

# **FCC Test Report**

Report No.: AGC02180201102FE03

FCC ID	: 2AR6E-HK302
APPLICATION PURPOSE	: Original Equipment
PRODUCT DESIGNATION	: Bluetooth FM Transmitter
BRAND NAME	: N/A
MODEL NAME	<ul> <li>НКЗ02, НКЗ01, НКЗ03, НКЗ05, НКЗ06, НКЗ07, НКЗ08,</li> <li>НКЗ09, НК601, НК602, НК603, НК605, НК606, НК607, НК608, НК609</li> </ul>
APPLICANT	: HAIKE PLASTIC AND ELECTRONIC CO LTD
DATE OF ISSUE	: Dec. 10,2020
STANDARD(S)	: FCC Part 15.247
REPORT VERSION	: V1.0



mpliance



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# **REPORT REVISE RECORD**

Report Version	Revise Time	Issued Date	Valid Version	Notes
V1.0	© /	Dec. 10,2020	Valid	Initial Release

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#### **1. VERIFICATION OF CONFORMITY**

HAIKE PLASTIC AND ELECTRONIC CO LTD		
Block B. Shanghenglang Bai Fuli Industrial, Dalang Street, Long Hua, ShenZhen, China.		
HAIKE PLASTIC AND ELECTRONIC CO LTD		
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HAIKE PLASTIC AND ELECTRONIC CO LTD		
Block B. Shanghenglang Bai Fuli Industrial, Dalang Street, Long Hua, ShenZhen, China.		
Bluetooth FM Transmitter		
N/A		
HK302		
HK301, HK303, HK305, HK306, HK307, HK308, HK309, HK601, HK602, HK603, HK605, HK606, HK607, HK608, HK609		
All the same except for the model name.		
Nov. 24,2020 to Dec. 10,2020		
No any deviation from the test method		
Normal		
Pass		
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

Sky dong

Sky Dong (Project Engineer)

Dec. 10,2020

Max Zhang

Reviewed By

Max Zhang (Reviewer)

Dec. 10,2020

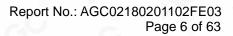
Approved By

Forrest Lei (Authorized Officer)

Dec. 10,2020

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# 2. GENERAL INFORMATION

# 2.1. PRODUCT DESCRIPTION

The EUT is designed as "Bluetooth FM Transmitter". It is designed by way of utilizing the GFSK and  $\pi$  /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	0.773dBm (Max)
Bluetooth Version	V 5.0
Modulation	BR ⊠GFSK, EDR ⊠π /4-DQPSK, ⊠8DPSK BLE □GFSK 1Mbps □GFSK 2Mbps
Number of channels	79
Hardware Version	V1
Software Version	V1
Antenna Designation	PCB Antenna (Comply with requirements of the FCC part 15.203)
Antenna Gain	0dBi
Power Supply	DC 12/24V by car battery

Note: The EUT doesn't support 8DPSK and BLE.

# 2.2. TABLE OF CARRIER FREQUENCYS

Frequency Band	Channel Number	Frequency
	0	2402 MHz
No CO	<u> </u>	2403 MHz
8		
	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: 2AR6E-HK302** 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  $y \pm U$ , 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 = ±3.2 dB
- Uncertainty of Radiated Emission below 1GHz, Uc = ±3.9 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	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

CCAssist 2.4	
R/EDR BLE	
MODE TX	
Channel 0         •         Packet type         1.0H1           Transmit Power 10         •         Hopping         OFF	Data Types Pro
2020-11-25_16:31:48 open COM5 succeed	Serial Port COMS Send configuration
2020-11-25_16:31:54	
	Description: 1. Channel: range 0-78, corresponding frequency 2.402GHz-2.480GHZ

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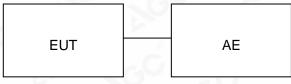
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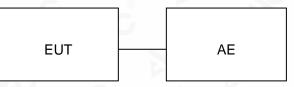
# **5. SYSTEM TEST CONFIGURATION**

**5.1. CONFIGURATION OF EUT SYSTEM** 

Radiated Emission Configure:



Conducted Emission Configure:



# 5.2. EQUIPMENT USED IN TESTED SYSTEM

Item	Equipment	Model No.	ID or Specification	Remark
1	Bluetooth FM Transmitter	HK302	2AR6E-HK302	EUT
2	Car battery	N/A	N/A	AE
3	SD card	N/A	N/A	AE
4	control board	EPS-35-3.3	DC 3.3V	AE
5	Load	N/A	N/A	AE
6	Earphone	N/A	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	Not applicable

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 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. 12, 2019	Dec. 11, 2020
2.4GHz Filter	EM Electronics	2400-2500MHz	N/A	Mar. 23, 2020	Mar. 22, 2022
Attenuator	ZHINAN	E-002	N/A	N/A	N/A
Horn antenna	SCHWARZBECK	BBHA 9170	#768	Sep. 09, 2019	Sep. 08, 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. 09, 2019	Jan. 08, 2021
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

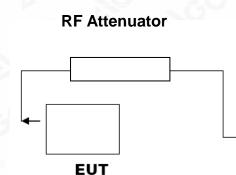
For peak power test:

- 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.

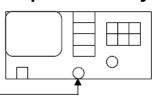
Allow trace to stabilize. Use the marker-to-peak function to set the marker to the peak of the emission. The indicated level is the peak output power, after any corrections for external attenuators and cables.

# 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						
FrequencyPeak Power(GHz)(dBm)		Applicable Limits (dBm)	Pass or Fail			
2.402	-0.072	30	Pass			
2.441	0.233	30	Pass			
2.480	0.201	30	Pass			

#### CH0

Agilent Spectr	rum Analyzer - Swept SA							
	RF 50 Ω AC req 2.40200000		SENSE:		LIGN AUTO		4 Nov 25, 2020 E 123456 E M WWWWWW T P N N N N N	Frequency
		PNO: Fast ↔ IFGain:Low	Atten: 30 o	Avginola:				Auto Tun
10 dB/div Log	Ref 20.00 dBm				Mkr1	2.401 7	45 GHz 72 dBm	Auto Tun
								Center Free
10.0			<u>_1</u>					2.402000000 GH
0.00				 				Start Free
-10.0								2.399500000 GH
-20.0	and and a second se							
								<b>Stop Fre</b> 2.404500000 GH
-30.0								
-40.0								CF Step 500.000 kH Auto Mai
-50.0								<u>Auto</u> Mai
-60.0								Freq Offse
-70.0								0 H
Center 2.4 #Res BW	402000 GHz	#\/B\A	/ 5.0 MHz		Sween 4	Span 5	.000 MHz 1001 pts)	
#RES DW		#VDV	7 <b>3.0</b> WINZ		Sweep		roor pisj	

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CU 70

XI RL Center Fr	RF 50 Ω AC Teq 2.480000000	CORREC ) GHZ PNO: Fast ↔ IFGain:Low	Trig: Free Run Atten: 30 dB	ALIGN AUTO Avg Type: Log-Pwr Avg Hold: 100/100	01:52:38 AMNov 25, 2020 TRACE 1 2 3 4 5 6 TYPE MWWWW DET P NNNNN	Frequency
10 dB/div	Ref 20.00 dBm			Mkr1	2.479 805 GHz 0.201 dBm	Auto Tune
10.0			.1			Center Freq 2.480000000 GHz
-10.0			 			<b>Start Freq</b> 2.477500000 GHz
-20.0						<b>Stop Freq</b> 2.482500000 GHz
-40.0						<b>CF Step</b> 500.000 kHz <u>Auto</u> Man
-60.0						<b>Freq Offset</b> 0 Hz
-70.0	80000 GHz				Span 5.000 MHz	
#Res BW	1.5 MHz	#VBV	V 5.0 MHz	Sweep 1	.000 ms (1001 pts)	

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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	0.667	21	Pass		
2.441	0.773	21	Pass		
2.480	0.737	21	Pass		

CH0



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CH39



CH78

	um Analyzer - Swept S							
Center F	RF 50 Ω A		SENSE:PULS	Avg Type:		TRAC	4Nov 25, 2020 E <b>1 2 3 4 5 6</b>	Frequency
	·	PNO: Fast ↔ IFGain:Low	⊢ Trig: Free Run Atten: 30 dB	Avg Hold:		DE	15 GHz	Auto Tune
10 dB/div Log	Ref 20.00 dBr	n				0.7	37 dBm	
10.0			.1					Center Freq 2.480000000 GHz
0.00			<b>\'</b>					Start Freq 2.477500000 GHz
-10.0								Stop Freq
-30.0								2.482500000 GHz
-40.0								<b>CF Step</b> 500.000 kHz <u>Auto</u> Man
-60.0								<b>Freq Offset</b> 0 Hz
-70.0								
Center 2.4 #Res BW	80000 GHz 1.5 MHz	#VBV	V 5.0 MHz	S	Sweep 1	Span 5 .000 ms (	.000 MHz 1001 pts)	
MSG					STATUS			

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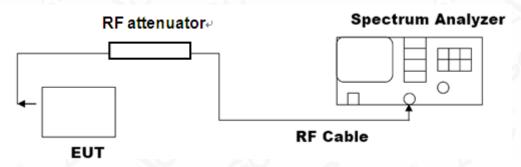


# 8. 20DB BANDWIDTH

#### **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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 E-mail: agc@agc-cert.com



#### 8.3. LIMITS AND MEASUREMENT RESULTS

MEASUREMENT RESULT FOR GFSK MOUDULATION						
Annliaghta Limita		Measurement Result				
Applicable Limits	Test Data	Criteria				
	Low Channel	0.950	PASS			
N/A	Middle Channel	0.953	PASS			
	High Channel	0.955	PASS			

#### 01:48:18 AMNov 25, 2020 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 7.02 dBm Occupied Bandwidth 853.17 kHz Freq Offset 0 Hz -53.679 kHz **Transmit Freq Error OBW Power** 99.00 % x dB Bandwidth 950.0 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

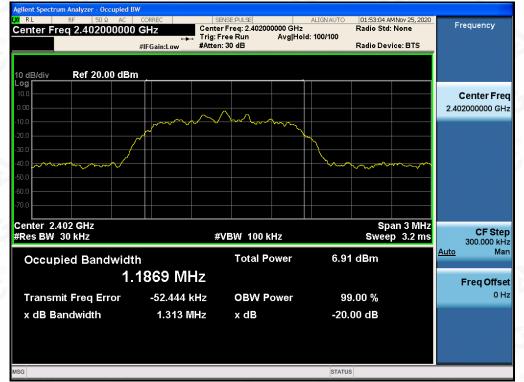


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MEASUREMENT RESULT FOR II /4-DQPSK MODULATION					
Annlinghla Limita	Measurement Result				
Applicable Limits	Test Data	(MHz)	Criteria		
	Low Channel	1.313	PASS		
N/A	Middle Channel	1.316	PASS		
	High Channel	1.317	PASS		

#### TEST PLOT OF BANDWIDTH FOR LOW CHANNEL



Any report having not been signed by authorized approver, or having been altered without authorization, or having not been stamped by the stand of the test results of the test results been at the report is not permitted without the writter aphorization of AGE in the test results presented in the report apply only to the tested sample. Any objections to report issued by AGC should be submitted to AGC within 15day after the issues of the test report. Further enquiry of validity or verification of the test report should be addressed to AGC by agc@agc-cert.com.



#### 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

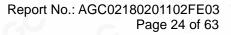
#### 9.3. MEASUREMENT EQUIPMENT USED

The same as described in section 6

#### 9.4. LIMITS AND MEASUREMENT RESULT

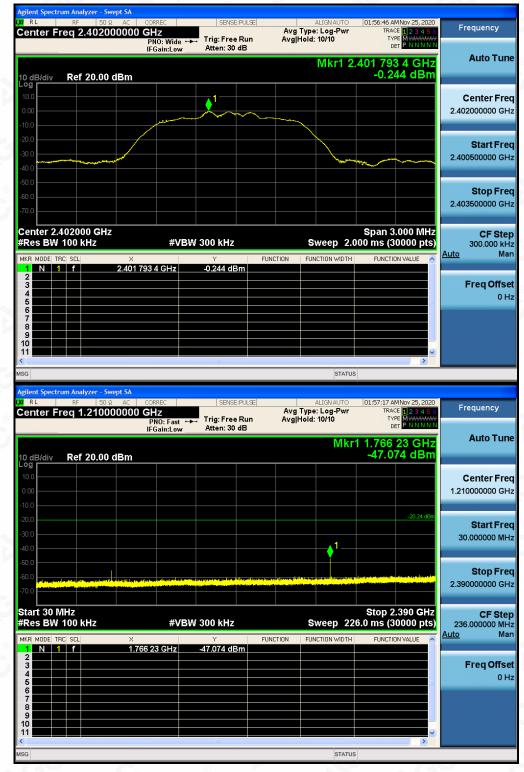
LIMITS AND MEASUREMENT RESULT							
Annlinghta Limita	Measurement Result						
Applicable Limits	Test Data	Criteria					
In any 100 kHz Bandwidth Outside the frequency band in which the spread spectrum intentional radiator is operating, the radio frequency	At least -20dBc than the limit Specified on 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 $\pi$ /4-DQPSK MODULATION IN LOW CHANNEL



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#### Report No.: AGC02180201102FE03 Page 25 of 63



	rum Analyzer - Sv						
Center F		2 AC   CORREC 750000 GHz			ALIGN AUTO g Type: Log-Pwr gHold: 8/10	01:57:39 AMNov 25, 202 TRACE 12345 TYPE MWWWW	6 Frequency
10 dB/div	Ref 20.00	IFGain:L			·	r1 4.803 5 GH: -42.525 dBn	Auto Tune
Log 10.0 0.00							Center Freq 13.741750000 GHz
-20.0 -30.0 -40.0	1					-20.24 dB	<b>Start Freq</b> 2.483500000 GHz
-50.0 -60.0 -70.0			Harry of the second state of the second of t		And the second		<b>Stop Freq</b> 25.000000000 GHz
Start 2.43 #Res BW	100 kHz	*	≠VBW 300 kHz	FUNCTION	Sweep	Stop 25.00 GH: 2.152 s (30000 pts	<b>CF Step</b> 2.251650000 GHz <u>Auto</u> Man
	1 f	4.803 5 GH					Freq Offset 0 Hz
7 8 9 10 11							
MSG					STATUS	5	

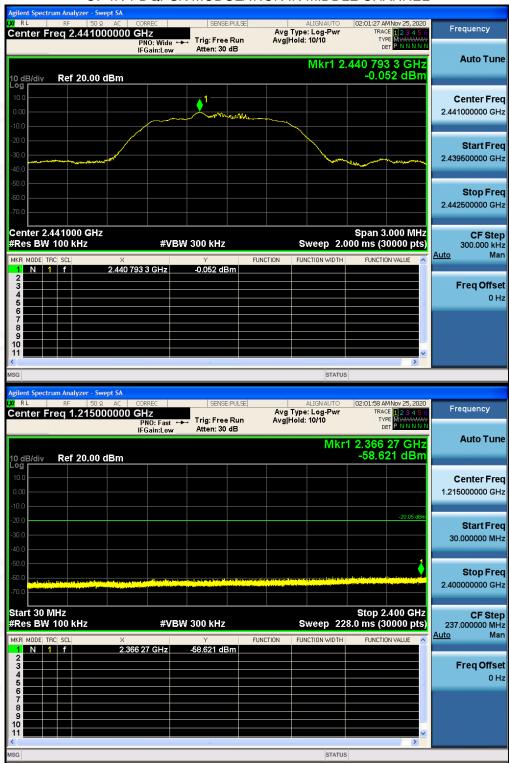
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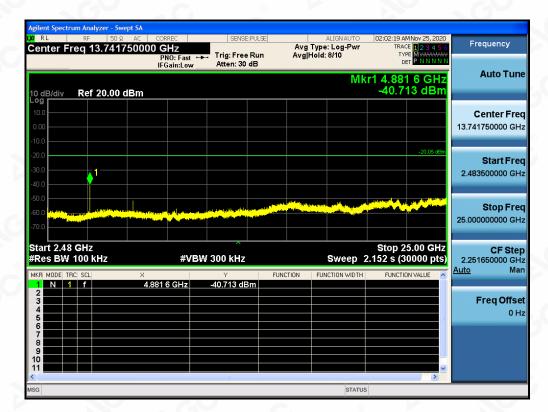


# TEST PLOT OF OUT OF BAND EMISSIONS OF $\pi$ /4-DQPSK MODULATION IN MIDDLE CHANNEL

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#### Report No.: AGC02180201102FE03 Page 27 of 63





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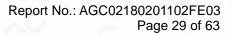
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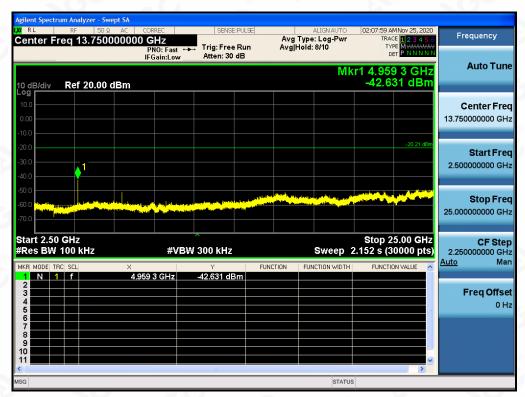
Agilent Spectrum Analyzer	- Swept SA				
RL RF S Center Freq 2.480	50 Ω AC CORREC	SENSE:PULSE	Avg Type: Log-Pwr	02:07:07 AM Nov 25, 2020 TRACE 1 2 3 4 5 6 TYPE MWWWWW	Frequency
	PNO: Wi IFGain:L		Avg Hold: 10/10	DET P N N N N	
			Mkr1 2	479 800 0 GHz	Auto Tu
10 dB/div Ref 20.0	00 dBm			-0.212 dBm	
10.0		1			Center Fr
-10.0		mannente			2.480000000 G
-20.0					Otest Es
-30.0					Start Fr 2.478500000 G
-40.0					
-50.0					Stop Fr
-70.0					2.481500000 G
Center 2.480000 G	iHz			Span 3.000 MHz	CF St
Res BW 100 kHz		VBW 300 kHz	Sweep 2.0	100 ms (30000 pts)	300.000 k
MKR MODE TRC SCL	× 2.479 800 0 GH	y z0.212 dBm	FUNCTION FUNCTION WIDTH	FUNCTION VALUE	Auto M
2 2 2					Freq Offs
4 5					0
6					
8 9 10					
11				<u> </u>	
ISG			STATUS		
Agilent Spectrum Analyzer -					
A <mark>gilent Spectrum Analyzer</mark> - K <mark>U</mark> RL RF 5	50 Ω AC CORREC 5000000 GHz	Tailer Free Day	ALIGNAUTO	02:07:38 AMNov 25, 2020 TRACE 1 2 3 4 5 6	Frequency
A <mark>gilent Spectrum Analyzer</mark> - K <mark>U</mark> RL RF 5	50 Ω AC CORREC	st 🔸 Trig: Free Run	ALIGNAUTO Avg Type: Log-Pwr Avg Hold: 10/10	02:07:38 AM Nov 25, 2020 TRACE 2 3 4 5 6 TYPE MUNUMULA DET P.NNNNN	
gilent Spectrum Analyzer - RL RF S Center Freq 1.215	50 Ω AC CORREC 5000000 GHz PN0: Fa IFGain:L	st 🔸 Trig: Free Run	ALIGNAUTO Avg Type: Log-Pwr Avg Hold: 10/10	02:07:38 AMNov 25, 2020 TRACE 12 3 4 5 6 TYPE MUNITORNO DET PINNINN 1 2.164 97 GHZ	
gilent Spectrum Analyzer Center Freq 1.215 10 dB/div Ref 20.0 Pg	50 Ω AC CORREC 5000000 GHz PN0: Fa IFGain:L	st 🔸 Trig: Free Run	ALIGNAUTO Avg Type: Log-Pwr Avg Hold: 10/10	02:07:38 AM Nov 25, 2020 TRACE 2 3 4 5 6 TYPE MUNUMULA DET P.NNNNN	
kgilent Spectrum Analyzer R RL RF S Center Freq 1.215 10 dB/div Ref 20.0 10 dB/div Ref 20.0	50 Ω AC CORREC 5000000 GHz PN0: Fa IFGain:L	st 🔸 Trig: Free Run	ALIGNAUTO Avg Type: Log-Pwr Avg Hold: 10/10	02:07:38 AMNov 25, 2020 TRACE 12 3 4 5 6 TYPE MUNITORNO DET PINNINN 1 2.164 97 GHZ	Auto Tu Center Fr
vgilent Spectrum Analyzer R R RE C Center Freq 1.215 10 dB/div Ref 20.0	50 Ω AC CORREC 5000000 GHz PN0: Fa IFGain:L	st 🔸 Trig: Free Run	ALIGNAUTO Avg Type: Log-Pwr Avg Hold: 10/10	02:07:38 AMNov 25, 2020 TRACE 12 3 4 5 6 TYPE MUNITORNO DET PINNINN 1 2.164 97 GHZ	Auto Tu Center Fr
Aglient Spectrum Analyzer X RL RE C Center Freq 1.215 10 dB/div Ref 20.0 0 00	50 Ω AC CORREC 5000000 GHz PN0: Fa IFGain:L	st 🔸 Trig: Free Run	ALIGNAUTO Avg Type: Log-Pwr Avg Hold: 10/10	02:07:38 AMNov 25, 2020 TRACE 12 3 4 5 6 TYPE MUNITORNO DET PINNINN 1 2.164 97 GHZ	Auto Tu Center Fr 1.215000000 G
Image: Second	50 Ω AC CORREC 5000000 GHz PN0: Fa IFGain:L	st 🔸 Trig: Free Run	ALIGNAUTO Avg Type: Log-Pwr Avg Hold: 10/10	02:07:38 AMNov 25, 2020 TRACE 12 3 4 5 6 TYPE MUNAWWY DET P MININ N 1 2.164 97 GHz -58.492 dBm	Auto Tu Center Fr 1.215000000 G Start Fr
Agilent. Spectrum Analyzer           RL         RF         S           Center Freq 1.215         Ref 20.6           10 dB/div         Ref 20.6           10	50 Ω AC CORREC 5000000 GHz PN0: Fa IFGain:L	st 🔸 Trig: Free Run	ALIGNAUTO Avg Type: Log-Pwr Avg Hold: 10/10	02:07:38 AMNov 25, 2020 TRACE 12 3 4 5 6 TYPE MUNAWWY DET P MININ N 1 2.164 97 GHz -58.492 dBm	Auto Tur Center Fra 1.21500000 G Start Fra
Agilent Spectrum Analyzer           RL         RF           Center Freq 1.215           10 dB/div         Ref 20.0           00	50 Ω AC CORREC 5000000 GHz PN0: Fa IFGain:L	st 🔸 Trig: Free Run	ALIGNAUTO Avg Type: Log-Pwr Avg Hold: 10/10	02:07:38 AMNov 25,2020 TRACE 19:28 4.5 6 TYPE MANNAW OFT P NANN N 1 2.164 97 GHz -58.492 dBm	Auto Tu Center Fr 1.21500000 G Start Fr 30.000000 M Stop Fr
Agilent Spectrum Analyzer           RL         RF         S           Center Freq 1.215         Ref 20.0           Og         Image: Comparison of the second s	50 Ω AC CORREC 5000000 GHz PN0: Fa IFGain:L	st 🔸 Trig: Free Run	ALIGNAUTO Avg Type: Log-Pwr Avg Hold: 10/10	02:07:38 AMNov 25,2020 TRACE 19:28 4.5 6 TYPE MANNAW OFT P NANN N 1 2.164 97 GHz -58.492 dBm	Auto Tur Center Fr 1.21500000 G Start Fr 30.000000 M Stop Fr
Image: second	50 Q AC   CORREC 5000000 GHZ PN0: FC IFGain:L 00 dBm	Trig: Free Run Atten: 30 dB	ALIGNAUTO Avg Type: Log-Pwr Avg Hold: 10/10 Mkr	02:07:38 AMNov 25, 2020 TRACE 1 2 3 4 5 6 TYPE M MUNUMUN DET P NINN N 1 2.164 97 GHz -58.492 dBm -2021 dBm -2021 dBm -2021 dBm -2021 dBm -2021 dBm	Auto Tu Center Fr 1.215000000 G Start Fr 30.000000 M Stop Fr 2.400000000 G
Image: second	50 Q AC CORREC 5000000 GHZ PN0: Fz IF6ain:L 00 dBm	st 🔸 Trig: Free Run	Arg Type: Log-Pwr Arg Hold: 10/10 Mkr	02:07:38 AMNov 25, 2020 TRACE 1 2 3 4 5 6 TYPE MUNUMUN DET P MININ N 1 2.164 97 GHz -58.492 dBm -2021 dbm -2021 dbm 1 Stop 2.400 GHz 8.0 ms (30000 pts)	Auto Tu Center Fr 1.215000000 G Start Fr 30.000000 M Stop Fr 2.400000000 G
Agilent Spectrum Analyzer           RL         Re         I           Center Freq 1.21           Conter Freq 1.21           Conter Freq 1.21           Re         I           Conter Freq 1.21	50 Q AC   CORREC 5000000 GHZ PN0: FC IFGain:L 00 dBm	Trig: Free Run Atten: 30 dB	ALIGNAUTO Avg Type: Log-Pwr Avg Hold: 10/10 Mkr	02:07:38 AMNov 25, 2020 TRACE 1 2 3 4 5 6 TYPE M MUNUMUN DET P NINN N 1 2.164 97 GHz -58.492 dBm -2021 dBm -2021 dBm -2021 dBm -2021 dBm -2021 dBm	Auto Tu Center Fr 1.215000000 G Start Fr 30.000000 M Stop Fr 2.400000000 G
vigilent Spectrum Analyzer           Q RL         RF         S           Center Freq 1.215           O dB/div         Ref 20.0           O 0         S         S           O 0         S         S         S           O 0         S         S         S         S           O 0         S         S         S         S         S           Start 30 MHz         #Res BW 100 kHz         MKR         MDE         TRC SCL         I           MKR MODE         TRC SCL         I         f         2         3         I         f         3         S	SD Q AC CORREC 5000000 GHZ PRO: REGain:L 00 dBm	Trig: Free Run Atten: 30 dB	Arg Type: Log-Pwr Arg Hold: 10/10 Mkr	02:07:38 AMNov 25, 2020 TRACE 1 2 3 4 5 6 TYPE MUNUMUN DET P MININ N 1 2.164 97 GHz -58.492 dBm -2021 dbm -2021 dbm 1 Stop 2.400 GHz 8.0 ms (30000 pts)	Auto Tu Center Fr 1.215000000 G Start Fr 30.000000 M Stop Fr 2.400000000 G CF Str 237.000000 M Auto M
Agilent Spectrum Analyzer           RL         RF         S           Center Freq 1.215           Conter Freq 1.215	SD Q AC CORREC 5000000 GHZ PRO: REGain:L 00 dBm	Trig: Free Run Atten: 30 dB	Arg Type: Log-Pwr Arg Hold: 10/10 Mkr	02:07:38 AMNov 25, 2020 TRACE 1 2 3 4 5 6 TYPE MUNUMUN DET P MININ N 1 2.164 97 GHz -58.492 dBm -2021 dbm -2021 dbm 1 Stop 2.400 GHz 8.0 ms (30000 pts)	Auto Tur Center Fr 1.215000000 G Start Fr 30.000000 M Stop Fr 2.400000000 G CF Sto 237.000000 M Auto M
Agilent Spectrum Analyzer           RL         RF         I           Center Freq 1.215           Conter Freq 1.215	SD Q AC CORREC 5000000 GHZ PRO: REGain:L 00 dBm	Trig: Free Run Atten: 30 dB	Arg Type: Log-Pwr Arg Hold: 10/10 Mkr	02:07:38 AMNov 25, 2020 TRACE 1 2 3 4 5 6 TYPE MUNUMUN DET P MININ M 1 2.164 97 GHz -58.492 dBm -2021 db	Auto Tur Center Fr 1.215000000 G Start Fr 30.000000 M Stop Fr 2.400000000 G CF Sto 237.000000 M Auto M
Agilent Spectrum Analyzer X RL RF 12 Center Freq 1.215 Conter Freq	SD Q AC CORREC 5000000 GHZ PRO: REGain:L 00 dBm	Trig: Free Run Atten: 30 dB	Arg Type: Log-Pwr Arg Hold: 10/10 Mkr	02:07:38 AMNov 25, 2020 TRACE 1 2 3 4 5 6 TYPE MUNUMUN DET P MININ M 1 2.164 97 GHz -58.492 dBm -2021 db	Auto Tur Center Fr 1.215000000 G Start Fr 30.000000 M Stop Fr 2.400000000 G CF Sto 237.000000 M Auto M
kgilent Spectrum Analyzer           Q         RL         Re         IS           Center Freq 1.215         Ref 20.0         IS         IS           Cog         IS         IS         IS         IS           10         dB/div         Ref 20.0         IS         IS         IS           100         IS         IS <this< th="">         IS         IS         IS</this<>	SD Q AC CORREC 5000000 GHZ PRO: REGain:L 00 dBm	Trig: Free Run Atten: 30 dB	Arg Type: Log-Pwr Arg Hold: 10/10 Mkr	02:07:38 AMNov 25, 2020 TRACE 1 2 3 4 5 6 TYPE MUNUMUN DET P MININ M 1 2.164 97 GHz -58.492 dBm -2021 db	Auto Tur Center Fra 1.215000000 Gi Start Fra 30.000000 Mi Stop Fra 2.400000000 Gi CF Sta 237.00000 Mi

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

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

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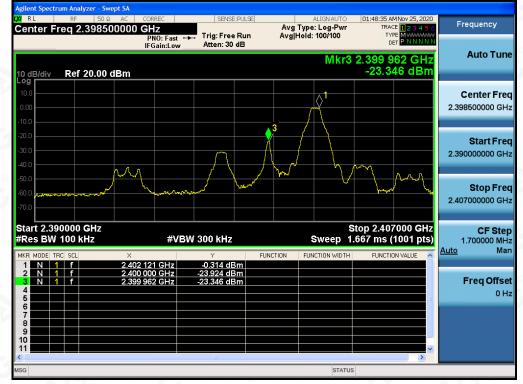
 Tel: +86-755 2523 4088
 E-mail: agc@agc-cert.com



#### TEST RESULT FOR BAND EDGE

#### GFSK MODULATION IN LOW CHANNEL

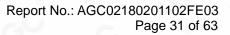
Hopping off



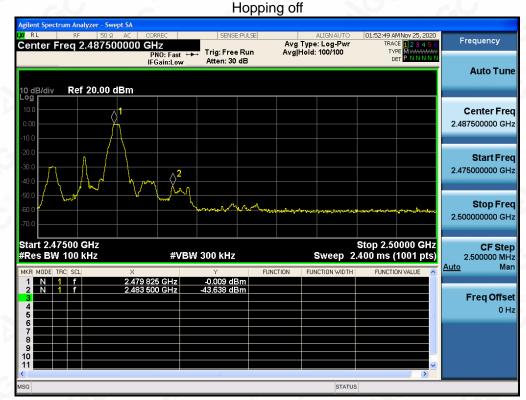
Hopping on



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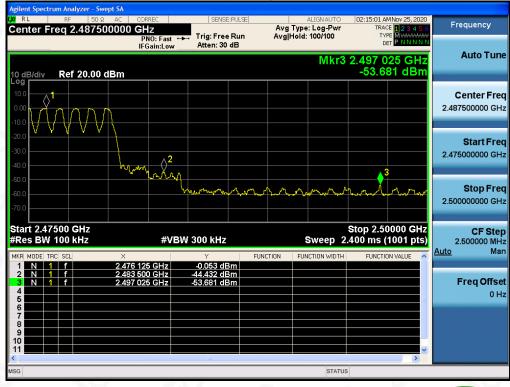






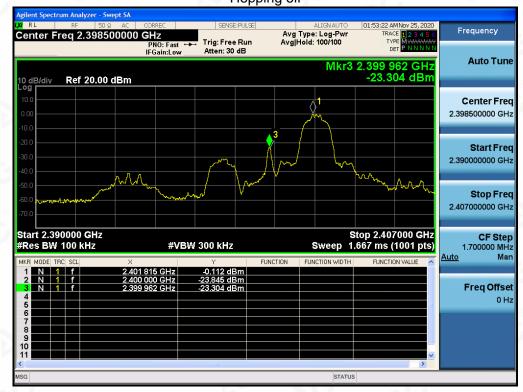
# GFSK MODULATION IN HIGH CHANNEL

Hopping 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 off

Hopping on



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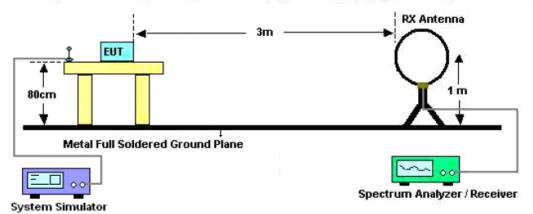
 Tel: +86-755 2523 4088
 E-mail: agc@agc-cert.com

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

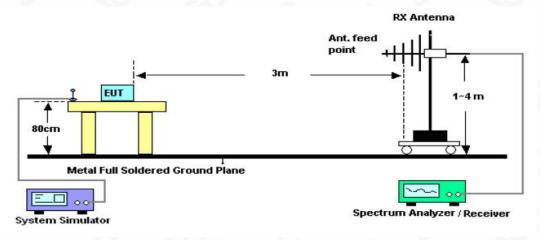


#### 10.2. TEST SETUP

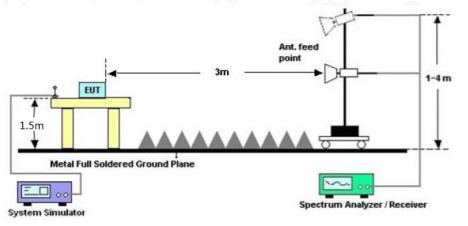
Radiated Emission Test-Setup Frequency Below 30MHz



# RADIATED EMISSION TEST SETUP 30MHz-1000MHz



# RADIATED EMISSION TEST SETUP ABOVE 1000MHz



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#### **10.3. LIMITS AND MEASUREMENT RESULT**

#### 15.209 Limit in the below table has to be followed

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

Note: All modes were tested for restricted band radiated emission, the test records reported below are the worst result compared to other modes.

# **10.4. TEST RESULT**

#### **RADIATED EMISSION BELOW 30MHz**

The amplitude of spurious emissions from 9kHz to 30MHz which are attenuated more than 20 dB below the permissible value need not be reported.

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EUT	Bluetooth FM Transmitter	Model Name	HK302
Temperature	25°C	Relative Humidity	55.4%
Pressure	960hPa	Test Voltage	Normal Voltage
Test Mode	Mode 5	Antenna	Horizontal

#### **RADIATED EMISSION BELOW 1GHz**



NO.	Freq. [MHz]	Level [dBµV/m]	Factor [dB]	Limit [dBµV/m]	Margin [dB]	Height [cm]	Angle [°]	Polarity
1	51.3400	23.59	11.57	40.00	16.41	100	313	Horizontal
2	149.3100	25.93	14.88	43.50	17.57	200	266	Horizontal
3	270.5600	28.78	15.47	46.00	17.22	100	104	Horizontal
4	361.7400	32.10	18.30	46.00	13.90	200	0	Horizontal
5	531.4900	33.15	22.88	46.00	12.85	100	1	Horizontal
6	787.5700	40.40	28.17	46.00	5.60	100	75	Horizontal

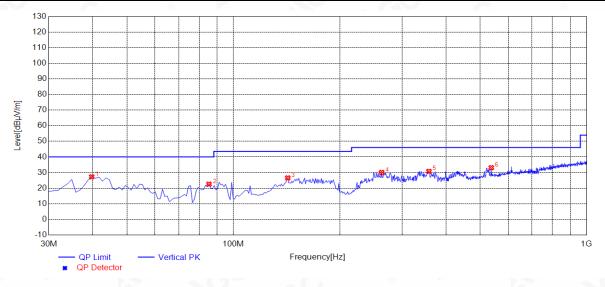
#### **RESULT: PASS**

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#### Report No.: AGC02180201102FE03 Page 39 of 63

EUT	Bluetooth FM Transmitter	Model Name	HK302
Temperature	25°C	Relative Humidity	55.4%
Pressure	960hPa	Test Voltage	Normal Voltage
Test Mode	Mode 5	Antenna	Vertical



9	NO.	Freq. [MHz]	Level [dBµV/m]	Factor [dB]	Limit [dBµV/m]	Margin [dB]	Height [cm]	Angle [°]	Polarity
	1	39.7000	27.27	11.86	40.00	12.73	100	282	Vertical
Γ	2	85.2900	22.56	7.20	40.00	17.44	100	317	Vertical
Γ	3	142.5200	26.55	14.88	43.50	16.95	100	303	Vertical
Γ	4	262.8000	30.07	14.80	46.00	15.93	100	67	Vertical
	5	357.8600	30.75	18.13	46.00	15.25	100	334	Vertical
	6	537.3100	33.12	22.98	46.00	12.88	100	276	Vertical

# **RESULT: PASS**

**Note:** 1. Factor=Antenna Factor + Cable loss, Margin= Limit-Level.

2. All test modes had been pre-tested. The mode 5 is the worst case and recorded in the report.

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#### Report No.: AGC02180201102FE03 Page 40 of 63

# **RADIATED EMISSION ABOVE 1GHz**

EUT	Bluetooth FM Transmitter	Model Name	HK302
Temperature	25°C	Relative Humidity	55.4%
Pressure	960hPa	Test Voltage	Normal Voltage
Test Mode	Mode 4	Antenna	Horizontal

Frequency	Meter Reading	Factor	Emission Level	Limits	Margin	
(MHz)	(dBµV)	(dB)	(dBµV/m)	(dBµV/m)	(dB)	- Value Type
4804.000	45.97	0.08	46.05	74	-27.95	peak
4804.000	36.36	0.08	36.44	54	-17.56	AVG
7206.000	39.87	2.21	42.08	74	-31.92	peak
7206.000	32.76	2.21	34.97	54	-19.03	AVG
59	. <u>C</u>			<b>S</b>		
emark:			0			
actor = Anter	nna Factor + Cab	le Loss – Pre-	amplifier.	8		

EUT	Bluetooth FM Transmitter	Model Name	HK302
Temperature	25°C	Relative Humidity	55.4%
Pressure	960hPa	Test Voltage	Normal Voltage
Test Mode	Mode 4	Antenna	Vertical

Meter Reading	Factor	Emission Level	Limits	Margin	Value Type
(dBµV)	(dB)	(dBµV/m)	(dBµV/m)	(dB)	value Type
45.96	0.08	46.04	74	-27.96	peak
35.54	0.08	35.62	54	-18.38	AVG
39.63	2.21	41.84	74	-32.16	peak
31.58	2.21	33.79	54	-20.21	AVG
0			9	G	8
<u>_</u>				Г с.	0
	(dBµV) 45.96 35.54 39.63	(dBµV)         (dB)           45.96         0.08           35.54         0.08           39.63         2.21	(dBµV)         (dB)         (dBµV/m)           45.96         0.08         46.04           35.54         0.08         35.62           39.63         2.21         41.84	(dBµV)         (dB)         (dBµV/m)         (dBµV/m)           45.96         0.08         46.04         74           35.54         0.08         35.62         54           39.63         2.21         41.84         74	(dBµV)         (dB)         (dBµV/m)         (dBµV/m)         (dB)           45.96         0.08         46.04         74         -27.96           35.54         0.08         35.62         54         -18.38           39.63         2.21         41.84         74         -32.16

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