

# **FCC Test Report**

Report No.: AGC12188210301FE03

FCC ID	: 2AZJ9F9
APPLICATION PURPOSE	: Original Equipment
PRODUCT DESIGNATION	: True Wireless Stereo Earbuds
BRAND NAME	: N/A
MODEL NAME	F9, F1, W15, W18, A1, T1, T2, T3, W1, W2, W3, W6, W8, W9, W10, W12, W16, W19, W20, W21, W22, Q12, Q2, Q3
APPLICANT	: Shenzhen Wanwei Acoustics Co., Ltd.
DATE OF ISSUE	: Mar. 29, 2021
STANDARD(S)	: FCC Part 15.247
REPORT VERSION	: V1.0

Attestation of Global Action Co., Ltd

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# **REPORT REVISE RECORD**

<b>Report Version</b>	Revise Time	Issued Date	Valid Version	Notes
V1.0	1	Mar. 29, 2021	Valid	Initial Release

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# **1. VERIFICATION OF CONFORMITY**

Applicant	Shenzhen Wanwei Acoustics Co., Ltd.	
Address	Room 401, No.5, Fudigang Second Industrial Zone, Pidong Community, Pingdi Street, Longgang District, Shenzhen China	
Manufacturer	Shenzhen Wanwei Acoustics Co., Ltd.	
Address	Room 401, No.5, Fudigang Second Industrial Zone, Pidong Community, Pingdi Street, Longgang District, Shenzhen China	
Factory	Shenzhen Wanwei Acoustics Co., Ltd.	
Address	Room 401, No.5, Fudigang Second Industrial Zone, Pidong Community, Pingdi Street, Longgang District, Shenzhen China	
Product Designation	True Wireless Stereo Earbuds	
Brand Name	N/A	
Test Model	F9	
Series Model	F1, W15, W18, A1, T1, T2, T3, W1, W2, W3, W6, W8, W9, W10, W12, W16, W19, W20, W21, W22, Q12, Q2, Q3	
Difference Description	All the same except for the model name	
Date of test	Mar. 23, 2021 to Mar. 29, 2021	
Deviation	No any deviation from the test method	
Condition of Test Sample	Normal	
Test Result	Pass	
Report Template	AGCRT-US-BR/RF	

We hereby certify that:

The above equipment was tested by Attestation of Global Compliance (Shenzhen) Co., Ltd. The test data, data evaluation, test procedures, and equipment configurations shown in this report were made in accordance with the procedures given in ANSI C63.10 (2013) and the energy emitted by the sample EUT tested as described in this report is in compliance with radiated emission limits of FCC PART 15.247.

Prepared By

wed chang

Cool Cheng (Project Engineer)

Mar. 29, 2021

Max Zhan

Reviewed By

Max Zhang (Reviewer)

Mar. 29, 2021

Approved By

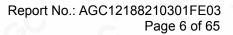
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Forrest Lei (Authorized Officer)

Mar. 29, 2021

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# 2. GENERAL INFORMATION

# 2.1. PRODUCT DESCRIPTION

The EUT is designed as "True Wireless Stereo Earbuds". It is designed by way of utilizing the GFSK, Pi/4 DQPSK technology to achieve the system operation.

A major technical description of EUT is described as following

Operation Frequency	2.402 GHz to 2.480 GHz	
RF Output Power	-4.199dBm (Max)	
Bluetooth Version	V5.1	
Modulation	BR $\boxtimes$ GFSK, EDR $\boxtimes \pi$ /4-DQPSK, $\square$ 8DPSK BLE $\square$ GFSK 1Mbps $\square$ GFSK 2Mbps	
Number of channels	79	
Hardware Version	V1.2	
Software Version	V1.0	
Antenna Designation	Ceramic Antenna (Comply with requirements of the FCC part 15.203)	
Antenna Gain	2dBi	
Power Supply	DC 3.7V by battery	
Note: 1. The EUT doesn't su	upport 8DPSK and BLE.	

2. The EUT comprises left and right channel headsets, both are the same, the left headset had been tested and recorded in this report as the worst case.

# 2.2. TABLE OF CARRIER FREQUENCYS

Frequency Band	Channel Number	Frequency
	0	2402 MHz
	C 1	2403 MHz
	38	2440 MHz
2402~2480MHz	39	2441 MHz
	40	2442 MHz
	77	2479 MHz
	78	2480 MHz

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# 2.3. RECEIVER INPUT BANDWIDTH

The input bandwidth of the receiver is 1.3MHz, in every connection one Bluetooth device is the master and the other one is slave. The master determines the hopping sequence. The slave follows this sequence. Both devices shift between RX and TX time slot according to the clock of the master. Additionally, the type of connection (e.g. single of multi slot packet) is set up at the beginning of the connection. The master adapts its hopping frequency and its TX/RX timing according to the packet type of the connection. Also, the slave of the connection will use these settings. Repeating of a packet has no influence on the hopping sequence. The hopping sequence generated by the master of the connection will be followed in any case. That means, a repeated packet will not be send on the same frequency, it is send on the next frequency of the hopping sequence.

#### 2.4. EXAMPLE OF A HOPPING SEQUENCY IN DATA MODE

Example of a hopping sequence in data mode: 40, 21, 44, 23, 04, 15, 66, 56, 19, 78, 07, 28, 69, 55, 36, 45, 05, 13, 43, 74, 57, 35, 67, 76, 02, 34, 54, 63, 42, 11, 30, 06, 64, 25, 75, 48, 17, 33, 58, 01, 29, 14, 51, 72, 03, 31, 50, 61, 77, 18, 10, 47, 12, 68, 08, 49, 20, 00, 73, 09, 16, 60, 71, 41, 24, 53, 38, 26, 46, 37, 65, 32, 70, 52, 27, 59, 22, 62, 39

# 2.5. EQUALLY AVERAGE USE OF FREQUENCIES AND BEHAVIOUR

The generation of the hopping sequence in connection mode depends essentially on two input values:

1. LAP/UAP of the master of the connection.

2. Internal master clock.

The LAP (lower address part) are the 24 LSB's of the 48 BD\_ADDRESS. The BD\_ADDRESS is an unambiguous number of every Bluetooth unit. The UAP (upper address part) are the 24MSB's of the 48BD\_ADDRESS

The internal clock of a Bluetooth unit is derived from a free running clock which is never adjusted and is never turned off. For behavior action with other units only offset is used. It has no relation to the time of the day. Its resolution is at least half the RX/TX slot length of 312.5us. The clock has a cycle of about one day(23h30). In most case it is implemented as 28 bits counter. For the deriving of the hopping sequence the entire. LAP (24 bits),4LSB's(4bits) (Input 1) and the 27MSB's of the clock (Input 2) are used. With this input values different mathematical procedures (permutations, additions, XOR-operations) are performed to generate the Sequence. This will be done at the beginning of every new transmission.

Regarding short transmissions the Bluetooth system has the following behavior:

The first connection between the two devices is established, a hopping sequence was generated. For Transmitting the wanted data the complete hopping sequence was not used. The connection ended.

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The second connection will be established. A new hopping sequence is generated. Due to the fact the Bluetooth clock has a different value, because the period between the two transmission is longer (and it Cannot be shorter) than the minimum resolution of the clock(312.5us). The hopping sequence will always differ from the first one.

# 2.6. RELATED SUBMITTAL(S) / GRANT (S)

This submittal(s) (test report) is intended for **FCC ID: 2AZJ9F9** filing to comply with the FCC PART 15.247 requirements.

# 2.7. TEST METHODOLOGY

Both conducted and radiated testing was performed according to the procedures in ANSI C63.10 (2013). Radiated testing was performed at an antenna to EUT distance 3 meters.

# 2.8. SPECIAL ACCESSORIES

Refer to section 5.2.

# 2.9. EQUIPMENT MODIFICATIONS

Not available for this EUT intended for grant.

# 2.10. ANTENNA REQUIREMENT

This intentional radiator is designed with a permanently attached antenna of an antenna to ensure that no antenna other than that furnished by the responsible party shall be used with the device. For more information of the antenna, please refer to the APPENDIX B: PHOTOGRAPHS OF EUT.

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# **3. 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%.

- Uncertainty of Conducted Emission, Uc = ±3.1 dB
- Uncertainty of Radiated Emission below 1GHz, Uc = ±4.0 dB
- Uncertainty of Radiated Emission above 1GHz, Uc = ±4.8 dB
- Uncertainty of total RF power, conducted, Uc = ±0.8dB
- Uncertainty of spurious emissions, conducted, Uc = ±2.7dB
- Uncertainty of Occupied Channel Bandwidth: Uc = ±2 %
- Uncertainty of Dwell Time: Uc =  $\pm 2$  %
- Uncertainty of Frequency: Uc = ±2 %

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# **4. DESCRIPTION OF TEST MODES**

NO.	TEST MODE DESCRIPTION	
1	Low channel GFSK	
2	Middle channel GFSK	
3	High channel GFSK	
4	Low channel π/4-DQPSK	
5	Middle channel π/4-DQPSK	
6	High channel π/4-DQPSK	
◎ 7	Hopping mode GFSK	
8	Hopping mode π/4-DQPSK	

Note:

1. Only the result of the worst case was recorded in the report, if no other cases.

- 2. For Radiated Emission, 3axis were chosen for testing for each applicable mode.
- 3. For Conducted Test method, a temporary antenna connector is provided by the manufacture.

Software Setting

助(H)		
串口设置 串 口 COM2 (USB-SERIAL CH340)	配置数据发送成功! reply data: 04 0E 04 01 01 FC 00	
波特率 115200	return code: 0x0 配置数据发送成功!	
数据位 8	reply data: 04 0E 04 01 01 FC 00	
校验位 None	return code: 0x0	
停止位 1 流 控 NoFlow	<ul> <li>配置数据发送成功!</li> <li>reply data: 04 0E 04 01 01 FC 00</li> <li>return code: 0×0</li> </ul>	[
流 投 Norlow 关闭	<ul> <li>return code: 0x0&lt;</li> <li>配置数据发送成功!</li> <li>reply data: 04 0E 04 01 01 FC 00</li> </ul>	
	return code: 0x0 配置数据发送成功 ! reply data: 04 06 04 01 01 FC 00 return code: 0x0 配置数据发送成功 !	
	reply data: 04 0E 04 01 01 FC 00	
	RET CODE: 000     配置数据发送成功 !     reply data: 04 0E 04 01 01 FC 00	
Data_Types Pn9	■ return code: 0x0 面音数据发送成功 !	
Send configuration	reply data: 04 0E 04 01 01 FC 00 return code: 0x0	
	配置数据发送成功! reply data: 04 0E 04 01 01 FC 00	
	return code: 0x0	
	配置数据发送成功!	

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# **5. SYSTEM TEST CONFIGURATION**

5.1. CONFIGURATION OF EUT SYSTEM

Radiated Emission Configure:

EUT

Conducted Emission Configure:

	0	
EUT		AE

# 5.2. EQUIPMENT USED IN TESTED SYSTEM

Item	Equipment	Model No.	ID or Specification	Remark
1	True Wireless Stereo Earbuds	F9	2AZJ9F9	EUT
2	Control Box	N/A	USB-TTL	AE

# 5.3. SUMMARY OF TEST RESULTS

FCC RULES	DESCRIPTION OF TEST	RESULT
15.247 (b)(1)	Peak Output Power	Compliant
15.247 (a)(1)	20 dB Bandwidth	Compliant
15.247 (d)	Conducted Spurious Emission	Compliant
15.209	Radiated Emission	Compliant
15.247 (a)(1)(iii)	Number of Hopping Frequency	Compliant
15.247 (a)(1)(iii)	Time of Occupancy	Compliant
15.247 (a)(1)	Frequency Separation	Compliant
15.207	Conducted Emission	Not applicable

Note: The BT function cannot transmit when charging.

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# 6. TEST FACILITY

Test Site	Attestation of Global Compliance (Shenzhen) Co., Ltd						
Location	1-2/F, Building 19, Junfeng Industrial Park, Chongqing Road, Heping Community, Fuhai Street, Bao'an District, Shenzhen, Guangdong, China						
Designation Number	CN1259						
FCC Test Firm Registration Number	975832						
A2LA Cert. No.	5054.02						
Description	Attestation of Global Compliance (Shenzhen) Co., Ltd is accredited by A2LA						

# TEST EQUIPMENT OF RADIATED EMISSION TEST

Equipment	Manufacturer	Model	S/N	Cal. Date	Cal. Due
TEST RECEIVER	R&S	ESCI	10096	May 15, 2020	May 14, 2021
EXA Signal Analyzer	Aglient	N9010A	MY53470504	Dec. 07, 2020	Dec. 06, 2021
2.4GHz Filter	EM Electronics	2400-2500MHz	N/A	Mar. 23, 2020	Mar. 22, 2022
Attenuator	ZHINAN	E-002	N/A	Sep. 03, 2020	Sep. 02, 2022
Horn antenna	SCHWARZBECK	BBHA 9170	#768	Sep. 21, 2019	Sep. 20, 2021
Active loop antenna (9K-30MHz)	ZHINAN	ZN30900C	18051	May 22, 2020	May 21, 2022
Double-Ridged Waveguide Horn	ETS LINDGREN	3117	00034609	May 17, 2019	May 16, 2021
Broadband Preamplifier	ETS LINDGREN	3117PA	00225134	Sep. 03, 2020	Sep. 02, 2022
ANTENNA	SCHWARZBECK	VULB9168	494	Jan. 08, 2021	Jan. 07, 2023
Test software	Tonscend	JS32-RE (Ver.2.5)	N/A	N/A	N/A

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# 7. PEAK OUTPUT POWER

# 7.1. MEASUREMENT PROCEDURE

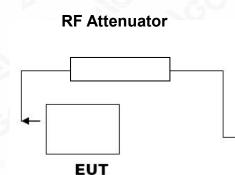
For peak power test:

- 1. Connect EUT RF output port to the Spectrum Analyzer through an RF attenuator
- 2. Span: Approximately five times the 20 dB bandwidth, centered on a hopping channel.
- 3. RBW > 20 dB bandwidth of the emission being measured.
- 4. VBW  $\geq$  RBW.
- 5. Sweep: Auto.
- 6. Detector function: Peak.
- 7. Trace: Max hold.

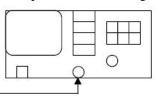
Allow trace to stabilize. Use the marker-to-peak function to set the marker to the peak of the emission. The indicated level is the peak output power, after any corrections for external attenuators and cables.

# 7.2. TEST SET-UP (BLOCK DIAGRAM OF CONFIGURATION)

# PEAK POWER TEST SETUP



# **Spectrum Analyzer**



**RF** Cable

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#### 7.3. LIMITS AND MEASUREMENT RESULT

PEAK OUTPUT POWER MEASUREMENT RESULT FOR GFSK MOUDULATION							
Frequency (GHz)	Peak Power (dBm)	Applicable Limits (dBm)	Pass or Fail				
2.402	-7.282	21	Pass				
2.441	-6.159	21	Pass				
2.480	-4.982	21	Pass				





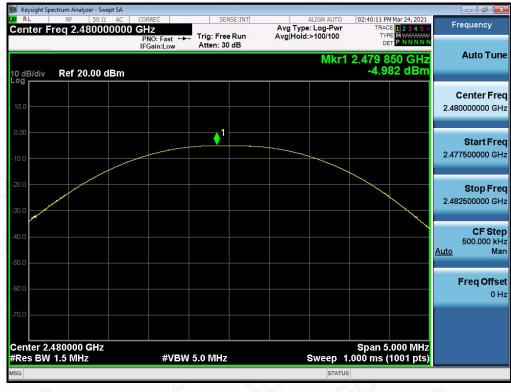
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**CH39** 02:38:45 PM Mar 24, 2021 ENSE:INT Avg Type: Log-Pwr Avg|Hold: 100/100 Frequency Center Freq 2.441000000 GHz Trig: Free Run Atten: 30 dB TYP PNO: Fast IFGain:Low Auto Tune Mkr1 2.440 820 GHz -6.159 dBm Ref 20.00 dBm 10 dB/div **Center Freq** 2.441000000 GHz ▲<sup>1</sup> Start Freq 2.438500000 GHz Stop Freq 2.443500000 GHz **CF** Step 500.000 kHz Auto Mar **Freq Offset** 0 Hz Center 2.441000 GHz #Res BW 1.5 MHz Span 5.000 MHz Sweep 1.000 ms (1001 pts) #VBW 5.0 MHz STATUS

CH78



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PEAK OUTPUT POWER MEASUREMENT RESULT FOR Π/4-DQPSK MODULATION								
Frequency (GHz)Peak Power (dBm)Applicable Limits (dBm)Pass or Fail								
2.402	-6.464	21	Pass					
2.441	-5.355	21	Pass					
2.480	-4.199	21	Pass					



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CH39



CH78

Keysight Spectrum Analyzer - Swept SA	CORREC	SENSE:INT		ALIGN AUTO	02:41:56 0	1 Mar 24, 2021	
Center Freq 2.48000000	) GHz	ig: Free Run	Avg Type Avg Hold:	: Log-Pwr	TRAC	E 1 2 3 4 5 6 E MWWWW	Frequency
		tten: 30 dB	Avginoid.	1. 2010/01 1 To 1 To 1 To 1	DE		Auto Tu
0 dB/div Ref 20.00 dBm				Mkr1	2.479 8	75 GHz 99 dBm	Auto Tu
							Center Fr
10.0							2.480000000 G
0.00			ē).				Start Fr
10.0							2.477500000 G
20.0							Stop Fr 2.482500000 G
30.0			e)				
10.0			63				CF St 500.000 F
0.0							Auto N
0.0							Freq Off
60.0			ō.				0
0.0							
enter 2.480000 GHz Res BW 1.5 MHz	#VBW 5.0	MHz		Sweep 1	Span 5 .000 ms (	.000 MHz 1001 pts)	
SG				STATUS	(		

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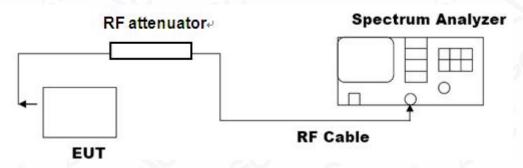


# 8. 20DB BANDWIDTH

#### 8.1. MEASUREMENT PROCEDURE

- 1. Connect EUT RF output port to the Spectrum Analyzer through an RF attenuator
- 2, Set the EUT Work on the top, the middle and the bottom operation frequency individually.
- 3. Set Span = approximately 2 to 5 times the 20 dB bandwidth, centered on a hoping channel The nominal IF filter bandwidth (3 dB RBW) shall be in the range of 1% to 5% of the OBW and video bandwidth (VBW) shall be approximately three times RBW; Sweep = auto; Detector function = peak
- 4. Set SPA Trace 1 Max hold, then View.

# 8.2. TEST SET-UP (BLOCK DIAGRAM OF CONFIGURATION)

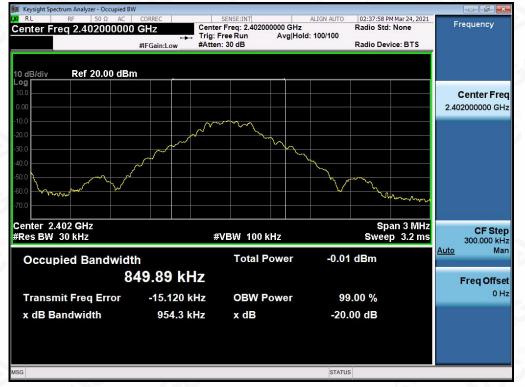


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#### **8.3. LIMITS AND MEASUREMENT RESULTS**

MEASUREMENT RESULT FOR GFSK MOUDULATION							
Annliachta Limite		Measurement Result					
Applicable Limits	Test Data	Criteria					
	Low Channel	0.954	PASS				
N/A	Middle Channel	0.952	PASS				
	High Channel	0.954	PASS				



#### TEST PLOT OF BANDWIDTH FOR LOW CHANNEL

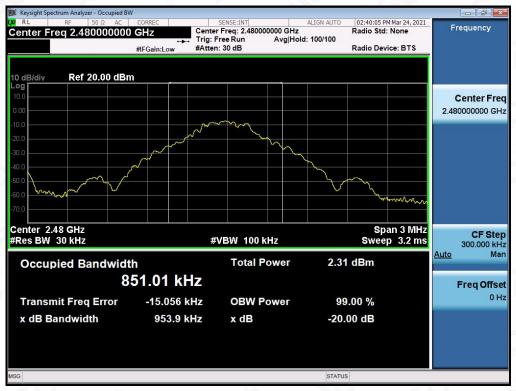
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#### TEST PLOT OF BANDWIDTH FOR MIDDLE CHANNEL

#### TEST PLOT OF BANDWIDTH FOR HIGH CHANNEL



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MEASUREMENT RESULT FOR II /4-DQPSK MODULATION							
Measurement Result							
Applicable Limits	Test Data	(MHz)	Criteria				
	Low Channel	1.282	PASS				
N/A	Middle Channel	1.281	PASS				
	High Channel	1.283	PASS				

#### TEST PLOT OF BANDWIDTH FOR LOW CHANNEL



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#### TEST PLOT OF BANDWIDTH FOR MIDDLE CHANNEL

#### TEST PLOT OF BANDWIDTH FOR HIGH CHANNEL



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# 9. CONDUCTED SPURIOUS EMISSION

# 9.1. MEASUREMENT PROCEDURE

- 1. Connect EUT RF output port to the Spectrum Analyzer through an RF attenuator
- 2. Set the EUT Work on the top, the Middle and the bottom operation frequency individually.
- Set the Span = wide enough to capture the peak level of the in-band emission and all spurious emissions from the lowest frequency generated in the EUT up through the 10th harmonic.
   RBW = 100 kHz; VBW= 300 kHz; Sweep = auto; Detector function = peak.
- 4. Set SPA Trace 1 Max hold, then View.

# 9.2. TEST SET-UP (BLOCK DIAGRAM OF CONFIGURATION)

The same as described in section 8.2

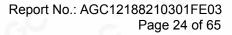
# 9.3. MEASUREMENT EQUIPMENT USED

The same as described in section 6

#### 9.4. LIMITS AND MEASUREMENT RESULT

LIMITS AND MEASUREMENT RESULT									
Annlingh In Limite	Measurement Result								
Applicable Limits	Test Data	Criteria							
In any 100 kHz Bandwidth Outside the frequency band in which the spread spectrum intentional radiator is operating, the radio frequency	At least -20dBc than the limit Specified on the BOTTOM Channel	PASS							
power that is produce by the intentional radiator shall be at least 20 dB below that in 100KHz bandwidth within the band that contains the highest level of the desired power. In addition, radiation 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))	At least -20dBc than the limit Specified on the TOP Channel	PASS							

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# TEST RESULT FOR ENTIRE FREQUENCY RANGE

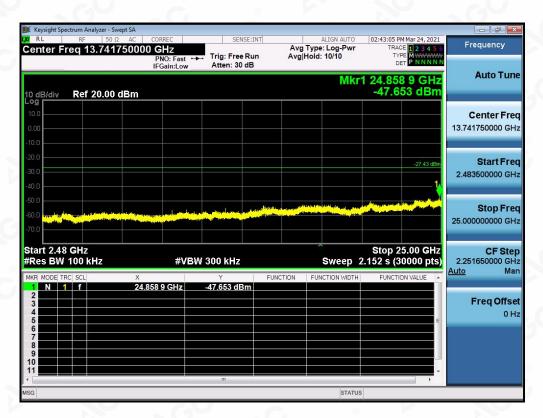
TEST PLOT OF OUT OF BAND EMISSIONS WITH THE WORST CASE OF  $\pi$  /4-DQPSK MODULATION IN LOW CHANNEL



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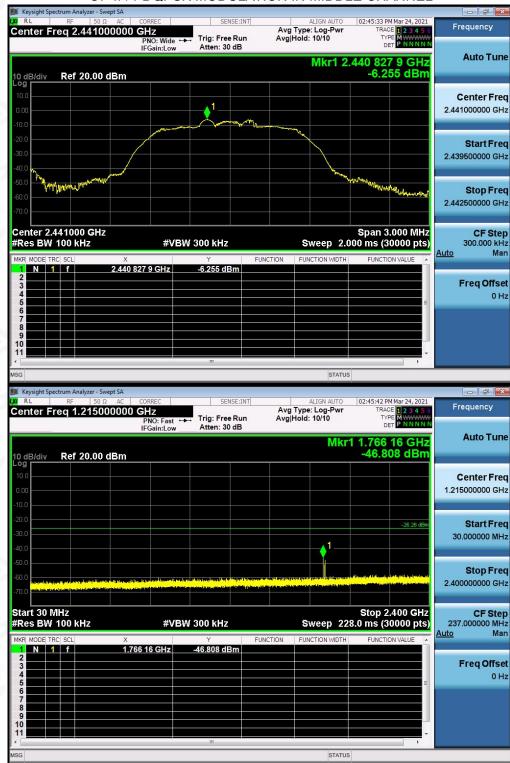
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 Attestation of Global Compliance(Shenzhen)Co., Ltd

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 Tel: +86-755 2523 4088
 E-mail: agc@agc-cert.com



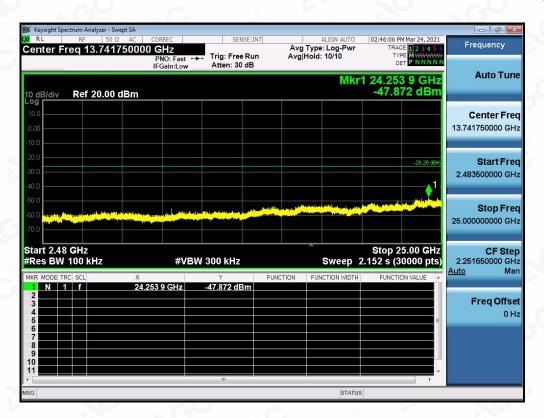


# TEST PLOT OF OUT OF BAND EMISSIONS OF $\pi$ /4-DQPSK MODULATION IN MIDDLE CHANNEL

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#### Report No.: AGC12188210301FE03 Page 27 of 65





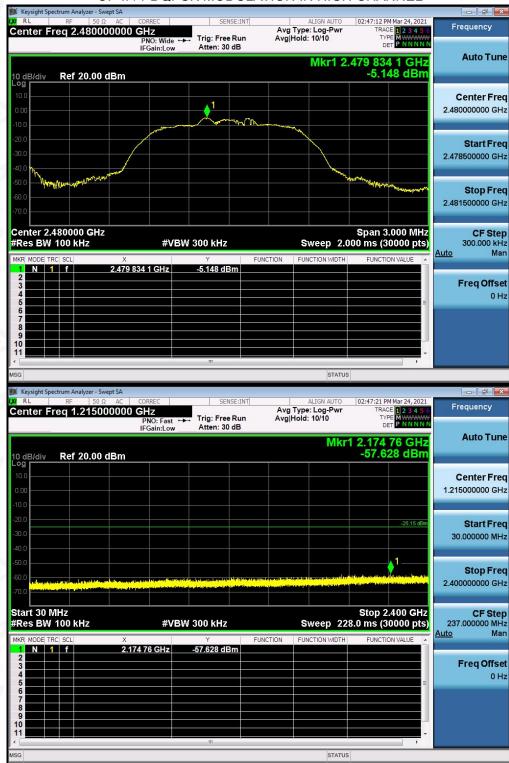
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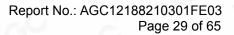
 Tel: +86-755 2523 4088
 E-mail: agc@agc-cert.com





# TEST PLOT OF OUT OF BAND EMISSIONS OF $\pi$ /4-DQPSK MODULATION IN HIGH CHANNEL

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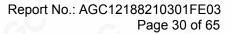




			Analyzer - S									
		RF	50	Ω AC		SE	NSE:INT	Avg T	ALIGN AUTO		Mar 24, 2021	Frequency
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10 0	B/div	Doi	7 20.00	dBm					IVIKI	-48.2	2 5 GHz 89 dBm	
Log	Bruiv	Kei	20.00									
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MKR	MODE TR	C SCI		Х		Y	FUN	CTION	FUNCTION WIDTH		ON VALUE	<u>Auto</u> Man
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6												
7												
9												
11											-	
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MSG									STATUS			

Note: The  $\pi$  /4-DQPSK modulation is the worst case and only those data recorded in the report.

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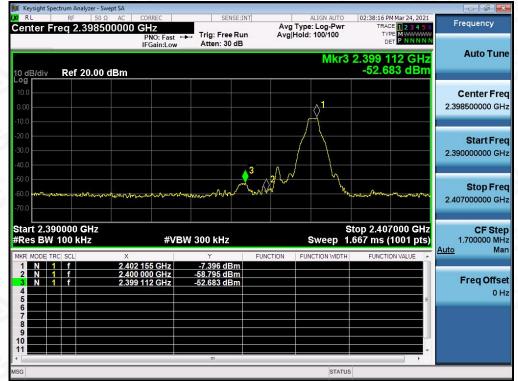




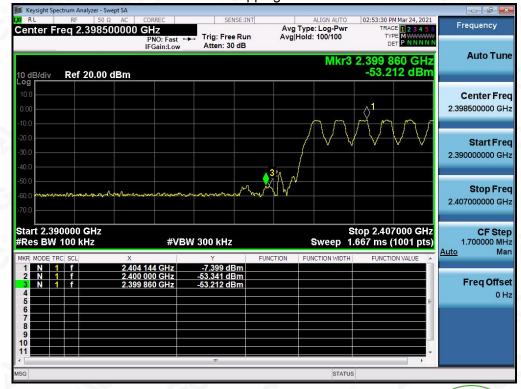
#### TEST RESULT FOR BAND EDGE

#### GFSK MODULATION IN LOW CHANNEL

Hopping off



Hopping on



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