



#### TEST REPORT Report verification: Report Reference No...... CHTEW19070150 Project No..... SHT1906074401EW FCC ID..... **QRP-SP-010** Applicant's name .....: Azumi S.A Avenida Aquilino de la Guardia con Calle 47, PH Ocean Plaza, Address..... Piso 16 of. 16-01, Marbella, Ciudad de Panama, Panama Manufacturer..... **AZUMI HK LTD** FLAT/RM 18 BLK 1 14/F GOLDEN INDUSTRIAL BUILDING 16-Address..... 26 KWAI TAK STREET KWAI CHUNG,HK Test item description .....: **Mobile Phone** Trade Mark ..... AZUMI M5 Model/Type reference.....: Listed Model(s) ..... Standard .....: FCC CFR Title 47 Part 15 Subpart C Section 15.247 Date of receipt of test sample.....: Jun 28, 2019 Date of testing..... Jun 29, 2019- Jul 25, 2019 Date of issue.....: Jul 26, 2019 Result.....: PASS Compiled by Silvia Li Aaron.Fang ( Position+Printed name+Signature): File administrators Silvia Li Supervised by (Position+Printed name+Signature): Project Engineer Aaron Fang Approved by (Position+Printed name+Signature): RF Manager Hans Hu Shenzhen Huatongwei International Inspection Co., Ltd. Testing Laboratory Name .....:: 1/F, Bldg 3, Hongfa Hi-tech Industrial Park, Genyu Road, Address..... Tianliao, Gongming, Shenzhen, China Shenzhen Huatongwei International Inspection Co., Ltd. All rights reserved.

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The test report merely correspond to the test sample.

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# 1. TEST STANDARDS AND REPORT VERSION

## 1.1. 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

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

<u>KDB 558074 D01 15.247 Meas Guidance v05r01:</u> Guidance for Compliance Measurements on Digital Transmission System, Frequency Hopping Spread Spectrum System, and Hybrid System Devices Operating under Section 15.247 of The FCC Rules

## 1.2. Report version

Revision No.	Date of issue	Description
N/A	2019-07-26	Original

# 2. TEST DESCRIPTION

Test Item	Section in CFR 47	Result	Test Engineer
Antenna Requirement	15.203/15.247 (c)	PASS	Kang Yang
AC Power Line Conducted Emissions	15.207	PASS	Kang Yang
Conducted Peak Output Power	15.247 (b)(1)	PASS	Bruce Wong
20 dB Bandwidth	15.247 (a)(1)	PASS	Bruce Wong
Carrier Frequencies Separation	15.247 (a)(1)	PASS	Bruce Wong
Hopping Channel Number	15.247 (a)(1)	PASS	Bruce Wong
Dwell Time	15.247 (a)(1)	PASS	Bruce Wong
Pseudorandom Frequency Hopping Sequence	15.247(b)(4)	PASS	Bruce Wong
Restricted band	15.247(d)/15.205	PASS	Tony Duan
Radiated Emissions	15.247(d)/15.209	PASS	Tony Duan

Note: The measurement uncertainty is not included in the test result.

# 3. <u>SUMMARY</u>

## 3.1. Client Information

Applicant:	Azumi S.A
Address:	Avenida Aquilino de la Guardia con Calle 47, PH Ocean Plaza, Piso 16 of. 16-01, Marbella, Ciudad de Panama, Panama
Manufacturer:	AZUMI HK LTD
Address:	FLAT/RM 18 BLK 1 14/F GOLDEN INDUSTRIAL BUILDING 16-26 KWAI TAK STREET KWAI CHUNG,HK

## 3.2. Product Description

Name of EUT:	Mobile Phone
Trade Mark:	AZUMI
Model No.:	M5
Listed Model(s):	-
IMEI:	Conducted: 357665063588130 Radiated: 357665063587231
Power supply:	DC 3.8V
Adapter information:	Input:100-240Va.c., 50/60Hz, 0.2A Output:5.0Vd.c., 1.0A
Hardware version:	AZUMI_M5+_HW_V01
Software version: AZUMI_M5+_SW_V01	
Bluetooth	
Version:	Supported BT4.2+EDR
Modulation:	GFSK, π/4DQPSK, 8DPSK
Operation frequency:	2402MHz~2480MHz
Channel number:	79
Channel separation: 1MHz	
Antenna type: PIFA Antenna	
Antenna gain:	0.5dBi

## 3.3. Operation state

## Test frequency list

According to section 15.31(m), regards to the operating frequency range over 10 MHz, must select three channel which were tested. the Lowest frequency, the middle frequency, and the highest frequency of channel were selected to perform the test, please see the above gray bottom.

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

## > <u>TEST MODE</u>

For RF test items:

The engineering test program was provided and enabled to make EUT continuous transmit

For AC power line conducted emissions:

The EUT was set to connect with the Bluetooth instrument under large package sizes transmission.

For Radiated suprious emissions test item:

The engineering test program was provided and enabled to make EUT continuous transmit. The EUT in each of three orthogonal axis emissions had been tested ,but only the worst case (X axis) data recorded in the report.

## 3.4. EUT configuration

#### The following peripheral devices and interface cables were connected during the measurement:

- supplied by the manufacturer
- supplied by the lab

	1	Manufacturer:	/
	7	Model No.:	/
	/	Manufacturer:	/
		Model No.:	/

## 3.5. Modifications

No modifications were implemented to meet testing criteria.

## 4. TEST ENVIRONMENT

## 4.1. Address of the test laboratory

Laboratory: Shenzhen Huatongwei International Inspection Co., Ltd. Address: 1/F, Bldg 3, Hongfa Hi-tech Industrial Park, Genyu Road, Tianliao, Gongming, Shenzhen, China

## 4.2. Test Facility

#### CNAS-Lab Code: L1225

Shenzhen Huatongwei International Inspection Co., Ltd. has been assessed and proved to be in compliance with CNAS-CL01 Accreditation Criteria for Testing and Calibration Laboratories (identical to ISO/IEC17025: 2005 General Requirements) for the Competence of Testing and Calibration Laboratories.

#### A2LA-Lab Cert. No.: 3902.01

Shenzhen Huatongwei International Inspection Co., Ltd. EMC Laboratory has been accredited by A2LA for technical competence in the field of electrical testing, and proved to be in compliance with ISO/IEC 17025: 2005 General Requirements for the Competence of Testing and Calibration Laboratories and any additional program requirements in the identified field of testing.

#### FCC-Registration No.: 762235

Shenzhen Huatongwei International Inspection Co., Ltd. EMC Laboratory has been registered and fully described in a report filed with the FCC (Federal Communications Commission). The acceptance letter from the FCC is maintained in our files.

#### **IC-Registration No.:5377A**

Two 3m Alternate Test Site of Shenzhen Huatongwei International Inspection Co., Ltd. has been registered by Certification and Engineering Bureau of Industry Canada for the performance of radiated measurements with Registration No.: 5377A.

## ACA

Shenzhen Huatongwei International Inspection Co., Ltd. EMC Laboratory can also perform testing for the Australian C-Tick mark as a result of our A2LA accreditation.

## 4.3. Environmental conditions

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

Temperature:	15~35°C
Relative Humidity:	30~60 %
Air Pressure:	950~1050mba

## 4.4. Statement of the measurement uncertainty

The data and results referenced in this document are true and accurate. The reader is cautioned that there may be errors in calibration limits of the equipment and facilities. The measurement uncertainty was calculated for all measurements listed in this test report according to TR-100028-01 "Electromagnetic compatibility and Radio spectrum Matters (ERM); Uncertainties in the measurement of mobile radio equipment characteristics; Part 1" and TR-100028-02 "Electromagnetic compatibility and Radio spectrum Matters (ERM); Uncertainties in the measurement of mobile radio equipment characteristics; Part 2" and is documented in the Shenzhen Huatongwei International Inspection Co., Ltd. quality system according to 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.

Here after the best measurement capability for Shenzhen Huatongwei International Inspection Co., Ltd. is reported:

Test Items	Measurement Uncertainty	Notes
Transmitter power conducted	0.51 dB	(1)
Conducted spurious emissions 9kHz~40GHz	0.51 dB	(1)
Conducted Disturbance 150kHz~30MHz	3.02 dB	(1)
Radiated Emissions below 1GHz	4.90 dB	(1)
Radiated Emissions above 1GHz	4.96 dB	(1)
Occupied Bandwidth	70 Hz	(1)

(1) This uncertainty represents an expanded uncertainty expressed at approximately the 95% confidence level using a coverage factor of k=1.96

## 4.5. Equipments Used during the Test

•	Conducted Emission						
Used	Test Equipment	Manufacturer	Model No.	Serial No.	Last Cal. Date (YY-MM-DD)	Next Cal. Date (YY-MM-DD)	
•	Shielded Room	Albatross projects	N/A	N/A	2018/09/28	2023/09/27	
•	EMI Test Receiver	R&S	ESCI	101247	2018/10/27	2019/10/26	
•	Artificial Mains	SCHWARZBECK	NNLK 8121	573	2018/10/27	2019/10/26	
•	Pulse Limiter	R&S	ESH3-Z2	100499	2018/10/27	2019/10/26	
•	RF Connection Cable	HUBER+SUHNER	EF400	N/A	2018/11/15	2019/11/14	
•	Test Software	R&S	ES-K1	N/A	N/A	N/A	
0	Single Balanced Telecom Pair ISN	FCC	FCC-TLISN-T2-02	20371	2018/10/28	2019/10/27	
0	Two Balanced Telecom Pairs ISN	FCC	FCC-TLISN-T4-02	20373	2018/10/28	2019/10/27	
0	Four Balanced Telecom Pairs ISN	FCC	FCC-TLISN-T8-02	20375	2018/10/28	2019/10/27	
0	V-Network	R&S	ESH3-Z6	100211	2018/10/27	2019/10/26	
0	V-Network	R&S	ESH3-Z6	100210	2018/10/27	2019/10/26	
0	2-Line V-Network	R&S	ESH3-Z5	100049	2018/10/27	2019/10/26	

•	Radiated Emission-6th test site					
Used	Test Equipment	Manufacturer	Model No.	Serial No.	Last Cal. Date (YY-MM-DD)	Next Cal. Date (YY-MM-DD)
•	Semi-Anechoic Chamber	Albatross projects	SAC-3m-02	N/A	2018/09/30	2021/09/29
•	EMI Test Receiver	R&S	ESCI	100900	2018/10/28	2019/10/27
•	Loop Antenna	R&S	HFH2-Z2	100020	2017/11/20	2020/11/19
•	Ultra-Broadband Antenna	SCHWARZBECK	VULB9163	546	2017/04/05	2020/04/04
•	Pre-Amplifer	SCHWARZBECK	BBV 9742	N/A	2018/11/15	2019/11/14
•	RF Connection Cable	HUBER+SUHNER	N/A	N/A	2018/09/28	2019/09/27
•	RF Connection Cable	HUBER+SUHNER	SUCOFLEX104	501184/4	2018/09/28	2019/09/27
•	Test Software	R&S	ES-K1	N/A	N/A	N/A
•	Turntable	Maturo Germany	TT2.0-1T	N/A	N/A	N/A
•	Antenna Mast	Maturo Germany	CAM-4.0-P-12	N/A	N/A	N/A

•	Radiated emission-7th test site						
Used	Test Equipment	Manufacturer	Model No.	Serial No.	Last Cal. Date (YY-MM-DD)	Next Cal. Date (YY-MM-DD)	
•	Semi-Anechoic Chamber	Albatross projects	SAC-3m-01	N/A	2018/09/30	2021/09/29	
•	Spectrum Analyzer	R&S	FSP40	100597	2018/10/27	2019/10/26	
•	Horn Antenna	SCHWARZBECK	9120D	1011	2017/03/27	2020/03/26	
•	Pre-amplifier	BONN	BLWA0160-2M	1811887	2018/11/14	2019/11/13	
•	Pre-amplifier	CD	PAP-0102	12004	2018/11/14	2019/11/13	
•	Broadband Pre- amplifier	SCHWARZBECK	BBV 9718	9718-248	2019/04/26	2020/04/25	
•	RF Connection Cable	HUBER+SUHNER	RE-7-FH	N/A	2018/11/15	2019/11/14	
•	RF Connection Cable	HUBER+SUHNER	RE-7-FL	N/A	2018/11/15	2019/11/14	
•	Test Software	Audix	E3	N/A	N/A	N/A	

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D	Turntable	Maturo Germany	TT2.0-1T	N/A	N/A	N/A
	Antenna Mast	Maturo Germany	CAM-4.0-P-12	N/A	N/A	N/A

•	RF Conducted Method								
Used	Test Equipment	Manufacturer	Model No.	Serial No.	Last Cal. Date (YY-MM-DD)	Next Cal. Date (YY-MM-DD)			
•	Signal and spectrum Analyzer	R&S	FSV40	100048	2018/10/28	2019/10/27			
•	Spectrum Analyzer	Agilent	N9020A	MY50510187	2018/09/29	2019/09/28			
0	Radio communication tester	R&S	CMW500	137688-Lv	2018/09/29	2019/09/28			
0	Test software	Tonscend	JS1120-1(LTE)	N/A	N/A	N/A			
0	Test software	Tonscend	JS1120-2(WIFI)	N/A	N/A	N/A			
0	Test software	Tonscend	JS1120-3(WCDMA)	N/A	N/A	N/A			
0	Test software	Tonscend	JS1120-4(GSM)	N/A	N/A	N/A			

## 5. TEST CONDITIONS AND RESULTS

## 5.1. Antenna requirement

## **Requirement**

#### FCC CFR Title 47 Part 15 Subpart C 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. The use of a permanently attached antenna or of anantenna that uses a unique coupling to the intentional radiator, the manufacturer may design the unit so that a broken antenna can be replaced by the user, but the use of a standard antenna jack or electrical connector is prohibited.

#### FCC CFR Title 47 Part 15 Subpart C Section 15.247(c) (1)(i):

(i) Systems operating in the 2400~2483.5 MHz band that is used exclusively for fixed. Point-to-point operations may employ transmitting antennas with directional gain greater than 6 dBi provided the maximum conducted output power of the intentional radiator is reduced by 1 dB for every 3 dB that the directional gain of the antenna exceeds 6 dBi.

## Test Result:

## ☑ Passed □ Not Applicable

The directional gain of the antenna less than 6 dBi, please refer to the below antenna photo.



## 5.2. Conducted Emissions (AC Main)

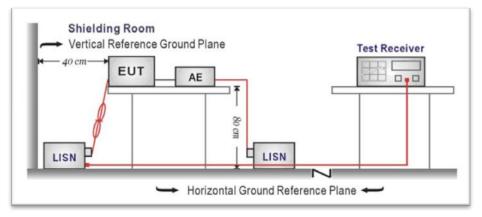
## <u>LIMIT</u>

FCC CFR Title 47 Part 15 Subpart C Section 15.207

	Limit (d	lBuV)
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 CONFIGURATION**



## TEST PROCEDURE

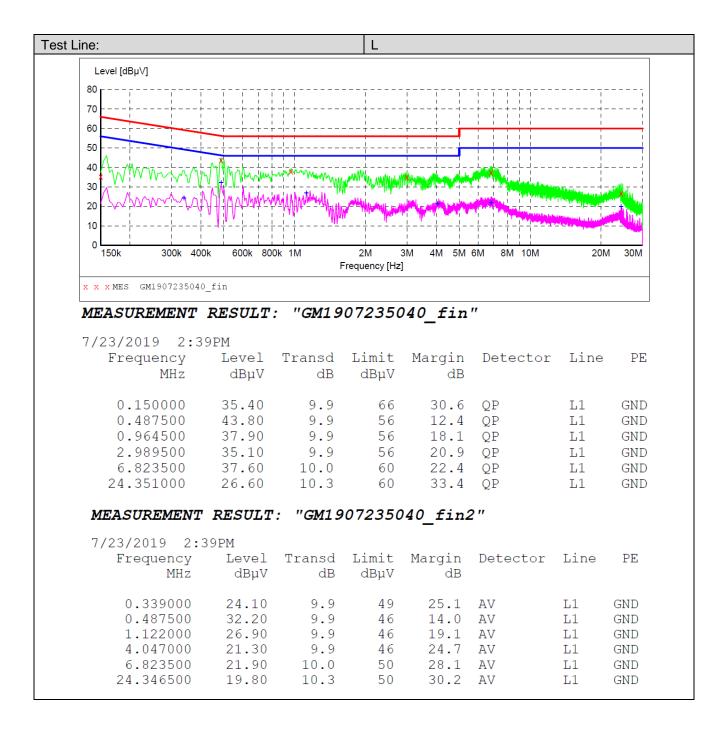
- 1. The EUT was setup according to ANSI C63.10:2013 requirements.
- 2. The EUT was placed on a platform of nominal size, 1 m by 1.5 m, raised 80 cm above the conducting ground plane. The vertical conducting plane was located 40 cm to the rear of the EUT. All other surfaces of EUT were at least 80 cm from any other grounded conducting surface.
- 3. The EUT and simulators are connected to the main power through a line impedances stabilization network (LISN). The LISN provides a 50 ohm /50uH coupling impedance for the measuring equipment.
- 4. The peripheral devices are also connected to the main power through a LISN. (Please refer to the block diagram of the test setup and photographs)
- 5. Each current-carrying conductor of the EUT power cord, except the ground (safety) conductor, was individually connected through a LISN to the input power source.
- 6. The excess length of the power cord between the EUT and the LISN receptacle were folded back and forth at the center of the lead to form a bundle not exceeding 40 cm in length.
- 7. Conducted emissions were investigated over the frequency range from 0.15MHz to 30MHz using a receiver bandwidth of 9 kHz.
- 8. During the above scans, the emissions were maximized by cable manipulation.

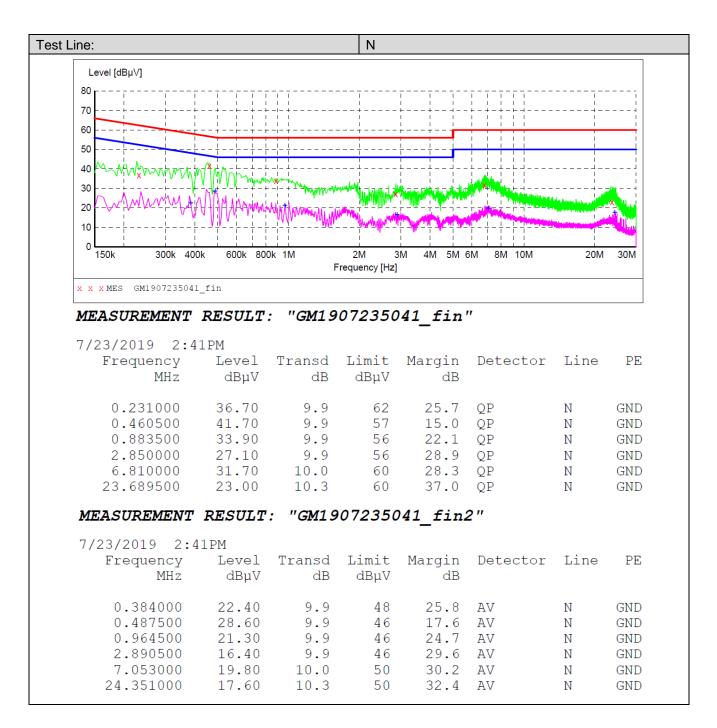
## TEST RESULTS

## ☑ Passed □ Not Applicable

Note:

- 1) Transd= Cable lose + Pulse Limiter Factor + Artificial Mains Factor
- 2) Margin= Limit Level



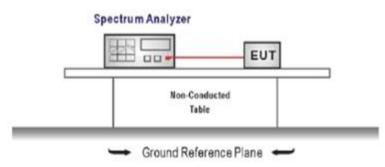


## 5.3. Conducted Peak Output Power

#### <u>LIMIT</u>

FCC CFR Title 47 Part 15 Subpart C Section 15.247 (b)(1): 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 CONFIGURATION**



#### TEST PROCEDURE

- 1. The transmitter output was connected to the spectrum analyzer through an attenuator, the pathloss was compensated to the results for each measurement.
- 2. Set to the maximum power setting and enable the EUT transmit continuously
- Use the following spectrum analyzer settings: Span = approximately 5 times the 20 dB bandwidth, centered on a hopping channel RBW≥ the 20 dB bandwidth of the emission being measured, VBW≥RBW Sweep = auto, Detector function = peak, Trace = max hold
- 4. Measure and record the results in the test report.

#### TEST MODE:

Please refer to the clause 3.3

#### TEST RESULTS

#### ☑ Passed □ Not Applicable

Modulation type	Modulation type Channel		Average Output power (dBm)	Limit (dBm)	Result
	00	4.59	4.55		
GFSK	39	3.82	3.75	≤ 30.00	Pass
	78	3.19	3.12		
	00	5.46	3.58		
π/4DQPSK	39	4.44	2.75	≤ 21.00	Pass
	78	4.02	2.60		
	00	5.57	3.99		
8DPSK	39	4.35	2.39	≤ 21.00	Pass
	78	3.91	2.27		

Modulation Type: GFSK Spectrum Ref Level 20.00 dBm Att 30 dB Count 500/500 1Pk View Offset 1.00 dB ● RBW 1 MHz SWT 1 ms ● VBW 3 MHz Mode Auto Sweep M1[1] 4.59 dt 2.40180460 G LO dBm M1 ) dBm **~**~ 10 dBm-7 -20 dBm CH00 M -38 dBm -40 dBm 50 dBm 60 dBm 70 dBm 691 pts .0 MHz CF 2.402 GH Date:10.JUL.2019 09:57:0 Spectrum 
 Ref Level
 20.00 dBm
 Offset
 1.00 dB
 RBW
 1 MHz

 Att
 30 dB
 SWT
 1 ms
 VBW
 3 MHz
 Mode Auto Sweep Count 500/500 M1[1] 3.82 dE 2.44081910 G 10 dBm M1 ) dBm--10 dBm 20 dBr UN CH39 18m 30 T I 40-dé 50 dBm -60 dBm 70 dBm-CF 2.441 GH 691 pts 5.0 MHz Sp 1110 A.M Date:10.JUL.2019 10:01:18 Spectrum RefLevel 20.00 dBm Offset 1.00 dB ● RBW 1 MHz Att 30 dB SWT 1 ms ● VBW 3 MHz Mode Auto Sweep Count 500/500 M1[1] 3.19 dB 2.48001450 GF 10 dBm-0 dBm -10 dBm 20 dBm CH78 80 dBm-40 dBm--50 dBm -60 dBm 70 dBm 691 pts .0 MHz CF 2.48 G **E** Date:10.JUL.2019 11:17:32

Modulation Type:	π/4DQPSK
	Spectrum         (100)           Ref Level 20.00 dBm         Offset 1.00 dB ● RBW 2 MHz
	Att 30 dB SWT 1 ms → VBW 5 MHz Mode Auto Sweep Count 500/500
	●1Pk View M1[1] 5.46 dBm
	10 dBm M1 Z.40216640 GHz
	0 dBm
	-10 dBm-
01100	-20 dBm
CH00	-30 dBm
	-40 d8m
	-50 dBm-
	-60 dBm
	-70 dBm
	CF 2.402 GHz 691 pts Span 5.0 MHz
	Messucino- (III IIII) 44
	Dam:10.JUL.2019 11:3319
	Spectrum Ref Level 20.00 dBm Offset 1.00 dB ● RBW 2 MHz
	Att 30 dB SWT 1 ms VBW 5 MHz Mode Auto Sweep Count 500/500
	IPk View
	10 dBm M1[1] 4.4+ dBm 2.4+1166+0 GHz
	0 dBm
	410 dBm
	-20 dBm
CH39	-30 dBm
	-40 dBm
	-50 dBm
	-60 dBm
	-70 dBm
	CF 2.441 GHz         691 pts         Span 5.0 MHz
	Cr 2.111 Gr 2 091 pts Span 3.0 Minz
	Date:10_JUL.2019 11:34:37
	Spectrum 🕎
	Ref Level 20.00 dBm         Offset 1.00 dB         RBW         2 MHz           ● Att         30 dB         SWT         1 ms         ● VBW 5 MHz
	Count 500/500
	M1[1] 4.02 dBm 2.48012300 GHz
	10 dBm M1
	0 dBm
	-10 dBm
	-20 dBm
CH78	
	-30 dBm
	-40 dBm
	-50 d8m-
	-60 dBm-
	-70 dBm
	CF 2.48 GHz 691 pts Span 5.0 MHz
	Measuring

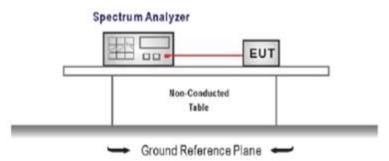
Iodulation Type:	8DPSK
	Spectrum Ref Level 20.00 dBm Offset 1.00 dB  RBW 2 MHz
	Att 30 dB SWT 1 ms VBW 5 MHz Mode Auto Sweep Count 500/500     1Pk View     M1[1] 5.57 dBm
	10 dBm
	0 dBm
CH00	-20 dBm
CHOO	-30 dBm
	-50 dBm
	-70 dBm
	CF 2.402 GHz 691 pts Span 4.804 MHz
	Spectrum
	Ref Level 20.00 dBm         Offset 1.00 dB         RBW 2 MHz         Att         30 dB         SWT         1 ms         VBW 5 MHz         Mode         Auto Sweep           Count 500/500         E         F         VBW 5 MHz         Mode         Auto Sweep         Count 500/500         E         F         VBW         S
	10 dBm M1[1] 4.35 dBm
	0 d8m
0.100	-20 dBm
CH39	-30 dBm
	-50 dBm
	-60 dBm
	CF 2.441 GHz 691 pts Span 5.0 MHz
	Spectrum
	Ref Level         20.00 dbm         Offset         1.00 db         RBW         2 MHz <ul></ul>
	PIR View      M1[1]     3.91 dBm      2.48005070 GHz
	0 dBm
	-10' dBm
CH78	-30 dBm
	-50 dBm-
	-60 dBm
	CF 2.48 GHz         691 pts         Span 5.0 MHz

## 5.4. 20 dB Bandwidth

## LIMIT

N/A

## **TEST CONFIGURATION**



## TEST PROCEDURE

- 1. The transmitter output was connected to the spectrum analyzer through an attenuator, the path loss was compensated to the results for each measurement.
- 2. Set to the maximum power setting and enable the EUT transmit continuously
- 3. Use the following spectrum analyzer settings:

Span = approximately 2 to 3 times the 20 dB bandwidth, centered on a hopping channel RBW  $\ge$  1% of the 20 dB bandwidth, VBW  $\ge$  RBW

Sweep = auto, Detector function = peak, Trace = max hold

4. Measure and record the results in the test report.

## TEST MODE:

Please refer to the clause 3.3

## TEST RESULTS

🛛 Passed

#### Not Applicable

Modulation type	Channel	20 dB Bandwidth (MHz)	Limit (MHz)	Result
	00	0.88		
GFSK	39	0.92	-	Pass
	78	0.92		
	00	1.28		
π/4DQPSK	39	1.28	-	Pass
	78	1.29		
	00	1.29		
8DPSK	39	1.29	-	Pass
	78	1.29		

Modulation Type:	GFSK
	Spectrum         Image: Constraint of the section of the sectio
	10 dBm         M1[1]         -21.98 dBm           10 dBm         2.40150250 GHz         -1.12 dBm           0 dBm         M2[1]         -1.12 dBm           0 dBm         /hc/M/M/M/M         2.40204000 GHz
СН00	-10 dBm -20. dBm -30 dBm -40 dBm -4
	-50 dBm -60 dBm -70
	Marker           Type         Ref         Trc         X-value         Y-value         Function         Function Result           M1         1         2.4015925 GHz         ~21.90 dBm              M2         1         2.40204 GHz         ~1.12 dBm               D3         M1         1         882.5 kHz         ~0.03 dB
	Date://0.2012/09.694688
	Att 30 dB SWT 189.6 µs v VBW 30 kHz Mode Auto FFT Count 500/500      ●1Pk View
01/00	-10 dBm -20 dBm -21 -21.943 dBm -30 dBm -40
CH39	-40 dsm
	CF 2.441 CHz         1001 pts         Span 2.5 MHz           Marker           Type         Ref         Tr         X-volue         Function         Function Result           M1         1         2.44053 GHz         -23.51 dBm         Function         Function Result           M2         1         2.44104 GHz         -1.94 dBm         Function         Function           D3         M1         92.55 kHz         1.20 dB         Function
	Mexandrap         Mexandrap           Date: 10_JUL_2019         10.01.09
	Spectrum         Image: Constraint of the sector of t
	10 dBm         M1[1]         -24.83 dBm           10 dBm         2.47953000 GHz         -3.44 dBm           0 dBm         M2[1]         -3.44 dBm           -10 dBm
CH78	-20 dBm 01 -23.440 dBm 44 77 77 77 77 77 77 77 77 77 77 77 77
	-50.48m
	Marker           Type         Ref         Trc.         X-value         Y-value         Function         Function Result           M2         1         2.4755         6½         -24.80 dbm         -24.91 dbm         -24.91 dbm           M2         1         2.49004         GHz         -3.44 dbm
	Date:10.JUL.2019 10.62:65

Modulation Type: π/4DQPSK Spectrum RefLevel 20.00 dBm Att 30 dB Offset 1.00 dB ● RBW 30 kHz SWT 63.1 µs ● VBW 100 kHz Mode Auto FFT Att Count 500/500 1Pk View M1[1] -18.29 dE 2.40135750 G 2.16 dE 2.40183500 G 10 dBm M2[1] 0 dBm-1  $\sim$ -10 dBm м1. -20 dBm--30 dBm CH00 -40 d8m--50 dBm 60 dBm 70 dBm CF 2.402 GHz 1001 pts Span 2.5 MHz X-value 2.4013575 GHz 2.401835 GHz 1.28 MHz Y-value -18.29 dBm 2.16 dBm 0.35 dB Type Ref Trc Function Function Result M2 M1 Date:10.JUL.2019 11:36:56 ₽ Spectrum Ref Level 20.00 dBm Att 30 dB Mode Auto FFT Count 500/500 M1[1] -19.61 c 10 dBm M2[1] 0.99.0 M2 2.44083500 GH 0 dBm 10 dBm M1 1 -19.01 20 dBm 30 dBm CH39 40 dBm 50 dBm -60 dBm -70 dBm CF 2.441 GH 1001 pt: Span 2.5 MHz larke Type Ref Trc M1 1 X-value 2.440355 GHz 2.440835 GHz 1.2825 MHz Y-value -19.61 dBm 0.99 dBm 0.41 dB Function Function Result M2 D3 М1 Date:10.JUL.2019 11:39:00 Spectrum ₿ RefLevel 20.00 dBm Att 30 dB Offset 1.00 dB ● RBW 30 kHz SWT 63.1 µs ● VBW 100 kHz Mode Auto FFT Count 500/500 M1[1] -20.11 dB 2.47935500 GH 10 dBm M2[1] 0.42 dB 2.47983500 GF M2 0 dBm -10 dBm мил 20 -19.5 30 dBi **CH78** 40 dBm 50 dBm 60 dBm 70 dBm CF 2.48 larke X-value 2.479355 GHz 2.479835 GHz 1.285 MHz Y-value -20.11 dBm 0.42 dBm 0.20 dB Function Result Type Ref Trc Function MI Date:10.JUL.2019 11:40:4

Modulation Type: **8DPSK** Spectrum RefLevel 20.00 dBm Att 30 dB Offset 1.00 dB ● RBW 30 kHz SWT 63.1 µs ● VBW 100 kHz Mode Auto FFT Att Count 500/500 1Pk View -18.86 dE 2.40133750 GI 1.22 dB 2.40182750 GI M1[1] 10 dBm M2[1] 0 dBm-~~ -10 dBm M1 D1 -18.7 -20 dBm--30 dBm -40 dBm<sub>2</sub> CH00 -50 dBm 60 dBm-70 dBm CF 2.402 GHz 1001 pts Span 2.5 MHz X-value 2.4013375 GHz 2.4018275 GHz 1.285 MHz Type Ref Trc Function Function Result Y-value -18.86 dBr -18.86 dBm 1.22 dBm -0.19 dB M1 M2 M1 Date:10.JUL.2019 13:12:52 Spectrum 
 Ref Level
 20.00 dBm
 Offset
 1.00 dB
 ■ RBW
 30 kHz

 Att
 30 dB
 SWT
 63.1 μs
 ■ VBW
 100 kHz
 Mode Auto FFT Count 500/500 M1[1] 2.440337 10 dBm M2[1] ..... M2 2.44082750 GH 0 dBm -10 dBm ML 01 -19.93 20 dBm 30 dBm CH39 40 dBm--50 dBm -60 dBm -70 dBm CF 2.441 GH 1001 pt Span 2.5 MHz larke Type Ref Trc M1 1 X-value 2.4403375 GHz 2.4408275 GHz 1.285 MHz Y-value -20.25 dBm 0.06 dBm 0.23 dB Function Function Result 1 M2 D3 М1 Date:10.JUL.2019 13:14:27 ♥ Spectrum 
 RefLevel
 20.00 dBm
 Offset
 1.00 dB ●
 RBW
 30 kHz

 Att
 30 dB
 SWT
 63.1 µs ●
 VBW
 100 kHz
 Mode Auto FFT
 Count 500/500 M1[1] -20.80 dB 2.47933750 GF 10 dBm M2[1] -0.55 dB 2.47982750 GF M 0 dBm Λ -10 dBm ML/ 20 dB -20.5 30 dBr **CH78** 40 dBm 50 dBm 60 dBm 70 dBm CF 2.48 larke X-value 2.4793375 GHz 2.4798275 GHz 1.285 MHz Y-value -20.80 dBm -0.55 dBm 0.11 dB Function Result Type Ref Trc Function MI ------Date:10.JUL.2019 13:15:42

## 5.5. Carrier Frequencies Separation

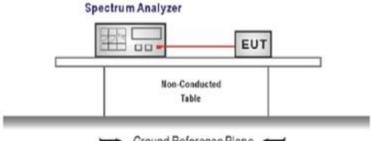
#### <u>LIMIT</u>

FCC CFR Title 47 Part 15 Subpart C Section 15.247 (a)(1):

Frequency hopping systems shall have hopping channel carrier frequencies separated by a minimum of 25 kHz or the 20 dB bandwidth of the hopping channel, whichever is greater. Alternatively,

Frequency hopping systems operating in the 2400-2483.5 MHz band may have hopping channel carrier frequencies 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.

#### **TEST CONFIGURATION**



- Ground Reference Plane

## TEST PROCEDURE

- 1. The transmitter output was connected to the spectrum analyzer through an attenuator, the path loss was compensated to the results for each measurement.
- 2. Set to the maximum power setting and enable the EUT transmit continuously
- Use the following spectrum analyzer settings: Span = wide enough to capture the peaks of two adjacent channels RBW ≥ 1% of the span, VBW ≥ RBW Sweep = auto, Detector function = peak, Trace = max hold
- 4. Measure and record the results in the test report.

#### TEST MODE:

Please refer to the clause 3.3

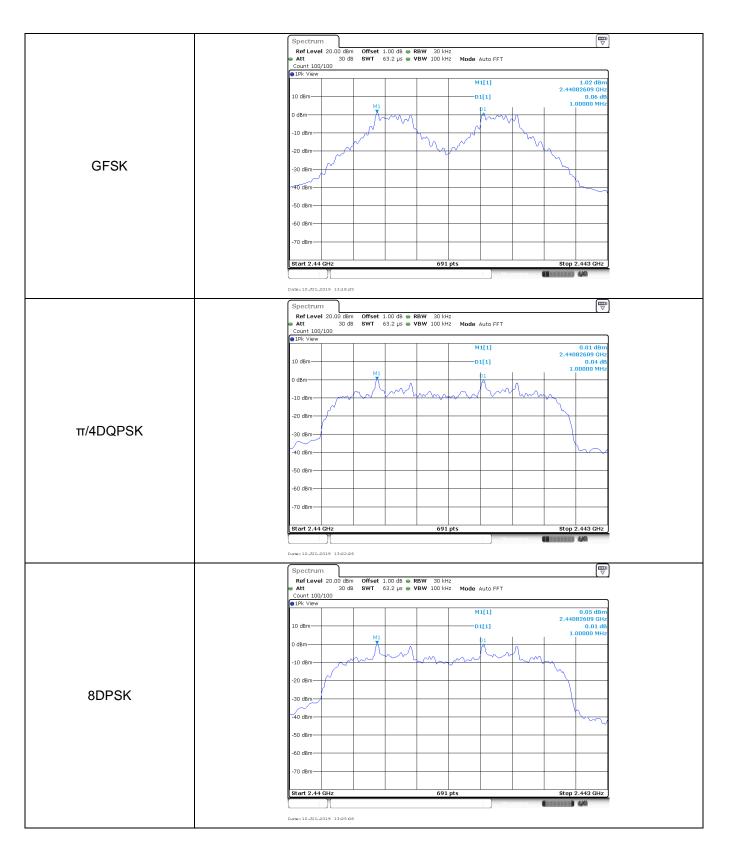
#### TEST RESULTS

#### ☑ Passed □ Not Applicable

Modulation type	Channel	Carrier Frequencies Separation (MHz)	Limit (MHz) *	Result
GFSK	39	1.00	≥0.92	Pass
π/4DQPSK	39	1.00	≥0.86	Pass
8DPSK	39	1.00	≥0.86	Pass

Note:

\*: GFSK limit = The maximum 20 dB Bandwidth for GFSK modulation on the section 5.4.  $\pi$ /4DQPSK limit = 2/3 \* The maximum 20 dB Bandwidth for  $\pi$ /4DQPSK modulation on the section 5.4. 8DPSK limit = 2/3 \* The maximum 20 dB Bandwidth for 8DPSK modulation on the section 5.4

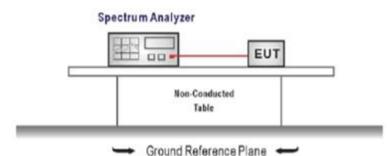


## 5.6. Hopping Channel Number

#### LIMIT

FCC CFR Title 47 Part 15 Subpart C Section 15.247 (a)(1):Frequency hopping systems in the 2400–2483.5 MHz band shall use at least **15** channels.

#### **TEST CONFIGURATION**



#### TEST PROCEDURE

- 1. The transmitter output was connected to the spectrum analyzer through an attenuator, the path loss was compensated to the results for each measurement.
- 2. Set to the maximum power setting and enable the EUT transmit continuously
- Use the following spectrum analyzer settings: Span = the frequency band of operation RBW ≥ 1% of the span, VBW ≥ RBW Sweep = auto, Detector function = peak, Trace = max hold
- 4. Measure and record the results in the test report.

## TEST MODE:

Please refer to the clause 3.3

#### TEST RESULTS

☑ Passed □ Not Applicable

Modulation type	Channel number	Limit	Result
GFSK	79		
π/4DQPSK	79	≥15.00	Pass
8DPSK	79		

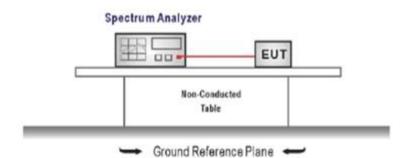
	Spectrum
	Ref Level 20.00 dBm         Offset 1.00 dB         RBW 100 kHz         Mode         Auto Sweep           Att         30 dB         SWT         1 ms         VBW 300 kHz         Mode         Auto Sweep
	10 dBm
	-14. <del>26.96.01.01.01.01.01.01.01.01.01.01.01.01.01.</del>
	-20 dBm
GFSK	-30 d8m
	40 d8m
	,50 d8m
	-60 d8m-
	-70 dBm
	Start 2.4 GHz 691 pts Stop 2.4835 GHz
	Nescring
	Data:10.JUL.2019 13:20:48
	Spectrum         T           Ref Level 20.00 dBm         Offset 1.00 dB • RBW 100 kHz
	Att 30 dB SWT 1 ms VBW 300 kHz Mode Auto Sweep
	10 dBm
	o Japh mar and an and an and an and a mark and a mark and an and a mark and and a mark and a mark and a mark and
	-10 dBm
	-20 dBm
π/4DQPSK	
11/4DQF3K	-80 dBm-
	#40 dBm
	-50 dBm
	-60 d8m
	-70 dBm-
	Start 2.4 GHz         691 pts         Stop 2.4835 GHz
	Data:10.JUL.2019 13.23.09
1	Spectrum
	Ref Level 20.00 dBm Offset 1.00 dB  RBW 100 kHz Att 30 dB SWT 1 ms VBW 300 kHz Mode Auto Sweep
	Pik View
	10 dBm
	opention and a second s
	-10 dBm-
	-20 dBm
8DPSK	-30 dBm
	pH0 dBm
	-50 dBm-
	-60 d8m
	-70 dBm

## 5.7. Dwell Time

## <u>LIMIT</u>

FCC CFR Title 47 Part 15 Subpart C Section 15.247 (a)(1):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 CONFIGURATION**



## TEST PROCEDURE

- 1. The transmitter output was connected to the spectrum analyzer through an attenuator, the path loss was compensated to the results for each measurement.
- 2. Set to the maximum power setting and enable the EUT transmit continuously
- Use the following spectrum analyzer settings: Span = zero span, centered on a hopping channel, RBW= 1 MHz, VBW ≥ RBW Sweep = as necessary to capture the entire dwell time per hopping channel, Detector function = peak, Trace = max hold
- 4. Measure and record the results in the test report.

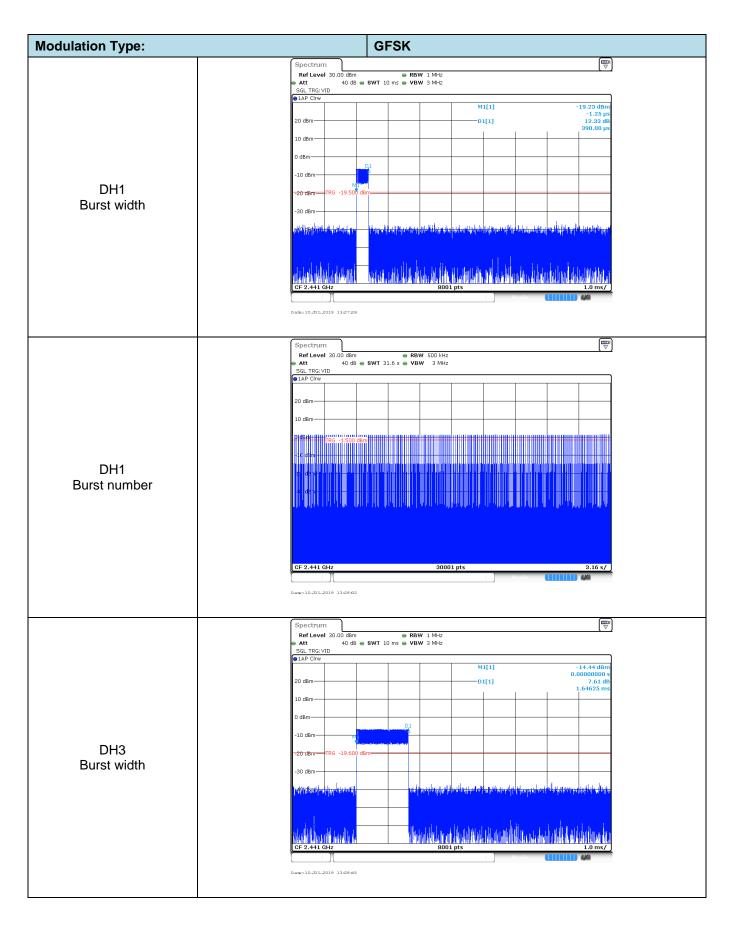
## TEST MODE:

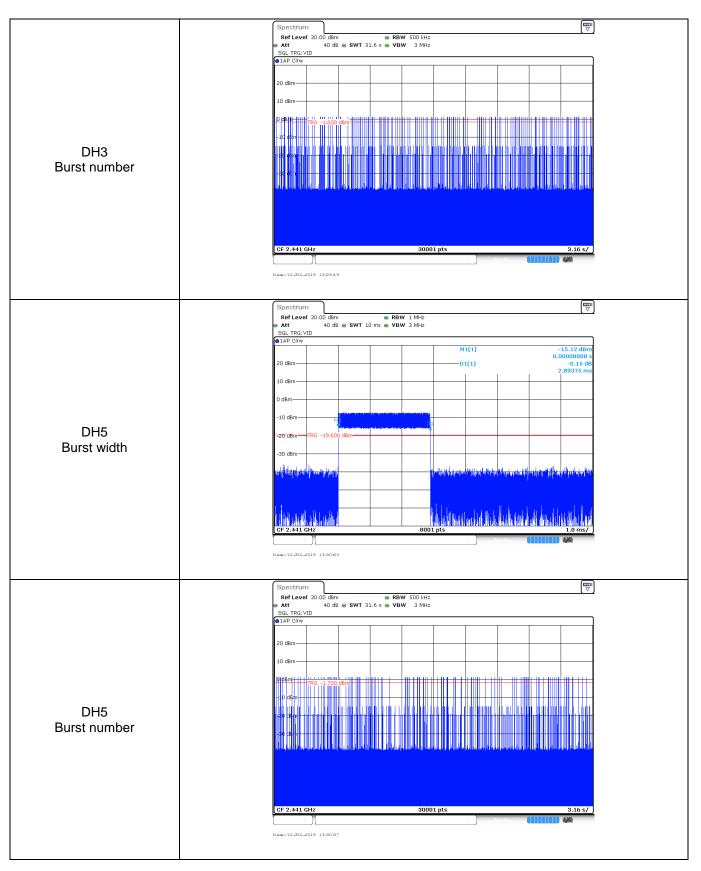
Please refer to the clause 3.3

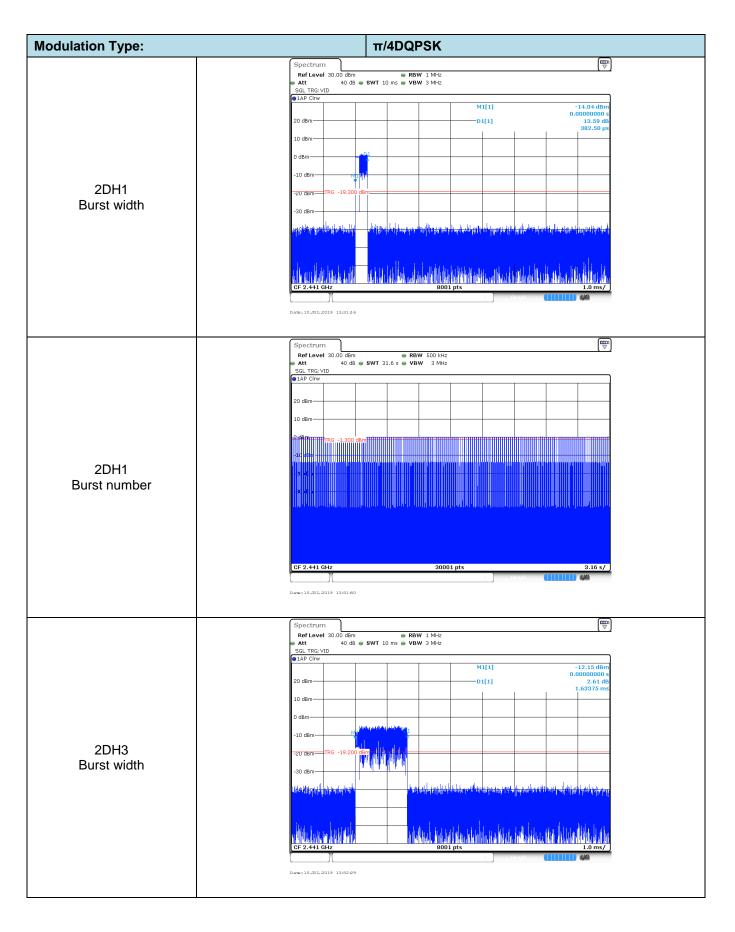
#### TEST RESULTS

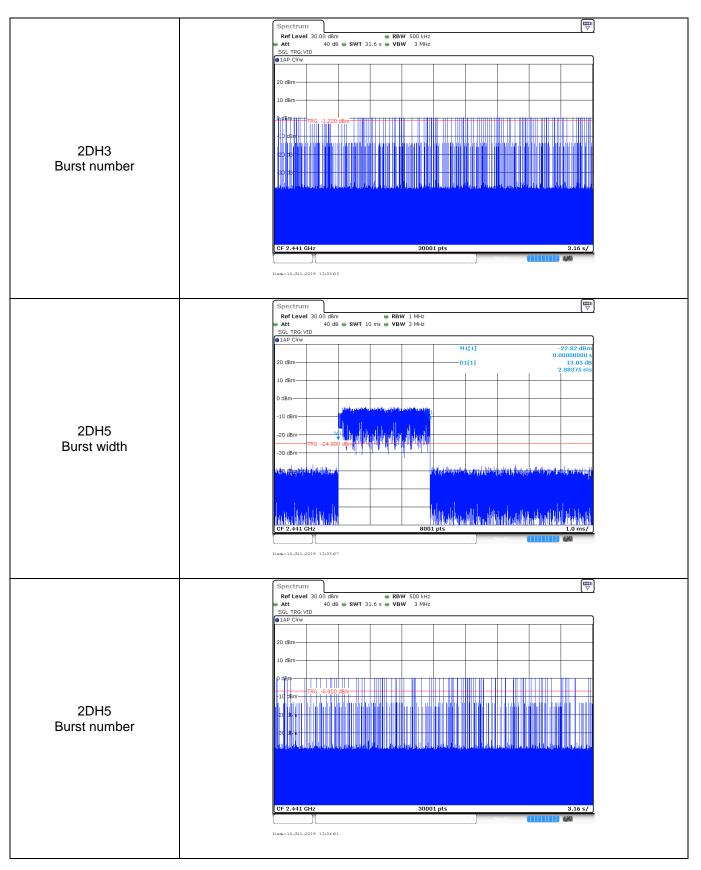
## ☑ Passed □ Not Applicable

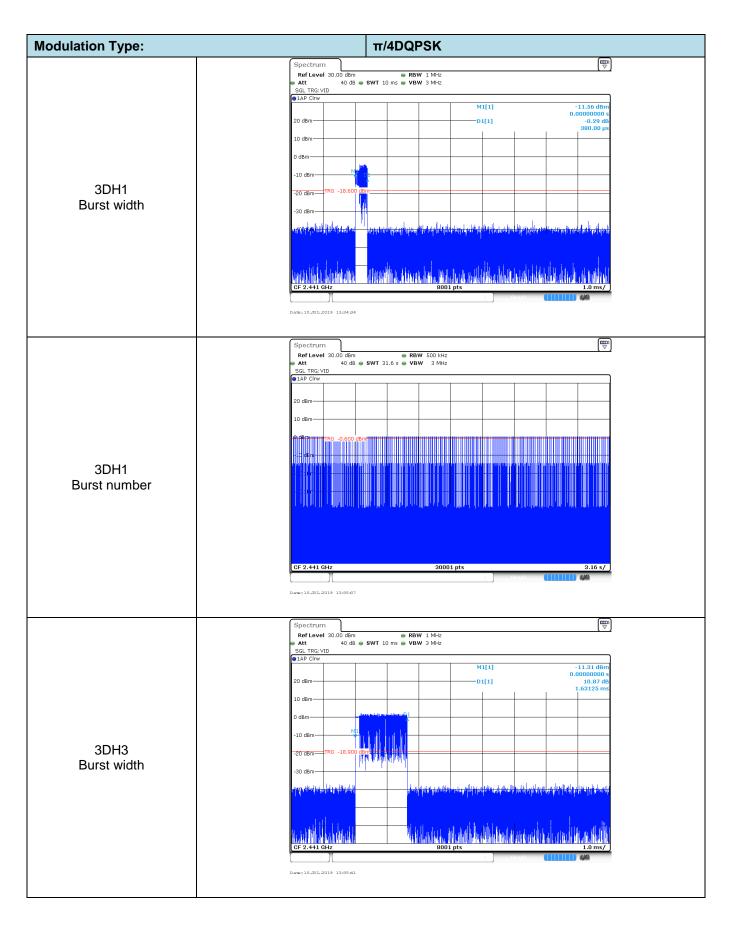
Modulation type	Channel	Burst Width [ms/hop/ch]	Total Hops[hop*ch]	Dwell time (Second)	Limit (Second)	Result
	DH1	0.39	320.00	0.13		
GFSK	DH3	1.65	156.00	0.26	≤ 0.40	Pass
	DH5	2.89	122.00	0.35		
	2DH1	0.38	320.00	0.12		
π/4DQPSK	2DH3	1.63	157.00	0.26	≤ 0.40	Pass
	2DH5	2.88	98.00	0.28		
	3DH1	0.38	321.00	0.12		
8DPSK	3DH3	1.63	162.00	0.26	≤ 0.40	Pass
	3DH5	2.88	103.00	0.30		

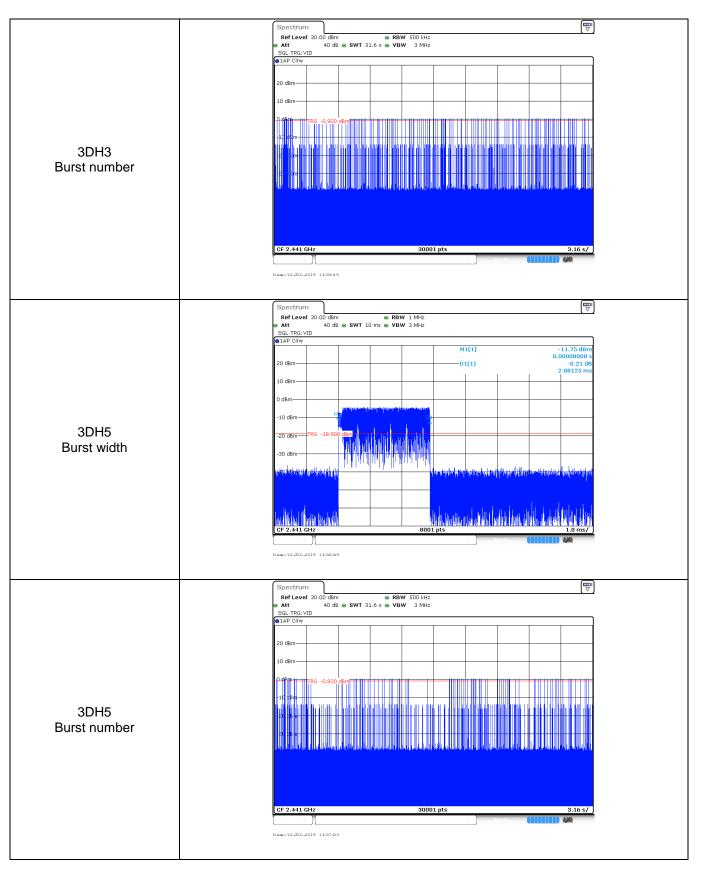












## 5.8. Pseudorandom Frequency Hopping Sequence

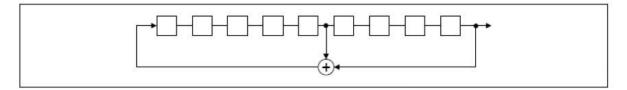
## <u>LIMIT</u>

FCC CFR Title 47 Part 15 Subpart C Section 15.247 (a)(1):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 chan-nel 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.

## TEST RESULTS

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 friststage. 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 7
٦				 ·····			1			П
							i i			
				1			1			
				 			<u>i</u>		 _Ĺ_	

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.

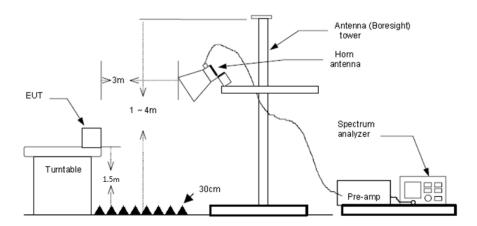
## 5.9. Restricted band (radiated)

#### <u>LIMIT</u>

#### FCC CFR Title 47 Part 15 Subpart C Section 15.247 (d):

In any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated intentional radiator is operating, Radiated Emissions which fall in the restricted bands, as defined in §15.205(a), must also comply with the Radiated Emissions limits specified in §15.209(a) (see §15.205(c)).

#### **TEST CONFIGURATION**



#### TEST PROCEDURE

- 1. The EUT was setup and tested according to ANSI C63.10:2013 for compliance to FCC 47CFR 15.247 requirements.
- 2. The EUT is placed on a turn table which is 1.5 meter above ground. The turn table is rotated 360 degrees to determine the position of the maximum emission level.
- 3. The EUT waspositioned such that the distance from antenna to the EUT was 3 meters.
- 4. The antenna is scanned from 1 meter to 4 meters to find out the maximum emission level. This is repeated for both horizontal and vertical polarization of the antenna. In order to find the maximum emission, all of the interface cables were manipulated according to ANSI C63.10:2013 on radiated measurement.
- The receiver set as follow: RBW=1 MHz, VBW=3 MHz Peak detector for Peak value RBW=1 MHz, VBW=10 Hz Peak detector for Average value.

#### TEST MODE:

Please refer to the clause 3.3

#### TEST RESULTS

☑ Passed □ Not Applicable

Note:

- 1) Final level= Read level + Factor
- 2) Have pre-scan all modulation mode, found the GFSK modulation which it was worst case, so only the worst case's data on the test report.
- 3) The peak level is lower than average limit(54 dBuV/m), this data is the too weak instrument of signal is unable to test.

Test channe	l:		С	СН00					
Frequency (MHz)	Read Level (dBuV)	Factor (dB/m)	Level (dBuV/m)	Limit Line (dBuV/m)	Margin (dB)	Polarization	Test value		
2310.10	52.36	-2.34	50.02	74.00	23.98	Horizontal	Peak		
2390.00	0.00 52.07 -2.41 49.66		74.00	24.34	Horizontal	Peak			
2310.10	0.10 52.26 -2.34 49.92		74.00	24.08	Vertical	Peak			
2390.00	52.91	-2.41	50.50	74.00	23.50	Vertical	Peak		
2310.10	42.30	-2.34	39.96	54.00	14.04	Horizontal	Average		
2390.00	41.83	-2.41	39.42	54.00	14.58	Horizontal	Average		
2310.10	42.30	-2.34	39.96	54.00	14.04	Vertical	Average		
2390.00	41.83	-2.41	39.42	54.00	14.58	Vertical	Average		

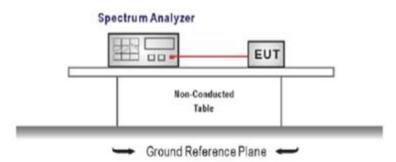
Test channe	l:		СН	CH78					
Frequency (MHz)	Read Level (dBuV)	Factor (dB/m)	Level (dBuV/m)	Limit Line (dBuV/m)	Margin (dB)	Polarization	Test value		
2483.50	55.49	-2.15	53.34	74.00	20.66	Horizontal	Peak		
2500.00	0.00 52.32 -2.10 50.22		50.22	74.00	23.78	Horizontal	Peak		
2483.50	3.50 55.49 -2.15 53.34		53.34	74.00	20.66	Vertical	Peak		
2500.00	52.06	-2.10	49.96	74.00	24.04	Vertical	Peak		
2483.50	42.61	-2.15	40.46	54.00	13.54	Horizontal	Average		
2500.00	42.04	-2.10	39.94	54.00	14.06	Horizontal	Average		
2483.50	83.50 42.53 -2.15 40.3		40.38	54.00	13.62	Vertical	Average		
2500.00	42.05	-2.10	39.95	54.00	14.05	Vertical	Average		

# 5.10. Band edge and Spurious Emissions (conducted)

## LIMIT

FCC CFR Title 47 Part 15 Subpart C Section 15.247 (d):In any 100 kHz bandwidth outside the frequency band in which the spread spectrum 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.

## TEST CONFIGURATION



# TEST PROCEDURE

- 1. The transmitter output was connected to the spectrum analyzer through an attenuator, the path loss was compensated to the results for each measurement.
- 2. Set to the maximum power setting and enable the EUT transmit continuously
- Use the following spectrum analyzer settings: RBW = 100 kHz, VBW ≥ RBW, scan up through 10<sup>th</sup> harmonic. Sweep = auto, Detector function = peak, Trace = max hold
- 4. Measure and record the results in the test report.

### TEST MODE:

Please refer to the clause 3.3

### TEST RESULTS

☑ Passed □ Not Applicable

est Item:	Band edge	Modulation type:	GFSK
CH00 No hopping mode	Spect Ref L Att Count 0 dBm -10 dBm -20 dBm -20 dBm -20 dBm -30 dBm -30 dBm -30 dBm -30 dBm -30 dBm -30 dBm -30 dBm -40 dBm -50 dBm -5	Avel         Offset         1.00 dB         RBW         100 kHz         Mode         Aut           30 dB         SWT         1.1 ms         VBW         300 kHz         Mode         Aut           500/500         SW         1.1 ms         VBW         300 kHz         Mode         Aut           500/500         SW         1.1 ms         VBW         300 kHz         Mode         Aut           500/500         SW	0 Sweep      1)
	Date:102	1 2.39963 GHz -53.81 dBm	
CH00 Hopping mode	→ Att Count ● 1Pk M 10 dBm -10 dBm -20 dBm -20 dBm -30 dBm	NVel         20.00 dBm         Offset         1.0 ms         NBW         300 kHz         Mode         Aut           500/500         SWT         1.1 ms         VBW         300 kHz         Mode         Aut           500/500         SWT         1.1 ms         VBW         300 kHz         Mode         Aut           500/500         SWT         1.1 ms         VBW         300 kHz         Mode         Aut           500/500         SWT         1.1 ms         VBW         300 kHz         Mode         Aut           500/500         SWT         Ms	o Sweep
CH78 No hopping mode	→ Att Count 10 dBm -10 dBm -20 dBg -30 dBg -30 dBg -50 dBg -50 dBg -70 dBg -70 dBg -70 dBg -70 dBg -70 dBg -70 dBg -70 dBg -70 dBg	Avel         Constraint         Constraint <td>2.82 dBm 2.4798310 GHz ] -59.30 dBm 2.4835000 GHz</td>	2.82 dBm 2.4798310 GHz ] -59.30 dBm 2.4835000 GHz

# Report No.: CHTEW19070150

	Spectrum         Π           Ref Level 20.00 dBm         Offset 1.00 dB         RBW 100 kHz           Att         30 dB         SWT         56.9 μs         YBW 300 kHz           Count 500/500         Count 50/500         State         Mode         Auto FFT
	Count subject
	10 dBm
	2.4835000 GH2
CH78	-20 dBm - 01 -18.240 dBm
Hopping mode	-40 d8m
	-50 dBill
	Start 2.478 GHz         691 pts         Stop 2.5 GHz
	Marker
	Type         Ref         Trc         X-value         Y-value         Function         Function Result           M1         1         2.479831 GHz         1.76 dBm
	M1 1 2.49331042 1.7008m M2 1 2.4935 04z -5.9108m
	M3         1         2.5 GHz         -60.53 dBm           M4         1         2.4919652 GHz         -57.62 dBm
	Dam: 10.2012.2019 13:21:49

Test Item:	Band edge		Modula	ation typ	e:	π/4DQP	SK
	-	Ref Level 20.00 dBm         O           Att         30 dB         S'           Sound Store         30 dB         S'	ifset 1.00 dB 👄	RBW 100 kHz	1ode Auto Sweep		
CH00 No hopping mode	ے۔ 	Pk. Max           dBm           dBm           jBm           jBm           jD Bm           jD 1-16.920 dBm           jD Bm           jD		691 pts	M1[1] M2[1]	2.4017 -50:3 2.4000 	
		M1         1           M2         1           M3         1           M4         1	-value 2.40177 GHz 2.4 GHz 2.39 GHz 2.31 GHz 2.399768 GHz	Y-value 3.08 dBm -50.35 dBm -54.78 dBm -55.60 dBm -49.34 dBm	Function	Function Result	
	-		ffset 1.00 dB ● 1 WT 1.1 ms ● 1		1ode Auto Sweep		
	11 0	Pk Max dBm			M1[1] M2[1]	1.9 2.40287 -51.6 2.40000	4 dBm 70 GHz 1 dRin 10 GHz
CH00 Hopping mode	ہ ۔ ٹی	D dBm D1 -18.060 dBm D dBm D1 -18.060 dBm D dBm D1 -18.060 dBm D dBm D1 -18.060 dBm	Auren Durren free			mis k	
	-7	0 dBm		691 pts		Stop 2.403	5 GHz
		M1         1           M2         1           M3         1           M4         1	-value 2.40287 GHz 2.4 GHz 2.39 GHz 2.31 GHz 2.399906 GHz	Y-value 1.94 dBm -51.61 dBm -56.31 dBm -56.30 dBm -53.02 dBm	Function	Function Result	
	6	pectrum					(₩)
		RefLevel 20.00 dBm O	ffset 1.00 dB ● I ₩T 56.9 μs ● '	RBW 100 kHz VBW 300 kHz N	1ode Auto FFT		
CH78 No hopping mode	0 t-	dBm			M1[1] M2[1]	1.6 2.479831 -5952 2.483500	6 dBm
	- 	D dBm	12		and the second	M4	 لوغ من
	S	Art 2.478 GHz           rker           ype         Ref         Trc         X           M1         1         1         1           M2         1         1         1	-value 2.479831 GHz 2.4835 GHz 2.5 GHz 4937188 GHz	691 pts Y-value 1.62 dBm -59.26 dBm -58.78 dBm -58.78 dBm -57.76 dBm	Function	Stop 2.4	<u>s GHz</u>
	Dat	M3         1           M4         1         2	2.5 GHZ 4937188 GHz	-50.76 dBm	Meas	(11111) 4/4	

# Report No.: CHTEW19070150

	Spectrum         Image: Constraint of the section of the sectio
CH78 Hopping mode	• 1Pk Max           • 0.17 dBm             10 dBm           • 0.17 dBm             10 dBm           • 0.17 dBm             • 0 dBm           • 0.170 dBm             • • 0 dBm           • 0.170 dBm             • • • • • • • • • • • • • • •
	Marker Type   Ref   Trc   X-value   Y-value   Function   Function Result
	M1         1         2.479003 GHz         -0.17 dBm           M2         1         2.4835 GHz         -59.40 dBm
	M3         1         2.5 GHz         -59.92 dBm           M4         1         2.4888406 GHz         -57.07 dBm
	M2         1         2.4835 GHz         ~59.40 dBm           M3         1         2.5 GHz         ~59.92 dBm

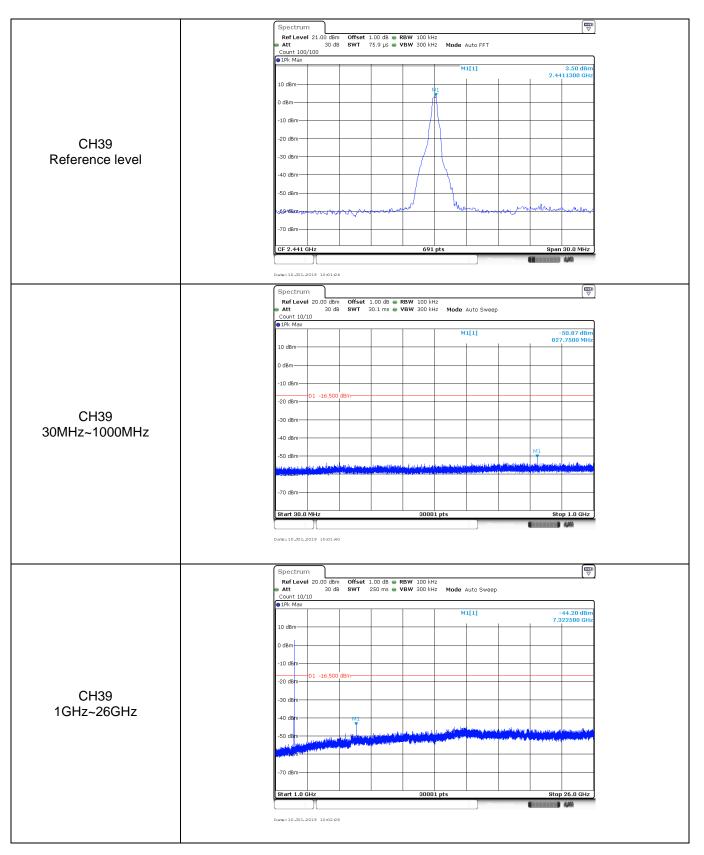
est Item:	Band edge		Modula	ation ty	ype:	8	BDPSK	
		Count 500/500	Offset 1.00 dB • SWT 1.1 ms •			eep		
		1Pk Max     10 dBm     0 dBm			M1[1] M2[1]		2.25 2.40177 -48.79 2.40000	MBm
CH00 No hopping mode		-10 dBm D1 -17.750 dl -20 dBm D1 -17.750 dl -30 dBm	3m					
		-50 dBm -60 dBm -70 dBm	Mananaharan akarana	hundund	NU-United - for the former of		M3 M3 Marrianna	<u>}</u>
		Start 2.31 GHz           Marker           Type         Ref         Trc           M1         1           M2         1	X-value 2.40177 GHz 2.4 GHz	691 p Y-value 2.25 dBm -48.79 dBm	Function	Fund	Stop 2.405	GHz
		M3 1 M4 1 M5 1	2.39 GHz 2.31 GHz 2.399768 GHz	-56.42 dBm -55.71 dBm -50.36 dBm		Measuring	<b>.</b>	
		Spectrum Ref Level 20.00 dBm Att 30 dB Count 500/500	Offset 1.00 dB SWT 1.1 ms	RBW 100 kHz VBW 300 kHz	Mode Auto Sw	еер		
		1Pk Max     10 dBm     0 dBm			M1[1] M2[1]		2.26 2.40177 -53.97 2.40000	MBm
CHOO		-10 dBm D1 -17.740 dl -20 dBm D1 -17.740 dl -30 dBm	3m					
CH00 Hopping mode		-60 dBm -70 dBm -70 dBm	hanner Medminister	n franke star en de ser de	muutos wahili	the marked and the	M3 M3	-
		Start 2.31 GHz           Marker           Type         Ref         Trc           M1         1           M2         1	X-value 2.40177 GHz 2.4 GHz	691 p Y-value 2.26 dBm -53.97 dBm	Function	Fund	Stop 2.405	GHz
		M3 1 M4 1 M5 1	2.39 GHz 2.31 GHz 2.399768 GHz	-55.29 dBm -56.03 dBm -51.83 dBm		Measuring		
		Att 30 dB	Offset 1.00 dB ● SWT 56.9 µs ●			r		
		Count 500/500 1Pk Max 10 dBm			M1[1] M2[1]		0.70 2.479831 -56.75 2.483500	i dBm
CH20		-10 dBm 01 -19.300 dl	3m					
CH78 No hopping mode		-f0 dBm -50 dBm -60 dBm -70 dBm	M2			, M4	· · · · · · · · · · · · · · · · · · ·	
		Start 2.478 GHz           Marker           Type         Ref         Trc           M1         1           M2         1	X-value 2.479831 GHz 2.4835 GHz	691 p Y-value 0.70 dBm -56.75 dBm	Function	Fund	Stop 2.5	GHz
		M3 1 M4 1	2.5 GHz 2.4937507 GHz	-60.60 dBm -57.95 dBm		Measuring		

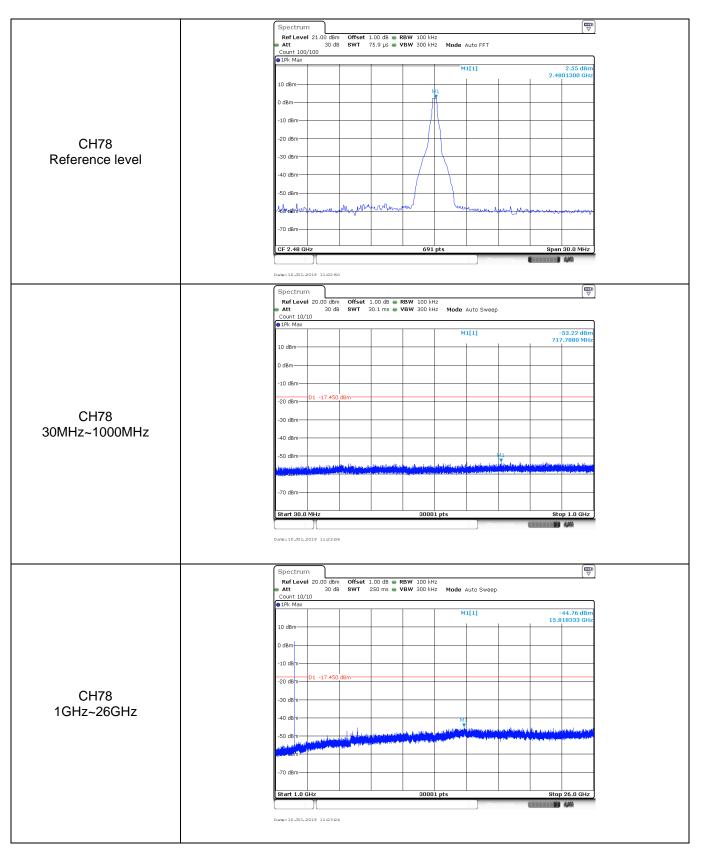
# Report No.: CHTEW19070150

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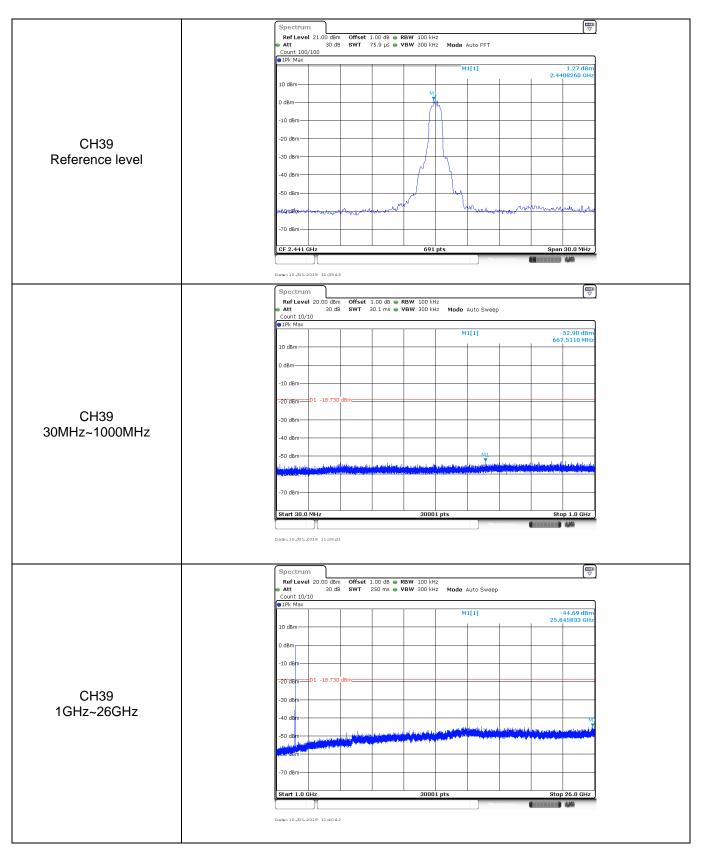
	Spectrum         Image: Construction         Image: Construction <t< th=""></t<>
	PIPK Max
	0 dgm 2.4835000 GHz
	-20. dBm 21.230 dBm
CH78 Hoppig mode	-40 dBm
	Start 2.478 GHz         691 pts         Stop 2.5 GHz
	Marker Type Ref Trc X-value Y-value Function Function Result
	M1 1 2.479003 GHz -1.23 dBm
	M2         1         2.4835 GHz         -59.99 dBm           M3         1         2.5 GHz         -59.78 dBm           M4         1         2.485971 GHz         -55.25 dBm
	Mesuring.

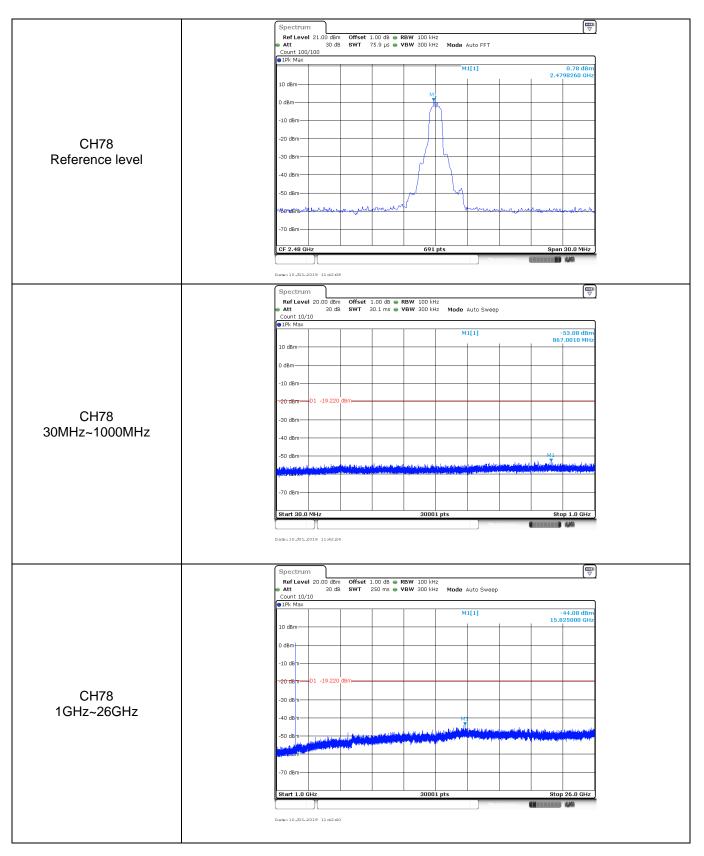
fest Item:	SE	Modulation type:	GFSK
		Spectrum           Ref Level         21.00 dBm         Offset         1.00 dB         RBW         100 kHz           Att         30 dB         SWT         75.9 μs         VBW         300 kHz         Mode         Auto FFT           Count 100/100	
		Colline 100/100     IPK Max     M1[1]     10 dBm	3.88 dBm 2.4018260 GHz
		0 dBm	
		-10 dBm	
CH00		-20 dBm	
Reference level		-30 dBm	
		-50 dBm	
		15B. 18m - the and the	Mary produced and the second of the second
		-70 dBm-	
		CF 2.402 GHz 691 pts	Span 30.0 MHz
		Dame:10.JUL.2019 09:57:31	
		Spectrum           Ref Level 20.00 d8m         Offset 1.00 d8 • RBW 100 kHz           Att         30 d8         SWT         30.1 ms • VBW 300 kHz         Mode Auto Sweep	
		Count 10/10 Provide Contract of the Contract o	-51.40 dBm
		10 dBm	742.5870 MHz
		0 dBm	
		-10 dBm	
CH00		-20 dBm	
30MHz~1000MHz			
		-50 dBm	M1 
			and an and a second second second second second second
		-70 dBm	
		Start 30.0 MHz 30001 pts	Stop 1.0 GHz
		Dams10_XUL2019 09:57%	
		Spectrum           RefLevel 20.00 dBm         Offset 1.00 dB         RBW 100 kHz           Att         30 dB         SWT         250 ms         VBW 300 kHz         Mode Auto Sweep           Count 10/10         30         SWT         250 ms         VBW 300 kHz         Mode Auto Sweep	
		Orani ta po     Orani ta po     Miliji     Miliji	-41.20 dBm 7.205833 GHz
		10 dBm	
		0 dBm	
		-20 dBm	
CH00 1GHz~26GHz		-30 dEm	
		-40 dem M1	Landra dest de la constanti producto de la desta
		-50 dlm	and a shift of the shift of the second state of the second state of the second state of the second state of the
		-70 dBm	
		Start 1.0 GHz 30001 pts	Stop 26.0 GHz
		Measu	uring



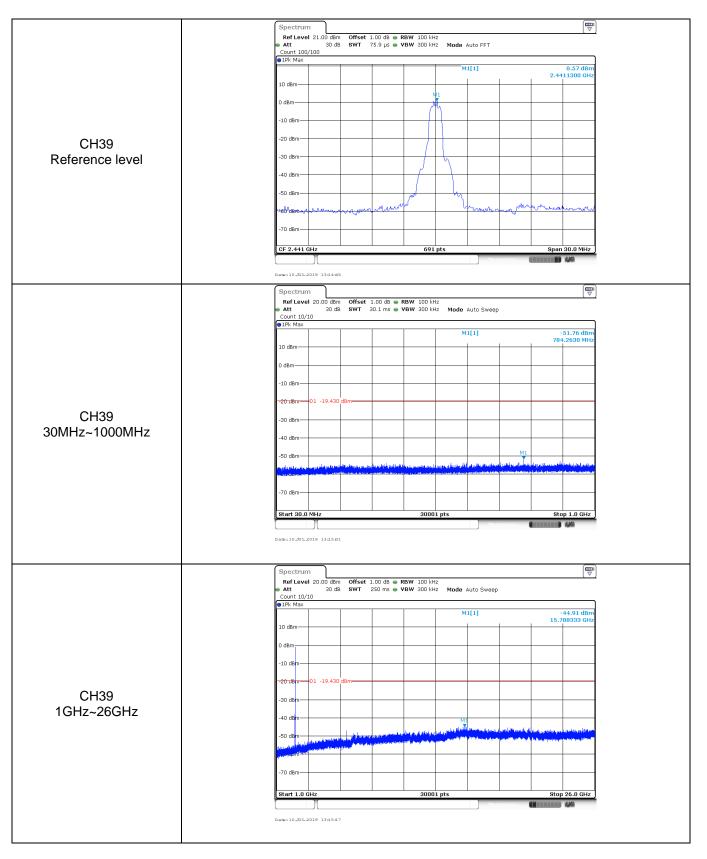


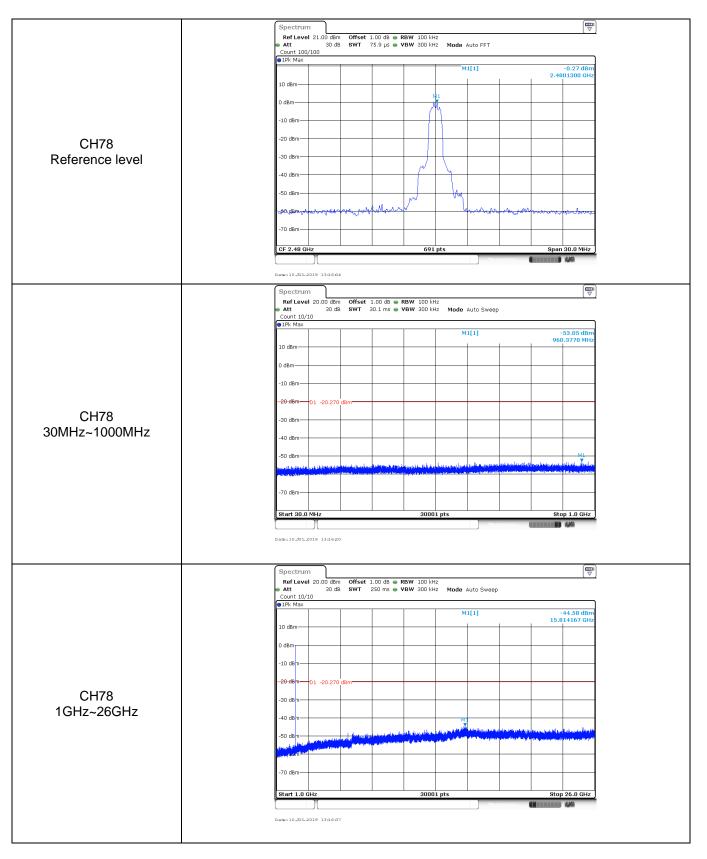
	SE		Modul	ation ty	pe:	π/4	DQPSK		
		Spectrum         Image: Spectrum           RefLevel 21.00 dBm         Offset 1.00 dB         RBW 100 kHz           Att         30 dB         SWT         75.9 μs         VBW 300 kHz         Mode Auto FFT							
		Count 100/100 1Pk Max			M1[1]		2.58 dBm 2.4018260 GHz		
		10 dBm		M			2.4018260 GHz		
		0 dBm		- 1					
		-10 dBm							
CH00		-20 dBm							
Reference level		-30 dBm							
		-40 dBm							
		-50 dBm	a se an anna	w Star	When a				
		/-60.dBm	mot markers.			mal market and	كالملامميصلحي يصي		
		CF 2.402 GHz		691 pts	Meas		Span 30.0 MHz		
		Date:10.JUL.2019 11:37:21	L						
		Spectrum Ref Level 20.00 dBm	Offset 1.00 dB e	RBW 100 kHz					
		<ul> <li>Att 30 dB Count 10/10</li> </ul>			Mode Auto Sweep				
		●1Pk Max			M1[1]		-53.62 dBm 223.8160 MHz		
		10 dBm							
		0 dBm							
		-10 dBm	dBm						
CH00		-20 dBm							
0MHz~1000MHz		-30 dBm							
		-50 dBmM	1						
		م المراجع المراجع المراجع ومراجع المراجع ا	da terrati ang sa sa kana sa bila			an an an the later was done it bloc it an Chan a second and a second and a second			
		-70 dBm							
		Start 30.0 MHz		30001 pt	s		Stop 1.0 GHz		
					Meas	suring	444		
		Data:10.JUL.2019 11:37:36	5						
		Spectrum Ref Level 20.00 dBm	Offset 1.00 dB 🖷	DDW 100 kus					
		<ul> <li>Att 30 dB Count 10/10</li> </ul>			Mode Auto Sweep				
		● 1Pk Max			M1[1]		-40.91 dBm 7.205000 GHz		
		10 dBm							
		0 dBm							
		-10 dEm	dBm						
CH00		-20 dBm							
1GHz~26GHz		-30 dBm	M1						
		-40 dBm	الغروبة المعرية المعرية	and the second second	a subdent flooren aufrac	ath the local by Annual way	أقصحار والأقرار متأور متأت		
						and the second			
		-70 dBm							
		Start 1.0 GHz		30001 pt			Stop 26.0 GHz		





Fest Item:	SE	Modulation type: 8DPSK	
		Spectrum         Image: Constraint of the section	
		IPK Max     I0 dBm     M1[1]     1.96 dBm     2.4018260 GHz	
		0 dBm	
CH00 Reference level		-30 dBm	
		-50 dBm	
		CF 2.402 GHz         691 pts         Span 30.0 MHz           Date:10.JUL2019 1383822         Image: CF 2.402 GHz	
		Spectrum         [100]           Ref Level 20.00 dBm         Offset 1.00 dB ● RBW 100 kHz	
		Att 30 dB SWT 30.1 ms VBW 300 kHz Mode Auto Sweep Count 10/10      ■ IPk Max	
		10 dBm	
CH00 30MHz~1000MHz		-20 dBm	
30101HZ~100010HZ		-40 dBm	
		-70 dBm	
		Data:10.001.2019 13:13:08	
		Spectrum         Image: Constraint of the sector of t	
		(1) PK Max     (	
0.140		-10 dEm	
CH00 1GHz~26GHz		-30 dfm M1	
		-ou dem	
		Start 1.0 GHz         30001 pts         Stop 26.0 GHz	





# 5.11. Spurious Emissions (radiated)

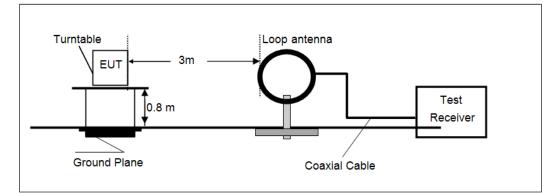
# <u>LIMIT</u>

# FCC CFR Title 47 Part 15 Subpart C Section 15.209

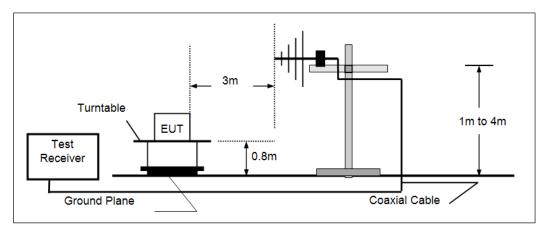
Frequency	Limit (dBuV/m @3m)	Value
30 MHz ~ 88 MHz	40.00	Quasi-peak
88 MHz ~ 216 MHz	43.50	Quasi-peak
216 MHz ~ 960 MHz	46.00	Quasi-peak
960 MHz ~ 1 GHz	54.00	Quasi-peak
Above 1 GHz	54.00	Average
	74.00	Peak

# **TEST CONFIGURATION**

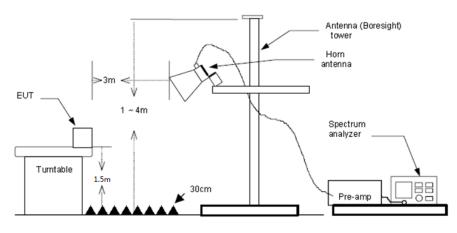
Below 30 MHz



# > 30 MHz ~1000 MHz



> Above 1 GHz



# TEST PROCEDURE

- 1. The EUT was tested according to ANSI C63.10:2013.
- 2. The EUT is placed on a turn table with 0.8 meter above ground for below 1GHz, 1.5 meter above ground for above 1GHz.
- 3. The EUT was set 3 meters from the receiving antenna, which was mounted on the top of a variable height antenna tower.
- 4. For each suspected emission, the EUT was arranged to its worst case and then tune the Antenna tower (from 1 m to 4 m) and turntable (from 0 degree to 360 degrees) to find the maximum reading. A pre-amp and a high pass filter are used for the test in order to get better signal level to comply with the guidelines.
- 5. Set to the maximum power setting and enable the EUT transmit continuously.
- 6. Use the following spectrum analyzer settings
  - (1) Span shall wide enough to fully capture the emission being measured;
    - (2) Below 1 GHz:

RBW=120 kHz, VBW=300 kHz, Sweep=auto, Detector function=peak, Trace=max hold; If the emission level of the EUT measured by the peak detectoris 3 dB lower than the applicable limit, the peak emission level will be reported. Otherwise, the emission measurement will be repeated using the quasi-peak detector and reported.

 (3) From 1 GHz to 10<sup>th</sup> harmonic: RBW=1 MHz, VBW=3 MHz Peak detector for Peak value RBW=1 MHz, VBW=10 Hz Peak detector for Average value.

### TEST MODE:

Please refer to the clause 3.3

### TEST RESULTS

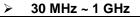
☑ Passed □ Not Applicable

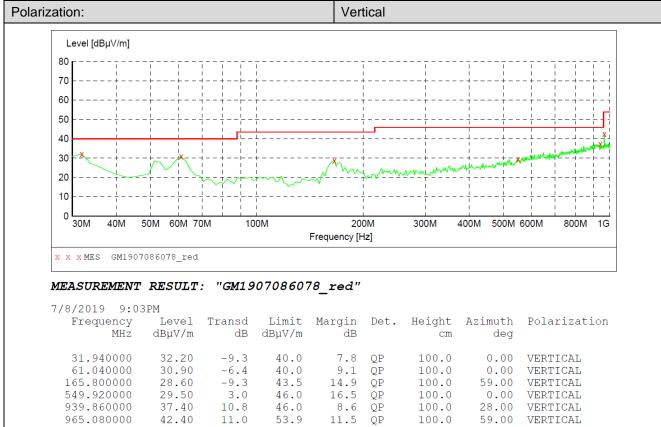
#### Note:

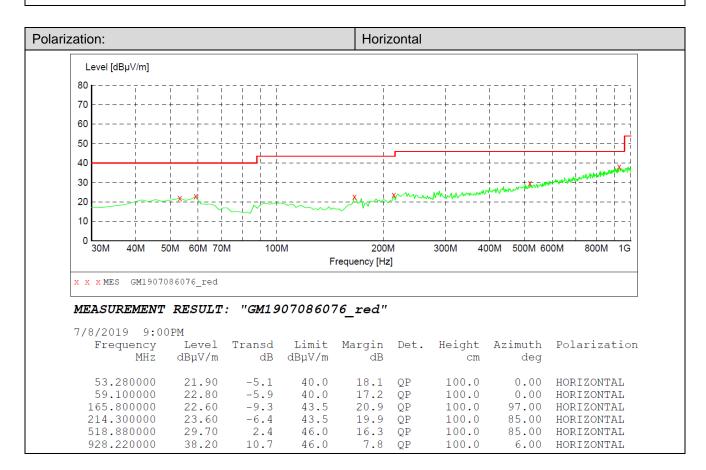
- 1) Final Level = Receiver Read level + Factor
- 2) The emission levels of other frequencies are very lower than the limit and not show in test report.
- 3) Below 1 GHz, Have pre-scan all modulation mode, found the GFSK modulation High channel which it was worst case, so only the worst case's data on the test report.
- 4) Above 1 GHz, Have pre-scan all modulation mode, found the GFSK modulation which it was worst case, so only the worst case's data on the test report
- 5) The peak level is lower than average limit(54 dBuV/m), this data is the too weak instrument of signal is unable to test.

### ➢ 9 kHz ~ 30 MHz

The low frequency, which started from 9 kHz to 30 MHz, was pre-scanned and the result which was 20 dB lower than the limit line per 15.31(o) was not reported.







# ≻ 1 GHz ~ 25 GHz

	CH00									
Frequency (MHz)	Read Level (dBuV/m)	Factor (dB/m)	Level (dBuV/m)	Limit Line (dBuV/m)	Margin (dB)	Polarization	Test value			
3176.6875	34.74	0.72	35.46	74.00	38.54	Vertical	Peak			
5149.2188	32.28	8.89	41.17	74.00	32.83	Vertical	Peak			
7205.4688	29.74	15.99	45.73	74.00	28.27	Vertical	Peak			
9417.4063	32.24	18.29	50.53	74.00	23.47	Vertical	Peak			
3145.8438	34.63	0.56	35.19	74.00	38.81	Horizontal	Peak			
4689.5000	30.94	6.32	37.26	74.00	36.74	Horizontal	Peak			
5190.3438	31.42	8.96	40.38	74.00	33.62	Horizontal	Peak			
7205.4688	36.49	15.99	52.48	74.00	21.52	Horizontal	Peak			

CH39									
Frequency (MHz)	Read Level (dBuV/m)	Factor (dB/m)	Level (dBuV/m)	Limit Line (dBuV/m)	Margin (dB)	Polarization	Test value		
1280.5313	35.47	-5.62	29.85	74.00	44.15	Vertical	Peak		
3160.5313	34.85	0.63	35.48	74.00	38.52	Vertical	Peak		
5091.9375	31.45	8.72	40.17	74.00	33.83	Vertical	Peak		
7322.9688	35.08	16.12	51.20	74.00	22.80	Vertical	Peak		
2818.3125	32.06	1.79	33.85	74.00	40.15	Horizontal	Peak		
3814.1250	34.15	2.09	36.24	74.00	37.76	Horizontal	Peak		
5127.1875	32.21	8.85	41.06	74.00	32.94	Horizontal	Peak		
7322.9688	34.65	16.12	50.77	74.00	23.23	Horizontal	Peak		

CH78							
Frequency (MHz)	Read Level (dBuV/m)	Factor (dB/m)	Level (dBuV/m)	Limit Line (dBuV/m)	Margin (dB)	Polarization	Test value
1634.5000	34.68	-6.22	28.46	74.00	45.54	Vertical	Peak
3081.2188	35.16	0.24	35.40	74.00	38.60	Vertical	Peak
5159.5000	31.60	8.91	40.51	74.00	33.49	Vertical	Peak
8014.7500	31.20	18.21	49.41	74.00	24.59	Vertical	Peak
1672.6875	34.45	-6.15	28.30	74.00	45.70	Horizontal	Peak
3159.0625	35.19	0.63	35.82	74.00	38.18	Horizontal	Peak
5210.9063	31.50	8.92	40.42	74.00	33.58	Horizontal	Peak
7356.7500	30.66	16.23	46.89	74.00	27.11	Horizontal	Peak

Remark:

1. Final Level = Receiver Read level + Antenna Factor + Cable Loss – Preamplifier Factor

2. The peak level is lower than average limit(54 dBuV/m), this data is the too weak instrument of signal is unable to test.

3. The emission levels of other frequencies are very lower than the limit and not show in test report.

# 6. TEST SETUP PHOTOS

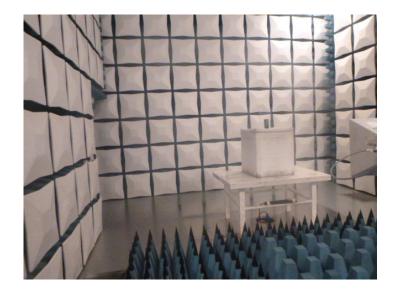
# Conducted Emissions (AC Mains)



### **Radiated Emissions**







# 7. EXTERANAL AND INTERNAL PHOTOS

Reference to the test report No.: CHTEW19070148

-----End of Report------