

# **TEST REPORT**

## FCC PART 15 SUBPART C 15.247

Test report On Behalf of KO-STAR DEVELOPMENT CO., LTD. For bluetooth headset Model No.: MZX770

#### FCC ID: 2ALHZNB-1090

Prepared for : KO-STAR DEVELOPMENT CO., LTD. No.3, Yicun Industrial Area, Xikeng, Henggang Town, Longgang District, Shenzhen, China 518115

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 Date of Test:
 Nov. 21, 2018 ~ Dec. 10, 2018

 Date of Report:
 Dec. 10, 2018

 Report Number:
 HK1812101838E



## **TEST RESULT CERTIFICATION**

Applicant's name	KO-STAR DEVELOPMENT CO., LTD.		
Address	No.3, Yicun Industrial Area, Xikeng, Henggang Town, Longgang District, Shenzhen, China 518115		
Manufacture's Name	SHENZHEN BASSWORLD TECHNOLOGY CO., LTD		
Address	No.3, Yicun Industrial Area, Xikeng, Henggang Town, Longgang District, Shenzhen, China 518115		
	SHENZHEN BASSWORLD TECHNOLOGY CO., LTD		
Address	No.3, Yicun Industrial Area, Xikeng, Henggang Town, Longgang District, Shenzhen, China 518115		
Product description			
Trade MarkN/A			
Product name bluetooth headset			
Model and/or type reference MZX770			
Series Model	MZX770-BLK, MZX770-WHT, MZX870, MZX870-BLK, MZX870-WHT,		
	<sup></sup> NB-1090, BT-2020, NB-2020, BT-1300, NB-1300		
Difference Description	MZX770-BLK, MZX770-WHT, MZX870, MZX870-BLK, MZX870-WHT, WB-1090, BT-2020, NB-2020, BT-1300, NB-1300 All the same except for the appearance color.		

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Date of Test	
Date (s) of performance of tests:	Nov. 21, 2018 ~ Dec. 10, 2018
Date of Issue:	Dec. 10, 2018
Test Result:	Pass

**Testing Engineer** 

Good Di an (Gary Qian)

**Technical Manager** 

Edon Hu

(Eden Hu)

Authorized Signatory :

(Jason Zhou)



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## 1. SUMMARY

## 1.1. TEST STANDARDS

The tests were performed according to following standards:

FCC Rules Part 15.247: Frequency Hopping, Direct Spread Spectrum and Hybrid Systems that are in operation within the bands of 902-928 MHz, 2400-2483.5 MHz, and 5725-5850 MHz

ANSI C63.10:2013 : American National Standard for Testing Unlicensed Wireless Devices

#### 1.2. Test Description

FCC PART 15.247		
FCC Part 15.207	AC Power Conducted Emission	PASS
FCC Part 15.247(a)(1)(i)	20dB Bandwidth	PASS
FCC Part 15.247(d)	Spurious RF Conducted Emission	PASS
FCC Part 15.247(b)	Maximum Peak Output Power	PASS
FCC Part 15.247(b)	Pseudorandom Frequency Hopping Sequence	PASS
FCC Part 15.247(a)(1)(iii)	Number of hopping frequency& Time of Occupancy	PASS
FCC Part 15.247(a)(1)	Frequency Separation	PASS
FCC Part 15.205/15.209	Radiated Emissions	PASS
FCC Part 15.247(d)	Band Edge Compliance of RF Emission	PASS



#### 1.3. Test Facility

#### **1.3.1 Address of the test laboratory**

Shenzhen HUAK Testing Technology Co., Ltd. Add.:1F, B2 Building, Junfeng Zhongcheng Zhizao Innovation Park,Heping Community, Fuhai Street, Bao'an District, Shenzhen, China

There is one 3m semi-anechoic chamber and two line conducted labs for final test. The Test Sites meet the requirements in documents ANSI C63.4 and CISPR 32/EN 55032 requirements.

#### 1.3.2 Laboratory accreditation

The test facility is recognized, certified, or accredited by the following organizations:

#### IC Registration No.: 21210

The 3m alternate test site of Shenzhen HUAK Testing Technology Co., Ltd. EMC Laboratory has been registered by Certification and Engineer Bureau of Industry Canada for the performance of with Registration No.: 21210 on May 24, 2016.

#### FCC Registration No.: CN1229

Test Firm Registration Number : 616276

#### 1.4. Statement of the measurement uncertainty

The data and results referenced in this document are true and accurate. The reader is cautioned that there may be errors within the calibration limits of the equipment and facilities. The measurement uncertainty was calculated for all measurements listed in this test report acc. to CISPR 16 - 4 "Specification for radio disturbance and immunity measuring apparatus and methods – Part 4: Uncertainty in EMC Measurements" and is documented in the Shenzhen HUAK Testing Technology Co., Ltd. quality system acc. to DIN EN ISO/IEC 17025. Furthermore, component and process variability of devices similar to that tested may result in additional deviation. The manufacturer has the sole responsibility of continued compliance of the device.

Hereafter the best measurement capability for HUAK laboratory is reported:

Test	Measurement Uncertainty	Notes
Transmitter power conducted	±0.57 dB	(1)
Transmitter power Radiated	±2.20 dB	(1)
Conducted spurious emission 9KHz-40 GHz	±2.20 dB	(1)
Occupied Bandwidth	±0.01ppm	(1)
Radiated Emission 30~1000MHz	±4.10dB	(1)
Radiated Emission Above 1GHz	±4.32dB	(1)
Conducted Disturbance0.15~30MHz	±3.20dB	(1)

(1) This uncertainty represents an expanded uncertainty expressed at approximately the 95% confidence level using a coverage factor of k=2.



## 2. GENERAL INFORMATION

### 2.1. Environmental conditions

During the measurement the environmental conditions were within the listed ranges:

Normal Temperature:		25°C	
	Relative Humidity:	55 %	
	Air Pressure:	101 kPa	

### 2.2. General Description of EUT

Product Name:	bluetooth headset	
Model/Type reference:	MZX770	
Power supply:	DC 3.7V by Battery	
Version:	V4.1	
Modulation:	GFSK, π/4DQPSK, 8DPSK for BR/EDR	
Operation frequency:	2402MHz~2480MHz	
Channel number: 79		
Channel separation: 1MHz		
Antenna type:	PCB Antenna	
Antenna gain:	-0.68dBi	
Hardware Version:	V3.2	
Software Version:	2.0	

Note: 1. For more details, refer to the user's manual of the EUT.

2. The EUT doesn't support BLE.

## 2.3. Description of Test Modes and Test Frequency

The Applicant provides communication tools software to control the EUT for staying in continuous transmitting and receiving mode for testing.

There are 79 channels provided to the EUT and Channel 00/39/78 was selected for testing.

#### Operation Frequency :

Channel	Frequency (MHz)	
00	2402	
01	2403	
:	:	
38	2440	
39	2441	
40	2442	
:	:	
77	2479	
78	2480	

Note: The line display in grey were the channel selected for testing



NO.	TEST MODE DESCRIPTION			
1	Low channel TX			
2	Middle channel TX			
3	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.

Configure :



## 2.4. Related Submittal(s) / Grant (s)

This submittal(s) (test report) is intended to comply with Section 15.247 of the FCC Part 15, Subpart C Rules.

### 2.5. Modifications

No modifications were implemented to meet testing criteria.

### 2.6. 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.

## 2.7. Example of a Hopping Sequence 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

## 2.8. 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 following9ehavior:

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.

## 2.9. Equipment Used

Item	Equipment	Manufacturer	Model No.	Serial No.	Last Cal.	Cal. Interval
1.	L.I.S.N. Artificial Mains Network	R&S	ENV216	HKE-002	Dec. 28, 2018	1 Year
2.	Receiver	R&S	ESCI 7	HKE-010	Dec. 28, 2018	1 Year
3.	RF automatic control unit	Tonscend	JS0806-2	HKE-060	Dec. 28, 2018	1 Year
4.	Spectrum analyzer	R&S	FSP40	HKE-025	Dec. 28, 2018	1 Year
5.	Spectrum analyzer	Agilent	N9020A	HKE-048	Dec. 28, 2018	1 Year
6.	Preamplifier	Schwarzbeck	BBV 9743	HKE-006	Dec. 28, 2018	1 Year
7.	EMI Test Receiver	Rohde & Schwarz	ESCI 7	HKE-010	Dec. 28, 2018	1 Year
8.	Bilog Broadband Antenna	Schwarzbeck	VULB9163	HKE-012	Dec. 28, 2018	1 Year
9.	Loop Antenna	Schwarzbeck	FMZB 1519 B	HKE-014	Dec. 28, 2018	1 Year
10.	Horn Antenna	Schewarzbeck	9120D	HKE-013	Dec. 28, 2018	1 Year
11.	Pre-amplifier	EMCI	EMC051845 SE	HKE-015	Dec. 28, 2018	1 Year
12.	Pre-amplifier	Agilent	83051A	HKE-016	Dec. 28, 2018	1 Year
13.	EMI Test Software EZ-EMC	Tonscend	JS1120-B Version	HKE-083	Dec. 28, 2018	N/A
14.	Power Sensor	Agilent	E9300A	HKE-086	Dec. 28, 2018	1 Year
15.	Spectrum analyzer	Agilent	N9020A	HKE-048	Dec. 28, 2018	1 Year
16.	Signal generator	Agilent	N5182A	HKE-029	Dec. 28, 2018	1 Year
17.	Signal Generator	Agilent	83630A	HKE-028	Dec. 28, 2018	1 Year
18.	Shielded room	Shiel Hong	4*3*3	HKE-039	Dec. 28, 2017	3 Year

The calibration interval was one year



## 3. Peak Output Power

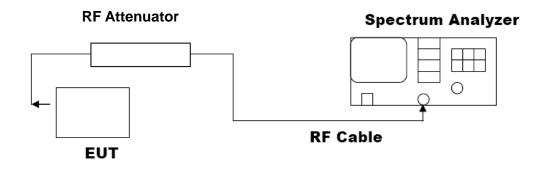
### 3.1. Measurement Procedure

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.

## 3.2. Test Set-Up (Block Diagram of Configuration)





### 3.3. Limits and Measurement Result

PEAK OUTPUT POWER MEASUREMENT RESULT FOR GFSK MOUDULATION									
Frequency (GHz)Peak Power (dBm)Applicable Limits (dBm)Pass or Fa									
2.402	2.873	30	Pass						
2.441	2.662	30	Pass						
2.480	2.284	30	Pass						







Kausiaht Ca	anterior Analysis Count CA			H39		
Keysight Sp	RF 50 Ω AC		SENSE:INT	ALIGN AUTO	09:38:00 AM Dec 08, 2018	
larker 1	2.44114000000	0 GHz PNO: Fast 😱 IFGain:Low	Trig: Free Run Atten: 30 dB	Avg Type: Log-Pwr Avg Hold:>100/100	12 3 4 5 6 TRACE 1 2 3 4 5 6 TYPE MWWWWW DET P N N N N N	Peak Search
) dB/div	Ref 20.00 dBm			Mkr1	2.441 140 GHz 2.662 dBm	Next Pea
0.0						Next Pk Righ
).00						
10.0						Next Pk Le
0.0 <b>1</b>						Marker Delt
0.0						Mkr→C
0.0						
0.0						Mkr→RefL
0.0						Mor
	441000 GHz				Span 5.000 MHz	1 of
Res BW	1.5 MHz	#VBW	5.0 MHz	Sweep 1	.000 ms (1001 pts)	

CH78

									trum Analyzer - Swe	Keysight Sp
Peak Search	AM Dec 08, 2018 ACE 1 2 3 4 5 6 YPE M	TRA	ALIGN AUTO ype: Log-Pwr old:>100/100		ENSE:INT		Hz PNO: Fast		RF 50 Ω 2.48014500	larker 1
Next Peal	145 GHz	0		,		Atten: 3	FGain:Low			
	284 dBm	2.2						lBm	Ref 20.00 d	0 dB/div
Next Pk Righ					Ĭ					
					<b>♦</b> <sup>1</sup>					10.0
New Oblast										0.00
Next Pk Lef										10.0
										20.0
Marker Delta										30.0
										30.0
Mkr→Cf										40.0
										50.0
Mkr→RefLv										60.0
										70.0
More										
1 of 2	5.000 MHz (1001 pts)	Span :	Sween 1		7	5.0 MHz	#VBW		80000 GHz	Center 2.4 Res BW
	(reer pro/		STATU				<i>"</i> •Bn			SG



	PEAK OUTPUT POWER MEASUREMENT RESULT FOR II /4-DQPSK MODULATION									
Frequency (GHz)Peak Power (dBm)Applicable Limits (dBm)Pass or Fail										
2.402	3.001	30	Pass							
2.441	2.877	30	Pass							
2.480	2.544	30	Pass							

			CH0				
🔤 Kej	ysight Spectrum Analyzer - Swept SA						
Mar	RF 50 Ω AC ker 1 2.402150000000	GHz PNO: Fast Trig: Free	Run Avg Ho	ALIGN AUTO /pe: Log-Pwr old:>100/100	TRAC	M Dec 08, 2018 DE 1 2 3 4 5 6 DE M H H H H H H H H H H H H H H H H H H	Peak Search
10 dE Log	B/div Ref 20.00 dBm	IFGain:Low Atten: 30	, dB	Mkr1	2.402 1	50 GHz 01 dBm	Next Peak
10.0							Next Pk Right
0.00							Next Pk Left
-20.0	Server and the server					and a second second	Marker Delta
-30.0							
-40.0							Mkr→CF
-60.0							Mkr→RefLvl
-70.0 Cen	ter 2.402000 GHz				Span 5	.000 MHz	More 1 of 2
#Re	s BW 1.5 MHz	#VBW 5.0 MHz			.000 ms (	1001 pts)	
MSG				STATUS			

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			H39		
Keysight Spectrum Analyzer - Swept SA					- 5 🗾
۵ RF 50 Ω A Marker 1 2.4410950000		SENSE:INT Trig: Free Run Atten: 30 dB	ALIGN AUTO Avg Type: Log-Pwr Avg Hold:>100/100	09:39:00 AM Dec 08, 2018 TRACE 1 2 3 4 5 6 TYPE MWWWW DET P N N N N N	Peak Search
0 dB/div Ref 20.00 dBn			Mkr1	2.441 095 GHz 2.877 dBm	Next Pea
10.0		1			Next Pk Righ
					Next Pk Let
20.0					Marker Delt
0.0					Mkr→C
50.0					
70.0					Mkr→RefLv
enter 2.441000 GHz				Span 5,000 MHz	<b>Mor</b> 1 of
Res BW 1.5 MHz	#VBW	5.0 MHz	Sweep 1	Span 5.000 MHz .000 ms (1001 pts)	

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									ctrum Analyzer - Sw	Keysight Sp
Peak Search	13 AM Dec 08, 2018 TRACE 1 2 3 4 5 6 TYPE M	TRA	ALIGN AUTO e: Log-Pwr d:>100/100					AC	RF 50 Ω 2.4800700	<mark>x</mark> Marker 1
Next Peak	0 070 GHz .544 dBm	1 2.480		, ngline.		Atten:	PNO: Fast Ģ FGain:Low		Ref 20.00	10 dB/div
Next Pk Right					<b>↓</b> 1					- <b>og</b>
Next Pk Left										-10.00
Marker Delta										30.0
Mkr→CF										40.0
Mkr→RefLv										60.0
More 1 of 2	n 5.000 MHz is (1001 pts)	Span 1.000 ms	Sweep 1		z	/ 5.0 MH	#VBW		80000 GHz	Center 2.
			STATUS							ISG



	PEAK OUTPUT POWER MEASUREMENT RESULT FOR 8DPSK MODULATION									
Frequency (GHz)Peak Power (dBm)Applicable Limits (dBm)Pass or Fail										
2.402	3.221	30	Pass							
2.441	3.098	30	Pass							
2.480	2.775	30	Pass							

		CH0		
Keysight Spectrum Analyzer - Swept SA     RF 50 Ω AC				
Marker 1 2.401985000000	PNO: Fast 😱 Trig: Free Rur	Avg Type: Log-Pwr	09:39:29 AM Dec 08, 2018 TRACE 1 2 3 4 5 6 TYPE M WWWW DET P NNNNN	Peak Search
10 dB/div Ref 20.00 dBm	IFGain:Low Atten: 30 dB	Mkr1	2.401 985 GHz 3.221 dBm	Next Peak
10.0	1			Next Pk Right
-10.0			Marine Carlos	Next Pk Left
-20.0				Marker Delta
-30.0				Mkr→CF
-50.0				Mkr→RefLvl
-60.0				MKr→Rei Lvi More
Center 2.402000 GHz #Res BW 1.5 MHz	#VBW 5.0 MHz	Sweep '	Span 5.000 MHz I.000 ms (1001 pts)	1 of 2
MSG		STATU	S	

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			(	CH39				
Keysight Sp	ectrum Analyzer - Swept SA							
<mark>x</mark> Marker 1	RF 50 Ω AC 2.440970000000	) GHz PNO: Fast G IFGain:Low	SENSE:IN Trig: Free Run Atten: 30 dB	Avg T	ALIGN AUTO /pe: Log-Pwr old:>100/100	TRAC	M Dec 08, 2018 DE <b>1 2 3 4 5 6</b> PE M WWWWW T P N N N N N	Peak Search
I0 dB/div	Ref 20.00 dBm				Mkr1	2.440 9 3.0	98 dBm	NextPeak
10.0			1					Next Pk Righ
0.00								Next Pk Lef
20.0	and the second se						March Mar	
30.0								Marker Delta
40.0								Mkr→Cl
0.0								Mkr→RefLv
70.0								MIKI → KEI LV
enter <u>2.</u>	441000 GHz					Span 5	.000 MHz	More 1 of 2
Res BW	1.5 MHz	#VBW	5.0 MHz		Sweep 1	.000 ms (	.000 MHz 1001 pts)	
ISG					STATUS	3		

CH78

								ctrum Analyzer - Sv	🔤 Keysight Sp
Peak Search	4 Dec 08, 2018		ALIGN AUTO E: Log-Pwr	SENSE:INT		CH2		RF 50 9 2.4800250	<mark>X</mark> Markor 1
NextPeak	25 GHz 75 dBm	2.480 0	:>100/100	Free Run n: 30 dB		PNO: Fast G		Ref 20.00	10 dB/div
Next Pk Right				1					10.0
Next Pk Left									-10.0
Marker Delta	North Contraction								-20.0
Mkr→CF									-40.0
Mkr→RefLv									60.0
More 1 of 2	.000 MHz 1001 pts)	Span 5 .000 ms (	Sweep_1	IHz	W 5.0 M	#VBV	2	80000 GHz	Center 2. #Res BW
			STATUS						MSG

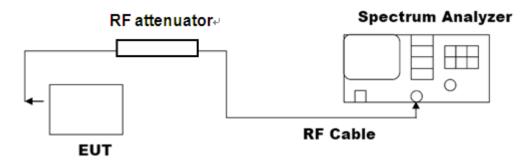


## 4. 20dB Bandwidth

## 4.1. 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.

## 4.2. Test Set-Up (Block Diagram of Configuration)





## 4.3. Limits and Measurement Results

MEASUREMENT RESULT FOR GFSK MOUDULATION								
Applieghte Limite		Measurement Resu	llt					
Applicable Limits	Test Da	Criteria						
	Low Channel	0.9238	PASS					
N/A	Middle Channel	0.9212	PASS					
	High Channel	0.9244	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					
Applicable Limits	Measurement Result				
	Test Data (MHz)		Criteria		
N/A	Low Channel	1.222	PASS		
	Middle Channel	1.253	PASS		
	High Channel	1.224	PASS		

#### TEST PLOT OF BANDWIDTH FOR LOW CHANNEL

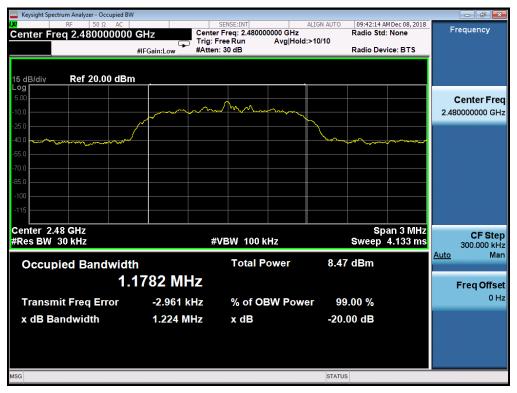






#### TEST PLOT OF BANDWIDTH FOR MIDDLE CHANNEL

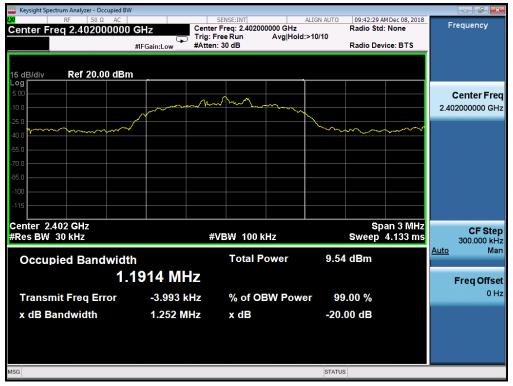
#### TEST PLOT OF BANDWIDTH FOR HIGH CHANNEL





MEASUREMENT RESULT FOR 8DPSK MODULATION					
Applicable Limits	Measurement Result				
	Test Data (MHz)		Criteria		
N/A	Low Channel	1.252	PASS		
	Middle Channel	1.256	PASS		
	High Channel	1.255	PASS		

#### TEST PLOT OF BANDWIDTH FOR LOW CHANNEL

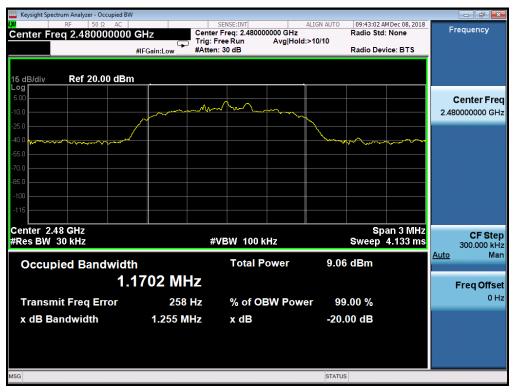






#### TEST PLOT OF BANDWIDTH FOR MIDDLE CHANNEL

#### TEST PLOT OF BANDWIDTH FOR HIGH CHANNEL





## 5. Conducted Spurious Emission

#### 5.1. 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.

## 5.2. Test Set-Up (Block Diagram of Configuration)

The same as described in section 4.2

### 5.3. Limits and Measurement Result

LIMITS AND MEASUREMENT RESULT					
Applicable Limite	Measurement Result				
Applicable Limits	Test Data	Criteria			
In any 100 KHz Bandwidth Outside the	At least -20dBc than the limit				
frequency band in which the spread spectrum	Specified on the BOTTOM	PASS			
intentional radiator is operating, the radio	Channel				
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 8DPSK MODULATION IN LOW CHANNEL





OF 8DPSK MODULATION IN MIDDLE CHANNEL Keysight Spectrum Analyzer - Swept SA ALIGN AUTO 09:45:04 AM Dec 08, 2018 SENSE:INT Avg Type: Log-Pwr Avg|Hold:>100/100 Peak Search Marker 1 2.441157657658 GHz PNO: Wide IFGain:Low TRACE 1 2 3 4 5 ( TYPE MWWWW DET P NNNN Trig: Free Run Atten: 30 dB Next Peak Mkr1 2.441 158 GHz 3.926 dBm 10 dB/div Ref 20.00 dBm Next Pk Right ø Next Pk Left Marker Delta Υ ዀ Mkr→CF Mkr→RefLvl More 1 of 2 Center 2.441000 GHz #Res BW 100 kHz Span 5.000 MHz Sweep 1.066 ms (1000 pts) #VBW 300 kHz STATUS Keysight Spectrum Analyzer - Swept SA 
 ALIGN AUTO
 09:45:27 AM Dec 08, 2018

 Avg Type: Log-Pwr
 TRACE
 2:2:45 G

 Avg|Hold: 3/100
 TYPE M
 DET
 Peak Search Marker 2 24.466456548552 GHz PNO: Fast C IFGain:Low Atten: 30 dB Next Peak Mkr2 24.466 5 GHz -49.363 dBm 10 dB/div <sup>Log</sup> Ref 20.00 dBm 1 Next Pk Right Next Pk Left Marker Delta Start 30 MHz #Res BW 100 kHz Stop 25.00 GHz Sweep 2.388 s (30000 pts) #VBW 300 kHz Mkr→CF FUNCTION IDTH FUN N 1 f N 1 f 2.441 4 GHz 24.466 5 GHz 2.276 dBm -49.363 dBm Mkr→RefLvl More 1 of 2 STATUS

#### TEST PLOT OF OUT OF BAND EMISSIONS OF 8DPSK MODULATION IN MIDDLE CHANNEL

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OF 8DPSK MODULATION IN HIGH CHANNEL 09:44:01 AM Dec 08, 2018 ALIGN AUTO Peak Search Avg Type: Log-Pwr Avg|Hold:>100/100 1 2.402160000000 GHz Marker Trig: Free Run Atten: 30 dB PNO: Wide 😱 IFGain:Low DET Next Peak Mkr1 2.402 160 GHz 4.186 dBm Ref 20.00 dBm 10 dB/div Next Pk Right ١ Next Pk Left Marker Delta Mkr→CF Mkr→RefLvl More 1 of 2 Center 2.402000 GHz #Res BW 100 kHz Span 5.000 MHz Sweep 1.000 ms (1001 pts) #VBW 300 kHz Keysight Spectrum Analyzer - Swept SA 09:44:31 AM Dec 08, 2018 TRACE 1 2 3 4 5 ( TYPE M Peak Search Avg Type: Log-Pwr Avg|Hold: 6/100 Marker 2 20.962216407214 GHz Trig: Free Run Atten: 30 dB TYF DE PNO: Fast 😱 IFGain:Low Next Peak Mkr2 20.962 2 GHz -50.609 dBm Ref 20.00 dBm 10 dB/div õg Next Pk Right Next Pk Left 2 Marker Delta Start 30 MHz Stop 25.00 GHz #VBW 300 kHz #Res BW 100 kHz Sweep 2.388 s (30000 pts) Mkr→CF 2.402 2 GHz 20.962 2 GHz 3.422 dBm -50.609 dBm 1 f 1 f Mkr→RefLvl More 1 of 2 STATUS

TEST PLOT OF OUT OF BAND EMISSIONS

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Note: The peak emissions without marker on the above plots are fundamental wave and need not to compare with the limit. The 8DPSK modulation is the worst case and only those data recorded in the report.

Mkr→RefLvl

More 1 of 2



2

#### GFSK MODULATION IN LOW CHANNEL Hopping off Keysight Spectrum Analyzer - Swept SA OD 09:48:18 AM Dec 08, 2018 'wr TRACE 1 2 3 4 5 6 00 TYPE MWWWWW DET P NNNN ALIGN AUTO Avg Type: Log-Pwr Avg|Hold:>100/100 Peak Search Marker 1 2.402160405347 GHz Trig: Free Run Atten: 30 dB PNO: Fast 😱 IFGain:Low **NextPeak** Mkr1 2.402 160 4 GHz 4.199 dBm 10 dB/div Log Ref 20.00 dBm Next Pk Right Next Pk Left NM Marker Delta Start 2.390000 GHz #Res BW 100 kHz Stop 2.405000 GHz Sweep 2.000 ms (30000 pts) #VBW 300 kHz Mkr→CF FUNCTION FUNCTION WIDTH FUNCTION VALUE 2.402 160 4 GHz 2.400 000 0 GHz N 1 f N 1 f 4.199 dBm -33.418 dBm

## **TEST RESULT FOR BAND EDGE**

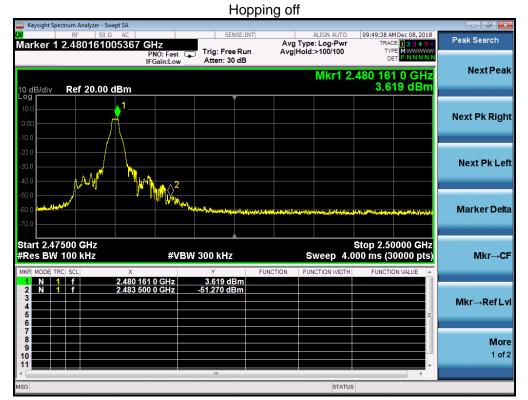
Hopping on Keysight Spectrum Analyzer - Swept SA 09:49:01 AM Dec 08, 2018 ALIGN AUTO Avg Type: Log-Pwr Avg|Hold:>100/100 Peak Search Marker 1 2.403987966266 GHz TRACE 1 2 3 4 5 TYPE MWWWW DET P N N N N Trig: Free Run Atten: 30 dB PNO: Fast 🖵 IFGain:Low Next Peak Mkr1 2.403 988 0 GHz 4.271 dBm 10 dB/div Log Ref 20.00 dBm Next Pk Right Next Pk Left  $\langle \rangle^2 \wedge$ where Marker Delta Start 2.390000 GHz #Res BW 100 kHz Stop 2.405000 GHz Sweep 2.000 ms (30000 pts) #VBW 300 kHz Mkr→CF FUNCTION FUNCTION WIDTH FUNCTION VALUE 2.403 988 0 GHz 2.400 000 0 GHz 4.271 dBm -38.935 dBm

STATUS

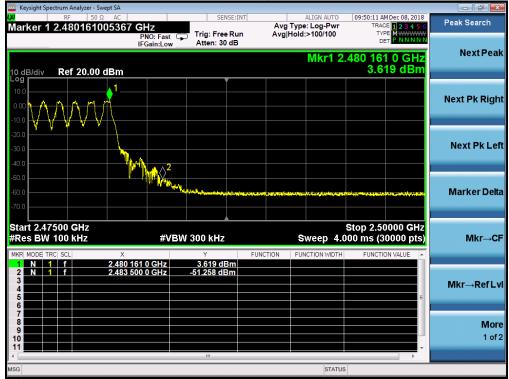
STATUS

N 1 <del>f</del> N 1 f Mkr→RefLvl More 1 of 2





#### GFSK MODULATION IN HIGH CHANNEL



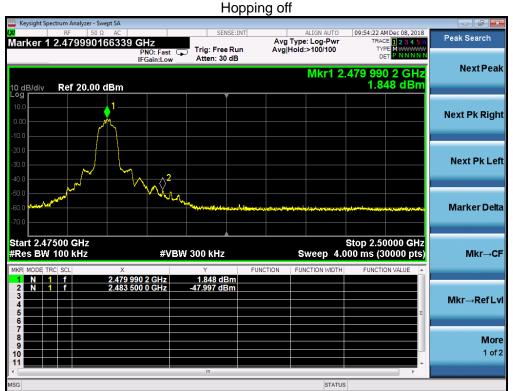




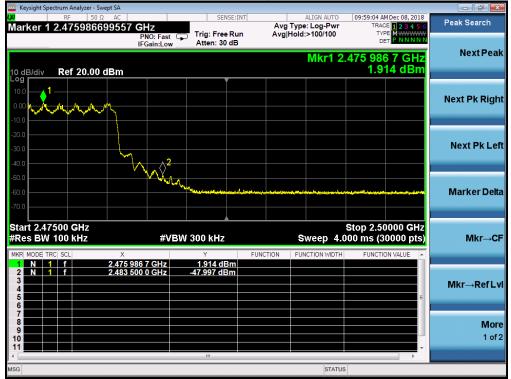
#### $\pi~$ /4-DQPSK MODULATION IN LOW CHANNEL







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



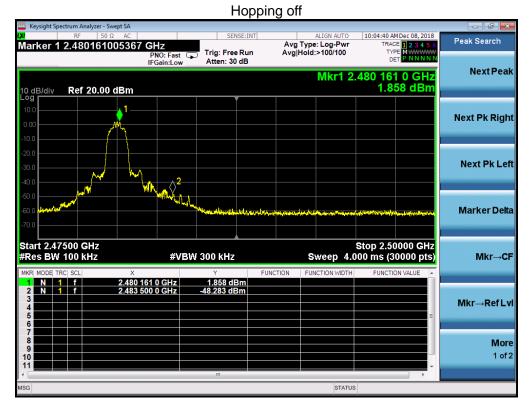


#### 8DPSK MODULATION IN LOW CHANNEL









#### 8DPSK MODULATION IN HIGH CHANNEL

