



# FCC PART 15C TEST REPORT

## BLUETOOTH LOW ENERGY (BLE) PART

No. I21Z62328-IOT02

for

**Wingtech Group (Hong Kong) Limited**

**4G Mobile Phone**

**Model Name: TMRVL4G**

**FCC ID: 2APXW-TMRVL4G1**

with

**Hardware Version: 98117\_1\_10**

**Software Version: TMRVL4G\_0.03.25**

**Issued Date: 2021-12-9**

**Note:**

The test results in this test report relate only to the devices specified in this report. This report shall not be reproduced except in full without the written approval of CTTL.

The report must not be used by the client to claim product certification, approval, or endorsement by NVLAP, NIST, or any agency of the U.S. Government.

**Test Laboratory:**

**CTTL, Telecommunication Technology Labs, CAICT**

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## **REPORT HISTORY**

<b>Report Number</b>	<b>Revision</b>	<b>Description</b>	<b>Issue Date</b>
I21Z62328-IOT02	Rev.0	1st edition	2021-12-9

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## **1. Test Laboratory**

### **1.1. Introduction & Accreditation**

**Telecommunication Technology Labs, CAICT** is an ISO/IEC 17025:2017 accredited test laboratory under NATIONAL VOLUNTARY LABORATORY ACCREDITATION PROGRAM (NVLAP) with lab code 600118-0, and is also an FCC accredited test laboratory (CN5017), and ISED accredited test laboratory (ISED#: 24849). The detail accreditation scope can be found on NVLAP website.

### **1.2. Testing Location**

Conducted testing Location: CTTL(huayuan North Road)

Address: No. 52, Huayuan North Road, Haidian District, Beijing,  
P. R. China100191

Radiated testing Location: CTTL(huayuan North Road)

Address: No. 52, Huayuan North Road, Haidian District, Beijing,  
P. R. China100191

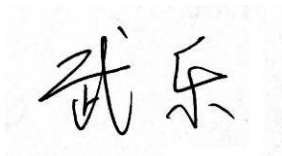
### 1.3. Testing Environment

Normal Temperature: 15-35℃  
Relative Humidity: 20-75%

### 1.4. Project data

Testing Start Date: 2021-6-10  
Testing End Date: 2021-12-9

### 1.5. Signature



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Wu Le  
(Prepared this test report)



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Sun Zhenyu  
(Reviewed this test report)



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Zhu Liang  
(Approved this test report)



## **2. Client Information**

### **2.1. Applicant Information**

Company Name: Wingtech Group (Hong Kong) Limited  
Address /Post: Flat/RM 1903, 19/F, Podium Plaza 5 Hanoi Road, Tsim Sha Tsui  
Kowloon, Hong Kong  
City: Hong Kong  
Postal Code: /  
Country: China  
Telephone: /  
Fax: /

### **2.2. Manufacturer Information**

Company Name: Wingtech Group (Hong Kong) Limited  
Address /Post: Flat/RM 1903, 19/F, Podium Plaza 5 Hanoi Road, Tsim Sha Tsui  
Kowloon, Hong Kong  
City: Hong Kong  
Postal Code: /  
Country: China  
Telephone: /  
Fax: /

### 3. Equipment Under Test (EUT) and Ancillary Equipment (AE)

#### 3.1. About EUT

Description	4G Mobile Phone
Model Name	TMRVL4G
FCC ID	2APXW-TMRVL4G1
Frequency Band	ISM 2400MHz~2483.5MHz
Type of Modulation(LE mode)	GFSK (Bluetooth Low Energy)
Number of Channels(LE mode)	40
Power Supply	3.85V DC by Battery
Antenna gain	1.96dBi

#### 3.2. Internal Identification of EUT

EUT ID*	SN or IMEI	HW Version	SW Version	Date of receipt
EUT1	/	98117_1_10	TMRVL4G_0.03.25	/
EUT2	863892050026356	98117_1_10	TMRVL4G_0.03.25	2021-11-16

\*EUT ID: is used to identify the test sample in the lab internally.

#### 3.3. Internal Identification of AE

AE ID*	Description	
AE1	Charger	/
AE2	USB cable	/
AE3	battery	/

##### AE1

Model	PA-US5V2A-036
Manufacturer	HUIZHOU PUAN ELECTRONICS CO., LTD
Length of cable	/

##### AE2

Description	USB CABLE ASSEMBLY
Manufacturer	Hui zhou washin
Type	711300001051
Length of cable	/

##### AE3

Model	JU001
Manufacturer	Jiade Energy Technology (Zhuhai) Co.,Ltd.
Length of cable	/

\*AE ID: is used to identify the test sample in the lab internally.





### **3.4. Normal Accessory setting**

Fully charged battery is used during the test.

### **3.5. General Description**

The Equipment Under Test (EUT) is a model of 4G Mobile Phone with integrated antenna. It consists of normal options: lithium battery, charger. Manual and specifications of the EUT were provided to fulfill the test. Samples undergoing test were selected by the Client.

## 4. Reference Documents

### 4.1. Documents supplied by applicant

EUT parameters, referring to Annex A for detailed information, is supplied by the client or manufacturer, which is the basis of testing.

### 4.2. Reference Documents for testing

The following documents listed in this section are referred for testing.

Reference	Title	Version
FCC Part15	FCC CFR 47, Part 15, Subpart C: 15.205 Restricted bands of operation; 15.209 Radiated emission limits, general requirements;	2019
ANSI C63.10	15.247 Operation within the bands 902–928MHz, 2400–2483.5 MHz, and 5725–5850 MHz. American National Standard of Procedures for Compliance Testing of Unlicensed Wireless Devices	June,2013

## 5. Test Results

### 5.1. Summary of EUT Mode

Two modes are provided:

Mode	Conditions
Mode A	1Mbps
Mode B	2Mbps

\*For the test results, the EUT had been tested all conditions. But only the worst case (Mode A) was shown in test report except the "Peak Output Power" test was shown all conditions.

### 5.2. Summary of Test Results

Abbreviations used in this clause:

- P** Pass, The EUT complies with the essential requirements in the standard.
- F** Fail, The EUT does not comply with the essential requirements in the standard
- NA** Not Applicable, The test was not applicable
- NP** Not Performed, The test was not performed by CTTL
- R** Re-use test data from basic model report.

SUMMARY OF MEASUREMENT RESULTS	Sub-clause	Verdict
Peak Output Power	15.247 (b)(1)	<b>P</b>
Frequency Band Edges- Conducted	15.247 (d)	<b>R</b>
Frequency Band Edges- Radiated	15.247, 15.205, 15.209	<b>R</b>
Transmitter Spurious Emission - Conducted	15.247 (d)	<b>R</b>
Transmitter Spurious Emission - Radiated	15.247, 15.205, 15.209	<b>R</b>
6dB Bandwidth	15.247 (a)(2)	<b>R</b>
Maximum Power Spectral Density Level	15.247(e)	<b>R</b>
AC Powerline Conducted Emission	15.107, 15.207	<b>R</b>

Please refer to **ANNEX A** for detail.

The measurement is made according to ANSI C63.10.

### 5.3. Statements

CTTL has evaluated the test cases requested by the applicant /manufacturer as listed in section 5.1 of this report for the EUT specified in section 3 according to the standards or reference documents listed in section 4.2

### 5.4. Explanation of re-use of test data

The Equipment Under Test (EUT) model TMRVL4G (FCC ID: 2APXW-TMRVL4G1) is variant product of TMRVL4G (FCC ID: 2APXW-TMRVL4G), according to the declaration of changes provided by the applicant and FCC KDB publication 484596 D01, spot check measurements (Peak Output Power-Conducted) were performed on this device, other test results are derived from test report No. I21Z61109-IOT20. Please refer Annex A for detail spot check verification data and reference data. the spot check test results are consistent with basic model.

For detail differences between two models please refer the Declaration of Changes document.

## 6. Test Facilities Utilized

### Conducted test system

No.	Equipment	Model	Serial Number	Manufacturer	Calibration Period	Calibration Due date
1	Vector Signal Analyzer	FSQ26	100024	Rohde & Schwarz	1 year	2022-03-25
2	LISN	ENV216	101200	R&S	1 year	2022-05-30
3	Test Receiver	ESCI	100344	R&S	1 year	2022-02-23
4	Shielding Room	S81	/	ETS-Lindgren	/	/

### Radiated emission test system

No.	Equipment	Model	Serial Number	Manufacturer	Calibration Period	Calibration Due date
1	Test Receiver	ESU26	100235	Rohde & Schwarz	1 year	2022-02-23
2	BiLog Antenna	VULB9163	9163-483	Schwarzbeck	1 year	2022-09-23
3	Antenna	3115	6914	ETS-Lindgren	1 year	2022-02-03
4	Dual-Ridge Waveguide Horn Antenna	3116	2661	ETS-Lindgren	1 year	2022-01-05
5	Analytical Spectrometer	FSV40	R&S	101047	1 year	2022-05-17

## 7. Measurement Uncertainty

### 7.1. Peak Output Power - Conducted

Measurement Uncertainty:

Measurement Uncertainty (k=2)	0.66dB
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### 7.2. Frequency Band Edges - Conducted

Measurement Uncertainty:

Measurement Uncertainty (k=2)	0.66dB
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### 7.3. Frequency Band Edges - Radiated

Measurement Uncertainty:

Measurement Uncertainty (k=2)	/
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### 7.4. Transmitter Spurious Emission - Conducted

Measurement Uncertainty:

Frequency Range	Uncertainty (k=2)
30 MHz ~ 8 GHz	1.22dB
8 GHz ~ 12.75 GHz	1.51dB
12.7GHz ~ 26 GHz	1.51dB

### 7.5. Transmitter Spurious Emission - Radiated

Measurement Uncertainty:

Frequency Range	Uncertainty(dBm) (k=2)
9kHz-30MHz	/
$30\text{MHz} \leq f \leq 1\text{GHz}$	5.16
$1\text{GHz} \leq f \leq 18\text{GHz}$	5.44
$18\text{GHz} \leq f \leq 40\text{GHz}$	5.28

### 7.6. 6dB Bandwidth

Measurement Uncertainty:

Measurement Uncertainty (k=2)	61.936Hz
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### 7.7. Maximum Power Spectral Density Level

**Measurement Uncertainty:**

Measurement Uncertainty (k=2)	0.66dB
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### 7.8. AC Powerline Conducted Emission

**Measurement Uncertainty:**

Measurement Uncertainty (k=2)	3.38dB
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## **ANNEX A: EUT parameters**

Disclaimer: The antenna gain provided by the client may affect the validity of the measurement results in this report, and the client shall bear the impact and consequences arising therefrom.

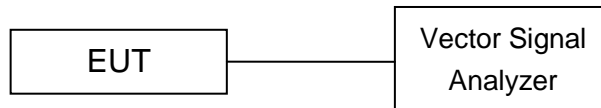
## **ANNEX B: Detailed Test Results**

### **B.1. Measurement Method**

#### **B.1.1. Conducted Measurements**

The measurement is made according to ANSI C63.10.

- 1). Connect the EUT to the test system correctly.
- 2). Set the EUT to the required work mode (Transmitter, receiver or transmitter & receiver).
- 3). Set the EUT to the required channel.
- 4). Set the EUT hopping mode (hopping or hopping off).
- 5). Set the spectrum analyzer to start measurement.
- 6). Record the values. Vector Signal Analyzer



#### **B.1.2. Radiated Emission Measurements**

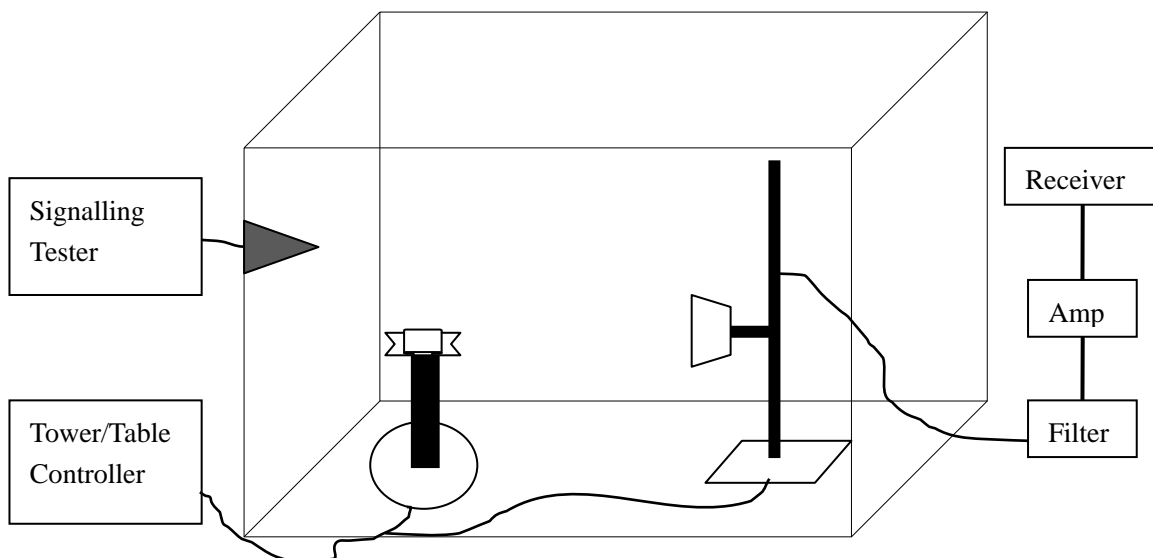
The measurement is made according to ANSI C63.10.

The radiated emission test is performed in semi-anechoic chamber. The distance from the EUT to the reference point of measurement antenna is 3m. The test is carried out on both vertical and horizontal polarization and only maximization result of both polarizations is kept. During the test, the turntable is rotated 360° and the measurement antenna is moved from 1m to 4m to get the maximization result.

In the case of radiated emission, the used settings are as follows,

Sweep frequency from 30 MHz to 1GHz, RBW = 100 kHz, VBW = 300 kHz;

Sweep frequency from 1 GHz to 26GHz, RBW = 1MHz, VBW = 1MHz;





## B.2. Peak Output Power

### B.2.1. Peak Output Power - Conducted

**Method of Measurement: See ANSI C63.10-clause 11.9.1.1**

- a) Set the RBW = 3 MHz.
- b) Set VBW = 10 MHz.
- c) Set span = 10 MHz.
- d) Sweep time = auto couple.
- e) Detector = peak.
- f) Trace mode = max hold.
- g) Allow trace to fully stabilize.
- h) Use peak marker function to determine the peak amplitude level.

**Measurement Limit:**

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

**Spot check Measurement Results:**

**For GFSK**

Sample Rate	Channel No.	Frequency (MHz)	Peak Conducted Output Power (dBm)	Conclusion
1Mbps	0	2402	-5.17	P
	19	2440	-3.42	P
	39	2480	-4.71	P
2Mbps	0	2402	-5.23	P
	19	2440	-3.63	P
	39	2480	-4.66	P

**Conclusion: PASS**

**Reference Measurement Results from basic model:**

**For GFSK**

Sample Rate	Channel No.	Frequency (MHz)	Peak Conducted Output Power (dBm)	Conclusion
1Mbps	0	2402	-4.09	P
	19	2440	-2.55	P
	39	2480	-3.76	P
2Mbps	0	2402	-4.26	P
	19	2440	-2.75	P
	39	2480	-3.94	P

**Conclusion: PASS**

### B.2.2. E.I.R.P.

The radiated E.I.R.P. is listed below:

Antenna gain = 1.96dBi

#### Spot check Measurement Results:

For GFSK

Sample Rate	Channel No.	Frequency (MHz)	E.I.R.P. (dBm)	Conclusion
1Mbps	0	2402	-3.21	P
	19	2440	-1.46	P
	39	2480	-2.75	P
2Mbps	0	2402	-3.27	P
	19	2440	-1.67	P
	39	2480	-2.7	P

Note: E.I.R.P. are calculated with the antenna gain.

**Conclusion: PASS**

#### Reference Measurement Results from basic model:

For GFSK

Sample Rate	Channel No.	Frequency (MHz)	E.I.R.P. (dBm)	Conclusion
1Mbps	0	2402	-2.13	P
	19	2440	-0.59	P
	39	2480	-1.80	P
2Mbps	0	2402	-2.30	P
	19	2440	-0.79	P
	39	2480	-1.98	P

Note: E.I.R.P. are calculated with the antenna gain.

**Conclusion: PASS**

### B.3. Frequency Band Edges - Conducted

**Method of Measurement: See ANSI C63.10-clause 6.10.4**

Connect the spectrum analyzer to the EUT using an appropriate RF cable connected to the EUT output. Configure the spectrum analyzer settings as described below.

- a) Set Span = 8MHz
- b) Sweep Time: Auto
- c) Set the RBW= 100 kHz
- c) Set the VBW= 300 kHz
- d) Detector: Peak
- e) Trace: Max hold

Observe the stored trace and measure the amplitude delta between the peak of the fundamental and the peak of the band-edge emission. This is not an absolute field strength measurement; it is only a relative measurement to determine the amount by which the emission drops at the band edge relative to the highest fundamental emission level.

**Measurement Limit:**

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

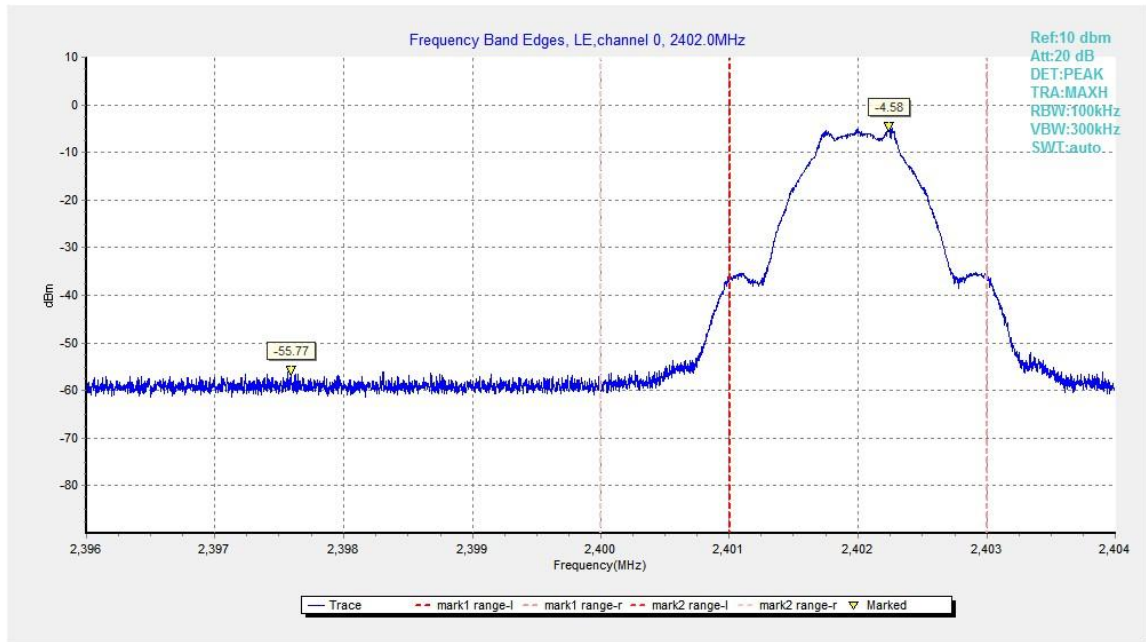
**Measurement Result:**

**For GFSK**

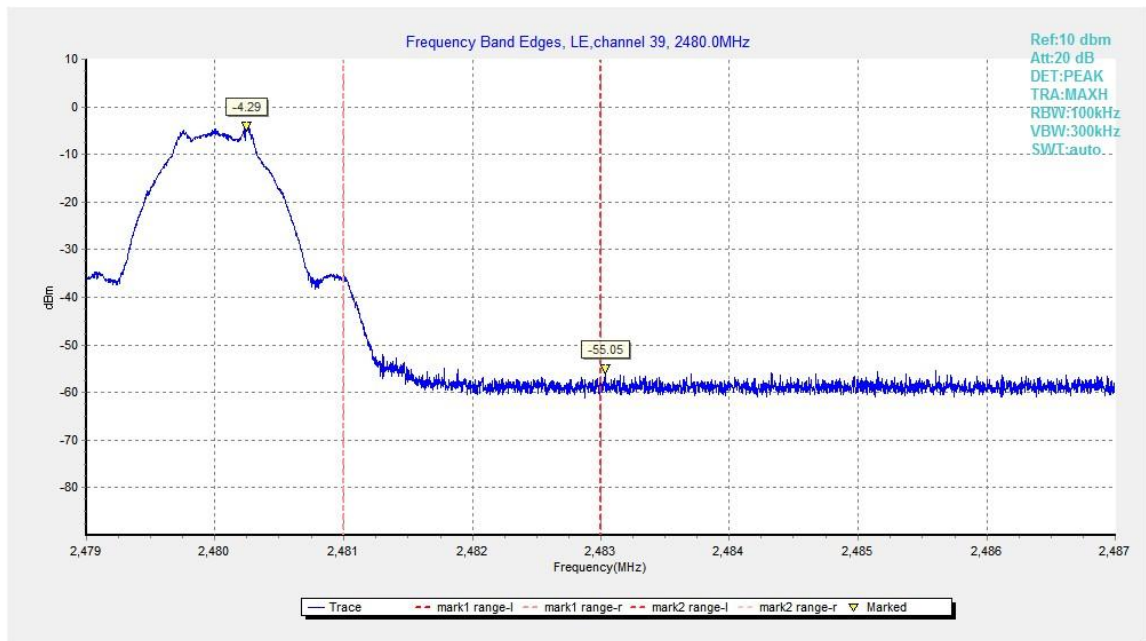
Channel No.	Frequency (MHz)	Hopping	Band Edge Power ( dBc)		Conclusion
0	2402	Hopping OFF	Fig.1	-51.19	P
39	2480	Hopping OFF	Fig.2	-50.76	P

**Conclusion: PASS**

Test graphs as below



**Fig.1.** Frequency Band Edges: GFSK, 2402 MHz, Hopping Off



**Fig.2.** Frequency Band Edges: GFSK, 2480 MHz, Hopping Off

## B.4. Frequency Band Edges –Radiated

**Method of Measurement:** See ANSI C63.10-2013-clause 6.4 &6.5 & 6.6

**Measurement Limit:**

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

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 (MHz)	Field strength( $\mu$ V/m)	Measurement distance (m)
0.009 - 0.490	2400/F(kHz)	300
0.490 - 1.705	24000/F(kHz)	30
1.705 – 30.0	30	30

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

**Set up:**

Tabletop devices shall be placed on a nonconducting platform with nominal top surface dimensions 1 m by 1.5 m and the table height shall be 1.5 m.

The EUT and transmitting antenna shall be centered on the turntable.

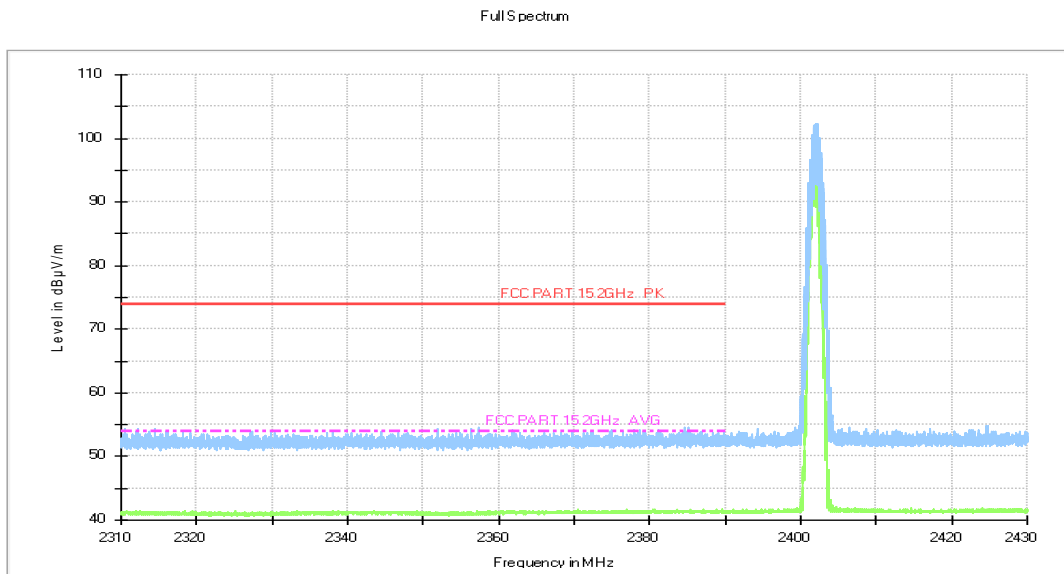
**EUT ID:** EUT1

**Measurement Results:**

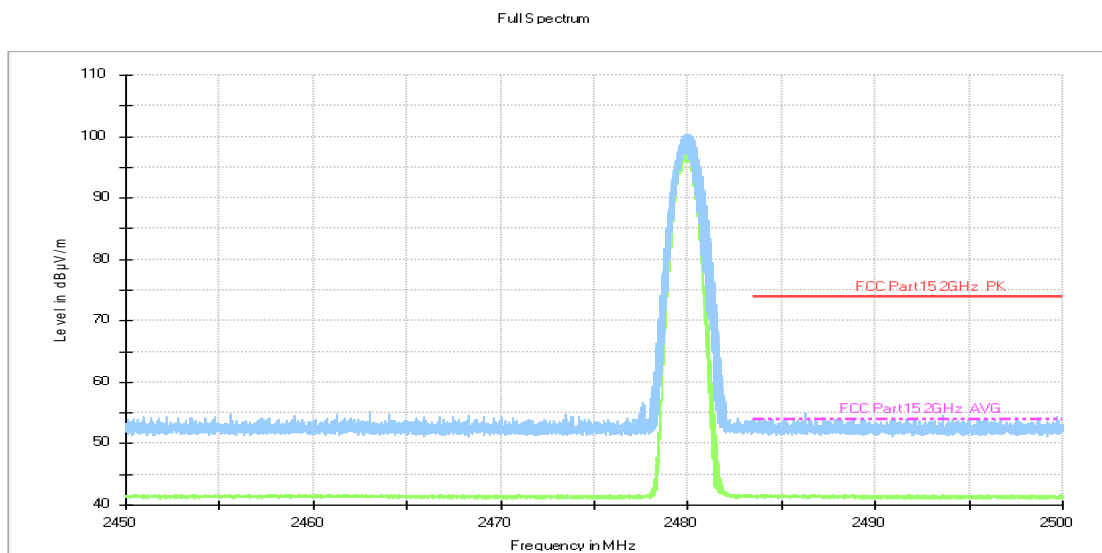
Mode	Channel	Frequency Range	Test Results	Conclusion
GFSK	0	2.31GHz ~2.45GHz	Fig.3	P
	39	2.45GHz ~2.5GHz	Fig.4	P

**Conclusion:** PASS

**Test graphs as below**



**Fig.3. Frequency Band Edges: GFSK, 2402 MHz, Hopping Off, 2.31 GHz – 2.45GHz**



**Fig.4. Frequency Band Edges: GFSK, 2480 MHz, Hopping Off , 2.45 GHz - 2.50GHz**

## B.5. Transmitter Spurious Emission - Conducted

**Method of Measurement: See ANSI C63.10-clause 11.11.2 and clause 11.11.3**

### Measurement Procedure – Reference Level

1. Set the RBW = 100 kHz.
2. Set the VBW = 300 kHz.
3. Set the span to  $\geq 1.5$  times the DTS bandwidth.
4. Detector = peak.
5. Sweep time = auto couple.
6. Trace mode = max hold.
7. Allow trace to fully stabilize.
8. Use the peak marker function to determine the maximum PSD level. Next, determine the power in 100 kHz band segments outside of the authorized frequency band using the following measurement:

### Measurement Procedure - Unwanted Emissions

1. Set RBW = 100 kHz.
  2. Set VBW = 300 kHz.
  3. Set span to encompass the spectrum to be examined.
  4. Detector = peak.
  5. Trace Mode = max hold.
  6. Sweep = auto couple.
  7. Allow the trace to stabilize (this may take some time, depending on the extent of the span).
- Ensure that the amplitude of all unwanted emissions outside of the authorized frequency band (excluding restricted frequency bands) is attenuated by at least the minimum requirements specified above.

### Measurement Limit:

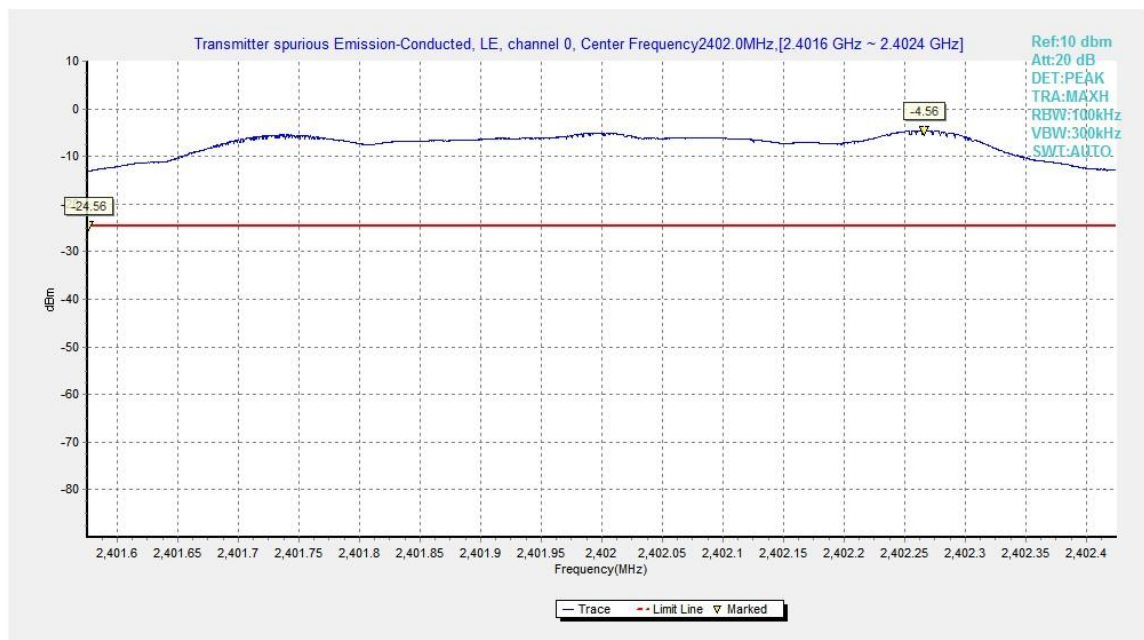
Standard	Limit
FCC 47 CFR Part 15.247 (d)	20dB below peak output power in 100 kHz bandwidth

**Measurement Results:  
For GFSK**

Channel No.	Frequency (MHz)	Frequency Range	Test Results	Conclusion
0	2402	Center Frequency	Fig.5	P
		30 MHz ~ 1 GHz	Fig.6	P
		1 GHz ~ 3 GHz	Fig.7	P
		3 GHz ~ 10 GHz	Fig.8	P
		10GHz ~ 26 GHz	Fig.9	P
19	2440	Center Frequency	Fig.10	P
		30 MHz ~ 1 GHz	Fig.11	P
		1 GHz ~ 3 GHz	Fig.12	P
		3 GHz ~ 10 GHz	Fig.13	P
		10GHz ~ 26 GHz	Fig.14	P
39	2480	Center Frequency	Fig.15	P
		30 MHz ~ 1 GHz	Fig.16	P
		1 GHz ~ 3GHz	Fig.17	P
		3 GHz ~ 10 GHz	Fig.18	P
		10 GHz ~ 26 GHz	Fig.19	P

**Conclusion: PASS**

**Test graphs as below**



**Fig.5.** Transmitter Spurious Emission - Conducted: GFSK,2402MHz



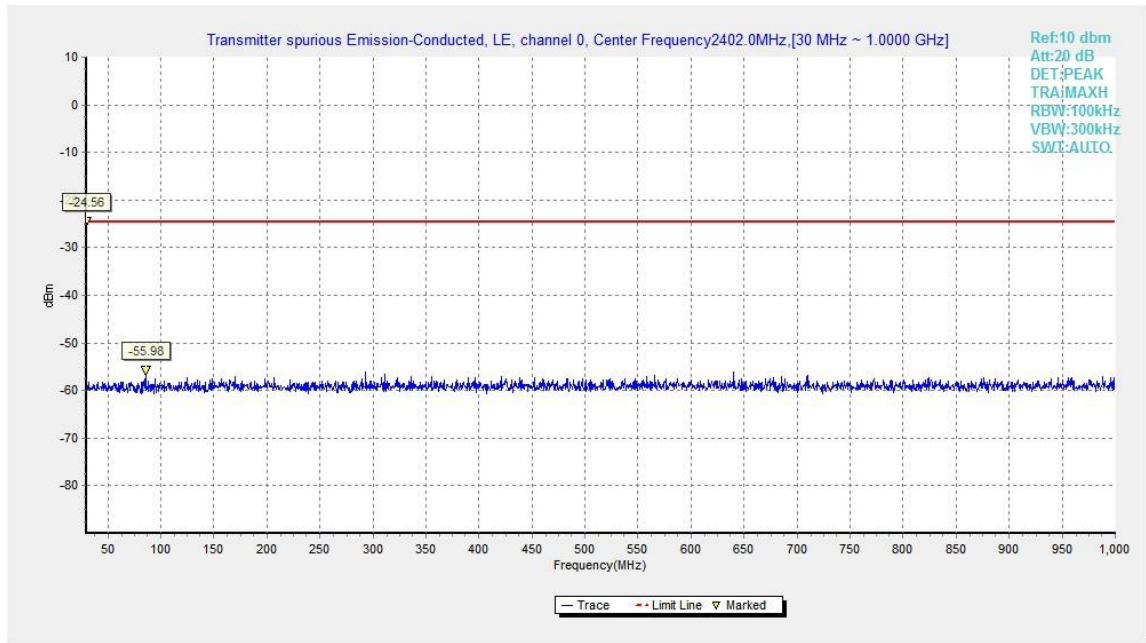


Fig.6. Transmitter Spurious Emission - Conducted: GFSK, 2402 MHz, 30MHz - 1GHz

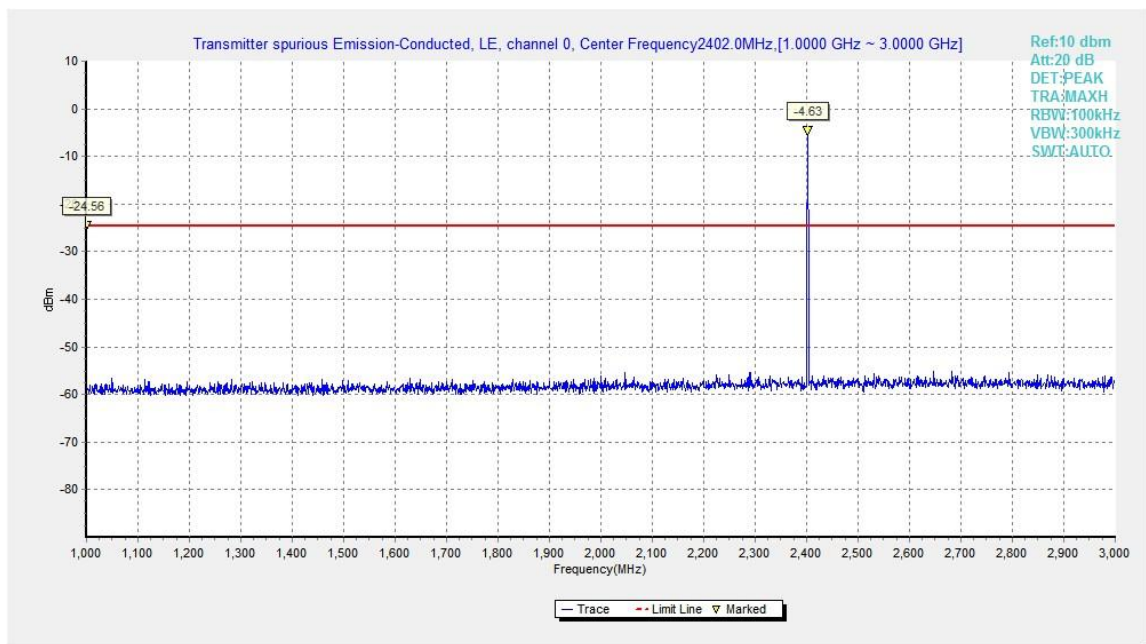
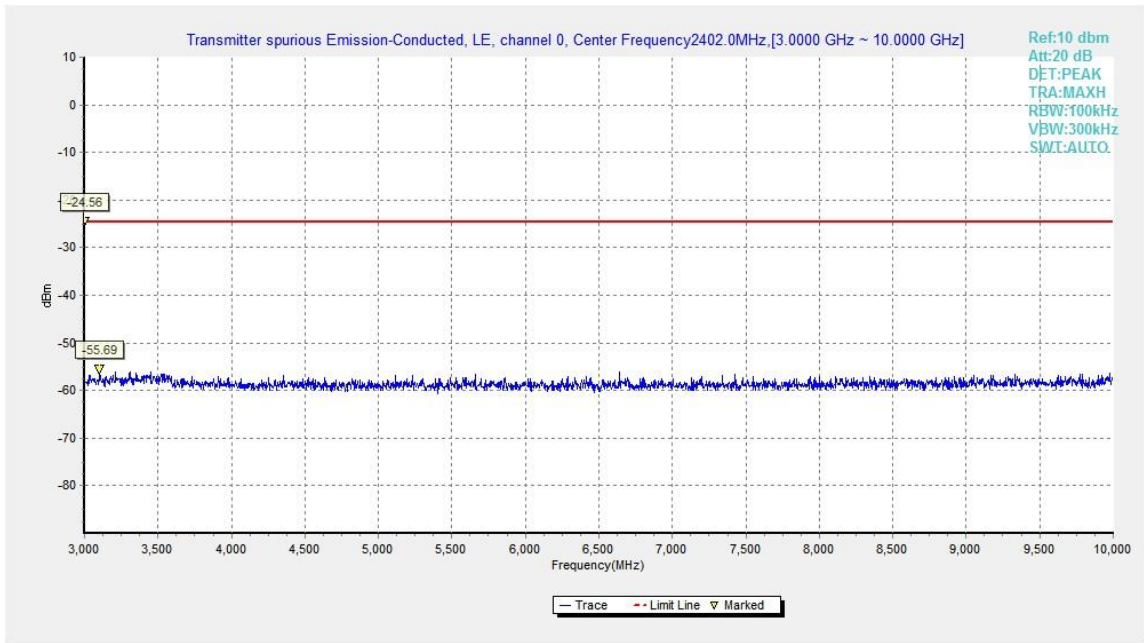
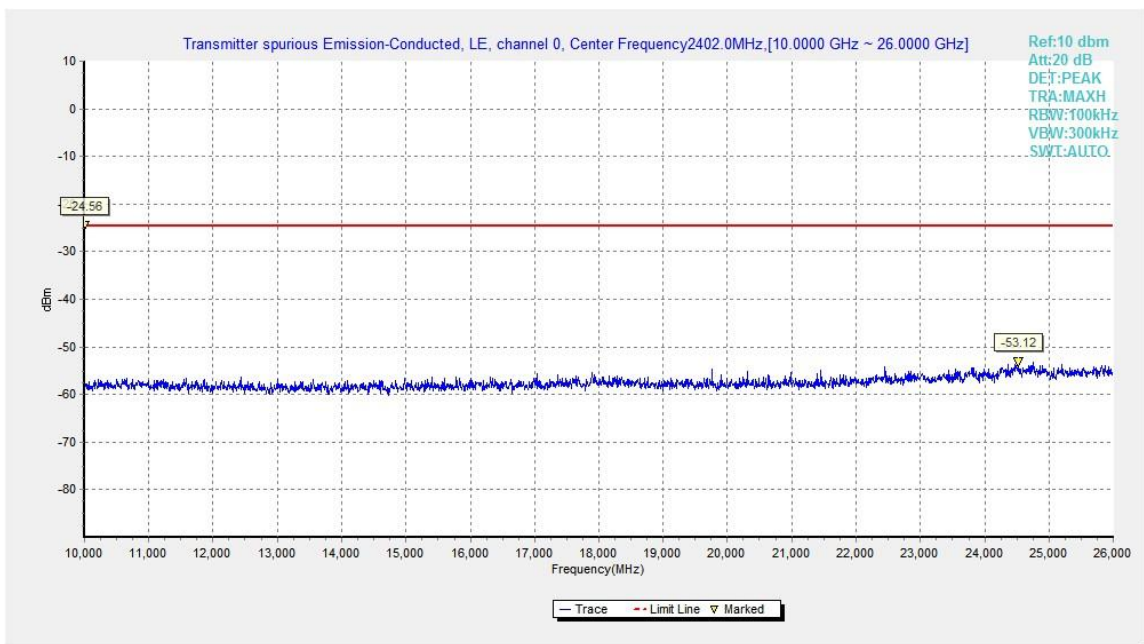


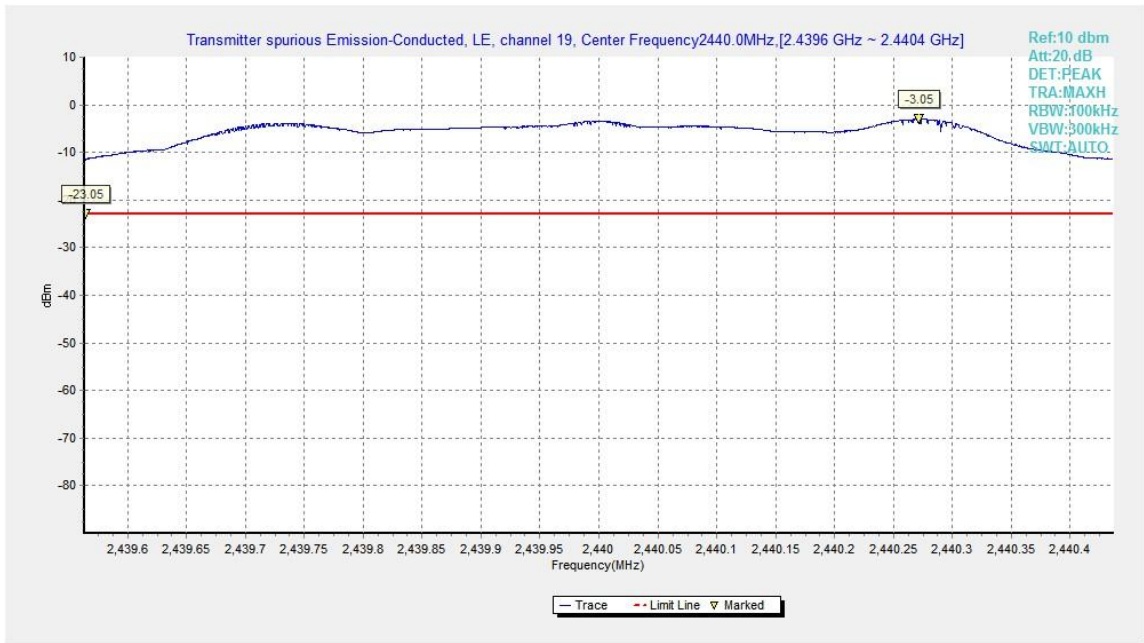
Fig.7. Transmitter Spurious Emission - Conducted: GFSK, 2402 MHz,1GHz - 3GHz



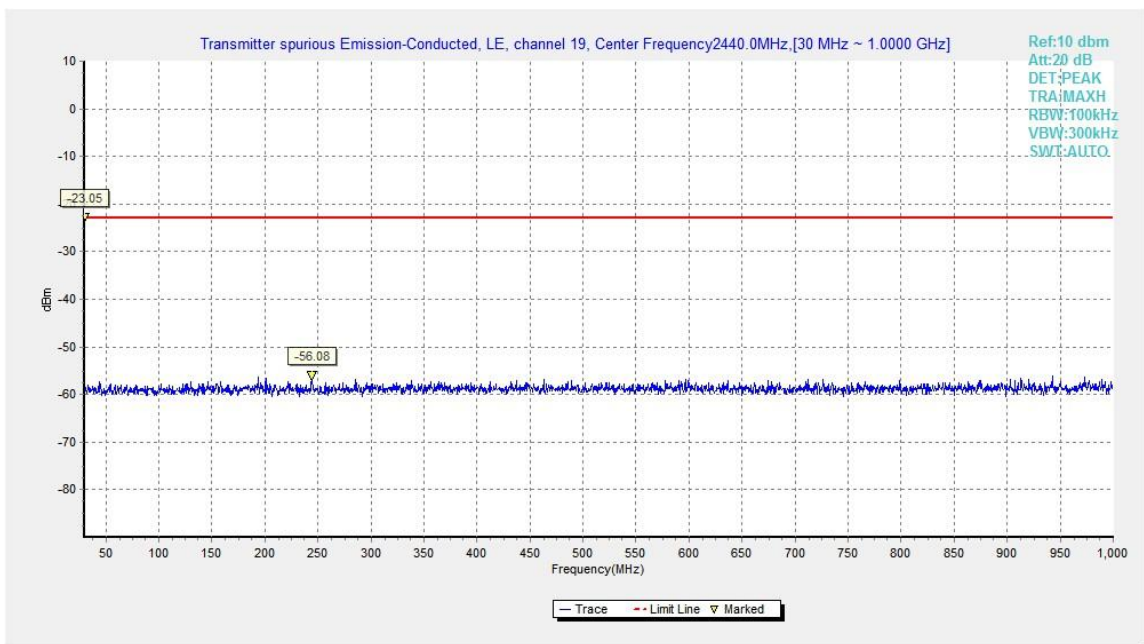
**Fig.8.** Transmitter Spurious Emission - Conducted: GFSK, 2402 MHz, 3GHz - 10GHz



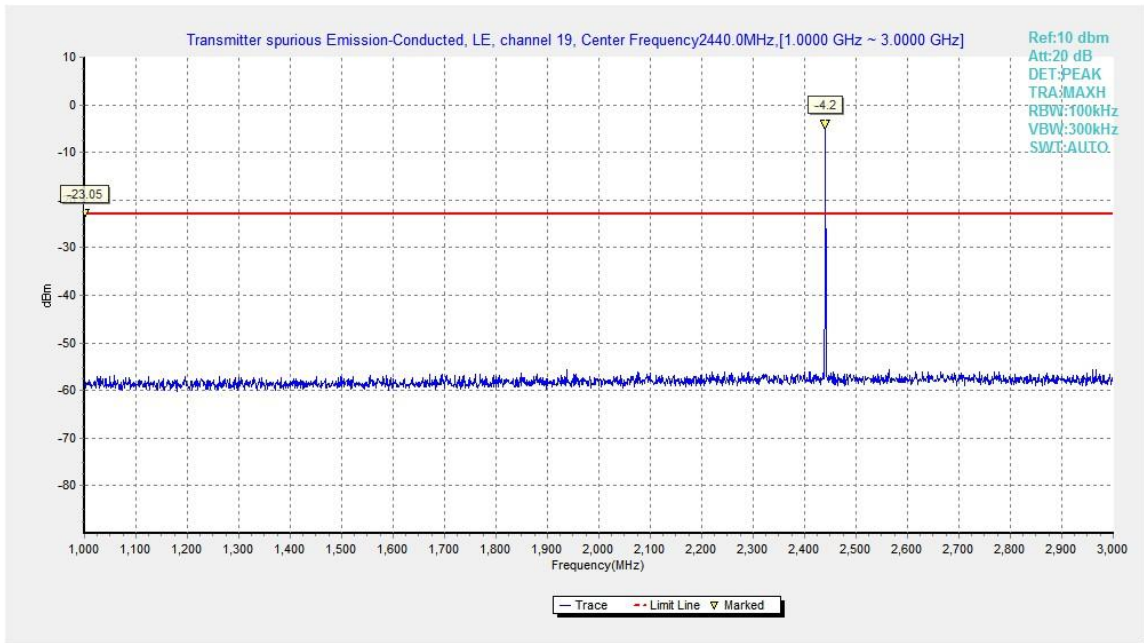
**Fig.9.** Transmitter Spurious Emission - Conducted: GFSK, 2402 MHz, 10GHz - 26GHz



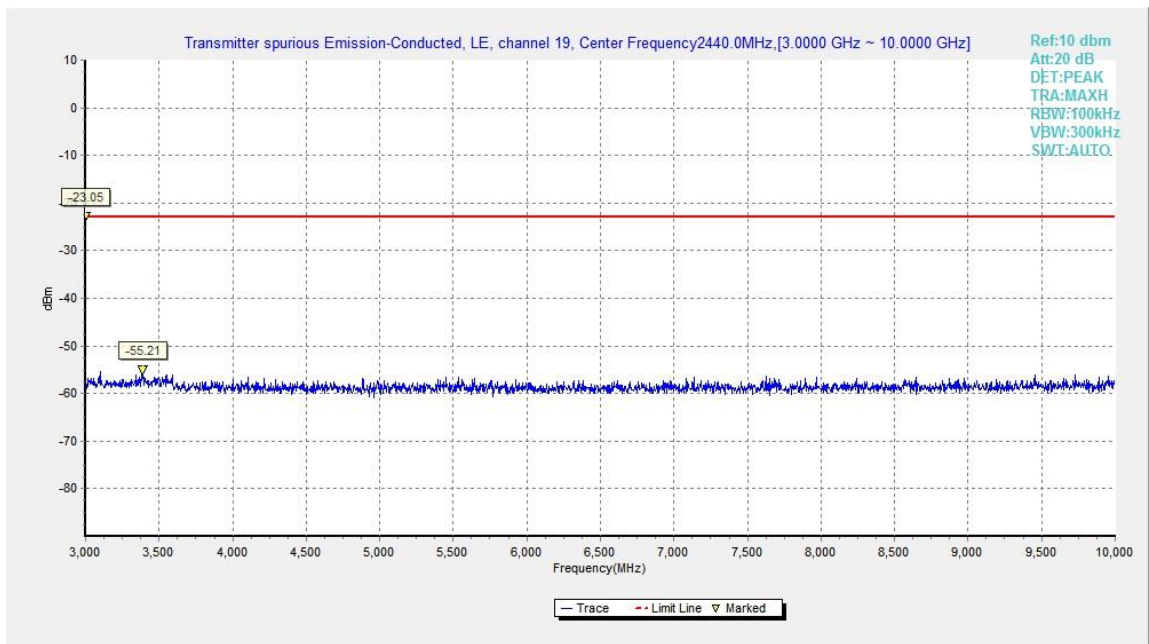
**Fig.10.** Transmitter Spurious Emission - Conducted: GFSK, 2440MHz



**Fig.11.** Transmitter Spurious Emission - Conducted: GFSK, 2440 MHz, 30MHz - 1GHz

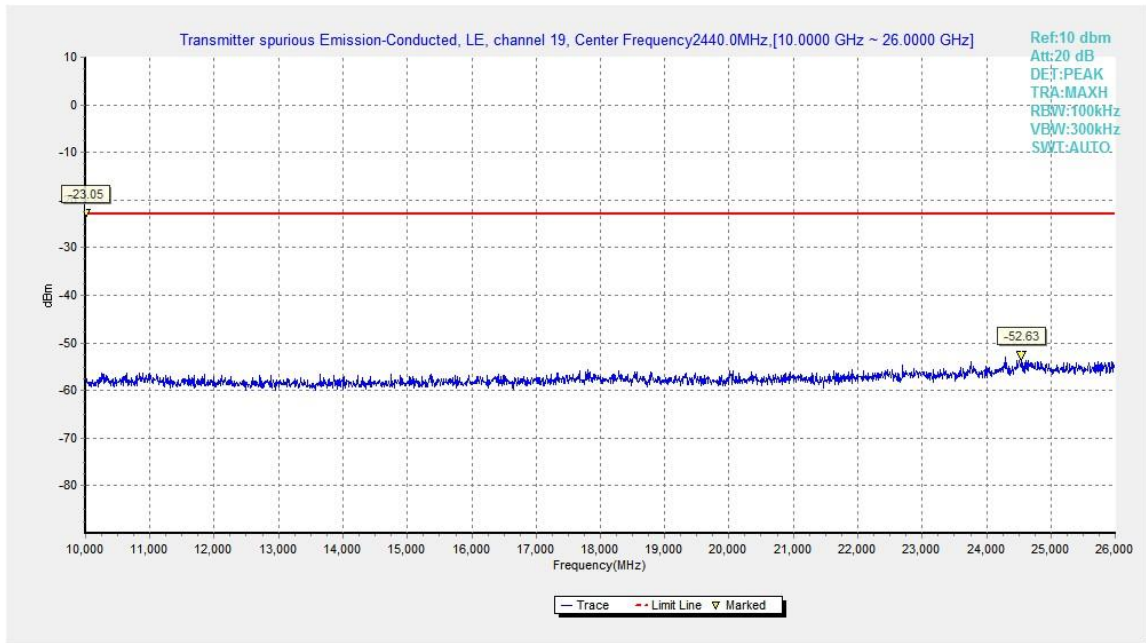


**Fig.12.** Transmitter Spurious Emission - Conducted: GFSK, 2440 MHz, 1GHz – 3GHz

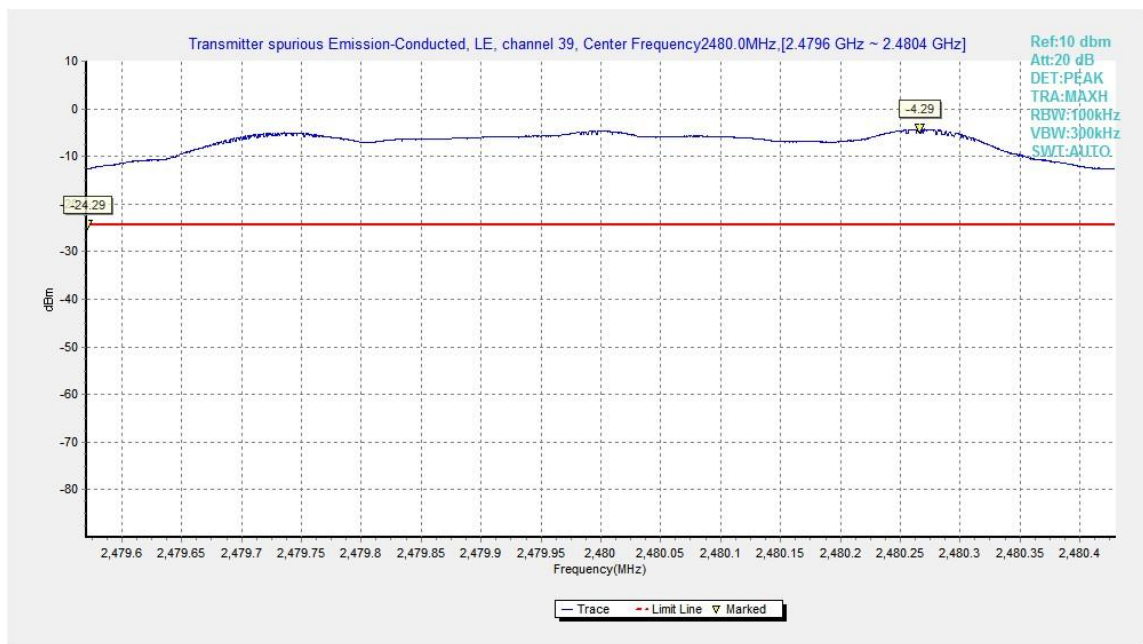


**Fig.13.** Transmitter Spurious Emission - Conducted: GFSK, 2440 MHz, 3GHz – 10GHz

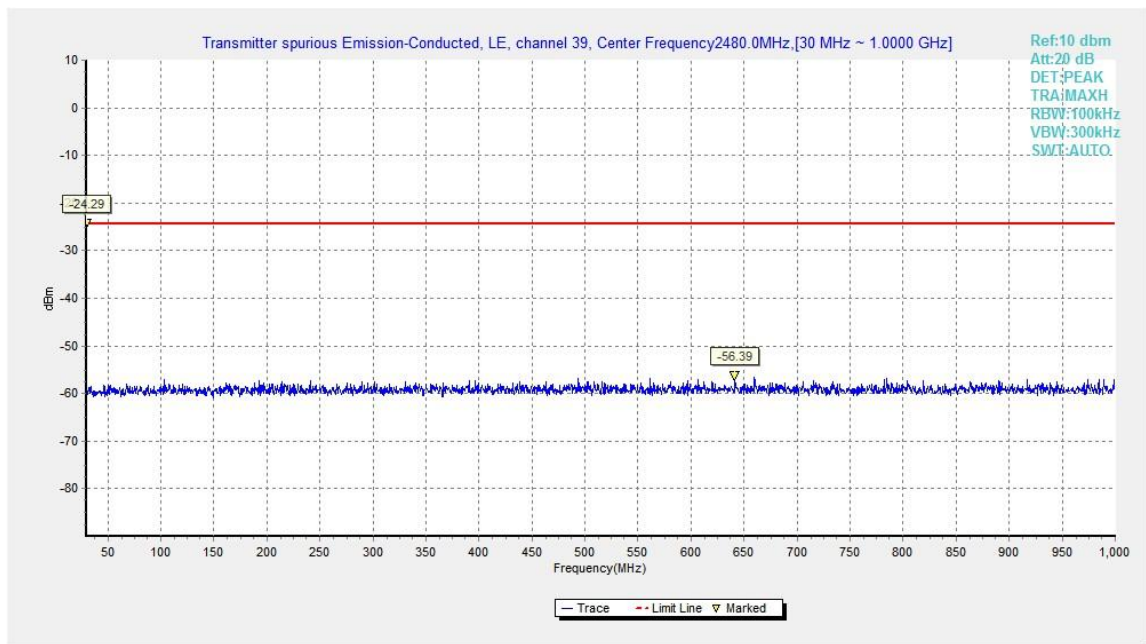




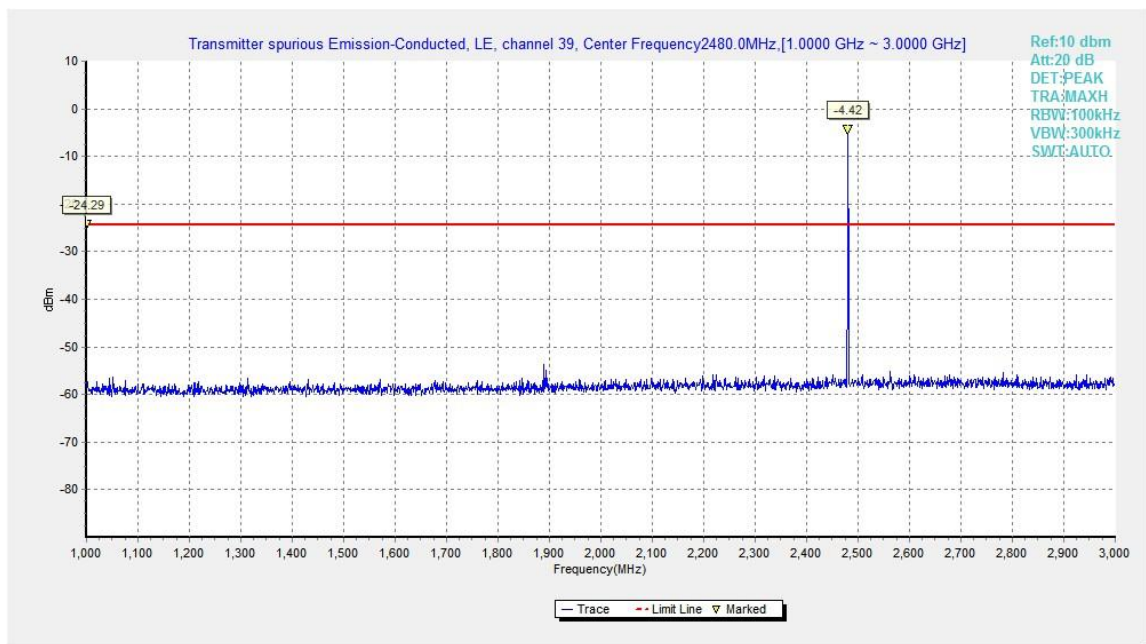
**Fig.14.** Transmitter Spurious Emission - Conducted: GFSK, 2440 MHz, 10GHz – 26GHz



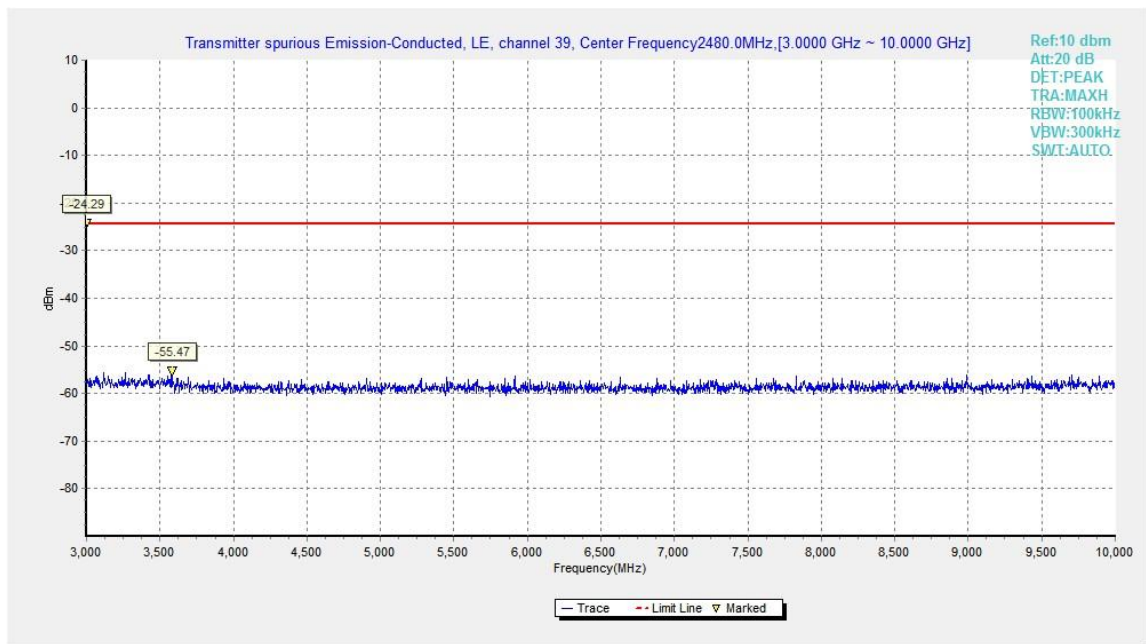
**Fig.15.** Transmitter Spurious Emission - Conducted: GFSK, 2480 MHz



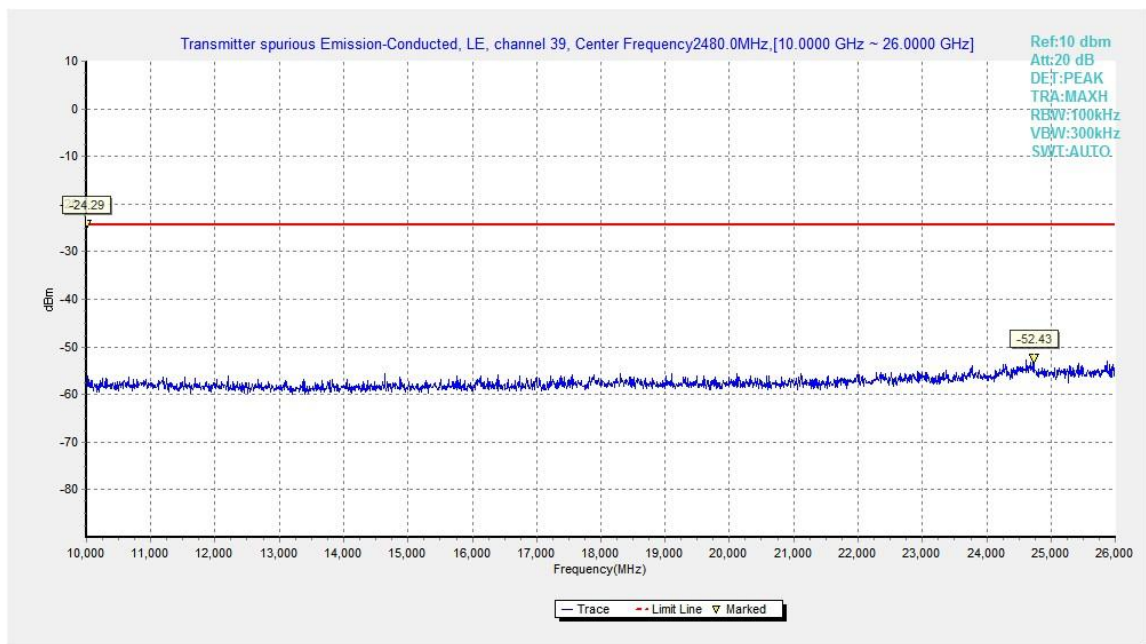
**Fig.16.** Transmitter Spurious Emission - Conducted: GFSK, 2480 MHz, 30MHz - 1GHz



**Fig.17.** Transmitter Spurious Emission - Conducted: GFSK, 2480 MHz, 1GHz - 3GHz



**Fig.18.** Transmitter Spurious Emission - Conducted: GFSK, 2480 MHz, 3GHz - 10GHz



**Fig.19.** Transmitter Spurious Emission - Conducted: GFSK, 2480 MHz, 10GHz - 26GHz

## B.6. Transmitter Spurious Emission - Radiated

**Method of Measurement:** See ANSI C63.10-2013-clause 6.4 & 6.5 & 6.6

**Measurement Limit:**

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

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 (MHz)	Field strength( $\mu$ V/m)	Measurement distance (m)
0.009 - 0.490	2400/F(kHz)	300
0.490 - 1.705	24000/F(kHz)	30
1.705 – 30.0	30	30

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

**Set up:**

Tabletop devices shall be placed on a nonconducting platform with nominal top surface dimensions 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

The EUT and transmitting antenna shall be centered on the turntable.

**Note:**

1. A "reference path loss" is established and the  $A_{Rpl}$  is the attenuation of "reference path loss", and including the gain of receive antenna, the gain of the preamplifier, the cable loss.

$P_{Mea}$  is the field strength recorded from the instrument.

The measurement results are obtained as described below:

$$\text{Result} = P_{Mea} + A_{Rpl} = P_{Mea} + \text{Cable Loss} + \text{Antenna Factor}$$

2. The range of evaluated frequency is from 9 kHz to 26GHz. Measurement value show only up to 6 maximum emissions noted.



### Average Measurement results

#### GFSK 2402MHz

Frequency (MHz)	Measurement Result (dBuV/m)	Cable Loss (dB)	Antenna Factor (dB/m)	Receiver Reading (dBuV)	Limit (dBuV/m)	Margin (dB)	Antenna Pol. (H/V)
17980	45.43	-25.5	46.7	24.23	54	8.57	H
14406.5	40.31	-28.6	42.5	26.41	54	13.69	V
12642	35.68	-31	39	27.78	54	18.32	V
9096.5	33.31	-33.8	38.1	28.91	54	20.69	H
7465	31.67	-34.5	36.8	29.37	54	22.33	V
2386.3	41.85	-20	28.1	33.85	54	12.15	V

#### GFSK 2440MHz

Frequency (MHz)	Measurement Result (dBuV/m)	Cable Loss (dB)	Antenna Factor (dB/m)	Receiver Reading (dBuV)	Limit (dBuV/m)	Margin (dB)	Antenna Pol. (H/V)
17968	45.5	-25.5	46.7	24.3	54	8.5	V
14389.5	40.1	-28.4	42.3	26.2	54	13.9	H
12645	35.94	-31	39	28.04	54	18.06	H
8998.5	32.96	-33.3	38.2	28.06	54	21.04	V
7934	31.78	-34.8	37.1	29.48	54	22.22	V
4824.5	27.78	-37.5	33.1	32.08	54	26.22	V

#### GFSK 2480MHz

Frequency (MHz)	Measurement Result (dBuV/m)	Cable Loss (dB)	Antenna Factor (dB/m)	Receiver Reading (dBuV)	Limit (dBuV/m)	Margin (dB)	Antenna Pol. (H/V)
17992	45.43	-25.5	46.7	24.23	54	8.57	V
14509	40.19	-28.6	42.5	26.29	54	13.81	V
12653	35.87	-30.5	39.1	27.27	54	18.13	H
8978.5	33	-33.3	38.2	28.1	54	21	V
7998	31.59	-34.8	37.1	29.29	54	22.41	V
2485.4	43.28	-20	28.3	34.98	54	10.72	H

**Peak Measurement results**
**GFSK 2402MHz**

Frequency (MHz)	Measurement Result (dBuV/m)	Cable Loss (dB)	Antenna Factor (dB/m)	Receiver Reading (dBuV)	Limit (dBuV/m)	Margin (dB)	Antenna Pol. (H/V)
17970.5	56.76	-25.5	46.7	35.56	74	17.24	H
14296	51.41	-28.4	42.3	37.51	74	22.59	V
12864	47.55	-30.7	39.1	39.05	74	26.45	V
9085	45.08	-33.8	38.1	40.68	74	28.92	V
7708.5	43.78	-34.8	37	41.68	74	30.22	V
2361.5	54.6	-20.1	28	46.6	74	19.4	V

**GFSK 2440MHz**

Frequency (MHz)	Measurement Result (dBuV/m)	Cable Loss (dB)	Antenna Factor (dB/m)	Receiver Reading (dBuV)	Limit (dBuV/m)	Margin (dB)	Antenna Pol. (H/V)
17991	56.58	-25.5	46.7	35.38	74	17.42	V
14362	51.9	-28.4	42.3	38	74	22.1	H
12454	47.71	-31.2	38.9	40.01	74	26.29	H
8974.5	45.19	-33.3	38.2	40.29	74	28.81	V
7939	43.66	-34.8	37.1	41.36	74	30.34	V
4963	39.6	-36.6	33.4	42.8	74	34.4	H

**GFSK 2480MHz**

Frequency (MHz)	Measurement Result (dBuV/m)	Cable Loss (dB)	Antenna Factor (dB/m)	Receiver Reading (dBuV)	Limit (dBuV/m)	Margin (dB)	Antenna Pol. (H/V)
17962.5	56.69	-25.5	46.7	35.49	74	17.31	V
14014.5	51.36	-29.4	41.7	39.16	74	22.64	V
12659.5	47.9	-30.5	39.1	39.3	74	26.1	H
8889	44.7	-33.5	38.1	40.1	74	29.3	V
7873.5	43.15	-34.9	37.1	40.95	74	30.85	H
2494.9	55.35	-20	28.3	47.05	74	18.65	V

**Conclusion: PASS**

## B.7. 6dB Bandwidth

### Method of Measurement:

The measurement is made according to ANSI C63.10 clause 11.8.1

1. Set RBW = 100 kHz.
2. Set the video bandwidth (VBW) = 300 kHz.
3. Detector = Peak.
4. Trace mode = max hold.
5. Sweep = auto couple.
6. Allow the trace to stabilize.
7. Measure the maximum width of the emission that is constrained by the frequencies associated with the two outermost amplitude points (upper and lower frequencies) that are attenuated by 6 dB relative to the maximum level measured in the fundamental emission.

### Measurement Limit:

Standard	Limit
FCC 47 CFR Part 15.247(a)(2)	$\geq 500\text{KHz}$

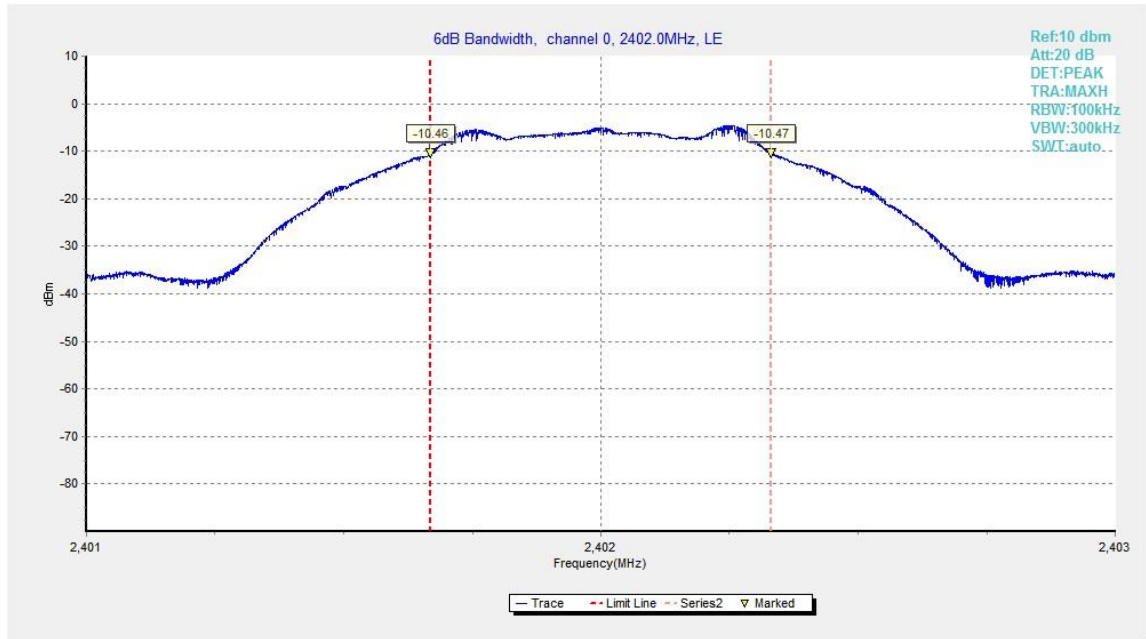
### Measurement Results:

#### For GFSK

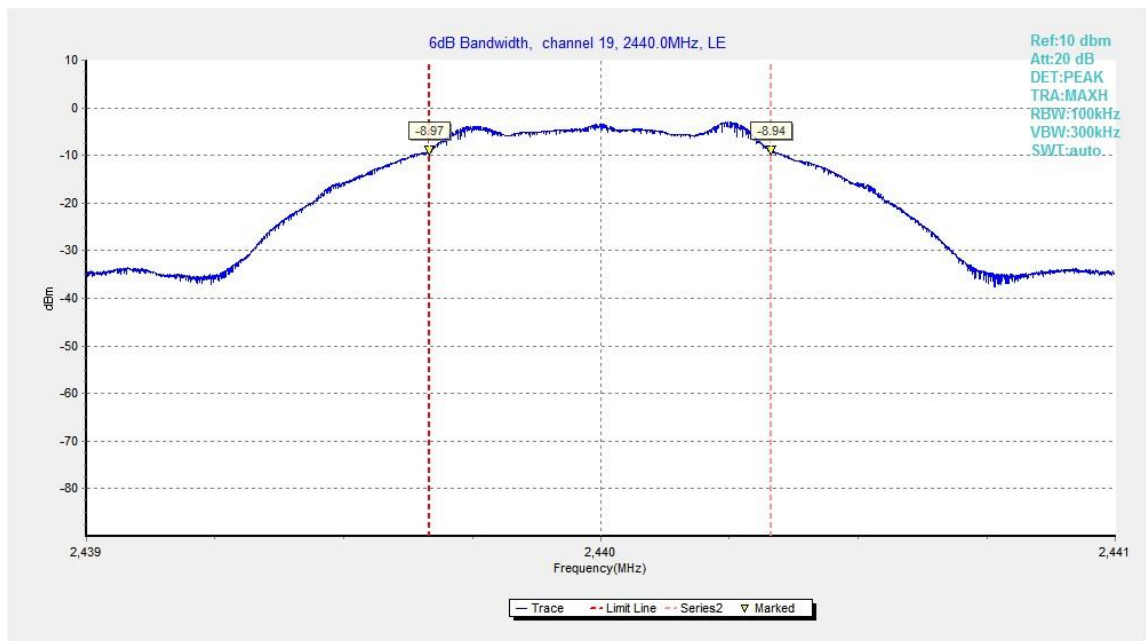
Channel No.	Frequency (MHz)	6dB Bandwidth (kHz)		Conclusion
0	2402	Fig.20	662.50	P
19	2440	Fig.21	664.50	P
39	2480	Fig.22	665.00	P

**Conclusion: PASS**

Test graphs as below:



**Fig.20.** 6dB Bandwidth: GFSK, 2402 MHz



**Fig.21.** 6dB Bandwidth: GFSK, 2440 MHz

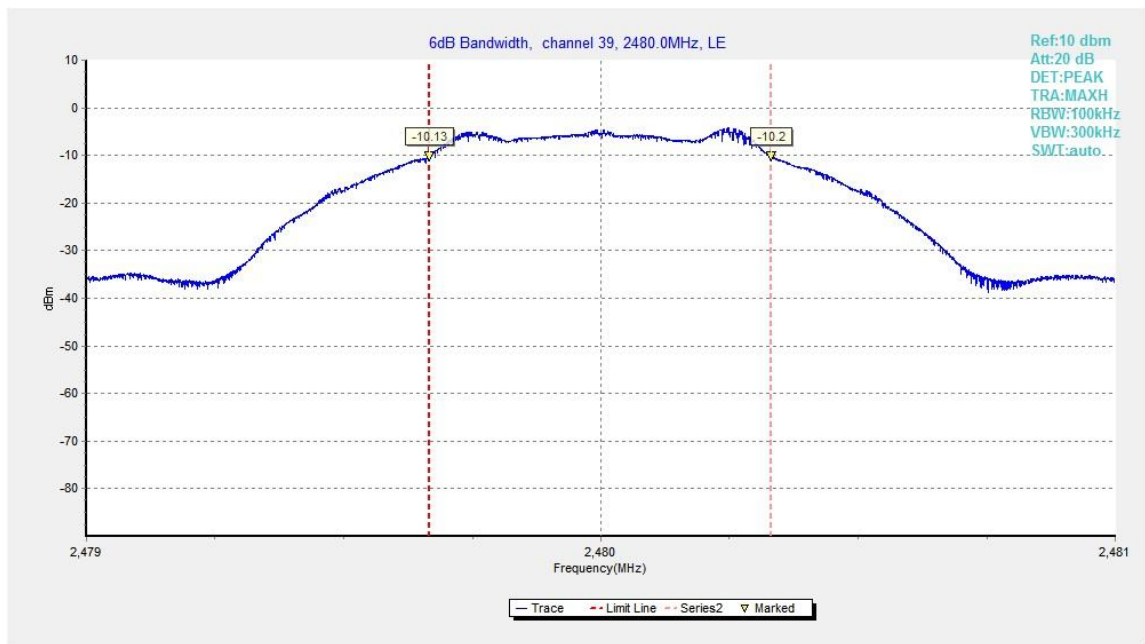


Fig.22. 6dB Bandwidth: GFSK, 2480 MHz

## B.8. Maximum Power Spectral Density Level

### Method of Measurement:

The measurement is made according to ANSI C63.10 clause 11.10.2

1. Set the RBW = 3 kHz.
2. Set the VBW = 10 kHz.
3. Set the span to 2 times the DTS bandwidth.
4. Detector = peak.
5. Sweep time = auto couple.
6. Trace mode = max hold.
7. Allow trace to fully stabilize.
8. Use the peak marker function to determine the maximum amplitude level within the RBW.

### Measurement Limit:

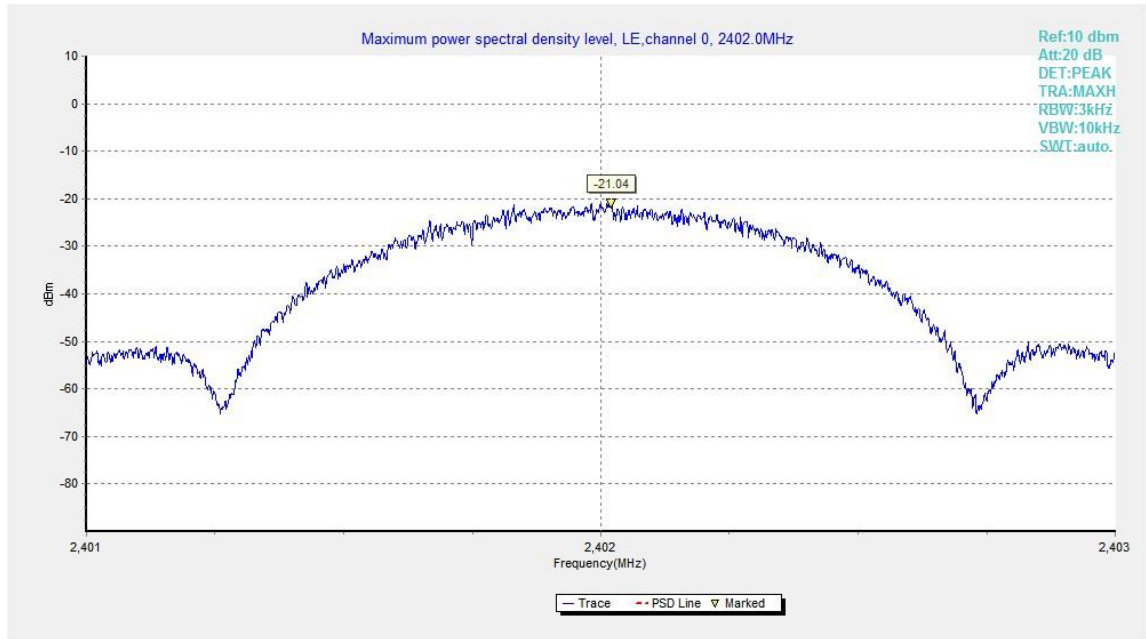
Standard	Limit
FCC 47 CFR Part 15.247(e)	$\leq 8.0\text{dBm}/3\text{kHz}$

### Measurement Results:

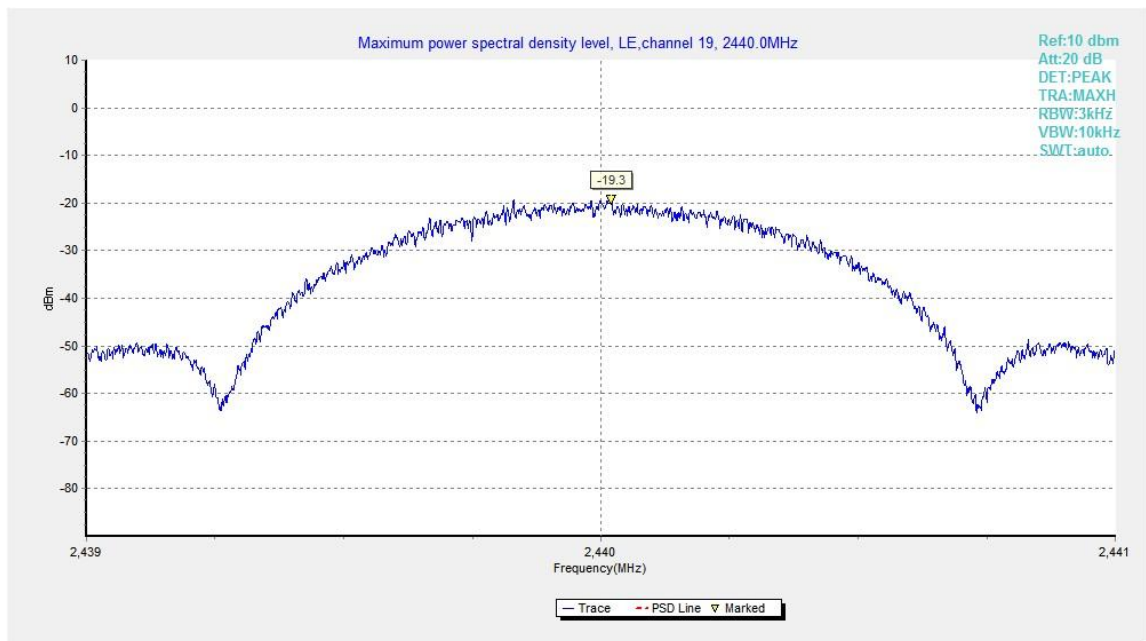
#### For GFSK

Channel No.	Frequency (MHz)	Maximum Power Spectral Density Level(dBm/3kHz)		Conclusion
		Fig.	Level	
0	2402	Fig.23	-21.04	P
19	2440	Fig.24	-19.30	P
39	2480	Fig.25	-20.46	P

Test graphs as below:



**Fig.23.** Maximum Power Spectral Density Level Function: GFSK, 2402 MHz



**Fig.24.** Maximum Power Spectral Density Level Function: GFSK, 2440 MHz

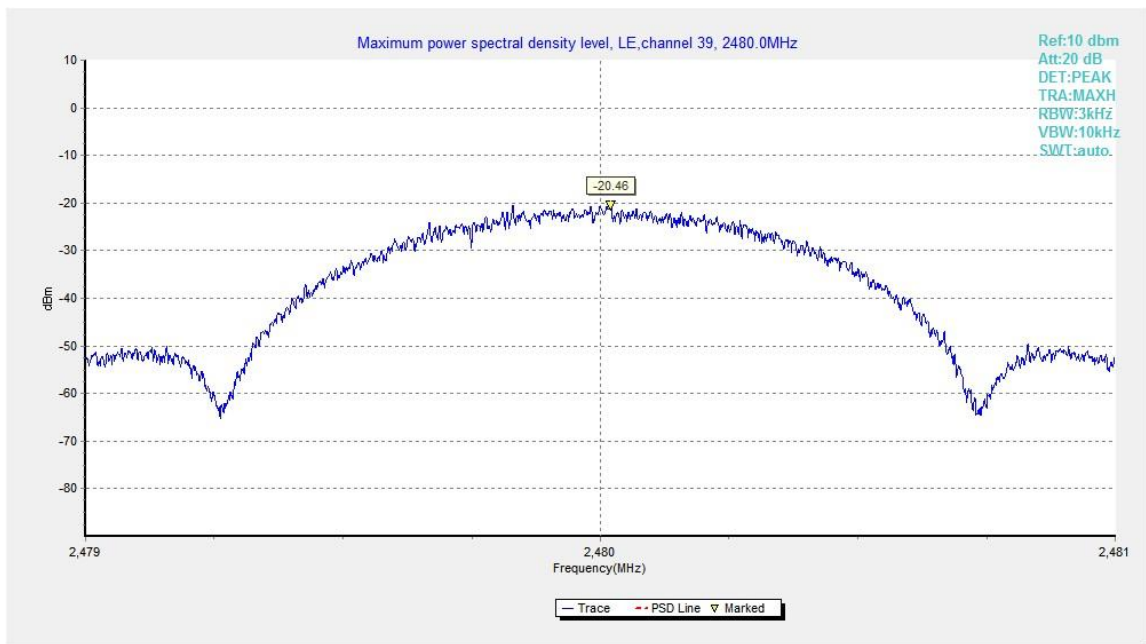


Fig.25. Maximum Power Spectral Density Level Function: GFSK, 2480 MHz



## B.9. AC Powerline Conducted Emission

### Method of Measurement:

See Clause 6.2 of ANSI C63.10-2013 specifically.

See Clause 4 and Clause 5 of ANSI C63.10-2013 generally.

The conducted emissions from the AC port of the EUT are measured in a shielding room. The EUT is connected to a Line Impedance Stabilization Network (LISN). An overview sweep with peak detection was performed. The measurements were performed with a quasi-peak detector and if required, an average detector.

The conducted emission measurements were made with the following detector of the test receiver: Quasi-Peak / Average Detector.

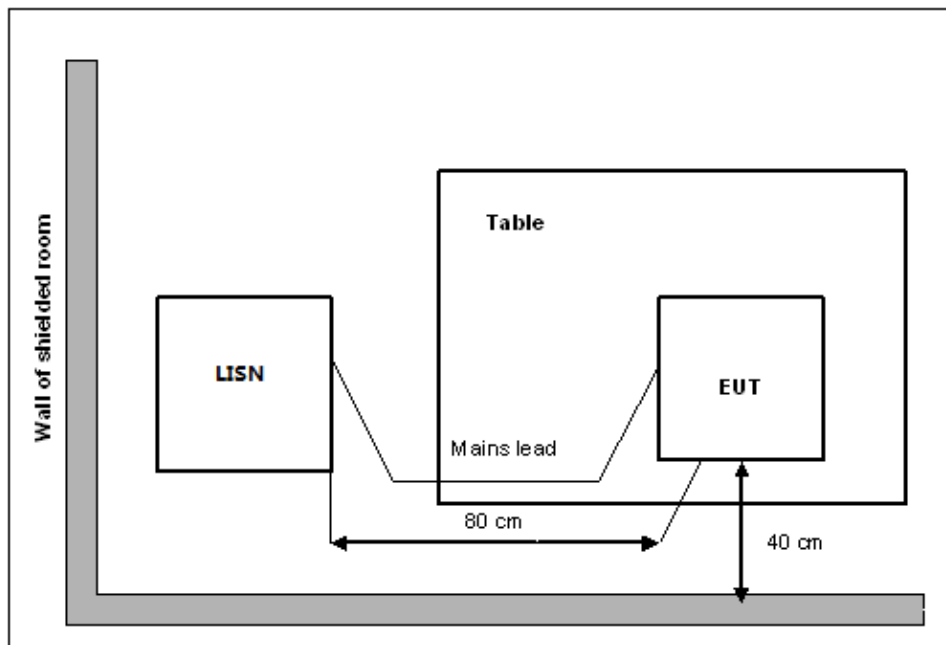
The measurement bandwidth is:

Frequency of Emission (MHz)	RBW/IF bandwidth
0.15-30	9kHz

### Test Condition:

Voltage (V)	Frequency (Hz)
120	60

### Measurement Setup



**Measurement Result and limit:**
**EUT ID: EUT1**

Bluetooth (Quasi-peak Limit)

Frequency range (MHz)	Quasi-peak Limit (dB $\mu$ V)	Result (dB $\mu$ V)		Conclusion
		With charger		
		bluetooth	Idle	
0.15 to 0.5	66 to 56	Fig.B.9.1	Fig.B.9.2	<b>P</b>
0.5 to 5	56			
5 to 30	60			

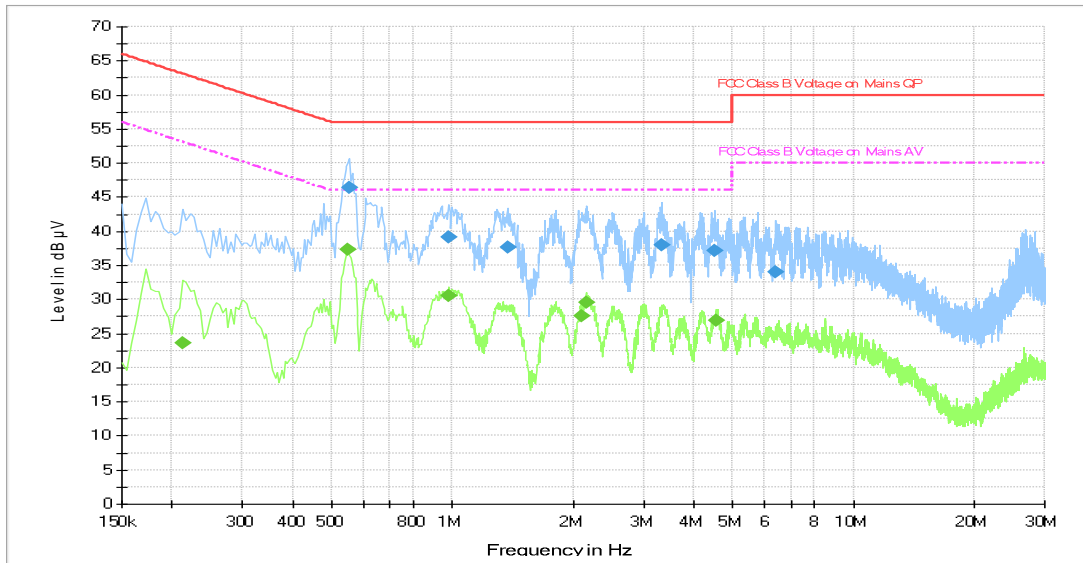
NOTE: The limit decreases linearly with the logarithm of the frequency in the range 0.15 MHz to 0.5 MHz.

Bluetooth (Average Limit)

Frequency range (MHz)	Average Limit (dB $\mu$ V)	Result (dB $\mu$ V)		Conclusion
		With charger		
		bluetooth	Idle	
0.15 to 0.5	56 to 46	Fig.B.9.1	Fig.B.9.2	<b>P</b>
0.5 to 5	46			
5 to 30	50			

NOTE: The limit decreases linearly with the logarithm of the frequency in the range 0.15 MHz to 0.5 MHz.

**Conclusion: Pass**
**Test graphs as below:**



**Fig.B.9.1 AC Powerline Conducted Emission- bluetooth**

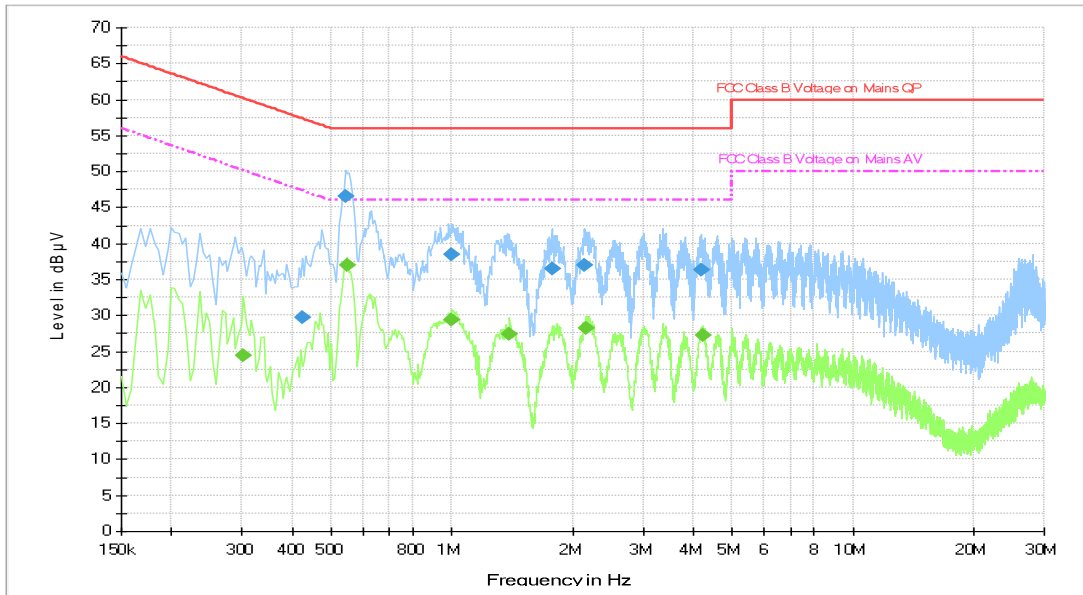
Note: The graphic result above is the maximum of the measurements for both phase line and neutral line.

**Final Result 1**

Frequency (MHz)	QuasiPeak (dBµV)	Meas. Time (ms)	Bandwidth (kHz)	Line	Corr. (dB)	Margin (dB)	Limit (dBµV)
0.555000	46.4	1000.	9.000	L1	19.9	9.6	56.0
0.982500	39.1	1000.	9.000	L1	19.6	16.9	56.0
1.374000	37.6	1000.	9.000	L1	19.5	18.4	56.0
3.336000	38.0	1000.	9.000	L1	19.5	18.0	56.0
4.528500	37.2	1000.	9.000	L1	19.5	18.8	56.0
6.418500	34.0	1000.	9.000	L1	19.5	26.0	60.0

**Final Result 2**

Frequency (MHz)	Average (dBµV)	Meas. Time (ms)	Bandwidth (kHz)	Line	Corr. (dB)	Margin (dB)	Limit (dBµV)
0.213000	23.6	1000.0	9.000	N	19.8	29.5	53.1
0.550500	37.4	1000.0	9.000	N	19.9	8.6	46.0
0.982500	30.6	1000.0	9.000	N	19.8	15.4	46.0
2.103000	27.6	1000.0	9.000	L1	19.5	18.4	46.0
2.152500	29.5	1000.0	9.000	L1	19.5	16.5	46.0
4.537500	26.8	1000.0	9.000	N	19.7	19.2	46.0



**Fig.B.9.2 AC Powerline Conducted Emission-Idle**

Note: The graphic result above is the maximum of the measurements for both phase line and neutral line.

**Final Result 1**


Frequency (MHz)	QuasiPeak (dBµV)	Meas. Time (ms)	Bandwidth (kHz)	Line	Corr. (dB)	Margin (dB)	Limit (dBµV)
0.424500	29.6	1000.	9.000	N	19.9	27.7	57.4
0.541500	46.5	1000.	9.000	L1	19.9	9.5	56.0
1.000500	38.5	1000.	9.000	L1	19.6	17.5	56.0
1.774500	36.5	1000.	9.000	L1	19.5	19.5	56.0
2.139000	36.9	1000.	9.000	L1	19.5	19.1	56.0
4.173000	36.3	1000.	9.000	L1	19.6	19.7	56.0

**Final Result 2**

Frequency (MHz)	Average (dBµV)	Meas. Time (ms)	Bandwidth (kHz)	Line	Corr. (dB)	Margin (dB)	Limit (dBµV)
0.303000	24.4	1000.0	9.000	N	19.9	25.8	50.2
0.550500	37.0	1000.0	9.000	N	19.9	9.0	46.0
1.000500	29.4	1000.0	9.000	L1	19.6	16.6	46.0
1.392000	27.4	1000.0	9.000	L1	19.5	18.6	46.0
2.166000	28.2	1000.0	9.000	L1	19.5	17.8	46.0
4.218000	27.2	1000.0	9.000	N	19.7	18.8	46.0

## ANNEX C: Accreditation Certificate

United States Department of Commerce  
National Institute of Standards and Technology

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**Certificate of Accreditation to ISO/IEC 17025:2017**

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NVLAP LAB CODE: 600118-0


**Telecommunication Technology Labs, CAICT**  
Beijing  
China

*is accredited by the National Voluntary Laboratory Accreditation Program for specific services,  
listed on the Scope of Accreditation, for:*

**Electromagnetic Compatibility & Telecommunications**

*This laboratory is accredited in accordance with the recognized International Standard ISO/IEC 17025:2017.  
This accreditation demonstrates technical competence for a defined scope and the operation of a laboratory quality  
management system (refer to joint ISO-ILAC-IAF Communique dated January 2009).*

2021-09-29 through 2022-09-30  
*Effective Dates*



  
*For the National Voluntary Laboratory Accreditation Program*

\*\*\*END OF REPORT\*\*\*