FCC PART 15C
TEST REPORT

BLUETOOTH LOW ENERGY (BLE) PART

No. I23Z70257-IOT02

for

Samsung Electronics Co., Ltd.

Wearable device

Model Name: SM-R390

FCC ID: ZCASMR390

with

Hardware Version: REV1.0

Software Version: R390XXU0AWHG

Issued Date: 2023-9-11

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
I23Z70257-IOT02	Rev.0	1st edition	2023-9-11

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

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CONTENTS

1. TEST LABORATORY 5

1.1. INTRODUCTION &ACCREDITATION 5
1.2. TESTING LOCATION 5
1.3. TESTING ENVIRONMENT 6
1.4. PROJECT DATA 6
1.5. SIGNATURE 6

2. CLIENT INFORMATION 7

2.1. APPLICANT INFORMATION 7
2.2. MANUFACTURER INFORMATION 7

3. EQUIPMENT UNDER TEST (EUT) AND ANCILLARY EQUIPMENT (AE) 8

3.1. ABOUT EUT 8
3.2. INTERNAL IDENTIFICATION OF EUT 8
3.3. INTERNAL IDENTIFICATION OF AE 8
3.4. NORMAL ACCESSORY SETTING 8
3.5. GENERAL DESCRIPTION 8

4. REFERENCE DOCUMENTS 9

4.1. DOCUMENTS SUPPLIED BY APPLICANT 9
4.2. REFERENCE DOCUMENTS FOR TESTING 9

5. TEST RESULTS 10

5.1. SUMMARY OF EUT MODE 10
5.2. SUMMARY OF TEST RESULTS 10
5.3. STATEMENTS 10

6. TEST FACILITIES UTILIZED 11

7. MEASUREMENT UNCERTAINTY 12

7.1. PEAK OUTPUT POWER - CONDUCTED 12
7.2. FREQUENCY BAND EDGES - CONDUCTED 12
7.3. TRANSMITTER SPURIOUS EMISSION - CONDUCTED 12
7.4. RADIATED UNWANTED EMISSION 12
7.5. 6DB BANDWIDTH 12
7.6. MAXIMUM POWER SPECTRAL DENSITY LEVEL 12
7.7. AC POWERLINE CONDUCTED EMISSION 13

ANNEX A: EUT PARAMETERS 14

ANNEX B: DETAILED TEST RESULTS 15

B.1. MEASUREMENT METHOD 15
B.2. PEAK OUTPUT POWER 16
B.3. FREQUENCY BAND EDGES - CONDUCTED 17

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B.4. TRANSMITTER SPURIOUS EMISSION - CONDUCTED 19
B.5. RADIATED UNWANTED EMISSION 28
B.6. 6DB BANDWIDTH 34
B.7. MAXIMUM POWER SPECTRAL DENSITY LEVEL 37
B.8. AC POWERLINE CONDUCTED EMISSION 40
B.9. ANTENNA REQUIREMENT 44

ANNEX C: ACCREDITATION CERTIFICATE 45

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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(huayuan North Road)

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

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1.3. Testing Environment

Normal Temperature: 20-27℃

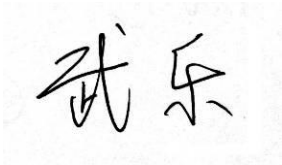
Relative Humidity: 20-50%

1.4. Project data

Testing Start Date: 2023-8-22

Testing End Date: 2023-9-11

1.5. Signature



Wu Le

(Prepared this test report)

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(Reviewed this test report)

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(Approved this test report)

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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:	/

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

3.1. About EUT

Description	Wearable device
Model Name	SM-R390
FCC ID	ZCASMR390
Frequency Band	ISM 2400MHz~2483.5MHz
Type of Modulation(LE mode)	GFSK (Bluetooth Low Energy)
Number of Channels(LE mode)	40
Power Supply	3.87V DC by Battery
Antenna gain	-4.0dBi

3.2. Internal Identification of EUT

EUT ID*	SN or IMEI	HW Version	SW Version	Date of receipt
EUT1	I23Z70257UT05a	REV1.0	R390XXU0AWHG	2023-8-21
EUT2	I23Z70257UT01a	REV1.0	R390XXU0AWHG	2023-8-22

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

3.3. Internal Identification of AE

AE ID*	Description	Model	Manufacture
AE1	Battery	B319	ATL
AE2	Battery	B319	Sunwoda
AE3	Cable	SLQ-A237A	Saibao
AE4	Charger	/	Provided by laboratory

*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 Wearable device 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.

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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

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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 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)	**P**
Frequency Band Edges- Conducted	15.247 (d)	**P**
Transmitter Spurious Emission - Conducted	15.247 (d)	**P**
Radiated Unwanted Emission	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**
Antenna Requirement	15.203	**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

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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	Test Receiver	ESCI	100344	R&S	1 year	2024-02-21
3	LISN	ENV216	101200	R&S	1 year	2024-06-05
4	Shielding Room	S81	/	ETS-Lindgren	/	/

Radiated emission test system

No.	Equipment	Model	Serial Number	Manufacturer	Calibration Period	Calibration Due date
1	Test Receiver	ESW44	103144	R&S	1 year	2023-10-25
2	EMI Antenna	VULB 9163	01222	SCHWARZBECK	1 year	2024-02-28
3	EMI Antenna	3115	6914	ETS-Lindgren	1 year	2024-04-25

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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. 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	/
30MHz ≤ f ≤ 1GHz	4.72
1GHz ≤ f ≤18GHz	4.84
18GHz ≤ f ≤40GHz	5.12

7.5. 6dB Bandwidth

Measurement Uncertainty:

Measurement Uncertainty (k=2)	61.936Hz

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)	3.08dB

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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.

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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.

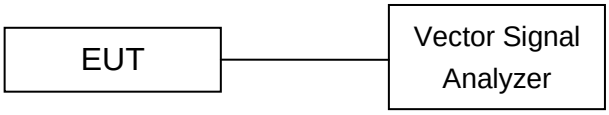
2). Set the EUT to the required work mode (Transmitter, receiver or transmitter & receiver).

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.

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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	8.87	P
	19	2440	8.58	P
	39	2480	8.54	P
2Mbps	0	2402	8.96	P
	19	2440	8.67	P
	39	2480	8.63	P

Conclusion: PASS

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

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

Antenna gain = -4.0dBi

For GFSK

Sample Rate	Channel No.	Frequency (MHz)	E.I.R.P. (dBm)	Conclusion
1Mbps	0	2402	4.87	P
	19	2440	4.58	P
	39	2480	4.54	P
2Mbps	0	2402	4.96	P
	19	2440	4.67	P
	39	2480	4.63	P

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

Conclusion: PASS

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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	-43.63	P
39	2480	Hopping OFF	Fig.2	-56.11	P

Conclusion: PASS

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Test graphs as below

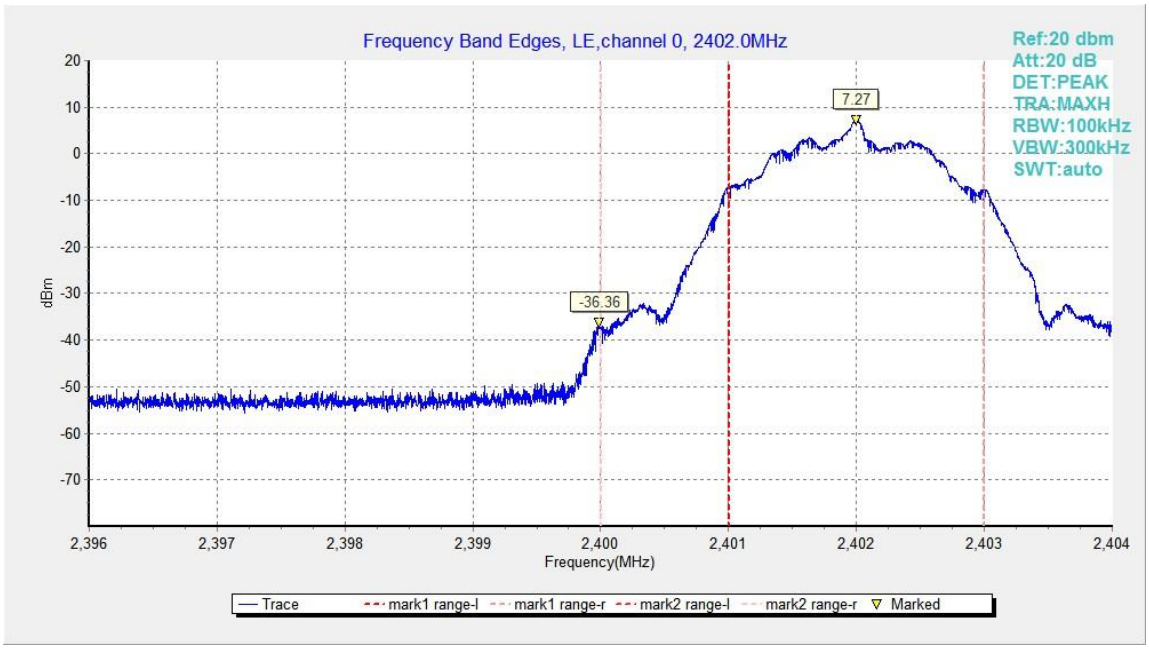

Fig.1. Frequency Band Edges: GFSK, 2402 MHz**,** Hopping Off

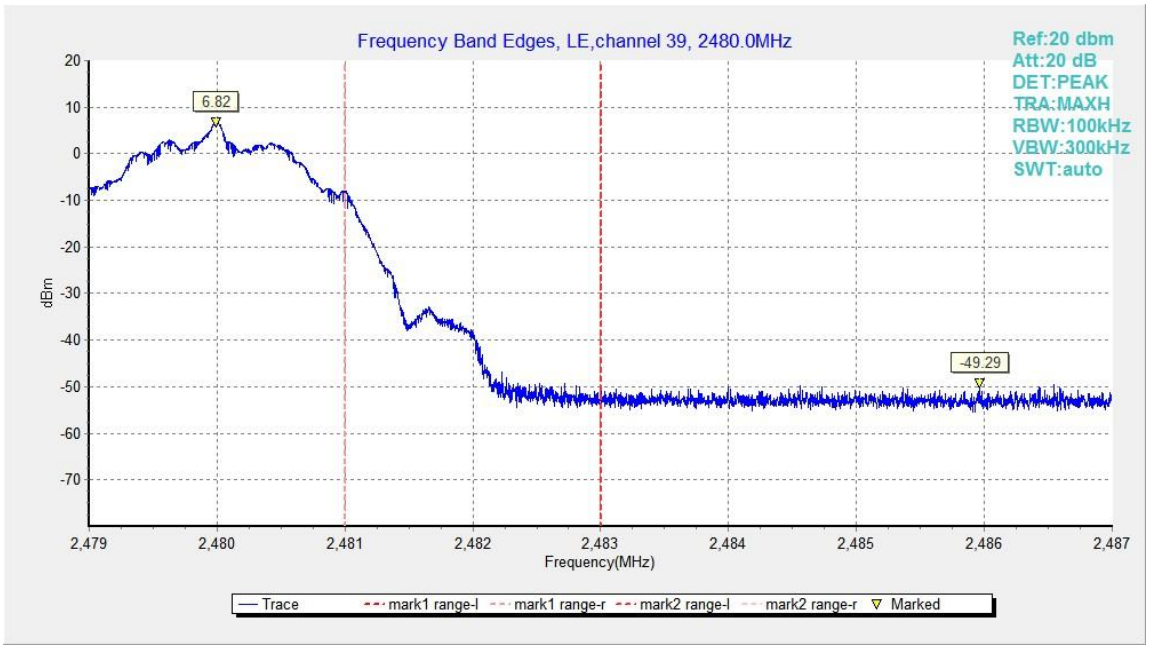

Fig.2. Frequency Band Edges: GFSK, 2480 MHz, Hopping Off

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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 ⩾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

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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

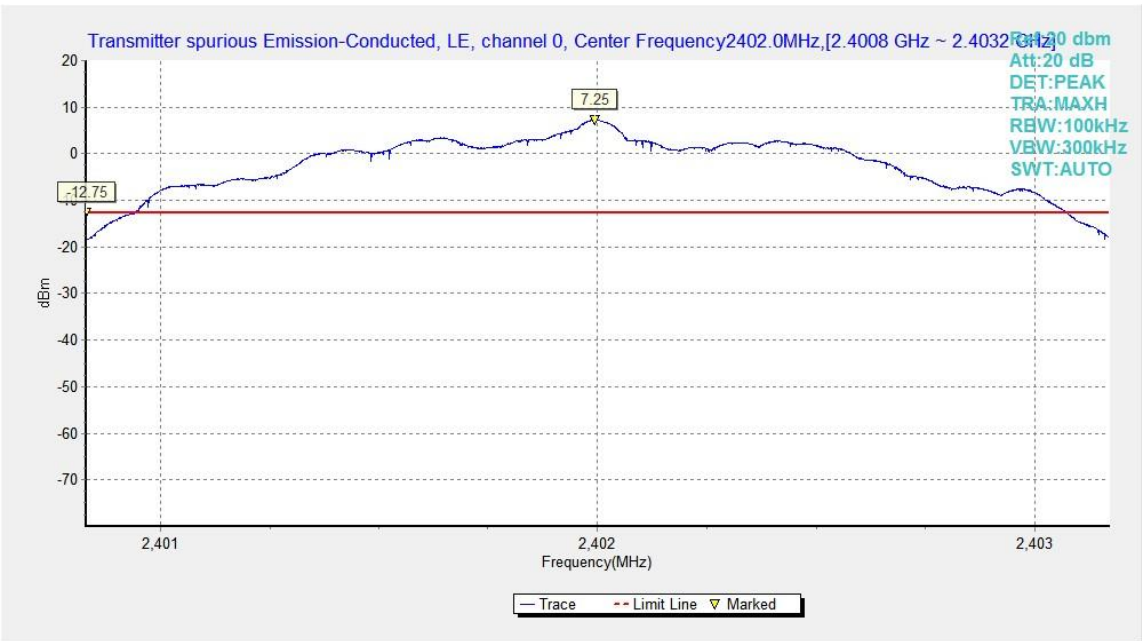

Fig.3. Transmitter Spurious Emission - Conducted: GFSK,2402MHz

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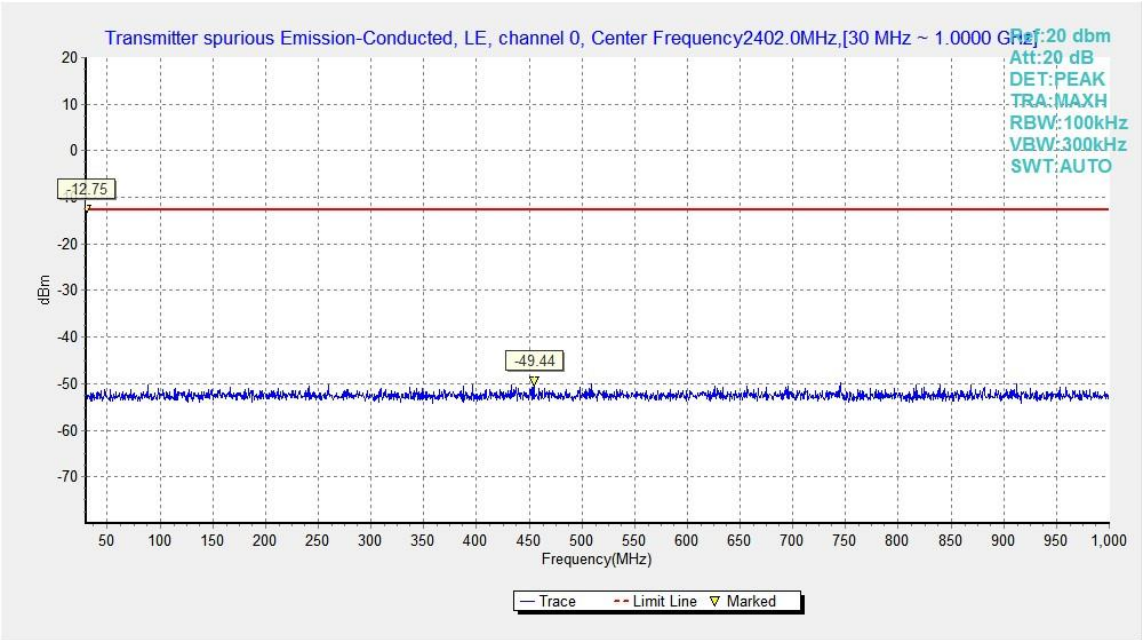

Fig.4. Transmitter Spurious Emission - Conducted: GFSK, 2402 MHz, 30MHz - 1GHz

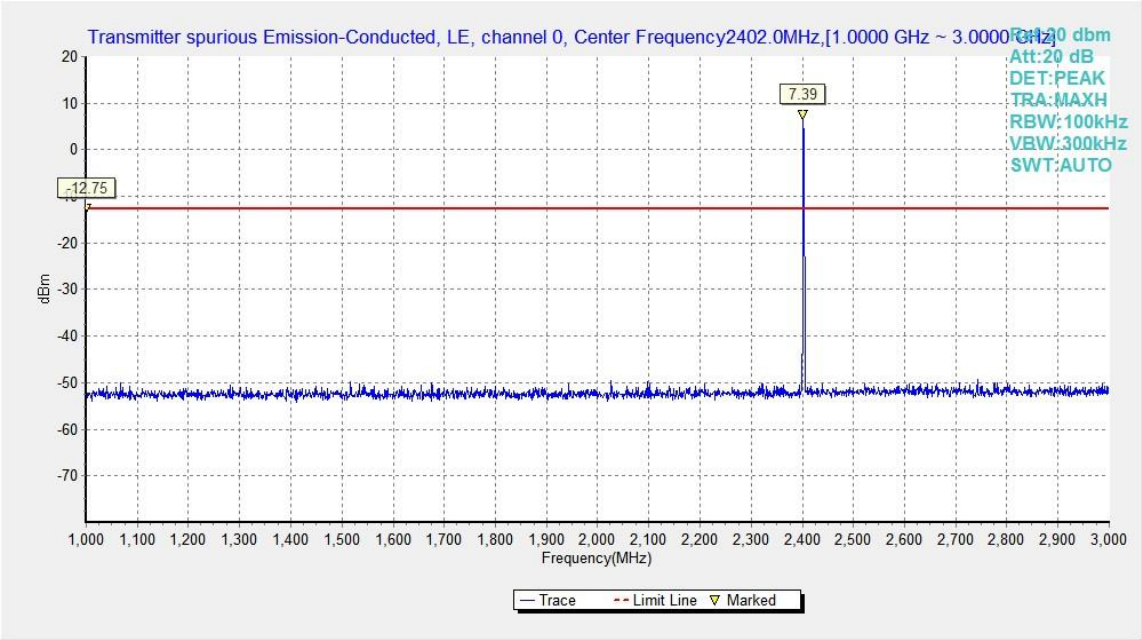

Fig.5. Transmitter Spurious Emission - Conducted: GFSK, 2402 MHz,1GHz - 3GHz

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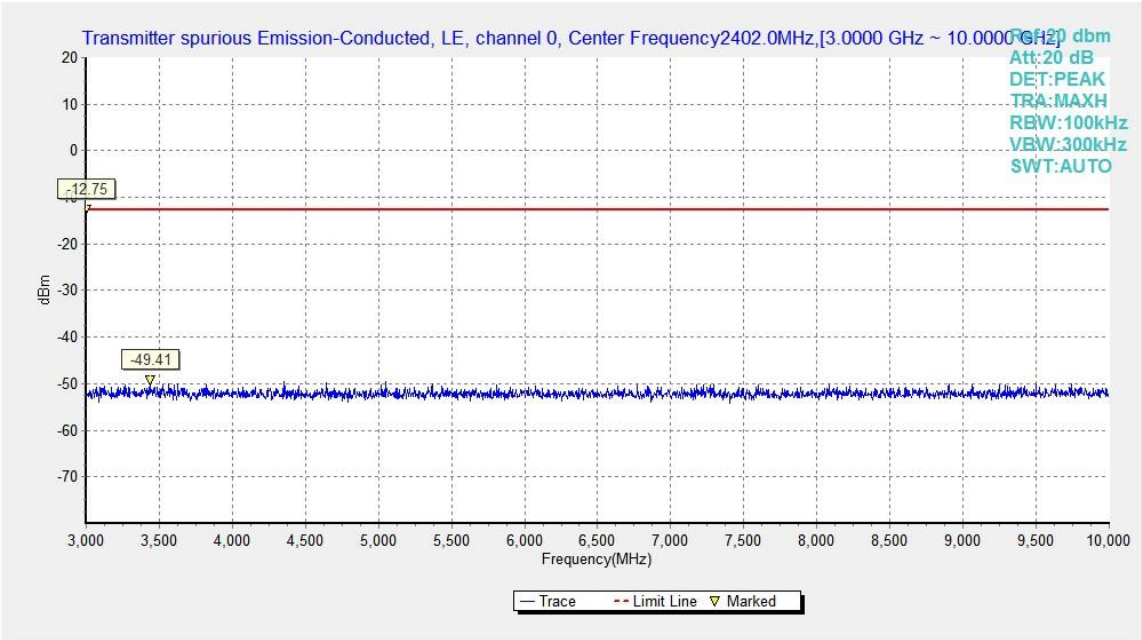

Fig.6. Transmitter Spurious Emission - Conducted: GFSK, 2402 MHz,3GHz - 10GHz

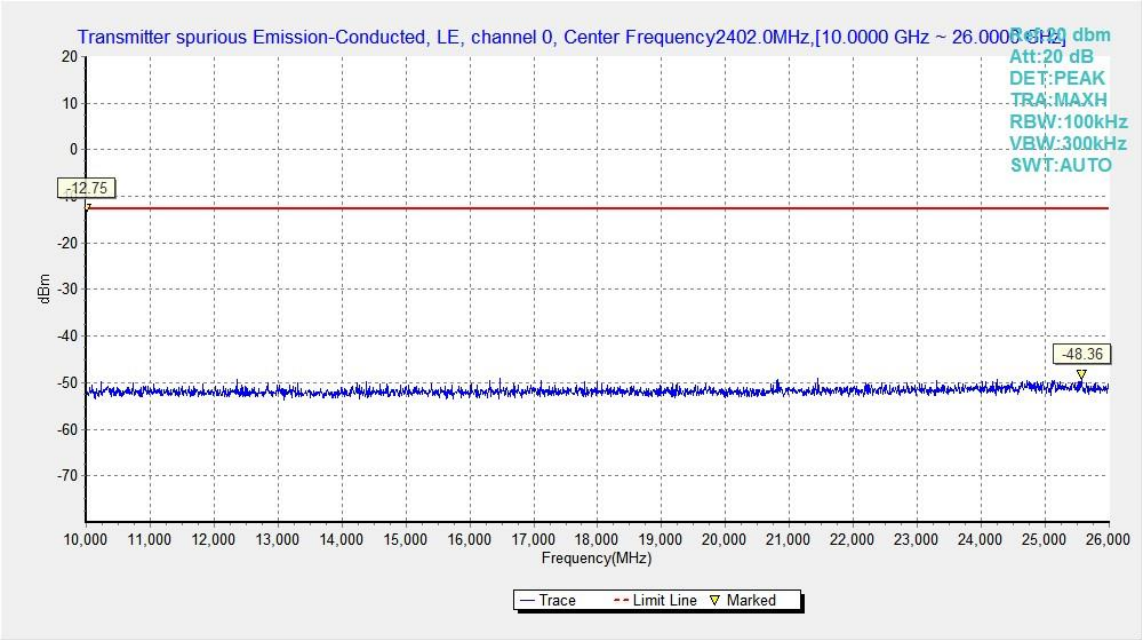

Fig.7. Transmitter Spurious Emission - Conducted: GFSK, 2402 MHz,10GHz - 26GHz

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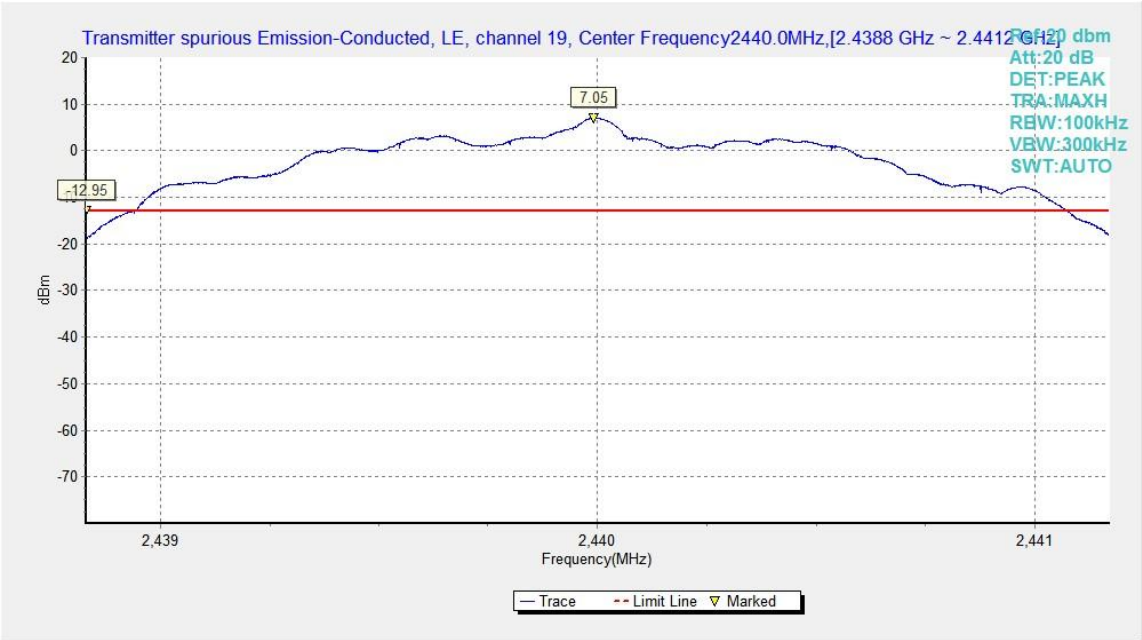

Fig.8. Transmitter Spurious Emission - Conducted: GFSK, 2440MHz

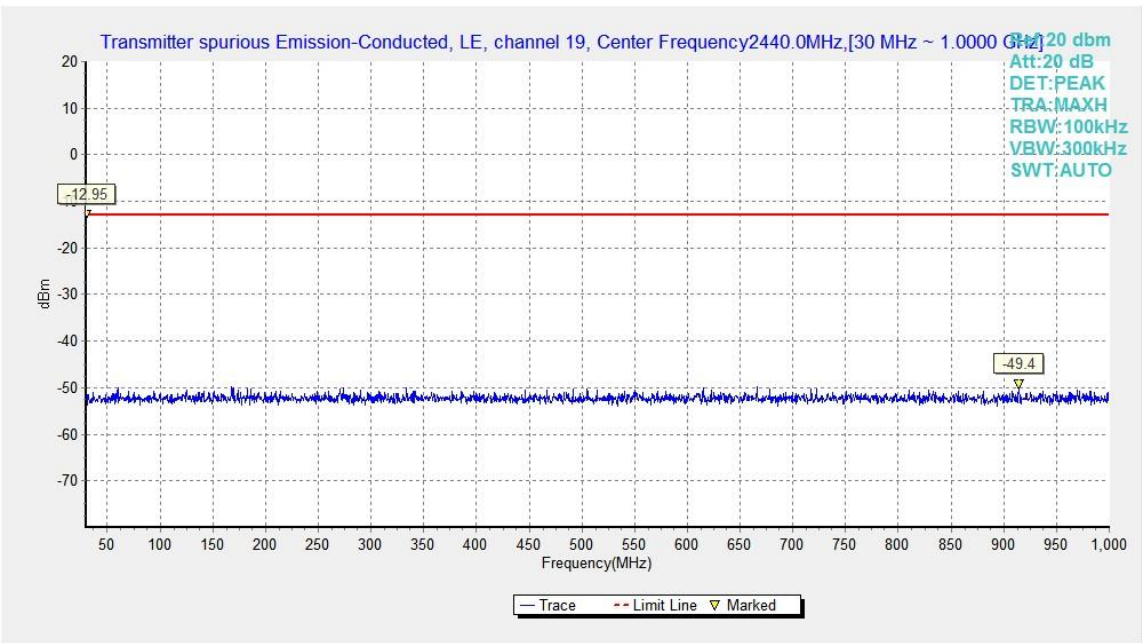

Fig.9. Transmitter Spurious Emission - Conducted: GFSK, 2440 MHz, 30MHz - 1GHz

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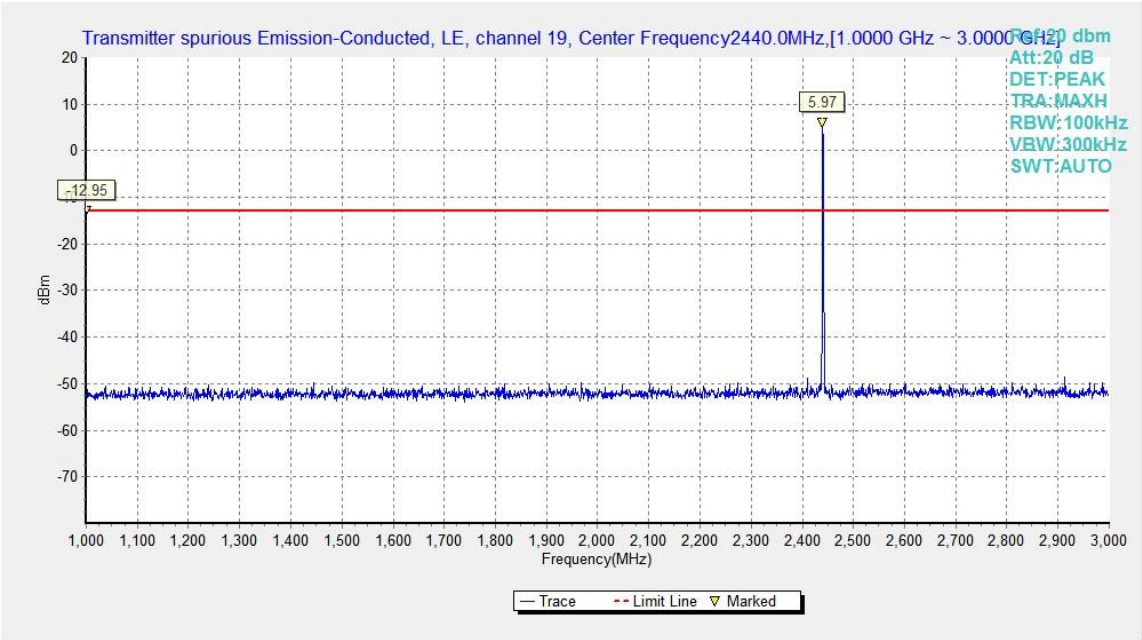

Fig.10. Transmitter Spurious Emission - Conducted: GFSK, 2440 MHz, 1GHz – 3GHz

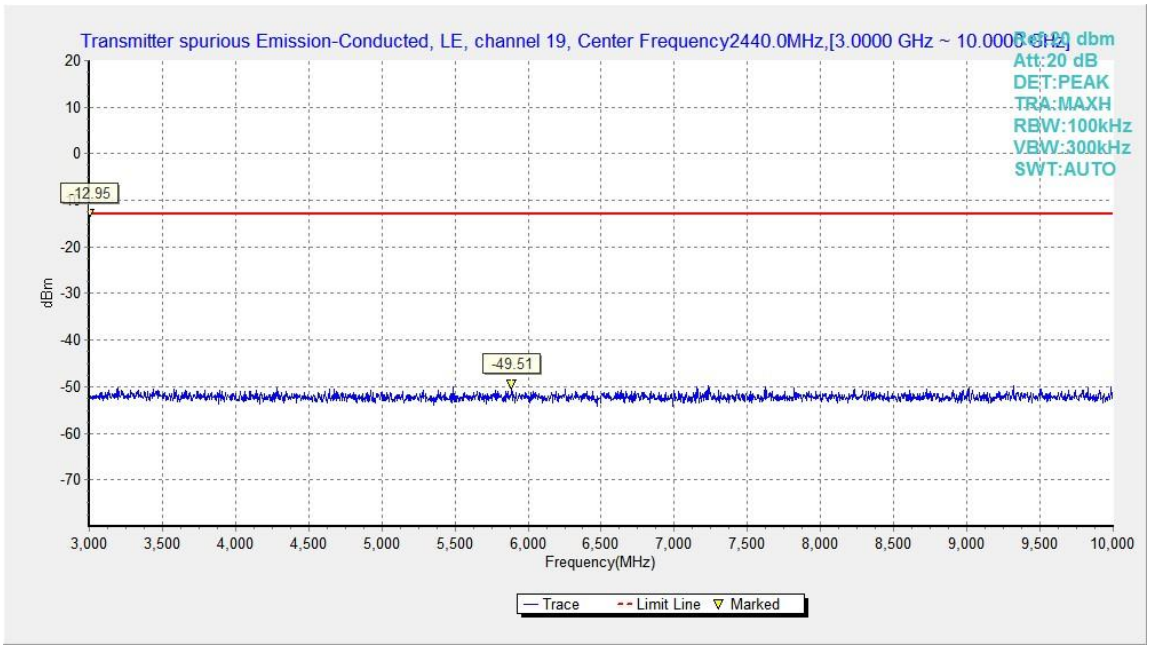

Fig.11. Transmitter Spurious Emission - Conducted: GFSK, 2440 MHz, 3GHz – 10GHz

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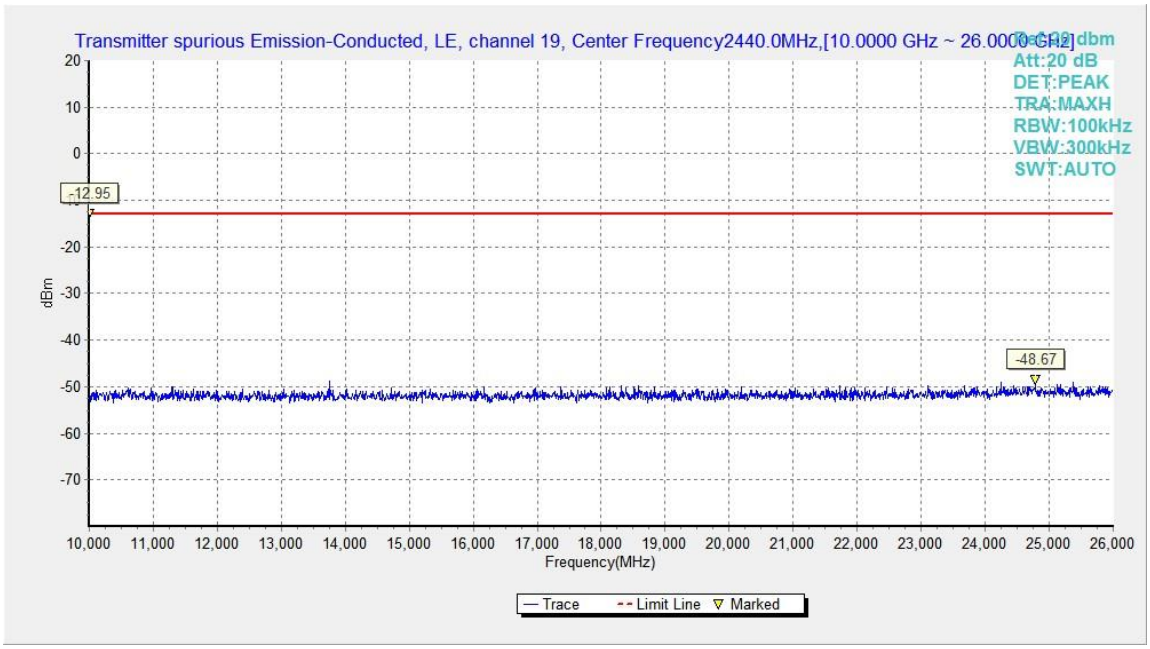

Fig.12. Transmitter Spurious Emission - Conducted: GFSK, 2440 MHz, 10GHz – 26GHz

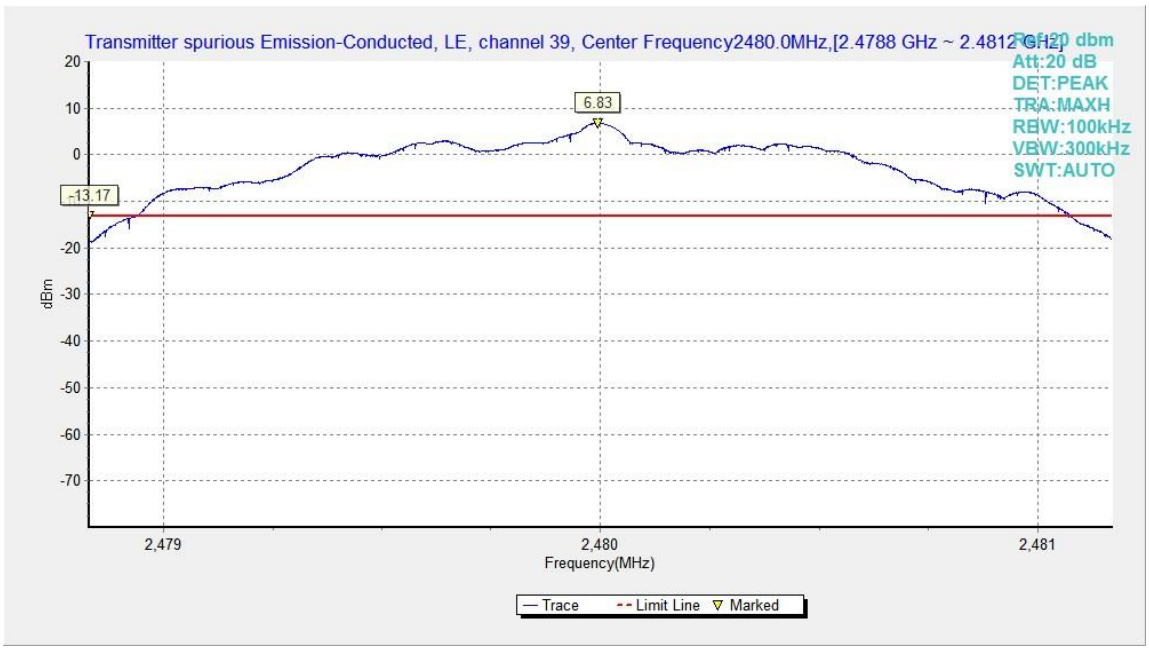

Fig.13. Transmitter Spurious Emission - Conducted: GFSK, 2480 MHz

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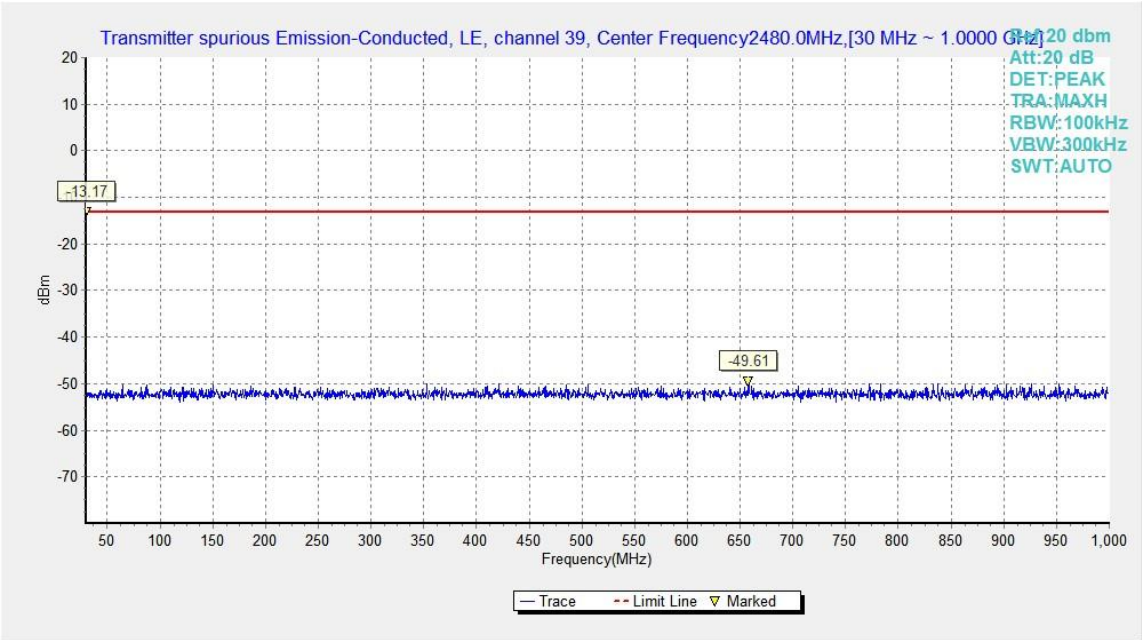

Fig.14. Transmitter Spurious Emission - Conducted: GFSK, 2480 MHz, 30MHz - 1GHz

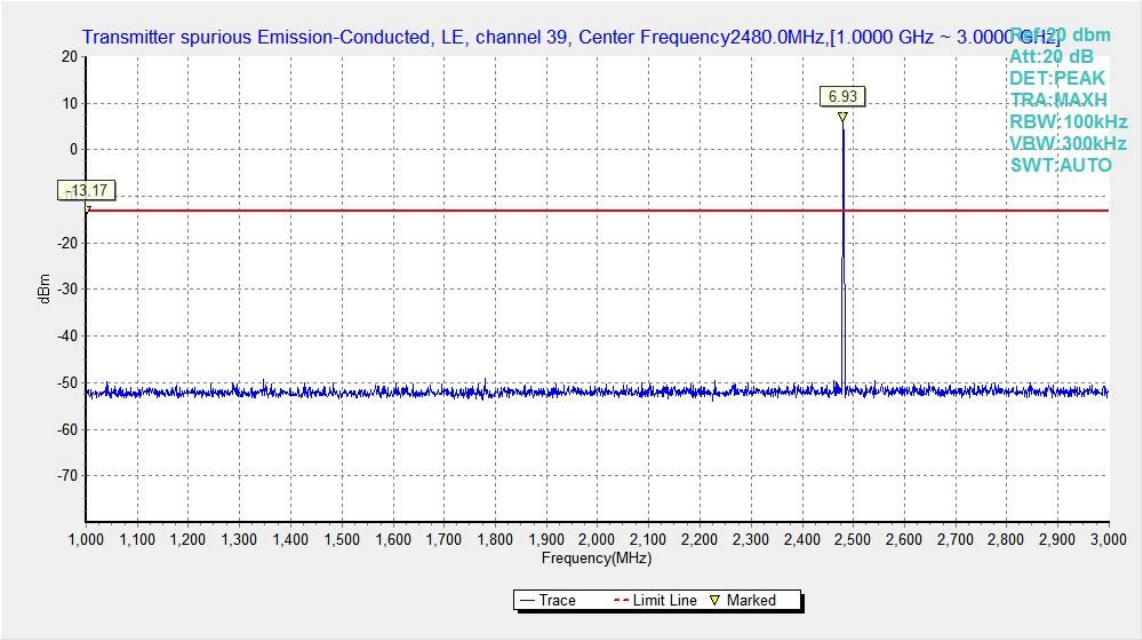

Fig.15. Transmitter Spurious Emission - Conducted: GFSK, 2480 MHz, 1GHz - 3GHz

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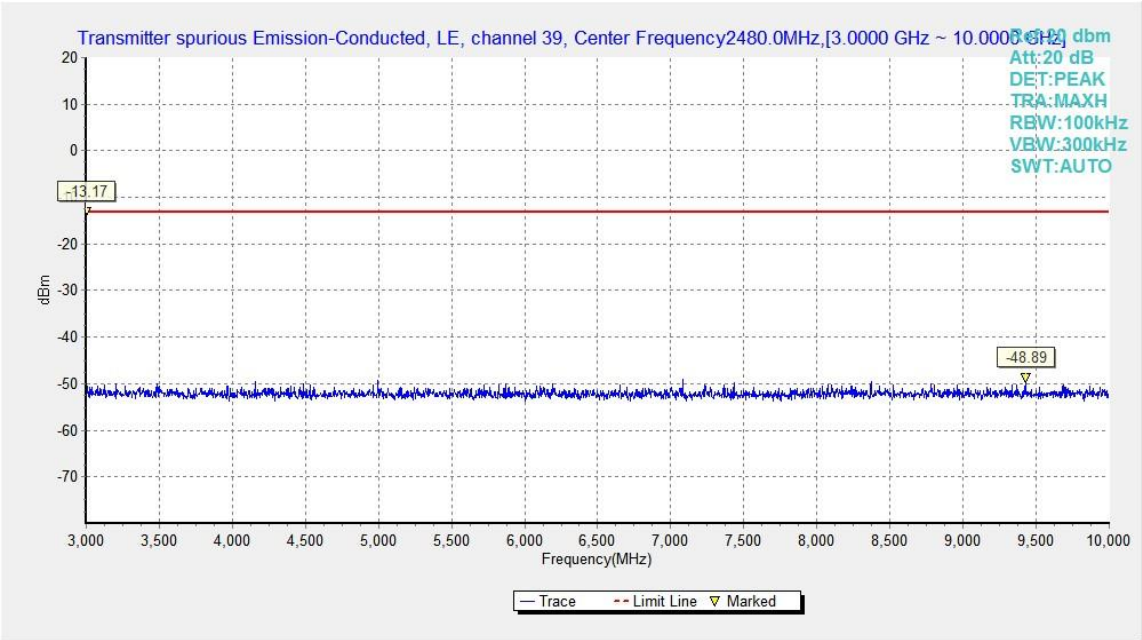

Fig.16. Transmitter Spurious Emission - Conducted: GFSK, 2480 MHz, 3GHz - 10GHz

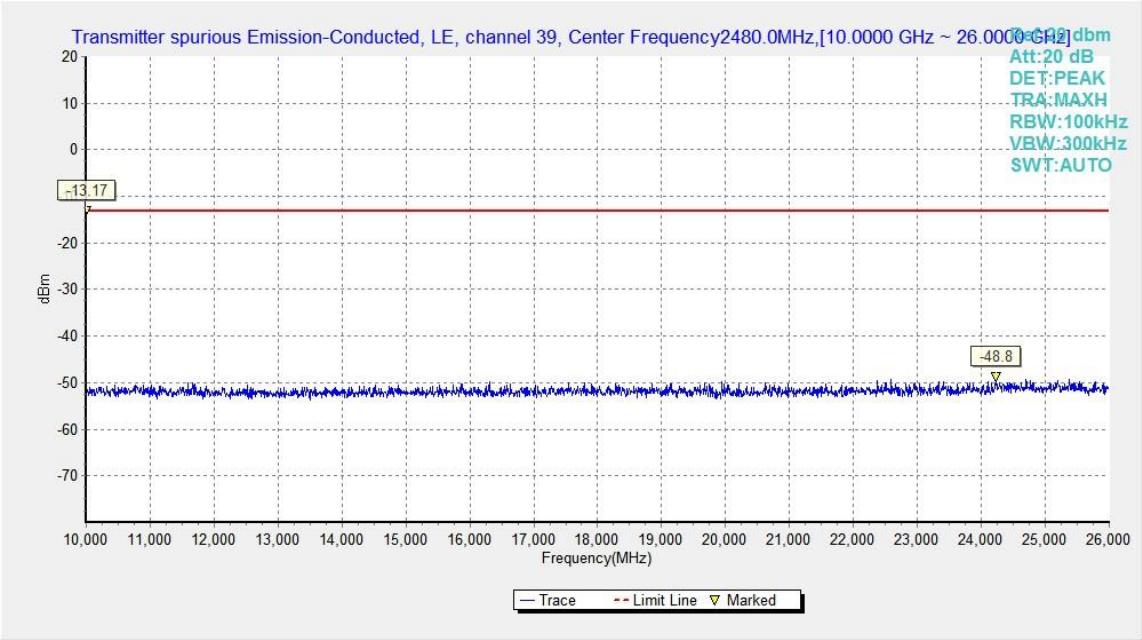

Fig.17. Transmitter Spurious Emission - Conducted: GFSK, 2480 MHz, 10GHz - 26GHz

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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(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

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

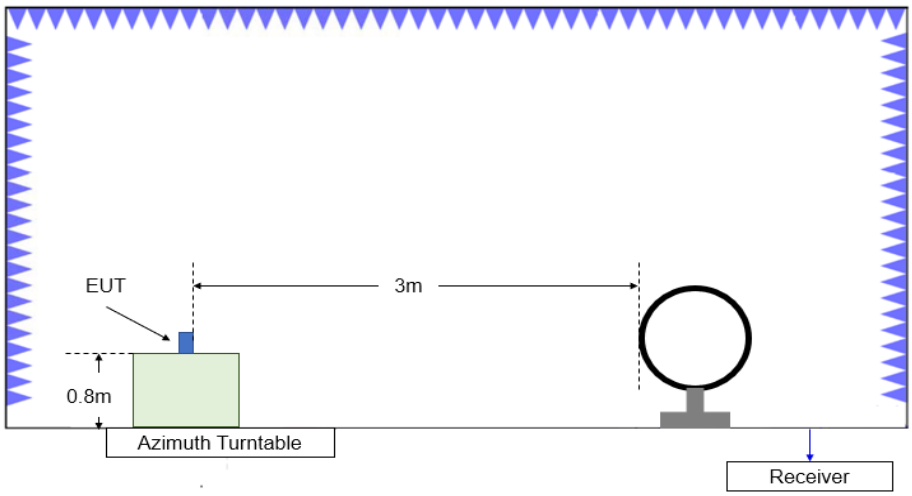

Figure B.5.1. Test Site Diagram (9kHz-30MHz)

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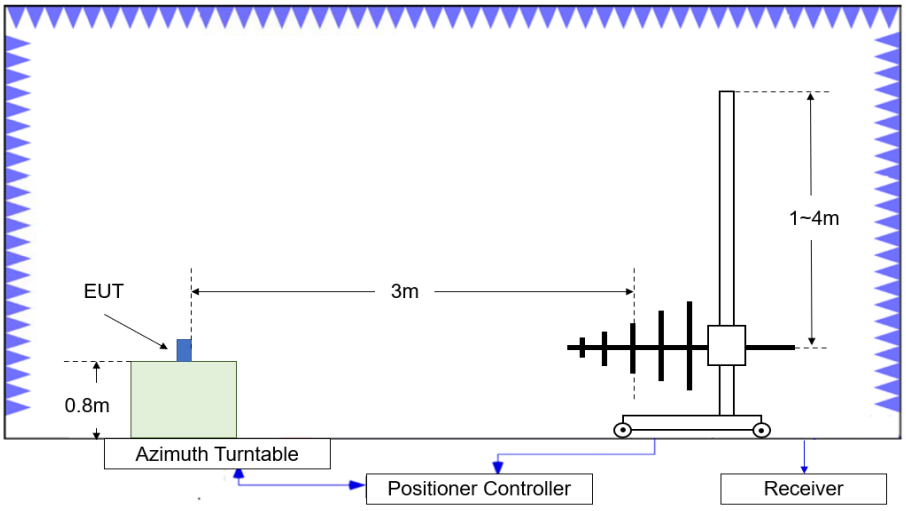

Figure B.5.2. Test Site Diagram (30MHz-1GHz)

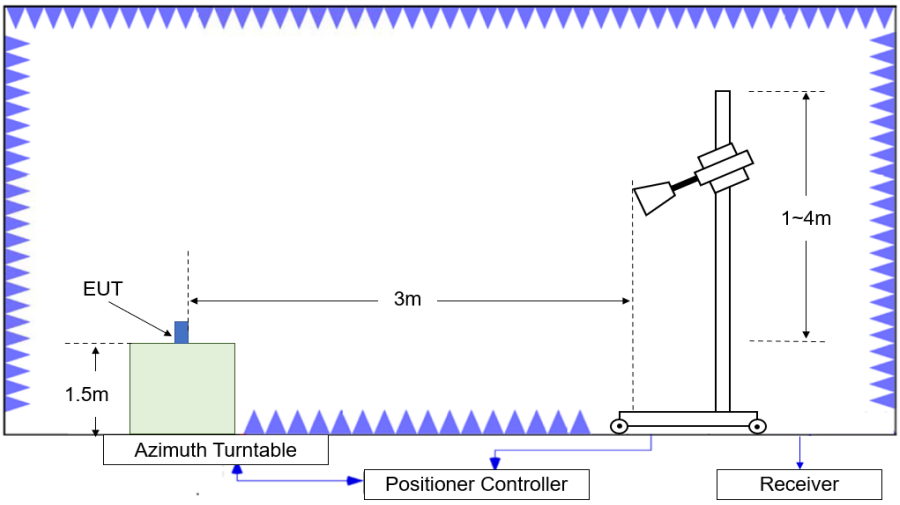

Figure B.5.3. Test Site Diagram (1GHz-40GHz)

Test Procedures

Radiated unwanted emissions from the EUT were measured according to ANSI C63.10-2013 (ANSI C63.10-2020).

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

Sample 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:

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Result=P_{Mea}+$A_{Rpl=}$ P_{Mea}+Cable Loss+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 10th harmonic of highest fundamental frequency or 40GHz, whichever is lower.

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Test Result

EUT ID: EUT1

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)
17869.500	44.57	-29.40	46.00	27.97	54.00	9.43	V
14582.500	41.05	-29.00	41.90	28.15	54.00	12.95	V
11890.500	37.74	-32.40	39.10	31.04	54.00	16.26	V
8881.000	36.37	-34.80	37.80	33.37	54.00	17.63	H
7905.500	33.95	-35.20	36.70	32.45	54.00	20.05	H
2368.400	42.88	-19.60	28.20	34.28	54.00	11.12	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)
17982.000	43.62	-29.40	46.00	27.02	54.00	10.38	V
14093.500	40.05	-30.20	41.70	28.55	54.00	13.95	H
11887.000	37.51	-32.40	39.10	30.81	54.00	16.49	H
9169.500	35.88	-34.70	37.70	32.88	54.00	18.12	H
7974.500	33.31	-35.40	36.90	31.81	54.00	20.69	H
4936.000	29.91	-37.60	33.30	34.21	54.00	24.09	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)
17995.500	43.75	-29.40	46.00	27.15	54.00	10.25	V
14567.000	40.16	-29.00	41.90	27.26	54.00	13.84	V
11911.000	37.18	-32.40	39.10	30.48	54.00	16.82	V
9155.500	35.37	-34.30	37.70	31.97	54.00	18.63	V
7995.000	33.72	-35.40	36.90	32.22	54.00	20.28	H
2491.800	43.19	-19.70	28.20	34.69	54.00	10.81	V

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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)
17913.000	53.10	-29.40	46.00	36.50	74.00	20.90	H
14662.500	50.17	-30.00	41.50	38.67	74.00	23.83	V
12521.500	47.09	-32.10	39.10	40.09	74.00	26.91	V
9145.500	45.21	-34.30	37.70	41.81	74.00	28.79	H
7530.500	43.67	-35.50	36.30	42.87	74.00	30.33	V
2361.700	54.25	-19.60	28.20	45.65	74.00	19.75	V

GFSK 2440MHz

Frequency (MHz)	Measurement Result (dBuV/m)	Cable Loss (dB)	Antenna Factor (dB/m)	Receiver Reading (dBuV)	Limit (dBuV/m)	Margin (dB)	Antenna Pol. (H/V)
17991.000	52.77	-29.40	46.00	36.17	74.00	21.23	H
14568.000	50.28	-29.00	41.90	37.38	74.00	23.72	V
11887.000	46.04	-32.40	39.10	39.34	74.00	27.96	H
9621.500	44.28	-34.30	37.60	40.98	74.00	29.72	H
7235.000	42.07	-35.60	36.40	41.27	74.00	31.93	H
4908.000	39.30	-37.60	33.30	43.60	74.00	34.70	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)
17993.500	52.59	-29.40	46.00	35.99	74.00	21.41	H
14564.500	49.49	-29.00	41.90	36.59	74.00	24.51	V
12835.000	46.19	-31.90	39.90	38.19	74.00	27.81	H
9193.000	44.85	-34.70	37.70	41.85	74.00	29.15	H
7533.500	41.87	-35.50	36.30	41.07	74.00	32.13	V
2488.400	54.61	-19.70	28.20	46.11	74.00	19.39	V

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

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Conclusion: PASS

Test graphs as below

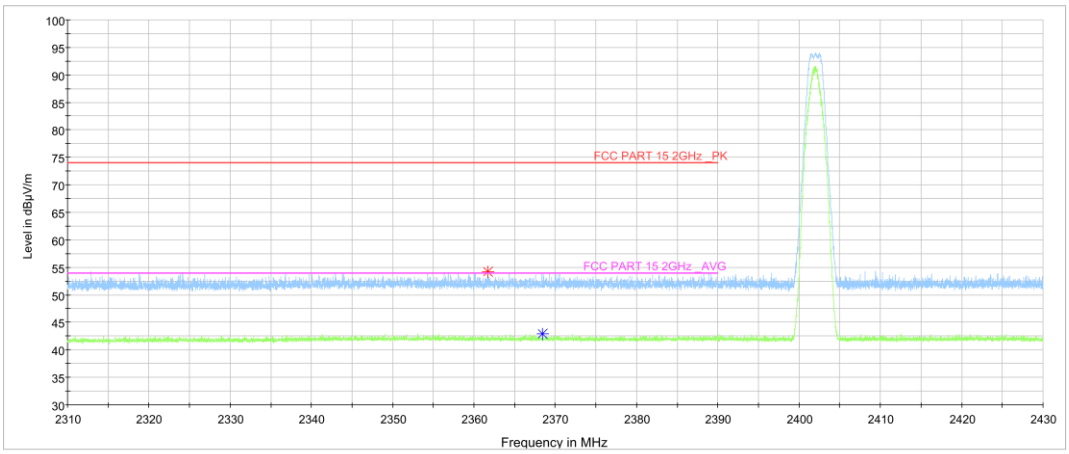

Fig.18. Frequency Band Edges: GFSK, 2402 MHz, Hopping Off, 2.31 GHz – 2.43GHz

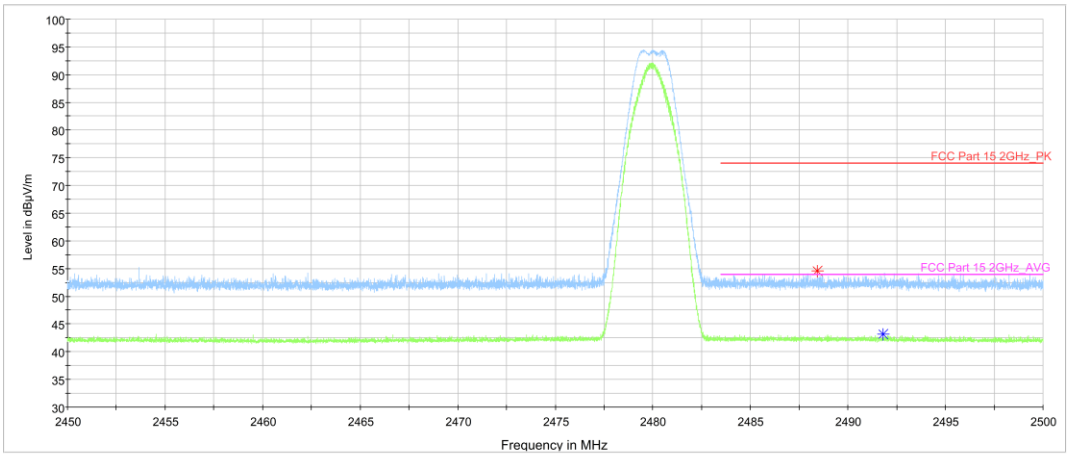

Fig.19. Frequency Band Edges: GFSK, 2480 MHz, Hopping Off , 2.45 GHz - 2.50GHz

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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)	>= 500KHz

Measurement Results:
For GFSK

Channel No.	Frequency (MHz)	6dB Bandwidth (kHz)		Conclusion
0	2402	Fig.20	1017.50	P
19	2440	Fig.21	1023.00	P
39	2480	Fig.22	1027.00	P

Conclusion: PASS
Test graphs as below:

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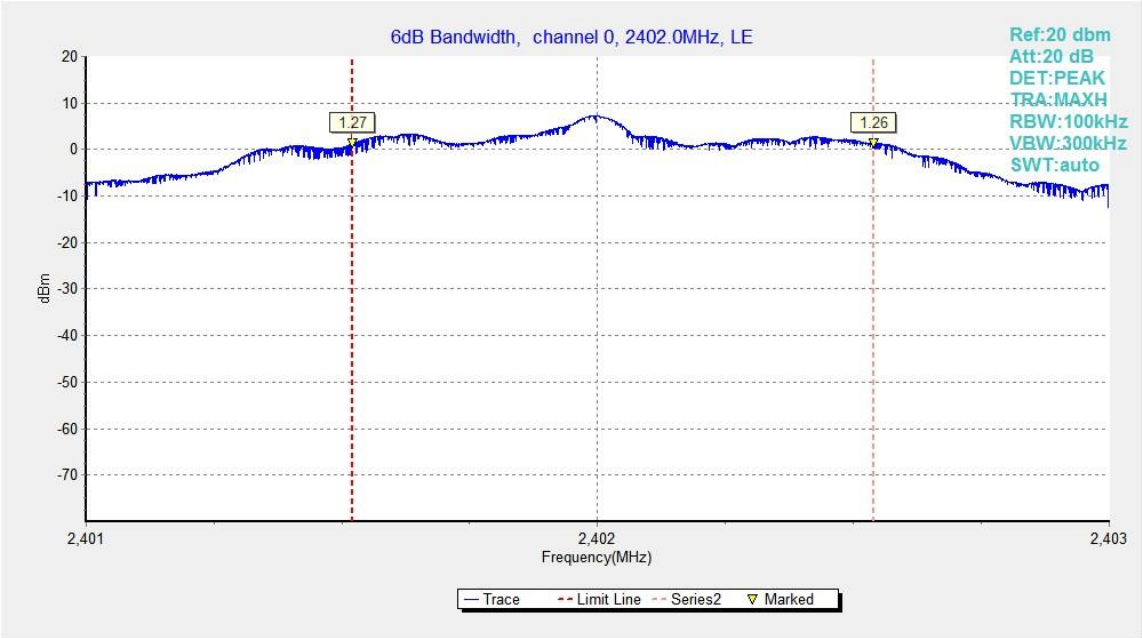

Fig.20. 6dB Bandwidth: GFSK, 2402 MHz

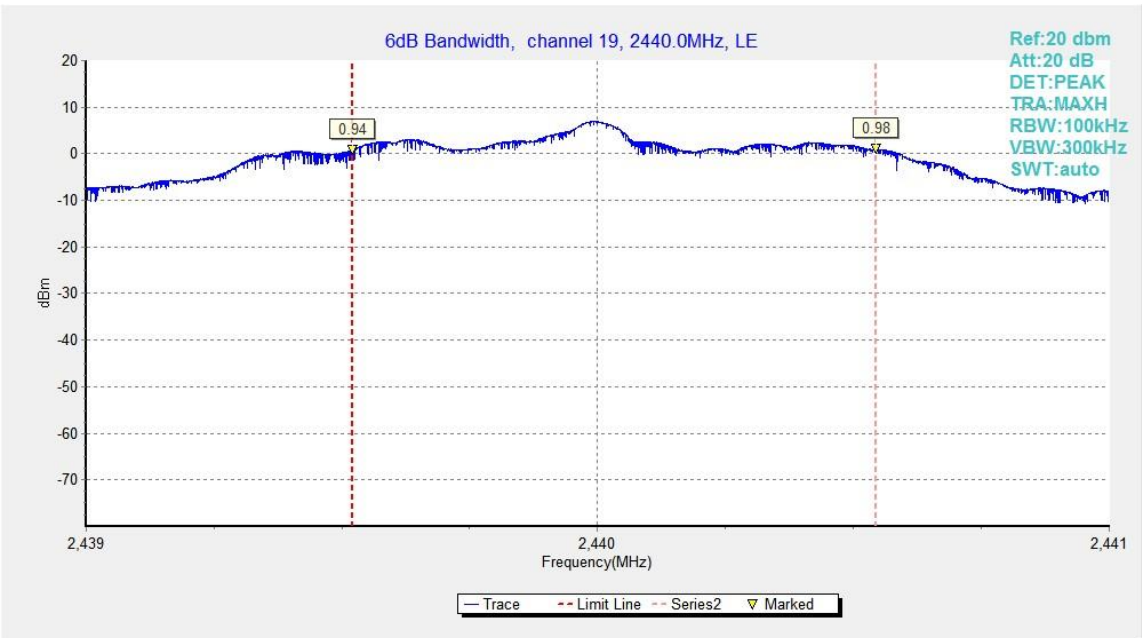

Fig.21. 6dB Bandwidth: GFSK, 2440 MHz

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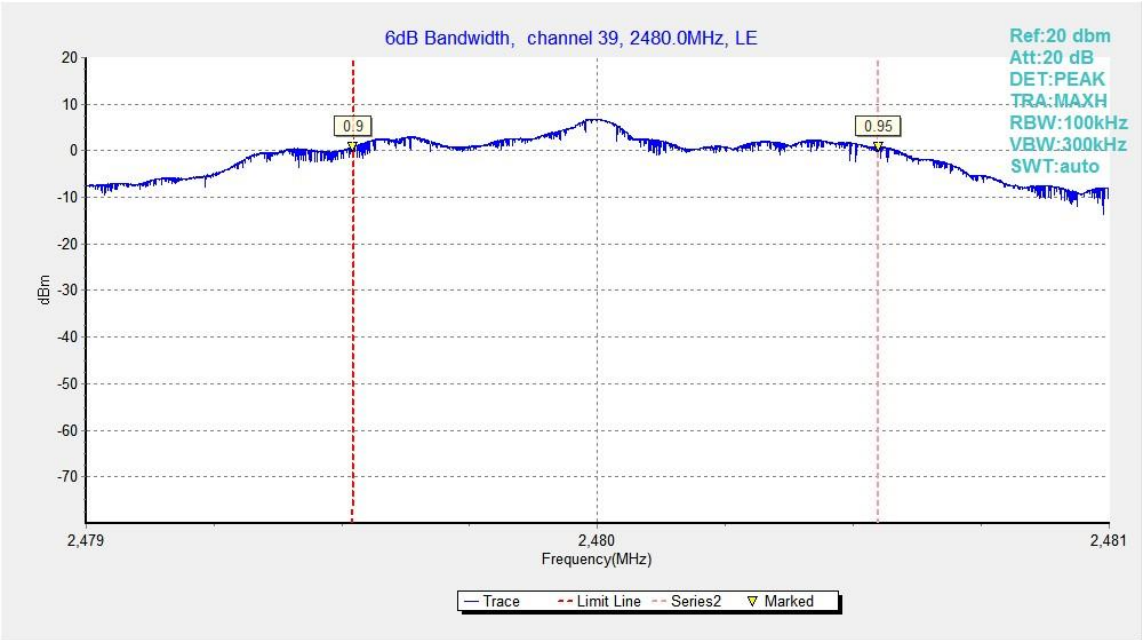

Fig.22. 6dB Bandwidth: GFSK, 2480 MHz

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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)	<=8.0dBm/3kHz

Measurement Results:

For GFSK

Channel No.	Frequency (MHz)	Maximum Power Spectral Density Level(dBm/3kHz)		Conclusion
0	2402	Fig.23	-10.41	P
19	2440	Fig.24	-10.69	P
39	2480	Fig.25	-10.76	P

Test graphs as below:

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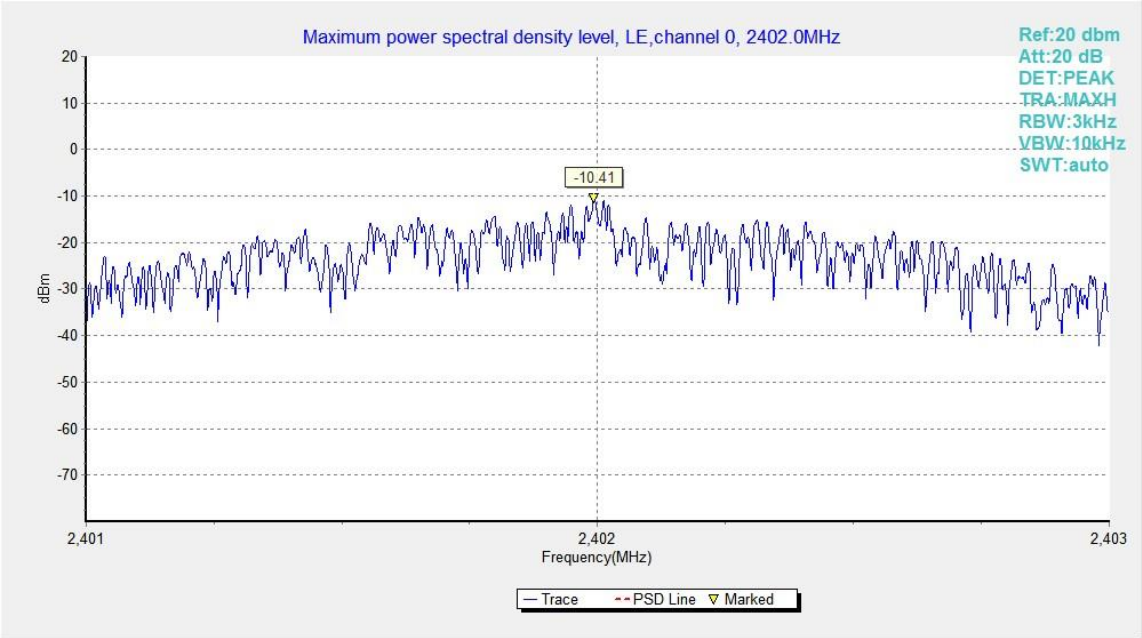

Fig.23. Maximum Power Spectral Density Level Function: GFSK, 2402 MHz

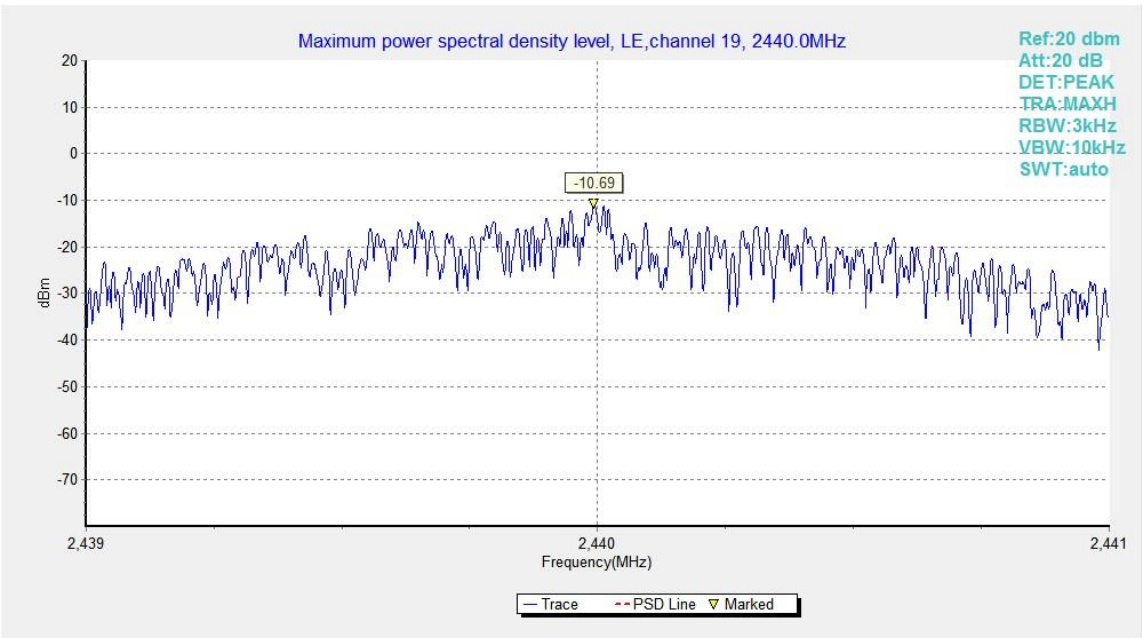

Fig.24. Maximum Power Spectral Density Level Function: GFSK, 2440 MHz

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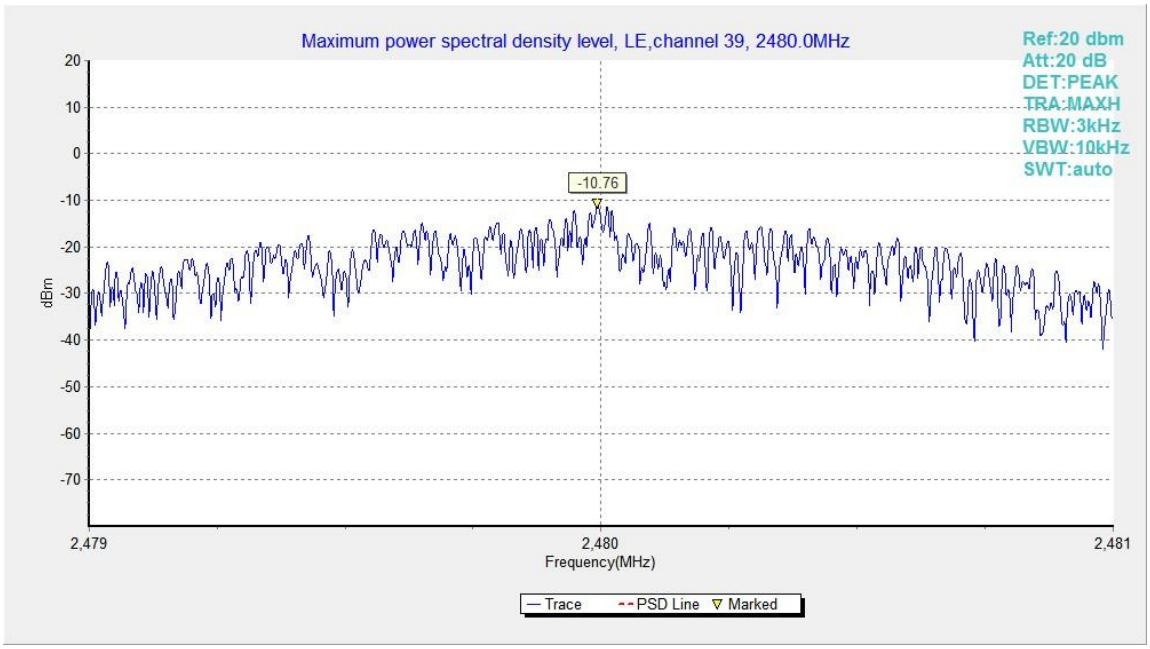

Fig.25. Maximum Power Spectral Density Level Function: GFSK, 2480 MHz

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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.

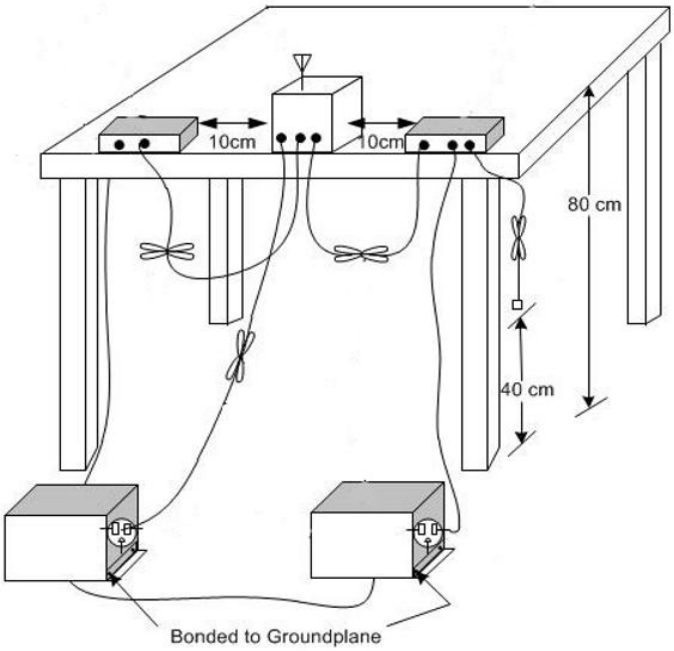
The measurement bandwidth is:

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

Test Condition:

Voltage（V）	Frequency（Hz）
120	60

Test setup



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Measurement Result and limit:

Bluetooth (Quasi-peak Limit)

Frequency range (MHz)	Quasi-peak Limit (dBμV)	Result (dBμV)		Conclusion
		With charger		
		bluetooth	Idle	
0.15 to 0.5	66 to 56	Fig.B.8.1	Fig. B.8.2	**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 (dBμV)	Result (dBμV)		Conclusion
		With charger		
		bluetooth	Idle	
0.15 to 0.5	56 to 46	Fig.B.8.1	Fig. B.8.2	**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:

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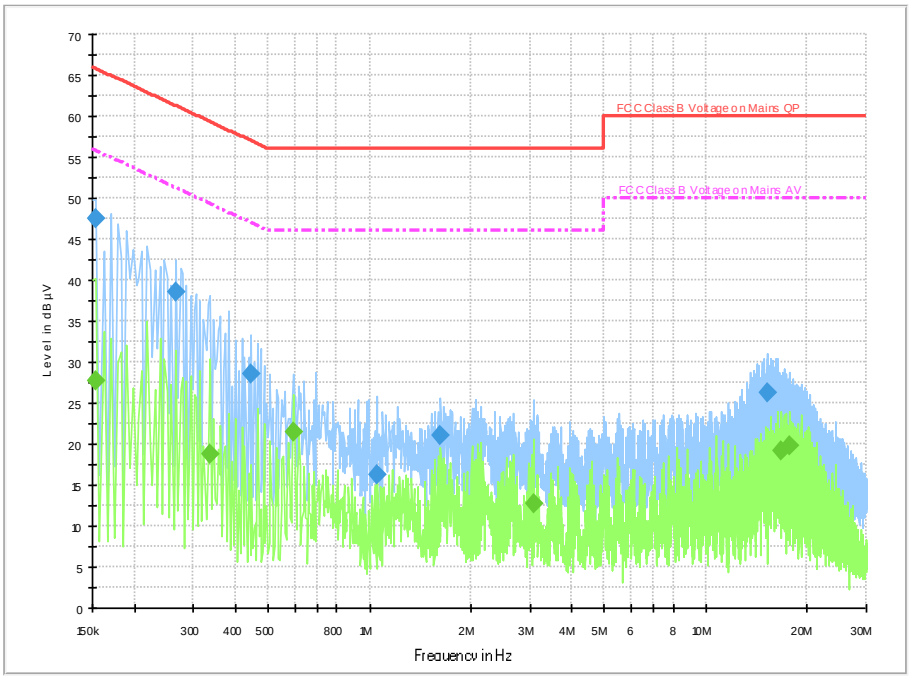

Fig.B.8.1 AC Powerline Conducted Emission- bluetooth

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

Final Result 1

Frequency (MHz)	QuasiPeak (dBµV)	Meas. Time	Bandwidth (kHz)	Filter	Line	Corr. (dB)	Margin (dB)	Limit (dBµV)	Comment
0.154000	**47.4**	**2000.0**	**9.000**	**On**	**N**	**19.9**	**18.4**	**65.8**	
0.266000	**38.6**	**2000.0**	**9.000**	**On**	**N**	**19.7**	**22.7**	**61.2**	
0.446000	**28.5**	**2000.0**	**9.000**	**On**	**L1**	**19.7**	**28.4**	**56.9**	
1.054000	**16.2**	**2000.0**	**9.000**	**On**	**L1**	**19.7**	**39.8**	**56.0**	
1.630000	**21.0**	**2000.0**	**9.000**	**On**	**N**	**19.6**	**35.0**	**56.0**	
15.198000	**26.3**	**2000.0**	**9.000**	**On**	**N**	**19.7**	**33.7**	**60.0**	

Final Result 2

Frequency (MHz)	CAverage (dBµV)	Meas. Time	Bandwidth (kHz)	Filter	Line	Corr. (dB)	Margin (dB)	Limit (dBµV)	Comment
0.154000	**27.8**	**2000.0**	**9.000**	**On**	**N**	**19.9**	**28.0**	**55.8**	
0.334000	**18.7**	**2000.0**	**9.000**	**On**	**N**	**19.7**	**30.6**	**49.4**	
0.594000	**21.4**	**2000.0**	**9.000**	**On**	**N**	**19.6**	**24.6**	**46.0**	
3.066000	**12.7**	**2000.0**	**9.000**	**On**	**N**	**19.6**	**33.3**	**46.0**	
16.762000	**19.1**	**2000.0**	**9.000**	**On**	**L1**	**19.7**	**30.9**	**50.0**	
17.674000	**19.7**	**2000.0**	**9.000**	**On**	**N**	**19.7**	**30.3**	**50.0**	

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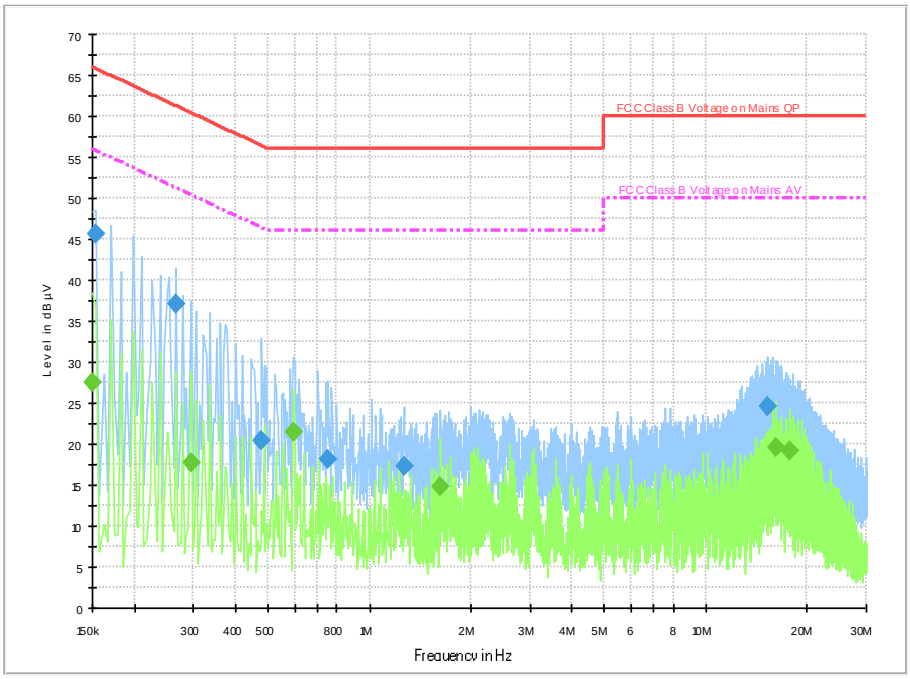

Fig.B.8.2 AC Powerline Conducted Emission-Idle

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	Bandwidth (kHz)	Filter	Line	Corr. (dB)	Margin (dB)	Limit (dBµV)	Comment
0.154000	**45.7**	**2000.0**	**9.000**	**On**	**N**	**19.9**	**20.1**	**65.8**	
0.266000	**37.0**	**2000.0**	**9.000**	**On**	**N**	**19.7**	**24.2**	**61.2**	
0.478000	**20.4**	**2000.0**	**9.000**	**On**	**N**	**19.7**	**36.0**	**56.4**	
0.754000	**18.2**	**2000.0**	**9.000**	**On**	**N**	**19.7**	**37.8**	**56.0**	
1.266000	**17.3**	**2000.0**	**9.000**	**On**	**N**	**19.6**	**38.7**	**56.0**	
15.330000	**24.6**	**2000.0**	**9.000**	**On**	**L1**	**19.7**	**35.4**	**60.0**	

Final Result 2

Frequency (MHz)	CAverage (dBµV)	Meas. Time	Bandwidth (kHz)	Filter	Line	Corr. (dB)	Margin (dB)	Limit (dBµV)	Comment
0.150000	**27.4**	**2000.0**	**9.000**	**On**	**N**	**20.0**	**28.6**	**56.0**	
0.294000	**17.8**	**2000.0**	**9.000**	**On**	**N**	**19.7**	**32.7**	**50.4**	
0.594000	**21.4**	**2000.0**	**9.000**	**On**	**N**	**19.6**	**24.6**	**46.0**	
1.630000	**14.8**	**2000.0**	**9.000**	**On**	**L1**	**19.6**	**31.2**	**46.0**	
16.174000	**19.5**	**2000.0**	**9.000**	**On**	**N**	**19.7**	**30.5**	**50.0**	
17.806000	**19.2**	**2000.0**	**9.000**	**On**	**L1**	**19.7**	**30.8**	**50.0**	

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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.

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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 26th day of June 2023.

Mr. Trace McInturff, 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*****

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