



# FCC PART 15C TEST REPORT

## BLUETOOTH LOW ENERGY (BLE) PART

No. I22Z70093-IOT02

for

**Samsung Electronics Co., Ltd.**

**Multi-band GSM/WCDMA/LTE phone with Bluetooth, WLAN**

**Model Name: SM-A045F/DS, SM-A045F**

**FCC ID: ZCASMA045F**

with

**Hardware Version: REV1.0**

**Software Version: A045F.001**

**Issued Date: 2022-6-27**

**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**

No.52, HuayuanNorth Road, Haidian District, Beijing, P. R. China 100191.

Tel:+86(0)10-62304633-2512,Fax:+86(0)10-62304633-2504

Email:[cttl\\_terminals@caict.ac.cn](mailto:cttl_terminals@caict.ac.cn), website: [www.chinattl.com](http://www.chinattl.com)



## **REPORT HISTORY**

<b>Report Number</b>	<b>Revision</b>	<b>Description</b>	<b>Issue Date</b>
I22Z70093-IOT02	Rev.0	1st edition	2022-6-27

## **CONTENTS**

<b>1. TEST LABORATORY .....</b>	<b>5</b>
1.1. INTRODUCTION & ACCREDITATION .....	5
1.2. TESTING LOCATION .....	5
1.3. TESTING ENVIRONMENT .....	6
1.4. PROJECT DATA .....	6
1.5. SIGNATURE .....	6
<b>2. CLIENT INFORMATION .....</b>	<b>7</b>
2.1. APPLICANT INFORMATION .....	7
2.2. MANUFACTURER INFORMATION .....	7
<b>3. EQUIPMENT UNDER TEST (EUT) AND ANCILLARY EQUIPMENT (AE) .....</b>	<b>8</b>
3.1. ABOUT EUT .....	8
3.2. INTERNAL IDENTIFICATION OF EUT .....	8
3.3. INTERNAL IDENTIFICATION OF AE .....	8
3.4. NORMAL ACCESSORY SETTING .....	9
3.5. GENERAL DESCRIPTION .....	9
<b>4. REFERENCE DOCUMENTS .....</b>	<b>10</b>
4.1. DOCUMENTS SUPPLIED BY APPLICANT .....	10
4.2. REFERENCE DOCUMENTS FOR TESTING .....	10
<b>5. TEST RESULTS .....</b>	<b>11</b>
5.1. SUMMARY OF EUT MODE .....	11
5.2. SUMMARY OF TEST RESULTS .....	11
5.3. STATEMENTS .....	11
<b>6. TEST FACILITIES UTILIZED .....</b>	<b>12</b>
<b>7. MEASUREMENT UNCERTAINTY .....</b>	<b>13</b>
7.1. PEAK OUTPUT POWER - CONDUCTED .....	13
7.2. FREQUENCY BAND EDGES - CONDUCTED .....	13
7.3. FREQUENCY BAND EDGES - RADIATED .....	13
7.4. TRANSMITTER SPURIOUS EMISSION - CONDUCTED .....	13
7.5. TRANSMITTER SPURIOUS EMISSION - RADIATED .....	13
7.6. 6dB BANDWIDTH .....	13
7.7. MAXIMUM POWER SPECTRAL DENSITY LEVEL .....	14
7.8. AC POWERLINE CONDUCTED EMISSION .....	14
<b>ANNEX A: EUT PARAMETERS .....</b>	<b>15</b>
<b>ANNEX B: DETAILED TEST RESULTS .....</b>	<b>16</b>
B.1. MEASUREMENT METHOD .....	16
B.2. PEAK OUTPUT POWER .....	17



B.3. FREQUENCY BAND EDGES - CONDUCTED ..... 18

B.4. FREQUENCY BAND EDGES –RADIATED ..... 20

B.5. TRANSMITTER SPURIOUS EMISSION - CONDUCTED ..... 22

B.6. TRANSMITTER SPURIOUS EMISSION - RADIATED ..... 31

B.7. 6dB BANDWIDTH ..... 34

B.8. MAXIMUM POWER SPECTRAL DENSITY LEVEL ..... 37

B.9. AC POWERLINE CONDUCTED EMISSION ..... 40

**ANNEX C: ACCREDITATION CERTIFICATE ..... 44**



## **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. China 100191

Radiated testing Location: CTTL (BDA)

Address: No. 18A, Kangding Street, Beijing Economic-Technology  
Development Area, Beijing, 100176, P.R. China

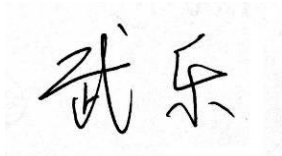
### 1.3. Testing Environment

Normal Temperature: 20-27°C  
Relative Humidity: 20-50%

### 1.4. Project data

Testing Start Date: 2022-4-11  
Testing End Date: 2022-6-27

### 1.5. Signature



---

**Wu Le**  
**(Prepared this test report)**



---

**Sun Zhenyu**  
**(Reviewed this test report)**



---

**Hu Xiaoyu**  
**(Approved this test report)**



## **2. Client Information**

### **2.1. Applicant Information**

Company Name: Samsung Electronics Co., Ltd.  
Address: 19 Chapin Rd., Building D Pine Brook, NJ 07058  
Contact: Jenni Chun  
Email: j1.chun@samsung.com  
Tel: +1-201-937-4203

### **2.2. Manufacturer Information**

Company Name: Samsung Electronics Co., Ltd.  
Address: Samsung R5, Maetan dong 129, Samsung ro  
Youngtong gu, Suwon city 443 742, Korea  
Contact: Sunghoon Cho  
Email: ggobi.cho@samsung.com  
Tel: +82-10-2722-4159

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

#### 3.1. About EUT

Description	Multi-band GSM/WCDMA/LTE phone with Bluetooth, WLAN
Model Name	SM-A045F/DS, SM-A045F
FCC ID	ZCASMA045F
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	-1.63dBi

#### 3.2. Internal Identification of EUT

EUT ID*	SN or IMEI	HW Version	SW Version	Date of receipt
UT17a(SM-A045F/DS)	I22Z70093UT17a	REV1.0	A045F.001	2022-05-26
UT05a(SM-A045F/DS)	I22Z70093UT05a	REV1.0	A045F.001	2022-04-11

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

#### 3.3. Internal Identification of AE

AE ID*	Description	Remark
AE1	Adapter1	/
AE2	Adapter2	/
AE3	Adapter3	/
AE4	Data Cable1	/
AE5	Data Cable2	/
AE6	Headset1	/
AE7	Headset2	/
AE8	Battery	/
AE1		
Model		EP-TA200JWE
Manufacturer		HAEM Co.,Ltd
Length of cable		/
AE2		
Model		EP-TA200JWE
Manufacturer		SoluM Co.,Ltd.
Length of cable		/
AE3		
Model		EP-TA200JWE



Manufacturer	RFTECH Co., Ltd.
Length of cable	/
AE4	
Model	EP-DR140AWE
Manufacturer	DONGGUAN KSD CO.,LTD
Length of cable	/
AE5	
Model	EP-DR140AWE
Manufacturer	CRESYN HANOI Co., Ltd
Length of cable	/
AE6	
Model	EHS61ASFWE
Manufacturer	DONGGUAN YOUNGBO ELECTRONICS CO.,LTD
Length of cable	/
AE7	
Model	EHS61ASFWE
Manufacturer	Shenzhen Grandsound Electronics Co.,Ltd
Length of cable	/
AE8	
Model	/
Manufacturer	/
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 Multi-band GSM/WCDMA/LTE phone with Bluetooth, WLAN 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

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>P</b>
Frequency Band Edges- Radiated	15.247, 15.205, 15.209	<b>P</b>
Transmitter Spurious Emission - Conducted	15.247 (d)	<b>P</b>
Transmitter Spurious Emission - Radiated	15.247, 15.205, 15.209	<b>P</b>
6dB Bandwidth	15.247 (a)(2)	<b>P</b>
Maximum Power Spectral Density Level	15.247(e)	<b>P</b>
AC Powerline Conducted Emission	15.107, 15.207	<b>P</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

The SM-A045F/DS with Dual SIM mode is a new product for this testing. The SM-A045F with single SIM mode is a variant product of SM-A045F/DS and shares the SM-A045F/DS results.

## 6. Test Facilities Utilized

### Conducted test system

No.	Equipment	Model	Serial Number	Manufacturer	Calibration Period	Calibration Due date
1	Vector Signal Analyzer	FSQ26	100024	R&S	1 year	2023-03-23
2	LISN	ENV216	101459	R&S	1 year	2023-03-26
3	Test Receiver	ESCI	100766	R&S	1 year	2023-03-02
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	100376	R&S	1 year	2022-09-15
2	Test Receiver	ESW44	103015	R&S	1 year	2022-09-02
3	EMI Antenna	VULB9163	01176	Schwarzbeck	1 year	2022-11-15
4	EMI Antenna	3117	00139065	ETS-Lindgren	1 year	2022-09-13
5	EMI Antenna	LB-180400 -25-C-KF	J211060826	A-INFO	1 year	2023-02-27
6	EMI Antenna	3115	00146404	ETS-Lindgren	1 year	2023-02-23
7	Loop Antenna	HFH2-Z2	829324/007	R&S	1 year	2022-12-22

## 7. Measurement Uncertainty

### 7.1. Peak Output Power - Conducted

Measurement Uncertainty:

Measurement Uncertainty (k=2)	0.66dB
-------------------------------	--------

### 7.2. Frequency Band Edges - Conducted

Measurement Uncertainty:

Measurement Uncertainty (k=2)	0.66dB
-------------------------------	--------

### 7.3. Frequency Band Edges - Radiated

Measurement Uncertainty:

Measurement Uncertainty (k=2)	/
-------------------------------	---

### 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	/
$30\text{MHz} \leq f \leq 1\text{GHz}$	5.73
$1\text{GHz} \leq f \leq 18\text{GHz}$	5.58
$18\text{GHz} \leq f \leq 40\text{GHz}$	3.37

### 7.6. 6dB Bandwidth

Measurement Uncertainty:

Measurement Uncertainty (k=2)	61.936Hz
-------------------------------	----------



### 7.7. Maximum Power Spectral Density Level

**Measurement Uncertainty:**

Measurement Uncertainty (k=2)	0.66dB
-------------------------------	--------

### 7.8. AC Powerline Conducted Emission

**Measurement Uncertainty:**

Measurement Uncertainty (k=2)	3.10dB
-------------------------------	--------



## **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.

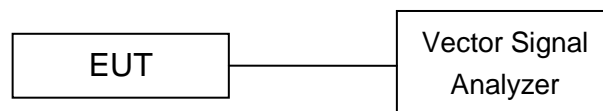
## **ANNEX B: Detailed Test Results**

### **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**

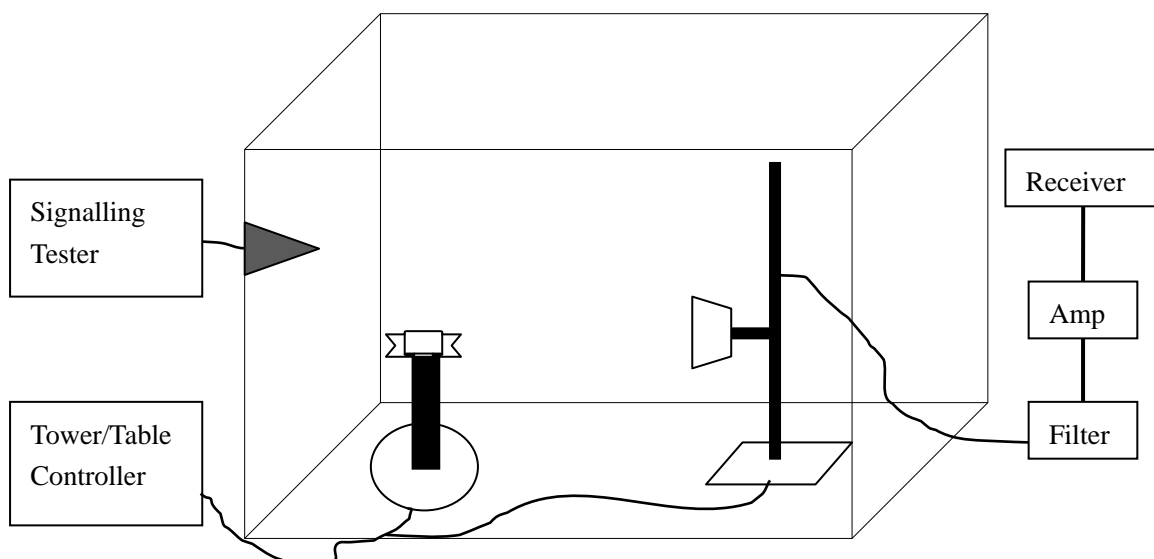
The measurement is made according to ANSI C63.10.

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. This maximization process was repeated with the EUT positioned in each of its three orthogonal orientations.

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 = 3MHz;





## 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

#### Measurement Results:

##### For GFSK

Sample Rate	Channel No.	Frequency (MHz)	Peak Conducted Output Power (dBm)	Conclusion
1Mbps	0	2402	1.08	P
	19	2440	2.72	P
	39	2480	1.00	P
2Mbps	0	2402	0.76	P
	19	2440	2.37	P
	39	2480	0.98	P

**Conclusion: PASS**

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

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

Antenna gain = -1.63dBi

##### For GFSK

Sample Rate	Channel No.	Frequency (MHz)	E.I.R.P. (dBm)	Conclusion
1Mbps	0	2402	-0.55	P
	19	2440	1.09	P
	39	2480	-0.63	P
2Mbps	0	2402	-0.87	P
	19	2440	0.74	P
	39	2480	-0.65	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

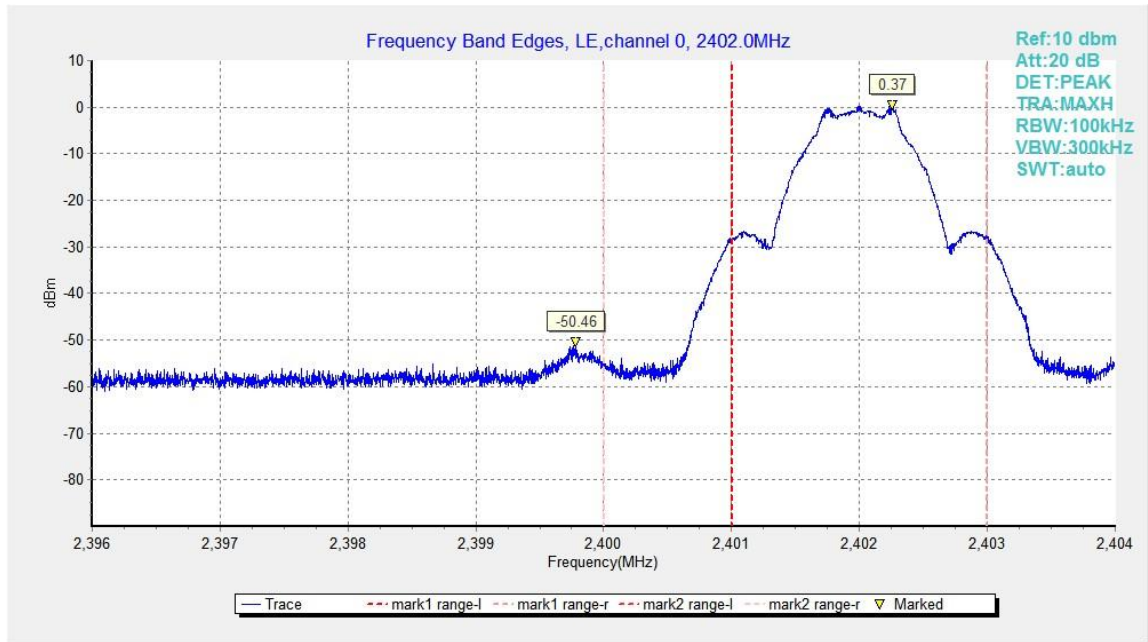
**Measurement Result:**

**For GFSK**

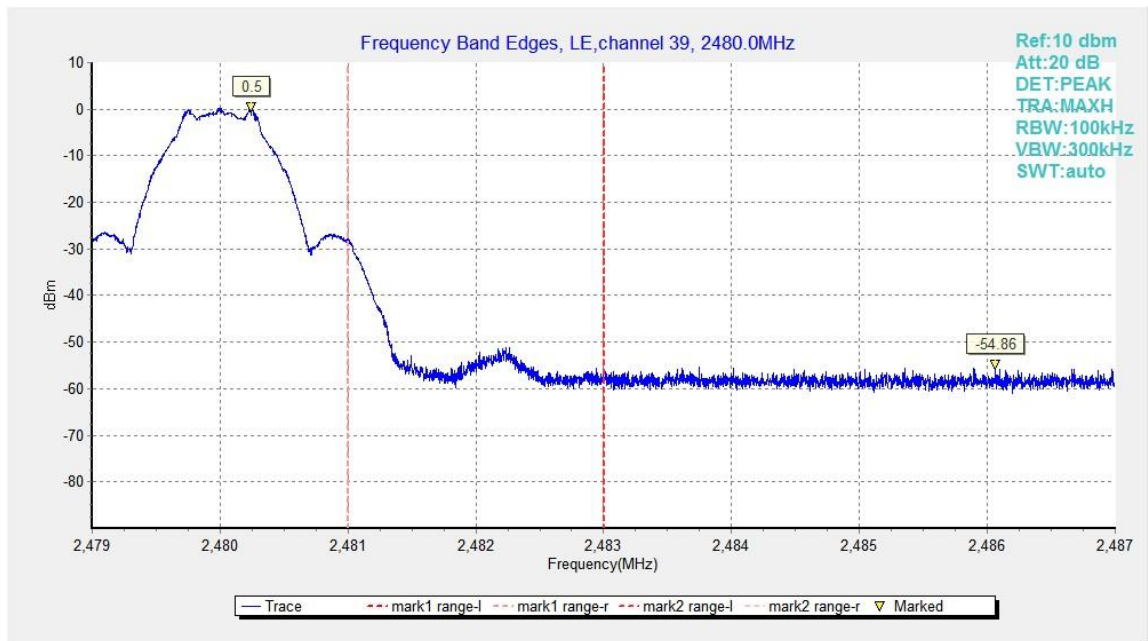
Channel No.	Frequency (MHz)	Hopping	Band Edge Power ( dBc)		Conclusion
0	2402	Hopping OFF	Fig.1	-50.83	P
39	2480	Hopping OFF	Fig.2	-55.36	P

**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 of emission (MHz)	Field strength (uV/m)	Field strength (dBuV/m)	Measurement distance (m)
Above 960	500	54	3

**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.

**Measurement Results:**

**EUT ID: UT17a**

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

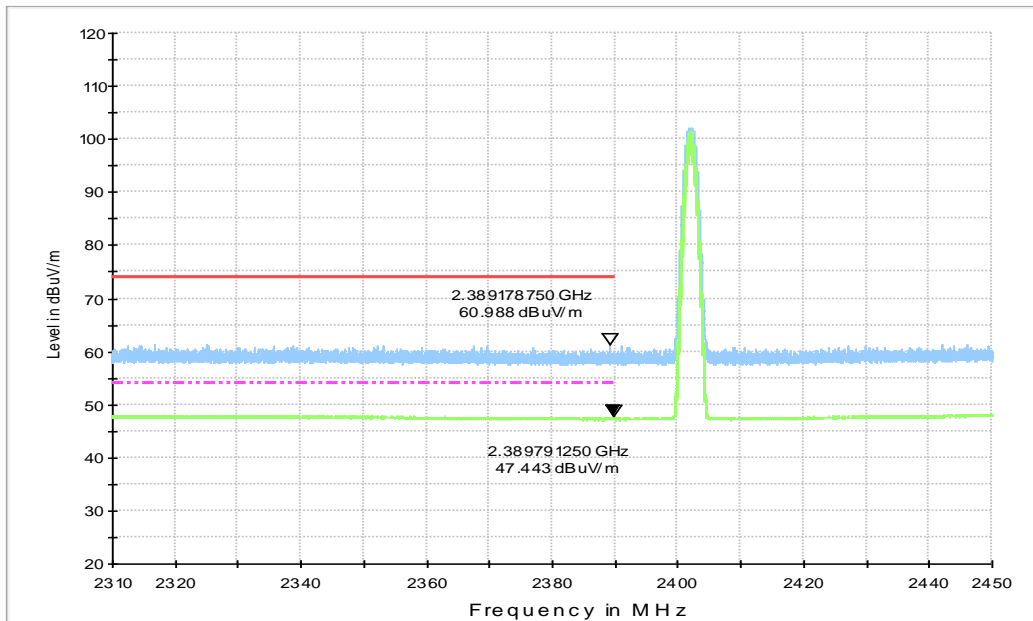


Fig.3. Frequency Band Edges: GFSK, 2402 MHz, 2.31 GHz – 2.45GHz

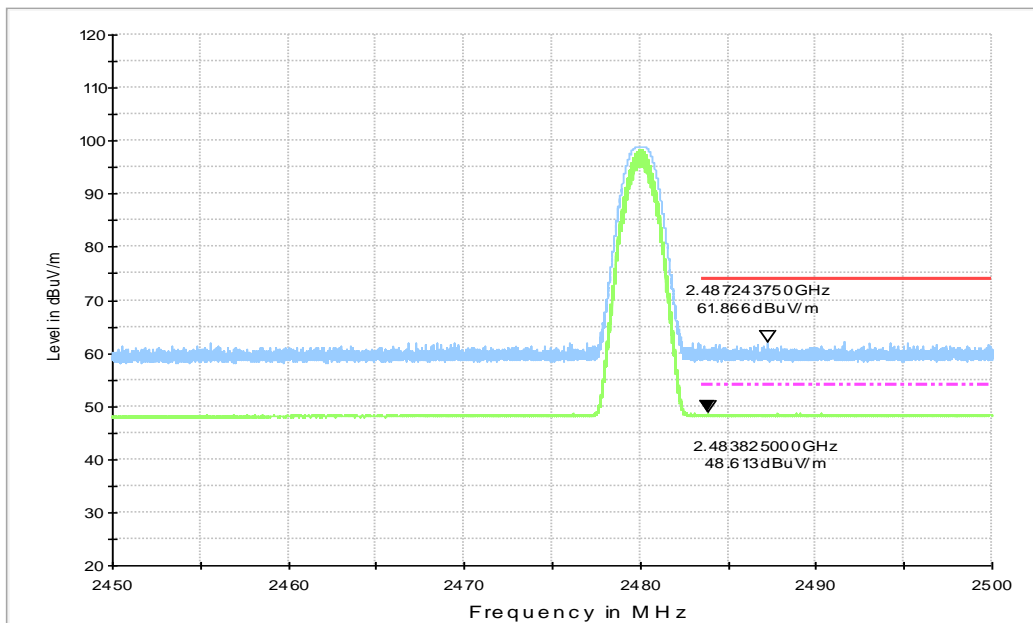


Fig.4. Frequency Band Edges: GFSK, 2480 MHz, 2.45 GHz - 2.50GHz

## 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:

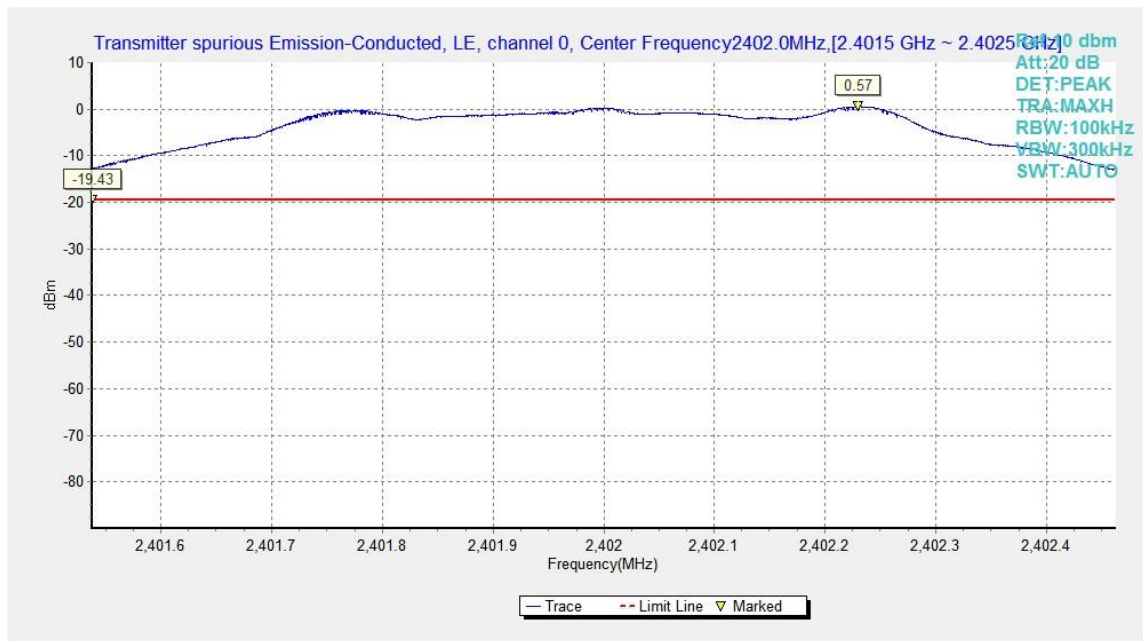
Standard	Limit
FCC 47 CFR Part 15.247 (d)	20dB below peak output power in 100 kHz bandwidth

**Measurement Results:  
For GFSK**

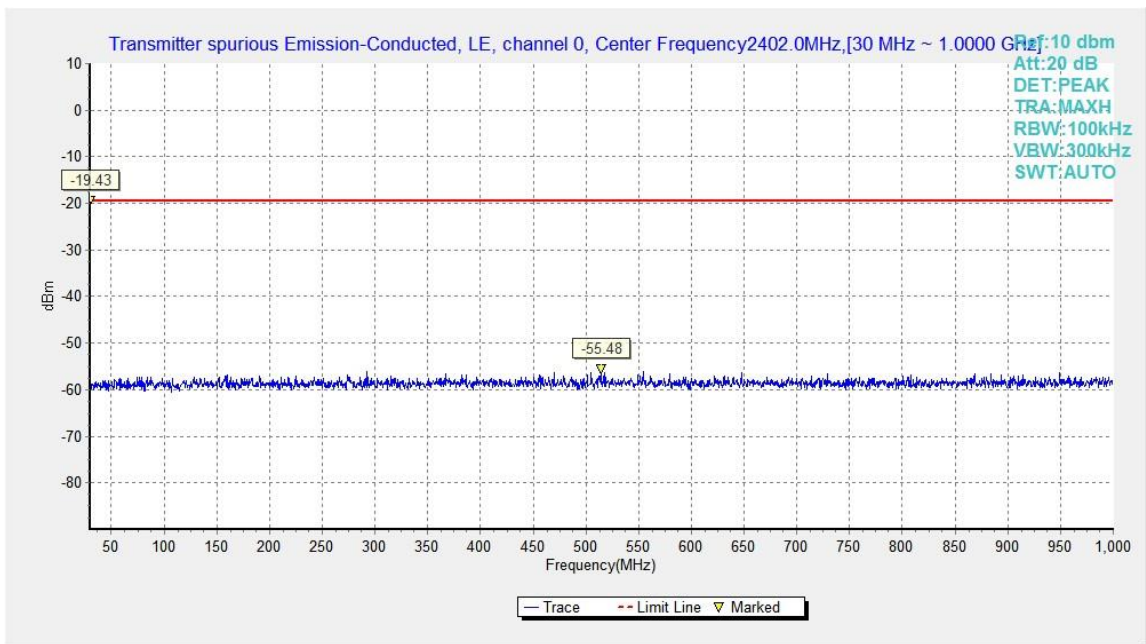
Channel No.	Frequency (MHz)	Frequency Range	Test Results	Conclusion
0	2402	Center Frequency	Fig.5	P
		30 MHz ~ 1 GHz	Fig.6	P
		1 GHz ~ 3 GHz	Fig.7	P
		3 GHz ~ 10 GHz	Fig.8	P
		10GHz ~ 26 GHz	Fig.9	P
19	2440	Center Frequency	Fig.10	P
		30 MHz ~ 1 GHz	Fig.11	P
		1 GHz ~ 3 GHz	Fig.12	P
		3 GHz ~ 10 GHz	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**

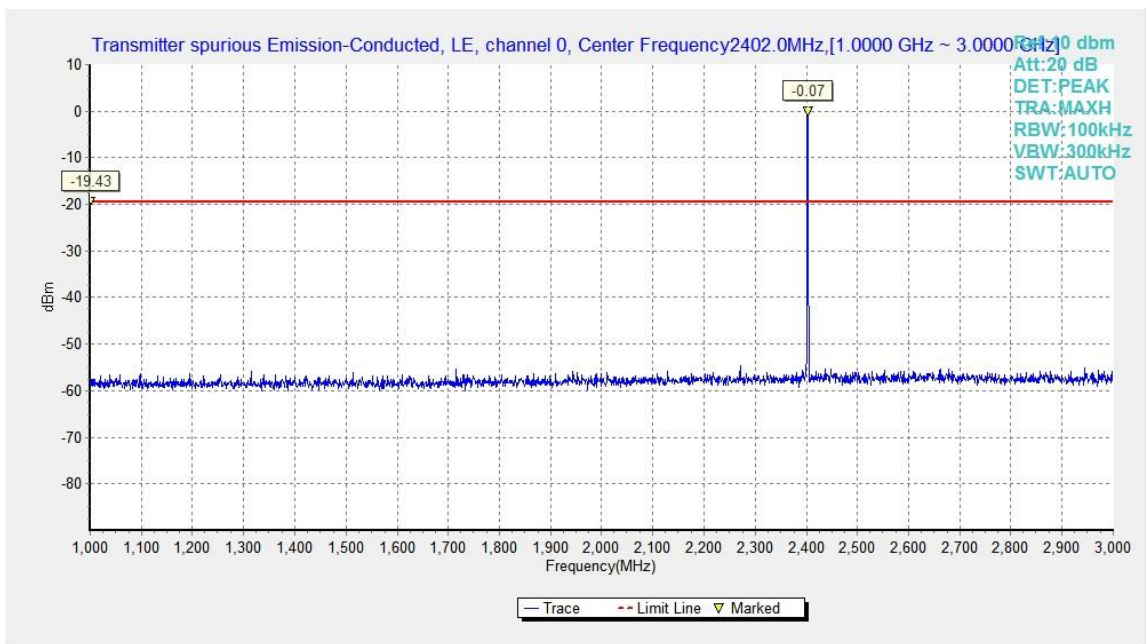
**Test graphs as below**



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

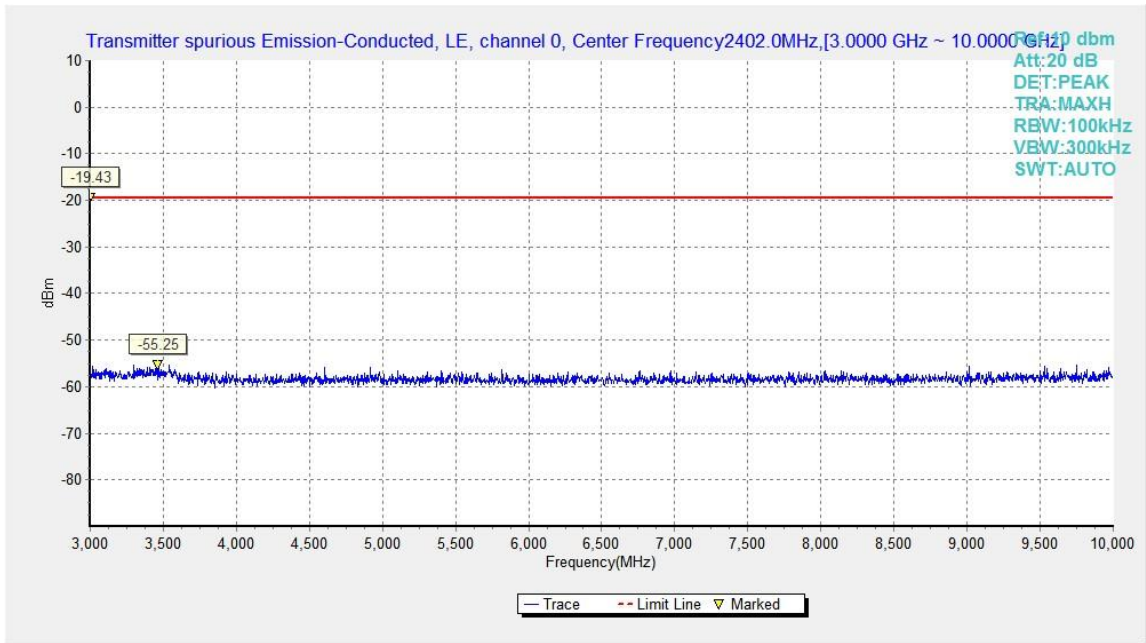


**Fig.6.** Transmitter Spurious Emission - Conducted: GFSK, 2402 MHz, 30MHz - 1GHz

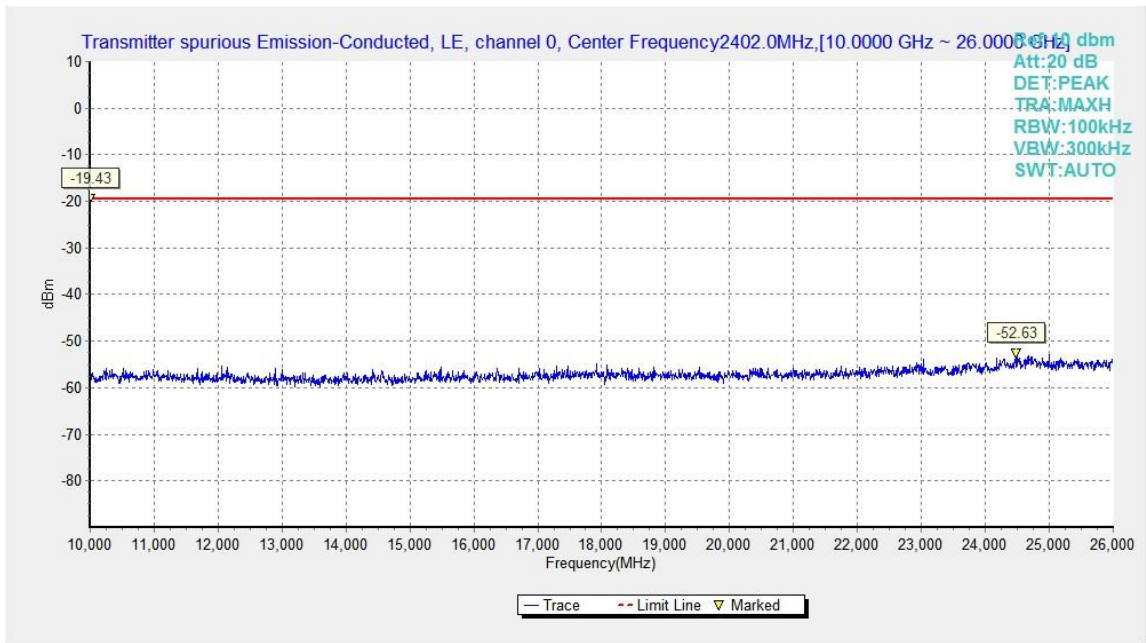


**Fig.7.** Transmitter Spurious Emission - Conducted: GFSK, 2402 MHz, 1GHz - 3GHz

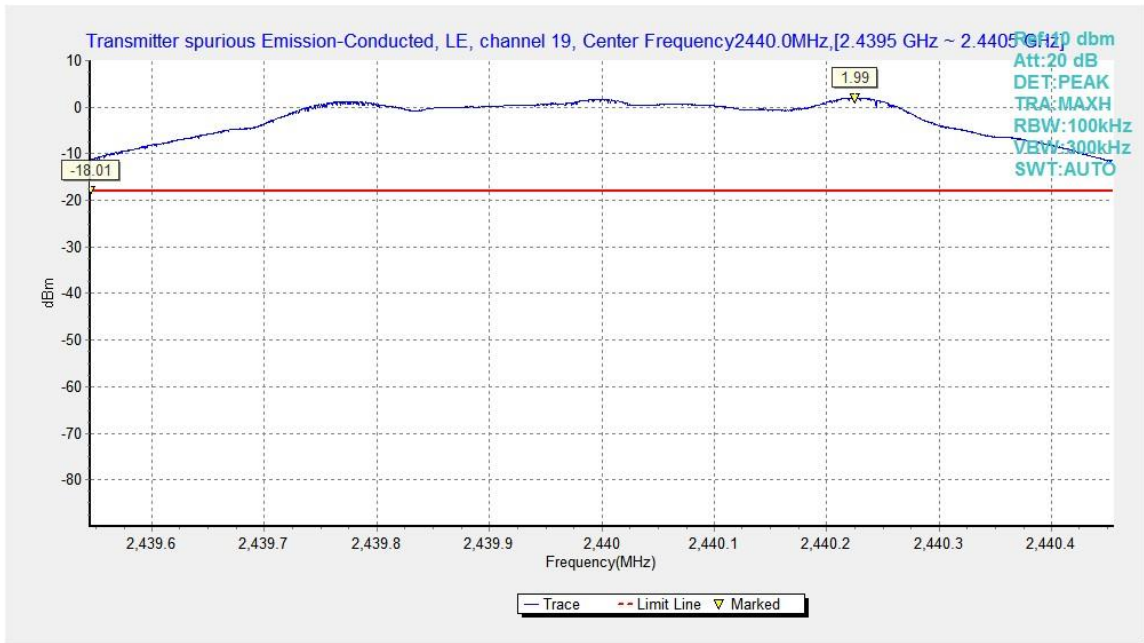




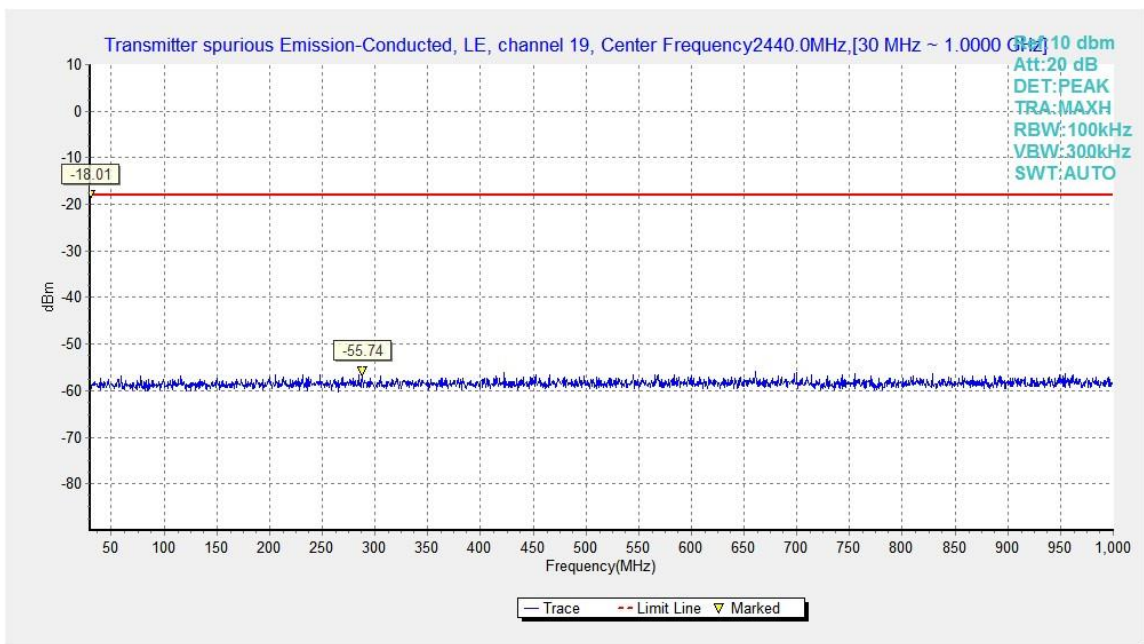
**Fig.8.** Transmitter Spurious Emission - Conducted: GFSK, 2402 MHz, 3GHz - 10GHz



**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

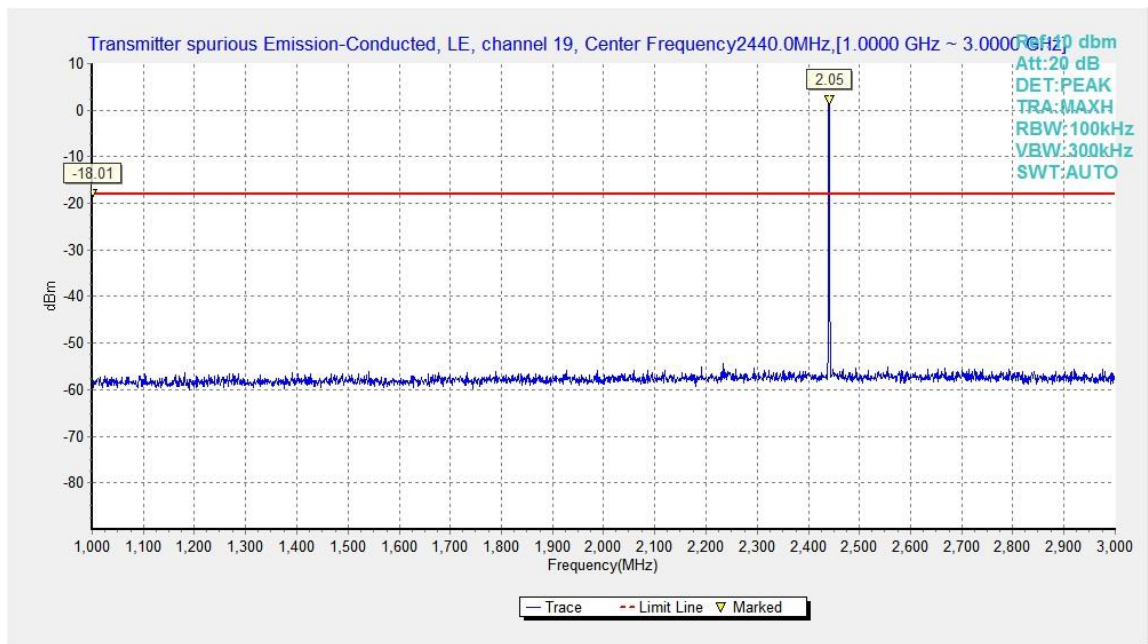


Fig.12. Transmitter Spurious Emission - Conducted: GFSK, 2440 MHz, 1GHz – 3GHz

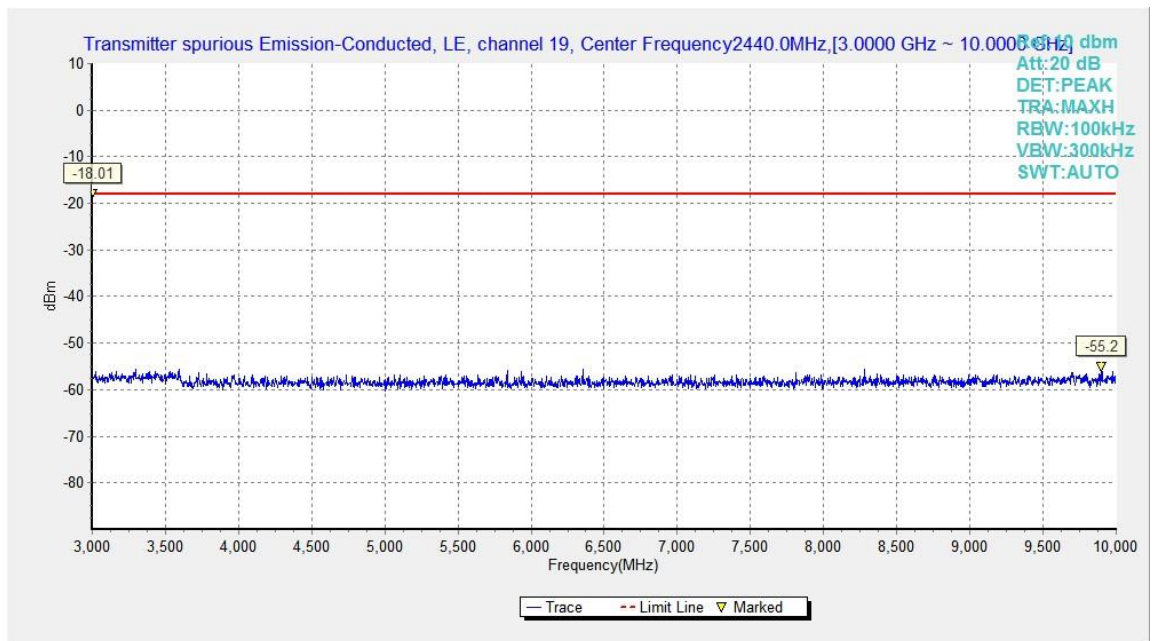
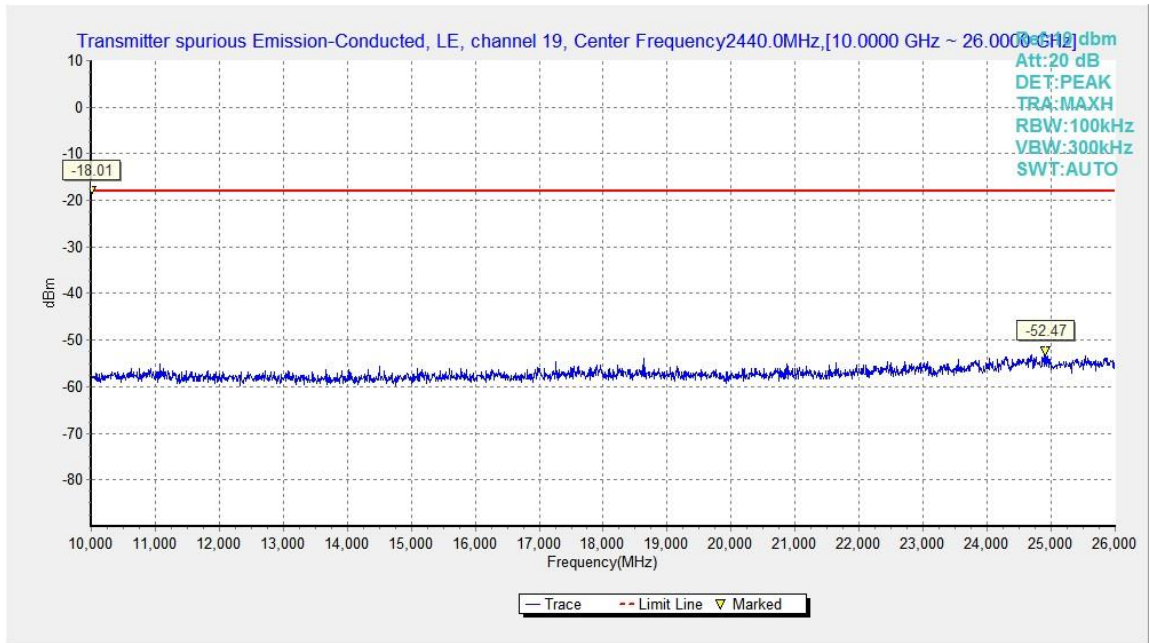
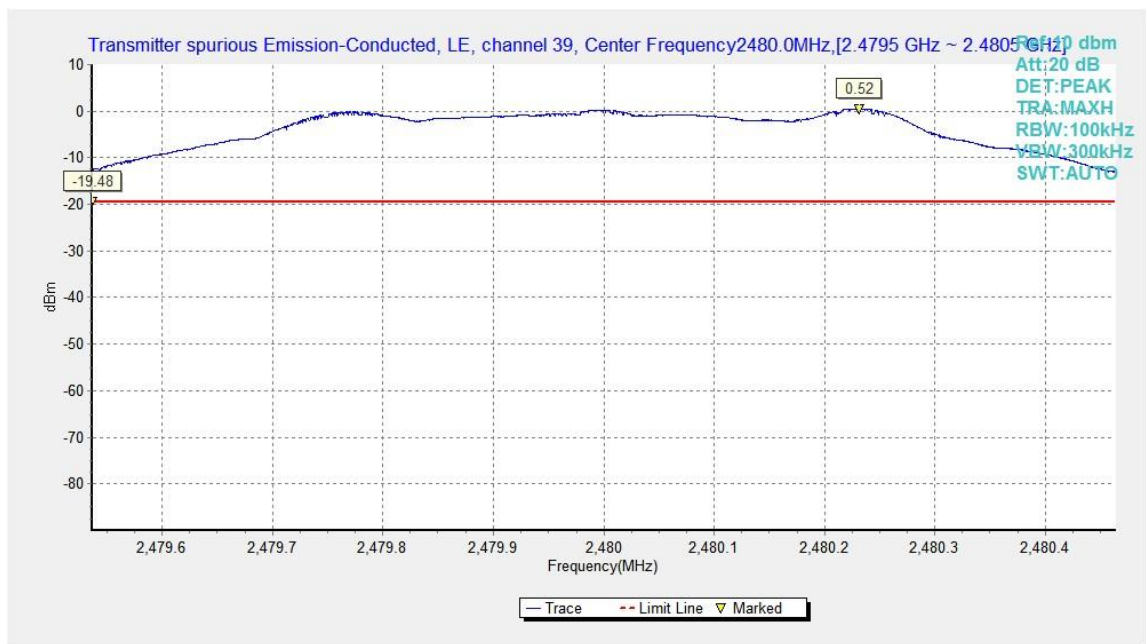


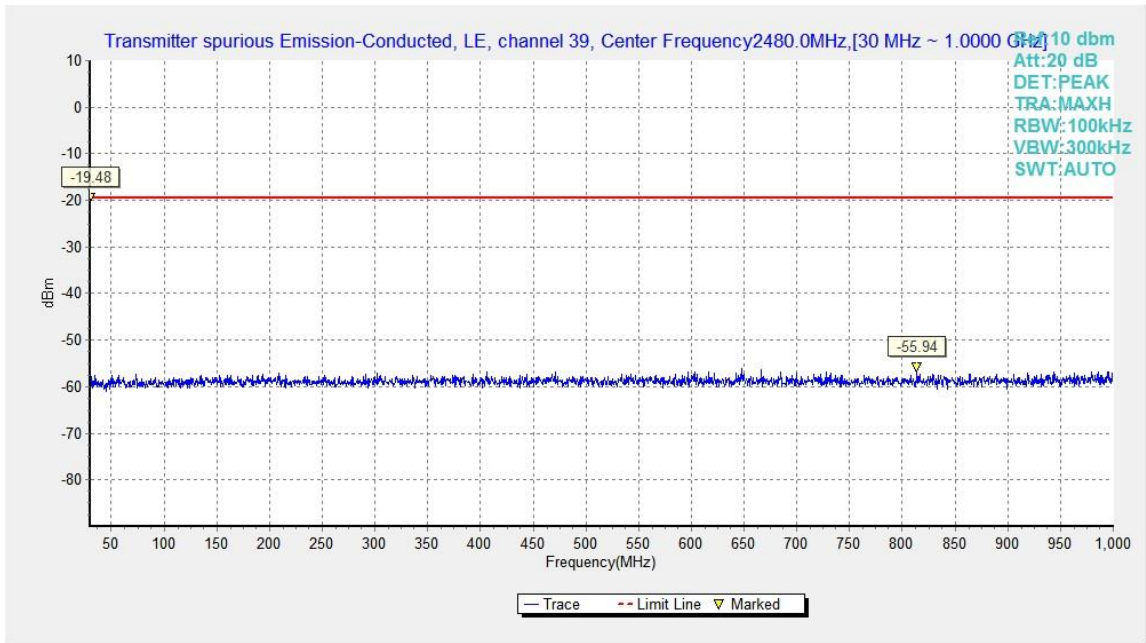
Fig.13. Transmitter Spurious Emission - Conducted: GFSK, 2440 MHz, 3GHz – 10GHz



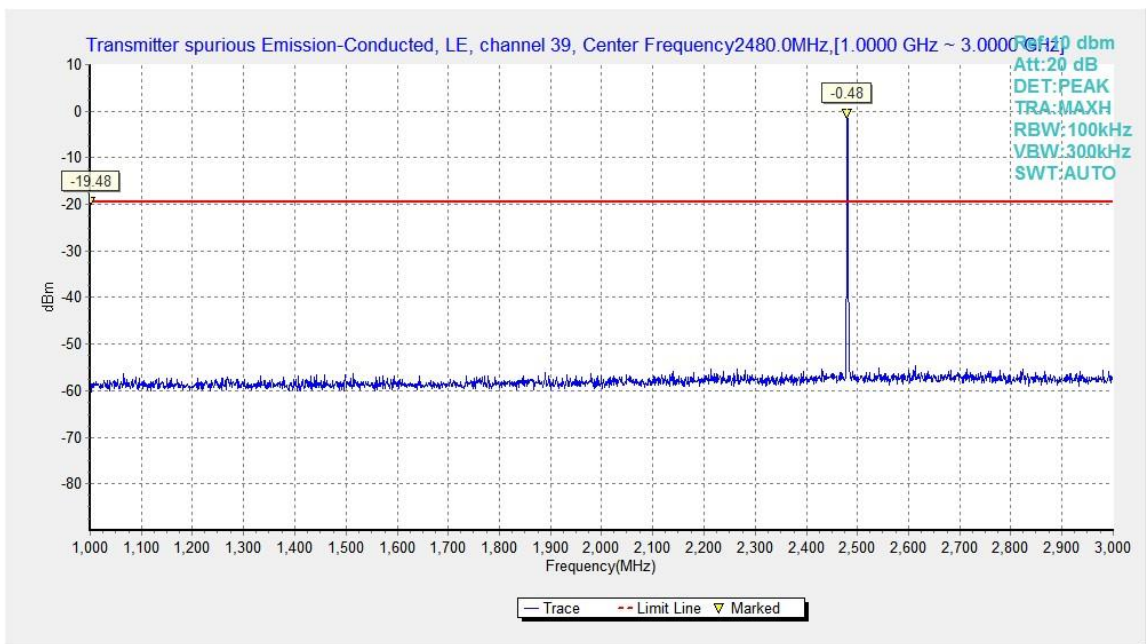
**Fig.14.** Transmitter Spurious Emission - Conducted: GFSK, 2440 MHz, 10GHz – 26GHz



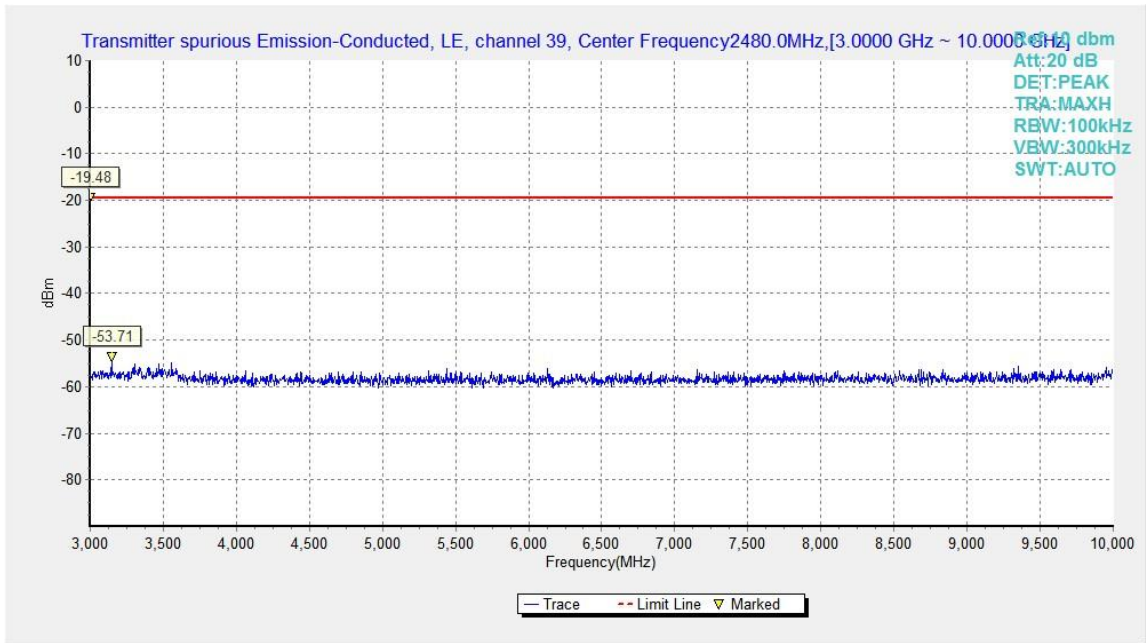
**Fig.15.** Transmitter Spurious Emission - Conducted: GFSK, 2480 MHz



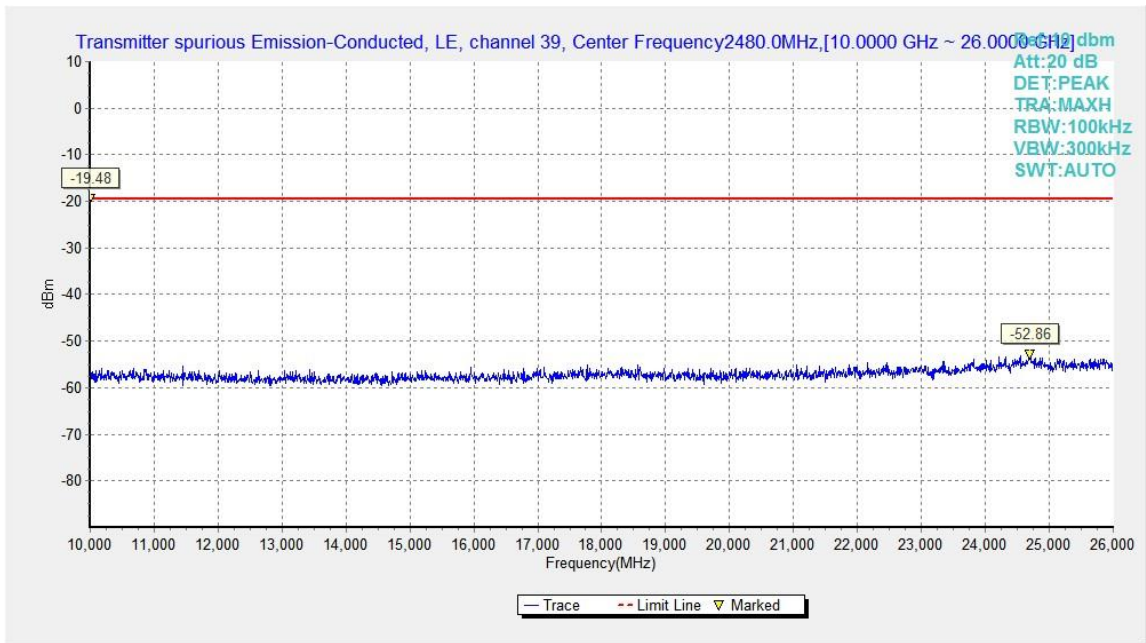
**Fig.16.** Transmitter Spurious Emission - Conducted: GFSK, 2480 MHz, 30MHz - 1GHz



**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 ( $\mu$ V/m)	Field strength (dBuV/m)	Measurement distance (m)
30-88	100	40	3
88-216	150	43.5	3
216-960	200	46	3
Above 960	500	54	3

**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 showed here only 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)
2388.637	45.97	4.61	27.42	13.93	54.00	8.03	V
2389.575	45.98	4.61	27.42	13.94	54.00	8.02	V
4804.000	30.95	-36.04	34.02	32.96	54.00	23.05	H
7206.000	31.67	-34.58	35.64	30.61	54.00	22.33	H
9608.000	32.98	-33.50	36.75	29.73	54.00	21.02	H
12010.000	35.35	-31.69	38.80	28.24	54.00	18.65	H

#### 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)
2436.488	46.41	4.66	27.55	14.21	54.00	7.59	V
2443.162	46.64	4.67	27.57	14.40	54.00	7.36	V
4882.000	30.99	-35.77	34.05	32.71	54.00	23.01	V
7323.000	32.11	-34.21	35.67	30.66	54.00	21.89	H
9764.000	33.05	-33.57	36.97	29.64	54.00	20.95	V
12205.000	35.19	-31.58	38.84	27.93	54.00	18.81	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)
2484.975	47.19	4.65	27.88	14.66	54.00	6.81	V
2485.275	47.16	4.65	27.88	14.63	54.00	6.84	V
4960.000	30.85	-35.60	34.08	32.37	54.00	23.15	V
7440.000	31.61	-34.17	35.69	30.09	54.00	22.39	V
9920.000	33.30	-33.25	37.19	29.36	54.00	20.70	V
12400.000	35.61	-31.25	38.88	27.98	54.00	18.39	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)
2386.037	60.87	4.60	27.43	28.84	74.00	13.13	H
2389.179	60.99	4.61	27.42	28.95	74.00	13.01	H
4804.000	43.19	-36.04	34.02	45.20	74.00	30.81	H
7206.000	43.93	-34.58	35.64	42.87	74.00	30.07	V
9608.000	44.64	-33.50	36.75	41.38	74.00	29.36	V
12010.000	47.96	-31.69	38.80	40.85	74.00	26.04	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)
2370.400	45.72	4.57	27.46	13.69	74.00	28.28	H
2504.000	45.94	4.65	28.02	13.28	74.00	28.06	H
4882.000	42.77	-35.77	34.05	44.49	74.00	31.23	V
7323.000	43.64	-34.21	35.67	42.19	74.00	30.36	V
9764.000	45.34	-33.57	36.97	41.93	74.00	28.66	V
12205.000	46.70	-31.58	38.84	39.44	74.00	27.30	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)
2484.312	61.55	4.65	27.88	29.02	74.00	12.45	H
2487.244	61.87	4.64	27.90	29.32	74.00	12.13	H
4960.000	41.61	-35.60	34.08	43.12	74.00	32.39	V
7440.000	43.50	-34.17	35.69	41.98	74.00	30.50	V
9920.000	44.74	-33.25	37.19	40.79	74.00	29.26	V
12400.000	47.96	-31.25	38.88	40.33	74.00	26.04	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)	$\geq 500\text{KHz}$

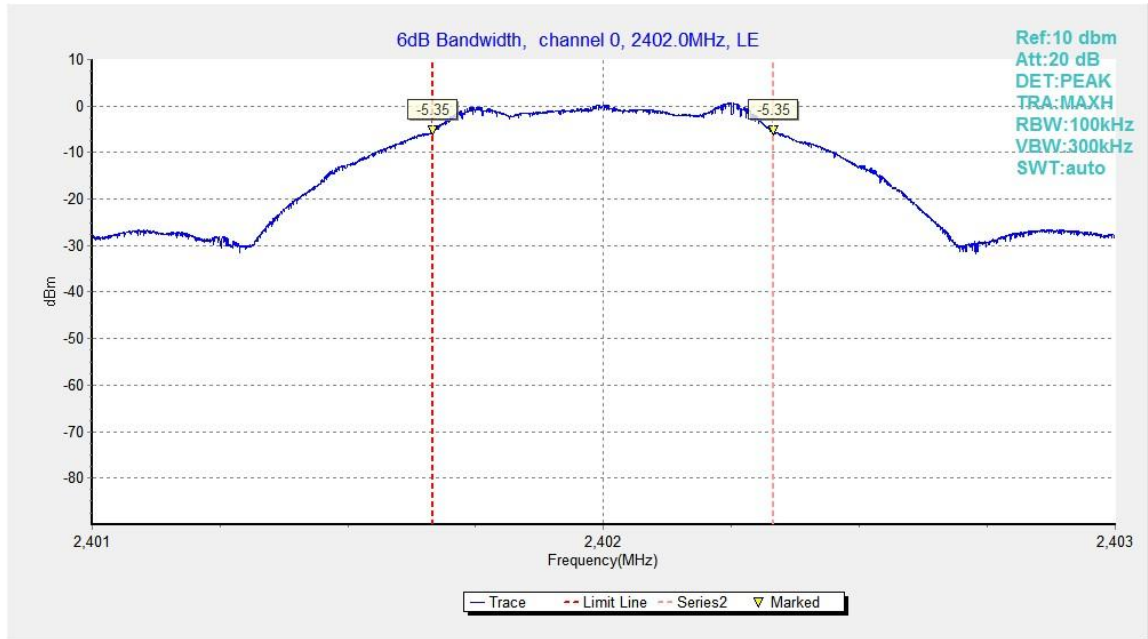
### Measurement Results:

#### For GFSK

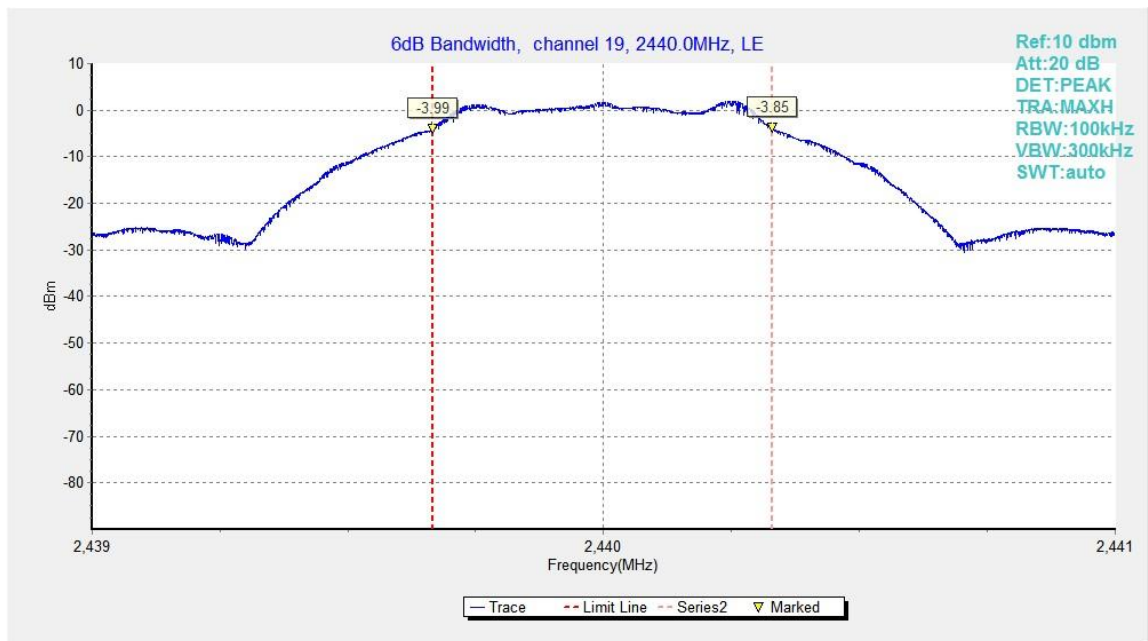
Channel No.	Frequency (MHz)	6dB Bandwidth (kHz)		Conclusion
0	2402	Fig.20	665.50	P
19	2440	Fig.21	663.50	P
39	2480	Fig.22	665.50	P

**Conclusion: PASS**

Test graphs as below:



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



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

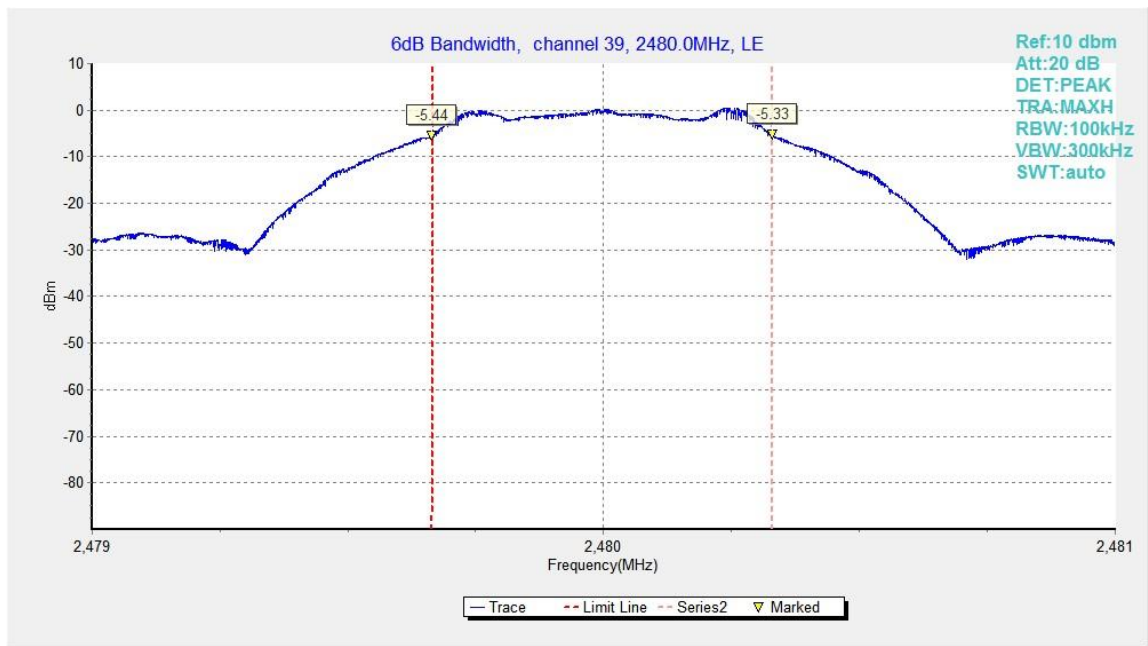


Fig.22. 6dB Bandwidth: GFSK, 2480 MHz

## 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:

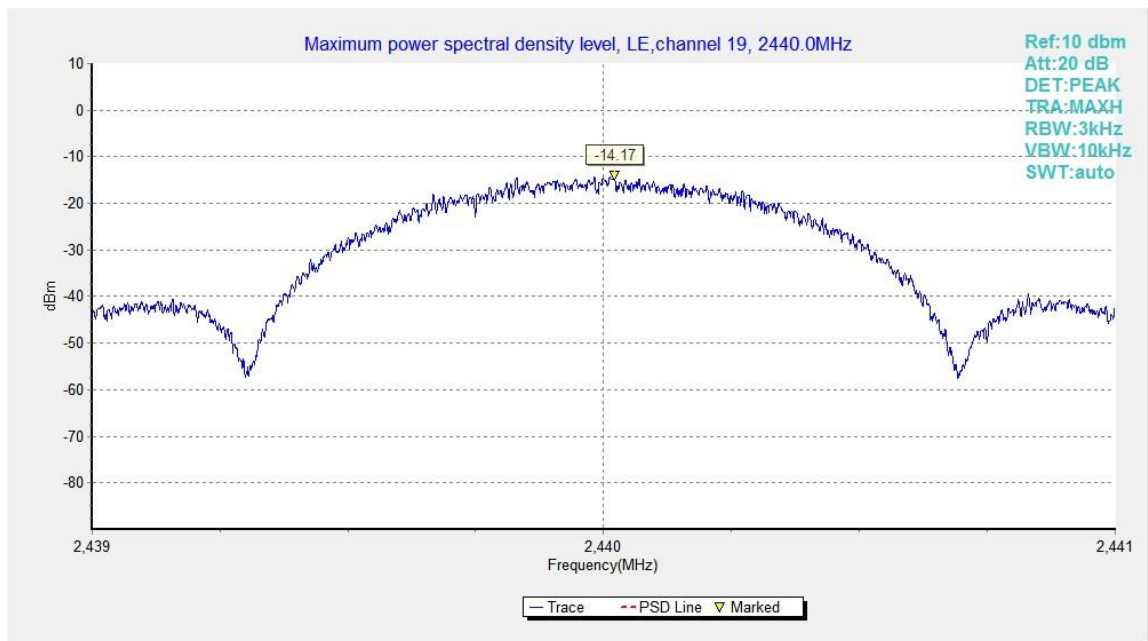
#### For GFSK

Channel No.	Frequency (MHz)	Maximum Power Spectral Density Level(dBm/3kHz)		Conclusion
0	2402	Fig.23	-15.59	P
19	2440	Fig.24	-14.17	P
39	2480	Fig.25	-15.60	P

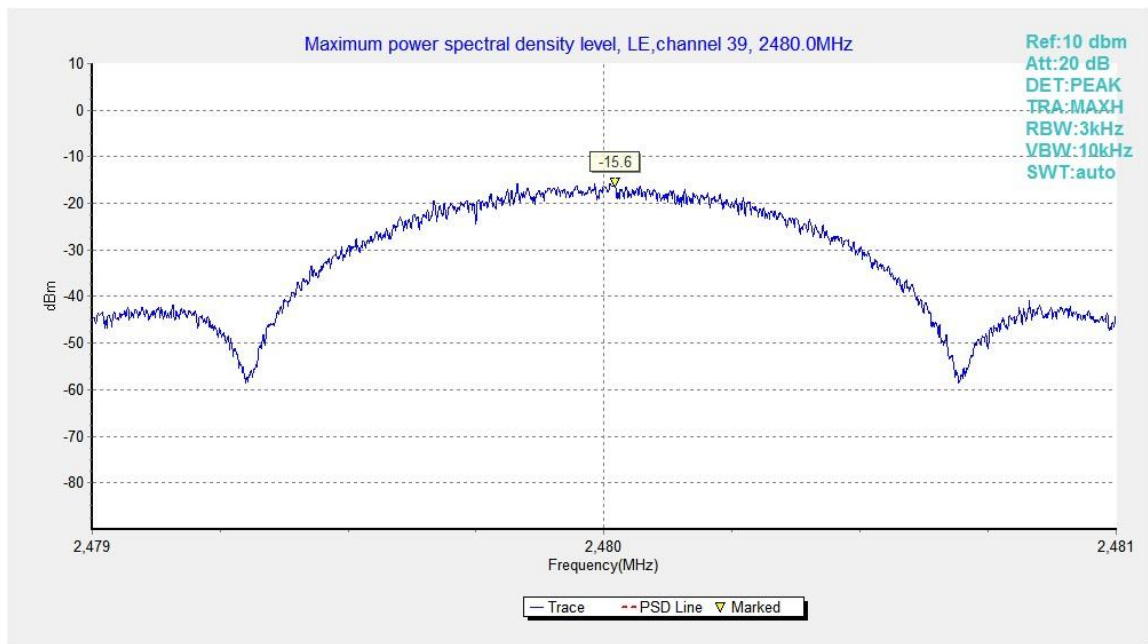
Test graphs as below:



**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.

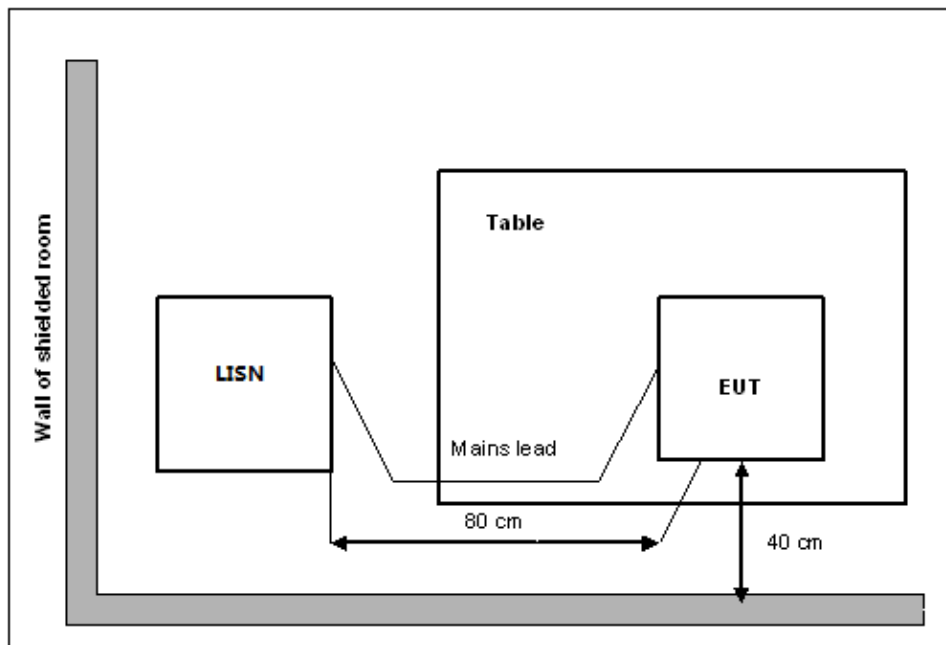
The measurement bandwidth is:

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: UT17a**

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			

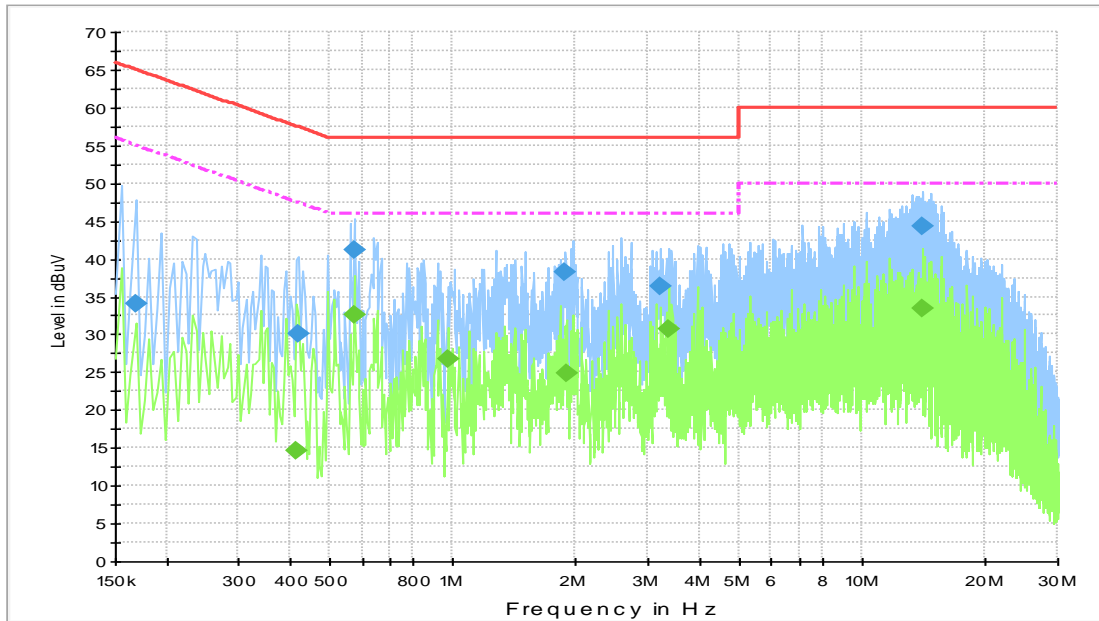
NOTE: The limit decreases linearly with the logarithm of the frequency in the range 0.15 MHz to 0.5 MHz.

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**

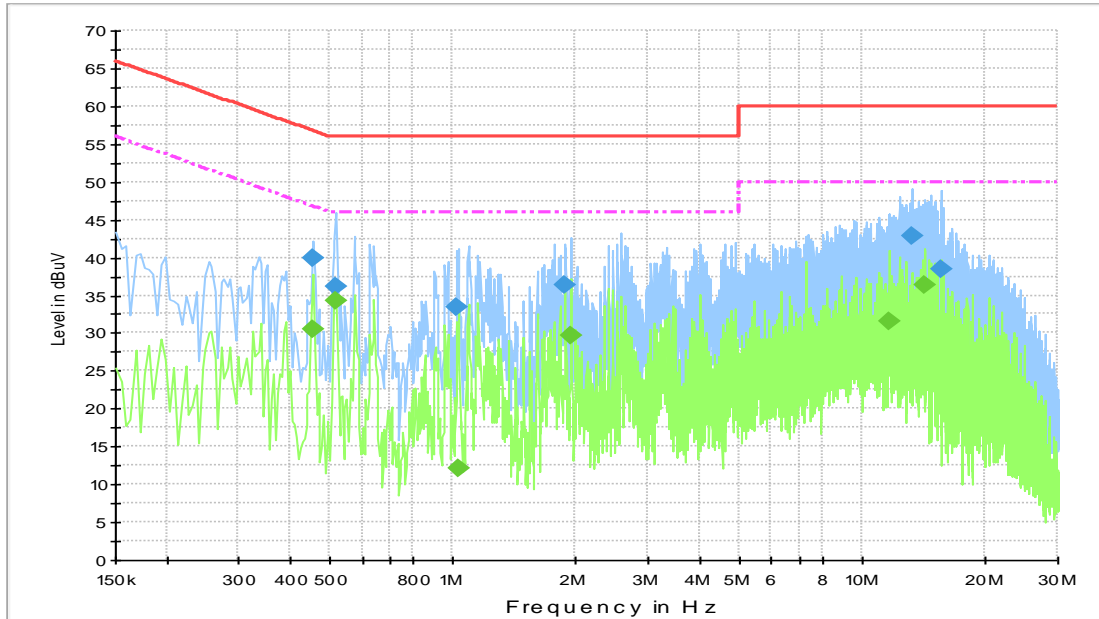
Note: The graphic result above is the maximum of the measurements for both phase line and neutral line.

**Final Result 1**

Frequency (MHz)	QuasiPeak (dB $\mu$ V)	Meas. Time (ms)	Bandwidth (kHz)	Filter	Line	Corr. (dB)	Margin (dB)	Limit (dB $\mu$ V)
0.168000	34.1	5000.0	9.000	On	L1	19.5	30.9	65.1
0.420000	30.1	5000.0	9.000	On	L1	19.5	27.4	57.4
0.573000	41.2	5000.0	9.000	On	L1	19.5	14.8	56.0
1.887000	38.2	5000.0	9.000	On	L1	19.6	17.8	56.0
3.201000	36.3	5000.0	9.000	On	L1	19.6	19.7	56.0
14.095500	44.2	5000.0	9.000	On	L1	19.9	15.8	60.0

**Final Result 2**

Frequency (MHz)	Average (dB $\mu$ V)	Meas. Time (ms)	Bandwidth (kHz)	Filter	Line	Corr. (dB)	Margin (dB)	Limit (dB $\mu$ V)
0.415500	14.5	5000.0	9.000	On	L1	19.5	33.0	47.5
0.573000	32.6	5000.0	9.000	On	L1	19.5	13.4	46.0
0.973500	26.8	5000.0	9.000	On	L1	19.5	19.2	46.0
1.891500	24.8	5000.0	9.000	On	L1	19.6	21.2	46.0
3.367500	30.8	5000.0	9.000	On	L1	19.6	15.2	46.0
14.095500	33.4	5000.0	9.000	On	L1	19.9	16.6	50.0



**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 (dB $\mu$ V)	Meas. Time (ms)	Bandwidth (kHz)	Filter	Line	Corr. (dB)	Margin (dB)	Limit (dB $\mu$ V)
0.456000	40.0	5000.0	9.000	On	L1	19.5	16.8	56.8
0.519000	36.1	5000.0	9.000	On	L1	19.5	19.9	56.0
1.023000	33.5	5000.0	9.000	On	N	19.6	22.5	56.0
1.878000	36.4	5000.0	9.000	On	L1	19.6	19.6	56.0
13.299000	42.9	5000.0	9.000	On	N	19.8	17.1	60.0
15.558000	38.5	5000.0	9.000	On	N	19.8	21.5	60.0

**Final Result 2**

Frequency (MHz)	Average (dB $\mu$ V)	Meas. Time (ms)	Bandwidth (kHz)	Filter	Line	Corr. (dB)	Margin (dB)	Limit (dB $\mu$ V)
0.456000	30.5	5000.0	9.000	On	L1	19.5	16.2	46.8
0.519000	34.3	5000.0	9.000	On	L1	19.5	11.7	46.0
1.032000	12.1	5000.0	9.000	On	L1	19.5	33.9	46.0
1.941000	29.7	5000.0	9.000	On	L1	19.6	16.3	46.0
11.692500	31.5	5000.0	9.000	On	N	19.8	18.5	50.0
14.154000	36.3	5000.0	9.000	On	L1	19.9	13.7	50.0

Note: The measurement results showed here are worst cases of the combination of different AE.

## ANNEX C: Accreditation Certificate

<p>United States Department of Commerce National Institute of Standards and Technology</p>  	
<hr/> <b>Certificate of Accreditation to ISO/IEC 17025:2017</b> <hr/>	
NVLAP LAB CODE: 600118-0	
<b>Telecommunication Technology Labs, CAICT</b> Beijing China	
<i>is accredited by the National Voluntary Laboratory Accreditation Program for specific services, listed on the Scope of Accreditation, for:</i>	
<b>Electromagnetic Compatibility &amp; Telecommunications</b>	
<i>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).</i>	
2021-09-29 through 2022-09-30 <i>Effective Dates</i>	 For the National Voluntary Laboratory Accreditation Program

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