

		EDODT				
FCC PART 15 SUBPART C TEST REPORT						
	FCC PART 15.247					
Report Reference No: FCC ID	GTS20190612005-1-15 2AQAA-EZPAD6PRO					
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Date of issue	Jul. 19, 2019					
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Address	101,102,201,301 No.13-2 Pingxi S	South Rd., Pingxi Community,				
	Pingdi Street,Longgang District,Shenzhen,GuangDong,China					
Test specification:						
Standard:	FCC Part 15.247: Operation with 2400-2483.5 MHz and 5725-5850					
TRF Originator	Shenzhen Global Test Service Co	.,Ltd.				
Master TRF						
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Test item description	Portable computer					
Trade Mark	/					
Manufacturer:	SHENZHEN JUMPER TECHNOL	OGY CO.,LTD				
Model/Type reference:	EZpad 6pro					
Listed Models	N/A					
Modulation Type	GFSK,π/4-DQPSK,8DPSK					
Operation Frequency	From 2402MHz to 2480MHz					
Hardware Version	N/A					
Software Version	N/A					
Rating	DC 7.6V form battery					
Result	PASS					

# TEST REPORT

Test Report No. :		GTS20190612005-1-15	Jul. 19, 2019 Date of issue
Equipment under Test	:	Portable computer	
Model /Type	:	EZpad 6pro	
Listed Models	:	N/A	
Applicant	:	SHENZHEN JUMPER TECHNO	LOGY CO.,LTD
Address	:	101,102,201,301 No.13-2 Pingxi Street,Longgang District,Shenzh	South Rd.,Pingxi Community,Pingdi en,GuangDong,China
Manufacturer	:	SHENZHEN JUMPER TECHNO	LOGY CO.,LTD
Address	:	101,102,201,301 No.13-2 Pingxi Street,Longgang District,Shenzh	South Rd.,Pingxi Community,Pingdi en,GuangDong,China

Test Result:	PASS
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The test report merely corresponds to the test sample. It is not permitted to copy extracts of these test result without the written permission of the test laboratory.

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# 1. TEST STANDARDS

The tests were performed according to following standards:

<u>FCC Rules Part 15.247</u>: 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. <u>ANSI C63.10-2013</u>: American National Standard for Testing Unlicensed Wireless Devices <u>DA 00-705</u>: Filing and Measurement Guidelines for Frequency Hopping Spread Spectrum Systems

# 2. <u>SUMMARY</u>

# 2.1. General Remarks

Date of receipt of test sample	:	Jun. 28, 2019
Testing commenced on	:	Jul. 18, 2019
Testing concluded on	:	Jul. 19, 2019

# 2.2. Product Description

Product Name:	Portable computer
Trade Mark:	N/A
Model/Type reference:	EZpad 6pro
Power supply:	DC 7.6V form battery
WIFI	
WLAN	Supported 802.11 b/g/n
Modulation Type	IEEE 802.11b: DSSS(CCK,DQPSK,DBPSK) IEEE 802.11g: OFDM(64QAM, 16QAM, QPSK, BPSK) IEEE 802.11n HT20: OFDM (64QAM, 16QAM, QPSK,BPSK) IEEE 802.11n HT40: OFDM (64QAM, 16QAM, QPSK,BPSK)
Operation frequency	IEEE 802.11b:2412-2462MHz IEEE 802.11g:2412-2462MHz IEEE 802.11n HT20:2412-2462MHz IEEE 802.11n HT40:2422-2452MHz
Channel number	11 Channels for WIFI 20MHz Bandwidth(802.11b/g/n-HT20) 7 Channels for WIFI 40MHz Bandwidth(802.11n-HT40)
Antenna Description	FPC Antenna,2.27dBi(Max.)
BT	
Operation frequency	2402-2480MHz
Channel Number	79 channels for Bluetooth (DSS) 40 channels for Bluetooth (DTS)
Channel Spacing	1MHz for Bluetooth (DSS) 2MHz for Bluetooth (DTS)
Modulation Type	GFSK, π/4DQPSK, 8DPSK for Bluetooth (DSS) GFSK for Bluetooth (DTS)
Antenna Description	FPC Antenna,2.27dBi(Max.)

# 2.3. Equipment Under Test

# Power supply system utilised

Power supply voltage	:	0	230V / 50 Hz	0	120V / 60Hz
		0	12 V DC	Ο	24 V DC
			Other (specified in blank bel	ow)	)

DC 7.6V form battery

# 2.4. Short description of the Equipment under Test (EUT)

This is a Portable computer

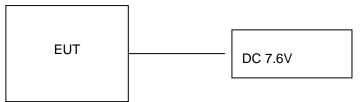
For more details, refer to the user's manual of the EUT.

# 2.5. EUT operation mode

The Applicant provides communication tools software to control the EUT for staying in continuous transmitting (Duty Cycle more than 98%) and receiving mode for testing .There are 79 channels provided to the EUT. Channel 00/38/78 was selected to test.

Channel	Frequency(MHz)	Channel	Frequency(MHz)
00	2402	40	2442
01	2403	41	2443
02	2404	42	2444
38	2440	78	2480
39	2441		

# 2.6. Block Diagram of Test Setup



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

This submittal(s) (test report) is intended for **FCC ID: 2AQAA-EZPAD6PRO** filing to comply with Section 15.247 of the FCC Part 15, Subpart C Rules.

# 2.8. Special Accessories

Manufacturer	Description	Model	Serial Number	Certificate
Shenzhen Jihongda Power Co.,Ltd.	Adapter	JHD-AP024U- 120200BA-B		SDOC

# 2.9. Modifications

No modifications were implemented to meet testing criteria.

# 3. <u>TEST ENVIRONMENT</u>

# 3.1. Address of the test laboratory

### Shenzhen Global Test Service Co.,Ltd.

No.7-101 and 8A-104, Building 7 and 8, DCC Cultural and Creative Garden, No.98, Pingxin North Road, Shangmugu Community, Pinghu Street, Longgang District, Shenzhen, Guangdong, China

# 3.2. Test Facility

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

CNAS (No. CNAS L8169)

Shenzhen Global Test Service Co., Ltd. has been assessed and proved to be in compliance with CNAS-CL01 Accreditation Criteria for Testing and Calibration Laboratories (identical to ISO/IEC 17025: 2019 General Requirements) for the Competence of Testing and Calibration Laboratories.

A2LA (Certificate No. 4758.01)

Shenzhen Global Test Service Co., Ltd. has been assessed by the American Association for Laboratory Accreditation (A2LA). Certificate No. 4758.01.

# 3.3. Environmental conditions

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

Temperature:	15-35 ° C
Humidity:	30-60 %
Atmospheric pressure:	950-1050mbar

# 3.4. Summary of measurement results

Test Specification clause	Test case	Test Mode	Test Channel	Reco In Re		Pass	Fail	NA	NP	Remark
§15.247(b)(4)	Antenna gain	GFSK	⊠ Lowest ⊠ Middle ⊠ Highest	GFSK	⊠ Lowest ⊠ Middle ⊠ Highest					complies
§15.247(e)	Power spectral density	-/-	-/-	-/-	-/-					Not applicable for FHSS
§15.247(a)(1)	Carrier Frequency separation	GFSK Π/4-DQPSK 8DPSK	⊠ Lowest ⊠ Middle ⊠ Highest	GFSK Π/4-DQPSK 8DPSK	🛛 Middle	$\boxtimes$				complies
§15.247(a)(1)	Number of Hopping channels	GFSK Π/4-DQPSK 8DPSK	🛛 Full	GFSK Π/4-DQPSK 8DPSK	🛛 Full	$\boxtimes$				complies
§15.247(a)(1)	Time of Occupancy (dwell time)	GFSK Π/4-DQPSK 8DPSK	⊠ Lowest ⊠ Middle ⊠ Highest	GFSK Π/4-DQPSK 8DPSK	🛛 Middle					complies
§15.247(a)(1)	Spectrum bandwidth of a FHSS system 20dB bandwidth	GFSK Π/4-DQPSK 8DPSK	⊠ Lowest ⊠ Middle ⊠ Highest	GFSK Π/4-DQPSK 8DPSK	⊠ Lowest ⊠ Middle ⊠ Highest	$\boxtimes$				complies
§15.247(b)(1)	Maximum output power	GFSK Π/4-DQPSK 8DPSK	⊠ Lowest ⊠ Middle ⊠ Highest	GFSK Π/4-DQPSK 8DPSK	⊠ Lowest ⊠ Middle ⊠ Highest	$\mathbb{X}$				complies
§15.247(d)	Band edge compliance conducted	GFSK Π/4-DQPSK 8DPSK	⊠ Lowest ⊠ Highest	GFSK Π/4-DQPSK 8DPSK	⊠ Lowest ⊠ Highest	$\boxtimes$				complies
§15.205	Band edge compliance radiated	GFSK Π/4-DQPSK 8DPSK	⊠ Lowest ⊠ Highest	GFSK	⊠ Lowest ⊠ Highest	$\boxtimes$				complies
§15.247(d)	TX spurious emissions conducted	-/-	-/-	-/-	-/-					complies
§15.247(d)	TX spurious emissions radiated	GFSK 8DPSK	⊠ Lowest ⊠ Middle ⊠ Highest	GFSK	⊠ Lowest ⊠ Middle ⊠ Highest	$\boxtimes$				complies
§15.109	RX spurious emissions radiated	-/-	-/-	-/-	-/-					complies
§15.209(a)	TX spurious Emissions radiated < 30 MHz	-/-	-/-	-/-	-/-					complies
§15.107(a) §15.207	Conducted Emissions < 30 MHz	GFSK	-/-	GFSK	-/-					complies

### Remark:

- 1. The measurement uncertainty is not included in the test result.
- 2.
- NA = Not Applicable; NP = Not PerformedWe tested all test mode and recorded worst case in report 3.
- 4. For  $\pi$ /4-DQPSK its same modulation type with 8-DPSK, and based exploratory test, there is no significant difference of that two types test result, so except output power, all other items final test were only performed with the worse case 8-DPSK and GFSK.

## 3.5. 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 Global Test Service 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 Shenzhen GTS laboratory is reported:

Test	Range	Measurement Uncertainty	Notes
Radiated Emission	30~1000MHz	4.10 dB	(1)
Radiated Emission	1~18GHz	4.32 dB	(1)
Radiated Emission	18-40GHz	5.54 dB	(1)
Conducted Disturbance	0.15~30MHz	3.12 dB	(1)

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

# 3.6. Equipments Used during the Test

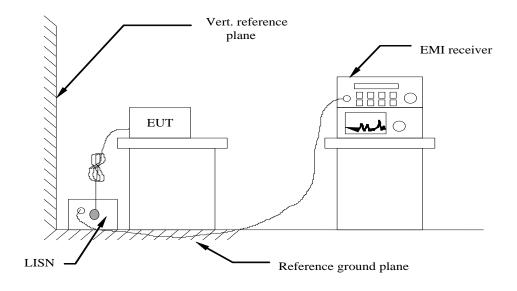
Test Equipment	Manufacturer	Model No.	Serial No.	Calibration Date	Calibration Due Date
LISN	R&S	ENV216	3560.6550.08	2018/09/28	2019/09/27
LISN	R&S	ESH2-Z5	893606/008	2018/09/27	2019/09/26
By-log Antenna	SCHWARZBECK	VULB9163	000976	2018/09/29	2019/09/28
EMI Test Receiver	R&S	ESCI	101102	2018/09/26	2019/09/25
Spectrum Analyzer	Agilent	N9020A	MY48010425	2018/09/17	2019/09/16
Spectrum Analyzer	R&S	FSV40-N	101800	2018/09/17	2019/09/16
Controller	EM Electronics	Controller EM 1000	N/A	2018/09/21	2019/09/20
Double Ridged Horn Antenna (1~18GHz)	SCHWARZBECK	BBHA 9120D	01622	2018/09/19	2019/09/18
Double Ridged Horn Antenna	Rohde&Schwarz	HF907	100265	2018/09/19	2019/09/18
Active Loop Antenna	SCHWARZBECK	FMZB1519	1519-037	2018/09/19	2019/09/18
Horn Antenna (18GHz~40GHz)	ETS	3116	00086467	2018/12/29	2019/12/28
Amplifier (26.5GHz~40GHz)	EMCI	EMC2654045	980028	2018/09/18	2019/09/17
Amplifier (0.1GHz~26.5GHz)	EMCI	EMC012645SE	980355	2018/09/19	2019/09/18
Temperature/Humidi ty Meter	Gangxing	CTH-608	02	2018/09/20	2019/09/19
High-Pass Filter	K&L	9SH10- 2700/X12750- O/O	N/A	2018/09/20	2019/09/19
High-Pass Filter	K&L	41H10- 1375/U12750- O/O	N/A	2018/09/20	2019/09/19
Data acquisition card	Agilent	U2531A	TW53323507	2018/09/20	2019/09/19
Power Sensor	Agilent	U2021XA	MY5365004	2018/09/20	2019/09/19
RF Cable	HUBER+SUHNER	RG214	N/A	2018/09/20	2019/09/19
Broadband Antenna	SCHWARZBECK	VULB 9163	00976	2018/09/29	2019/09/28
Conducted Emission	ES-K1	V1.71	N/A	N/A	N/A
Radiated Emission	JS32-RE	V2.5.0.9	N/A	N/A	N/A

Note: The Cal.Interval was one year.

# 4. TEST CONDITIONS AND RESULTS

# 4.1. AC Power Conducted Emission

## TEST CONFIGURATION



## TEST PROCEDURE

1 The equipment was set up as per the test configuration to simulate typical actual usage per the user's manual. The EUT is a tabletop system, a wooden table with a height of 0.8 meters is used and is placed on the ground plane as per ANSI C63.10-2013.

2 Support equipment, if needed, was placed as per ANSI C63.10-2013.

3 All I/O cables were positioned to simulate typical actual usage as per ANSI C63.10-2013.

4 The EUT received DC 12V power, the adapter received AC120V/60Hz or AC 240V/50Hz power through a Line Impedance Stabilization Network (LISN) which supplied power source and was grounded to the ground plane.

5 All support equipments received AC power from a second LISN, if any.

6 The EUT test program was started. Emissions were measured on each current carrying line of the EUT using a spectrum Analyzer / Receiver connected to the LISN powering the EUT. The LISN has two monitoring points: Line 1 (Hot Side) and Line 2 (Neutral Side). Two scans were taken: one with Line 1 connected to Analyzer / Receiver and Line 2 connected to a 50 ohm load; the second scan had Line 1 connected to a 50 ohm load and Line 2 connected to the Analyzer / Receiver.

7 Analyzer / Receiver scanned from 150 KHz to 30MHz for emissions in each of the test modes.

8 During the above scans, the emissions were maximized by cable manipulation.

### AC Power Conducted Emission Limit

For intentional device, according to § 15.207(a) AC Power Conducted Emission Limits is as following :

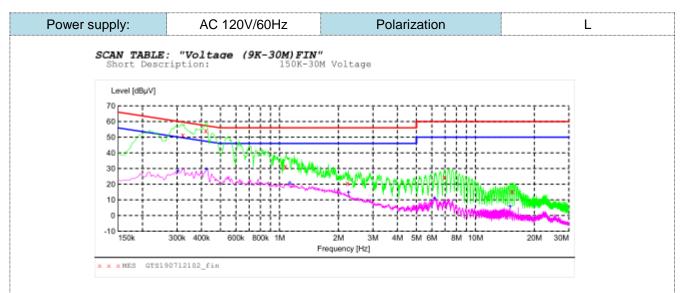
	Limit (dBuV)				
Frequency range (MHz)	Quasi-peak	Average			
0.15-0.5	66 to 56*	56 to 46*			
0.5-5	56	46			
5-30	60	50			
* Decreases with the logarithm of the frequency.					

### TEST RESULTS

Remark: We measured Conducted Emission at GFSK,  $\pi$ /4-DQPSK and 8DPSK mode in AC 120V/60Hz and AC 240V/50Hz, the worst case was recorded .

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#### MEASUREMENT RESULT: "GTS190712102\_fin"

7/12/2019 5:50PM Frequency Level Transd Limit Margin Detector Line PE

MHz	dBµV	dB	dΒμV	dB			
0.321000 0.420000 1.072500 2.224500 6.945000	51.50 54.20 31.40 20.60 24.50	9.9 9.8 9.6 9.5 9.1	60 57 56 56	8.2 3.2 24.6 35.4 35.5	QP QP QP QP	L1 L1 L1 L1 L1	GND GND GND GND GND
15.387000	15.40	8.1	60	44.6	QP	L1	GND

#### MEASUREMENT RESULT: "GTS190712102\_fin2"

7/1	2/2019 5:5	0 PM						
	Frequency MHz	Level dBµV	Transd dB	Limit dBµV	Margin dB	Detector	Line	PE
	0.303000	28.60	9.9	50	21.6	AV	L1	GND
	0.424500	29.50	9.8	47	17.9	AV	L1	GND
	1.126500	21.00	9.6	46	25.0	AV	L1	GND
	2.251500	14.90	9.5	46	31.1	AV	L1	GND
	6.180000	11.10	9.2	50	38.9	AV	L1	GND
	15.022500	5.80	8.2	50	44.2	AV	L1	GND

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0.321000

0.429000

1.009500

2.134500

7.602000

16.327500

25.70

25.50

18.70

12.70 11.40

1.30

9.9

9.8

9.6

9.5

9.1 7.8 50

47

46

46

50

50

24.0 AV

27.3 AV

33.3 AV

38.6 AV

48.7 AV

AV

21.8

GND

GND

GND

GND

GND

GND

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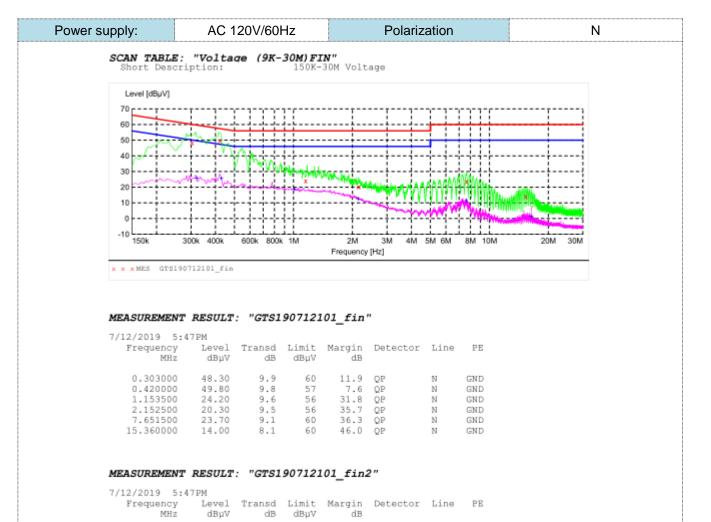
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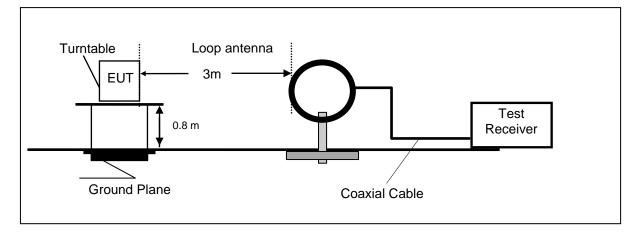
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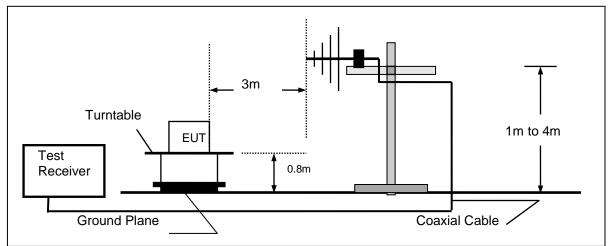
# 4.2. Radiated Emission

# **TEST CONFIGURATION**

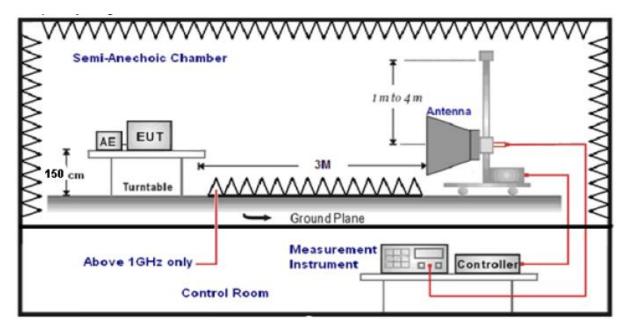
Frequency range 9 KHz – 30MHz



## Frequency range 30MHz – 1000MHz



Frequency range above 1GHz-25GHz



#### TEST PROCEDURE

- 1. The EUT was placed on a turn table which is 0.8m above ground plane when testing frequency range 9 KHz –1GHz;the EUT was placed on a turn table which is 1.5m above ground plane when testing frequency range 1GHz 25GHz.
- 2. Maximum procedure was performed by raising the receiving antenna from 1m to 4m and rotating the turn table from 0° to 360° to acquire the highest emissions from EUT.
- 3. And also, each emission was to be maximized by changing the polarization of receiving antenna both horizontal and vertical.
- 4. Repeat above procedures until all frequency measurements have been completed.
- 5. The EUT minimum operation frequency was 32.768KHz and maximum operation frequency was 2480MHz.so radiated emission test frequency band from 9KHz to 25GHz.
- 6. The distance between test antenna and EUT as following table states:

Test Frequency range	Test Antenna Type	Test Distance
9KHz-30MHz	Active Loop Antenna	3
30MHz-1GHz	Ultra-Broadband Antenna	3
1GHz-18GHz	Double Ridged Horn Antenna	3
18GHz-25GHz	Horn Anternna	1

7. Setting test receiver/spectrum as following table states:

Test Frequency range	Test Receiver/Spectrum Setting	Detector		
9KHz-150KHz	9KHz-150KHz RBW=200Hz/VBW=3KHz,Sweep time=Auto			
150KHz-30MHz	RBW=9KHz/VBW=100KHz,Sweep time=Auto	QP		
30MHz-1GHz	RBW=120KHz/VBW=1000KHz,Sweep time=Auto	QP		
	Peak Value: RBW=1MHz/VBW=3MHz,			
1GHz-40GHz	1GHz-40GHz Sweep time=Auto Average Value: RBW=1MHz/VBW=10Hz,			
	Sweep time=Auto			

#### Field Strength Calculation

The field strength is calculated by adding the Antenna Factor and Cable Factor and subtracting the Amplifier Gain and Duty Cycle Correction Factor(if any) from the measured reading. The basic equation with a sample calculation is as follows:

#### FS = RA + AF + CL - AG

Where FS = Field Strength	CL = Cable Attenuation Factor (Cable Loss)		
RA = Reading Amplitude	AG = Amplifier Gain		
AF = Antenna Factor			

Transd=AF +CL-AG

#### RADIATION LIMIT

For intentional device, according to § 15.209(a), the general requirement of field strength of radiated emission from intentional radiators at a distance of 3 meters shall not exceed the following table. According to § 15.247(d), in any 100kHz bandwidth outside the frequency band in which the EUT is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20dB below that in the100kHz bandwidth within the band that contains the highest level of desired power.

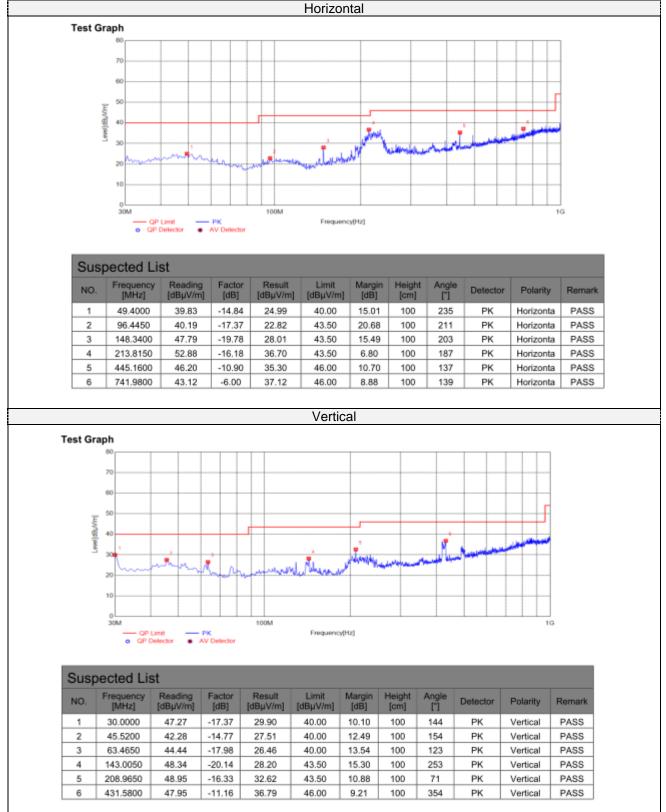
The pre-test have done for the EUT in three axes and found the worst emission at position shown in test setup photos.

Frequency (MHz)	Distance (Meters)	Radiated (dBµV/m)	Radiated (µV/m)
0.009-0.49	3	20log(2400/F(KHz))+40log(300/3)	2400/F(KHz)
0.49-1.705	3	20log(24000/F(KHz))+ 40log(30/3)	24000/F(KHz)
1.705-30	3	20log(30)+ 40log(30/3)	30
30-88	3	40.0	100
88-216	3	43.5	150
216-960	3	46.0	200
Above 960	3	54.0	500

#### TEST RESULTS

Remark: We measured Radiated Emission at GFSK,  $\pi/4$ -DQPSK and 8DPSK mode from 30MHz to 25GHz and recorded worst case at GFSK mode.

#### For 30MHz-1GHz



Frequency	Meter Reading	Antenna Factor	Cable loss	Preamp factor	Emission Level	Limits	Margin	Detector Type	Comment
(MHz)	(dBµV)	(dB)	(dB)	(dB)	(dBµV/m)	(dBµV/m)	(dB)		
				ΤX	-2402				
4804	45.8	32.44	30.25	7.95	55.94	74	18.06	Pk	Vertical
4804	35.58	32.44	30.25	7.95	45.72	54	8.28	AV	Vertical
4804	40.22	32.44	30.25	7.95	50.36	74	23.64	Pk	Horizontal
4804	32.62	32.44	30.25	7.95	42.76	54	11.24	AV	Horizontal
				ΤX	-2441				
4882	46.34	32.52	30.31	8.12	56.67	74	17.33	Pk	Vertical
4882	36.41	32.52	30.31	8.12	46.74	54	7.26	AV	Vertical
4882	41.46	32.52	30.31	8.12	51.79	74	22.21	Pk	Horizontal
4882	31.99	32.52	30.31	8.12	42.32	54	11.68	AV	Horizontal
				ΤX	-2480				
4960	44.87	32.68	30.27	7.88	55.16	74	18.84	Pk	Vertical
4960	34.93	32.68	30.27	7.88	45.22	54	8.78	AV	Vertical
4960	40.61	32.68	30.27	7.88	50.9	74	23.1	Pk	Horizontal
4960	31.04	32.68	30.27	7.88	41.33	54	12.67	AV	Horizontal

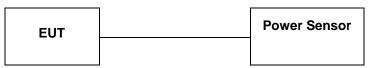
#### For 1GHz to 25GHz

### **REMARKS**:

- Emission level (dBuV/m) =Raw Value (dBuV)+Correction Factor (dB/m)
  Correction Factor (dB/m) = Antenna Factor (dB/m)+Cable Factor (dB)-Pre-amplifier Factor
- 3. Margin value = Limit value- Emission level.
- -- Mean the PK detector measured value is below average limit.
  The other emission levels were very low against the limit.

# 4.3. Maximum Peak Output Power

## TEST CONFIGURATION



### TEST PROCEDURE

According to ANSI C63.10:2013 Maximum peak conducted output power for HFSS devices:

The maximum peak conducted output power may be measured using a broadband peak RF power meter. The power meter shall have a video bandwidth that is greater than or equal to the HFSS bandwidth and shall utilize a fast-responding diode detector.

The maximum Average conducted output power may be measured using a wideband RF power meter with a thermocouple derector or equivalent. The power meter shall have a video bandwidth that is greater than or equal to the HFSS bandwidth and shall utilize a fast-responding diode detector.

### <u>LIMIT</u>

For frequency hopping systems operating in the 2400–2483.5 MHz band employing at least 75 nonoverlapping hopping channels, and all frequency hopping systems in the 5725–5850 MHz band: 1 watt. For all other frequency hopping systems in the 2400–2483.5 MHz band: 0.125 watts.

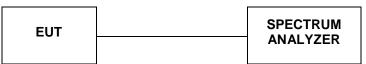
### TEST RESULTS

Modulation	Channel	Peak Output power (dBm)	Limit (dBm)	Result
	00	2.21		
GFSK	39	2.57	21	Pass
	78	2.09		
	00	3.34		
π/4-DQPSK	39	3.96	21	Pass
	78	3.42		
	00	3.51		
8DPSK	39	4.05	21	Pass
	78	3.45		

Note: The test results including the cable lose.

# 4.4. 20dB Bandwidth

## **TEST CONFIGURATION**



### TEST PROCEDURE

The transmitter output was connected to the spectrum analyzer through an attenuator. The bandwidth of the fundamental frequency was measured by spectrum analyzer with RBW=30KHz and VBW=100KHz. The 20dB bandwidth is defined as the total spectrum the power of which is higher than peak power minus 20dB.

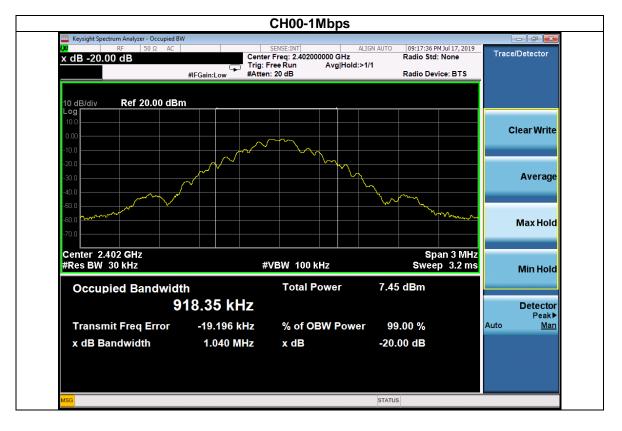
# <u>LIMIT</u>

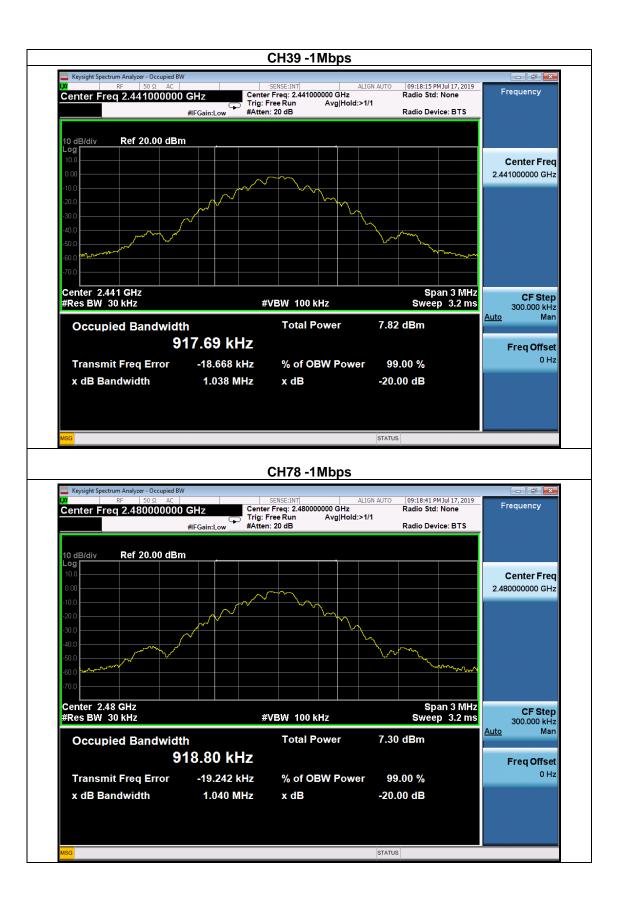
For frequency hopping systems operating in the 2400MHz-2483.5MHz no limit for 20dB bandwith.

# TEST RESULTS

Modulation	Frequency	20dB Bandwidth (MHz)	Result
	2402 MHz	1.04	PASS
GFSK	2441 MHz	1.04	PASS
	2480 MHz	1.04	PASS

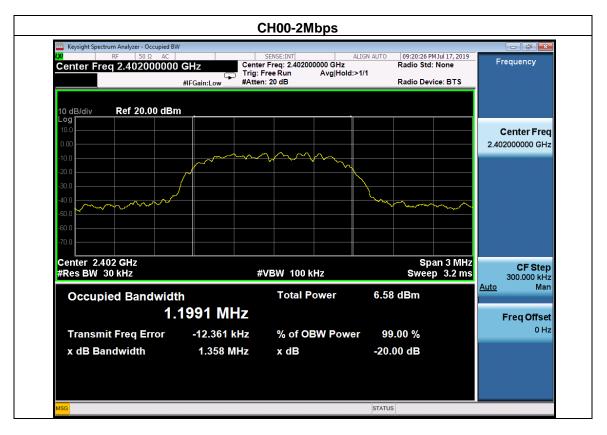
Test plot as follows:

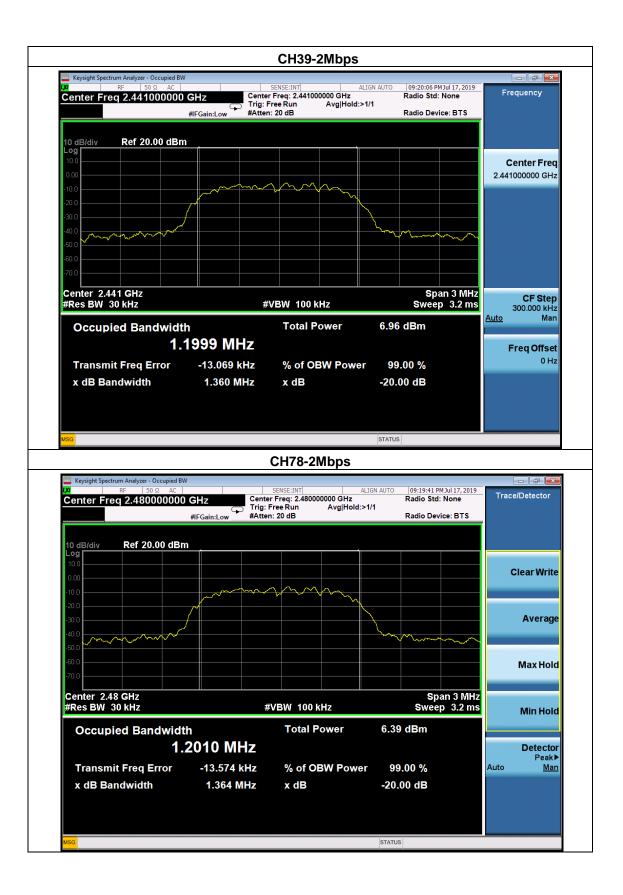




Modulation	Frequency	Frequency 20dB Bandwidth (MHz)	
	2402 MHz	1.36	PASS
π /4-DQPSK	2441 MHz	1.36	PASS
	2480 MHz	1.36	PASS

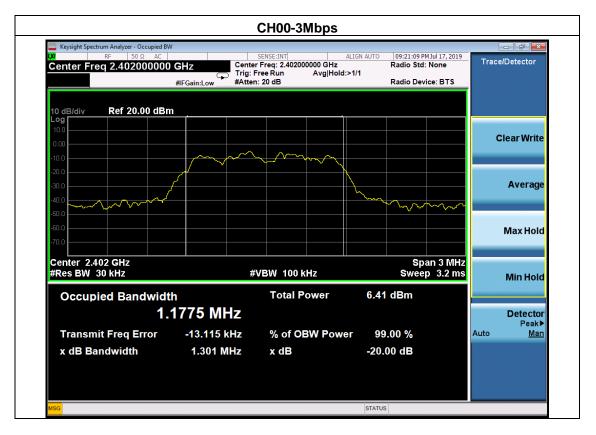
Test plot as follows:

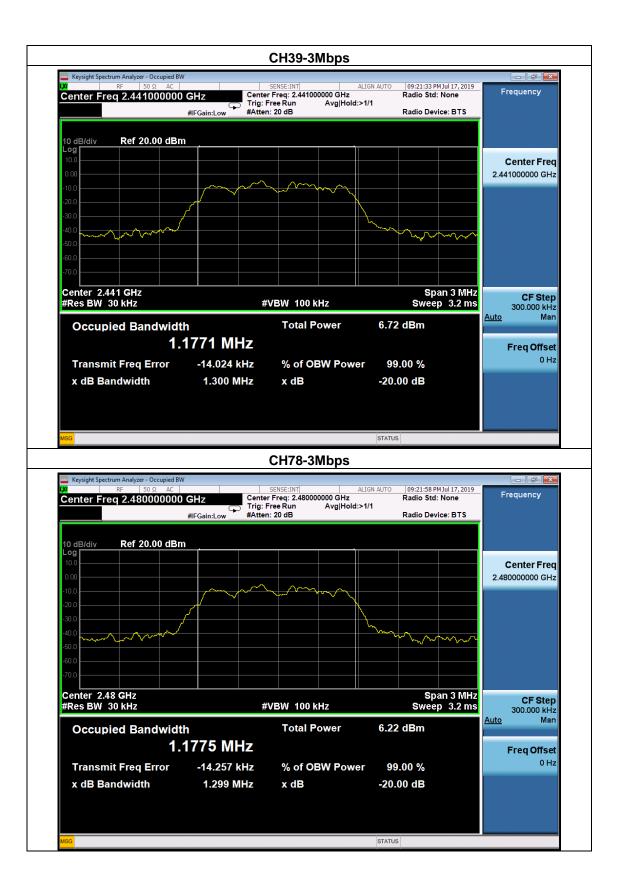




Modulation	Frequency	20dB Bandwidth (MHz)	Result
	2402 MHz	1.30	PASS
8-DPSK	2441 MHz	1.30	PASS
	2480 MHz	1.30	PASS

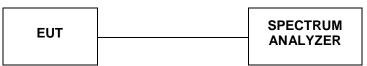
Test plot as follows:





# 4.5. Frequency Separation

## **TEST CONFIGURATION**



### TEST PROCEDURE

The transmitter output was connected to the spectrum analyzer through an attenuator. The bandwidth of the fundamental frequency was measured by spectrum analyzer with RBW=30KHz and VBW=100KHz.

### <u>LIMIT</u>

According to 15.247(a)(1), frequency hopping systems shall have hopping channel carrier frequencies separated by minimum of 25KHz or the 2/3\*20dB bandwidth of the hopping channel, whichever is greater.

## TEST RESULTS

Modulation	Frequency	Ch. Separation (MHz)	Limit (MHz)	Result
	2402 MHz	1.002	0.693	Complies
GFSK	2441 MHz	0.992	0.693	Complies
	2480 MHz	1.002	0.693	Complies

# Ch. Separation Limits: > 2/3 of 20dB bandwidth





Modulation	Frequency	Ch. Separation (MHz)	Limit (MHz)	Result
	2402 MHz	1.004	0.907	Complies
π /4-DQPSK	2441 MHz	1.004	0.907	Complies
	2480 MHz	1.000	0.907	Complies

Ch. Separation Limits: >2/3 of 20dB bandwidth.

Keysight Spectrum /								
<mark>»</mark> Marker 1 Δ 1.	50 Ω AC 004000000 M		SENS		ALIGN AUTO	r TRA	PM Jul 18, 2019 CE 1 2 3 4 5 6	Peak Search
		PNO: Wide G	Trig: Free I Atten: 20 d		Avg Hold:>1/1	Ē		
Ref	Offset 10.5 dB				Δ	Mkr1 1.(	004 MHz 0.011 dB	Next Peak
10 dB/div Ref	20.00 dBm		Ţ			<b>`</b>	John dB	
10.0								Next Pk Right
10.0	v				1∆2			
0.00	X2	man W	ᡃᡙᡗᡨ᠆᠇᠁ᠬ	mhum	~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~	man	AD	
-10.0			• W (- +~~ (	1000 0			MANNA	Next Pk Left
-20.0								Marker Delta
-30.0								
-40.0								Mkr→CF
-50.0								
-60.0								Mkr→RefLvl
-00.0								WIKI →RCI LVI
-70.0								
								More 1 of 2
Center 2.4025 #Res BW 100			/ 300 kHz			Span 2	2.000 MHz (1001 pts)	1012

	CH39 -	2Mbps		
Keysight Spectrum Analyzer - Swept SA		A1 9 (04) A1 (0)-	124142 041 142 2015	
Marker 1 Δ 1.004000000		ALIGN AUTO Avg Type: Log-Pwr Avg Hold:>1/1	12:41:12 PM Jul 18, 2019 TRACE 1 2 3 4 5 6 TYPE M	Peak Search
	PNO: Wide Trig: Free Run IFGain:Low Atten: 20 dB			NextDeak
Ref Offset 10.5 dB		ΔΜ	kr1 1.004 MHz -0.005 dB	NextPeak
10 dB/div Ref 20.00 dBm			0.000 aD	
10.0				Next Pk Right
X.				
0.00 workywwwwwwwww	may when when	man manun	Anna and anna and anna and anna anna ann	
-10.0				Next Pk Left
-20.0				Marker Delta
-30.0				
-40.0				
				Mkr→CF
-50.0				
-60.0				Mkr→RefLv
-70.0				More
Center 2.441500 GHz			Span 2.000 MHz	1 of 2
#Res BW 100 kHz			opan 2.000 min2	
#Res DW TOO KHZ	#VBW 300 kHz	Sweep 1.0	000 ms (1001 pts)	
	#VBW 300 KHz	Sweep 1.0	000 ms (1001 pts)	
MSG	#VBW 300 KHZ	STATUS	000 ms (1001 pts)	
MSG Keysight Spectrum Analyzer - Swept SA	CH78 -	status 2Mbps		- <i>•</i>
MSG Keysight Spectrum Analyzer - Swept SA XI RF 50 Ω AC	CH78 -	STATUS 2Mbps ALIGN AUTO Avg Type: Log-Pwr	12:39:43 PM Jul 18, 2019 TRACE 123456	Peak Search
MSG Keysight Spectrum Analyzer - Swept SA XI RF 50 Ω AC	CH78 -	STATUS 2Mbps Align Auto Avg Type: Log-Pwr Avg Hold:>1/1	12:39:43 PM Jul 18, 2019 TRACE <b>1</b> 2 3 4 3 6 TYPE <b>M</b> DET <b>P</b> NNNN	Peak Search
MSG Keysight Spectrum Analyzer - Swept SA RF 50 Ω AC Marker 1 Δ 1.000000000 Ref Offset 10.5 dB	CH78 - SENSE:INT MHz PNO: Wide C Trig: Free Run	STATUS 2Mbps Align Auto Avg Type: Log-Pwr Avg Hold:>1/1	12:39:43 PMJul 18, 2019 TRACE 2 2 3 4 5 6 TYPE MWWWW DET PNNNN Kr1 1.000 MHz	Peak Search
MSG Keysight Spectrum Analyzer - Swept SA Marker 1 Δ 1.0000000000	CH78 - SENSE:INT MHz PNO: Wide C Trig: Free Run	STATUS 2Mbps Align Auto Avg Type: Log-Pwr Avg Hold:>1/1	12:39:43 PM Jul 18, 2019 TRACE <b>1</b> 2 3 4 3 6 TYPE <b>M</b> DET <b>P</b> NNNN	
MSG Keysight Spectrum Analyzer - Swept SA RF 50 Ω AC Marker 1 Δ 1.000000000 Ref Offset 10.5 dB	CH78 - SENSE:INT MHz PNO: Wide C Trig: Free Run	STATUS 2Mbps Aug Type: Log-Pwr Avg Hold:>1/1	12:39:43 PMJul 18, 2019 TRACE 2 2 3 4 5 6 TYPE MWWWW DET PNNNN Kr1 1.000 MHz	Peak Search
MSG Keysight Spectrum Analyzer - Swept SA Marker 1 Δ 1.0000000000 Ref Offset 10.5 dB Ref 20.00 dBm 10.0	CH78 -	STATUS 2Mbps Align Auto Avg Type: Log-Pwr Avg Hold:>1/1	12:39:43 PMJul 18, 2019 TRACE 2 2 3 4 5 6 TYPE MWWWW DET PNNNN Kr1 1.000 MHz	Peak Search Next Peak
MSG Keysight Spectrum Analyzer - Swept SA RF 50 Ω AC Marker 1 Δ 1.0000000000 Ref Offset 10.5 dB 10 dB/div Ref 20.00 dBm 10 0	CH78 - SENSE:INT MHz PNO: Wide C Trig: Free Run	STATUS 2Mbps Aug Type: Log-Pwr Avg Hold:>1/1	12:39:43 PMJul 18, 2019 TRACE 2 2 3 4 5 6 TYPE MWWWW DET PNNNN Kr1 1.000 MHz	Peak Search Next Peak Next Pk Right
MSG Keysight Spectrum Analyzer - Swept SA Marker 1 Δ 1.0000000000 Ref Offset 10.5 dB Ref 20.00 dBm 10.0	CH78 -	STATUS 2Mbps Aug Type: Log-Pwr Avg Hold:>1/1	12:39:43 PMJul 18, 2019 TRACE 2 2 3 4 5 6 TYPE MWWWW DET PNNNN Kr1 1.000 MHz	Peak Search Next Peak
MSG Keysight Spectrum Analyzer - Swept SA RF 50 Ω AC Marker 1 Δ 1.0000000000 Ref Offset 10.5 dB 10 dB/div Ref 20.00 dBm 10 0	CH78 -	STATUS 2Mbps Aug Type: Log-Pwr Avg Hold:>1/1	12:39:43 PMJul 18, 2019 TRACE 2 2 3 4 5 6 TYPE MWWWW DET PNNNN Kr1 1.000 MHz	Peak Search Next Peak Next Pk Right
MSG Keysight Spectrum Analyzer - Swept SA RF 50 Ω AC Marker 1 Δ 1.0000000000 Ref Offset 10.5 dB 10 dB/div Ref 20.00 dBm 10.0 .000 .10.0 .20.0	CH78 -	STATUS 2Mbps Aug Type: Log-Pwr Avg Hold:>1/1	12:39:43 PMJul 18, 2019 TRACE 2 2 3 4 5 6 TYPE MWWWW DET PNNNN Kr1 1.000 MHz	Peak Search Next Peak Next Pk Right
MSG Keysight Spectrum Analyzer - Swept SA RF 50 Ω AC Marker 1 Δ 1.0000000000 Ref Offset 10.5 dB 10 dB/div Ref 20.00 dBm 10.0 .0000 .0000	CH78 -	STATUS 2Mbps Aug Type: Log-Pwr Avg Hold:>1/1	12:39:43 PMJul 18, 2019 TRACE 2 2 3 4 5 6 TYPE MWWWW DET PNNNN Kr1 1.000 MHz	Peak Search Next Peak Next Pk Right Next Pk Left
MSG Keysight Spectrum Analyzer - Swept SA RF 50 Ω AC Marker 1 Δ 1.0000000000 Ref Offset 10.5 dB 10 dB/div Ref 20.00 dBm 10.0 .000 .10.0 .20.0	CH78 -	STATUS 2Mbps Aug Type: Log-Pwr Avg Hold:>1/1	12:39:43 PMJul 18, 2019 TRACE 2 2 3 4 5 6 TYPE MWWWW DET PNNNN Kr1 1.000 MHz	Peak Search Next Peak Next Pk Right Next Pk Left Marker Delta
MSG Keysight Spectrum Analyzer - Swept SA RF 50 Ω AC Marker 1 Δ 1.0000000000 Ref Offset 10.5 dB 10 dB/div Ref 20.00 dBm 10.0 .0000 .000 .000 .000 .000 .000 .00000 .0000 .0000 .0000 .0000 .0	CH78 -	STATUS 2Mbps Aug Type: Log-Pwr Avg Hold:>1/1	12:39:43 PMJul 18, 2019 TRACE 2 2 3 4 5 6 TYPE MWWWW DET PNNNN Kr1 1.000 MHz	Peak Search Next Peak Next Pk Right Next Pk Left
MSG Keysight Spectrum Analyzer - Swept SA RF 50 Ω AC Marker 1 Δ 1.0000000000 Ref Offset 10.5 dB 10 dB/div Ref 20.00 dBm 10.0 -0.0 -0.0 -30.0	CH78 -	STATUS 2Mbps Aug Type: Log-Pwr Avg Hold:>1/1	12:39:43 PMJul 18, 2019 TRACE 2 2 3 4 5 6 TYPE MWWWW DET PNNNN Kr1 1.000 MHz	Peak Search Next Peak Next Pk Right Next Pk Left Marker Delta
MSG Keysight Spectrum Analyzer - Swept SA 20 RF 50 Ω AC Marker 1 Δ 1.0000000000 Ref Offset 10.5 dB 10 dB/div Ref 20.00 dBm 10.0 .0000 .000 .000 .000 .000 .000	CH78 -	STATUS 2Mbps Aug Type: Log-Pwr Avg Hold:>1/1	12:39:43 PMJul 18, 2019 TRACE 2 2 3 4 5 6 TYPE MWWWW DET PNNNN Kr1 1.000 MHz	Peak Search Next Peak Next Pk Right Next Pk Left Marker Delta
MSG Keysight Spectrum Analyzer - Swept SA 32 RF 50 Ω AC Marker 1 Δ 1.0000000000 10.0	CH78 -	STATUS 2Mbps Aug Type: Log-Pwr Avg Hold:>1/1	12:39:43 PMJul 18, 2019 TRACE 2 2 3 4 5 6 TYPE MWWWW DET PNNNN Kr1 1.000 MHz	Peak Search Next Peak Next Pk Right Next Pk Left Marker Delta Mkr→CF
MSG Keysight Spectrum Analyzer - Swept SA RF 50 Ω AC Marker 1 Δ 1.0000000000 Ref Offset 10.5 dB 10 dB/div Ref 20.00 dBm 10.0 -0.0	CH78 -	STATUS 2Mbps Aug Type: Log-Pwr Avg Hold:>1/1	12:39:43 PMJul 18, 2019 TRACE 2 2 3 4 5 6 TYPE MWWWW DET PNNNN Kr1 1.000 MHz	Peak Search Next Peak Next Pk Right Next Pk Left Marker Delta Mkr→CF
Keysight Spectrum Analyzer - Swept SA        RF      S0 Ω      AC        Marker 1 Δ 1.000000000      Ref Offset 10.5 dB      Ref 20.00 dBm        10 dB/div      Ref 20.00 dBm      Ref 20.00 dBm        -000      2000      2000      2000        -10.0	CH78 -	STATUS 2Mbps Avg Type: Log-Pwr Avg Hold:>1/1 Avg	12:39:43 PMJul 18, 2019 TRACE 2 2 3 4 5 6 TYPE MWWWW DET PNNNN Kr1 1.000 MHz	Peak Search Next Peak Next Pk Right Next Pk Left Marker Delta Mkr→CF

Modulation	Frequency	Ch. Separation (MHz)	Limit (MHz)	Result
	2402 MHz	1.000	0.867	Complies
8-DPSK	2441 MHz	1.000	0.867	Complies
	2480 MHz	1.004	0.867	Complies

Ch. Separation Limits: >2/3 of 20dB bandwidth.

	CH00	-3Mbps		
Keysight Spectrum Analyzer - Swept SA RF 50 Ω AC Marker 1 Δ 1.0000000000 M	PNO: Wide Trig: Free Run Atten: 20 dB	ALIGN AUTO Avg Type: Log-Pwr Avg Hold:>1/1	12:45:48 PM Jul 18, 2019 TRACE 1 2 3 4 5 6 TYPE M WWWWW DET P N N N N N	Peak Search
Ref Offset 10.5 dB 10 dB/div Ref 20.00 dBm		ΔΝ	kr1 1.000 MHz -0.004 dB	Next Peak
10.0 0 00 <b>X</b> 2 000		1Δ2		Next Pk Right
-10.0	- many	www.	- www.	Next Pk Left
-20.0				Marker Delta
-40.0				Mkr→CF
-60.0				Mkr→RefLvl
-70.0 Center 2.402500 GHz			Span 2.000 MHz	More 1 of 2
#Res BW 100 kHz	#VBW 300 kHz	Sweep 1	.000 ms (1001 pts)	

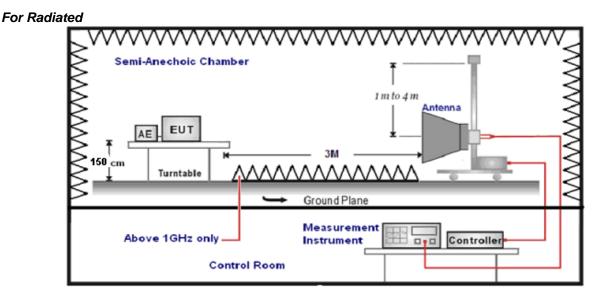
	CH39 -	3Mbps		
Keysight Spectrum Analyzer - Swept SA	SENSE:INT	ALIGN AUTO	12:47:07 PM Jul 18, 2019	
Marker 1 Δ 1.000000000 M		ALIGN AUTO Avg Type: Log-Pwr Avg Hold:>1/1	TRACE 1 2 3 4 5 6	Peak Search
	IFGain:Low Atten: 20 dB			NextPeak
Ref Offset 10.5 dB 10 dB/div Ref 20.00 dBm		АМІ	r1 1.000 MHz -0.016 dB	Nextr cur
10 dB/div Ref 20.00 dBm				
10.0		1Δ2		Next Pk Right
	m m	narow.		
Morright	ma. Mun Munum	-m	, My Monrow	Next Pk Lef
-10.0				
-20.0				
~				Marker Delta
-30.0				
-40.0				Mkr→CF
-50.0				
				Mire D. O
-60.0				Mkr→RefLv
-70.0				
				<b>More</b> 1 of 2
Center 2.441500 GHz #Res BW 100 kHz	#VBW 300 kHz		Span 2.000 MHz	
WINDOW FOR TWO MILE	#VDVV JUU KHZ	Sweep 1.0	00 ms (1001 pts)	
MSG	#VDW 300 KH2	Sweep 1.0	00 ms (1001 pts)	
	#VBW 300 KH2	STATUS	00 ms (1001 pts)	
MSG Keysight Spectrum Analyzer - Swept SA	CH78 -	status 3Mbps		
MSG Keysight Spectrum Analyzer - Swept SA 20 RF   50 Ω AC	CH78 -	STATUS 3Mbps ALIGN AUTO Avg Type: Log-Pwr	12:49:11 PM Jul 18, 2019 TRACE 12 2 4 5 6	Peak Search
MSG Keysight Spectrum Analyzer - Swept SA 20 RF   50 Ω AC	CH78 -	STATUS 3Mbps Align Auto Avg Type: Log-Pwr Avg Hold:>1/1	12:49:11 PM Jul 18, 2019 TRACE 12 23 45 6 TYPE MWWWW DET PNNNNN	Peak Search
MSG Keysight Spectrum Analyzer - Swept SA RF 50 Ω AC Marker 1 Δ 1.004000000 M Ref Offset 10.5 dB	CH78 - SENSE:INT HZ PNO: Wide Trig: Free Run	STATUS 3Mbps Align Auto Avg Type: Log-Pwr Avg Hold:>1/1	12:49:11 PM Jul 18, 2019 TRACE 12 2 4 5 6	
MSG Keysight Spectrum Analyzer - Swept SA RF 50 Ω AC Marker 1 Δ 1.004000000 M Ref Offset 10.5 dB	CH78 - SENSE:INT HZ PNO: Wide Trig: Free Run	STATUS 3Mbps Align Auto Avg Type: Log-Pwr Avg Hold:>1/1	12:49:11 PMJul 18, 2019 TRACE 1 2 3 4 5 6 TYPE MWWWW DET PNNNNN CT1 1.004 MHz	Peak Search
MSG Keysight Spectrum Analyzer - Swept SA RF 50 Ω AC Marker 1 Δ 1.004000000 M Ref Offset 10.5 dB	CH78 - SENSE:INT HZ PNO: Wide Trig: Free Run	STATUS 3Mbps ALIGN AUTO Avg Type: Log-Pwr Avg Hold:>1/1 AM	12:49:11 PMJul 18, 2019 TRACE 1 2 3 4 5 6 TYPE MWWWW DET PNNNNN CT1 1.004 MHz	Peak Search
MSG Keysight Spectrum Analyzer - Swept SA Marker 1 Δ 1.004000000 M Marker 1 Δ 1.004000000 M Nef Offset 10.5 dB 10 dB/div Ref 20.00 dBm	CH78 - SENSE:INT HZ PNO: Wide Trig: Free Run	STATUS 3Mbps Align Auto Avg Type: Log-Pwr Avg Hold:>1/1	12:49:11 PMJul 18, 2019 TRACE 1 2 3 4 5 6 TYPE MWWWW DET PNNNNN CT1 1.004 MHz	Peak Search Next Peak
MSG Keysight Spectrum Analyzer - Swept SA X RF 50 Ω AC Marker 1 Δ 1.004000000 M Ref Offset 10.5 dB 10 dB/div Ref 20.00 dBm 10.0	CH78 - SENSE:INT HZ PNO: Wide Trig: Free Run	STATUS 3Mbps ALIGN AUTO Avg Type: Log-Pwr Avg Hold:>1/1 AM	12:49:11 PMJul 18, 2019 TRACE 1 2 3 4 5 6 TYPE MWWWW DET PNNNNN CT1 1.004 MHz	Peak Search Next Peak
MSG Keysight Spectrum Analyzer - Swept SA Marker 1 Δ 1.004000000 M Marker 1 Δ 1.004000000 M Nef Offset 10.5 dB 10 dB/div Ref 20.00 dBm	CH78 - SENSE:INT HZ PNO: Wide Trig: Free Run	STATUS 3Mbps ALIGN AUTO Avg Type: Log-Pwr Avg Hold:>1/1 AM	12:49:11 PMJul 18, 2019 TRACE 1 2 3 4 5 6 TYPE MWWWW DET PNNNNN CT1 1.004 MHz	Peak Search Next Peak Next Pk Right
MSG Keysight Spectrum Analyzer - Swept SA Marker 1 Δ 1.004000000 M Marker 1 Δ 1.004000000 M Nef Offset 10.5 dB 10 dB/div Ref 20.00 dBm	CH78 - SENSE:INT HZ PNO: Wide Trig: Free Run	STATUS 3Mbps ALIGN AUTO Avg Type: Log-Pwr Avg Hold:>1/1 AM	12:49:11 PMJul 18, 2019 TRACE 1 2 3 4 5 6 TYPE MWWWW DET PNNNNN CT1 1.004 MHz	Peak Search Next Peak Next Pk Right
MSG Keysight Spectrum Analyzer - Swept SA RF 50 Ω AC Marker 1 Δ 1.004000000 M 10 dB/div Ref Offset 10.5 dB Ref 0ffset 10.5 dB Ref 20.00 dBm 10.0 10.0 -10.0 -20.0	CH78 - SENSE:INT HZ PNO: Wide Trig: Free Run	STATUS 3Mbps ALIGN AUTO Avg Type: Log-Pwr Avg Hold:>1/1 AM	12:49:11 PMJul 18, 2019 TRACE 1 2 3 4 5 6 TYPE MWWWW DET PNNNNN CT1 1.004 MHz	Peak Search Next Peak Next Pk Right
MSG Keysight Spectrum Analyzer - Swept SA RF 50 Ω AC Marker 1 Δ 1.004000000 M 10 dB/div Ref Offset 10.5 dB Ref Offset 10.5 dB Ref 20.00 dBm -0.0 -0.0 -30.0	CH78 - SENSE:INT HZ PNO: Wide Trig: Free Run	STATUS 3Mbps ALIGN AUTO Avg Type: Log-Pwr Avg Hold:>1/1 AM	12:49:11 PMJul 18, 2019 TRACE 1 2 3 4 5 6 TYPE MWWWW DET PINNNN CT1 1.004 MHz	Peak Search Next Peak Next Pk Right
MSG Keysight Spectrum Analyzer - Swept SA RF 50 Ω AC Marker 1 Δ 1.004000000 M 10 dB/div Ref Offset 10.5 dB Ref 0ffset 10.5 dB 10 dB/div Ref 20.00 dBm 10.0 10.0 -10.0 -20.0	CH78 - SENSE:INT HZ PNO: Wide Trig: Free Run	STATUS 3Mbps ALIGN AUTO Avg Type: Log-Pwr Avg Hold:>1/1 AM	12:49:11 PMJul 18, 2019 TRACE 1 2 3 4 5 6 TYPE MWWWW DET PINNNN CT1 1.004 MHz	Peak Search Next Peak Next Pk Right
MSG Keysight Spectrum Analyzer - Swept SA RF 50 Ω AC Marker 1 Δ 1.004000000 M 10 dB/div Ref Offset 10.5 dB Ref Offset 10.5 dB Ref 20.00 dBm -0.0 -0.0 -30.0	CH78 - SENSE:INT HZ PNO: Wide Trig: Free Run	STATUS 3Mbps ALIGN AUTO Avg Type: Log-Pwr Avg Hold:>1/1 AM	12:49:11 PMJul 18, 2019 TRACE 1 2 3 4 5 6 TYPE MWWWW DET PINNNN CT1 1.004 MHz	Peak Search Next Peak Next Pk Right Next Pk Left Marker Delta
MSG Keysight Spectrum Analyzer - Swept SA Marker 1 Δ 1.004000000 M Marker 1 Δ 1.004000000 M Ref Offset 10.5 dB 10 dB/div Ref 20.00 dBm 	CH78 - SENSE:INT HZ PNO: Wide Trig: Free Run	STATUS 3Mbps ALIGN AUTO Avg Type: Log-Pwr Avg Hold:>1/1 AM	12:49:11 PMJul 18, 2019 TRACE 1 2 3 4 5 6 TYPE MWWWW DET PINNNN CT1 1.004 MHz	Peak Search Next Peak Next Pk Right Next Pk Left Marker Delta Mkr→CF
MSG Keysight Spectrum Analyzer - Swept SA Marker 1 Δ 1.004000000 M 10 dB/div Ref 20.00 dBm 10.0 .000	CH78 - SENSE:INT HZ PNO: Wide Trig: Free Run	STATUS 3Mbps ALIGN AUTO Avg Type: Log-Pwr Avg Hold:>1/1 AM	12:49:11 PMJul 18, 2019 TRACE 1 2 3 4 5 6 TYPE MWWWW DET PINNNN CT1 1.004 MHz	Peak Search Next Peak Next Pk Right Next Pk Left Marker Delta
MSG Keysight Spectrum Analyzer - Swept SA Marker 1 Δ 1.004000000 M Marker 1 Δ 1.004000000 M Ref Offset 10.5 dB 10 dB/div Ref 20.00 dBm 	CH78 - SENSE:INT HZ PNO: Wide Trig: Free Run	STATUS 3Mbps ALIGN AUTO Avg Type: Log-Pwr Avg Hold:>1/1 AM	12:49:11 PMJul 18, 2019 TRACE 1 2 3 4 5 6 TYPE MWWWW DET PINNNN CT1 1.004 MHz	Peak Search Next Peak Next Pk Right Next Pk Left Marker Delta Mkr→CF
MSG Keysight Spectrum Analyzer - Swept SA X RF 50 Ω AC Marker 1 Δ 1.004000000 M 10 dB/div Ref 20.00 dBm 10 dB/div Ref 20.00 dBm 	CH78 - SENSE:INT HZ PNO: Wide Trig: Free Run	STATUS 3Mbps ALIGN AUTO Avg Type: Log-Pwr Avg Hold:>1/1 AM	12:49:11 PMJul 18, 2019 TRACE 1 2 3 4 5 6 TYPE MWWWW DET PINNNN CT1 1.004 MHz	Peak Search Next Peak Next Pk Right Next Pk Left Marker Delta Mkr→CF

# 4.6. Band Edge Compliance of RF Emission

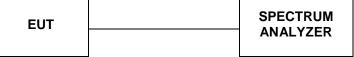
## TEST REQUIREMENT

In any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power, based on either an RF conducted or a radiated measurement, provided the transmitter demonstrates compliance with the peak conducted power limits. If the transmitter complies with the conducted power limits based on the use of RMS averaging over a time interval, as permitted under paragraph (b)(3) of this section, the attenuation required under this paragraph shall be 30 dB instead of 20 dB. Attenuation below the general limits specified in §15.209(a) is not required. In addition, radiated 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) (see §15.205(c)).

## TEST CONFIGURATION



### For Conducted



# TEST PROCEDURE

- 1. The EUT was placed on a turn table which is 1.5m above ground plane.
- 2. Maximum procedure was performed by raising the receiving antenna from 1m to 4m and rotating the turn table from 0° to 360° to acquire the highest emissions from EUT.
- 3. And also, each emission was to be maximized by changing the polarization of receiving antenna both horizontal and vertical.
- 4. Repeat above procedures until all frequency measurements have been completed..
- 5. The distance between test antenna and EUT was 3 meter:
- 6. Setting test receiver/spectrum as following table states:

Test Frequency range	Test Receiver/Spectrum Setting	Detector
1GHz-40GHz	Peak Value: RBW=1MHz/VBW=3MHz, Sweep time=Auto Average Value: RBW=1MHz/VBW=10Hz, Sweep time=Auto	Peak

### <u>LIMIT</u>

Below -20dB of the highest emission level in operating band.

Radiated 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)

# TEST RESULTS

Remark: we measured all conditions(DH1,DH3,DH5) and recorded worst case at DH1.

## 4.6.1 For Radiated Bandedge Measurement

Remark: we tested radiated bandedge at both hopping and no-hopping modes, recorded worst case at nohopping mode

					GFS	ĸ					
Frequency	y(MHz):			2402		Polarit			ŀ	IORIZO	NTAL
Fraguanay	Emiss	ion	Limit	Morgin	Antenna	Table	Raw	Antenna	Cable	Pre-	Correction
Frequency (MHz)	Leve		(dBuV/m)	Margin (dB)	Height	Angle	Value	Factor	Factor	amplifi	Factor
(101112)	(dBuV	/m)	(ubu v/m)	(uD)	(m)	(Degree)	(dBuV)	(dB/m)	(dB)	er	(dB/m)
2390.00	48.45	PK	74	25.55	1	193	53.76	27.49	3.32	36.12	-5.31
2390.00	38.35	AV	54	15.65	1	193	43.66	27.49	3.32	36.12	-5.31
Frequency	y(MHz):			2402			Polarity:			VERTI	CAL
Frequency	Emiss	ion	Limit	Margin	Antenna	Table	Raw	Antenna	Cable	Pre-	Correction
(MHz)	Leve		(dBuV/m)	(dB)	Height	Angle	Value			amplifi	Factor
(101112)	(dBuV	/m)	(ubu v/m)	(UD)	(m)	(Degree)	(dBuV)	(dB/m)	(dB)	er	(dB/m)
2390.00	48.64	PK	74	25.36	1	286	53.95	27.49	3.32	36.12	-5.31
2390.00	38.94	AV	54	15.06	1	286	44.25	27.49	3.32	36.12	-5.31
Frequency	y(MHz):		2480			Polarity:			HORIZONTAL		
Fraguanav	Emiss	ion	Limit	Morgin	Antenna	Table	Raw	Antenna	Cable	Pre-	Correction
Frequency (MHz)	Leve	el	(dBuV/m)	Margin (dB)	Height	Angle	Value	Factor	Factor	amplifi	Factor
(101112)	(dBuV	/m)	(ubu v/m)	(UD)	(m)	(Degree)	(dBuV)	(dB/m)	(dB)	er	(dB/m)
2483.50	48.01	PK	74	24.67	1	108	53.73	27.45	3.38	36.55	-5.72
2483.50	37.9	AV	54	12.37	1	108	43.62	27.45	3.38	36.55	-5.72
Frequency	y(MHz):			2480			Polarity:		VERTICAL		
Fraguanay	Emiss	ion	Limit	Morgin	Antenna	Table	Raw	Antenna	Cable	Pre-	Correction
Frequency (MHz)	Leve	el	(dBuV/m)	Margin (dB)	Height	Angle	Value	Factor	Factor	amplifi	Factor
(101112)	(dBuV	/m)		(uD)	(m)	(Degree)	(dBuV)	(dB/m)	(dB)	er	(dB/m)
2483.50	47.85	ΡK	74	24.67	1	109	53.57	27.45	3.38	36.55	-5.72
2483.50	38.49	AV	54	12.37	1	109	44.21	27.45	3.38	36.55	-5.72

# 4.6.2 For Conducted Bandedge Measurement

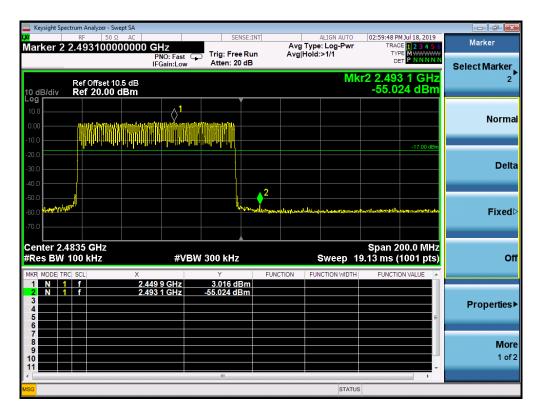
Keysight Spe	ectrum Analyze	r - Swept SA			,	u Euge-L			
larker 2			GHz PNO: Wide ⊂ IFGain:Low	Trig: Free R Atten: 20 dl	Av un Av	ALIGN AUTO g Type: Log-Pwr g Hold:>1/1	TYP	Jul 18, 2019 <b>1 2 3 4 5 6</b> <b>F</b> M M M M M M M M M M M M M M M M M M M	Peak Search
0 dB/div		et 10.5 dB 00 dBm	IFGall:LOW	Atten: 20 di		Mk	r2 2.399 -51.31	47 GHz 15 dBm	Next Pea
og 10.0 0.00									Next Pk Rig
0.0 0.0 0.0				2			~	-18.50 dBm	Next Pk Lo
0.0 0.0 0.0		<u></u>	,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,		manual .			****	Marker De
	400000 G 100 kHz	SHZ	#VB1	N 300 kHz	FUNCTION	Sweep	1.000 ms (1		Mkr→(
1 N 1 2 N 1 3 4 5 5 6 1	f	2.401	99 GHz 47 GHz	<u>1.462 dBm</u> -51.315 dBm				=	Mkr→RefL
7 8 9 0				m					<b>M</b> c 1 o

BDR mode	(GESK)	Band	Edge-I	eft Side
DDIVINUUE		Danu	Luye-i	

Keysight Spe		yzer - Swept SA								
Marker 2	RF 2.3994	50 Ω AC 400000000	GHz		ISE:INT	Avg Type	ALIGN AUTO	TRAC	M Jul 18, 2019 E <b>1 2 3 4 5 6</b>	Marker
			PNO: Fast IFGain:Low	Trig: Free Atten: 20		Avg Hold	:>1/1	DE		Select Marker
10 dB/div	Ref Of	fset 10.5 dB <b>0.00 dBm</b>					Mk	r2 2.399	9 4 GHz 37 dBm	2
		0.00 0811								
0.00					Shiddah Jaffaf Shid	ANDAMININLAAAANNIYY	daaalidolieethaaaaaada	นี้ที่นี้ไปปลายสิทธิสร้างแล		Normal
-10.0					and section with	in University	يتبونون المربي	يريا الحرامة الم		
-20.0									-16.90 dBm	
-30.0										Delta
-40.0					2					
-50.0		ki ki kata na sa	ka fille fatas at						mound	
-60.0	personal and the second se	an sin tura sanan tira							T Prove	Fixed⊵
Center 2.4 #Res BW			#VE	W 300 kHz			Sweep 1	2 Span 9.13 ms (	00.0 MHz 1001 pts)	Off
MKR MODE TH		Х		Y		CTION FUI	NCTION WIDTH	FUNCTIO	DN VALUE	
1 N 1 2 N 1			450 8 GHz 399 4 GHz	<u>3.057 dE</u> -49.837 dE						
3 4										Properties►
5 6									=	
7 8										More
9 10										1 of 2
11				III					+	
MSG							STATU	5		

Keysight Spectrum Analyzer - Swept SA							
LXI RF 50 Ω AC		SENSE:INT		ALIGN AUTO	02:58:32 PM Jul 18, 2		Select Marker
Marker 2 2.48370000000		Trig: Free Run		ype: Log-Pwr old:>1/1	TRACE 1 2 3 TYPE MWW	4 5 6	o o lo o c inici nici
		Atten: 20 dB	Avgine	510:21/1	DET P N N	NNN	
	IFGain:Low	Atten: 20 db					Mankond
				Mkr	2 2.483 70 G	Ηz	Marker 1
Ref Offset 10.5 dB					-56.071 dl	Rm	
10 dB/div Ref 20.00 dBm					-00.071 0	-	
10.0							Marker 2
-10.0					-18.2	0.101	
-20.0			_		-18.2	Uaem	
							Marker 3
-30.0							Marker J
-40.0							
	<b>`</b>	<b>2</b>					
-50.0	Jun	<u>+</u> ♦ <sup>∠</sup> −					
-60.0	munt	man	· ····································		wannan	<u>~~~</u>	Marker 4
							indi Kor 4
-70.0							
Center 2.483500 GHz					Span 10.00 N	ЛНZ	
#Res BW 100 kHz	#VBW 3	00 kHz		Sweep 1	.000 ms (1001 j		Marker 5
				-			
MKR MODE TRC SCL X			FUNCTION	FUNCTION WIDTH	FUNCTION VALUE	•	
1 N 1 f 2.48	30 00 GHz	1.774 dBm				- 1	
	33 70 GHz -5	6.071 dBm					
3 4						- 1	Marker 6
5						=	
6						-	
7							
8							More
9							
10							1 of 2
11							
•		III				P	
MSG				STATUS			
						_	

### EDR mode (GFSK): Band Edge-Right Side



Keysight Spectrum Analyzer - Swept SA				- 7
RF 50Ω AC arker 2 2.399960000000	PNO: Wide 😱 Trig: Free Run	ALIGN AUTO Avg Type: Log-Pwr Avg Hold:>1/1	02:54:30 PM Jul 18, 2019 TRACE 1 2 3 4 5 6 TYPE M	Peak Search
Ref Offset 10.5 dB dB/div Ref 20.00 dBm	IFGain:Low Atten: 20 dB	Mkr2	2.399 96 GHz -50.546 dBm	Next Pea
				Next Pk Rig
1.0 .0 .0	2		-20.50 dBm	Next Pk Le
0.0				Marker De
enter 2.400000 GHz Res BW 100 kHz	#VBW 300 kHz	Sweep 1.0	Span 10.00 MHz 000 ms (1001 pts)	Mkr→0
1 N 1 f 2.4	01 69 GHz -0.451 dBm 99 96 GHz -50.546 dBm			Mkr→RefL
				<b>Mo</b> 1 o
🛚 🔀 No Peak Found	III	STATUS	•	

# EDR mode ( $\pi$ /4-DQPSK): Band Edge-Left Side

	PM Jul 18, 2019		ALIGN AUTO		NSE:IN	SE		pt SA AC	nalyzer - Swe 50 Ω	<mark>ctrum A</mark> RF	ight Spe	Keys
Marker Select Marker	ACE 1 2 3 4 5 6 (PE M WWWW DET P N N N N N	TRAC TYF DE	ype: Log-Pwr old:>1/1			Trig: Fre Atten: 2	<b>IZ</b> NO:Fast ⊊ Gain:Low		920000	2.39	er 2	lark
2	9 2 GHz 10 dBm		Mk						Offset 10. <b>20.00</b> d		/div	0 dB
Norma	*	kihovanalla Niviva. J	1	hand and the	liwlu							- <b>og</b> 10.0 0.00
	-17.00 dBm				1							10.0 20.0
Delta												30.0 40.0
Fixed⊳	Marger Haywapond				2	ullife, how have the	and phage second	-haulhaanast	elan, and always	njqanads	ogen <sup>(h</sup> efterer	40.0 - 50.0 - 60.0 -
Of	200.0 MHz (1001 pts)	Span 2 9.13 ms (	Sweep 1			/ 300 kHz	#VBV				er 2.4 BW	
Properties	ION VALUE	FUNCTIO	FUNCTION WIDTH	FUNCTION	Bm Bm	Y 3.001 d -54.210 d	8 GHz 2 GHz			f	ODE TR N 1 N 1	1
More 1 of 2												6 7 8 9
						III						11 <b>_</b>
		6	STATUS									SG

Keysight Spectrum Analyzer - Swept SA							
RF 50 Ω AC		SENSE:		ALIGN AUTO	02:57:39 PM Jul		Marker
Marker 2 2.48398000000	) GHz			Type: Log-Pwr	TRACE	<b>2 3 4 5</b> 6	warker
	PNO: Wide	Trig: Free Ru		lold:>1/1		N N N N N	
	IFGain:Low	Atten: 20 dB			DEI		Select Marker
				Mkr	2 2.483 98	GHZ	2
Ref Offset 10.5 dB				i i i i i i i i i i i i i i i i i i i	-55.711		2
10 dB/div Ref 20.00 dBm					-55.711	ubiii	
Log		The second secon					
10.0							N
							Normal
-10.0							
-20.0						-20.70 dBm	
-20.0							
-30.0							Delta
	$\sim$						
-40.0	- \ <u>\</u>		_				
-50.0	- <u>\</u>		2				
		man and a start and a start a					
-60.0			we converted to the second starting	~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~	how we have a second	and the second second	Fixed⊳
-70.0							
10.0							
Contor 2 492500 Olla					<b>C</b> non 10.0		
Center 2.483500 GHz					Span 10.0	0 MHz	
Center 2.483500 GHz #Res BW 100 kHz	#VB	300 kHz		Sweep 1	Span 10.0 .000 ms (100	0 MHz 01 pts)	Off
#Res BW 100 kHz	#VB		EUNCTION		.000 ms (100	01 pts)	Off
#Res BW 100 kHz		Y	FUNCTION	Sweep 1	Span 10.0 .000 ms (100 FUNCTION V.	01 pts)	Off
#Res BW 100 kHz        MKR_MODE_TRC_SCL      X        1      N      1      f      2.4	79 69 GHz	۲ -0.711 dBm	FUNCTION		.000 ms (100	01 pts)	Off
#Res BW 100 kHz        MKR_MODE_TRC_SCL      X        1      N      1      f      2.4		Y	FUNCTION		.000 ms (100	01 pts)	
#Res BW 100 kHz        MKR MODE TRC SCL      X        1      N      1      f      2.4        2      N      1      f      2.4	79 69 GHz	۲ -0.711 dBm	FUNCTION		.000 ms (100	01 pts)	Off Properties▶
#Res BW 100 kHz        MKR MODE TRC SCL      X        1      N      1      f      2.4        2      N      1      f      2.4        3      -      -      -      -	79 69 GHz	۲ -0.711 dBm	FUNCTION		.000 ms (100	01 pts)	
#Res BW 100 kHz        MKR_MODE TRC  SCL      X        1      N      1      f      2.4        2      N      1      f      2.4        3      4      5      5      6	79 69 GHz	۲ -0.711 dBm	FUNCTION		.000 ms (100	01 pts)	
#Res BW 100 kHz        MKR MODE TRC SCL      X        1      N      1      f      2.4        2      N      1      f      2.4        3      -      -      -      -        4      -      -      -      -        5      -      -      -      -        6      -      -      -      -        7      -      -      -      -	79 69 GHz	۲ -0.711 dBm	FUNCTION		.000 ms (100	01 pts)	Properties▶
#Res BW 100 kHz        MKR MODE TRC SCL      X        1      N      1      f      2.4        2      N      1      f      2.4        3      4      4      5      5        6      7      8      8      8	79 69 GHz	۲ -0.711 dBm	FUNCTION		.000 ms (100	01 pts)	
#Res BW 100 kHz        MKR MODE TRC SCL      X        1      N      1      f      2.4        2      N      1      f      2.4        3      4      -      -      -        6      -      -      -      -        7      -      -      -      -        9      -      -      -      -	79 69 GHz	۲ -0.711 dBm	FUNCTION		.000 ms (100	01 pts)	Properties <b>⊳</b> More
#Res BW 100 kHz        MKR MODE TRC SCL      X        1      N      1      f      2.4        2      N      1      f      2.4        3      4      -      -      -        5      -      -      -      -        6      -      -      -      -        7      -      -      -      -        8      -      -      -      -        9      -      -      -      -        10      -      -      -      -	79 69 GHz	۲ -0.711 dBm	FUNCTION		.000 ms (100	01 pts)	Properties▶
#Res BW 100 kHz        MKR MODE TRC SCL      X        1      N      1      f      2.4        2      N      1      f      2.4        3      4      -      -      -        6      -      -      -      -        7      -      -      -      -        9      -      -      -      -	79 69 GHz	¥ _0.711 dBm _55.711 dBm	FUNCTION		.000 ms (100	01 pts)	Properties <b>⊳</b> More
#Res BW 100 kHz        MKR MODE TRC  SCL      X        1      N      1      f      2.4        2      N      1      f      2.4        3      4      4      5      5        6      6      6      6      7        10      11      11      11      11	79 69 GHz	۲ -0.711 dBm	FUNCTION	FUNCTION WIDTH	.000 ms (100 FUNCTION V.	01 pts)	Properties <b>⊳</b> More
#Res BW 100 kHz        MKR MODE TRC SCL      X        1      N      1      f      2.4        2      N      1      f      2.4        3      4      -      -      -        5      -      -      -      -        6      -      -      -      -        7      -      -      -      -        8      -      -      -      -        9      -      -      -      -        10      -      -      -      -	79 69 GHz	¥ _0.711 dBm _55.711 dBm	FUNCTION		.000 ms (100 FUNCTION V.	01 pts)	Properties <b>⊳</b> More

# EDR mode ( $\pi$ /4-DQPSK): Band Edge- Right Side

Keysight Spectrum Analyzer - Swept SA					
₩ RF 50 Ω AC Marker 2 2.483700000000	GHz	SENSE:IN	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:>1/1		
Ref Offset 10.5 dB 10 dB/div Ref 20.00 dBm				Mkr2 2.483 7 GHz -52.455 dBm	Next Peak
Log 10.0 0.00	1 	-All-Aldilling in n			Next Pk Righ
-10.0				-17.00 dBm	
-30.0		2			Next Pk Lef
-50.0 -60.0			Autologikati Antalangana ang kati pangangan	ananan ar barran an a	Marker Delt
Center 2.4835 GHz #Res BW 100 kHz	#VBW	/ 300 kHz	Swee	Span 200.0 MHz ep  19.13 ms (1001 pts)	Mkr→C
MKR MODE TRC SCL X	438 9 GHz	Y 2.984 dBm	FUNCTION FUNCTION	WIDTH FUNCTION VALUE	
2 N 1 f 2.4 3 4 5 6	483 7 GHz	-52.455 dBm			Mkr→RefLv
7 8 8 9 10					<b>Mor</b> 1 of:
11		III			
MSG 🔀 No Peak Found				STATUS	

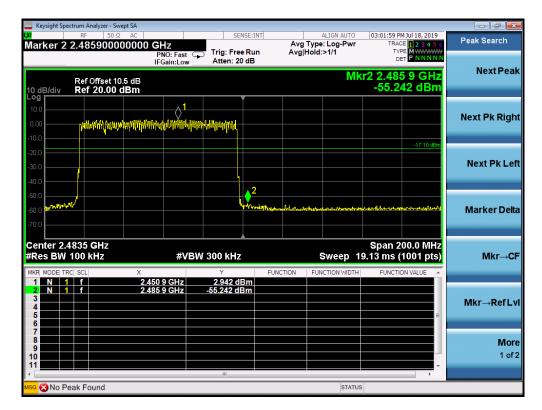
Keysight Spectrum Analy RF arker 2 2.3998	50 Ω AC 370000000 GHz PNO: Wid IEGain Lo		ALIGN AUTO Avg Type: Log-Pwr Avg Hold:>1/1	02:55:22 PM Jul 18, 2019 TRACE 1 2 3 4 5 6 TYPE MWWWWW DET P NN N N N	Peak Search
0 dB/div Ref 2	fset 10.5 dB 0.00 dBm	W Atten. 20 dB	Mkr	2 2.399 87 GHz -51.160 dBm	NextPea
og 10.0 					Next Pk Rig
20.0				-20.50 dBm	Next Pk Le
50.0 50.0	Section of the sectio	and the second sec		- Lumm	Marker De
enter 2.400000 Res BW 100 kH		VBW 300 kHz	Sweep 1	Span 10.00 MHz .000 ms (1001 pts)	Mkr→C
1 N 1 f 2 N 1 f 3 4 5	2.402 18 GHz 2.399 87 GHz	-0.524 dBm		E	Mkr→RefL
6 7 8 9 0					<b>Mo</b> 1 o
				•	

# EDR mode(8DPSK): Band Edge-Left Side

						lyzer - Swept SA		Keysight
Marker	02:52:53 PM Jul 18, 2019 TRACE 1 2 3 4 5 6	ALIGN AUTO		SENSE:I	GHz	50 Ω AC 80000000	RF 2 2.399	arker
Select Marker	DET P NNNN	d:>1/1	Avg Ho	Trig: Free Ru Atten: 20 dB	PNO: Fast O IFGain:Low		_	
2	2 2.399 8 GHz -50.822 dBm	Mki				fset 10.5 dB 2 <b>0.00 dBm</b>		) dB/div
Norma	4.1.1.1.1.1.1.1.1.1.1.1.1.1.1.1.1.1.1.1	1 Nykulinny vikulini	aliyayeyayayayayayayayayayayayayayayayayay	put				o.o
Delta	-17.00 dBm							0.0 0.0 0.0
=:	y Mineria da			2-		oasholomita asa mahaa		0.0
Fixed▷								
Of	Span 200.0 MHz .13 ms (1001 pts)	Sweep 19		N 300 kHz	#VB		2.4000 G V 100 kH	
	FUNCTION VALUE	JNCTION WIDTH	FUNCTION F	Y 3.048 dBm -50.822 dBm	135 8 GHz 899 8 GHz		TRC SCL 1 f 1 f	1 N 2 N
Properties)	Ξ.							3 4 5 6
Mor 1 of:								7 8 9 0
				m				1
		STATUS						G

			): Band E			
Keysight Spectrum Analyzer - Swept SA RF 50 Ω AC		SENSE:I		ALIGN AUTO	02:57:01 PM Jul 18, 20	
larker 2 2.4836600000	00 GHz PNO: Wide C IFGain:Low	► Trig: Free Ru Atten: 20 dB		/pe: Log-Pwr Id:>1/1	TRACE 1234 TYPE MWWW DET PNNN	
Ref Offset 10.5 dl 0 dB/div Ref 20.00 dBn				Mkr	2 2.483 66 GI -56.533 dB	
						Next Pk Righ
20.0 30.0 40.0	~~~				-20.60	Next Pk Le
50.0 60.0 70.0		m	) Marmulanurana	~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~	en hen an	Marker Del
Center 2.483500 GHz Res BW 100 kHz	# <b>VB</b>	W 300 kHz	FUNCTION	Sweep 1.	Span 10.00 M 000 ms (1001 p	Hz ts) Mkr→C
1 N 1 f	2.480 19 GHz 2.483 66 GHz	-0.648 dBm -56.533 dBm	PONCTION	ONC HON WIDTH	PONCTION VALUE	Mkr→RefL
7 8 9 9 10 10 10 10 10 10 10 10 10 10 10 10 10						Mo 1 of
s <mark>g</mark> 🔀 No Peak Found		III		STATUS		

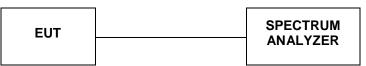
## EDR mode(8DPSK): Band Edge-Right Side



NOTE: Hopping enabled and disabled have evaluated, and the worst data was reported.

# 4.7. Number of hopping frequency

## **TEST CONFIGURATION**



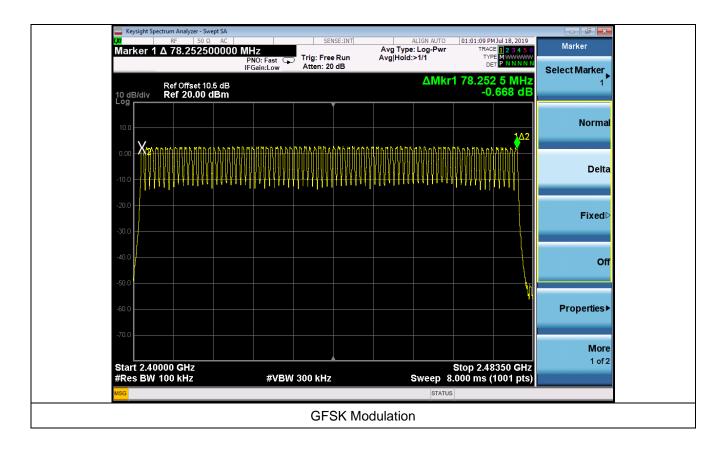
### TEST PROCEDURE

The transmitter output was connected to the spectrum analyzer through an attenuator.Set spectrum analyzer start 2400MHz to 2483.5MHz with RBW=1MHz and VBW=3MHz.

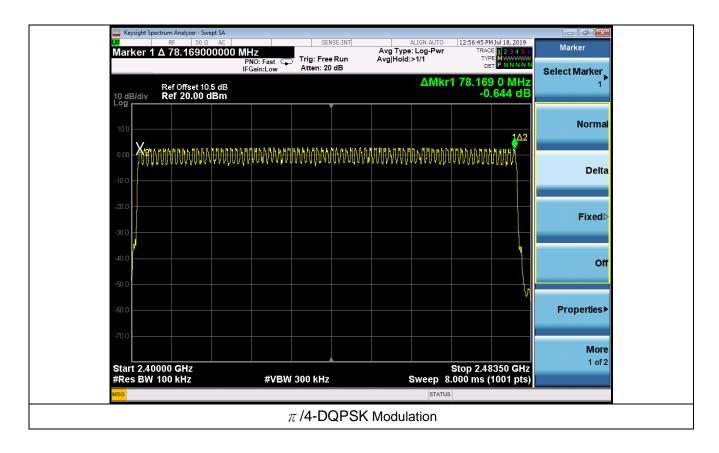
## <u>LIMIT</u>

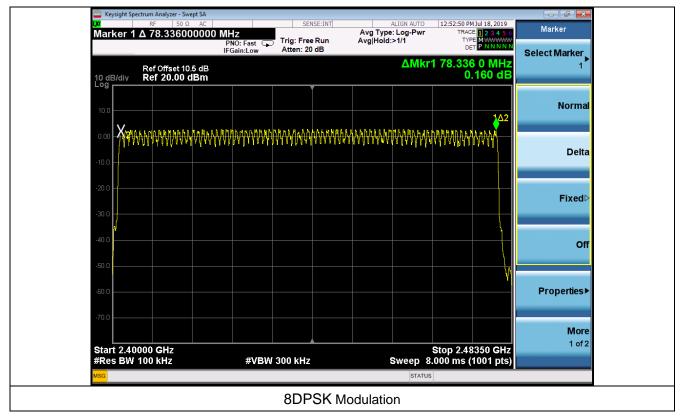
Frequency hopping systems in the 2400–2483.5MHz band shall use at least 15 channels.

Modulation	Number of Hopping Channel	Limit	Result
GFSK	79	≥15	Pass
π /4-DQPSK	79	≥15	Pass
8DPSK	79	≥15	Pass



#### Report No.: GTS20190612005-1-15





# 4.8. Time Of Occupancy(Dwell Time)

## **TEST CONFIGURATION**



#### TEST PROCEDURE

The transmitter output was connected to the spectrum analyzer through an attenuator. Set center frequency of spectrum analyzer=operating frequency with RBW=1MHz and VBW=3MHz,Span=0Hz.

#### LIMIT

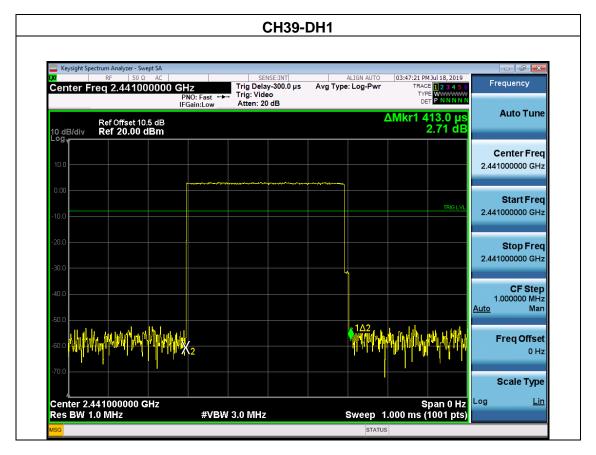
The average time of occupancy on any channel shall not be greater than 0.4 seconds within a pe-riod of 0.4 seconds multiplied by the number of hopping channels employed.

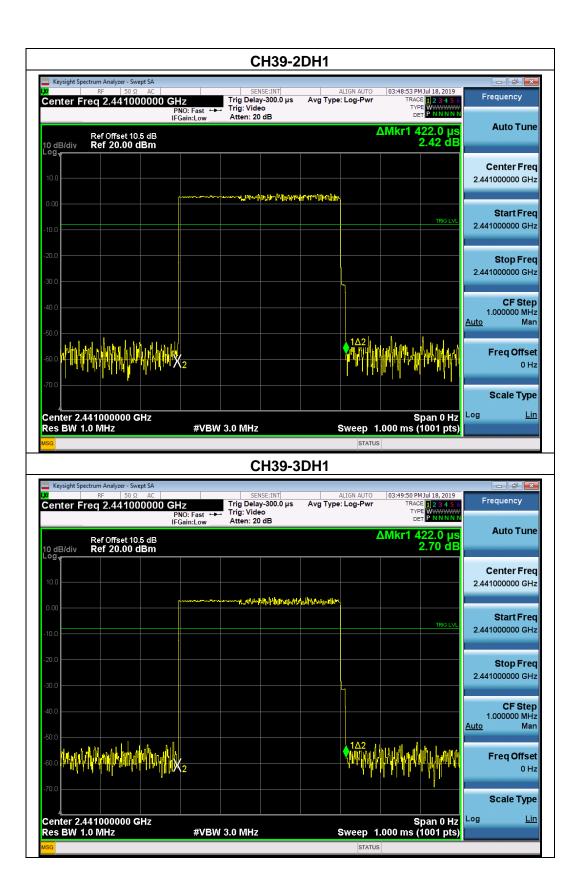
#### TEST RESULTS

#### Report No.: GTS20190612005-1-15

Modulation	Data Packet	Frequency	Pulse Duration	Dwell Time	Limits
			(ms)	(s)	(S)
	DH1	2441 MHz	0.413	0.13	0.4
GFSK	2DH1	2441 MHz	0.422	0.14	0.4
	3DH1	2441 MHz	0.422	0.14	0.4

Test plot as follows:

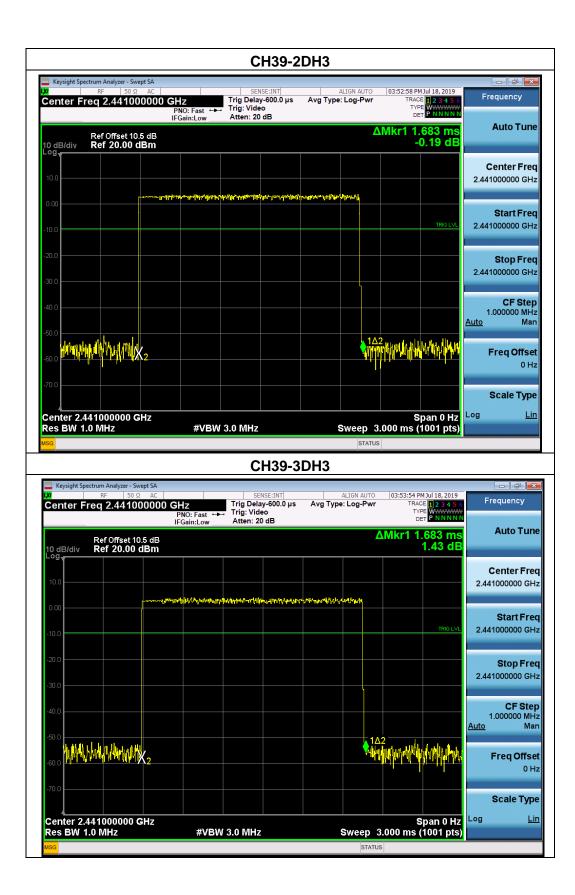




Modulation	Data Packet	Frequency	Pulse Duration	Dwell Time	Limits
			(ms)	(s)	(s)
	DH3	2441 MHz	1.683	0.27	0.4
π/4-DQPSK	2DH3	2441 MHz	1.683	0.27	0.4
	3DH3	2441 MHz	1.683	0.27	0.4

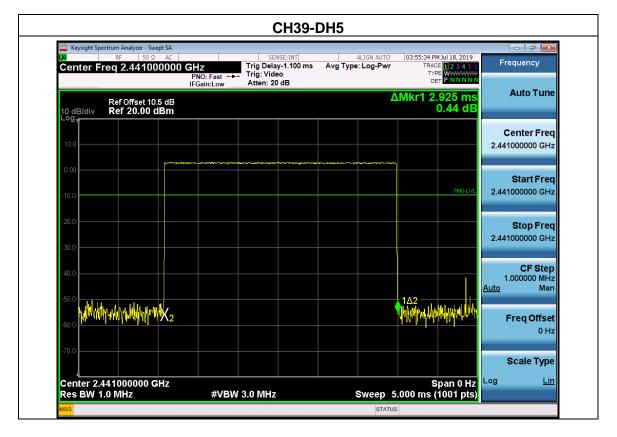
Test plot as follows:

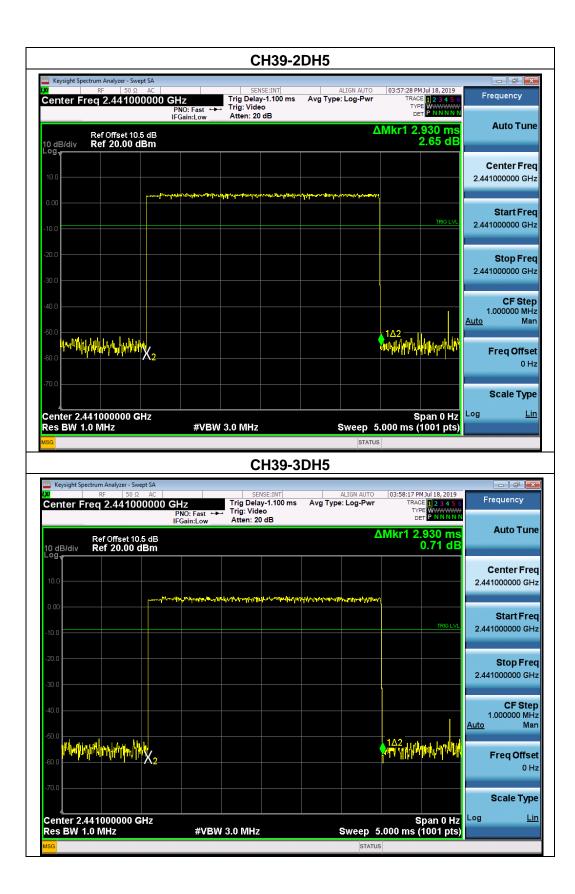
	CH39-	DH3	
Keysight Spectrum Analyzer - Swept SA        RF      50 Ω      AC        Center Freq 2.441000000 G	HZ Trig Delay-600.0 µs NO: Fast →→ Trig: Video	ALIGN AUTO 03:52:10 PMJul 18, 2019 Avg Type: Log-Pwr TRACE 12:34 5 6 TYPE	Frequency
	Gain:Low Atten: 20 dB	ΔMkr1 1.683 ms -2.02 dB	Auto Tune
			Center Freq 2.441000000 GHz
0.00			Start Freq
-10.0		TRIG LVL	2.441000000 GHz
-20.0			<b>Stop Freq</b> 2.441000000 GHz
-40.0			CF Step
-50.0		le 122 เปลา ประกัตรงสมัยเคืองว	1.000000 MHz <u>Auto</u> Man
-60.0 <b>///////////////////////////////////</b>			Freq Offset 0 Hz
-70.0			Scale Type
Center 2.441000000 GHz Res BW 1.0 MHz	#VBW 3.0 MHz	Span 0 Hz Sweep   3.000 ms (1001 pts)	Log <u>Lin</u>



Modulation	Data Packet	Frequency	Pulse Duration	Dwell Time	Limits
			(ms)	(s)	(s)
	DH5	2441 MHz	2.925	0.31	0.4
8-DPSK	2DH5	2441 MHz	2.930	0.31	0.4
	3DH5	2441 MHz	2.930	0.31	0.4

Test plot as follows:





# 4.9. Pseudorandom Frequency Hopping Sequence

### TEST APPLICABLE

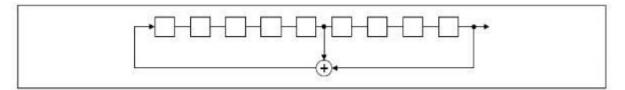
#### For 47 CFR Part 15C section 15.247 (a)(1) requirement:

Frequency hopping systems shall have hopping channel carrier fre-quencies separated by a minimum of 25 kHz or the 20 dB bandwidth of the hop-ping channel, whichever is greater. Al-ternatively, frequency hopping systems operating in the 2400–2483.5 MHz band may have hopping channel carrier fre-quencies that are separated by 25 kHz or two-thirds of the 20 dB bandwidth of the hopping channel, whichever is greater, provided the systems operate with an output power no greater than 125 mW. The system shall hop to channel frequencies that are selected at the system hopping rate from a pseudo ran-domly ordered list of hopping fre-quencies. Each frequency must be used equally on the average by each trans-mitter. The system receivers shall have input bandwidths that match the hop-ping channel bandwidths of their cor-responding transmitters and shall shift frequencies in synchronization with the transmitted signals.

#### EUT Pseudorandom Frequency Hopping Sequence Requirement

The pseudorandom frequency hopping sequence may be generated in a nice-stage shift register whose 5<sup>th</sup> and 9<sup>th</sup> stage outputs are added in a modulo-two addition stage. And the result is fed back to the input of the frist stage. The sequence begins with the frist one of 9 consecutive ones, for example: the shift register is initialized with nine ones.

- Number of shift register stages:9
- Length of pseudo-random sequence:29-1=511 bits
- Longest sequence of zeros:8(non-inverted signal)



Linear Feedback Shift Register for Generation of the PRBS sequence

An explame of pseudorandom frequency hopping sequence as follows:

0	2	4	6	62 64	78 1	73 75 77
Т						
				1 1 1		1
1					3 1 5	1

Each frequency used equally one the average by each transmitter.

The system receiver have input bandwidths that match the hopping channel bandwidths of their corresponding transmitter and shift frequencies in synchronization with the transmitted signals.

## 4.10. Antenna Requirement

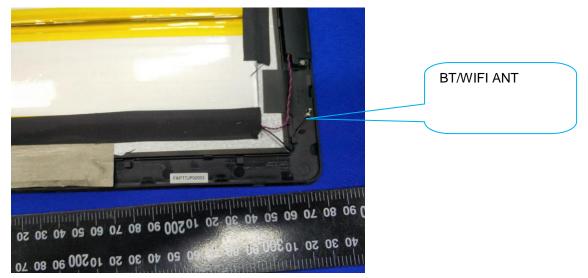
#### Standard Applicable

For intentional device, according to FCC 47 CFR Section 15.203, an intentional radiator shall be designed to ensure that no antenna other than that furnished by the responsible party shall be used with the device.

And according to FCC 47 CFR Section 15.247 (c), if transmitting antennas of directional gain greater than 6dBi are used, the power shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6dBi.

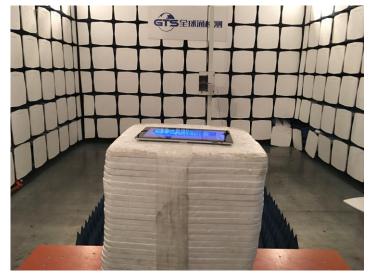
#### Test Result

The antenna used for this product is FPC Antenna and that no antenna other than that furnished by the responsible party shall be used with the device, the maximum peak gain of the transmit antenna is only 2.27dBi.

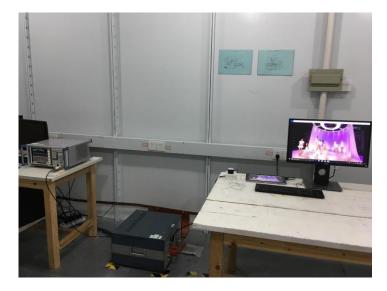


# 5. Test Setup Photos of the EUT





**Conducted Emission** 



# 6. External and Internal Photos of the EUT

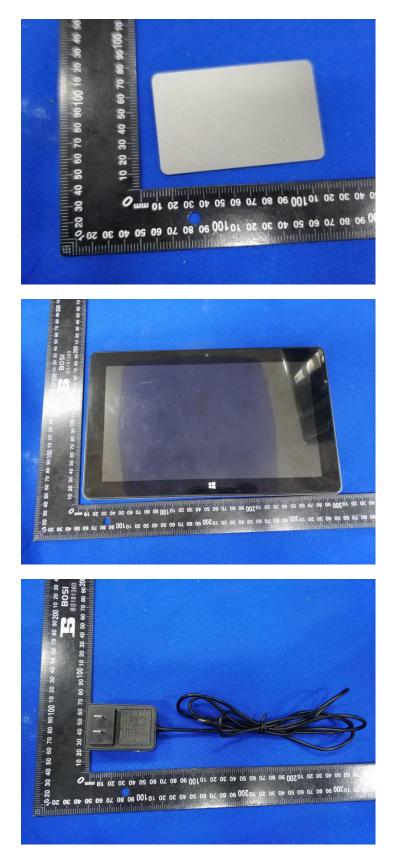
External Photos

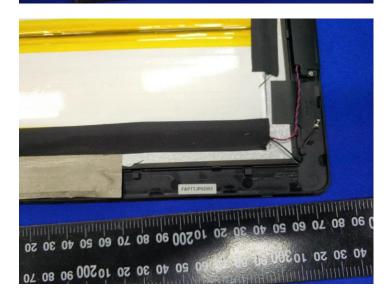








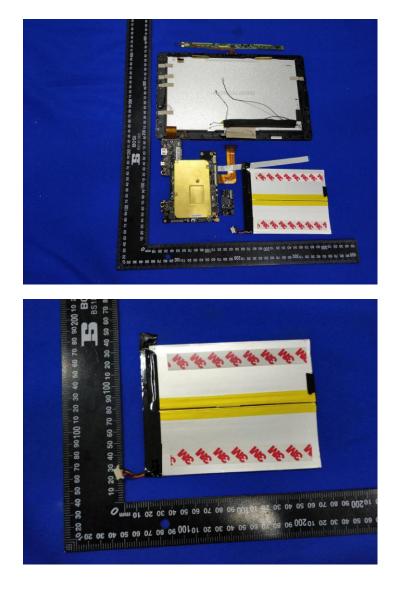




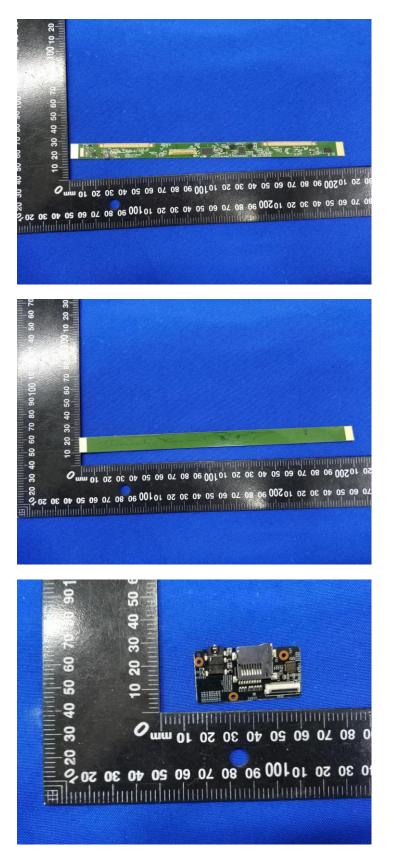


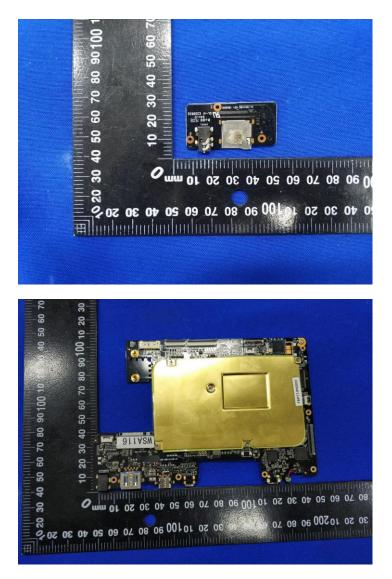
**Internal Photos** 

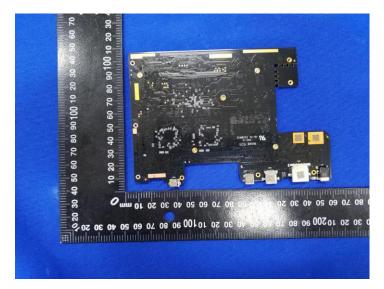
















.....End of Report.....