FCC PART 15C
TEST REPORT

BLUETOOTH LOW ENERGY (BLE) PART

No. I18Z60700-IOT10

for

WORKERBASE GmbH

WIFI/BT Watch

Model Name: WB-3301

FCC ID: 2APQFWB3301

with

Hardware Version: PIO01

Software Version: W0P

Issued Date: 2018-9-13

TESTING
NVLAP LAB CODE 600118-0

Note:

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Test Laboratory:

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REPORT HISTORY

Report Number	Revision	Description	Issue Date
I18Z60700-IOT10	Rev.0	1st edition	2018-9-13

CONTENTS

1. Test Laboratory

1.1. 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(Shouxiang)

Address: No. 51 Shouxiang Science Building, Xueyuan Road, Haidian District, Beijing, P. R. China100191

1.2. Testing Environment

Normal Temperature: 15-35℃

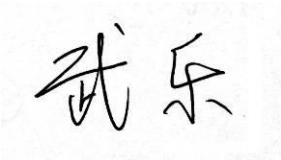
Relative Humidity: 20-75%

1.3. Project data

Testing Start Date: 2018-5-28

Testing End Date: 2018-9-13

1.4. Signature



Wu Le

(Prepared this test report)

Sun Zhenyu

(Reviewed this test report)

Li Zhuofang

(Approved this test report)

2. Client Information

2.1. Applicant Information

Company Name:	WORKERBASE GmbH
Address /Post:	Aventinstr. 7, Munich, Germany
City:	Munich
Postal Code:	/
Country:	Germany
Telephone:	+49 89 21540295
Fax:	/

2.2. Manufacturer Information

Company Name:	WORKERBASE GmbH
Address /Post:	Aventinstr. 7, Munich, Germany
City:	Munich
Postal Code:	/
Country:	Germany
Telephone:	+49 89 21540295
Fax:	/

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

3.1. About EUT

Description	WIFI/BT Watch
Model Name	WB-3301
FCC ID	2APQFWB3301
Frequency Band	ISM 2400MHz~2483.5MHz
Type of Modulation(LE mode)	GFSK (Bluetooth Low Energy)
Number of Channels(LE mode)	40
Power Supply	3.7V DC by Battery

3.2. Internal Identification of EUT

EUT ID*	SN or IMEI	HW Version	SW Version
EUT4	5C7776F1D85B380	PIO01	W0P
EUT5	5C7776ECCF2A250	PIO01	W0P

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

3.3. Internal Identification of AE

AE ID*	Description	
AE1	Battery	inbuilt

AE1

Model	CAB22B0000C1
Manufacturer	BYD
Capacitance	750mAh
Nominal voltage	3.7V

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

3.4. EUT set-ups

EUT set-up No.	Combination of EUT and AE	Remarks
Set.10	EUT4+ AE1	BT&WIFI

3.5. Normal Accessory setting

Fully charged battery is used during the test.

3.6. General Description

The Equipment Under Test (EUT) is a model of WIFI/BT Watch 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 feature information is supplied by the applicant 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.	2016
ANSI C63.10	American National Standard of Procedures for Compliance Testing of Unlicensed Wireless Devices	June,2013

5. Test Results

5.1. 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
6dB Bandwidth	15.247 (a)(2)	**P**
Peak Output Power - Conducted	15.247 (b)(1)	**P**
Maximum Power Spectral Density Level	15.247(e)	**P**
Transmitter Spurious Emission - Conducted	15.247 (d)	**P**
Transmitter Spurious Emission - Radiated	15.247, 15.205, 15.209	**P**
Frequency Band Edges	15.247 (d)	**P**

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

The measurement is made according to ANSI C63.10.

5.2. 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	200136	Rohde & Schwarz	1 year	2018-09-30
2	Test Receiver	ESCI 3	100344	Rohde & Schwarz	1 year	2019-02-28
3	LISN	ENY216	101200	Rohde & Schwarz	1 year	2019-04-15
4	Shielding Room	S81	/	ETS-Lindgren	/	/

Radiated emission test system

No.	Equipment	Model	Serial Number	Manufacturer	Calibration Period	Calibration Due date
1	Test Receiver	ESU26	100235	Rohde & Schwarz	1 year	2019-03-01
2	BiLog Antenna	VULB9163	302	Schwarzbeck	3 years	2019-02-03
3	EMI Antenna	3115	00167250	ETS-Lindgren	3 Years	2020-05-21

7. Measurement Uncertainty

7.1. Peak Output Power - Conducted

Measurement Uncertainty:

Measurement Uncertainty (k=2)	0.66dB

7.2. Frequency Band Edges

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. Transmitter Spurious Emission - Radiated

Measurement Uncertainty:

Frequency Range	Uncertainty (k=2)
＜ 1 GHz	4.86dB
＞ 1 GHz	5.26dB

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

ANNEX A: Detailed Test Results

A.1. Measurement Method

A.1.1. Conducted Measurements

The measurement is made according to ANSI C63.10.

1). Connect the EUT to the test system correctly.

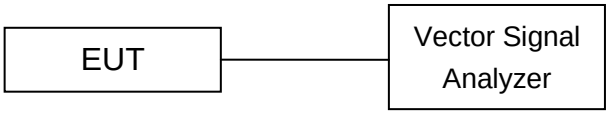
2). Set the EUT to the required work mode (Transmitter, receiver or transmitter & receiver).

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



A.1.2. Radiated Emission Measurements

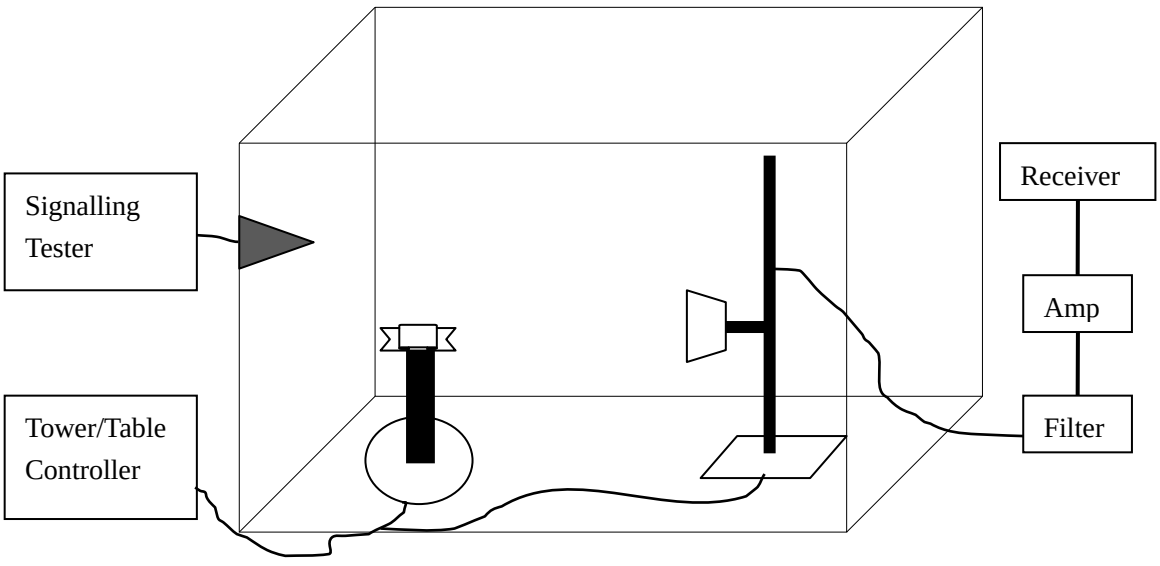
The measurement is made according to ANSI C63.10.

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

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

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

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



A.2. Peak Output Power - Conducted

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

a) Set the RBW = 1 MHz.
b) Set VBW = 3 MHz.
c) Set span = 3 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)(1)	< 30

Measurement Results:

For GFSK

Channel No.	Frequency (MHz)	Peak Conducted Output Power (dBm)	Conclusion
0	2402	2.86	P
19	2440	2.48	P
39	2480	1.12	P

Conclusion: PASS

A.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	-55.77	P
39	2480	Hopping OFF	Fig.2	-59.12	P

Conclusion: PASS

Test graphs as below

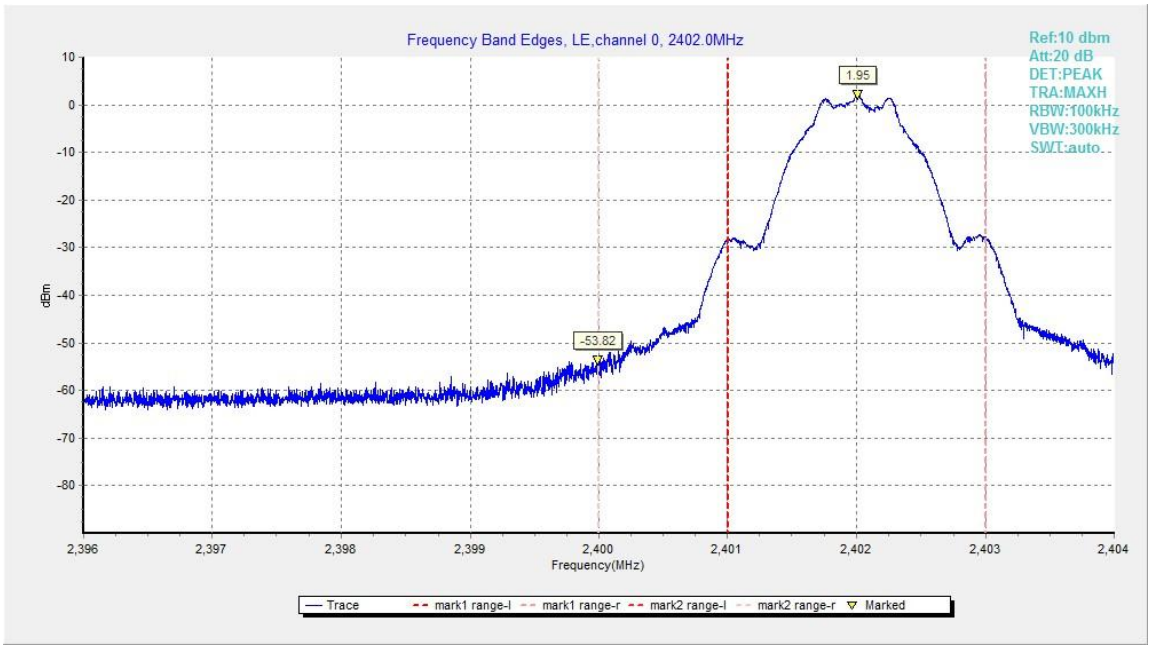


Fig.1. Frequency Band Edges: GFSK, 2402 MHz**,** Hopping Off

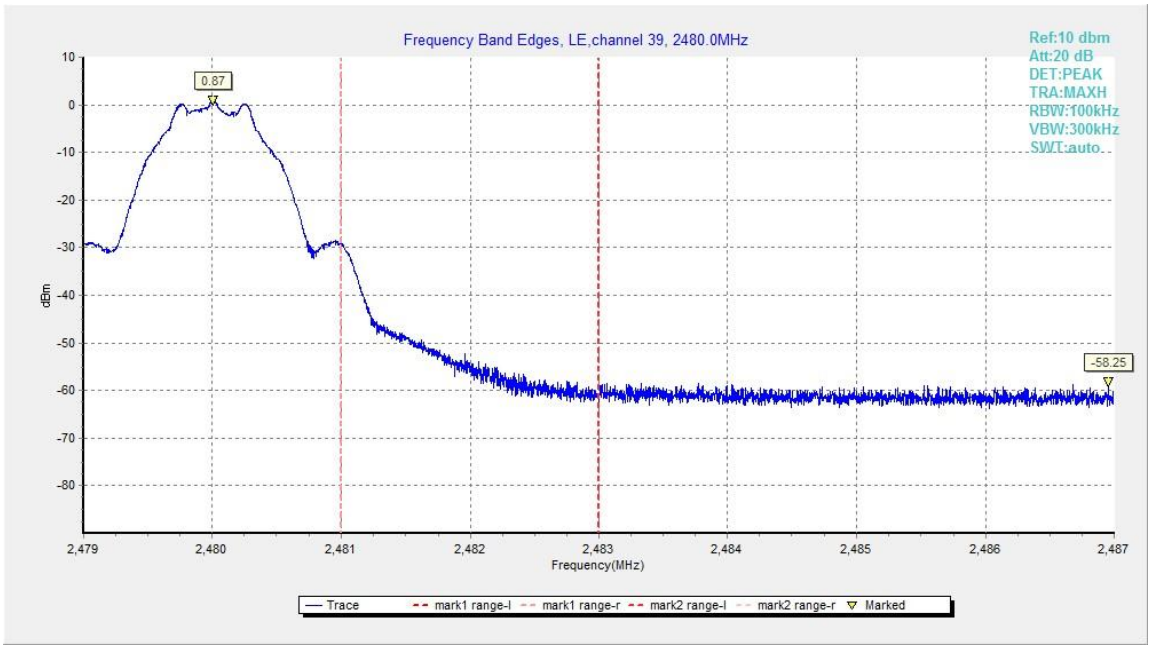


Fig.2. Frequency Band Edges: GFSK, 2480 MHz, Hopping Off

A.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

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

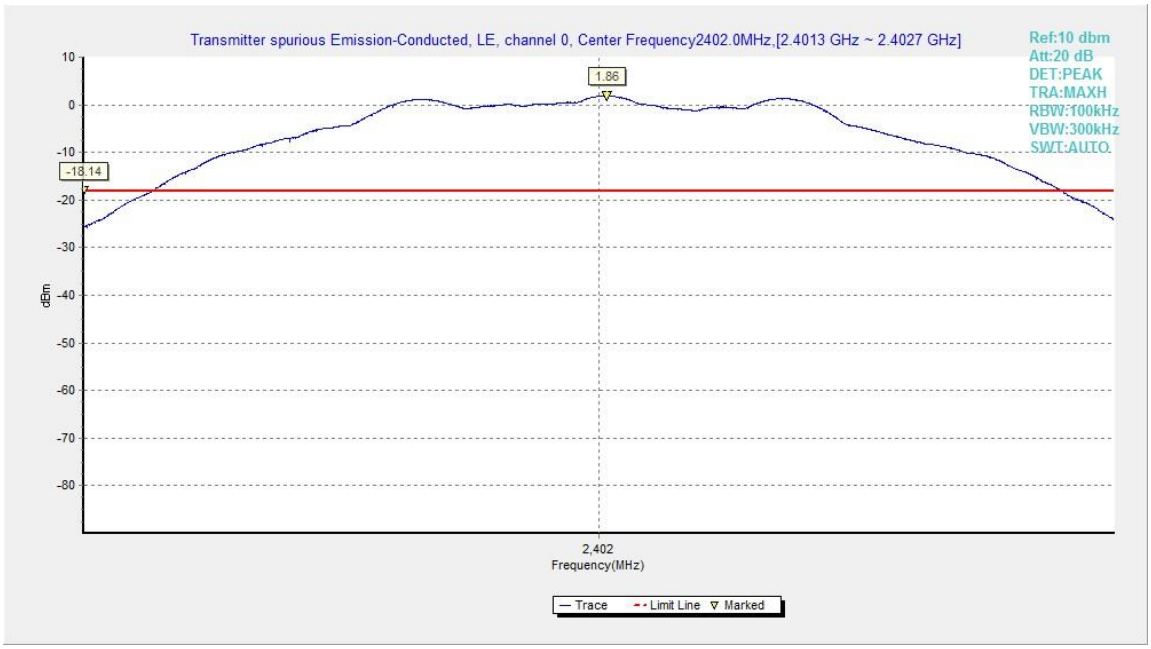


Fig.3. Transmitter Spurious Emission - Conducted: GFSK,2402MHz

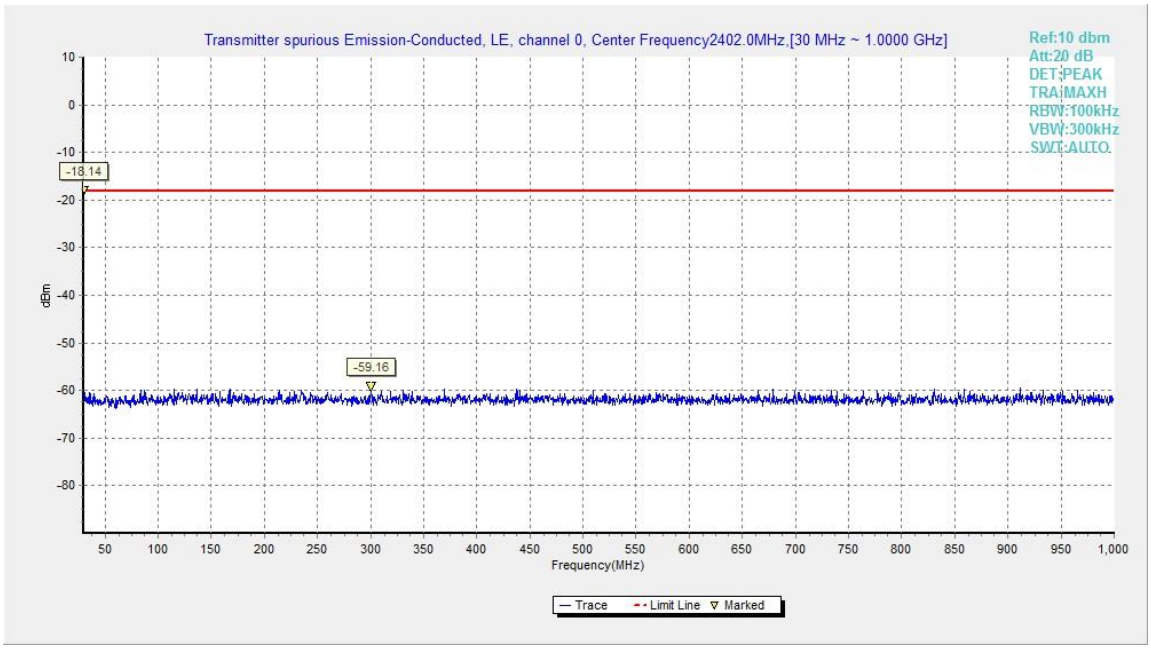


Fig.4. Transmitter Spurious Emission - Conducted: GFSK, 2402 MHz, 30MHz - 1GHz

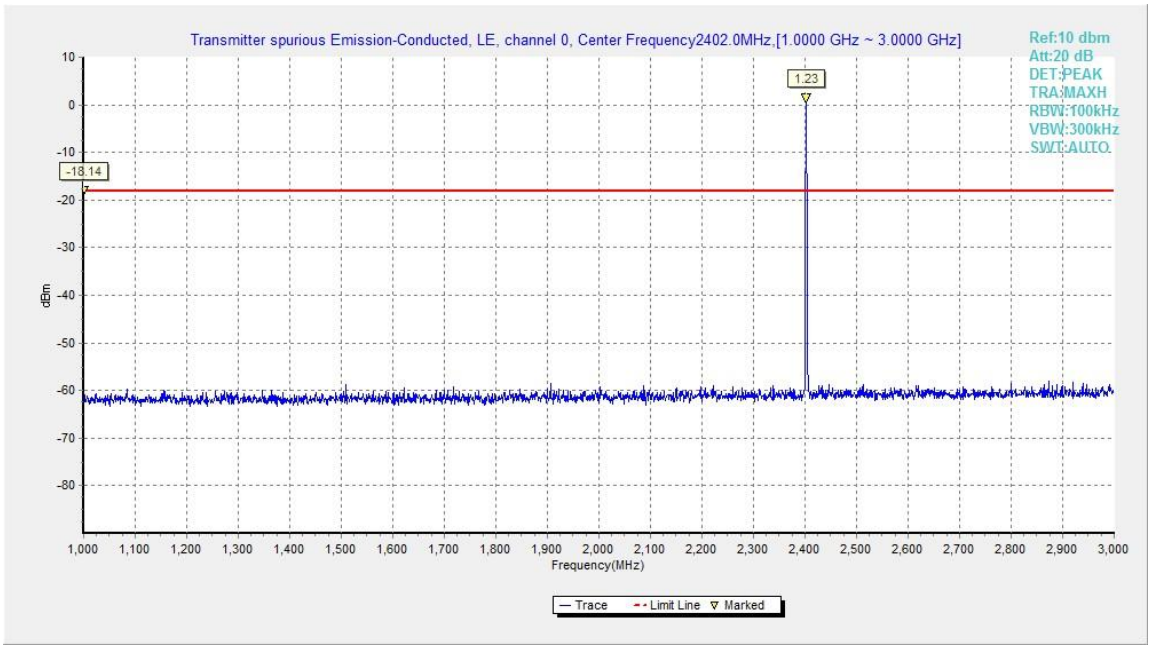


Fig.5. Transmitter Spurious Emission - Conducted: GFSK, 2402 MHz,1GHz - 3GHz

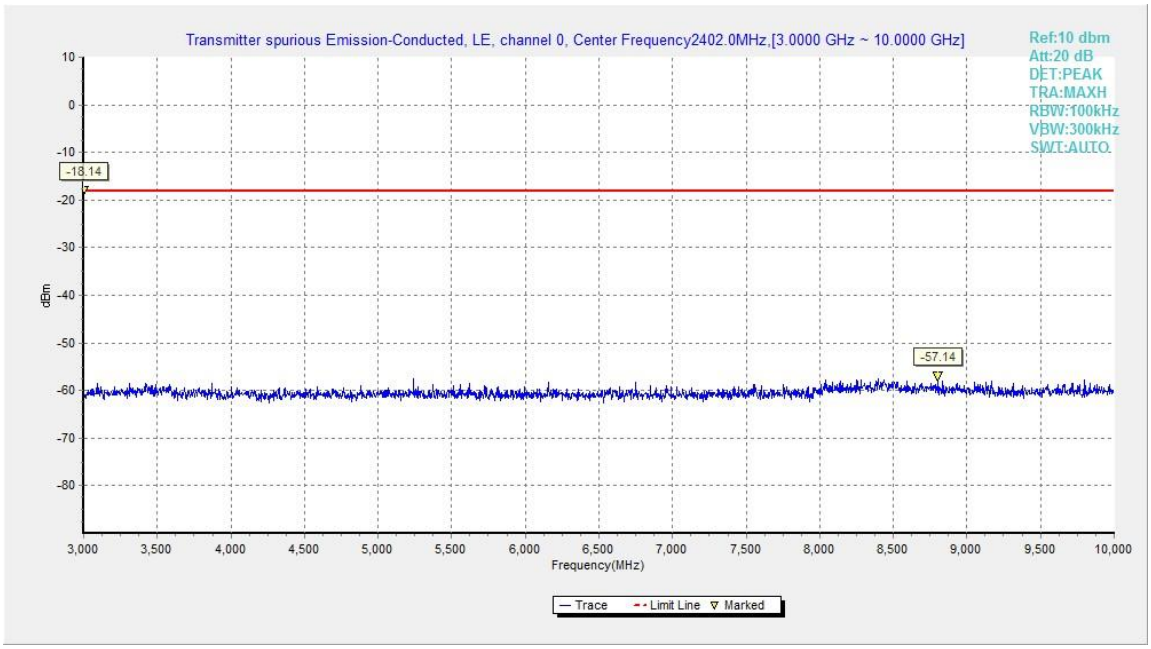


Fig.6. Transmitter Spurious Emission - Conducted: GFSK, 2402 MHz,3GHz - 10GHz

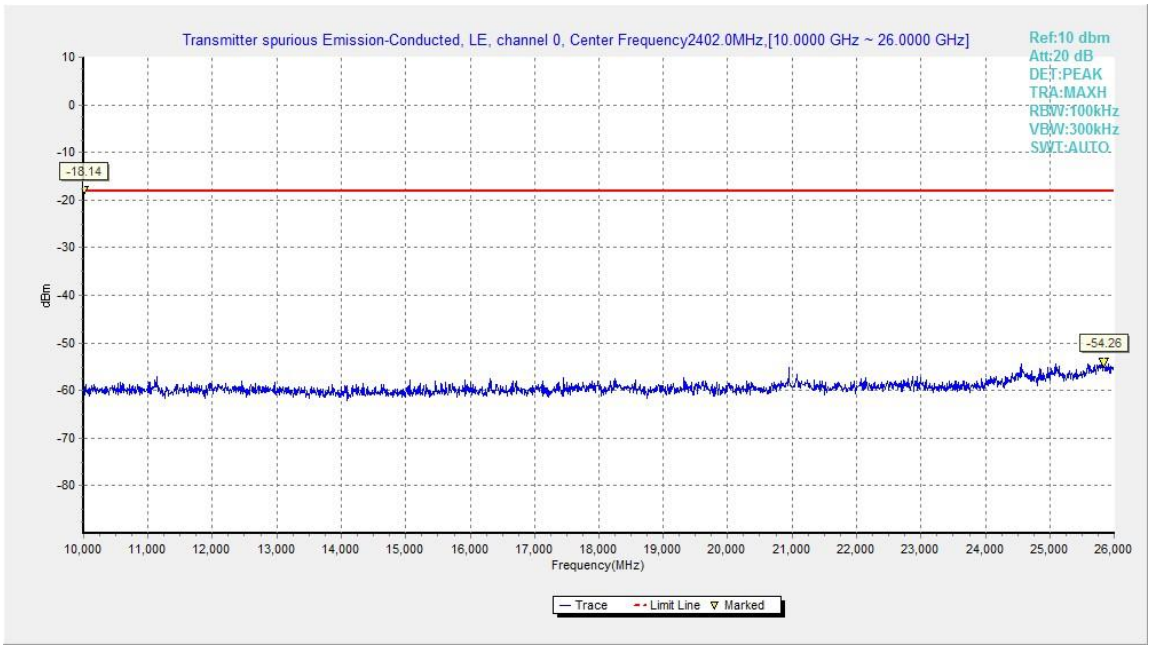


Fig.7. Transmitter Spurious Emission - Conducted: GFSK, 2402 MHz,10GHz - 26GHz

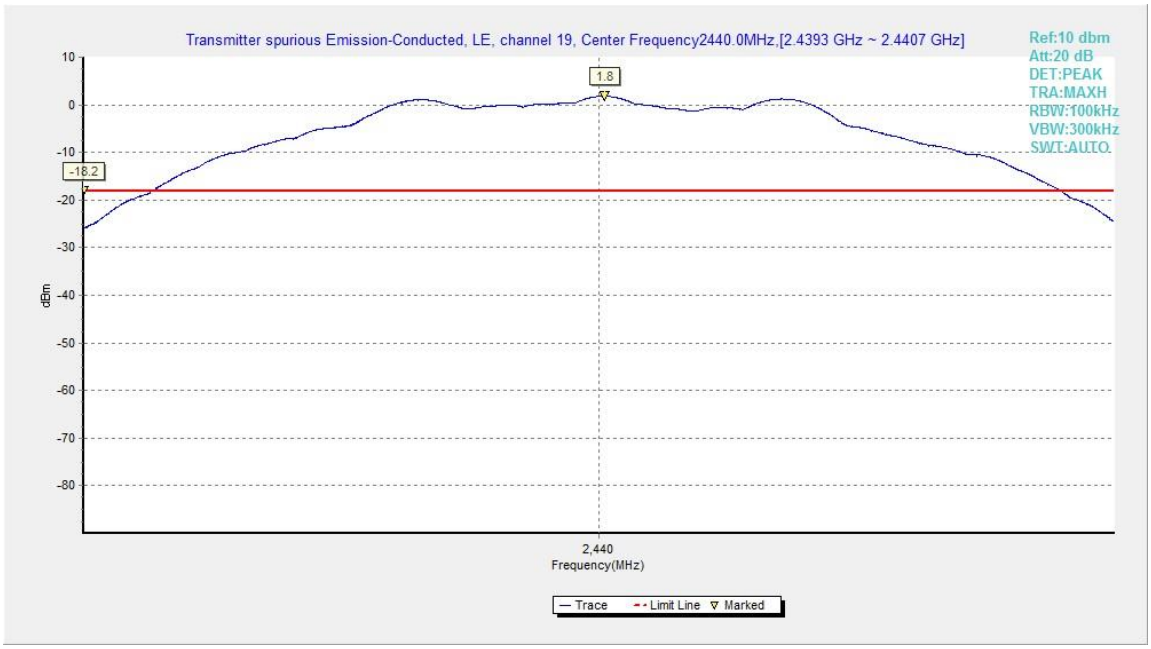


Fig.8. Transmitter Spurious Emission - Conducted: GFSK, 2440MHz

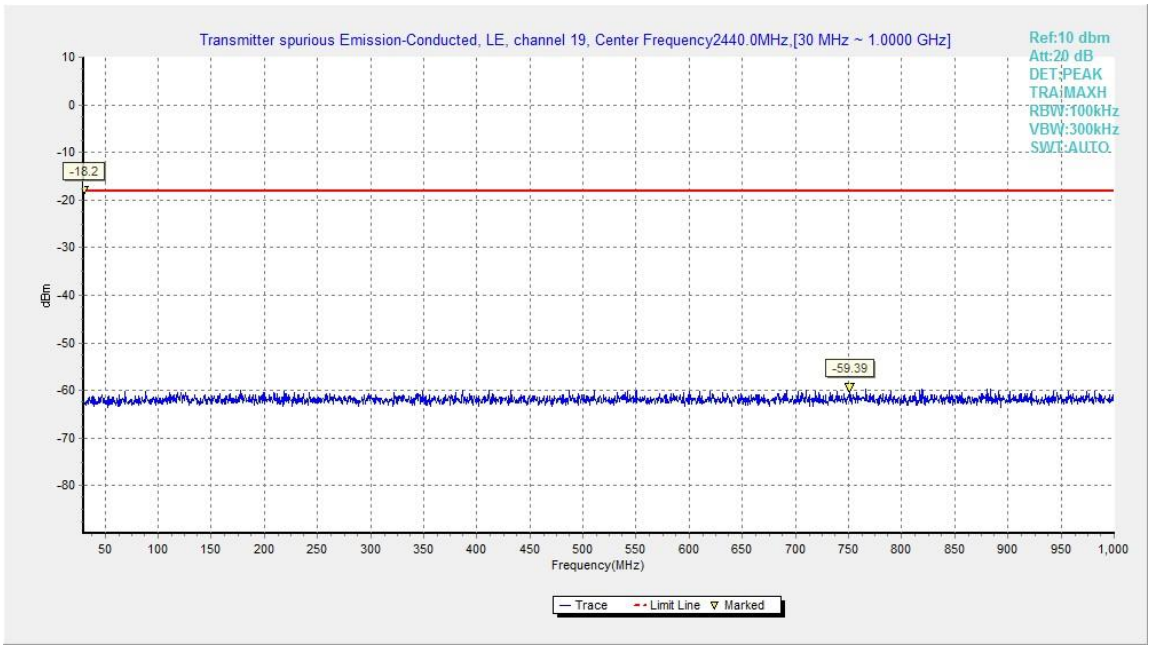


Fig.9. Transmitter Spurious Emission - Conducted: GFSK, 2440 MHz, 30MHz - 1GHz

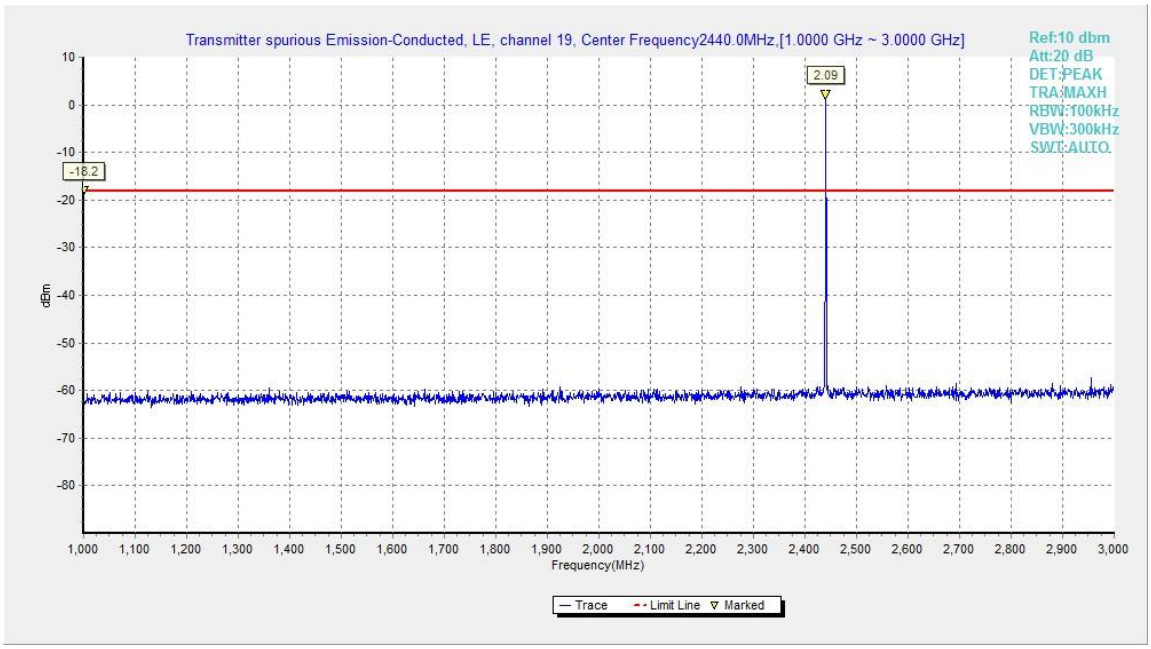


Fig.10. Transmitter Spurious Emission - Conducted: GFSK, 2440 MHz, 1GHz – 3GHz

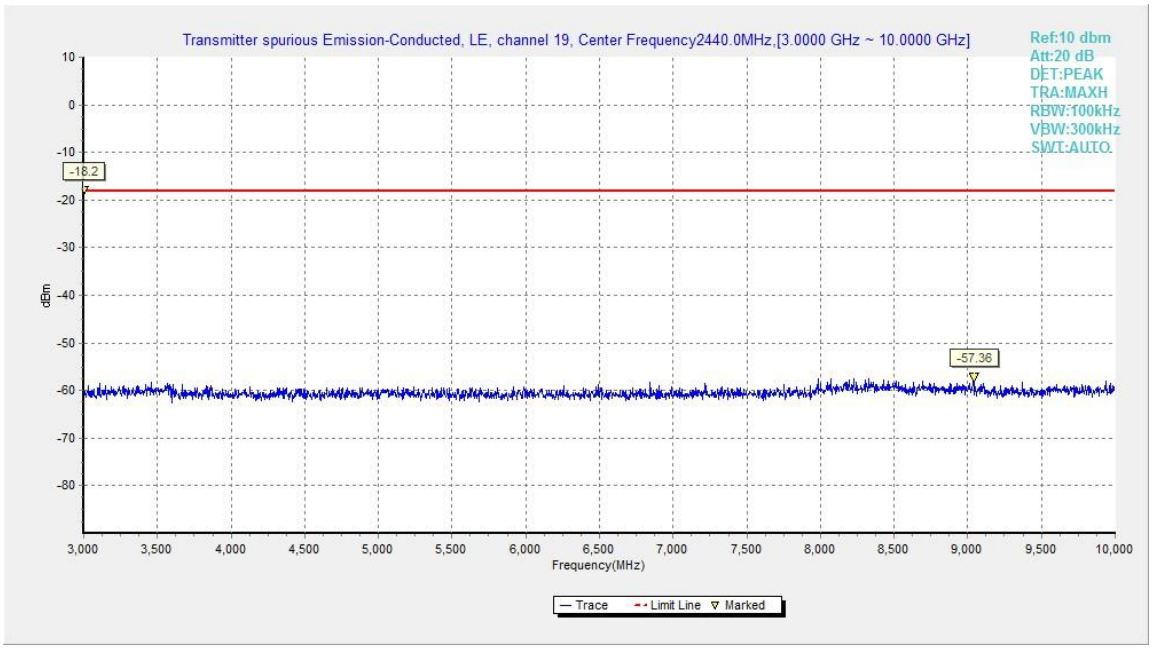


Fig.11. Transmitter Spurious Emission - Conducted: GFSK, 2440 MHz, 3GHz – 10GHz

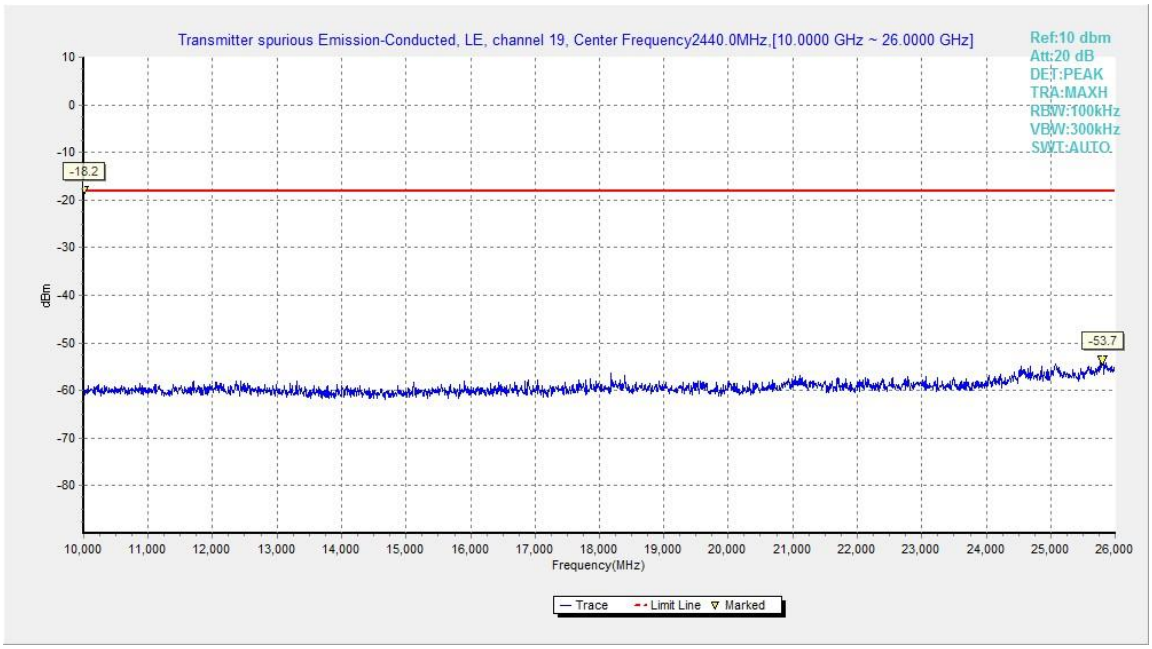


Fig.12. Transmitter Spurious Emission - Conducted: GFSK, 2440 MHz, 10GHz – 26GHz

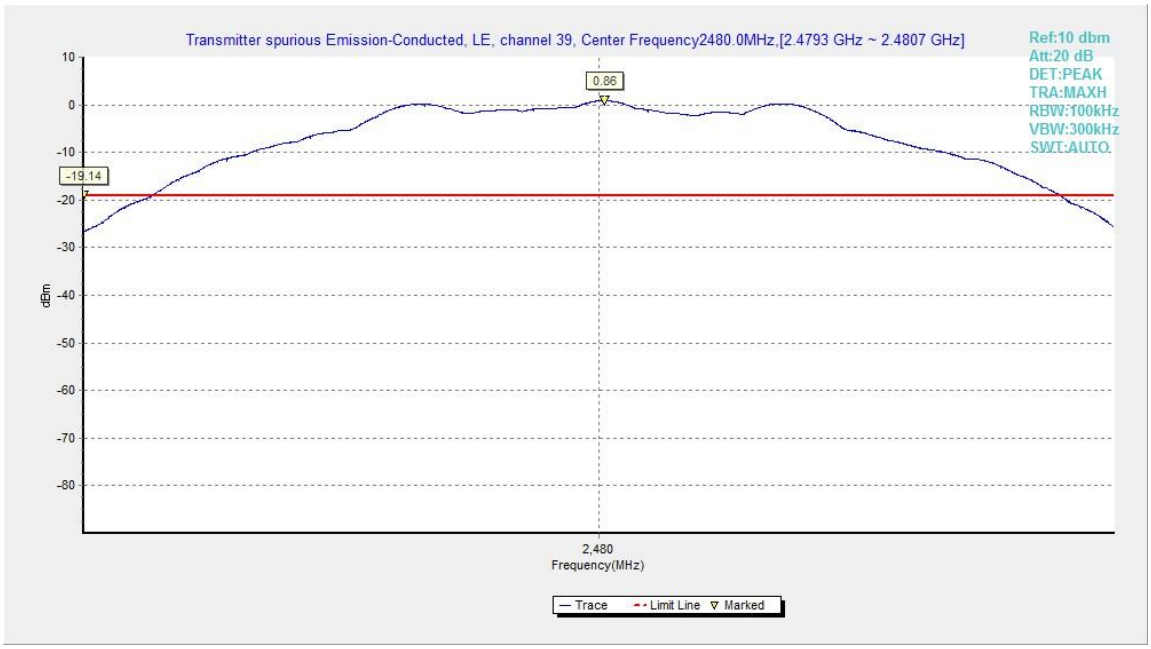


Fig.13. Transmitter Spurious Emission - Conducted: GFSK, 2480 MHz

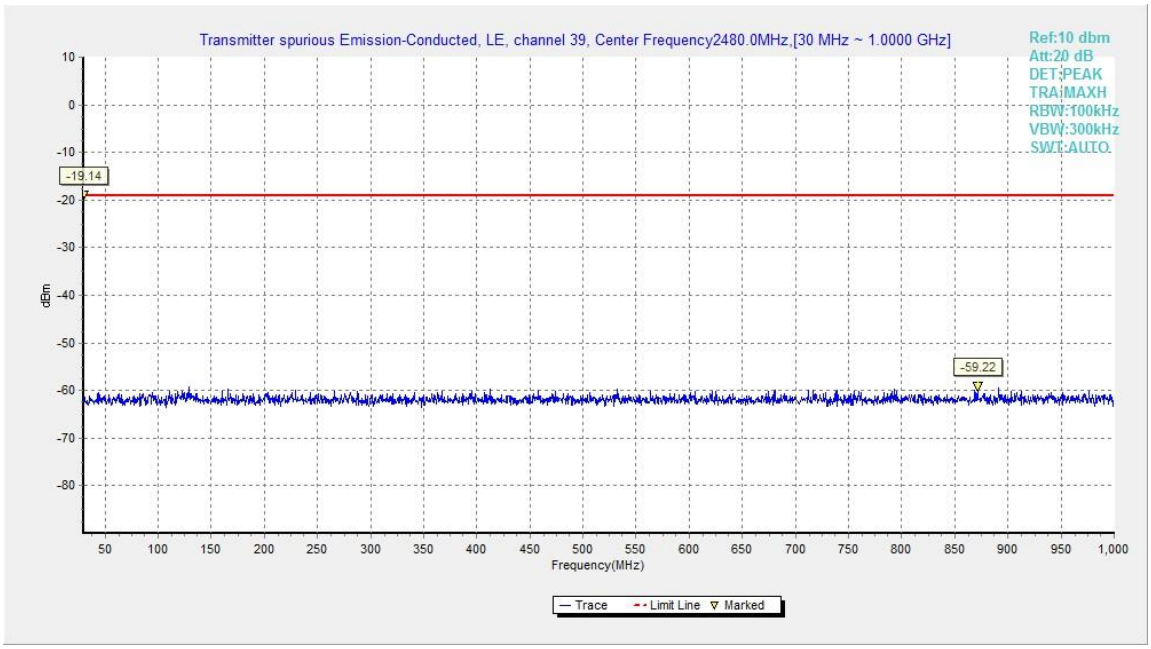


Fig.14. Transmitter Spurious Emission - Conducted: GFSK, 2480 MHz, 30MHz - 1GHz

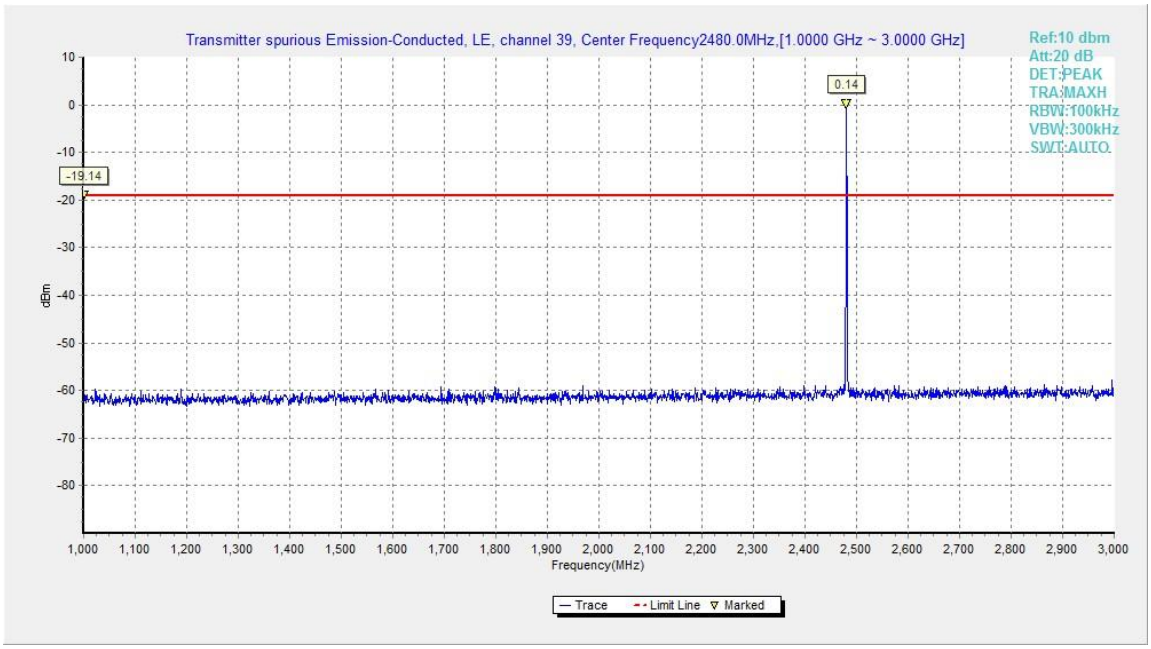


Fig.15. Transmitter Spurious Emission - Conducted: GFSK, 2480 MHz, 1GHz - 3GHz

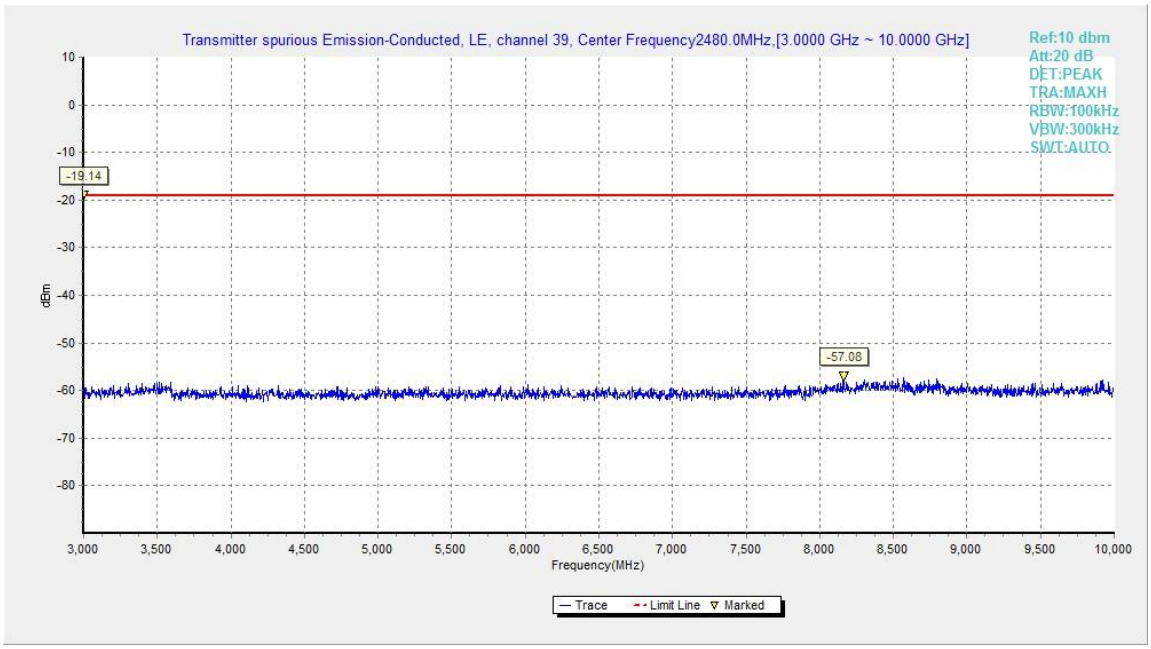


Fig.16. Transmitter Spurious Emission - Conducted: GFSK, 2480 MHz, 3GHz - 10GHz

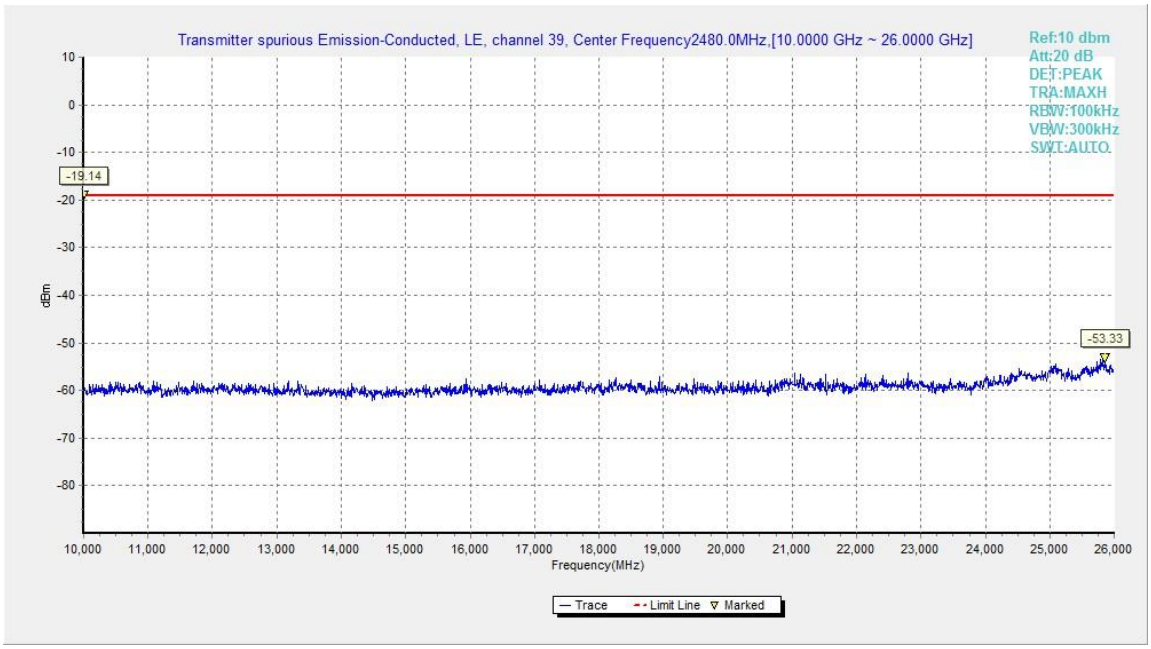


Fig.17. Transmitter Spurious Emission - Conducted: GFSK, 2480 MHz, 10GHz - 26GHz

A.5. Transmitter Spurious Emission - Radiated

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)).

The measurement is made according to ANSI C63.10

Limit in restricted band:

Frequency of emission (MHz)	Field strength(uV/m)	Field strength(dBuV/m)
30-88	100	40
88-216	150	43.5
216-960	200	46
Above 960	500	54

Test Condition

The EUT was placed on a non-conductive table. The measurement antenna was placed at a distance of 3 meters from the EUT. During the tests, the antenna height and the EUT azimuth were varied in order to identify the maximum level of emissions from the EUT. This maximization process was repeated with the EUT positioned in each of its three orthogonal orientations.

Frequency of emission (MHz)	RBW/VBW	Sweep Time(s)
30-1000	100KHz/300KHz	5
1000-4000	1MHz/1MHz	15
4000-18000	1MHz/1MHz	40
18000-26500	1MHz/1MHz	20

Measurement Results:

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.
The measurement results are obtained as described below:

$Result=P_{Mea}+A_{Rpl}$

For GFSK

Frequency	Frequency Range	Test Results	Conclusion
2402 MHz	1 GHz ~ 3 GHz	--	P
	3 GHz ~ 18 GHz	--	P
2440 MHz	9 kHz ~ 30 MHz	--	P
	30 MHz ~ 1 GHz	--	P
	1 GHz ~ 3 GHz	--	P
	3 GHz ~ 18 GHz	--	P

2480 MHz	1 GHz ~ 3 GHz	--	P
	3 GHz ~ 18 GHz	--	P
Power	2.38GHz~2.4GHz---L	Fig.18	P
Power	2.45GHz~2.5GHz---H	Fig.19	P
For all channels	18 GHz ~ 26.5 GHz	--	P

GFSK 2402MHz–Average

Frequency (MHz)	Measurement Result (dBμV/m)	Cable loss (dB)	Antenna Factor (dB/m)	Receiver Reading (dBμV)	Antenna Pol. (H/V)
2389.945	42.2	-38.8	27.2	53.849	H
18000.000	40.3	-26.5	46.4	20.405	H
17992.500	40.2	-25.5	43.4	22.302	V
17995.500	40.0	-25.5	43.4	22.102	H
17998.500	40.0	-25.5	43.4	22.102	H
17997.000	40.0	-25.5	43.4	22.102	H

GFSK 2440MHz–Average

Frequency (MHz)	Measurement Result (dBμV/m)	Cable loss (dB)	Antenna Factor (dB/m)	Receiver Reading (dBμV)	Antenna Pol. (H/V)
17997.000	40.3	-25.5	43.4	22.402	H
17995.500	40.2	-25.5	43.4	22.302	H
17994.000	40.1	-25.5	43.4	22.202	V
17992.500	40.1	-25.5	43.4	22.202	H
17998.500	40.0	-25.5	43.4	22.102	H
18000.000	40.0	-26.5	46.4	20.105	H

GFSK 2480MHz–Average

Frequency (MHz)	Measurement Result (dBμV/m)	Cable loss (dB)	Antenna Factor (dB/m)	Receiver Reading (dBμV)	Antenna Pol. (H/V)
2485.560	42.1	-39.0	27.2	53.914	H
17995.500	40.4	-25.5	43.4	22.502	H
17992.500	40.2	-25.5	43.4	22.302	V
18000.000	40.1	-26.5	46.4	20.205	H
17998.500	40.0	-25.5	43.4	22.102	H
17997.000	40.0	-25.5	43.4	22.102	H

GFSK 2402MHz–Peak

Frequency (MHz)	Measurement Result (dBμV/m)	Cable loss (dB)	Antenna Factor (dB/m)	Receiver Reading (dBμV)	Antenna Pol. (H/V)
2389.930	54.2	-38.8	27.2	65.849	H
17962.500	52.4	-25.5	43.4	34.502	H
17988.000	52.3	-25.5	43.4	34.402	V
17976.000	51.8	-25.5	43.4	33.902	H
17983.500	51.7	-25.5	43.4	33.802	H
17917.500	51.6	-25.5	43.4	33.702	H

GFSK 2440MHz–Peak

Frequency (MHz)	Measurement Result (dBμV/m)	Cable loss (dB)	Antenna Factor (dB/m)	Receiver Reading (dBμV)	Antenna Pol. (H/V)
17929.500	52.2	-25.5	43.4	34.302	H
17995.500	51.9	-25.5	43.4	34.002	H
17911.500	51.7	-25.7	43.4	34.042	V
17767.500	51.6	-25.7	43.4	33.942	H
17994.000	51.4	-25.5	43.4	33.502	H
17881.500	51.4	-25.7	43.4	33.742	H

GFSK 2480MHz–Peak

Frequency (MHz)	Measurement Result (dBμV/m)	Cable loss (dB)	Antenna Factor (dB/m)	Receiver Reading (dBμV)	Antenna Pol. (H/V)
2487.905	54.8	-39.0	27.2	66.614	H
17998.500	51.7	-25.5	43.4	33.802	H
17959.500	51.7	-25.5	43.4	33.802	V
17920.500	51.6	-25.5	43.4	33.702	H
17946.000	51.5	-25.5	43.4	33.602	H
17818.500	51.5	-25.7	43.4	33.842	H

Conclusion: PASS

Test graphs as below:

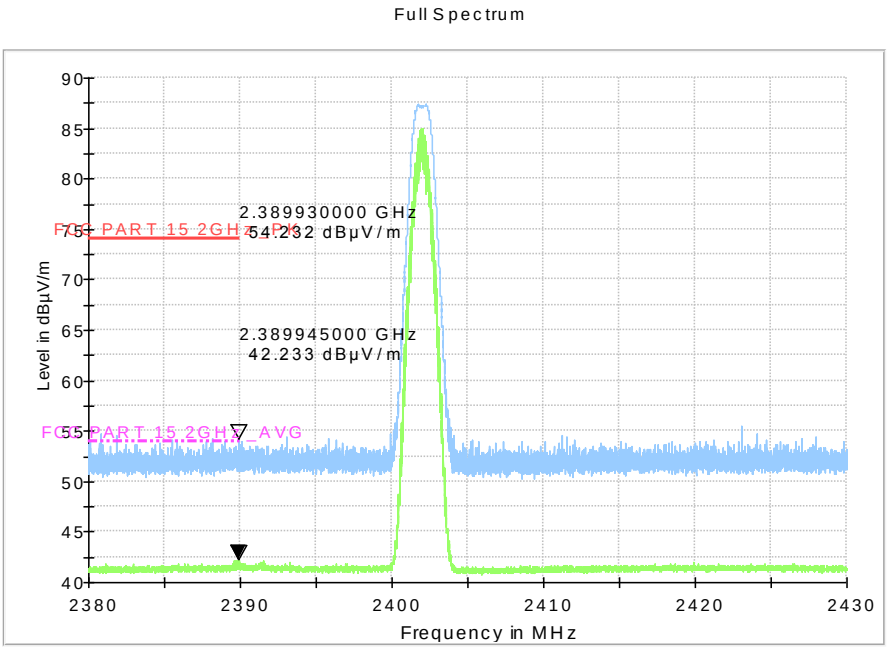


Fig.18. Transmitter Spurious Emission - Radiated (Power): GFSK low channel

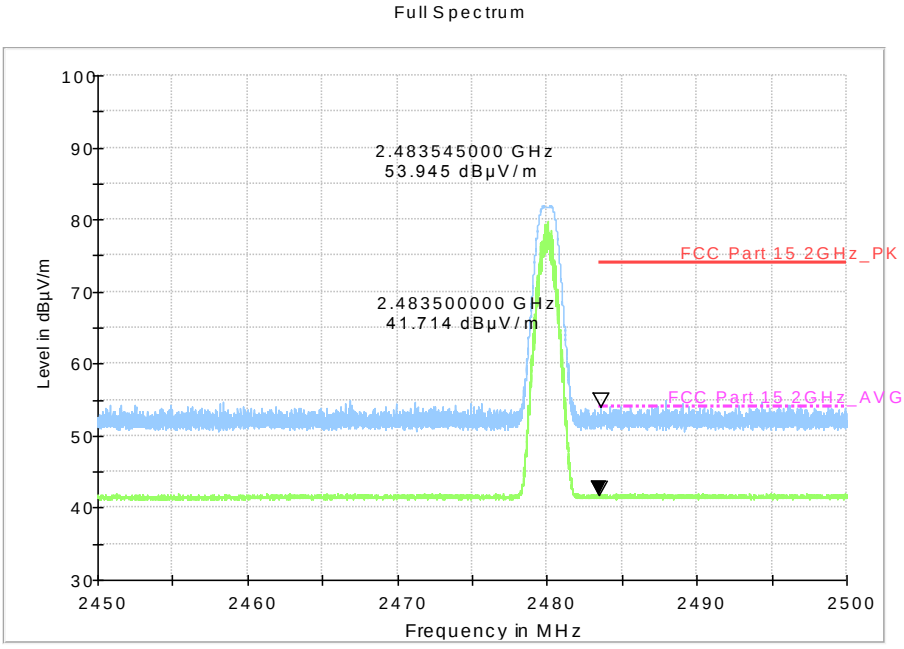


Fig.19. Transmitter Spurious Emission - Radiated (Power): GFSK high channel

A.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	668.50	P
19	2440	Fig.21	668.00	P
39	2480	Fig.22	669.50	P

Conclusion: PASS

Test graphs as below:

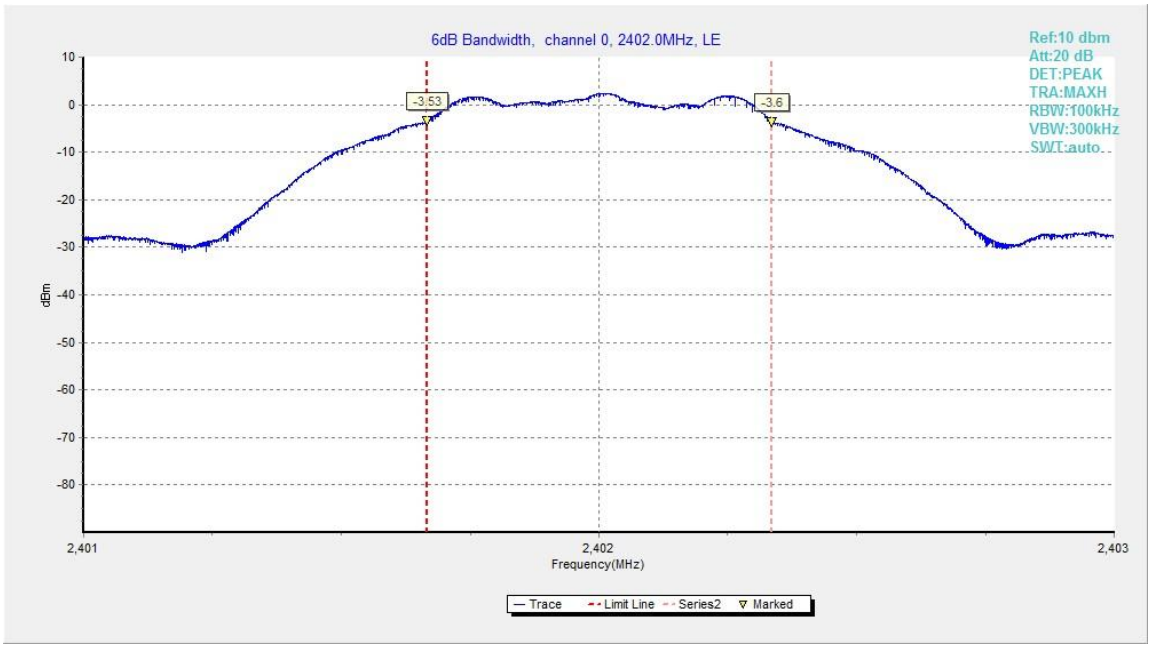


Fig.20. 6dB Bandwidth: GFSK, 2402 MHz

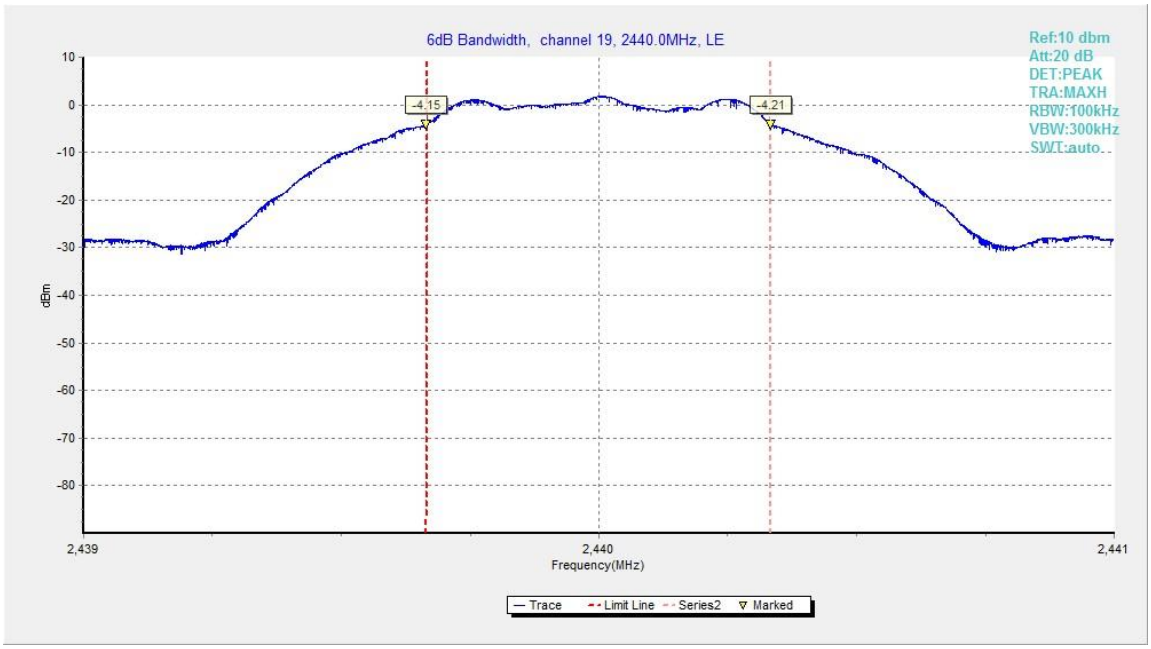


Fig.21. 6dB Bandwidth: GFSK, 2440 MHz

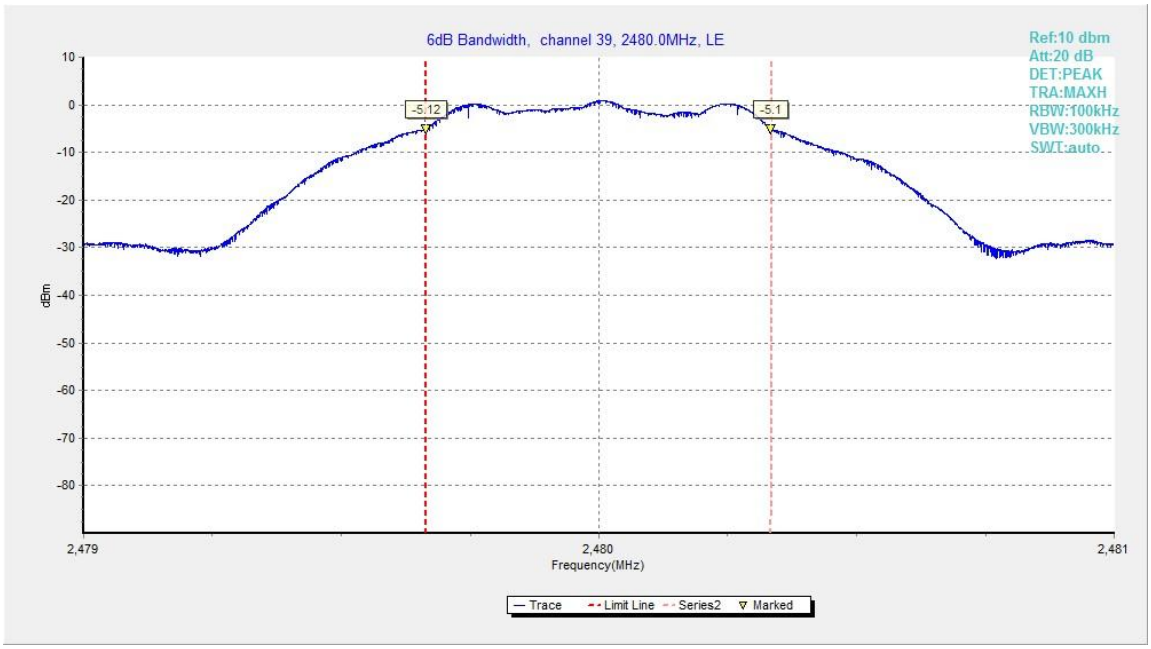


Fig.22. 6dB Bandwidth: GFSK, 2480 MHz

A.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	-13.19	P
19	2440	Fig.24	-12.96	P
39	2480	Fig.25	-14.01	P

Test graphs as below:

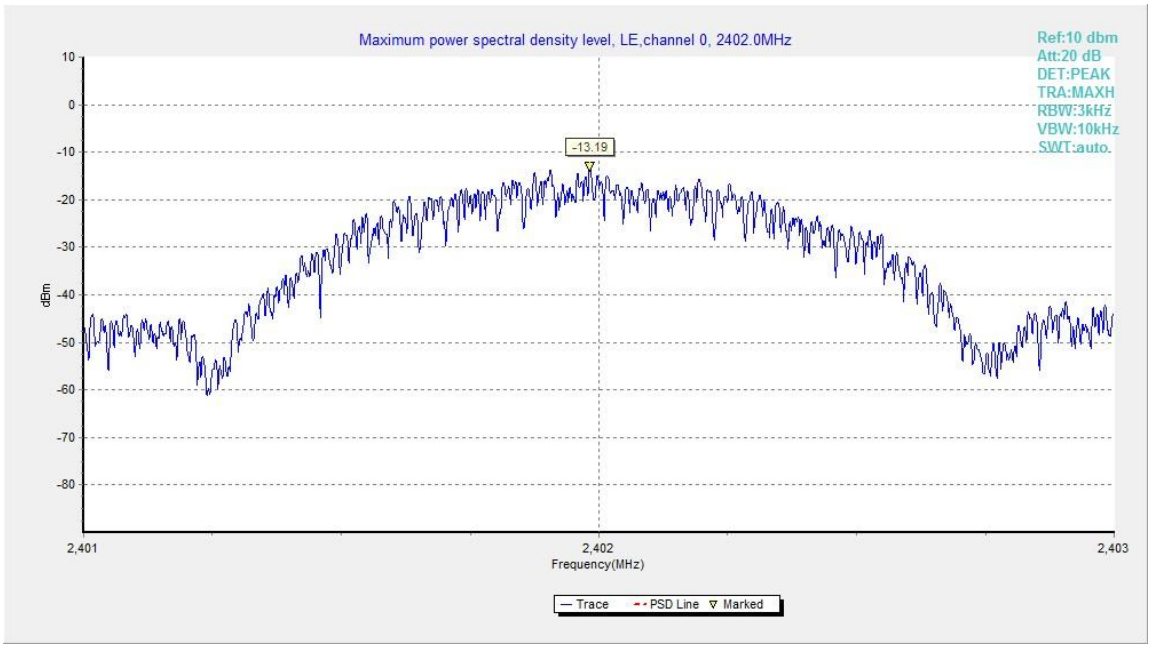


Fig.23. Maximum Power Spectral Density Level Function: GFSK, 2402 MHz

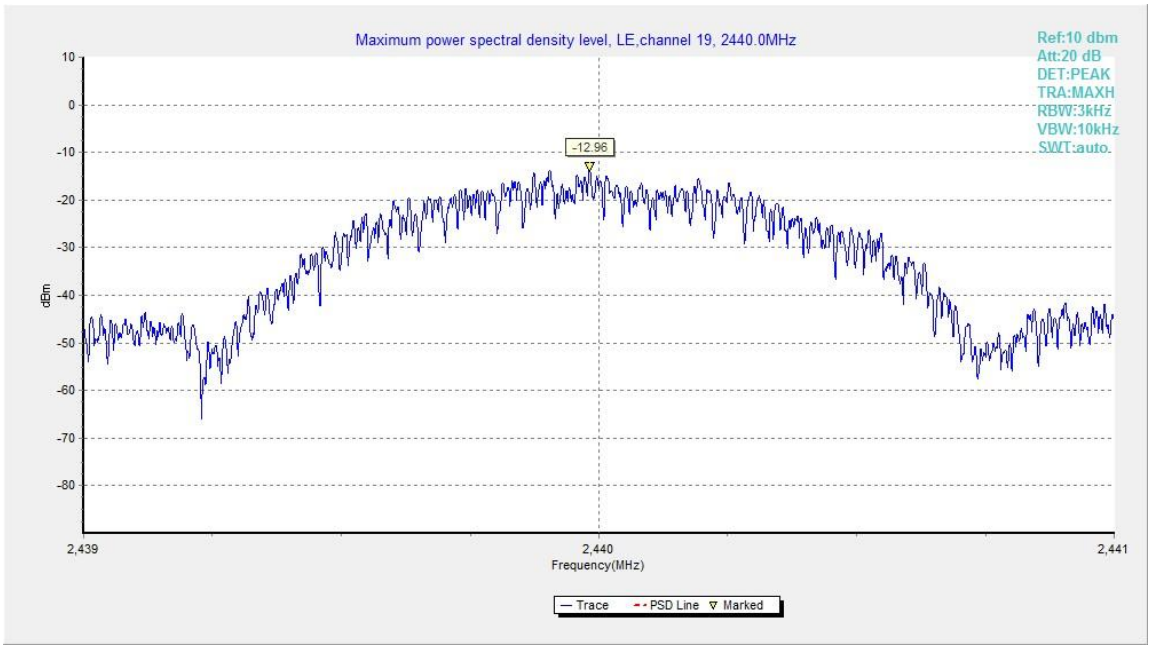


Fig.24. Maximum Power Spectral Density Level Function: GFSK, 2440 MHz

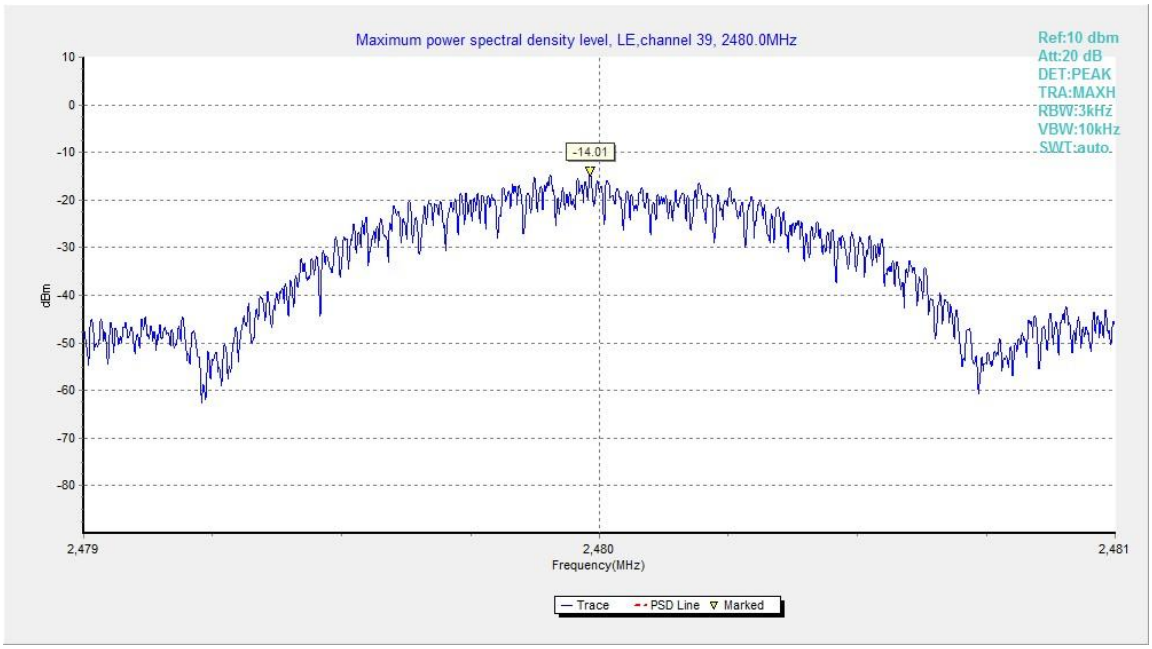


Fig.25. Maximum Power Spectral Density Level Function: GFSK, 2480 MHz

ANNEX E: Accreditation Certificate

United States Department of Commerce
National Institute of Standards and Technology

NVLAP®

Certificate of Accreditation to ISO/IEC 17025:2005

NVLAP LAB CODE: 600118-0

Telecommunication Technology Labs, CAICT
Beijing
China

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

Electromagnetic Compatibility & Telecommunications

This laboratory is accredited in accordance with the recognized International Standard ISO/IEC 17025:2005. 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).

2017-08-22 through 2018-09-30
Effective Dates

For the National Voluntary Laboratory Accreditation Program

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