

# **FCC Test Report**

Report No.: AGC00803201213FE03

FCC ID	: 2AKHJ-HB305-3
APPLICATION PURPOSE	: Original Equipment
PRODUCT DESIGNATION	: BT KEYBOARD
BRAND NAME	: N/A
MODEL NAME	: HB305-3, HB305-2
APPLICANT	: Shenzhen Hangshi Technology Co., Ltd
DATE OF ISSUE	: Jan. 07, 2021
STANDARD(S)	: FCC Part 15.247
REPORT VERSION	: V1.0

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

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## **REPORT REVISE RECORD**

Report Version	Revise Time	Issued Date	Valid Version	Notes
V1.0	. /	Jan. 07, 2021	Valid	Initial Release

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## TABLE OF CONTENTS

	1. VERIFICATION OF CONFORMITY	5
	2. GENERAL INFORMATION	6
	2.1. PRODUCT DESCRIPTION	6
	2.2. TABLE OF CARRIER FREQUENCYS	6
	2.3. RECEIVER INPUT BANDWIDTH	7
	2.4. EXAMPLE OF A HOPPING SEQUENCY IN DATA MODE	7
	2.5. EQUALLY AVERAGE USE OF FREQUENCIES AND BEHAVIOUR	7
	2.6. RELATED SUBMITTAL(S) / GRANT (S)	8
	2.7. TEST METHODOLOGY	8
	2.8. SPECIAL ACCESSORIES	8
	2.9. EQUIPMENT MODIFICATIONS	8
	2.10. ANTENNA REQUIREMENT	8
	3. MEASUREMENT UNCERTAINTY	9
	4. DESCRIPTION OF TEST MODES	10
	5. SYSTEM TEST CONFIGURATION	11
	5.1. CONFIGURATION OF EUT SYSTEM	11
	5.2. EQUIPMENT USED IN TESTED SYSTEM	11
	5.3. SUMMARY OF TEST RESULTS	11
	6. TEST FACILITY	12
	7. PEAK OUTPUT POWER	13
	7.1. MEASUREMENT PROCEDURE	13
	7.2. TEST SET-UP (BLOCK DIAGRAM OF CONFIGURATION)	
	7.3. LIMITS AND MEASUREMENT RESULT	
	8. 20DB BANDWIDTH	16
	8.1. MEASUREMENT PROCEDURE	16
	8.2. TEST SET-UP (BLOCK DIAGRAM OF CONFIGURATION)	
	8.3. LIMITS AND MEASUREMENT RESULTS	
	9. CONDUCTED SPURIOUS EMISSION	
A۱	9.1. MEASUREMENT PROCEDURE	19
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9.2. TEST SET-UP (BLOCK DIAGRAM OF CONFIGURATION)	
9.3. MEASUREMENT EQUIPMENT USED	
9.4. LIMITS AND MEASUREMENT RESULT	
10. RADIATED EMISSION	
10.1. MEASUREMENT PROCEDURE	
10.2. TEST SETUP	
10.3. LIMITS AND MEASUREMENT RESULT	
10.4. TEST RESULT	
11. NUMBER OF HOPPING FREQUENCY	
11.1. MEASUREMENT PROCEDURE	
11.2. TEST SETUP (BLOCK DIAGRAM OF CONFIGURATION)	
11.3. MEASUREMENT EQUIPMENT USED	
11.4. LIMITS AND MEASUREMENT RESULT	
12. TIME OF OCCUPANCY (DWELL TIME)	
12.1. MEASUREMENT PROCEDURE	
12.2. TEST SETUP (BLOCK DIAGRAM OF CONFIGURATION)	
12.3. MEASUREMENT EQUIPMENT USED	
12.4. LIMITS AND MEASUREMENT RESULT	
13. FREQUENCY SEPARATION	
13.1. MEASUREMENT PROCEDURE	
13.2. TEST SETUP (BLOCK DIAGRAM OF CONFIGURATION)	
13.3. MEASUREMENT EQUIPMENT USED	
13.4. LIMITS AND MEASUREMENT RESULT	
14. FCC LINE CONDUCTED EMISSION TEST	
14.1. LIMITS OF LINE CONDUCTED EMISSION TEST	
14.2. BLOCK DIAGRAM OF LINE CONDUCTED EMISSION TEST	
14.3. PRELIMINARY PROCEDURE OF LINE CONDUCTED EMISSION TEST	
14.4. FINAL PROCEDURE OF LINE CONDUCTED EMISSION TEST	
14.5. TEST RESULT OF LINE CONDUCTED EMISSION TEST	
APPENDIX A: PHOTOGRAPHS OF TEST SETUP	
APPENDIX B: PHOTOGRAPHS OF EUT	

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## **1. VERIFICATION OF CONFORMITY**

Applicant	t Shenzhen Hangshi Technology Co., Ltd		
Address	Hangshi Technology Park, Democracy West Industry Area, Shajing Town, Bao'an District, Shenzhen, China.		
Manufacturer	anufacturer Shenzhen Hangshi Technology Co., Ltd		
Address	Hangshi Technology Park, Democracy West Industry Area, Shajing Town, Bao'an District, Shenzhen, China.		
Factory	Shenzhen Hangshi Technology Co., Ltd		
Address	Hangshi Technology Park, Democracy West Industry Area, Shajing Town, Bao'an District, Shenzhen, China.		
Product Designation	BT KEYBOARD		
Brand Name	N/A		
Test Model	HB305-3		
Series Model	HB305-2		
Difference Description	All the same except for the model name.		
Date of test	Dec. 25, 2020 to Jan. 06, 2021		
Deviation	No any deviation from the test method		
Condition of Test Sample	Idition of Test Sample Normal		
Test Result	Pass		
Report Template	AGCRT-US-BR/RF		

We hereby certify that:

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

Prepared By

**Reviewed By** 

Eddy . Liu

Eddy Liu (Project Engineer)

Jan. 06, 2021

Max Zhans

(Reviewer)

Max Zhang

Jan. 07, 2021

Approved By

Forrest Lei (Authorized Officer)

Jan. 07, 2021

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## 2. GENERAL INFORMATION

## 2.1. PRODUCT DESCRIPTION

The EUT is designed as "BT KEYBOARD". It is designed by way of utilizing the GFSK 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	-5.443dBm (Max)		
Bluetooth Version	V5.1		
Modulation	BR ⊠GFSK, EDR □π /4-DQPSK, □8DPSK BLE □GFSK 1Mbps □GFSK 2Mbps		
Number of channels	79		
Hardware Version	VER:01		
Software Version	V1.0		
Antenna Designation	PCB Antenna (Comply with requirements of the FCC part 15.203)		
Antenna Gain	1.87dBi		
Power Supply	DC 3.7V by battery		
Note: The EUT only support	GFSK of BR.		

## 2.2. TABLE OF CARRIER FREQUENCYS

Frequency Band	Channel Number	Frequency
	0	2402 MHz
	1	2403 MHz
	38	2440 MHz
2402~2480MHz	39	2441 MHz
C C	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:2AKHJ-HB305-3** 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 = ±3.1 dB
- Uncertainty of Radiated Emission below 1GHz, Uc = ±4.0 dB
- Uncertainty of Radiated Emission above 1GHz, Uc = ±4.8 dB
- Uncertainty of total RF power, conducted,  $Uc = \pm 0.8$ dB
- Uncertainty of spurious emissions, conducted, Uc = ±2.7dB
- Uncertainty of Occupied Channel Bandwidth: Uc = ±2 %
- Uncertainty of Dwell Time: Uc =  $\pm 2$  %
- Uncertainty of Frequency:  $Uc = \pm 2 \%$

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## 4. DESCRIPTION OF TEST MODES

NO.	TEST MODE DESCRIPTION
1	Low channel GFSK
2	Middle channel GFSK
3	High channel GFSK
4	Hopping mode GFSK

#### 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.

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Software Setting

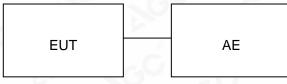
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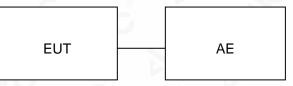
## **5. SYSTEM TEST CONFIGURATION**

**5.1. CONFIGURATION OF EUT SYSTEM** 

Radiated Emission Configure:



Conducted Emission Configure:



#### 5.2. EQUIPMENT USED IN TESTED SYSTEM

ltem	Equipment	Model No.	ID or Specification	Remark
1	BT KEYBOARD	HB305-3	2AKHJ-HB305-3	EUT
2	Control Box	N/A	USB-TTL	AE
3	USB Cable	N/A	0.8m unshielded	
9	Adapter	Takara	MID210	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 Comp		
15.207	Conducted Emission	Compliant	

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## 6. TEST FACILITY

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

## TEST EQUIPMENT OF CONDUCTED EMISSION TEST

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

## TEST EQUIPMENT OF RADIATED EMISSION TEST

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

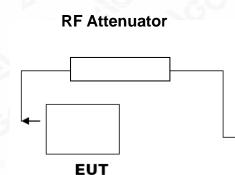
For peak power test:

- 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.

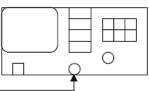
Allow trace to stabilize. Use the marker-to-peak function to set the marker to the peak of the emission. The indicated level is the peak output power, after any corrections for external attenuators and cables.

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

## PEAK POWER TEST SETUP







RF Cable

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#### 7.3. LIMITS AND MEASUREMENT RESULT

PEAK OUTPUT POWER MEASUREMENT RESULT FOR GFSK MOUDULATION						
Frequency (GHz)Peak Power (dBm)Applicable Limits (dBm)Pass or F						
2.402	-5.443	21	Pass			
2.441	-6.651	21	Pass			
2.480	-7.899	21	Pass			

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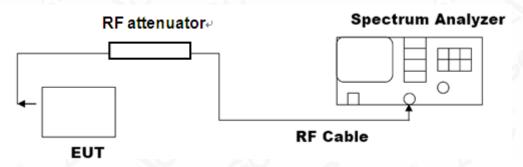


## 8. 20DB BANDWIDTH

#### **8.1. MEASUREMENT PROCEDURE**

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

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



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#### 8.3. LIMITS AND MEASUREMENT RESULTS

MEASUREMENT RESULT FOR GFSK MOUDULATION						
Appliachta Limita	Measurement Result					
Applicable Limits	Test Data	Criteria				
	Low Channel	1.043	PASS			
N/A	Middle Channel	1.096	PASS			
	High Channel	1.036	PASS			

#### 12:41:01 PM Dec 30, 2020 Radio Std: None Frequency Center Freq: 2.402000000 GHz 402000000 GH Avg|Hold>100/100 Trig: Free Run #Atten: 30 dB Radio Device: BTS 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 #VBW 100 kHz 300.000 kH <u>Auto</u> Ma Occupied Bandwidth **Total Power** 1.42 dBm 938.12 kHz Freq Offset 0 Hz -3.293 kHz **Transmit Freq Error OBW Power** 99.00 % x dB Bandwidth 1.043 MHz 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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## 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

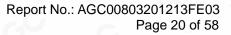
#### 9.3. MEASUREMENT EQUIPMENT USED

The same as described in section 6

#### 9.4. LIMITS AND MEASUREMENT RESULT

LIMITS AND MEASUREMENT RESULT							
Annlinghig Limite	Measurement Resu	ult					
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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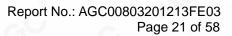




## TEST RESULT FOR ENTIRE FREQUENCY RANGE TEST PLOT OF OUT OF BAND EMISSIONS WITH THE WORST CASE OFGFSK MODULATION IN LOW CHANNEL



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	m Analyzer - Swept								
Center F	RF 50 Ω reg 13.7417	AC CORREC		VSE:INT	Avg Type	ALIGNAUTO e: Log-Pwr	TRA	MDec 30, 2020 CE <mark>1 2 3 4 5 6</mark>	Frequency
		PNO: Fast IFGain:Lov			Avg Hold		D		Auto Tune
10 dB/div	Ref 20.00	dBm						7 2 GHz 36 dBm	
10.0									Center Freq
-10.0									13.741750000 GHz
-20.0								-26.26 dBm	Start Freq
-30.0		<b>_</b> 1							2.483500000 GHz
-40.0								and the second parts	
-60.0 <b>a data</b>		the second second	w. eutomatic	and produced the second se Second second			Anton office and		Stop Freq 25.00000000 GHz
-70.0									
Start 2.48 #Res BW		#V	/BW 300 kHz			Sweep 2	Stop 2 2.152 s (3	25.00 GHz 10000 pts)	CF Step 2.251650000 GHz Auto Man
MKR MODE T		× 9.607 2 GHz	۲ -44.636 dE		CTION FUI	NCTION WIDTH	FUNCTI	ON VALUE	Auto Mari
2 3									Freq Offset
4 5 6									0 Hz
7 8									
9 10 11									
MSG						STATUS	5		

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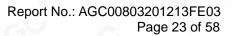
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 E-mail: agc@agc-cert.com
 Web: http://cn.agc-cert.com/





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

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Agilent Spectrum /										
Center Fre	RF 50 Ω cq 13.7417		z		Run	Avg Type Avg Hold	ALIGNAUTO e: Log-Pwr · 10/10	TRA	MDec 30, 2020 CE 1 2 3 4 5 6 PE M 444444	Frequency
	Ref 20.00 d	IFGa	): Fast ↔ in:Low	Atten: 30				r <mark>1 9.76</mark>	4 8 GHz 33 dBm	Auto Tune
Log 10.0 0.00										Center Freq 13.741750000 GHz
-20.0 -30.0 -40.0			<b>♦</b> <sup>1</sup>						-27.38 dBm	<b>Start Freq</b> 2.483500000 GHz
-50.0 -60.0 -70.0										<b>Stop Freq</b> 25.000000000 GHz
Start 2.48 C #Res BW 1	SCL	X		300 kHz		CTION FU	Sweep	2.152 s (3	25.00 GHz 0000 pts) ON VALUE	<b>CF Step</b> 2.251650000 GHz <u>Auto</u> Man
1 N 1 2 3 4 4 5 6 7 7 8 9 9 10 1 11 1 11	f	9.764 8	GHz	-44.133 dE	3m 					Freq Offset 0 Hz
MSG							STATUS	6		

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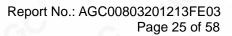
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## TEST PLOT OF OUT OF BAND EMISSIONS OF GFSK MODULATION IN HIGH CHANNEL

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Agilent Spectru												
Center F	RF rea '	50 Ω			SE	NSE:INT	Avg	ALIGI Type: Lo	g-Pwr	TRAC	MDec 30, 2020	Frequency
Contor I	roq	10.1000	Р	NO: Fast Gain:Low	Atten: 3		Avgi	Hold: 10/1	10	TYI	PE MWWWWWWW ET P N N N N N	
			IF	Sain:Low	Attent of				ML	-1 0 0 0	07 GHz	Auto Tune
10 dB/div	Dol	20.00 (	Rm						IVIN		87 dBm	
Log	Ke	20.00 (										
10.0												Center Freq
0.00												13.750000000 GHz
-10.0												
-20.0												Start Freq
-30.0											-28.65 dBm	2.500000000 GHz
-40.0				<b>↓ ♦ '</b>								
-50.0			L.								and the state of the	
-60.0 Konting		al bissis di		A. Antonio								Stop Freq
-70.0	No. of Concession, Name											25.00000000 GHz
Start 2.50 #Res BW				-#\/I	3W 300 kHz	_		C.u.		Stop 2	5.00 GHz 0000 pts)	CF Step 2.25000000 GHz
		КПZ		#VI								Auto Man
MKR MODE T			× 9 920	7 GHz	۲ -42.787 d		NCTION	FUNCTIO	N WIDTH	FUNCTIO	ON VALUE	
2			0.020	0112	42.101 4							Freq Offset
3 4												0 Hz
5												
7												
9												
10	_											
MSG									STATUS			

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

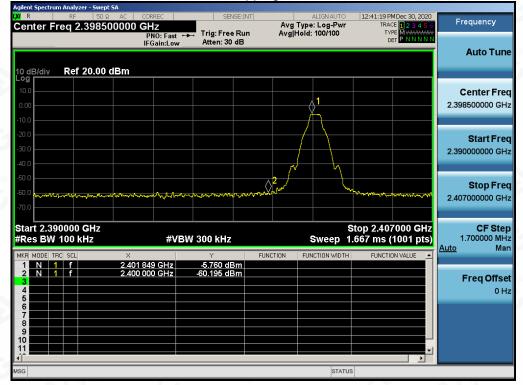
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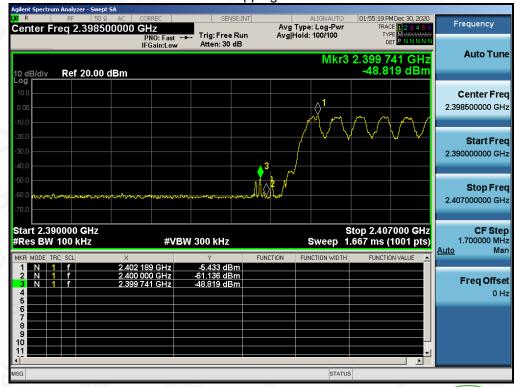
#### TEST RESULT FOR BAND EDGE

#### GFSK MODULATION IN LOW CHANNEL

Hopping off



Hopping on

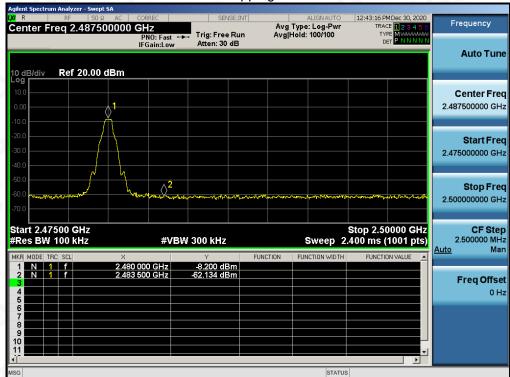


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Page 27 of 58

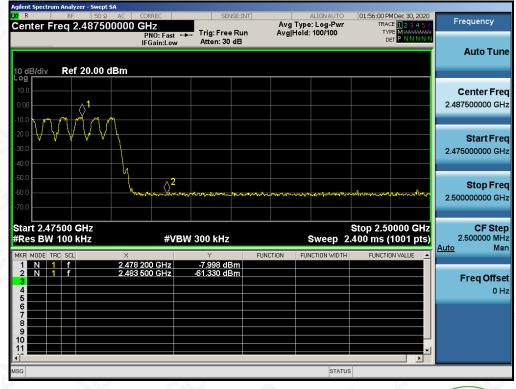




## **GFSK MODULATION IN HIGH CHANNEL**

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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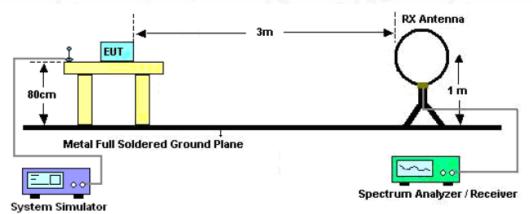
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 E-mail: agc@agc-cert.com

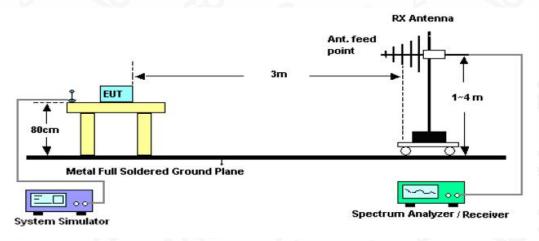


#### 10.2. TEST SETUP

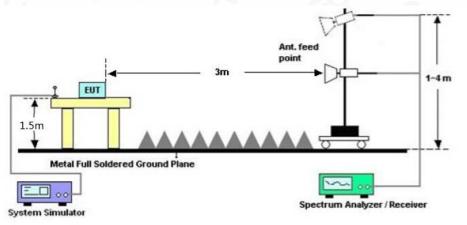
Radiated Emission Test-Setup Frequency Below 30MHz



#### 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.

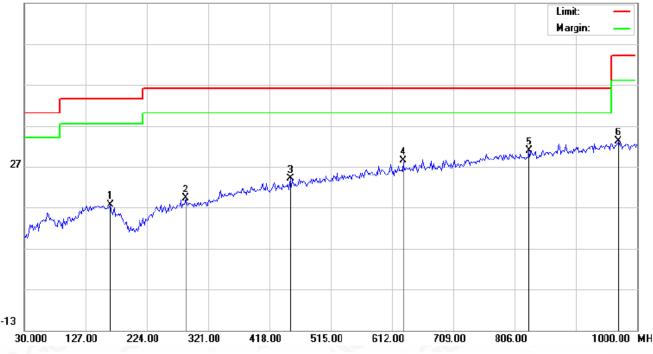
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## **RADIATED EMISSION BELOW 1GHz**

EUT	BT KEYBOARD	Model Name	HB305-3
Temperature	25°C	Relative Humidity	55.4%
Pressure	960hPa	Test Voltage	Normal Voltage
Test Mode	Mode 1	Antenna	Horizontal

## dBu¥/m 66.9



No.	Mk.	Freq.	Reading Level	Correct Factor	Measure- ment	Limit	Over	
		MHz	dBuV	dB	dBuV/m	dBuV/m	dB	Detector
1		165.8000	-0.90	18.59	17.69	43.50	-25.81	peak
2		285.4333	-0.59	19.81	19.22	46.00	-26.78	peak
3		450.3333	0.11	23.99	24.10	46.00	-21.90	peak
4		629.7833	1.00	27.31	28.31	46.00	-17.69	peak
5	*	828.6332	0.10	30.78	30.88	46.00	-15.12	peak
6		969.2833	0.83	32.30	33.13	54.00	-20.87	peak

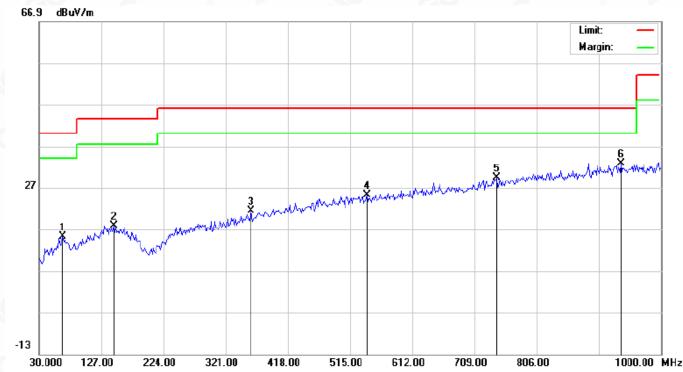
## **RESULT: PASS**

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#### Report No.: AGC00803201213FE03 Page 33 of 58

EUT	BT KEYBOARD	Model Name	HB305-3	
Temperature	25°C	Relative Humidity	55.4%	
Pressure	960hPa	Test Voltage	Normal Voltage	
Test Mode	Mode 1	Antenna	Vertical	



No.	Mk	. Freq.	Reading Level	Correct Factor	Measure- ment	Limit	Over	
		MHz	dBuV	dB	dBuV/m	dBuV/m	dB	Detector
1		67.1833	-1.57	16.76	15.19	40.00	-24.81	peak
2		146.4000	-1.36	19.22	17.86	43.50	-25.64	peak
3		359.8000	-0.09	21.57	21.48	46.00	-24.52	peak
4		540.8667	-0.51	25.79	25.28	46.00	-20.72	peak
5		742.9500	0.28	29.12	29.40	46.00	-16.60	peak
6	*	936.9500	0.84	32.02	32.86	46.00	-13.14	peak

## **RESULT: PASS**

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

2. All test modes had been pre-tested. The mode 1 is the worst case and recorded in the report.

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## **RADIATED EMISSION ABOVE 1GHz**

EUT	BT KEYBOARD	Model Name	HB305-3
Temperature	25°C	Relative Humidity	55.4%
Pressure	960hPa	Test Voltage	Normal Voltage
Test Mode	Mode 1	Antenna	Horizontal

Frequency	Meter Reading	Factor	Emission Level	Limits	Margin	Value Type
(MHz)	(dBµV)	(dB)	(dBµV/m)	(dBµV/m)	(dB)	value Type
4804.000	45.67	0.08	45.75	74	-28.25	peak 💿
4804.000	38.28	0.08	38.36	54	-15.64	AVG
7206.000	41.84	2.21	44.05	74	-29.95	peak
7206.000	33.46	2.21	35.67	54	-18.33	AVG
	20				20	
emark:			®			
actor = Anter	nna Factor + Cable	Loss – Pre-	amplifier.	8		

EUT	BT KEYBOARD Model Name		HB305-3
Temperature	25°C	Relative Humidity	55.4%
Pressure	960hPa	Test Voltage	Normal Voltage
Test Mode	Mode 1	Antenna	Vertical

Meter Reading	Factor	Emission Level	Limits	Margin	Value Type
(dBµV)	(dB)	(dBµV/m)	(dBµV/m)	(dB)	value Type
44.73	0.08	44.81	74	-29.19	peak
37.96	0.08	38.04	54	-15.96	AVG
41.23	2.21	43.44	74	-30.56	peak
32.17	2.21	34.38	54	-19.62	AVG
0		0	C .	0	(8)
					0
	(dBµV) 44.73 37.96 41.23	(dBµV)         (dB)           44.73         0.08           37.96         0.08           41.23         2.21	(dBµV)         (dB)         (dBµV/m)           44.73         0.08         44.81           37.96         0.08         38.04           41.23         2.21         43.44	(dBµV)         (dB)         (dBµV/m)         (dBµV/m)           44.73         0.08         44.81         74           37.96         0.08         38.04         54           41.23         2.21         43.44         74	(dBµV)         (dB)         (dBµV/m)         (dBµV/m)         (dB)           44.73         0.08         44.81         74         -29.19           37.96         0.08         38.04         54         -15.96           41.23         2.21         43.44         74         -30.56

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#### Report No.: AGC00803201213FE03 Page 35 of 58

EUT	BT KEYBOARD	Model Name	HB305-3	
Temperature	25°C	Relative Humidity	55.4%	
Pressure	960hPa	Test Voltage	Normal Voltage	
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
4882.000	45.72	0.14	45.86	74	-28.14	peak
4882.000	39.64	0.14	39.78	54	-14.22	AVG
7323.000	43.16	2.36	45.52	74	-28.48	peak
7323.000	35.45	2.36	37.81	54	-16.19	AVG
0	8				8	
emark:	- 6	8			- 6	8
actor = Anter	na Factor + Cable	Loss – Pre-	-amplifier.			- 6

EUT	BT KEYBOARD	Model Name	HB305-3
Temperature	25°C	Relative Humidity	55.4%
Pressure	960hPa	Test Voltage	Normal Voltage
Test Mode	Mode 2	Antenna	Vertical

Frequency	Meter Reading	Factor	Emission Level	Limits	Margin	Value Type
(MHz)	(dBµV)	(dB)	(dBµV/m)	(dBµV/m)	(dB)	value Type
4882.000	45.22	0.14	45.36	74	-28.64	peak
4882.000	37.08	0.14	37.22	54	-16.78	AVG
7323.000	41.57	2.36	43.93	74	-30.07	peak
7323.000	34.36	2.36	36.72	54	-17.28	AVG
	0					
	0					2
lemark:	- C.	8				0

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

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#### Report No.: AGC00803201213FE03 Page 36 of 58

EUT	BT KEYBOARD	Model Name	HB305-3
Temperature	25°C	Relative Humidity	55.4%
Pressure	960hPa	Test Voltage	Normal Voltage
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
4960.000	46.87	0.22	47.09	74	-26.91	peak
4960.000	38.75	0.22	38.97	54	-15.03	AVG
7440.000	40.59	2.64	43.23	74	-30.77	peak
7440.000	32.41	2.64	35.05	54	-18.95	AVG
	0				0	
emark:	- 61	0			- 61	8
ctor = Anter	na Factor + Cable	Loss - Pre-	amplifier.			

EUT	BT KEYBOARD	Model Name	HB305-3
Temperature	25°C	Relative Humidity	55.4%
Pressure	960hPa	Test Voltage	Normal Voltage
Test Mode	Mode 3	Antenna	Vertical

Frequency	Meter Reading	Factor	Emission Level	Limits	Margin	
(MHz)	(dBµV)	(dB)	(dBµV/m)	(dBµV/m)	(dB)	Value Type
4960.000	45.62	0.22	45.84	74	-28.16	peak
4960.000	38.46	0.22	38.68	54	-15.32	AVG
7440.000	40.13	2.64	42.77	74	-31.23	peak
7440.000	31.94	2.64	34.58	54	-19.42	AVG
		- C	®			
				8		

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

## **RESULT: PASS**

Note:

The amplitude of other spurious emissions from 1G to 25 GHz which are attenuated more than 20 dB below the permissible value need not be reported.

Factor = Antenna Factor + Cable loss - Amplifier gain, Over=Measure-Limit.

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

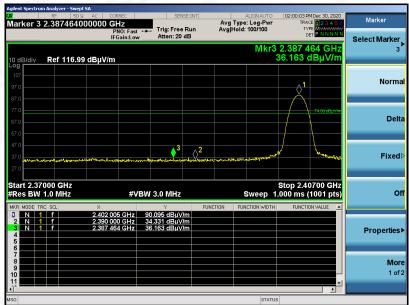
All test modes had been tested. The GFSK modulation is the worst case and recorded in the report.

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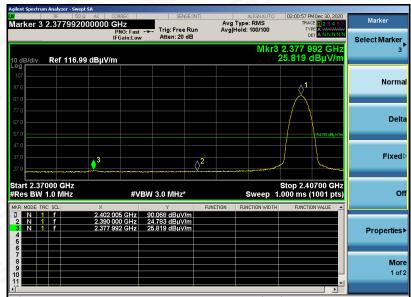


TEST RESULT FOR RESTRICTED BANDS REQUIREMENTS								
EUT	BT KEYBOARD Model Name HB305-3							
Temperature	25°C	Relative Humidity	55.4%					
Pressure	960hPa	Test Voltage	Normal Voltage					
Test Mode	Mode 1	Antenna	Horizontal					

ΡK







## **RESULT: PASS**

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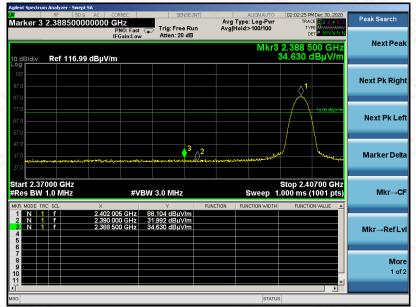
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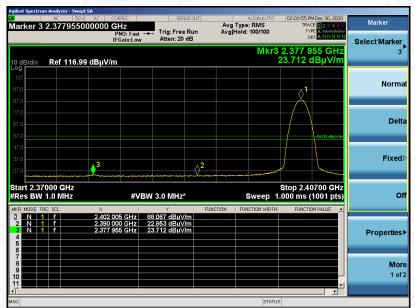
#### Report No.: AGC00803201213FE03 Page 38 of 58

EUT	BT KEYBOARD	Model Name	HB305-3
Temperature	25°C	Relative Humidity	55.4%
Pressure	960hPa	Test Voltage	Normal Voltage
Test Mode	Mode 1	Antenna	Vertical

PK



AV



**RESULT: PASS** 

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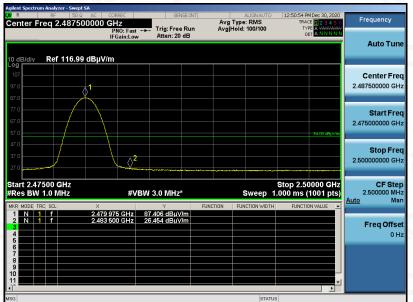
#### Report No.: AGC00803201213FE03 Page 39 of 58

EUT	BT KEYBOARD	Model Name	HB305-3
Temperature	25°C	Relative Humidity	55.4%
Pressure	960hPa	Test Voltage	Normal Voltage
Test Mode	Mode 3	Antenna	Horizontal

PK

Frequency enter Freq 2.487500000 GHz Avg Type: Log-Pw Avg|Hold: 100/100 Trig: Free Run Atten: 20 dB PNO: Fast +++ IFGain:Low Auto Tun Ref 116.99 dBµV/m Center Fred 2.487500000 GHz Start Freq 2.475000000 GHz Stop Free 2.50000000 GH CF Step 2.500000 MH 2.47500 GHz BW 1.0 MHz #VBW 3.0 MHz Sween 2.479 825 GHz 87.671 dBµV/m 2.483 500 GHz 36.540 dBµV/m Freq Offse 0 H;





**RESULT: PASS** 

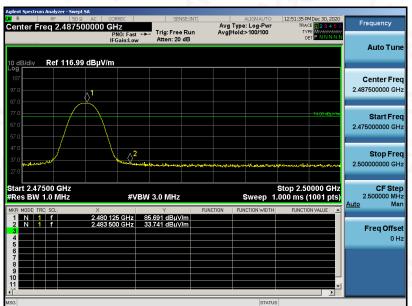
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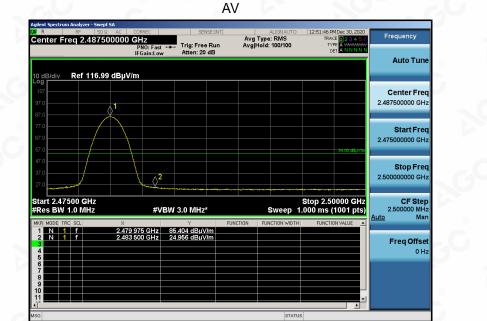


#### Report No.: AGC00803201213FE03 Page 40 of 58

EUT	BT KEYBOARD	Model Name	HB305-3
Temperature	25°C	Relative Humidity	55.4%
Pressure	960hPa	Test Voltage	Normal Voltage
Test Mode	Mode 3	Antenna	Vertical



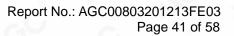
PK



#### **RESULT: PASS**

**Note**: The factor had been edited in the "Input Correction" of the Spectrum Analyzer. 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)**

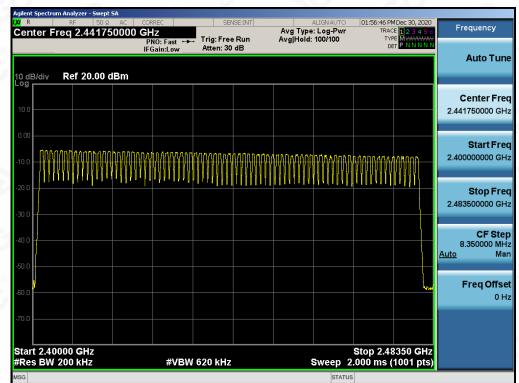
Same as described in section 8.2

#### **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		



### TEST PLOT FOR NO. OF TOTAL CHANNELS

Note: The GFSK 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

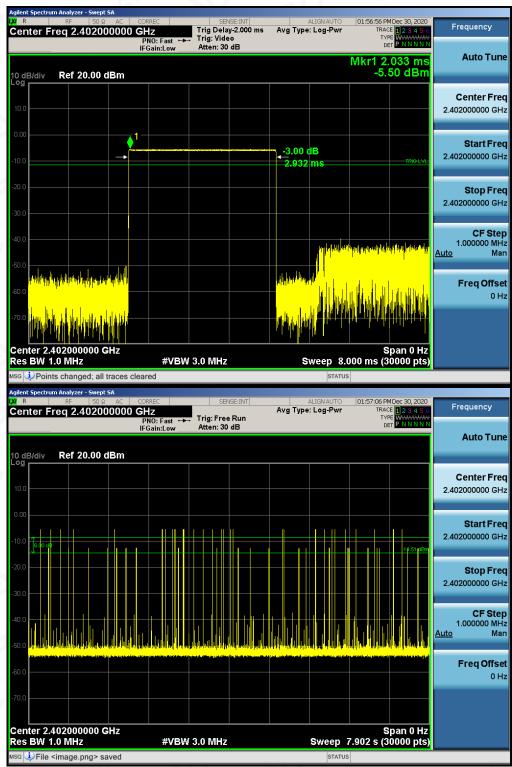
## **12.4. LIMITS AND MEASUREMENT RESULT**

Channel	Time of Pulse for DH5 (ms)	Number of hops in the period specified in the requirements	Sweep Time (ms)	Limit (ms)
Low	2.932	29*4	340.112	400
Middle	2.932	31*4	363.568	400
High	2.932	27*4	281.472	400

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

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## TEST PLOT OF LOW CHANNEL

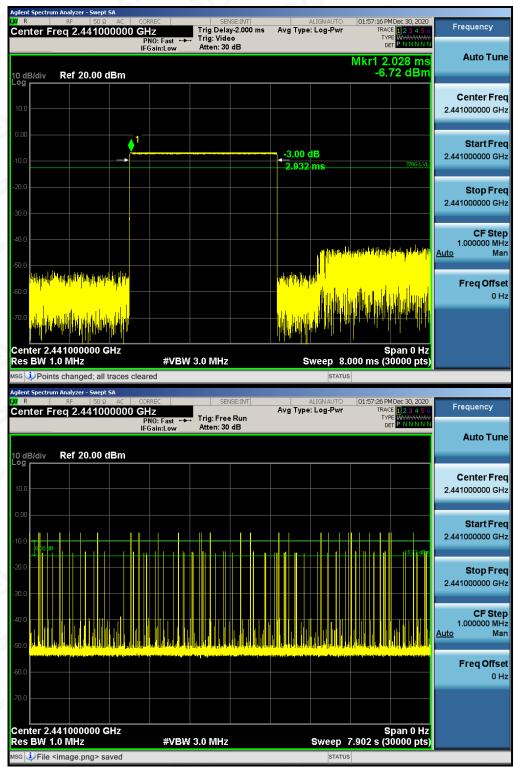
Any report having not been signed by authorized approver, or having been altered without authorization, or having not been stamped by the Bedicated Festing/Inspection Stamp" is deemed to be invalid. Copying or excerpting portion of, or altering the content of the report is not permitted without the writter approver, and AGC 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 15days 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.

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### TEST PLOT OF MIDDLE CHANNEL

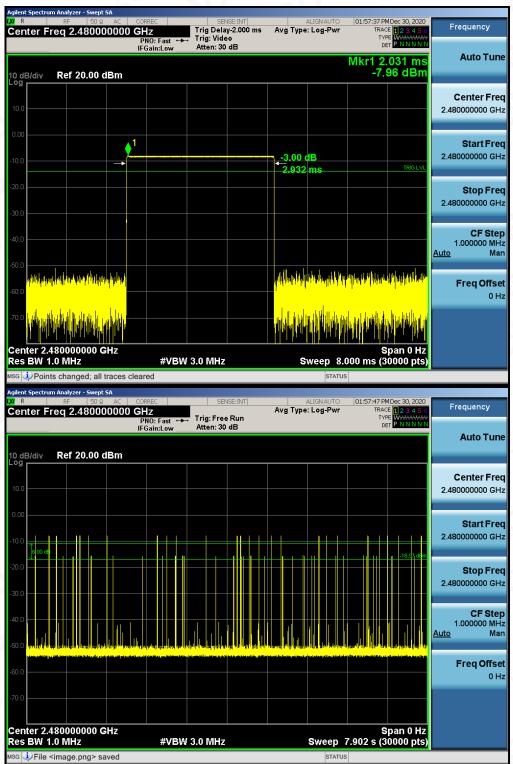
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#### TEST PLOT OF HIGH CHANNEL

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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**

TEST MODE	CHANNEL SEPARATION	LIMIT	RESULT
	MHz		Dava
Hopping Mode	1.001	>= 2/3 20 dB BW	Pass

#### 58 PM Dec 30, 2020 Peak Search Marker 2 2.441990990991 GHz Avg Type: Log-Pv AvgiHold: 100/100 Trig: Free Run Atten: 30 dB PNO: Wide IFGain:Lov Next Peak Mkr2 2.441 -7.097 dBm Ref 20.00 dBm Next Pk Right Next Pk Left Marker Delta Center 2.441000 GHz #Res BW 30 kHz Span 4.000 MHz Sweep 4.262 ms (1000 pts) #VBW 100 kHz Mkr→CF 2.440 990 GHz 2.441 991 GHz -7.164 dBm -7.097 dBm Mkr→RefLvl More 1 of 2

# Note: The GFSK modulation is the worst case and recorded in the report.

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#### TEST PLOT FOR FREQUENCY SEPARATION

## 14. FCC LINE CONDUCTED EMISSION TEST

## 14.1. LIMITS OF LINE CONDUCTED EMISSION TEST

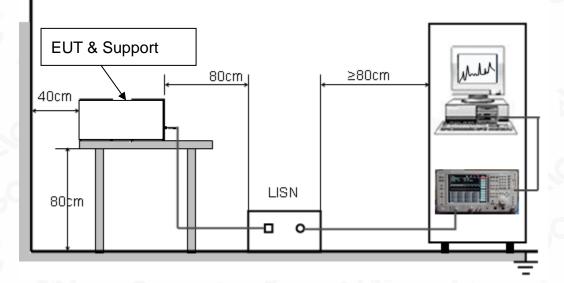
Francianau	Maximum RF	Line Voltage		
Frequency	Q.P. (dBµV)	Average (dBμV)           56-46           46		
150kHz~500kHz	66-56	56-46		
500kHz~5MHz	56	46		
5MHz~30MHz	60	50		

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 equipment received AC120V/60Hz power from a LISN, if any.
- 5. The EUT received DC 5V power from adapter which received AC120V/60Hz power from 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.

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

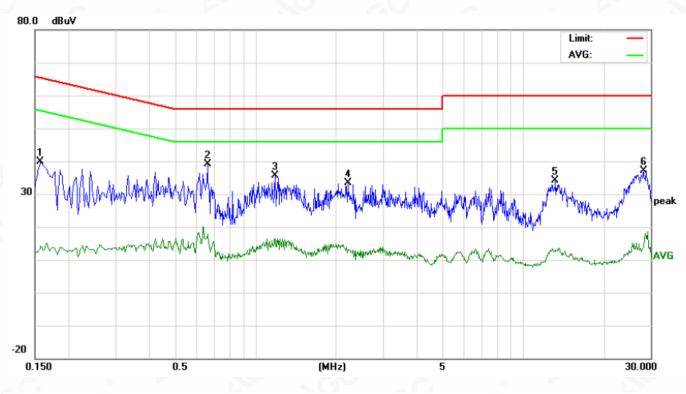
Line Conducted Emission Test Line 1-L

No.	No. Freq.				Correct Factor				Limit (dBuV)		Margin (dB)		P/F
	(MHz)	Peak	QP	AVG	dB	Peak	QP	AVG	QP	AVG	QP	AVG	
1	0.1740	26.53		2.66	12.82	39.35		15.48	64.76	54.76	-25.41	-39.28	Р
2	0.2260	24.98		0.44	12.91	37.89		13.35	62.59	52.59	-24.70	-39.24	Р
3	0.6419	26.79		7.59	13.82	40.61		21.41	56.00	46.00	-15.39	-24.59	Р
4	2.8540	20.66		1.30	13.36	34.02		14.66	56.00	46.00	-21.98	-31.34	Р
5	12.9860	23.40		1.62	13.45	36.85		15.07	60.00	50.00	-23.15	-34.93	Р
6	26.7980	24.47		2.58	13.18	37.65		15.76	60.00	50.00	-22.35	-34.24	Р

Any report having not been signed by authorized approver, or having been altered without authorization, or having not been stamped by the "Dedicated Pesting/Inspection Stamp" is deemed to be invalid. Copying or excerpting portion of, or altering the content of the report is not permitted without the written authorization of AGE, he 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 Safter 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.



Report No.: AGC00803201213FE03 Page 50 of 58



Line Conducted Emission Test Line 2-N

No.	Freq.	· (abar)		Correct Measurement Factor (dBuV)			Limit (dBuV)		Margin (dB)		P/F		
	(MHz)	Peak	QP	AVG	dB	Peak	QP	AVG	QP	AVG	QP	AVG	
1	0.1580	27.18		1.28	12.79	39.97		14.07	65.56	55.56	-25.59	-41.49	Р
2	0.6620	25.28		3.95	13.81	<b>39.0</b> 9		17.76	56.00	46.00	-16.91	-28.24	Р
3	1.1860	21.89		2.49	13.79	35.68		16.28	56.00	46.00	-20.32	-29.72	Р
4	2.2220	19.68		-0.46	13.60	33.28		13.14	56.00	46.00	-22.72	-32.86	Р
5	13.2660	20.57		-0.40	13.46	34.03		13.06	60.00	50.00	-25.97	-36.94	Р
6	28.2180	23.93		0.73	13.21	37.14		13.94	60.00	50.00	-22.86	-36.06	Р

### **RESULT: PASS**

Note: All the test modes had been tested, the mode 1 was the worst case. Only the data of the worst case would be record in this test report.

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