

FCC Test Report

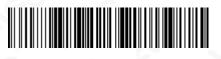
Report No.: AGC06904200702FE03

FCC ID	: 2AHYV-JAIRJ
APPLICATION PURPOSE	: Original Equipment
PRODUCT DESIGNATION	: TRUE WIRELESS EARBUDS
BRAND NAME	: JLAB
MODEL NAME	: JBuds Air
APPLICANT	: PEAG, LLC dba JLab Audio
DATE OF ISSUE	: July 22, 2020
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		July 22, 2020	Valid	Initial Release





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1. VERIFICATION OF CONFORMITY

Applicant	PEAG, LLC dba JLab Audio	
Address	2281 Las Palmas Drive, Suite 101, Carlsbad, CA 92011, USA	
Manufacturer	PEAG, LLC dba JLab Audio	
Address 2281 Las Palmas Drive, Suite 101, Carlsbad, CA 92011, USA		
Factory	Actory PEAG, LLC dba JLab Audio	
Address	2281 Las Palmas Drive, Suite 101, Carlsbad, CA 92011, USA	
Product Designation	TRUE WIRELESS EARBUDS	
Brand Name	JLAB	
Test Model	JBuds Air	
Date of test	July 14, 2020 to July 22, 2020	
Deviation	No any deviation from the test method	
Condition of Test Sample	Normal	
Test Result	Pass	
Report Template	AGCRT-US-BR/RF	

We hereby certify that:

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

Prepared By

Jonjin Hueorg

Donjon Huang Project Engineer

July 22, 2020

Max Zhan

Reviewed By

Max Zhang Reviewer

July 22, 2020

Approved By

fores

Forrest Lei Authorized Officer

July 22, 2020



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

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

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



2. GENERAL INFORMATION

2.1. PRODUCT DESCRIPTION

The EUT is designed as "TRUE WIRELESS EARBUDS". 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	2.402GHz to 2.480GHz
RF Output Power	2.074dBm(Max)
Bluetooth Version	V5.0
Modulation	BR ⊠GFSK, EDR ⊠π /4-DQPSK, ⊠8DPSK BLE □GFSK 1Mbps □GFSK 2Mbps
Number of Channels	79 Channels
Hardware Version	V5.0
Software Version	V5.0
Antenna Designation	FPC Antenna(Comply with requirements of the FCC part 15.203)
Antenna Gain	1.2dBi
Power Supply	DC 3.7V by battery
Note: 1.The EUT doesn't su	pport BLE.

2. The EUT comprises left and right channel earphone, both are the same and have been tested, Only the test data right earphone recorded in this report.

2.2. TABLE OF CARRIER FREQUENCYS

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





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.





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

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





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: $Uc = \pm 2\%$





4. DESCRIPTION OF TEST MODES

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

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

2. For Radiated Emission, 3axis were chosen for testing for each applicable mode.

3. For Conducted Test method, a temporary antenna connector is provided by the manufacture. Software Setting

	Bluetooth RF Test Tool (RtlBluetoothMP.dll Version :5,2,2,1 RTLBTAPP Version :5,2,2,1) Adde About Control Co	- D REALTEK
R	Non Link Mode Hopping LE Test Tx Settings Battery Resistance Cal	Hot Key Mode
TM FCC	Channel 0 Image: Certification Image: Certification Image: Certification Packet Type 30H5 Image: Certification Image: Certification Image: Certification Payload Type PRBS3 Image: Certification Image: Certification Image: Certification Tx Packet Count 0 Image: Certification Image: Certification Image: Certification Tx Packet Count 0 Image: Certification Image: Certification Image: Certification Tx Level 0x30 Image: Certification Image: Certification Image: Certification PHY LE 1M PHY Image: Certification Image: Certification Image: Certification Hit Target (0x00000c6967e Image: Certification Image: Certification Parameter 1 Parameter 2 Celtification	HCI Reset Test Mode
	Message >>ActionControlExcute[Tx (for Certification)] Success!! >>ActionControlExcute[Tx (for Certification)] Stop!!	Power Tracking C OFF © ON Ge





5. SYSTEM TEST CONFIGURATION

5.1. CONFIGURATION OF EUT SYSTEM

Radiated Emission Configure :

EUT

Conducted Emission Configure :

	0	
EUT		AE

5.2 EQUIPMENT USED IN TESTED SYSTEM

Item	Equipment	Model No.	ID or Specification	Remark
1	TRUE WIRELESS EARBUDS	JBuds Air	2AHYV-JAIRJ	EUT

5.3. SUMMARY OF TEST RESULTS

FCC RULES	DESCRIPTION OF TEST	RESULT
15.247 (b)(1)	Peak Output Power	Compliant
15.247 (a)(1)	20 dB Bandwidth	Compliant
15.247 (d)	Conducted Spurious Emission	Compliant
15.209	Radiated Emission	Compliant
15.247 (a)(1)(iii)	Number of Hopping Frequency	Compliant
15.247 (a)(1)(iii)	Time of Occupancy	Compliant
15.247 (a)(1)	Frequency Separation	Compliant
15.207	Conducted Emission	N/A

Note: 1.N/A means not applicable in this report.

2. The EUT is powered by battery.





6. TEST FACILITY

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

TEST EQUIPMENT OF RADIATED EMISSION TEST

Equipment	Manufacturer	Model	S/N	Cal. Date	Cal. Due
TEST RECEIVER	R&S	ESCI	10096	May 15, 2020	May 14, 2022
EXA Signal Analyzer	Aglient	N9010A	MY53470504	Dec. 12, 2019	Dec. 11, 2020
2.4GHz Fliter	EM Electronics	2400-2500MHz	N/A	Mar. 23, 2020	Mar. 22, 2022
Attenuator	ZHINAN	E-002	N/A	Sep. 09, 2019	Sep. 08, 2020
Horn antenna	SCHWARZBE CK	BBHA 9170	#768	Sep. 09, 2019	Sep. 08, 2021
Active loop antenna (9K-30MHz)	ZHINAN	ZN30900C	18051	May 22, 2020	May 21, 2022
Double-Ridged Waveguide Horn	ETS LINDGREN	3117	00034609	May 17, 2019	May 16, 2021
Broadband Preamplifier	ETS LINDGREN	3117PA	00225134	Oct. 15, 2019	Oct. 16, 2020
ANTENNA	SCHWARZBE CK	VULB9168	494	Jan. 09, 2019	Jan. 08, 2021
Test software	FARA	EZ-EMC (Ver RA-03A)	N/A	N/A	N/A





7. PEAK OUTPUT POWER

7.1. MEASUREMENT PROCEDURE

For peak power test:

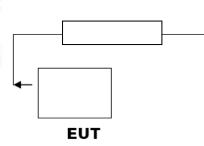
- 1. Connect EUT RF output port to the Spectrum Analyzer through an RF attenuator
- 2. Span: Approximately five times the 20 dB bandwidth, centered on a hopping channel.
- 3. RBW > 20 dB bandwidth of the emission being measured.
- 4. VBW \geq RBW.
- 5. Sweep: Auto.
- 6. Detector function: Peak.
- 7.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

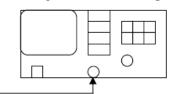
Allow trace to stabilize. Use the marker-to-peak function to set the marker to the peak of the emission. The indicated level is the peak output power, after any corrections for external attenuators and cables.

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

RF Attenuator

PEAK POWER TEST SETUP





Spectrum Analyzer







Frequency

Auto Tune

Center Freq 2.402000000 GHz

Start Freq 2.399500000 GHz

Stop Freq 2.404500000 GHz

CF Step 500.000 kHz

Freq Offset 0 Hz

Ma

7.3. LIMITS AND MEASUREMENT RESULT

Cent

10 dB/div Loa

PEAK OUTPUT POWER MEASUREMENT RESULT FOR GFSK MOUDULATION					
Frequency (GHz)	Peak Power (dBm)	Applicable Limits (dBm)	Pass or Fail		
2.402	2.074	21	Pass		
2.441	1.903	21	Pass		
2.480	1.247	21	Pass		

CH0

RF 50 Ω AL CONSEC cq 2.4020000000 GHz PNO: Fast ↔ IFGain:Low Avg Type: Log-Pwi Avg|Hold: 100/100 Trig: Free Run Atten: 30 dB Mkr1 2.401 885 GHz 2.074 dBm Ref 20.00 dBm **≜**¹

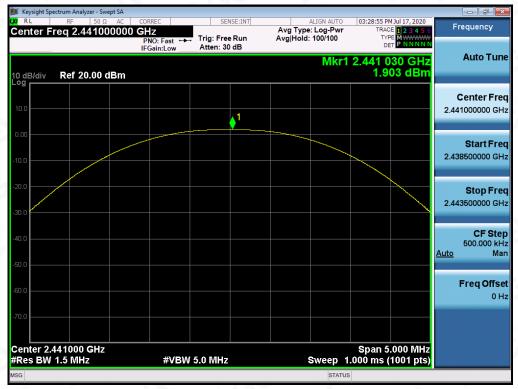
<u>Auto</u> Center 2.402000 GHz #Res BW 1.5 MHz Span 5.000 MHz Sweep 1.000 ms (1001 pts)

#VBW 5.0 MHz

G



CH39



CH78

Keysight Spectrum Analyzer	- Swept SA 50 Ω AC CORRE	C SEI	NSE:INT	ALIGN AUTO	03:29:19 PM Jul 17, 202	
enter Freq 2.480	0000000 GHz	: Fast 🛶 Trig: Free	Avg T e Run Avg Ho	ype: Log-Pwr old: 100/100	TRACE 1234 TYPE MWWW DET PNNN	Frequency
0 dB/div Ref 20.0		n:Low Atten: 30) dB	Mkr1	2.479 810 GH 1.247 dBi	Auto Tu
10.0		1				Center F 2.480000000 0
.00						Start F 2.477500000
0.0						Stop F 2.482500000
0.0						CF S 500.000 <u>Auto</u>
0.0						Freq Off
0.0						
enter 2.480000 G Res BW 1.5 MHz	Hz	#VBW 5.0 MHz		Sweep 1.	Span 5.000 MH 000 ms (1001 pt	lz s)
6G				STATUS		



	PEAK OUTPUT POWER MEA FOR II /4-DQPSK M		
Frequency (GHz)	Peak Power (dBm)	Applicable Limits (dBm)	Pass or Fail
2.402	0.955	21	Pass
2.441	0.696	21	Pass
2.480	0.005	21	Pass

CH0







CH39



CH78

Keysight Spectrum Ana RL RF	lyzer - Swept SA 50 Ω AC	CORREC	SENSE:INT	ALIGN AUT	03:32:13 PM Jul 17, 2020	
enter Freq 2.		GHz PNO: Fast ↔	Trig: Free Run	Avg Type: Log-Pv Avg Hold: 100/100	Vr TRACE 1 2 3 4 5 6	Frequency
0 dB/div Ref 2	20.00 dBm	IFGain:Low	Atten: 30 dB	Mk	r1 2.480 095 GHz 0.005 dBm	Auto Tu
10.0						Center Fr 2.480000000 0
0.00						Start F 2.477500000
0.0						Stop F 2.482500000
0.0						CF S 500.000
0.0						Auto Freg Off
0.0						(
enter 2.480000 Res BW 1.5 MH		#VBM	/ 5.0 MHz	Sweep	Span 5.000 MHz 1.000 ms (1001 pts)	
iG				STA	ATUS	



PEAK OUTPUT POWER MEASUREMENT RESULT FOR 8DPSK MODULATION					
Frequency (GHz)	Peak Power (dBm)	Applicable Limits (dBm)	Pass or Fail		
2.402	1.443	21	Pass		
2.441	1.206	21	Pass		
2.480	0.522	21	Pass		

CH0

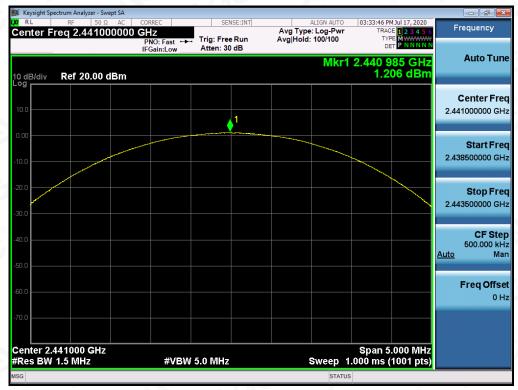




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CH78

💓 Keysight S	pectrum Analyzer - S RF 50		CORREC	CENCEJNE			02:24:14.0	11.117.2020	
	req 2.4800		GHz	Trig: Free Run	Avg Type: Avg Hold:		TRAC	M Jul 17, 2020 E 1 2 3 4 5 6 PE M WWWW	Frequency
			PNO: Fast ++ IFGain:Low	Atten: 30 dB	Avginoid.		DE		Auto Tu
10 dB/div Log	Ref 20.00	dBm				Mkr1	2.479 9 0.5	90 GHz 22 dBm	Auto Tu
									Center Fr
10.0				.1					2.480000000 G
0.00				· · · · ·					04
-10.0									Start Fr 2.477500000 G
-10.0									
-20.0									Stop Fr
-30.0									2.482500000 G
-40.0									CF St
-40.0									500.000 k <u>Auto</u> M
-50.0									
-60.0									Freq Offs 0
									U
-70.0									
Center 2	.480000 GH:	z					Span 5	.000 MHz	
	/ 1.5 MHz		#VBW	/ 5.0 MHz	S	weep 1	.000 ms (1001 pts)	
MSG						STATUS	3		



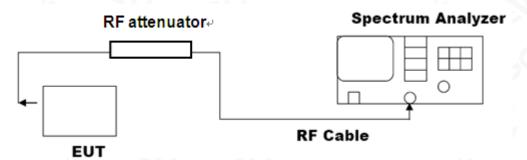


8. 20DB BANDWIDTH

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

MEASUREMENT RESULT FOR GFSK MOUDULATION					
Angliashta Linsita		Measurement Result			
Applicable Limits	Test Data	Criteria			
E DO GO	Low Channel	1.028	PASS		
N/A	Middle Channel	1.029	PASS		
	High Channel	1.023	PASS		







TEST PLOT OF BANDWIDTH FOR LOW CHANNEL

TEST PLOT OF BANDWIDTH FOR MIDDLE CHANNEL







TEST PLOT OF BANDWIDTH FOR HIGH CHANNEL





MEASUREMENT RESULT FOR II /4-DQPSK MODULATION					
Angliachte Limite		Measurement Result			
Applicable Limits	Test Data	(MHz)	Criteria		
	Low Channel	1.374	PASS		
N/A	Middle Channel	1.375	PASS		
	High Channel	1.373	PASS		

TEST PLOT OF BANDWIDTH FOR LOW CHANNEL

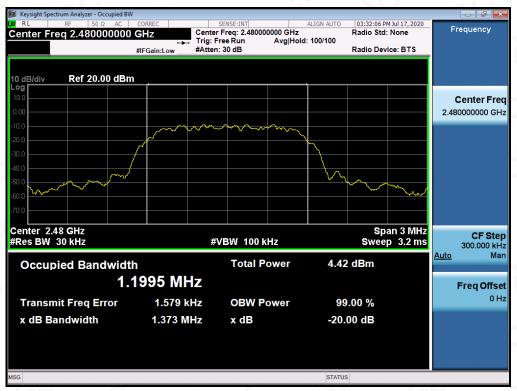






TEST PLOT OF BANDWIDTH FOR MIDDLE CHANNEL

TEST PLOT OF BANDWIDTH FOR HIGH CHANNEL

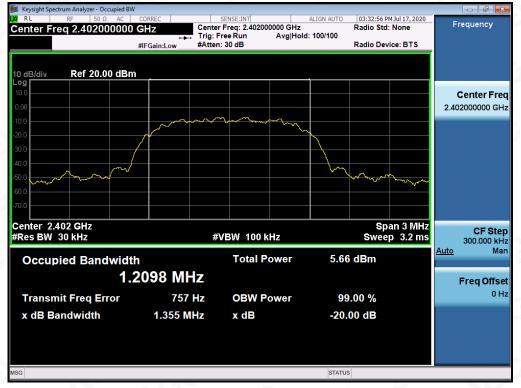






MEASUREMENT RESULT FOR 8DPSK MODULATION						
Appliachta Limita		Measurement Result				
Applicable Limits	Test Data	Test Data (MHz)				
	Low Channel	1.355	PASS			
N/A	Middle Channel	1.356	PASS			
.C 2	High Channel	1.354	PASS			

TEST PLOT OF BANDWIDTH FOR LOW CHANNEL







TEST PLOT OF BANDWIDTH FOR MIDDLE CHANNEL

TEST PLOT OF BANDWIDTH FOR HIGH CHANNEL







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.
- 3. 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

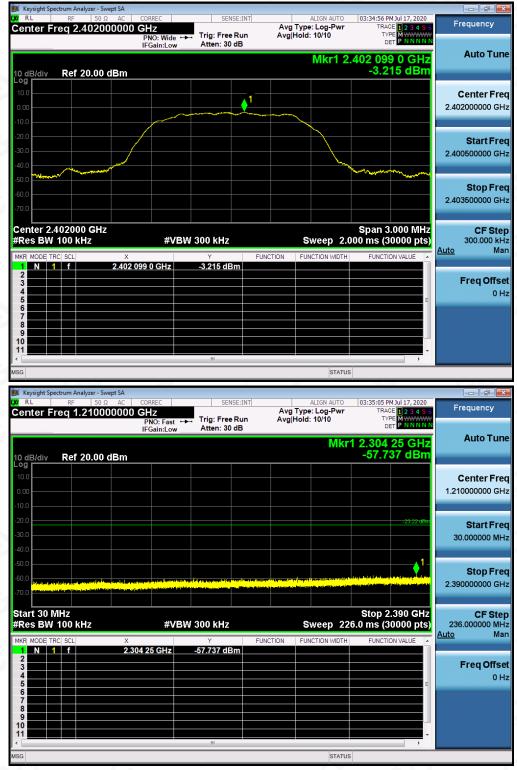
9.4. LIMITS AND MEASUREMENT RESULT

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





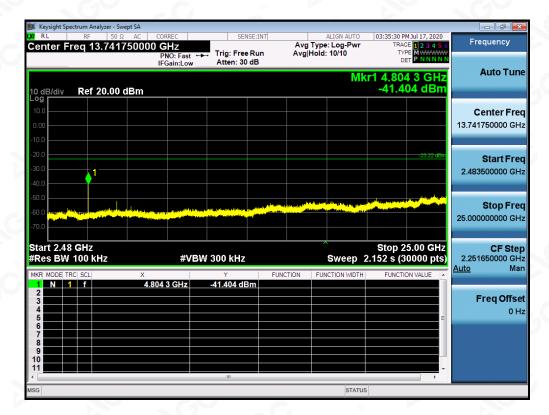
TEST RESULT FOR ENTIRE FREQUENCY RANGE TEST PLOT OF OUT OF BAND EMISSIONS WITH THE WORST CASE OF GFSK MODULATION IN LOW CHANNEL





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Attestation of Global Compliance(Shenzhen)Co.,Ltd.Tel: +86-755 2523 4088E-mail: agc@agc-cert.comWeb: http://cn.agc-cert.com/



📕 Keysight Sp ept SA Center Freq 2.441000000 GHz PNO: Wide IFGain:Low ctrum Analy Jul 17, 20 Frequency Avg Type: Log-Pwi Avg|Hold: 10/10 Trig: Free Run Atten: 30 dB Auto Tune Mkr1 2.441 -3.483 dBm Ref 20.00 dBm Center Freq 2.441000000 GHz Start Freq 2.439500000 GHz Stop Freq 2.442500000 GHz Center 2.441000 GHz #Res BW 100 kHz Span 3.000 MHz Sweep 2.000 ms (30000 pts) CF Step 300.000 kHz Man #VBW 300 kHz <u>Auto</u> FUNCTION EUNCTIO 2.441 092 1 GHz -3.483 dBm **Freq Offset** 0 Hz 📕 Keysight Sp 03:38:33 PM Jul 17, 2020 Center Freq 1.215000000 GHz PNO: Fast IFGain:Low R Frequency Avg Type: Log-Pwr Avg|Hold: 10/10 Trig: Free Run Atten: 30 dB Auto Tune Mkr1 2.048 75 GHz -57.364 dBm Ref 20.00 dBm 0 dB/div .od **Center Freq** 1.215000000 GHz Start Freq 30.000000 MHz 1 **Stop Freq** 2.40000000 GHz Start 30 MHz #Res BW 100 kHz Stop 2.400 GHz Sweep 228.0 ms (30000 pts) CF Step 237.000000 MHz #VBW 300 kHz <u>Auto</u> Mar 2.048 75 GHz -57.364 dBm Freq Offset 0 Hz STATUS

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



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🔰 Keysight Spectrum Analyzer - Swept SA				
RL RF 50 Ω AC Center Freq 13.74175000	CORREC SENSE:	Avg Type: Log-Pwr	03:38:57 PM Jul 17, 2020 TRACE 1 2 3 4 5 6	Frequency
	PNO: Fast ↔ Trig: Free Ro IFGain:Low Atten: 30 dE	3		Auto Tune
10 dB/div Ref 20.00 dBm			-42.486 dBm	Center Freq 13.741750000 GHz
-20.0 -30.0 -40.0			-23:48 dBm	Start Freq 2.483500000 GHz
-50.0				Stop Freq 25.000000000 GHz
Start 2.48 GHz #Res BW 100 kHz	#VBW 300 kHz 881 6 GHz -42.486 dBm	FUNCTION FUNCTION WIDTH	Stop 25.00 GHz 2.152 s (30000 pts) FUNCTION VALUE	CF Step 2.251650000 GHz <u>Auto</u> Man
			=E	Freq Offset 0 Hz
7 8 9 10 11				
MSG	m	STATU	3	



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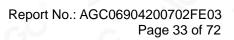


	Ω AC CORREC	SENSE:INT	ALIGN AUTO	03:40:03 PM Jul 17, 2020	Frequency
enter Freq 2.480	000000 GHz PNO: Wide ↔ IFGain:Low	Trig: Free Run Atten: 30 dB	Avg Type: Log-Pwr Avg Hold: 10/10	TRACE 123456 TYPE MWWWW DET PNNNN	
			Mkr1 2	480 099 8 GHz	Auto Tu
10 dB/div Ref 20.0	0 dBm			-4.229 dBm	
10.0					Center Fr
0.00		↓ ↓ 1			2.48000000 G
-10.0					
-20.0			+		Start Fro
-30.0			\rightarrow		2.478500000 G
-40.0	mar and a second		- han,		
-50.0				ALCON A MARKED AND AND AND AND AND AND AND AND AND AN	Stop Fr
-60.0					2.481500000 G
-70.0					
Center 2.480000 GH #Res BW 100 kHz		V 300 kHz	Sween 2 (Span 3.000 MHz 00 ms (30000 pts)	CF Ste 300.000 k
MKR MODE TRC SCL	X		JNCTION FUNCTION WIDTH	FUNCTION VALUE	Auto M
1 N 1 f	2.480 099 8 GHz	-4.229 dBm			
3					Freq Offs
4 5				E	01
6					
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10 11					
				~	
< ISG		m	STATUS	*	
Keysight Spectrum Analyzer -	Swept SA	m	STATUS		
Keysight Spectrum Analyzer -	Ω AC CORREC	m SENSE:INT	ALIGN AUTO	03:40:12 PM Jul 17, 2020	Frequency
Keysight Spectrum Analyzer -	Ω AC CORREC 0000000 GHz PNO: Fast ↔	SENSE:INT			
Keysight Spectrum Analyzer -	Ω AC CORREC	SENSE:INT	ALIGN AUTO Avg Type: Log-Pwr Avg Hold: 10/10	03:40:12 PMJul 17, 2020 TRACE 1 2 3 4 5 6 TYPE M	Frequency
Keysight Spectrum Analyzer - RL RF 50 Center Freq 1.215 10 dB/div Ref 20 0	Ω AC CORREC 0000000 GHz PN0: Fast → IFGain:Low	SENSE:INT	ALIGN AUTO Avg Type: Log-Pwr Avg Hold: 10/10	03:40:12 PM Jul 17, 2020 TRACE 1 2 3 4 5 6	Frequency
Keysight Spectrum Analyzer - RL RF 50 Center Freq 1.215 10 dB/div Ref 20.00	Ω AC CORREC 0000000 GHz PN0: Fast → IFGain:Low	SENSE:INT	ALIGN AUTO Avg Type: Log-Pwr Avg Hold: 10/10	03:40:12 PMJul 17, 2020 TRACE 1 2 3 4 5 6 TYPE MUNICAL DET P NN NN N 1 2.233 46 GHZ	Frequency Auto Tur
I Keysight Spectrum Analyzer - RL RF 50 Center Freq 1.215 10 dB/div Ref 20.00 -99 10.0	Ω AC CORREC 0000000 GHz PN0: Fast → IFGain:Low	SENSE:INT	ALIGN AUTO Avg Type: Log-Pwr Avg Hold: 10/10	03:40:12 PMJul 17, 2020 TRACE 1 2 3 4 5 6 TYPE MUNICAL DET P NN NN N 1 2.233 46 GHZ	Frequency Auto Tur Center Fre
Keysight Spectrum Analyzer - RF St RL RF St Center Freq 1.215 R St 10 dB/div Ref 20.00 St -00 -00 -00	Ω AC CORREC 0000000 GHz PN0: Fast → IFGain:Low	SENSE:INT	ALIGN AUTO Avg Type: Log-Pwr Avg Hold: 10/10	03:40:12 PMJul 17, 2020 TRACE 1 2 3 4 5 6 TYPE MUNICAL DET P NN NN N 1 2.233 46 GHZ	Frequency Auto Tur Center Fre
I Keysight Spectrum Analyzer - RL RF 50 Center Freq 1.215 10 dB/div Ref 20.00 -99 10.0	Ω AC CORREC 0000000 GHz PN0: Fast → IFGain:Low	SENSE:INT	ALIGN AUTO Avg Type: Log-Pwr Avg Hold: 10/10	03:40:12 PM Jul 17, 2020 TRACE 1 2 3 4 5 6 TYPE MWWWW OET PNNNN 1 2.233 46 GHz -58.397 dBm	Frequency Auto Tur Center Fre 1.215000000 G
Keysight Spectrum Analyzer - RL RF 50 Center Freq 1.2151 0 dB/div Ref 20.00 0 0 0 0 0.00 0	Ω AC CORREC 0000000 GHz PNO: Fast → IFGain:Low	SENSE:INT	ALIGN AUTO Avg Type: Log-Pwr Avg Hold: 10/10	03:40:12 PMJul 17, 2020 TRACE 1 2 3 4 5 6 TYPE MUNICAL DET P NN NN N 1 2.233 46 GHZ	Frequency Auto Tur Center Fre 1.215000000 Gi Start Fre
Keysight Spectrum Analyzer - RL RF 50 Center Freq 1.2151 IO dB/div Ref 20.00 00 00 00 00 00 00 000 000 000 000 000 000 000 000 000 000 000 000	Ω AC CORREC 0000000 GHz PNO: Fast → IFGain:Low	SENSE:INT	ALIGN AUTO Avg Type: Log-Pwr Avg Hold: 10/10	03:40:12 PM Jul 17, 2020 TRACE 1 2 3 4 5 6 TYPE MWWWW OET PNNNN 1 2.233 46 GHz -58.397 dBm	Frequency Auto Tur Center Fre
Keysight Spectrum Analyzer - RL RF 50 Center Freq 1.2151 IO dB/div Ref 20.01 -99	Ω AC CORREC 0000000 GHz PNO: Fast → IFGain:Low	SENSE:INT	ALIGN AUTO Avg Type: Log-Pwr Avg Hold: 10/10	03:40:12 PM Jul 17, 2020 TRACE 1 2 3 4 5 6 TYPE MWWWW OET PNNNN 1 2.233 46 GHz -58.397 dBm	Frequency Auto Tur Center Fre 1.21500000 GI Start Fre 30.00000 Mi
Keysight Spectrum Analyzer - RL RF 50 Center Freq 1.2151 IO dB/div Ref 20.01 -9	Ω AC CORREC 0000000 GHz PNO: Fast → IFGain:Low	SENSE:INT Trig: Free Run Atten: 30 dB	ALIGN AUTO Avg Type: Log-Pwr Avg Hold: 10/10 MKr	03:40:12 PM Jul 17, 2020 TRACE 1 2 3 4 5 6 TYPE MWWWW OET PNNNN 1 2.233 46 GHz -58.397 dBm	Frequency Auto Tur Center Fre 1.215000000 GI Start Fre 30.000000 MI Stop Fre
Keysight Spectrum Analyzer - RL RF 50 Center Freq 1.2151 IO dB/div Ref 20.01 -9	Ω AC CORREC 000000 GHz PNO: Fast → IFGain:Low	SENSE:INT Trig: Free Run Atten: 30 dB	ALIGN AUTO Avg Type: Log-Pwr Avg Hold: 10/10 MKr	03:40:12 PM Jul 17, 2020 TRACE 1 2 3 4 5 6 TYPE MWWWW OET PNNNN 1 2.233 46 GHz -58.397 dBm	Frequency Auto Tur Center Fre 1.215000000 GI Start Fre 30.000000 MI Stop Fre
Keysight Spectrum Analyzer - Stress G RL RF 50 Center Freq 1.215 1.215 1.215 10 dB/div Ref 20.00 1.215 -0 0 0.00 1.0.0 1.0.0 -10.0 0.00 1.215 1.215 -20.0 0.00 1.215 1.215 -30.0 0.00 1.215 1.215 -40.0 0.00 1.215 1.215 -70.0 1.215 1.215 1.215	Ω AC CORREC 000000 GHz PNO: Fast → IFGain:Low	SENSE:INT Trig: Free Run Atten: 30 dB	ALIGN AUTO Avg Type: Log-Pwr Avg Hold: 10/10 MKr	03:40:12 PM Jul 17, 2020 TRACE 12 3 4 5 6 TYPE NINNIN 1 2.233 46 GHz -58.397 dBm -24.23 dbn -24.23 dbn 1	Frequency Auto Tur Center Frr 1.215000000 G Start Frr 30.000000 M Stop Frr 2.400000000 G
Keysight Spectrum Analyzer - RL RF 50 Center Freq 1.2151 10 dB/div Ref 20.01 -9	Ω AC CORREC 000000 GHz PN0: Fast → IFGain:Low	SENSE:INT Trig: Free Run Atten: 30 dB	ALIGN AUTO Avg Type: Log-Pwr Avg Hold: 10/10 Mkr	03:40:12 PM Jul 17, 2020 TRACE 1 2 3 4 5 6 TYPE MWWWW OET PNNNN 1 2.233 46 GHz -58.397 dBm	Frequency Auto Tur Center Fr 1.215000000 G Start Fr 30.000000 M Stop Fr 2.400000000 G CF Str 237.000000 M
Keysight Spectrum Analyzer - RL RF 50 Center Freq 1.215 IO dB/div Ref 20.00 Og IO IO IO Og IO IO IO	Ω AC CORREC 000000 GHz PN0: Fast → IFGain:Low 0 dBm 0 0 #VBW X	SENSE:INT Trig: Free Run Atten: 30 dB	ALIGN AUTO Avg Type: Log-Pwr Avg Hold: 10/10 Mkr	03:40:12 PM Jul 17, 2020 TRACE 12 3 4 5 6 TYPE NNNNN 1 2.233 46 GHz -58.397 dBm	Frequency Auto Tur Center Fre 1.215000000 GI Start Fre 30.000000 MI Stop Fre 2.400000000 GI CF Ste 237.000000 MI
Keysight Spectrum Analyzer - Sc RL RF 50 Center Freq 1.215 50 -00	Ω AC CORREC 000000 GHz PN0: Fast → IFGain:Low 0 BM	SENSE:INT Trig: Free Run Atten: 30 dB	ALIGN AUTO Avg Type: Log-Pwr Avg Hold: 10/10 Mkr	03:40:12 PM Jul 37, 2020 TRACE 2 3 4 5 6 TYPE NINNIN 1 2.233 46 GHz -58.397 dBm -24 23 dBm -24 23 dBm -1 Stop 2.400 GHz 8.0 ms (30000 pts)	Frequency Auto Tur Center Fre 1.215000000 GI Start Frr 30.000000 MI Stop Frr 2.400000000 GI CF Ste 237.000000 MI Auto Tur
Keysight Spectrum Analyzer 50 Center Freq 1.215 50 O dB/div Ref 20.00 -00 -00<	Ω AC CORREC 000000 GHz PN0: Fast → IFGain:Low 0 dBm 0 0 #VBW X	SENSE:INT Trig: Free Run Atten: 30 dB	ALIGN AUTO Avg Type: Log-Pwr Avg Hold: 10/10 Mkr	03:40:12 PM Jul 37, 2020 TRACE 2 3 4 5 6 TYPE NINNIN 1 2.233 46 GHz -58.397 dBm -24 23 dBm -24 23 dBm -1 Stop 2.400 GHz 8.0 ms (30000 pts)	Frequency Auto Tur Center Fr 1.215000000 G Start Fr 30.000000 M Stop Fr 2.400000000 G CF Str 237.000000 M Auto Auto Tur Treq Offs
Keysight Spectrum Analyzer - RL RF 50 Center Freq 1.215 IO dE/div Ref 20.04 00 20 20 10.0 20.0 20.0 20.0 20.0 20.0 20.0 20.0 20.0 30.0 20.0 20.0 50.0 20.0 20.0 Start 30 MHz 4 5 #Res BW 100 kHz MKR MODE TRC SCL 1 1 1 2 3 3 4 3 3	Ω AC CORREC 000000 GHz PN0: Fast → IFGain:Low 0 dBm 0 0 #VBW X	SENSE:INT Trig: Free Run Atten: 30 dB	ALIGN AUTO Avg Type: Log-Pwr Avg Hold: 10/10 Mkr	03:40:12 PM Jul 37, 2020 TRACE 2 3 4 5 6 TYPE NINNIN 1 2.233 46 GHz -58.397 dBm -24 23 dBm -24 23 dBm -1 Stop 2.400 GHz 8.0 ms (30000 pts)	Frequency Auto Tur Center Fre 1.215000000 GI Start Fre 30.000000 MI Stop Fre 2.400000000 GI CF Ste 237.000000 MI
Keysight Spectrum Analyzer - RL RF 50 Center Freq 1.215 50 -00	Ω AC CORREC 000000 GHz PN0: Fast → IFGain:Low 0 dBm 0 0 #VBW X	SENSE:INT Trig: Free Run Atten: 30 dB	ALIGN AUTO Avg Type: Log-Pwr Avg Hold: 10/10 Mkr	03:40:12 PM Jul 37, 2020 TRACE 2 3 4 5 6 TYPE NINNIN 1 2.233 46 GHz -58.397 dBm -24 23 dBm -24 23 dBm -1 Stop 2.400 GHz 8.0 ms (30000 pts)	Frequency Auto Tur Center Fr 1.215000000 G Start Fr 30.000000 M Stop Fr 2.400000000 G CF Str 237.000000 M Auto Auto Tur Treq Offs
Keysight Spectrum Analyzer - Sc Center Freq 1.215 Sc 0 dB/div Ref 20.00 0 0 Ref 20.00	Ω AC CORREC 000000 GHz PN0: Fast → IFGain:Low	SENSE:INT Trig: Free Run Atten: 30 dB	ALIGN AUTO Avg Type: Log-Pwr Avg Hold: 10/10 Mkr	03:40:12 PM Jul 37, 2020 TRACE 2 3 4 5 6 TYPE NINNIN 1 2.233 46 GHz -58.397 dBm -24 23 dBm -24 23 dBm -1 Stop 2.400 GHz 8.0 ms (30000 pts)	Frequency Auto Tur Center Fr 1.215000000 G Start Fr 30.000000 M Stop Fr 2.400000000 G CF Str 237.000000 M Auto Auto Tur Treq Offs
Keysight Spectrum Analyzer - RL RF 50 Center Freq 1.215 IO dB/div Ref 20.00 Og Io IO dB/div Ref 20.00 Og Io IO dB/div Ref 20.00 IO dB/div Io IO dB/div Ref 20.00 IO dB/div Io IO dB/div <t< td=""><td>Ω AC CORREC 000000 GHz PN0: Fast → IFGain:Low</td><td>SENSE:INT Trig: Free Run Atten: 30 dB</td><td>ALIGN AUTO Avg Type: Log-Pwr Avg Hold: 10/10 Mkr</td><td>03:40:12 PM Jul 37, 2020 TRACE 2 3 4 5 6 TYPE NINNIN 1 2.233 46 GHz -58.397 dBm -24 23 dBm -24 23 dBm -1 Stop 2.400 GHz 8.0 ms (30000 pts)</td><td>Frequency Auto Tu Center Fr 1.215000000 G Start Fr 30.000000 M Stop Fr 2.400000000 G CF Str 237.000000 M Auto Auto Tu Stop Fr 2.400000000 G CF Str Auto Auto Freq Offs</td></t<>	Ω AC CORREC 000000 GHz PN0: Fast → IFGain:Low	SENSE:INT Trig: Free Run Atten: 30 dB	ALIGN AUTO Avg Type: Log-Pwr Avg Hold: 10/10 Mkr	03:40:12 PM Jul 37, 2020 TRACE 2 3 4 5 6 TYPE NINNIN 1 2.233 46 GHz -58.397 dBm -24 23 dBm -24 23 dBm -1 Stop 2.400 GHz 8.0 ms (30000 pts)	Frequency Auto Tu Center Fr 1.215000000 G Start Fr 30.000000 M Stop Fr 2.400000000 G CF Str 237.000000 M Auto Auto Tu Stop Fr 2.400000000 G CF Str Auto Auto Freq Offs

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



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	ectrum Analyzer -										×
Center F				SEN	ISE:INT	Avg Typ	ALIGN AUTO e: Log-Pwr		M Jul 17, 2020	Frequenc	у
			PNO: Fast ↔ FGain:Low	Trig: Free Atten: 30		Avg Hold		D		Auto 1	Гune
10 dB/div	Ref 20.0	0 dBm							11 dBm		
Log 10.0 0.00 -10.0										Center 13.750000000	•
-20.0 -30.0 -40.0	1								-24.23 dBm	Start 2.500000000	
-50.0 -60.0 -70.0						a had a los of				Stop 25.000000000	
Start 2.50 #Res BW			#VBV	V 300 kHz		^	Sweep 2	Stop 2 2.152 s (3	5.00 GHz 0000 pts)	CF 2.250000000 Auto	Step GHz Man
MKR MODE TI	RC SCL	× 4.960) 1 GHz	۲ -44.611 dE		TION FU	NCTION WIDTH	FUNCTI	ON VALUE		
2 3 4 5 6 7									=	Freq O	o ffset 0 Hz
8 9 10 11									-		
MSG							STATUS	3			

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

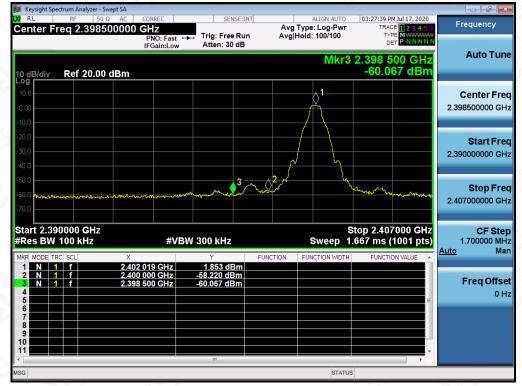




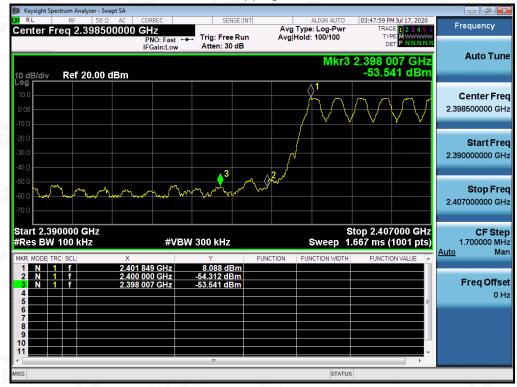
TEST RESULT FOR BAND EDGE

GFSK MODULATION IN LOW CHANNEL

Hopping off



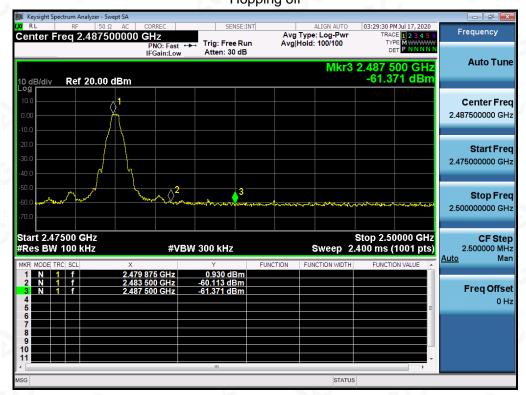
Hopping on





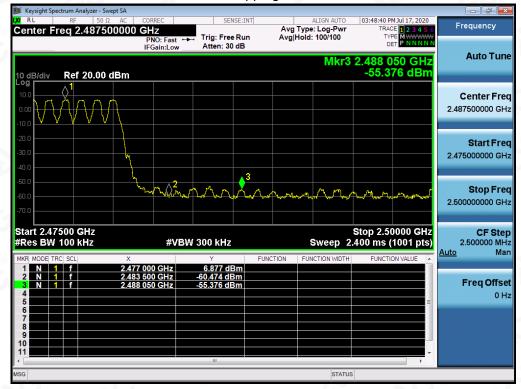
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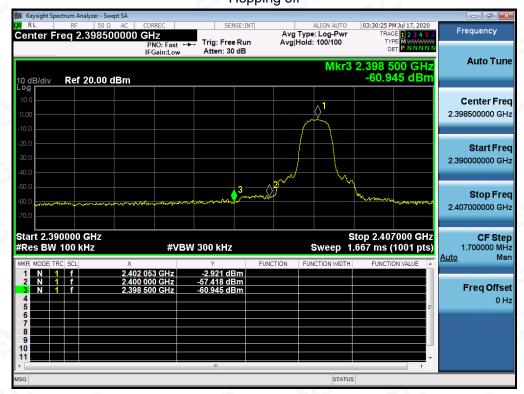
GFSK MODULATION IN HIGH CHANNEL Hopping off

Hopping on



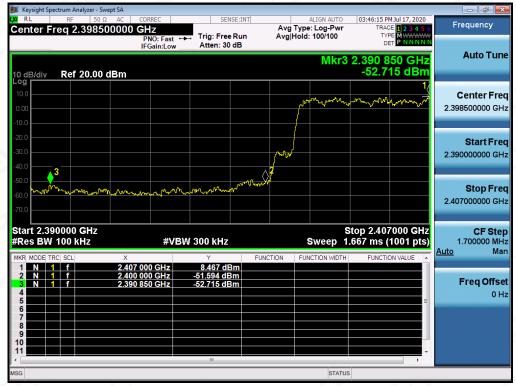






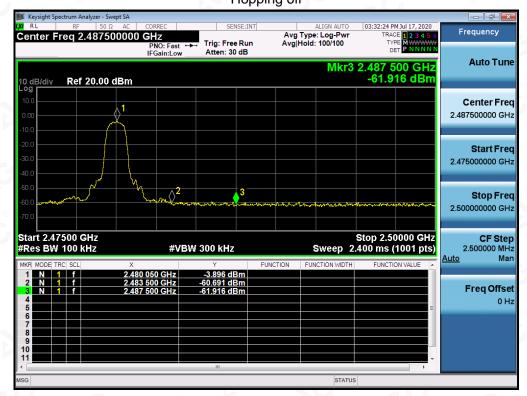
π /4-DQPSK MODULATION IN LOW CHANNEL Hopping off

Hopping on









π /4-DQPSK MODULATION IN HIGH CHANNEL Hopping off

Hopping on

