TECT	REPORT
ILJI	REPURI

	DT&C Co., Ltd.					
	, Yurim-ro, 154Beon-gil, Cheoin-gu, Yongin-si, Gyeonggi-do, Korea, 17042 Tel : 031-321-2664, Fax : 031-321-1664					
1. Report No: DRTFCC2111-0143(1)						
2. Customer						
Name (FCC) : Point Mobile Co., LTD. / Name (IC) : POINTMOBILE CO.,LTD						
	 Address (FCC) : B-9F, Kabul Great Valley 32 Digital-ro 9-gil, Geumcheon-gu Seoul South Korea 153-709 Address (IC) : B-9F Kabul Great Valley, 32, Digital-ro 9-gil, Geumcheon-gu Seoul Korea (Republic Of) 					
3. Use of Report : FCC & IC Certification						
4. Product Name / Model Name : Mobile	Computer / PM75W					
FCC ID : V2X-PM75W IC : 10664A-PM75W						
5. FCC Regulation(s): Part 15.247						
IC Standard(s): RSS-247 Issue 2, RSS						
Test Method used: KDB558074 D01v0						
6. Date of Test : 2021.09.16 ~ 2021.10.2	6. Date of Test : 2021.09.16 ~ 2021.10.27, 2021.11.02					
7. Location of Test : I Permanent Testing Lab I On Site Testing						
8. Testing Environment : See appended	test report.					
9. Test Result : Refer to the attached tes	t result.					
The results shown in this test report refer only This test report is not related to KOLAS accre	y to the sample(s) tested unless otherwise stated.					
Tested by						
Affirmation	Sal A.					
Name : SeungMin Gil	(Signature) Name : JaeJin Lee (Signature)					
2021.12.02.						
DI	DT&C Co., Ltd.					

If this report is required to confirmation of authenticity, please contact to report@dtnc.net



Test Report Version

Test Report No.	Date	Description	Revised by	Reviewed by
DRTFCC2111-0143	Nov. 26, 2021	Initial issue	SeungMin Gil	JaeJin Lee
DRTFCC2111-0143(1)	Dec. 02, 2021	Correct the typo in section 1.1.2 SeungMin Gil		JaeJin Lee

Table of Contents

1. General Information	
1.1. Explanations for Reference Test Data	4
1.1.1. Introduction	
1.1.2. Explain the Differences	4
1.1.3. Spot Check Verification Data	4
1.1.4. Reference Section	4
1.2. Description of EUT	5
1.3. Declaration by the applicant / manufacturer	5
1.4. Testing Laboratory	6
1.5. Testing Environment	6
1.6. Measurement Uncertainty	
1.7. Information about the FHSS characteristics	
1.8. Conclusion of worst-case and operation mode	
1.9. Test Equipment List	
2. Antenna Requirement	
3. Summary of Test Results	
4. Maximum Peak Conducted Output Power	
4.1. Test Setup	
4.2. Limit	
4.3. Test Procedure	
4.4. Test Results	
5. 20 dB BW & Occupied BW	
5.1. Test Setup	
5.2. Limit	
5.3. Test Procedure	
5.4. Test Results	
6. Carrier Frequency Separation	
6.1. Test Setup	
6.2. Limit	
6.3. Test Procedure	25
6.3. Test Procedure	
6.4. Test Results	25
6.4. Test Results 7. Number of Hopping Channels	25 30
6.4. Test Results 7. Number of Hopping Channels 7.1. Test Setup	25 30 30
 6.4. Test Results 7. Number of Hopping Channels 7.1. Test Setup	25 30 30 30
6.4. Test Results 7. Number of Hopping Channels 7.1. Test Setup 7.2. Limit 7.3. Test Procedure	25 30 30 30 30
6.4. Test Results 7. Number of Hopping Channels 7.1. Test Setup 7.2. Limit. 7.3. Test Procedure 7.4. Test Results	25 30 30 30 30 30
6.4. Test Results 7. Number of Hopping Channels 7.1. Test Setup 7.2. Limit 7.3. Test Procedure 7.4. Test Results 8. Time of Occupancy	25 30 30 30 30 30 36
6.4. Test Results 7. Number of Hopping Channels 7.1. Test Setup 7.2. Limit 7.3. Test Procedure 7.4. Test Results 8. Time of Occupancy 8.1. Test Setup	25 30 30 30 30 30 36 36
6.4. Test Results 7. Number of Hopping Channels 7.1. Test Setup 7.2. Limit 7.3. Test Procedure 7.4. Test Results 8. Time of Occupancy 8.1. Test Setup 8.2. Limit	25 30 30 30 30 36 36 36
6.4. Test Results 7. Number of Hopping Channels 7.1. Test Setup 7.2. Limit 7.3. Test Procedure 7.4. Test Results 8. Time of Occupancy 8.1. Test Setup 8.2. Limit 8.3. Test Procedure	25 30 30 30 30 36 36 36 36
6.4. Test Results 7. Number of Hopping Channels 7.1. Test Setup 7.2. Limit 7.3. Test Procedure 7.4. Test Results 8. Time of Occupancy 8.1. Test Setup 8.2. Limit 8.3. Test Procedure 8.4. Test Results	25 30 30 30 30 36 36 36 36 36
6.4. Test Results 7. Number of Hopping Channels 7.1. Test Setup 7.2. Limit. 7.3. Test Procedure. 7.4. Test Results 8. Time of Occupancy 8.1. Test Setup 8.2. Limit. 8.3. Test Procedure. 8.4. Test Results 9. Unwanted Emissions	25 30 30 30 30 36 36 36 36 36 36 36 36 36
6.4. Test Results 7. Number of Hopping Channels 7.1. Test Setup 7.2. Limit. 7.3. Test Procedure. 7.4. Test Results 8. Time of Occupancy 8.1. Test Setup 8.2. Limit. 8.3. Test Procedure 8.4. Test Results 9. Unwanted Emissions 9.1. Test Setup	25 30 30 30 30 30 36 36 36 36 36 36 36 341
6.4. Test Results 7. Number of Hopping Channels 7.1. Test Setup 7.2. Limit. 7.3. Test Procedure. 7.4. Test Results 8. Time of Occupancy 8.1. Test Setup 8.2. Limit. 8.3. Test Procedure. 8.4. Test Results 9. Unwanted Emissions 9.1. Test Setup 9.2. Limit.	25 30 30 30 30 36 36 36 36 36 36 36 36 341 41
6.4. Test Results 7. Number of Hopping Channels 7.1. Test Setup 7.2. Limit. 7.3. Test Procedure 7.4. Test Results 8. Time of Occupancy 8.1. Test Setup 8.2. Limit. 8.3. Test Procedure 8.4. Test Results 9. Unwanted Emissions 9.1. Test Setup 9.2. Limit. 9.3. Test Procedures	25 30 30 30 30 36 36 36 36 36 36 36 36 341 41 41
6.4. Test Results 7. Number of Hopping Channels 7.1. Test Setup 7.2. Limit 7.3. Test Procedure 7.4. Test Results 8. Time of Occupancy 8.1. Test Setup 8.2. Limit 8.3. Test Procedure 8.4. Test Results 9. Unwanted Emissions 9.1. Test Setup 9.2. Limit 9.3. Test Procedures 9.3.1. Test Procedures for Unwanted Emissions(Radiated)	25 30 30 30 30 36 30 30 30 30 30 30 30 30 30 30 30 30 30 30 30 30 30 30 30 36
 6.4. Test Results	25 30 30 30 30 30 36
6.4. Test Results 7. Number of Hopping Channels 7.1. Test Setup 7.2. Limit. 7.3. Test Procedure. 7.4. Test Results 8. Time of Occupancy. 8.1. Test Setup 8.2. Limit. 8.3. Test Procedure. 8.4. Test Results 9. Unwanted Emissions. 9.1. Test Setup 9.2. Limit. 9.3. Test Procedures. 9.3.1. Test Procedures for Unwanted Emissions(Radiated). 9.3.2. Test Procedures for Unwanted Emissions(Conducted). 9.4. Test Results	25 30 30 30 30 36 36 36 36 36 36 36 36 36 34 1 41 41 43 43 44
6.4. Test Results 7. Number of Hopping Channels 7.1. Test Setup 7.2. Limit 7.3. Test Procedure 7.4. Test Results 8. Time of Occupancy 8.1. Test Setup 8.2. Limit 8.3. Test Procedure 8.4. Test Results 9. Unwanted Emissions 9.1. Test Setup 9.2. Limit 9.3. Test Procedures 9.3.1. Test Procedures 9.3.2. Test Procedures for Unwanted Emissions(Radiated) 9.3.2. Test Procedures for Unwanted Emissions(Conducted) 9.4.1. Unwanted Emissions(Radiated)	25 30 30 30 30 36
6.4. Test Results 7. Number of Hopping Channels 7.1. Test Setup 7.2. Limit 7.3. Test Procedure 7.4. Test Results 8. Time of Occupancy 8.1. Test Setup 8.2. Limit 8.3. Test Procedure 8.4. Test Results 9. Unwanted Emissions 9.1. Test Setup 9.2. Limit 9.3. Test Procedures 9.3.1. Test Procedures for Unwanted Emissions(Radiated) 9.3.2. Test Procedures for Unwanted Emissions(Conducted) 9.4.1. Unwanted Emissions(Radiated) 9.4.2. Unwanted Emissions(Conducted)	25 30 30 30 30 36
6.4. Test Results 7. Number of Hopping Channels 7.1. Test Setup 7.2. Limit 7.3. Test Procedure 7.4. Test Results 8. Time of Occupancy 8.1. Test Setup 8.2. Limit 8.3. Test Procedure 8.4. Test Results 9. Unwanted Emissions 9.1. Test Setup 9.2. Limit 9.3.1. Test Procedures 9.3.1. Test Procedures for Unwanted Emissions(Radiated) 9.3.2. Test Procedures for Unwanted Emissions(Conducted) 9.4.1. Unwanted Emissions(Radiated) 9.4.2. Unwanted Emissions(Conducted) 9.4.2. Unwanted Emissions(Conducted) 10. AC Power-Line Conducted Emissions.	25 30 30 30 30 36
6.4. Test Results 7. Number of Hopping Channels 7.1. Test Setup 7.2. Limit 7.3. Test Procedure 7.4. Test Results 8. Time of Occupancy 8.1. Test Setup 8.2. Limit 8.3. Test Procedure 8.4. Test Results 9. Unwanted Emissions 9.1. Test Setup 9.2. Limit 9.3. Test Procedures 9.4. Limit 9.3.1. Test Procedures for Unwanted Emissions(Radiated) 9.3.2. Test Procedures for Unwanted Emissions(Conducted) 9.4.1. Unwanted Emissions(Radiated) 9.4.2. Unwanted Emissions(Conducted) 10. AC Power-Line Conducted Emissions 10.1. Test Setup	25 30 30 30 30 36
6.4. Test Results 7. Number of Hopping Channels 7.1. Test Setup 7.2. Limit 7.3. Test Procedure 7.4. Test Results 8. Time of Occupancy 8.1. Test Setup 8.2. Limit 8.3. Test Procedure 8.4. Test Results 9. Unwanted Emissions 9.1. Test Setup 9.2. Limit 9.3. Test Procedures 9.4. Test Results 9.3.1. Test Procedures for Unwanted Emissions(Radiated) 9.3.2. Test Procedures for Unwanted Emissions(Conducted) 9.4.1. Unwanted Emissions(Conducted) 9.4.2. Unwanted Emissions(Conducted) 10. AC Power-Line Conducted Emissions 10.1. Test Setup 10.2. Limit	25 30 30 30 30 36 37 37 37 37 37 37 37 37 37 37 37
6.4. Test Results 7. Number of Hopping Channels 7.1. Test Setup 7.2. Limit 7.3. Test Procedure 7.4. Test Results 8. Time of Occupancy 8.1. Test Setup 8.2. Limit 8.3. Test Procedure 8.4. Test Setup 8.5. Test Procedure 8.4. Test Results 9. Unwanted Emissions 9.1. Test Setup 9.2. Limit 9.3. Test Procedures 9.3. Test Procedures 9.3.1. Test Procedures for Unwanted Emissions(Radiated) 9.3.2. Test Procedures for Unwanted Emissions(Conducted) 9.4.1. Unwanted Emissions(Conducted) 9.4.2. Unwanted Emissions(Conducted) 9.4.1. Unwanted Emissions(Conducted) 9.4.2. Unwanted Emissions(Conducted) 9.4.3. Test Setup 10. AC Power-Line Conducted Emissions. 10.1. Test Setup 10.2. Limit. 10.3. Test Procedure	25 30 30 30 30 36 37 37 37 37 37 37 37 37 37 37 37 37 37 37
6.4. Test Results 7. Number of Hopping Channels 7.1. Test Setup 7.2. Limit 7.3. Test Procedure 7.4. Test Results 8. Time of Occupancy 8.1. Test Setup 8.2. Limit 8.3. Test Procedure 8.4. Test Setup 8.5. Time of Occupancy 8.6. Test Setup 8.7. Test Setup 8.8. Test Results 9. Unwanted Emissions 9.1. Test Setup 9.2. Limit 9.3. Test Procedures 9.3.1. Test Setup 9.3.1. Test Procedures for Unwanted Emissions(Radiated) 9.3.2. Test Procedures for Unwanted Emissions(Conducted) 9.4.1. Unwanted Emissions(Conducted) 9.4.2. Unwanted Emissions(Conducted) 9.4.2. Unwanted Emissions(Conducted) 10. AC Power-Line Conducted Emissions 10.1. Test Setup 10.2. Limit. 10.3. Test Procedure 10.4. Test Results	25 30 30 30 30 36 37
6.4. Test Results 7. Number of Hopping Channels 7.1. Test Setup 7.2. Limit 7.3. Test Procedure 7.4. Test Results 8. Time of Occupancy 8.1. Test Setup 8.2. Limit 8.3. Test Procedure 8.4. Test Setup 8.5. Test Procedure 8.4. Test Results 9. Unwanted Emissions 9.1. Test Setup 9.2. Limit 9.3. Test Procedures 9.3. Test Procedures 9.3.1. Test Procedures for Unwanted Emissions(Radiated) 9.3.2. Test Procedures for Unwanted Emissions(Conducted) 9.4.1. Unwanted Emissions(Conducted) 9.4.2. Unwanted Emissions(Conducted) 9.4.1. Unwanted Emissions(Conducted) 9.4.2. Unwanted Emissions(Conducted) 9.4.3. Test Setup 10. AC Power-Line Conducted Emissions. 10.1. Test Setup 10.2. Limit. 10.3. Test Procedure	25 30 30 30 30 36 37 37 37



1. General Information

1.1. Explanations for Reference Test Data

1.1.1. Introduction

This report includes the Bluetooth test data of FCC ID: V2X-PM75 / IC: 10664A-PM75 with reference to KDB 484596 D01v01. The applicant takes full responsibility that the test data as reference section below represents compliance for FCC ID: V2X-PM75W / IC: 10664A-PM75W.

Reference FCC ID / IC	Exhibit type	Separated FCC ID / IC
FCC ID: V2X-PM75 /	Original Grant /	FCC ID: V2X-PM75W /
IC: 10664A-PM75	New Single Certification	IC: 10664A-PM75W

1.1.2. Explain the Differences

FCC ID: V2X-PM75W / IC: 10664A-PM75W is same the internal printed circuit board with FCC ID: V2X-PM75 / IC: 10664A-PM75. For FCC ID: V2X-PM75W / IC: 10664A-PM75W, WWAN transmitter has been removed. (It does not changed the SW/HW component of Bluetooth.)

1.1.3. Spot Check Verification Data

Equipment Class	FCC Part/	Mode	TX Freq.	Test item Detector	Refere FCC ID: V22 IC: 106644	X-PM75 /	Separat FCC ID: V2X- IC: 10664A-I	PM75W /	Limit (dBuV/m)	Deviation		
(capability)	RSS Std.		(MHz)	(MHZ)	Mode	wode	Frequency (MHz)	Result (dBuV/m)	Frequency (MHz)	Result (dBuV/m)	(abuv/m)	(dB)
DSS	15.247 /	1Mbps	2 480	Radiated Band edge	Peak	2.483.94	55.71	2 483.94	55.35	74.00	-0.36	
(Bluetooth)	RSS-247	1Mbps	2 480	Radiated Spurious emission	Peak	4 960.21	53.18	4 960.02	52.90	74.00	-0.28	

Note1: The spot check were performed based on worst-case results reported in the original test report.

The spot check test results are within 3dB and two products shows a good correlation. It also complies with the FCC limit.

1.1.4. Reference Section

Reference FCC ID: V2X-PM75 / IC: 10664A-PM75

Equipment Class	FCC Part/ RSS Std.	Capability	Band(MHz)	Exhibit type	Report title	Reference Sections
DSS	15.247 / RSS-247	Bluetooth	2 402 ~ 2 480	Original Grant/ New Single Certification	DSS	All

1.2. Description of EUT

Part 15 Spread Spectrum Transmitter (DSS)
Mobile Computer
PM75W
-
75.00
Conducted : 21196A0012 Radiated: 21197A0022
Conducted : 21197A0021 Radiated: 21197A0041
DC 3.85 V
2 402 MHz ~ 2 480 MHz
8.49 dBm (0.007 W)
GFSK(1 Mbps), π/4DQPSK(2 Mbps), 8DPSK(3 Mbps)
79
Antenna Type: LDS Antenna Gain: 2.79 dBi (PK)

Note1: Reference FCC ID: V2X-PM75 / IC: 10664A-PM75 Note2: Separated FCC ID: V2X-PM75W / IC: 10664A-PM75W

1.3. Declaration by the applicant / manufacturer

- NA

1.4. Testing Laboratory

DT&C Co., Ltd.

The 3 m test site and conducted measurement facility used to collect the radiated data are located at the 42, Yurim-ro, 154beon-gil, Cheoin-gu, Yongin-si, Gyeonggi-do, Korea 17042.

The test site complies with the requirements of Part 2.948 according to ANSI C63.4-2014.

- FCC & IC MRA Designation No. : KR0034

- ISED#: 5740A

www.dtnc.net			
Telephone	:	+ 82-31-321-2664	
FAX	:	+ 82-31-321-1664	

1.5. Testing Environment

Ambient Condition	
Temperature	+22 ℃ ~ +25 ℃
 Relative Humidity 	42 % ~ 48 %

1.6. Measurement Uncertainty

The measurement uncertainties shown below were calculated in accordance with requirements of ANSI C63.4-2014 and ANSI C63.10-2013. All measurement uncertainty values are shown with a coverage factor of k = 2 to indicate a 95 % level of confidence.

Parameter	Measurement uncertainty
Antenna-port conducted emission	0.9 dB (The confidence level is about 95 %, $k = 2$)
AC power-line conducted emission	3.4 dB (The confidence level is about 95 %, $k = 2$)
Radiated emission (1 GHz Below)	4.9 dB (The confidence level is about 95 %, k = 2)
Radiated emission (1 GHz ~ 18 GHz)	5.0 dB (The confidence level is about 95 %, k = 2)
Radiated emission (18 GHz Above)	5.3 dB (The confidence level is about 95 %, k = 2)

1.7. Information about the FHSS characteristics

- This Bluetooth module has been tested by a Bluetooth Qualification Lab, and we confirm the following :
 - A) The hopping sequence is pseudorandom
 - Note 1 : Pseudorandom Frequency Hopping Sequence Table as below:
 - Channel: 08, 24, 40, 56, 42, 54, 72, 09, 01, 11, 33, 41, 34, 42, 65, 73, 53, 69, 06, 22, 04, 20, 36, 52, 38, 46, 70, 78, 68, 76, 21, 29, 10, 26, 41, 58, 44, 60, 76, 13, 03, 11, 35, 43, 37, 45, 69, 77, 52, 71, 08, 24, 06, 24, 48, 56, 45, 46, 70, 01, 72, 06, 25, 33, 12, 28, 49, 60, 45, 58, 74, 13, 05, 18, 37, 49 etc

The System receiver have input bandwidths that match the hopping channel bandwidths of their corresponding transmitters and shift frequencies in synchroniztation with the transmit ted signals.

- B) All channels are used equally on average
- C) The receiver input bandwidth equals the transmit bandwidth
- D) The receiver hops in sequenc e with the transmit signal
- 15.247(g) : In accordance with the Bluetooth Industry Standard, the system is designed to comply with all
 of the regulations in Section 15.247 when the transmitter is presented with a continuous data
 (or information) system.
- 15.247(h) : In accordance with the Bluetooth Industry Standard, the system does not coordinate its channels selection / hopping sequence with other frequency hopping systems for the express purpose of avoiding the simultaneous occupancy of individual hopping frequencies by multiple transmitters.
- 15.247(h): The EUT employs Adaptive Frequency Hopping (AFH) which identifies sources of interference namely devices operating in 802.11 WLAN and excludes them from the list of available channels. The process of re-mapping reduces the number of test channels from 79 channels to a minimum number of 20 channels.

1.8. Conclusion of worst-case and operation mode

The EUT has three types of modulation (GFSK, π /4DQPSK and 8DPSK). Therefore all applicable requirements were tested with all the modulations. And packet type was tested at the worst case(DH5).

EUT Operation test setup

Bluetooth tester was used to control the transmit parameters during test.

Tested frequency information

- Hopping Function : Enable

	Tested Frequency (MHz)
Hopping Band	2 402 ~ 2 480

- Hopping Function : Disable

	Tested Frequency (MHz)
Lowest Channel	2 402
Middle Channel	2 441
Highest Channel	2 480



1.9. Test Equipment List

Туре	Manufacturer	Model	Cal.Date (yy/mm/dd)	Next.Cal.Date (yy/mm/dd)	S/N
Spectrum Analyzer	Agilent Technologies	N9020A	21/08/30	22/08/30	MY46471622
Spectrum Analyzer	Agilent Technologies	N9020A	20/12/16	21/12/16	MY48011700
Spectrum Analyzer Agilent Technologies		N9020A	21/06/24	22/06/24	US47360812
DC Power Supply Agilent Technologies		66332A	21/06/24	22/06/24	US37473422
Multimeter	FLUKE	17B+	20/12/16	21/12/16	36390701WS
Signal Generator	Rohde Schwarz	SMBV100A	20/12/16	21/12/16	255571
Signal Generator	ANRITSU	MG3695C	20/12/16	21/12/16	173501
Thermohygrometer	BODYCOM	BJ5478	20/12/16	21/12/16	120612-1
Thermohygrometer	BODYCOM	BJ5478	20/12/16	21/12/16	120612-2
Thermohygrometer	BODYCOM	BJ5478	21/06/24	22/06/24	N/A
BlueTooth Tester	Tescom	TC-3000C	21/06/24	22/06/24	3000C000563
Power Divider	Anritsu	K240B	21/06/24	22/06/24	1701099
Loop Antenna	ETS-Lindgren	6502	21/01/28	23/01/28	00226186
BILOG ANTENNA	Schwarzbeck	VULB 9160	20/12/16	21/12/16	3362
Horn Antenna	ETS-Lindgren	3117	21/06/24	22/06/24	00143278
Horn Antenna	A.H.Systems Inc.	SAS-574	21/06/24	22/06/24	155
PreAmplifier	tsj	MLA-0118-B01-40	20/12/16	21/12/16	1852267
PreAmplifier	tsj	MLA-1840-J02-45	21/06/24	22/06/24	16966-10728
PreAmplifier	H.P	8447D	20/12/16	21/12/16	2944A07774
High Pass Filter	Wainwright Instruments	WHKX12-935- 1000-15000-40SS	21/06/24	22/06/24	8
High Pass Filter	Wainwright Instruments	WHKX10-2838- 3300-18000-60SS	21/06/24	22/06/24	1
High Pass Filter	Wainwright Instruments	WHNX8.0/26.5- 6SS	21/06/24	22/06/24	3
Attenuator	Hefei Shunze	SS5T2.92-10-40	21/06/24	22/06/24	16012202
Attenuator	Aeroflex/Weinschel	56-3	21/06/24	22/06/24	Y2370
Attenuator	SMAJK	SMAJK-2-3	21/06/24	22/06/24	3
Attenuator	SMAJK	SMAJK-2-3	21/06/24	22/06/24	2
Power Meter & Wide Bandwidth Sensor	Anritsu	ML2495A MA2490A	21/06/24	22/06/24	1306007 1249001
EMI Receiver	ROHDE&SCHWARZ	ESU	21/01/19	22/01/19	100538
PULSE LIMITER	Rohde Schwarz	ESH3-Z2	21/08/23	22/08/23	101333
LISN	SCHWARZBECK	NSLK 8128 RC	20/10/23 21/10/22	21/10/23 22/10/22	8128 RC-387
HYGROMETER	TESTO	608-H1	21/01/19	22/01/19	34862883
Cable	DT&C	Cable	21/01/08	22/01/08	G-1
Cable	DT&C	Cable	21/01/08	22/01/08	G-2
Cable	HUBER+SUHNER	SUCOFLEX 100	21/01/08	22/01/08	G-3
Cable	DT&C	Cable	21/01/08	22/01/08	G-4
Cable	Junkosha	MWX241	21/01/08	22/01/08	mmW-1
Cable	Junkosha	MWX241	21/01/08	22/01/08	mmW-4
Cable	HUBER+SUHNER	SUCOFLEX100	21/01/08	22/01/08	M-01
Cable	HUBER+SUHNER	SUCOFLEX100	21/01/08	22/01/08	M-02
Cable	JUNFLON	MWX241	21/01/08	22/01/08	M-03
Cable	JUNFLON	J12J101757-00	21/01/08	22/01/08	M-07
Cable	HUBER+SUHNER	SUCOFLEX106	21/01/08	22/01/08	M-09
Cable	DT&C	Cable	21/01/05	22/01/05	RFC-11
Cable	DT&C	Cable	21/01/05	22/01/05	RFC-69
Test Software	tsj	Radiated Emission Measurement	NA	NA	Version 2.00.0177
Test Software	tsj	Noise Terminal Measurement	NA	NA	Version 2.00.0170

Note1: The measurement antennas were calibrated in accordance to the requirements of ANSI C63.5-2017 Note2: The cable is not a regular calibration item, so it has been calibrated by DT & C itself.

2. Antenna Requirement

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 an antenna that uses a unique coupling to the intentional radiator shall be considered sufficient to comply with the provisions.

Conclusion: Comply

The antenna is attached on the device by means of unique coupling method (Spring Tension). Therefore this E.U.T complies with the requirement of Part 15.203

3. Summary of Test Results

Maximum Peak Conducted Output Power 20 dB Bandwidth Carrier Frequency Separation	For FCC =< 1 Watt , if CHs >= 75 Others =< 0.125 W For IC if CHs >= 75 =< 1 Watt For Conducted Power =< 4 Watt For e.i.r.p, Others =< 0.125 W For Conducted Power. =< 4 Watt For e.i.r.p NA >= 25 kHz or >= Two thirds of the 20 dB BW, whichever is greater.	Conducted	C C
Carrier Frequency Separation	NA >= 25 kHz or >= Two thirds of the 20 dB BW,	Conducted	С
Separation	>= Two thirds of the 20 dB BW,	Conducted	
			С
Number of Hopping Channels	>= 15 hops		с
Time of Occupancy =< 0.4 seconds			С
Occupied Bandwidth (99 %)	NA		с
Unwanted Emissions (Conducted)	The radiated emission to any 100 kHz of out-band shall be at least 20 dB below the highest in-band spectral density.		с
Unwanted Emissions (Radiated)	Part 15.209 Limits (Refer to section 9)	Radiated	C Note3
AC Power-Line Conducted Emissions	Part 15.207 Limits (Refer to section 10)	AC Line Conducted	С
	Part 15.203 (Refer to section 2)	-	С
À	AC Power-Line	AC Power-Line Conducted Emissions Antenna Requirement Part 15.207 Limits (Refer to section 10) Part 15.203 (Refer to section 2)	Radiated) (Refer to section 9) AC Power-Line Part 15.207 Limits Conducted Emissions (Refer to section 10) Antenna Requirement Part 15.203



4. Maximum Peak Conducted Output Power

4.1. Test Setup

Refer to the APPENDIX I.

4.2. Limit

FCC Requirements

The maximum peak output power of the intentional radiator shall not exceed the following :

- 1. §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 2 400 MHz 2 483.5 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.
- 2. §15.247(b)(1), For frequency hopping systems operating in the 2 400 2 483.5 MHz employing at least 75 non-overlapping hopping channels, and all frequency hopping systems in the 5 725 MHz 5 805 MHz band : 1 Watt. For all other frequency hopping systems in the 2 400 MHz 2 483.5 MHz band: 0.125 watts.

IC Requirements

 RSS-247(5.4) (b), For FHSS operating in the band 2 400 MHz – 2 483.5 MHz, the maximum peak conducted output power shall not exceed 1.0 W if the hopset uses 75 or more hopping channels, the maximum peak conducted output power shall not exceed 0.125 W if the hopset uses less than 75 hopping channels. The e.i.r.p shall not exceed 4 W, except as provided in section 5.4(e)

4.3. Test Procedure

- 1. The RF output power was measured with a spectrum analyzer connected to the RF Antenna connector (conducted measurement) while EUT was operating in transmit mode at the appropriate center frequency, A spectrum analyzer was used to record the shape of the transmit signal.
- 2. The peak output power of the fundamental frequency was measured with the spectrum analyzer using ;

Span = approximately 5 times of the 20 dB bandwidth, centered on a hopping channel

RBW ≥ 20 dB BW VBW ≥ RBW Sweep = auto Detector function = peak Trace = max hold

4.4. Test Results

Modulation	Tested Channel		verage Power		Output wer	Antenna Gain	e.i.r.p ^{Note3}
wouldton	Tested Chaimer	dBm	mW	dBm	mW	(dBi)	(dBm)
	Lowest	6.09	4.06	6.26	4.23	2.79	9.05
<u>GFSK</u>	Middle	6.42	4.39	6.49	4.46	2.79	9.28
	Highest	5.51	3.56	5.62	3.65	2.79	8.41
	Lowest	5.81	3.81	7.90	6.17	2.79	10.69
<u>π/4DQPSK</u>	Middle	6.17	4.14	8.21	6.62	2.79	11.00
	Highest	5.39	3.46	7.28	5.35	2.79	10.07
	Lowest	5.82	3.82	8.13	6.50	2.79	10.92
<u>8DPSK</u>	Middle	6.18	4.15	8.49	7.06	2.79	11.28
	Highest	5.39	3.46	7.56	5.70	2.79	10.35

Note 1: The average output power was tested using an average power meter for reference only. Note 2: See next pages for actual measured spectrum plots.

Note 3: e.i.r.p = $P_{cond} + G_{EUT}$

 P_{cond} = measured power at feedpoint of the EUT antenna, in dBm (Peak Conducted Output Power) G_{EUT} = gain of the EUT radiating element (antenna), in dBi







Peak Output Power

Middle Channel & Modulation : GFSK



Highest Channel & Modulation : GFSK



Peak Output Power

Lowest Channel & Modulation : π/4DQPSK





Middle Channel & Modulation : π/4DQPSK



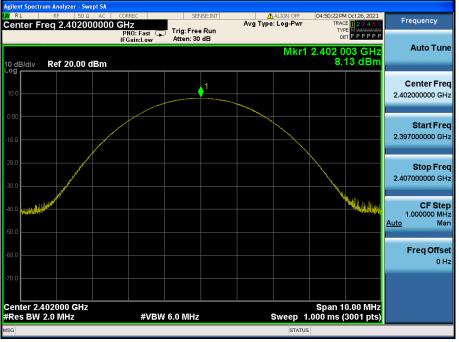
Peak Output Power

Highest Channel & Modulation : π/4DQPSK









Peak Output Power

Middle Channel & Modulation : 8DPSK





Highest Channel & Modulation : 8DPSK





5. 20 dB BW & Occupied BW

5.1. Test Setup

Refer to the APPENDIX I.

5.2. Limit

Limit : Not Applicable

5.3. Test Procedure

- 1. The 20 dB bandwidth was measured with a spectrum analyzer connected to RF antenna Connector (conducted measurement) while EUT was operating in transmit mode. The analyzer center frequency was set to the EUT carrier frequency, using the analyzer.
- 2. The bandwidth of the fundamental frequency was measured with the spectrum analyzer using below setting:

RBW = 1 % to 5 % of the 20 dB BW & Occupied BW

 $VBW \ge 3 \times RBW$

Span = between two times and five times the 20 dB bandwidth & Occupied BW

Sweep = auto

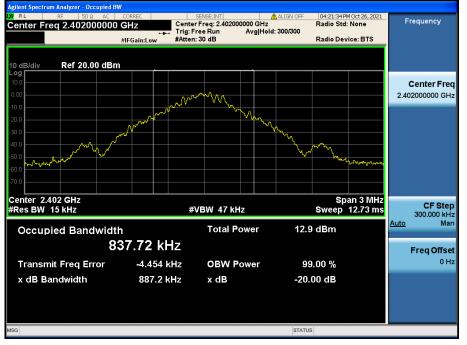
Detector function = peak

Trace = max hold

5.4. Test Results

Modulation	Tested Channel	20 dB BW (MHz)	Occupied BW (MHz)
	Lowest	0.887	0.838
<u>GFSK</u>	Middle	0.886	0.840
	Highest	0.887	0.838
	Lowest	1.327	1.177
<u>π/4DQPSK</u>	Middle	1.323	1.180
	Highest	1.319	1.179
	Lowest	1.325	1.184
<u>8DPSK</u>	Middle	1.311	1.184
	Highest	1.293	1.184





20 dB BW & Occupied BW







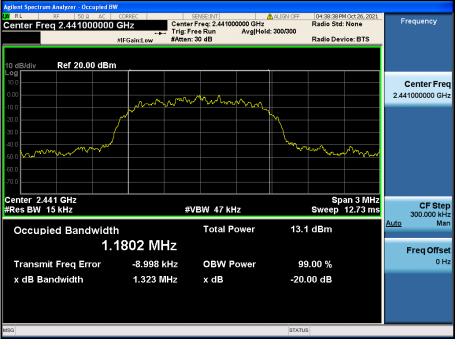


20 dB BW & Occupied BW

Lowest Channel & Modulation : π/4DQPSK



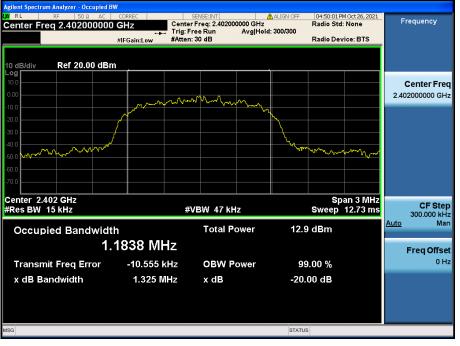
Middle Channel & Modulation : π/4DQPSK



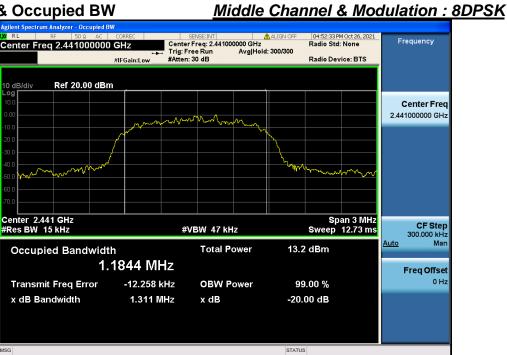
20 dB BW

Highest Channel & Modulation : π/4DQPSK m Analyzer - Occupied BV nt So 04:41:11PM Oct 26, 2021 Radio Std: None 🛕 ALIGN C Center Freq: 2.48000000 GHz Trig: Free Run Avg|Hold: 300/300 #Atten: 30 dB Frequency Center Freq 2.480000000 GHz #IFGain:Low Radio Device: BTS Ref 20.00 dBm **Center Freq** 2 48000000 GHz w. M.M. Center 2.48 GHz #Res BW 15 kHz Span 3 MHz Sweep 12.73 ms CF Step 300.000 kHz #VBW 47 kHz Mar <u>Auto</u> 12.3 dBm Total Power **Occupied Bandwidth** 1.1788 MHz Freq Offset 0 Hz Transmit Freq Error -8.829 kHz **OBW Power** 99.00 % x dB Bandwidth 1.319 MHz x dB -20.00 dB STATUS

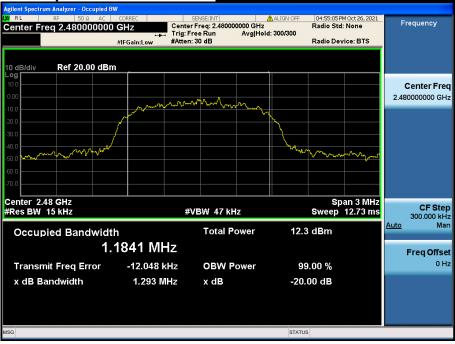
Lowest Channel & Modulation : 8DPSK



20 dB BW & Occupied BW









6. Carrier Frequency Separation

6.1. Test Setup

Refer to the APPENDIX I.

6.2. Limit

Limit : \geq 25 kHz or \geq Two-Thirds of the 20 dB BW whichever is greater.

6.3. Test Procedure

The carrier frequency separation was measured with a spectrum analyzer connected to the antenna terminal, while EUT had its hopping function enabled.

After the trace being stable, the reading value between the peaks of the adjacent channels using the markerdelta function was recorded as the measurement results.

The spectrum analyzer is set to :

Span = wide enough to capture the peaks of two adjacent channels

RBW = Start with the RBW set to approximately 30 % of the channel spacing; adjust as necessary to best identify the center of each individual channel.

VBW ≥ RBW Sweep = auto

Detector function = peak Trace = max hold

6.4. Test Results

FH mode

Hopping Mode	Modulation	Peak of reference channel(MHz)	Peak of adjacent Channel(MHz)	Test Result (MHz)
	GFSK	2 439.987	2 440.984	0.997
Enable	π/4DQPSK	2 439.986	2 440.987	1.001
	8DPSK	2 440.987	2 441.994	1.007

AFH mode

Hopping Mode	Modulation	Peak of reference channel(MHz)	Peak of adjacent Channel(MHz)	Test Result (MHz)
	GFSK	2 440.986	2 441.985	0.999
Enable	π/4DQPSK	2 439.989	2 440.995	1.006
	8DPSK	2 440.984	2 441.983	0.999

Note 1 : See next pages for actual measured spectrum

Dt&C

Carrier Frequency Separation (FH)





Carrier Frequency Separation (FH)

Hopping mode : Enable & π/4DQPSK





Carrier Frequency Separation (FH)



	ent Spe	ectru																				
LXI	RL		RF	_	50 Q	AC	CORRE	C		S	ENSE:IN	Г			ALIGN OFF	05:0		l Oct 26, 20			Frequenc	v
Ce	nter	Fre	ed 2	2.44	100	0000	GHz			Trig: Fr	o Dun		Avg I	ype:	Log-Pwr		TYP	E 1234	56 4444		requerie	,
								: Wide in:Low	Ŷ	Atten: 3							DE	Е М илии Т Р Р Р Р	ΡP			
		_							_						Δ.	Miland	4.0	07 MH			Auto '	Tune
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#R	es D	VV 3	DI K	Π2				#VI	200	150 kH	۷			5	weep	1.200	ms (	3001 pi	s,	A	300.00	0 kHz Man
MKF	MODE					Х				Y		FUN	CTION	FUNC	TION WIDTH	1	UNCTIO	N VALUE	^	<u>Auto</u>		wan
1	Δ2	1	f	( <u>(</u> )		~	1.007	MHz (	Δ)	-0.6	3 dB											
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67																						
8																						
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Carrier Frequency Separation (AFH) <u>Hopping mode : Enable & GFSK</u>

🛈 Dt&C



### Carrier Frequency Separation (AFH) <u>Hopping mode : Enable & $\pi/4DQPSK$ </u>



Carrier Frequency Separation (AFH) Hopping mode : Enable & 8DPSK

RL	m Analyzer - Sw RF 50 Q eq 2.4410	AC COR 00000 GH		SENS	E:INT		ALIGN OFF	TRAC	M Oct 26, 2021 CE <b>1 2 3 4 5</b> 6 PE M <del>WWWWW</del>	Frequency
0 dB/div	Ref 20.00	IFC	Sain:Low	Atten: 30 d	iB			ΔMkr1	999 kHz 0.78 dB	Auto Tune
.og 10.0 0.00		^	~~~	X	2~~	~~~~	~~~~	1Δ2		<b>Center Fre</b> 2.441000000 GH
20.0 30.0 40.0										Start Fre 2.439500000 G⊦
50.0 50.0 70.0										Stop Fre 2.442500000 G⊦
enter 2.4 Res BW :		×	#VBW	150 kHz	EUN		Sweep 1	.200 ms (	.000 MHz 3001 pts)	CF Ste 300.000 kH Auto Ma
1 Δ2 1 2 F 1 3 4 5 5			99 kHz (Δ) 4 GHz	-0.78 d 5.47 dB	в			ronent		Freq Offse 0 H
6 7 8 9 10										
G				Ш			STATUS	ý.	>	

# 7. Number of Hopping Channels

### 7.1. Test Setup

Refer to the APPENDIX I.

### 7.2. Limit

Limit : >= 15 hops

#### 7.3. Test Procedure

The number of hopping frequencies was measured with a spectrum analyzer connected to the antenna terminal, while EUT had its hopping function enabled.

To get higher resolution, two frequency ranges for FH mode within the 2 400 MHz ~ 2 483.5 MHz were examined.

The spectrum analyzer is set to :

Span for FH mode = 50 MHz	Start Frequency = 2 391.5 MHz,	Stop Frequency = 2 441.5 MHz						
	Start Frequency = 2 441.5 MHz,	Stop Frequency = 2 491.5 MHz						
Span for AFH mode = 30 MHz Start Frequency = 2 426.0 MHz, Stop Frequency = 2 456.0 MHz								
	RBW = To identify clearly the individual channels, set the RBW to less than 30 % of the channel spacing							
or the 20 dB bandwidth, whichever is smaller.								
VBW ≥ RBW Sweep = auto								
Detector function = peak	Trace = max hold							

#### 7.4. Test Results

#### FH mode

Hopping mode	Modulation	Test Result (Total Hops)
	GFSK	79
Enable	π/4DQPSK	79
	8DPSK	79

#### AFH mode

Hopping mode	Modulation	Test Result (Total Hops)
	GFSK	20
Enable	π/4DQPSK	20
	8DPSK	20

Note 1 : See next pages for actual measured spectrum plots.

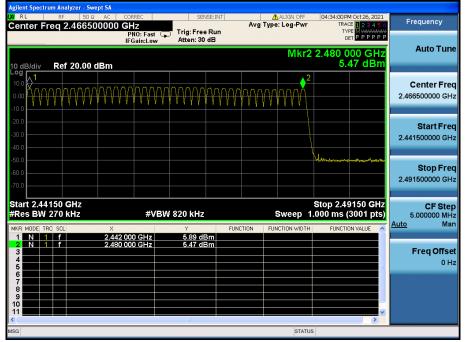
### Number of <u>Hopping Frequencies 1(FH)</u>

#### Hopping mode : Enable & GFSK

		cuu		uyzer - Sw																									
		Ere	RF	50 Q 2.41650	AC							SENS	SE:IN	T		Av	a T		ALIGI : Log			04			1 Oct 26, 2 E <mark>1 2 3</mark> 4			Frequen	су
66	ille1	TTE	-q 2	-41030	5000	1	PNO:	Fast			ig: F													TYP	E MWWW	<b>LIALA</b>			
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-30.1																													tFreq
-40.1																												2.39150000	0 GHZ
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-60.1																								_		-		2.44150000	
-70.1																								_		_		2.44100000	JO GHZ
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	rt 2.							-40.0	-		A 1.1	-													150 G				Step
#R	es Bl	WV Z	70	KHZ				₩V	BW	82	0 kl	ΊZ						ì	swe	ep	1.	uuu	lims	5 (,	3001 p	πs)		5.00000 Auto	0 MHz Man
MKR	MODE	TRC			×						Y			FL	JNC1	TION		FUN	CTION	WIDT	[H]		FUNC	CTIO	IN VALUE	^	1	4010	IVIAII
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#### Number of Hopping Frequencies 2(FH)

#### Hopping mode : Enable & GFSK



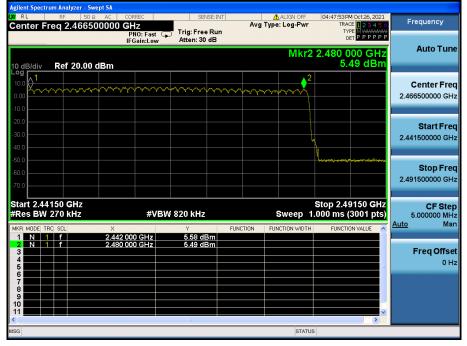
# Number of Hopping Frequencies 1(FH)

# Hopping mode : Enable & π/4DQPSK

XI RL Center Fi	RF 50 eq 2.4165	500000 GH	REC Z NO: Fast				ALIGN OFF e: Log-Pwr	TRA	M Oct 26, 2021 CE 1 2 3 4 5 6 PE M <del>WWWWW</del> ET P P P P P P P	Frequency
10 dB/div	Ref 20.00	IFO	NO: Fast G Gain:Low	Atten: 30			Mkr2	2.441 0	00 GHz 87 dBm	Auto Tune
10.0 0.00		01	ᠰ᠆ᠰ᠕ᡃᠰᠬ᠕ᠰ	~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~	ᢞᡟᡟᠰ᠋ᢩ᠆᠆	~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~	~~~~~~	¥~~~~~~	, , , , , , , , , , , , , , , , , , ,	Center Fred 2.416500000 GH;
-20.0 -30.0 -40.0		л Л								Start Fred 2.391500000 GHz
-50.0	manget are strandbard									Stop Fred 2.441500000 GHz
Start 2.39 #Res BW	270 kHz	×		V 820 kHz Y			Sweep 1	.000 ms (	4150 GHz 3001 pts)	CF Step 5.000000 MH; <u>Auto</u> Mar
1 N 1 2 N 1 3 4 5	f	2.402 00 2.441 00	0 GHz 0 GHz	5.76 df 5.87 df	3m 3m					Freq Offset 0 Hz
6 7 8 9 10 11										
< NSG				IU			STATU	s	>	

Number of Hopping Frequencies 2(FH)

### Hopping mode : Enable & π/4DQPSK



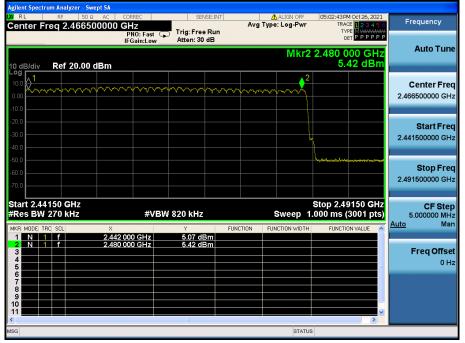
# Number of <u>Hopping Frequencies 1(FH)</u>

# Hopping mode : Enable & 8DPSK

	spectru		ilyzer - Sv														
LXI RL		RF		Ω AC	COR			SE	NSE:INT				ALIGN OFF		M Oct 26, 2021		Frequency
Cent	er Fre	eq 2	2.4165	00000				Trig: Fre	. D		Avg	Type	e: Log-Pwr		CE 123456		inequency
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-60.0																	
-70.0																	2.441500000 GHz
70.0																	
Start	2.391	50.4	247											Stop 24	4150 GHz		
	BW 2					40.4	DIM	000 KH					Swoon	300p 2.4	4100 GHZ		CF Step
#Res	DW 2	70	мпZ			#V	-144	820 kHz					sweep 1	.000 ms	(3001 pts)		5.000000 MHz
MKR M	ODE TRC	SCL		×				Y		FUNC	TION	FUN	ICTION WIDTH	FUNCT	ION VALUE	Au	i <u>to</u> Man
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2	N 1	f				) GHz		5.90 d	Bm								Ener Office
3																	Freq Offset
4																	0 Hz
6																	
7																	
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10															~		
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mSG		_			_	_	_		_	_	_		STATU	°			

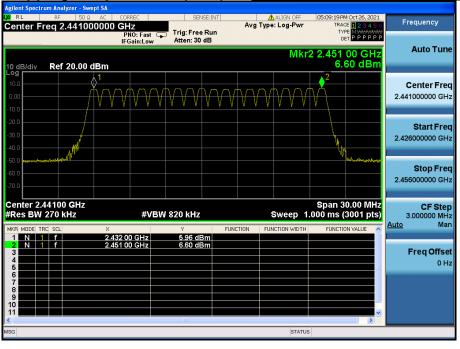
# Number of <u>Hopping Frequencies 2(FH)</u>

#### Hopping mode : Enable & 8DPSK



Number of Hopping Frequencies 1(AFH)

Hopping mode : Enable & GFSK



#### Number of Hopping Frequencies 1(AFH)

<u>Hopping mode : Enable & π/4DQPSK</u>



# Number of Hopping Frequencies 1(AFH) Hopping mode : Enable & 8DPSK

RL RF	yzer - Swept SA 50 Ω AC	CORREC	SENSE:INT		🛕 ALIGN OFF	05:17:51 PM Oct 26, 202:	
enter Freq 2	.441000000	PNO: Fast G	Trig: Free Run Atten: 30 dB	Avg	Type: Log-Pwr	TRACE 12345 TYPE MINANIMA DET PPPPP	44
) dB/div Ref	20.00 dBm	IFGain:Low	Atten: 30 dB		Mkr	2 2.451 00 GH: 6.59 dBn	Auto Tun
og 10.0 1.00	1	~~~~	~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~	~~~~~	~~~~~~	2	Center Fre 2.441000000 G⊦
0.0	- ful						Start Fre 2.426000000 G⊦
0.0 <b>, , , , , , , , , , , , , , , , , , ,</b>	~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~						<b>Stop Fre</b> 2.456000000 G⊢
enter 2.44100 Res BW 270 k KR MODE TRC SCL		#VB\	W 820 kHz	FUNCTION	Sweep 1	Span 30.00 MH .000 ms (3001 pts FUNCTION VALUE	3.000000 MH
1 N 1 f 2 N 1 f 3 4 5 6 6		132 00 GHz 151 00 GHz	5.94 dBm 6.59 dBm				Freq Offs 0 F
7 8 8 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9							
G					STATUS		



# 8. Time of Occupancy

### 8.1. Test Setup

Refer to the APPENDIX I.

# 8.2. Limit

The maximum permissible time of occupancy is 400 ms within a period of 400 ms multiplied by the number of hopping channels employed.

### 8.3. Test Procedure

The dwell time was measured with a spectrum analyzer connected to the antenna terminal, while EUT had its hopping function enabled.

The spectrum analyzer is set to :

Center frequency = 2 441 MHz

Span = zero

RBW = 1 MHz (RBW shall be ≤ channel spacing and where possible RBW should be set >> 1 / T, where T is the expected dwell time per channel)

VBW ≥ RBW

Detector function = peak

Trace = max hold

# 8.4. Test Results

#### FH mode

Hopping mode	Packet Type	Number of hopping Channels	Burst On Time (ms)	Period (ms)	Test Result (sec)
	DH 5	79	2.880	3.750	0.307
Enable	2 DH 5	79	2.880	3.750	0.307
	3 DH 5	79	2.880	3.750	0.307

AFH mode

Hopping mode	Packet Type	Number of hopping Channels	Burst On Time (ms)	Period (ms)	Test Result (sec)
	DH 5	20	2.880	3.750	0.154
Enable	2 DH 5	20	2.880	3.750	0.154
	3 DH 5	20	2.880	3.750	0.154

Note 1 : Dwell Time = 0.4 × Hopping channel × Burst ON time ×

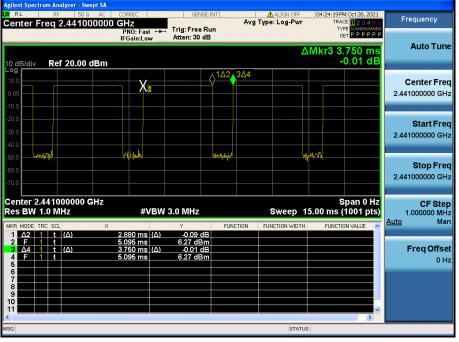
((Hopping rate ÷ Time slots) ÷ Hopping channel)

- Time slots for DH5 = 6 slots (TX = 5 slots / RX = 1 slot)
- Hopping Rate = 1 600 for FH mode & 800 for AFH mode

Note 2 : See next pages for actual measured spectrum plots.

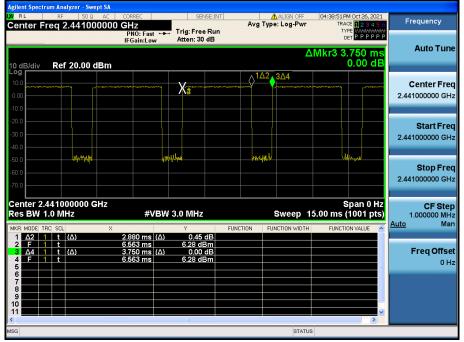


## Time of Occupancy (FH)



#### Time of Occupancy (FH)

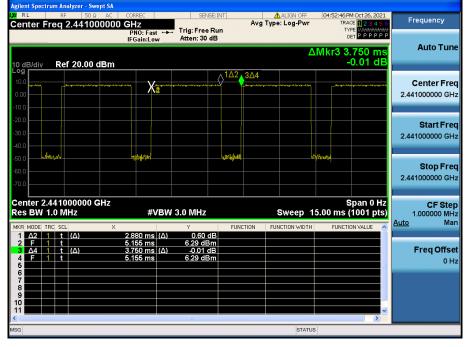
# Hopping mode : Enable & 2-DH5



# Hopping mode : Enable & DH5

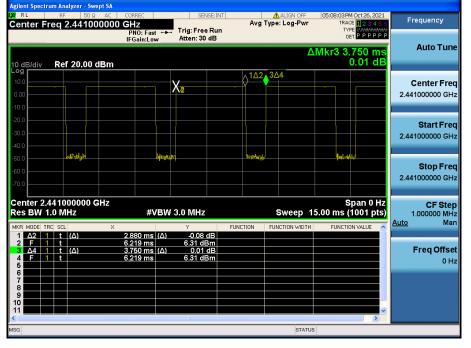
# Time of Occupancy (FH)

# Hopping mode : Enable & 3-DH5



# Time of Occupancy (AFH)

# Hopping mode : Enable & DH5



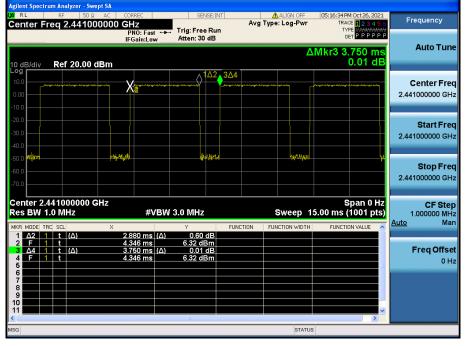
#### Time of Occupancy (AFH)

#### Hopping mode : Enable & 2-DH5 RL Avg Type: Log-Pwr Frequency Center Freq 2.441000000 GHz PNO: Fast TYPE WWWWWWW DET P P P P P Trig: Free Run Atten: 30 dB Auto Tune ∆Mkr3 3.750 ms 0.02 dE 10 dB/div Log Ref 20.00 dBm 3/4 ¢ **Center Freq** Х 2.441000000 GHz Start Freq 2.441000000 GHz approli la, _{en}tetha Stop Freq 2.441000000 GHz Center 2.441000000 GHz Res BW 1.0 MHz Span 0 Hz Sweep 15.00 ms (1001 pts) CF Step 1.000000 MHz #VBW 3.0 MHz Man <u>Auto</u> Δ2 1 t (Δ) 6.22 dBm 0.02 dB 6.22 dBm $\begin{array}{c|ccccc} F & 1 & t \\ \hline \Delta 4 & 1 & t \\ \hline F & 1 & t \end{array}$ Freq Offset s (Δ) 0 Hz STATUS



# Time of Occupancy (AFH)

# Hopping mode : Enable & 3-DH5





# 9. Unwanted Emissions

# 9.1. Test Setup

Refer to the APPENDIX I.

# 9.2. Limit

Part 15.247(d), Part 15.205, Part 15.209 & RSS-247 [5.5], RSS-Gen [8.9], RSS-Gen [8.10] 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 Part 15.247 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)).

#### FCC Limit (uV/m) IC Limit (µA/m) Measurement Distance (m) Frequency (MHz) 2 400 / F (kHz) 6.37/F (F in kHz) 0.009 - 0.490300 0.490 - 1.705 2 4000 / F (kHz) 63.7/F (F in kHz) 30 1.705 - 30.0 30 0.08 30

Frequency (MHz)	FCC Limit (uV/m)	IC Limit (uV/m)	Measurement Distance (m)
30 ~ 88	100 **	100	3
88 ~ 216	150 **	150	3
216 ~ 960	200 **	200	3
Above 960	500	500	3

**Except as provided in paragraph (g), fundamental emissions from intentional radiators operating under this section shall not be located in the frequency bands 54-72 MHz, 76-88 MHz, 174-216 MHz or 470-806 MHz. However, operation within these frequency bands is permitted under other sections of this part, e.g., §§15.231 and 15.241.

# - Part 15.209 & RSS-Gen[8.9]: General requirement



#### - Part 15.205(a): Restricted band of operation

MHz	MHz	MHz	MHz	GHz	GHz
0.009 ~ 0.110	8.414 25 ~ 8.414 75	108 ~ 121.94	1 300 ~ 1 427	4.5 ~ 5.15	14.47 ~ 14.5
0.495 ~ 0.505	12.29 ~ 12.293	123 ~ 138	1 435 ~ 1 626.5	5.35 ~ 5.46	15.35 ~ 16.2
2.173 5 ~ 2.190 5	12.519 75 ~ 12.520 25	149.9 ~ 150.05	1 645.5 ~ 1 646.5	7.25 ~ 7.75	17.7 ~ 21.4
4.125 ~ 4.128	12.576 75 ~ 12.577 25	156.524 75 ~ 156.525 25	1 660 ~ 1 710	8.025 ~ 8.5	22.01 ~ 23.12
4.177 25 ~ 4.177 75	13.36 ~ 13.41	156.7 ~ 156.9	1 718.8 ~ 1 722.2	9.0 ~ 9.2	23.6 ~ 24.0
4.207 25 ~ 4.207 75	16.42 ~ 16.423	162.012 5 ~ 167.17	2 200 ~ 2 300	9.3 ~ 9.5	31.2 ~ 31.8
6.215 ~ 6.218	16.694 75 ~ 16.695 25	167.72 ~ 173.2	2 310 ~ 2 390	10.6 ~ 12.7	36.43 ~ 36.5
6.267 75 ~ 6.268 25	16.804 25 ~ 16.804 75	240 ~ 285	2 483.5 ~ 2 500	13.25 ~ 13.4	Above 38.6
6.311 75 ~ 6.312 25	25.5 ~ 25.67	322 ~ 335.4	2 655 ~ 2 900		
8.291 ~ 8.294	37.5 ~ 38.25	399.90 ~ 410	3 260 ~ 3 267		
8.362 ~ 8.366	73 ~ 74.6	608 ~ 614	3 332 ~ 3 339		
8.376 25 ~ 8.386 75	74.8 ~ 75.2	960 ~ 1240	3 345.8 ~ 3 358		
			3 600 ~ 4 400		

#### - RSS-GEN[8.10]: Restricted frequency bands

MHz	MHz	MHz	MHz	MHz	GHz
0.090 ~ 0.110	8.362 ~ 8.366	73 ~ 74.6	608 ~ 614	3 345.8 ~ 3 358	9.0 ~ 9.2
0.495 ~ 0.505	8.376 25 ~ 8.386 75	74.8 ~ 75.2	960 ~ 1 427	3 500 ~ 4 400	9.3 ~ 9.5
2.173 5 ~ 2.190 5	8.414 25 ~ 8.414 75	108 ~ 138	1 435 ~ 1 626.5	4 500 ~ 5 150	10.6 ~ 12.7
3.020 ~ 3.026	12.29 ~ 12.293	149.9 ~ 150.05	1 645.5 ~ 1 646.5	5 350 ~ 5 460	13.25 ~ 13.4
4.125 ~ 4.128	12.519 75 ~ 12.520 25	156.524 75 ~	1 660 ~ 1 710	7 250 ~ 7 750	14.47 ~ 14.5
4.177 25 ~ 4.177 75	12.576 75 ~ 12.577 25	156.525 25	1 718.8 ~ 1 722.2	8 025 ~ 8 500	15.35 ~ 16.2
4.207 25 ~ 4.207 75	13.36 ~ 13.41	156.7 ~ 156.9	2 200 ~ 2 300		17.7 ~ 21.4
5.677 ~ 5.683	16.42 ~ 16.423	162.01 25 ~ 167.17	2 310 ~ 2 390		22.01 ~ 23.12
6.215 ~ 6.218	16.694 75 ~ 16.695 25	167.72 ~ 173.2	2 483.5 ~ 2 500		23.6 ~ 24.0
6.267 75 ~ 6.268 25	16.804 25 ~ 16.804 75	240 ~ 285	2 655 ~ 2 900		31.2 ~ 31.8
6.311 75 ~ 6.312 25	25.5 ~ 25.67	322 ~ 335.4	3 260 ~ 3 267		36.43 ~ 36.5
8.291 ~ 8.294	37.5 ~ 38.25	399.90 ~ 410	3 332 ~ 3 339		Above 38.6



# 9.3. Test Procedures

#### 9.3.1. Test Procedures for Unwanted Emissions(Radiated)

- The EUT is placed on a non-conductive table. For emission measurements at or below 1 GHz, the table height is 80 cm. For emission measurements above 1 GHz, the table height is 1.5 m. The table was rotated 360 degrees to determine the position of the highest radiation.
- 2. During performing radiated emission below 1 GHz, the EUT was set 3 meters away from the interference receiving antenna, which was mounted on the top of a variable-height antenna tower. During performing radiated emission above 1 GHz, the EUT was set 1 or 3 meter away from the interference-receiving antenna.
- For measurements above 1 GHz absorbers are placed on the floor between the turn table and the antenna mast in such a way so as to maximize the reduction of reflections. For measurements below 1 GHz, the absorbers are removed.
- 4. The antenna is a broadband antenna, and its height is varied from one meter to four meters above the ground to determine the maximum value of the field strength. Both horizontal and vertical polarizations of the antenna are set to make the measurement.
- 5. For each suspected emission, the EUT was arranged to its worst case and then the antenna was tuned to heights from 1 meter to 4 meters and the table was turned from 0 degrees to 360 degrees to find the maximum reading.
- 6. The test-receiver system was set to Peak Detect Function and Specified Bandwidth with Maximum Hold Mode.
- 7. If the emission level of the EUT in peak mode was 10 dB lower than the limit specified, then testing could be stopped and the peak values of the EUT would be reported. Otherwise the emissions that did not have 10 dB margin would be re-tested one by one using peak, quasi-peak or average method as specified and then reported in a data sheet.

#### **Measurement Instrument Setting**

- Frequencies less than or equal to 1 000 MHz The resolution bandwidth and video bandwidth of test receiver/spectrum analyzer is 120 kHz for Quasipeak detection (QP) at frequency below 1 GHz.
- Frequencies above 1 000 MHz
   The resolution bandwidth and video bandwidth of test receiver/spectrum analyzer is 1 MHz for Peak detection and frequency above 1 GHz.
   The result of Average measurement is calculated using PK result and duty correction factor.



#### 9.3.2. Test Procedures for Unwanted Emissions(Conducted)

- 1. The transmitter output was connected to the spectrum analyzer.
- 2. The **reference level** of the fundamental frequency was measured with the spectrum analyzer using RBW = 100 kHz, VBW = 300 kHz.
- 3. The conducted spurious emission was tested each ranges were set as below.

Frequency range : 9 kHz ~ 30 MHz RBW = 100 kHz, VBW = 300 kHz, SWEEP TIME = AUTO, DETECTOR = PEAK, TRACE = MAX HOLD, SWEEP POINT : 40 001

Frequency range : 30 MHz ~ 10 GHz, 10 GHz ~ 25 GHz RBW = 1 MHz, VBW = 3 MHz, SWEEP TIME = AUTO, DETECTOR = PEAK, TRACE = MAX HOLD, SWEEP POINT : 40 001

LIMIT LINE = 20 dB below of the reference level of above measurement procedure Step 2. (RBW = 100 kHz, VBW = 300 kHz)

If the emission level with above setting was close to the limit (ie, less than 3 dB margin) then zoom scan is required using RBW = 100 kHz, VBW = 300 kHz, SPAN = 100 MHz and BINS = 2 001 to get accurate emission level within 100 kHz BW.

Also the path loss for conducted measurement setup was used as described on the Appendix I of this test report.

# 9.4. Test Results

#### 9.4.1. Unwanted Emissions(Radiated)

#### Test Notes.

1. The radiated emissions were investigated 9 kHz to 25 GHz. And no other spurious and harmonic emissions were found below listed frequencies.

2. Information of Distance Correction Factor

For finding emissions, measurements may be performed at a distance closer than that specified in the regulations.

In this case, the distance correction factor is applied to the result.

- Calculation of distance factor

At frequencies below 30 MHz = 40 log(tested distance / specified distance)

At frequencies at or above 30 MHz = 20 log(tested distance / specified distance)

When distance factor is "N/A", the measurements were performed at the specified distance and distance factor is not applied. 3. DCCF Calculation. (DCCF = Duty Cycle Correction Factor)

- Time to cycle through all channels =  $\Delta t$  = T [ms] X 20 minimum hopping channels , where T = pulse width = 2.88 ms

- 100 ms / Δt [ms] = H -> Round up to next highest integer, to account for worst case, H' = 100 / (2.88 X 20) = 1.74 = 2

- The Worst Case Dwell Time = T [ms] x H' = 2.88 ms X 2 = 5.76 ms

- DCCF = 20 Log(The Worst Case Dwell Time / 100 ms) dB = 20 log( 5.76 / 100 ) = -24.79 dB

4. Sample Calculation.

Margin = Limit - Result / Result = Reading + TF+ DCCF + DCF / TF = AF + CL + HL + AL - AG

Where, TF = Total Factor, AF = Antenna Factor, CL = Cable Loss, AG = Amplifier Gain, HL = High pass filter Loss,

AL = Attenuator Loss, DCCF = Duty Cycle Correction Factor, DCF = Distance Correction Factor

#### 9 kHz ~ 25 GHz Data (Modulation : GFSK)

#### Lowest Channel

Frequency (MHz)	ANT Pol	EUT Position (Axis)	Detector Mode	Reading (dBuV)	TF (dB/m)	DCCF (dB)	DCF (dB)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)
2 389.19	V	Z	PK	49.98	4.46	N/A	N/A	54.44	74.00	19.56
2 389.19	V	Z	AV	49.98	4.46	-24.79	N/A	29.65	54.00	24.35
4 803.85	Н	Z	PK	49.85	2.40	N/A	N/A	52.25	74.00	21.75
4 803.85	Н	Z	AV	49.85	2.40	-24.79	N/A	27.46	54.00	26.54

#### Middle Channel

Frequency (MHz)	ANT Pol	EUT Position (Axis)	Detector Mode	Reading (dBuV)	TF (dB/m)	DCCF (dB)	DCF (dB)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)
4 881.94	Н	Z	PK	50.29	2.38	N/A	N/A	52.67	74.00	21.33
4 881.94	Н	Z	AV	50.29	2.38	-24.79	N/A	27.88	54.00	26.12

Highest Channel

Frequency (MHz)	ANT Pol	EUT Position (Axis)	Detector Mode	Reading (dBuV)	TF (dB/m)	DCCF (dB)	DCF (dB)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)
2 483.94	V	Z	PK	50.31	5.40	N/A	N/A	55.71	74.00	18.29
2 483.94	V	Z	AV	50.31	5.40	-24.79	N/A	30.92	54.00	23.08
4 960.21	Н	Z	PK	50.73	2.45	N/A	N/A	53.18	74.00	20.82
4 960.21	Н	Z	AV	50.73	2.45	-24.79	N/A	28.39	54.00	25.61

#### 9 kHz ~ 25 GHz Data (Modulation : $\pi$ /4DQPSK)

Lowest Channel

Frequency (MHz)	ANT Pol	EUT Position (Axis)	Detector Mode	Reading (dBuV)	TF (dB/m)	DCCF (dB)	DCF (dB)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)
2 387.93	V	Z	PK	49.96	4.46	N/A	N/A	54.42	74.00	19.58
2 387.93	V	Z	AV	49.96	4.46	-24.79	N/A	29.63	54.00	24.37
4 803.57	Н	Z	PK	49.90	2.40	N/A	N/A	52.30	74.00	21.70
4 803.57	Н	Z	AV	49.90	2.40	-24.79	N/A	27.51	54.00	26.49

#### Middle Channel

Frequency (MHz)	ANT Pol	EUT Position (Axis)	Detector Mode	Reading (dBuV)	TF (dB/m)	DCCF (dB)	DCF (dB)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)
4 881.58	Н	Z	PK	50.11	2.37	N/A	N/A	52.48	74.00	21.52
4 881.58	Н	Z	AV	50.11	2.37	-24.79	N/A	27.69	54.00	26.31

#### Highest Channel

Frequency (MHz)	ANT Pol	EUT Position (Axis)	Detector Mode	Reading (dBuV)	TF (dB/m)	DCCF (dB)	DCF (dB)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)
2 488.91	V	Z	PK	49.99	5.48	N/A	N/A	55.47	74.00	18.53
2 488.91	V	Z	AV	49.99	5.48	-24.79	N/A	30.68	54.00	23.32
4 959.72	Н	Z	PK	50.37	2.45	N/A	N/A	52.82	74.00	21.18
4 959.72	Н	Z	AV	50.37	2.45	-24.79	N/A	28.03	54.00	25.97



#### 9 kHz ~ 25 GHz Data (Modulation : 8DPSK)

Lowest Channel

Frequency (MHz)	ANT Pol	EUT Position (Axis)	Detector Mode	Reading (dBuV)	TF (dB/m)	DCCF (dB)	DCF (dB)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)
2 385.81	V	Z	PK	50.07	4.45	N/A	N/A	54.52	74.00	19.48
2 385.81	V	Z	AV	50.07	4.45	-24.79	N/A	29.73	54.00	24.27
4 804.32	Н	Z	PK	50.23	2.40	N/A	N/A	52.63	74.00	21.37
4 804.32	Н	Z	AV	50.23	2.40	-24.79	N/A	27.84	54.00	26.16

#### Middle Channel

Frequency (MHz)	ANT Pol	EUT Position (Axis)	Detector Mode	Reading (dBuV)	TF (dB/m)	DCCF (dB)	DCF (dB)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)
4 881.37	Н	Z	PK	49.56	2.36	N/A	N/A	51.92	74.00	22.08
4 881.37	Н	Z	AV	49.56	2.36	-24.79	N/A	27.13	54.00	26.87

#### Highest Channel

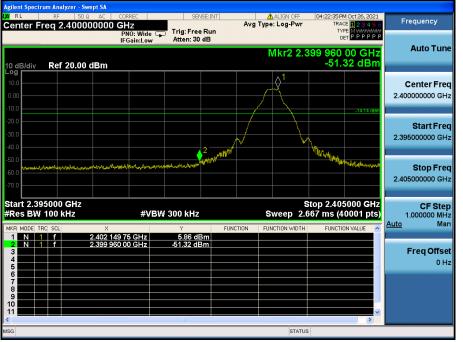
Frequency (MHz)	ANT Pol	EUT Position (Axis)	Detector Mode	Reading (dBuV)	TF (dB/m)	DCCF (dB)	DCF (dB)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)
2 483.72	V	Z	PK	50.00	5.40	N/A	N/A	55.40	74.00	18.60
2 483.72	V	Z	AV	50.00	5.40	-24.79	N/A	30.61	54.00	23.39
4 959.86	Н	Z	PK	49.66	2.45	N/A	N/A	52.11	74.00	21.89
4 959.86	Н	Z	AV	49.66	2.45	-24.79	N/A	27.32	54.00	26.68



### 9.4.2. Unwanted Emissions(Conducted)

#### Low Band-edge

#### Lowest Channel & Modulation : GFSK



#### Low Band-edge

# Hopping mode & Modulation : GFSK





# Conducted Spurious Emissions

### Lowest Channel & Modulation : GFSK

Agilent Spectrum Analyzer - Swept SA					
	CORREC	SENSE:INT	ALIGN OFF 0	4:22:58 PM Oct 26, 2021 TRACE 2 3 4 5 6	Frequency
Center Freq 15.004500 M	PNO: Fast 😱 Trig:	Free Run	ype. Log-r wi	TYPE M WWW.	
	IFGain:Low Atte	n: 30 dB		DETPPPP	
			Mk	r1 299.2 kHz	Auto Tune
10 dB/div Ref 20.00 dBm				-41.20 dBm	
Log					
10.0					Center Freq
0.00					15.004500 MHz
					10.004000 11112
-10.0				-14.14 dBm	
-20.0					Start Freq
-30.0 🕂 1					9.000 kHz
-40.0					0.000 1112
-50.0					
Mokan and An and a set	ويربعه ومعاوية ومحاور ومعاورة والمعاور	winnerstand a week stand and her have and	and the state of the sec	المحمد والعروبان المراجع	Stop Freq
-60.0	a a sea a	an ann an tha an ann an ann an an ann an an an an an	an ann a she ann an ann an 1 a taobh ann an	a na anna an an an an ann an an an an an	30.000000 MHz
-70.0					00.000000 11112
Start 9 kHz				Stop 30.00 MHz	CF Step
#Res BW 100 kHz	#VBW 300 I	KHZ	Sweep 5.333	ms (40001 pts)	2.999100 MHz
MKR MODE TRC SCL X	Y	FUNCTION	FUNCTION WIDTH	FUNCTION VALUE	<u>Auto</u> Man
1 N 1 f	299.2 kHz -41.2	0 dBm			
2 3					Freq Offset
4					0 Hz
5				=	
7					
8					
9					
11				~	
<				>	
MSG			STATUS 🚺	DC Coupled	

LXI RL F	nalyzer - Swept SA RF 50 Ω AC		SENS	E:INT		ALIGN OFF		1 Oct 26, 2021	Frequency
Center Freq	5.01500000	0 GHz PNO: Fast IFGain:Low	Trig: Free Atten: 30 d		Avg Type	e: Log-Pwr	TRAC TYP DE	E 123456 E M WWWWWW T P P P P P P	Frequency
10 dB/div R	ef 20.00 dBm					Mkr	5 5.807 -40.0	86 GHz 08 dBm	Auto Tune
Log 10.0 0.00 -10.0		1						-14:14 dBm	Center Freq 5.015000000 GHz
-20.0 -30.0 -40.0		<b>⊘</b> ³ <b>⊘</b> ⁴	in the second could get history of	¢25	1. 1. f 1. g 2. s. f 2. g 2. s. or 1. f 1. g 2. g 2.			Theory of Standards	Start Freq 30.000000 MHz
-50.0									<b>Stop Freq</b> 10.000000000 GHz
Start 30 MHz #Res BW 1.0	ttart 30 MHz Stop 10.000 GHz Res BW 1.0 MHz #VBW 3.0 MHz Sweep 18.67 ms (40001 pts)						.000 GHz 0001 pts)	CF Step 997.000000 MHz Auto Man	
MKR         MODE         TRC         SI           1         N         1         f           2         N         1         f           3         N         1         f           4         N         1         f           5         N         1         f           6         7         1         f           8         9         1         f           10         10         10         11	2. 5. 2.	402 11 GHz 677 26 GHz 666 32 GHz 156 84 GHz 807 86 GHz		n n	TION FUI	NCTION WIDTH	FUNCTIC		Freq Offset 0 Hz
MSG			III			STATUS		>	

# **Dt&C**

# Conducted Spurious Emissions

# Lowest Channel & Modulation : GFSK





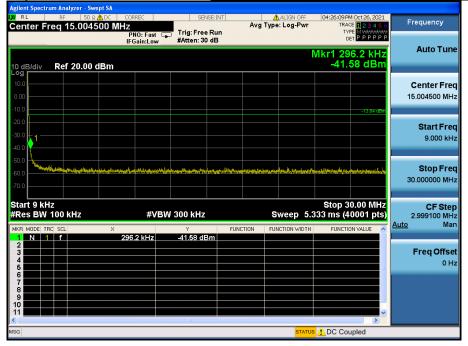
#### **Reference for limit**

#### Middle Channel & Modulation : GFSK



# Conducted Spurious Emissions

#### Middle Channel & Modulation : GFSK



# **Dt&C**

# Conducted Spurious Emissions

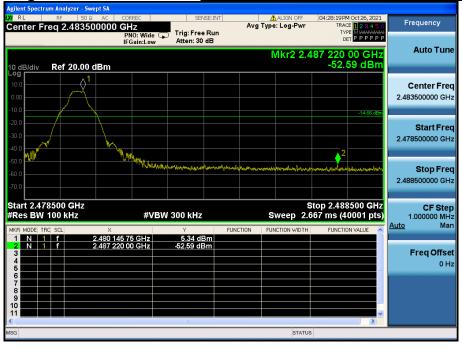
# Middle Channel & Modulation : GFSK



Agilent Spectru								
Center Fr		0 Q AC CORREC	SENSE	Avg	ALIGN OFF	TRACI	Oct 26, 2021	Frequency
		PNO: Fa IFGain:Li					E MWWWWWW T P P P P P P	Auto Tune
10 dB/div								
10.0 0.00							-13.84 dBm	Center Freq 17.50000000 GHz
-20.0 -30.0 -40.0			3		a la constante en sel de	2	ð	<b>Start Freq</b> 10.000000000 GHz
-50.0 -60.0 -70.0								<b>Stop Freq</b> 25.000000000 GHz
	start 10.000 GHz Stop 25.000 GHz Res BW 1.0 MHz #VBW 3.0 MHz Sweep 40.00 ms (40001 pts)							CF Step 1.50000000 GHz Auto Man
MKR MODE TRO	C SCL	× 24.882 250 GHz	y -32.14 dBm	FUNCTION	FUNCTION WIDTH	FUNCTIO	N VALUE	<u>Auto</u> Man
2 N 1 3 N 1 4 5	f	21.905 125 GHz 16.765 375 GHz	z -34.14 dBm z -35.35 dBm				=	<b>Freq Offset</b> 0 Hz
6 7 8 9 10								
11							>	
MSG	SG STATUS							

### High Band-edge

### Highest Channel & Modulation : GFSK



#### **High Band-edge**

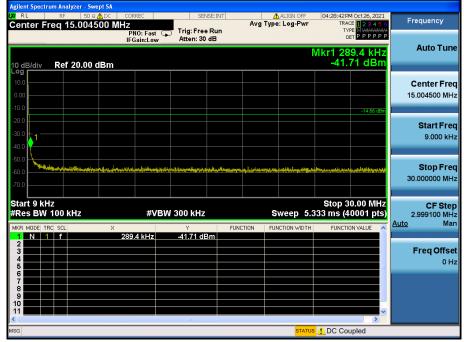
#### Hopping mode & Modulation : GFSK





#### Conducted Spurious Emissions

# Highest Channel & Modulation : GFSK

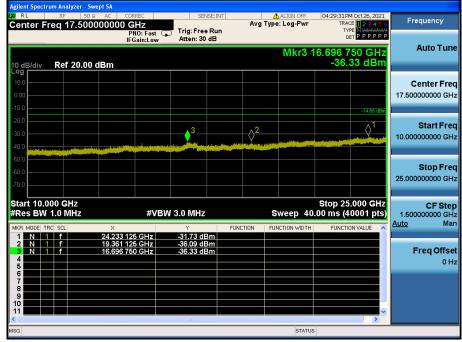


Agilent Spectrum Analyzer - Sw							
	AC CORREC	SENSE:INT	ALIGN OFF	04:29:07 PM Oct 26, 2021 TRACE 1 2 3 4 5 6	Frequency		
Center Freq 5.0150	PNO: Fast G IFGain:Low	Trig: Free Run Atten: 30 dB	Avg Type. Log-t wi	TYPE MWWWWW DET PPPPP	Auto Tune		
10 dB/div Ref 20.00	D dB/div Ref 20.00 dBm -40.66 dBm						
10.0 0.00 -10.0	1 			-14,56 dBm	Center Freq 5.015000000 GHz		
-20.0		Lange of the local division of the second			Start Free 30.000000 MHz		
-60.0 -60.0 -70.0					Stop Fred 10.000000000 GH2		
Start 30 MHz #Res BW 1.0 MHz	#Res BW 1.0 MHz						
MKR MODE TRC SCL	× 2.480 13 GHz	Y FUN 5.67 dBm	CTION FUNCTION WIDTH	FUNCTION VALUE	<u>Auto</u> Mar		
2 N 1 f 3 N 1 f 4 N 1 f 5 N 1 f	3.227 63 GHz 6.185 23 GHz 5.760 26 GHz 6.913 04 GHz	-40.13 dBm -40.35 dBm -40.52 dBm -40.66 dBm			Freq Offset 0 Hz		
7 8 9 10 11							
<		10		>			
SG			STATUS				



### Conducted Spurious Emissions

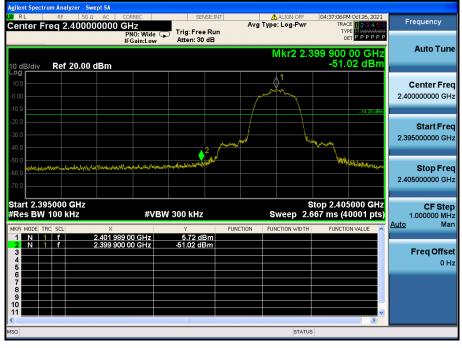
# Highest Channel & Modulation : GFSK





#### Low Band-edge

## Lowest Channel & Modulation : π/4DQPSK



#### Low Band-edge

## Hopping mode & Modulation : π/4DQPSK

