

# **FCC Test Report**

Report No.: AGC04138210301FE03

FCC ID	: 2AAXO-SML654
APPLICATION PURPOSE	: Original Equipment
PRODUCT DESIGNATION	: MP3+G KARAOKE PLAYER WITH BLUETOOTH
BRAND NAME	: Singing Machine
MODEL NAME	<ul> <li>SML654, SML652BK, SML652P, SML652W, SML652XX, SML654BK, SML654BL, SML654P, SML654V, SML654XX</li> <li>(X is reserved for future color change, it can be 0-9, A-Z or NA), GROOVE MINI</li> </ul>
APPLICANT	: The Singing Machine Company Inc.
DATE OF ISSUE	: May 06, 2021
STANDARD(S)	: FCC Part 15.247
REPORT VERSION	: V1.0

# Attestation of Global Compliance (Shenzhen) Co., Ltd



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## **REPORT REVISE RECORD**

Report Version	Revise Time	Issued Date	Valid Version	Notes
V1.0	© /	May 06, 2021	Valid	Initial Release

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## **1. VERIFICATION OF CONFORMITY**

Applicant	The Singing Machine Company Inc.		
Address	6301 NW 5th Way, Suite 2900 Fort Lauderdale, FL, 33309, U.S.A.		
Manufacturer	ZHUHAI FULLWING ELECTRONIC CO., LTD ZHONGSHAN BRANCH		
Address	4/F & 5/F, No 10, Xingye Road, Xinxu, San Xiang, Zhongshan, Guangdong, China		
Factory	ZHUHAI FULLWING ELECTRONIC CO., LTD ZHONGSHAN BRANCH		
Address	4/F & 5/F, No 10, Xingye Road, Xinxu, San Xiang, Zhongshan, Guangdong, China		
Product Designation	MP3+G KARAOKE PLAYER WITH BLUETOOTH		
Brand Name	Singing Machine		
Test Model	SML654		
Series Model	SML652BK, SML652P, SML652W, SML652XX, SML654BK, SML654BL, SML654P, SML654V, SML654XX (X is reserved for future color change, it car be 0-9, A-Z or NA), GROOVE MINI		
Difference Description	All the same except for the model name and color.		
Date of test	Apr. 20, 2021 to May 06, 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

Then Hunny

Thea Huang Project Engineer

May 06, 2021

Max Zhan

Reviewed By

Max Zhang Reviewer

May 06, 2021

Approved By

Forrest Lei Authorized Officer

May 06, 2021

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## 2. GENERAL INFORMATION

## 2.1. PRODUCT DESCRIPTION

The EUT is designed as "MP3+G KARAOKE PLAYER WITH BLUETOOTH". It is designed by way of utilizing the GFSK,  $\pi$  /4-DQPSK and 8DPSK technology to achieve the system operation.

A major technical description of EUT is described as following

Operation Frequency	Frequency     2.402 GHz to 2.480 GHz		
RF Output Power     -5.573dBm (Max)			
Bluetooth Version V5.0			
Modulation       BR ⊠GFSK, EDR ⊠π /4-DQPSK, ⊠8DPSK         BLE □GFSK 1Mbps □GFSK 2Mbps			
Number of channels 79			
Hardware Version	V1.0		
Software Version	V1.0		
Antenna Designation	PCB Antenna (Comply with requirements of the FCC part 15.203)		
Antenna Gain	-0.5dBi		
Power Supply	DC 9V by battery DC 9V by adapter		
Note: The EUT doesn't supp	ort BLE.		

## 2.2. TABLE OF CARRIER FREQUENCYS

Frequency Band	Channel Number	Frequency
	0	2402 MHz
0	64 .6	2403 MHz
30 20		
	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: 2AAXO-SML654** 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,  $Uc = \pm 0.8$ dB
- 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:  $Uc = \pm 2 \%$

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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	Low channel 8DPSK			
8	Middle channel 8DPSK			
9	High channel 8DPSK			
10	Hopping mode GFSK			
11	Hopping mode π/4-DQPSK			
12	Hopping mode 8DPSK			

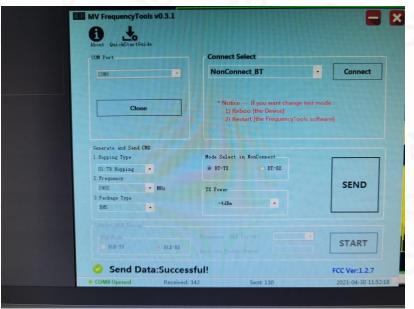
Note:

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



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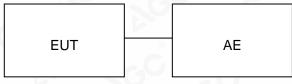
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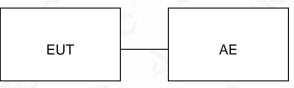
## **5. SYSTEM TEST CONFIGURATION**

**5.1. CONFIGURATION OF EUT SYSTEM** 

Radiated Emission Configure:



Conducted Emission Configure:



## 5.2. EQUIPMENT USED IN TESTED SYSTEM

ltem	Equipment	Model No.	ID or Specification	Remark
- 6	MP3+G KARAOKE			
1	PLAYER WITH	SML654	2AAXO-SML654	EUT
0	BLUETOOTH			
2	Control Box	USB-TTL	N/A	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	Compliant	

Note: The EUT is powered by battery.

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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 CONDUCTED EMISSION TEST

Equipment	Manufacturer	Model	S/N	Cal. Date	Cal. Due
TEST RECEIVER	R&S	ESPI	101206	May 15, 2020	May 14, 2021
LISN	R&S	ESH2-Z5	100086	Jul. 03, 2020	Jul. 02, 2021
Test software	R&S	ES-K1(Ver.V1.71)	N/A	N/A	N/A

## 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

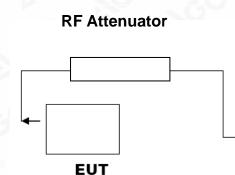
For peak power test:

- 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.

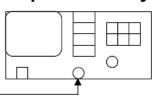
Allow trace to stabilize. Use the marker-to-peak function to set the marker to the peak of the emission. The indicated level is the peak output power, after any corrections for external attenuators and cables.

## 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	-5.573	21	Pass	
2.441	-7.856	21	Pass	
2.480	-10.044	21	Pass	

## CH0

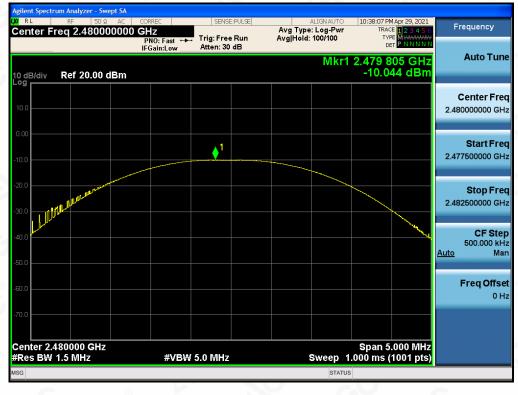


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PEAK OUTPUT POWER MEASUREMENT RESULT FOR Π/4-DQPSK MODULATION			
Frequency (GHz)	Peak Power (dBm)	Applicable Limits (dBm)	Pass or Fail
2.402	-5.693	21	Pass
2.441	-7.930	21	Pass
2.480	-10.138	21	Pass

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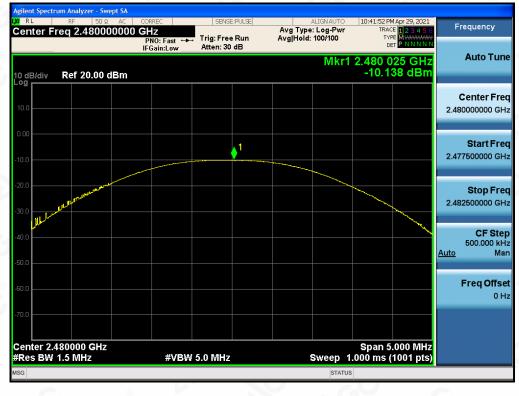


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PEAK OUTPUT POWER MEASUREMENT RESULT FOR 8-DPSK MODULATION			
Frequency (GHz)	Peak Power (dBm)	Applicable Limits (dBm)	Pass or Fail
2.402	-5.727	21	Pass
2.441	-8.014	21	Pass
2.480	-10.192	21	Pass

CH0



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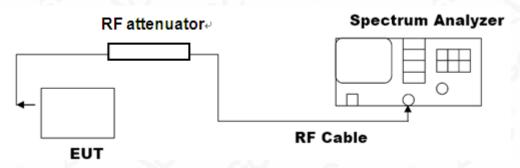


## 8. 20DB BANDWIDTH

#### **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				
Appliachta Limita	Measurement Result			
Applicable Limits	Test Data (MHz)		Criteria	
N/A	Low Channel	0.987	PASS	
	Middle Channel	0.993	PASS	
	High Channel	0.971	PASS	

#### 10:36:39 PM Apr 29, 2021 Radio Std: None Frequency Center Freq: 2.402000000 GHz Trig: Free Run Avg|Hold: 100/100 #Atten: 30 dB 402000000 GHz Center Radio Device: BTS #IFGain:Low Ref 20.00 dBm **Center Freq** 2.402000000 GHz Center 2.402 GHz #Res BW 30 kHz Span 3 MHz Sweep 3.2 ms CF Step 300.000 kHz #VBW 100 kHz <u>Auto</u> Mar Total Power 2.07 dBm Occupied Bandwidth 907.11 kHz Freq Offset 0 Hz -31.863 kHz **Transmit Freq Error OBW Power** 99.00 % x dB Bandwidth 987.0 kHz x dB -20.00 dB

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				
Appliachte Limite		Measurement Result		
Applicable Limits	Test Data	Test Data (MHz)		
N/A	Low Channel	1.302	PASS	
	Middle Channel	1.314	PASS	
	High Channel	1.309	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

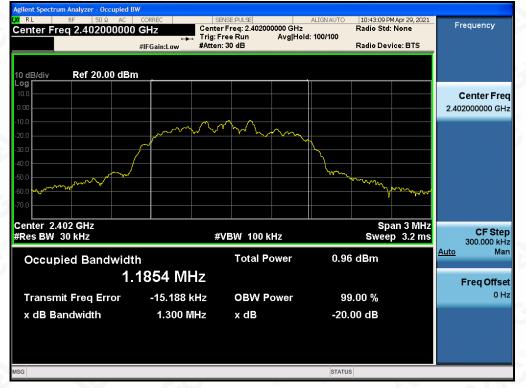


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MEASUREMENT RESULT FOR 8-DPSK MODULATION				
Measurement Result				
Applicable Limits	Test Data	Test Data (MHz)		
	Low Channel	1.300	PASS	
N/A	Middle Channel	1.300	PASS	
	High Channel	1.300	PASS	

#### 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

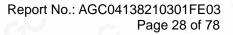
## 9.3. MEASUREMENT EQUIPMENT USED

The same as described in section 6

#### 9.4. LIMITS AND MEASUREMENT RESULT

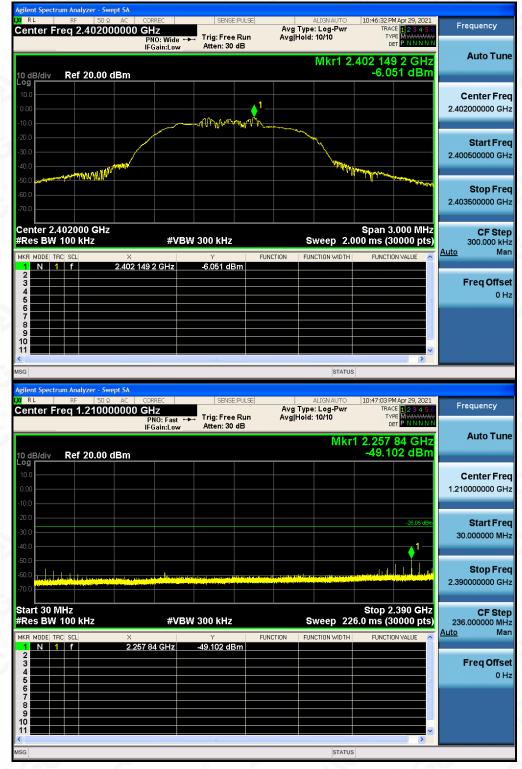
LIMITS AND MEASUREMENT RESULT				
Annlinghta Limita	Measurement Result			
Applicable Limits	Test Data	Criteria		
In any 100 kHz Bandwidth Outside the frequency band in which the spread spectrum intentional radiator is operating, the radio frequency	At least -20dBc than the limit Specified on the BOTTOM 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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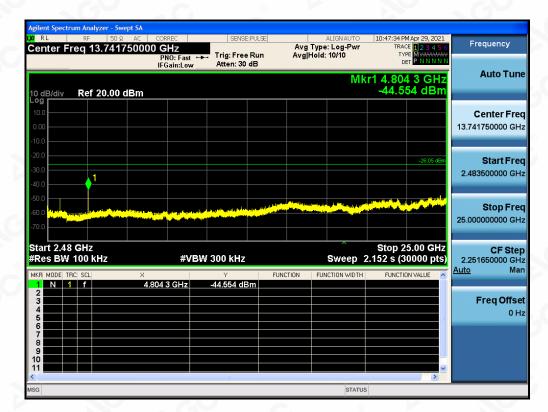
## TEST RESULT FOR ENTIRE FREQUENCY RANGE TEST PLOT OF OUT OF BAND EMISSIONS WITH THE WORST CASE OF GFSK MODULATION IN LOW CHANNEL



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#### Report No.: AGC04138210301FE03 Page 29 of 78





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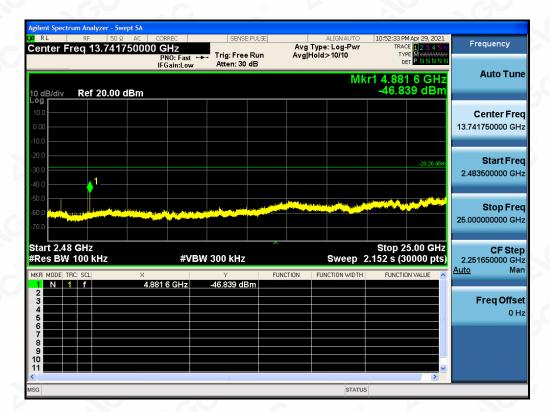
Agilent Spectrum Analyzer - Swep X RL RF 50 Ω Center Freq 2.441000 10 dB/div Ref 20.00 dl 10 0 10 0	AC CORREC	SENSE:PULSE			
Center Freq 2.441000	0000 GHz PNO: Wide ←				
10 dB/div Ref 20.00 dl	PNO: Wide ←			0:51:31 PM Apr 29, 2021	Frequency
10.0		🛌 Trig: Free Run	Avg Type: Log-Pwr Avg Hold: 10/10	TRACE 123456 TYPE MMMMM DET P N N N N N	
10.0		Atten: 30 dB		DET PNNNN	
10.0			Mkr1 2 A	40 795 3 GHz	Auto Tune
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10.0	BM			-0.200 dBm	
					Center Fred
					2.441000000 GHz
-10.0					
-20.0		1. 11 11 14			
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-40.0	WW .		Millio Los		
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-60.0					Stop Free
-70.0					2.442500000 GH:
-70.0					
Center 2.441000 GHz				Span 3.000 MHz	CE Stor
#Res BW 100 kHz	#VB	W 300 kHz		ms (30000 pts)	CF Step 300.000 kHz
					Auto Mar
MKR MODE TRC SCL	× 2.440 795 3 GHz	-8.256 dBm	UNCTION FUNCTION WIDTH	FUNCTION VALUE	
2	2.440 795 3 GHZ	-6.256 dBm			
3					Freq Offse
4					0 H:
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7					
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11				~	
<					
ASG			STATUS		
Agilent Spectrum Analyzer - Swep	ot SA				
<mark>X/</mark> RL RF 50Ω		SENSE:PULSE		10:52:02 PM Apr 29, 2021	Frequency
Center Freq 1.215000		► Trig: Free Run	Avg Type: Log-Pwr Avg Hold: 10/10	TRACE 123456 TYPE MMMMM DET P N N N N N	Trequency
	PNO: Fast ← IFGain:Low	Atten: 30 dB	Avginola, lono	DET PNNNN	
			Mkr1	2.248 79 GHz	Auto Tune
				-50.264 dBm	
10 dB/div Ref 20.00 dl	BM			-00.204 abiii	
					Center Fred
10.0					1.215000000 GH
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0.00				-28.26 dBm	Start Free
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0.00 -10.0 -20.0 -30.0				-28.26 dBm	Start Free
0.00 -10.0 -20.0 -30.0				-28.26 dBm	Start Free 30.000000 MH;
0.00 -10.0 -20.0 -30.0 -40.0 -50.0				-28.26 dBm	Start Free 30.000000 MH; Stop Free
0.00 -10.0 -20.0 -30.0 -40.0 -50.0 -				-29.26 dBm	Start Frec 30.000000 MH Stop Frec 2.40000000 GH
0.00 -10.0 -20.0 -30.0 -40.0 -50.0					Start Free 30.000000 MH Stop Free
0.00 -10.0 -20.0 -30.0 -40.0 -50.0				1 Stop 2.400 GHz	Start Free 30.000000 MH: Stop Free 2.400000000 GH:
0.00 -10.0 -20.0 -30.0 -40.0 -50.0 -50.0 -60.0 -70.0	#VB	W 300 kHz			Start Free 30.000000 MH Stop Free 2.400000000 GH CF Step
0.00 -10.0 -20.0 -30.0 -40.0 -50			Sweep 228.0	1 Stop 2.400 GHz	Start Free 30.000000 MH Stop Free 2.400000000 GH CF Step 237.000000 MH
0.00 -10.0 -20.0 -30.0 -40.0 -40.0 -50	#VB 2.248 79 GHz		Sweep 228.0	1 Stop 2.400 GHz ms (30000 pts)	Start Free 30.000000 MH; Stop Free 2.400000000 GH; CF Step 237.000000 MH;
0.00 -10.0 -20.0 -30.0 -40.0 -40.0 -50.0 -40.0 -50	×	Y FI	Sweep 228.0	1 Stop 2.400 GHz ms (30000 pts)	Start Free           30.000000 MH;           Stop Free           2.400000000 GH;           CF Step           237.000000 MH;           Auto         Mar
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0.00 -10.0 -20.0 -20.0 -30.0 -40.0 -50	×	Y FI	Sweep 228.0	1 Stop 2.400 GHz ms (30000 pts)	Start Free 30.000000 MH; Stop Free 2.400000000 GH; 2.400000000 GH; CF Step 237.000000 MH; Auto Mar Freq Offset
000 10.0 -20.0 -30.0 -40.0	×	Y FI	Sweep 228.0	Stop 2.400 GHz ms (30000 pts)	Start Free 30.000000 MH; Stop Free 2.400000000 GH; 2.400000000 GH; CF Step 237.000000 MH; Auto Mar Freq Offset

## TEST PLOT OF OUT OF BAND EMISSIONS OF GFSK MODULATION IN MIDDLE CHANNEL

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#### Report No.: AGC04138210301FE03 Page 31 of 78





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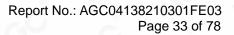
 Tel: +86-755 2523 4088
 E-mail: agc@agc-cert.com





## TEST PLOT OF OUT OF BAND EMISSIONS OF GFSK MODULATION IN HIGH CHANNEL

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Note: The GFSK modulation is the worst case and only those data recorded in the report.

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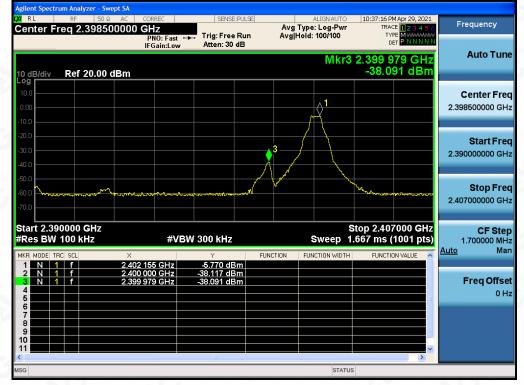
Web: http://cn.agc-cert.com/



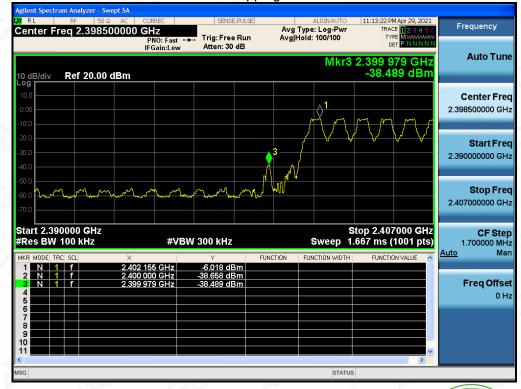
#### TEST RESULT FOR BAND EDGE

#### GFSK MODULATION IN LOW CHANNEL

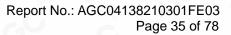
Hopping off



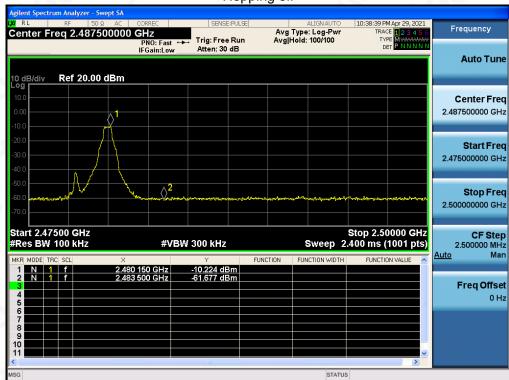
Hopping on



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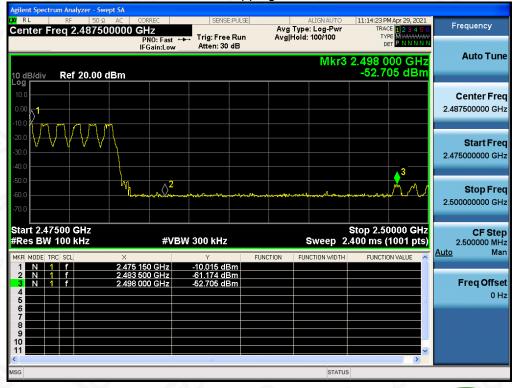




## GFSK MODULATION IN HIGH CHANNEL

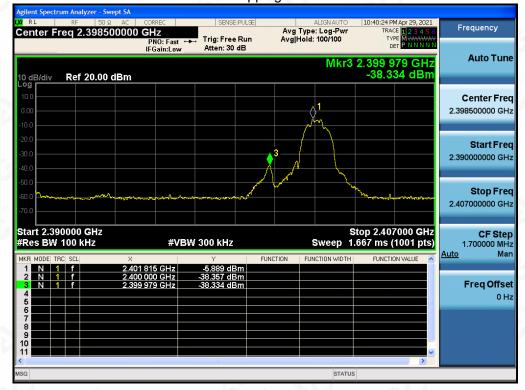
Hopping off

Hopping on



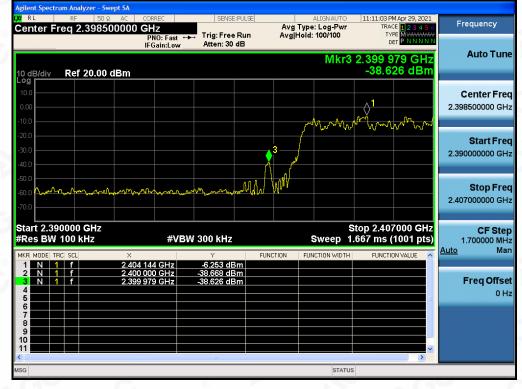
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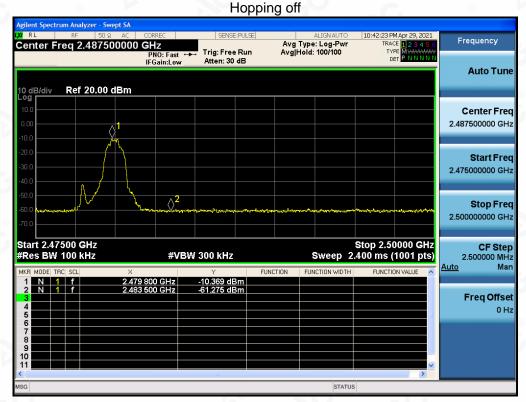


## $\pi$ /4-DQPSK MODULATION IN LOW CHANNEL Hopping off

Hopping on

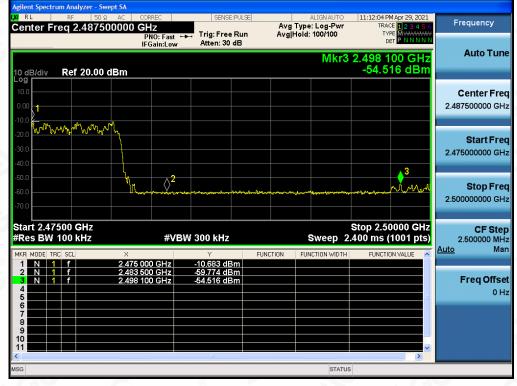


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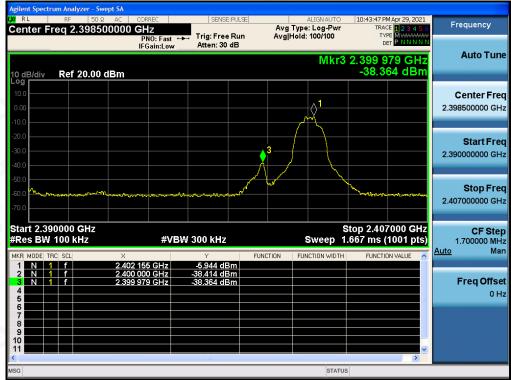
## $\pi$ /4-DQPSK MODULATION IN HIGH CHANNEL

Hopping on



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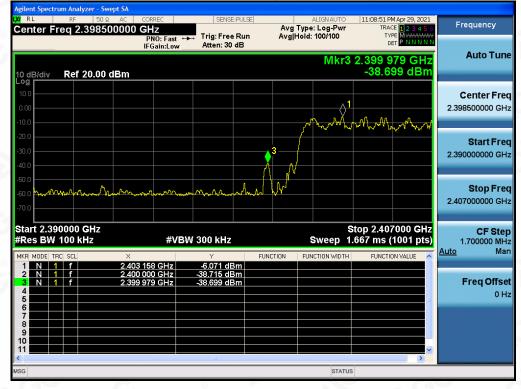




## 8-DPSK MODULATION IN LOW CHANNEL

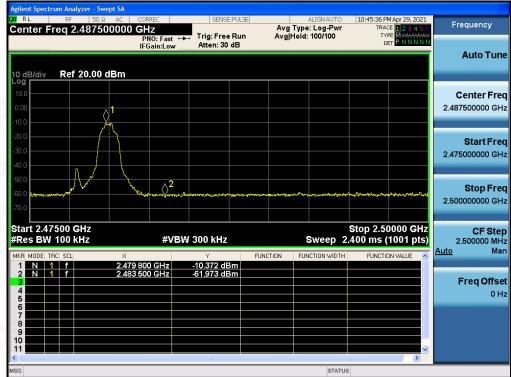
Hopping off

Hopping on



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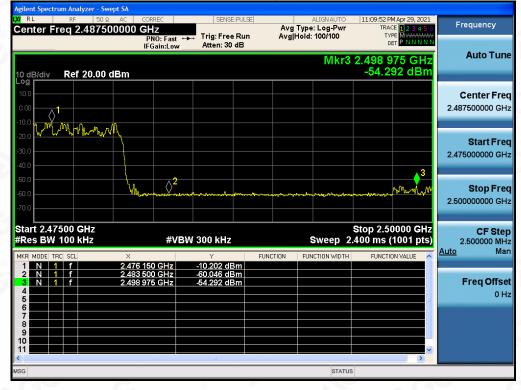




## 8-DPSK MODULATION IN HIGH CHANNEL

Hopping off

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## **10. RADIATED EMISSION**

#### **10.1. MEASUREMENT PROCEDURE**

- 1. The EUT was placed on the top of the turntable 0.8 or 1.5 meter above ground. The phase center of the receiving antenna mounted on the top of a height-variable antenna tower was placed 3 meters far away from the turntable.
- 2. Power on the EUT and all the supporting units. The turntable was rotated by 360 degrees to determine the position of the highest radiation.
- 3. The height of the broadband receiving antenna was varied between one meter and four meters above ground to find the maximum emissions field strength of both horizontal and vertical polarization.
- 4. For each suspected emission, the antenna tower was scan (from 1 M to 4 M) and then the turntable was rotated (from 0 degree to 360 degrees) to find the maximum reading.
- 5. Set the test-receiver system to Peak or CISPR quasi-peak Detect Function with specified bandwidth under Maximum Hold Mode.
- 6. For emissions above 1GHz, use 1MHz RBW and 3MHz VBW for peak reading. Place the measurement antenna away from each area of the EUT determined to be a source of emissions at the specified measurement distance, while keeping the measurement antenna aimed at the source of emissions at each frequency of significant emissions, with polarization oriented for maximum response. The measurement antenna may have to be higher or lower than the EUT, depending on the radiation pattern of the emission and staying aimed at the emission source for receiving the maximum signal. The final measurement antenna elevation shall be that which maximizes the emissions. The measurement antenna elevation for maximum emissions shall be restricted to a range of heights of from 1 m to 4 m above the ground or reference ground plane.
- 7. When the radiated emissions limits are expressed in terms of the average value of the emissions, and pulsed operation is employed, the measurement field strength shall be determined by averaging over one complete pulse train, including blanking intervals, as long as the pulse train does not exceed 0.1 seconds. As an alternative (provided the transmitter operates for longer than 0.1 seconds) or in cases where the pulse train exceeds 0.1 seconds, the measured field strength shall be determined from the average absolute voltage during a 0.1 second interval during which the field strength is at its maximum values.
- 8. If the emissions level of the EUT in peak mode was 3 dB lower than the average limit specified, then testing will be stopped and peak values of EUT will be reported, otherwise, the emissions which do not have 3 dB margin will be repeated one by one using the quasi-peak method for below 1GHz.
- 9. For testing above 1GHz, the emissions level of the EUT in peak mode was lower than average limit (that means the emissions level in peak mode also complies with the limit in average mode), then testing will be stopped and peak values of EUT will be reported, otherwise, the emissions will be measured in average mode again and reported.
- 10. In case the emission is lower than 30MHz, loop antenna has to be used for measurement and the recorded data should be QP measured by receiver. High Low scan is not required in this case.

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The following table is the setting of spectrum analyzer and receiver.

Spectrum Parameter	Setting
Start ~Stop Frequency	9KHz~150KHz/RB 200Hz for QP
Start ~Stop Frequency	150KHz~30MHz/RB 9KHz for QP
Start ~Stop Frequency	30MHz~1000MHz/RB 120KHz for QP
Start ~Stop Frequency	1GHz~26.5GHz 1MHz/3MHz for Peak, 1MHz/3MHz for Average

Receiver Parameter	Setting
Start ~Stop Frequency	9KHz~150KHz/RB 200Hz for QP
Start ~Stop Frequency	150KHz~30MHz/RB 9KHz for QP
Start ~Stop Frequency	30MHz~1000MHz/RB 120KHz for QP

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