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# **ELECTROMAGNETIC EMISSIONS COMPLIANCE REPORT**





**FCC Applicant:** HP Inc.

1501 Page Mill Road Palo Alto, California 94304, U.S.

**ISED Applicant:** HP Inc.

1501 Page Mill Road Palo Alto, California 94304, U.S.

**Product Name:** Embedded HyperX Wireless Module

**Brand Name:** HP

Model No.: TPN-M101D

Model Difference: N/A

**Report Number:** TERF2210002096E2

FCC ID B94TNM101D

IC: 466X-TNM101D

Date of EUT Received: September 28, 2022

Date of Test: October 31, 2022~November 04, 2022

Issue Date: January 05, 2023

Approved By

### We hereby certify that:

The above equipment was tested by SGS Taiwan Ltd. Central RF Lab The test data, data evaluation, test procedures, and equipment configurations shown in this report were made in accordance with the procedures given in ANSI C63.10:2013 and the energy emitted by the sample EUT comply with FCC rule part §15.247, ISED RSS-247.

The results of this report relate only to the sample identified in this report.

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	Revision History						
Report Number	Revision	Description	Issue Date	Revised By	Remark		
TERF2210002096E2	00	Original	January 05, 2023	Candice Li			

### Note:

1 The remark "\*" indicates modification of the report upon requests from certification body.

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## **GENERAL INFORMATION**

#### 1.1 **Product Description**

Product Name:	Embedded HyperX Wireless Module
Brand Name:	HP
Model No.:	TPN-M101D
Model Difference:	N/A
Hardware Version:	N/A
Firmware Version:	N/A
EUT Series No.:	TE-2209000077P (Conducted) TE_SP_20220906348 (Conduction · Radiated)
Power Supply:	5Vdc
Test Software (Name/Version)	AB1565/68 Lab Test Tool-3.2.2

#### 1.2 **RF Specification**

Radio Technology:	BT BR+EDR
Channel number:	79 channels
Modulation type:	GFSK + π/4DQPSK + 8DPSK
Transmit Power:	11.95 dBm
Frequency Range:	2.402GHz – 2.480GHz
Dwell Time:	≦ 0.4s

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## **Antenna Designation**

Antenna Type	Supplier	Antenna Part No.	Freq. (MHz)	Peak Antenna Gain (dBi)	Worst Antenna Gain
	Vendor 1	WA-P-LE-02-311	2400~2500	3.41	V
	Vendor 1	WA-P-LA-03-316	2400~2500	2.73	
PIFA	Vendor 2	81EABP15.060	2400~2500	-0.65	
	Vendor 1	WA-P-LA-02-288	2400~2500	2.43	
	Vendor 2	81EABP15.G57	2400~2500	0.97	

#### Note:

- 1. Pre-scanned was done on the above antennas, measurements were demonstrated by using the antenna with the highest gain as the worst case scenarios.
- Antenna information is provided by the applicant.

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## **Test Methodology of Applied Standards**

FCC Part 15, Subpart C §15.247 FCC KDB 558074 D01 15.247 Meas. Guidance v05r02 RSS-247 issue 2 Feb. 2017 RSS-Gen, Issue 5 April 2018 ANSI C63.10:2013

#### 1.5 **Test Facility**

Laboratory	Test Site Address	Test Site Name	FCC Designa- tion number	IC CAB identifier
		SAC 1		
		SAC 2		
		SAC 3		
	No 124 Wu Kung Dood New Toingi	Conduction 1		
	No.134, Wu Kung Road, New Taipei Industrial Park, Wuku District, New	Conducted 1	TW0027	
	Taipei City, Taiwan.	Conducted 2	1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1	
	Conducted 3 Conducted 4 Conducted 5 Conducted 6	Conducted 3		
		Conducted 4		
SGS Taiwan Ltd.		Conducted 6		TW3702
Central RF Lab.		Conduction C		
(TAF code 3702)		SAC C		
		SAC D		
		SAC G		
	No 2 Koji 1et Pd. Cujeban Dietriet	Conducted A		
	No.2, Keji 1st Rd., Guishan District, Taoyuan City, Taiwan 333	Conducted B	TW0028	
	laoyuan City, Taiwan 555	Conducted C		
		Conducted D		
		Conducted E		
		Conducted F		
		Conducted G		

Note: Test site name is remarked on the equipment list in each section of this report as an indication where measurements occurred in specific test site and address.

#### 1.6 **Special Accessories**

There is no special accessory used while test was conducted.

#### 1.7 **Equipment Modifications**

There was no modification incorporated into the EUT.

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## SYSTEM TEST CONFIGURATION

#### 2.1 **EUT Configuration**

The EUT configuration for testing is installed on RF field strength measurement to meet the Commissions requirement and operating in a manner which intends to maximize its emission characteristics in a continuous normal application.

#### 2.2 **EUT Exercise**

An engineering test mode (software/firmware) that applicant provided was utilized to manipulate the EUT into transmit, selection of the test channel, and modulation scheme.

#### 2.3 **Test Procedure**

#### 2.3.1 **Conducted Emissions**

The EUT is a placed on a table which is 0.8 m above ground plane. Conducted emissions from the EUT measured in the frequency range between 0.15 MHz and 30MHz. The CISPR Quasi-Peak and Average detector mode is employed. The two LISNs provide 50uH/50 ohm of coupling impedance for the measuring instrument. Both lines of the power mains connected to the EUT were checked for maximum conducted interference.

#### 2.3.2 **Conducted Test (RF)**

The active antenna port of the unlicensed wireless device is connected to the spectrum analyzer with attenuator to protect the instrumentation. If a second antenna port is available, it is tested at one operating frequency, with other port(s) appropriately terminated, to verify it has similar output characteristics as the fully tested port.

#### 2.3.3 Radiated Emissions

The EUT is a placed on a turn table. For emissions testing at or below 1 GHz, the table height shall be 0.8 m above the reference ground plane. For emission measurements above 1 GHz, the table height shall be 1.5 m. The turn table shall rotate 360 degrees to determine the position of maximum emission level. EUT is set 3m away from the receiving antenna which varied from 1m to 4m to find out the highest emission. And also, each emission was to be maximized by changing the polarization of receiving antenna both horizontal and vertical. In order to find out the max. emission, the relative positions of this transmitter (EUT) was rotated through three orthogonal axes and measurement procedures for electric field radiated emissions above 1 GHz the EUT measurement is to be made "while keeping the antenna in the 'cone of radiation' from that area and pointed at the area both in azimuth and elevation, with polarization oriented for maximum response." is still within the 3dB illumination BW of the measurement antenna.

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## 2.4 Measurement Results Explanation Example

### 2.4.1 Radiated Emission Test Sites For Measurements From 9 kHz To 30 MHz

Radiated emission below 30MHz is measured in a 9m\*6m\*6m semi-ane choic chamber, the measurements correspond to those obtained at an open-field test site.

There is a comparison data of both open-field test site and semi-Anechoic chamber, and the result came out very similar.

### 2.4.2 For all conducted test items:

The offset level is set in the spectrum analyzer to compensate the RF cable loss and attenuation factor between EUT conducted port and spectrum analyzer. With the offset compensation, the spectrum analyzer reading level is exactly EUT RF output level.

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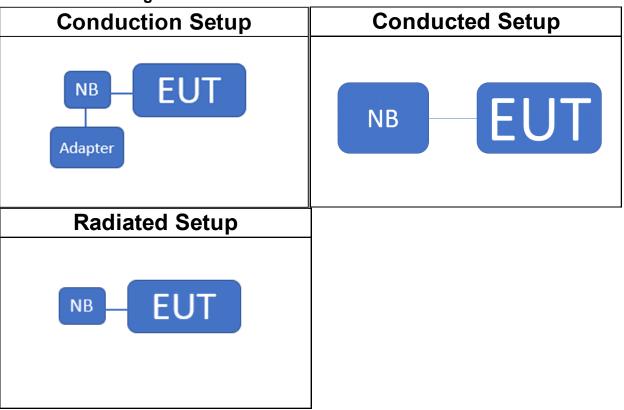
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## **Test Configuration**



#### 2.6 Control Unit(s)

		• •					
	AC Power-Line Conducted Emission Test Site: Conduction C						
EQUIPMENT TYPE MFR MODEL NUMBER SERIAL NUMBER LAST CAL. CA					CAL DUE.		
	Notebook	НР	Poly BHC128	N/A	N.C.R	N.C.R	
	Adapter HP TPN-CA14 N/A N.C.R N.C.R						

Conducted Emission Test Site: Conducted A					
EQUIPMENT TYPE MFR MODEL NUMBER SERIAL NUMBER LAST CAL. CAL DUE.					CAL DUE.
USB Cable	Magic	MA-MF001	N/A	N.C.R	N.C.R
Notebook	НР	Poly BHC128	N/A	N.C.R	N.C.R

Radiated Emission Test Site: SAC G					
EQUIPMENT TYPE	MFR	MODEL NUMBER	SERIAL NUMBER	LAST CAL.	CAL DUE.
USB Cable	Magic	MA-MF001	N/A	N.C.R	N.C.R
Notebook	HP	Poly BHC128	N/A	N.C.R	N.C.R

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## 3 SUMMARY OF TEST RESULTS

FCC Rules	ISED Rules	Description Of Test	Result
§15.207(a)	RSS-Gen §8.8	AC Power Line Conducted Emission	Compliant
§15.247(b)(1)	RSS-247 §5.4 b	Peak Output Power	Compliant
§15.247(a)(1)	RSS-247 §5.1 b RSS-Gen §6.7	Emission Bandwidth	Compliant
§15.205 §15.209 §15.247(d)	RSS-247 §5.5 RSS-Gen §8.9 RSS-Gen §8.10	Conducted & Radiated Band Edge and Spurious Emission	Compliant
§15.247(a)(1)	RSS-247 §5.1 b	Frequency Separation	Compliant
§15.247(a)(1)(iii)	RSS-247 §5.1 d	Number of hopping frequency Time of Occupancy	Compliant
§15.203	N/A	Antenna Requirement	Compliant

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## 4 DESCRIPTION OF TEST MODES

## 4.1 Operated in 2400 ~ 2483.5MHz Band

79 channels are provided for Bluetooth

ITEM	FREQUENCY	ITEM	FREQUENCY	ITEM	FREQUENCY	ITEM	FREQUENCY
1	2402 MHz	21	2422 MHz	41	2442 MHz	71	2462 MHz
2	2403 MHz	22	2423 MHz	42	2443 MHz	72	2463 MHz
3	2404 MHz	23	2424 MHz	43	2444 MHz	73	2464 MHz
4	2405 MHz	24	2425 MHz	44	2445 MHz	74	2465 MHz
5	2406 MHz	25	2426 MHz	45	2446 MHz	75	2466 MHz
6	2407 MHz	26	2427 MHz	46	2447 MHz	76	2467 MHz
7	2408 MHz	27	2428 MHz	47	2448 MHz	77	2468 MHz
8	2409 MHz	28	2429 MHz	48	2449 MHz	78	2469 MHz
9	2410 MHz	29	2430 MHz	49	2450 MHz	79	2470 MHz
10	2411 MHz	30	2431 MHz	50	2451 MHz	70	2471 MHz
11	2412 MHz	31	2432 MHz	51	2452 MHz	71	2472 MHz
12	2413 MHz	32	2433 MHz	52	2453 MHz	72	2473 MHz
13	2414 MHz	33	2434 MHz	53	2454 MHz	73	2474 MHz
14	2415 MHz	34	2435 MHz	54	2455 MHz	74	2475 MHz
15	2416 MHz	35	2436 MHz	55	2456 MHz	75	2476 MHz
16	2417 MHz	36	2437 MHz	56	2457 MHz	76	2477 MHz
17	2418 MHz	37	2438 MHz	57	2458 MHz	77	2478 MHz
18	2419 MHz	38	2439 MHz	58	2459 MHz	78	2479 MHz
19	2420 MHz	39	2440 MHz	59	2460 MHz	79	2480 MHz
20	2421 MHz	40	2441 MHz	60	2461 MHz		

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### The Worst Test Modes and Channel Details

- The EUT has been tested under operating condition.
- Test program used to control the EUT for staying in continuous transmitting and receiving mode is programmed.
- The field strength of radiated emission was measured as the EUT positioned in different orthogonal planes (E1/E2/H) based on actual usage of the EUT to pre-scan the emissions for determining the worst case scenario.
- Investigation has been done on all the possible configurations for searching the worst case.

_		•	_	•
	,	ANTNNA PORT CONDUCTE	ED TEST	
MODE	AVAILABLE CHANNEL	TESTED CHANNEL	MODULATION	PACKET TYPE
	Р	eak Output Power, 20dB Ba	and Width	•
	0 to 78	0,39,78	GFSK	DH5
Bluetooth	0 to 78	0,39,78	π/4-DQPSK	2DH5
	0 to 78	0,39,78	8-DPSK	3DH5
		Band Edge		
Bluetooth	0 to 78	0,78	GFSK/8-DPSK	DH5/3DH5
		Frequency Separation	on	
Bluetooth	0 to 78	0,1,2,38,39,40,76,77,78	GFSK π/4-DQPSK 8-DPSK	DH5 2DH5 3DH5
	Number	of Hopping Frequency, Ho	pping Band edge	•
Bluetooth	0 to 78	0 to 78	GFSK/8-DPSK	DH5/3DH5
		Time of Occupancy(Dwe	Il time)	
			GFSK	DH1/DH3/DH5
Bluetooth	0 to 78	39	π/4-DQPSK	2DH1/2DH3/2DH
			8-DPSK	3DH1/3DH3/3DF
MODE	AVAILABLE CHANNEL	TESTED CHANNEL	MODULATION	PACKET TYPE
	RAD	IATED EMISSION TEST (BE	ELOW 1 GHz)	
Bluetooth	0 to 78	39	GFSK	DH5
	RAD	NATED EMISSION TEST (A	BOVE 1 GHz)	
Bluetooth	0 to 78	0,39,78	GFSK/8-DPSK	DH5/3DH5
			•	

Note: The field strength of radiation emission was measured as EUT stand-up position (H mode) and lie down position (E1, E2 mode) for channel Low, Mid and High, the worst case position was reported.

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## 5 MEASUREMENT UNCERTAINTY

Test Items	l	Incertair	nty
AC Power Line Conducted Emission	+/-	2.34	dB
Output Power measurement	+/-	1	dB
Emission Bandwidth	+/-	1.53	Hz
Undesignable radiated emission measurement	+/-	1.68	dB
Frequency Separation	+/-	1.53	Hz
Number of hopping frequency	+/-	1.53	Hz
Time of Occupancy	+/-	1.53	Hz
Temperature	+/-	0.4	°C
Humidity	+/-	3.5	%
DC / AC Power Source	+/-	1	%

Radiated Spurious Emission Measurement Uncertainty							
	+/-	2.57	dB	9kHz~30MHz			
Polarization: Vertical	+/-	4.85	dB	30MHz - 1000MHz			
Polarization: Vertical	+/-	4.45	dB	1GHz - 18GHz			
	+/-	4.24	dB	18GHz - 40GHz			
	+/-	2.57	dB	9kHz~30MHz			
Polarization: Horizontal	+/-	4.37	dB	30MHz - 1000MHz			
FUIAIIZALIUII. MUIIZUIILAI	+/-	4.45	dB	1GHz - 18GHz			
	+/-	4.24	dB	18GHz - 40GHz			

### Note:

- 1. This uncertainty represents an expanded uncertainty expressed at approximately the 95% confidence level using a coverage factor of k=2.
- 2. The conformity assessment statement in this report is based solely on the test results, measurement uncertainty is excluded.

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## MEASUREMENT EQUIPMENT USED

#### 6.1 **Emission from AC power line**

	AC Power-Line Conducted Emission Test Site: Conduction C								
EQUIPMENT TYPE	MFR	MODEL NUMBER	SERIAL NUMBER	LAST CAL.	CAL DUE.				
LISN	SCHWARZBECK Mess- Elektronik	NSLK8127	973	04/13/2022	04/12/2023				
EMI Test Receiver	R&S	ESCI	101342	04/25/2022	04/24/2023				
Coaxial Cable	EC Lab	RF-HY-CAB-250	RF-HY-CAB-250-01	03/27/2022	03/26/2023				
Pulse Limiter	EC Lab	VTSD 9561F-N	485	03/27/2022	03/26/2023				
Test Software	audix	e3	E3 20923 SGS Ver.9 ( C )	N.C.R	N.C.R				

#### 6.2 **Conducted Measurement**

Conducted Emission Test Site: Conducted A								
EQUIPMENT TYPE	MFR	MODEL NUMBER	SERIAL NUMBER	LAST CAL.	CAL DUE.			
Spectrum Analyzer KEYSIGHT		N9010B	MY59071574	06/20/2022	06/19/2023			
Power Meter	Power Meter Anrits u		1512003	07/26/2022	07/25/2023			
Power Sensor	Anritsu	MA2411B	1339378	07/26/2022	07/25/2023			
Test Software	SGS Taiwan	Radio Test Software	Ver.21	N.C.R	N.C.R			
Attenuator	Marvelous	MVE2213-10	RF05	11/18/2021	11/17/2022			
Attenuator Marvelous		MVE2213-10	RF12	11/18/2021	11/17/2022			
DC Block	PASTERNACK	PE8210	RF155	11/18/2021	11/17/2022			

#### 6.3 **Radiated Measurement**

Radiated Emission Test Site: SAC G								
EQUIPMENT TYPE MFR		MODEL NUMBER	SERIAL NUMBER	LAST CAL.	CAL DUE.			
Broadband Antenna	SCHWARZBECK	VULB 9168	1206	02/15/2022	02/14/2023			
Horn Antenna	Schwarzbeck	BBHA9170	184	12/15/2022	12/14/2023			
Horn Antenna	RF SPIN	DRH18-E	210105A18E	04/08/2022	04/07/2023			
Loop Antenna	ETS.LINDGREN	6502	143303	05/06/2022	05/07/2023			
3m Site NSA	SGS	966 chamber G	N/A	03/30/2022	03/29/2023			
Spectrum Analyzer	KEYSIGHT	N9010A	MY51440113	07/13/2022	07/14/2023			
Test Software	audix	e3	E3 20923 SGS Ver.9 ( C )	N.C.R	N.C.R			
Pre-Amplifier	EMC Instruments	EMC18405SEE	980881	10/25/2022	10/24/2023			
Pre-Amplifier	EMC Instruments	EMC330N	980781	03/15/2022	03/14/2023			
Pre-Amplifier	EMC Instruments	EMC118A45SE	980815	03/15/2022	03/14/2023			
Coaxial Cable	EMCInstruments	EMCCFD400-NM-NM- 8000-5000-2000	210216 ` 210217 ` 210218	03/15/2022	03/14/2023			
Coaxial Cable	FMC104-SM-SM-8000-		210219 ` 210220 ` 210221	03/15/2022	03/14/2023			
Coaxial Cable	EMC105-NM-NM-5000-		210224 ` 210306	03/15/2022	03/14/2023			

**NOTE:** N.C.R refers to Not Calibrated Required.

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## 7 CONDUCTED EMISSION TEST

## 7.1 Standard Applicable

Frequency within 150 kHz to 30MHz shall not exceed the limit table as below.

Frequency range		nits (uV)
MHz	Quasi-peak	Average
0.15 to 0.50	66 to 56	56 to 46
0.50 to 5	56	46
5 to 30	60	50

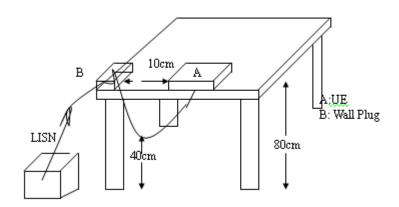
#### Note

- 1. The lower limit shall apply at the transition frequencies
- 2. The limit decreases linearly with the logarithm of the frequency in the range 0.15 MHz to 0.50 MHz.

## 7.2 EUT Setup

- 1. The conducted emission tests were performed in the test site, using the setup in accordance with the ANSI 63.10:2013.
- 2. The AC/DC Power adaptor of EUT was plug-in LISN. The EUT was placed flushed with the rear of the table.
- 3. The LISN was connected with 120Vac/60Hz power source.

## 7.3 Test Setup



### 7.4 Measurement Procedure

- 1. The EUT was placed on a table which is 0.8m above ground plane.
- 2. Maximum procedure was performed on the six highest emissions to ensure EUT compliance.
- 3. Repeat above procedures until all frequency measured were complete.

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### 7.5 Measurement Result

Note: Refer to next page for measurement data and plots.

Note2: The \* reveals the worst-case results that closest to the limit.

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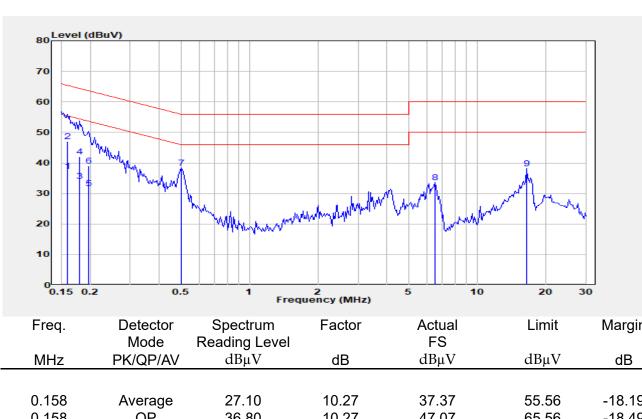
## AC POWER LINE CONDUCTED EMISSION TEST DATA

Report Number :TERF2210002096E2 Test Site :Conduction C

Test Mode :BT **Test Date** :2022-11-04

Power :120V/60Hz Temp./Humi :24.3/66

Probe :L1 Engineer :Temo Chen



Freq.	Detector Mode	Spectrum Reading Level	Factor	Actual FS	Limit	Margin
		•				
MHz	PK/QP/AV	dΒμV	dB	dΒμV	dΒμV	dB
0.158	Average	27.10	10.27	37.37	55.56	-18.19
0.158	QP	36.80	10.27	47.07	65.56	-18.49
0.180	Average	23.80	10.27	34.07	54.50	-20.43
0.180	QP	31.80	10.27	42.07	64.50	-22.43
0.198	Average	21.30	10.27	31.57	53.71	-22.14
0.198	QP	28.70	10.27	38.97	63.71	-24.74
0.502	Peak	28.09	10.32	38.41	56.00	-17.59
6.523	Peak	23.10	10.59	33.69	60.00	-26.31
16.573	Peak	27.34	10.81	38.15	60.00	-21.85

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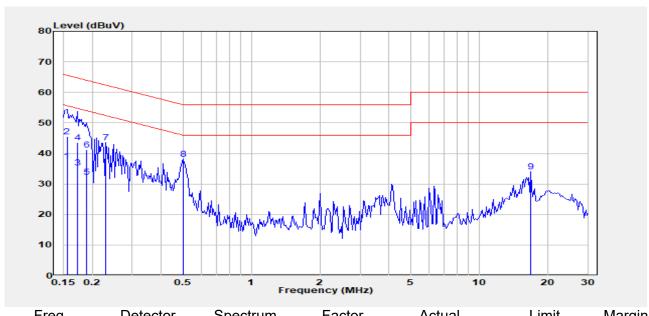
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Report Number :TERF2210002096E2 **Test Site** :Conduction C

Test Mode :BT **Test Date** :2022-11-04

Power :120V/60Hz Temp./Humi :24.3/66

Probe :N Engineer :Temo Chen



Freq.	Detector Mode	Spectrum Reading Level	Factor	Actual FS	Limit	Margin
MHz	PK/QP/AV	dΒμV	dB	dΒμV	dΒμV	dB
0.155	Average	27.30	10.28	37.58	55.74	-18.16
0.155	QP	35.20	10.28	45.48	65.74	-20.26
0.172	Average	25.00	10.28	35.28	54.86	-19.58
0.172	QP	33.40	10.28	43.68	64.86	-21.18
0.189	Average	22.10	10.27	32.37	54.06	-21.69
0.189	QP	31.00	10.27	41.27	64.06	-22.79
0.229	Peak	33.39	10.27	43.67	62.48	-18.81
0.502	Peak	27.81	10.30	38.11	56.00	-17.89
16.928	Peak	23.23	10.78	34.02	60.00	-25.98

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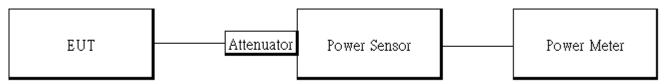
### PEAK OUTPUT POWER MEASUREMENT

#### 8.1 Standard Applicable

For frequency hopping systems operating in the 2400-2483.5 MHz band employing at least 75 hopping channels, The Limit: 1Watt. For all other frequency hopping systems in the 2400 2483.5MHz band: The Limit: 0.125 Watts. The power limit for 1Mbps is 1watt, and 2Mbps, 3Mbps and AFH mode are 0.125 watts.

The e.i.r.p. shall not exceed 4 W.

#### 8.2 **Test Setup**



#### 8.3 **Measurement Procedure:**

- 1. Place the EUT on the table and set it in transmitting mode.
- 2. The testing follows ANSI C63.10 Measurement Guidelines.
- 3. Remove the antenna from the EUT and then connect a low loss RF cable from the antenna port to the power meter or spectrum. (Max Hold, Detector = Peak, RBW >=20dB bandwidth)
- 4. Record the max. reading.
- 5. Repeat above procedures until all default test channel is completed.

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## Peak & Average Power Measurement Result

#### 1M BR mode (Peak):

СН	Freq. (MHz)	Power set	Peak Output Power (dBm)	Output Power (mW)	Limit (mW)
Low	2402	63	11.91	15.524	1000
Mid	2441	63	11.83	15.241	1000
High	2480	63	11.74	14.928	1000

#### 1M BR mode (Average):

	• • /				
СН	Freq. (MHz)	Power set	Max. Avg.Output include tune up tolerance Power (dBm)	Output Power (mW)	Limit (mW)
Low	2402	63	11.80	15.123	1000
Mid	2441	63	11.56	14.310	1000
High	2480	63	11.68	14.711	1000

#### 2M EDR mode (Peak):

Ziii Ziit inouo (i outi).						
СН	Freq. (MHz)	Power set	Peak Output Power (dBm)	Output Power (mW)	Limit (mW)	
Low	2402	63	11.89	15.453	125	
Mid	2441	63	11.83	15.241	125	
High	2480	63	11.72	14.859	125	

#### 2M EDR mode (Average):

	- (				
СН	Freq. (MHz)	Power set	Max. Avg.Output include tune up tolerance Power (dBm)	Output Power (mW)	Limit (mW)
Low	2402	63	10.47	11.153	125
Mid	2441	63	10.33	10.799	125
High	2480	63	9.27	8.460	125

### 3M EDR mode (Peak):

СН	Freq. (MHz)	Power set	Peak Output Power (dBm)	Output Power (mW)	Limit (mW)
Low	2402	63	11.95	15.668	125
Mid	2441	63	11.88	15.417	125
High	2480	63	11.78	15.066	125
NOTE: cable loss as dB that offsets in the spectrum					

#### 3M EDR mode (Average):

СН	Freq. (MHz)	Power set	Max. Avg.Output include tune up tolerance Power (dBm)	Output Power (mW)	Limit (mW)
Low	2402	63	10.52	11.263	125
Mid	2441	63	10.46	11.108	125
High	2480	63	10.34	10.805	125

\*Note: Max. Output include tune up tolerance Power measured by using average detector.

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### **EIRP Measurement Result**

### 1M BR mode EIRP

Channel	Frequency (MHz)	Power set	Max. Avg. Output include tune up tolerance Power (dBm)	Antenna Gain (dBi)	EIRP (mW)	Limit (mW)
Low	2402	63	11.80	3.41	33.162	4000
Mid	2441	63	11.56	3.41	31.379	4000
High	2480	63	11.68	3.41	32.258	4000

### 2M EDR mode EIRP

Channel	Frequency (MHz)	Power set	Max. Avg.Output include tune up tolerance Power (dBm)	Antenna Gain (dBi)	EIRP (mW)	Limit (mW)
Low	2402	63	10.47	3.41	24.456	4000
Mid	2441	63	10.33	3.41	23.680	4000
High	2480	63	9.27	3.41	18.552	4000

### 3M EDR mode EIRP

Channel	Frequency (MHz)	Power set	Max. Avg.Output include tune up tolerance Power (dBm)	Antenna Gain (dBi)	EIRP (mW)	Limit (mW)
Low	2402	63	10.52	3.41	24.697	4000
Mid	2441	63	10.46	3.41	24.358	4000
High	2480	63	10.34	3.41	23.694	4000

\* Note: EIRP = Average Power + Gain

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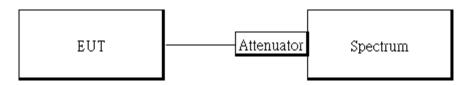
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### 9 EMISSION BANDWIDTH MEASUREMENT

## 9.1 Standard Applicable

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

## 9.2 Test Setup



### 9.3 Measurement Procedure

- 1. Place the EUT on the table and set it in transmitting mode.
- 2. The testing follows ANSI C63.10:2013.
- 3. Remove the antenna from the EUT and then connect a low loss RF cable from the antenna port to the spectrum analyzer.
- 4. Set the spectrum analyzer as

RBW= 1 % to 5% of OBW,

VBW = 3 X RBW,

Span= 2 to 5 times of the OBW,

Sweep=auto,

Detector = Peak, and Max hold for 20dB Bandwidth test.

- 5. Mark the peak frequency and -20dB (upper and lower) frequency
- 6. Set the spectrum analyzer as

RBW= 1 % to 5% of 99% Bandwidth,

VBW ≥ 3 X RBW,

Span= large enough to capture all products of the modulation process,

Sweep=auto,

Detector = Peak, and Max hold for 99% Bandwidth test.

- 7. Mark the peak frequency and 99%dB (upper and lower) frequency
- 8. Repeat above procedures until all test default channel is completed

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### **GFSK**

СН	20 dB BW (MHz)	2/3 BW (MHz)
Low	0.9665	0.64
Mid	0.9671	0.64
High	0.9657	0.64

### π/4-DQPSK

СН	20 dB BW	2/3 BW
011	(MHz)	(MHz)
Low	1.278	0.85
Mid	1.278	0.85
High	1.278	0.85

### 8-DPSK

СН	20 dB BW (MHz)	2/3 BW (MHz)
Low	1.298	0.87
Mid	1.299	0.87
High	1.300	0.87

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#### **GESK**

GI SIN				
СН	99% BW			
011	(MHz)			
Low	0.88385			
Mid	0.88521			
High	0.88487			

### π/4-DQPSK

СН	99% BW (MHz)
Low	1.1765
Mid	1.1765
High	1.1762

### 8-DPSK

СН	99% BW (MHz)
Low	1.1854
Mid	1.1885
High	1.1899

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#### OBW 20dB GFSK 1M DH5 2402MHz OBW 20dB π/4DQPSK 2M DH5 2402MHz Trig: Free Run Gate: Off #IF Gain: Low Input Z: 50 Ω Corrections: Freq Ref: Int Trig: Free Run Gate: Off #IF Gain: Low KEYSIGHT Input RF KEYSIGHT Input: Ri 1 Graph 1 Graph Scale/Div 10.0 dB Occupied Bandwidth 884.75 kHz Occupied Bandwidth 1.1867 MHz Total Power 18.9 dBm Total Power 18.5 dBm Transmit Freq Error x dB Bandwidth % of OBW Power x dB Transmit Freq Error x dB Bandwidth % of OBW Power x dB 99.00 % -20.00 dB 99.00 % -20.00 dB Oct 31, 2022 2:01:46 PM Oct 31, 2022 2:09:27 PM # **#** # X OBW 20dB\_GFSK\_1M\_DH5\_2441MHz OBW 20dB\_π/4DQPSK\_2M\_DH5\_2441MHz + 1 + KEYSIGHT Input: RE Input Z: 50 Ω Trig: Free Run Gate: Off #IF Gain: Low KEYSIGHT Input R nput Z: 50 Ω Trig: Free Run Gate: Off #IF Gain: Low Corrections: Off Freq Ref: Int (S) Corrections: Off Freq Ref: Int (S) Ref Lvi Offset 10.80 dB Ref Value 30.00 dBm Ref Lvi Offset 10.80 dB Ref Value 30.00 dBm Scale/Div 10.0 dB Scale/Div 10.0 dB Span 3 MH: Sweep 3.20 ms (1001 pts % of OBW Power Transmit Freq Error x dB Bandwidth Transmit Freq Error x dB Bandwidth 329 Hz 1.278 MHz % of OBW Power x dB 99.00 % -20.00 dB Oct 31, 2022 2:03:15 PM # ₩ # X (Ct 31, 2022) 2:12:12 PM # **#** # X OBW 20dB\_π/4DQPSK\_2M\_DH5\_2480MHz OBW 20dB\_GFSK\_1M\_DH5\_2480MHz Input Z: 50 Ω Corrections: Off Freq Ref: Int (S) KEYSIGHT Input: Ri KEYSIGHT Input: Ri Ref Lvi Offset 10.80 dB Ref Value 30.00 dBm Ref Lvi Offset 10.80 dB Ref Value 30.00 dBm Scale/Div 10.0 dB Center 2.480000 GHz #Res BW 30.000 kHz #Video BW 100.00 kH: Center 2.480000 GHz #Res BW 30.000 kHz #Video BW 100.00 kH: Span 3 MHz Sweep 3.20 ms (1001 pts) Sweep 3.20 ms (1001 pt Occupied Bandwidth 885.56 kHz Occupied Bandwidth 1.1891 MHz Total Power 18.7 dBm Total Powe 18.2 dBm Transmit Freq Error x dB Bandwidth % of OBW Power x dB 99.00 % -20.00 dB Transmit Freq Error x dB Bandwidth % of OBW Power x dB 99.00 % -20.00 dB

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Oct 31, 2022 2:13:17 PM

1 Oct 31, 2022 2:08:25 PM 

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#### OBW 20dB 8DPSK 3M DH5 2402MHz IC OBW 99%\_GFSK\_1M\_DH5\_2402MHz Spectrum Analyzer Trig: Free Run Gate: Off #IF Gain: Low Input Z: 50 Ω Corrections: Freq Ref: Int Trig: Free Run Gate: Off #IF Gain: Low KEYSIGHT Input RF KEYSIGHT Input RF 1 Graph 1 Graph Scale/Div 10.0 dB Occupied Bandwidth 1.2028 MHz Occupied Bandwidth 883.85 kHz Total Power 18.6 dBm Total Power 18.8 dBm Transmit Freq Error x dB Bandwidth % of OBW Power x dB Transmit Freq Error % of OBW Power x dB 99.00 % -20.00 dB 99.00 % -20.00 dB Oct 31, 2022 2:14:24 PM Oct 31, 2022 2:01:29 PM # ₩ # X OBW 20dB\_8DPSK\_3M\_DH5\_2441MHz IC OBW 99%\_GFSK\_1M\_DH5\_2441MHz Spectrum Analyzer 1 Occupied BW + + Center Freq: 2.441000000 GHz Avg|Hold: 100/100 Radio Std: None Center Freq: 2.441000000 GHz Avg|Hold: 100/100 Radio Std: None KEYSIGHT Input: RE Input Z: 50 Ω Trig: Free Run Gate: Off #IF Gain: Low KEYSIGHT Input R Input Z: 50 Ω Trig: Free Run Gate: Off #IF Gain: Low Corrections: Off Freq Ref: Int (S) Corrections: Off Freq Ref: Int (S) Ref Lvi Offset 10.80 dB Ref Value 30.00 dBm Ref Lvi Offset 10.80 dB Ref Value 30.00 dBm Scale/Div 10.0 dB Scale/Div 10.0 dB Span 3 MH: Sweep 3.20 ms (1001 pts Span 2 MHz Sweep 2.13 ms (1001 pts) Occupied Bandwidth 885.21 kHz Occupied Bandwidth 1.2027 MHz % of OBW Power Transmit Freq Error x dB Bandwidth Transmit Freq Error x dB Bandwidth % of OBW Power x dB 99.00 % -20.00 dB (C) C (C) Oct 31, 2022 2:15:27 PM # ₩ # X Oct 31, 2022 2:02:59 PM # **#** # X OBW 20dB\_8DPSK\_3M\_DH5\_2480MHz IC OBW 99%\_GFSK\_1M\_DH5\_2480MHz Spectrum Analyzer 1 Occupied BW Trig: Free Run Gate: Off #IF Gain: Low Input Z: 50 Ω Corrections: Off Freq Ref: Int (S) Trig: Free Run Gate: Off #IF Gain: Low KEYSIGHT Input: Ri KEYSIGHT Input: Ri Ref Lvi Offset 10.80 dB Ref Value 30.00 dBm Ref Lvi Offset 10.80 dB Ref Value 30.00 dBm Scale/Div 10.0 dB Center 2.480000 GHz #Res BW 30.000 kHz #Video BW 100.00 kH: Center 2.480000 GHz #Res BW 30.000 kHz #Video BW 100.00 kH: Span 2 MHz Sweep 2.13 ms (1001 pts) Sweep 3.20 ms (1001 pt Occupied Bandwidth 1.2003 MHz Occupied Bandwidth 884.87 kHz Total Power 18.5 dBm Total Powe 18.6 dBm Transmit Freq Error x dB Bandwidth Transmit Freq Error x dB Bandwidth % of OBW Power x dB 99.00 % -20.00 dB % of OBW Power x dB 99.00 % -20.00 dB

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(Ct 31, 2022) 2:08:09 PM

1 Oct 31, 2022 2:16:30 PM 

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#### IC OBW 99% $\pi/4DQPSK$ 2M DH5 2402MHz IC OBW 99% 8DPSK 3M DH5 2402MHz Spectrum Analyzer Occupied BW Trig: Free Run Gate: Off #IF Gain: Low Input Z: 50 Ω Corrections: Freq Ref: Int Trig: Free Run Gate: Off #IF Gain: Low KEYSIGHT Input RF KEYSIGHT Input RF 1 Graph 1 Graph Scale/Div 10.0 dB Scala/Div 10 0 dB Occupied Bandwidth 1.1765 MHz Occupied Bandwidth 1.1854 MHz Total Power 18.5 dBm Total Power 18.6 dBm Transmit Freq Error x dB Bandwidth % of OBW Power x dB Transmit Freq Error x dB Bandwidth % of OBW Power x dB 25 Hz 1.297 MHz 99.00 % -20.00 dB 99.00 % -20.00 dB Oct 31, 2022 2:09:10 PM Oct 31, 2022 2:14:06 PM ## # X # **#** # X IC OBW 99%\_ $\pi$ /4DQPSK\_2M\_DH5\_2441MHz IC OBW 99%\_8DPSK\_3M\_DH5\_2441MHz Spectrum Analyzer 1 Occupied BW 1 + 1 + Center Freq: 2.441000000 GHz Avg|Hold: 100/100 Radio Std: None KEYSIGHT Input R Input Z: 50 Ω Trig: Free Run Gate: Off #IF Gain: Low KEYSIGHT Input R nput Z: 50 Ω Trig: Free Run Gate: Off #IF Gain: Low Center Freq: 2.441000000 GHz Avg|Hold: 100/100 Radio Std: None Corrections: Off Freq Ref: Int (S) Corrections: Off Freq Ref: Int (S) Ref Lvi Offset 10.80 dB Ref Value 30.00 dBm Ref Lvi Offset 10.80 dB Ref Value 30.00 dBm Scale/Div 10.0 dB Scale/Div 15.0 dB Span 2 MHz Sweep 2.13 ms (1001 pts) % of OBW Power Transmit Freq Error x dB Bandwidth -857 Hz 1.276 MHz Transmit Freq Error x dB Bandwidth % of OBW Power x dB 99.00 % -20.00 dB (1) C (1) Oct 31, 2022 2:11:55 PM Oct 31, 2022 2:15:11 PM # **#** # X IC OBW 99% $\pi$ /4DQPSK 2M DH5 2480MHz IC OBW 99% 8DPSK 3M DH5 2480MHz Spectrum Analyzer 1 Occupied BW Input Z: 50 Ω Corrections: Off Freq Ref: Int (S) Input Z: 50 Ω Corrections: Off Freq Ref: Int (S) Trig: Free Run Gate: Off #IF Gain: Low KEYSIGHT Input: R Trig: Free Run Gate: Off #IF Gain: Low KEYSIGHT Input: Ri Ref Lvi Offset 10.80 dB Ref Value 30.00 dBm Ref Lvi Offset 10.80 dB Ref Value 30.00 dBm Scale/Div 10.0 dB Center 2.480000 GHz #Res BW 30.000 kHz #Video BW 100.00 kH: Snan 2 MH: Center 2.480000 GHz #Res BW 30.000 kHz #Video BW 100.00 kH: Span 2 MHz Sweep 2.13 ms (1001 pts) Sweep 2.13 ms (1001 pt Occupied Bandwidth 1.1762 MHz Occupied Bandwidth 1.1899 MHz Total Power 18.3 dBm Total Powe 18.3 dBm Transmit Freq Error x dB Bandwidth % of OBW Power x dB 99.00 % -20.00 dB Transmit Freq Error x dB Bandwidth % of OBW Power x dB 99.00 % -20.00 dB

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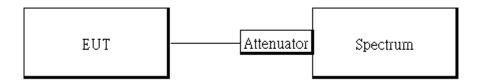
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## 10 CONDUCTED BAND EDGES AND SPURIOUS EMISSION MEASUREMENT

### 10.1 Standard Applicable

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. In addition, radiated emissions which fall in the restricted bands, as defined in §15.205(a) & RSS-Gen §8.10, must also comply with the radiated emission limits specified in §15.209(a) & RSS-Gen §8.9.

## 10.2 Test Setup



#### 10.3 Measurement Procedure

## 10.3.1 Conducted Band Edge:

- 1. Place the EUT on the table and set it in transmitting mode.
- 2. The testing follows ANSI C63.10:2013.
- 3. Remove the antenna from the EUT and then connect a low loss RF cable from the antenna port to the spectrum analyzer.
- 4. Set center frequency of spectrum analyzer = operating frequency.
- 5. Set the spectrum analyzer as RBW=100 kHz, VBW=300 kHz, Sweep = auto
- 6. Mark Peak, 2.3999GHz and 2.4836GHz and record the max. level.
- 7. Repeat above procedures until all frequency measured were complete.

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## 10.3.2 Conducted Spurious Emission:

- 1. To connect Antenna Port of EUT to Spectrum.
- 2. The testing follows ANSI C63.10:2013.
- 3. Set RBW = 100 kHz & VBW = 300 kHz, Detector = Peak, Sweep = Auto
- 4. Allow trace to fully stabilize.
- 5. Use the peak marker function to determine the maximum power level in any 100 kHz band segment within the fundamental EBW.
- 6. Repeat above procedures until all default test channel measured were complete.

### 10.4 Measurement Result

See next page for test plots.

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#### Hopping Band Edge 8DPSK 3M DH5 2402MHz Spurious Emission GFSK 1M DH5 2441MHz Spectrum Analyzer 1 Swept SA Spectrum Analyzer Swept SA + Input Z: 50 Ω Corrections: 0 Freq Ref: Int ( PNO: Fast Gate: Off IF Gain: Low Sig Track: Off KEYSIGHT Input KEYSIGHT In Mkr3 2.399 65 GHz Mkr4 22.583 GHz 1 Spectrun 1 Spectrum Ref Lvi Offset 10.80 dB Ref Level 30.00 dBm Scale/Div 10 dB -41.19 dB -43.23 dBr #Video BW 300 kHz Center 12.52 GHz #Res BW 100 kHz #Video BW 300 kH; Span 24.97 GHz eep ~2.39 s (24971 pts Center 2.36500 GH: #Res BW 100 kHz Mode Trace Scal Function Width Function Value Function Value Oct 31, 2022 3:10:43 PM Oct 31, 2022 2:03:37 PM ## # X Hopping Band Edge\_8DPSK\_3M\_DH5\_2480MHz Spurious Emission\_GFSK\_1M\_DH5\_2480MHz · + 1 + KEYSIGHT Input: R KEYSIGHT Input: R nput Z: 50 Ω 1 2 3 4 5 6 M W W W W W P N N N N N Corrections: Off Freq Ref: Int (S) Sig Track: Off Mkr3 2.493 375 GHz Mkr4 23.824 GHz Ref Lvi Offset 10.80 dB Ref Level 30.00 dBm Scale/Div 10 dE -46.90 dB Scale/Div 10 dE -42.16 dBr •4 5 Marker Table .# 🐺 .# 🐺 Spurious Emission\_GFSK\_1M\_DH5\_2402MHz Spurious Emission\_π/4DQPSK\_2M\_DH5\_2402MHz Input Z: 50 Ω Corrections: Off Freq Ref: Int (S) Input Z: 50 Ω Corrections: Off Freq Ref: Int (S KEYSIGHT KEYSIGHT Input F Mkr4 24 435 GHz Mkr4 23 972 GHz Ref Lvi Offset 10.80 dB Ref Level 30.00 dBm Ref Lvi Offset 10.80 dB Ref Level 30.00 dBm Scale/Div 10 dl -41.12 dB -41.97 dBi • an 24 97 GF r 12 52 GH #Video BW 300 kH: n 24.97 GH Sweep ~2.39 s (24971 pts #Res BW 100 kHz #Res BW 100 kH 6.119 dBm -49.90 dBm -49.65 dBm -41.97 dBm 10.63 dBm

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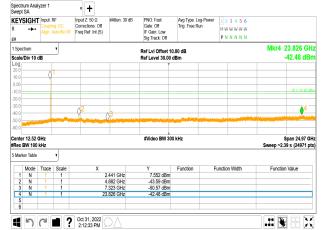
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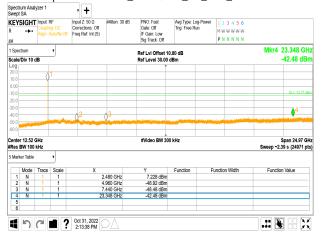


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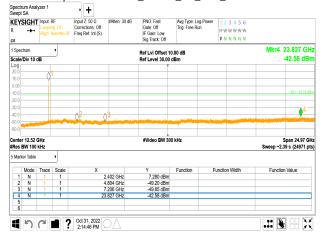
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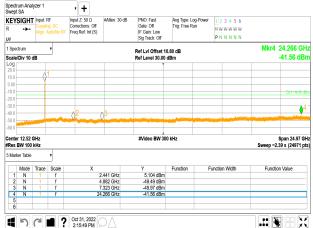
### Spurious Emission\_π/4DQPSK\_2M\_DH5\_2480MHz



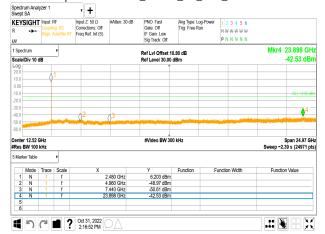
#### Spurious Emission\_8DPSK\_3M\_DH5\_2402MHz



### Spurious Emission\_8DPSK\_3M\_DH5\_2441MHz



### Spurious Emission\_8DPSK\_3M\_DH5\_2480MHz



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### 11 RADIATED BANDEDGE AND SPURIOUS EMISSION MEASUREMENT

## Standard Applicable

#### 11.1.1 **Duty Cycle Correction Factor**

According to 15. 35(c) and RSS-Gen §8.2, the measurement field strength shall be determined by averaging over one complete pulse train, including blanking intervals, as long as the pulse train does not exceed 0.1 seconds. As an alternative (provided the transmitter operates for longer than 0.1 seconds) or in cases where the pulse train exceeds 0.1 seconds, the measured field strength shall be determined from the average absolute voltage during a 0.1 second interval during which the field strength is at its maximum value. The exact method of calculating the average field strength shall be submitted with any application for certification.

#### 11.1.2 **Spurious Emission**

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. In addition, radiated emissions which fall in the restricted bands must also comply with the §15.209 and RSS-Gen §8.9 Table 5 and 6 limit as below.

And according to §15.33(a) (1) & RSS-Gen §6.13.2.a, for an intentional radiator operates below 10GHz, the frequency range of measurements: to the tenth harmonic of the highest fundamental frequency or to 40GHz, whichever is lower.

Frequency (MHz)	Field strength (microvolts/meter)	Distance (meters)
0.009-0.490	2400/F(kHz)	300
0.490-1.705	24000/F(kHz)	30
1.705-30	30	30
30-88	100	3
88-216	150	3
216-960	200	3
Above 960	500	3

#### Note:

1. The lower limit shall apply at the transition frequencies.

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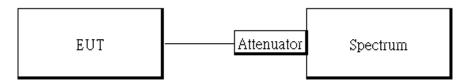


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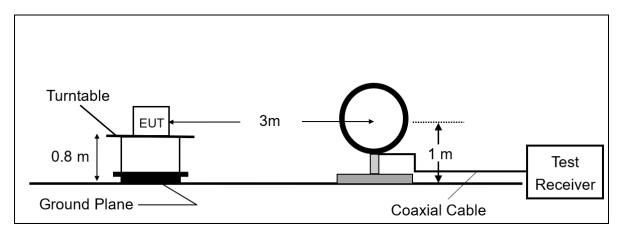
## 11.2 Test Setup

## 11.2.1 Duty Cycle Correction Factor

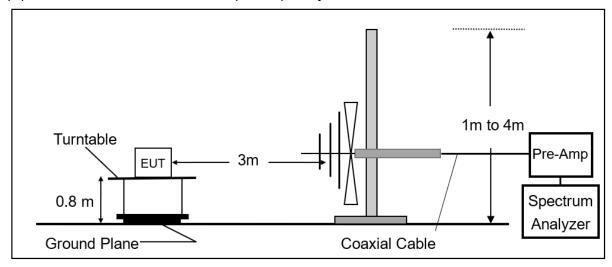


### 11.2.2 Radiated Emission

(A) Radiated Emission Test Set-Up, Frequency Below 30MHz.



(B) Radiated Emission Test Set-Up, Frequency From 30MHz to 1000MHz.



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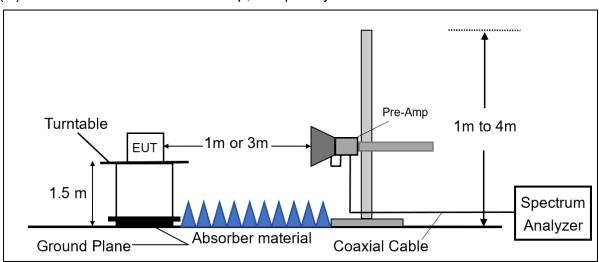
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## (C) Radiated Emission Test Set-Up, Frequency Above 1 GHz.



### 11.3 Measurement Procedure

## 11.3.1 Duty Cycle Correction Factor

- 1.Adjust and configure any EUT switches, controls, or input data streams to ensure that the EUT is transmitting or encoded to obtain the "worst-case" pulse ON time.
- 2. The testing follows ANSI C63.10:2013.
- 3. Remove the antenna from the EUT and then connect a low loss RF cable from the antenna port to the spectrum analyzer.
- 4. Set center frequency of spectrum analyzer = operating frequency.
- 5. Set the spectrum analyzer as RBW, VBW=1MHz, 3MHz, Span = 0Hz, Detector = Peak, Adjust Sweep = 2~8ms.
- 6. Repeat above procedures until all frequency of the interest measured were complete.

## 11.3.2 Radiated Emission

- 1. The testing follows the Measurement Procedure of ANSI C63.10:2013.
- 2. The EUT was placed on a turn table with 0.8m for frequency< 1GHz and 1.5m for frequency> 1GHz above ground plane.
- 3. The turn table shall rotate 360 degrees to determine the position of maximum emission level.
- 4. EUT is set 3m away from the receiving antenna which varied from 1m to 4m to find out the highest emissions.
- 5. Set the spectrum analyzer as RBW=100 kHz and VBW=300 kHz for Peak Detector (PK) at frequency between 30MHz and 1 GHz.
- 6. Use receiver mode as RBW=120 kHz for Quasi-peak (QP) at frequency between 30MHz and 1 GHz.

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7. Set the spectrum analyzer as RBW=1 MHz, VBW=3 MHz for Maximum Emission Measurements at frequency above 1 GHz.

- 8. According to C63.10:2013 Section 7.5 Procedure for determining the average value of pulsed emissions with duty cycle correction factor 20 log (Ton/100ms).
- 9. When measurement procedures for electric field radiated emissions above 1 GHz the EUT measurement is to be made "while keeping the antenna in the 'cone of radiation' from that area and pointed at the area both in azimuth and elevation, with polarization oriented for maximum response." is still within the 3dB illumination BW of the measurement antenna.
- 10. Maximum procedure was performed on the six highest emissions to ensure EUT compliance.
- 11. And also, each emission was to be maximized by changing the polarization of receiving antenna both horizontal and vertical.
- 12. Repeat above procedures until all default test channel measured were complete.

## 11.4 Field Strength Calculation

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

## FS = RA + AF + CL - AG

Where FS = Field Strength

CL = Cable Attenuation Factor (Cable Loss)

RA = Reading Amplitude

AG = Amplifier Gain

AF = Antenna Factor

The limit of the emission level is expressed in dBuV/m, which converts 20\*log(uV/m)

Actual FS(dB $\mu$ V/m) = SPA. Reading level(dB $\mu$ V) + Factor(dB)

Factor(dB) = Antenna Factor(dBµV/m) + Cable Loss(dB) – Pre Amplifier Gain(dB)

Average value(dBµV/m)=Peak Actual FS(dBµV/m)+ Duty Cycle Correction Factor(dB)

Duty Cycle Correction Factor(dB) = 20 log (Ton/100 ms)

### 11.5 Test Results of Radiated Spurious Emissions form 9 kHz to 30 MHz

The low frequency, which started from 9 kHz to 30MHz, was pre-scanned and the result which was 20dB lower than the limit per 15.31(o) & RSS-GEN §6.13.2 was not reported.

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### **Measurement Result:**

#### 11.6.1 **Duty Cycle Correction Factor**

#### BR

Time ON of 100ms:	8.700	ms	
Duty Cycle=8.7ms / 100	0ms: 0.087	%	
Duty Cycle correction f	actor=20 LOG 0.087=	-21.21	dB

#### **EDR**

Time ON of 100ms:	8.700	ms	
Duty Cycle=8.7ms / 100ms	s: 0.087	%	
Duty Cycle correction factor	or=20 LOG 0.087=	-21.21	dB

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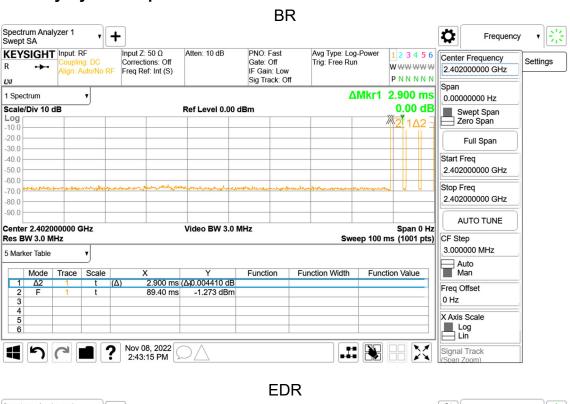
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## 11.6.2 Duty Cycle test plot





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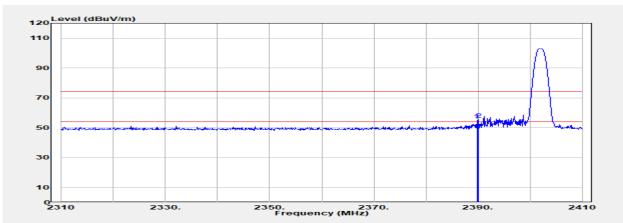
## 11.6.3 Bandedge Result

Report Number :TERF2210002096E2 Test Site :SAC G

Operation Mode :BT BR DH5 :2022-11-03 Test Date

Test Frequency :2402 MHz Temp./Humi. :19.5/67 Test Mode :Bandedge Antenna Pol. :Vertical

**EUT Pol** :E2 Plane :Temo Chen Engineer



	2310	2330.	2350. Freq	2370. Juency (MHz)	2390.	2410	
	Freq.	Detector Mode	Spectrum Reading Level	Factor	Actual FS	Limit @3m	Margin
_	MHz	PK/QP	dΒμV	dB	dBμV/m	dBμV/m	dB
	2389.800	Peak	58.64	-3.80	54.84	74.00	-19.16
	2390.000	Peak	59.41	-3.80	55.61	74.00	-18.39
	Freq.	Detector Mode	Peak Actual FS	Duty Cycle Factor	Average Value	Average Limit@3m	Margin
	MHz	AV	(dBµV/m)	(dB)	(dBuV/m)	(dBuV/m)	(dB)
-							
	2389.800	Average	54.84	-21.21	33.63	54.00	-20.37
	2390.000	Average	55.61	-21.21	34.40	54.00	-19.60

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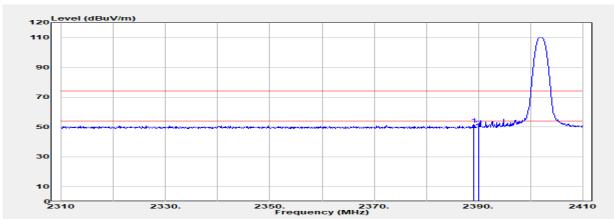
Report Number :TERF2210002096E2 Test Site :SAC G

Operation Mode :BT BR DH5 Test Date :2022-11-03

Test Frequency :2402 MHz Temp./Humi. :19.5/67

Test Mode :Bandedge Antenna Pol. :Horizontal

EUT Pol :E2 Plane Engineer :Temo Chen



2310	2330.	2350. Freq	2370. quency (MHz)	2390.	2410	
Freq.	Detector Mode	Spectrum Reading Level	Factor	Actual FS	Limit @3m	Margin
MHz	PK/QP	dΒμV	dB	dBμV/m	dBμV/m	dB
2389.100	Peak	55.56	-3.80	51.76	74.00	-22.24
2390.000	Peak	53.93	-3.80	50.13	74.00	-23.87
Freq.	Detector	Peak Actual	Duty Cycle	Average	Average	Margin
	Mode	FS	Factor	Value	Limit(@3m	(-ID)
MHz	Mode AV	FS (dBµV/m)	ractor (dB)	value (dBuV/m)	Limit@3m (dBuV/m)	(dB)
MHz						(dB)

2389.100	Average	51.76	-21.21	30.55	54.00	-23.45
2390.000	Average	50.13	-21.21	28.92	54.00	-25.08

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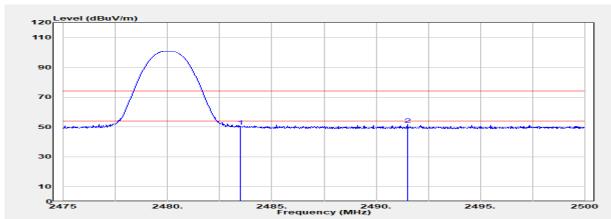
Report Number :TERF2210002096E2 **Test Site** :SAC G

Operation Mode :BT BR DH5 Test Date :2022-11-03

Test Frequency :2480 MHz Temp./Humi. :19.5/67

Test Mode :Bandedge Antenna Pol. :Vertical

**EUT Pol** :E2 Plane Engineer :Temo Chen



	24/3	2400.	Fred	quency (MHz)	2493.	2300	
	Freq.	Detector Mode	Spectrum Reading Level	Factor	Actual FS	Limit @3m	Margin
	MHz	PK/QP	dΒμV	dB	dBμV/m	dBμV/m	dB
	2483.500	Peak	54.19	-3.82	50.37	74.00	-23.63
	2491.500	Peak	55.40	-3.78	51.62	74.00	-22.38
	Freq.	Detector Mode	Peak Actual FS	Duty Cycle Factor	Average Value	Average Limit@3m	Margin
	MHz	AV	(dBµV/m)	(dB)	(dBuV/m)	(dBuV/m)	(dB)
-							
	2483.500	Average	50.37	-21.21	29.16	54.00	-24.84

2483.500	Average	50.37	-21.21	29.16	54.00	-24.84
2491.500	Average	51.62	-21.21	30.41	54.00	-23.59

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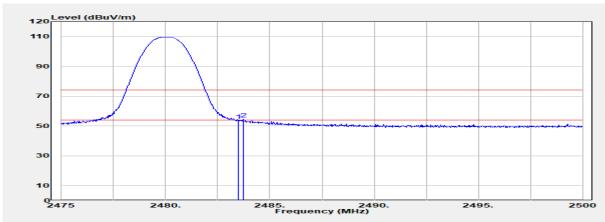
Report Number :TERF2210002096E2 **Test Site** :SAC G

Operation Mode :BT BR DH5 Test Date :2022-11-03

Test Frequency :2480 MHz Temp./Humi. :19.5/67

Test Mode :Bandedge Antenna Pol. :Horizontal

**EUT Pol** :E2 Plane Engineer :Temo Chen



	2475	2480.	2485. Fred	2490. Juency (MHz)	2495.	2500	
	Freq.	Detector Mode	Spectrum Reading Level	Factor	Actual FS	Limit @3m	Margin
_	MHz	PK/QP	dBμV	dB	dBμV/m	dBμV/m	dB
	2483.500	Peak	57.46	-3.82	53.64	74.00	-20.36
	2483.725	Peak	58.33	-3.82	54.51	74.00	-19.49
	Freq.	Detector Mode	Peak Actual FS	Duty Cycle Factor	Average Value	Average Limit@3m	Margin
	MHz	AV	(dBµV/m)	(dB)	(dBuV/m)	(dBuV/m)	(dB)
	2483.500	Average	53.64	-21.21	32.43	54.00	-21.57

2483.500	Average	53.64	-21.21	32.43	54.00	-21.57
2483.725	Average	54.51	-21.21	33.30	54.00	-20.70

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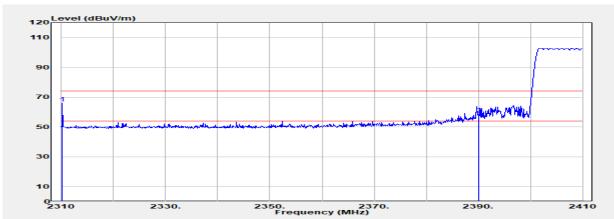
Report Number :TERF2210002096E2 Test Site :SAC G

Operation Mode :BT BR DH5 Hopping Test Date :2022-11-03

Test Frequency :2402 MHz Temp./Humi. :19.5/67

Test Mode :Bandedge Antenna Pol. :Vertical

EUT Pol :E2 Plane Engineer :Temo Chen



Frequency (MHz)							
Freq.	Detector Mode	Spectrum Reading Level	Factor	Actual FS	Limit @3m	Margin	
MHz	PK/QP	dΒμV	dB	dBμV/m	dBμV/m	dB	
2310.200	Peak	69.68	-3.61	66.07	74.00	-7.93	
2390.000	Peak	62.44	-3.80	58.64	74.00	-15.36	
Freq.	Detector Mode	Peak Actual FS	Duty Cycle Factor	Average Value	Average Limit@3m	Margin	
MHz	AV	(dBµV/m)	(dB)	(dBuV/m)	(dBuV/m)	(dB)	

2310.200	Average	66.07	-21.21	44.86	54.00	-9.14
2390.000	Average	58.64	-21.21	37.43	54.00	-16.57

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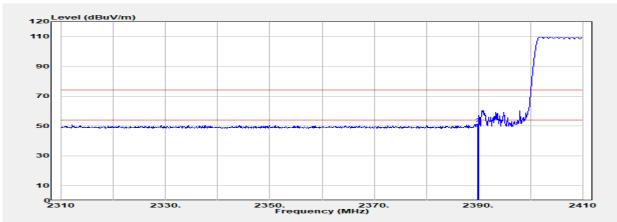
Report Number :TERF2210002096E2 Test Site :SAC G

Operation Mode :BT BR DH5 Hopping Test Date :2022-11-03

Test Frequency :2402 MHz Temp./Humi. :19.5/67

Test Mode :Bandedge Antenna Pol. :Horizontal

EUT Pol :E2 Plane Engineer :Temo Chen



	2310	2330.	2350. Freq	2370. Juency (MHz)	2390.	2410	
	Freq.	Detector Mode	Spectrum Reading Level	Factor	Actual FS	Limit @3m	Margin
_	MHz	PK/QP	dBμV	dB	dBμV/m	dBμV/m	dB
	2389.900	Peak	55.26	-3.80	51.46	74.00	-22.54
	2390.000	Peak	53.27	-3.80	49.47	74.00	-24.53
	Freq.	Detector Mode	Peak Actual FS	Duty Cycle Factor	Average Value	Average Limit@3m	Margin
	Freq. MHz			• •	•	Average Limit@3m (dBuV/m)	Margin (dB)
	·	Mode	FS	Factor	Value	Limit@3m	•

2389.900	Average	51.46	-21.21	30.25	54.00	-23.75
2390.000	Average	49.47	-21.21	28.26	54.00	-25.74

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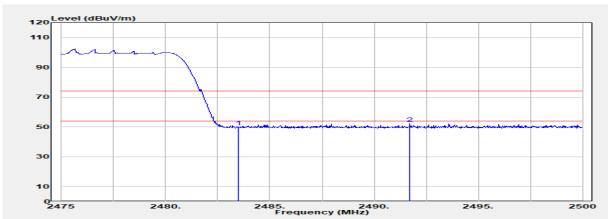
Report Number :TERF2210002096E2 **Test Site** :SAC G

Operation Mode :BT BR DH5 Hopping Test Date :2022-11-03

Test Frequency :2480 MHz Temp./Humi. :19.5/67

Test Mode :Bandedge Antenna Pol. :Vertical

**EUT Pol** :E2 Plane Engineer :Temo Chen



			quotie, (iiii.z,			
Freq.	Detector Mode	Spectrum Reading Level	Factor	Actual FS	Limit @3m	Margin
MHz	PK/QP	dΒμV	dB	dBμV/m	dBμV/m	dB
2483.500	Peak	53.89	-3.82	50.07	74.00	-23.93
2491.725	Peak	56.16	-3.77	52.38	74.00	-21.62
Freq.	Detector Mode	Peak Actual FS	Duty Cycle Factor	Average Value	Average Limit@3m	Margin
MHz	AV	(dBµV/m)	(dB)	(dBuV/m)	(dBuV/m)	(dB)

2483.500	Average	50.07	-21.21	28.86	54.00	-25.14
2491.725	Average	52.38	-21.21	31.17	54.00	-22.83

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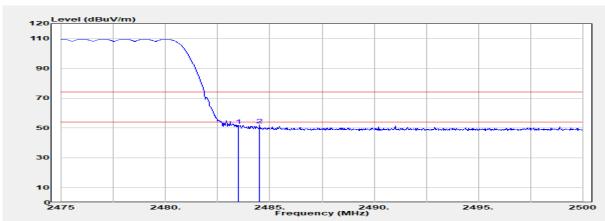
Report Number :TERF2210002096E2 **Test Site** :SAC G

Operation Mode :BT BR DH5 Hopping Test Date :2022-11-03

Test Frequency :2480 MHz Temp./Humi. :19.5/67

Test Mode :Bandedge Antenna Pol. :Horizontal

**EUT Pol** :E2 Plane Engineer :Temo Chen



	2475	2480.	2485. Fred	2490. quency (MHz)	2495.	2500	
	Freq.	Detector Mode	Spectrum Reading Level	Factor	Actual FS	Limit @3m	Margin
_	MHz	PK/QP	dΒμV	dB	dBμV/m	dBμV/m	dB
	2483.500	Peak	55.42	-3.82	51.60	74.00	-22.40
	2484.500	Peak	55.86	-3.81	52.04	74.00	-21.96
	Freq.	Detector Mode	Peak Actual FS	Duty Cycle Factor	Average Value	Average Limit@3m	Margin
	MHz	AV	(dBµV/m)	(dB)	(dBuV/m)	(dBuV/m)	(dB)
-							
	2483.500	Average	51.60	-21.21	30.39	54.00	-23.61
	2484 500	Average	52 04	-21 21	30.83	54 00	-23 17

	· ·					
2484.500	Average	52.04	-21.21	30.83	54.00	-23.17

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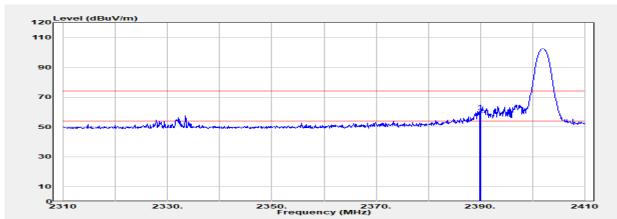
Report Number :TERF2210002096E2 Test Site :SAC G

Operation Mode :BT EDR 3DH5 Test Date :2022-11-03

Test Frequency :2402 MHz Temp./Humi. :19.5/67

Test Mode :Bandedge Antenna Pol. :Vertical

EUT Pol :E2 Plane Engineer :Temo Chen



2310	2330.	Free	quency (MHz)	2330.	2410	
Freq.	Detector Mode	Spectrum Reading Level	Factor	Actual FS	Limit @3m	Margin
MHz	PK/QP	dΒμV	dB	dBμV/m	dBμV/m	dB
2389.900	Peak	64.48	-3.80	60.68	74.00	-13.32
2390.000	Peak	61.94	-3.80	58.14	74.00	-15.86
Freq.	Detector Mode	Peak Actual FS	Duty Cycle Factor	Average Value	Average Limit@3m	Margin
MHz	AV	(dBµV/m)	(dB)	(dBuV/m)	(dBuV/m)	(dB)

2389.900	Average	60.68	-21.21	39.47	54.00	-14.53
2390.000	Average	58.14	-21.21	36.93	54.00	-17.07

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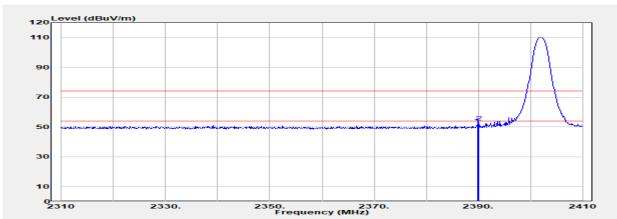
Report Number :TERF2210002096E2 **Test Site** :SAC G

Operation Mode :BT EDR 3DH5 Test Date :2022-11-03

Test Frequency :2402 MHz Temp./Humi. :19.5/67

Test Mode :Bandedge Antenna Pol. :Horizontal

**EUT Pol** :E2 Plane Engineer :Temo Chen



2310	2330.	Fred	quency (MHz)	2390.	2410	
Freq.	Detector Mode	Spectrum Reading Level	Factor	Actual FS	Limit @3m	Margin
MHz	PK/QP	dBμV	dB	dBμV/m	dBμV/m	dB
2389.800	Peak	55.42	-3.80	51.62	74.00	-22.38
2390.000	Peak	57.11	-3.80	53.31	74.00	-20.69
Freq.	Detector Mode	Peak Actual FS	Duty Cycle Factor	Average Value	Average Limit@3m	Margin
MHz	AV	(dBµV/m)	(dB)	(dBuV/m)	(dBuV/m)	(dB)
2389.800	Average	51.62	-21.21	30.41	54.00	-23.59

2389.800	Average	51.62	-21.21	30.41	54.00	-23.59
2390.000	Average	53.31	-21.21	32.10	54.00	-21.90

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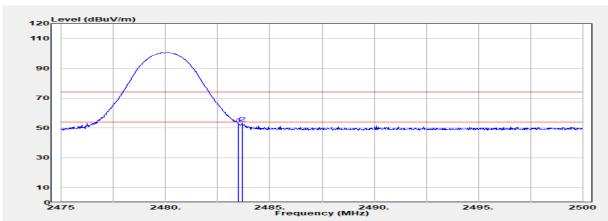
Report Number :TERF2210002096E2 **Test Site** :SAC G

Operation Mode :BT EDR 3DH5 Test Date :2022-11-03

Test Frequency :2480 MHz Temp./Humi. :19.5/67

Test Mode :Bandedge Antenna Pol. :Vertical

**EUT Pol** :E2 Plane Engineer :Temo Chen



2475	2480.	2485. Fred	2490. Juency (MHz)	2495.	2500	
Freq.	Detector Mode	Spectrum Reading Level	Factor	Actual FS	Limit @3m	Margin
MHz	PK/QP	dBμV	dB	dBμV/m	dBμV/m	dB
2483.500	Peak	56.47	-3.82	52.65	74.00	-21.35
2483.675	Peak	57.06	-3.82	53.24	74.00	-20.76
Freq.	Detector Mode	Peak Actual FS	Duty Cycle Factor	Average Value	Average Limit@3m	Margin
MHz	AV	(dBµV/m)	(dB)	(dBuV/m)	(dBuV/m)	(dB)
2483.500	Average	52.65	-21.21	31.44	54.00	-22.56
0400.075	A	F2 24	04.04	20.02	E4.00	04.07

2483.500	Average	52.65	-21.21	31.44	54.00	-22.56
2483.675	Average	53.24	-21.21	32.03	54.00	-21.97

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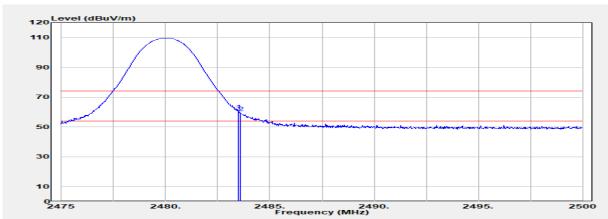
Report Number :TERF2210002096E2 Test Site :SAC G

Operation Mode :BT EDR 3DH5 Test Date :2022-11-03

Test Frequency :2480 MHz Temp./Humi. :19.5/67

Test Mode :Bandedge Antenna Pol. :Horizontal

EUT Pol :E2 Plane Engineer :Temo Chen



			Fred	luency (MHZ)			
	Freq.	Detector Mode	Spectrum Reading Level	Factor	Actual FS	Limit @3m	Margin
_	MHz	PK/QP	dΒμV	dB	dBμV/m	dBμV/m	dB
_							
	2483.500	Peak	64.72	-3.82	60.90	74.00	-13.10
	2483.600	Peak	63.24	-3.82	59.42	74.00	-14.58
	Freq.	Detector Mode	Peak Actual FS	Duty Cycle Factor	Average Value	Average Limit@3m	Margin
	MHz	AV	(dBµV/m)	(dB)	(dBuV/m)	(dBuV/m)	(dB)
-							
	2483.500	Average	60.90	-21.21	39.69	54.00	-14.31

2483.500	Average	60.90	-21.21	39.69	54.00	-14.31
2483.600	Average	59.42	-21.21	38.21	54.00	-15.79

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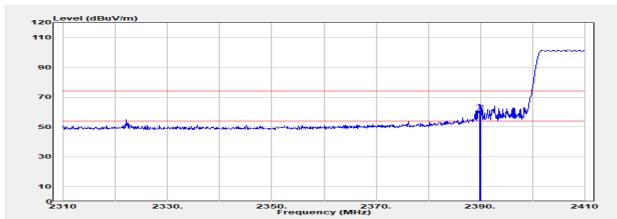
Report Number :TERF2210002096E2 Test Site :SAC G

Operation Mode :BT EDR 3DH5 Hopping Test Date :2022-11-03

Test Frequency :2402 MHz Temp./Humi. :19.5/67

Test Mode :Bandedge Antenna Pol. :Vertical

**EUT Pol** :E2 Plane Engineer :Temo Chen



	2310	2330.	2350. Fred	2370. quency (MHz)	2390.	2410	
	Freq.	Detector Mode	Spectrum Reading Level	Factor	Actual FS	Limit @3m	Margin
_	MHz	PK/QP	dΒμV	dB	dBμV/m	dBμV/m	dB
	2389.800	Peak	65.36	-3.80	61.56	74.00	-12.44
	2390.000	Peak	64.53	-3.80	60.73	74.00	-13.27
	Freq.	Detector Mode	Peak Actual FS	Duty Cycle Factor	Average Value	Average Limit@3m	Margin
	MHz	AV	(dBµV/m)	(dB)	(dBuV/m)	(dBuV/m)	(dB)
	2389.800	Average	61.56	-21.21	40.35	54.00	-13.65

-21.21

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54.00

-14.48

2390.000

Average

39.52



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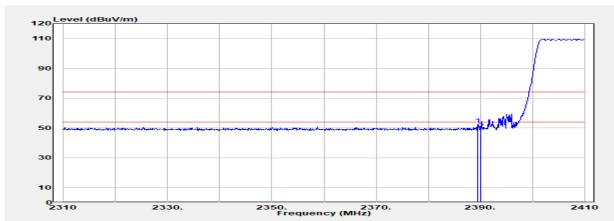
Report Number :TERF2210002096E2 Test Site :SAC G

Operation Mode :BT EDR 3DH5 Hopping Test Date :2022-11-03

Test Frequency :2402 MHz Temp./Humi. :19.5/67

Test Mode :Bandedge Antenna Pol. :Horizontal

EUT Pol :E2 Plane Engineer :Temo Chen



ector Spectrum ode Reading Lev /QP dBμV		Actual FS dBμV/m	Limit @3m	Margin
'QP dBμV	dВ	dRuV/m	4DV/	
	uБ	αυμν/ πι	dBμV/m	dB
ak 56.19	-3.80	52.39	74.00	-21.61
ak 53.05	-3.80	49.25	74.00	-24.75
ector Peak Actua	al Duty Cycle	Average	Average	Morgin
de FS	Factor	Value	Limit@3m	Margin (dB)
V (dBµV/m)	(dB)	(dBuV/m)	(dBuV/m)	(GD)
	ak 53.05 ector Peak Actua de FS	ak 53.05 -3.80  ctor Peak Actual Duty Cycle de FS Factor	ak 53.05 -3.80 49.25  ector Peak Actual Duty Cycle Average de FS Factor Value	ak 53.05 -3.80 49.25 74.00  ctor Peak Actual Duty Cycle Average Average de FS Factor Value Limit@3m

2389.500	Average	52.39	-21.21	31.18	54.00	-22.82
2390.000	Average	49.25	-21.21	28.04	54.00	-25.96

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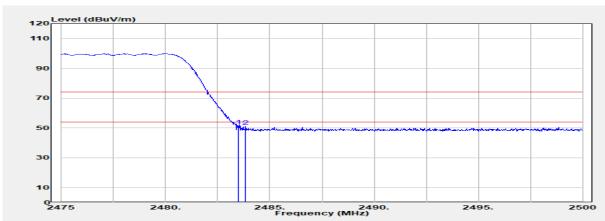
Report Number :TERF2210002096E2 **Test Site** :SAC G

Operation Mode :BT EDR 3DH5 Hopping Test Date :2022-11-03

Test Frequency :2480 MHz Temp./Humi. :19.5/67

Test Mode :Bandedge Antenna Pol. :Vertical

**EUT Pol** :E2 Plane Engineer :Temo Chen



2475	2480.	2485. Fred	2490. quency (MHz)	2495.	2500	
Freq.	Detector Mode	Spectrum Reading Level	Factor	Actual FS	Limit @3m	Margin
MHz	PK/QP	dΒμV	dB	dBμV/m	dBμV/m	dB
2483.500	Peak	55.16	-3.82	51.34	74.00	-22.66
2483.825	Peak	54.89	-3.82	51.07	74.00	-22.93
Freq.	Detector Mode	Peak Actual FS	Duty Cycle Factor	Average Value	Average Limit@3m	Margin
MHz	AV	(dBµV/m)	(dB)	(dBuV/m)	(dBuV/m)	(dB)
2483.500	Average	51.34	-21.21	30.13	54.00	-23.87
0.400.005		E4 07	04.04	00.00	<b>54.00</b>	0444

2483.500	Average	51.34	-21.21	30.13	54.00	-23.87
2483.825	Average	51.07	-21.21	29.86	54.00	-24.14

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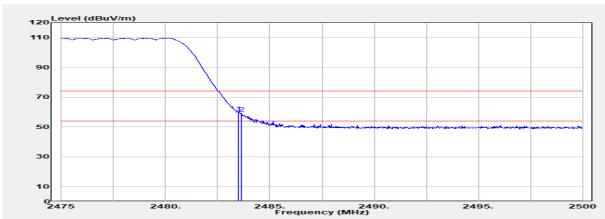
Report Number :TERF2210002096E2 **Test Site** :SAC G

Operation Mode :BT EDR 3DH5 Hopping Test Date :2022-11-03

Test Frequency :2480 MHz Temp./Humi. :19.5/67

Test Mode :Bandedge Antenna Pol. :Horizontal

**EUT Pol** :E2 Plane Engineer :Temo Chen



2475	2480.	2485. Fred	2490. Juency (MHz)	2495.	2500	
Freq.	Detector Mode	Spectrum Reading Level	Factor	Actual FS	Limit @3m	Margin
MHz	PK/QP	dΒμV	dB	dBμV/m	dBμV/m	dB
2483.500	Peak	63.46	-3.82	59.64	74.00	-14.36
2483.650	Peak	62.98	-3.82	59.16	74.00	-14.84
Freq.	Detector Mode	Peak Actual FS	Duty Cycle Factor	Average Value	Average Limit@3m	Margin
MHz	AV	$(dB\mu V/m)$	(dB)	(dBuV/m)	(dBuV/m)	(dB)
2483.500	Average	59.64	-21.21	38.43	54.00	-15.57
0.400.0=0		=0.40	04.04		- 4 00	40.05

2483.500	Average	59.64	-21.21	38.43	54.00	-15.5 <i>1</i>
2483.650	Average	59.16	-21.21	37.95	54.00	-16.05

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## 11.6.4 Radiated Spurious Emission

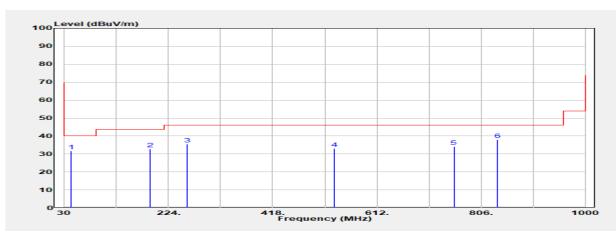
Report Number :TERF2210002096E2 Test Site :SAC G

Operation Mode :BT BR DH5 Test Date :2022-11-04

Test Frequency :2441 MHz Temp./Humi. :21.6/70

Test Mode :Tx Antenna Pol. :VERTICAL

EUT Pol :E2 Plane Engineer :Temo Chen



Freq.	Detector	Spectrum	Factor	Actual	Limit	Margin
	Mode	Reading Level		FS	@3m	
MHz	PK/QP/AVG	dΒμV	dB	dBμV/m	dBμV/m	dB
42.610	Peak	44.57	-12.95	31.63	40.00	-8.37
190.050	Peak	48.60	-15.70	32.90	43.50	-10.60
258.920	Peak	49.35	-13.97	35.38	46.00	-10.62
533.430	Peak	40.52	-7.33	33.19	46.00	-12.81
755.560	Peak	37.65	-3.57	34.08	46.00	-11.92
837.040	Peak	40.02	-2.15	37.87	46.00	-8.13

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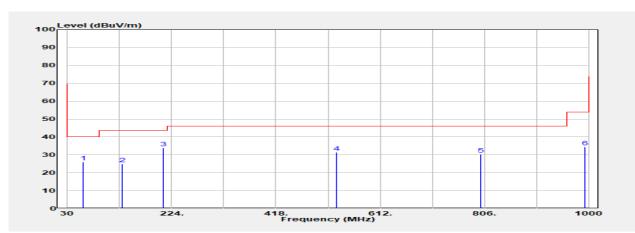
Report Number :TERF2210002096E2 Test Site :SAC G

Operation Mode :BT BR DH5 Test Date :2022-11-04

Test Frequency :2441 MHz Temp./Humi. :21.6/70

Test Mode :Tx Antenna Pol. :HORIZONTAL

Engineer **EUT Pol** :E2 Plane :Temo Chen



Freq.	Detector Mode	Spectrum Reading Level	Factor	Actual FS	Limit @3m	Margin
MHz	PK/QP/AVG	dΒμV	dB	dBμV/m	dBμV/m	dB
59.100	Peak	39.69	-13.61	26.07	40.00	-13.93
131.850	Peak	39.14	-14.11	25.03	43.50	-18.47
207.510	Peak	50.17	-16.32	33.85	43.50	-9.65
531.490	Peak	38.78	-7.35	31.43	46.00	-14.57
800.180	Peak	32.52	-2.15	30.36	46.00	-15.64
994.180	Peak	34.36	-0.07	34.29	54.00	-19.71

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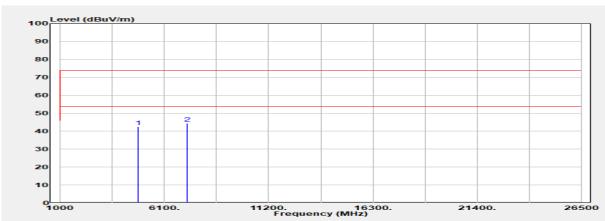
Report Number :TERF2210002096E2 Test Site :SAC G

Operation Mode :BT BR DH5 Test Date :2022-11-03

Test Frequency :2402 MHz Temp./Humi. :19.5/67

Test Mode :Tx Antenna Pol. :VERTICAL

**EUT Pol** :E2 Plane Engineer :Temo Chen



1000	6100.	11200. Freq	16300. Juency (MHz)	21400.	26500	
Freq.	Detector Mode	Spectrum Reading Level	Factor	Actual FS	Limit @3m	Margin
 MHz	PK/QP	dΒμV	dB	dBμV/m	dBμV/m	dB
4804.000	Peak	39.13	3.44	42.57	74.00	-31.43
7206.000	Peak	37.01	7.31	44.32	74.00	-29.68
Freq.	Detector	Peak Actual	Duty Cycle	Average	Average	Margin
N.41 I.—	Mode	FS (dD-1)(ha)	Factor	Value	Limit@3m	(dB)
 MHz	AV	(dBµV/m)	(dB)	(dBuV/m)	(dBuV/m)	
4804.000	Average	42.57	-21.21	21.36	54.00	-32.64
7206.000	Average	44.32	-21.21	23.11	54.00	-30.89

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Report Number :TERF2210002096E2 Test Site :SAC G

Operation Mode :BT BR DH5 Test Date :2022-11-03

Test Frequency :2402 MHz Temp./Humi. :19.5/67

:Tx Test Mode Antenna Pol. :HORIZONTAL

**EUT Pol** :E2 Plane :Temo Chen Engineer



		0.00.	Fred	quency (MHz)	2		
	Freq.	Detector Mode	Spectrum Reading Level	Factor	Actual FS	Limit @3m	Margin
_	MHz	PK/QP	dΒμV	dB	dBμV/m	dBμV/m	dB
	4804.000	Peak	41.92	3.44	45.36	74.00	-28.64
	7206.000	Peak	41.36	7.31	48.67	74.00	-25.33
	Freq.	Detector	Peak Actual	<b>Duty Cycle</b>	Average	Average	Margin
		Mode	FS	Factor	Value	Limit@3m	(dB)
_	MHz	AV	(dBµV/m)	(dB)	(dBuV/m)	(dBuV/m)	()
	4804.000	Average	45.36	-21.21	24.15	54.00	-29.85
	7206.000	Average	48.67	-21.21	27.46	54.00	-26.54

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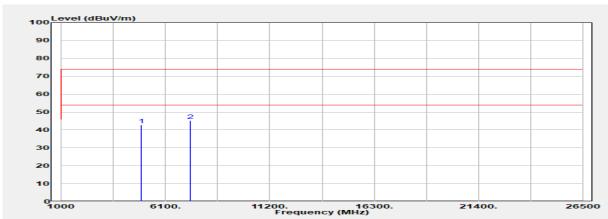
Report Number :TERF2210002096E2 Test Site :SAC G

Operation Mode :BT BR DH5 Test Date :2022-11-03

Test Frequency :2441 MHz Temp./Humi. :19.5/67

Test Mode :Tx Antenna Pol. :VERTICAL

EUT Pol :E2 Plane Engineer :Temo Chen



			Fred	quency (MHz)			
	Freq.	Detector Mode	Spectrum Reading Level	Factor	Actual FS	Limit @3m	Margin
_	MHz	PK/QP	dΒμV	dB	dBμV/m	dBμV/m	dB
	4882.000	Peak	39.21	3.55	42.76	74.00	-31.24
	7323.000	Peak	37.61	7.66	45.27	74.00	-28.73
	Freq.	Detector	Peak Actual FS	Duty Cycle Factor	Average	Average	Margin
	MHz	Mode AV	ro (dBµV/m)	(dB)	Value (dBuV/m)	Limit@3m (dBuV/m)	(dB)
	1411 12	7.10	(αυμν/ιιι)	(42)	(abaviii)	(aBa v/iii)	
	4882.000	Average	42.76	-21.21	21.55	54.00	-32.45
	7323.000	Average	45.27	-21.21	24.06	54.00	-29.94

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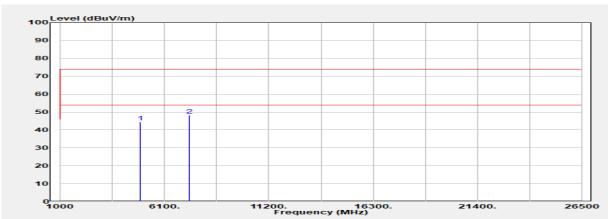
Report Number :TERF2210002096E2 Test Site :SAC G

Operation Mode :BT BR DH5 Test Date :2022-11-03

Test Frequency :2441 MHz Temp./Humi. :19.5/67

Test Mode :Tx Antenna Pol. :HORIZONTAL

EUT Pol :E2 Plane Engineer :Temo Chen



		0.00.	Freq	quency (MHz)	2.100.		
	Freq.	Detector Mode	Spectrum Reading Level	Factor	Actual FS	Limit @3m	Margin
_	MHz	PK/QP	dΒμV	dB	dBμV/m	dBμV/m	dB
	4882.000	Peak	41.01	3.55	44.56	74.00	-29.44
	7323.000	Peak	40.48	7.66	48.14	74.00	-25.86
	Freq.	Detector	Peak Actual	Duty Cycle	Average	Average	Margin
	N 41 1—	Mode	FS	Factor	Value	Limit@3m	(dB)
	MHz	AV	(dBµV/m)	(dB)	(dBuV/m)	(dBuV/m)	
	4882.000	Average	44.56	-21.21	23.35	54.00	-30.65
	7323.000	Average	48.14	-21.21	26.93	54.00	-27.07

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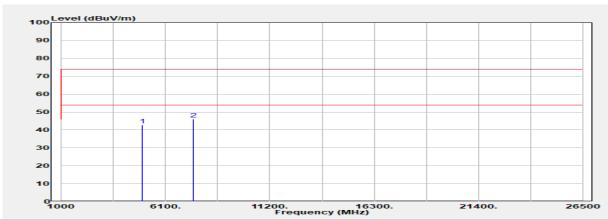
Report Number :TERF2210002096E2 Test Site :SAC G

Operation Mode :BT BR DH5 Test Date :2022-11-03

Test Frequency :2480 MHz Temp./Humi. :19.5/67

Test Mode :Tx Antenna Pol. :VERTICAL

**EUT Pol** :E2 Plane :Temo Chen Engineer



			Fred	quency (MHz)			
	Freq.	Detector Mode	Spectrum Reading Level	Factor	Actual FS	Limit @3m	Margin
	MHz	PK/QP	dΒμV	dB	dBμV/m	dBμV/m	dB
	4960.000	Peak	39.11	3.58	42.69	74.00	-31.31
	7440.000	Peak	37.97	8.19	46.16	74.00	-27.84
	Freq.	Detector	Peak Actual	Duty Cycle	Average	Average	Margin
	NAL I—	Mode	FS	Factor	Value	Limit@3m	(dB)
-	MHz	AV	(dBµV/m)	(dB)	(dBuV/m)	(dBuV/m)	
	4960.000	Average	42.69	-21.21	21.48	54.00	-32.52
	7440.000	Average	46.16	-21.21	24.95	54.00	-29.05

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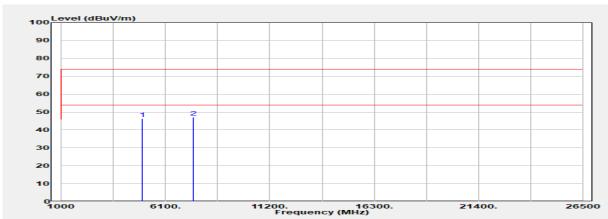
Report Number :TERF2210002096E2 Test Site :SAC G

Operation Mode :BT BR DH5 Test Date :2022-11-03

Test Frequency :2480 MHz Temp./Humi. :19.5/67

Test Mode :Tx Antenna Pol. :HORIZONTAL

**EUT Pol** :E2 Plane Engineer :Temo Chen



		Freq	juency (MHz)				
Freq.	Detector Mode	Spectrum Reading Level	Factor	Actual FS	Limit @3m	Margin	
MHz	PK/QP	dΒμV	dB	dBμV/m	dBμV/m	dB	
4960.000	Peak	42.68	3.58	46.26	74.00	-27.74	
7440.000	Peak	39.07	8.19	47.26	74.00	-26.74	
Freq.	Detector	Peak Actual	Duty Cycle	Average	Average	Margin	
NAL I—						(dB)	
IVIHZ	AV	(aBhv/m)	(aB)	(aBuv/m)	(aBuv/m)		
4960.000	Average	46.26	-21.21	25.05	54.00	-28.95	
7440.000	Average	47.26	-21.21	26.05	54.00	-27.95	
MHz	Mode AV	FS (dBµV/m)	Factor (dB)	Value (dBuV/m)	Limit@3m (dBuV/m)	(dB	3)

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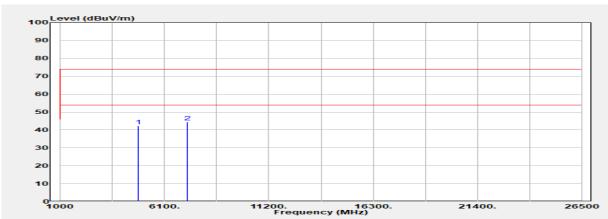
Report Number :TERF2210002096E2 Test Site :SAC G

Operation Mode: BT EDR 3DH5 Test Date :2022-11-03

Test Frequency :2402 MHz Temp./Humi. :19.5/67

Test Mode :Tx Antenna Pol. :VERTICAL

**EUT Pol** :E2 Plane :Temo Chen Engineer



Detector Mode	Spectrum Reading Level	Factor	Actual FS	Limit @3m	Margin
PK/QP	dΒμV	dB	dBμV/m	dBμV/m	dB
Peak	38.77	3.44	42.21	74.00	-31.79
Peak	37.16	7.31	44.47	74.00	-29.53
Detector	Peak Actual	, ,	Average	Average	Margin
				_	(dB)
	(ασμν/π)	(db)	(dbdv/iii)	(dDd V/III)	
Average	42.21	-21.21	21.00	54.00	-33.00
Average	44.47	-21.21	23.26	54.00	-30.74
	Mode PK/QP  Peak Peak  Detector Mode AV  Average	Mode PK/QP Reading Level dBμV  Peak 38.77 Peak 37.16  Detector Peak Actual FS (dBμV/m)  Average 42.21	Mode PK/QP         Reading Level dBμV         dB           Peak Peak         38.77         3.44           Peak Peak         37.16         7.31           Detector Mode AV         Peak Actual Peak Peak Peak Peak Peak Peak Peak Peak	Mode PK/QP         Reading Level dBμV         FS dBμV/m           Peak Peak 38.77         3.44         42.21           Peak 37.16         7.31         44.47           Detector Mode AV         Peak Actual Peak Actual Factor (dBμV/m)         Duty Cycle Factor Value (dBuV/m)           AV         (dBμV/m)         (dBμV/m)	Mode PK/QP         Reading Level dBμV         FS dBμV/m         @3m dBμV/m           Peak PK/QP         38.77 dBμV/m         3.44 dBμV/m         42.21 dBμV/m         74.00 dBμV/m           Peak Peak 37.16         7.31 d4.47 d4.47 d4.00         74.00 degree d

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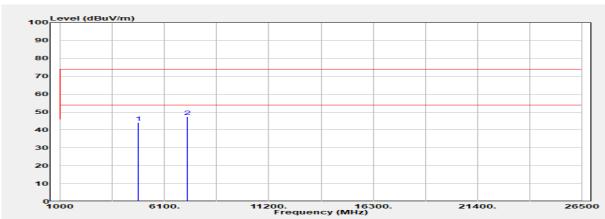
Report Number :TERF2210002096E2 Test Site :SAC G

Operation Mode :BT EDR 3DH5 Test Date :2022-11-03

Test Frequency :2402 MHz Temp./Humi. :19.5/67

Test Mode :Tx Antenna Pol. :HORIZONTAL

**EUT Pol** :E2 Plane :Temo Chen Engineer



1000	0100.	Freq	luency (MHz)	21400	. 20300	
Freq.	Detector Mode	Spectrum Reading Level	Factor	Actual FS	Limit @3m	Margin
MHz	PK/QP	dΒμV	dB	dBμV/m	dBμV/m	dB
4804.000	Peak	40.74	3.44	44.18	74.00	-29.82
7206.000	Peak	40.13	7.31	47.43	74.00	-26.57
Freq.	Detector	Peak Actual	Duty Cycle	Average	Average	Margin
	Mode	FS	Factor	Value	Limit@3m	(dB)
MHz	AV	(dBµV/m)	(dB)	(dBuV/m)	(dBuV/m)	,
4804.000	Average	44.18	-21.21	22.97	54.00	-31.03
7206.000	Average	47.43	-21.21	26.22	54.00	-27.78

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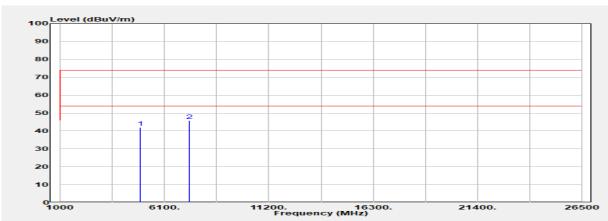
Report Number :TERF2210002096E2 Test Site :SAC G

Operation Mode :BT EDR 3DH5 Test Date :2022-11-03

Test Frequency :2441 MHz Temp./Humi. :19.5/67

Test Mode :Tx Antenna Pol. :VERTICAL

EUT Pol :E2 Plane Engineer :Temo Chen



			Fred	quency (MHz)			
	Freq.	Detector Mode	Spectrum Reading Level	Factor	Actual FS	Limit @3m	Margin
	MHz	PK/QP	dΒμV	dB	dBμV/m	dBμV/m	dB
Ī							
	4882.000	Peak	38.32	3.55	41.87	74.00	-32.13
	7323.000	Peak	38.25	7.66	45.91	74.00	-28.09
	Freq.	Detector	Peak Actual	Duty Cycle	Average	Average	Margin
	MHz	Mode	FS	Factor	Value	Limit@3m	(dB)
	IVITZ	AV	(dBµV/m)	(dB)	(dBuV/m)	(dBuV/m)	
	4882.000	Average	41.87	-21.21	20.66	54.00	-33.34
	7323.000	Average	45.91	-21.21	24.70	54.00	-29.30

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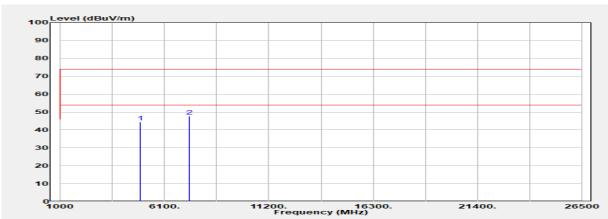
Report Number :TERF2210002096E2 Test Site :SAC G

Operation Mode: BT EDR 3DH5 Test Date :2022-11-03

Test Frequency :2441 MHz Temp./Humi. :19.5/67

Test Mode :Tx Antenna Pol. :HORIZONTAL

Engineer **EUT Pol** :E2 Plane :Temo Chen



300
Margin
dB
-29.52
-26.35
Margin
(dB)
-30.73

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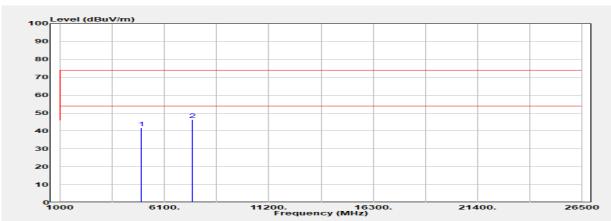
Report Number :TERF2210002096E2 Test Site :SAC G

Operation Mode :BT EDR 3DH5 Test Date :2022-11-03

Test Frequency :2480 MHz Temp./Humi. :19.5/67

Test Mode :Tx Antenna Pol. :VERTICAL

Engineer **EUT Pol** :E2 Plane :Temo Chen



		0.00.	Fred	Frequency (MHz)		2.130.	
	Freq.	Detector Mode	Spectrum Reading Level	Factor	Actual FS	Limit @3m	Margin
_	MHz	PK/QP	dΒμV	dB	dBμV/m	dBμV/m	dB
	4960.000	Peak	38.07	3.58	41.65	74.00	-32.35
	7440.000	Peak	38.06	8.19	46.25	74.00	-27.75
	Freq.	Detector	Peak Actual	Duty Cycle	Average	Average	Margin
	MUz	Mode	FS (dPu\//m)	Factor	Value	Limit@3m	(dB)
-	MHz	AV	(dBµV/m)	(dB)	(dBuV/m)	(dBuV/m)	
	4960.000	Average	41.65	-21.21	20.44	54.00	-33.56

4960.000	Average	41.65	-21.21	20.44	54.00	-33.56
7440.000	Average	46.25	-21.21	25.04	54.00	-28.96

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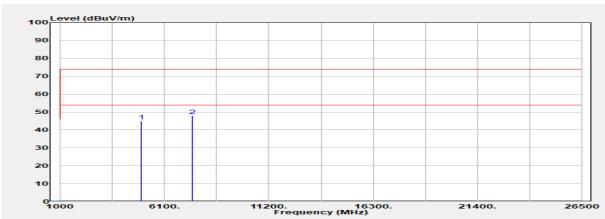
Report Number :TERF2210002096E2 Test Site :SAC G

Operation Mode :BT EDR 3DH5 Test Date :2022-11-03

Test Frequency :2480 MHz Temp./Humi. :19.5/67

Test Mode :Tx Antenna Pol. :HORIZONTAL

EUT Pol :E2 Plane Engineer :Temo Chen



	1000	6100.	0. 11200. 16300. 21 Frequency (MHz)		21400.	1400. 26500	
	Freq.	Detector Mode	Spectrum Reading Level	Factor	Actual FS	Limit @3m	Margin
_	MHz	PK/QP	dΒμV	dB	dBμV/m	dBμV/m	dB
	4960.000	Peak	41.42	3.58	45.00	74.00	-29.00
	7440.000	Peak	39.81	8.19	48.00	74.00	-26.00
	Freq.	Detector Mode	Peak Actual FS	Duty Cycle Factor	Average Value	Average Limit@3m	Margin
	MHz	AV	(dBµV/m)	(dB)	(dBuV/m)	(dBuV/m)	(dB)
	4960.000	Averege	45.00	-21.21	23.79	54.00	-30.21
	4900.000	Average	45.00	-21.21	23.19	34.00	-30.21

	· ·					
7440.000	Average	48.00	-21.21	26.79	54.00	-27.21
		.0.00		_00	555	

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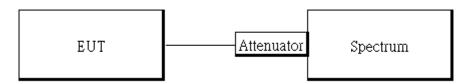
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## 12 FREQUENCY SEPARATION

## Standard Applicable

Frequency hopping systems shall have hopping channel carrier frequencies separated by minimum of 25 kHz or the 2/3\*20dB bandwidth of the hopping channel, whichever is greater.

## 12.2 Test Setup



#### 12.3 **Measurement Procedure**

- 1. Place the EUT on the table and set it in transmitting mode.
- The testing follows ANSI C63.10:2013.
- 3. Remove the antenna from the EUT and then connect a low loss RF cable from the antenna port to the spectrum analyzer.
- 4. Set center frequency of spectrum analyzer = middle of hopping channel.
- 5. Set the RBW approximately 30% of the channel spacing, VBW≥ RBW.
- 6. Adjust Span to Wide enough to capture the peaks of two adjacent channels.
- 7. Sweep = auto.
- 8. Max hold. Mark 3 Peaks of hopping channel and record the 3 peaks frequency.

#### 12.4 **Measurement Result**

Channel separation (MHz)	Limit	Result
1	≥25 kHz or 2/3 times 20dB bandwidth	PASS

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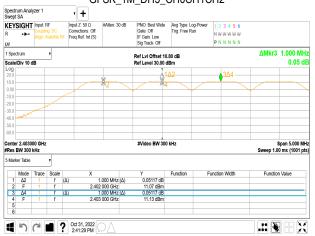
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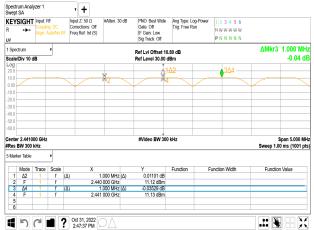
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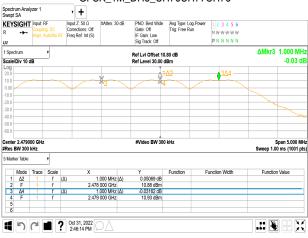
GFSK 1M DH5\_CH0CH1CH2



## GFSK\_1M\_DH5\_CH38CH39CH40



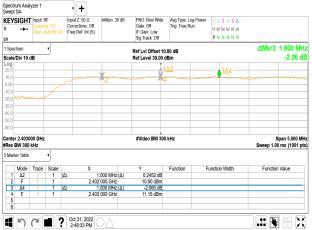
#### GFSK\_1M\_DH5\_CH76CH77CH78



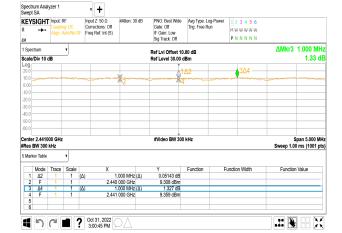
# Report No.: TERF2210002096E2

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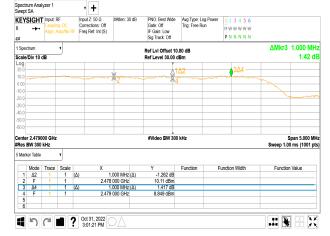
# π/4DQPSK\_2M\_DH5\_CH0CH1CH2



#### π/4DQPSK\_2M\_DH5\_CH38CH39CH40



## $\pi$ /4DQPSK\_2M\_DH5\_CH76CH77CH78



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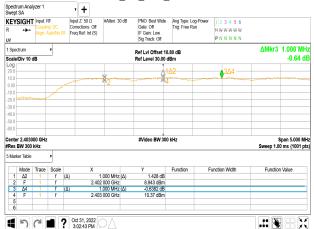
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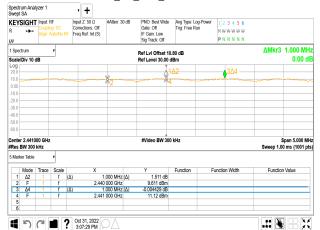


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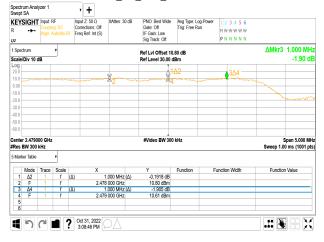
## 8DPSK\_3M\_DH5\_CH0CH1CH2



#### 8DPSK\_3M\_DH5\_CH38CH39CH40



#### 8DPSK\_3M\_DH5\_CH76CH77CH78



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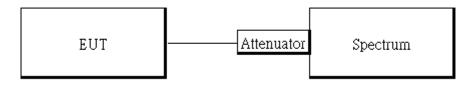
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## 13 NUMBER OF HOPPING FREQUENCY

## 13.1 Standard Applicable

Frequency hopping systems operating in the 2400MHz-2483.5 MHz bands shall use at least 15 hopping frequencies.

## 13.2 Test Setup



#### 13.3 Measurement Procedure

- 1. Place the EUT on the table and set it in transmitting mode.
- 2. The testing follows ANSI C63.10:2013.
- 3. Remove the antenna from the EUT and then connect a low loss RF cable from the antenna port to the spectrum analyzer.
- 4. Set spectrum analyzer Start=2400MHz, Stop = 2483.5MHz, Sweep = auto.
- 5. Set the spectrum analyzer as RBW=430kHz, VBW=1.5MHz., Detector = Peak
- 6. Max hold, view and count how many channel in the band.

#### 13.4 Measurement Result

## Tabular Data of Total Channel Number

	Channel Number	Limit
2.4 GHz – 2.441 GHz	40	
2.441 GHz – 2.4835 GHz	39	>15
2.4 GHz ~2.4835 GHz	(40+39) = 79	

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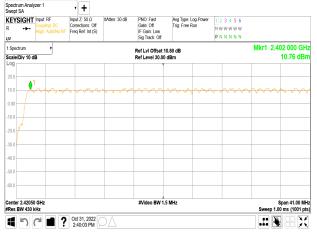
GFSK 1M DH5 2400-2441







## 8DPSK\_3M\_DH5\_2400-2441



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#### 8DPSK\_3M\_DH5\_2441-2480



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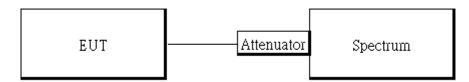
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## 14 TIME OF OCCUPANCY (DWELL TIME)

## 14.1 Standard Applicable

Frequency hopping systems operating in the 2400MHz-2483.5MHz. The average time of occupancy on any frequency shall not greater than 0.4 s within period of 0.4 seconds multiplied by the number of hopping channel employed.

## 14.2 Test Setup



### 14.3 Measurement Procedure

- 1. Place the EUT on the table and set it in transmitting mode.
- 2. The testing follows ANSI C63.10:2015.
- 3. Remove the antenna from the EUT and then connect a low loss RF cable from the antenna port to the spectrum analyzer.
- 4. Set center frequency of spectrum analyzer = operating frequency.
- 5. Set the spectrum analyzer as RBW, VBW=1MHz, 3MHz, Span = 0Hz , Detector = Peak, Adjust Sweep =  $2\sim8$ ms.
- 6. Repeat above procedures until all frequency of the interest measured were complete.

Formula Deduced: time occupancy of one time slot X Hopping rate / total slot in one channel / total channel that hops X period of working channels.

Where, standard hopping rate is 1600 hops/s, slot in one channel for DH1, DH3, and DH5 is 2, 4, and 6, respectively.

DH1 consists of single time slot of the uplink, and one slot of the downlink Total Slot: 2 DH3 consists of three time slot of the uplink, and one slot of the downlink. Total Slot: 4 DH5 consists of five time slot of the uplink, and one slot of the downlink. Total Slot: 6

Note: the result of the complete test default channel at 1Mbps is recorded on the test report, 2Mbps, and 3Mbps only records the measurement result at middle channel that reveals no much deviation.

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## 14.4 Measurement Result

## GFSK (1Mbps)

Channel	PACKET TYPE	Measurement Result (ms)	Limit (ms)	VBW setting (kHz)
	DH1	121.60	400ms	3.00
Mid	DH3	260.80	400ms	1.00
	DH5	307.20	400ms	1.00

## π/4 DQPSK (2Mbps)

Channel	PACKET TYPE	Measurement Result (ms)	Limit (ms)	VBW setting (kHz)	
	2DH1	121.60	400ms	3.00	
Mid	2DH3	260.80	400ms	1.00	
	2DH5	308.80	400ms	1.00	

## 8-DPSK (3Mbps)

<u> </u>				
Channel	PACKET TYPE	Measurement Result (ms)	Limit (ms)	VBW setting (kHz)
	3DH1	123.20	400ms	3.00
Mid	3DH3	262.40	400ms	1.00
	3DH5	307.20	400ms	1.00

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## GFSK (1Mbps):

CH Mid	DH1 time slot	=	0.380 *	(1600/2/79)	*	31.6 =	121.60	(ms)	)
--------	---------------	---	---------	-------------	---	--------	--------	------	---

(1600/4/79) \* 31.6 = 260.80 (ms) DH3 time slot = 1.630 \* DH5 time slot = 2.880 \* (1600/6/79) \* 31.6 = 307.20 (ms)

## $\pi/4$ -DQPSK (2Mbps):

CH Mid	2DH1 time slot =	0.380 *	(1600/2/79) *	31.6 =	121.60 (ms)
--------	------------------	---------	---------------	--------	-------------

2DH3 time slot = 1.630 \*(1600/4/79) \* 31.6 = 260.80 (ms) 2DH5 time slot = 2.895 \* (1600/6/79) \* 31.6 = 308.80 (ms)

## 8-DPSK (3Mbps):

CH Mid	3DH1 time slot =	0.385 *	(1600/2/79) *	31.6 =	123.20 (ms)

(1600/4/79) \* 31.6 = 262.40 (ms) 1.640 \* 3DH3 time slot = (1600/6/79) \* 3DH5 time slot = 2.880 \* 31.6 = 307.20 (ms)

A period time = 0.4 (s) \* 79 = 31.6 (s)

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+

Spectrum Analyzer 1 Swept SA

1 Spectrun

KEYSIGHT Input RI

Center 2.441000000 GHz Res BW 1.0 MHz

KEYSIGHT Input: R

Scale/Div 10 dB

KEYSIGHT

Res BW 1.0 MHz

| Mode | Trace | Scale | | Δ2 | 1 | t | (Δ) |

(1 1 2022 9:03:31 AM

Mode Trace Scale

(A)

? Oct 31, 2022 9:03:06 AM

1 +

2.500 ms (Δ)

2.880 ms (Δ)

Report No.: TERF2210002096E2

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# Dwell Time 8DPSK 3M DH1 2441MHz Spectrum Analyzer 1 Swept SA + KEYSIGHT Input RI ΔMkr3 1.250 ms -0.04 dB #Video BW 3.0 MHz Center 2.441000 Res BW 1.0 MHz Mode Trace Scale (A) ? Oct 31, 2022 9:05:40 AM Dwell Time\_8DPSK\_3M\_DH3\_2441MHz · + 1 2 3 4 5 6 W W W W W W P N N N N N KEYSIGHT Input: R Sig Track: Off ΔMkr3 2.500 ms Scale/Div 10 dB 0.00 dB -16.72 dB 10.53 dBm 2.500 ms (Δ) (1) C (2) Oct 31, 2022 9:06:01 AM # ₩ Dwell Time\_8DPSK\_3M\_DH5\_2441MHz KEYSIGHT Freq Ref: Int (S) ΔMkr3 3.750 ms Ref Lvi Offset 10.80 dB Ref Level 30.00 dBm 0.00 dB eep 15.0 ms (1001 p Mode Trace Scal .le (Δ) 2.880 ms (Δ)

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1 9 C 2 9:08:50 AM



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## 15 ANTENNA REQUIREMENT

## Standard Applicable

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 of this section. 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. This requirement does not apply to carrier current devices or to devices operated under the provisions of §§ 15.211, 15.213, 15.217, 15.219, 15.221, or § 15.236. Further, this requirement does not apply to intentional radiators that must be professionally installed, such as perimeter protection systems and some field disturbance sensors, or to other intentional radiators which, in accordance with § 15.31(d), must be measured at the installation site. However, the installer shall be responsible for ensuring that the proper antenna is employed so that the limits in this part are not exceeded.

### 15.2 Antenna Connected Construction

The antenna complies with this requirement and no consideration of replacement. Please see EUT photo for details.

~ End of Report ~

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