



FCC PART 15C TEST REPORT

BLUETOOTH LOW ENERGY (BLE) PART

No. I22Z70189-IOT02

for

Samsung Electronics Co., Ltd.

Multi-band GSM/WCDMA/LTE Tablet with Bluetooth, WLAN

Model Name: SM-T509

FCC ID: ZCASMT509

with

Hardware Version: REV1.0

Software Version: T509.001

Issued Date: 2022-8-25

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.

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REPORT HISTORY

| Report Number | Revision | Description | Issue Date |
|----------------------|-----------------|---------------------------|-------------------|
| I22Z70189-IOT02 | Rev.0 | 1st edition | 2022-8-16 |
| I22Z70189-IOT02 | Rev.1 | Update chapter 5.1 in p12 | 2022-8-25 |

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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. China 100191

Radiated testing Location: CTTL (BDA)

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

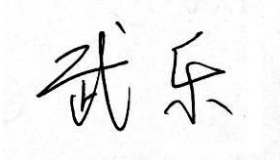
1.3. Testing Environment

Normal Temperature: 20-27℃
Relative Humidity: 20-50%

1.4. Project data

Testing Start Date: 2022-7-12
Testing End Date: 2022-8-16

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

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Contact: Jenni Chun
Email: j1.chun@samsung.com
Tel: +1-201-937-4203

2.2. Manufacturer Information

Company Name: Samsung Electronics Co., Ltd.
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Youngtong gu, Suwon city 443 742, Korea
Contact: Kobe 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 Tablet with Bluetooth, WLAN |
| Model Name | SM-T509 |
| FCC ID | ZCASMT509 |
| Frequency Band | ISM 2400MHz~2483.5MHz |
| Type of Modulation(LE mode) | GFSK (Bluetooth Low Energy) |
| Number of Channels(LE mode) | 40 |
| Power Supply | 3.8V DC by Battery |
| Antenna gain | -1.53dBi |

3.2. Internal Identification of EUT

| EUT ID* | SN or IMEI | HW Version | SW Version | Date of receipt |
|---------|----------------|------------|------------|-----------------|
| UT11a | I22Z70189UT11a | REV1.0 | T509.001 | 2022-7-13 |
| UT15a | I22Z70189UT15a | REV1.0 | T509.001 | 2022-7-12 |

*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 | Adapter 2 | / |
| AE3 | Adapter 3 | / |
| AE4 | Adapter 4 | / |
| AE5 | Adapter 5 | / |
| AE6 | USB cable1 | / |
| AE7 | USB cable2 | / |
| AE8 | USB cable3 | / |
| AE9 | Headset1 | / |
| AE10 | Headset2 | / |
| AE11 | Battery | / |

AE1

| | |
|-----------------|--------------|
| Model | EP-TA50JWE |
| Manufacturer | HAEM Co.,Ltd |
| Length of cable | / |

AE2

| | |
|-----------------|--------------|
| Model | EP-TA50EWE |
| Manufacturer | HAEM Co.,Ltd |
| Length of cable | / |

AE3

| | |
|-----------------|--------------------------------------|
| Model | EP-TA50JWE |
| Manufacturer | RFTECH Co., Ltd |
| Length of cable | / |
| AE4 | |
| Model | EP-TA50EWE |
| Manufacturer | RFTECH Co., Ltd |
| Length of cable | / |
| AE5 | |
| Model | EP-TA50UWE |
| Manufacturer | HAEM Co.,Ltd |
| Length of cable | / |
| AE6 | |
| Model | EP-DT725BWE |
| Manufacturer | RFTECH Co., Ltd. |
| Length of cable | / |
| AE7 | |
| Model | EP-DT725BWE |
| Manufacturer | DONGGUAN KSD CO.,LTD |
| Length of cable | / |
| AE8 | |
| Model | EP-DR140AWE |
| Manufacturer | CRESYN HANOI Co., Ltd |
| Length of cable | / |
| AE9 | |
| Model | EHS64AVFWE |
| Manufacturer | DONGGUAN YOUNGBO ELECTRONICS CO.,LTD |
| Length of cable | / |
| AE10 | |
| Model | EHS61ASFWE |
| Manufacturer | DONGGUAN YOUNGBO ELECTRONICS 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 Multi-band GSM/WCDMA/LTE Tablet 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

Four modes are provided:

| Mode | Conditions |
|--------|------------|
| Mode A | 1Mbps |
| Mode B | 125Kbps |
| Mode C | 500Kbps |
| Mode D | 2Mbps |

*For the test results, the EUT had been tested in Mode A and Mode D. But only the worst case (Mode D) was shown in test report except the " Peak Output Power " test was shown in Mode A and Mode D. Mode A, Mode B and Mode C are same modulation in 1 Msym/s, so only Mode A had been tested.

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

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 | 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 | 00167252 | ETS-Lindgren | 1 year | 2022-12-26 |
| 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.

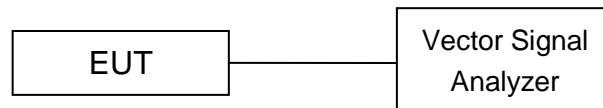
ANNEX B: Detailed Test Results

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

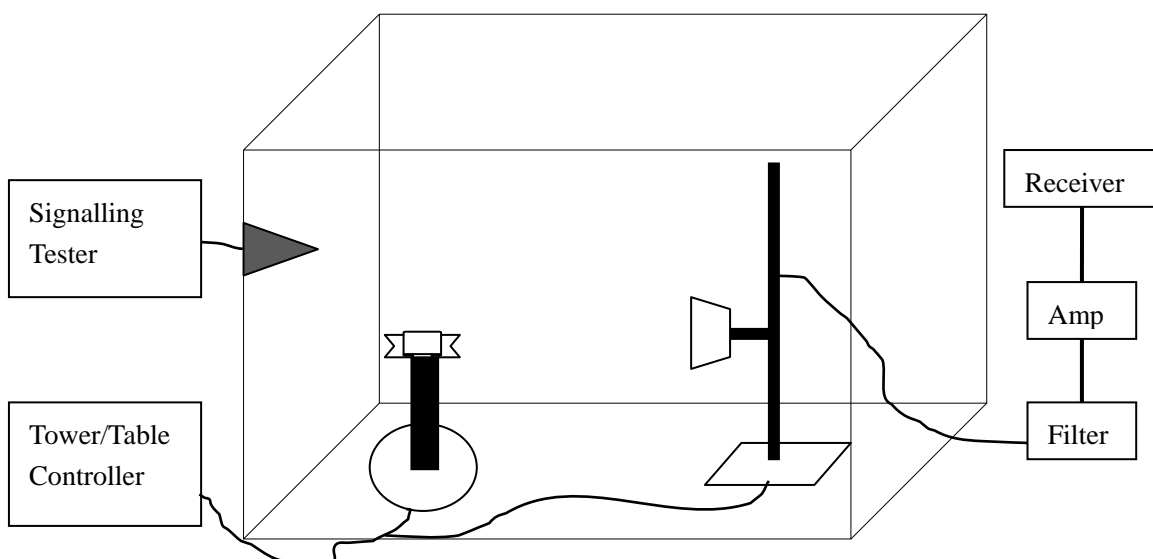
The measurement is made according to ANSI C63.10.

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 | -1.50 | P |
| | 19 | 2440 | -1.26 | P |
| | 39 | 2480 | -0.72 | P |
| 2Mbps | 0 | 2402 | -1.43 | P |
| | 19 | 2440 | -1.22 | P |
| | 39 | 2480 | -0.62 | P |

Conclusion: PASS

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

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

Antenna gain = -1.53dBi

For GFSK

| Sample Rate | Channel No. | Frequency (MHz) | E.I.R.P. (dBm) | Conclusion |
|-------------|-------------|-----------------|----------------|------------|
| 1Mbps | 0 | 2402 | -3.03 | P |
| | 19 | 2440 | -2.79 | P |
| | 39 | 2480 | -2.25 | P |
| 2Mbps | 0 | 2402 | -2.96 | P |
| | 19 | 2440 | -2.75 | P |
| | 39 | 2480 | -2.15 | 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 | -44.55 | P |
| 39 | 2480 | Hopping OFF | Fig.2 | -53.59 | P |

Conclusion: PASS

Test graphs as below

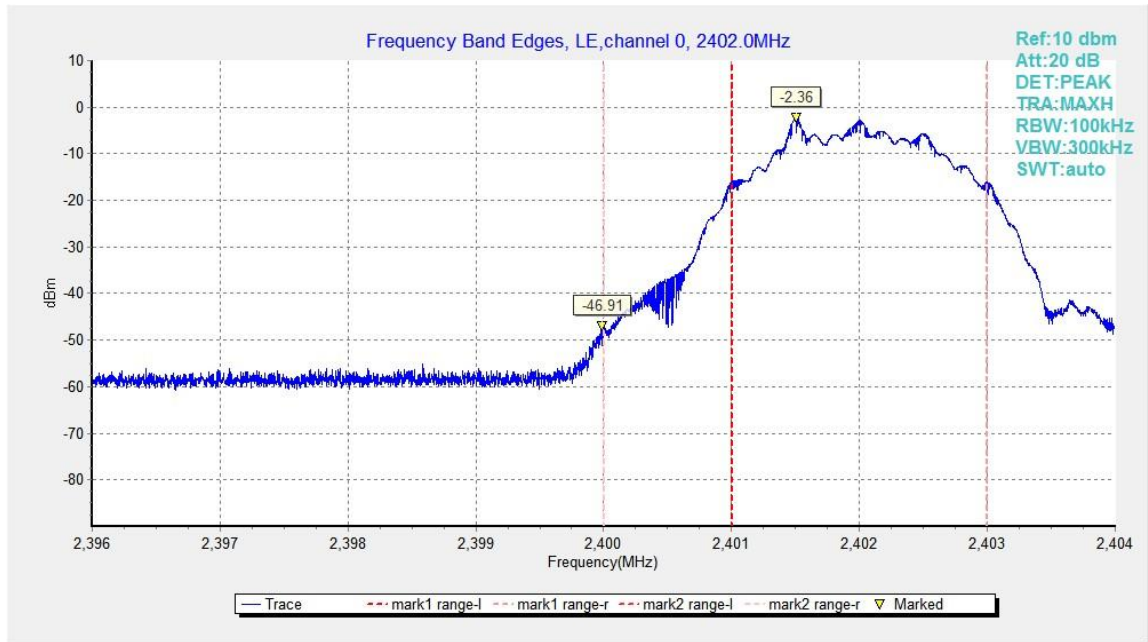


Fig.1. Frequency Band Edges: GFSK, 2402 MHz, Hopping Off

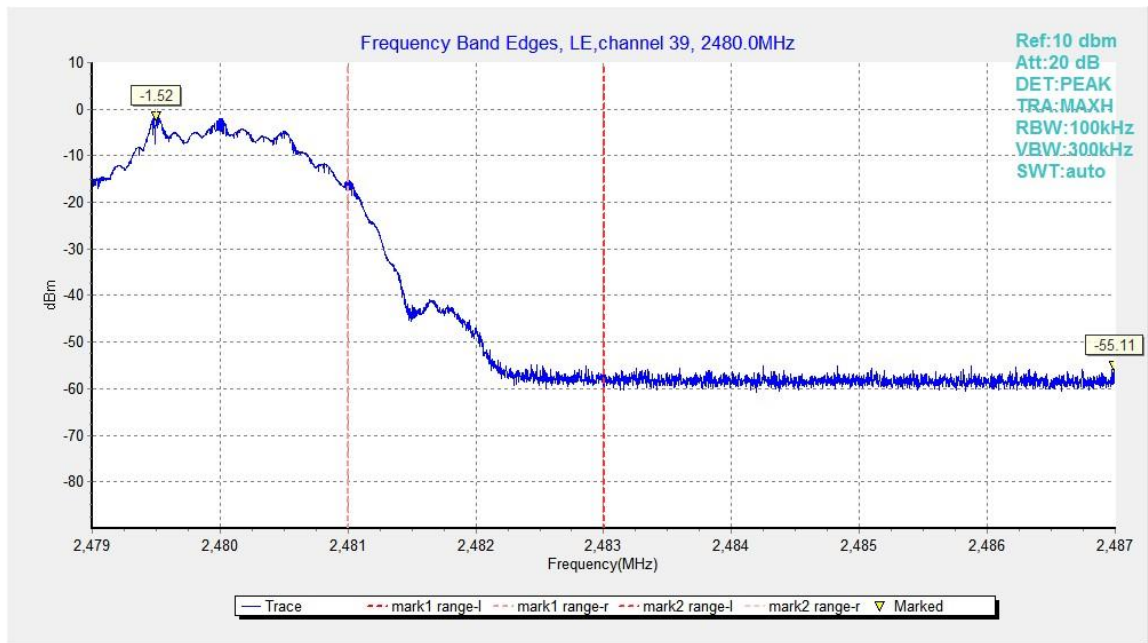


Fig.2. Frequency Band Edges: GFSK, 2480 MHz, Hopping Off

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: UT11a

| 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

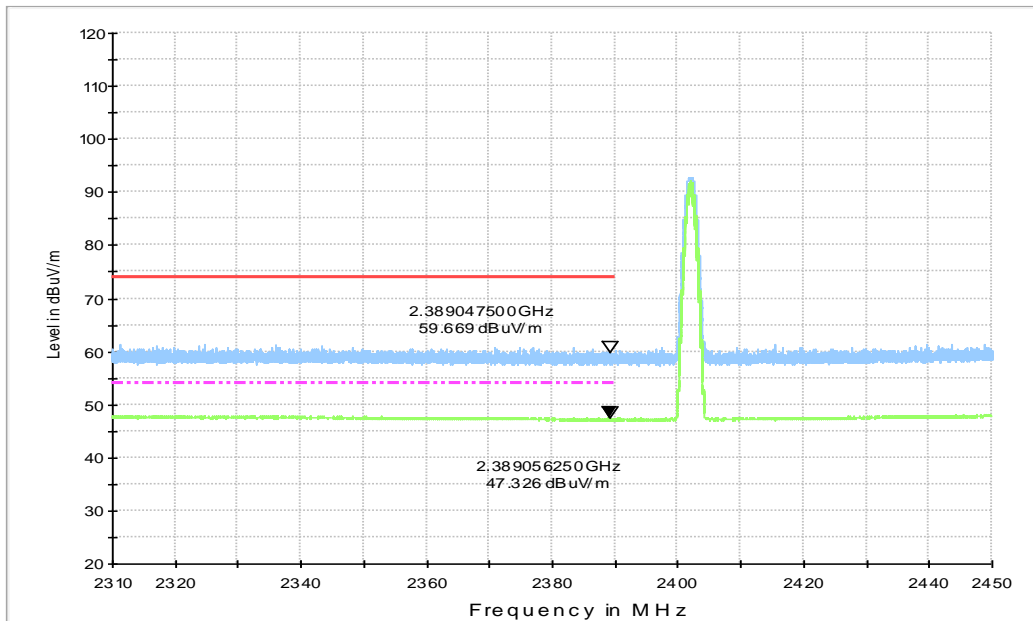


Fig.3. Frequency Band Edges: GFSK, 2402 MHz, 2.31 GHz – 2.45GHz

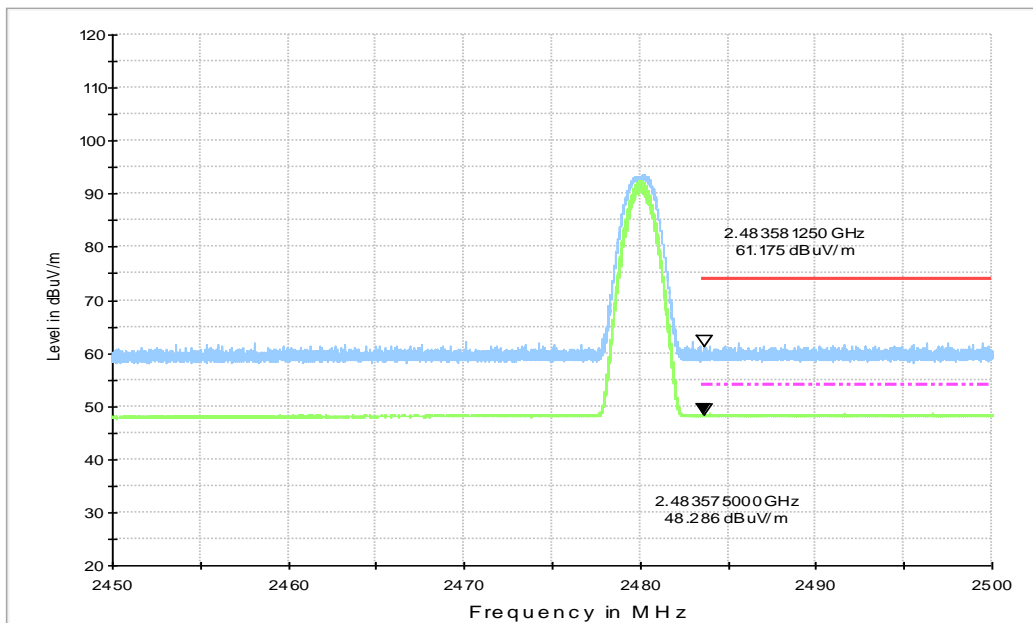


Fig.4. Frequency Band Edges: GFSK, 2480 MHz, 2.45 GHz - 2.50GHz

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 ≥ 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

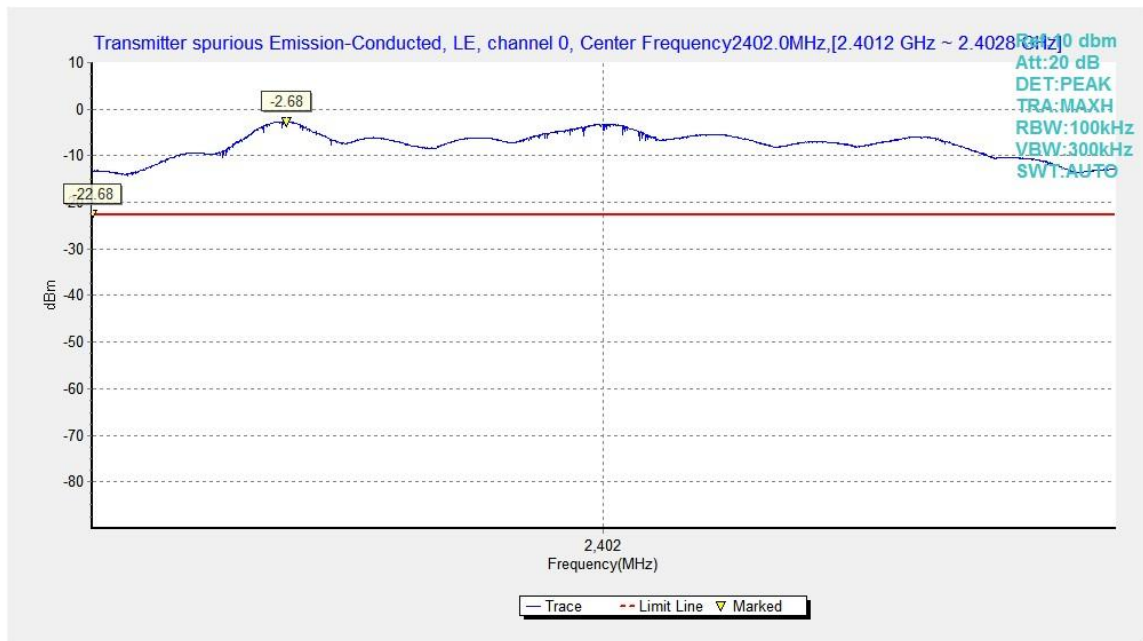


Fig.5. Transmitter Spurious Emission - Conducted: GFSK, 2402MHz

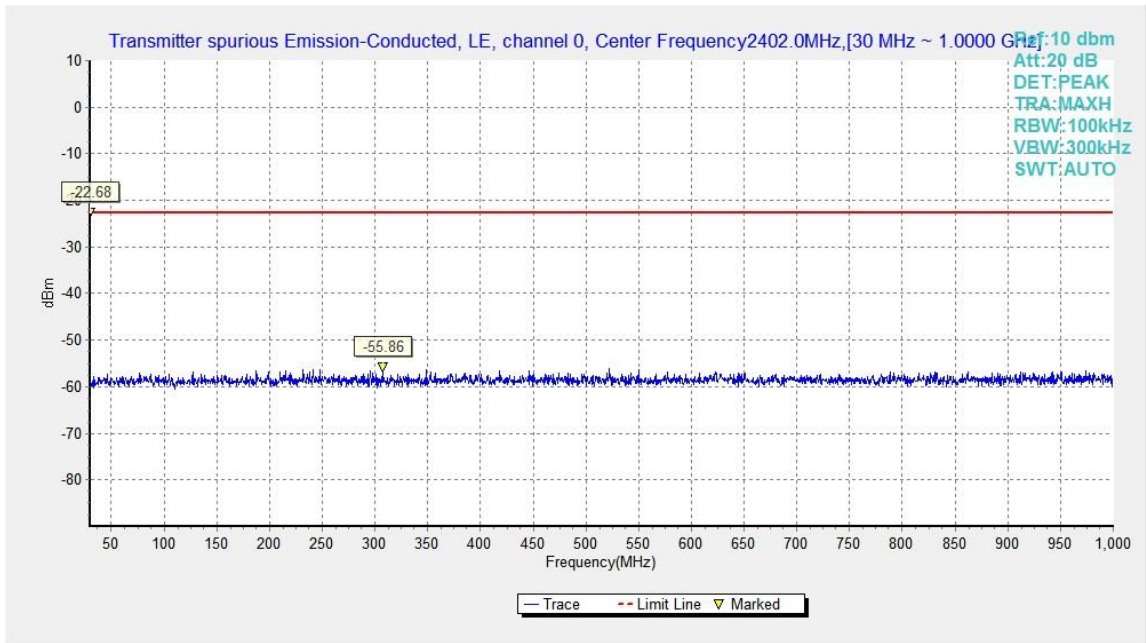


Fig.6. Transmitter Spurious Emission - Conducted: GFSK, 2402 MHz, 30MHz - 1GHz

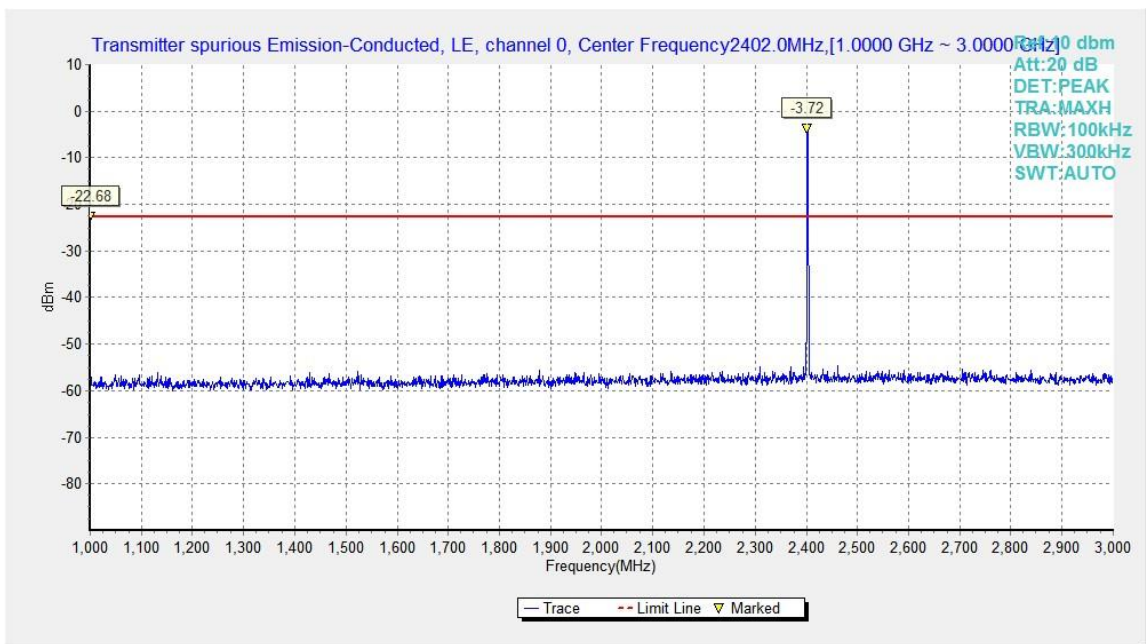


Fig.7. Transmitter Spurious Emission - Conducted: GFSK, 2402 MHz, 1GHz - 3GHz

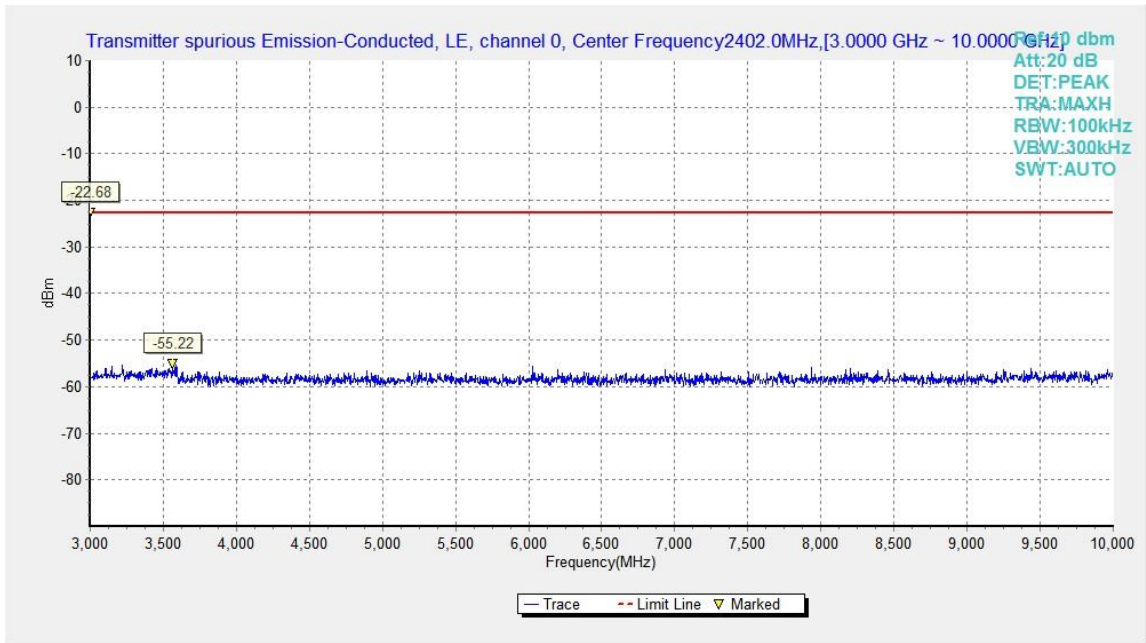


Fig.8. Transmitter Spurious Emission - Conducted: GFSK, 2402 MHz, 3GHz - 10GHz

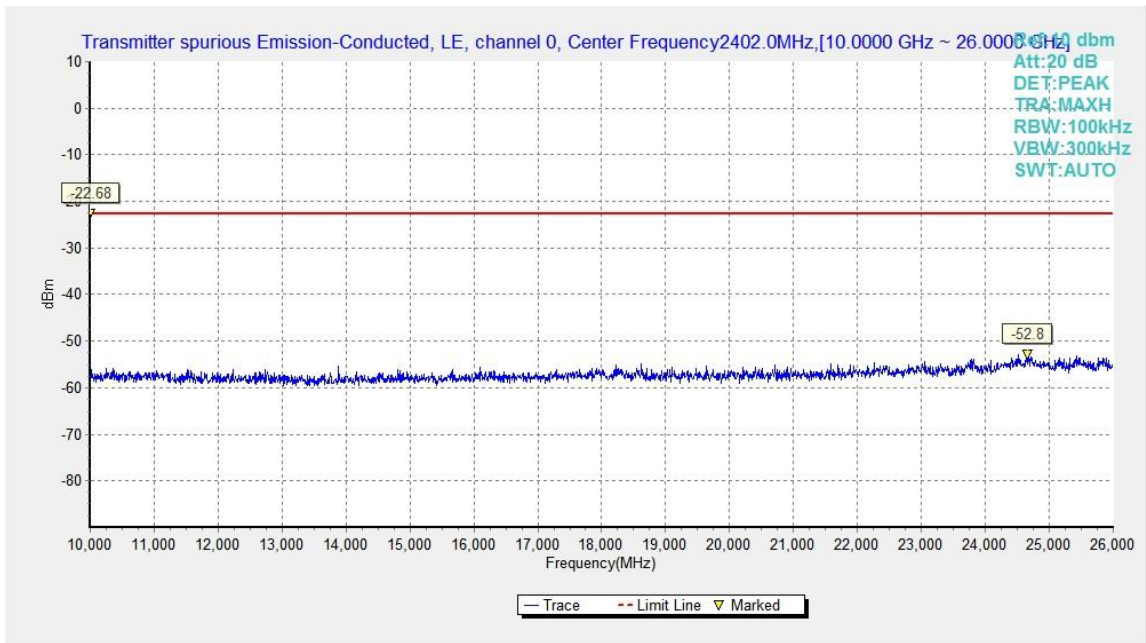


Fig.9. Transmitter Spurious Emission - Conducted: GFSK, 2402 MHz, 10GHz - 26GHz

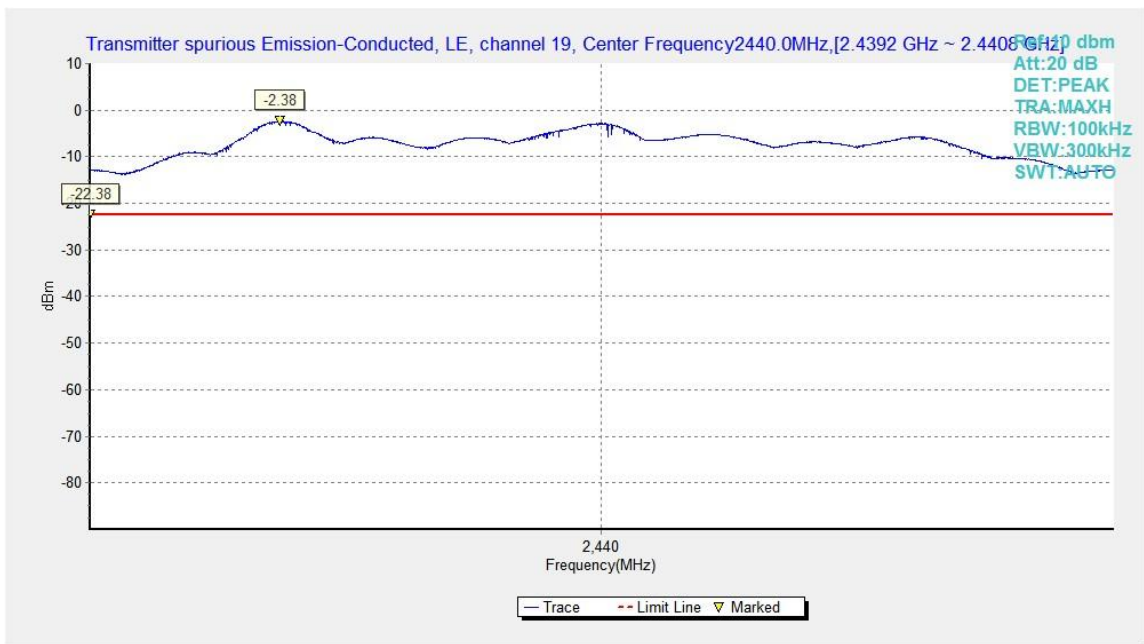


Fig.10. Transmitter Spurious Emission - Conducted: GFSK, 2440MHz

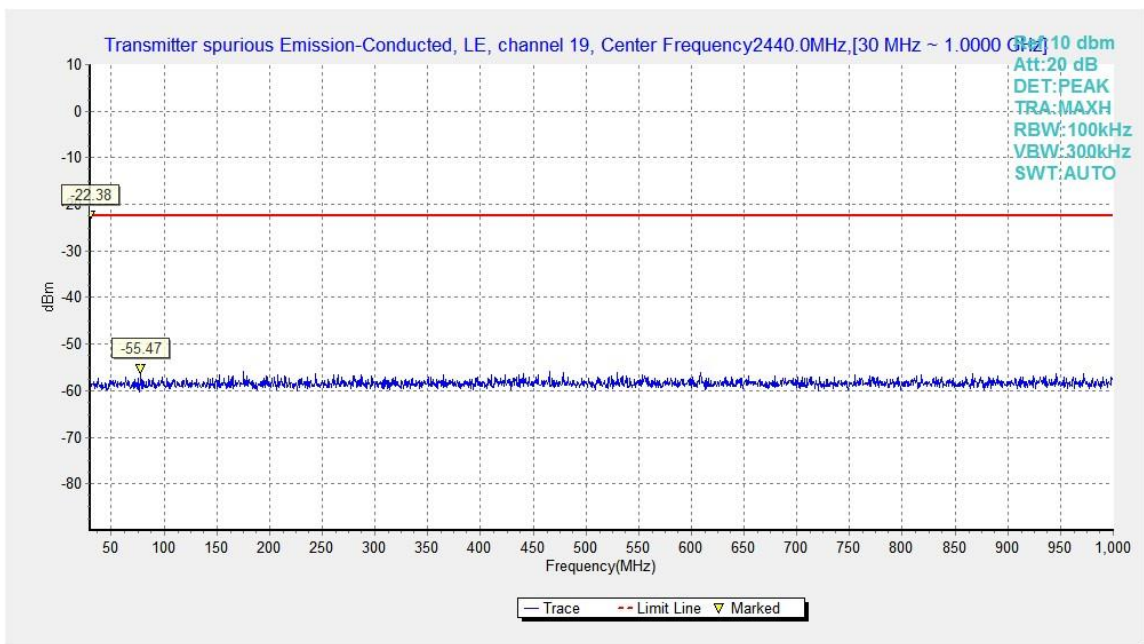


Fig.11. Transmitter Spurious Emission - Conducted: GFSK, 2440 MHz, 30MHz - 1GHz

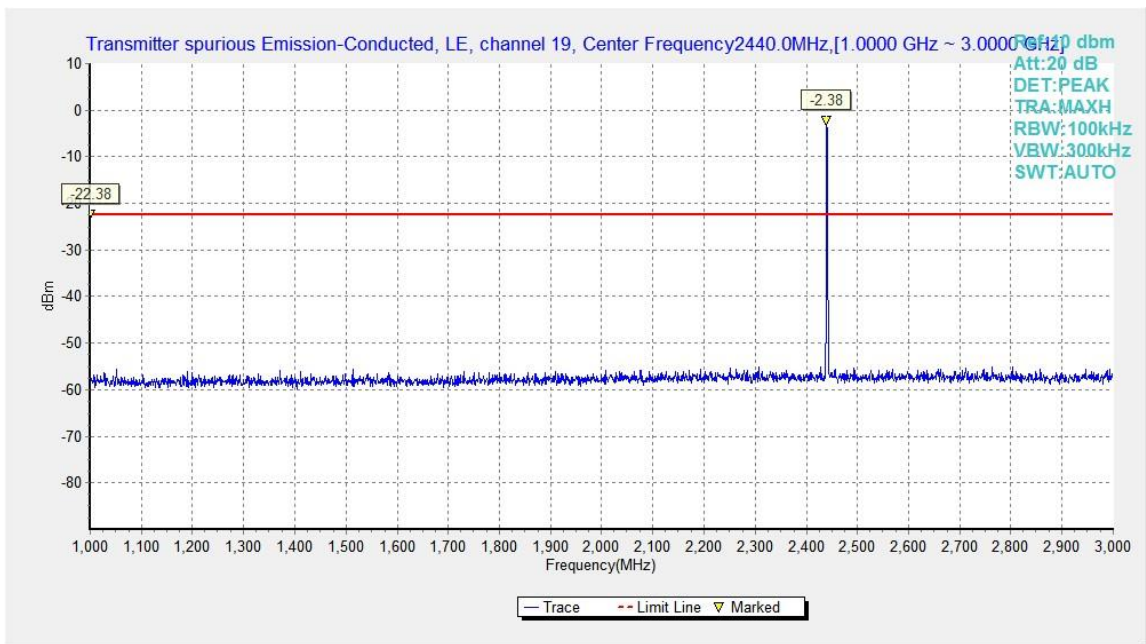


Fig.12. Transmitter Spurious Emission - Conducted: GFSK, 2440 MHz, 1GHz – 3GHz

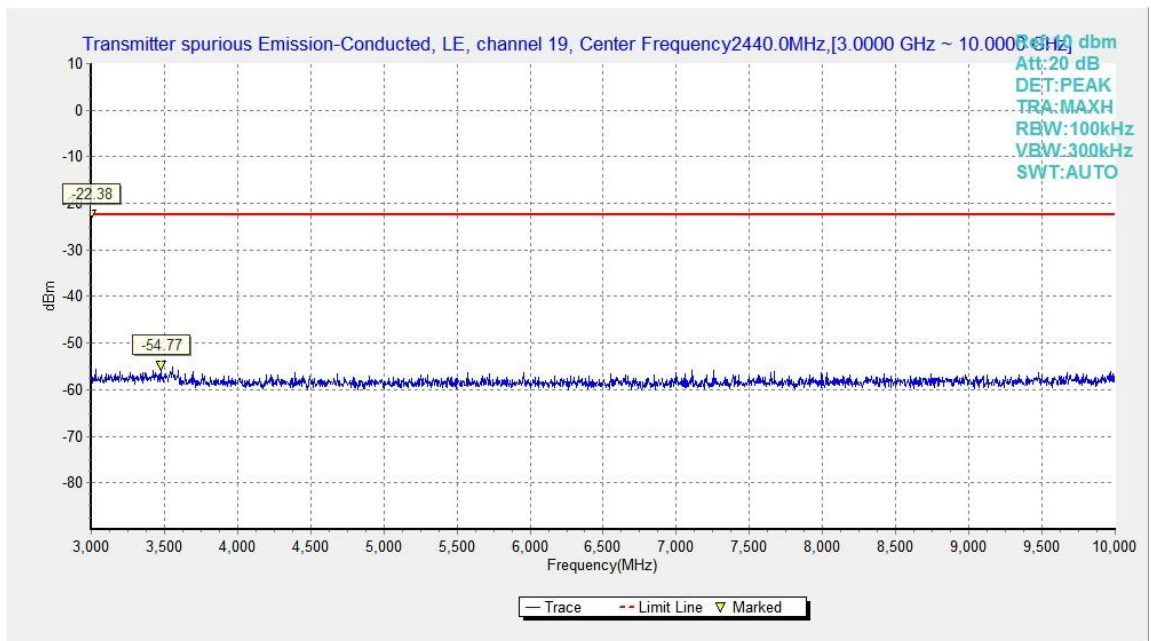


Fig.13. Transmitter Spurious Emission - Conducted: GFSK, 2440 MHz, 3GHz – 10GHz

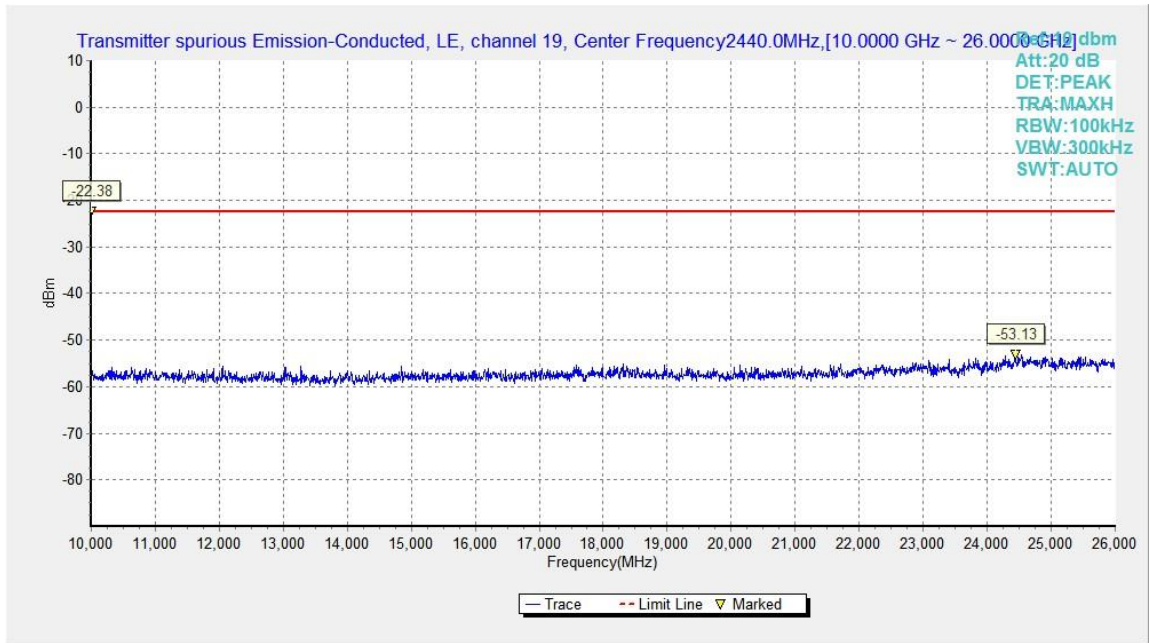


Fig.14. Transmitter Spurious Emission - Conducted: GFSK, 2440 MHz, 10GHz – 26GHz

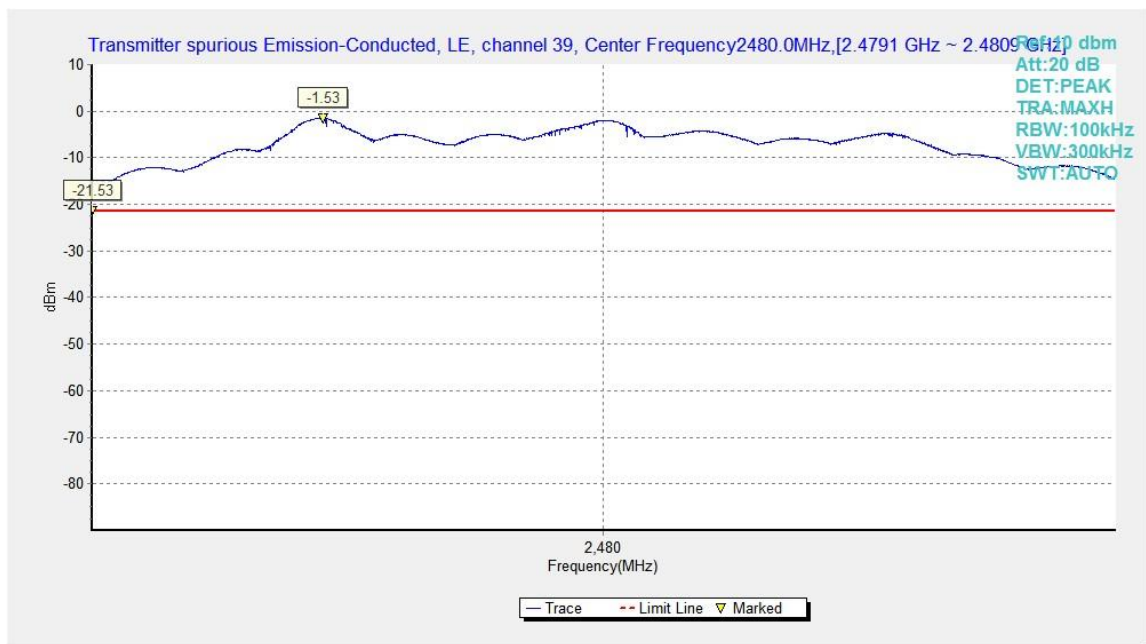


Fig.15. Transmitter Spurious Emission - Conducted: GFSK, 2480 MHz

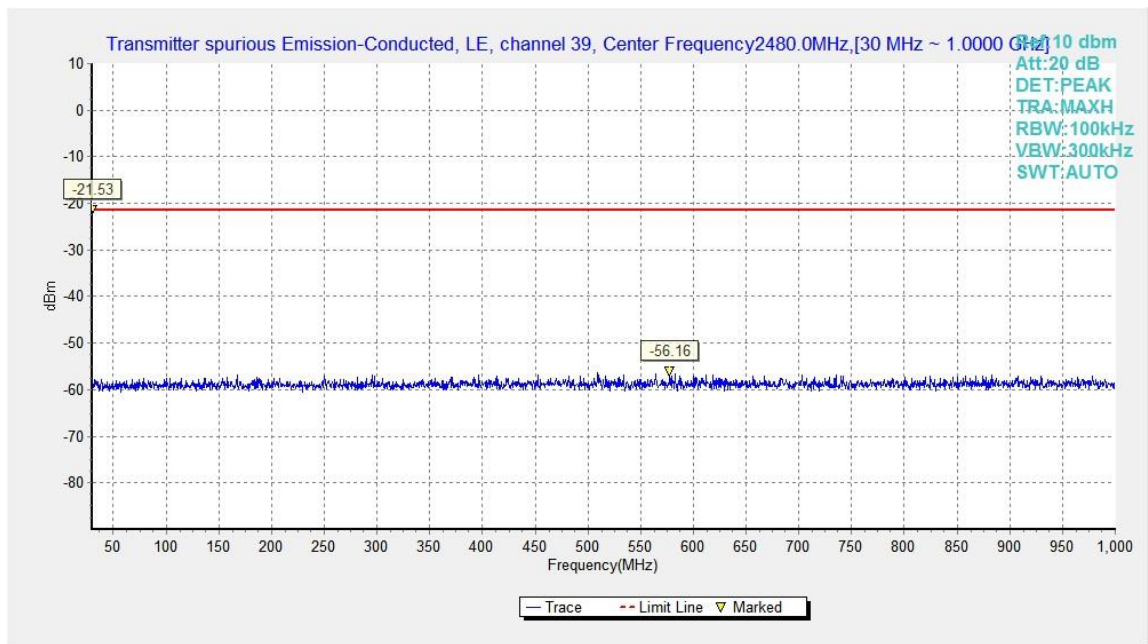


Fig.16. Transmitter Spurious Emission - Conducted: GFSK, 2480 MHz, 30MHz - 1GHz

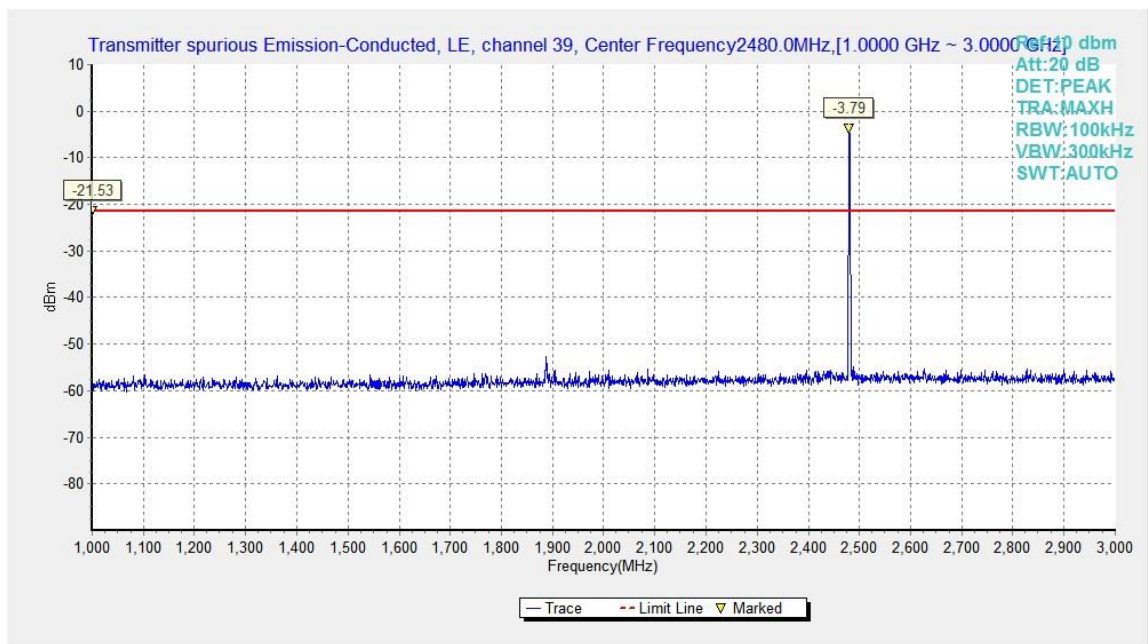


Fig.17. Transmitter Spurious Emission - Conducted: GFSK, 2480 MHz, 1GHz - 3GHz

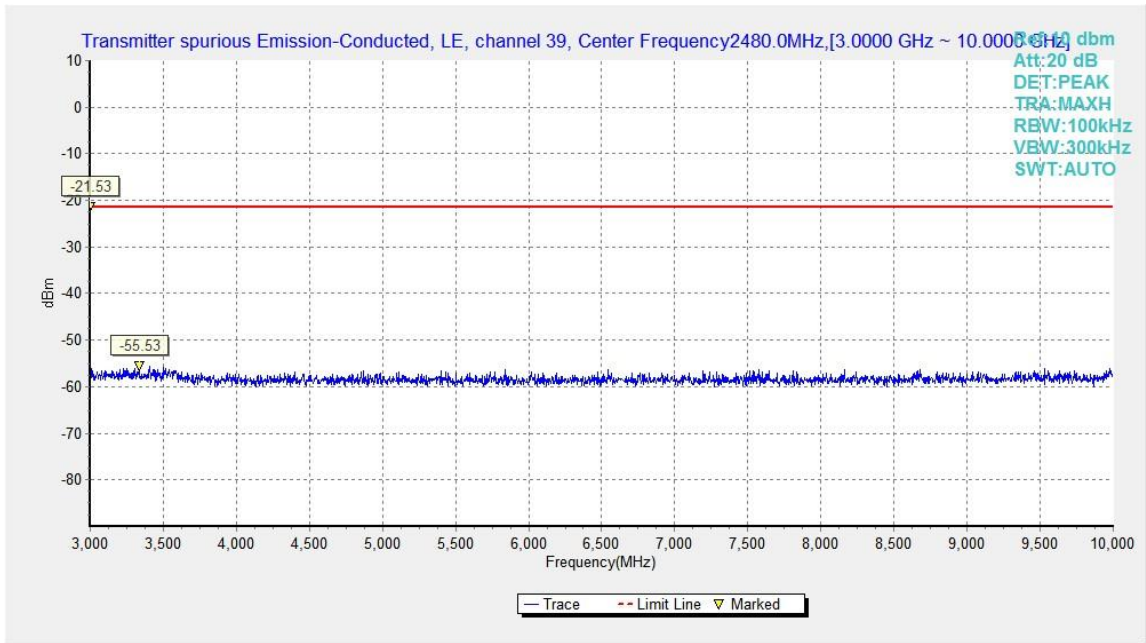


Fig.18. Transmitter Spurious Emission - Conducted: GFSK, 2480 MHz, 3GHz - 10GHz

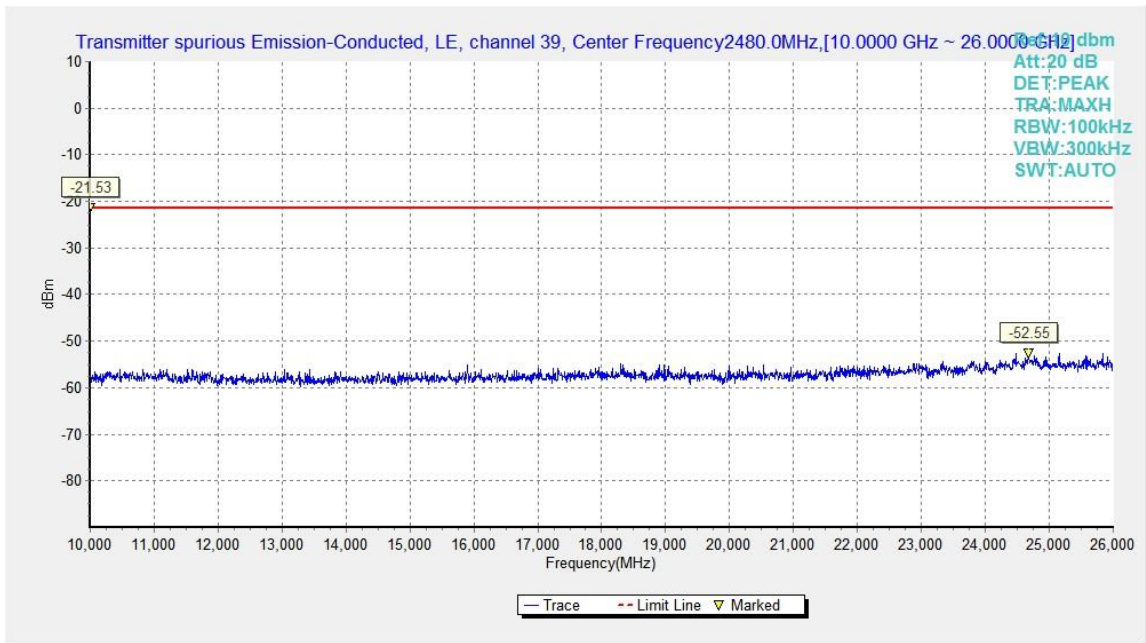


Fig.19. Transmitter Spurious Emission - Conducted: GFSK, 2480 MHz, 10GHz - 26GHz

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(μV/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) | 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:

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

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) |
|-----------------|-----------------------------|-----------------|-----------------------|-------------------------|----------------|-------------|--------------------|
| 2377.350 | 46.13 | 4.58 | 27.45 | 14.10 | 54.00 | 7.87 | V |
| 2384.400 | 46.08 | 4.60 | 27.43 | 14.05 | 54.00 | 7.92 | H |
| 4804.000 | 29.97 | -36.04 | 34.02 | 31.99 | 54.00 | 24.03 | V |
| 7206.100 | 30.57 | -34.58 | 35.64 | 29.51 | 54.00 | 23.43 | V |
| 9607.900 | 32.01 | -33.50 | 36.75 | 28.75 | 54.00 | 21.99 | V |
| 12010.000 | 34.46 | -31.69 | 38.80 | 27.35 | 54.00 | 19.54 | 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) |
|-----------------|-----------------------------|-----------------|-----------------------|-------------------------|----------------|-------------|--------------------|
| 2422.125 | 46.46 | 4.65 | 27.49 | 14.33 | 54.00 | 7.54 | V |
| 2451.225 | 46.91 | 4.67 | 27.61 | 14.63 | 54.00 | 7.09 | H |
| 4879.900 | 29.95 | -35.78 | 34.05 | 31.68 | 54.00 | 24.05 | H |
| 7323.100 | 30.90 | -34.21 | 35.67 | 29.45 | 54.00 | 23.10 | H |
| 9763.900 | 31.88 | -33.57 | 36.97 | 28.47 | 54.00 | 22.12 | V |
| 12205.000 | 34.31 | -31.58 | 38.84 | 27.05 | 54.00 | 19.69 | 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) |
|-----------------|-----------------------------|-----------------|-----------------------|-------------------------|----------------|-------------|--------------------|
| 2483.812 | 46.97 | 4.65 | 27.87 | 14.45 | 54.00 | 7.03 | V |
| 2485.088 | 47.01 | 4.65 | 27.88 | 14.48 | 54.00 | 6.99 | V |
| 4959.400 | 29.75 | -35.60 | 34.08 | 31.26 | 54.00 | 24.25 | H |
| 7440.100 | 30.33 | -34.17 | 35.69 | 28.81 | 54.00 | 23.67 | V |
| 9919.900 | 32.24 | -33.25 | 37.19 | 28.30 | 54.00 | 21.76 | V |
| 12400.000 | 34.85 | -31.25 | 38.88 | 27.22 | 54.00 | 19.15 | V |

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) |
|-----------------|-----------------------------|-----------------|-----------------------|-------------------------|----------------|-------------|--------------------|
| 2383.238 | 60.77 | 4.60 | 27.43 | 28.73 | 74.00 | 13.23 | H |
| 2389.048 | 59.67 | 4.61 | 27.42 | 27.63 | 74.00 | 14.33 | H |
| 4804.000 | 41.50 | -36.04 | 34.02 | 43.51 | 74.00 | 32.50 | H |
| 7206.000 | 42.42 | -34.58 | 35.64 | 41.36 | 74.00 | 31.58 | H |
| 9608.000 | 43.35 | -33.50 | 36.75 | 40.10 | 74.00 | 30.65 | H |
| 12010.000 | 46.48 | -31.69 | 38.80 | 39.37 | 74.00 | 27.52 | 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) |
|-----------------|-----------------------------|-----------------|-----------------------|-------------------------|----------------|-------------|--------------------|
| 2355.400 | 45.01 | -37.10 | 32.13 | 51.42 | 74.00 | 28.99 | H |
| 2512.800 | 45.62 | -36.75 | 32.41 | 51.42 | 74.00 | 28.38 | H |
| 4882.000 | 40.00 | -35.77 | 34.05 | 41.71 | 74.00 | 34.00 | H |
| 7323.000 | 42.19 | -34.21 | 35.67 | 40.74 | 74.00 | 31.81 | V |
| 9764.000 | 42.38 | -33.57 | 36.97 | 38.98 | 74.00 | 31.62 | V |
| 12205.000 | 47.37 | -31.58 | 38.84 | 40.11 | 74.00 | 26.63 | 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) |
|-----------------|-----------------------------|-----------------|-----------------------|-------------------------|----------------|-------------|--------------------|
| 2483.581 | 61.17 | 4.65 | 27.87 | 28.65 | 74.00 | 12.83 | H |
| 2483.753 | 60.97 | 4.65 | 27.87 | 28.45 | 74.00 | 13.03 | H |
| 4960.000 | 40.74 | -35.60 | 34.08 | 42.26 | 74.00 | 33.26 | H |
| 7440.000 | 42.55 | -34.17 | 35.69 | 41.03 | 74.00 | 31.45 | V |
| 9920.000 | 44.47 | -33.25 | 37.19 | 40.53 | 74.00 | 29.53 | V |
| 12400.000 | 45.81 | -31.25 | 38.88 | 38.18 | 74.00 | 28.19 | H |

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 | 1166.00 | P |
| 19 | 2440 | Fig.21 | 1162.00 | P |
| 39 | 2480 | Fig.22 | 1160.00 | P |

Conclusion: PASS

Test graphs as below:

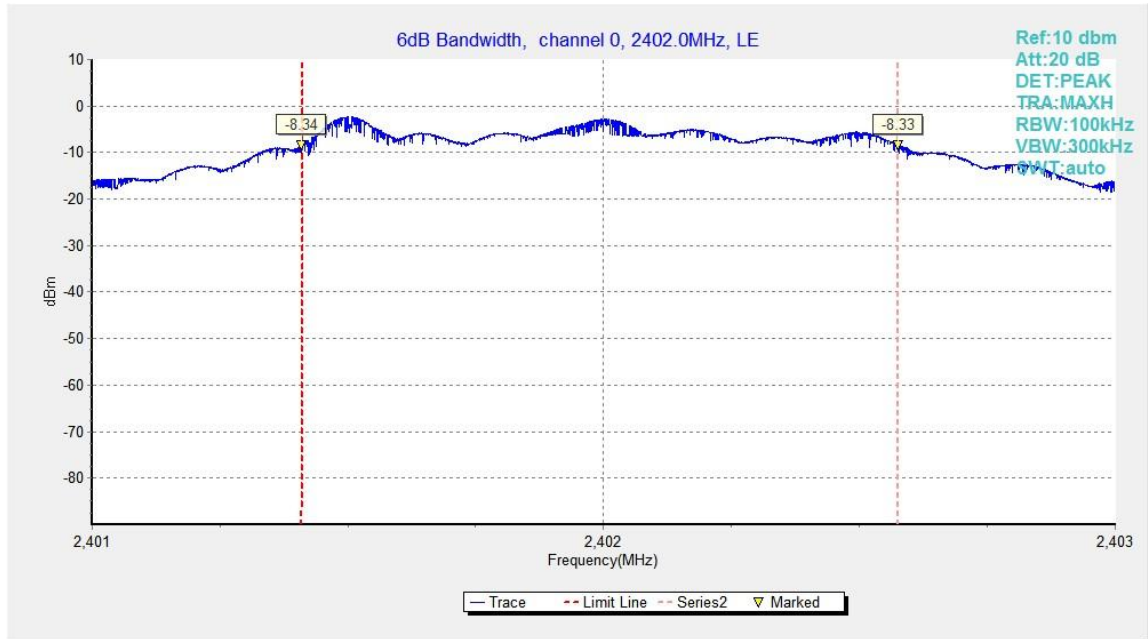


Fig.20. 6dB Bandwidth: GFSK, 2402 MHz

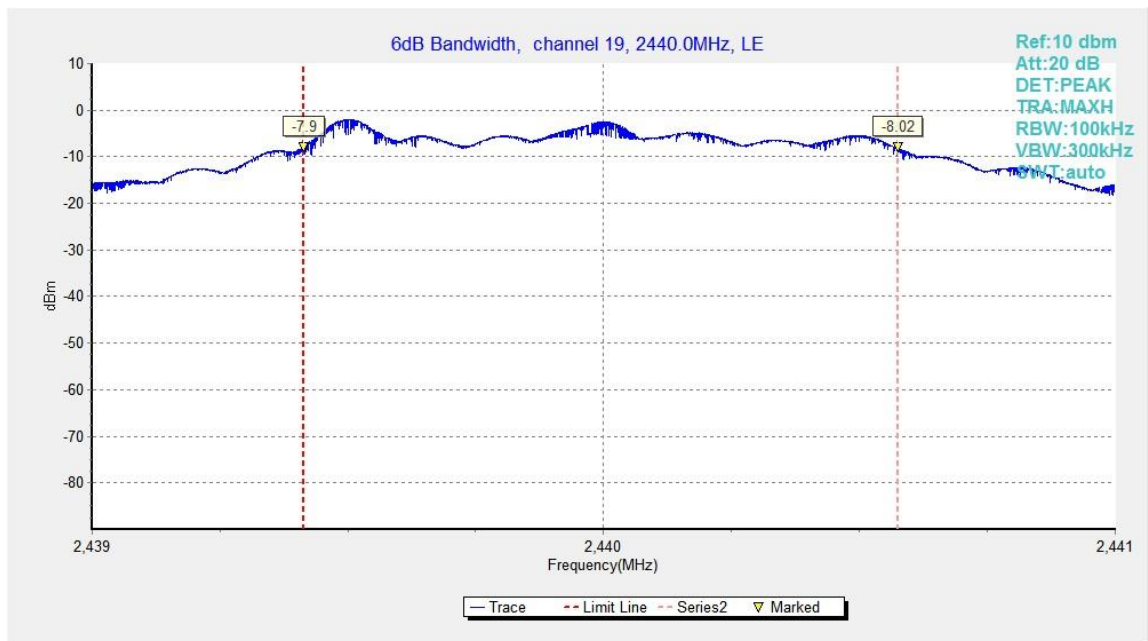


Fig.21. 6dB Bandwidth: GFSK, 2440 MHz

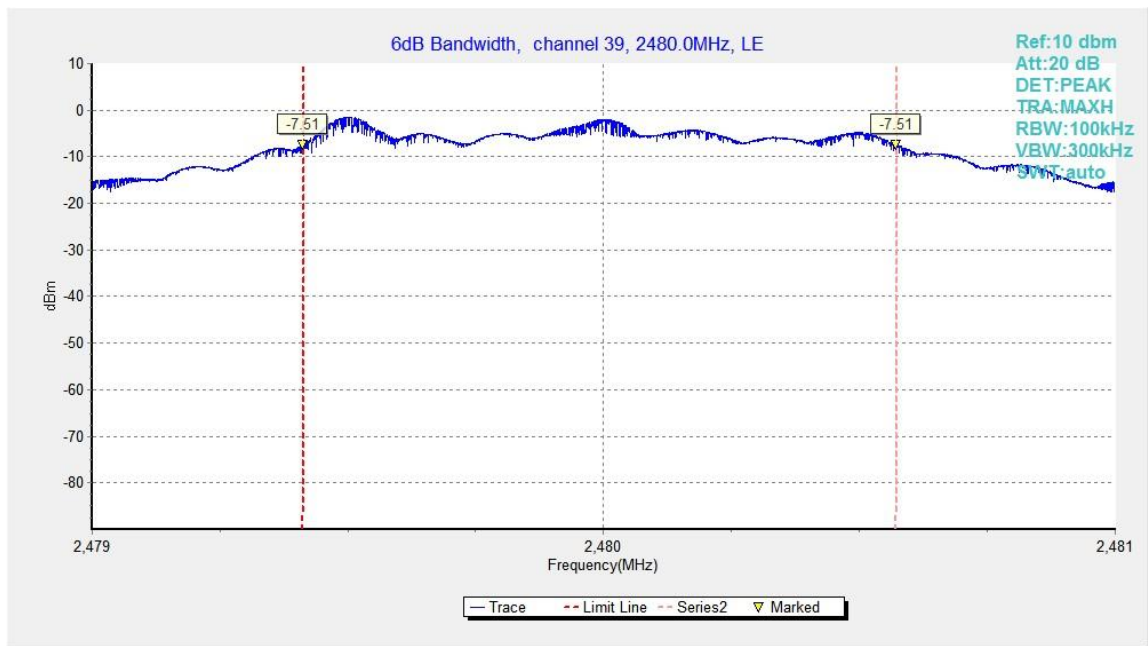


Fig.22. 6dB Bandwidth: GFSK, 2480 MHz

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 | -21.49 | P |
| 19 | 2440 | Fig.24 | -21.17 | P |
| 39 | 2480 | Fig.25 | -20.82 | P |

Test graphs as below:

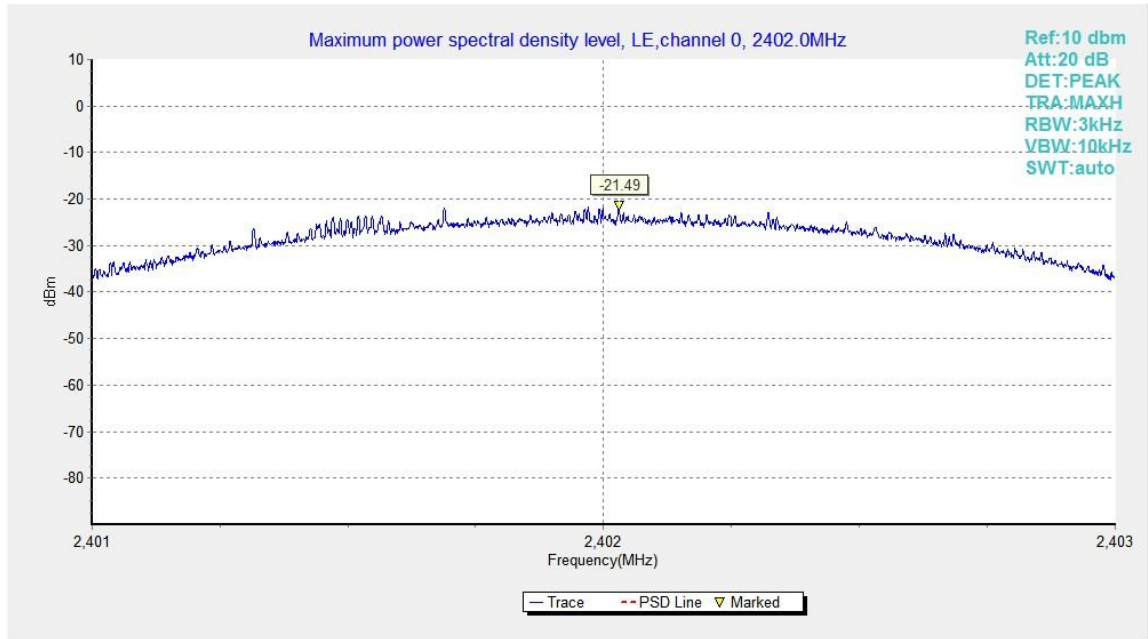


Fig.23. Maximum Power Spectral Density Level Function: GFSK, 2402 MHz

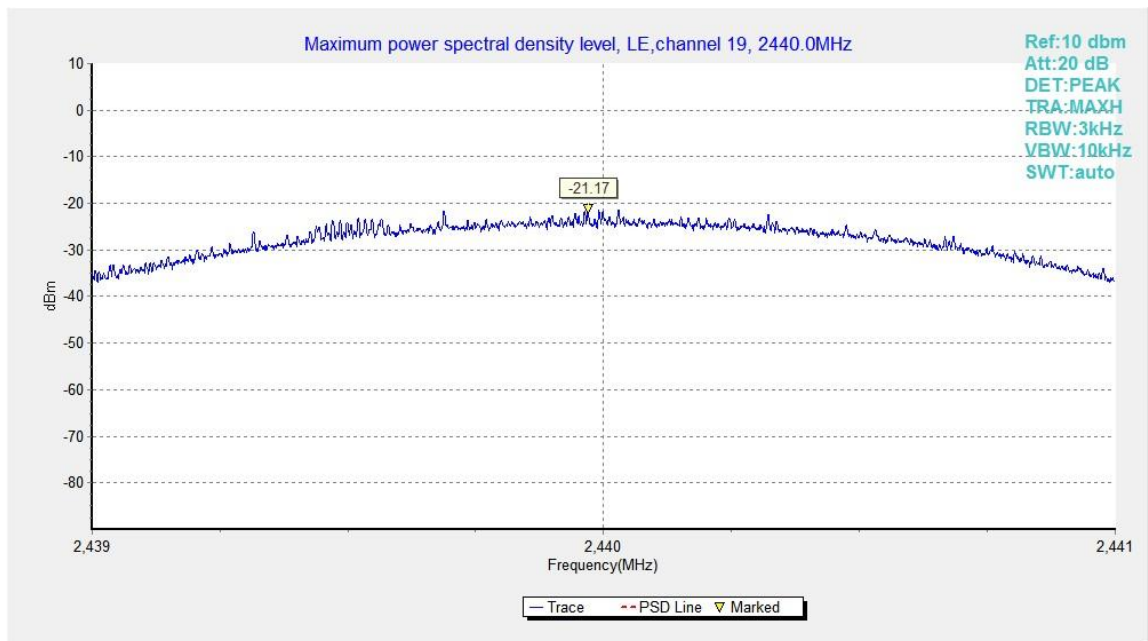


Fig.24. Maximum Power Spectral Density Level Function: GFSK, 2440 MHz

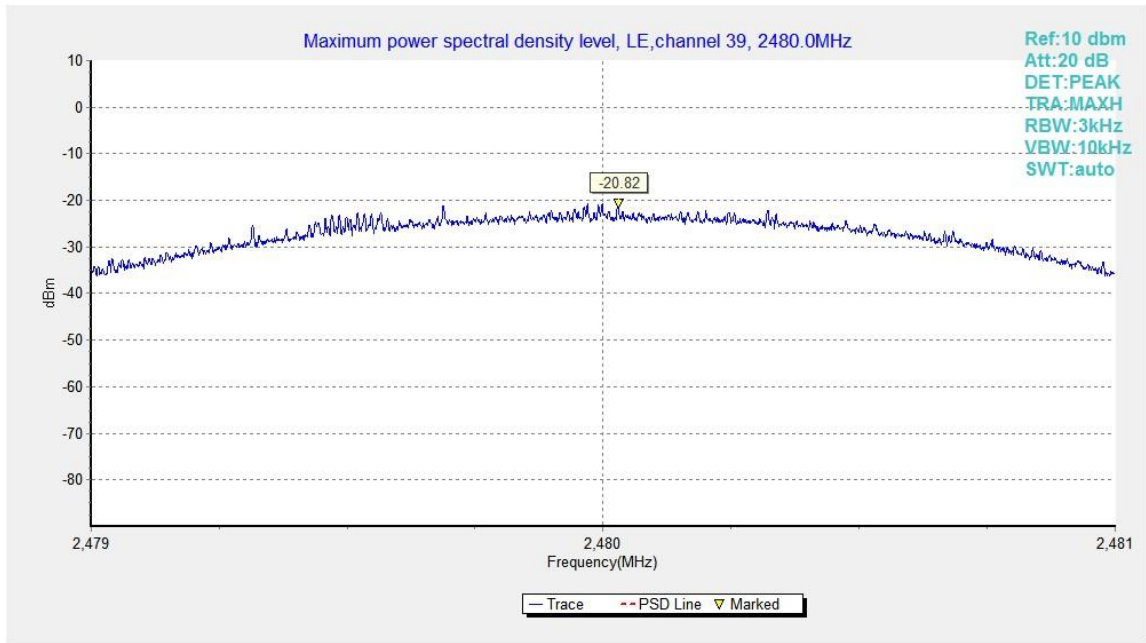


Fig.25. Maximum Power Spectral Density Level Function: GFSK, 2480 MHz

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.

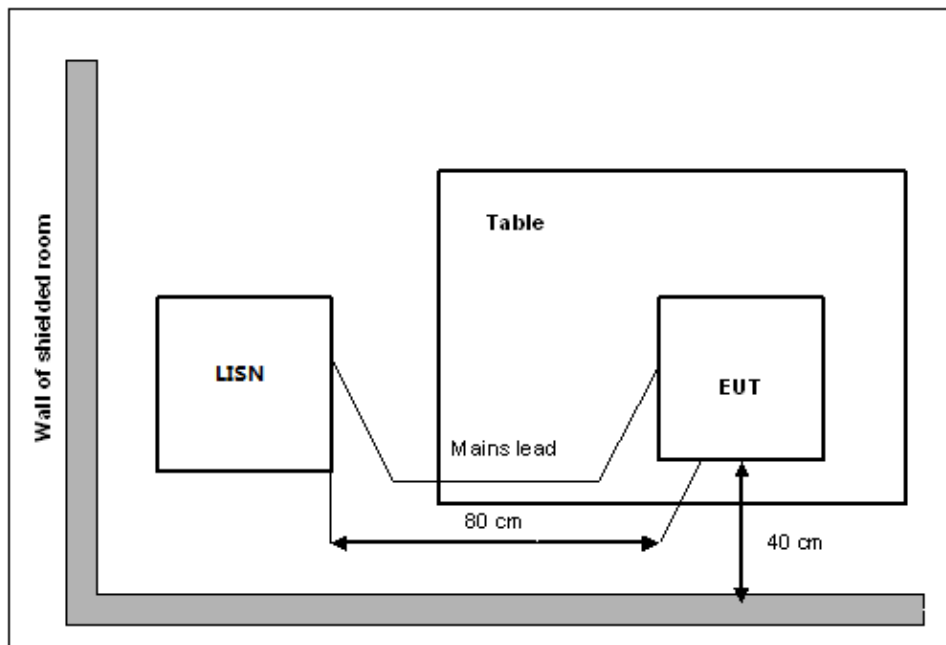
The measurement bandwidth is:

| 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: UT11a

Bluetooth (Quasi-peak Limit)

| Frequency range (MHz) | Quasi-peak Limit (dB μ V) | Result (dB μ V) | | Conclusion |
|-----------------------|-------------------------------|---------------------|-----------|------------|
| | | With charger | | |
| | | bluetooth | Idle | |
| 0.15 to 0.5 | 66 to 56 | Fig.B.9.1 | Fig.B.9.2 | P |
| 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 μ V) | Result (dB μ V) | | Conclusion |
|-----------------------|----------------------------|---------------------|-----------|------------|
| | | With charger | | |
| | | bluetooth | Idle | |
| 0.15 to 0.5 | 56 to 46 | Fig.B.9.1 | Fig.B.9.2 | P |
| 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:

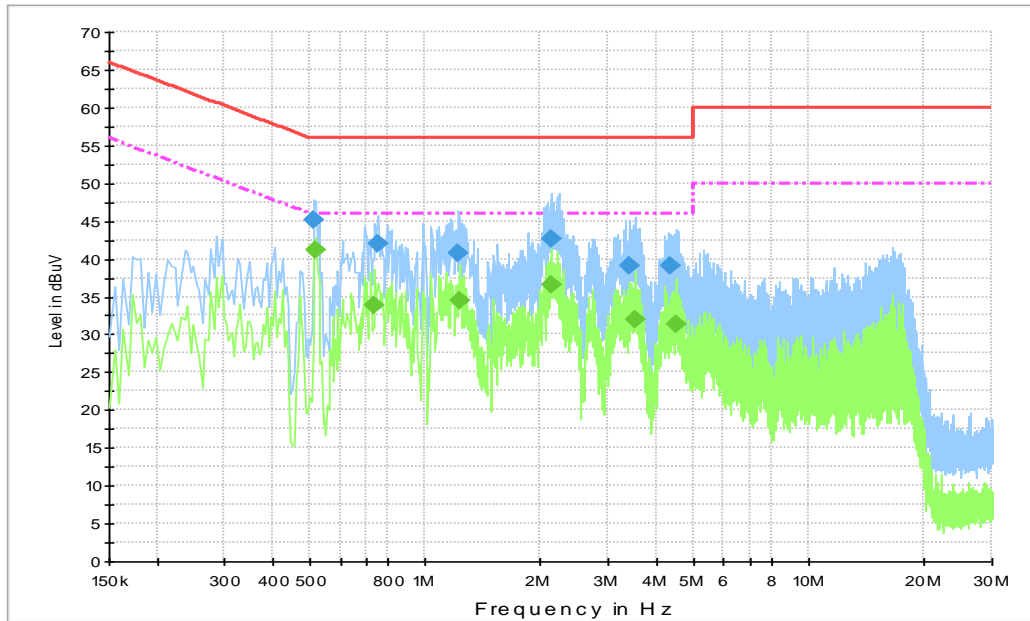


Fig.B.9.1 AC Powerline Conducted Emission- bluetooth

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) | Filter | Line | Corr. (dB) | Margin (dB) | Limit (dBμV) |
|-----------------|------------------|-----------------|-----------------|--------|------|------------|-------------|--------------|
| 0.514500 | 45.2 | 3000.0 | 9.000 | On | L1 | 19.8 | 10.8 | 56.0 |
| 0.753000 | 42.0 | 3000.0 | 9.000 | On | N | 19.7 | 14.0 | 56.0 |
| 1.221000 | 40.7 | 3000.0 | 9.000 | On | L1 | 19.6 | 15.3 | 56.0 |
| 2.125500 | 42.6 | 3000.0 | 9.000 | On | L1 | 19.6 | 13.4 | 56.0 |
| 3.394500 | 39.2 | 3000.0 | 9.000 | On | N | 19.6 | 16.8 | 56.0 |
| 4.362000 | 39.1 | 3000.0 | 9.000 | On | N | 19.6 | 16.9 | 56.0 |

Final Result 2

| Frequency (MHz) | Average (dBμV) | Meas. Time (ms) | Bandwidth (kHz) | Filter | Line | Corr. (dB) | Margin (dB) | Limit (dBμV) |
|-----------------|----------------|-----------------|-----------------|--------|------|------------|-------------|--------------|
| 0.519000 | 41.1 | 3000.0 | 9.000 | On | N | 19.8 | 4.9 | 46.0 |
| 0.739500 | 33.9 | 3000.0 | 9.000 | On | N | 19.7 | 12.1 | 46.0 |
| 1.225500 | 34.6 | 3000.0 | 9.000 | On | N | 19.6 | 11.4 | 46.0 |
| 2.125500 | 36.6 | 3000.0 | 9.000 | On | N | 19.6 | 9.4 | 46.0 |
| 3.547500 | 32.0 | 3000.0 | 9.000 | On | N | 19.6 | 14.0 | 46.0 |
| 4.492500 | 31.3 | 3000.0 | 9.000 | On | N | 19.6 | 14.7 | 46.0 |

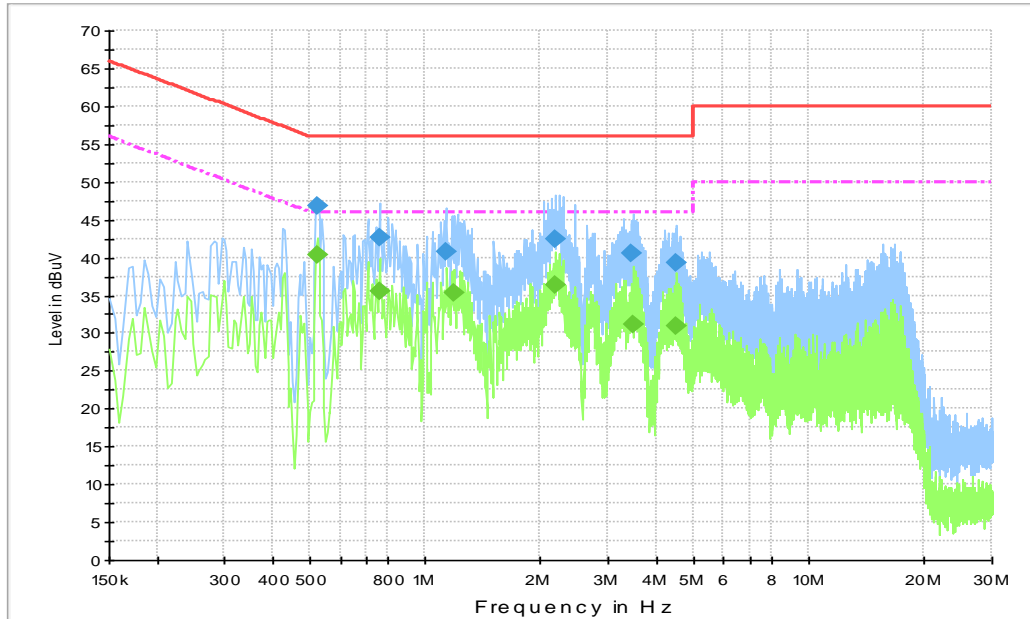


Fig.B.9.2 AC Powerline Conducted Emission-Idle

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) | Filter | Line | Corr. (dB) | Margin (dB) | Limit (dBμV) |
|-----------------|------------------|-----------------|-----------------|--------|------|------------|-------------|--------------|
| 0.523500 | 46.8 | 3000.0 | 9.000 | On | N | 19.8 | 9.2 | 56.0 |
| 0.762000 | 42.6 | 3000.0 | 9.000 | On | N | 19.7 | 13.4 | 56.0 |
| 1.135500 | 40.8 | 3000.0 | 9.000 | On | L1 | 19.7 | 15.2 | 56.0 |
| 2.179500 | 42.4 | 3000.0 | 9.000 | On | L1 | 19.6 | 13.6 | 56.0 |
| 3.457500 | 40.4 | 3000.0 | 9.000 | On | N | 19.6 | 15.6 | 56.0 |
| 4.533000 | 39.2 | 3000.0 | 9.000 | On | N | 19.6 | 16.8 | 56.0 |

Final Result 2

| Frequency (MHz) | Average (dBμV) | Meas. Time (ms) | Bandwidth (kHz) | Filter | Line | Corr. (dB) | Margin (dB) | Limit (dBμV) |
|-----------------|----------------|-----------------|-----------------|--------|------|------------|-------------|--------------|
| 0.523500 | 40.3 | 3000.0 | 9.000 | On | L1 | 19.8 | 5.7 | 46.0 |
| 0.762000 | 35.5 | 3000.0 | 9.000 | On | N | 19.7 | 10.5 | 46.0 |
| 1.189500 | 35.4 | 3000.0 | 9.000 | On | N | 19.6 | 10.6 | 46.0 |
| 2.179500 | 36.4 | 3000.0 | 9.000 | On | N | 19.6 | 9.6 | 46.0 |
| 3.489000 | 31.2 | 3000.0 | 9.000 | On | N | 19.6 | 14.8 | 46.0 |
| 4.533000 | 30.9 | 3000.0 | 9.000 | On | N | 19.6 | 15.1 | 46.0 |

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/> Certificate of Accreditation to ISO/IEC 17025:2017 <hr/> | |
| NVLAP LAB CODE: 600118-0 | |
| Telecommunication Technology Labs, CAICT Beijing China | |
| <i>is accredited by the National Voluntary Laboratory Accreditation Program for specific services, listed on the Scope of Accreditation, for:</i> | |
| Electromagnetic Compatibility & Telecommunications | |
| <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