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# **TEST REPORT**

WET THE

FCC ID: 2ADYY-AE10
Product: Mobile Phone

Model No.: AE10

**Trade Mark: TECNO** 

Report No.: WSCT-A2LA-R&E240300009A-BT

Issued Date: 11 July 2024

Issued for:

TECNO MOBILE LIMITED

FLAT N 16/F BLOCK B UNIVERSAL INDUSTRIAL CENTRE 19-25 SHAN MEI

STREET FOTAN NT HONGKONG

Issued By:

World Standardization Certification & Testing Group(Shenzhen) Co.,Ltd.
Building A-B, Baoshi Science & Technology Park, Baoshi Road,
Bao'an District, Shenzhen, Guangdong, China

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**Note:** The results contained in this report pertain only to the tested sample. This report shall not be reproduced, except in full, without written approval of World Standardization Certification & Testing Group(Shenzhen) Co., Ltd. This report must not be used by the client to claim product certification, approval, or any agency of the U.S. Government.

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# **TABLE OF CONTENTS**

	1679B 1679B	116
1.	. Test Certification	3
× 2.	. Test Result Summary	4
5// 3.	EUT Description	5
4.		7
	4.1. Test environment and mode	7
	4.2. DESCRIPTION OF SUPPORT UNITS	
<b>5</b> .	. Facilities and Accreditations	8
	5.1. FACILITIES	8
517	5.2. ACCREDITATIONS	8
	5.3. MEASUREMENT UNCERTAINTY	9
	5.4. MEASUREMENT INSTRUMENTS	10
6.	. Test Results and Measurement Data	11
	6.1. ANTENNA REQUIREMENT	11
X	6.2. CONDUCTED EMISSION	12
741	6.3. CONDUCTED OUTPUT POWER	V AND
	6.4. 20DB OCCUPY BANDWIDTH	23
	6.5. CARRIER FREQUENCIES SEPARATION	
	6.6. HOPPING CHANNEL NUMBER	4.7
/	6.7. DWELL TIME	1
X	6.8. PSEUDORANDOM FREQUENCY HOPPING SEQUENCE	
344	6.9. CONDUCTED BAND EDGE MEASUREMENT	
17/	6.10. CONDUCTED SPURIOUS EMISSION MEASUREMENT	
_	6.11. RADIATED SPURIOUS EMISSION MEASUREMENT	
7.	. Test Setup Photographs	73









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## Report No.: WSCT-A2LA-R&E240300009A-BT

#### 1. Test Certification

Product: Mobile Phone

**TECNO** 

Model No.: AE10

Additional Model:

Applicant:

TECNO MOBILE LIMITED

FLAT N 16/F BLOCK B UNIVERSAL INDUSTRIAL CENTRE 19-25 SHAN MEI

STREET FOTAN NT HONGKONG

Manufacturer:

**TECNO MOBILE LIMITED** 

FLAT N 16/F BLOCK B UNIVERSAL INDUSTRIAL CENTRE 19-25 SHAN MEI

STREET FOTAN NT HONGKONG

Date of receipt:

14 February 2024

Date of Test:

15 February 2024 to 11 July 2024

Xiang

Applicable Standards:

FCC CFR Title 47 Part 15 Subpart C Section 15.247

The above equipment has been tested by World Standardization Certification & Testing Group (Shenzhen) Co., Ltd. and found compliance with the requirements set forth in the technical standards mentioned above. The results of testing in this report apply only to the product/system, which was tested. Other similar equipment will not necessarily produce the same results due to production tolerance and measurement uncertainties.

Tested By:

Wang

(Wang Xiang)

Checked By:

(Qin Shuiguan)

Approved By:

MAN \* PI

(Liu Fuxin)

Date:

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#### **Test Result Summary** 2.

	AUZIMA AUZIM	11/2-1-0-0	All Addison
7	Requirement	CFR 47 Section	Result
	Antenna Requirement	§15.203/§15.247 (c)	PASS
	AC Power Line Conducted Emission	§15,207	PASS
	Maximum conducted output power	§15.247 (b)(1) §2.1046	PASS
	20dB Occupied Bandwidth	§15.247 (a)(1) §2.1049	PASS
	Carrier Frequencies Separation	§15.247 (a)(1)	PASS
	Hopping Channel Number	§15.247 (a)(1)	PASS
,	Dwell Time	§15.247 (a)(1)	PASS
	Radiated Emission	§15.205/§15.209 §2.1053, §2.1057	PASS
	Band Edge	§15.247(d) §2.1051, §2.1057	PASS
	The state of the s		

#### Note:

- 1. PASS: Test item meets the requirement.
- 2. Fail: Test item does not meet the requirement.
- 3. N/A: Test case does not apply to the test object.
- 4. The test result judgment is decided by the limit of test standard.

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# 3. **EUT Description**

Product Name:	Mobile Phone
Model :	AE10
Trade Mark:	TECNO
Software version:	AE10-H833A-U-OP-240421V2267
Hardware version:	V2.0
Operation Frequency:	2402MHz~2480MHz
Channel Separation:	1MHz
Number of Channel:	79
Modulation Type:	GFSK, π/4-DQPSK, 8-DPSK
Antenna Type:	FIPA Antenna
Antenna Gain:	-4.01dBi
Operating Voltage:	Adapter: U700TSA Input: 100-240V~50/60Hz 2.0A Output: 5.0V3.0A 15.0W or 5.0-10.0V7.0A MAX or 11.0V6.4A MAX or 4.0-20.0V3.5A 70.0W MAX Rechargeable Li-ion Polymer Battery Model1: BL-29GT Rated Voltage: 3.86V Rated Capacity: 2973mAh/11.48Wh Typical Capacity: 3043mAh/11.75Wh Limited Charge Voltage: 4.53V Rechargeable Li-ion Polymer Battery Model2: BL-25MT Rated Voltage: 3.86V Rated Capacity: 2637mAh/10.18Wh Typical Capacity: 2707mAh/10.45Wh Limited Charge Voltage: 4.53V
Remark:	N/A.

Note: 1. N/A stands for no applicable.

2. Antenna gain provided by the customer.



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Operation Frequency each of channel for GFSK, π/4-DQPSK, 8DPSK

7	Channel	Frequency	Channel	Frequency	Channel	Frequency	Channel	Frequency
	0	2402MHz	20	2422MHz	40	2442MHz	60	2462MHz
	1	2403MHz	21	2423MHz	41	2443MHz	61	2463MHz
Ì		ATTAGE		AVISTET		ATHE		AVA H
	10	2412MHz	30	2432MHz	50	2452MHz	70	2472MHz
	13	2413MHz	31	2433MHz	51	2453MHz	71	2473MHz
						<u> </u>		
7	18	2420MHz	38	2440MHz	58	2460MHz	78	2480MHz
	19	2421MHz	39	2441MHz	59	2461MHz		- //

Remark: Channel 0, 39 &78 have been tested for GFSK,  $\pi$ /4-DQPSK, 8DPSK modulation mode.

	77719	WHITE	77594	N/H	WHITE
N. E.	TO AVE			TO AVE	
	NVE TET	NVE I W	NET OF	VI-14	WHITE
	14 AVE			$\langle \ \ \rangle$	191
À	WE191	WHA	17/5/91	WESTER	WEIGE
- T	14			TO AVE	
	X	WATER A	11/2-19	176514	NV-100
	stication & Testino G	111111111111111111111111111111111111111	1000	111111111111111111111111111111111111111	- June 19

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#### 4. Genera Information

#### 4.1. Test environment and mode

Operating Environment:	
Temperature:	25.0 °C
Humidity:	56 % RH
Atmospheric Pressure:	1010 mbar
Test Mode:	
Engineering mode:	Keep the EUT in continuous transmitting by select channel and modulations with
forest forest	Fully-charged battery

The sample was placed 0.8m & 1.5m for the measurement below & above 1GHz above the ground plane of 3m chamber. Measurements in both horizontal and vertical polarities were performed. During the test, each emission was maximized by: having the EUT continuously working, investigated all operating modes, rotated about all 3 axis (X, Y & Z) and considered typical configuration to obtain worst position, manipulating interconnecting cables, rotating the turntable, varying antenna height from 1m to 4m in both horizontal and vertical polarizations. The emissions worst-case are shown in Test Results of the following pages.

## 4.2. Description of Support Units

The EUT has been tested as an independent unit together with other necessary accessories or support units. The following support units or accessories were used to form a representative test configuration during the tests.

Equipment	Model No.	Serial No.	FCC ID	Trade Name
/	1	1	1	/ /

#### Note:

- 1. All the equipment/cables were placed in the worst-case configuration to maximize the emission during the test.
- Grounding was established in accordance with the manufacturer's requirements and conditions for the intended use.
- 3. For conducted measurements (Output Power, 20dB Occupied Bandwidth, Carrier Frequencies Separation, Hopping Channel Number, Dwell Time, Spurious Emissions), the antenna of EUT is connected to the test equipment via temporary antenna connector, the antenna connector is soldered on the antenna port of EUT, and the temporary antenna connector is listed in the Test Instruments.



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#### 5. Facilities and Accreditations

#### 5.1. Facilities

All measurement facilities used to collect the measurement data are located at Building A-B, Baoshi Science & Technology Park, Baoshi Road, Bao'an District, Shenzhen, Guangdong, China of the World Standardization Certification & Testing Group(Shenzhen) CO., LTD

The sites are constructed in conformance with the requirements of ANSI C63.4 and CISPR Publication 22. All receiving equipment conforms to CISPR Publication 16-1, "Radio Interference Measuring Apparatus and Measurement Methods."

#### 5.2. ACCREDITATIONS

**CNAS - Registration Number: L3732** 

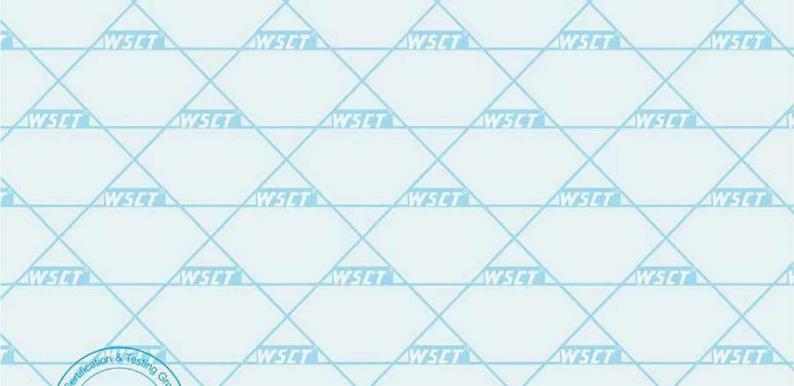
China National Accreditation Service for Conformity Assessment, The test firm Registration Number: L3732

FCC - Designation Number: CN1303

World Standardization Certification & Testing Group(Shenzhen) CO., LTD. has been accredited as a testing laboratory by FCC(Federal Communications Commission). The test firm Designation Number: CN1303.

A2LA - Certificate Number: 5768.01

The EMC Laboratory has been accredited by the American Association for Laboratory Accreditation (A2LA). Certification Number: 5768.01



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## 5.3. Measurement Uncertainty

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The reported uncertainty of measurement  $y \pm U$ , where expended uncertainty U is based on a standard uncertainty multiplied by a coverage factor of k=2, providing a level of confidence of approximately 95 %.

No.	Item	MU
1	Duty Cycle and Tx-Sequence and Tx-Gap	±1%
2	Dwell Time and Minimum Frequency Occupation	±1.2%
3	Medium Utilisation Factor	±1.3%
4	Occupied Channel Bandwidth	±2.4%
5	Transmitter Unwanted Emission in the out-of Band	±1.3%
6	Transmitter Unwanted Emissions in the Spurious Domain	±2.5%
7	Receiver Spurious Emissions	±2.5%
8	Conducted Emission Test	±3.2dB
9	RF power, conducted	±0.16dB
10	Spurious emissions, conducted	±0.21dB
11	All emissions, radiated(<1GHz)	±4.7dB
12	All emissions, radiated(>1GHz)	±4.7dB
13	Temperature	±0.5°C
14	Humidity	±2.0%



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### **5.4. MEASUREMENT INSTRUMENTS**

						www.ws	1-0
	NAME OF EQUIPMENT	MANUFACTURER	MODEL	SERIAL NUMBER	Calibration Date	Calibration Due.	Z
	Test software		EZ-EMC	CON-03A	-	Χ-	
7	Test software		MTS8310	(VZ14)	- 1	2788	
	EMI Test Receiver	R&S	ESCI	100005	11/05/2023	11/04/2024	
	LISN	AFJ	LS16	16010222119	11/05/2023	11/04/2024	
	LISN(EUT)	Mestec	AN3016	04/10040	11/05/2023	11/04/2024	Z
/	Universal Radio Communication Tester	R&S	CMU 200	1100.0008.02	11/05/2023	11/04/2024	
	Coaxial cable	Megalon	LMR400	N/A	11/05/2023	11/04/2024	
	GPIB cable	Megalon	GPIB	N/A	11/05/2023	11/04/2024	-
	Spectrum Analyzer	R&S	FSU	100114	11/05/2023	11/04/2024	
	Pre Amplifier	H.P.	HP8447E	2945A02715	11/05/2023	11/04/2024	7
/	Pre-Amplifier	CDSI	PAP-1G18-38		11/05/2023	11/04/2024	
	Bi-log Antenna	SCHWARZBECK	VULB9168	01488	7/29/2023	7/28/2024	
9	9*6*6 Anechoic	4 ·· /	1941	ATH THE	11/05/2023	11/04/2024	
	Horn Antenna	COMPLIANCE ENGINEERING	CE18000		11/05/2023	11/04/2024	١
	Horn Antenna	SCHWARZBECK	BBHA9120D	9120D-631	11/05/2023	11/04/2024	
	Cable	TIME MICROWAVE	LMR-400	N-TYPE04	11/05/2023	11/04/2024	é
1	System-Controller	ccs	N/A	N/A	N.C.R	N.C.R	
7	Turn Table	ccs	N/A	N/A	N.C.R	N.C.R	
	Antenna Tower	ccs	N/A	N/A	N.C.R	N.C.R	
	RF cable	Murata	MXHQ87WA300 0	-	11/05/2023	11/04/2024	
	Loop Antenna	EMCO	6502	00042960	11/05/2023	11/04/2024	2
1	Horn Antenna	SCHWARZBECK	BBHA 9170	1123	11/05/2023	11/04/2024	
1	Power meter	Anritsu	ML2487A	6K00003613	11/05/2023	11/04/2024	
7	Power sensor	Anritsu	MX248XD	ATEST	11/05/2023	11/04/2024	
	Spectrum Analyzer	Keysight	N9010B	MY60241089	11/05/2023	11/04/2024	
		_	_	E			











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#### Test Results and Measurement Data 6.

## 6.1. Antenna requirement

Standard requirement: FCC Part15 C Section 15.203 /247(c)

15.203 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. permanently attached antenna or of an antenna that uses a unique coupling to the intentional radiator, the manufacturer may design the unit so that a broken antenna can be replaced by the user, but the use of a standard antenna jack or electrical connector is prohibited.

15.247(c) (1)(i) requirement:

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

#### E.U.T Antenna:

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The Bluetooth antenna is a FIPA Antenna, it meets the standards, and the best case gain of the antenna is -4.01dBi.



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### 6.2. Conducted Emission

## 6.2.1. Test Specification

6.2.1. Test Specification		\/	
Test Requirement:	FCC Part15 C Section	15.207	$\times$
Test Method:	ANSI C63.10:2014	1779	ATE OF
Frequency Range:	150 kHz to 30 MHz		
Receiver setup:	RBW=9 kHz, VBW=30	kHz, Sweep time	=auto
Limits:	Frequency range (MHz) 0.15-0.5 0.5-5 5-30	Limit (c Quasi-peak 66 to 56* 56 60	Average 56 to 46* 46 50
X	Reference	Plane	
NISTE SHIFTE	40cm	80cm LISN	40
Test Setup:	Test table/Insulation plane  Remark E.U.T. Equipment Under Test	EMI Receiver	— AC power
Test Mode:	LISN: Line Impedence Stabilization Ne Test table height=0.8m  Refer to item 4.1	X	X
WEIGH	1. The E.U.T is connecting impedance stabilized provides a 50ohm/5 measuring equipment	ation network OuH coupling im	(L.I.S.N.). This
NISTE NISTE	2. The peripheral device power through a LI coupling impedance	SN that provides	a 50ohm/50uH
Test Procedure:	refer to the block photographs).  3. Both sides of A.C.	diagram of the	test setup and
	conducted interferent emission, the relative the interface cables  ANSI C63.10:2014 of the interface cables	nce. In order to fir e positions of equi must be changed	nd the maximum ipment and all of according to
Tant Da Gill.		in conducted intea	outernent.
Test Result:	N/A	X	X

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#### 6.2.2. EUT OPERATING CONDITIONS

The EUT is working in the Normal link mode. All modes have been tested and normal link mode is worst.

Devices subject to Part 15 must be tested for all available U.S. voltages and frequencies (such as a nominal 120 VAC, 60 Hz and 240 VAC, 50 Hz) for which the device is capable of operation. So, The configuration 120 VAC, 60 Hz and 240 VAC, 50 Hz were tested respectively, but only the worst configuration (120 VAC, 60 Hz) shown here.

WEIGH	WHEE	WEIGH
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WETT	WESTER	WEIGH
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World Start in System Commonton (Shenzhan)	(正版份 ADD:Building A-B Baoshi Science & Technology Park, Ba	oshi Road, Bao'an District, Shenzhen, Guangdong, China mail: Fengbing Wang@wsct-cert.com Http://www.wsct-cert.com Member of the WSCT_INC





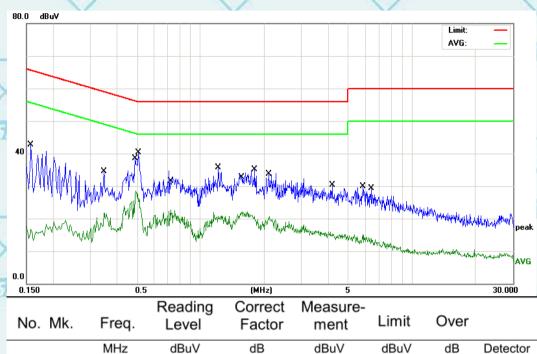


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#### **Test data**

#### Conducted Emission on Line Terminal of the power line (150 kHz to 30MHz)



	No.	Mk.	Freq.	Reading Level	Correct Factor	Measure- ment	Limit	Over	
Ī			MHz	dBuV	dB	dBuV	dBuV	dB	Detector
	1		0.1580	32.31	10.45	42.76	65.56	-22.80	QP
>	2		0.3500	11.28	10.48	21.76	48.96	-27.20	AVG
	3		0.4940	17.92	10.52	28.44	46.10	-17.66	AVG
9	4	*	0.5100	29.77	10.52	40.29	56.00	-15.71	QP
	5		0.7220	12.27	10.53	22.80	46.00	-23.20	AVG
	6		1.2140	25.03	10.58	35.61	56.00	-20.39	QP
	7		1.5740	11.53	10.64	22.17	46.00	-23.83	AVG
>	8		1.8020	24.48	10.68	35.16	56.00	-20.84	QP
	9		2.1140	9.94	10.71	20.65	46.00	-25.35	AVG
1	10		4.1979	19.58	10.73	30.31	56.00	-25.69	QP
	11		5.8500	4.40	10.76	15.16	50.00	-34.84	AVG
ľ	12		6.4180	18.45	10.77	29.22	60.00	-30.78	QP





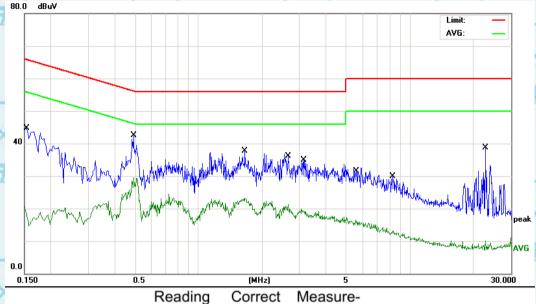






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# Conducted Emission on Neutral Terminal of the power line (150 kHz to 30MHz) Please Contact with WSCT www.wsct-cert.com



	0.150		0.5	l .	(MHz)	5			30.000
>	No.	Mk.	Freq.	Reading Level	Correct Factor	Measure- ment	Limit	Over	
2			MHz	dBuV	dB	dBuV	dBuV	dB	Detector
	1		0.1500	10.27	10.45	20.72	55.99	-35.27	AVG
ĺ	2		0.1539	34.26	10.45	44.71	65.78	-21.07	QP
	3	*	0.4940	31.93	10.52	42.45	56.10	-13.65	QP
>	4		0.4940	19.06	10.52	29.58	46.10	-16.52	AVG
	5		1.6420	12.42	10.65	23.07	46.00	-22.93	AVG
2	6		1.6620	27.01	10.66	37.67	56.00	-18.33	QP
	7		2.6540	10.49	10.72	21.21	46.00	-24.79	AVG
	8		3.1460	24.16	10.72	34.88	56.00	-21.12	QP
	9		5.5380	5.77	10.75	16.52	50.00	-33.48	AVG
>	10		8.2500	19.16	10.80	29.96	60.00	-30.04	QP
	11		22.7139	27.57	11.09	38.66	60.00	-21.34	QP
-7	12		22.7139	-1.07	11.09	10.02	50.00	-39.98	AVG

#### Note1:

Freq. = Emission frequency in MHz

Reading level  $(dB\mu V)$  = Receiver reading

Corr. Factor (dB) = LISN Factor + Cable loss

Measurement  $(dB\mu V)$  = Reading level  $(dB\mu V)$  + Corr. Factor (dB)

Limit (dBµV) = Limit stated in standard

Margin (dB) = Measurement (dB $\mu$ V) – Limits (dB $\mu$ V)

O.P. =Quasi-Peak AVG =average

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<sup>\*</sup> is meaning the worst frequency has been tested in the frequency range 150 kHz to 30MHz.









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## 6.3. Conducted Output Power

### 6.3.1. Test Specification

Test Requirement:	FCC Part15 C Section 15.247 (b)(3)
Test Method:	ANSI C63.10:2014
Limit:	Section 15.247 (b) The maximum peak conducted output power of the intentional radiator shall not exceed the following: (1) For frequency hopping systems operating in the 2400-2483.5 MHz band employing at least 75 non-overlapping hopping channels, and all frequency hopping systems in the 5725-5850 MHz band: 1 watt. For all other frequency hopping systems in the 2400-2483.5 MHz band 0.125 watts.
Test Setup:	Spectrum Analyzer EUT
Test Mode:	Transmitting mode with modulation
Test Procedure:	Use the following spectrum analyzer settings: Span = approximately 5 times the 20 dB bandwidth, centered on a hopping channel RBW > the 20 dB bandwidth of the emission being measured VBW ≥ RBW Sweep = auto Detector function = peak Trace = max hold Allow the trace to stabilize. Use the marker-to-peak function to set the marker to the peak of the emission.
Test Result:	PASS



W614

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#### 6.3.2. Test Data

,	GFSK mode					
	Test channel	Maximum conducted output power (dBm)	Limit (dBm)	Result		
5	Lowest	0.93	20.97	PASS		
	Middle	0.60	20.97	PASS		
	Highest	-0.24	20.97	PASS		

Pi/4DQPSK mode				
Test channel	Maximum conducted output power (dBm)	Limit (dBm)	Result	
Lowest	-0.43	20.97	PASS	
Middle	-0.43	20.97	PASS	
Highest	-1.34	20.97	PASS	

y					
8DPSK mode					
0	Test channel	Maximum conducted output power (dBm)	Limit (dBm)	Result	
	Lowest	-0.59	20.97	PASS	
	Middle	-0.47	20.97	PASS	
	Highest	-1.42	20.97	PASS	

Test plots as follows:

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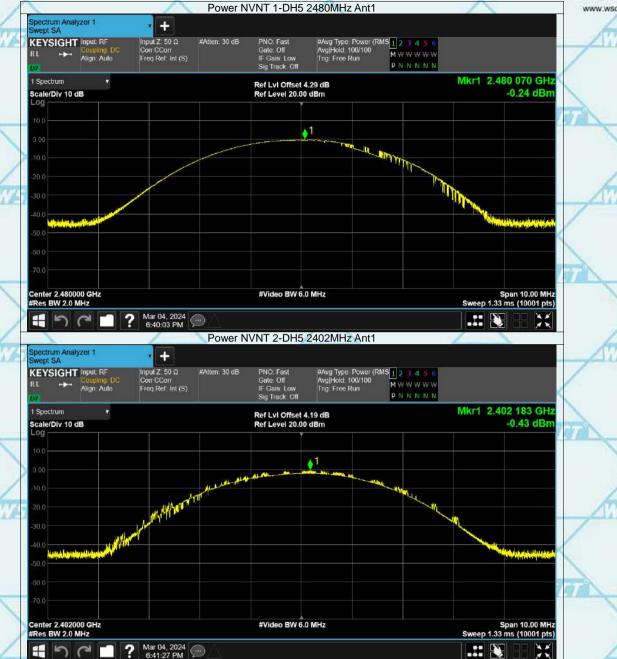






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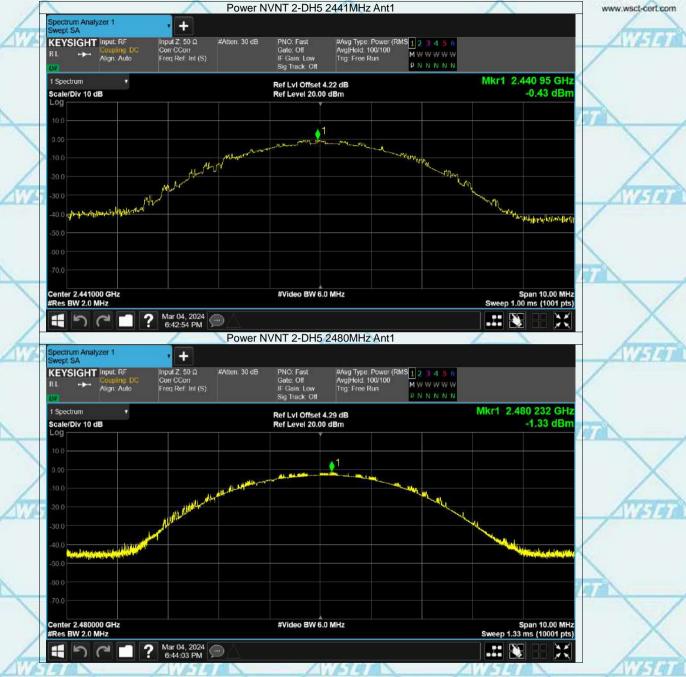






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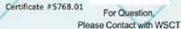


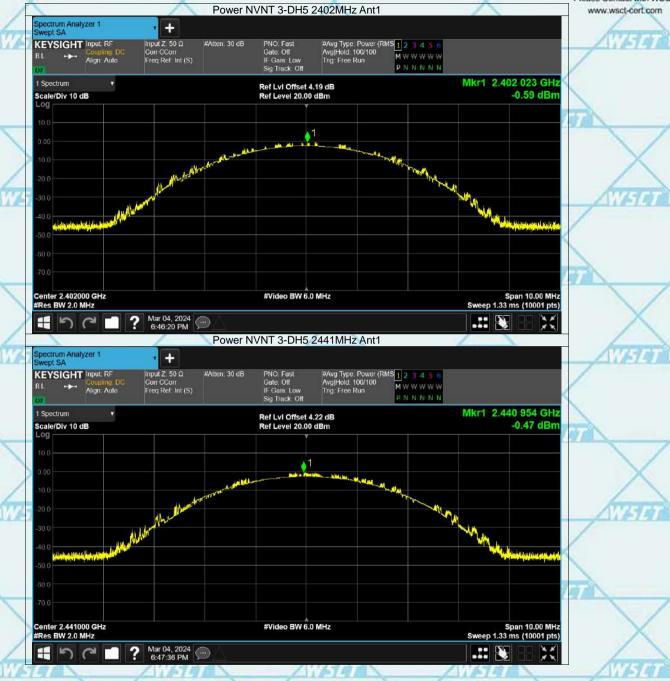






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Span 10.00 MHz Sweep 1.33 ms (10001 pts)

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#Video BW 6.0 MHz









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#### 20dB Occupy Bandwidth 6.4.

## 6.4.1. Test Specification

	Test Requirement:	FCC Part15 C Section 15.247 (a)(1)
2	Test Method:	ANSI C63.10:2014
	Limit:	N/A
7	Test Setup:	Spectrum Analyzer EUT
	Test Mode:	Transmitting mode with modulation
	Test Procedure:	<ol> <li>The testing follows ANSI C63.10:2014 Measurement Guidelines.</li> <li>The RF output of EUT was connected to the spectrum analyzer by RF cable and attenuator. The path loss was compensated to the results for each measurement.</li> <li>Set to the maximum power setting and enable the EUT transmit continuously.</li> <li>Use the following spectrum analyzer settings for 20dB Bandwidth measurement.         Span = approximately 2 to 5 times the 20 dB bandwidth, centered on a hopping channel; 1%≤ RBW≤5% of the 20 dB bandwidth; VBW≥3RBW; Sweep = auto; Detector function = peak; Trace = max hold.     </li> <li>Measure and record the results in the test report.</li> </ol>
	Test Result:	PASS











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## 6.4.2. Test data

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5	Test channel	20dB Occupy Bandwidth (MHz)				
	rest charmer	GFSK	π/4-DQPSK	8DPSK	Conclusion	
	Lowest	0.7061	0.9406	1.027	PASS	
	Middle	0.7021	1.098	1.111	PASS	
	Highest	0.8035	1.068	1.100	PASS	

Test plots as follows: Saddication & Test Moup (Shenz)

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Report No.: WSCT-A2LA-R&E240300009A-BT Certificate #5768.01 For Question, Please Contact with WSCT Test Graphs www.wsct-cert.com -20dB Bandwidth NVNT 1-DH5 2402MHz Ant1 pectrum Analyzer 1 ccupied BW + Input Z: 50 Ω Corr CCorr Freq Ref: Int (S) Trig. Free Run Gate: Off #IF Gain: Low Center Freq. 2.402000000 GHz Avg|Hold: 100/100 Radio Std. None KEYSIGHT Input: RF Mkr3 2.402346000 GHz Ref LvI Offset 4.19 dB -17.45 dBm Scale/Div 10.0 dB Ref Value 24.19 dBm Center 2.402000 GHz #Res BW 30.000 kHz Span 2 MHz Sweep 2.67 ms (10001 pts) #Video BW 100.00 kHz Occupied Bandwidth 813.24 kHz Total Power 4.68 dBm % of OBW Pow x dB -7.097 kHz 706.1 kHz 99 00 % Transmit Freq Error x dB Bandwidth ? Mar 04, 2024 6:37:11 PM .:: 📝 3.4 190 -20dB Bandwidth NVNT 1-DH5 2441MHz Ant1 ectrum Analyzer 1 cupied BW + Input Z: 50 Ω Corr CCorr Freq Ref: Int (S) Trig. Free Run Gate. Off #IF Gain. Low Center Freq. 2.441000000 GHz Avg|Hold: 100/100 Radio Std. None KEYSIGHT Input: RF Mkr3 2.441388000 GHz Ref LvI Offset 4.22 dB Ref Value 24.22 dBm -22.63 dBm Scale/Div 10.0 dB Span 2 MHz Sweep 2.67 ms (10001 pts) Center 2.441000 GHz #Res BW 30.000 kHz #Video BW 100.00 kHz Occupied Bandwidth 796.73 kHz Total Power 5.25 dBm Transmit Freq Error 37.432 kHz 702.1 kHz 99.00 % -20.00 dB % of OBW Pow # 5 .:: 🔌



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## 6.5. Carrier Frequencies Separation

## 6.5.1. Test Specification

Test Requirement:	FCC Part15 C Section 15.247 (a)(1)
Test Method:	ANSI C63.10:2014
Limit:	Frequency hopping systems operating in the 2400-2483.5 MHz band may have hopping channel carrier frequencies that are separated by 25 kHz or two-thirds of the 20 dB bandwidth of the hopping channel, whichever is greater.
Test Setup:	Spectrum Analyzer EUT
Test Mode:	Hopping mode
Test Procedure:	<ol> <li>The testing follows ANSI C63.10:2014 Measurement Guidelines.</li> <li>The RF output of EUT was connected to the spectrum analyzer by RF cable and attenuator. The path loss was compensated to the results for each measurement.</li> <li>Set to the maximum power setting and enable the EUT transmit continuously.</li> <li>Enable the EUT hopping function.</li> <li>Use the following spectrum analyzer settings:         <ul> <li>Span = wide enough to capture the peaks of two adjacent channels; RBW is set to approximately 30% of the channel spacing, adjust as necessary to best identify the center of each individual channel; VBW≥RBW; Sweep = auto;</li> </ul> </li> </ol>
Test Result:	Detector function = peak; Trace = max hold.  6. Use the marker-delta function to determine the separation between the peaks of the adjacent channels. Record the value in report.  PASS



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#### 6.5.2. Test data

	GFSK mode					
Test channel	Carrier Frequencies Separation (MHz)	Limit (2/3*20dB BW MHz)	Result			
Lowest	775790	0.471	PASS			
Middle	1	0.468	PASS			
Highest	1.002	0.536	PASS			

	Pi/4 DQPSK mode						
200	Test channel	Carrier Frequencies Limit (2/3*20dB BW Separation (MHz) MHz)		Result			
	Lowest	1	0.627	PASS			
	Middle	1	0.732	PASS			
	Highest	W/79 1 W	0.712	PASS			

	8DPSK mode						
No.	Test channel	Carrier Frequencies Separation (MHz)	Limit (2/3*20dB BW MHz)	Result			
	Lowest	1	0.685	PASS			
	Middle	1	0.741	PASS			
7	Highest	ATTENDED TO	0.733	PASS			

Test plots as follows:

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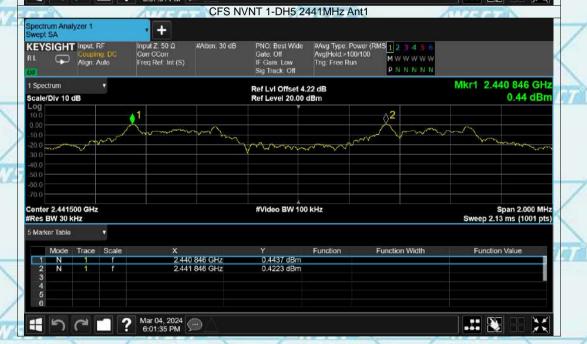






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Function Value

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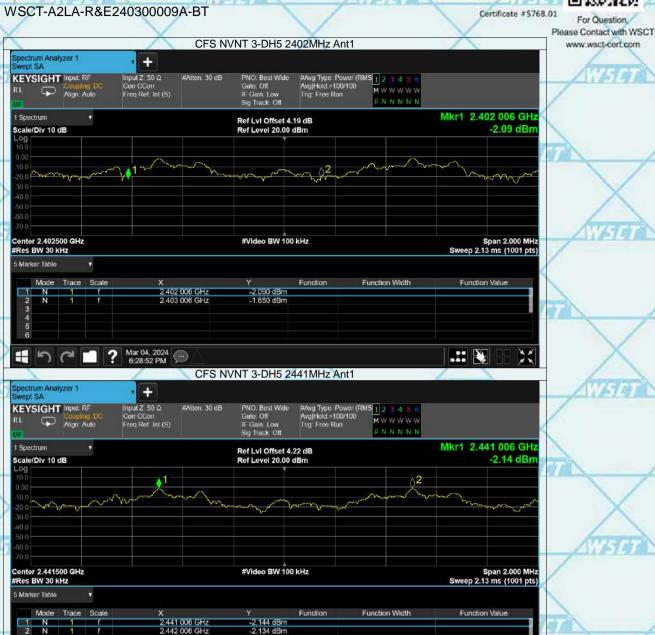
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# 6.6. Hopping Channel Number

## 6.6.1. Test Specification

2	Test Requirement:	FCC Part15 C Section 15.247 (a)(1)
	Test Method:	ANSI C63.10:2014
	Limit:	Frequency hopping systems in the 2400-2483.5 MHz band shall use at least 15 channels.
7	Test Setup:	EUT EUT
		Spectrum Analyzer
	Test Mode:	Hopping mode
		<ol> <li>The testing follows ANSI C63.10:2014 Measurement Guidelines.</li> <li>The RF output of EUT was connected to the spectrum analyzer by RF cable and attenuator. The path loss was compensated to the results for each measurement.</li> <li>Set to the maximum power setting and enable the</li> </ol>
	Test Procedure:	<ul> <li>EUT transmit continuously.</li> <li>4. Enable the EUT hopping function.</li> <li>5. Use the following spectrum analyzer settings: Span = the frequency band of operation; 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.</li> <li>6. The number of hopping frequency used is defined as the number of total channel.</li> <li>7. Record the measurement data in report.</li> </ul>
	Test Result:	PASS PASS
	Annual Antibore	



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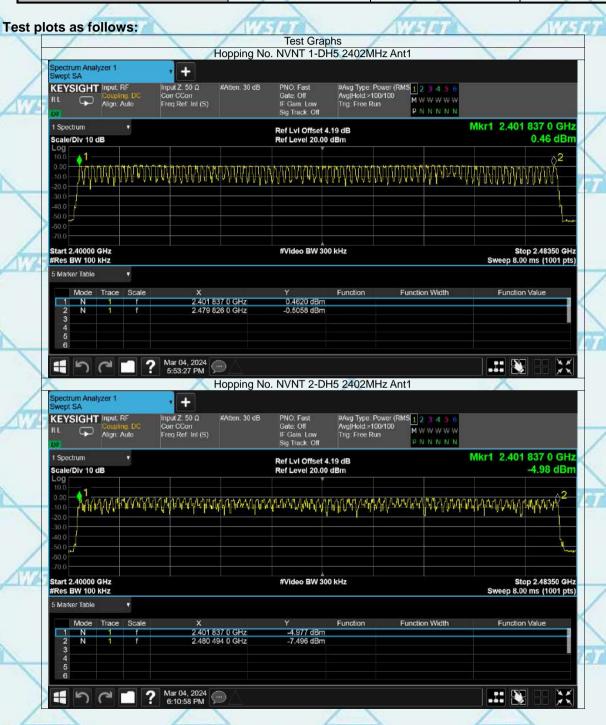
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#### 6.6.2. Test data

Mode	Hopping channel numbers	Limit	Result
GFSK, P/4-DQPSK, 8DPSK	79	15	PASS











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Certificate #5768.01 For Question, Please Contact with WSCT Hopping No. NVNT 3-DH5 2402MHz Ant1 www.wsct-cert.com + #Avg Type: Power (RMS 1 2 3 4 5 6 Avg|Hold:>100/100 Trig: Free Run Input Z: 50 Ω Corr CCorr Freq Ref: Int (S) KEYSIGHT Input RF PNO: Fast Gate: Off IF Gain: Low Sig Track: Off MWWWW Align: Auto PNNNNN Mkr1 2.401 670 0 GHz Ref LvI Offset 4.19 dB Ref Level 20.00 dBm -8.86 dBm Scale/Div 10 dB \*gradedry-powedhareddarhallardarhadddallardareddarhadlaredbarddyddlenharadarhadarhadddarharadddarhad Start 2.40000 GHz #Res BW 100 kHz #Video BW 300 kHz Stop 2.48350 GHz Sweep 8.00 ms (1001 pts) Function Value 2.401 670 0 GHz 2.479 993 0 GHz

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## 6.7. Dwell Time

## 6.7.1. Test Specification

Test Requirement:	FCC Part15 C Section 15.247 (a)(1)
Test Method:	ANSI C63.10:2014
Limit:	The average time of occupancy on any channel shall not be greater than 0.4 seconds within a period of 0.4 seconds multiplied by the number of hopping channels employed.
Test Setup:	Spectrum Analyzer EUT
Test Mode:	Hopping mode
Test Procedure:	<ol> <li>The testing follows ANSI C63.10:2014 Measurement Guidelines.</li> <li>The RF output of EUT was connected to the spectrum analyzer by RF cable and attenuator. The path loss was compensated to the results for each measurement.</li> <li>Set to the maximum power setting and enable the EUT transmit continuously.</li> <li>Enable the EUT hopping function.</li> <li>Use the following spectrum analyzer settings: Span = zero span, centered on a hopping channel; RBW shall be ≤ channel spacing and where possible RBW should be set &gt;&gt; 1 / T, where T is the expected dwell time per channel; VBW≥RBW; Sweep = as necessary to capture the entire dwell time per hopping channel; Detector function = peak; Trace = max hold.</li> <li>Measure and record the results in the test report.</li> </ol>
Test Result:	PASS
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#### 6.7.2. Test Data

Mode	Frequency	Pulse Time	Total Dwell Time	Burst	Period Time	Limit	Verdict
	(MHz)	(ms)	(ms)	Count	(ms)	(ms)	
1-DH1	2402	0.375	114.75	306	31600	400	Pass
1-DH1	2441	0.375	115.875	309	31600	400	Pass
1-DH1	2480	0.374	118.558	317	31600	400	Pass
1-DH3	2402	1.63	285.25	175	31600	400	Pass
1-DH3	2441	1.63	246.13	151	31600	400	Pass
1-DH3	2480	1.628	271.876	167	31600	400	Pass
1-DH5	2402	2.879	319.569	111	31600	400	Pass
1-DH5	2441	2.877	302.085	105	31600	400	Pass
1-DH5	2480	2.877	281.946	98	31600	400	Pass

Note: 1. In normal mode, hopping rate is 1600 hops/s with 6 slots in 79 hopping channels.

For DH1, With channel hopping rate (1600 / 2 / 79) in Occupancy Time Limit (0.4 x 79) (s), Hops Over Occupancy Time comes to  $(1600 / 2 / 79) \times (0.4 \times 79) = 320$  hops

For DH3, With channel hopping rate (1600/4/79) in Occupancy Time Limit  $(0.4 \times 79)$  (s), Hops Over Occupancy Time comes to  $(1600/4/79) \times (0.4 \times 79) = 160$  hops

For DH5, With channel hopping rate (1600 / 6 / 79) in Occupancy Time Limit (0.4 x 79) (s), Hops Over Occupancy Time comes to  $(1600 / 6 / 79) \times (0.4 \times 79) = 106.67$  hops

2. Dwell Time(s) = Hops Over Occupancy Time (hops) x Package Transfer Time

Test plots as follows:

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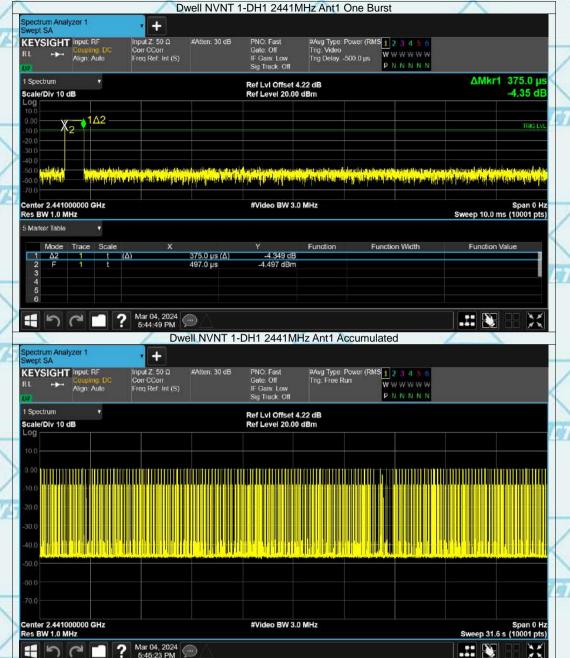






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Certificate #5768.01 For Question, Please Contact with WSCT Dwell NVNT 1-DH1 2480MHz Ant1 One Burst www.wsct-cert.com + Input Z. 50 Ω Corr CCorr Freq Ref: Int (S) KEYSIGHT Input RF PNO: Fast Gate: Off IF Gain: Low Sig Track: Off #Avg Type: Power (RMS 1 2 3 4 5 6 Trig. Video Trig Delay. -500.0 µs. WWWWW Align: Auto PNNNNN ΔMkr1 374.0 μs Ref LvI Offset 4.29 dB Ref Level 20.00 dBm 0.07 dB Scale/Div 10 dB 1Δ2 #Video BW 3.0 MHz Span 0 Hz Sweep 10.0 ms (10001 pts) Center 2.480000000 GHz Res BW 1.0 MHz 5 Markor Tablo Function Value 374.0 μs (Δ) 497.0 μs 0.07055 dB .:: 🔌 Dwell NVNT 1-DH1 2480MHz Ant1 Accumulated + KEYSIGHT Input: RF Input Z: 50 Ω #Avg Type: Power (RMS 1 2 3 4 5 Trig: Free Run Corr CCorr Freq Ref: Int (S) WWWWW PNNNNN Ref LvI Offset 4.29 dB Ref Level 20.00 dBm Scale/Div 10 dB Center 2.480000000 GHz #Video BW 3.0 MHz Span 0 Hz Sweep 31.6 s (10001 pts)



Res BW 1.0 MHz

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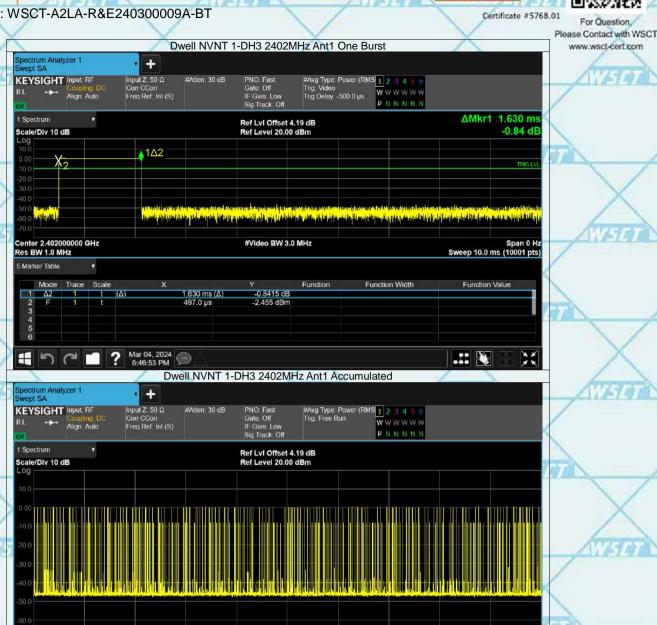








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#Video BW 3.0 MHz

Span 0 Hz Sweep 31.6 s (10001 pts)

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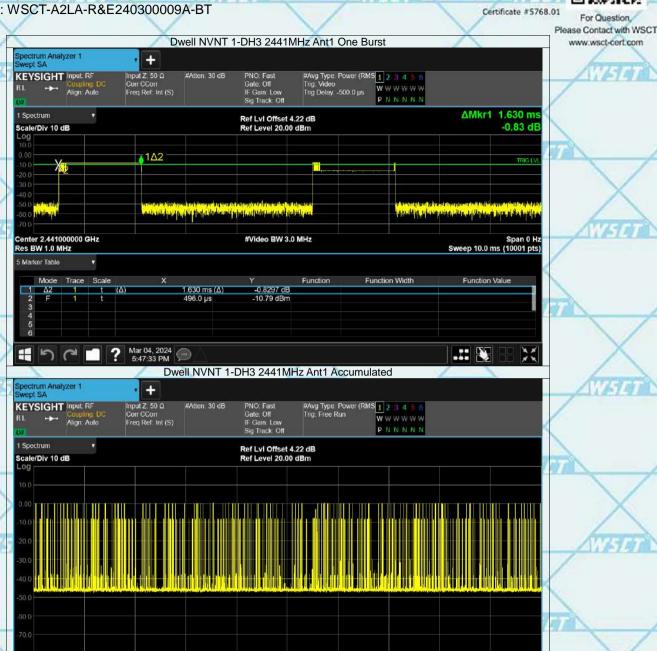


Span 0 Hz Sweep 31.6 s (10001 pts)

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Res BW 1.0 MHz

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#Video BW 3.0 MHz



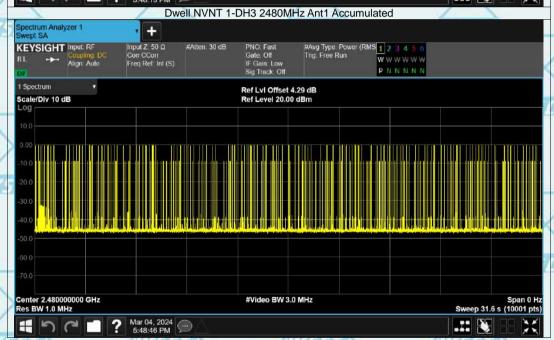






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Certificate #5768.01 For Question, Please Contact with WSCT Dwell NVNT 1-DH3 2480MHz Ant1 One Burst www.wsct-cert.com + Input Z. 50 Ω Corr CCorr Freq Ref: Int (S) KEYSIGHT Input RF PNO: Fast Gate: Off IF Gain: Low Sig Track: Off #Avg Type: Power (RMS 1 2 3 4 5 6 Trig. Video Trig Delay. -500.0 µs. WWWWW Align: Auto PNNNNN ΔMkr1 1.628 ms Ref LvI Offset 4.29 dB Ref Level 20.00 dBm -0.35 dB Scale/Div 10 dB **1**Δ2 Span 0 Hz Sweep 10.0 ms (10001 pts) Center 2,480000000 GHz #Video BW 3.0 MHz Res BW 1.0 MHz 5 Markor Tablo Function Value -16.30 dBm 496.0 µs .:: 🔌





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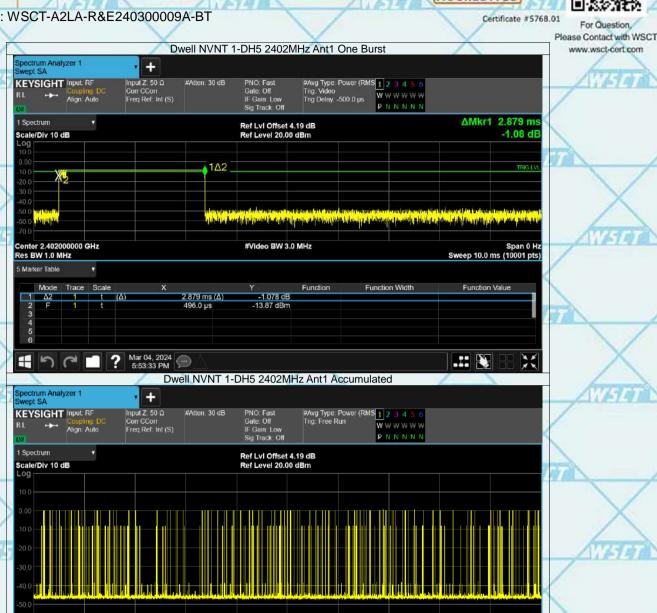








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#Video BW 3.0 MHz

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#Video BW 3.0 MHz

Span 0 Hz Sweep 31.6 s (10001 pts)

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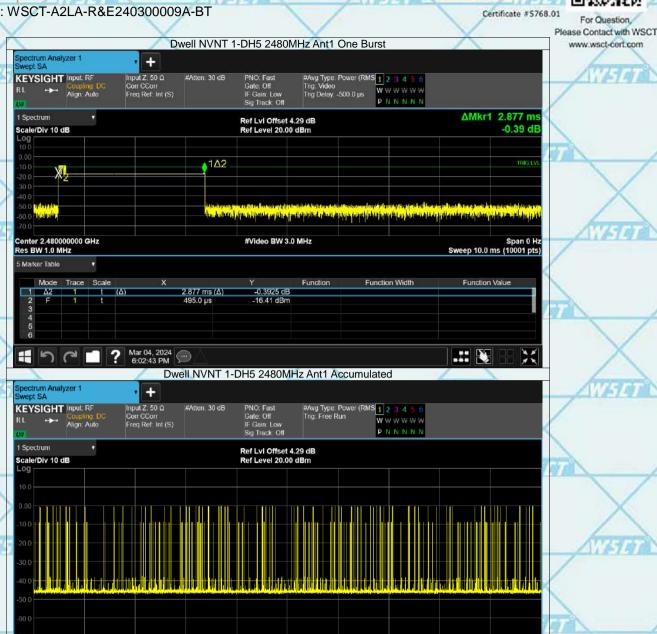








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Res BW 1.0 MHz

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#Video BW 3.0 MHz

Span 0 Hz Sweep 31.6 s (10001 pts)

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## 6.8. Pseudorandom Frequency Hopping Sequence

## Test Requirement: FCC Part15 C Section 15.247 (a)(1) requirement:

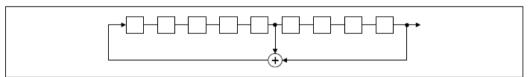
Frequency hopping systems shall have hopping channel carrier frequencies separated by a minimum of 25 kHz or the 20 dB bandwidth of the hopping channel, whichever is greater.

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

## **EUT Pseudorandom Frequency Hopping Sequence**

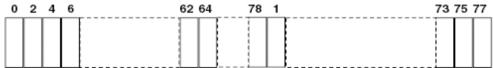
The pseudorandom sequence may be generated in a nine-stage shift register whose 5th and 9th stage outputs are added in a modulo-two addition stage. And the result is fed back to the input of the first stage. The sequence begins with the first one of 9 consecutive ones; i.e. the shift register is initialized with nine ones.

- Number of shift register stages: 9
- Length of pseudo-random sequence: 2<sup>9</sup>-1 = 511 bits
- Longest sequence of zeros: 8 (non-inverted signal)



Linear Feedback Shift Register for Generation of the PRBS sequence

An example of Pseudorandom Frequency Hopping Sequence as follow:



Each frequency used equally on the average by each transmitter.

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











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## 6.9. Conducted Band Edge Measurement

# 6.9.1. Test Specification

Test Requirement:	FCC Part15 C Section 15.247 (d)
Test Method:	ANSI C63.10:2014
Limit:	In any 100 kHz bandwidth outside the intentional radiation frequency band, the radio frequency power shall be at least 20 dB below the highest level of the radiated power. In addition, radiated emissions which fall in the restricted bands must also comply with the radiated emission limits.
Test Setup:	Spectrum Analyzer EUT
Test Mode:	Transmitting mode with modulation
Test Procedure:	<ol> <li>The testing follows the guidelines in Band-edge Compliance of RF Conducted Emissions of ANSI C63.10:2014 Measurement Guidelines.</li> <li>Set to the maximum power setting and enable the EUT transmit continuously.</li> <li>Set RBW = 100 kHz (≥1% span=10MHz), VBW = 300 kHz (≥RBW). Band edge emissions must be at least 20 dB down from the highest emission level within the authorized band as measured with a 100kHz RBW. The attenuation shall be 30 dB instead of 20 dB when RMS conducted output power procedure is used.</li> <li>Enable hopping function of the EUT and then repeat step 2 and 3.</li> <li>Measure and record the results in the test report.</li> </ol>
Test Result:	PASS
	Test Method:  Limit:  Test Setup:  Test Mode:  Test Procedure:











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**Test Data** 

GFSK Modulation (the worst case)

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# 6.10. Conducted Spurious Emission Measurement

## 6.10.1. Test Specification

Test Requirement:	FCC Part15 C Section 15.247 (d)
Test Method:	ANSI C63.10:2014
Limit:	In any 100 kHz bandwidth outside the intentional radiation frequency band, the radio frequency power shall be at least 20 dB below the highest level of the radiated power. In addition, radiated emissions which fall in the restricted bands must also comply with the radiated emission limits.
Test Setup:	Spectrum Analyzer EUT
Test Mode:	Transmitting mode with modulation
Test Procedure:	<ol> <li>The testing follows the guidelines in Spurious RF Conducted Emissions of ANSI C63.10:2014 Measurement Guidelines</li> <li>The RF output of EUT was connected to the spectrum analyzer by RF cable and attenuator. The path loss was compensated to the results for each measurement.</li> <li>Set to the maximum power setting and enable the EUT transmit continuously.</li> <li>Set RBW = 100 kHz, VBW = 300kHz, scan up through 10th harmonic. All harmonics / spurs must be at least 20 dB down from the highest emission level within the authorized band as measured with a 100 kHz RBW.</li> <li>Measure and record the results in the test report.</li> <li>The RF fundamental frequency should be excluded against the limit line in the operating frequency band.</li> </ol>
Test Result:	PASS











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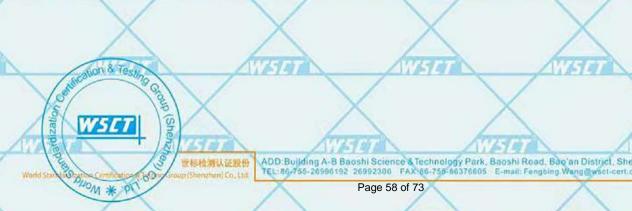




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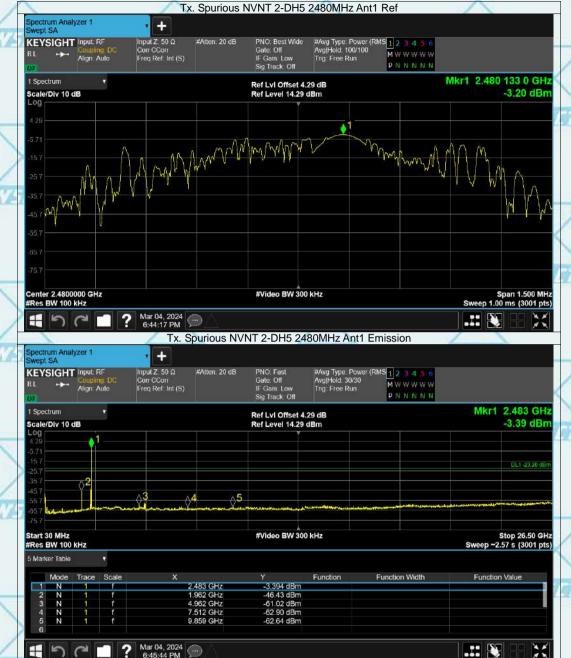






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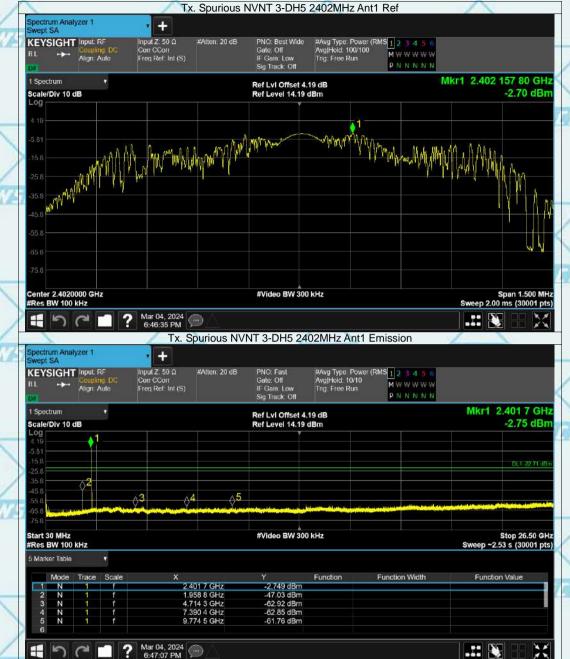






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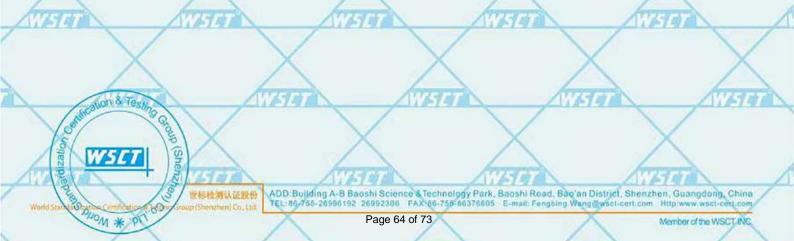




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#### **Radiated Spurious Emission Measurement** 6.11.

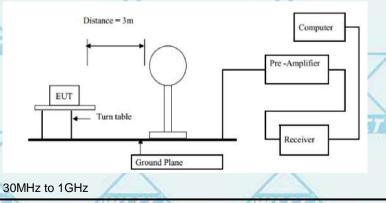
C 44 4 Toot Consideration		474			48
6.11.1. Test Specification	/		\ /		
Test Requirement:	FCC Part15	C Sectio	n 15.209		X
Test Method:	ANSI C63.10	):2014	17294	1	NV-14
Frequency Range:	9 kHz to 25 (	GHz			
Measurement Distance:	3 m		6	X	
Antenna Polarization:	Horizontal &	Vertical		1169	4
	Frequency	Detecto	r RBW	VBW	Remark
X	9kHz- 150kHz	Quasi-pea	ak 200Hz	1kHz	Quasi-peak Value
	150kHz-	Quasi-pea	ak 9kHz	30kHz	Quasi-peak Value
Receiver Setup:	30MHz		17724 111		AUZ9 de
1	30MHz-1GHz	Quasi-pea	ak 100KHz	300KHz	Quasi-peak Value
	Abaya 4011-	Peak	1MHz	3MHz	Peak Value
	Above IGHZ	Peak	1MHz	10Hz	Average Value
	1	Acres 1	Field Chris	and the second	Measurement
27679 X 1679	Frequen	су		F 1 1 Mm 2	Distance (meters)
	0.009-0.4	190			300
X				,	30
			30	/	30
17274	30-88		100	1	35
	88-216		150		3
Limit:	216-96	0	200		3
	Test Method: Frequency Range: Measurement Distance: Antenna Polarization:  Receiver Setup:	Test Requirement:  Test Method:  ANSI C63.10  Frequency Range:  9 kHz to 25 0  Measurement Distance:  Antenna Polarization:  Horizontal &  Frequency 9kHz- 150kHz 150kHz- 30MHz-150kHz 30MHz-1GHz Above 1GHz  Frequency 9kHz-1705-3 30-88 88-216	Test Requirement:  FCC Part15 C Section  ANSI C63.10:2014  Frequency Range:  9 kHz to 25 GHz  Measurement Distance:  3 m  Antenna Polarization:  Horizontal & Vertical  Frequency Detector 9kHz-150kHz Quasi-pear 150kHz-30MHz 30MHz-1GHz Quasi-pear Above 1GHz  Peak Peak  Frequency 0.009-0.490 0.490-1.705 1.705-30 30-88 88-216	Test Requirement: FCC Part15 C Section 15.209  Test Method: ANSI C63.10:2014  Frequency Range: 9 kHz to 25 GHz  Measurement Distance: 3 m  Antenna Polarization: Horizontal & Vertical  Frequency Detector RBW 9kHz-150kHz Quasi-peak 200Hz 150kHz-150kHz Quasi-peak 9kHz 30MHz 30MHz-1GHz Quasi-peak 100KHz Above 1GHz Peak 1MHz  Frequency Field Stre (microvolts 0.009-0.490 2400/F(t 0.490-1.705 24000/F(t 1.705-30 30 30-88 100 88-216 150	Test Requirement: FCC Part15 C Section 15.209  Test Method: ANSI C63.10:2014  Frequency Range: 9 kHz to 25 GHz  Measurement Distance: 3 m  Antenna Polarization: Horizontal & Vertical  Frequency Detector RBW VBW 9kHz-150kHz Quasi-peak 200Hz 1kHz 150kHz-150kHz Quasi-peak 9kHz 30kHz 30MHz 30MHz 30MHz 30MHz 4 Hz 30MHz 30MHz 4 Hz 30MHz 4 Hz 30MHz 30MHz 4 Hz 30MHz 30MHz 4 Hz 30MHz 30MHz 4 Hz 30MHz 30

Frequency	Field Strength (microvolts/meter)	Measurement Distance (meters)	Detector
Above 4011	500	3	Average
Above 1GHz	5000	3	Peak

For radiated emissions below 30MHz

Above 960

Test setup:



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Report No.: WSCT-A2LA-R&E240300009A-BT ontact with WSCT wsct-cert.com Pre-amplifier Coaxial cable (1m) Above 1GHz Receive **Test Mode:** Transmitting mode with modulation The testing follows the guidelines in Spurious Radiated **Emissions** of ANSI C63.10:2014 Measurement Guidelines. For the radiated emission test below 1GHz: The EUT was placed on a turntable with 0.8 meter above ground. The EUT was set 3 meters from the interference receiving antenna, which was mounted on the top of a variable height antenna tower. The EUT was arranged to its worst case and then tune the antenna tower (from 1 m to 4 m) and turntable (from 0 degree to 360 degrees) to find the maximum reading. A pre-amp and a high PASS filter are used for the test in order to get better signal level. Test Procedure: For the radiated emission test above 1GHz: Place the measurement antenna on a turntable with 1.5 meter above ground, which is away from each area of the EUT determined to be a source of emissions at the specified measurement distance, while keeping the measurement antenna aimed at the source of emissions at each frequency of significant emissions, with polarization oriented for maximum response. The measurement antenna may have to be higher or lower than the EUT, depending on the radiation pattern of the emission and staying aimed at the emission source for receiving the maximum signal. The final measurement antenna elevation shall be that which

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		4							
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			em	ission being	g measur	ed;			V
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	Test results:	PA	22				/		\ /
	restresuits.	FA.	55	X		×			X

Note 1: The symbol of "--" in the table which means not application.

Note 2: For the test data above 1 GHz, According the ANSI C63.10-2013, where limits are specified for both average and peak (or quasi-peak) detector functions, if the peak (or quasi-peak) measured value complies with the average limit, it is unnecessary to perform an average measurement.

Note 3: The low frequency, which started from 9 kHz to 30 MHz, was pre-scanned and the result which was 20 dB lower than the limit line per 15.31(o) was not reported.

Note 4: The EUT is working in the Normal link mode below 1 GHz. All modes have been tested and normal link mode is worst.











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6.11.2. Test Data

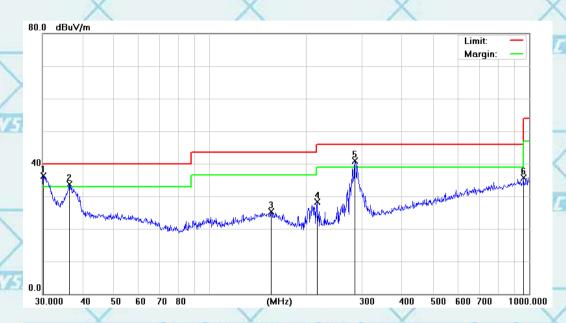
Please refer to following diagram for individual

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## Below 1GHz

Horizontal:



	No.	Mk	Freq.	Reading Level	Correct Factor	Measure- ment	Limit	Over	ET.
ĺ			MHz	dBuV	dB	dBuV/m	dBuV/m	dB	Detector
>	1	*	30.2111	39.45	-3.20	36.25	40.00	-3.75	QP
	2	10	36.3814	36.15	-2.52	33.63	40.00	-6.37	QP
2	3		155.9101	27.16	-1.89	25.27	43.50	-18.23	QP
	4		216.7828	33.69	-5.43	28.26	46.00	-17.74	QP
	<b>4</b> 5	1	284.9767	44.08	-3.20	40.88	46.00	-5.12	QP
	6		958.7943	28.25	7.48	35.73	46.00	-10.27	QP

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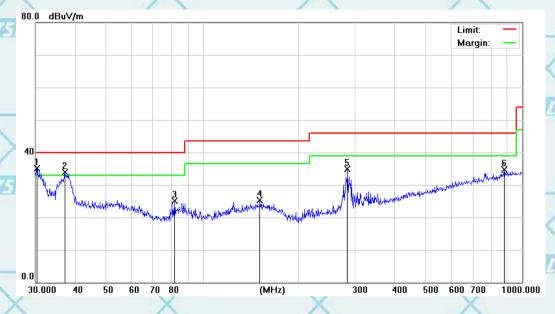




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No.	Mk.	Freq.	Reading Level	Correct Factor	Measure- ment	Limit	Over	141
		MHz	dBuV	dB	dBuV/m	dBuV/m	dB	Detector
1	* /	30.3173	38.25	-3.20	35.05	40.00	-4.95	QP
2	All	37.0248	36.30	-2.40	33.90	40.00	-6.10	QP
3		81.7833	31.95	-6.82	25.13	40.00	-14.87	QP
4		151.0666	27.20	-1.99	25.21	43.50	-18.29	QP
<b>5</b> 5	1	283.9791	38.08	-3.24	34.84	46.00	-11.16	QP
6		878.3214	27.95	6.70	34.65	46.00	-11.35	QP

### Note1:

Freq. = Emission frequency in MHz

Reading level (dBµV) = Receiver reading

Corr. Factor (dB) = Antenna factor + Cable loss - Amplifier factor.

Measurement ( $dB\mu V$ ) = Reading level ( $dB\mu V$ ) + Corr. Factor (dB)

Limit (dBµV) = Limit stated in standard

Margin (dB) = Measurement (dB $\mu$ V) – Limits (dB $\mu$ V)



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#### **Above 1GHz**

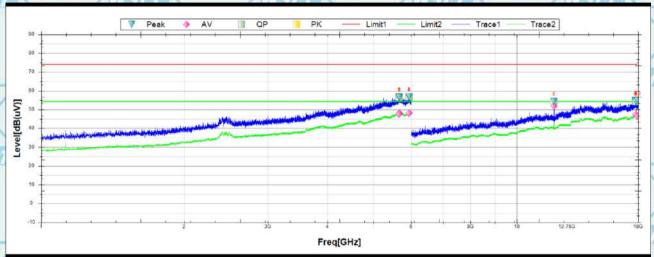
Note 1: The marked spikes near 2400 MHz with circle should be ignored because they are Fundamental

Note 2: The spurious above 18G is noise only, do not show on the report.

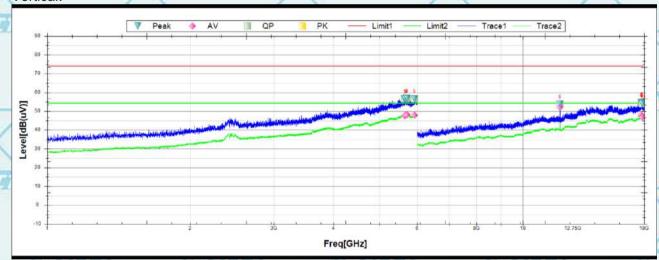
#### **GFSK**

Low channel: 2402MHz

Horizontal:



#### Vertical:



ON \* PI

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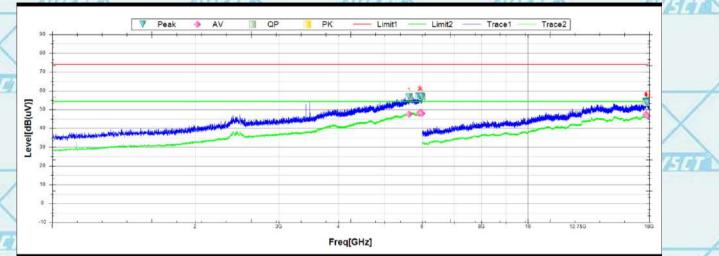
Report No.: WSCT-A2LA-R&E240300009A-BT

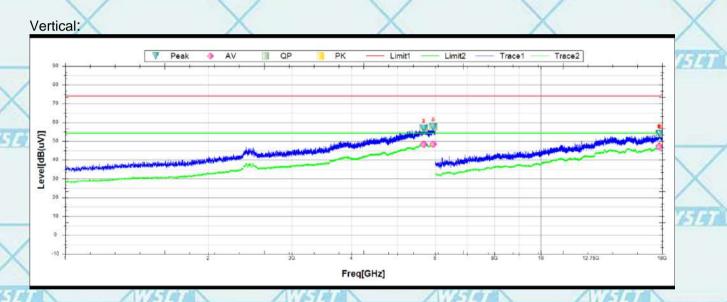
Middle channel: 2441MHz

Horizontal:



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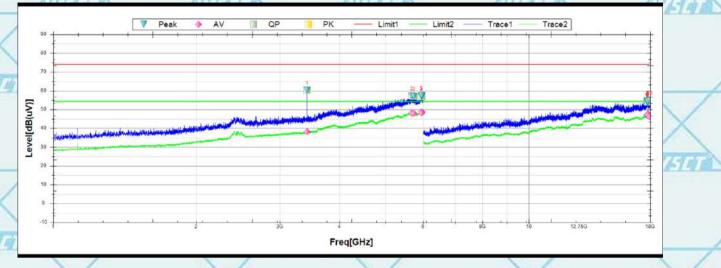
Report No.: WSCT-A2LA-R&E240300009A-BT

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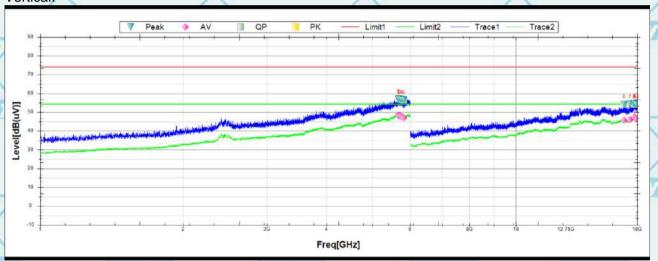
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High channel: 2480MHz

Horizontal:



#### Vertical:



#### Note:

- 1. The emission levels of other frequencies are very lower than the limit and not show in test report.
- 2. Measurements were conducted from 1 GHz to the 10th harmonic of highest fundamental frequency.
- 3. Data of measurement shown "---"in the above table mean that the reading of emissions is attenuated more than 20 dB below the limits or the field strength is too small to be measured.
- 4. Measurements were conducted in all three modulation (GFSK, Pi/4 DQPSK, 8DPSK), and the worst case Mode (GFSK) was submitted only.
- 5. EUT has been tested in unfolded states, and the report only reflects data in the unfolded state (worst-case scenario)



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# 7. Test Setup Photographs

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Please refer to Annex "Set Up Photos-15C" for test setup photos \*\*\*\*\*END OF REPORT\*\*\*\* oup (Shen

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