

Industrial Internet Innovation Center (Shanghai) Co.,Ltd.**FCC BT TEST REPORT**

PRODUCT	4G Wireless Smart Module
BRAND	SIMCom
MODEL	SIM8905A-R2
APPLICANT	SIMCom Wireless Solutions Limited
FCC ID	2AJYU-8PSA303
ISSUE DATE	Septmber 15, 2022
STANDARD(S)	FCC Part15

Prepared by: Tao Lingyan**Signature****Reviewed by: Yang Fan****Signature****Approved by: Liu Long****Signature****CAUTION:**

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1. Summary of Test Report

1.1 Test Standard(s)

No.	Test Standard(s)	Title	Version
1	FCC Part15	FCC CFR 47, Part 15, Subpart C: 15.205 Restricted bands of operation; 15.209 Radiated emission limits, general requirements; 15.247 Operation within the bands 902-928MHz, 2400-2483.5MHz, and 5725-5850MHz.	2020

1.2 Reference Documents

No.	Test Standard(s)	Title	Version
1	ANSI C63.10	American National Standard of Procedures for Compliance Testing of Unlicensed Wireless Devices	2013
2	KDB 558074	Guidance for Performing Compliance Measurements on Frequency Hopping Spread Spectrum systems (DSS) Operating Under §15.247	2019

1.3 Summary of Test Results

Measurement Items	Sub-clause of Part15C	Verdict
Maximum Peak Output Power	15.247(b)	Pass
20dB Occupied Bandwidth	15.247(a)	Pass
99% Occupied Bandwidth	N/A	Pass
Band Edges Compliance	15.247 (d)	Pass
Time Of Occupancy (Dwell Time)	15.247(a)	Pass
Carrier Frequency Separation	15.247(a)	Pass
Number Of Hopping Channels	15.247(a)	Pass
Transmitter Spurious Emission-Conducted	15.247(d)	Pass
Transmitter Spurious Emission-Radiated	15.247,15.209,15.205	Pass

NOTE:

The SIM8905A-R2 manufactured by SIMCom Wireless Solutions Limited. Incorporated is a new products for testing.

Industrial Internet Innovation Center (Shanghai) Co., Ltd. only performed test cases which identified with Pass/Fail/Inc result in section 5.1.

Industrial Internet Innovation Center (Shanghai) Co., Ltd. has verified that the compliance of the tested device specified in section 3 of this test report is successfully evaluated according to the procedure and test methods as defined in type certification requirement listed in section 4 of this test report.

- a. All the test data for each data were verified, but only the worst case was reported.
- b. The GFSK, $\pi/4$ DQPSK and 8DPSK were set in DH1 for GFSK, 2-DH1 for $\pi/4$ DQPSK, 3-DH1 for 8DPSK.
- c. The DC and low frequency voltages' measurement uncertainty is $\pm 2\%$.

1.4 Data Provided by Applicant

No.	Item(s)	Data
1	Antenna gain of EUT	5 dBi

Note: The data of 1.3 is provided by the customer may affect the validity of the test results in this report, and the impact and consequences of this shall be undertaken by the customer.

2. General Information of The Laboratory

2.1 Testing Laboratory

Lab Name	Industrial Internet Innovation Center (Shanghai) Co.,Ltd.
Address	Building 4, No. 766, Jingang Road, Pudong, Shanghai, China
Telephone	021-68866880
FCC Registration No.	958356
FCC Designation No.	CN1177

2.2 Laboratory Environmental Requirements

Temperature	15°C~35°C
Relative Humidity	25%RH~75%RH
Atmospheric Pressure	101kPa

2.3 Project Information

Project Manager	Xu Yuting
Test Date	June 8, 2022 to August 18, 2022

3. General Information of The Customer

3.1 Applicant

Company	SIMCom Wireless Solutions Limited
Address	8F, Bldg3 No.289 Linhong Rd, ChangNing District Shanghai, PRC China
Telephone	02131575100/15102196457

3.2 Manufacturer

Company	SIMCom Wireless Solutions Limited
Address	8F, Bldg3 No.289 Linhong Rd, ChangNing District Shanghai, PRC China

4. General Information of The Product

4.1 Product Description for Equipment under Test (EUT)

Product	4G Wireless Smart Module
Model	SIM8905A-R2
Date of Receipt	August 2,2022/ August 3,2022
EUT ID*	N01/N02
SN/IMEI	861384050078878861384050080916/ 861384050078126861384050080163
Supported Radio Technology and Bands	LTE Band 2/4/5/7/8/12/13/17/25/26/41 BT BR EDR,BLE WLAN 802.11 b, g,n GPS/Glonass/BDS/Gallileo
Hardware Version	V1.03
Software Version	R2148.02
FCC ID	2AJYU-8PSA303
NOTE: EUT ID is the internal identification code of the laboratory.	

4.2 Description for Auxiliary Equipment (AE)

AE ID*	Description	Model	SN/Remark
AE1	RF Cable	N/A	N/A
NOTE: AE ID is the internal identification code of the laboratory.			

5. Test Configuration Information

5.1 Laboratory Environmental Conditions

5.1.1 Permanent Facilities

Relative Humidity	Min. = 45 %, Max. = 55 %		
Atmospheric Pressure	101kPa		
Temperature	Normal	Minimum	Maximum
	25℃	-35℃	75℃
Working Voltage of EUT	Normal	Minimum	Maximum
	3.9V	3.4V	4.4V

5.2 Test Equipments Utilized

5.2.1 Conducted Test System

No	Name	Model	S/N	Manufacturer	Cal. Date	Cal. Interval
1	Programmable Power Supply	Keithley 2303	4039070	Starpoint	May 10, 2021	1.5years
2	Vector Signal Generator	SMBV100A	257904	R&S	February 21, 2022	1 year
3	Temperature box	B-TF-107C	BTF107C-201804107	Boyi	May 10, 2021	1.5 years
4	Spectrum Analyzer	FSQ40	200063	R&S	November 02, 2021	1 year
5	USB Wideband Power Sensor	U2021XA	MY56410009	Keysight	February 21, 2022	1 year
6	Simultaneous Sampling DQA	U2531A	TW56183514	Agilent	March 02, 2022	1 year
7	Vector Signal Generator	SMU200A	104684	R&S	May 10, 2021	1.5 years
8	Wireless communication comprehensive tester	CMW270	100919	R&S	May 10, 2021	1.5 years
9	Eagle Test Software	Eagle V3.3	N/A	ECIT	N/A	N/A

5.2.2 Radiated Emission Test System

No.	Name	Model	S/N	Manufacturer	Cal. Date	Cal. Interval
1	Universal Radio Communication Tester	CMU200	123123	R&S	May 10,2021	1.5 years
2	Universal Radio Communication Tester	CMW500	104178	R&S	May 10,2021	1.5 years
3	EMI Test Receiver	ESU40	100307	R&S	February 23, 2022	1 year
4	TRILOG Broadband Antenna	VULB9163	VULB9163-515	Schwarzbeck	March 11, 2022	1 year
5	Double- ridged Waveguide Antenna	ETS-3117	00135890	ETS	March 9, 2022	2 years
6	2-Line V-Network	ENV216	101380	R&S	February 21, 2022	1 year
7	EMI Test Software	EMC32 V9.15.00	N/A	R&S	N/A	N/A

5.2.3 Test Environment

Shielding Room1 (6.0 meters×3.0 meters×2.7 meters) did not exceed following limits along the conducted RF performance testing:

Temperature	Min. = 15 °C, Max. = 35 °C
Relative humidity	Min. = 20 %, Max. = 75 %
Shielding effectiveness	> 100 dB
Ground system resistance	< 0.5 Ω
Temperature	Min. = 15 °C, Max. = 35 °C

Control room did not exceed following limits along the EMC testing:

Temperature	Min. = 15 °C, Max. = 35 °C
Relative humidity	Min. =30 %, Max. = 60 %
Shielding effectiveness	> 100 dB
Electrical insulation	> 10 kΩ
Ground system resistance	< 0.5 Ω

Fully-anechoic chamber1 (6.9 meters×10.9 meters×5.4 meters) did not exceed following limits along the EMC testing:

Temperature	Min. = 15 °C, Max. = 35 °C
Relative humidity	Min. = 25 %, Max. = 75 %
Shielding effectiveness	> 100 dB

Electrical insulation	> 10 kΩ
Ground system resistance	< 0.5 Ω
VSWR	Between 0 and 6 dB, from 1GHz to 18GHz
Site Attenuation Deviation	Between -4 and 4 dB,30MHz to 1GHz

5.3 Measurement Uncertainty

Measurement Items	Range	Confidence Level	Calculated Uncertainty
Peak Output Power-Conducted	2402MHz-2480MHz	95%	0.544dB
Frequency Band Edges-Conducted	2402MHz-2480MHz	95%	0.544dB
Conducted Emission	30MHz-2GHz	95%	0.90dB
Conducted Emission	2GHz-3.6GHz	95%	0.88dB
Conducted Emission	3.6GHz-8GHz	95%	0.96dB
Conducted Emission	8GHz-20GHz	95%	0.94dB
Conducted Emission	20GHz-22GHz	95%	0.88dB
Conducted Emission	22GHz-26GHz	95%	0.86dB
Transmitter Spurious Emission-Radiated	9KHz-30MHz	95%	5.66dB
Transmitter Spurious Emission-Radiated	30MHz-1000MHz	95%	4.98dB
Transmitter Spurious Emission-Radiated	1000MHz -18000MHz	95%	5.06dB
Transmitter Spurious Emission-Radiated	18000MHz -40000MHz	95%	5.20dB
Dwell Time	2402MHz-2480MHz	95%	0.218ms
20dB Bandwidth	2402MHz-2480MHz	95%	62.04Hz
AC Power line Conducted Emission	0.15MHz-30MHz	95%	3.66 dB

6. Test Results

6.1 Peak Output Power-Conducted

6.1.1 Measurement Limit

Standard	Limit (dBm)
FCC 47 Part 15.247(b)(3)	<30

6.1.2 Test Condition

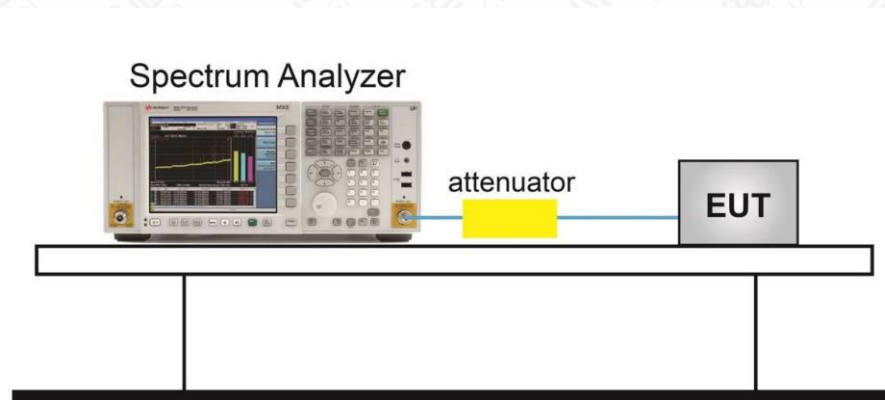
Hopping Mode	RBW	VBW	Span	Sweep time
Hopping OFF	3MHz	10MHz	9MHz	Auto

6.1.3 Test Procedure

The measurement is according to ANSI C63.10 clause 7.8.5.

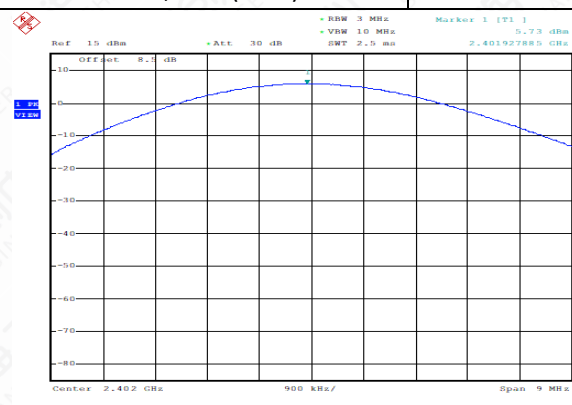
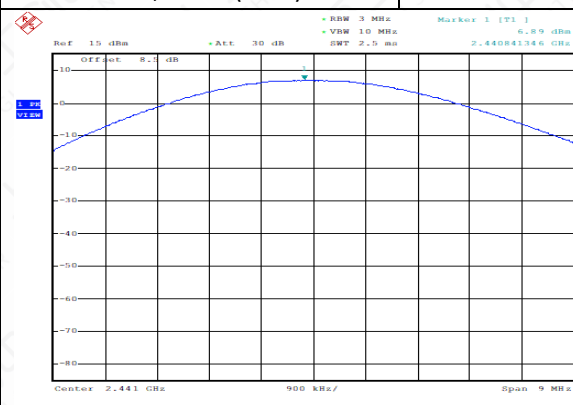
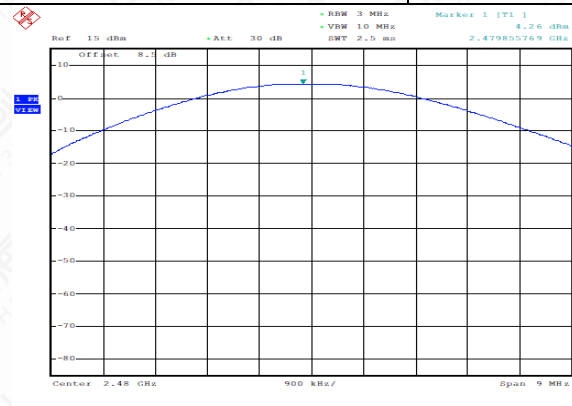
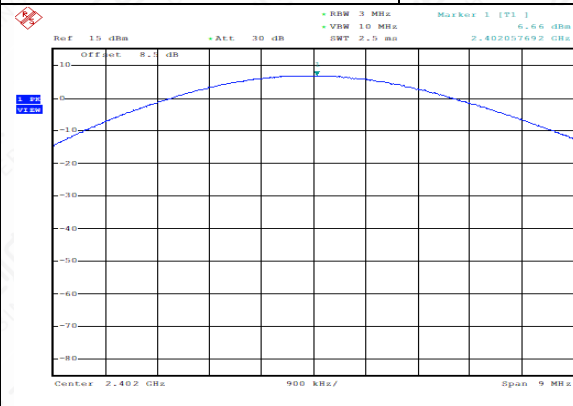
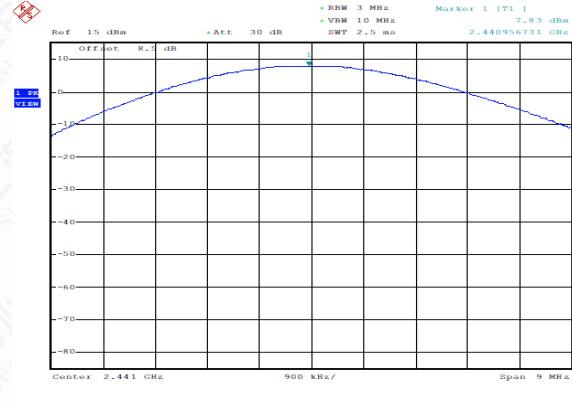
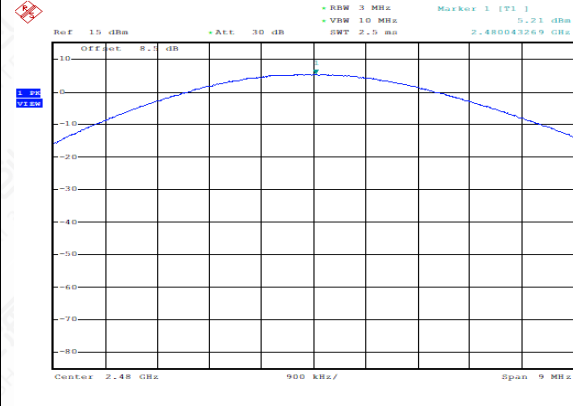
1. The output power of EUT was connected to the spectrum analyzer and CMW270 by cable and divide. The path loss was compensated to the results for each measurement.
2. Enable EUT transmitter maximum power continuously.
3. Measure the conducted output power and record the results it

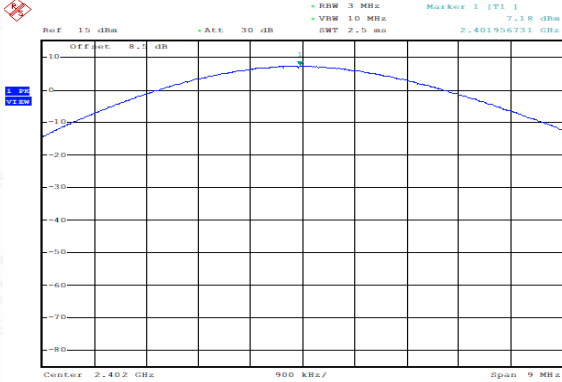
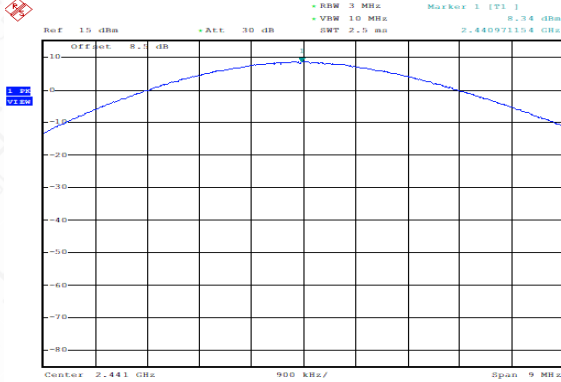
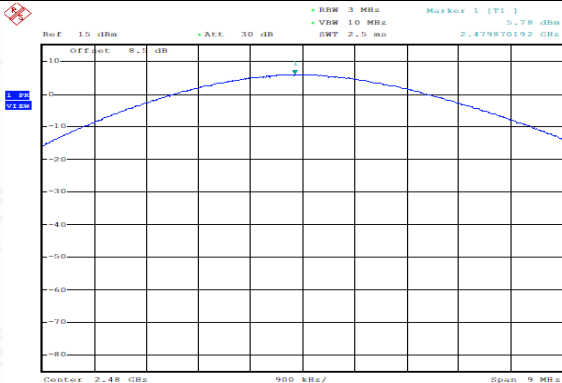
6.1.4 Test setup



Measurement Results

Note: Bold font is the maximum Value

Peak Conducted Output Power GFSK, CH0 (dBm)	5.73	Peak Conducted Output Power GFSK, CH39 (dBm)	6.89
 Ref: 15 dBm, Att: 30 dB, RBW: 3 MHz, VSW: 10 MHz, SWT: 2.5 ms, Marker 1 [T1]: 5.73 dBm, 2.403927895 GHz Center: 2.402 GHz, Span: 9 MHz Date: 5.AUG.2022 20:54:49		 Ref: 15 dBm, Att: 30 dB, RBW: 3 MHz, VSW: 10 MHz, SWT: 2.5 ms, Marker 1 [T1]: 6.89 dBm, 2.440841346 GHz Center: 2.441 GHz, Span: 9 MHz Date: 5.AUG.2022 20:55:16	
Peak Conducted Output Power GFSK, CH78 (dBm)	4.26	Peak Conducted Output Power $\pi/4$ DQPSK, CH0 (dBm)	6.66
 Ref: 15 dBm, Att: 30 dB, RBW: 3 MHz, VSW: 10 MHz, SWT: 2.5 ms, Marker 1 [T1]: 4.26 dBm, 2.479855769 GHz Center: 2.48 GHz, Span: 9 MHz Date: 5.AUG.2022 20:55:42		 Ref: 15 dBm, Att: 30 dB, RBW: 3 MHz, VSW: 10 MHz, SWT: 2.5 ms, Marker 1 [T1]: 6.66 dBm, 2.402057692 GHz Center: 2.402 GHz, Span: 9 MHz Date: 5.AUG.2022 20:56:10	
Peak Conducted Output Power $\pi/4$ DQPSK, CH39 (dBm)	7.83	Peak Conducted Output Power $\pi/4$ DQPSK, CH78 (dBm)	5.21
 Ref: 15 dBm, Att: 30 dB, RBW: 3 MHz, VSW: 10 MHz, SWT: 2.5 ms, Marker 1 [T1]: 7.83 dBm, 2.440956731 GHz Center: 2.441 GHz, Span: 9 MHz Date: 5.AUG.2022 20:56:34		 Ref: 15 dBm, Att: 30 dB, RBW: 3 MHz, VSW: 10 MHz, SWT: 2.5 ms, Marker 1 [T1]: 5.21 dBm, 2.420043269 GHz Center: 2.48 GHz, Span: 9 MHz Date: 5.AUG.2022 20:57:08	

Peak Conducted Output Power 8DPSK, CH0 (dBm)	7.18	Peak Conducted Output Power 8DPSK, CH39 (dBm)	8.34
 Date: 5.AUG.2022 20:57:56		 Date: 5.AUG.2022 20:58:46	
Peak Conducted Output Power 8DPSK, CH78 (dBm)	5.78	/	/
 Date: 5.AUG.2022 20:59:30		/	/

6.2 Frequency Band Edges-Conducted

6.2.1 Measurement Limit

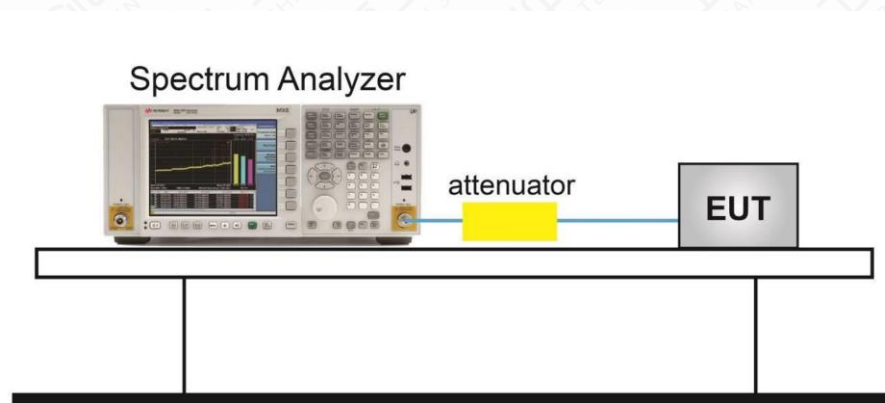
Standard	Limit(dBc)
FCC 47 CFR Part 15.247(d)	>20

6.2.2 Test procedures

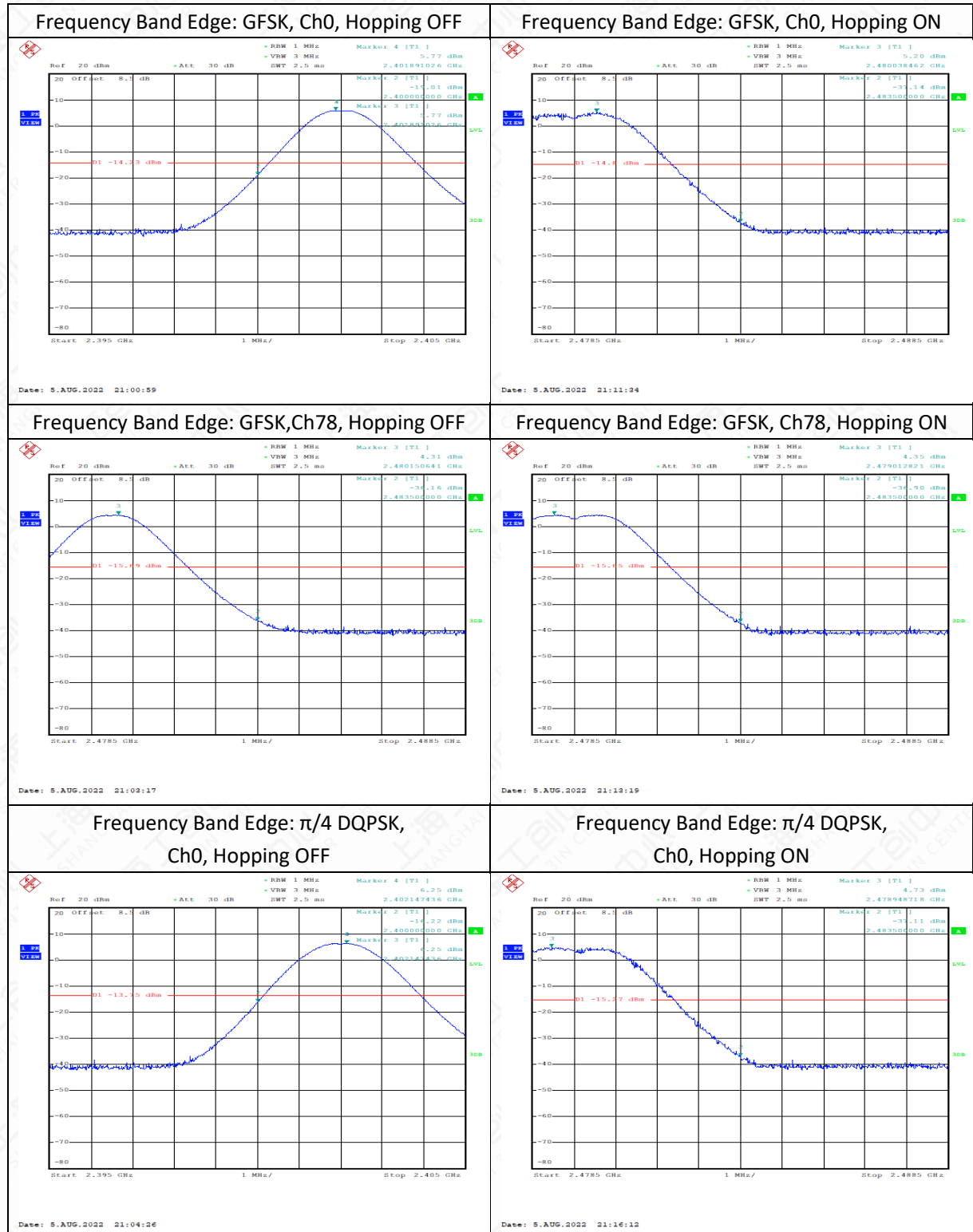
The measurement is according to ANSI C63.10 clause 7.8.6.

1. Connect the EUT to spectrum analyzer.
2. Set RBW=100KHz, VBW=300KHz, span more than 1.5 times channel bandwidth (2MHz).
3. Detector =peak, sweep time=auto couple, trace mode=max hold.Allow sweep to continue until the trace stabilizes.

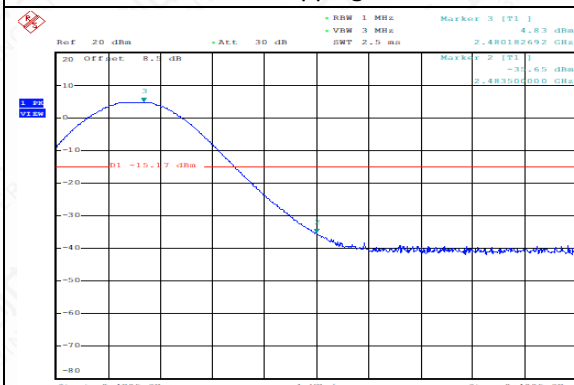
6.2.3 Test setup



Measurement Result

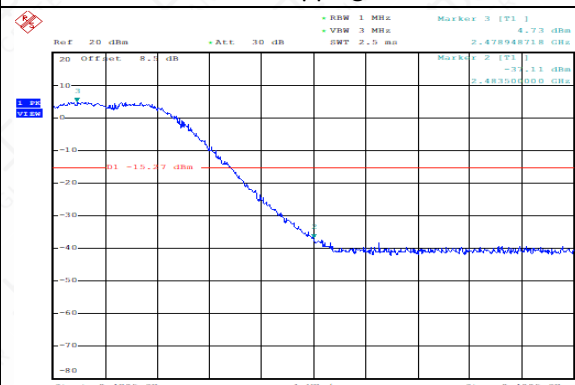


Frequency Band Edge: $\pi/4$ DQPSK,
Ch78, Hopping OFF



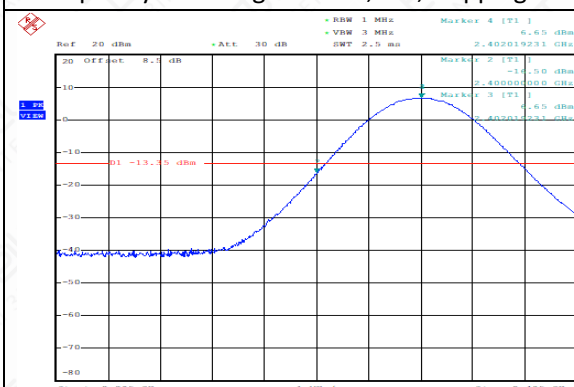
Date: 5.AUG.2022 21:06:25

Frequency Band Edge: $\pi/4$ DQPSK,
Ch78, Hopping ON



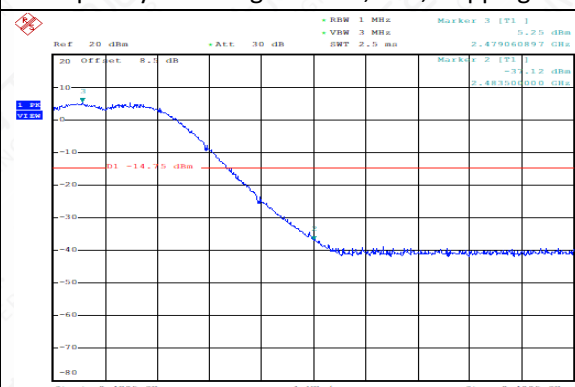
Date: 5.AUG.2022 21:16:12

Frequency Band Edge: 8DPSK, Ch0, Hopping OFF



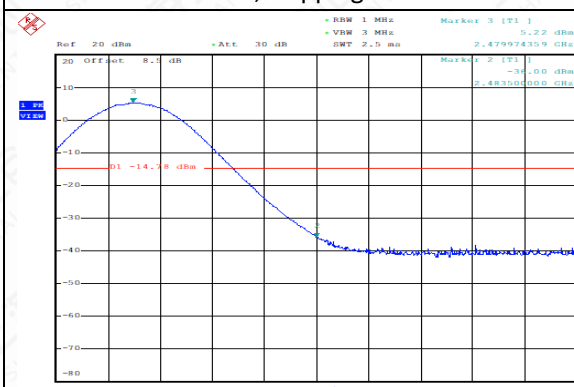
Date: 5.AUG.2022 21:07:22

Frequency Band Edge: 8DPSK, Ch0, Hopping ON



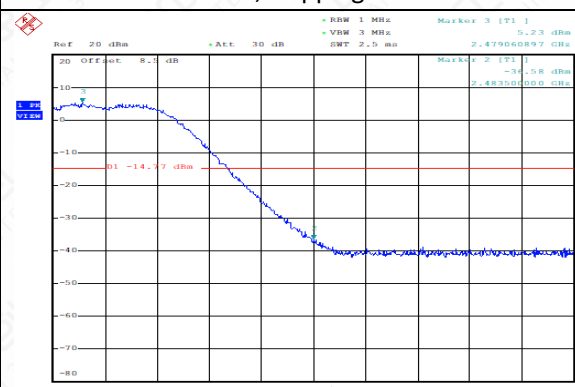
Date: 5.AUG.2022 21:18:47

Frequency Band Edge: 8DPSK,
Ch78, Hopping OFF



Date: 5.AUG.2022 21:09:30

Frequency Band Edge: 8DPSK,
Ch78, Hopping ON



Date: 5.AUG.2022 21:20:29

6.3 Conducted Emission

6.3.1 Measurement Limit

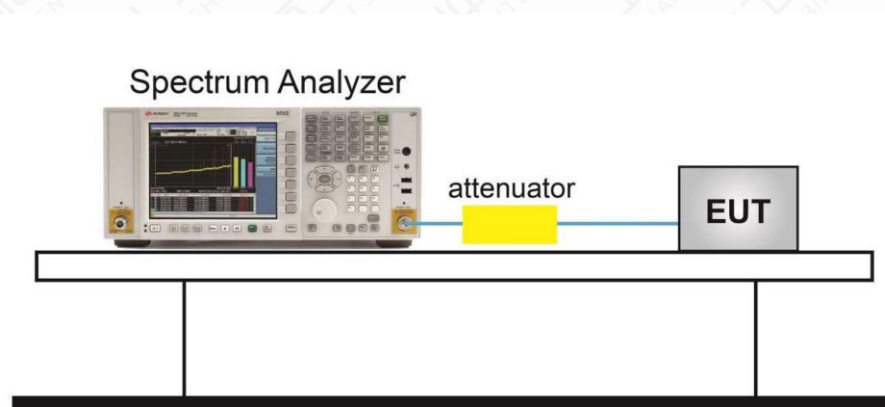
Standard	Limit
FCC 47 CFR Part15.247 (d)	20dB below peak output power in 100KHz

6.3.2 Test procedures

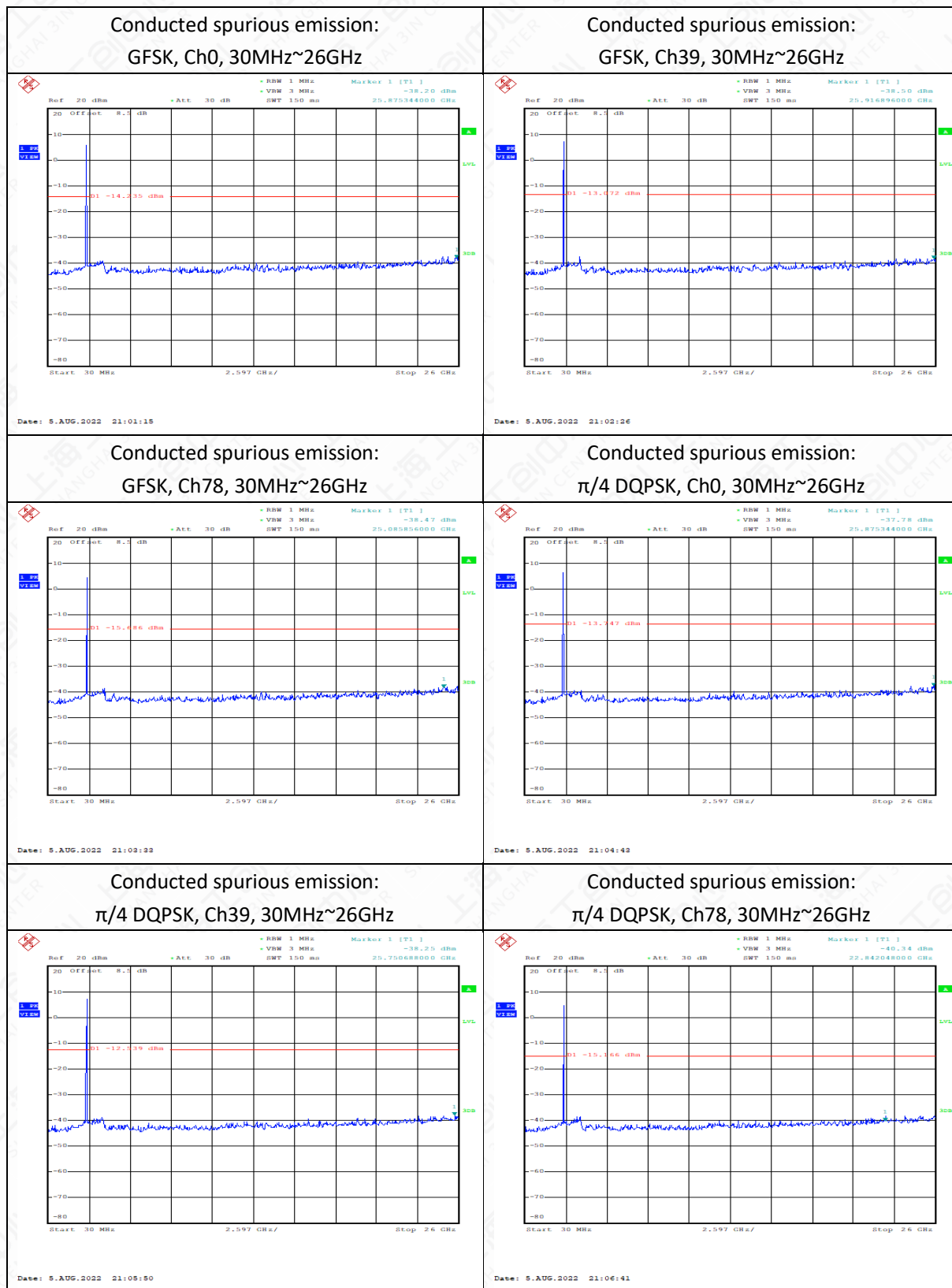
The measurement is according to ANSI C63.10 clause 7.8.8.

1. Connect the EUT to spectrum analyzer.
2. Set RBW=100KHz, VBW=300KHz.
3. Detector =peak, sweep time=auto couple, trace mode=max hold

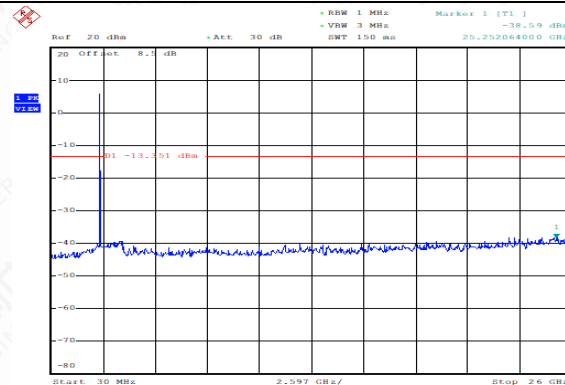
6.3.3 Test Setup



Measurement Results

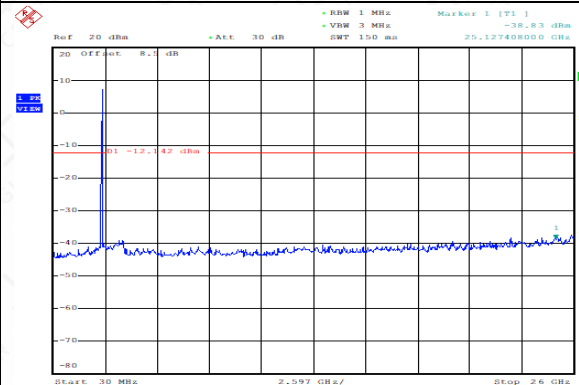


Conducted spurious emission:
8DPSK, Ch0, 30MHz~26GHz



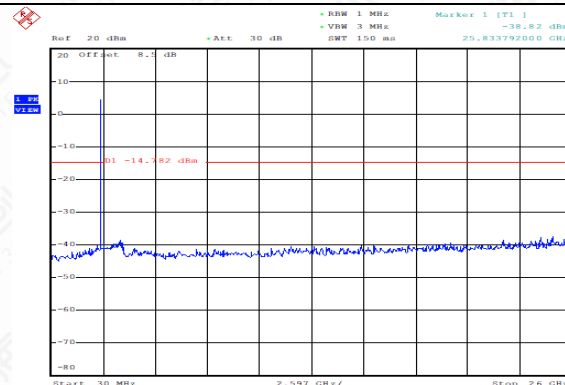
Date: 5.AUG.2022 21:07:39

Conducted spurious emission:
8DPSK, Ch39, 30MHz~26GHz



Date: 5.AUG.2022 21:08:41

Conducted spurious emission:
8DPSK, Ch78, 30MHz~26GHz



Date: 5.AUG.2022 21:09:46

/

/

6.4 Radiated Emission

6.4.1 Measurement Limit

Standard	Limit
FCC 47 CFR Part 15.247, 15.205, 15.209	20dB below peak output power

In addition, radiated emissions which fall in the restricted bands, as defined in 15.205(a), must also comply with the radiated emission limits specified in 15.209(a) (see 15.205(c)).

Limit in restricted band

Frequency of emission (MHz)	Field strength (uV/m)	Field strength (dBuV/m)
30~88	100	40
88~216	150	43.5
216~960	200	46
Above 960	500	54

6.4.2 Test Method

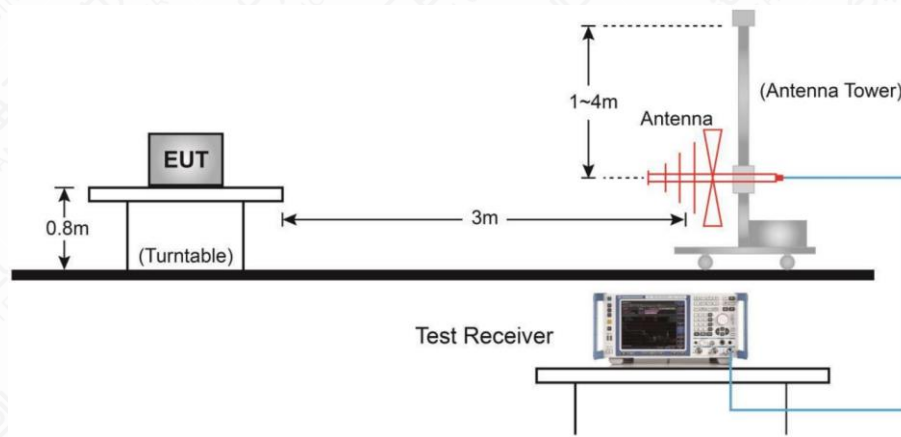
Portable, small, lightweight, or modular devices that may be handheld, worn on the body, or placed on a table during operation shall be positioned on a non-conducting platform, the top of which is 80 cm above the reference ground plane. The preferred area occupied by the EUT arrangement is 1 m by 1.5 m. For emissions testing at or below 1 GHz, the table height shall be 80 cm above the reference ground plane. For emission measurements above 1 GHz, the table height shall be 1.5 m. but it may be larger or smaller to accommodate various sized EUTs. For testing purposes, ceiling- and wall-mounted devices also shall be positioned on a tabletop (see also ANSI C63.10-2013 section 6.3.4 and 6.3.5). In making any tests involving handheld, body-worn, or ceiling-mounted equipment, it is essential to recognize that the measured levels may be dependent on the orientation (attitude) of the three orthogonal axes of the EUT. Thus, exploratory tests as specified in 8.3.1 shall be carried out for various axes orientations to determine the attitude having maximum or near-maximum emission level.

The EUT was placed on a non-conductive table. The measurement antenna was placed at a distance of 3 meters from the EUT. During the tests, the antenna height and the EUT azimuth were varied in order to identify the maximum level of emissions from the EUT. This maximization process was repeated with the EUT positioned in each of its three orthogonal orientations.

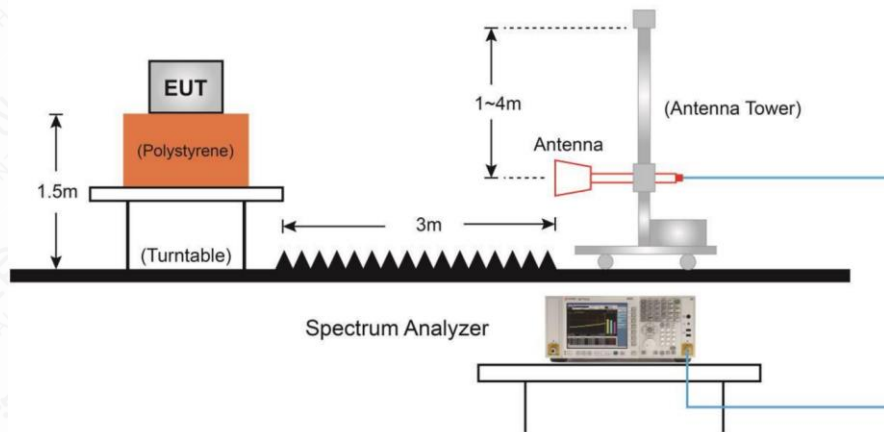
Frequency of emission	RBW/VBW	Sweep Time (s)
30~1000	100KHz/300KHz	5
1000~4000	1MHz/3MHz	15
4000~18000	1MHz/3MHz	40
18000~26500	1MHz/3MHz	20

6.4.3 Test Setup

Below 1GHz Test Setup



Above 1GHz Test Setup



Measurement Results

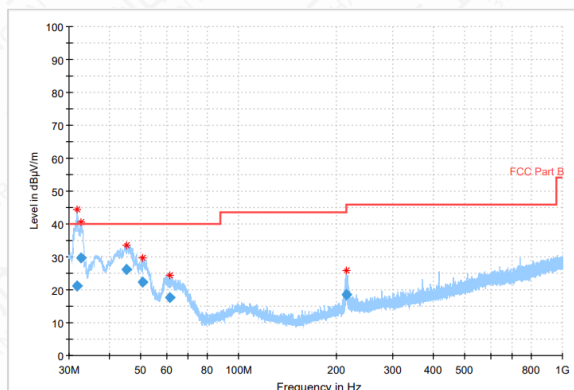
A “reference path loss” is established and AR_{pi} is the attenuation of “reference path loss”, and including the gain of receive antenna, the gain of the preamplifier, the cable loss.

The measurement results are obtained as described below:

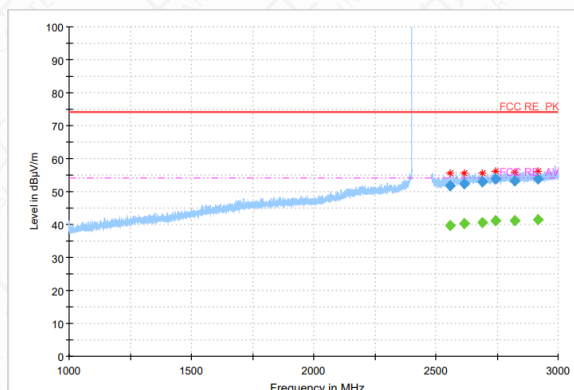
$$AR_{pi} = \text{Cable loss} + \text{Antenna Factor} - \text{Preamplifier gain}$$

$$\text{Result} = PM_{ea} + AR_{pi}$$

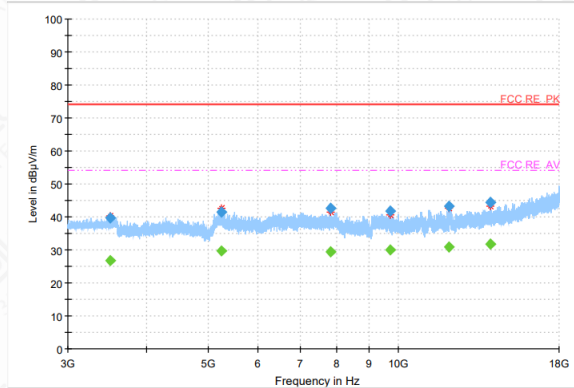
Radiated emission: GFSK, Ch0, 30MHz~1GHz



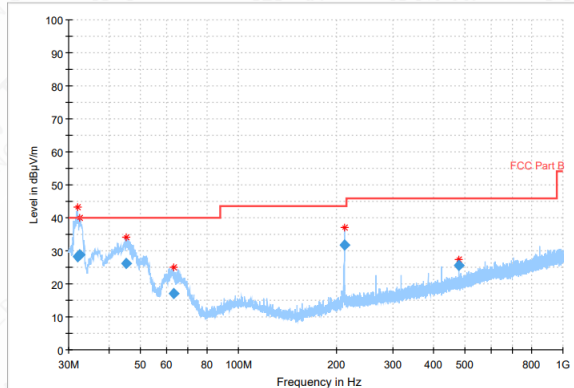
Radiated emission: GFSK, Ch0, 1GHz~3GHz



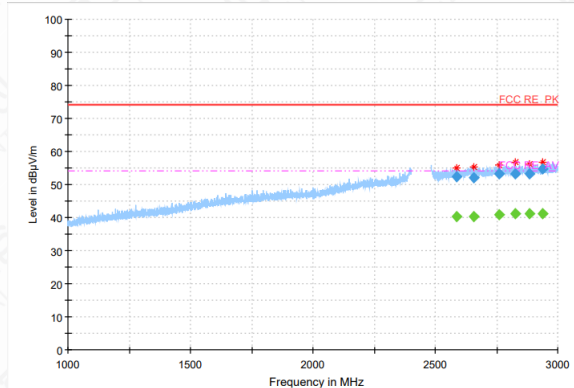
Radiated emission: GFSK, Ch0, 3GHz~18GHz



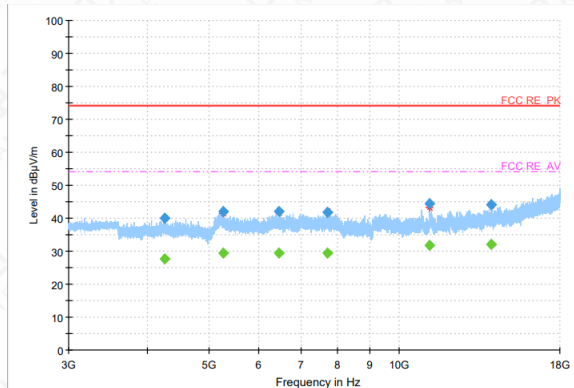
Radiated emission: GFSK, Ch78, 30MHz~1GHz

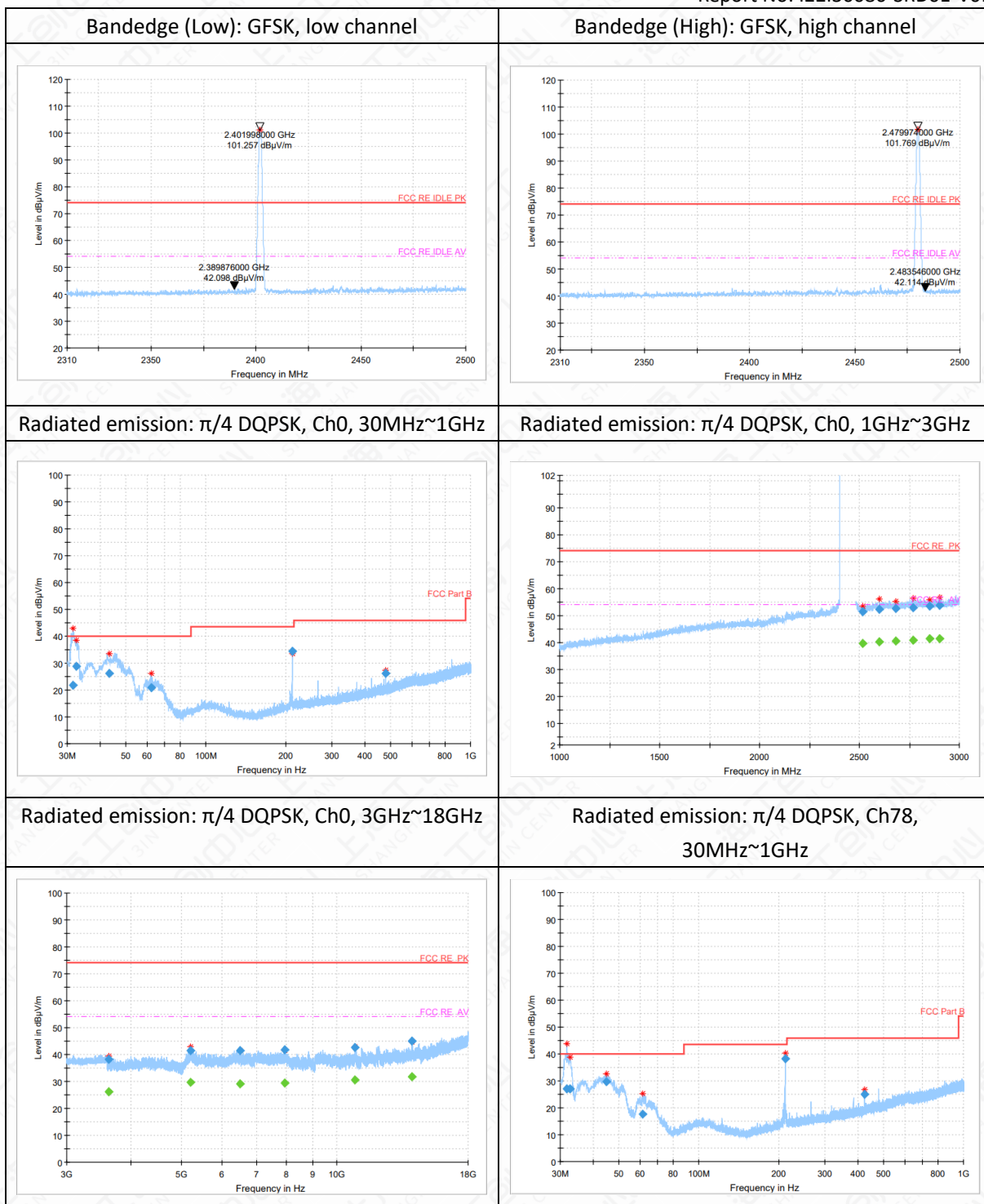


Radiated emission: GFSK, Ch78, 1GHz~3GHz

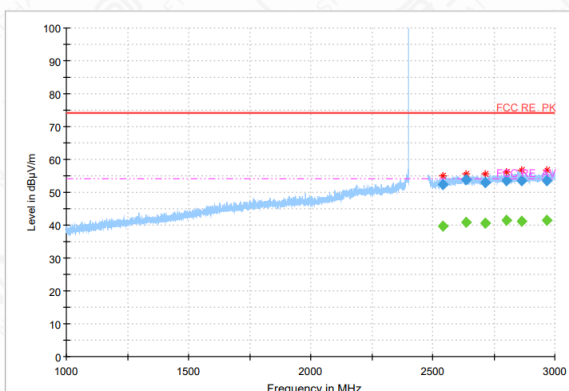


Radiated emission: GFSK, Ch78, 3GHz~18GHz

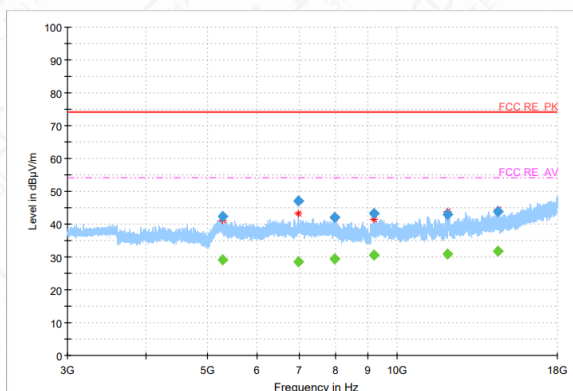




Radiated emission: $\pi/4$ DQPSK, Ch78, 1GHz~3GHz



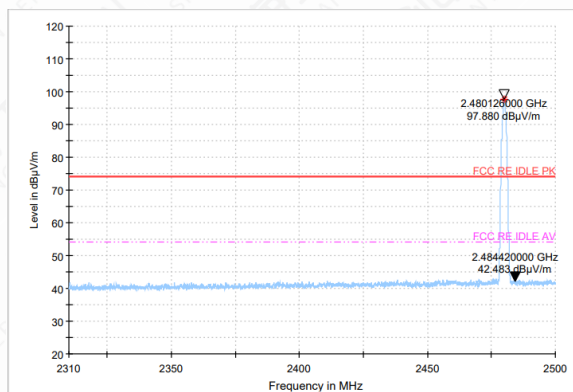
Radiated emission: $\pi/4$ DQPSK, Ch78, 3GHz~18GHz



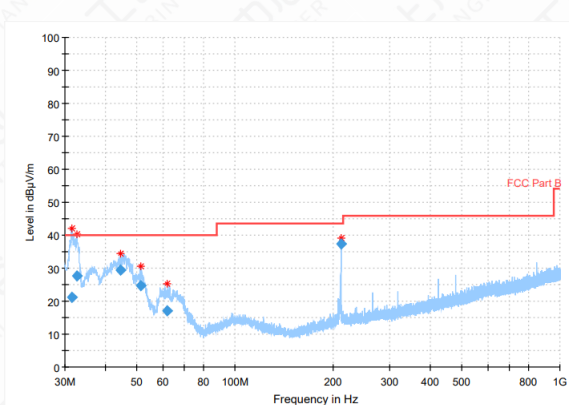
Bandedge (Low): $\pi/4$ DQPSK, low channel



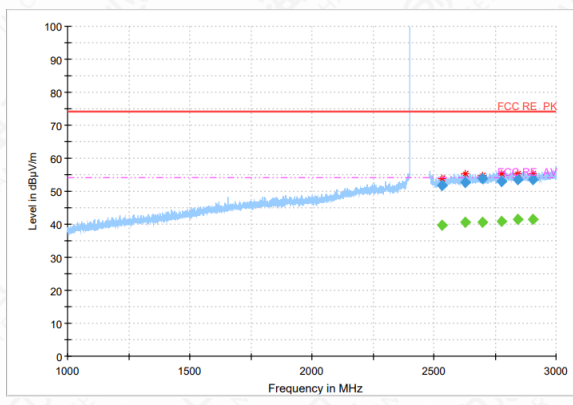
Bandedge (High): $\pi/4$ DQPSK, high channel



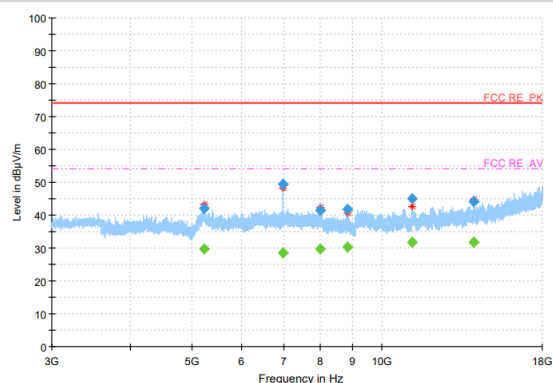
Radiated emission: 8DPSK, Ch0, 30MHz~1GHz



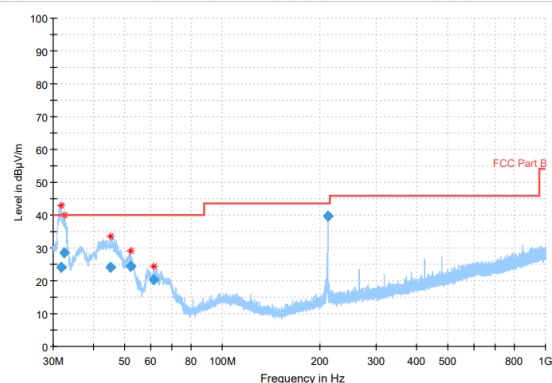
Radiated emission: 8DPSK, Ch0, 1GHz~3GHz



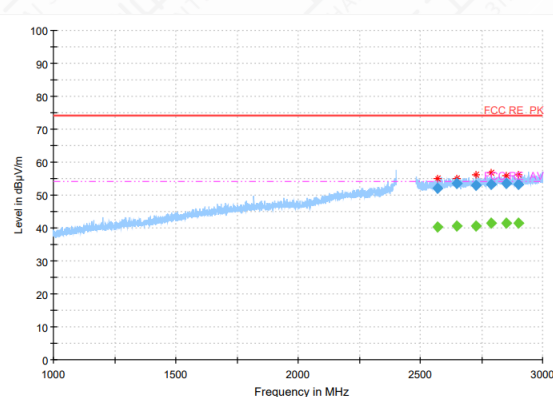
Radiated emission: 8DPSK, Ch0, 3GHz~18GHz



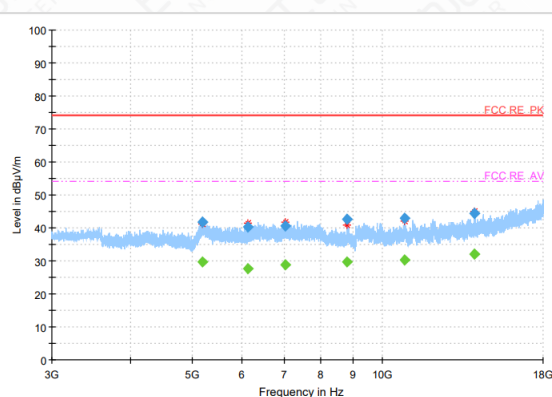
Radiated emission: 8DPSK, Ch78, 30MHz~1GHz



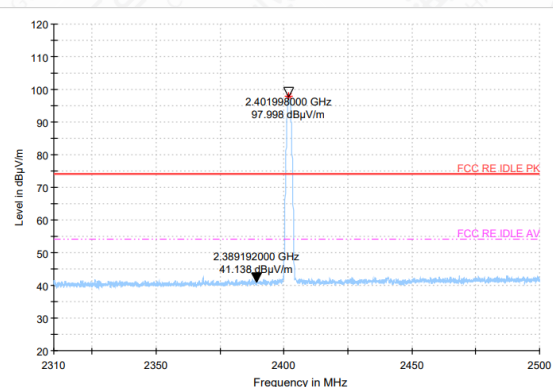
Radiated emission: 8DPSK, Ch78, 1GHz~3GHz



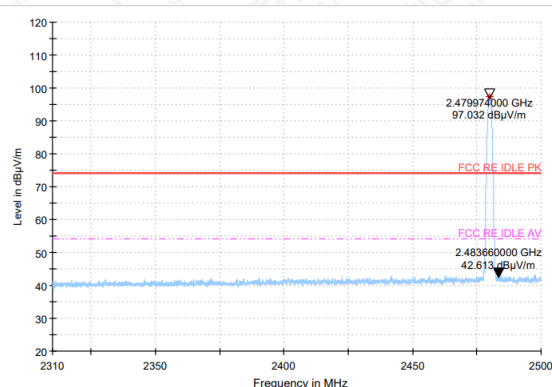
Radiated emission: 8DPSK, Ch78, 3GHz~18GHz



Bandedge (Low): 8DPSK, low channel



Bandedge (High): 8DPSK, high channel



GFSK Ch0 30MHz-1GHz

Frequency (MHz)	Result (dBμV/m)	ARpl (dB)	PMea (dBμV/m)	Polarity
31.8	21.26	-14.3	35.56	V
32.7	29.82	-14.2	44.02	H
45.1	26.23	-12.3	38.53	H
50.5	22.5	-11.9	34.4	H
61.3	17.55	-12.7	30.25	V
215.9	18.59	-12.8	31.39	H

GFSK Ch0 1GHz-3GHz

Frequency (MHz)	Result (dBμV/m)	ARpl (dB)	PMea (dBμV/m)	Polarity
2556.6	51.72	15.2	36.52	V
2616.6	52.38	15.6	36.78	V
2688.9	53.06	15.9	37.16	V
2744.9	53.68	16.2	37.48	V
2821.2	53.29	16.6	36.69	V
2917.0	53.82	16.8	37.02	V

GFSK Ch0 3GHz-18GHz

Frequency (MHz)	Result (dBμV/m)	ARpl (dB)	PMea (dBμV/m)	Polarity
3505.4	39.59	-6.8	46.39	V
5263.2	41.5	-1.9	43.4	V
7823.6	42.51	-1.8	44.31	V
9711.2	41.88	-0.6	42.48	V
12056.3	43.24	2	41.24	V
14002.0	44.34	4.7	39.64	V

GFSK Ch78 30MHz-1GHz

Frequency (MHz)	Result (dBμV/m)	ARpl (dB)	PMea (dBμV/m)	Polarity
32.0	28.13	-14.3	42.43	V
32.5	28.86	-14.2	43.06	V
45.1	26.12	-12.4	38.52	H
63.0	16.95	-13.4	30.35	V
211.9	31.8	-13.1	44.9	H
476.7	25.5	-6.7	32.2	V

GFSK Ch78 1GHz-3GHz

Frequency (MHz)	Result (dBμV/m)	ARpl (dB)	PMea (dBμV/m)	Polarity
2585.2	52.29	15.4	36.89	V
2656.1	52.18	15.9	36.28	V
2760.6	53.12	16.3	36.82	V

2824.6	53.17	16.6	36.57	V
2885.6	53.14	16.7	36.44	V
2937.8	54.58	16.8	37.78	V

GFSK Ch78 1GHz-3GHz(Average)

Frequency (MHz)	Result (dBμV/m)	ARpl (dB)	PMea (dBμV/m)	Polarity
2937.8	41.27	16.8	24.47	V

GFSK Ch78 3GHz-18GHz

Frequency (MHz)	Result (dBμV/m)	ARpl (dB)	PMea (dBμV/m)	Polarity
4251.7	40	-5.4	45.4	V
5274.8	42.02	-2.1	44.12	V
6449.3	42.11	-2.6	44.71	V
7703.6	41.63	-1.7	43.33	V
11201.5	44.55	1.7	42.85	V
14002.7	44.16	4.7	39.46	V

 $\pi/4$ DQPSK Ch0 30MHz-1GHz

Frequency (MHz)	Result (dBμV/m)	ARpl (dB)	PMea (dBμV/m)	Polarity
31.6	21.66	-14.3	35.96	H
32.4	28.84	-14.2	43.04	V
43.4	26.24	-12.5	38.74	V
62.1	20.88	-13.1	33.98	V
211.9	34.36	-13.1	47.46	H
476.7	26.11	-6.7	32.81	V

 $\pi/4$ DQPSK Ch0 1GHz-3GHz

Frequency (MHz)	Result (dBμV/m)	ARpl (dB)	PMea (dBμV/m)	Polarity
2516.7	51.39	14.7	36.69	V
2598.9	52.29	15.5	36.79	V
2683.2	52.59	15.9	36.69	V
2770.6	52.95	16.4	36.55	V
2849.2	53.53	16.6	36.93	V
2901.3	53.86	16.7	37.16	V

 $\pi/4$ DQPSK Ch0 3GHz-18GHz

Frequency (MHz)	Result (dBμV/m)	ARpl (dB)	PMea (dBμV/m)	Polarity
3616.0	38.17	-6.8	44.97	V
5223.0	41.6	-1.2	42.8	V
6514.9	41.52	-2.6	44.12	V
7940.9	41.86	-1.2	43.06	V
10843.5	42.57	1.1	41.47	V
14002.0	44.89	4.7	40.19	V

$\pi/4$ DQPSK Ch78 30MHz-1GHz

Frequency (MHz)	Result (dB μ V/m)	ARpl (dB)	PMea (dB μ V/m)	Polarity
31.8	26.97	-14.3	41.27	H
32.7	27.13	-14.2	41.33	V
44.9	29.76	-12.4	42.16	V
61.3	17.51	-12.8	30.31	H
211.9	38.34	-13.1	51.44	H
423.7	24.97	-7.7	32.67	V

 $\pi/4$ DQPSK Ch78 1GHz-3GHz

Frequency (MHz)	Result (dB μ V/m)	ARpl (dB)	PMea (dB μ V/m)	Polarity
2542.9	52.5	15	37.5	V
2635.9	53.75	15.8	37.95	V
2715.9	53.06	16	37.06	V
2802.7	53.57	16.6	36.97	V
2862.1	53.49	16.7	36.79	V
2966.2	53.58	17	36.58	V

 $\pi/4$ DQPSK Ch78 3GHz-18GHz

Frequency (MHz)	Result (dB μ V/m)	ARpl (dB)	PMea (dB μ V/m)	Polarity
5292.9	42.22	-2.5	44.72	V
6969.5	46.97	-2.4	49.37	V
7962.1	41.99	-1.1	43.09	V
9197.1	43.17	-0.3	43.47	V
12056.0	42.88	2	40.88	V
14488.5	43.9	5.1	38.8	V

8DPSK Ch0 30MHz-1GHz

Frequency (MHz)	Result (dB μ V/m)	ARpl (dB)	PMea (dB μ V/m)	Polarity
31.5	21.29	-14.3	35.59	V
32.7	27.61	-14.2	41.81	H
44.6	29.52	-12.4	41.92	H
51.3	24.78	-12	36.78	V
62.0	17.09	-13	30.09	V
211.9	37.44	-13.1	50.54	H

8DPSK Ch0 1GHz-3GHz

Frequency (MHz)	Result (dB μ V/m)	ARpl (dB)	PMea (dB μ V/m)	Polarity
2533.4	51.8	14.8	37	V
2627.3	52.66	15.7	36.96	V
2696.5	53.77	15.9	37.87	V
2775.1	52.94	16.4	36.54	V

2842.5	53.39	16.6	36.79	V
2903.1	53.51	16.7	36.81	V

8DPSK Ch0 3GHz-18GHz

Frequency (MHz)	Result (dBμV/m)	ARpl (dB)	PMea (dBμV/m)	Polarity
5238.0	41.92	-1.4	43.32	V
6990.2	49.45	-2.3	51.75	V
7989.3	41.56	-1	42.56	V
8848.2	41.84	-1.3	43.14	V
11201.5	45.02	1.7	43.32	V
13999.7	44.02	4.7	39.32	V

8DPSK Ch78 30MHz-1GHz

Frequency (MHz)	Result (dBμV/m)	ARpl (dB)	PMea (dBμV/m)	Polarity
31.7	23.98	-14.3	38.28	H
32.5	28.57	-14.2	42.77	V
45.2	24.2	-12.3	36.5	H
51.9	24.35	-12	36.35	H
61.5	20.19	-12.8	32.99	H
211.9	39.59	-13.1	52.69	H

8DPSK Ch78 1GHz-3GHz

Frequency (MHz)	Result (dBμV/m)	ARpl (dB)	PMea (dBμV/m)	Polarity
2569.9	51.93	15.3	36.63	V
2647.2	53.51	15.9	37.61	V
2728.8	52.96	16.1	36.86	V
2790.0	53.16	16.5	36.66	V
2850.0	53.54	16.6	36.94	V
2900.9	53.28	16.7	36.58	V

8DPSK Ch78 3GHz-18GHz

Frequency (MHz)	Result (dBμV/m)	ARpl (dB)	PMea (dBμV/m)	Polarity
5205.0	41.79	-1	42.79	V
6139.5	40.31	-3.5	43.81	V
7028.9	40.49	-2.2	42.69	V
8796.2	42.75	-1.5	44.25	V
10844.8	42.93	1.1	41.83	V
14003.0	44.35	4.7	39.65	V

6.5 Time Of Occupancy (Dwell Time)

6.5.1 Measurement Limit

Standard	Limit(ms)
FCC 47 Part 15.247 (a) (1) (iii)	<400

6.5.2 Test procedures

The measurement is according to ANSI C63.10 clause 7.8.4

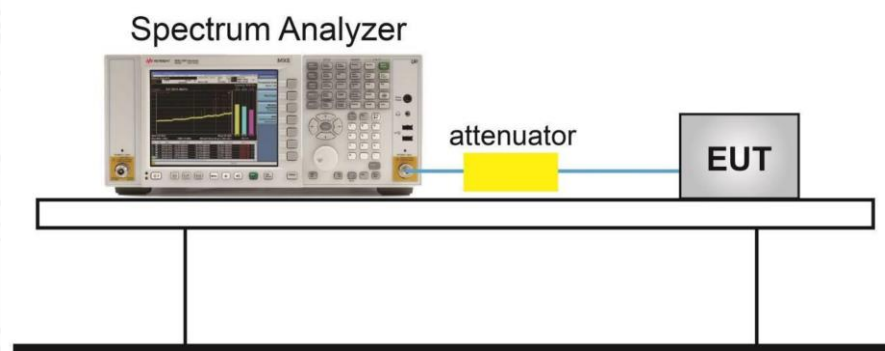
1. Connect the EUT through cable and divide with CMW270 and spectrum analyzer.
2. Enable the EUT transmit maximum power.
3. Set the spectrum analyzer as step 4 to step 8.
4. Span: Zero span, centered on a hopping channel.
5. RBW shall be $\leq$ channel spacing and where possible RBW should be set $\gg 1/T$, where T is the expected dwell time per channel.
6. Sweep: As necessary to capture the entire dwell time per hopping channel; where possible use a video trigger and trigger delay so that the transmitted signal starts a little to the right of the start of the plot. The trigger level might need slight adjustment to prevent triggering when the system hops on an adjacent channel; a second plot might be needed with a longer sweep time to show two successive hops on a channel.
7. Detector function: Peak.
8. Trace: Max hold.
9. Use the marker-delta function, and record it.

Note: For AFH mode, Test Period = 0.4 (second/ channel) x 20 Channel = 8 sec,

For FHSS mode, Test Period = 0.4 (second/ channel) x 79 Channel = 31.6 sec,

So the Time of Occupancy (Dwell Time) of AFH mode= Time of Occupancy (Dwell Time) of FHSS mode / 79 Channel x 20 Channel.

6.5.3 Test Setup

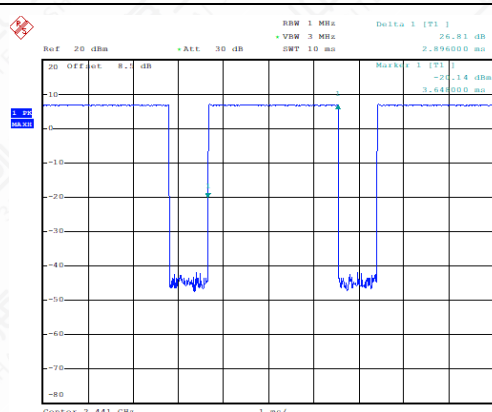


Measurement Result

Modulation type	Frequency (MHz)	Time slot length (ms)	Hop Number	Dwell Time (ms)	Limit (ms)	Conclusion
GFSK DH5	2402-2480	2.90	86	249.06	400	P
$\pi/4$ DQPSK 2DH5	2402-2480	2.91	53	154.34	400	P
8DPSK 3DH5	2402-2480	2.90	65	188.24	400	P

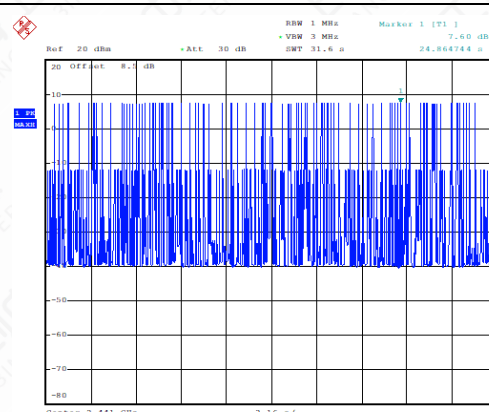
Note: Dwell time = time slot length * hop rate

For GFSK, Ch39,Packet DH5
Time of occupancy (Dwell Time)



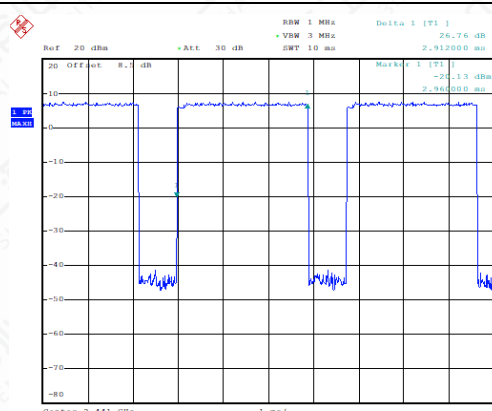
Date: 5.AUG.2022 21:28:27

For GFSK, Ch39,Packet DH5
Number of Transmissions Measurement



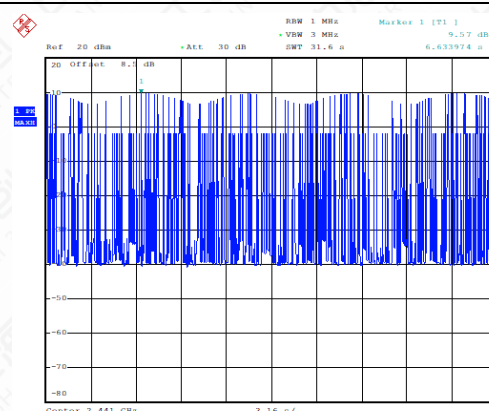
Date: 5.AUG.2022 21:29:27

For $\pi/4$ DQPSK, Ch39,Packet 2DH5
Time of occupancy (Dwell Time)



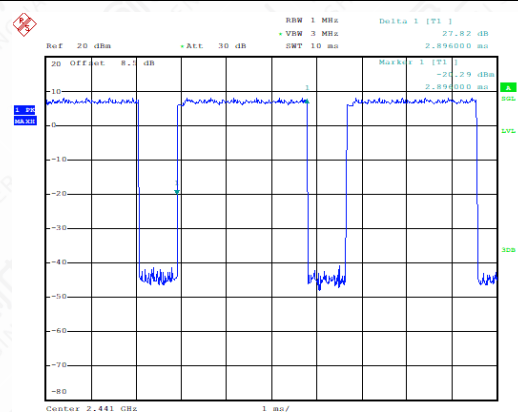
Date: 5.AUG.2022 21:30:13

For $\pi/4$ DQPSK, Ch39,Packet 2DH5
Number of Transmissions Measurement

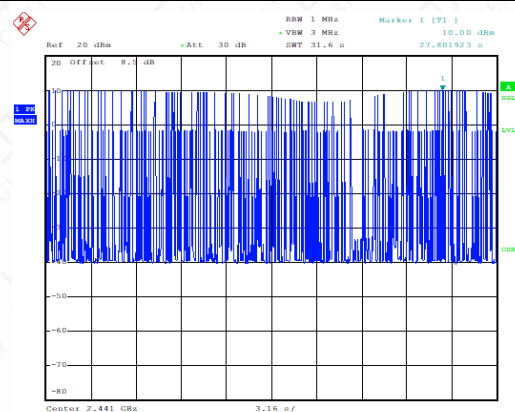


Date: 5.AUG.2022 21:31:10

For 8DPSK, Ch39, Packet 3DH5
Time of occupancy (Dwell Time)



For 8DPSK, Ch39, Packet 3DH5
Number of Transmissions Measurement



6.6 20dB Bandwidth

6.6.1 Measurement Limit

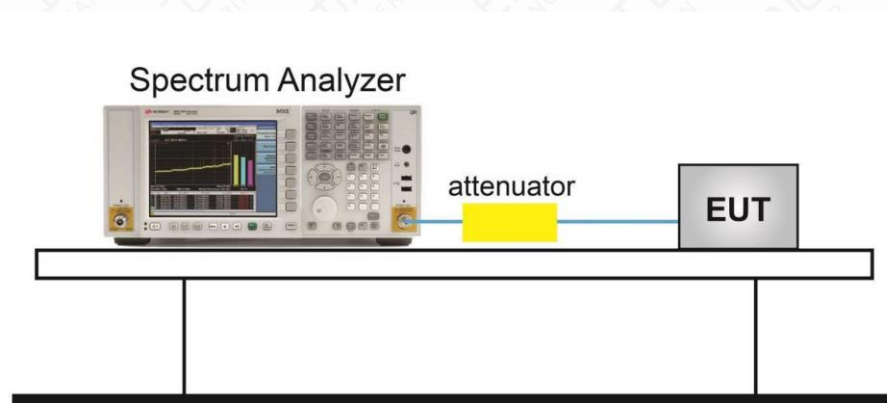
Standard	Limit
FCC 47 Part 15.247(d)	20dB below peak output power in 100KHz bandwidth

6.6.2 Test procedures

The measurement is according to ANSI C63.10 clause 7.8.7

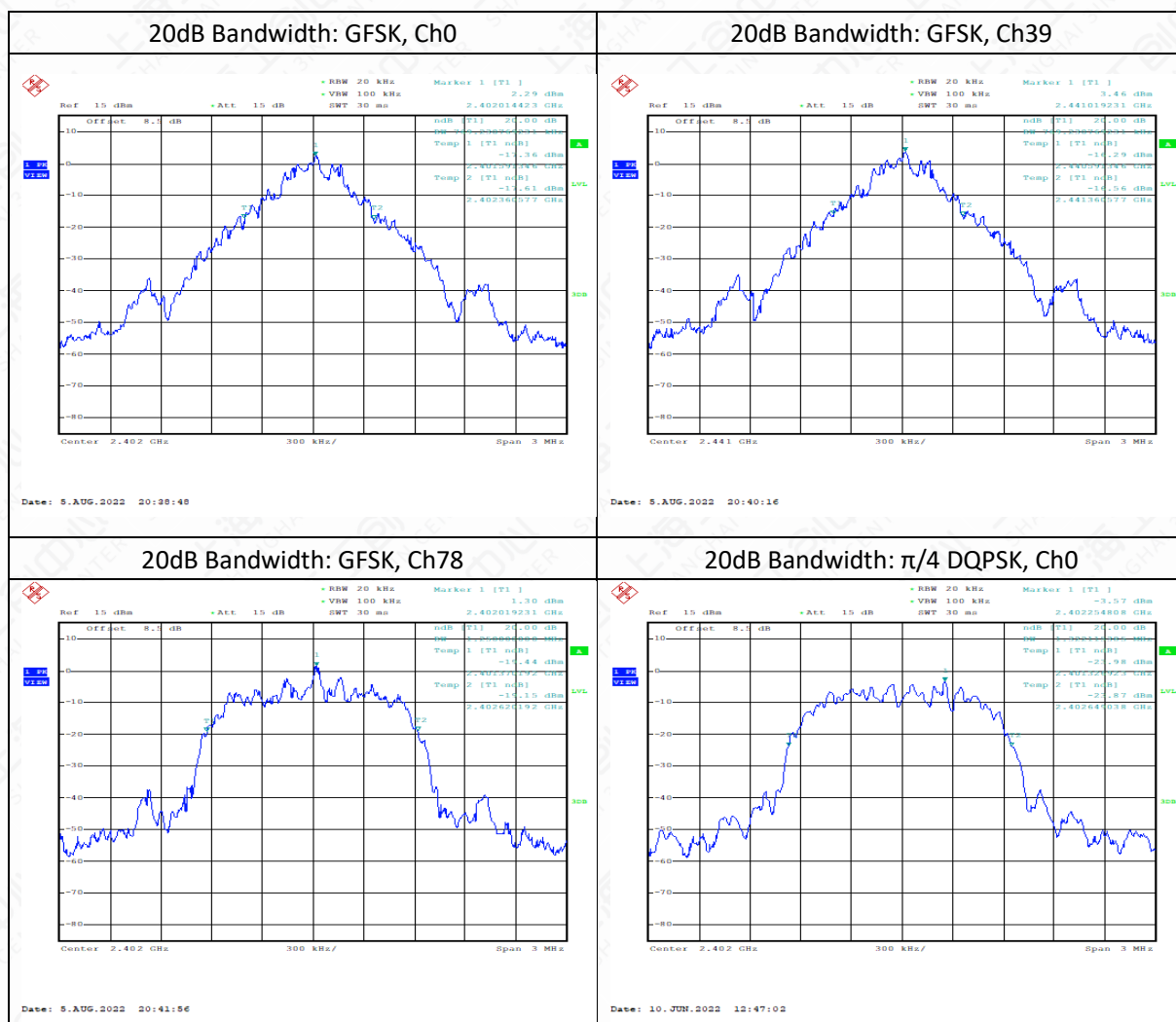
1. Connect the EUT through cable and divide with CMW270 and spectrum analyzer.
2. Enable the EUT transmit maximum power.
3. Set the spectrum analyzer as step 4 to step 7.
4. Span: two or five times of OBW
5. RBW= 1% to 5% of the OBW; VBW is approximately three times of RBW; Max Hold.
6. Select the max peak, and N DB DOWN=20dB.
7. Record the results.

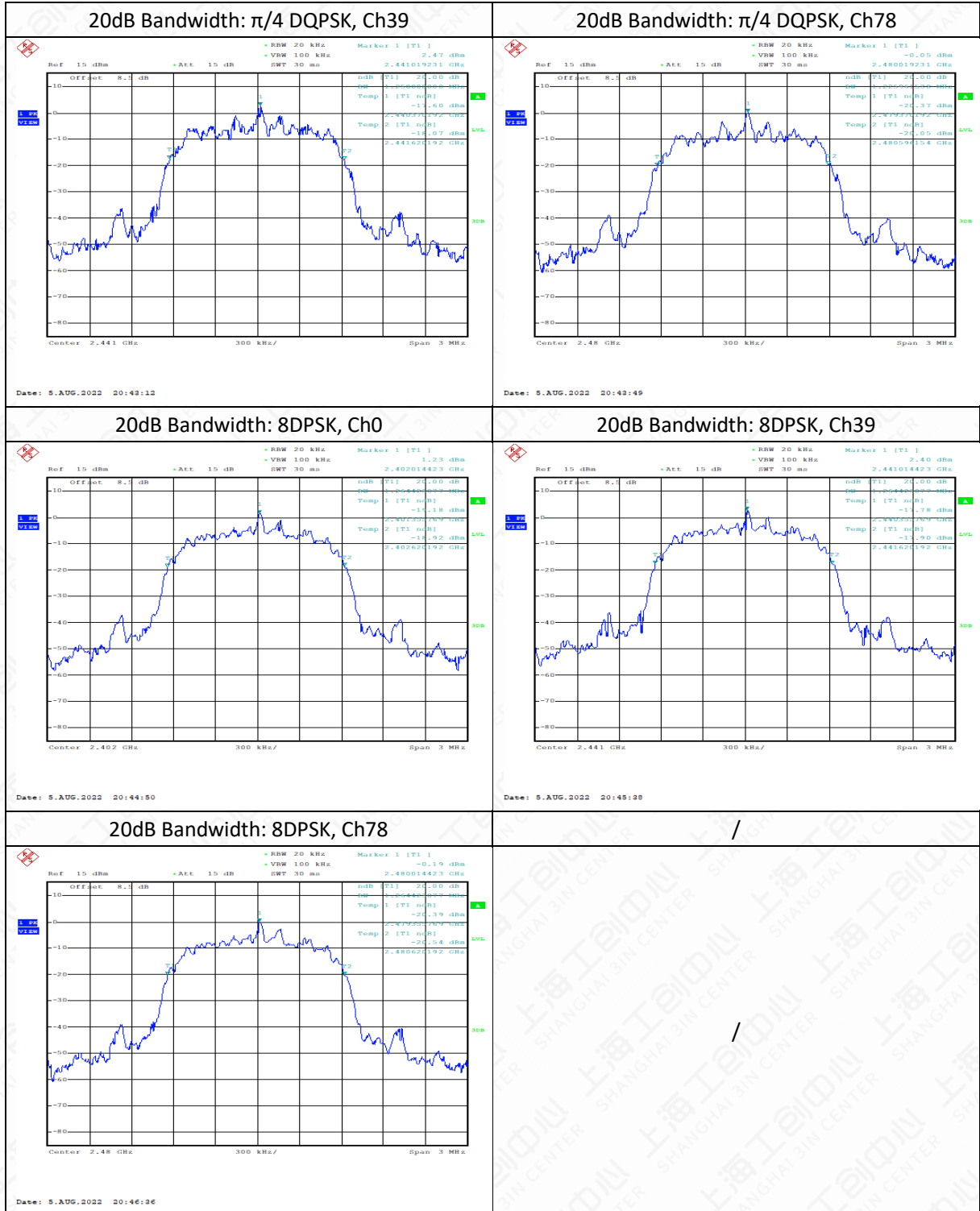
6.6.3 Test Setup



Measurement Result

Modulation type	Frequency (MHz)	20dB Bandwidth (MHz)
GFSK DH5	2402	0.769
	2441	0.769
	2480	0.769
$\pi/4$ DQPSK 2DH5	2402	1.250
	2441	1.250
	2480	1.226
8DPSK 3DH5	2402	1.264
	2441	1.264
	2480	1.264





6.7 99% Occupied Bandwidth

6.7.1 Measurement Limit

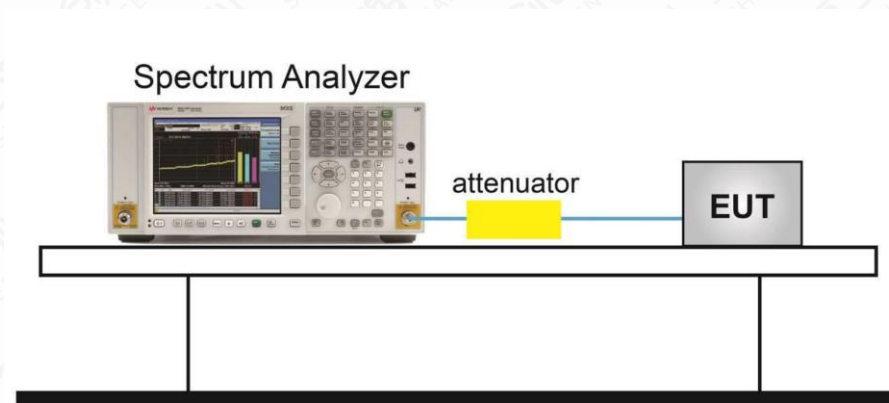
Standard	Limit
N/A	N/A

6.7.2 Test procedures

The measurement is according to ANSI C63.10 clause 6.9.3.

1. The output power of EUT was connected to the spectrum analyzer. The path loss was compensated to the results for each measurement.
2. Enable EUT transmitter maximum power continuously.
3. Set RBW shall be in the range of 1% to 5% of the OBW.
4. Set the VBW $\geq [3 \times \text{RBW}]$.
5. Detector = peak.
6. Trace mode = max hold.
7. Sweep = auto couple.
8. Allow the trace to stabilize.
9. The occupied bandwidth is the frequency bandwidth such that, below its lower and above its upper frequency limits, the mean powers are each equal to 0.5% of the total mean power of the given emission.

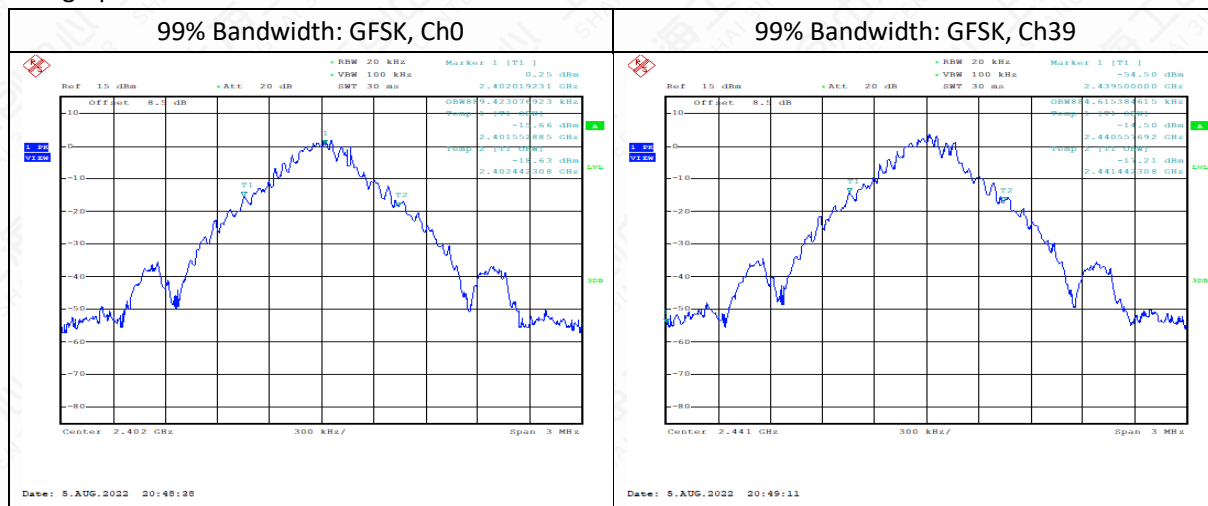
6.7.3 Test setup

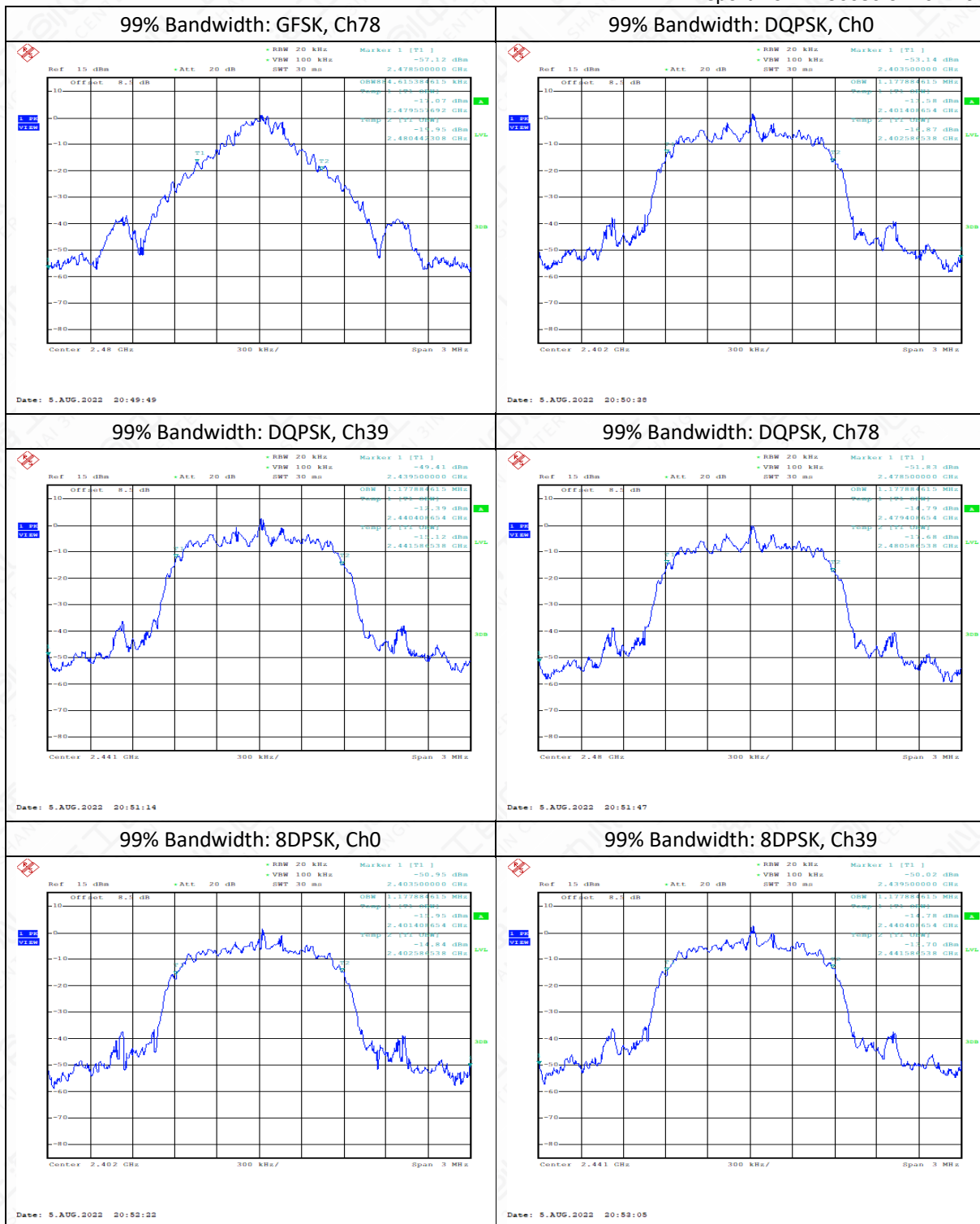


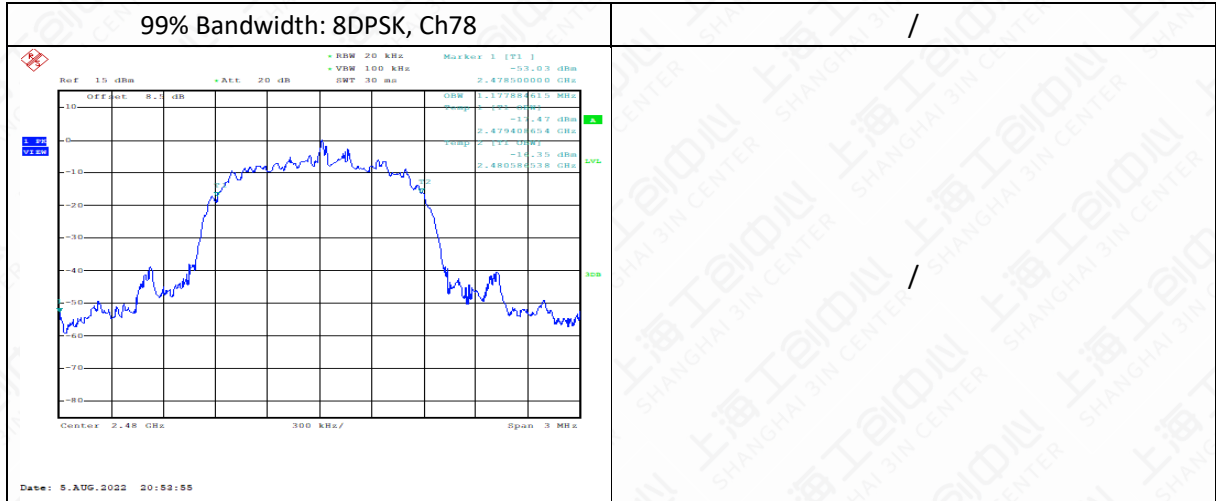
Measurement Result

Modulation type	Channel	99% Bandwidth (MHz)
GFSK DH5	2402	0.904
	2441	0.904
	2480	0.904
$\pi/4$ DQPSK 2DH5	2402	1.183
	2441	1.183
	2480	1.188
8DPSK 3DH5	2402	1.163
	2441	1.163
	2480	1.168

Test graphs as below







6.8 Carrier Frequency Separation

6.8.1 Measurement Limit

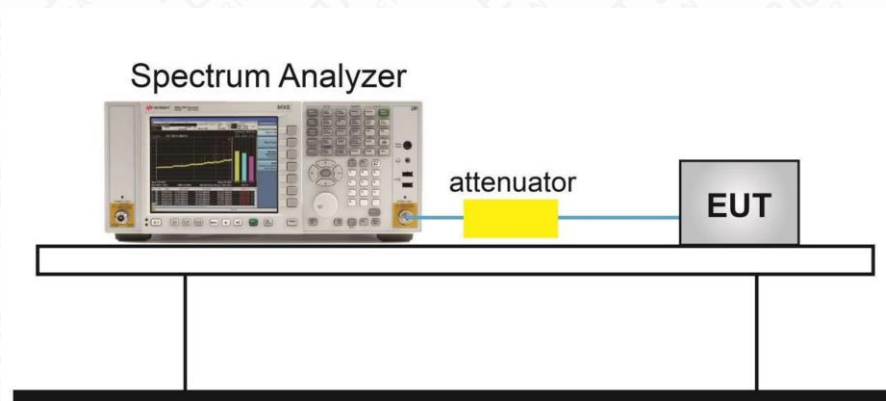
Standard	Limit(KHz)
FCC 47 Part 15.247 (a) (1)	Over 25KHz or $(2/3) \times 20\text{dB}$ bandwidth

6.8.2 Test procedures

The measurement is according to ANSI C63.10 clause 11.13.2

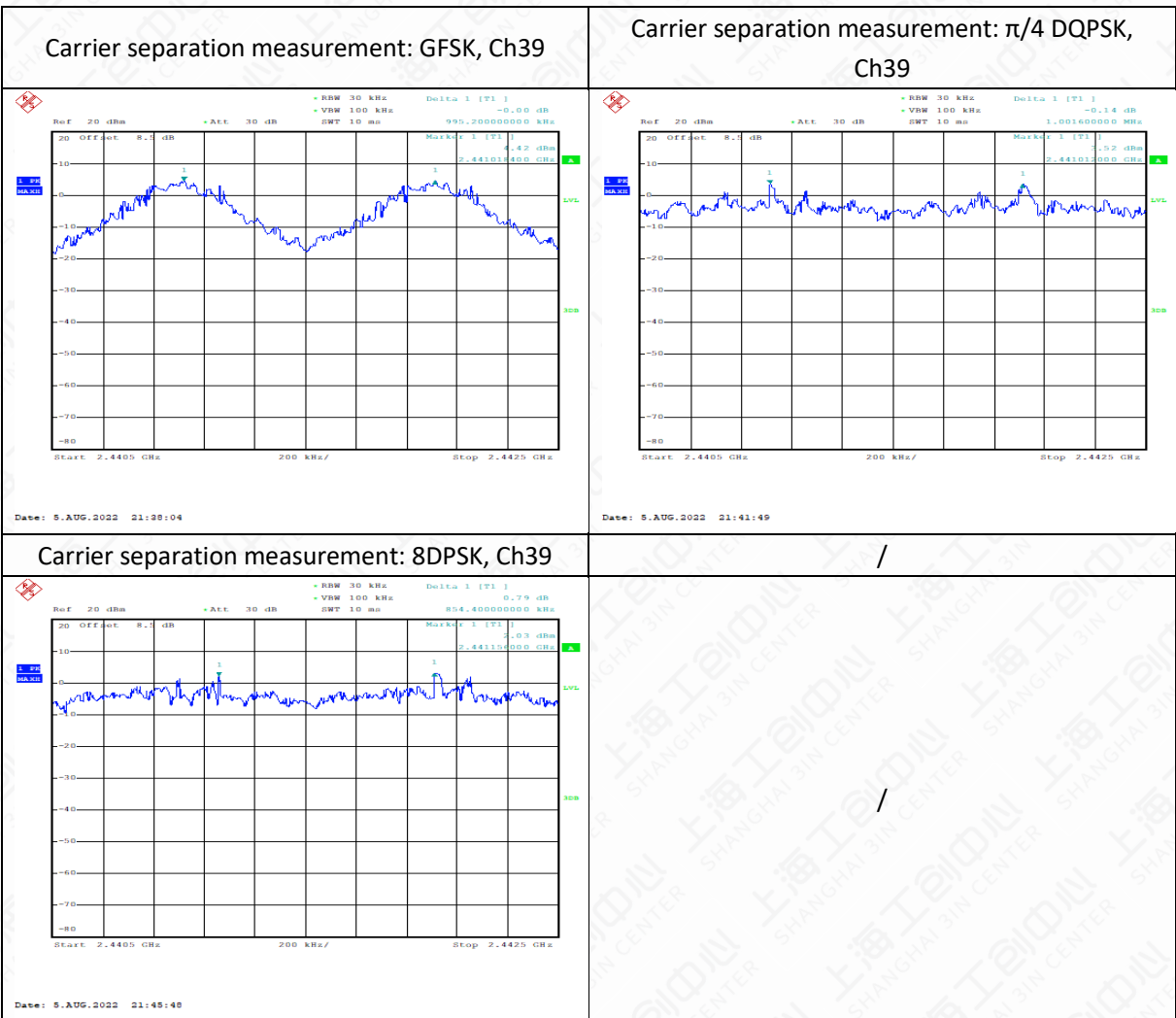
- 1) Span: Wide enough to capture the peak level of the emission operating on the channel closest to the band edge, as well as any modulation products that fall outside of the authorized band of operation.
- 2) Reference level: As required to keep the signal from exceeding the maximum instrument input mixer level for linear operation. In general, the peak of the spectral envelope shall be more than $[10 \log (\text{OBW}/\text{RBW})]$ below the reference level. Specific guidance is given in 4.1.5.2.
- 3) Attenuation: Auto (at least 10 dB preferred).
- 4) Sweep time: Coupled.
- 5) Resolution bandwidth: 100 kHz.6) Video bandwidth: 300 kHz.7) Detector: Peak.8) Trace: Max hold.

6.8.3 Test Setup



Measurement Result

Modulation type	Frequency (MHz)	Carrier separation measurement (KHz)
GFSK DH5	2441	995.2
$\pi/4$ DQPSK 2DH5	2441	1001.6
8DPSK 3DH5	2441	854.4



6.9 Number Of Hopping Channels

6.9.1 Measurement Limit

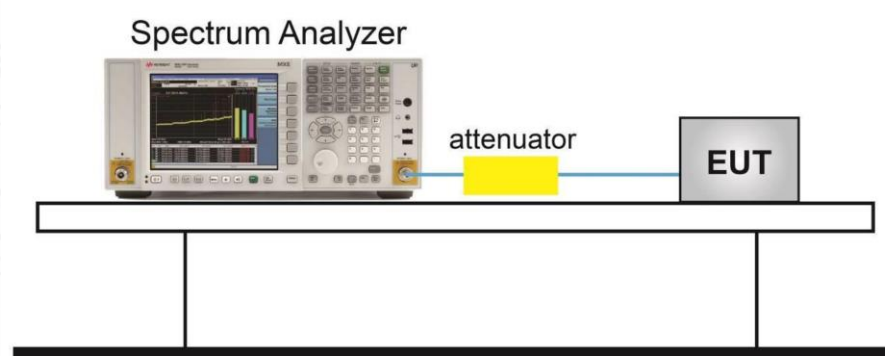
Standard	Limit
FCC 47 CFR Part 15.247 (a)(1)(iii)	At least 15 non-overlapping channels
RSS-247 5.1	At least 15 non-overlapping channels

6.9.2 Test procedure

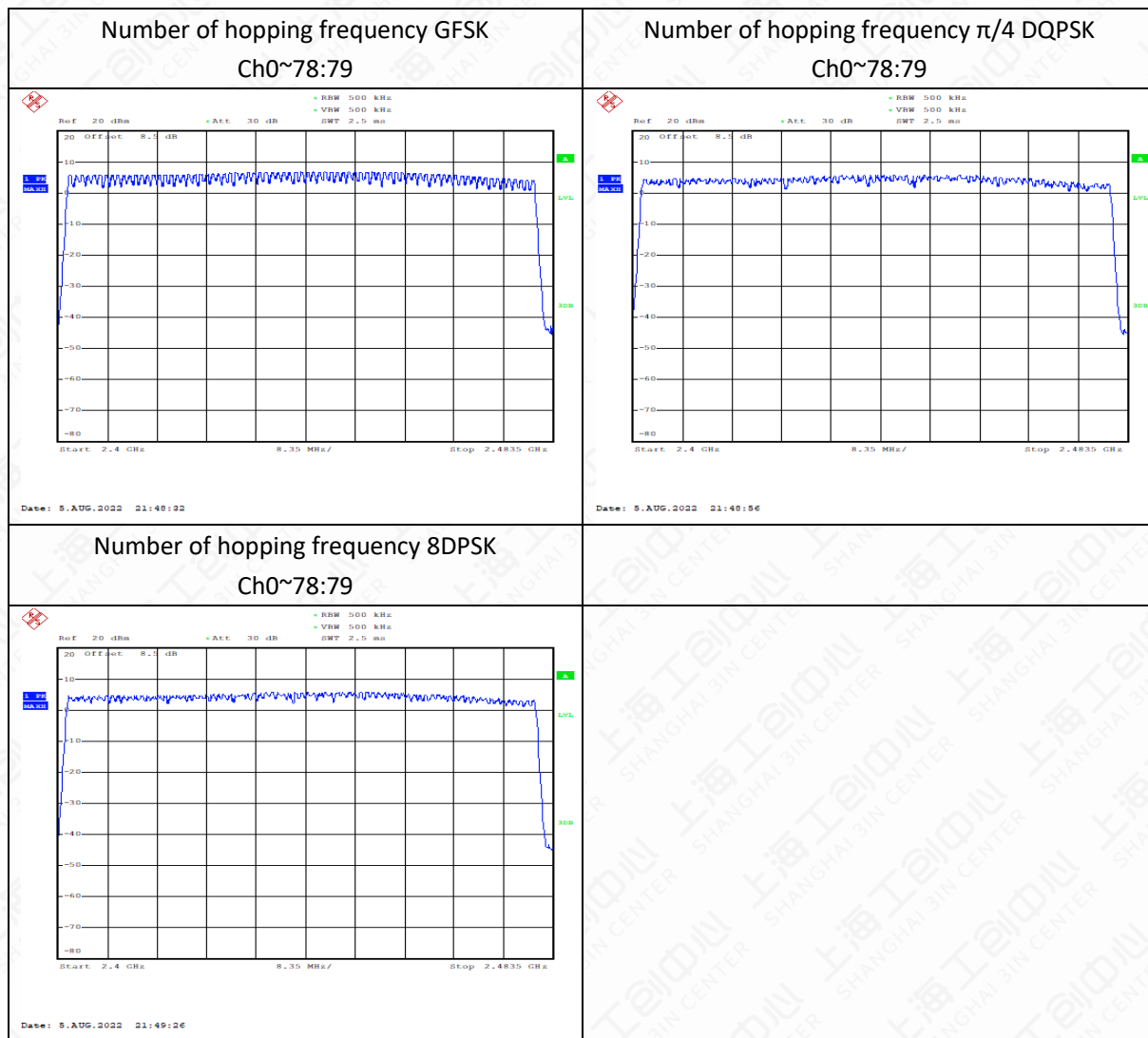
The measurement is according to ANSI C63.10 clause 7.8.3.

1. Connect the EUT through cable and divide with CMW270 and spectrum analyzer.
2. Enable the EUT transmit in hopping mode.
3. Span: The frequency band of operation. Depending on the number of channels the device supports, it may be necessary to divide the frequency range of operation across multiple spans, to allow the individual channels to be clearly seen.
4. RBW: To identify clearly the individual channels, set the RBW to less than 30% of the channel spacing or the 20 dB bandwidth, whichever is smaller.
5. VBW $\geq$ RBW.
6. Sweep: Auto.
7. Detector function: Peak.
8. Trace: Max hold.
9. Allow the trace to stabilize.
10. Record the test results.

6.9.3 Test Setup



Measurement Result



Annex A: Revised History

Version	Revised Content
V00	Initial
V01	Add the test lab's registered MRA test site number

Annex B: Accreditation Certificate

Accredited Laboratory

A2LA has accredited

**INDUSTRIAL INTERNET INNOVATION CENTER
(SHANGHAI) CO., LTD.**

Shanghai, People's Republic of China

for technical competence in the field of

Electrical Testing

This laboratory is accredited in accordance with the recognized International Standard ISO/IEC 17025:2017 General requirements for the competence of testing and calibration laboratories. This accreditation demonstrates technical competence for a defined scope and the operation of a laboratory quality management system (refer to joint ISO-ILAC-IAF Communiqué dated April 2017).



Presented this 12th day of April 2021.



Vice President, Accreditation Services
For the Accreditation Council
Certificate Number 3682.01
Valid to February 28, 2023

For the tests to which this accreditation applies, please refer to the laboratory's Electrical Scope of Accreditation.

END OF REPORT