

CTC Laboratories, Inc.

2/F., Building 1 and 1-2/F., Building 2, Jiaquan Building, Guanlan High-Tech Park, Longhua District, Shenzhen, Guangdong, China

Tel: +86-755-27521059 Fax: +86-755-27521011 Http://www.sz-ctc.org.cn

TEST REPORT						
Report No: CTC20240747E06						
FCC ID:	2BFST-SANAGS3S					
Applicant:	Zhichuang All Technology Co. L	td				
Address:	31st Floor, West Tower of Xinghe Twin Towers, No. 8 Yaxing Rd, Bantian St, Longgang Dist, Shenzhen					
Manufacturer	Zhichuang All Technology Co. Ltd					
Address	31st Floor, West Tower of Xinghe Bantian St, Longgang Dist, Shenz					
Product Name:	OWS BLUETOOTH HEADSET					
Trade Mark:	/					
Model/Type reference:	sanag S3S					
Listed Model(s):	sanag S3S Al					
Standard:	Standard FCC CFR Title 47 Part 15 Subpart C Section 15.247					
Date of receipt of test sample:	Mar. 11, 2024					
Date of testing	: Mar. 12, 2024 ~ Mar. 14, 2024					
Date of issue	Date of issue Apr. 29, 2024					
Result	PASS					
Compiled by:		lucat am.				
(Printed name+signature)	Lucy Lan	(Nob) (WW) C				
Supervised by:		luery lan Zric 2hang				
(Printed name+signature)	Eric Zhang					
Approved by:		Temas				
(Printed name+signature)	Totti Zhao	1*				
Testing Laboratory Name:	CTC Laboratories, Inc.					
Address 2/F., Building 1 and 1-2/F., Building 2, Jiaquan Building, Guanlan High-Tech Park, Longhua District, Shenzhen, Guangdong, China						
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1. TEST SUMMARY

1.1. Test Standards

The tests were performed according to following standards:

FCC Rules Part 15.247: Operation within the bands 902–928MHz, 2400–2483.5MHz, and 5725-5850MHz.

ANSI C63.10-2013: American National Standard of Procedures for Compliance Testing of Unlicensed Wireless Devices.

1.2. Report Version

Revised No.	Report No.	Date of issue	Description
01	CTC20240747E05	Apr. 29, 2024	Original

1.3. Test Description

FCC Part 15 Subpart C (15.247)				
Test Item	Standard Section	Result	Test Engineer	
Antenna Requirement	15.203	Pass	Kyrie	
Conducted Emission	15.207	Pass	Kyrie	
Restricted Bands	15.205	Pass	Kyrie	
Hopping Channel Separation	15.247(a)(1)	Pass	Kyrie	
Dwell Time	15.247(a)(iii)	Pass	Kyrie	
Peak Output Power	15.247(b)(1)	Pass	Kyrie	
Number of Hopping Frequency	15.247(a)(iii)	Pass	Kyrie	
Conducted Band Edge and Spurious Emissions	15.247(d)	Pass	Kyrie	
Radiated Band Edge and Spurious Emissions	15.205&15.209& 15.247(d)	Pass	Kyrie	
Radiated Spurious Emission	15.247(d) &15.209	Pass	Kyrie	
20dB Bandwidth	15.247(a)	Pass	Kyrie	

Note:

1. The measurement uncertainty is not included in the test result.

2. N/A: means this test item is not applicable for this device according to the technology characteristic of device.

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1.4. Test Facility

Address of the report laboratory

CTC Laboratories, Inc.

Add: 2/F., Building 1 and 1-2/F., Building 2, Jiaquan Building, Guanlan High-Tech Park, Longhua District, Shenzhen, Guangdong, China

Laboratory accreditation

The test facility is recognized, certified, or accredited by the following organizations:

A2LA-Lab Cert. No.: 4340.01

CTC Laboratories, Inc. EMC Laboratory has been accredited by A2LA for technical competence in the field of electrical testing, and proved to be in compliance with ISO/IEC 17025:2017 General Requirements for the Competence of Testing and Calibration Laboratories and any additional program requirements in the identified field of testing.

Industry Canada (Registration No.: 9783A, CAB Identifier: CN0029)

CTC Laboratories, Inc. EMC Laboratory has been registered by Certification and Engineer Bureau of Industry Canada for the performance of with Registration NO.: 9783A on Jan, 2016.

FCC (Registration No.: 951311, Designation Number CN1208)

CTC Laboratories, Inc. EMC Laboratory has been registered and fully described in a report filed with the (FCC) Federal Communications Commission. The acceptance letter from the FCC is maintained in our files. Registration 951311, Aug 26, 2017.



1.5. Measurement Uncertainty

The data and results referenced in this document are true and accurate. The reader is cautioned that there may be errors within the calibration limits of the equipment and facilities. The measurement uncertainty was calculated for all measurements listed in this test report acc. to TR-100028-01 "Electromagnetic compatibility and Radio spectrum Matters (ERM);Uncertainties in the measurement of mobile radio equipment characteristics; Part 1" and TR-100028-02 "Electromagnetic compatibility and Radio spectrum Matters (ERM); Uncertainties in the measurement of mobile radio equipment characteristics; Part 2" and is documented in the CTC Laboratories, Inc. quality system acc. to DIN EN ISO/IEC 17025. Furthermore, component and process variability of devices similar to that tested may result in additional deviation. The manufacturer has the sole responsibility of continued compliance of the device.

Test Items	Measurement Uncertainty	Notes
20dB Emission Bandwidth	±0.0196%	(1)
Carrier Frequency Separation	±1.9%	(1)
Number of Hopping Channel	±1.9%	(1)
Time of Occupancy	±0.028%	(1)
Max Peak Conducted Output Power	±0.743 dB	(1)
Band-edge Spurious Emission	±1.328 dB	(1)
Conducted RF Spurious Emission	9kHz-1GHz: ±0.746dB 1GHz-26GHz: ±1.328dB	(1)
Conducted Emissions 9kHz~30MHz	±3.08 dB	(1)
Radiated Emissions 30~1000MHz	±4.51 dB	(1)
Radiated Emissions 1~18GHz	±5.84 dB	(1)
Radiated Emissions 18~40GHz	±6.12 dB	(1)

Below is the best measurement capability for CTC Laboratories, Inc.

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

1.6. Environmental Conditions

During the measurement the environmental conditions were within the listed ranges:

Temperature:	15 °C to 35 °C
Relative Humidity:	20 % to 75 %
Air Pressure:	101 kPa

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2. GENERAL INFORMATION

2.1. Client Information

Applicant:	Zhichuang All Technology Co. Ltd
Address:	31st Floor, West Tower of Xinghe Twin Towers, No. 8 Yaxing Rd, Bantian St, Longgang Dist, Shenzhen
Manufacturer:	Zhichuang All Technology Co. Ltd
Address:	31st Floor, West Tower of Xinghe Twin Towers, No. 8 Yaxing Rd, Bantian St, Longgang Dist, Shenzhen

2.2. General Description of EUT

Product Name:	OWS BLUETOOTH HEADSET		
Trade Mark:	/		
Model/Type reference:	sanag S3S		
Listed Model(s):	sanag S3S AI		
Model Difference:	Only the model name is different, the rest is the same		
Power Supply:	Charging bay: DC 5V 1A from External adapter 400mAh from Battery Earphone: 40mAh from Battery		
Hardware Version:	/		
Software Version:	/		
Bluetooth 5.3 / BR+EDR			
Modulation:	GFSK, π/4-DQPSK, 8-DPSK		
Operation Frequency:	2402MHz~2480MHz		
Channel Number: 79			
Channel Separation:	1MHz		
Antenna Type:	SMD Ceramic Antenna		
Antenna Gain:	2.71dBi		

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2.3. Accessory Equipment Information

Equipment Information						
Name	Model	S/N	Manufacturer			
Adapter	PS06CA050K1000CU	/	/			
Cable Information	Cable Information					
Name	Shielded Type	Ferrite Core	Length			
USB Cable	Unshielded	NO	150cm			
Test Software Information						
Name	Version	/	/			
FCC_assist_1.0.2.2	1.0.2.2	/	/			



2.4. Operation State

Operation Frequency List: The EUT has been tested under typical operating condition. The Applicant provides communication tools software to control the EUT for staying in continuous transmitting and receiving mode for testing. BT EDR, 79 channels are provided to the EUT. Channels 00/39/78 were selected for testing.

Operation Frequency List:

Channel	Frequency (MHz)
00	2402
01	2403
÷	:
38	2440
39	2441
40	2442
:	E
77	2479
78	2480

Note: The display in grey were the channel selected for testing.

Test Mode:

For RF test items:

The engineering test program was provided and enabled to make EUT continuous transmit.

For AC power line conducted emissions:

The EUT was set to connect with the Bluetooth instrument under large package sizes transmission.

For Radiated spurious emissions test item:

The engineering test program was provided and enabled to make EUT continuous transmit. The EUT in each of three orthogonal axis emissions had been tested, but only the worst case (X axis) data recorded in the report.





2.5. Measurement Instruments List

RF Test System - SRD					
Item	Item Test Equipment Manufacturer Model No. Serial No. Calibrated U				
1	MXA Signal Analyzer Keysight		N9020A	MY46471737	Dec. 12, 2024
2	Test Software	WCS	WCS-WCN	2023.08.04	/

	Radiated emission					
Item	Test Equipment	Manufacturer	Model No.	Serial No.	Calibrated Until	
1	Trilog-Broadband Antenna	Schwarzbeck	VULB 9168	9168-1013	Dec. 07, 2024	
2	Horn Antenna	Schwarzbeck	BBHA 9120D	9120D-648	Dec. 07, 2024	
3	Spectrum Analyzer	R&S	FSU26	100105	Dec. 12, 2024	
4	Spectrum Analyzer	R&S	FSV40-N	101331	Mar. 14 2024	
5	Pre-Amplifier	SONOMA	310	186194	Dec. 12, 2024	
6	Low Noise Pre-Amplifier	EMCI	EMC051835	980075	Dec. 12, 2024	
7	Test Receiver	R&S	ESCI7	100967	Dec. 12, 2024	
8	3m chamber 2	Frankonia	EE025	/	Oct. 23, 2024	
9	Test Software	FARA	EZ-EMC	FA-03A2	/	

		Con	ducted emission		
Item	Test Equipment	Manufacturer	Model No.	Serial No.	Calibrated until
1	LISN	R&S	ENV216	101112	Dec. 12, 2024
2	LISN	R&S	ENV216	101113	Dec. 12, 2024
3	EMI Test Receiver	R&S	ESCS30	100353	Dec. 12, 2024
4	ISN CAT6	Schwarzbeck	NTFM 8158	CAT6-8158-0046	Dec. 12, 2024
5	ISN CAT5	Schwarzbeck	NTFM 8158	CAT5-8158-0046	Dec. 12, 2024
6	Test Software	R&S	EMC32	6.10.10	/

Note: 1. The Cal. Interval was one year.

2. The Cal. Interval was three years of the antenna.

3. The cable loss has been calculated in test result which connection between each test instruments.





3. TEST ITEM AND RESULTS

3.1. Conducted Emission

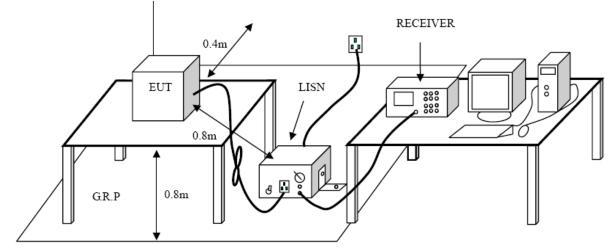
Limit

FCC CFR Title 47 Part 15 Subpart C Section 15.207

	Conducte	d Limit (dBµV)
Frequency (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 of the frequency.

Test Configuration



Test Procedure

1. The EUT was setup according to ANSI C63.10:2013 requirements.

The EUT was placed on a platform of nominal size, 1 m by 1.5 m, raised 80 cm above the conducting 2. ground plane. The vertical conducting plane was located 40 cm to the rear of the EUT. All other surfaces of EUT were at least 80 cm from any other grounded conducting surface.

The EUT and simulators are connected to the main power through a line impedance stabilization 3. network (LISN). The LISN provides a 50 ohm / 50 µH coupling impedance for the measuring equipment. The peripheral devices are also connected to the main power through a LISN. (Please refer to the 4. block diagram of the test setup and photographs)

Each current-carrying conductor of the EUT power cord, except the ground (safety) conductor, was 5. individually connected through a LISN to the input power source.

The excess length of the power cord between the EUT and the LISN receptacle were folded back and 6. forth at the center of the lead to form a bundle not exceeding 40 cm in length.

Conducted emissions were investigated over the frequency range from 0.15MHz to 30MHz using a 7. receiver bandwidth of 9 kHz.

During the above scans, the emissions were maximized by cable manipulation. 8.

Test Mode

Please refer to the clause 2.4.

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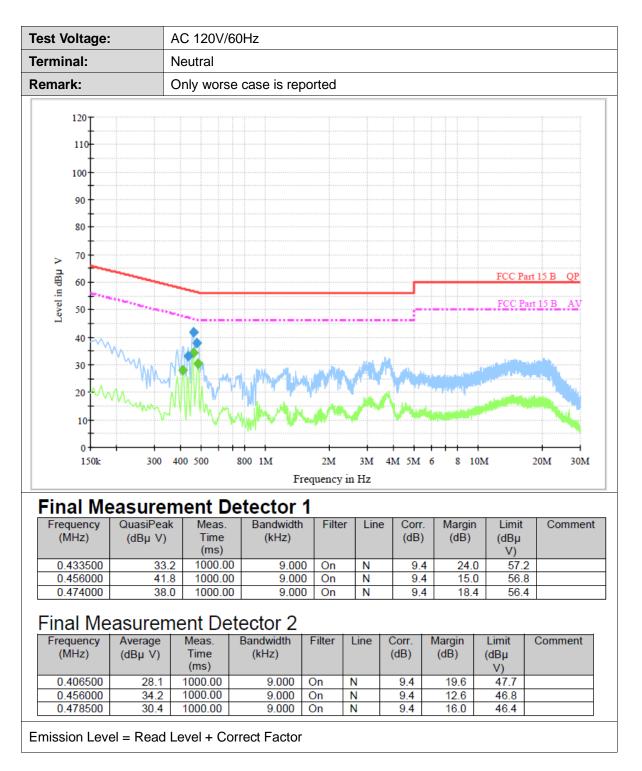


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Freq (M 0.4 0.4 0.4 Fina Freq (M 0.4	20 10 10 150k al Me 438000 465000 478500 al Me uency Hz)	QuasiPeak (dBµ V) 35.8 40.3 42.0 easurem Average (dBµ V)	Meas. Time (ms) 1000.00 1000.00 1000.00 1000.00 1000.00 1000.00 Time (ms)	Etector Bandwidth (kHz) 9.000 9.000 9.000 9.000 9.000 9.000 9.000 9.000 9.000 9.000	Image: requency Image: Imag	Line Line Line Line	Corr. (dB) 9.5 9.5 9.5 Corr. (dB)	Margin (dB) 21.3 16.3 14.4 Margin (dB)	Limit (dBµ V) 57.1 56.6 56.4 Limit (dBµ V)	Comment

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3.2. Radiated Emission

<u>Limit</u>

FCC CFR Title 47 Part 15 Subpart C Section 15.209

Frequency	Field Strength	Measurement Distance
(MHz)	(microvolts/meter)	(meters)
0.009~0.490	2400/F (kHz)	300
0.490~1.705	24000/F (kHz)	30
1.705~30.0	30	30
30~88	100	3
88~216	150	3
216~960	200	3
960~1000	500	3

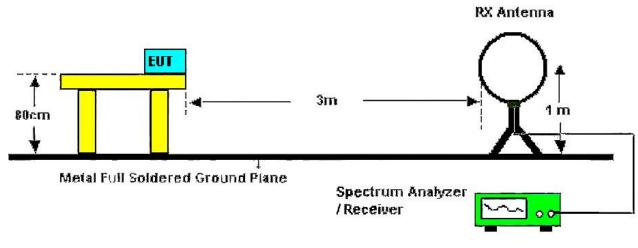
	dBµV/m (at 3 meters)		
Frequency Range (MHz)	Peak	Average	
Above 1000	74	54	

Note:

(1) The tighter limit applies at the band edges.

(2) Emission Level (dB μ V/m)=20log Emission Level (μ V/m).

Test Configuration



Below 30MHz Test Setup

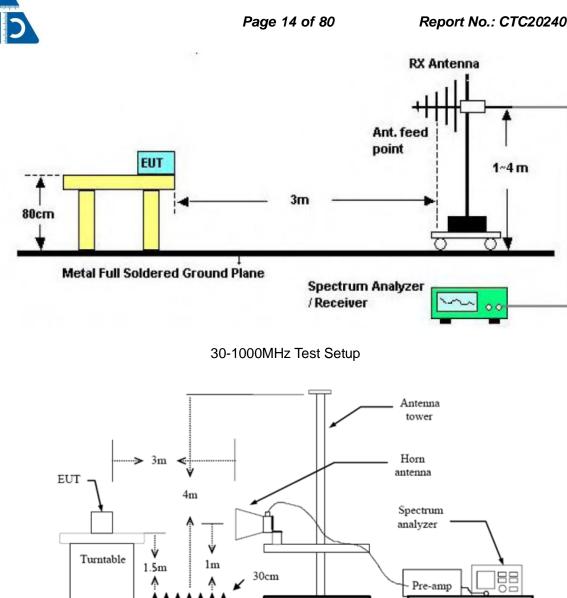
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Above 1GHz Test Setup

Test Procedure

1. The EUT was setup and tested according to ANSI C63.10:2013.

The EUT is placed on a turn table which is 0.8 meter above ground for below 1 GHz, and 1.5 m for 2. above 1 GHz. The turn table is rotated 360 degrees to determine the position of the maximum emission level.

The EUT was set 3 meters from the receiving antenna, which was mounted on the top of a variable 3. height antenna tower.

For each suspected emission, the EUT was arranged to its worst case and then tune the Antenna 4. tower (from 1 m to 4 m) and turntable (from 0 degree to 360 degrees) to find the maximum reading. A pre-amp and a high pass filter are used for the test in order to get better signal level to comply with the guidelines.

- Set to the maximum power setting and enable the EUT transmit continuously. 5.
- Use the following spectrum analyzer settings 6.
- Span shall wide enough to fully capture the emission being measured; (1)
- (2) 9k 150kHz:

RBW=300 Hz, VBW=1 kHz, Sweep=auto, Detector function=peak, Trace=max hold (3) 0.15M – 30MHz:

RBW=10 kHz, VBW=30 kHz, Sweep=auto, Detector function=peak, Trace=max hold (4) 30M - 1 GHz:

RBW=120 kHz, VBW=300 kHz, Sweep=auto, Detector function=peak, Trace=max hold If the emission level of the EUT measured by the peak detector is 3 dB lower than the applicable limit, the

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peak emission level will be reported. Otherwise, the emission measurement will be repeated using the quasi-peak detector and reported.

(5) From 1 GHz to 10th harmonic:

RBW=1MHz, VBW=3MHz Peak detector for Peak value.

RBW=1MHz, VBW see note 1 with Peak Detector for Average Value.

Note 1: For measurements above 1 GHz the resolution bandwidth is set to 1 MHz, then the video bandwidth is set to 3 MHz for peak measurements and 1 MHz resolution bandwidth with 1/T video bandwidth with peak detector for average measurements. For the Duty Cycle please refer to clause 3.10 Duty Cycle.

Test Mode

Please refer to the clause 2.4.

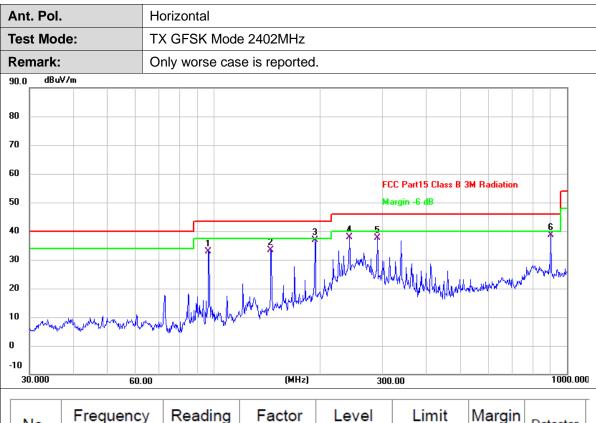
Test Result

9 kHz~30 MHz

From 9 kHz to 30 MHz: The conclusion is PASS.

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



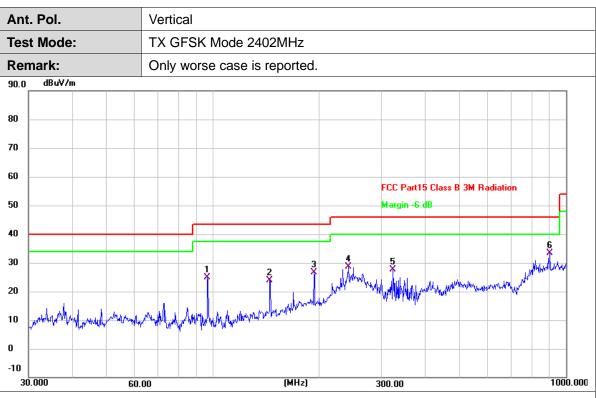


No.	Frequency (MHz)	Reading (dBuV)	Factor (dB/m)	Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Detector
1	96.4362	54.95	-22.13	32.82	43.50	-10.68	QP
2	144.8418	51.82	-18.53	33.29	43.50	-10.21	QP
3 *	193.0945	57.60	-20.77	36.83	43.50	-6.67	QP
4	241.6763	57.54	-19.73	37.81	46.00	-8.19	QP
5	290.0172	55.44	-17.86	37.58	46.00	-8.42	QP
6	900.1474	43.46	-4.92	38.54	46.00	-7.46	QP

1.Factor (dB/m) = Antenna Factor (dB/m)+Cable Factor (dB)-Pre-amplifier Factor

2.Margin value = Level -Limit value





No.	Frequency (MHz)	Reading (dBuV)	Factor (dB/m)	Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Detector
1	96.4362	47.12	-22.13	24.99	43.50	-18.51	QP
2	144.8418	42.46	-18.53	23.93	43.50	-19.57	QP
3	193.0945	47.36	-20.77	26.59	43.50	-16.91	QP
4	241.6763	48.39	-19.73	28.66	46.00	-17.34	QP
5	323.3204	44.58	-16.92	27.66	46.00	-18.34	QP
6 *	900.1474	38.35	-4.92	33.43	46.00	-12.57	QP

ΕN

1.Factor (dB/m) = Antenna Factor (dB/m)+Cable Factor (dB)-Pre-amplifier Factor

2.Margin value = Level -Limit value

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Ant. Pol.	Horizontal
Test Mode:	TX GFSK Mode 2402MHz
Remark:	No report for the emission which more than 20 dB below the prescribed limit.

No.	Frequency (MHz)	Reading (dBuV)	Factor (dB/m)	Level (dBuV/m)		Margin (dB)	Detector
1 *	4803.878	44.94	-3.40	41.54	54.00	-12.46	AVG
2	4803.910	50.24	-3.40	46.84	74.00	-27.16	peak

1.Factor (dB/m) = Antenna Factor (dB/m)+Cable Factor (dB)-Pre-amplifier Factor

2.Margin value = Level -Limit value

Ant. Pol.		Vertical					
Test Mod	de:	TX GFSK Mode 2402MHz					
Remark:No report for the emission which more than 20 dB below the prese limit.				rescribed			
No.	Frequency (MHz)	Reading (dBuV)	Factor (dB/m)	Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Detector
No. 1 *		· · ·					Detector AVG

Remarks:

1.Factor (dB/m) = Antenna Factor (dB/m)+Cable Factor (dB)-Pre-amplifier Factor

2.Margin value = Level -Limit value

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Ant. Pol.		Horizontal					
Test Mod	de:	TX GFSK Mo	de 2441MHz	2			
Remark:		No report for limit.	the emission	which more t	han 20 dB be	elow the p	rescribed
No.	Frequency (MHz)	Reading (dBuV)	Factor (dB/m)	Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Detector
1	4881.772	48.47	-3.26	45.21	74.00	-28.79	peak
2 *	4881.922	40.23	-3.26	36.97	54.00	-17.03	AVG
	1						<u> </u>

1.Factor (dB/m) = Antenna Factor (dB/m)+Cable Factor (dB)-Pre-amplifier Factor

2.Margin value = Level -Limit value

Ant. Po	l.	Vertical						
Fest Mo	de:	TX GFSK Mo	de 2441MHz	2				
Remark	:	No report for limit.	No report for the emission which more than 20 dB below the prescribed limit.					
No.	Frequency (MHz)	Reading (dBuV)	Factor (dB/m)	Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Detector	
1	4881.848	51.80	-3.26	48.54	74.00	-25.46	peak	
2 *	4881.878	47.60	-3.26	44.34	54.00	-9.66	AVG	

2.Margin value = Level -Limit value





Ant. Pol.		Horizontal	Horizontal					
Test Mode: TX GFSK Mode 2480MHz								
Remark:		No report for limit.	the emission	which more t	han 20 dB be	elow the p	rescribed	
No.	Frequency (MHz)	Reading (dBuV)	Factor (dB/m)	Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Detector	
1 *	4959.842	42.72	-3.10	39.62	54.00	-14.38	AVG	
2	4959.910	49.14	-3.10	46.04	74.00	-27.96	peak	
			·				<u>.</u>	

1.Factor (dB/m) = Antenna Factor (dB/m)+Cable Factor (dB)-Pre-amplifier Factor

2.Margin value = Level -Limit value

Ant. Pol.		Vertical						
Test Mod	e:	TX GFSK Mode 2480MHz						
Remark:		No report for the emission which more than 20 dB below the prescribe limit.					rescribed	
No.	Frequency (MHz)	Reading (dBuV)	Factor (dB/m)	Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Detector	
1 *	4960.036	43.78	-3.10	40.68	54.00	-13.32	AVG	
2	4960.136	49.83	-3.10	46.73	74.00	-27.27	peak	
	dB/m) = Antenna value = Level -L)+Cable Fac	tor (dB)-Pre-a	amplifier Fact	or		



Ant. Pol.	Horizontal
Test Mode:	TX π/4-DQPSK Mode 2402MHz
Remark:	No report for the emission which more than 20 dB below the prescribed limit.

No.	Frequency (MHz)	Reading (dBuV)	Factor (dB/m)	Level (dBuV/m)		Margin (dB)	Detector
1 *	4803.840	44.87	-3.40	41.47	54.00	-12.53	AVG
2	4803.874	50.03	-3.40	46.63	74.00	-27.37	peak

1.Factor (dB/m) = Antenna Factor (dB/m)+Cable Factor (dB)-Pre-amplifier Factor 2.Margin value = Level -Limit value

Ant. Pol.	Vertical
Test Mode:	TX π/4-DQPSK Mode 2402MHz
Remark:	No report for the emission which more than 20 dB below the prescribed limit.

No.	Frequency (MHz)	Reading (dBuV)	Factor (dB/m)	Level (dBuV/m)		Margin (dB)	Detector
1 *	4803.848	46.87	-3.40	43.47	54.00	-10.53	AVG
2	4803.908	51.00	-3.40	47.60	74.00	-26.40	peak

Remarks:

1.Factor (dB/m) = Antenna Factor (dB/m)+Cable Factor (dB)-Pre-amplifier Factor

2.Margin value = Level -Limit value



Ant. Pol.		Horizontal					
Test Mode: ΤΧ π/4-DQPSK Mode 2441MHz							
Remark:		No report for limit.	the emission	which more t	han 20 dB be	elow the p	rescribed
No.	Frequency (MHz)	Reading (dBuV)	Factor (dB/m)	Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Detector
No.		· · · ·				-	Detector AVG

1.Factor (dB/m) = Antenna Factor (dB/m)+Cable Factor (dB)-Pre-amplifier Factor

2.Margin value = Level -Limit value

Test Mode: TX π/4-DQPSK Mode 2441MHz Remark: No report for the emission which more than 20 dB below the prescritimit. No. Frequency (MHz) Reading (dBuV) Factor (dB/m) Level (dBuV/m) Limit (dB) Determine	bed									
No Frequency Reading Factor Level Limit Margin	bed									
	ector									
1 4881.846 51.52 -3.26 48.26 74.00 -25.74 pe	ak									
2 * 4881.864 46.18 -3.26 42.92 54.00 -11.08 AV	/G									

2.Margin value = Level -Limit value



Ant. Pol.		Horizontal					
Test Mode: TX π/4-DQPSK Mode 2480MHz							
Remark:		No report for limit.	the emission	which more t	han 20 dB be	elow the p	rescribed
No.	Frequency (MHz)	Reading (dBuV)	Factor (dB/m)	Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Detector
1	4959.976	48.91	-3.10	45.81	74.00	-28.19	peak
2 *	4960.046	42.21	-3.10	39.11	54.00	-14.89	AVG
							l

1.Factor (dB/m) = Antenna Factor (dB/m)+Cable Factor (dB)-Pre-amplifier Factor

2.Margin value = Level -Limit value

A	nt. Pol.		Vertical						
Т	est Mod	le:	TX π/4-DQPSK Mode 2480MHz						
R	Remark:		No report for the emission which more than 20 dB below the prescril limit.					rescribed	
	No.	Frequency (MHz)	Reading (dBuV)	Factor (dB/m)	Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Detector	
	1	4959.952	50.12	-3.10	47.02	74.00	-26.98	peak	
ľ	2 *	4960.014	43.55	-3.10	40.45	54.00	-13.55	AVG	
-									
1		: (dB/m) = Antenn value = Level -L	· ·	n)+Cable Fac	tor (dB)-Pre-a	amplifier Fact	or		



Ant. Pol.	Horizontal
Test Mode:	TX 8-DPSK Mode 2402MHz
Remark:	No report for the emission which more than 20 dB below the prescribed limit.

No.	Frequency (MHz)	Reading (dBuV)	Factor (dB/m)	Level (dBuV/m)		Margin (dB)	Detector
1 *	4803.876	44.47	-3.40	41.07	54.00	-12.93	AVG
2	4803.914	49.88	-3.40	46.48	74.00	-27.52	peak

1.Factor (dB/m) = Antenna Factor (dB/m)+Cable Factor (dB)-Pre-amplifier Factor 2.Margin value = Level -Limit value

Ant. Pol.	Vertical
Test Mode:	TX 8-DPSK Mode 2402MHz
Remark:	No report for the emission which more than 20 dB below the prescribed limit.

No.	Frequency (MHz)	Reading (dBuV)	Factor (dB/m)	Level (dBuV/m)		Margin (dB)	Detector
1 *	4803.762	46.65	-3.40	43.25	54.00	-10.75	AVG
2	4803.920	51.15	-3.40	47.75	74.00	-26.25	peak

Remarks:

1.Factor (dB/m) = Antenna Factor (dB/m)+Cable Factor (dB)-Pre-amplifier Factor

2.Margin value = Level -Limit value





Ant. Pol.	1	Horizontal											
Test Mod	de:	TX 8-DPSK N	/lode 2441Ml	Ηz									
Remark:		No report for limit.	No report for the emission which more than 20 dB below the prescribed limit.										
No.	Frequency (MHz)	Reading (dBuV)	Factor (dB/m)	Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Detector						
1 *	4881.816	40.12	-3.26	36.86	54.00	-17.14	AVG						
2	4881.836	47.88	-3.26	44.62	74.00	-29.38	peak						

1.Factor (dB/m) = Antenna Factor (dB/m)+Cable Factor (dB)-Pre-amplifier Factor

2.Margin value = Level -Limit value

nt. Pol		Vertical					
est Mo	de:	TX 8-DPSK N	/lode 2441Ml	Ηz			
Remark		No report for limit.	the emission	which more t	han 20 dB be	elow the p	rescribed
No.	Frequency (MHz)	Reading (dBuV)	Factor (dB/m)	Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Detector
1 *	4881.816	46.33	-3.26	43.07	54.00	-10.93	AVG
2	4881.892	51.35	-3.26	48.09	74.00	-25.91	peak



Ant. Pol.		Horizontal								
Test Mod	de:	TX 8-DPSK N	/lode 2480Ml	Hz						
Remark:		No report for the emission which more than 20 dB below the prescribe limit.								
No.	Frequency (MHz)	Reading (dBuV)	Factor (dB/m)	Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Detector			
1 *	4959.866	42.02	-3.10	38.92	54.00	-15.08	AVG			
2	4959.956	48.88	-3.10	45.78	74.00	-28.22	peak			
		- · · ·	-							

1.Factor (dB/m) = Antenna Factor (dB/m)+Cable Factor (dB)-Pre-amplifier Factor

2.Margin value = Level -Limit value

Ant. Pol	-	Vertical										
Test Mo	de:	TX 8-DPSK M	lode 2480M	Ηz								
Remark:		No report for timit.	the emission	which more t	han 20 dB be	low the p	rescribed					
	-											
No.	Frequency (MHz)	Reading (dBuV)	Factor (dB/m)	Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Detector					
1	4959.976	49.74	-3.10	46.64	74.00	-27.36	peak					
2 *	4960.032	43.28	-3.10	40.18	54.00	-13.82	AVG					
				-								
	: (dB/m) = Antenn value = Level -L		n)+Cable Fac	tor (dB)-Pre-a	amplifier Fact	or						

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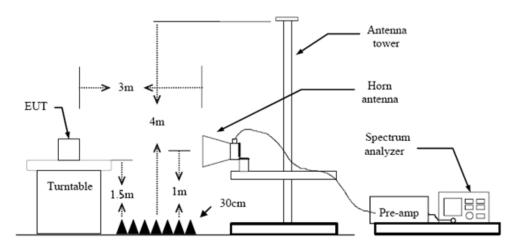
3.3. Band Edge Emissions (Radiated)

Limit

FCC CFR Title 47 Part 15 Subpart C Section 15.247 (d)

Restricted Frequency Band	(dBµV/m	ı) (at 3m)
(MHz)	Peak	Average
2310 ~ 2390	74	54
2483.5 ~ 2500	74	54

Test Configuration



Test Procedure

1. The EUT was setup and tested according to ANSI C63.10:2013 requirements.

The EUT is placed on a turn table which is 1.5 meter above ground. The turn table is rotated 360 2. degrees to determine the position of the maximum emission level.

The EUT was positioned such that the distance from antenna to the EUT was 3 meters. 3.

4. The antenna is scanned from 1 meter to 4 meters to find out the maximum emission level. This is repeated for both horizontal and vertical polarization of the antenna. In order to find the maximum emission, all of the interface cables were manipulated according to ANSI C63.10:2013 on radiated measurement. The receiver set as follow: 5

RBW=1MHz, VBW=3MHz Peak detector for Peak value.

RBW=1MHz, VBW see note 1 with Peak Detector for Average Value.

Note 1: For measurements above 1 GHz the resolution bandwidth is set to 1 MHz, then the video bandwidth is set to 3 MHz for peak measurements and 1 MHz resolution bandwidth with 1/T video bandwidth with peak detector for average measurements. For the Duty Cycle please refer to clause 3.10 Duty Cycle.

Test Mode

Please refer to the clause 2.4.

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Ant. Pol	•		Horizontal										
Fest Mo	de:		GFSK M	ode 240	2MHz								
10.0 dBu	iV/m												
100													
0													
								FCC Part 15C 3M	Above-16 Pea				
0									ADOTE TO T CO				
:0								FCC Part 15C 3M	Above-16 AV	-++			
0									×	7			
0									2				
D													
o													
0.0 2305.000	2315.00	2325.00	2335.00	2345.0	0 (MH:		5.00	2375.00 2385	.00 2395.0	0 2405.0			
						-							
No.	Frequ (MF		Readi (dBu\		Factor dB/m)		vel iV/m)	Limit (dBuV/m)	Margin (dB)	Detector			
No. 1		lz)		/) ((dBu				Detector peak			

1.Factor (dB/m) = Antenna Factor (dB/m)+Cable Factor (dB)-Pre-amplifier Factor 2.Margin value = Level -Limit value

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Ant. Pol.			Vertical											
est Mod	de:		GFSK M	lode 2	2402MH	z								
10.0 dBu\	V/m													_
00														
ı														
,									FCC Part	15C 3M /	Above-16	i Peak	+	H
ı													\downarrow	
. –									FCC Part	15C 3M	Aboye-16	i AV	+	+
)													1	
'							<u></u>				2)	1
)														_
ı														_
).0 2305.000	2315.00	2325.00	2335.00	23	45.00	(MHz)	236	5.00	2375.00	2385	00 2	395.00	1	2405.1
No.	Frequency		Read		Fact		1	vel	Lir		Març		Det	ector
	(MF		(dBu	-	(dB/r	· ·	-		(dBuV/m)		· ·			
1	2390.		19.8		31.0			.88		.00	-23.1		-	eak
2 *	2390.	000	7.5	7	31.0	8	38	.65	54	.00	-15.3	·		

1.Factor (dB/m) = Antenna Factor (dB/m)+Cable Factor (dB)-Pre-amplifier Factor 2.Margin value = Level -Limit value

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Ant	. Pol.		Horizontal					
Tes	t Mod	le:	GFSK Mode	2480MHz				
110.0) dBu¥	//m		1			i	
100								
90	Λ							
80	\wedge					FCC Part 15C 3M /	Above-1G Pea	k
70								
60	\square					FCC Part 15C 3M /	Above-1G AV	
50								
40		2				y	~~~~	monson
30								
20 10.0								
	77.000	2487.00 2497.0	0 2507.00 2	517.00 (MHz)	2537.00	2547.00 2557.	00 2567.0	10 2577.00
				1	Ι	1		
N	۹o.	Frequency (MHz)	Reading (dBuV)	Factor (dB/m)	Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Detector
	1	2483.500	20.30	31.43	51.73	74.00	-22.27	peak
2	2 *	2483.500	9.11	31.43	40.54	54.00	-13.46	AVG

1.Factor (dB/m) = Antenna Factor (dB/m)+Cable Factor (dB)-Pre-amplifier Factor 2.Margin value = Level -Limit value

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No. Frequency (MHz) Reading (dBuV) Factor (dB/m) Level (dBuV/m) Limit (dBuV/m) Margin (dBuV/m) Dete	nt. Pol			Verti	cal									
No. Frequency (MHz) Reading (dBuV) Factor (dB/m) Level (dBuV/m) Limit (dBuV/m) Margin (dBuV/m) Dete	est Moo	de:		GFS	K Mode	2480MHz								
No. Frequency (MHz) Reading (dBuV) Factor (dB/m) Level (dBuV/m) Limit (dBuV/m) Margin (dBuV/m) Dete	0.0 dBu	//m												
No. Frequency (MHz) Reading (dBuV) Factor (dB/m) Level (dBuV/m) Limit (dBuV/m) Margin (dBuV/m) Dete	0													
No. Frequency (MHz) Reading (dBuV) Factor (dB/m) Level (dBuV/m) Limit (dBuV/m) Margin (dBuV/m) Dete	A	Λ												
No. Frequency (MHz) Reading (dBuV) Factor (dB/m) Level (dBuV/m) Limit (dBuV/m) Margin (dB) Dete	·										15C 2M	About 16	Posk	
No. Frequency (MHz) Reading (dBuV) Factor (dB/m) Level (dBuV/m) Limit (dBuV/m) Margin (dB) Dete	· Ħ											ADUYE-TO	r edk	
No. Frequency (MHz) Reading (dBuV) Factor (dB/m) Level (dBuV/m) Limit (dBuV/m) Margin (dB) Dete										450.01				
No. Frequency (MHz) Reading (dBuV) Factor (dB/m) Level (dBuV/m) Limit (dBuV/m) Margin (dB) Dete		ż.								FUC Part	15C 3M	Above-16		
No. Frequency (MHz) Reading (dBuV) Factor (dB/m) Level (dBuV/m) Limit (dBuV/m) Margin (dB) Dete		2		·										
No. Frequency (MHz) Reading (dBuV) Factor (dB/m) Level (dBuV/m) Limit (dBuV/m) Margin (dB) Dete														
No. Frequency (MHz) Reading (dBuV) Factor (dB/m) Level (dBuV/m) Limit (dBuV/m) Margin (dB) Dete														
2476.000 2486.00 2496.00 2506.00 2516.00 (MHz) 2536.00 2546.00 2556.00 2566.00 2 No. Frequency (MHz) Reading (dBuV) Factor (dB/m) Level (dBuV/m) Limit (dBuV/m) Margin (dB) Dete														
No. (MHz) (dBuV) (dB/m) (dBuV/m) (dBuV/m) (dB) Dete	2476.000	2486.00	2496.0	0 250	6.00 2	516.00 (M	Hz)	253	6.00	2546.00	2556.	00 25	66.00	2576.0
1 2402 500 40.05 24.40 50.40 74.00 20.50	No.		-											tector
1 2483.500 19.05 31.43 50.48 74.00 -23.52 per	1	248	3.500	1	9.05	31.43	}	50.	48	74.00		-23.5	2 p	eak
2 * 2483.500 7.94 31.43 39.37 54.00 -14.63 AV	2 *	248	3.500	7	7.94	31.43	}	39.	37	54	.00	-14.6	3 A	VG

2.Margin value = Level -Limit value

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Ant	. Pol.			Horiz	ontal										
	t Mod	le:				Mode 24	102M	Hz							
110.0															_
100														_	
90													л	_	
80								FCC Part	15C 3M /	Above-1G	Peak		_		
70						_									Ħ
60							ECC Part	15C 3M	Above-1G	Δ٧	_	ļ.			
50												1 X	-	\mp	1
40												2]	4
30													_		_
20													_		
10.0	05.000	2315.00	2325.00	2335	.00 23	345.00	(MHz)	226	5.00	2375.00	2385	00 23	395.0	.	2405.00
								1							
N	lo.	Frequ (MI			ading BuV)	Fac (dB/			vel V/m)	Lin (dBu)		Marg (dB		Dete	ector
	1	2390	.000	17	7.84	31.0	8	48	.92	74.	00	-25.0	8	pe	ak
2	*	2390	.000	7	.31	31.0	8(38.	.39	54.	00	-15.6	61	A٧	′G
		* 2390.000 7.31													

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Remarks:

1.Factor (dB/m) = Antenna Factor (dB/m)+Cable Factor (dB)-Pre-amplifier Factor 2.Margin value = Level -Limit value

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Ant. Pol.		,	Vertical											
Test Mode:			π/4-DQPSK Mode 2402MHz											
10.0 dBu	V/m													
00														
o														
o								FCC Part 15	1 3M A	bove-16 Pe	ak	A		
0												Ħ		
D								FCC Part 15	C 3M A	bove-1G AV	,	+		
0										1 X				
0								·		2				
)														
)												_		
0.0 2305.000	2315.00	2325.00	2335.00	2345.00	(MHz)	236	5.00	2375.00	2385.0	00 2395	00	2405.0		
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1.Factor (dB/m) = Antenna Factor (dB/m)+Cable Factor (dB)-Pre-amplifier Factor

2.Margin value = Level -Limit value





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1.Factor (dB/m) = Antenna Factor (dB/m)+Cable Factor (dB)-Pre-amplifier Factor 2.Margin value = Level -Limit value

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Ant. Pol.		V	Vertical π/4-DQPSK Mode 2480MHz												
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2.Margin value = Level -Limit value

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	2390.	000	18.39		31.08		49.47		74.00		-24.5	53	pea	k
1		000	7.33		31.08		38.4	4	54	00	-15.5	0	AVC	`

1.Factor (dB/m) = Antenna Factor (dB/m)+Cable Factor (dB)-Pre-amplifier Factor 2.Margin value = Level -Limit value

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le:		8-DPSK Mode 2402MHz							
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1.Factor (dB/m) = Antenna Factor (dB/m)+Cable Factor (dB)-Pre-amplifier Factor 2.Margin value = Level -Limit value

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Remarks:

1.Factor (dB/m) = Antenna Factor (dB/m)+Cable Factor (dB)-Pre-amplifier Factor 2.Margin value = Level -Limit value

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2.Margin value = Level -Limit value

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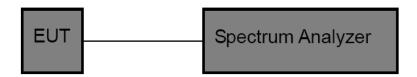
3.4. Band Edge and Spurious Emissions (Conducted)

<u>Limit</u>

FCC CFR Title 47 Part 15 Subpart C Section 15.247 (d)

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, 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.

Test Configuration



Test Procedure

- 1. The transmitter output was connected to the spectrum analyzer through an attenuator, the path loss was compensated to the results for each measurement.
- 2. Set to the maximum power setting and enable the EUT transmit continuously.
- Use the following spectrum analyzer settings: RBW = 100 kHz, VBW ≥ RBW, scan up through 10th harmonic. Sweep = auto, Detector function = peak, Trace = max hold.
- 4. Measure and record the results in the test report.

Test Mode

Please refer to the clause 2.4.



Test Result

Band Edge Conducted Test & Conducted Spurious Emissions Test

Modulation	Packet	Channel	OOB Emission Frequency (MHz)	OOB Emission Level (dBm)	Limit (dBm)	Over Limit (dB)	Result
			2400.00	-60.212	-26.69	-33.522	PASS
		0	2382.01	-59.437	-26.69	-32.747	PASS
GFSK	DH5		5223.90	-51.963	-26.69	-25.273	PASS
GFSK	DHC	39	24900.1	-51.976	-25.07	-26.906	PASS
		78	2483.50	-59.613	-24.17	-35.443	PASS
			7440.03	-52.427	-24.17	-28.257	PASS
		0	2400.00	-58.615	-26.71	-31.905	PASS
			24192.2	-52.913	-26.71	-26.203	PASS
π/4DQPSK	2-DH5	39	23528.6	-51.736	-25.07	-26.666	PASS
		70	2483.50	-58.581	-24.19	-34.391	PASS
		78	5745.15	-49.983	-24.19	-25.793	PASS
		0	2400.00	-59.082	-28.19	-30.892	PASS
		0	2593.86	-51.418	-28.19	-23.228	PASS
8DPSK	3-DH5	39	4881.79	-50.626	-28.54	-22.086	PASS
		70	2483.50	-63.873	-26.84	-37.033	PASS
		78	4960.45	-48.945	-26.84	-22.105	PASS

Hopping

Modulation	Packet	OOB Emission Frequency (MHz)	OOB Emission Level (dBm)	Limit (dBm)	Over Limit (dB)	Result
GFSK	DH5	2400.00	-60.574	-26.72	-33.854	PASS
GFSK	DHS	2483.50	-59.298	-24.14	-35.158	PASS
π/4DQPSK	2-DH5	2400.00	-55.847	-26.71	-29.137	PASS
11/4DQFSK	2-005	2483.50	-59.386	-24.23	-35.156	PASS
8DPSK	3-DH5	2400.00	-56.984	-28.36	-28.624	PASS
ODFSK		2483.50	-63.196	-26.75	-36.446	PASS



Band Edge Conducted & Conducted Spurious Emissions Test plot as follows:

Band Edge Conducted & Conducted Spu		rest plot as follows:	
Agitent Spectrum Analyzer - Swept SA	SENSE:INT	ALIGN AUTO 04:49:42 PM Mar 12, 2024	
Center Freq 2.40200000 0	PNO: Wide Trig: Free Run IFGain:Low #Atten: 26 dB	AvgType: Log-Pwr AvgType: Log-Pwr AvgType: Log-Pwr Drace 12 2 4 5 TYPE Type: Log-Pwr Drace 12 2 4 5 TYPE Type: Log-Pwr Drace 12 2 4 5 TYPE Type: Log-Pwr	
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-36.0			
-42.0			
-65.0			
-65.0			
-75.0			
Center 2.4020000 GHz #Res BW 100 kHz	#VBW 300 kHz	Span 1.500 MHz Sweep 1.000 ms (1001 pts)	
MSG		STATUS	
	In-Band Reference		
	GFSK_DH5_Cha	annel 0	
Agilent Spectrum Analyzer - Swept SA	SENSE:INT	ALISN AUTO D4:50:03 PM Mar 12, 2024 Avg Type: Log-Pwr TRACE D P C LOG Avg Lid (200100 Trace Trace D P C LOG	
Center Freq 2.352500000 0	PNO: Fast Trig: Free Run IFGain:Low #Atten: 26 dB	Avg Type: Log-Pwr Avg[Hold: 100/100 Det PPPPP	
	iFGain:Low #Atten: 26 aB	Mkr1 2.382 010 GHz -59.437 dBm	
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	Out Of Band Em		
	GFSK_DH5_Cha	annel 0	
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Center Freq 12.515000000	GHz PNO: Fast IFGain:Low Atten: 26 dB	Avg Type: Log-Pwr Avg Hold: 10/10 DET PPPPP	
	IFGain:Low Atten: 26 dB	Mkr1 5.223 9 GHz	
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Start 30 MHz #Res BW 100 kHz	#VBW 300 kHz	Stop 25.00 GHz Sweep 2.387 s (40000 pts)	
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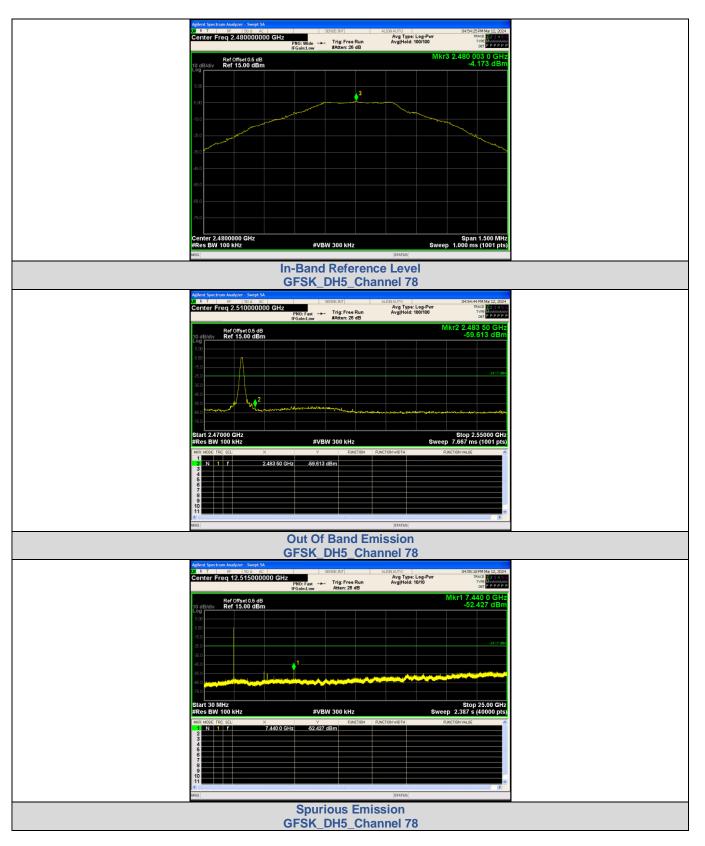
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Center Freq 2.441000	DOO GHZ PNO: Wide Trig: Free I	Avg Type: Log Run Avg Hold: 100/1	100 TRACE 2 3 4 5 6 TYPE TYPE DET PPPPP
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	In-Band Refe	ronco Lovol	
	GFSK_DH5_	Channel 39	
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Center Freq 12.51500	PNO: Fast Trig: Free I	Avg Type: Log Run Avg Hold: 10/10	PWr TRACE 123455 0 TYPE MODEL
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Start 30 MHz #Res BW 100 kHz	#VBW 300 kHz		Stop 25.00 GHz Sweep 2.387 s (40000 pts)
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interes	Onumia E		
	Spurious E		
	GFSK_DH5_	Channel 39	

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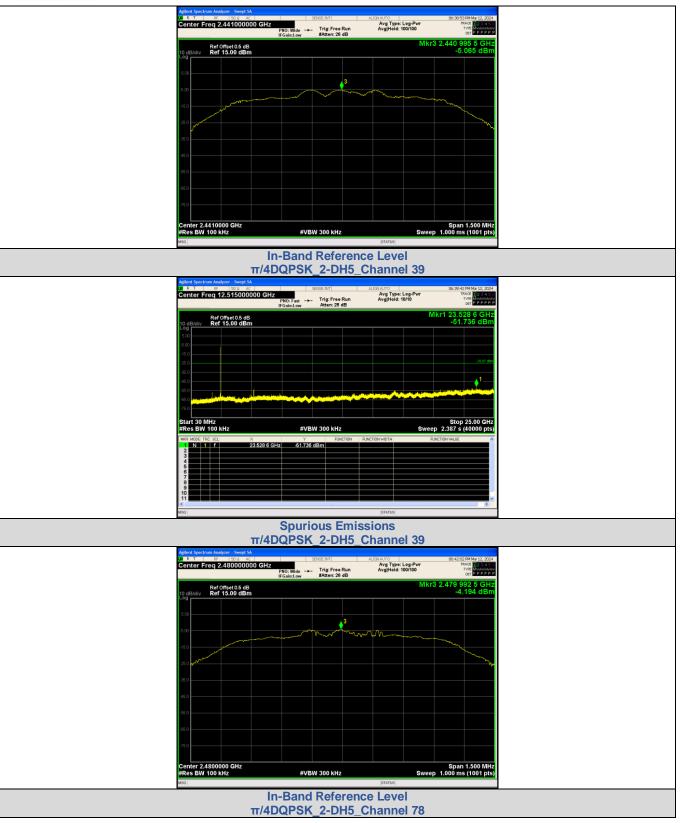


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	Agitent Spectrum Analyzer - Swept SA 120 R T RF 50 Q AC SENSE:INT ALIGN AUT	0 06/35/35 PM Mar 12, 2024
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	IFGain:Low #Atten: 26 dB	
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	00 R T RF 50 Q AC SENSE:INT ALIGNAUT	06335367PM Mar 12, 2024 Type: Log-Pwr 164350700
	PNO: Fast Trig: Free Run Avg IFGain:Low #Atten: 26 dB	DET Lakatatatat
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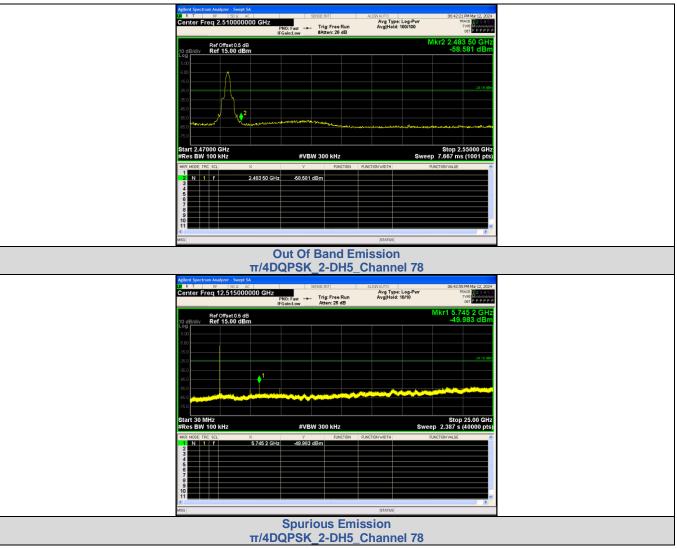


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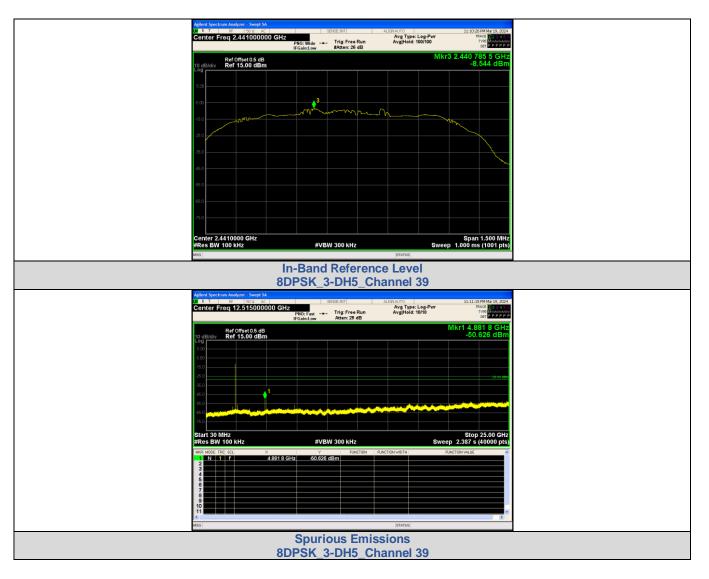
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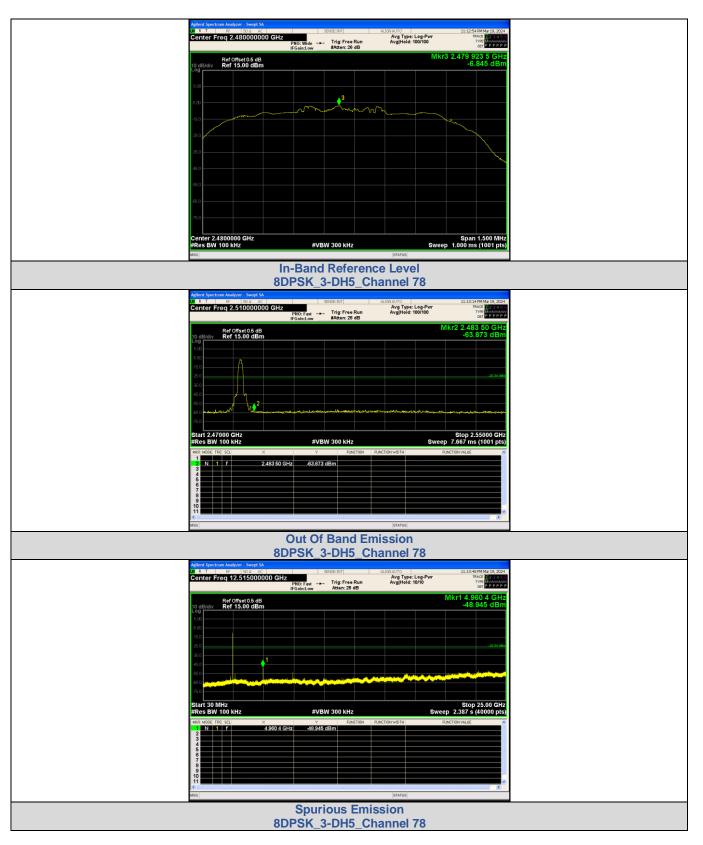
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Start 30 MHz Stop 25.00 GHz #Res BW 100 kHz #VBW 300 kHz Sweep 2.387 s (40000 pts)
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Spurious Emission
8DPSK_3-DH5_Channel 0

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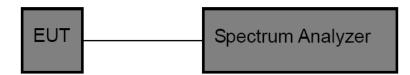


3.5. 20dB Bandwidth

Limit

N/A

Test Configuration



Test Procedure

- 1. The EUT was directly connected to the spectrum analyzer and antenna output port as show in the block diagram above.
- 2. OCB and 20dB Spectrum Setting:
 - (1) Set RBW = $1\% \sim 5\%$ occupied bandwidth.
 - (2) Set the video bandwidth (VBW) \geq 3 RBW.
 - (3) Detector = Peak.
 - (4) Trace mode = Max hold.
 - (5) Sweep = Auto couple.

Note: The EUT was set to continuously transmitting in each mode and low, Middle and high channel for the test.

Test Mode

Please refer to the clause 2.4.

Test Result

Test Mode	Frequency (MHz)	99% Bandwidth (MHz)	20dB Bandwidth (MHz)	20dB Bandwidth *2/3 (MHz)
	2402	0.91488	1.033	0.689
GFSK	2441	0.94986	1.036	0.691
	2480	0.97186	1.065	0.710
	2402	1.1934	1.319	0.879
π/4-DQPSK	2441	1.2118	1.335	0.890
	2480	1.2524	1.347	0.898
	2402	1.1885	1.299	0.866
8-DPSK	2441	1.1888	1.298	0.865
	2480	1.1869	1.294	0.863

CTC Laboratories, Inc.