



# FCC PART 15C TEST REPORT

**BLUETOOTH LOW ENERGY (BLE) PART**

**No. 23T04Z70626-013**

**for**

**Samsung Electronics Co., Ltd.**

**Multi-band GSM/WCDMA/LTE/5G NR Phone with Bluetooth, WLAN**

**Model Name: SM-M556B/DS**

**FCC ID: ZCASMM556B**

**with**

**Hardware Version: REV1.0**

**Software Version: M556B.001**

**Issued Date: 2024-1-12**

**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>
23T04Z70626-013	Rev.0	1st edition	2024-1-12

Note: the latest revision of the test report supersedes all previous version.

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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 American Association for Laboratory Accreditation (A2LA) with lab code 7049.01, and is also an FCC accredited test laboratory (CN1349), and ISED accredited test laboratory (CAB identifier:CN0066). The detail accreditation scope can be found on A2LA 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 (BDA)

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

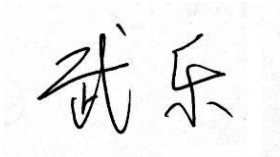
### 1.3. Testing Environment

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

### 1.4. Project data

Testing Start Date: 2023-11-17  
Testing End Date: 2024-1-12

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



## **2. Client Information**

### **2.1. Applicant Information**

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

### **2.2. Manufacturer Information**

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

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

#### 3.1. About EUT

Description	Multi-band GSM/WCDMA/LTE/5G NR Phone with Bluetooth, WLAN
Model Name	SM-M556B/DS
FCC ID	ZCASMM556B
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 6 gain	-2.2dBi
Antenna 10 gain	-5.8dBi

#### 3.2. Internal Identification of EUT

EUT ID*	SN or IMEI	HW Version	SW Version	Date of receipt
UT29a	23T04Z70626UT29a	REV1.0	M556B.001	2023-11-28
UT10a	23T04Z70626UT10a	REV1.0	M556B.001	2023-11-17

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

#### 3.3. Internal Identification of AE

AE ID*	Name	Model	Manufacturer
AE1	Battery	HQ-6887NAS	Ningde Amperex Technology Limited
AE2-1*	Adapter	EP-TA845	SoluM Co.,Ltd.
AE2-2*	Adapter	EP-T1510JWE	DONGYANG E&P INC
AE3-1	Date Cable1 C-C	EP-DN975BWE	ASAP TECHNOLOGY(JIANGXI) CO.,LTD.
AE3-2	Date Cable2 C-C	EP-DN975BWE	RFTECH ELECTRONICS (HUIZHOU) CO., LTD
AE4*	Date Cable3 C-A	EP-DR140AWE	CRESYN HANOI Co., Ltd
AE5*	Headset	QL6601A	Quancheng Electronics

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

\*AE2-1, AE2-2, AE4 and A5 are not the AE for EUT, provided by the client for relevant tests.





### **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/5G NR 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; 15.247 Operation within the bands 902–928MHz, 2400–2483.5 MHz, and 5725–5850 MHz.	2021
ANSI C63.10	American National Standard of Procedures for Compliance Testing of Unlicensed Wireless Devices	June,2013

## 5. Test Results

### 5.1. Summary of EUT Mode

Four modes are provided:

Mode	Conditions
Mode A	ANT6 1Mbps
Mode B	ANT6 2Mbps
Mode C	ANT10 1Mbps
Mode D	ANT10 2Mbps

\*For the test results, the EUT had been tested all conditions. But only the worst case (Mode B) 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>
Transmitter Spurious Emission - Conducted	15.247 (d)	<b>P</b>
Radiated Unwanted Emission	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>
Antenna Requirement	15.203	<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

## 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	2024-03-09
2	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	2024-06-29
2	Test Receiver	ESW44	103015	R&S	1 year	2024-01-14
3	Test Receiver	FSV40	101047	R&S	1 year	2024-07-25
4	Loop Antenna	HFH2-Z2	829324/007	R&S	1 year	2024-12-21
5	EMI Antenna	VULB9163	9163-235	Schwarzbeck	1 year	2024-06-10
6	EMI Antenna	3117	00119021	ETS-Lindgren	1 year	2024-06-24
7	EMI Antenna	LB-180400 -25-C-KF	21100840000 06	A-INFO	1 year	2024-03-02

### AC Power Line Conducted Emission

No.	Equipment	Model	Serial Number	Manufacturer	Calibration Period	Calibration Due date
1	LISN	ENV216	101459	R&S	1 year	2024-02-29
2	Test Receiver	ESCI	100766	R&S	1 year	2024-03-30

## 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. 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

### 7.4. Radiated Unwanted Emission

Measurement Uncertainty:

Frequency Range	Uncertainty(dBm) (k=2)
9kHz-30MHz	4.92
$30\text{MHz} \leq f \leq 1\text{GHz}$	5.73
$1\text{GHz} \leq f \leq 18\text{GHz}$	5.58
$18\text{GHz} \leq f \leq 40\text{GHz}$	3.37

### 7.5. 6dB Bandwidth

Measurement Uncertainty:

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

Measurement Uncertainty:

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

**Measurement Uncertainty:**

Measurement Uncertainty (k=2)	3.10dB
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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.

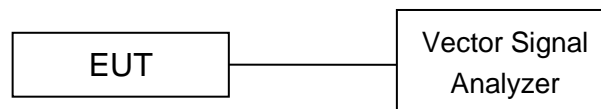
## **ANNEX B: Detailed Test Results**

### **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 EUT was placed on a non-conductive table with 80cm above the ground plane for measurement below 1GHz and 1.5m above the ground plane for measurement above 1GHz. The measurement antenna was placed at a distance of 3 meters from the EUT. 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 from 0° to 360° and the measurement antenna is moved from 1m to 4m to get the maximization result. The maximization process was repeated with the EUT positioned in each of its three orthogonal orientations.



## 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:

##### ANT6

Sample Rate	Channel No.	Frequency (MHz)	Peak Conducted Output Power (dBm)	Conclusion
1Mbps	0	2402	4.05	P
	19	2440	5.12	P
	39	2480	6.73	P
2Mbps	0	2402	4.27	P
	19	2440	5.34	P
	39	2480	6.89	P

##### ANT10

Sample Rate	Channel No.	Frequency (MHz)	Peak Conducted Output Power (dBm)	Conclusion
1Mbps	0	2402	4.43	P
	19	2440	4.17	P
	39	2480	7.44	P
2Mbps	0	2402	4.63	P
	19	2440	4.36	P
	39	2480	7.59	P

**Conclusion: PASS**

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

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

Antenna 6 gain = -2.2dBi

Antenna 10 gain = -5.8dBi

#### ANT6

Sample Rate	Channel No.	Frequency (MHz)	E.I.R.P. (dBm)	Conclusion
1Mbps	0	2402	1.85	P
	19	2440	2.92	P
	39	2480	4.53	P
2Mbps	0	2402	2.07	P
	19	2440	3.14	P
	39	2480	4.69	P

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

#### ANT10

Sample Rate	Channel No.	Frequency (MHz)	E.I.R.P. (dBm)	Conclusion
1Mbps	0	2402	-1.37	P
	19	2440	-1.63	P
	39	2480	1.64	P
2Mbps	0	2402	-1.17	P
	19	2440	-1.44	P
	39	2480	1.79	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	-47.96	P
39	2480	Hopping OFF	Fig.2	-60.15	P

**Conclusion: PASS**

Test graphs as below

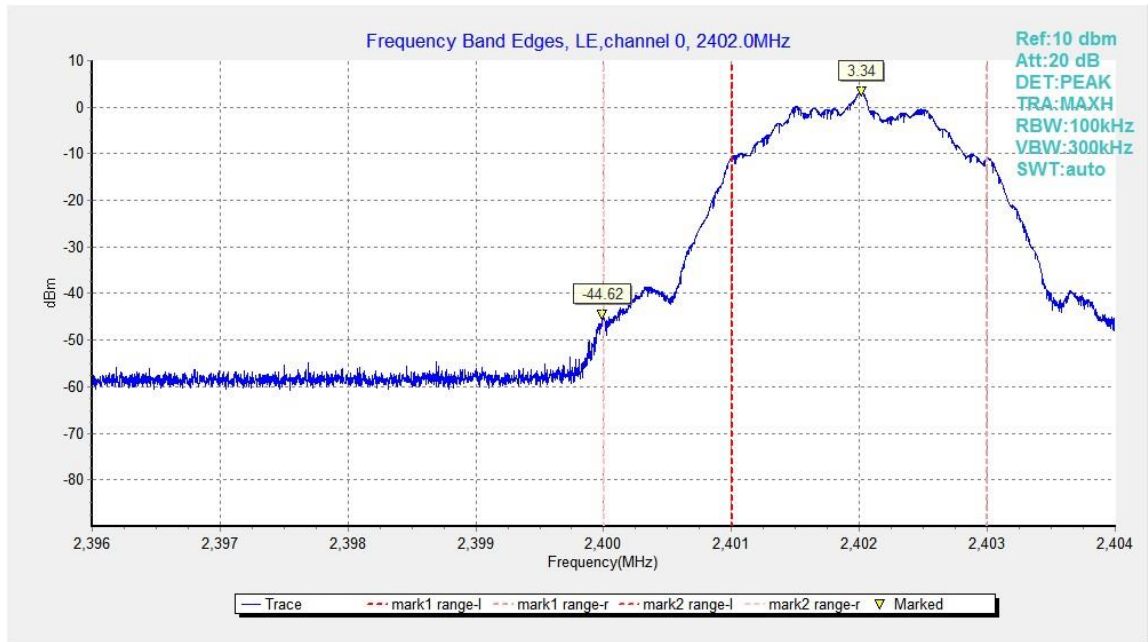


Fig.1. Frequency Band Edges: GFSK, 2402 MHz, Hopping Off

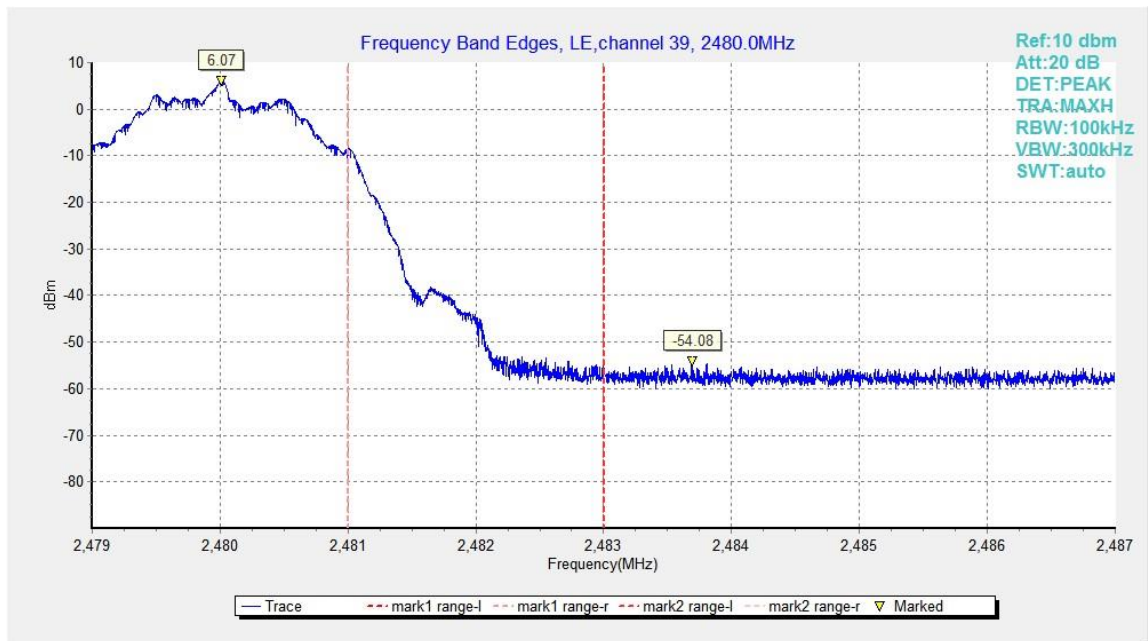


Fig.2. Frequency Band Edges: GFSK, 2480 MHz, Hopping Off

## B.4. 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:

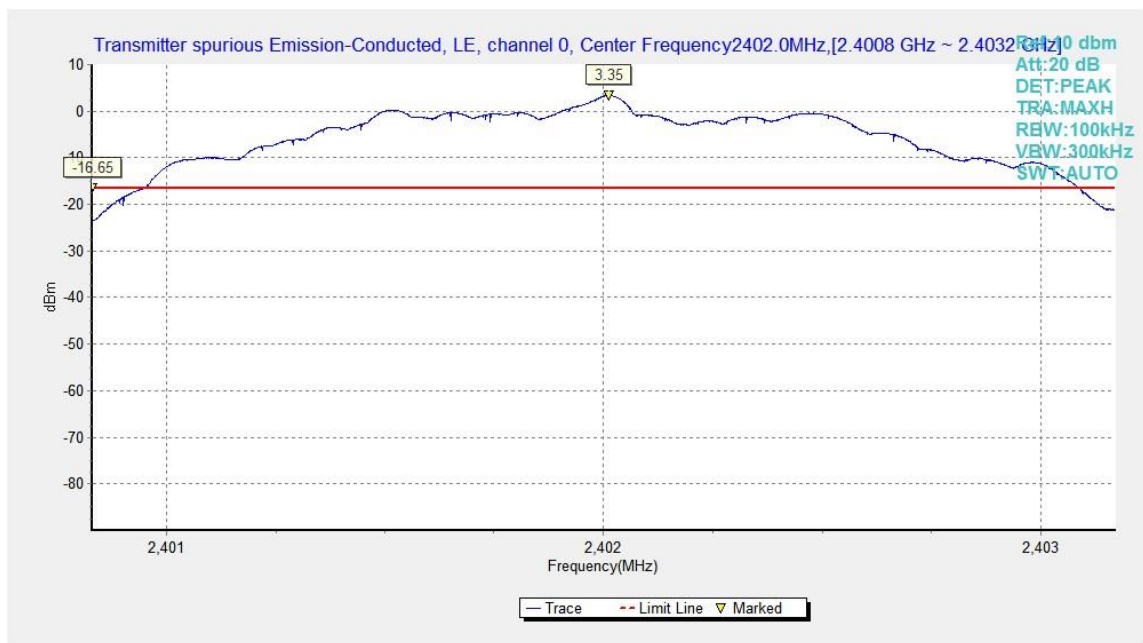
Standard	Limit
FCC 47 CFR Part 15.247 (d)	20dB below peak output power in 100 kHz bandwidth

**Measurement Results:  
For GFSK**

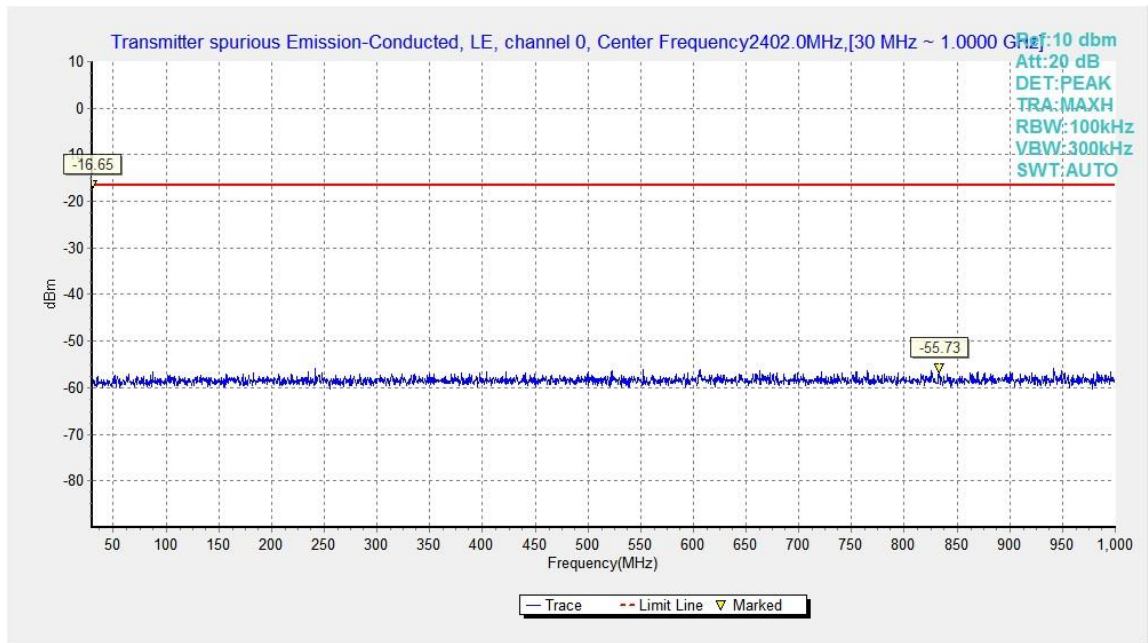
Channel No.	Frequency (MHz)	Frequency Range	Test Results	Conclusion
0	2402	Center Frequency	Fig.3	P
		30 MHz ~ 1 GHz	Fig.4	P
		1 GHz ~ 3 GHz	Fig.5	P
		3 GHz ~ 10 GHz	Fig.6	P
		10GHz ~ 26 GHz	Fig.7	P
19	2440	Center Frequency	Fig.8	P
		30 MHz ~ 1 GHz	Fig.9	P
		1 GHz ~ 3 GHz	Fig.10	P
		3 GHz ~ 10 GHz	Fig.11	P
		10GHz ~ 26 GHz	Fig.12	P
39	2480	Center Frequency	Fig.13	P
		30 MHz ~ 1 GHz	Fig.14	P
		1 GHz ~ 3GHz	Fig.15	P
		3 GHz ~ 10 GHz	Fig.16	P
		10 GHz ~ 26 GHz	Fig.17	P

**Conclusion: PASS**

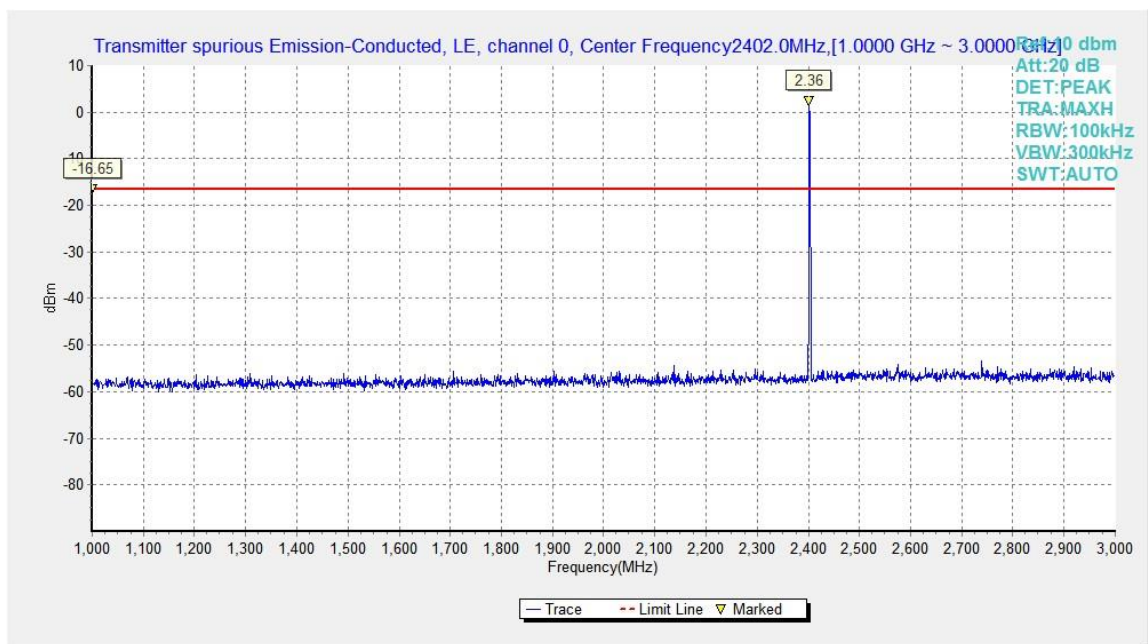
**Test graphs as below**



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

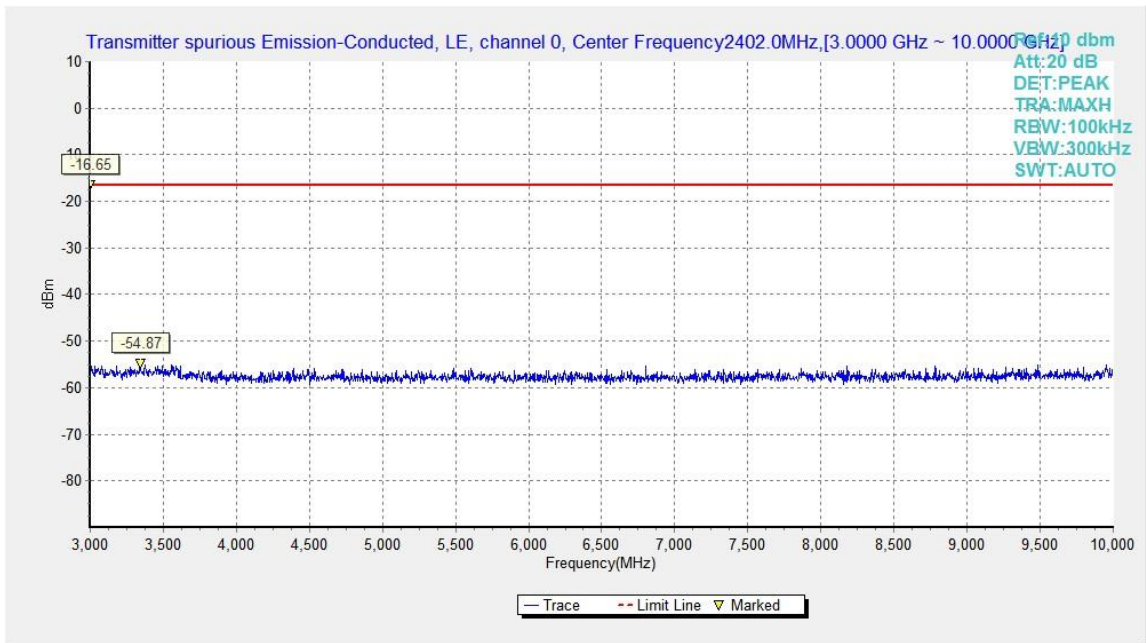


**Fig.4.** Transmitter Spurious Emission - Conducted: GFSK, 2402 MHz, 30MHz - 1GHz

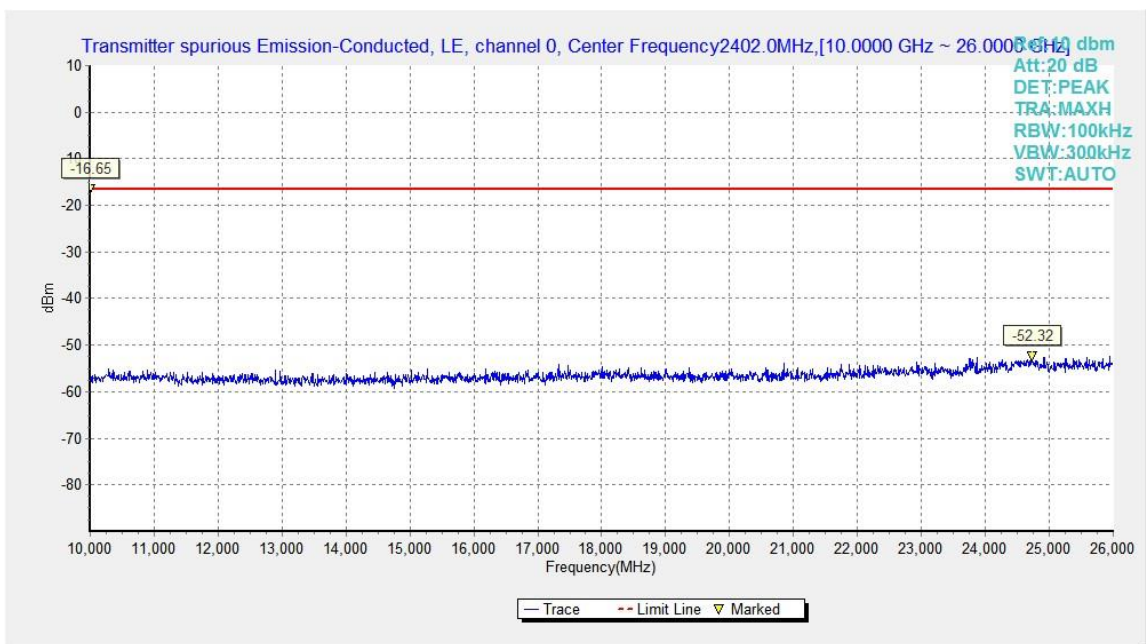


**Fig.5.** Transmitter Spurious Emission - Conducted: GFSK, 2402 MHz, 1GHz - 3GHz



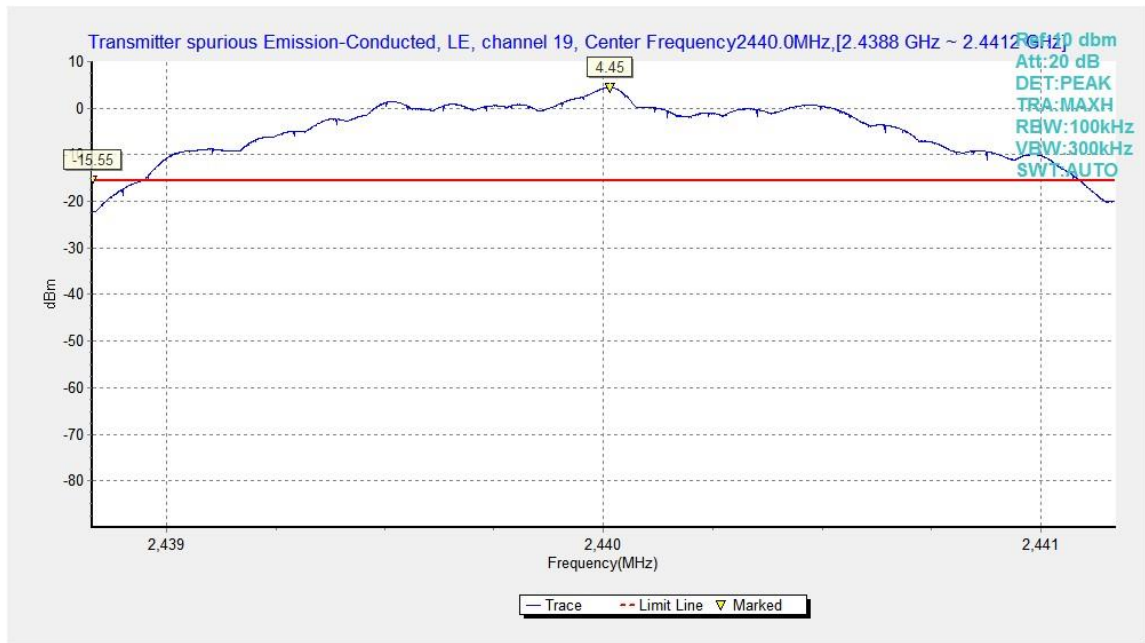


**Fig.6.** Transmitter Spurious Emission - Conducted: GFSK, 2402 MHz, 3GHz - 10GHz

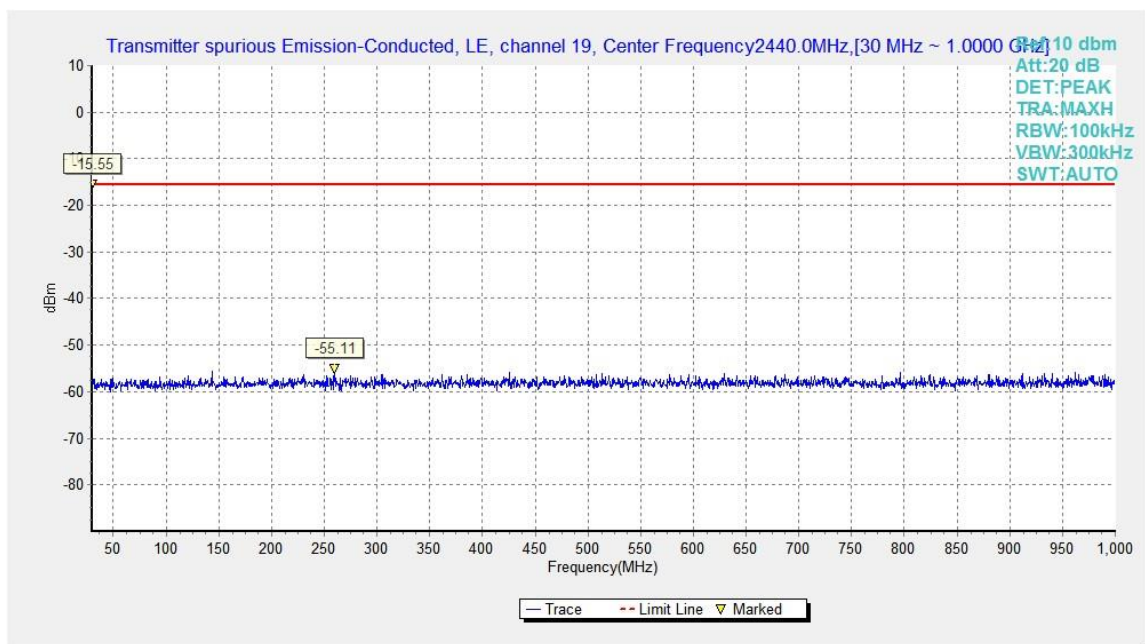


**Fig.7.** Transmitter Spurious Emission - Conducted: GFSK, 2402 MHz, 10GHz - 26GHz

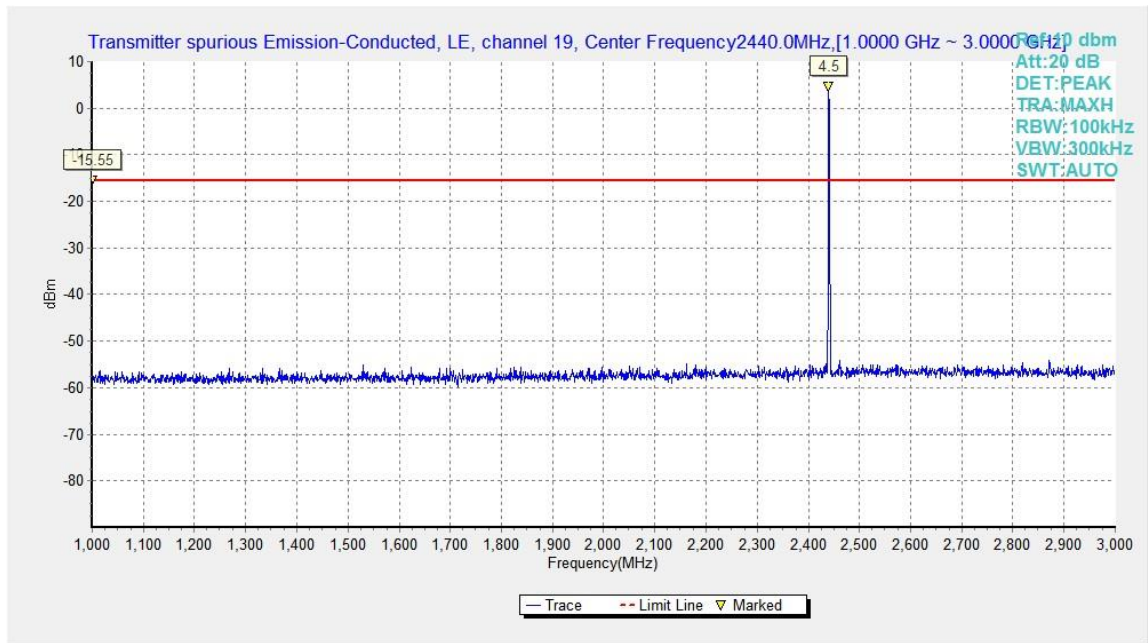




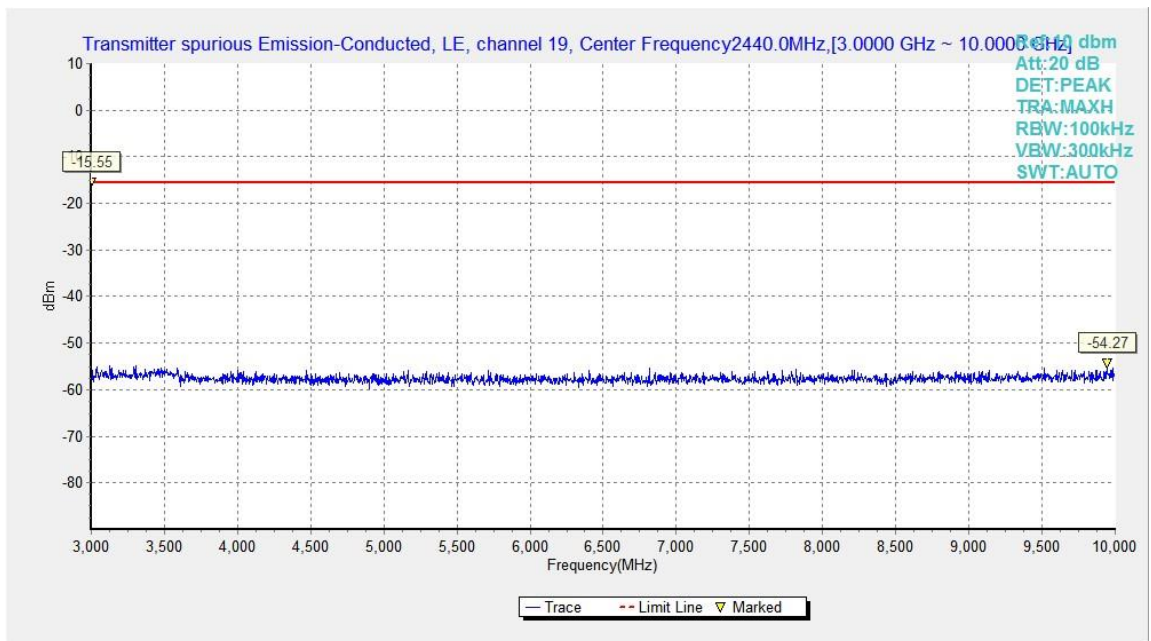
**Fig.8.** Transmitter Spurious Emission - Conducted: GFSK, 2440MHz



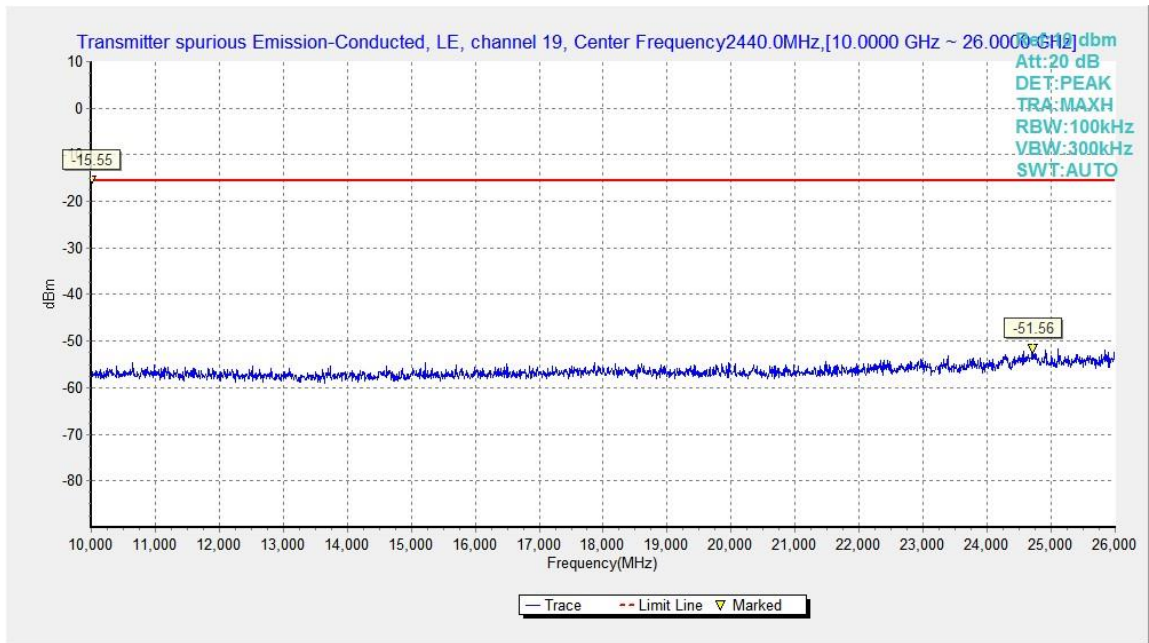
**Fig.9.** Transmitter Spurious Emission - Conducted: GFSK, 2440 MHz, 30MHz - 1GHz



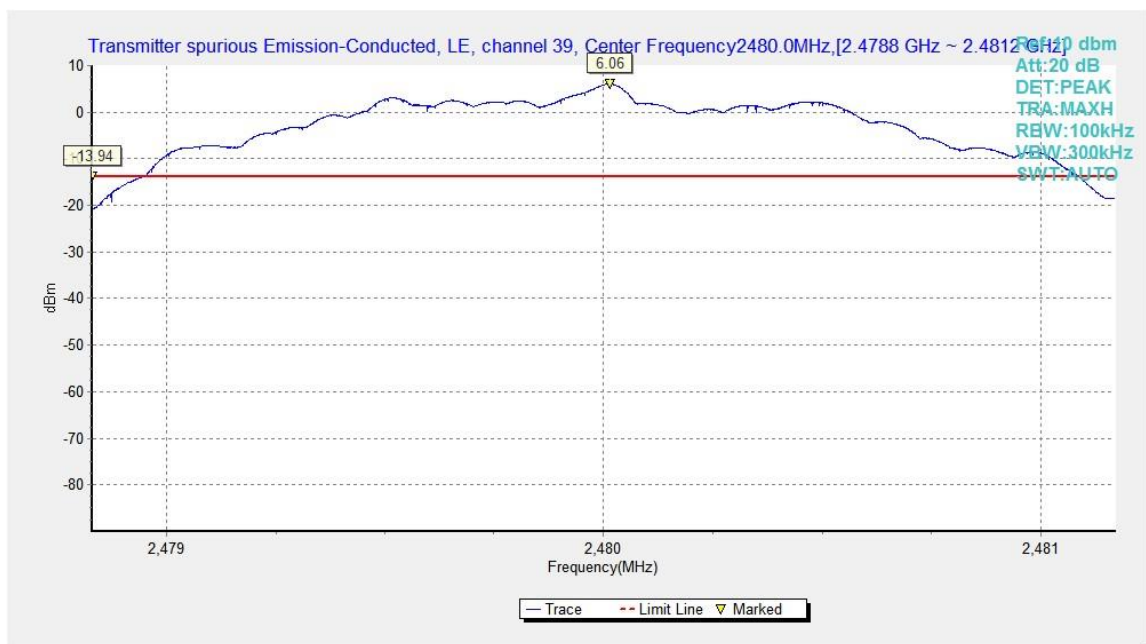
**Fig.10.** Transmitter Spurious Emission - Conducted: GFSK, 2440 MHz, 1GHz – 3GHz



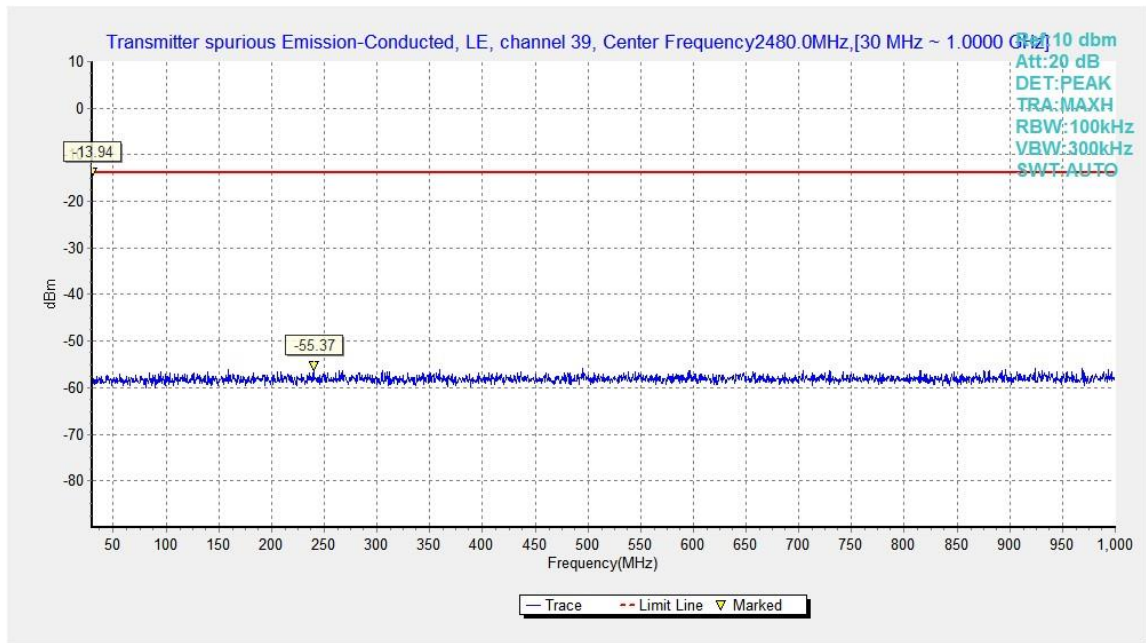
**Fig.11.** Transmitter Spurious Emission - Conducted: GFSK, 2440 MHz, 3GHz – 10GHz



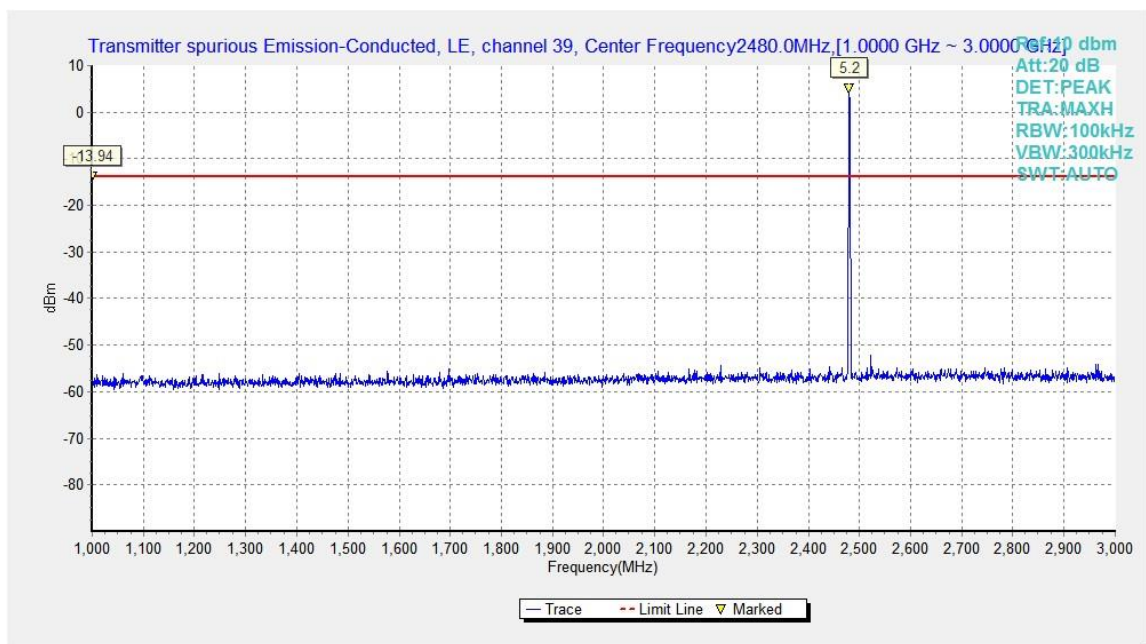
**Fig.12.** Transmitter Spurious Emission - Conducted: GFSK, 2440 MHz, 10GHz – 26GHz



**Fig.13.** Transmitter Spurious Emission - Conducted: GFSK, 2480 MHz

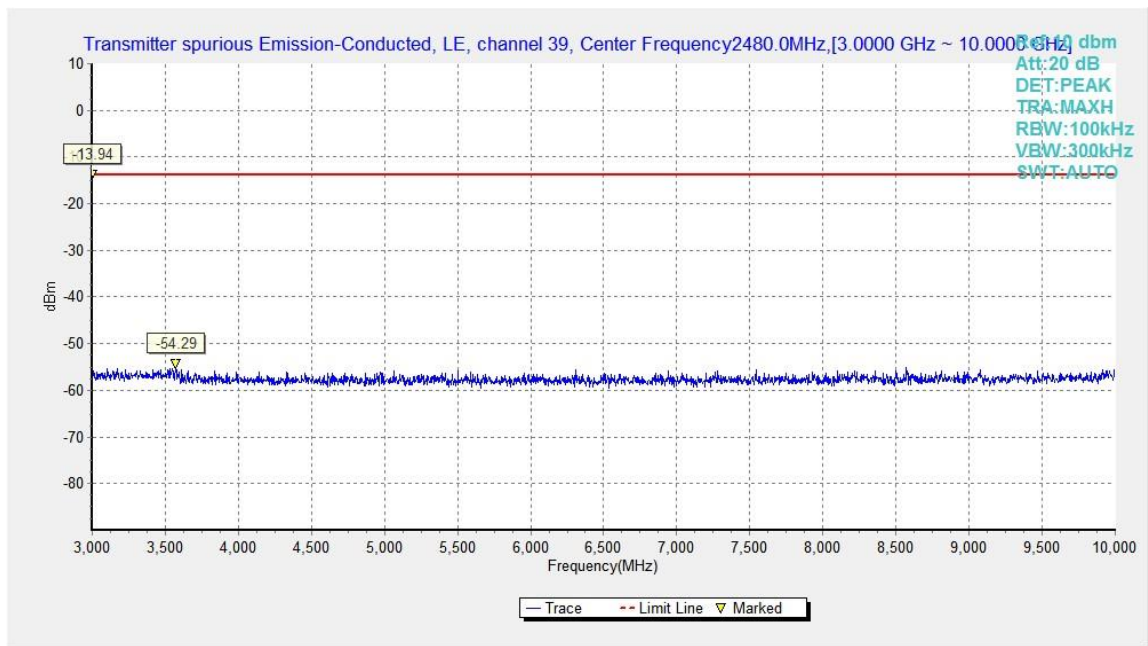


**Fig.14.** Transmitter Spurious Emission - Conducted: GFSK, 2480 MHz, 30MHz - 1GHz

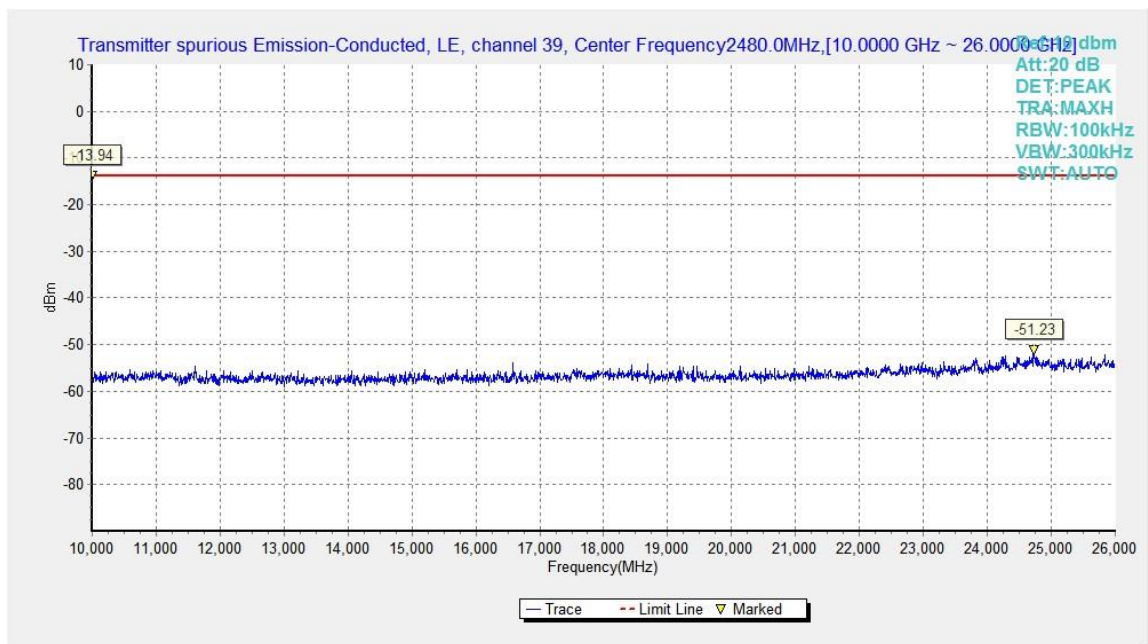


**Fig.15.** Transmitter Spurious Emission - Conducted: GFSK, 2480 MHz, 1GHz - 3GHz





**Fig.16.** Transmitter Spurious Emission - Conducted: GFSK, 2480 MHz, 3GHz - 10GHz



**Fig.17.** Transmitter Spurious Emission - Conducted: GFSK, 2480 MHz, 10GHz - 26GHz

## B.5. Radiated Unwanted Emission

### Limits

#### 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)).

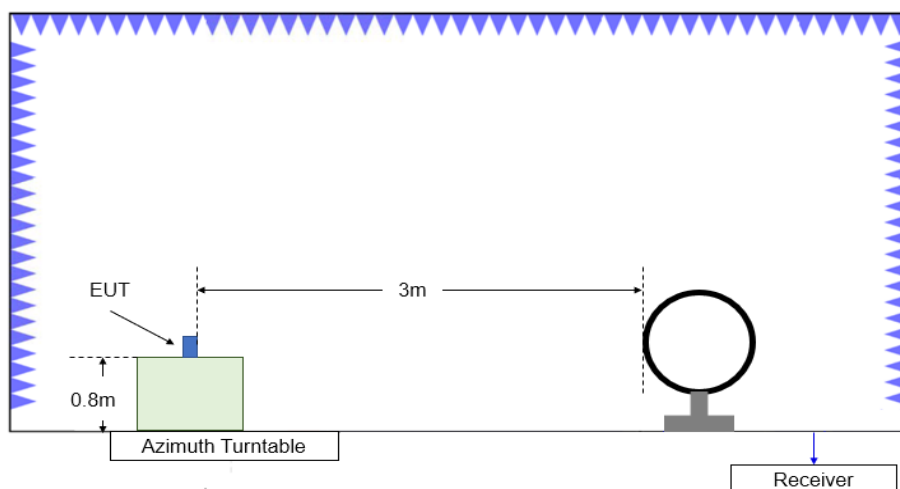
#### Limit in restricted band

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

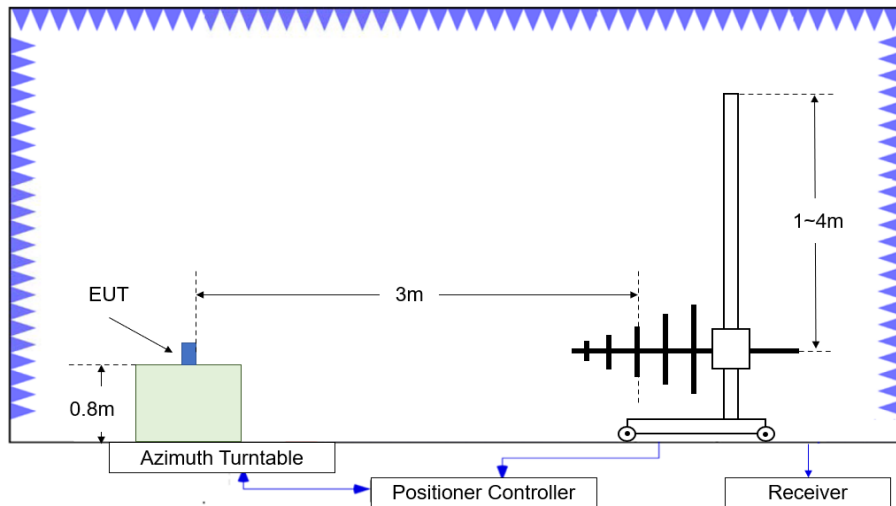
Frequency of emission (MHz)	Field strength ( $\mu\text{V}/\text{m}$ )	Field strength (dBuV/m)	Measurement distance (m)
30-88	100	40	3
88-216	150	43.5	3
216-960	200	46	3
Above 960	500	54	3

Note: When performing measurements at a distance other than that specified, the results shall be extrapolated to the specified distance using an extrapolation factor.

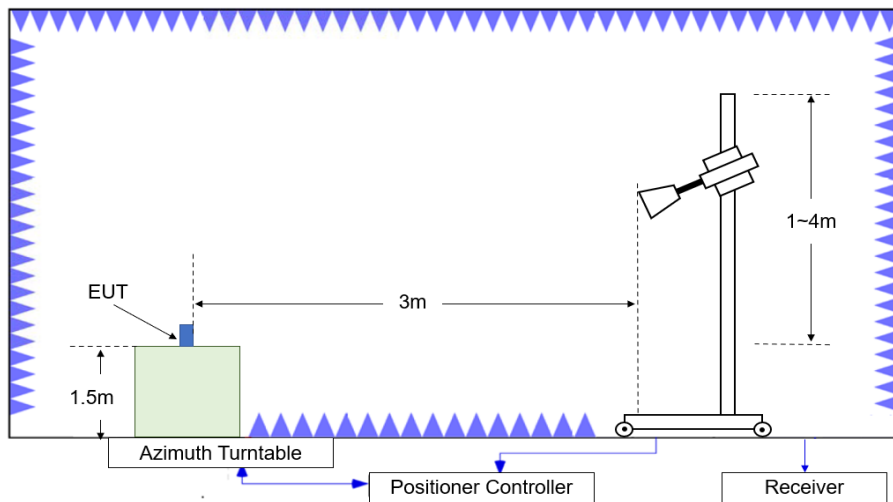
### Test setup



**Figure B.5.1. Test Site Diagram (9kHz-30MHz)**



**Figure B.5.2. Test Site Diagram (30MHz-1GHz)**



**Figure B.5.3. Test Site Diagram (1GHz-40GHz)**

**Test Procedure**

Radiated unwanted emissions from the EUT were measured according to ANSI C63.10.

**Test setting**

Frequency of emission (MHz)	RBW/VBW	Sweep Time(s)
30-1000	100kHz/300kHz	5
1000-3000	1MHz/3MHz	15
3000-18000	1MHz/3MHz	40
18000-26500	1MHz/3MHz	20

**Calculation**

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:

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



### **Test note**

1. Investigation has been done on all modes and modulations/data rates. Only the radiated emissions of the configuration that produced the worst case emissions are reported in this section.
2. Spurious emissions for all channels were investigated and almost the same below 1GHz. According to FCC 47 CFR §15.31, emission levels are not report much lower than the limit by over 20dB
3. Measurement frequencies were performed from 9 kHz to the 10<sup>th</sup> harmonic of highest fundamental frequency.
4. The measurements were performed separately in chain1, chain2 and only the worst cases are shown in this section.

### **Test Result**



**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)
2323.325	46.49	4.53	27.29	14.67	54.00	7.51	V
2358.956	46.27	4.55	27.42	14.30	54.00	7.73	V
4804.000	27.97	-35.05	33.98	29.05	54.00	26.03	V
7206.000	30.17	-33.04	35.52	27.69	54.00	23.83	H
9608.000	31.13	-32.21	36.32	27.02	54.00	22.88	H
12010.000	33.68	-30.19	38.80	25.07	54.00	20.32	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)
2384.119	46.28	4.60	27.47	14.21	54.00	7.72	V
2495.138	47.33	4.62	27.80	14.90	54.00	6.67	V
4882.000	28.70	-34.37	33.83	29.25	54.00	25.30	H
7323.000	30.14	-33.03	35.40	27.77	54.00	23.86	H
9764.000	31.56	-31.87	36.57	26.86	54.00	22.44	H
12205.000	34.31	-29.39	38.79	24.91	54.00	19.69	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)
2485.313	47.19	4.65	27.80	14.75	54.00	6.81	V
2487.713	47.15	4.64	27.80	14.71	54.00	6.85	V
4960.000	28.33	-34.42	33.80	28.95	54.00	25.67	H
7440.000	29.62	-32.79	35.42	26.99	54.00	24.38	V
9920.000	31.39	-32.04	36.84	26.59	54.00	22.61	H
12400.000	34.07	-29.42	38.60	24.88	54.00	19.94	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)
2356.603	61.06	4.55	27.41	29.09	74.00	12.94	V
2374.356	60.96	4.58	27.45	28.94	74.00	13.04	V
4804.000	42.13	-35.05	33.98	43.20	74.00	31.87	V
7206.500	43.09	-33.04	35.53	40.61	74.00	30.91	H
9607.500	44.88	-32.21	36.32	40.77	74.00	29.12	H
12011.000	46.82	-30.19	38.80	38.21	74.00	27.18	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)
2357.200	44.77	-35.83	31.29	49.31	74.00	29.24	H
2508.800	46.69	-35.72	32.44	49.98	74.00	27.31	H
4881.000	40.97	-34.39	33.82	41.53	74.00	33.03	H
7324.500	42.33	-33.02	35.40	39.95	74.00	31.67	V
9762.500	43.19	-31.87	36.57	38.49	74.00	30.81	H
12203.000	46.81	-29.38	38.79	37.39	74.00	27.19	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)
2490.522	61.49	4.63	27.80	29.06	74.00	12.51	H
2492.747	62.05	4.63	27.80	29.62	74.00	11.95	H
4960.000	40.66	-34.42	33.80	41.29	74.00	33.34	V
7440.500	41.51	-32.79	35.42	38.88	74.00	32.49	V
9918.500	44.68	-32.04	36.84	39.89	74.00	29.32	V
12401.000	45.84	-29.41	38.60	36.66	74.00	28.16	H

**Conclusion: PASS**

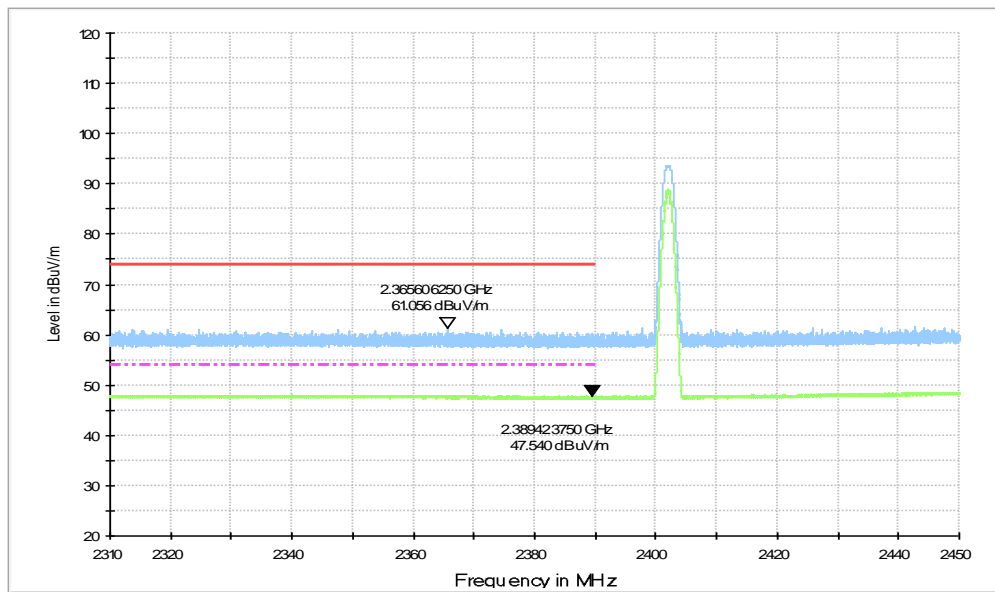
Note: the spurious emission above 18G is noise only and did not show on the report.

**Band edge compliance**

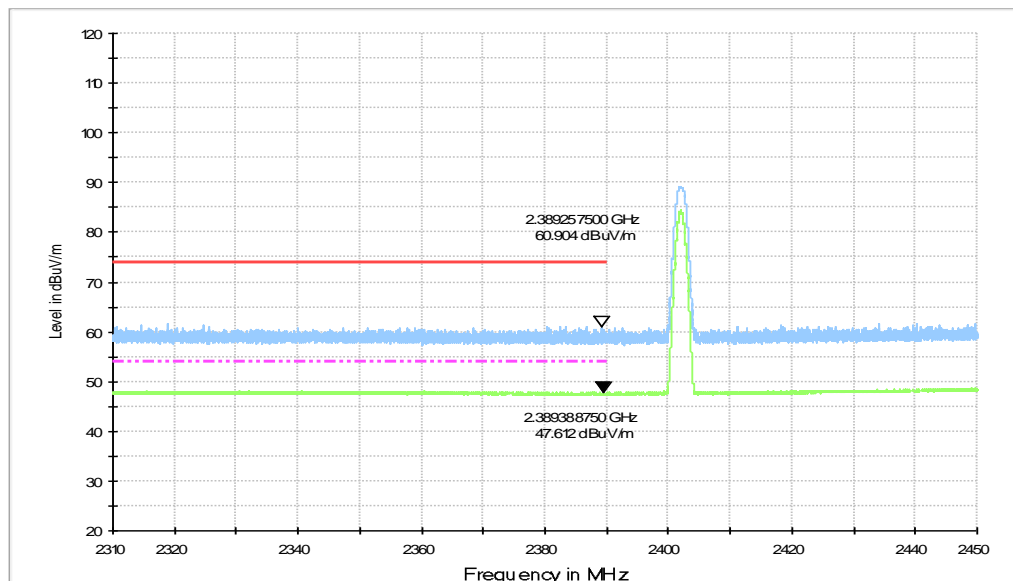
Mode	Channel	Frequency Range	Test Results	Conclusion
GFSK	0	2.31GHz ~2.43GHz	Fig.18	P
	39	2.45GHz ~2.5GHz	Fig.19	P

**Conclusion: PASS**

Test graphs as below



**Fig.18. Frequency Band Edges: GFSK, 2402 MHz, Hopping Off, 2.31 GHz – 2.43GHz**



**Fig.19. Frequency Band Edges: GFSK, 2480 MHz, Hopping Off , 2.45 GHz - 2.50GHz**

## B.6. 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)	$\geq 500\text{KHz}$

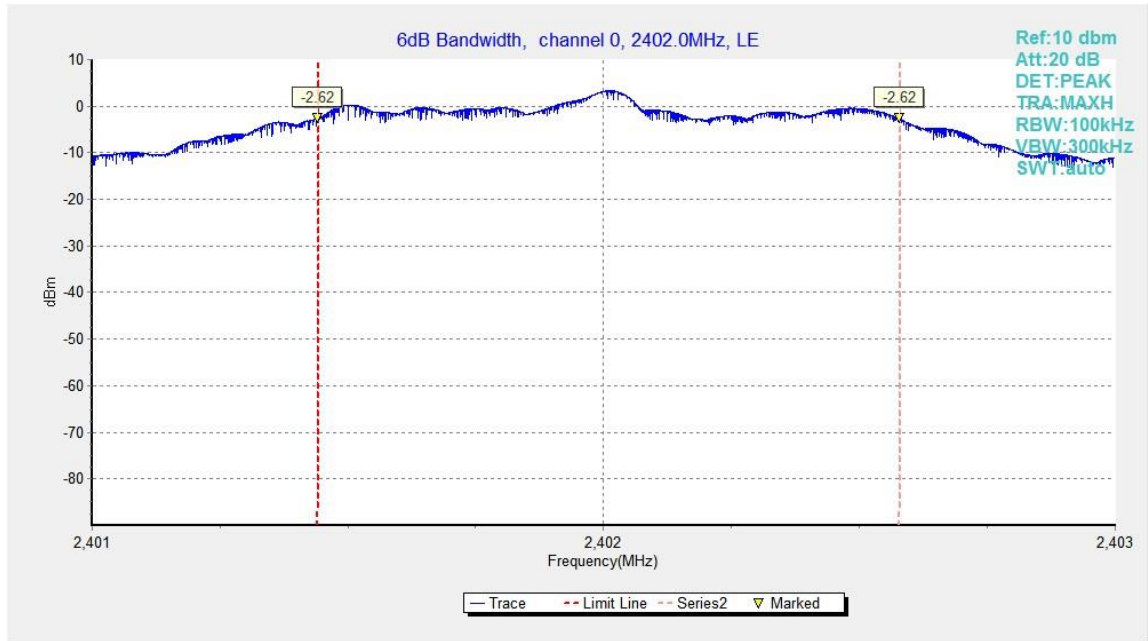
### Measurement Results:

#### For GFSK

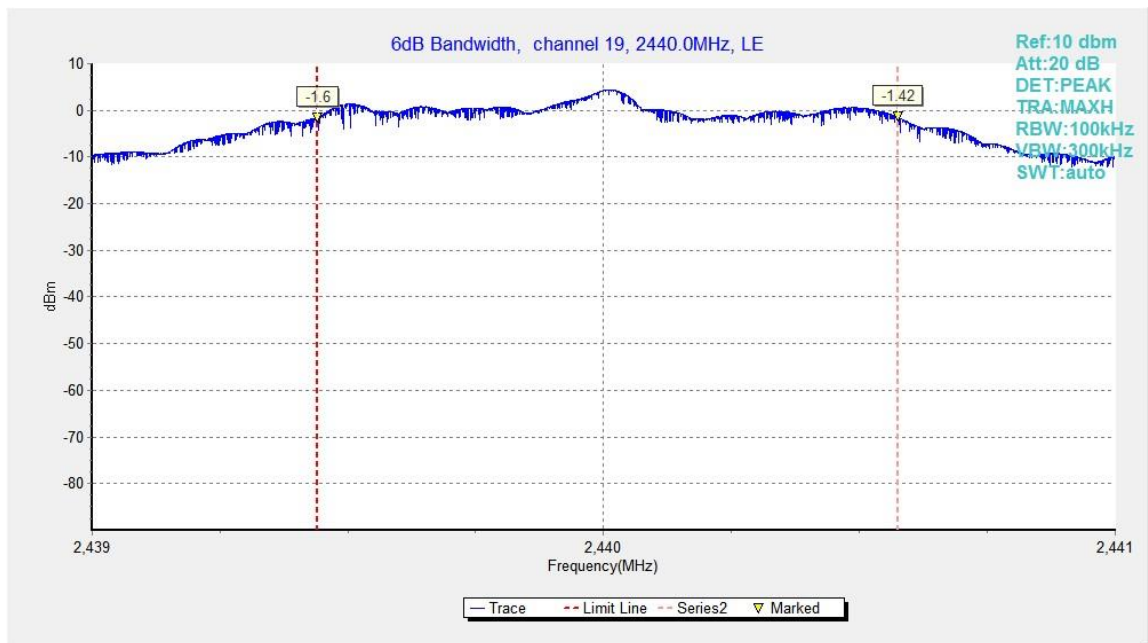
Channel No.	Frequency (MHz)	6dB Bandwidth (kHz)		Conclusion
0	2402	Fig.20	1137.50	P
19	2440	Fig.21	1135.50	P
39	2480	Fig.22	1141.00	P

**Conclusion: PASS**

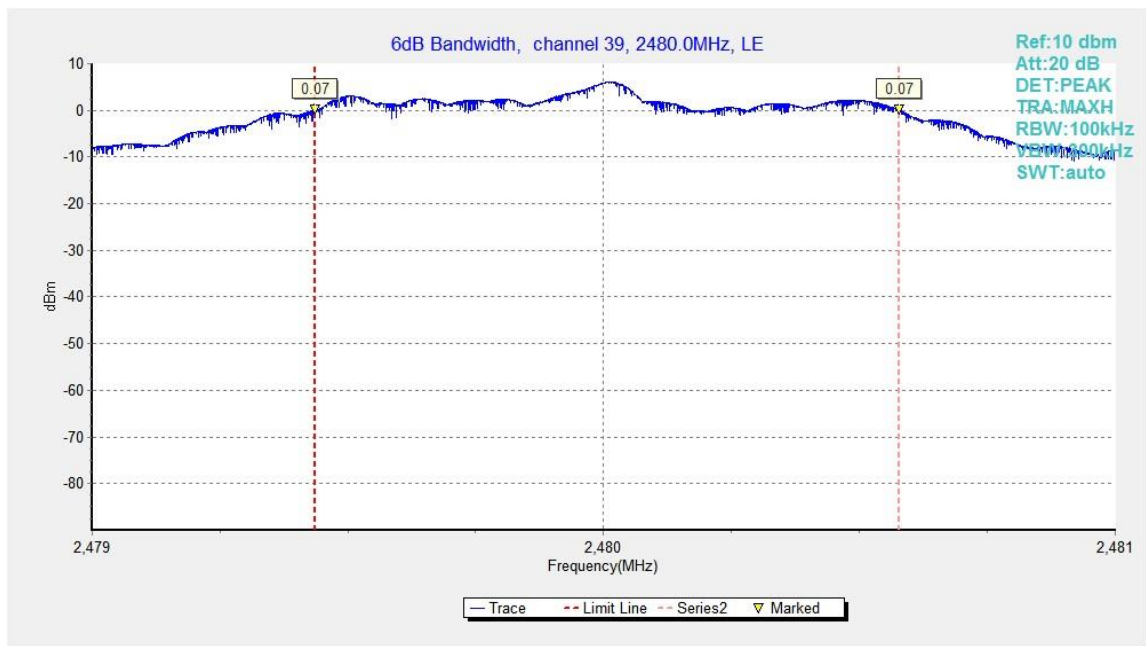
**Test graphs as below:**



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



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



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

## B.7. 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:

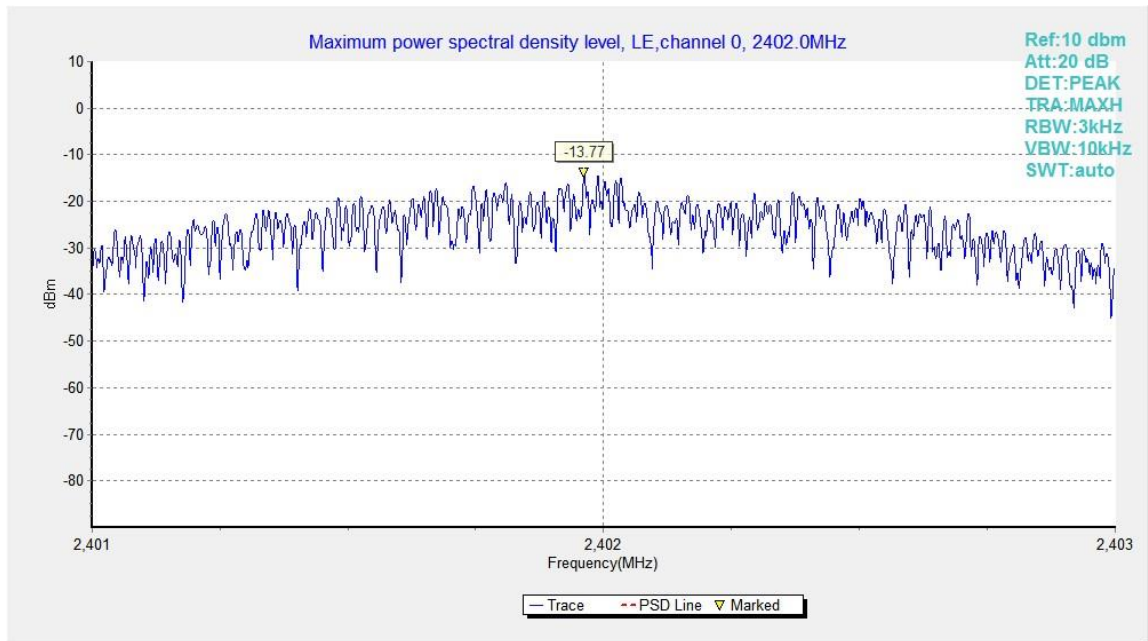
Standard	Limit
FCC 47 CFR Part 15.247(e)	$\leq 8.0\text{dBm}/3\text{kHz}$

### Measurement Results:

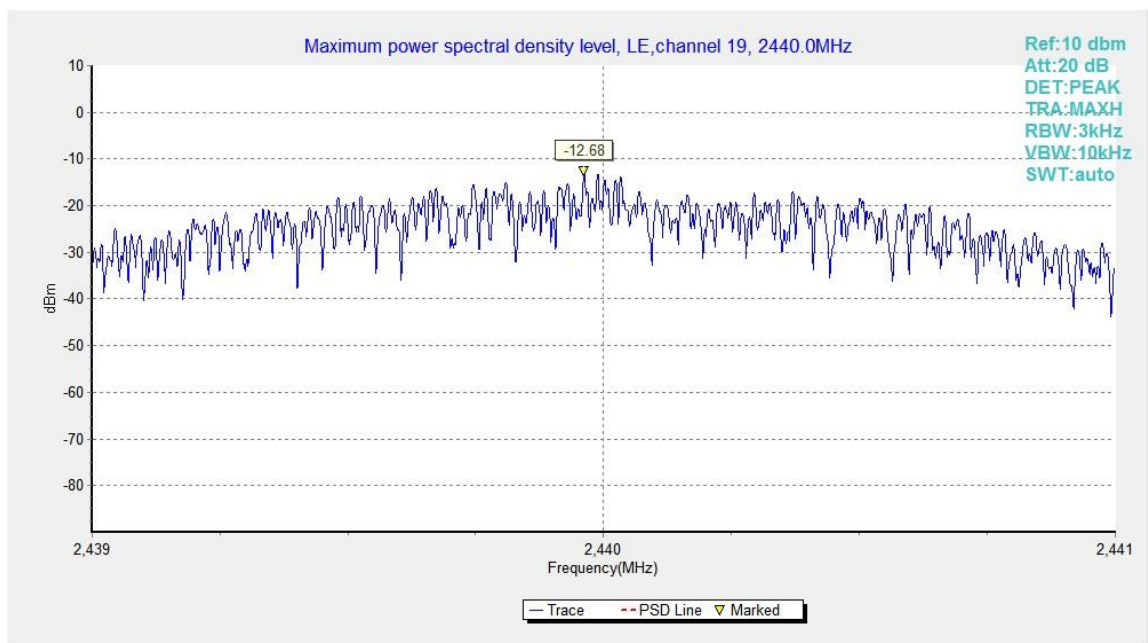
#### For GFSK

Channel No.	Frequency (MHz)	Maximum Power Spectral Density Level(dBm/3kHz)		Conclusion
0	2402	Fig.23	-13.77	P
19	2440	Fig.24	-12.68	P
39	2480	Fig.25	-11.00	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



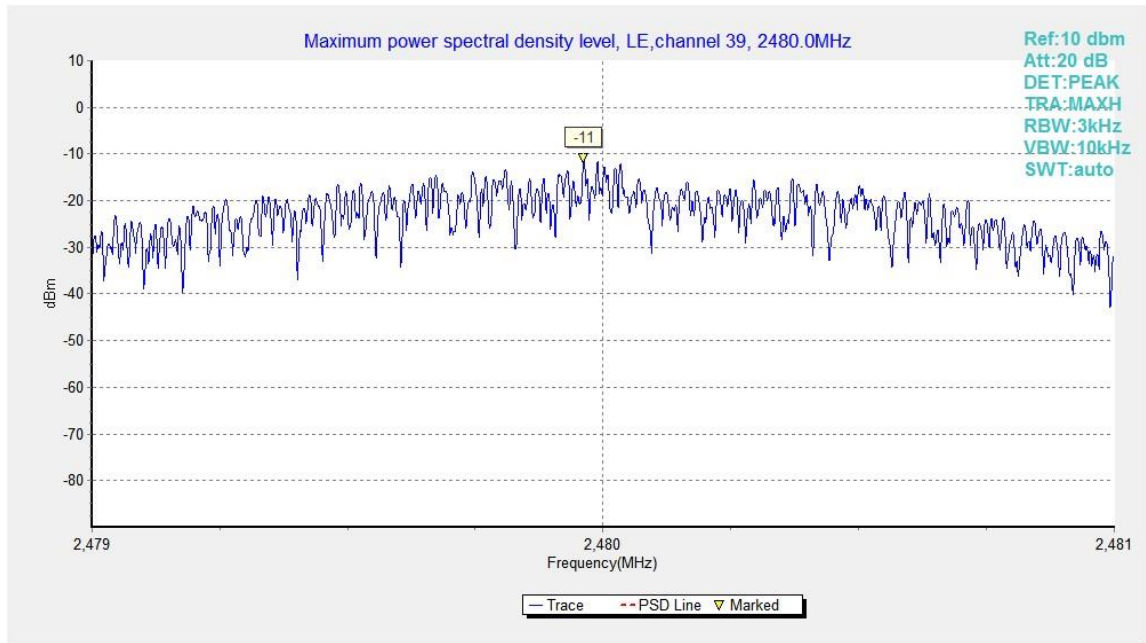


Fig.25. Maximum Power Spectral Density Level Function: GFSK, 2480 MHz

## B.8. AC Powerline Conducted Emission

### Summary

All AC line conducted spurious emissions are measured with a receiver connected to a grounded LISN while the EUT is operating at its maximum duty cycle, at maximum power, and at the appropriate frequencies. All data rates and modes were investigated for conducted spurious emissions. Only the conducted emissions of the configuration that produced the worst case emissions are reported in this section

### Method of Measurement:

See Clause 6.2 of ANSI C63.10 specifically.

See Clause 4 and Clause 5 of ANSI C63.10 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.

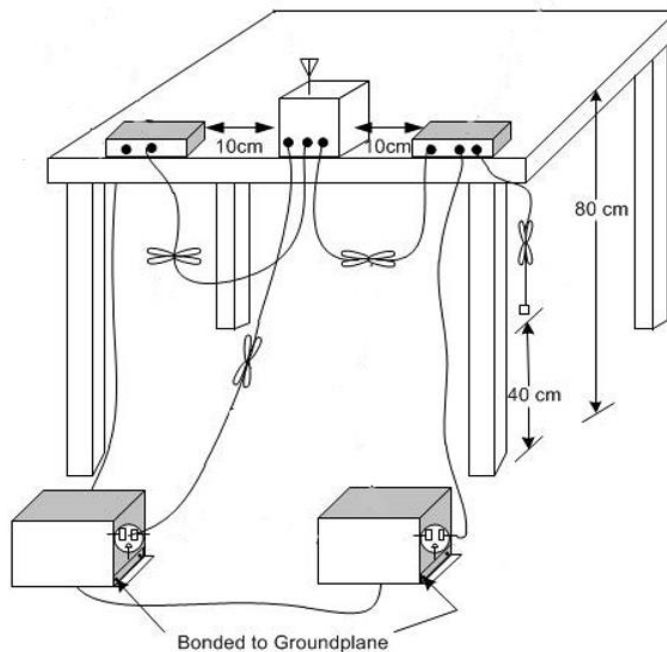
The measurement bandwidth is:

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

### Test Condition:

Voltage (V)	Frequency (Hz)
120	60

### Test setup



**Measurement Result and limit:**

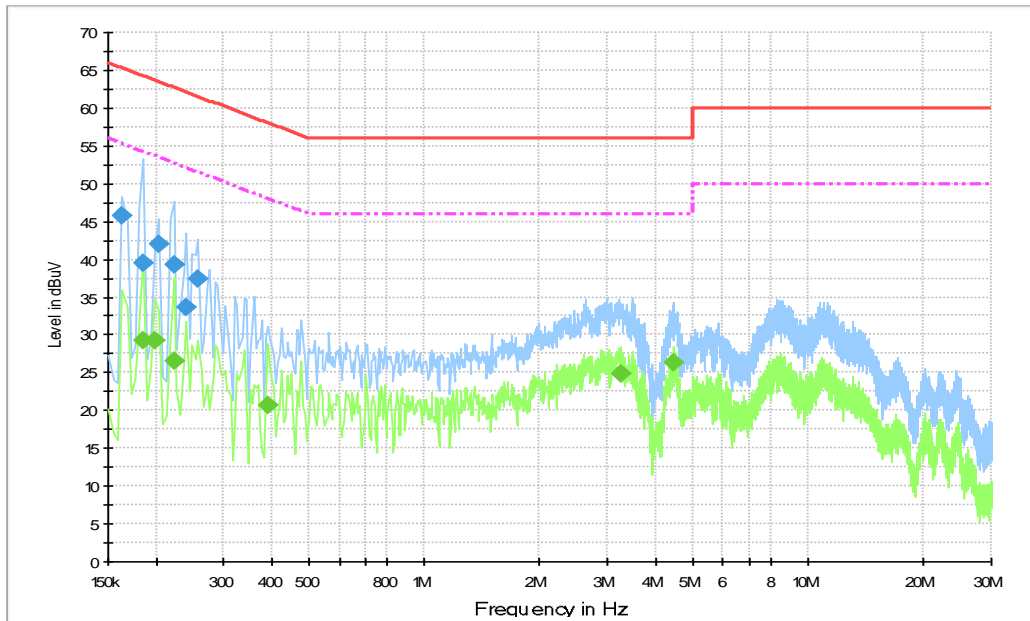
## Bluetooth (Quasi-peak Limit)

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.8.1	Fig. B.8.2	<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.8.1	Fig. B.8.2	<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.8.1 AC Powerline Conducted Emission- bluetooth**

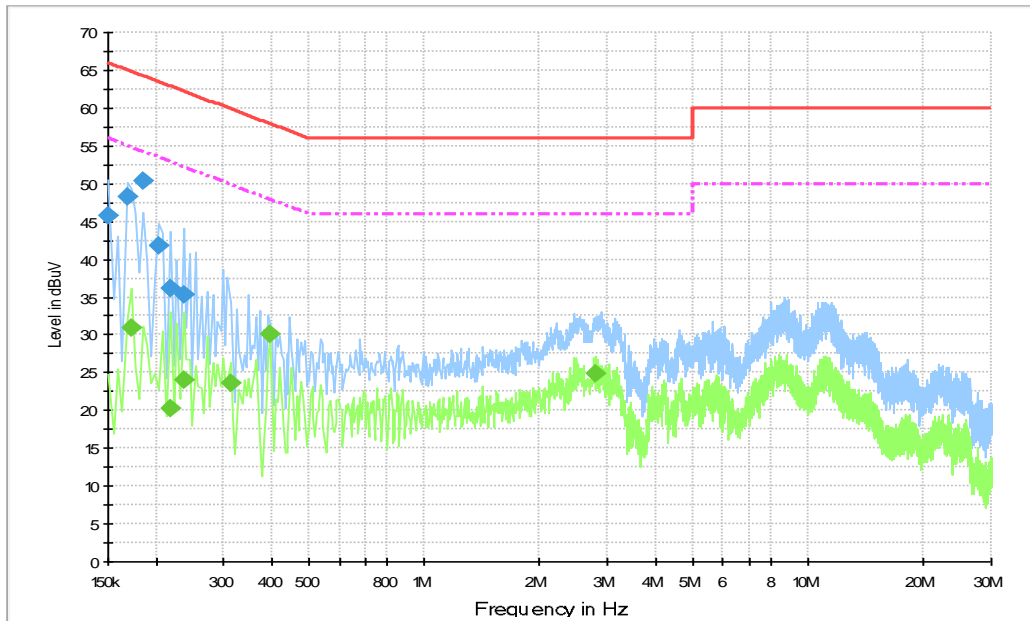
Note: The graphic result above is the maximum of the measurements for both phase line and neutral line.

**Final Result 1**

Frequency (MHz)	QuasiPeak (dB $\mu$ V)	Meas. Time (ms)	Bandwidth (kHz)	Filter	Line	Corr. (dB)	Margin (dB)	Limit (dB $\mu$ V)
0.163500	45.9	2000.0	9.000	Off	N	19.7	19.4	65.3
0.186000	39.6	2000.0	9.000	Off	L1	19.7	24.7	64.2
0.204000	42.0	2000.0	9.000	Off	L1	19.7	21.4	63.4
0.222000	39.3	2000.0	9.000	Off	L1	19.7	23.5	62.7
0.240000	33.7	2000.0	9.000	Off	L1	19.6	28.4	62.1
0.258000	37.4	2000.0	9.000	Off	L1	19.6	24.0	61.5

**Final Result 2**

Frequency (MHz)	Average (dB $\mu$ V)	Meas. Time (ms)	Bandwidth (kHz)	Filter	Line	Corr. (dB)	Margin (dB)	Limit (dB $\mu$ V)
0.186000	29.4	2000.0	9.000	Off	N	19.7	24.9	54.2
0.199500	29.3	2000.0	9.000	Off	L1	19.7	24.3	53.6
0.222000	26.5	2000.0	9.000	Off	L1	19.7	26.3	52.7
0.393000	20.7	2000.0	9.000	Off	L1	19.6	27.3	48.0
3.232500	24.8	2000.0	9.000	Off	L1	19.7	21.2	46.0
4.443000	26.2	2000.0	9.000	Off	L1	19.7	19.8	46.0



**Fig.B.8.2 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)	Filter	Line	Corr. (dB)	Margin (dB)	Limit (dBμV)
0.150000	45.7	2000.0	9.000	Off	N	19.6	20.3	66.0
0.168000	48.3	2000.0	9.000	Off	N	19.7	16.8	65.1
0.186000	50.4	2000.0	9.000	Off	L1	19.7	13.8	64.2
0.204000	41.9	2000.0	9.000	Off	N	19.7	21.6	63.4
0.217500	36.2	2000.0	9.000	Off	N	19.7	26.8	62.9
0.235500	35.3	2000.0	9.000	Off	N	19.6	26.9	62.3

**Final Result 2**

Frequency (MHz)	Average (dBμV)	Meas. Time (ms)	Bandwidth (kHz)	Filter	Line	Corr. (dB)	Margin (dB)	Limit (dBμV)
0.172500	31.0	2000.0	9.000	Off	N	19.7	23.9	54.8
0.217500	20.2	2000.0	9.000	Off	N	19.7	32.7	52.9
0.235500	24.1	2000.0	9.000	Off	N	19.6	28.2	52.3
0.312000	23.7	2000.0	9.000	Off	N	19.7	26.2	49.9
0.397500	30.0	2000.0	9.000	Off	N	19.7	17.9	47.9
2.805000	25.0	2000.0	9.000	Off	L1	19.7	21.0	46.0



## **B.9. Antenna Requirement**

The antenna of the device is permanently attached. There are no provisions for connection to an external antenna.

The unit complies with the requirement of FCC Part 15.203.

## ANNEX C: Accreditation Certificate



### Accredited Laboratory

A2LA has accredited

#### TELECOMMUNICATION TECHNOLOGY LABS, CAICT

Beijing, 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 26<sup>th</sup> day of June 2023.



Mr. Trace McInturf, Vice President, Accreditation Services  
For the Accreditation Council  
Certificate Number 7049.01  
Valid to July 31, 2024

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

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