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# FCC Test Report

## Report No.: AGC00737180603FE03

FCC ID	: 2AIL4-BH169A
APPLICATION PURPOSE	: Original Equipment
PRODUCT DESIGNATION	: BLUETOOTH FM TRANSMITTER
BRAND NAME	: VTIN
MODEL NAME	: BH169A
CLIENT	: VTIN TECHNOLOGY CO., LIMITED
DATE OF ISSUE	: Jun. 23, 2018
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		Jun. 23, 2018	Valid	Initial Release





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Unit D,16/F, One Capital Place, 18 Luard Road Wan Chai, HongKong ,China
VTIN TECHNOLOGY CO., LIMITED
Unit D,16/F, One Capital Place, 18 Luard Road Wan Chai, HongKong ,China
BLUETOOTH FM TRANSMITTER
VTIN
BH169A
Jun. 08, 2018 to Jun. 23, 2018
None
Normal
Pass
AGCRT-US-BR/RF

#### 1. VERIFICATION OF CONFORMITY

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.

Tested By

Max Zhan

Max Zhang(Zhang Yi)

Jun. 23, 2018

Reviewed By

BONPL Nie

Bart Xie(Xie Xiaobin)

Jun. 23, 2018

Approved By

-owesto en

Forrest Lei(Lei Yonggang) Authorized Officer

Jun. 23, 2018





#### 2. GENERAL INFORMATION 2.1. PRODUCT DESCRIPTION

The EUT is designed as "BLUETOOTH FM TRANSMITTER". 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	2.402 GHz to 2.480GHz
RF Output Power	3.564dBm(Max)
Bluetooth Version	V2.1+EDR
Modulation	GFSK, π /4-DQPSK, 8DPSK
Number of channels	79
Hardware Version	BM169A_MB_V1.0
Software Version	V1.0
Antenna Designation	Integral Antenna
Antenna Gain	-0.55dBi
Power Supply	DC 12V/24V

#### 2.2. TABLE OF CARRIER FREQUENCYS

Frequency Band	Channel Number	Frequency
Theread and a construction of the second	0	2402MHZ
	THE 1 TH AS COMMENT	2403MHZ
The the allow	The contract of the standard o	
C These of Contract of Contrac	38	2440 MHZ
2402~2480MHZ	39	2441 MHZ
THE STATE	40	2442 MHZ
And Compares Based	CO M	
	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 multislot 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 79 hopping sequence in data mode: 40,21,44,23,42,53,46,55,48,33,52,35,50,65,54,67 56,37,60,39,58,69,62,71,64,25,68,27,66,57,70,59 72,29,76,31,74,61,78,63,01,41,05,43,03,73,07,75 09,45,13,47,11,77,15,00,64,49,66,53,68,02,70,06 01, 51, 03, 55, 05, 04

#### 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 ehavior zation with other units only offset are 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 bit 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 te Sequence. This will be done at the beginning of every new transmission.

Regarding short transmissions the Bluetooth system has the following ehavior:

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. 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.

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

This submittal(s) (test report) is intended for **FCC ID: 2AIL4-BH169A** 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.



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#### **3. MEASUREMENT UNCERTAINTY**

The uncertainty is calculated using the methods suggested in the "Guide to the Expression of Uncertainty in

- measurement" (GUM) published by CISPR and ANSI.
- Uncertainty of Conducted Emission,  $Uc = \pm 3.2 dB$
- Uncertainty of Radiated Emission below 1GHz, Uc =  $\pm 3.9$  dB
- Uncertainty of Radiated Emission above 1GHz, Uc = ±4.8 dB





#### 4. DESCRIPTION OF TEST MODES

NO.	TEST MODE DESCRIPTION			
1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1	Low channel TX			
© 2 de la contra	Middle channel TX			
603	High channel TX			
4	Normal Operating (BT)			

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. All the modes are tested under DC 12V and DC 24V, but only the worst case is recorded in this report.



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#### 5. SYSTEM TEST CONFIGURATION 5.1. CONFIGURATION OF EUT SYSTEM

EUT

Support

#### 5.2 EQUIPMENT USED IN TESTED SYSTEM

Item	Equipment	Mfr/Brand	Model/Type No.	Remark
1	BLUETOOTH FM TRANSMITTER	BH169A	2AIL4-BH169A	EUT
2	U-disk	Kingston	P BOU	Support
3	Load	10 - A	DC5V 2A	Support
4	Battery	and Contraction of Colors	DC 12V	Support *2

#### **5.3. SUMMARY OF TEST RESULTS**

FCC RULES	DESCRIPTION OF TEST	RESULT	
15.247	Peak Output Power	Compliant	
15.247	20 dB Bandwidth	Compliant	
15.247	Spurious Emission	Compliant	
15.247&15.209	Radiated Emission	Compliant	
15.247	Number of Hopping Frequency	Compliant	
15.247	Time of Occupancy	Compliant	
15.247	Frequency Separation	Compliant	
15.207	Conducted Emission	N/A	

Note: N/A stands for not applicable.





#### 6. TEST FACILITY

Test Site	Attestation of Global Compliance (Shenzhen) Co., Ltd
Location	1-2F., Bldg.2, No.1-4, Chaxi Sanwei Technical Industrial Park, Gushu, Xixiang, Bao'an District B112-B113, Bldg.12, Baoan Bldg Materials Center, No.1 of Xixiang Inner Ring Road, Baoan District, Shenzhen 518012
NVLAP LAB CODE	600153-0
Designation Number	CN5028
FCC Test Firm Registration Number	682566
Description	Attestation of Global Compliance(Shenzhen) Co., Ltd is accredited by National Voluntary Laboratory Accreditation program, NVLAP Code 600153-0

#### TEST EQUIPMENT OF CONDUCTED EMISSION TEST

Equipment	Manufacturer	Model	S/N	Cal. Date	Cal. Due
TEST RECEIVER	R&S	SCI SCI	100096	Jul. 02, 2017	Jul. 01, 2018
LISN	R&S	ESH2-Z5	100086	Aug.21, 2017	Aug.20, 2018

#### **TEST EQUIPMENT OF RADIATED EMISSION TEST**

		- 10173	20173		NOV ADDA LOO
Equipment	Manufacturer	Model	S/N	Cal. Date	Cal. Due
TEST RECEIVER	R&S	ESPI	101206	Jul. 02, 2017	Jul. 01, 2018
EXA Signal Analyzer	Aglient	N9010A	MY53470504	Dec.08, 2017	Dec.07, 2018
Horn antenna	SCHWARZBECK	BBHA 9170	#768	Sep.20, 2017	Sep.19, 2018
preamplifier	ChengYi	EMC184045SE	980508	Sep.15, 2017	Sep.14, 2018
Active loop antenna (9K-30MHz)	A.H.	SAS-562B	N/A	Mar.01, 2018	Feb.28, 2020
Double-Ridged Waveguide Horn	ETS LINDGREN	3117	00034609	May 18, 2017	May 17, 2019
Broadband Preamplifier	SCHWARZBECK	BBV 9718	9718-205	Jul. 02, 2017	Jul. 01, 2018
ANTENNA	SCHWARZBECK	VULB9168	D69250	Sep.28, 2017	Sep.27, 2018
			a do		



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#### 7. PEAK OUTPUT POWER

#### 7.1. MEASUREMENT PROCEDURE

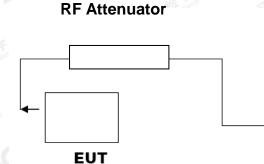
For peak power test:

- 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 ≥RBW.
- 5. Sweep: Auto.
- 6. Detector function: Peak.
- 7. Trace: Max hold.

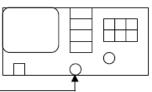
Allow trace to stabilize. Use the marker-to-peak function to set the marker to the peak of the emission. The indicated level is the peak output power, after any corrections for external attenuators and cables.

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

#### PEAK POWER TEST SETUP



#### Spectrum Analyzer

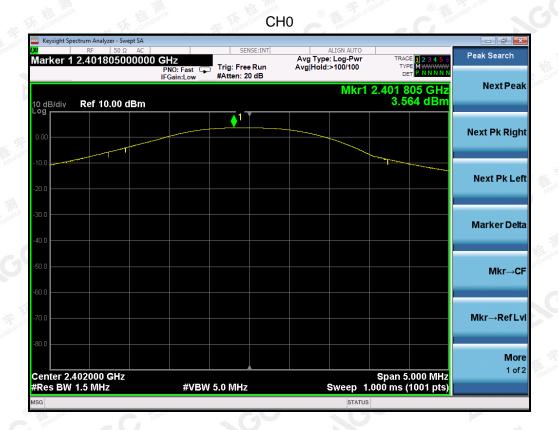






#### 7.3. LIMITS AND MEASUREMENT RESULT

	PEAK OUTPUT POWER MEASUR	EMENT RESULT	
	FOR GFSK MOUDULA	TION	
Frequency (GHz)	Peak Power (dBm)	Applicable Limits (dBm)	Pass or Fail
2.402	3.564	30	Pass
2.441	3.022	30	Pass
2.480	2.106	30	Pass





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ctrum Analyzer - Swept SA Keysight Sp Avg Type: Log-Pwr Avg|Hold:>100/100 Peak Search Marker 1 2.440800000000 GHz PNO: Fast 234 TYP DE Trig: Free Run #Atten: 20 dB Next Peak Mkr1 2.440 800 GHz 3.022 dBm 10 dB/div Log Ref 10.00 dBm 1 **Next Pk Right** Next Pk Left Marker Delta Mkr→CF Mkr→RefLvi More 1 of 2 Center 2.441000 GHz #Res BW 1.5 MHz Span 5.000 MHz Sweep 1.000 ms (1001 pts) #VBW 5.0 MHz

CH39

CH78

arker 1 2.47980000000		SENSE:INT	Avg Type: Log-Pwr	TRACE 1 2 3 4 5 6 TYPE MWWWWW	Peak Search
	PNO: Fast ( IFGain:Low	Trig: Free Run #Atten: 20 dB	Avg Hold:>100/100	DET P NNNN	
dB/div Ref 10.00 dBm			Mkr1	2.479 800 GHz 2.106 dBm	NextPe
		<b>↓</b> <sup>1</sup>			Next Pk Ri
0.0					
0.0					Next Pk I
0.0					
0.0					Marker D
0.0					
0.0					Mkr–
0.0					Mkr→Ref
0.0					wiki → Rei
					М
enter 2.480000 GHz Res BW 1.5 MHz	#VB	W 5.0 MHz	Sweep 1	Span 5.000 MHz .000 ms (1001 pts)	1



	PEAK OUTPUT POWER MEASUF FOR II /4-DQPSK MOD		
Frequency (GHz)	Peak Power (dBm)	Applicable Limits (dBm)	Pass or Fail
2.402	2.566	30	Pass
2.441	2.040	30	Pass
2.480	1.060	30	Pass

CH0





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Keysight Spectrum Analyzer - Swept SA Peak Search Marker 1 2.440805000000 GHz PNO: Fast IFGain:Low Avg Type: Log-Pwi Avg|Hold:>100/100 234 Trig: Free Run TYP DE #Atten: 20 dB Next Peak Mkr1 2.440 805 GHz 2.040 dBm 10 dB/div Ref 10.00 dBm ▲1 Next Pk Right Next Pk Left Marker Delta Mkr→CF Mkr→RefLvl More 1 of 2 Center 2.441000 GHz #Res BW 1.5 MHz Span 5.000 MHz Sweep 1.000 ms (1001 pts) #VBW 5.0 MHz

CH39

CH78





Frequency (GHz)	FOR 8-DPSK MODU Peak Power (dBm)	Applicable Limits (dBm)	Pass or Fail
2.402	2.568	30	Pass
2.441	2.040	30	Pass
2.480	1.070	30	Pass

#### CH0





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Keysight Spectrum Analyzer - Swept SA Peak Search Marker 1 2.440975000000 GHz PNO: Fast IFGain:Low Avg Type: Log-Pwi Avg|Hold:>100/100 Trig: Free Run TYP DE #Atten: 20 dB Mkr1 2.440 975 GHz 2.040 dBm Next Peak 10 dB/div Ref 10.00 dBm Next Pk Right Next Pk Left Marker Delta Mkr→CF Mkr→RefLvl More 1 of 2 Center 2.441000 GHz #Res BW 1.5 MHz Span 5.000 MHz Sweep 1.000 ms (1001 pts) #VBW 5.0 MHz

CH39

CH78



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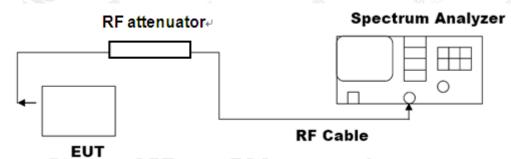
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#### 8. 20DB BANDWIDTH

#### 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)



#### 8.3. LIMITS AND MEASUREMENT RESULTS

MEASURE	MENT RESULT FOR	GFSK MOUDULATION	
Appliechle Limite		Measurement Result	
Applicable Limits	Test Da	ata (MHz)	Criteria
The training of the training of the training	Low Channel	0.8316	PASS
N/A	Middle Channel	0.8220	PASS
	High Channel	0.8262	PASS





#### TEST PLOT OF BANDWIDTH FOR LOW CHANNEL

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#### Center Freq: 2.441000000 GHz Trig: Free Run Avg|Ho Frequency Center Freq 2.441000000 GHz Radio Std: None Avg|Hold:>10/10 #IFGain:Low #Atten: 20 dB Radio Device: BTS Ref 10.00 dBm 5 dB/div ٥g **Center Freq** 2 441000000 GHz Span 3 MHz Sweep 4.133 ms Center 2.441 GHz #Res BW 30 kHz **CF** Step #VBW 100 kHz 300.000 kH Auto Mar **Occupied Bandwidth** Total Power 8.63 dBm 830.35 kHz **Freq Offset** 0 H; -36.079 kHz 99.00 % Transmit Freg Error % of OBW Power -20.00 dB x dB Bandwidth 822.0 kHz x dB

TEST PLOT OF BANDWIDTH FOR MIDDLE CHANNEL

STATUS



		-		line	the sold	31
Keysight Spec	ctrum Analyzer - Occupied BV RF 50 Ω AC	v	SENSE:INT	ALIGN AU	F0	
enter Fr	req 2.48000000	I GHz #IFGain:Low	Center Freq: 2.4800		Radio Std: None Radio Device: BTS	Frequency
5 dB/div	Ref 10.00 dBr	n .				
.og 5.00			Am			Center Fre
20.0		~~~~		~~~~		2.480000000 GH
i5.0						
6.0						
0.0						
5.0 110						
125						
enter 2.4			#) (BW) 4001		Span 3 M	
Res BW	30 KHZ		#VBW 100	KHZ	Sweep 4.133 r	ms 300.000 kH Auto Ma
Occup	bied Bandwidt		Total F	Power 7	.87 dBm	
	8	36.80 kH	IZ			Freq Offs
Transm	nit Freq Error	-35.955 k	Hz % of O	BW Power	99.00 %	0 H
x dB Ba	andwidth	826.2 k	Hz x dB	-2	20.00 dB	

STATUS

#### TEST PLOT OF BANDWIDTH FOR HIGH CHANNEL



MEASURE		4-DQPSK MODULATIO	N
Angliaghta Limita		Measurement Result	t
Applicable Limits	Test Da	ata (MHz)	Criteria
	Low Channel	1.113	PASS
N/A	Middle Channel	1.114	PASS
Standard Calendard Constant	High Channel	1.112	PASS

#### TEST PLOT OF BANDWIDTH FOR LOW CHANNEL







#### TEST PLOT OF BANDWIDTH FOR MIDDLE CHANNEL

#### TEST PLOT OF BANDWIDTH FOR HIGH CHANNEL



REMENT RESULT FOR 8-D	PSK MODULATION	
	Measurement Resul	t
Test Data	(MHz)	Criteria
Low Channel	1.112	PASS
Middle Channel	1.135	PASS
High Channel	1.112	PASS
	Test Data Low Channel Middle Channel	Test Data (MHz)Low Channel1.112Middle Channel1.135

#### TEST PLOT OF BANDWIDTH FOR LOW CHANNEL



STATUS





#### 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

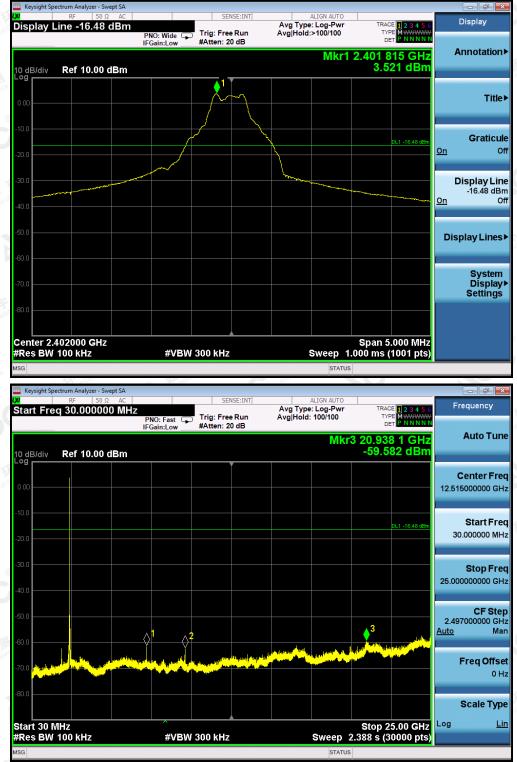
LIMITS AND MEAS	SUREMENT RESULT	
Applieghte Limite	Measurement Res	sult
Applicable Limits	Test Data	Criteria
In any 100 KHz Bandwidth Outside the frequency band in which the spread spectrum intentional radiator is operating, the radio frequency	At least -20dBc than the limit Specified on the BOTTOM Channel	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





<mark>x</mark> Display I	RF 50 Ω /	sm	SE	e Dun		e: Log-Pwr :>100/100	TRA	CE 1 2 3 4 5 6 PE M	D	isplay
		PNO: Wide IFGain:Low	#Atten: 2		Avginoid		D	ET P NNNN		inotatior
I0 dB/div	Ref 10.00 dB	m				MKr1	2.440 8	812 GHz )79 dBm		Totation
			1							Title
0.00										TILLE
-10.0										Graticu
20.0			<i>/</i>					DL1 -17.02 dBm	<u>On</u>	(
-30.0									Di	splay Lii
									<u>On</u>	-17.02 dB
-40.0										
-50.0									Disp	lay Lines
-60.0										
-70.0										Systen Display
										Setting
-80.0										
	441000 GHz			<b>_</b>			Span :	5.000 MHz		
	100 kHz	#VI	3W 300 kHz	-		Sweep 1		(1000 pts)		
ISG	100 kHz		3W 300 kHz			Sweep 1		(1000 pts)		
ISG Keysight Sp 4 T	2 100 kHz pectrum Analyzer - Swept RF 50 Ω	SA AC	- M. N.	NSE:INT		STATUS			[	allency/
ISG Keysight Sp 4 T	100 kHz	SA AC MHZ PNO: Fast	SE	INSE:INT	Avg Type	STATUS	TRA	CE 1 2 3 4 5 6 PE M	[	a a quency
Keysight Sp G T Start Fre	2 100 kHz	SA AC MHZ PNO: Fast IFGain:Low	SE	INSE:INT	Avg Type	STATUS ALIGN AUTO E: Log-Pwr :>100/100	TRA TY D T <b>3 7.32</b>		Fre	quency
isg Keysight Sp U T Start Fre	2 100 kHz pectrum Analyzer - Swept RF 50 Ω	SA AC MHZ PNO: Fast IFGain:Low	SE	INSE:INT	Avg Type	STATUS ALIGN AUTO E: Log-Pwr :>100/100	TRA TY D T <b>3 7.32</b>	CE 1 2 3 4 5 6 PE M WWWWW ET P N N N N	Fre	quency Auto Tui
isg Keysight Sp X T Start Fre	2 100 kHz	SA AC MHZ PNO: Fast IFGain:Low	SE	INSE:INT	Avg Type	STATUS ALIGN AUTO E: Log-Pwr :>100/100	TRA TY D T <b>3 7.32</b>		Fre	quency Auto Tui enter Fre
Keysight Sp Keysight Sp T Start Fre 10 dB/div Og 10.0	2 100 kHz	SA AC MHZ PNO: Fast IFGain:Low	SE	INSE:INT	Avg Type	STATUS ALIGN AUTO E: Log-Pwr :>100/100	TRA TY D T <b>3 7.32</b>		Fre	quency Auto Tui enter Fre
Keysight Sp T Start Fre 10 dB/div 0 00 0 00	2 100 kHz	SA AC MHZ PNO: Fast IFGain:Low	SE	INSE:INT	Avg Type	STATUS ALIGN AUTO E: Log-Pwr :>100/100	TRA TY D T <b>3 7.32</b>		Fre C 12.515	quency Auto Tur enter Fre 000000 Gi Start Fre
Keysight Sp Keysight Sp T Start Fre 10 dB/div Og 10.0	2 100 kHz	SA AC MHZ PNO: Fast IFGain:Low	SE	INSE:INT	Avg Type	STATUS ALIGN AUTO E: Log-Pwr :>100/100	TRA TY D T <b>3 7.32</b>		Fre C 12.515	
ISG	2 100 kHz	SA AC MHZ PNO: Fast IFGain:Low	SE	INSE:INT	Avg Type	STATUS ALIGN AUTO E: Log-Pwr :>100/100	TRA TY D T <b>3 7.32</b>	2 3 4 5 6 PE PE 2 3 GHz 04 dBm	C 12.515 30.1	quency Auto Tur enter Fra 200000 Gi Start Fra 2000000 Mi Stop Fra
Keysight Sp T Start Fre 10 dB/div 0 00 0 00	2 100 kHz	SA AC MHZ PNO: Fast IFGain:Low	SE	INSE:INT	Avg Type	STATUS ALIGN AUTO E: Log-Pwr :>100/100	TRA TY D T <b>3 7.32</b>	2 3 4 5 6 PE PE 2 3 GHz 04 dBm	C 12.515 30.1	quency Auto Tur enter Fra 200000 Gi Start Fra 2000000 Mi Stop Fra
Keysight Sp       K     T       Start Fre       10 dB/div       °9       10.0       .000       .000       .000       .000       .000       .000       .000       .000       .000       .000       .000	2 100 kHz	SA AC MHZ PNO: Fast IFGain:Low	SE	INSE:INT	Avg Type	STATUS ALIGN AUTO E: Log-Pwr :>100/100	TRA TY D T <b>3 7.32</b>	2 3 4 5 6 PE PE 2 3 GHz 04 dBm	C 12.515 30.0	quency Auto Tur enter Fro 000000 Gi Start Fro 000000 Gi Stop Fro 000000 Gi
tsg     Start Sp       0 dB/div     0 dB/div       0 0 dB/div     0 dB/div       0 0 0     0 00       10 0     0 00       .0 0 0     0 00       .10 0     0 00       .10 0     0 00       .10 0     0 00       .10 0     0 00       .10 0     0 00       .10 0     0 00	2 100 kHz	SA AC MHZ PNO: Fast IFGain:Low	SE	INSE:INT	Avg Type Avg Hold	STATUS ALIGN AUTO E: Log-Pwr :>100/100	TRA TY D T <b>3 7.32</b>	2 3 4 5 6 PE PE 2 3 GHz 04 dBm	C 12.515 30.0	quency Auto Tur enter Fro 000000 G Start Fro 000000 M Stop Fro
tsg     Start Sp       0 dB/div     0 dB/div       0 0 dB/div     0 dB/div       0 0 0     0 00       10 0     0 00       .0 0 0     0 00       .10 0     0 00       .10 0     0 00       .10 0     0 00       .10 0     0 00       .10 0     0 00       .10 0     0 00	2 100 kHz	SA AC MHZ PNO: Fast IFGain:Low	Trig: Fre Atten: 3	e Run 0 dB	Avg Type	STATUS ALIGN AUTO E: Log-Pwr :>100/100	TRA TV □ 1 1 1 1	2 3 4 5 6 PE PE 2 3 GHz 04 dBm	C 12.515 30.1 25.000 2.497 <u>Auto</u>	quency Auto Tur enter Fra booooo Gi Start Fra booooo Gi Stop Fra booooo Gi CF Ste booooo Gi M
Keysight Sp       X     T       Start Fre       10 dB/div       0 g       10.0       -0 g       -10.0       -20.0	2 100 kHz	SA AC MHZ PNO: Fast IFGain:Low	Trig: Fre Atten: 3	INSE:INT	Avg Type Avg Hold	STATUS ALIGN AUTO E: Log-Pwr :>100/100	TRA TV □ 1 1 1 1	CE 1 2 3 4 5 6 PE MWWWWET PNNNN 2 3 GHz 204 dBm	C 12.515 30.1 25.000 2.497 <u>Auto</u>	quency Auto Tur enter Fro 000000 Gi Start Fro 000000 Gi Stop Fro 000000 Gi CF Sta
tsg     tsg       X     T     T       Start Fre     T     T       0     dB/div     T       0     0     T     T       0     0     T     T       0     0     T     T       0     0     T     T       0     0     T     T       10     0     T     T       10     0     T     T       20     0     T     T       30     0     T     T       40     0     T     T       50     0     T     T	2 100 kHz ectrum Analyzer - Swept Ref 20.00 dB Ref 20.00 dB	SA AC MHZ PNO: Fast IFGain:Low	Trig: Fre Atten: 3	e Run 0 dB	Avg Type Avg Hold	STATUS ALIGN AUTO E: Log-Pwr :>100/100	TRA TV □ 1 1 1 1	CE 1 2 3 4 5 6 PE MWWWWET PNNNN 2 3 GHz 204 dBm	C 12.515 30.0 25.000 2.497 <u>Auto</u> F	quency Auto Tur enter Fro booooo Gi Start Fro booooo Gi Stop Fro booooo Gi CF Ste booooo Gi M req Offs 0 1
ISG Keysight Sp C T Start Free 10.0 dB/div .0 0 .0 0	2 100 kHz Pectrum Analyzer - Swept RF 50 Ω - 2 2q 30.000000 I Ref 20.00 dB	SA AC MHZ PNO: Fast IFGain:Low	Trig: Fre Atten: 3	e Run 0 dB	Avg Type Avg Hold	STATUS ALIGN AUTO E: Log-Pwr :>100/100	TRA TV <b>I</b> <b>I</b> <b>I</b> <b>I</b> <b>I</b> <b>I</b> <b>I</b> <b>I</b>	CE 1 2 3 4 5 6 PE MWWWWET PNNNN 2 3 GHz 204 dBm	C 12.515 30.0 25.000 2.497 <u>Auto</u> F	quency Auto Tur enter Fra 2000000 Gl Start Fra 2000000 Gl Stop Fra 2000000 Gl CF Ste 2000000 Gl M req Offs

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

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

Note: The peak emissions without marker on the above plots are fundamental wave and need not to compare with the limit. The GFSK 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

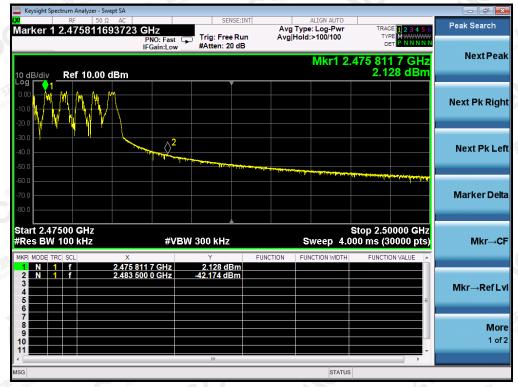






#### GFSK MODULATION IN HIGH CHANNEL Hopping off

Hopping on





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

Hopping on





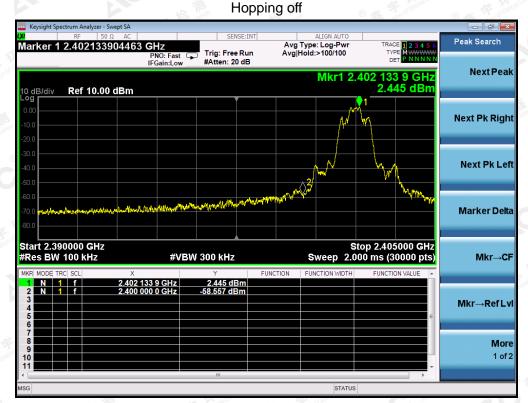


## $\pi$ /4-DQPSK MODULATION IN HIGH CHANNEL

Hopping on







## 8-DPSK MODULATION IN LOW CHANNEL

Hopping on







#### 8-DPSK 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 emissions, 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
Fill and	Start ~Stop Frequency	9KHz~150KHz/RB 200Hz for QP
© 🐔	Start ~Stop Frequency	150KHz~30MHz/RB 9KHz for QP
-,C *	Start ~Stop Frequency	30MHz~1000MHz/RB 120KHz for QP
TA	Start ~Stop Frequency	1GHz~26.5GHz 1MHz/3MHz for Peak, 1MHz/10Hz 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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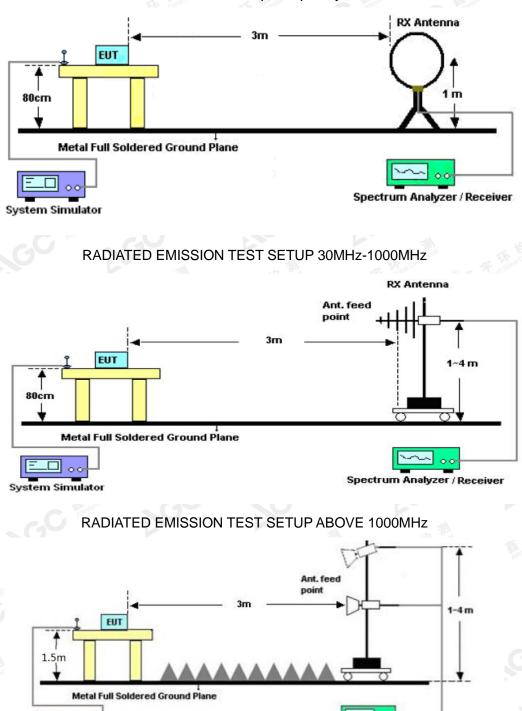


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#### 10.2. TEST SETUP

Radiated Emission Test-Setup Frequency Below 30MHz



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Tel: +86-755 2908 1955 Fax: +86-755 2600 8484 E-mail: agc@agc-cert.com @ 400 089 2118 Add: 2/F., Building 2, No.1-4, Chaxi Sanwei Technical Industrial Park, Gushu, Xixiang, Baoan District, Shenzhen, Guangdong China

ctrum Analyzer

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

15.209 Limit in the below table has to be followed

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

No emission found between lowest internal used/generated frequencies to 30MHz.

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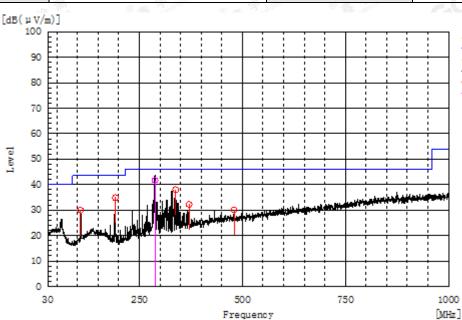


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#### Report No.: AGC00737180603FE03 Page 41 of 61

EUT	BLUETOOTH FM TRANSMITTER	Model Name	BH169A
Temperature	25°C	Relative Humidity	55.4%
Pressure	960hPa	Test Voltage	DC12V
Test Mode	Mode 4	Antenna	Horizontal

## **RADIATED EMISSION BELOW 1GHZ**



Frequency MHz	Polarization	Reading dB(uV)	Factor dB (1/m)	Level dB(uV/m) PK	Limit dB(uV/m) QP	Margin dB	Pass/Fail	Height cm	Angle deg
107.600	Mad Glow H	15.7	14.3	30.0	43.5	13.5	Pass	100.0	321.2
191.990	Н	21.2	13.7	34.9	43.5	8.6	Pass	100.0	262.2
338.460	Н	19.6	18.4	38.0	46.0	8.0	Pass	100.0	71.5
370.955	C H at Cooler	12.5	19.7	32.2	46.0	13.8	Pass	100.0	131.4
480.080	Н	7.5	22.6	30.1	46.0	15.9	Pass	100.0	89.6
107.600	Н	15.7	14.3	30.0	43.5	13.5	Pass	100.0	321.2

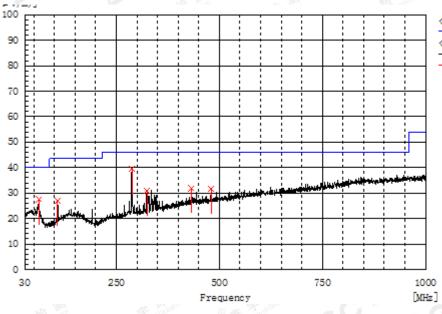
**RESULT: PASS** 

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EUT	BLUETOOTH FM TRANSMITTER	Model Name	BH169A
Temperature	25°C	Relative Humidity	55.4%
Pressure	960hPa	Test Voltage	DC12V
Test Mode	Mode 4	Antenna	Vertical



	Frequency., MHz.,	Polarization.,	Reading. dB( <u>uV</u> ).,	Factor dB (1/m).,	Level., dB(uV/m)., PK.,	Limit., dB(uV/m)., QP.,	Margin., dB.,	Pass/Fail.,	Height., cm.,	Angle., deg.,
0	<b>62.980</b> .,	<b>V</b> .1	11.6.,	15.9.,	27.5.,	40.0.1	12.5.,	Pass.	100.0.1	267.6.1
	107.600.,	V.a	12.7.,	14.3.,	27.0.,	43.5.,	16.5.,	Pass.	100.0.1	296.2.1
	288.020.,	<b>V</b> .,	21.9.,	17.6.,	39.5.	46.0.,	6.5.,	Pass.	200.0.1	65.8.1
	324.395.,	<b>V</b> .,	13.1.,	17.9.,	31.0.,	46.0.,	15.0.,	Pass.	200.0.1	<b>89.6</b> .1
V - 5	432.065.,	<b>V</b> .,	10.2.,	21.7.,	31.9.,	46.0.,	14.1.,	Pass.	150.0.1	350.5.1
	480.565.,	V.a	9.1.,	22.6.,	31.7.,	46.0.,	14.3.,	Pass.	100.0.1	39.1.

#### **RESULT: PASS**

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

2. All test modes had been pre-tested. The mode 4 is the worst case and recorded in the report.

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EUT	BLUETOOTH FM TRANSMITTER	Model Name	BH169A
Temperature	25°C	Relative Humidity	55.4%
Pressure	960hPa	Test Voltage	DC12V
Test Mode	Mode 1	Antenna	Horizontal

## **RADIATED EMISSION ABOVE 1GHZ**

S I CONT	Alter	A 1109.			
Meter Reading	Factor	Emission Level	Limits	Margin	Value Type
(dBµV)	(dB)	(dBµV/m)	(dBµV/m)	(dB)	value Type
43.96	7.12	51.08	74	-22.92	peak
42.05	7.12	49.17	54	-4.83	AVG
39.14	9.84	48.98	74	-25.02	peak
37.85	9.84	47.69	54	-6.31	AVG
	C Aves				HEL TH
			4	Compliance	The stopal Convent
	(dBµV) 43.96 42.05 39.14	(dBµV)     (dB)       43.96     7.12       42.05     7.12       39.14     9.84	(dBµV)(dB)(dBµV/m)43.967.1251.0842.057.1249.1739.149.8448.98	(dBµV)     (dB)     (dBµV/m)     (dBµV/m)       43.96     7.12     51.08     74       42.05     7.12     49.17     54       39.14     9.84     48.98     74	(dBµV)     (dB)     (dBµV/m)     (dBµV/m)     (dB)       43.96     7.12     51.08     74     -22.92       42.05     7.12     49.17     54     -4.83       39.14     9.84     48.98     74     -25.02

EUT	BLUETOOTH FM TRANSMITTER	Model Name	BH169A
Temperature	25°C	Relative Humidity	55.4%
Pressure	960hPa	Test Voltage	DC12V
Test Mode	Mode 1	Antenna	Vertical

Frequency	Meter Reading	Factor	Emission Level	Limits	Margin		
(MHz)	(dBµV)	(dB)	(dBµV/m)	(dBµV/m)	(dB)	Value Type	
4804.008	43.25	7.12	50.37	74	-23.63	peak 🧹	
4804.008	39.13	7.12	46.25	54	-7.75	AVG	
7206.011	38.21	9.84	48.05	74	-25.95	peak	
7206.011	34.67	9.84	44.51	54	-9.49	AVG	
C AMAGE		lion C	GC 1	69			
emark:				14			
actor = Ante	enna Factor + Cal	ole Loss – I	Pre-amplifier.	The Tel plance	The m	alcomp	

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#### Report No.: AGC00737180603FE03 Page 44 of 61

EUT	BLUETOOTH FM TRANSMITTER	Model Name	BH169A
Temperature	25°C	Relative Humidity	55.4%
Pressure	960hPa	Test Voltage	DC12V
Test Mode	Mode 2	Antenna	Horizontal

Frequency	Meter Reading	Factor	Emission Level	Limits	Margin	Value Type
(MHz)	(dBµV)	(dB)	(dBµV/m)	(dBµV/m)	(dB)	value Type
4882.007	44.31	7.12	51.43	74	-22.57	peak
4882.007	42.01	7.12	49.13	54	-4.87	AVG
7323.012	38.75	9.84	48.59	74	-25.41	peak
7323.012	37.11	9.84	46.95	54	-7.05	AVG
The balcom	The Complexity	14 3	Nops Con	testatio	Attes	
C Tailon of Cu	C Stand Go	C Thestation of				
Remark:	Allest				1111	
Factor = Ante	enna Factor + Ca	ble Loss – I	Pre-amplifier.		12 notance	The Compliant
			1111			

EUT	BLUETOOTH FM TRANSMITTER	Model Name	BH169A
Temperature	25°C	Relative Humidity	55.4%
Pressure	960hPa	Test Voltage	DC12V
Test Mode	Mode 2	Antenna	Vertical

Value Type
6 peak
AVG
peak
AVG
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EUT	BLUETOOTH FM TRANSMITTER	Model Name	BH169A
Temperature	25°C	Relative Humidity	55.4%
Pressure	960hPa	Test Voltage	DC12V
Test Mode	Mode 3	Antenna	Horizontal

Frequency	Meter Reading	Factor	Emission Level	Limits	Margin	Value Type
(MHz)	(dBµV)	(dB)	(dBµV/m)	(dBµV/m)	(dB)	value Type
4960.011	45.42	7.12	52.54	74	-21.46	peak
4960.011	41.76	7.12	48.88	54	-5.12	AVG
7440.026	41.41	9.84	51.25	74	-22.75	peak
7440.026	37.69	9.84	47.53	54	-6.47	AVG
The acom	The Completion	17 V	lops Coll.	testatic	Alle	2
B The salor of Car	C The Hop of Glov	B Hestation of				
Remark:	Allesin	G			line	
actor = Ante	nna Factor + Ca	ble Loss – F	Pre-amplifier.		the pollance	The Compliant
						224 100

EUT	BLUETOOTH FM TRANSMITTER	Model Name	BH169A
Temperature	25°C	Relative Humidity	55.4%
Pressure	960hPa	Test Voltage	DC12V
Test Mode	Mode 3	Antenna	Vertical

Meter Reading					
Meter Reading	Factor	Emission Level	Limits	Margin	Value Type
(dBµV)	(dB)	(dBµV/m)	(dBµV/m)	(dB)	value Type
41.98	7.12	49.1	74	-24.9	peak
40.52	7.12	47.64	54	-6.36	AVG
38.88	9.84	48.72	74	-25.28	peak
36.54	9.84	46.38	54	-7.62	AVG
17 - 19 - 19 - 19 - 19 - 19 - 19 - 19 -	The Hermoniance	Slop	00" (8) <i>E</i> E	on of Globe	G M
A balcome	# Giobal	Mestatione	Allest		
	(dBµV) 41.98 40.52 38.88	(dBµV)     (dB)       41.98     7.12       40.52     7.12       38.88     9.84	(dBµV)     (dB)     (dBµV/m)       41.98     7.12     49.1       40.52     7.12     47.64       38.88     9.84     48.72	(dBµV)     (dB)     (dBµV/m)     (dBµV/m)       41.98     7.12     49.1     74       40.52     7.12     47.64     54       38.88     9.84     48.72     74	(dBµV)     (dB)     (dBµV/m)     (dBµV/m)     (dB)       41.98     7.12     49.1     74     -24.9       40.52     7.12     47.64     54     -6.36       38.88     9.84     48.72     74     -25.28

Factor = Antenna Factor + Cable Loss – Pre-amplifier.

## **RESULT: PASS**

#### Note:

Other emissions from 1G to 25 GHz are considered as ambient noise. No recording in the test report. Factor = Antenna Factor + Cable loss - Amplifier gain, Over=Measure-Limit.

The "Factor" value can be calculated automatically by software of measurement system.

All test modes had been tested. The GFSK modulation is the worst case and recorded in the report.

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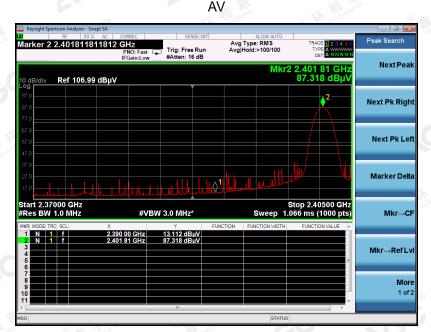


EUT	BLUETOOTH FM TRANSMITTER	Model Name	BH169A
Temperature	25°C	Relative Humidity	55.4%
Pressure	960hPa	Test Voltage	DC12V
Test Mode	Mode 1	Antenna	Horizontal

#### TEST RESULT FOR RESTRICTED BANDS REQUIREMENTS

PK





#### **RESULT: PASS**

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EUT	BLUETOOTH FM TRANSMITTER	Model Name	BH169A
Temperature	25°C	Relative Humidity	55.4%
Pressure	960hPa	Test Voltage	DC12V
Test Mode	Mode 1	Antenna	Vertical

PK



#### AV



**RESULT: PASS** 

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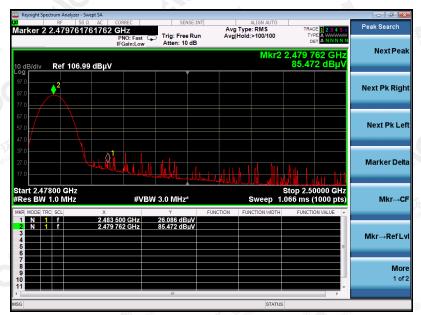
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EUT	BLUETOOTH FM TRANSMITTER	Model Name	BH169A
Temperature	25°C	Relative Humidity	55.4%
Pressure	960hPa	Test Voltage	DC12V
Test Mode	Mode 3	Antenna	Horizontal

PK



#### AV



**RESULT: PASS** 

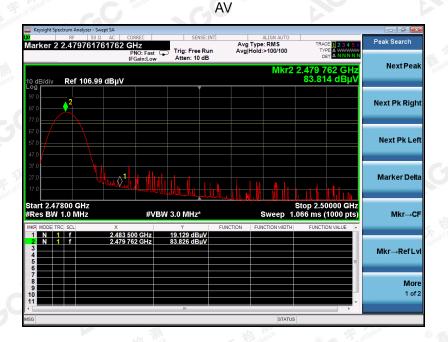
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EUT	BLUETOOTH FM TRANSMITTER	Model Name	BH169A
Temperature	25°C	Relative Humidity	55.4%
Pressure	960hPa	Test Voltage	DC12V
Test Mode	Mode 3	Antenna	Vertical
Autom		PK 🔬 💀	The Franciscom

#### Peak Sear Avg Type: Log-Pw Avg|Hold:>100/100 arker 2 2.479805805806 GHz Trig: Free Run Atten: 10 dB NextPe Mkr2 2.479 806 G 85.008 dB Ref 106.99 dBµV Next Pk Righ Next Pk Lef Marker Delt Start 2.47800 GHz #Res BW 1.0 MHz Stop 2.50000 GHz Sweep 1.066 ms (1000 pts) #VBW 3.0 MHz Mkr→C 2.483 500 GHz 2.479 806 GHz 60.876 dBµ 85.008 dBµ Mkr→RefLv More 1 of



#### **RESULT: PASS**

**Note**: The factor had been edited in the "Input Correction" of the Spectrum Analyzer. So the Amplitude of test plots is equal to Reading level plus the Factor in dB. Use the A dB( $\mu$ V) to represent the Amplitude. Use the F dB( $\mu$ V/m) to represent the Field Strength. So A=F. All test modes had been pre-tested. The GFSK modulation is the worst case and recorded in the report.

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# **11. NUMBER OF HOPPING FREQUENCY**

## **11.1. MEASUREMENT PROCEDURE**

The EUT shall have its hopping function enabled. Use the following spectrum analyzer settings: 1. Span: The frequency band of operation. Depending on the number of channels the device supports, it may be necessary to divide the frequency range of operation across multiple spans, to allow the individual channels to be clearly seen.

2. RBW: To identify clearly the individual channels, set the RBW to less than 30% of the channel spacing or the 20 dB bandwidth, whichever is smaller.

3. VBW  $\geq$  RBW. Sweep: Auto. Detector function: Peak. Trace: Max hold.

4. Allow the trace to stabilize.

## 11.2. TEST SETUP (BLOCK DIAGRAM OF CONFIGURATION)

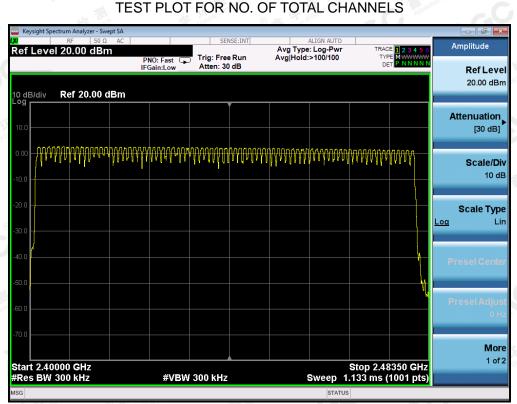
Same as described in section 8.2

## **11.3. MEASUREMENT EQUIPMENT USED**

The same as described in section 6

## **11.4. LIMITS AND MEASUREMENT RESULT**

TOTAL NO. OF	LIMIT (NO. OF CH)	MEASUREMENT (NO. OF CH)	RESULT
HOPPING CHANNEL	>=15	79	PASS



Note: The 8-DPSK modulation is the worst case and recorded in the report.

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# 12. TIME OF OCCUPANCY (DWELL TIME)

## 12.1. MEASUREMENT PROCEDURE

The EUT shall have its hopping function enabled. Use the following spectrum analyzer settings:

1. Span: Zero span, centered on a hopping channel.

2. RBW shall be  $\leq$  channel spacing and where possible RBW should be set >> 1 / T, where T is the expected dwell time per channel.

3. Sweep: As necessary to capture the entire dwell time per hopping channel; where possible use a video trigger and trigger delay so that the transmitted signal starts a little to the right of the start of the plot. The trigger level might need slight adjustment to prevent triggering when the system hops on an adjacent channel; a second plot might be needed with a longer sweep time to show two successive hops on a channel.

4. Detector function: Peak. Trace: Max hold.

5. Use the marker-delta function to determine the transmit time per hop.

6. Repeat the measurement using a longer sweep time to determine the number of hops over the period specified in the requirements. The sweep time shall be equal to, or less than, the period specified in the requirements. Determine the number of hops over the sweep time and calculate the total number of hops in the period specified in the requirements, using the following equation:

(Number of hops in the period specified in the requirements) = (number of hops on spectrum analyzer)  $\times$  (period specified in the requirements / analyzer sweep time)

7. The average time of occupancy is calculated from the transmit time per hop multiplied by the number of hops in the period specified in the requirements.

# 12.2. TEST SETUP (BLOCK DIAGRAM OF CONFIGURATION)

Same as described in section 8.2

## 12.3. MEASUREMENT EQUIPMENT USED

The same as described in section 6

## **12.4. LIMITS AND MEASUREMENT RESULT**

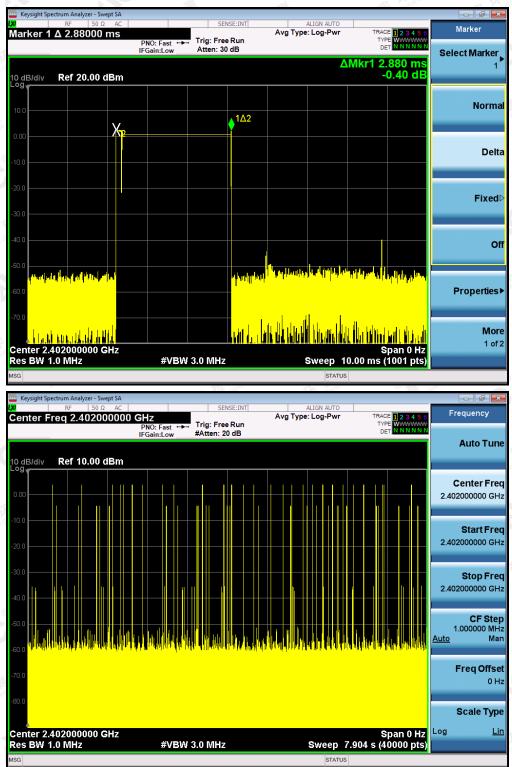
Channel	Time of Pulse for DH5 (ms)	Number of hops in the period specified in the requirements	Sweep Time (ms)	Limit (ms)
Low	2.88	28*4	322.56	400
Middle	2.878	28*4	322.336	400
High	2.878	28*4	322.336	400

Note: The 8-DPSK modulation is the worst case and recorded in the report.

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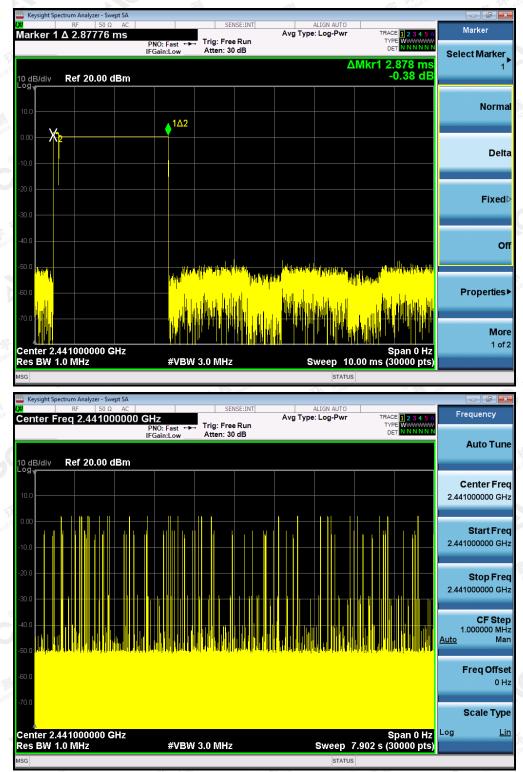




## TEST PLOT OF LOW CHANNEL

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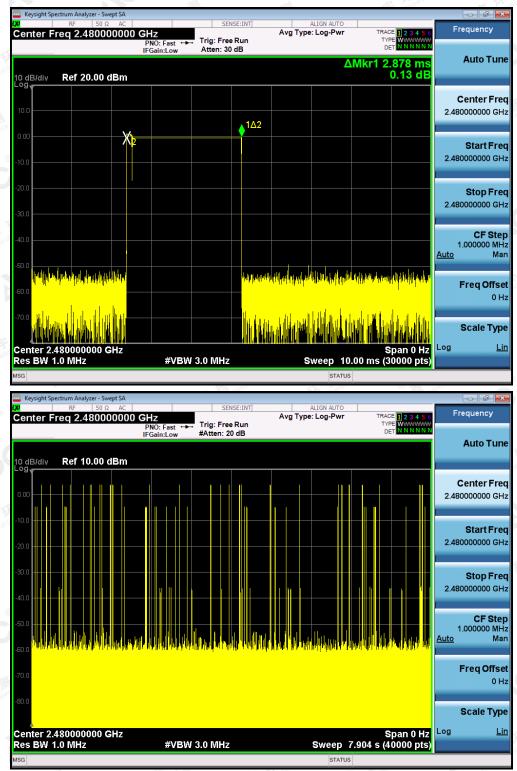




## TEST PLOT OF MIDDLE CHANNEL

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## TEST PLOT OF HIGH CHANNEL

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## **13. FREQUENCY SEPARATION**

#### 13.1. MEASUREMENT PROCEDURE

The EUT shall have its hopping function enabled. Use the following spectrum analyzer settings:

1. Span: Wide enough to capture the peaks of two adjacent channels.

2. RBW: Start with the RBW set to approximately 30% of the channel spacing; adjust as necessary to best identify the center of each individual channel.

3. Video (or average) bandwidth (VBW)  $\geq$  RBW.

4. Sweep: Auto. e) Detector function: Peak. f) Trace: Max hold. g) Allow the trace to stabilize.

Use the marker-delta function to determine the separation between the peaks of the adjacent channels.

#### **13.2. TEST SETUP (BLOCK DIAGRAM OF CONFIGURATION)**

Same as described in section 6.2

#### 13.3. MEASUREMENT EQUIPMENT USED

The same as described in section 6.3

#### **13.4. LIMITS AND MEASUREMENT RESULT**

CHANNEL	CHANNEL SEPARATION	LIMIT	RESULT	
	KHz	KHz	Pass The Pass	
CH01-CH02	1001	>=25 KHz or 2/3 20 dB BW		

TEST PLOT FOR FREQUENCY SEPARATION

Peak Search Avg Type: Log-Pw Avg|Hold:>100/100 Trig: Free **Next Pea** Mkr2 2.402 973 GHz 0.868 dBm Ref 20.00 dBm 0 dB/di Next Pk Right Next Pk Left Marker Delta Start 2.400000 GHz #Res BW 30 kHz Stop 2.405000 GHz #VBW 30 kHz Mkr→CF Sweep 6.727 ms (1000 pts) 2.401 972 GHz 2.402 973 GHz 0.870 dBm 0.868 dBm Mkr→RefL More 1 of 2

Note: The 8-DPSK modulation is the worst case and recorded in the report.

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# 14. FCC LINE CONDUCTED EMISSION TEST

# 14.1. LIMITS OF LINE CONDUCTED EMISSION TEST

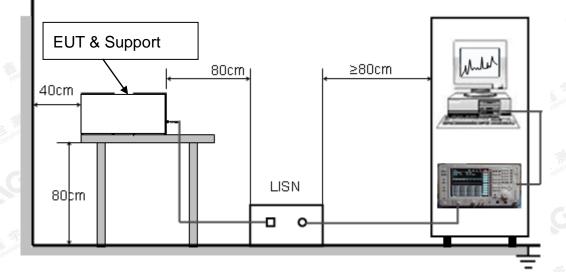
Francisco	Maximum RF Line Voltage		
Frequency	Q.P.( dBuV)	Average( dBuV)	
150kHz~500kHz	66-56	56-46	
500kHz~5MHz	56	46	
5MHz~30MHz	60	50	

Note:

1. The lower limit shall apply at the transition frequency.

2. The limit decreases linearly with the logarithm of the frequency in the range 0.15 MHz to 0.50 MHz.

# 14.2. BLOCK DIAGRAM OF LINE CONDUCTED EMISSION TEST



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#### 14.3. PRELIMINARY PROCEDURE OF LINE CONDUCTED EMISSION TEST

- The equipment was set up as per the test configuration to simulate typical actual usage per the user's manual. When the EUT is a tabletop system, a wooden table with a height of 0.8 meters is used and is placed on the ground plane as per ANSI C63.10 (see Test Facility for the dimensions of the ground plane used). When the EUT is a floor-standing equipment, it is placed on the ground plane which has a 3-12 mm non-conductive covering to insulate the EUT from the ground plane.
- 2. Support equipment, if needed, was placed as per ANSI C63.10.
- 3. All I/O cables were positioned to simulate typical actual usage as per ANSI C63.10.
- 4. All support equipments received AC9V/1A power from a LISN, if any.
- 5. The EUT received DC charging voltage by PC which received 9V/1Azpower by a LISN..
- 6. The test program was started. Emissions were measured on each current carrying line of the EUT using a spectrum Analyzer / Receiver connected to the LISN powering the EUT. The LISN has two monitoring points: Line 1 (Hot Side) and Line 2 (Neutral Side). Two scans were taken: one with Line 1 connected to Analyzer / Receiver and Line 2 connected to a 50 ohm load; the second scan had Line 1 connected to a 50 ohm load and Line 2 connected to the Analyzer / Receiver.
- 7. Analyzer / Receiver scanned from 150 kHz to 30MHz for emissions in each of the test modes.
- 8. During the above scans, the emissions were maximized by cable manipulation.
- 9. The test mode(s) were scanned during the preliminary test.

Then, the EUT configuration and cable configuration of the above highest emission level were recorded for reference of final testing.

#### 14.4. FINAL PROCEDURE OF LINE CONDUCTED EMISSION TEST

- 1. EUT and support equipment was set up on the test bench as per step 2 of the preliminary test.
- A scan was taken on both power lines, Line 1 and Line 2, recording at least the six highest emissions. Emission frequency and amplitude were recorded into a computer in which correction factors were used to calculate the emission level and compare reading to the applicable limit. If EUT emission level was less –2dB to the A.V. limit in Peak mode, then the emission signal was re-checked using Q.P and Average detector.
- 3. The test data of the worst case condition(s) was reported on the Summary Data page.

#### 14.5. TEST RESULT OF LINE CONDUCTED EMISSION TEST

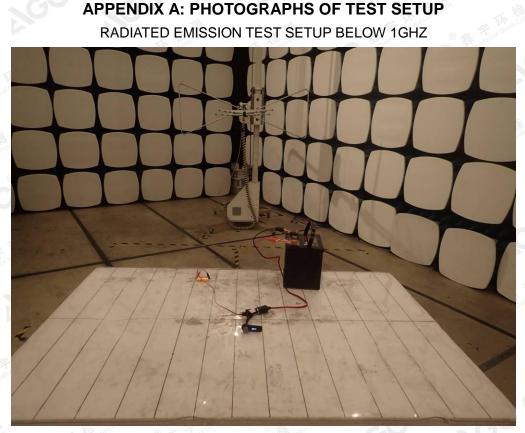
Because of this product is powered by DC battery, so this item is not applicable.

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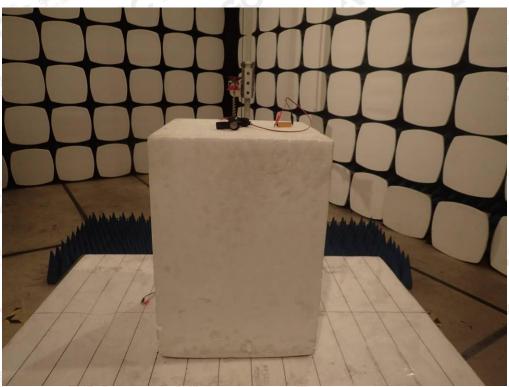




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#### RADIATED EMISSION TEST SETUP ABOVE 1GHZ



#### ----END OF REPORT----

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