 C Section 15.247 (a)(1)(iii) & RSS-247.5.1(4)
Test Method:	ANSI C63.10:2013 and RSS-Gen
Receiver setup:	RBW=100kHz, VBW=300kHz, Frequency range=2400MHz-2483.5MHz, Detector=Peak
Limit:	15 channels

10.1 Test Setup

EUT	SPECTRUM
	ANALYZER

10.2 Test procedure

1. Remove the antenna from the EUT and then connect a low RF cable from the antenna port to the spectrum.

2. Set the spectrum analyzer: RBW = 100kHz. VBW = 300kHz. Sweep = auto; Detector Function = Peak. Trace = Max hold.

3. Allow the trace to stabilize. It may prove necessary to break the span up to sections. in order to clearly show all of the hopping frequencies. The limit is specified in one of the subparagraphs of this Section.

4. Set the spectrum analyzer: Start Frequency = 2.4GHz, Stop Frequency = 2.4835GHz. Sweep=auto;

10.3 DEVIATION FROM STANDARD No deviation.

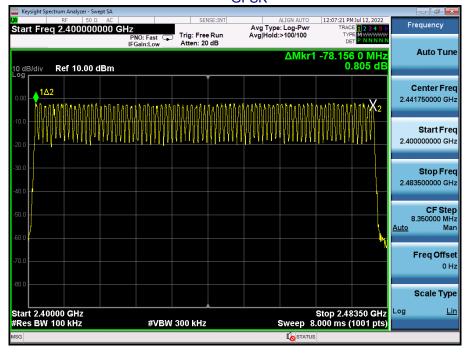




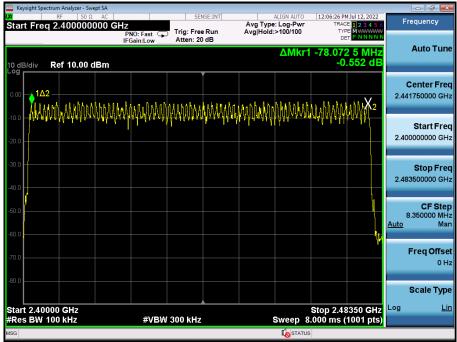


10.4 Test Result

Test Plots: 79 Channels in total GFSK



π/4-DQPSK









	8-C	PSK		
Keysight Spectrum Analyzer - Swept SA				- 7 -
RF 50 Ω AC Start Freg 2.400000000 GHz 50 Ω 50 Ω	SENSE:INT	ALIGN AUTO Avg Type: Log-Pwr	12:05:28 PM Jul 12, 2022 TRACE 1 2 3 4 5 6	Frequency
PNO: Fast 😱 IFGain:Low	Trig: Free Run Atten: 20 dB	Avg Hold:>100/100	DET P NNNN	
		ΔMkr1	-78.406 5 MHz	Auto Tune
10 dB/div Ref 10.00 dBm			-0.329 dB	
Log	ľ			Center Freq
0.00 142				2.441750000 GHz
אאלו גאל גער או אין	10.50 JAAA (6.57 JAAA		MANAAAAMAX2	
-10.0	<u>ամիկ և Ռ</u> ՈՌԴՈՒՈՒՈՐՈ օՐ	մանվիծ հանհոս իսնվ։	ah nathati an nath	Start Freq
-20.0				2.400000000 GHz
-20.0				
-30.0				Stop Freq
				2.483500000 GHz
-40.0				
-50.0			ų į	CF Step
				8.350000 MHz <u>Auto</u> Man
-60.0				<u>Auto</u> murr
			۳ı	Freq Offset
-70.0				0 Hz
-80.0				
-60.0				Scale Type
Start 2.40000 GHz #Res BW 100 kHz #VBW 1	300 kHz	Sweep 8	Stop 2.48350 GHz .000 ms (1001 pts)	
MSG				





11. DWELL TIME

Test Requirement:	FCC Part15 C Section 15.247 (a)(1)(iii) & RSS-247.5.1(4)	
Test Method:	ANSI C63.10:2013 and RSS-Gen	
Receiver setup:	RBW=1MHz, VBW=3MHz, Span=0Hz, Detector=Peak	
Limit:	0.4 Second	

11.1 Test Setup

EUT	SPECTRUM
	ANALYZER

11.2 Test procedure

1. Remove the antenna from the EUT and then connect a low RF cable from the antenna port to the spectrum.

2. Set spectrum analyzer span = 0Hz;

3. Set RBW = 1MHz and VBW = 3MHz.Sweep = as necessary to capture the entire dwell time per hopping channel. Set the EUT for DH5, DH3 and DH1 packet transmitting.

4. Use the marker-delta function to determine the dwell time. If this value varies with different modes of operation (e.g., data rate, modulation format, etc.), repeat this test for each variation. The limit is specified in one of the subparagraphs of this Section. Submit this plot(s).

11.3 DEVIATION FROM STANDARD No deviation.





11.4 Test Result

GFSK DH5 mode:

Frequency	Packet	Dwell time(ms)	Limit(ms)	Result
2402MHz	2402MHz DH5 3 ⁴		400	Pass
2441MHz	2441MHz DH5		315.52 400	
2480MHz	2480MHz DH5		400	Pass

Remarks:

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

Test channel: as blow

CH:2402MHz time slot=2.942(ms)*(1600/ (6*79))*31.6=313.81ms

CH:2441MHz time slot=2.958(ms)*(1600/ (6*79))*31.6=315.52ms

CH:2480MHz time slot=2.925(ms)*(1600/ (6*79))*31.6=312.00ms

 π /4-DQPSK mode:

Frequency	Packet Dwell time(ms) Limit(ms)		Result	
2402MHz	2DH5	312.85	400	Pass
2441MHz	MHz 2DH5 315.52		400	Pass
2480MHz	2DH5	314.67	400	Pass

Remarks:

The test period: T= 0.4 Second/Channel x 79 Channel = 31.6 s Test channel: as blow CH:2402MHz time slot=2.933(ms)*(1600/ (6*79))*31.6=312.85ms CH:2441MHz time slot=2.958(ms)*(1600/ (6*79))*31.6=315.52ms CH:2480MHz time slot=2.950(ms)*(1600/ (6*79))*31.6=314.67ms

8-DPSK mode:

Frequency	Packet	Dwell time(ms)	Limit(ms)	Result
2480MHz	3DH5	312.85	400	Pass
2480MHz	lz 3DH5 315.52		400	Pass
2480MHz	3DH5	312.00	400	Pass

Remarks:

The test period: T= 0.4 Second/Channel x 79 Channel = 31.6 s Test channel: as blow CH:2402MHz time slot=2.933(ms)*(1600/ (6*79))*31.6=312.85ms CH:2441MHz time slot=2.958(ms)*(1600/ (6*79))*31.6=315.52ms CH:2480MHz time slot=2.925(ms)*(1600/ (6*79))*31.6=312.00ms



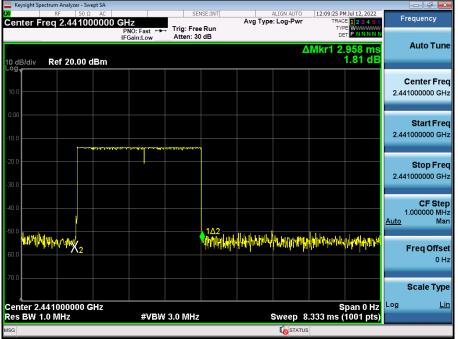


Test Plots

GFSK 2402MHz

Keysight Sp	ectrum Analyzer - Swe								
	RF 50 Ω		~	SENSE:IN	ALIGN AUTO	12:08:41 PM Ju		E	requency
enter F	req 2.40200		PNO: Fast ++ IFGain:Low	. Trig: Free Run Atten: 30 dB	be: Log-Pwr	TYPE	123456 WWWWWW PNNNNN		
l0 dB/div _og _w	Ref 20.00 c	lBm			Δ	Mkr1 2.9 -1.	42 ms 62 dB		Auto Tune
10.0									Center Free 2000000 GH
0.00								2.40	2000000 GH
								2.40	Start Fre 2000000 GH
10.0			والاسمى لينشك المرادية	[
20.0								2.40	Stop Fre 2000000 GH
30.0									CF Ste
40.0								<u>Auto</u>	1.000000 MH Ma
-50.0 <mark>МР_ИМ</mark>	hteller and the second	Hinkey.»	2		Multinur	. Ipristerings	mlluhh		Freq Offse
60.0									0 H
70.0									Scale Type
	402000000 G	Hz				Sp	an 0 Hz	Log	Lir
Res BW 1	I.U MHZ		#VBN	3.0 MHz	Sweep 8	.333 ms (10	001 pts)		

GFSK 2441MHz



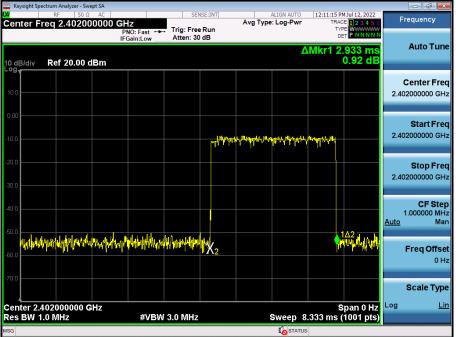




GFSK 2480MHz

Keysight Sp	ectrum Analyzer - Swept SA							- J ×
4 Center E	RF 50 Ω AC req 2.480000000		SENSE:INT	Avg Type:	LIGN AUTO		1 Jul 12, 2022 E 1 2 3 4 5 6	Frequency
Senter P	req 2.400000000	PNO: Fast +++ IFGain:Low	Trig: Free Run Atten: 30 dB			TYP	E WWWWWW T P N N N N N	
		IFGalli.Low	Allen: 00 dB		Λ	Mkr1 2.	925 ms	Auto Tune
l0 dB/div _og_	Ref 20.00 dBm					(0.97 dB	
^{og}								Center Free
10.0								2.48000000 GH
0.00								
			~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~		·····			Start Free
10.0								2.480000000 GH:
20.0								
20.0								Stop Free 2.48000000 GH
30.0								2.4000000000
40.0								CF Step
10.0								1.000000 MH Auto Ma
50.0	under Arlate im anne difere a d	المراجع والمراجع				1∆2 <u>haluli</u>	he and solve	
60.0	Manual Abalter Manual Islandsi	Al Walder and a state	X ₂		M	Hui dah Kadidi	and when the	Freq Offse
30.0								0 H:
70.0								
								Scale Type
	480000000 GHz	#\/D\\	0.0411-			S	pan 0 Hz	Log <u>Lir</u>
Res BW 1	LU MHZ	#VBW 3	.U MHZ		Sweep 8	.333 ms (	rour pts)	
20					STATUS			

# π/4-DQPSK 2402MHz

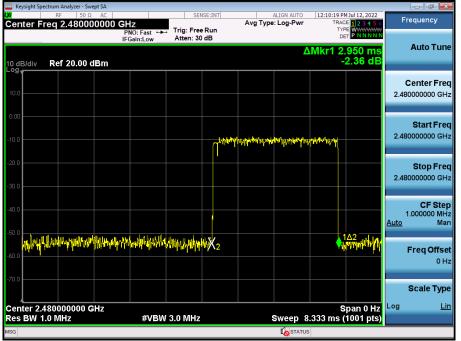




## π/4-DQPSK 2441MHz

Keysight S	pectrum Analyzer - Swept SA					- 7 💌
XI	RF 50 Ω AC		SENSE:INT	ALIGN AUTO Avg Type: Log-Pwr	12:10:55 PM Jul 12, 2022 TRACE 1 2 3 4 5 6	Frequency
Senter I	Freq 2.441000000	PNO: Fast ++	. Trig: Free Run	Avg Type. Log-Pwi	TYPE WWWWWW	
		IFGain:Low	Atten: 30 dB		DET P NNNNN	Auto Tuno
					\Mkr1 2.958 ms	Auto Tune
l0 dB/div _og _w	Ref 20.00 dBm				-0.43 dB	
^{og}						Conton From
10.0						Center Free 2.441000000 GH;
10.0						2.441000000 GH2
0.00						
0.00				here the second s		Start Freq
-10.0						2.441000000 GHz
-20.0						Stop Freq
						2.441000000 GHz
30.0						2.441000000 GH2
		ł				
40.0						CF Step 1.000000 MHz
						Auto Man
-50.0				1Δ2 .t. I		
MP/M	where the share the same and the share by the state of th	MX2		Shine a	n an	Freq Offset
-60.0						0 Hz
						0112
70.0						
						Scale Type
Center 2	.441000000 GHz				Span 0 Hz	Log <u>Lin</u>
	1.0 MHz	#VBW	3.0 MHz	Sweep	3.333 ms (1001 pts)	
SG						
				<u> </u>		

### π/4-DQPSK 2480MHz



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+86-755-2233 6688

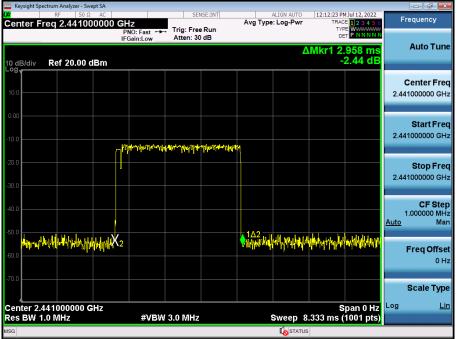
1



## 8-DPSK 2402MHz

Keysight Sp	pectrum Analyzer - Swept SA					- F 🗙
0 Comtor E	RF 50 Ω AC req 2.402000000		SENSE:INT	ALIGN AUTO Avg Type: Log-Pwr	12:11:51 PM Jul 12, 2022 TRACE 1 2 3 4 5 6	Frequency
senter r	req 2.40200000	PNO: Fast +++ IFGain:Low	Trig: Free Run Atten: 30 dB	Ang Type. Logi wi		
l0 dB/div _og _w	Ref 20.00 dBm			L	Mkr1 2.933 ms -4.14 dB	Auto Tune
						Center Fre
10.0						2.402000000 GH
0.00						Start Fre
10.0	- Mallahara	เป็นทางสารสารสารสาร เป็นทาง	Analythic and			2.402000000 GH
20.0						Stop Fre
30.0						2.402000000 GH
40.0						CF Ste 1.000000 M⊦
50.0			142		Latin a bat	<u>Auto</u> Ma
60.0				and the second		Freq Offse
70.0						0 H
70.0						Scale Typ
	.402000000 GHz 1.0 MHz	#VBW 3	0 MHz	Sween	Span 0 Hz 3.333 ms (1001 pts)	Log <u>Li</u>
SG	10 10112	# V D V V	-V-WI12	Sweep a		

# 8-DPSK 2441MHz







# 8-DPSK 2480MHz

🔤 Keysight Spe	ctrum Analyzer - Swept SA									
<u>u</u>	RF 50 Ω AC		SEN	ISE:INT		ALIGN AUTO : Log-Pwr		M Jul 12, 2022	Fr	equency
Senter Fr	req 2.48000000	PNO: Fast	Trig: Free Atten: 30		Avg Type	e: Log-Pwr				
10 dB/div _og _w	Ref 20.00 dBm					Δ		.925 ms 2.45 dB		Auto Tune
10.0										Center Free
0.00									2.48	0000000 GH
									2.48	Start Free
10.0	- Anton Martin - Martin	nfeefafrafra fransfirsteren fransfirster	n ₁						2.40	
20.0									2.48	Stop Fre
30.0										
40.0									1 Auto	CF Stej .000000 MH Ma
50.0	<u>k</u> ,			Malen Inst	han had at	huidhanalu	Anterland while	Alder Mar M		
60.0	<u>گ</u> 2		. <b>4</b> 4 4.	a hot a	1.1.1.1.1.1.1.1.1.1.1.1.1.1.1.1.1.1.1.1.	1 <b>6. 1</b> 7. 11.	անու անուլ վա			Freq Offse 0 H
70.0										Scale Typ
Center 2.4	80000000 GHz						s	ipan 0 Hz	Log	<u>Lii</u>
Res BW 1.		#VBW	3.0 MHz			Sweep 8	.333 ms (	1001 pts)		
SG						<b>I</b> STATUS				







# 12. Antenna Requirement

Standard requirement:	FCC Part15 C Section 15.203 /247(c) & RSS-Gen 6.8					
be used with the device. The use of a intentional radiator, the manufacturer is use of a standard antenna jack or elect 15.247(c) (1)(i) requirement:	ed to ensure that no antenna other than that furnished by the responsible party shall a permanently attached antenna or of an antenna that uses a unique coupling to the may design the unit so that a broken antenna can be replaced by the user, but the trical connector is prohibited. 83.5 MHz band that is used exclusively for fixed. Point-to-point operations may					
employ transmitting antennas with dire	ectional gain greater than 6dBi provided the maximum conducted output power of dB for every 3 dB that the directional gain of the antenna exceeds 6dBi.					
EUT Antenna:						
The antennas are PCB antenna, the be	est case gain of the antennas are 2.6dBi.					







Reference to the **appendix I** for details.

# **14. EUT Constructional Details**

Reference to the appendix II for details.

***** END OF REPORT *****

