

# **TEST REPORT**

# FCC PART 15 SUBPART C 15.247

### Test report On Behalf of iLuv Creative Technology For True Wireless Stereo In-ear Fitness Earbuds with Ear Hooks and Charging Case

## Model No.: FITACTJET5,FITACTJET5BK,17LY86 FCC ID: ATL-FITATEJET5

Prepared for :	iLuv Creative Technology	
	2 Harbor Park Drive Port Washington, NY 11050	

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 Date of Test:
 Jan. 16, 2019~ Jan. 23, 2019

 Date of Report:
 Jan. 23, 2019

 Report Number:
 HK1901230216E



.

# **TEST RESULT CERTIFICATION**

Applicant's name iLuv Creative Technology				
Address	. 2 Harbor Park Drive Port Washington, NY 11050			
Manufacture's Name Shenzhen Jia Hua Li Dian Zi You Xian Gong Si				
NO 101,201, BUILDING E, NEW INDUSTRIAL, ZONE, SHENZHU Address				
Factory	Shenzhen Jia Hua Li Dian Zi You Xian Gong Si			
Address	NO 101,201, BUILDING E, NEW INDUSTRIAL, ZONE, SHENZHU ROAD, LIUYUE SHENKENG, VILLAGE, HENGGANG, LONGGANG DISTRICT, SHENZHEN, CHINA.			
Product description				
Trade Mark:	iLuv			
Product name	True Wireless Stereo In-ear Fitness Earbuds with Ear Hooks and Charging Case			
Model and/or type reference	. FITACTJET5,FITACTJET5BK,17LY86			
Difference description	All the same except for the model name			
Standards	. 47 CFR FCC Part 15 Subpart C 15.247			

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Date of Test	
Date (s) of performance of tests:	Jan. 16, 2019 ~ Jan. 23, 2019
Date of Issue	Jan. 23, 2019
Test Result	Pass

:

:

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fiant

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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

AC Power Conducted Emission	N/A
20dB Bandwidth	PASS
Spurious RF Conducted Emission	PASS
Maximum Peak Output Power	PASS
Pseudorandom Frequency Hopping Sequence	PASS
Number of hopping frequency& Time of Occupancy	PASS
Frequency Separation	PASS
Radiated Emissions	PASS
Band Edge Compliance of RF Emission	PASS
	20dB BandwidthSpurious RF Conducted EmissionMaximum Peak Output PowerPseudorandom Frequency Hopping SequenceNumber of hopping frequency& Time of OccupancyFrequency SeparationRadiated Emissions

NOTE: N/A stands for not applicable. The device can not use the BT function in charging mode.



# **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

# 1.3. 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.

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)

Hereafter the best measurement capability for HUAK laboratory is reported:

(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:	True Wireless Stereo In-ear Fitness Earbuds with Ear Hooks and Charging Case	
Model/Type reference:	FITACTJET5	
Power supply:	DC 3.7V by Battery	
Version:	V4.2	
Modulation:	GFSK, π/4DQPSK, 8DPSK	
Operation frequency:	2402MHz~2480MHz	
Channel number:	79	
Channel separation:	1MHz	
Antenna type:	Chip Antenna	
Antenna gain:	0dBi	
Hardware Version:	V1.1	
Software Version:	V1.1	

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

The EUT consists of left earphone and right earphone, they are same in the circuit but little different in the PCB layout which the position of some components is changed. Both of them had been tested, the left earphone is the worst case recorded in the report.

# 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 :

EUT	



# 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 following8ehavior:

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. 27, 2018	1 Year
2.	Receiver	R&S	ESCI 7	HKE-010	Dec. 27, 2018	1 Year
3.	RF automatic control unit	Tonscend	JS0806-2	HKE-060	Dec. 27, 2018	1 Year
4.	Spectrum analyzer	R&S	FSP40	HKE-025	Dec. 27, 2018	1 Year
5.	Spectrum analyzer	Agilent	N9020A	HKE-048	Dec. 27, 2018	1 Year
6.	Preamplifier	Schwarzbeck	BBV 9743	HKE-006	Dec. 27, 2018	1 Year
7.	EMI Test Receiver	Rohde & Schwarz	ESCI 7	HKE-010	Dec. 27, 2018	1 Year
8.	Bilog Broadband Antenna	Schwarzbeck	VULB9163	HKE-012	Dec. 27, 2018	1 Year
9.	Loop Antenna	Schwarzbeck	FMZB 1519 B	HKE-014	Dec. 27, 2018	1 Year
10.	Horn Antenna	Schewarzbeck	9120D	HKE-013	Dec. 27, 2018	1 Year
11.	Pre-amplifier	EMCI	EMC051845 SE	HKE-015	Dec. 27, 2018	1 Year
12.	Pre-amplifier	Agilent	83051A	HKE-016	Dec. 27, 2018	1 Year
13.	EMI Test Software EZ-EMC	Tonscend	JS1120-B Version	HKE-083	Dec. 27, 2018	N/A
14.	Power Sensor	Agilent	E9300A	HKE-086	Dec. 27, 2018	1 Year
15.	Spectrum analyzer	Agilent	N9020A	HKE-048	Dec. 27, 2018	1 Year
16.	Signal generator	Agilent	N5182A	HKE-029	Dec. 27, 2018	1 Year
17.	Signal Generator	Agilent	83630A	HKE-028	Dec. 27, 2018	1 Year
18.	Shielded room	Shiel Hong	4*3*3	HKE-039	Dec. 27, 2018	3 Year

The calibration interval was one year



# 3. Peak Output Power

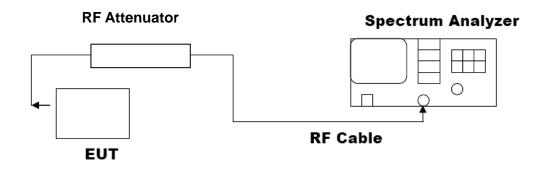
# 3.1. Measurement Procedure

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  $\geq$  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.

# 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 Fail		
2.402	-5.455	30	Pass		
2.441	-4.656	30	Pass		
2.480	-4.874	30	Pass		







🔤 Keysight Sp	ectrum Analyzer - Swept SA					- 6 -
🙀 Marker 1	RF 50 Ω AC 2.479955000000	GHz	SENSE:INT	ALIGN AUTO Avg Type: Log-Pwr	TRACE 1 2 3 4 5 6	Peak Search
		PNO: Fast 😱 IFGain:Low	Trig: Free Run Atten: 20 dB	Avg Hold:>100/100	DET P N N N N N	
				Mkr1	2.479 955 GHz	Next Peak
10 dB/div Log	Ref 10.00 dBm				-4.874 dBm	
Ĭ			Ĭ			
0.00			î1			Next Pk Right
-10.0						
-10.0						Next Pk Left
-20.0						NEXLER LEIL
111						
-30.0						Marker Delta
-40.0						
-50.0						Mkr→CF
-60.0						
-80.0						
-70.0						Mkr→RefLvl
-80.0						
						More 1 of 2
Center 2. #Res BW	480000 GHz 1.5 MHz	#VBM	5.0 MHz	Sween 1	Span 5.000 MHz .000 ms (1001 pts)	. 012
MSG		# V D V V		STATUS	· · · · · ·	



PEAK OUTPUT POWER MEASUREMENT RESULT FOR Π /4-DQPSK MODULATION						
Frequency (GHz)	Peak Power (dBm)	Applicable Limits (dBm)	Pass or Fail			
2.402	-3.167	30	Pass			
2.441	-2.376	30	Pass			
2.480	-2.509	30	Pass			







Keysight Specific Keysight	ectrum Analyzer - Swept SA					
Marker 1	RF 50 Ω AC 2.479880000000	GHz	SENSE:INT	ALIGN AUTO Avg Type: Log-Pwr	TRACE 1 2 3 4 5 6	Peak Search
		PNO: Fast 🖵 IFGain:Low	Trig: Free Run Atten: 20 dB	Avg Hold:>100/100		NextPeak
10 dB/div Log	Ref 10.00 dBm				2.479 880 GHz -2.509 dBm	
0.00			1			Next Pk Right
-10.0	and the second second second second	and the second				Next Pk Left
-20.0 Juliu -30.0						_
-40.0						Marker Delta
-50.0						Mkr→CF
-60.0						Mkr→RefLvl
-80.0						More 1 of 2
Center 2.4 #Res BW	480000 GHz 1.5 MHz	#VBW	5.0 MHz	Sweep 1	Span 5.000 MHz .000 ms (1001 pts)	
MSG				STATUS		

PEAK OUTPUT POWER MEASUREMENT RESULT FOR 8-DPSK MODULATION						
Frequency (GHz)	Peak Power (dBm)	Applicable Limits (dBm)	Pass or Fail			
2.402	-2.162	30	Pass			
2.441	-1.294	30	Pass			
2.480	-1.496	30	Pass			







🔤 Keysight S	pectrum Analyzer - Swept SA					
Marker	RF 50 Ω AC 1 2.47996000000	0 GHz	SENSE:INT	ALIGN AUTO Avg Type: Log-Pwr	TRACE 1 2 3 4 5 6	Peak Search
		PNO: Fast 🖵 IFGain:Low	Trig: Free Run Atten: 20 dB	Avg Hold:>100/100	DET PNNNN	
				Mkr1	2.479 960 GHz	Next Peak
10 dB/div Log	Ref 10.00 dBm				-1.496 dBm	
			Ť • 1			
0.00						Next Pk Right
10.0						
-10.0	- Aller and a second					Next Pk Left
-20.0	and the low man					Next PK Leit
w and						
-30.0						Marker Delta
-40.0						Marker Dela
-50.0						Mkr→CF
-60.0						
-70.0						Mkr→RefLvl
-80.0						
						More 1 of 2
Center 2	.480000 GHz / 1.5 MHz	#\/B\M	5.0 MHz	Sween 1	Span 5.000 MHz .000 ms (1001 pts)	1012
MSG		#VDVV	5.0 10112	SWEED		
				UNIO		

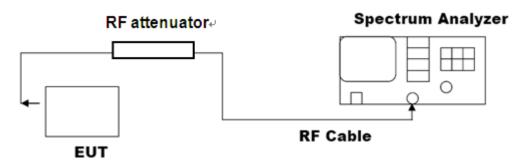


# 4. 20dB Bandwidth

# 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

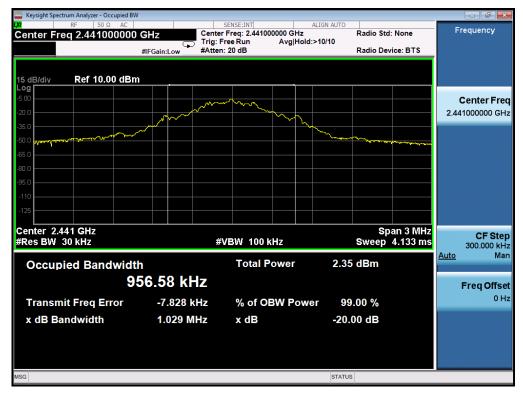
MEASUREMENT RESULT FOR GFSK MOUDULATION				
Annlinghla Limita		Measurement Result		
Applicable Limits	Test Da	ita (MHz)	Criteria	
	Low Channel	1.036	PASS	
N/A	Middle Channel	1.029	PASS	
	High Channel	1.037	PASS	

#### Keysight Spectrum Analyzer - Occupied BW - 6 2 GHZ SENSE:INT ALIGN AUTO Center Freq: 2.402000000 GHz Trig: Free Run Avg|Hold:>10/10 #Atten: 20 dB Frequency Center Freq 2.402000000 GHz Radio Std: None Radio Device: BTS 15 dB/div Log Ref 10.00 dBm **Center Freq** 2.402000000 GHz Center 2.402 GHz #Res BW 30 kHz Span 3 MHz Sweep 4.133 ms CF Step 300.000 kHz Man #VBW 100 kHz Auto Total Power 1.67 dBm **Occupied Bandwidth** 956.24 kHz Freq Offset 0 Hz -9.898 kHz Transmit Freq Error % of OBW Power 99.00 % x dB Bandwidth 1.036 MHz x dB -20.00 dB STATUS G

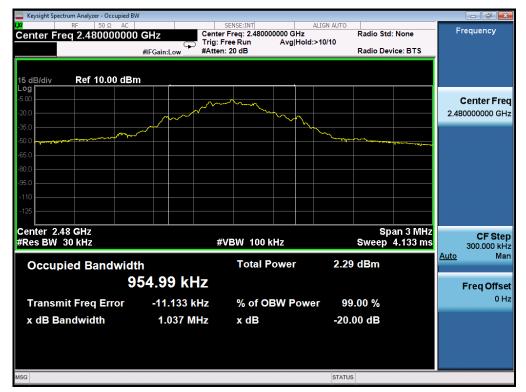
### TEST PLOT OF BANDWIDTH FOR LOW CHANNEL



### TEST PLOT OF BANDWIDTH FOR MIDDLE CHANNEL



### TEST PLOT OF BANDWIDTH FOR HIGH CHANNEL





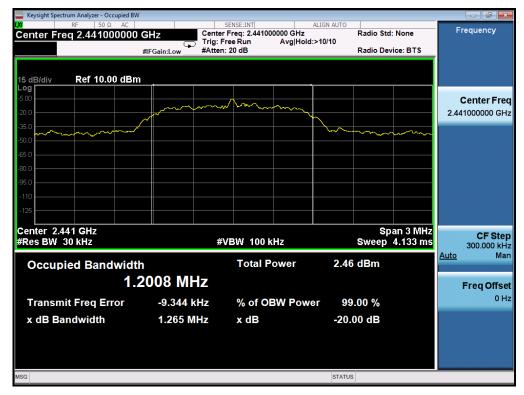
MEASUREMENT RESULT FOR II /4-DQPSK MODULATION				
Angliaghta Limita	Measurement Result			
Applicable Limits	Test Data (MHz)		Criteria	
	Low Channel	1.269	PASS	
N/A	Middle Channel	1.265	PASS	
	High Channel	1.265	PASS	

#### Keysight Spectrum Analyzer - Occupied BW đ 🔁 SENSE:INT ALIGN AUTO Center Freq: 2.402000000 GHz Trig: Free Run Avg|Hold:>10/10 #Atten: 20 dB Frequency Center Freq 2.402000000 GHz Radio Std: None 9 Radio Device: BTS #IFGain:Low 15 dB/div Log Ref 10.00 dBm **Center Freq** 2.40200000 GHz Center 2.402 GHz #Res BW 30 kHz Span 3 MHz Sweep 4.133 ms CF Step 300.000 kHz Man #VBW 100 kHz <u>Auto</u> **Total Power** 1.57 dBm **Occupied Bandwidth** 1.2030 MHz Freq Offset 0 Hz Transmit Freq Error -5.169 kHz % of OBW Power 99.00 % x dB Bandwidth 1.269 MHz x dB -20.00 dB STATUS G

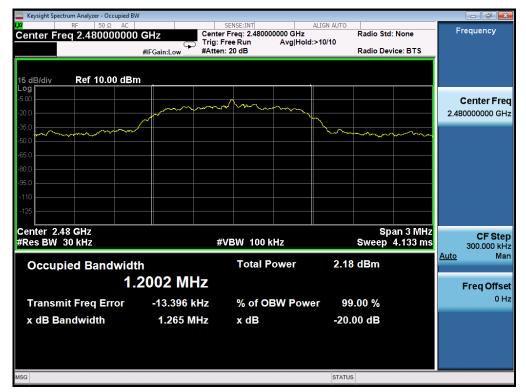
### TEST PLOT OF BANDWIDTH FOR LOW CHANNEL



### TEST PLOT OF BANDWIDTH FOR MIDDLE CHANNEL



### TEST PLOT OF BANDWIDTH FOR HIGH CHANNEL





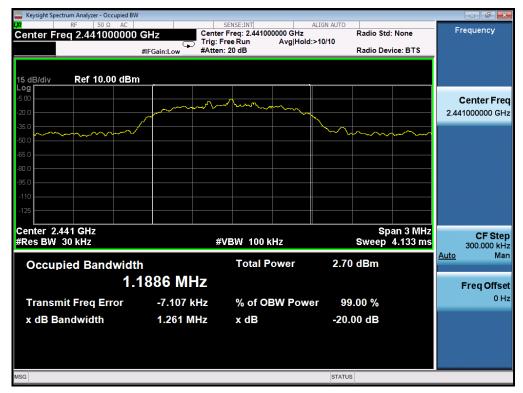
MEASUREMENT RESULT FOR 8-DPSK MODULATION				
Annlinghle Limite	Measurement Result			
Applicable Limits	Test Data (MHz)		Criteria	
	Low Channel	1.264	PASS	
N/A	Middle Channel	1.261	PASS	
	High Channel	1.261	PASS	

### TEST PLOT OF BANDWIDTH FOR LOW CHANNEL

Keysight Spectrum Analyzer - Occupied BW					- 7 -
₩ RF 50 Ω AC Center Freq 2.402000000 (	GHz Center Trig: F	SENSE:INT Freq: 2.402000000 GHz iree Run Avg Hold : 20 dB		d: None vice: BTS	Frequency
15 dB/div Ref 10.00 dBm					
-5.00	~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~	- Marine - M			<b>Center Freq</b> 2.402000000 GHz
-35.0					
-65.0					
-95.0					
-125 Center 2.402 GHz					
#Res BW 30 kHz	#`	VBW 100 kHz	Sweep	oan 3 MHz 4.133 ms	CF Step 300.000 kHz
Occupied Bandwidth		Total Power	1.93 dBm		<u>Auto</u> Man
1.1	883 MHz				Freq Offset
Transmit Freq Error	-5.830 kHz	% of OBW Pow	ver 99.00 %		0 Hz
x dB Bandwidth	1.264 MHz	x dB	-20.00 dB		
MSG			STATUS		



### 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.
- 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.

# 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				
Applieghte 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 GFSK MODULATION IN LOW CHANNEL

Keysight Spe	RF 50 Ω AC		SENSE:INT		IGN AUTO		
Marker 1	2.4018000000	00 GHz		Avg Type: L Avg Hold:>1	_og-Pwr	TRACE 1 2 3 4 TYPE MWWW	5 6 Peak Search
		PNO: Wide G	Trig: Free Run Atten: 30 dB	Avginoid.>	100/100	DET P NNN	NN
					Mkr1 2.4	401 800 GI -4.495 dB	Next Peak
10 dB/div <sup>Log</sup>	Ref 20.00 dBm		The second secon			-4.495 UB	
							Next Pk Right
10.0							J
0.00			1				
10.0							Next Pk Left
-10.0							
-20.0							
~							Marker Delta
-30.0							
-40.0		and a stand and a stand a stan stand a stan stand a st			~~~		Mkr→CF
	w mw m r				war	-Mrs	
-50.0	Mu .				`	Mar Mar	<u>۱</u> ۳۰
-60.0							Mkr→RefLv
-70.0							More
Contor 2 d	(03000 OU-					non 5 000 M	1 of 2
#Res BW	402000 GHz 100 kHz	#VBW	300 kHz	S	ə weep 1.000	pan 5.000 M ) ms (1001 p	nz ts)
MSG					STATUS		
Keysight Spe	ectrum Analyzer - Swept SA						
× Marker 3	RF 50 Ω AC 17.0925697523	325 GHz	SENSE:INT	Avg Type: L	IGN AUTO	TRACE 1 2 3 4	5 6 Peak Search
		PNO: Fast G	Trig: Free Run Atten: 30 dB	Avg Hold:>1	100/100		
					Mkr3 1	7.092 6 GH 51.779 dB	Next Peak
10 dB/div Log	Ref 20.00 dBm		The second se		-	51.779 aB	
10.0							
-10.0							Next Pk Right
-10.0							Next Pk Righ
-20.0							
-20.0						DL1 -24.50 c	en
						DL1 -24.50 c	en
-30.0 -40.0 -50.0				3		0L1 -24.50 c	Next Pk Lef
-30.0		Mich (Jacobie) (Arganic Providence) (Arganic Provid		3		0L1 -24 50 c	Next Pk Lef
-30.0 -40.0 -50.0 -60.0 -70.0		the force of the second s		3			Next Pk Lef
-30.0 -40.0 -50.0 -60.0 -70.0 Start 30 N		#14.1, employee, strately (	300 kHz	3	S Weep 2.38		Marker Delta
-30.0 -40.0 -50.0 -60.0 -70.0 Start 30 N	100 kHz		/ 300 KHz		weep 2.38		Next Pk Left Marker Delta
-30.0 -40.0 -50.0 -50.0 -70.0 Start 30 M #Res BW	100 kHz	X	Y F -48.519 dBm		weep 2.38	¢2 top 25.00 Gl 8 s (30000 p	Next Pk Left Marker Delta
-30.0 -40.0 -50.0 -60.0 -70.0 Start 30 N #Res BW	100 kHz RC SCL > 1 f 2 1 f 2		Y F		weep 2.38	¢2 top 25.00 Gl 8 s (30000 p	Marker Delta
-30.0 -40.0 -5	100 kHz RC SCL > 1 f 2 1 f 2	× 24.269 2 GHz 21.349 3 GHz	Y F -48.519 dBm -50.781 dBm		weep 2.38	¢2 top 25.00 Gl 8 s (30000 p	Marker Delta
-30.0 -40.0 -50.0 -50.0 -60.0 Start 30 N #Res BW MKR MODE TF 1 N 1 2 N 1 3 N 1 4 5 6 7 7 8	100 kHz RC SCL > 1 f 2 1 f 2	× 24.269 2 GHz 21.349 3 GHz	Y F -48.519 dBm -50.781 dBm		weep 2.38	¢2 top 25.00 Gl 8 s (30000 p	Next Pk Left Marker Delta Mkr→CF
-30.0 -40.0 -50.0 -50.0 -50.0 Start 30 M #Res BW MKR MODE TR 1 N 1 2 N 1 3 N 1 5 5 6 6 7 7 8 9 9	100 kHz RC SCL > 1 f 2 1 f 2	× 24.269 2 GHz 21.349 3 GHz	Y F -48.519 dBm -50.781 dBm		weep 2.38	¢2 top 25.00 Gl 8 s (30000 p	I Next Pk Left Marker Delta Mkr→CF Mkr→Ref Lv
-30.0 -40.0 -50.0 -50.0 -70.0 Start 30 N #Res BW MKR MODE TE 1 N 1 2 N 1 3 N 1 4 5 6 6 7 8 9	100 kHz RC SCL > 1 f 2 1 f 2	× 24.269 2 GHz 21.349 3 GHz	Y F -48.519 dBm -50.781 dBm		weep 2.38	¢2 top 25.00 Gl 8 s (30000 p	Next Pk Left Marker Delta Mkr→CF



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

Keysight Spectrum Analyze	50 Ω AC		SENSE:INT	Avg Type: I	IGN AUTO		23456	Display	
		PNO: Wide Ģ IFGain:Low	Trig: Free Run Atten: 30 dB	Avg Hold:>	100/100	TYPE M DET			
0 dB/div Ref 20.	00 dBm				Mkr1 2.4	440 972 -3.801	GHz dBm	Annotation	
og			Ĭ						
10.0							_	Title	
0.00								Graticu	
10.0				ι.			<u>c</u>	<u>)n</u>	
20.0								Display Li -24.48 dB	
0.0							C	)n	
40.0		mon		man					
Mar	mar Mara			- u ,	May May May	ma		Display Line	
						- Perel wrz	w Yw	Syster	
60.0								Displa	
70.0								octariy	
enter 2.441000 G	Hz				S weep 1.06	pan 5.00	0 MHz		
Res BW 100 kHz		#VBV	V 300 kHz	5	ween lun	0 11 5 11 11 11	10 pfs)		
Res BW 100 kHz		#VBV	V 300 kHz	31	STATUS	0 IIIS (100	io pts)		
SG Keysight Spectrum Analyze		#VBV			STATUS	o ms (100	io pts)		
GG Keysight Spectrum Analyze RF	50 Ω AC 586422881	GHz	SENSE:INT		STATUS	TRACE	2 3 4 5 6	Peak Search	
G Keysight Spectrum Analyze	50 Ω AC 586422881		SENSE:INT	AL Avg Type: I	IGN AUTO	TRACE TYPE MN DET P	2 3 4 5 6 ******	Peak Search	
Keysight Spectrum Analyze RF larker 3 16.9926	50 Ω AC 586422881	GHz PNO: Fast G		AL Avg Type: I	STATUS IGN AUTO Log-Pwr 100/100 Mkr3 1	TRACE	2 3 4 5 6 	Peak Search	
Keysight Spectrum Analyze RF arker 3 16.9926 0 dB/div Ref 20.	50 Ω AC 586422881	GHz PNO: Fast G		AL Avg Type: I	STATUS IGN AUTO Log-Pwr 100/100 Mkr3 1	TRACE TYPE DET 6.992 7	2 3 4 5 6 	Peak Search Next Pe	
G Keysight Spectrum Analyze RF Iarker 3 16.9920 0 dB/div Ref 20. 0 0 0	50 Ω AC 586422881	GHz PNO: Fast G		AL Avg Type: I	STATUS IGN AUTO Log-Pwr 100/100 Mkr3 1	TRACE TYPE DET 6.992 7	2 3 4 5 6 	Peak Search Next Pe	
sg keysight Spectrum Analyze RF larker 3 16.9926	50 Ω AC 586422881	GHz PNO: Fast G		AL Avg Type: I	STATUS IGN AUTO Log-Pwr 100/100 Mkr3 1	TRACE TYPE DET 6.992 7	2 3 4 5 6 		
SG         Re           Iarker 3 16.9926         RF           0 dB/div         Ref 20.	50 Ω AC 586422881	GHz PNO: Fast G		AL Avg Type: I	STATUS IGN AUTO Log-Pwr 100/100 Mkr3 1	TRACE TYPE DET 6.992 7	2 3 4 5 6 	Peak Search Next Pe Next Pk Rig	
SG         Ref	50 Ω AC 586422881	GHz PNO: Fast G		AL Avg Type: I	STATUS IGN AUTO Log-Pwr 100/100 Mkr3 1	TRACE TYPE DET 6.992 7	2 3 4 5 6 	Peak Search Next Pe Next Pk Rig	
SG         Ref           Iarker 3 16.9920         Ref           0 dB/div         Ref 20.           0 dB/div         Ref 20.           0 dB/div         Ref 20.	50 Ω AC 586422881	GHz PNO: Fast G		AL Avg Type: I	STATUS IGN AUTO Log-Pwr 100/100 Mkr3 1	TRACE TYPE DET 6.992 7	2 3 4 5 0 WWWWW NNNNN GHz dBm	Peak Search Next Pe	
SG         Reysight Spectrum Analyze           RF         Iarker 3 16.9926           0 dB/div         Ref 20.           9         0           0 0 00         0           0 0 00         0           0 0 00         0           0 0 00         0           0 0 00         0           0 0 00         0           0 00         0           0 00         0           0 00         0           0 00         0           0 00         0           0 00         0           0 00         0           0 00         0           0 00         0           0 00         0           0 00         0	50 Ω AC 586422881	GHz PNO: Fast G		AL Avg Type: I	IGN AUTO	TRACE 1 TYPE M DPE M 6.992 7 52.383		Peak Search Next Pe Next Pk Rig Next Pk L	
Image: Section Analyze           RF         Image: Section Analyze           Image: Section Analyze         RF           Image: Section Analyze         Image: Section Analyze           Image: Section Analyze         RF           Image: Section Analyze         Image: Section Analyze           Image: Section Analyze         Imag	50 Ω AC 886422881 1 .00 dBm	CHZ PNO: Fast FGain:Low	SENSE:INT Trig: Free Run Atten: 30 dB	Avg Type: Avg Hold:>	ISN AUTO	TRACE ]] TYPE M 6.992 7 52.383 20		Peak Search Next Pe Next Pk Rig Next Pk L Marker De	
Image: Section Analyze           RF           RF           Iarker 3 16.9926           0 dB/div           Ref 20.           0 dB/div           Ref 20.           0 dB/div           Ref 20.           0 dB/div           Ref 20.           0 dB/div	50 Ω AC 386422881 	GHz PNO: Fast FGain:Low #VBW	SENSE:INT Trig: Free Run Atten: 30 dB	Avg Type: I Avg Hold:>	IGN AUTO	TRACE ]] TYPE M 6.992 7 52.383 20	2 3 4 5 0 NN NN N GHz dBm	Peak Search Next Pe Next Pk Rig Next Pk L Marker De	
G         RF         Iarker 3 16.9920         Iarker 3 Iarker	50 Ω AC 386422881 .00 dBm 	GHz PNO: Fast FGain:Low #VBV	SENSE:INT Trig: Free Run Atten: 30 dB	Avg Type: I Avg Hold:>	ISN AUTO	TRACE 1 TYPE M DET P 52.383 01 -2 01 -	2 3 4 5 0 NN NN N GHz dBm	Peak Search Next Pe Next Pk Rig Next Pk L Marker De	
G         Isrker 3 16.9920         Is	50 Ω AC 386422881 .00 dBm 	GHz PNO: Fast FGain:Low #VBW	SENSE:INT Trig: Free Run Atten: 30 dB	Avg Type: I Avg Hold:>	ISN AUTO	TRACE 1 TYPE M DET P 52.383 01 -2 01 -	2 3 4 5 0 NN NN N GHz dBm	Peak Search Next Pe Next Pk Rig Next Pk L Marker De Mkr→	
G         Ise spectrum Analyze         Ise spectrum	50 Ω AC 386422881 .00 dBm 	GHz PNO: Fast FGain:Low #VBV	SENSE:INT Trig: Free Run Atten: 30 dB	Avg Type: I Avg Hold:>	ISN AUTO	TRACE 1 TYPE M DET P 52.383 01 -2 01 -	2 3 4 5 1 NNNNN GHZ dBm 1 0 GHZ 0 GHZ 0 pts)	Peak Search Next Pe Next Pk Rig Next Pk L Marker De Mkr→	
G         Rejuint Spectrum Analyze         Iarker 3 16.9926         Iarker 3 16.9926 <th colspa<="" td=""><td>50 Ω AC 386422881 .00 dBm </td><td>GHz PNO: Fast FGain:Low #VBV</td><td>SENSE:INT Trig: Free Run Atten: 30 dB</td><td>Avg Type: I Avg Hold:&gt;</td><td>ISN AUTO</td><td>TRACE 1 TYPE M DET P 52.383 01 -2 01 -</td><td>2 3 4 5 1 NNNNN GHZ dBm 1 0 GHZ 0 GHZ 0 pts)</td><td>Peak Search Next Pe Next Pk Rig Next Pk L Marker De Mkr→Ref I</td></th>	<td>50 Ω AC 386422881 .00 dBm </td> <td>GHz PNO: Fast FGain:Low #VBV</td> <td>SENSE:INT Trig: Free Run Atten: 30 dB</td> <td>Avg Type: I Avg Hold:&gt;</td> <td>ISN AUTO</td> <td>TRACE 1 TYPE M DET P 52.383 01 -2 01 -</td> <td>2 3 4 5 1 NNNNN GHZ dBm 1 0 GHZ 0 GHZ 0 pts)</td> <td>Peak Search Next Pe Next Pk Rig Next Pk L Marker De Mkr→Ref I</td>	50 Ω AC 386422881 .00 dBm 	GHz PNO: Fast FGain:Low #VBV	SENSE:INT Trig: Free Run Atten: 30 dB	Avg Type: I Avg Hold:>	ISN AUTO	TRACE 1 TYPE M DET P 52.383 01 -2 01 -	2 3 4 5 1 NNNNN GHZ dBm 1 0 GHZ 0 GHZ 0 pts)	Peak Search Next Pe Next Pk Rig Next Pk L Marker De Mkr→Ref I
Id Iteration in the section of the sec	50 Ω AC 386422881 .00 dBm 	GHz PNO: Fast FGain:Low #VBV	SENSE:INT Trig: Free Run Atten: 30 dB	Avg Type: I Avg Hold:>	ISN AUTO	TRACE 1 TYPE M DET P 52.383 01 -2 01 -	2 3 4 5 1 NNNNN GHZ dBm 1 0 GHZ 0 GHZ 0 pts)	Peak Search Next Pe Next Pk Rig Next Pk L	



#### Display RACE 123456 TYPE MWWWW DET PNNNN Avg Type: Log-Pwr Avg|Hold:>100/100 RACE Trig: Free Run Atten: 30 dB PNO: Wide IFGain:Low Ģ Annotation Mkr1 2.480 138 GHz -3.352 dBm 10 dB/div Log Ref 20.00 dBm Title▶ 1 Graticule On Off Display Line -23.80 dBm On <u>Off</u> Display Lines► 1~1 System Display▶ Settings Center 2.480000 GHz #Res BW 100 kHz Span 5.000 MHz Sweep 1.066 ms (1000 pts) #VBW 300 kHz STATUS Keysight Spectrum Analyzer - Swept SA Peak Search Avg Type: Log-Pwr Avg Hold:>100/100 Marker 3 16.906953231774 GHz Trig: Free Run Atten: 30 dB TYP PNO: Fast 😱 IFGain:Low DE **Next Peak** Mkr3 16.907 0 GHz -52.424 dBm 10 dB/div Log Ref 20.00 dBm Next Pk Right Next Pk Left $\Diamond^2$ $\Diamond$ 3 Marker Delta Start 30 MHz #Res BW 100 kHz Stop 25.00 GHz Sweep 2.388 s (30000 pts) #VBW 300 kHz Mkr→CF FUNC 23.663 2 GHz 21.107 0 GHz 16.907 0 GHz -50.914 dBm -52.424 dBm N Mkr→RefLvl More 1 of 2 STATUS

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

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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 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

🔤 Keysight Spectrum Analyzer - Swept SA 👘			
RF 50 Ω AC Marker 1 2.404992999767	GHz PNO: Fast C Trig: Free Run	ALIGN AUTO Avg Type: Log-Pwr Avg Hold:>100/100 TYPE	Peak Search
10 dB/div Ref 20.00 dBm	IFGain:Low Atten: 30 dB	Mkr1 2.404 993 0 GHz -5.610 dBm	Next Peak
10.0 0.00 -10.0			Next Pk Right
-10.0			Next Pk Left
-50.0 -60.0 manhalingnangahitmatinghinghinghinghinghinghinghinghinghingh	essentin metric the the test of the second		Marker Delta
Start 2.390000 GHz #Res BW 100 kHz	#VBW 300 kHz	Stop 2.405000 GHz Sweep 2.000 ms (30000 pts)	Mkr→CF
	193 0 GHz -5.610 dBm 100 0 GHz -54.646 dBm		Mkr→RefLvl
7 8 9 10 11			More 1 of 2
MSG		STATUS	

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# GFSK MODULATION IN HIGH CHANNEL

Hopping off

Keysight Spectrum Analyzer - Swept SA	Поррії	<u> </u>		
RF 50 Ω AC	SENSE:INT	ALIGN AUTO		
Marker 1 2.479995166506 GHz		Avg Type: Log-Pwr Avg Hold:>100/100	TRACE 1 2 3 4 5 6 TYPE MWWWWW DET P N N N N N	Peak Search
10 dB/div Ref 20.00 dBm	n:Low Atten: 00 dB	Mkr1 2.4	479 995 2 GHz -4.892 dBm	NextPeak
				Next Pk Righ
20.0	^2			Next Pk Lef
60.0	and an and the property of the second parts of	n ffi si kali fa shi ka ka shi ka	We have a factor of the second for the second for the second for the second for the second second second second	Marker Delta
Start 2.47500 GHz #Res BW 100 kHz	#VBW 300 kHz	Sweep 4.0	Stop 2.50000 GHz 00 ms (30000 pts)	Mkr→CF
I         N         I         f         2.479         995         2 C           2         N         I         f         2.483         500         0           3	GHz -4.892 dBm		=	Mkr→RefLv
7 8 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9			•	More 1 of 2
ISG	m	STATUS	•	

Keysight Spectrum Analyzer - Swept SA				
Marker 1 2.478988466282	PNO: Fast C Trig: Free Run	ALIGN AUTO Avg Type: Log-Pwr Avg Hold:>100/100	TRACE 123456 TYPE MWWWW DET PNNNN	Peak Search
10 dB/div Ref 20.00 dBm	IFGain:Low Atten: 30 dB	Mkr1 2.	478 988 5 GHz -4.892 dBm	Next Peak
				Next Pk Righ
-20.0 VVVV -30.0 -40.0				Next Pk Lef
-50.0	YANYA KANGANA KANA KANA KANA KANA KANA KANA	helidiyahidimaashadaiyo canisemaa	n de a ana an an Anna a Anna an Anna an	Marker Delta
Start 2.47500 GHz #Res BW 100 kHz	#VBW 300 kHz	Sweep 4.0	Stop 2.50000 GHz 00 ms (30000 pts)	Mkr→Ci
	988 5 GHz -4.892 dBm 500 0 GHz -60.516 dBm		=	Mkr→RefLv
7 8 9 10 11				More 1 of 2
MSG		STATUS		



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

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Hopping off



🔤 Keysight Spectrum Analyzer - Swept SA 👘				
₩ RF 50 Ω AC Marker 1 2.4039984666616		ALIGN AUTO Avg Type: Log-Pwr Avg Hold:>100/100	TRACE 1 2 3 4 5 6	Peak Search
10 dB/div Ref 20.00 dBm	PNO: Fast Trig: Free Run IFGain:Low Atten: 30 dB	-	3 998 5 GHz -5.536 dBm	Next Peak
Log 10.0 0.00 -10.0			mm 1	Next Pk Right
-20.0				Next Pk Left
-50.0 -60.0 <mark>- MANANAN (พระพ.ศ.ศ. 2</mark> .44 <mark>1/1)</mark> -70.0	wannerster had die NAN Maria Maria			Marker Delta
Start 2.390000 GHz           #Res BW 100 kHz           MKR MODE TRC SCL         X		Stop Sweep 2.000	2.405000 GHz ms (30000 pts)	Mkr→CF
	998 5 GHz -5.536 dBm 000 0 GHz -44.797 dBm		=	Mkr→RefLv
7 8 9 10 11 •			•	More 1 of 2
MSG		STATUS		



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

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Hopping off

	торрі	.g e		
Keysight Spectrum Analyzer - Swept SA				
<b>LX</b> RF 50 Ω AC	SENSE:INT	ALIGN AUTO		Peak Search
Marker 1 2.479987666256 GHz	t Trig: Free Run	Avg Type: Log-Pwr Avg Hold:>100/100	TRACE 1 2 3 4 5 6 TYPE MWWWW	r cak ocarem
PNO: Fas IFGain:Lo		Avginola.>100/100	DET PNNNN	
IPGalit.L0	W / Men: oo ub			Next Peak
		Mkr1 2.4	479 987 7 GHz	HOATT OUR
10 dB/div Ref 20.00 dBm			-4.871 dBm	
Log				
10.0				
0.00				Next Pk Right
-10.0				
-20.0				
-30.0				Next Pk Left
-30.0				
-40.0	2			
-50.0				
		(Augustane al		Marila - Dalia
-60.0			a si	Marker Delta
-70.0				
Start 2.47500 GHz		Ş	Stop 2.50000 GHz	
#Res BW 100 kHz #	/BW 300 kHz	Sweep 4.0	00 ms (30000 pts)	Mkr→CF
MKR MODE TRC SCL X	Y EUN	ICTION FUNCTION WIDTH	FUNCTION VALUE	
1 N 1 f 2.479 987 7 GHz		CTION FUNCTION WIDTH	FUNCTION VALUE	
2 N 1 f 2.483 500 0 GHz				
3				Mkr→RefLvl
4				
5			=	
7				
8				More
9				1 of 2
10				1012
MSG		STATUS		
NOG COM		STATUS		

🚾 Keysight Spectrum Analyzer - Swept SA					
Marker 1 2.475990866362	GHz		ALIGN AUTO	TRACE 1 2 3 4 5 6 TYPE MWWWWW	Peak Search
10 dB/div Ref 20.00 dBm	PNO: Fast Trig: Fre IFGain:Low Atten: 3		old:>100/100 Mkr1 2.4	175 990 9 GHz -4.852 dBm	Next Peak
1000 1 1000 1 1000 1 1000 1					Next Pk Righ
-20.0	1				Next Pk Lef
-50.0	- Willing Hilling	hertellykar, other and here as	hálas <mark>h</mark> a gus ains the second of soft	eheistaren italari ortekarat haantatu	Marker Delta
Start 2.47500 GHz #Res BW 100 kHz MKR MODE TRC SCL X 1 N 1 f 24759	#VBW 300 kHz	FUNCTION	Sweep 4.00	top 2.50000 GHz 0 ms (30000 pts) FUNCTION VALUE	Mkr→CF
	90 9 GHz -58.533 d	Bm			Mkr→RefLv
7 8 9 10 11					More 1 of 2
MSG			STATUS		



### 8-DPSK MODULATION IN LOW CHANNEL

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Hopping off



Keysight Spectrum Analyzer - Swept SA			
RF 50 Ω AC Marker 1 2.404989999667		ALIGN AUTO Avg Type: Log-Pwr Avg Hold:>100/100	TRACE 123456 TYPE MWWWWW
10 dB/div Ref 20.00 dBm	PNO: Fast Trig: Free Run IFGain:Low Atten: 30 dB	Mkr1 2.404 9	
Log 10.0 0.00 -10.0			Next Pk Rigi
-20.0			Next Pk Le
-50.0 -60.0 Laborananananananananananananananananananan	entre meren strettin hiller a		Marker Del
Start 2.390000 GHz #Res BW 100 kHz	#VBW 300 kHz	Sweep 2.000 ms	405000 GHz s (30000 pts) Mkr→C
	990 0 GHz -5.591 dBm 900 0 GHz -45.086 dBm		Mkr→RefL
7 8 9 10 11 11			Moi 1 of
ASG		STATUS	





## 8-DPSK MODULATION IN HIGH CHANNEL

Hopping off

	поррії	ig oli	
Keysight Spectrum Analyzer - Swept SA		1	
₩ RF 50 Ω AC Marker 1 2.479986832894	PNO: Fast 🕞 Trig: Free Run	ALIGN AUTO Avg Type: Log-Pwr Avg Hold:>100/100 TYPE	www.
10 dB/div Ref 20.00 dBm	IFGain:Low Atten: 30 dB	Mkr1 2.479 986 8 0 -4.893 d	Next Peak
Log 10.0 0.00 -10.0			Next Pk Right
-20.0	νη <sub>δ</sub> <sup>2</sup>		Next Pk Left
-50.0		le land fan yn ferdig her ffefan de glewin syn fan ferdine fan sam af an sam af an sam af an sam af	Marker Delta
Start 2.47500 GHz #Res BW 100 kHz	#VBW 300 kHz	Stop 2.50000 Sweep 4.000 ms (30000	pts) Mkr→CF
1         N         1         f         2.479 9           2         N         1         f         2.483 5           3	986 8 GHz -4.893 dBm 900 0 GHz -48.302 dBm		Mkr→RefLvi
7 8 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9			More 1 of 2
MSG		STATUS	

🤤 Keysight Spectrum Analyzer - Swept SA 👘				
RF 50 Ω AC Marker 1 2.475990866362		Avg Type: Log-Pwr	TRACE 1 2 3 4 5 6 TYPE MWWWW	Peak Search
10 dB/div Ref 20.00 dBm	PNO: Fast Trig: Free R IFGain:Low Atten: 30 dE	3	.475 990 9 GHz -4.902 dBm	Next Peak
Log 10.0 0.00 -10.0 http://hyp/hyp/hyp/hyp/hyp/hyp/hyp/hyp/hyp/hy				Next Pk Right
-20.0	veru)			Next Pk Left
-50.0 -60.0 -70.0		hill Martine for the strand for the former for the strand for the	nan gala selasetni en d <mark>en afrika din Pasada en</mark>	Marker Delta
Start 2.47500 GHz #Res BW 100 kHz MKR MODE TRC SCL X	#VBW 300 kHz	FUNCTION FUNCTION WIDTH	Stop 2.50000 GHz 000 ms (30000 pts) FUNCTION VALUE	Mkr→CF
	99 9 GHz -4.902 dBm 600 0 GHz -53.850 dBm		E	Mkr→RefLvi
7 8 9 10 11 11				More 1 of 2
MSG		STATU	3	



# 6. Radiated Emission

# 6.1. Measurement Procedure

- 1. The EUT was placed on the top of the turntable 0.8 or 1.5 meter above ground. The phase center of the receiving antenna mounted on the top of a height-variable antenna tower was placed 3 meters far away from the turntable.
- 2. Power on the EUT and all the supporting units. The turntable was rotated by 360 degrees to determine the position of the highest radiation.
- 3. The height of the broadband receiving antenna was varied between one meter and four meters above ground to find the maximum emissions field strength of both horizontal and vertical polarization.
- 4. For each suspected emissions, the antenna tower was scan (from 1 M to 4 M) and then the turntable was rotated (from 0 degree to 360 degrees) to find the maximum reading.
- 5. Set the test-receiver system to Peak or CISPR quasi-peak Detect Function with specified bandwidth under Maximum Hold Mode.
- 6. For emissions above 1GHz, use 1MHz RBW and 3MHz VBW for peak reading. Place the measurement antenna away from each area of the EUT determined to be a source of emissions at the specified measurement distance, while keeping the measurement antenna aimed at the source of emissions at each frequency of significant emissions, with polarization oriented for maximum response. The measurement antenna may have to be higher or lower than the EUT, depending on the radiation pattern of the emission and staying aimed at the emission source for receiving the maximum signal. The final measurement antenna elevation shall be that which maximizes the emissions. The measurement antenna elevation for maximum emissions shall be restricted to a range of heights of from 1 m to 4 m above the ground or reference ground plane.
- 7. When the radiated emissions limits are expressed in terms of the average value of the emissions, and pulsed operation is employed, the measurement field strength shall be determined by averaging over one complete pulse train, including blanking intervals, as long as the pulse train does not exceed 0.1 seconds. As an alternative (provided the transmitter operates for longer than 0.1 seconds) or in cases where the pulse train exceeds 0.1 seconds, the measured field strength shall be determined from the average absolute voltage during a 0.1 second interval during which the field strength is at its maximum values.
- 8.If the emissions level of the EUT in peak mode was 3 dB lower than the average limit specified, then testing will be stopped and peak values of EUT will be reported, otherwise, the emissions which do not have 3 dB margin will be repeated one by one using the quasi-peak method for below 1GHz.
- 9. For testing above 1GHz, the emissions level of the EUT in peak mode was lower than average limit (that means the emissions level in peak mode also complies with the limit in average mode), then testing will be stopped and peak values of EUT will be reported, otherwise, the emissions will be measured in average mode again and reported.
- 10. In case the emission is lower than 30MHz, loop antenna has to be used for measurement and the recorded data should be QP measured by receiver. High Low scan is not required in this case.



### 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
Start ~Stop Frequency	1MHz/3MHz for Peak, 1MHz/10Hz for Average

Receiver Parameter	Setting
Start ~Stop Frequency	9KHz~150KHz/RB 200Hz for QP
Start ~Stop Frequency	150KHz~30MHz/RB 9KHz for QP
Start ~Stop Frequency	30MHz~1000MHz/RB 120KHz for QP