FCC PART 15C
TEST REPORT
No. **I18Z60067-IOT07**

for

Vodafone

GSM UMTS LTE mobile phone

Model Name: VFD 720

FCC ID:2ACCJH081

with

Hardware Version:PIO 02

Software Version:3E22

Issued Date: 2018-3-19

Note:

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REPORT HISTORY

Report Number	Revision	Description	Issue Date
I18Z60067-IOT07	Rev.0	1st edition	2018-3-19

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: 2018-1-18

Testing End Date: 2018-3-16

1.4. Signature

Wu Le

(Prepared this test report)

Sun Zhenyu

(Reviewed this test report)

Lv Songdong

(Approved this test report)

2. Client Information

2.1. Applicant Information

Company Name:	TCL Communication Ltd.
Address /Post:	7/F, Block F4, TCL International E City, Zhong Shan Yuan Road, Nanshan District, Shenzhen, Guangdong, P.R. China 518052
City:	Shenzhen
Postal Code:	518052
Country:	China
Telephone:	0086-755-36611722
Fax:	0086-755-36612000-81722

2.2. Manufacturer Information

Company Name:	Vodafone Procurement Company S.à.r.l
Address /Post:	15 rue Edward Steichen, L-2540 Luxembourg, Grand-Duché de Luxembourg
City:	/
Postal Code:	/
Country:	/
Telephone:	/
Fax:	/

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

3.1. About EUT

Description	GSM UMTS LTE mobile phone
Model Name	VFD 720
FCC ID	2ACCJH081
Frequency Band	ISM 2400MHz~2483.5MHz
Type of Modulation	GFSK/π/4 DQPSK/8DPSK
Number of Channels	79
Power Supply	3.8V DC by Battery

3.2. Internal Identification of EUT

EUT ID*	SN or IMEI	HW Version	SW Version
EUT9	352861090205575/ 352861090205583	PIO 02	3E22
EUT2	352861090205252/ 352861090205260	PIO 02	3E22

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

3.3. Internal Identification of AE

AE ID*	Description	SN	Remarks
AE1	Battery	/	inbuilt
AE2	Charger	/	17TCT-CH-1235
AE3	Charger	/	18TCT-CH-0001
AE4	Charger	/	1860067CH013
AE9	USB Cable	/	17TCT-DC-0222

AE1

Model	CAC2900007C1
Manufacturer	BYD
Capacitance	2900mAh
Nominal voltage	V

AE2

Model	CBA0058AGAC5
Manufacturer	PUAN
Length of cable	/

AE3

Model	CBA0058AAAC4
Manufacturer	BYD
Length of cable	/

AE4

Model	CBA0058AAVC1
Manufacturer	BYD
Length of cable	/

AE9

Model	CDA6050000C1
Manufacturer	Juwei
Length of cable	m

*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	EUT9+ AE1+ AE2+ AE9	BT
Set.13	EUT9+ AE1+ AE3+ AE9	BT
Set.15	EUT9+ AE1+ AE4+ AE9	BT

3.5. Normal Accessory setting

Fully charged battery should be used during the test.

3.6. General Description

The Equipment Under Test (EUT) is a model of GSM UMTS LTE mobile phone 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
Peak Output Power - Conducted	15.247 (b)(1)	**P**
Frequency Band Edges	15.247 (d)	**P**
Transmitter Spurious Emission - Conducted	15.247 (d)	**P**
Transmitter Spurious Emission - Radiated	15.247, 15.205, 15.209	**P**
Time of Occupancy (Dwell Time)	15.247 (a) (1)(iii)	**P**
20dB Bandwidth	15.247 (a)(1)	**NA**
Carrier Frequency Separation	15.247 (a)(1)	**P**
Number of hopping channels	15.247 (a)(b)(iii)	**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.

5.2. 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	Bluetooth Tester	CBT32	100649	Rohde & Schwarz	1 year	2018-09-29
3	LISN	ENV216	101200	Rohde & Schwarz	1 year	2018-08-03
4	Test Receiver	ESCI	100344	Rohde & Schwarz	1 year	2019-02-08
5	Shielding Room	S81	/	ETS-Lindgren	/	/

Radiated emission test system

No.	Equipment	Model	Serial Number	Manufacturer	Calibration Period	Calibration Due date
1	Test Receiver	ESCI 7	100948	Rohde & Schwarz	1 year	2018-07-25
2	Loop antenna	HFH2-Z2	829324/007	Rohde & Schwarz	3 years	2019-01-13
3	BiLog Antenna	VULB9163	235	Schwarzbeck	3 years	2019-05-10
4	Dual-Ridge Waveguide Horn Antenna	3117	6914	EMCO	3 years	2020-12-15
5	Dual-Ridge Waveguide Horn Antenna	3116	2663	ETS-Lindgren	3 years	2020-05-31
6	Vector Signal Analyzer	FSV	101047	Rohde & Schwarz	1 year	2018-06-27
7	Bluetooth Tester	CBT	101042	Rohde & Schwarz	1 year	2019-02-08

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. Time of Occupancy (Dwell Time)

Measurement Uncertainty:

Measurement Uncertainty (k=2)	0.88ms

7.6. 20dB Bandwidth

Measurement Uncertainty:

Measurement Uncertainty (k=2)	61.936Hz

7.7. Carrier Frequency Separation

Measurement Uncertainty:

Measurement Uncertainty (k=2)	61.936Hz

7.8. AC Powerline Conducted Emission

Measurement Uncertainty:

Measurement Uncertainty (k=2)	3.38dB

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 7.8.5

a) Use the following spectrum analyzer settings:

- Span: 6MHz
- RBW: 3MHz
- VBW: 3MHz
- Sweep time: 2.5ms
- Detector function: peak
- Trace: max hold

b) Allow trace to stabilize.

c) Use the marker-to-peak function to set the marker to the peak of the emission.

d) The indicated level is the peak output power.

Measurement Limit:

Standard	Limit (dBm)
FCC Part 15.247(b)(1)	< 30

Measurement Results:

For GFSK

Channel	Ch 0 2402 MHz	Ch 39 2441 MHz	Ch 78 2480 MHz	Conclusion
Peak Conducted Output Power (dBm)	6.21	7.22	6.93	P

For π/4 DQPSK

Channel	Ch 0	Ch 39	Ch 78	Conclusion

	2402 MHz	2441 MHz	2480 MHz	
Peak Conducted Output Power (dBm)	5.19	6.22	5.80	P

For 8DPSK

Channel	Ch 0 2402 MHz	Ch 39 2441 MHz	Ch 78 2480 MHz	Conclusion
Peak Conducted Output Power (dBm)	5.24	6.52	6.05	P

Conclusion: PASS

A.3. Frequency Band Edges – Conducted

Method of Measurement: See ANSI C63.10-clause 7.8.6

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 (be sure to enter all losses between the unlicensed wireless device output and the spectrum analyzer).

– Span: 10 MHz
– Resolution Bandwidth: 100 kHz
– Video Bandwidth: 300 kHz
– Sweep Time:Auto
– Detector: Peak
– Trace: max hold

Place a marker at the end of the restricted band closest to the transmit frequency to show compliance. Also measure any emissions in the restricted bands. Save the spectrum analyzer plot. Repeat for each power and modulation for lowest and highest channel.

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	Hopping	Band Edge Power (dBc)		Conclusion
0	Hopping OFF	Fig.1	-58.31	P
	Hopping ON	Fig.2	-66.18	P
78	Hopping OFF	Fig.3	-65.85	P
	Hopping ON	Fig.4	-65.19	P

For π/4 DQPSK

Channel	Hopping	Band Edge Power (dBc)		Conclusion
0	Hopping OFF	Fig.5	-56.50	P
	Hopping ON	Fig.6	-63.70	P
78	Hopping OFF	Fig.7	-63.69	P
	Hopping ON	Fig.8	-66.06	P

For 8DPSK

Channel	Hopping	Band Edge Power (dBc)		Conclusion
0	Hopping OFF	Fig.9	-56.32	P
	Hopping ON	Fig.10	-57.03	P

78	Hopping OFF	Fig.11	-63.35	P
	Hopping ON	Fig.12	-64.23	P

Conclusion: PASS

Test graphs as below

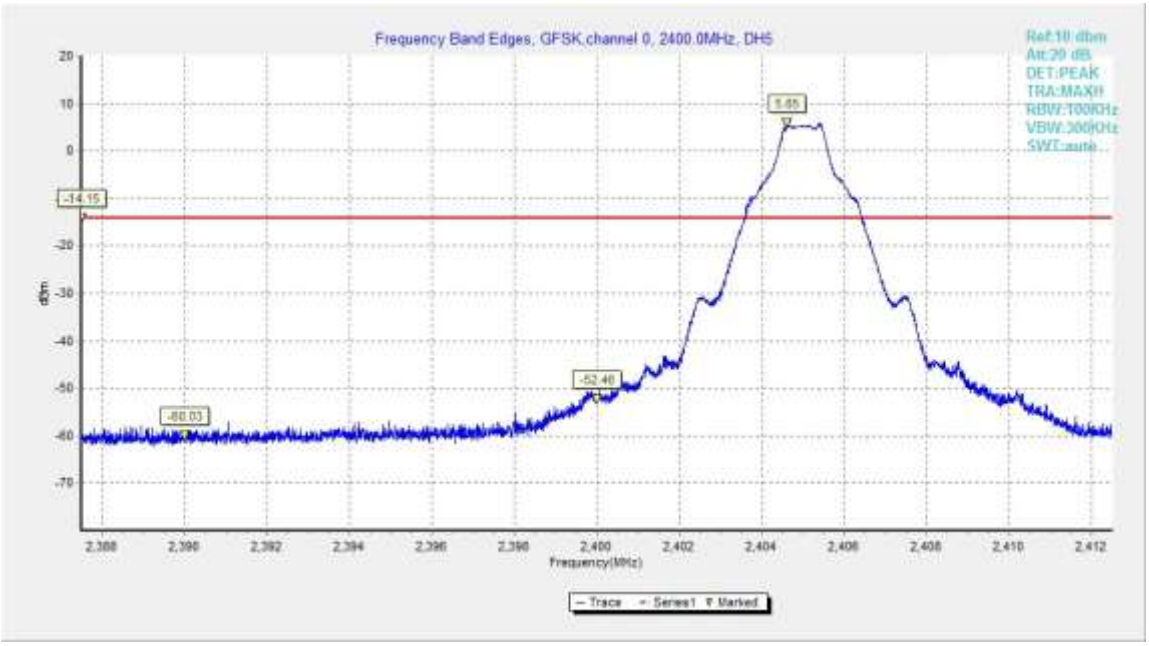


Fig.1. Frequency Band Edges: GFSK, Channel 0, Hopping Off

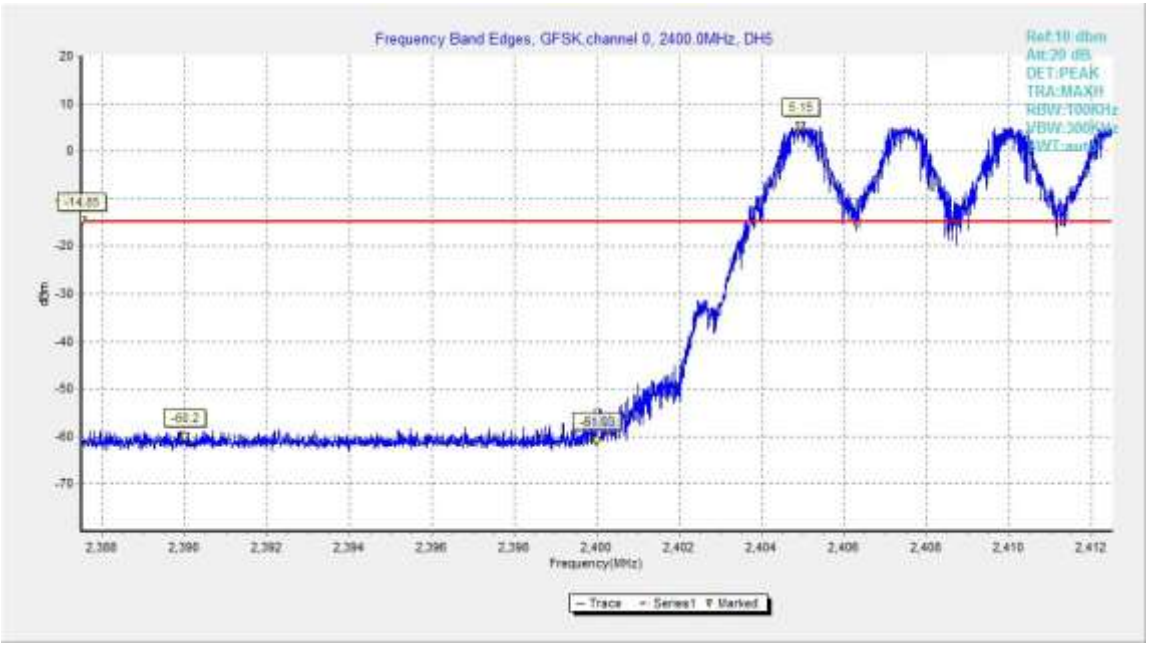


Fig.2. Frequency Band Edges: GFSK, Channel 0, Hopping On

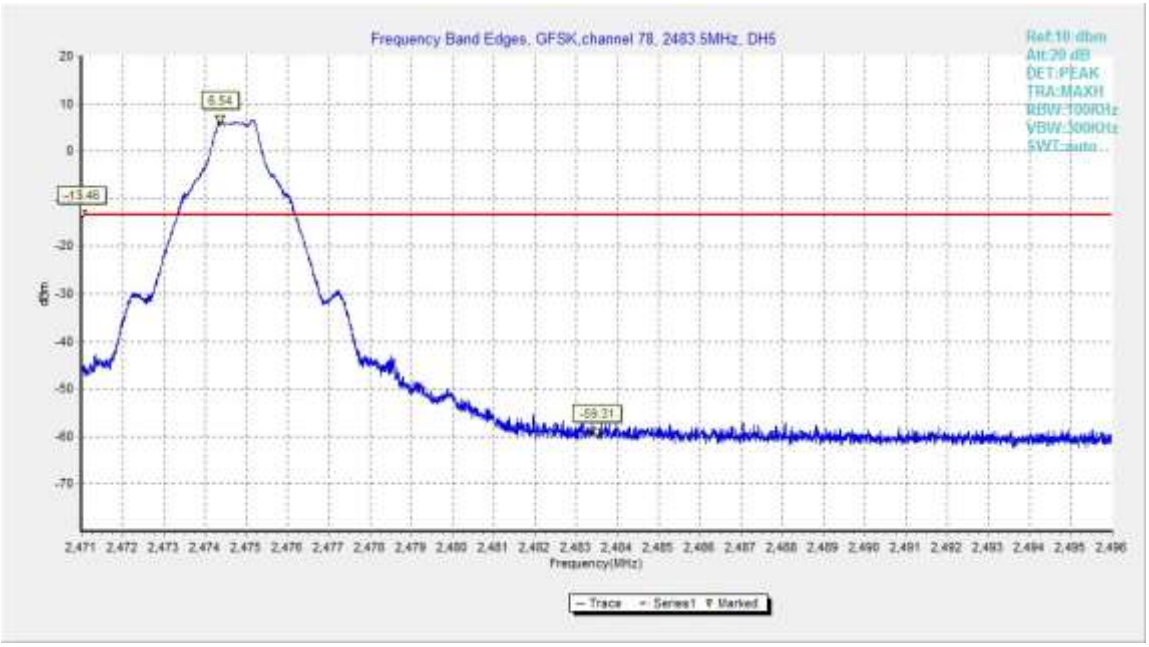


Fig.3. Frequency Band Edges: GFSK, Channel 78, Hopping Off

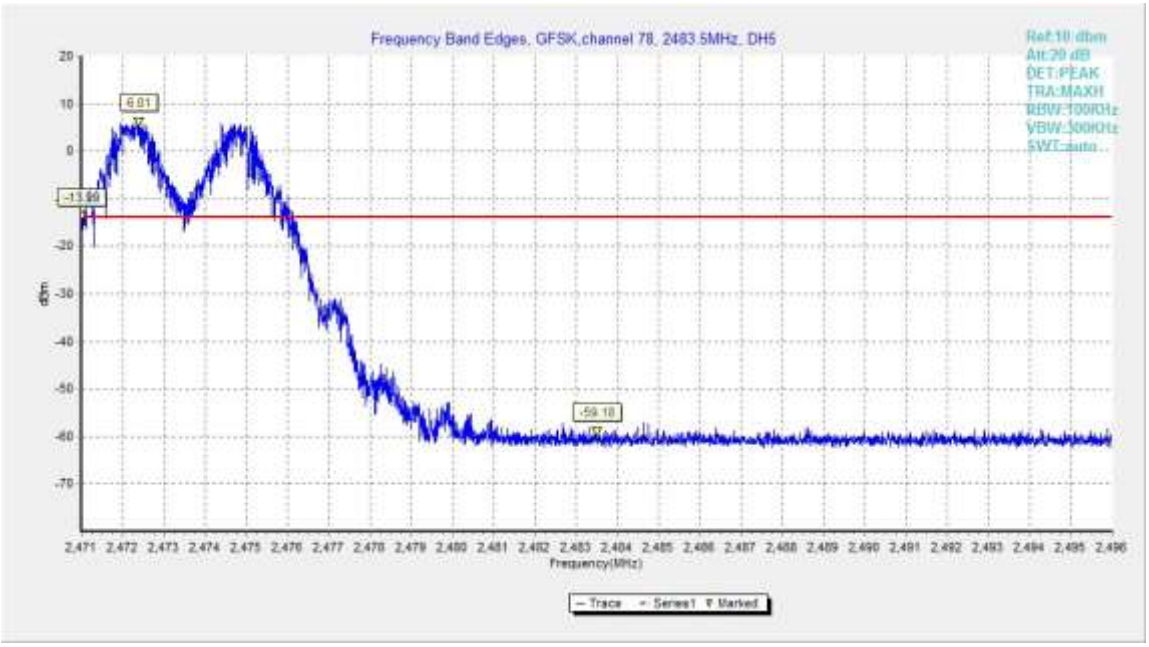


Fig.4. Frequency Band Edges: GFSK, Channel 78, Hopping On

Fig.5. Frequency Band Edges: π/4 DQPSK, Channel 0, Hopping Off

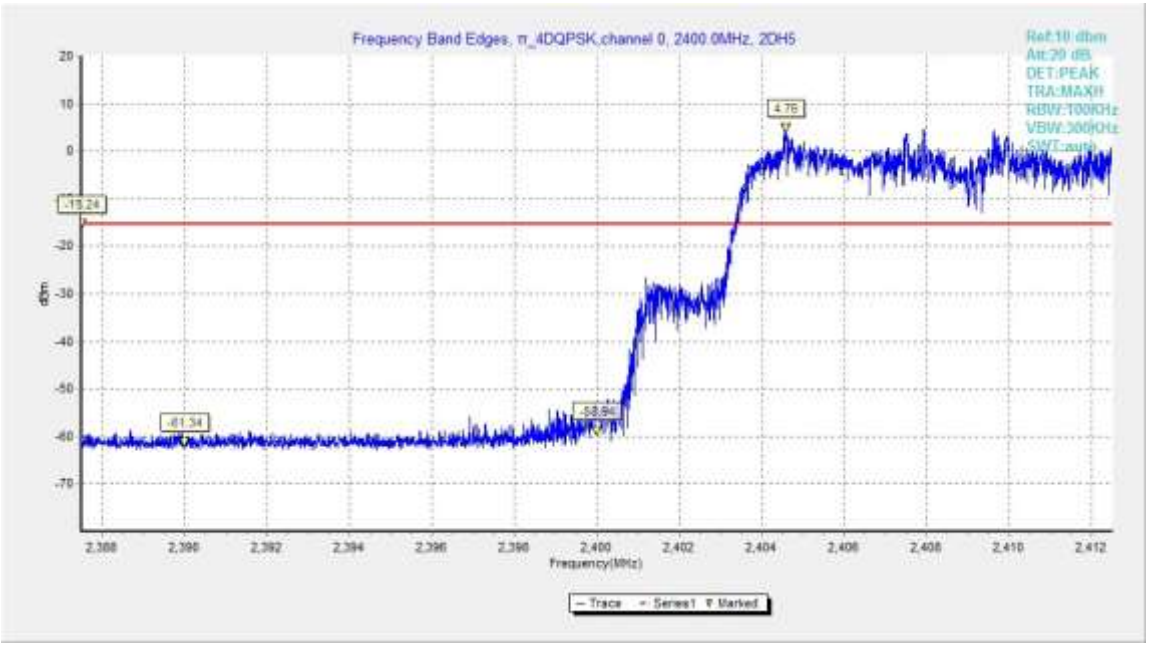


Fig.6. Frequency Band Edges: π/4 DQPSK, Channel 0, Hopping On

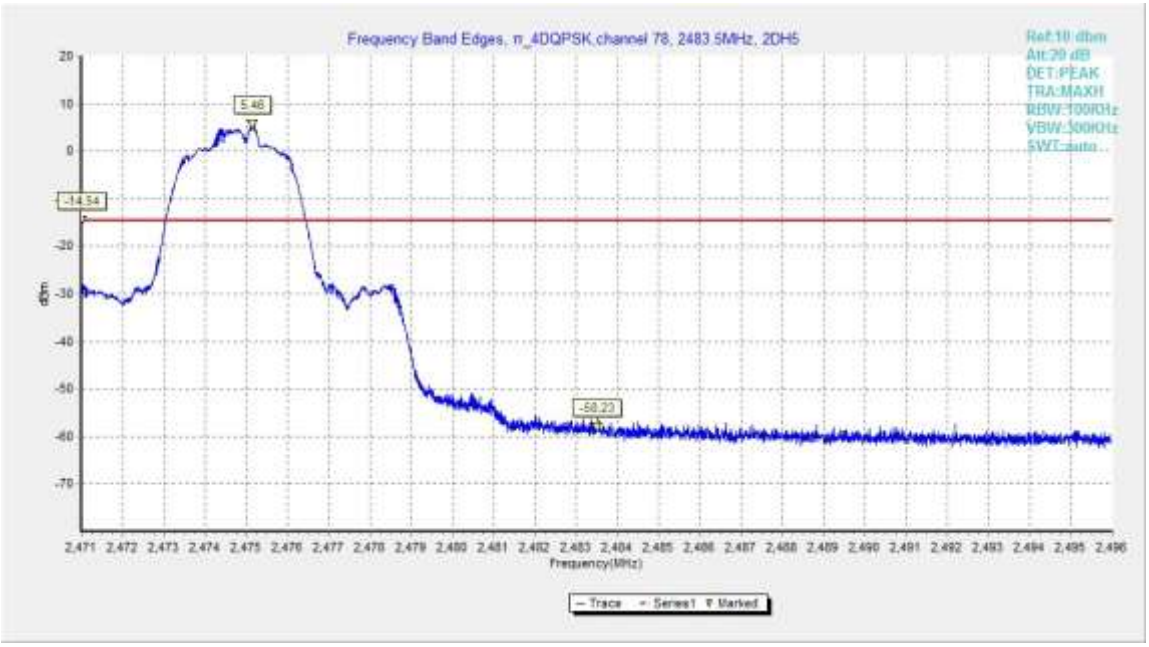


Fig.7. Frequency Band Edges: π/4 DQPSK, Channel 78, Hopping Off

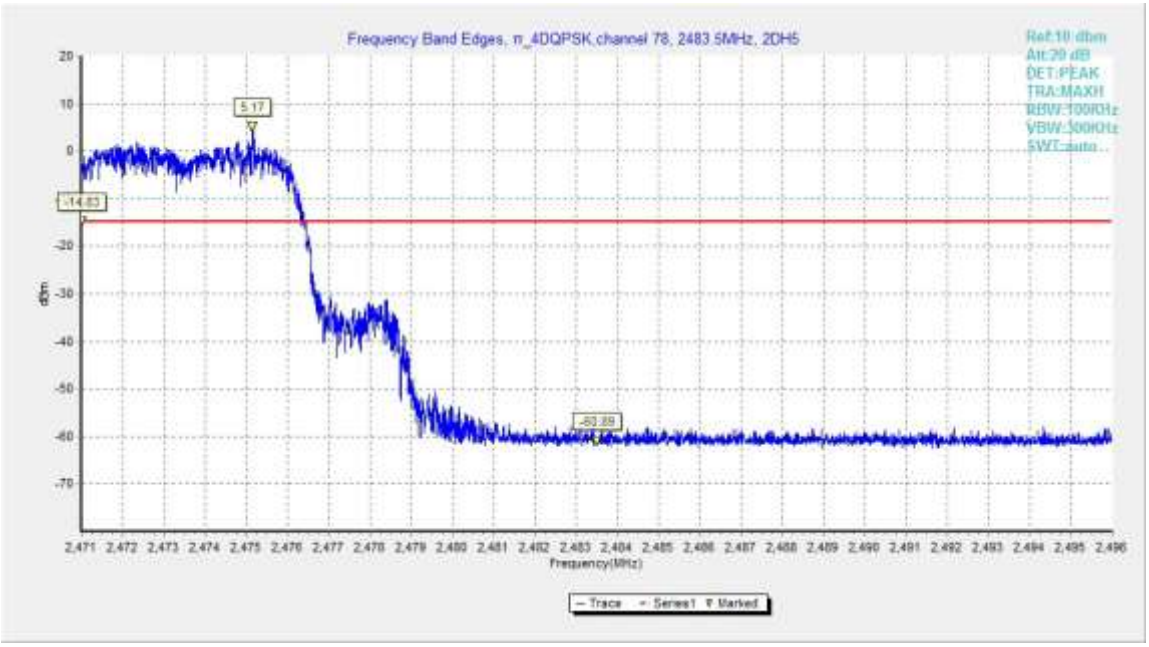


Fig.8. Frequency Band Edges: π/4 DQPSK, Channel 78, Hopping On

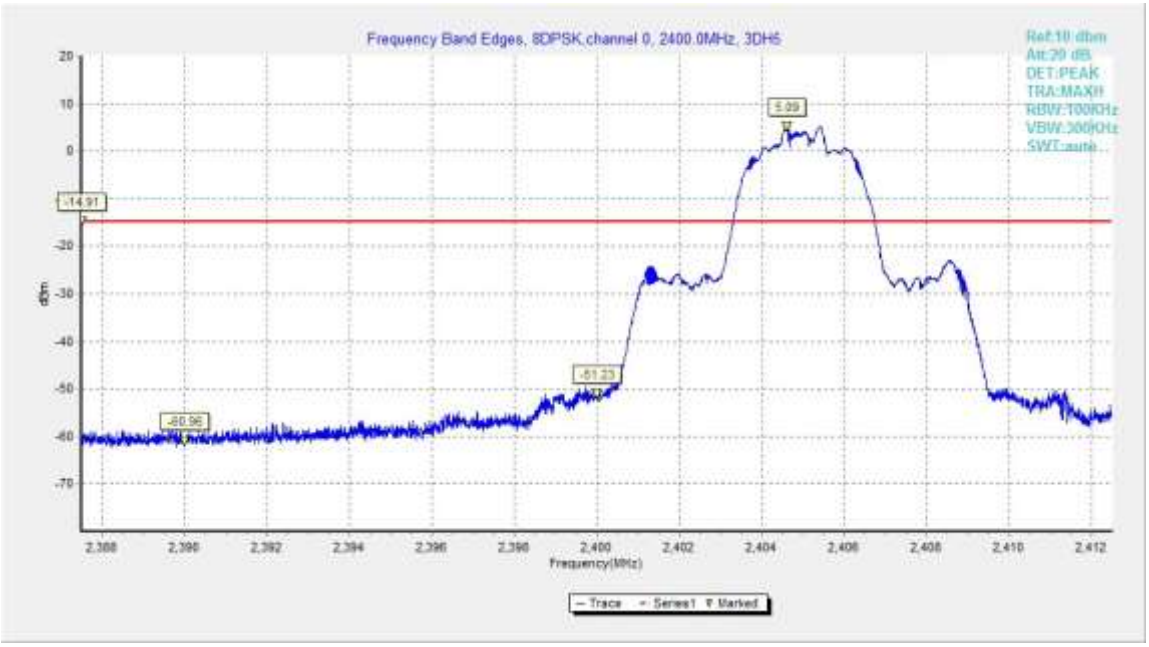


Fig.9. Frequency Band Edges: 8DPSK, Channel 0, Hopping Off

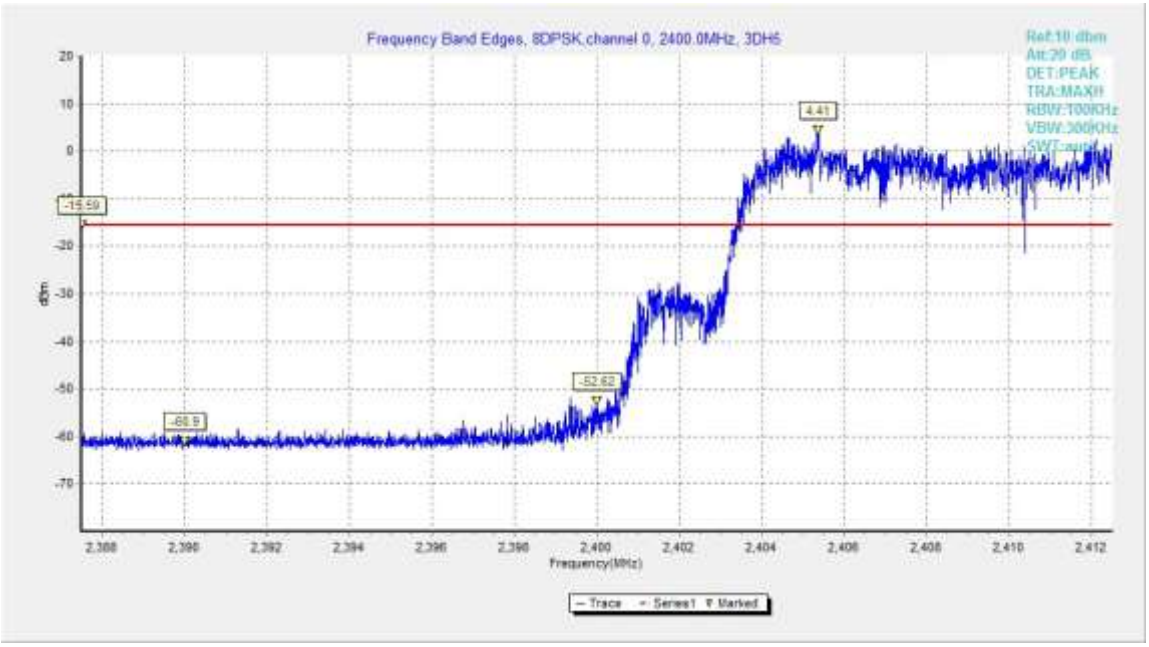


Fig.10. Frequency Band Edges: 8DPSK, Channel 0, Hopping On

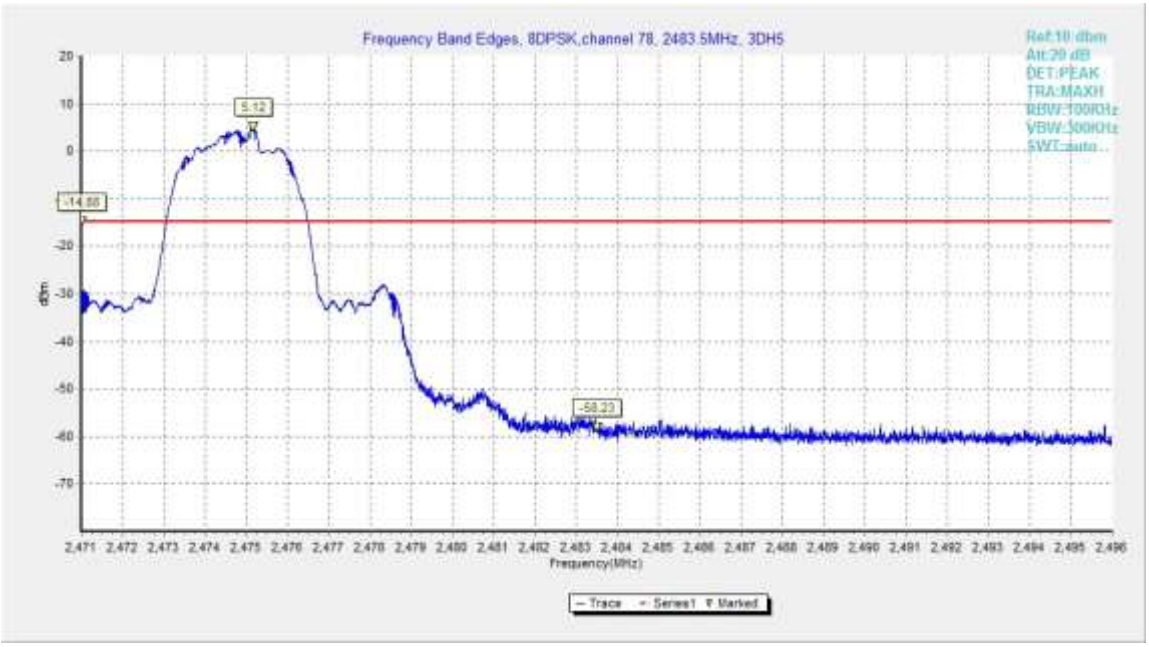


Fig.11. Frequency Band Edges: 8DPSK, Channel 78, Hopping Off

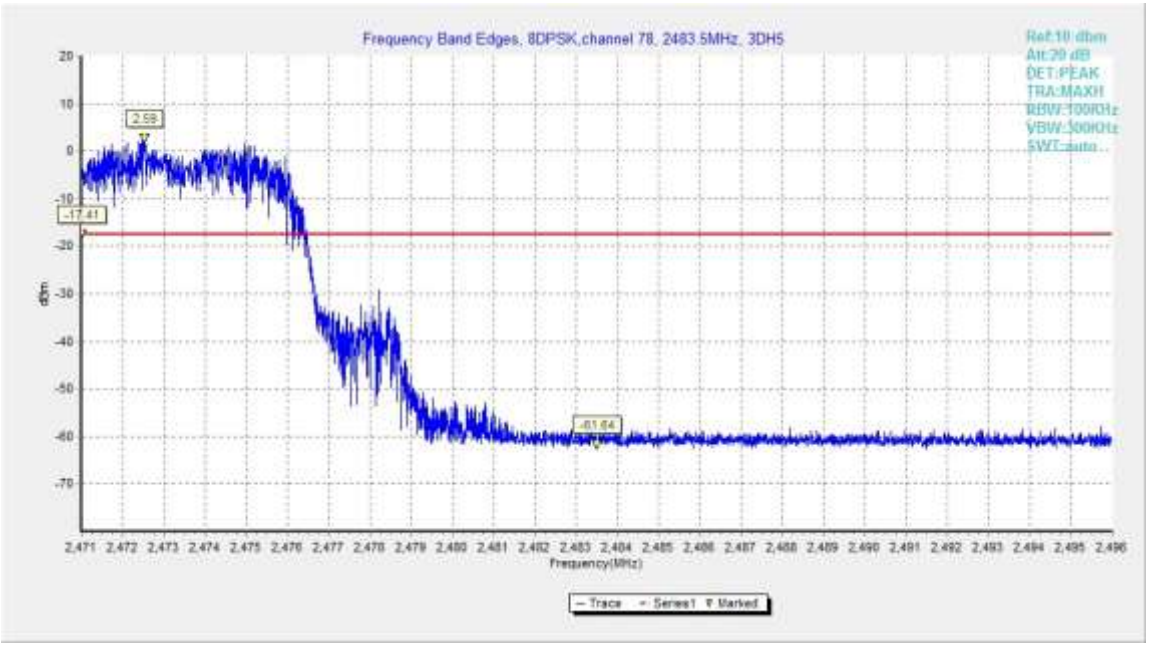


Fig.12. Frequency Band Edges: 8DPSK, Channel 78, Hopping On

A.4. Transmitter Spurious Emission - Conducted

Method of Measurement: See ANSI C63.10-clause 7.8.8

Measurement Procedure – Reference Level

1. Set the RBW = 100 kHz.

2. Set the VBW = 300 kHz.

3. Set the span to 5-30 % greater than the EBW.

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 power level in any 100 kHz band segment within the fundamental EBW. 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	Frequency Range	Test Results	Conclusion
Ch 0	Center Frequency	Fig.13	P

2402 MHz	30 MHz ~ 1 GHz	Fig.14	P
	1 GHz ~ 3 GHz	Fig.15	P
	3 GHz ~ 10 GHz	Fig.16	P
	10 GHz ~ 26 GHz	Fig.17	P
Ch 39 2441 MHz	Center Frequency	Fig.18	P
	30 MHz ~ 1 GHz	Fig.19	P
	1 GHz ~ 3 GHz	Fig.20	P
	3 GHz ~ 10 GHz	Fig.21	P
	10 GHz ~ 26 GHz	Fig.22	P
Ch 78 2480 MHz	Center Frequency	Fig.23	P
	30 MHz ~ 1 GHz	Fig.24	P
	1 GHz ~ 3 GHz	Fig.25	P
	3 GHz ~ 10 GHz	Fig.26	P
	10 GHz ~ 26 GHz	Fig.27	P

For π/4 DQPSK

Channel	Frequency Range	Test Results	Conclusion
Ch 0 2402 MHz	Center Frequency	Fig.28	P
	30 MHz ~ 1 GHz	Fig.29	P
	1 GHz ~ 3 GHz	Fig.30	P
	3 GHz ~ 10 GHz	Fig.31	P
	10 GHz ~ 26 GHz	Fig.32	P
Ch 39 2441 MHz	Center Frequency	Fig.33	P
	30 MHz ~ 1 GHz	Fig.34	P
	1 GHz ~ 3 GHz	Fig.35	P
	3 GHz ~ 10 GHz	Fig.36	P
	10 GHz ~ 26 GHz	Fig.37	P
Ch 78 2480 MHz	Center Frequency	Fig.38	P
	30 MHz ~ 1 GHz	Fig.39	P
	1 GHz ~ 3 GHz	Fig.40	P
	3 GHz ~ 10 GHz	Fig.41	P
	10 GHz ~ 26 GHz	Fig.42	P

For 8DPSK

Channel	Frequency Range	Test Results	Conclusion
Ch 0 2402 MHz	Center Frequency	Fig.43	P
	30 MHz ~ 1 GHz	Fig.44	P
	1 GHz ~ 3 GHz	Fig.45	P
	3 GHz ~ 10 GHz	Fig.46	P
	10 GHz ~ 26 GHz	Fig.47	P

Ch 39 2441 MHz	Center Frequency	Fig.48	P
	30 MHz ~ 1 GHz	Fig.49	P
	1 GHz ~ 3 GHz	Fig.50	P
	3 GHz ~ 10 GHz	Fig.51	P
	10 GHz ~ 26 GHz	Fig.52	P
Ch 78 2480 MHz	Center Frequency	Fig.53	P
	30 MHz ~ 1 GHz	Fig.54	P
	1 GHz ~ 3 GHz	Fig.55	P
	3 GHz ~ 10 GHz	Fig.56	P
	10 GHz ~ 26 GHz	Fig.57	P

Conclusion: PASS

Test graphs as below

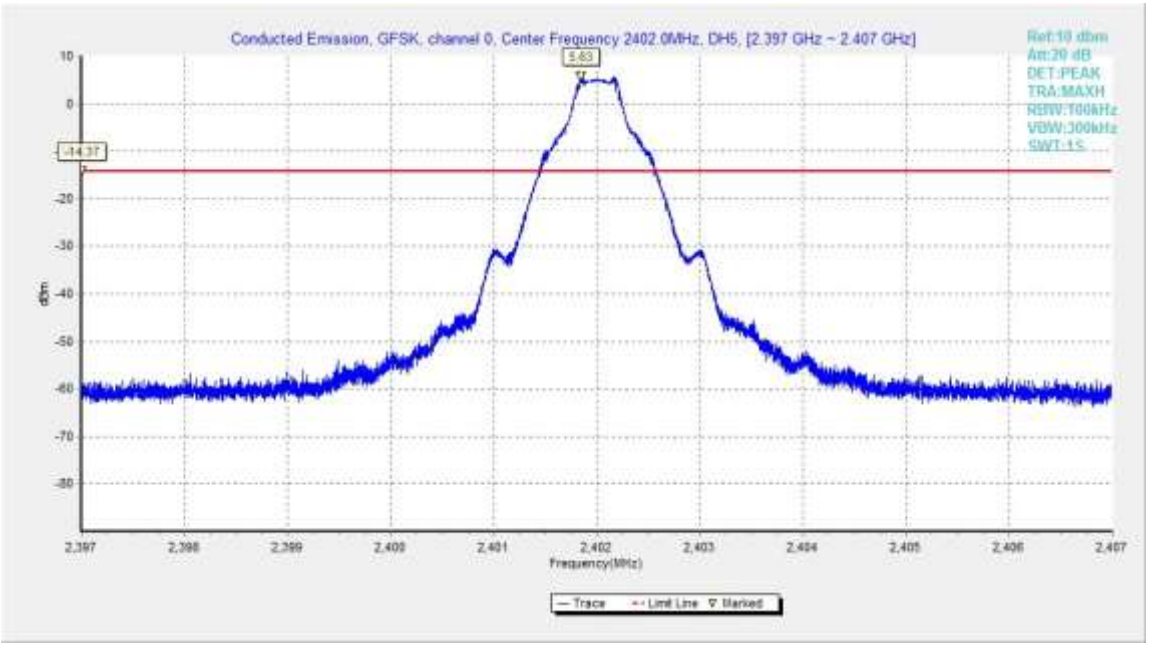


Fig.13. Conducted spurious emission: GFSK, Channel 0,2402MHz

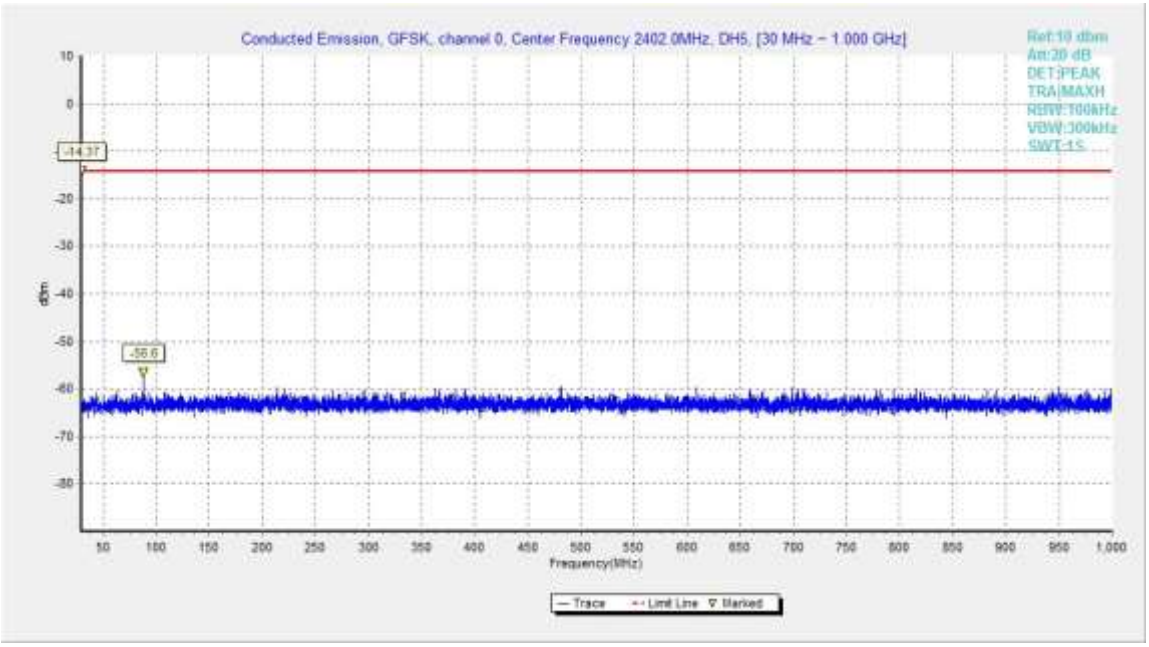


Fig.14. Conducted spurious emission: GFSK, Channel 0, 30MHz - 1GHz

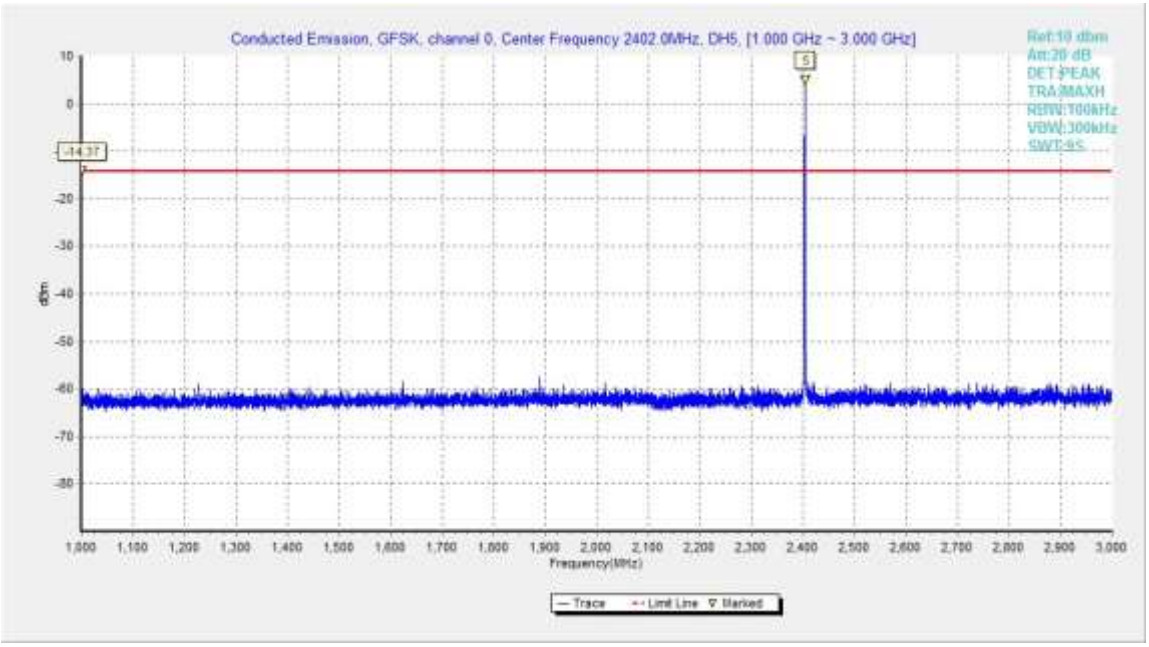


Fig.15. Conducted spurious emission: GFSK, Channel 0, 1GHz - 3GHz

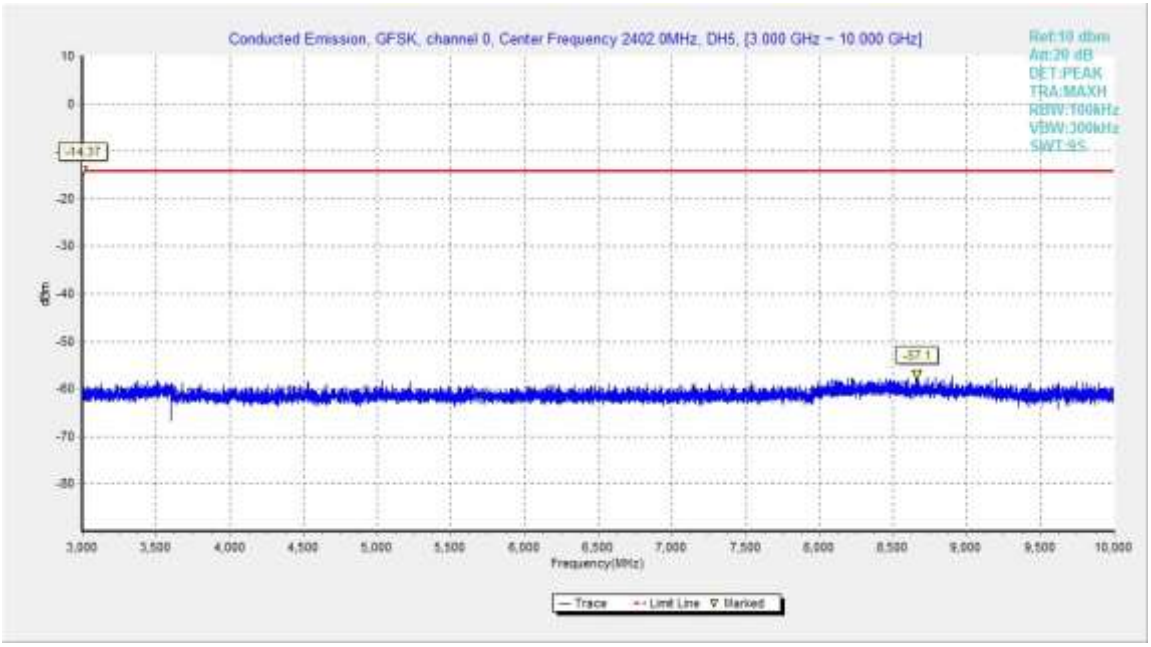


Fig.16. Conducted spurious emission: GFSK, Channel 0, 3GHz - 10GHz

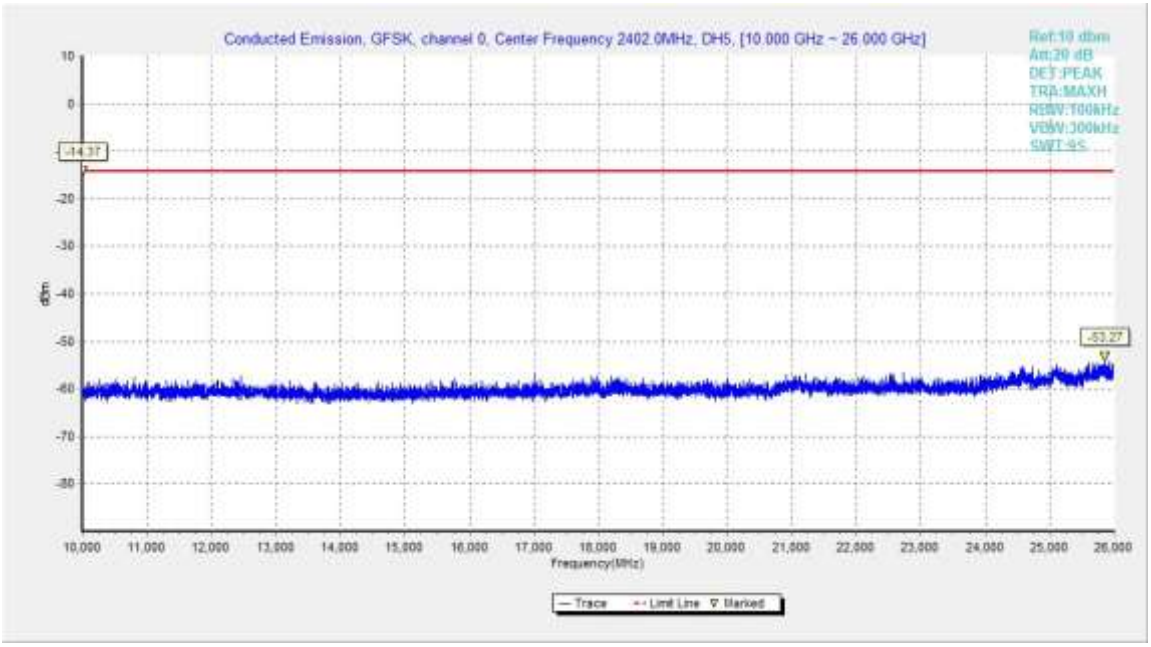


Fig.17. Conducted spurious emission: GFSK, Channel 0,10GHz - 26GHz

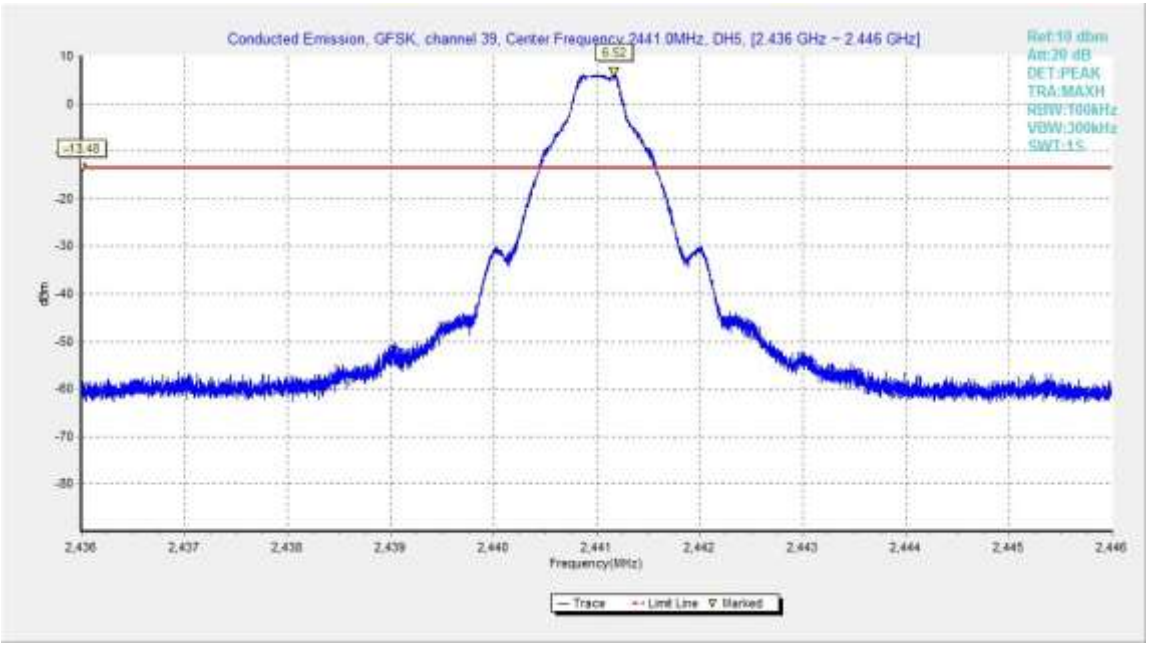


Fig.18. Conducted spurious emission: GFSK, Channel 39, 2441MHz

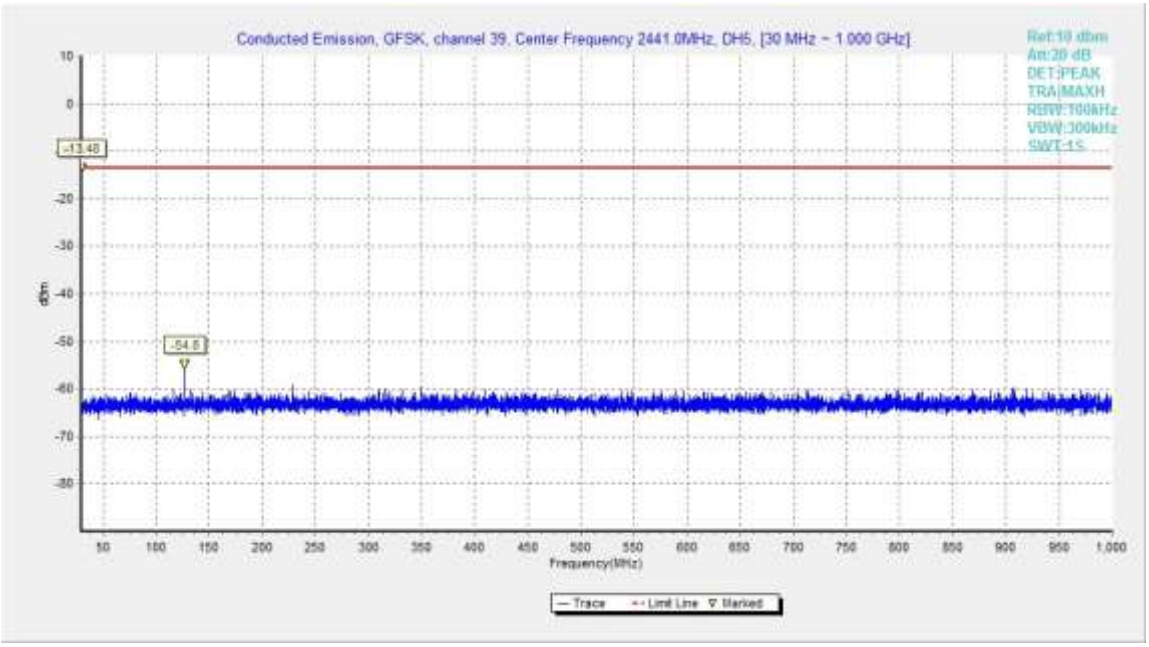


Fig.19. Conducted spurious emission: GFSK, Channel 39, 30MHz - 1GHz

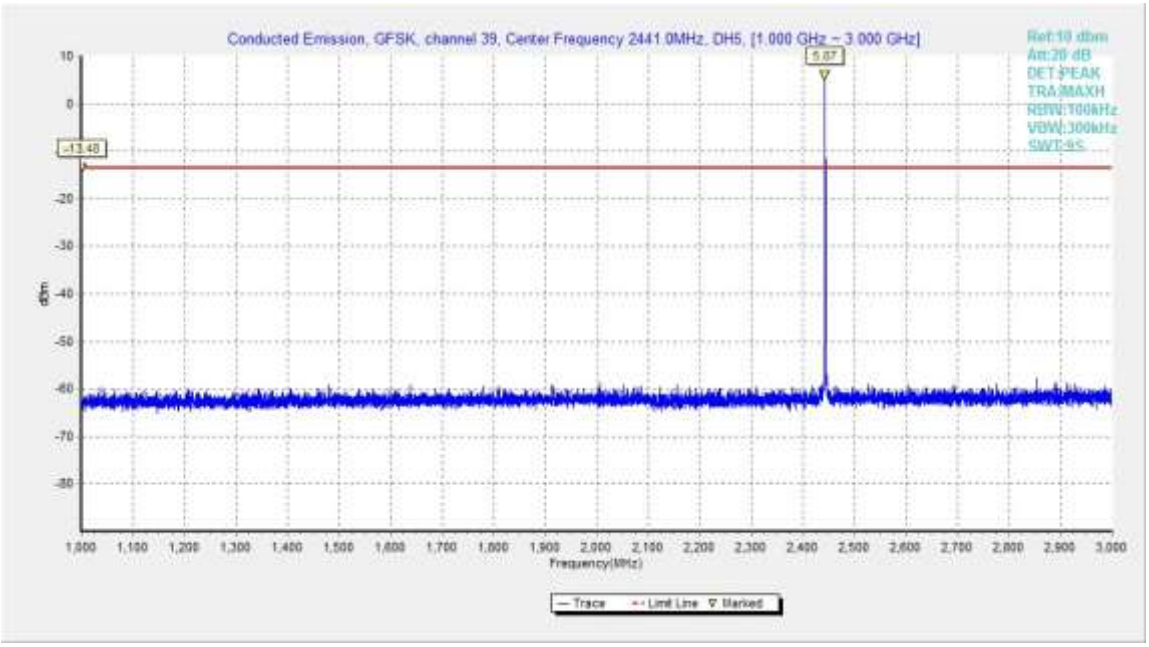


Fig.20. Conducted spurious emission: GFSK, Channel 39, 1GHz – 3GHz

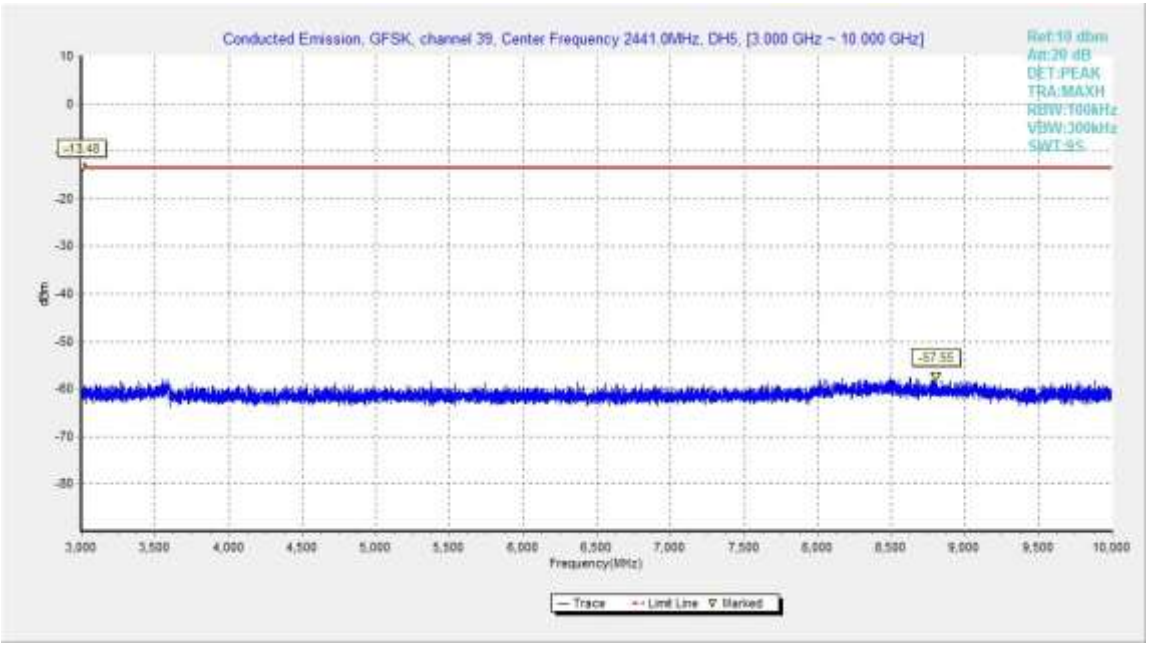


Fig.21. Conducted spurious emission: GFSK, Channel 39, 3GHz – 10GHz

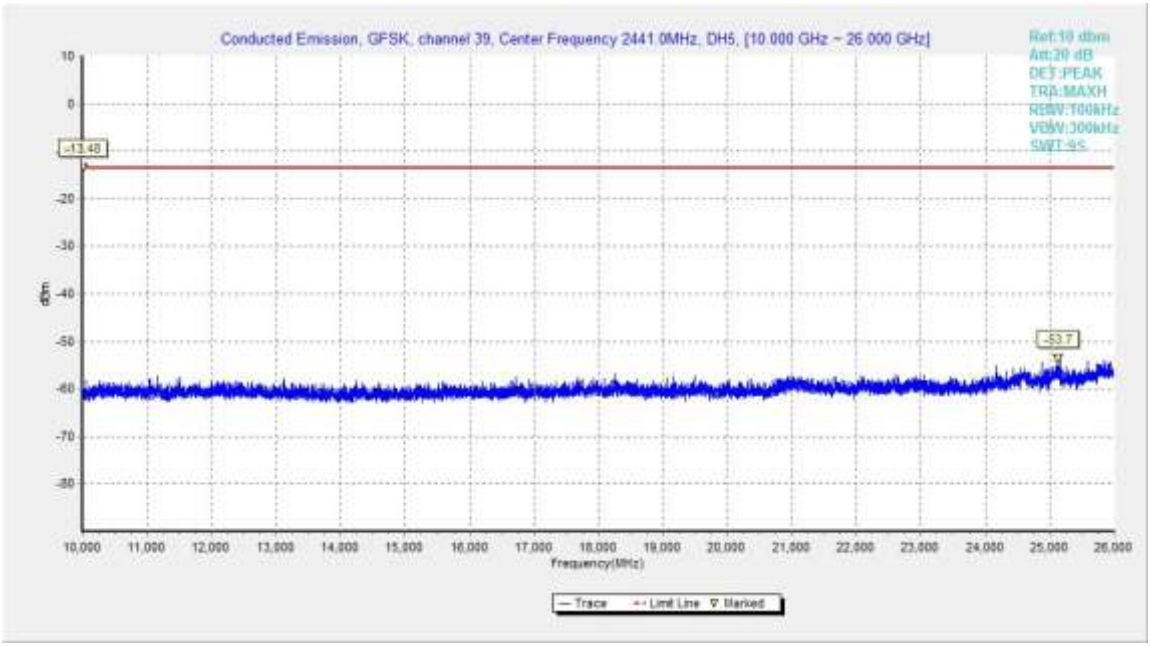


Fig.22. Conducted spurious emission: GFSK, Channel 39, 10GHz – 26GHz

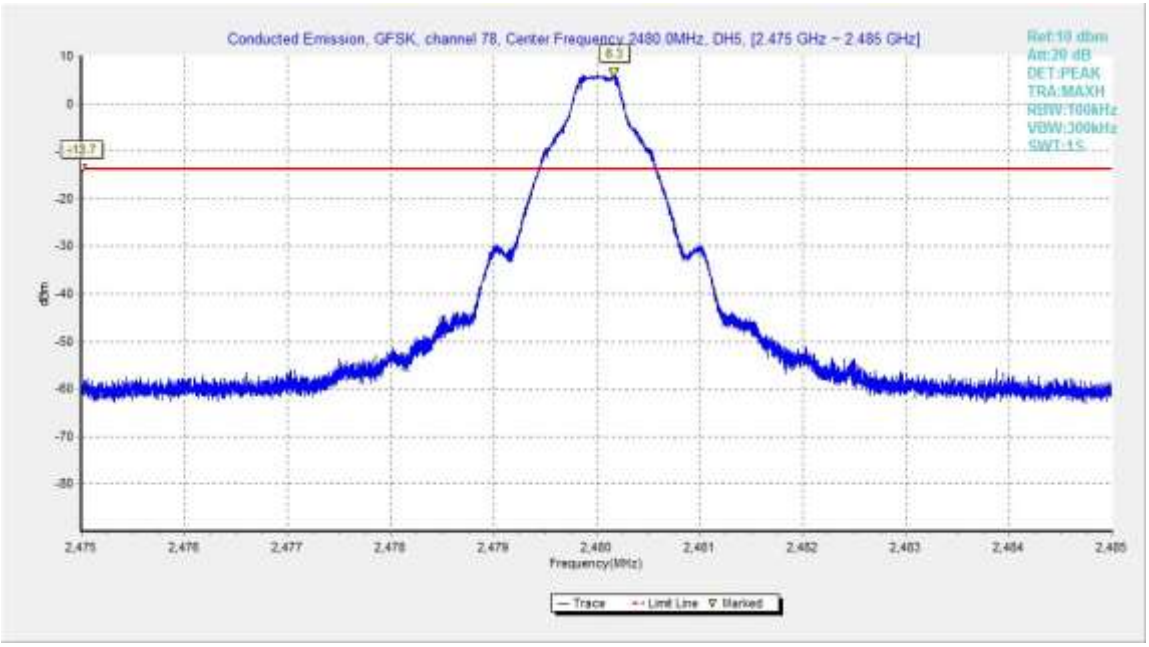


Fig.23. Conducted spurious emission: GFSK, Channel 78, 2480MHz

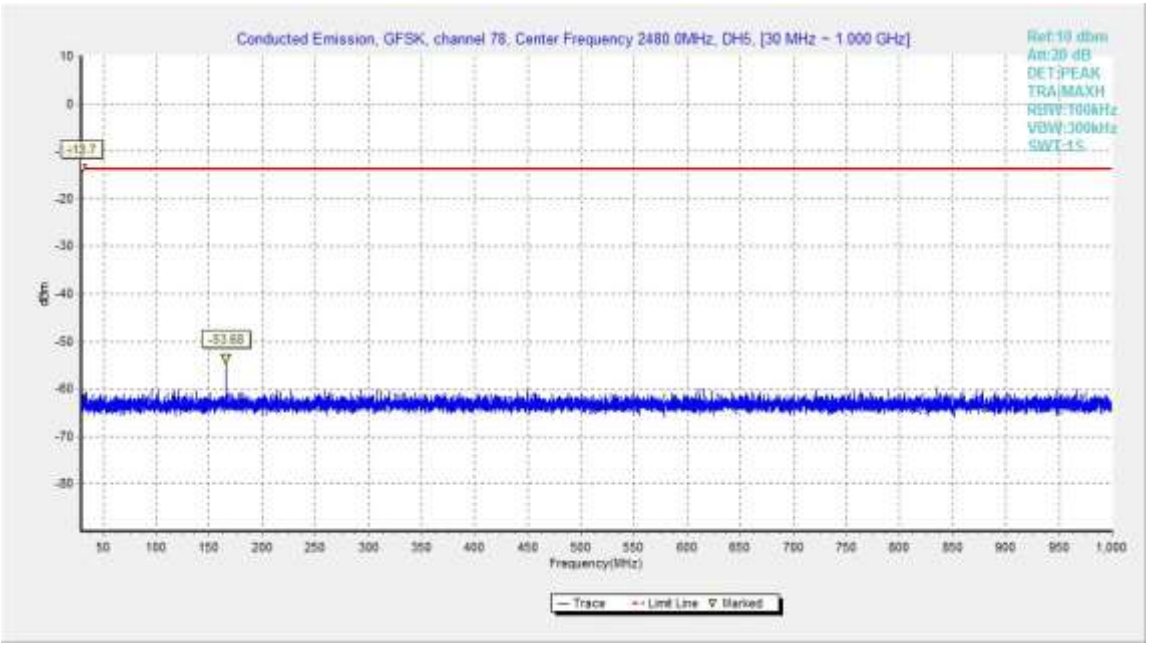


Fig.24. Conducted spurious emission: GFSK, Channel 78, 30MHz - 1GHz

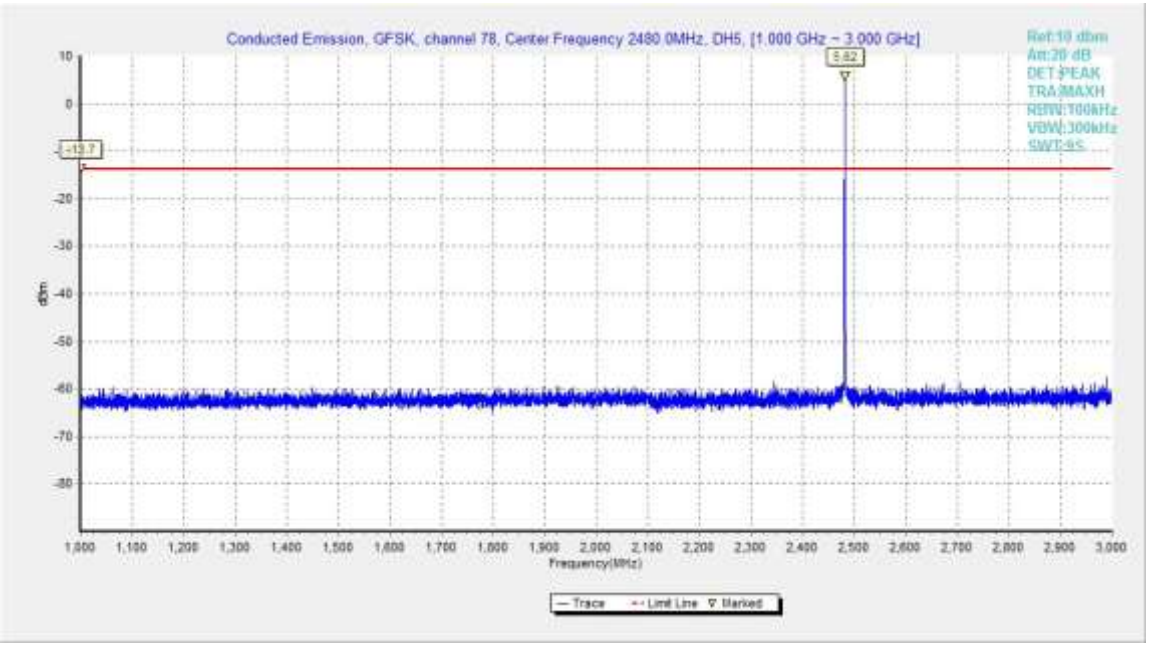


Fig.25. Conducted spurious emission: GFSK, Channel 78, 1GHz - 3GHz

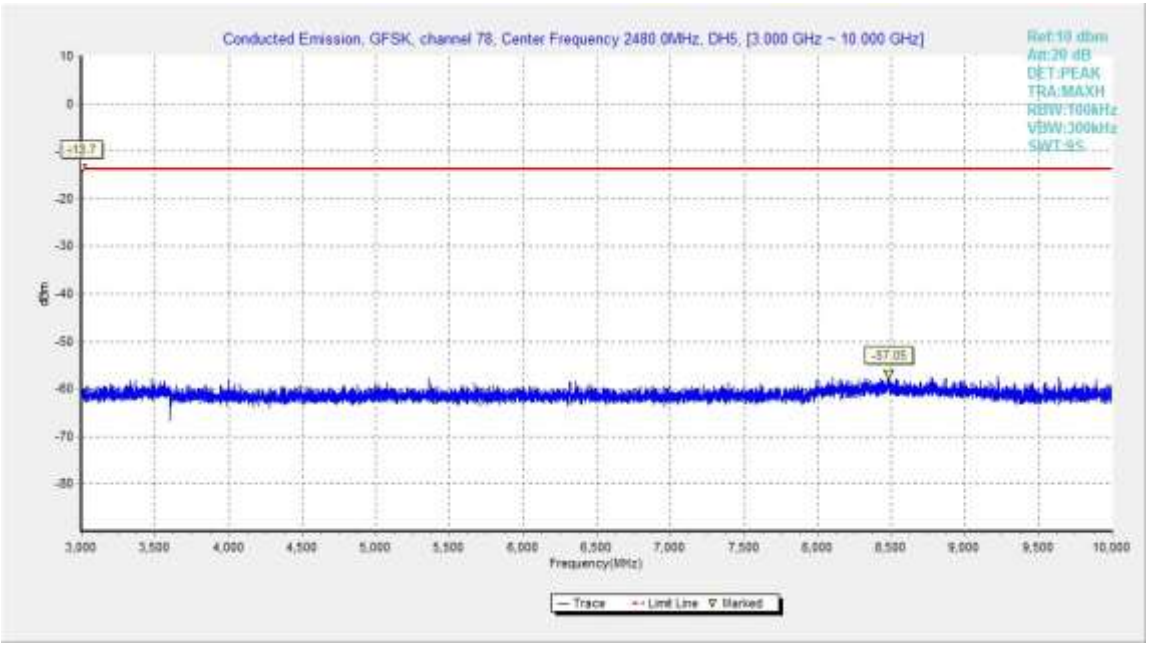


Fig.26. Conducted spurious emission: GFSK, Channel 78, 3GHz - 10GHz

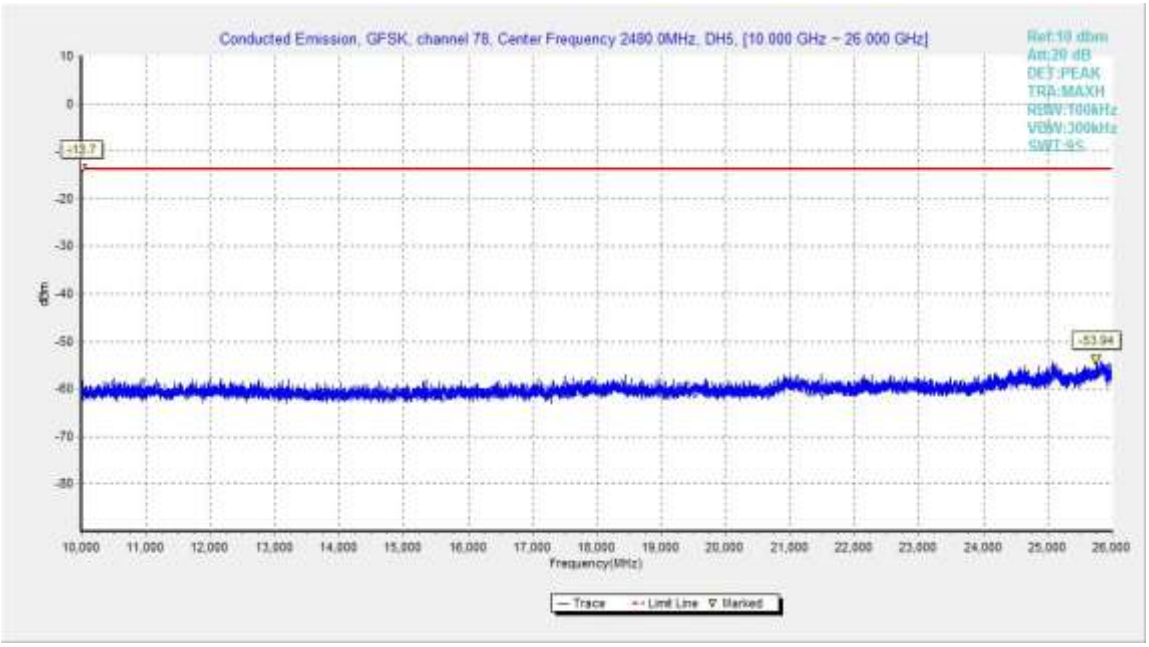


Fig.27. Conducted spurious emission: GFSK, Channel 78, 10GHz - 26GHz

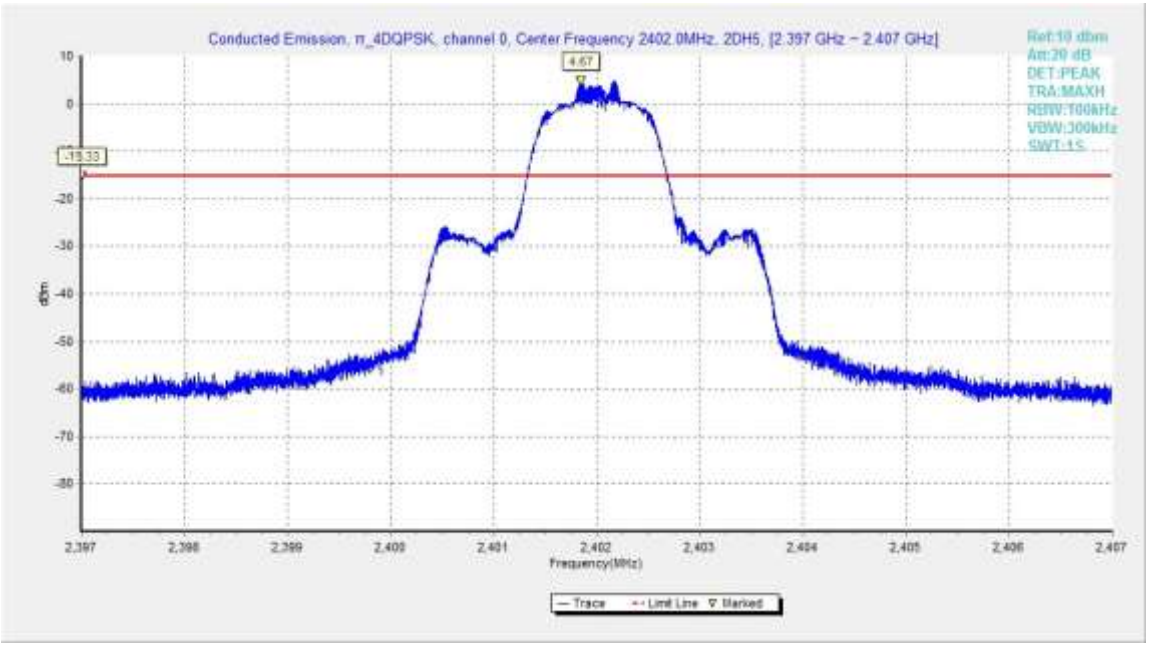


Fig.28. Conducted spurious emission: π/4 DQPSK, Channel 0,2402MHz

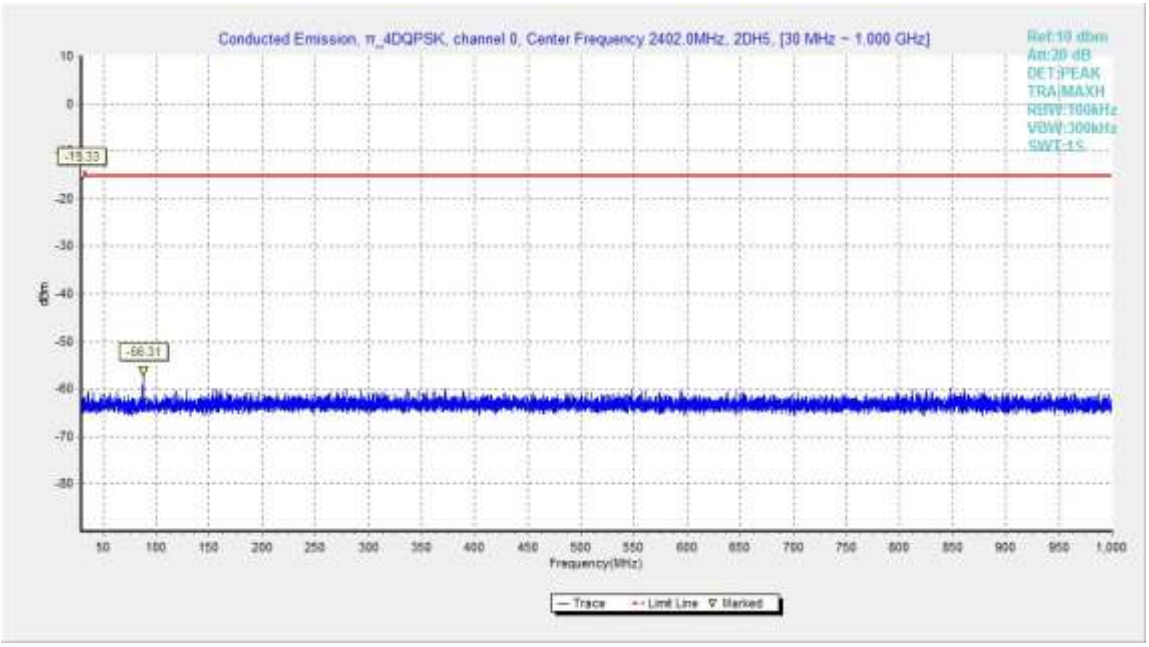


Fig.29. Conducted spurious emission: π/4 DQPSK, Channel 0, 30MHz - 1GHz

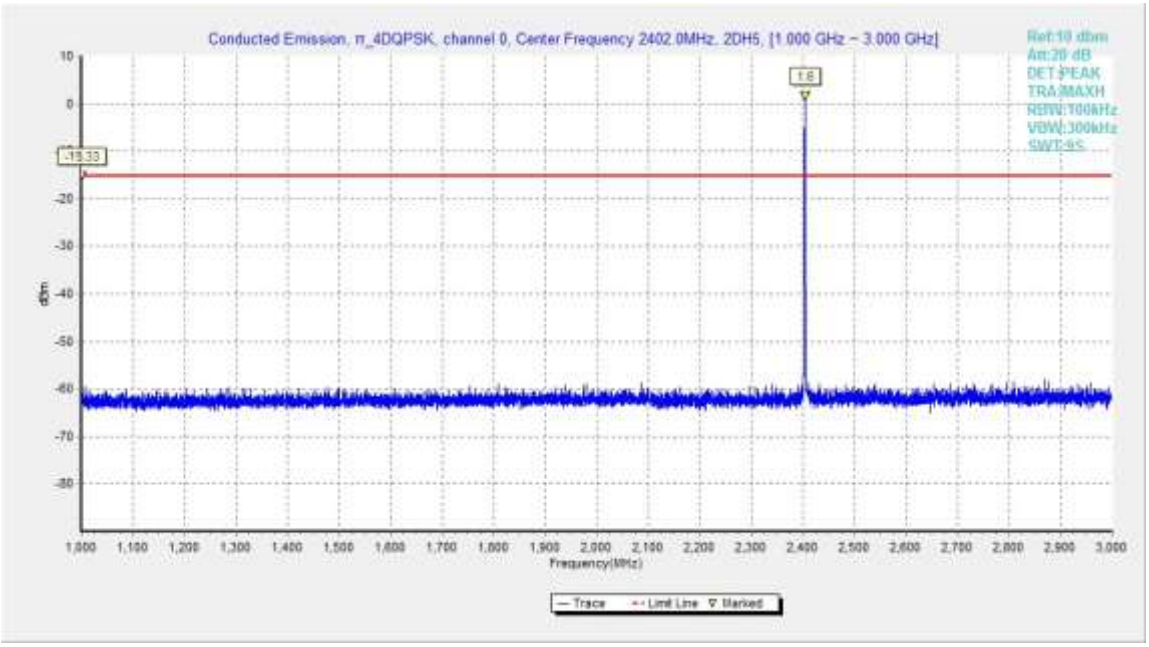


Fig.30. Conducted spurious emission: π/4 DQPSK, Channel 0, 1GHz - 3GHz

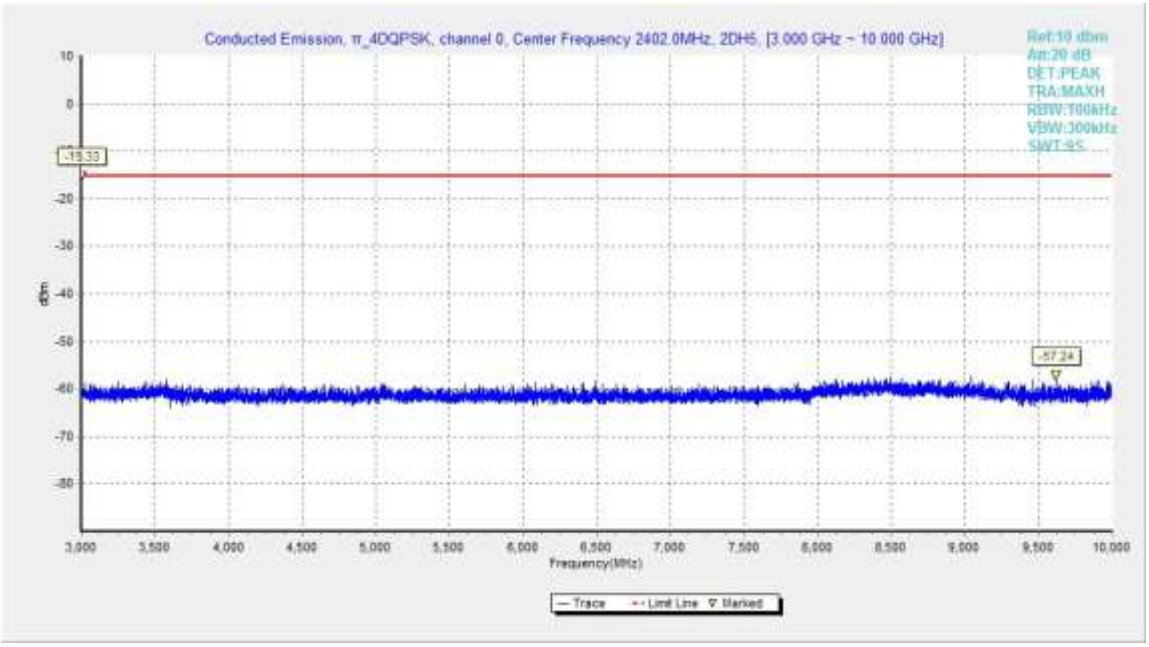


Fig.31. Conducted spurious emission: π/4 DQPSK, Channel 0, 3GHz - 10GHz

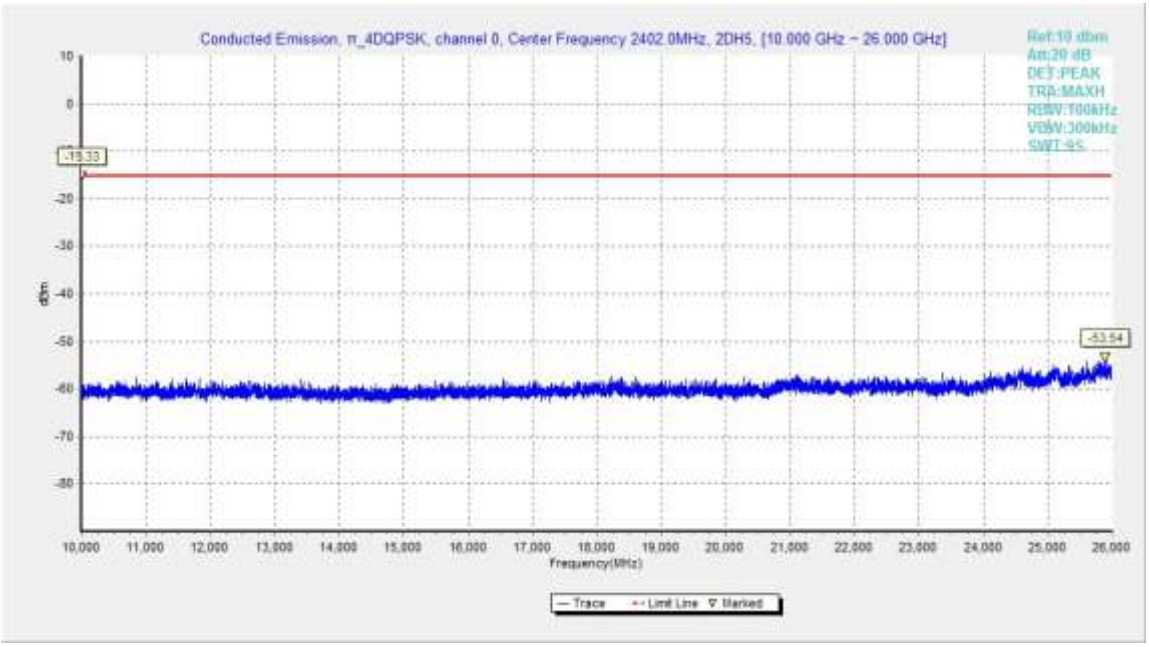


Fig.32. Conducted spurious emission: π/4 DQPSK, Channel 0,10GHz - 26GHz

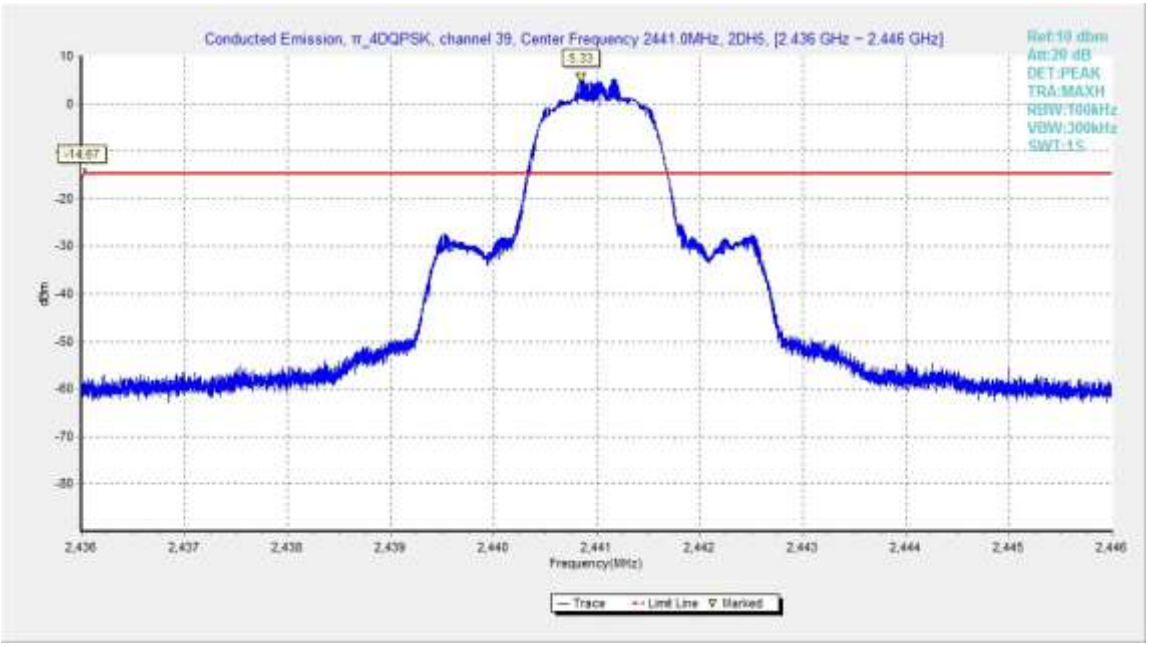


Fig.33. Conducted spurious emission: π/4 DQPSK, Channel 39, 2441MHz

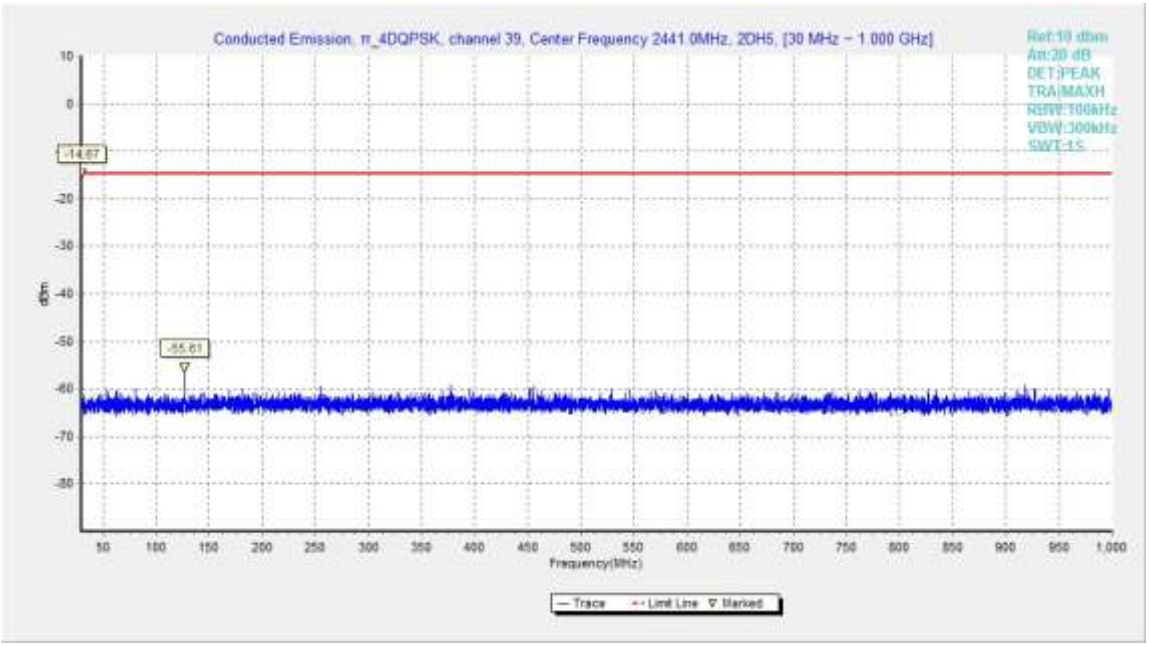


Fig.34. Conducted spurious emission: π/4 DQPSK, Channel 39, 30MHz - 1GHz

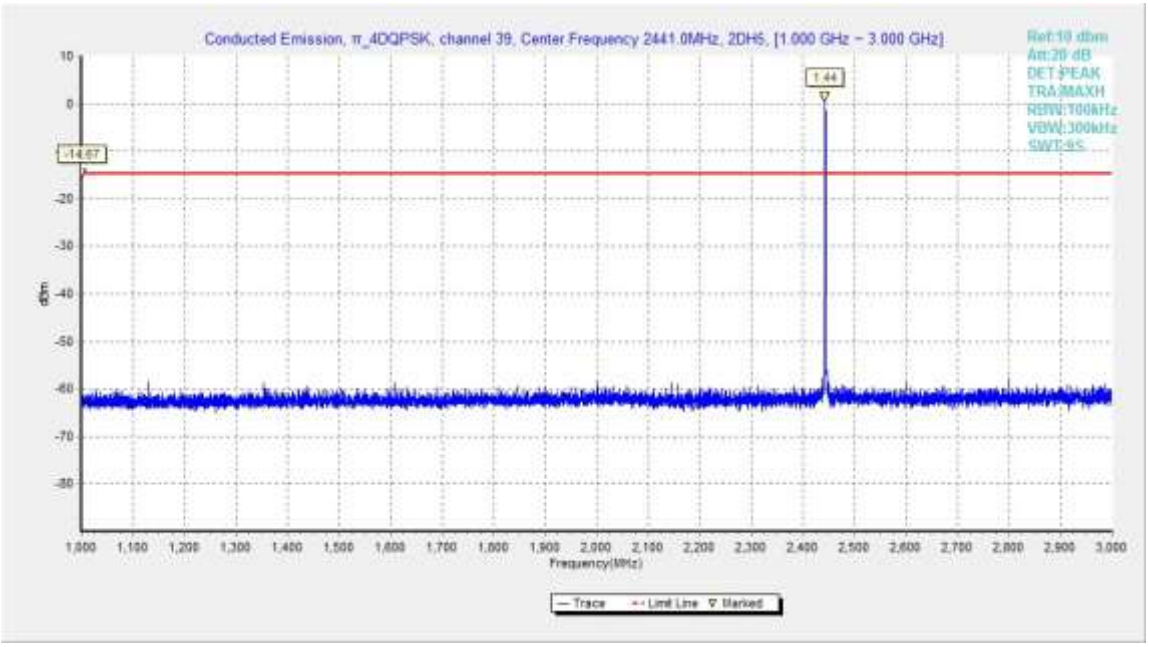


Fig.35. Conducted spurious emission: π/4 DQPSK, Channel 39, 1GHz - 3GHz

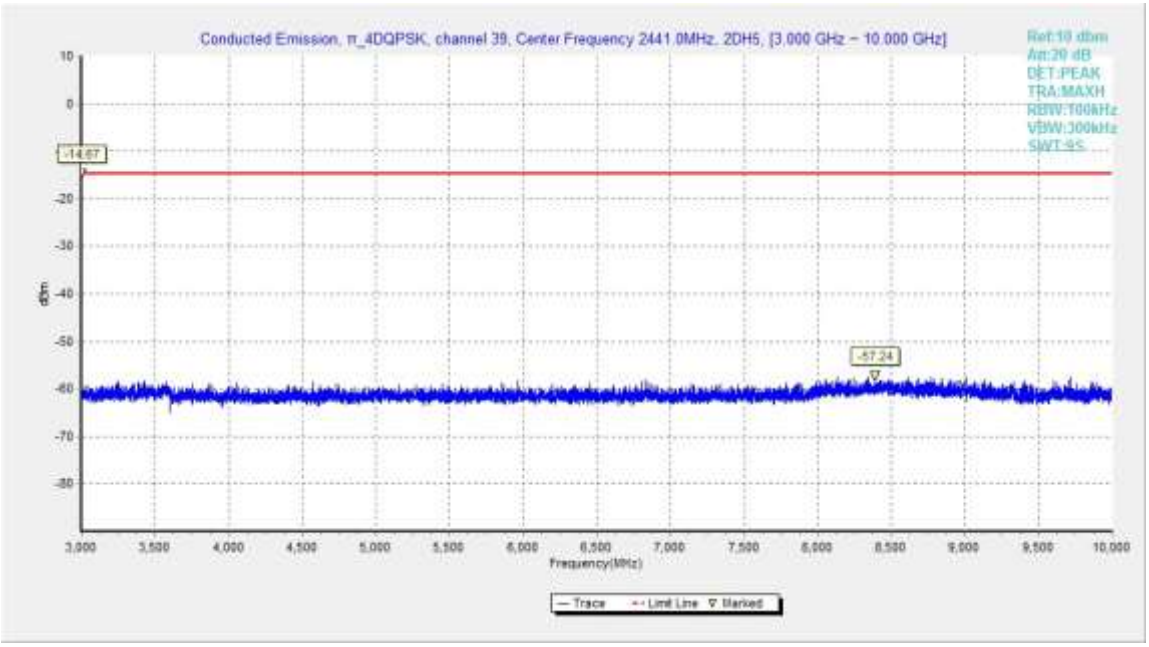


Fig.36. Conducted spurious emission: π/4 DQPSK, Channel 39, 3GHz - 10GHz

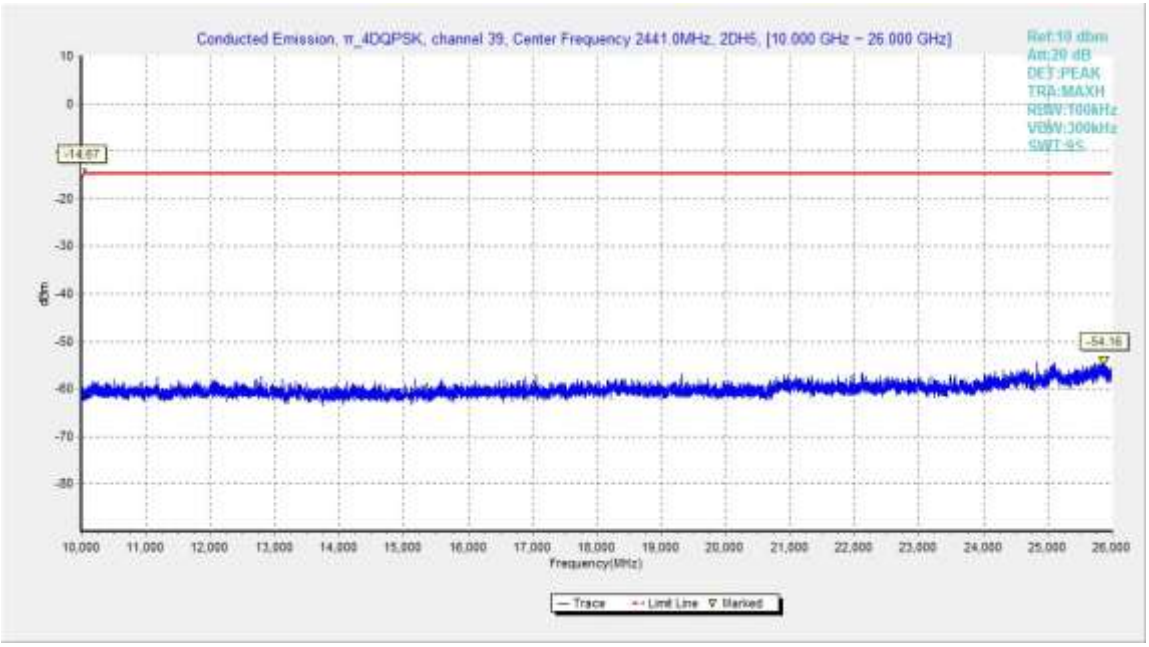


Fig.37. Conducted spurious emission: π/4 DQPSK, Channel 39, 10GHz – 26GHz

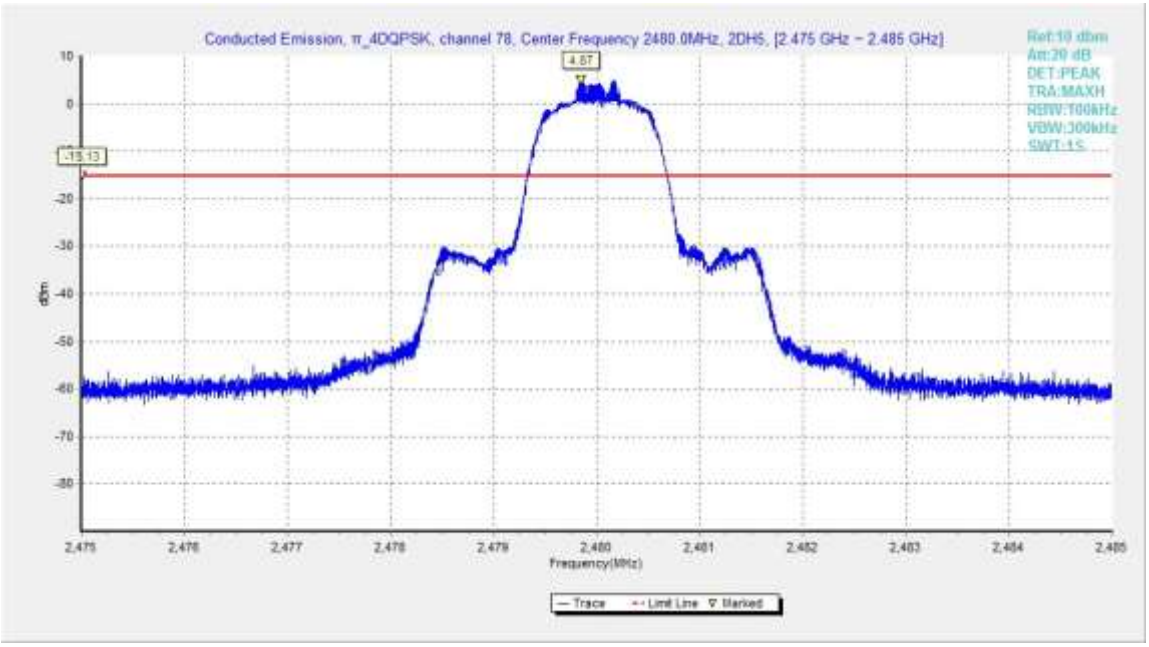


Fig.38. Conducted spurious emission: π/4 DQPSK, Channel 78, 2480MHz

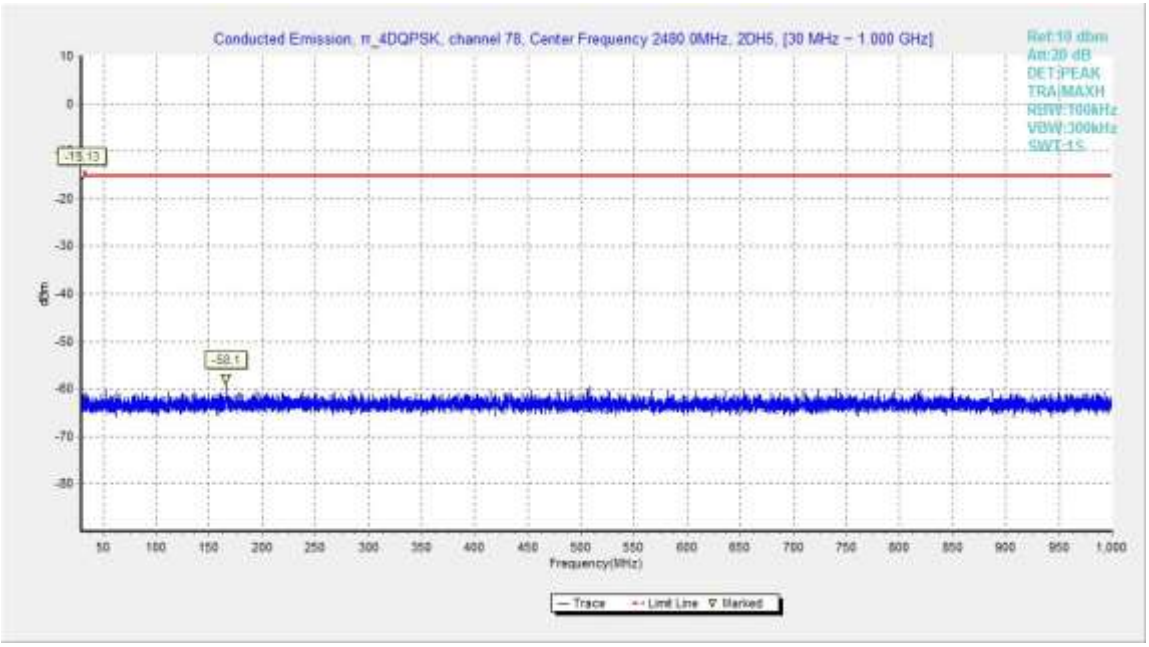


Fig.39. Conducted spurious emission: π/4 DQPSK, Channel 78, 30MHz - 1GHz

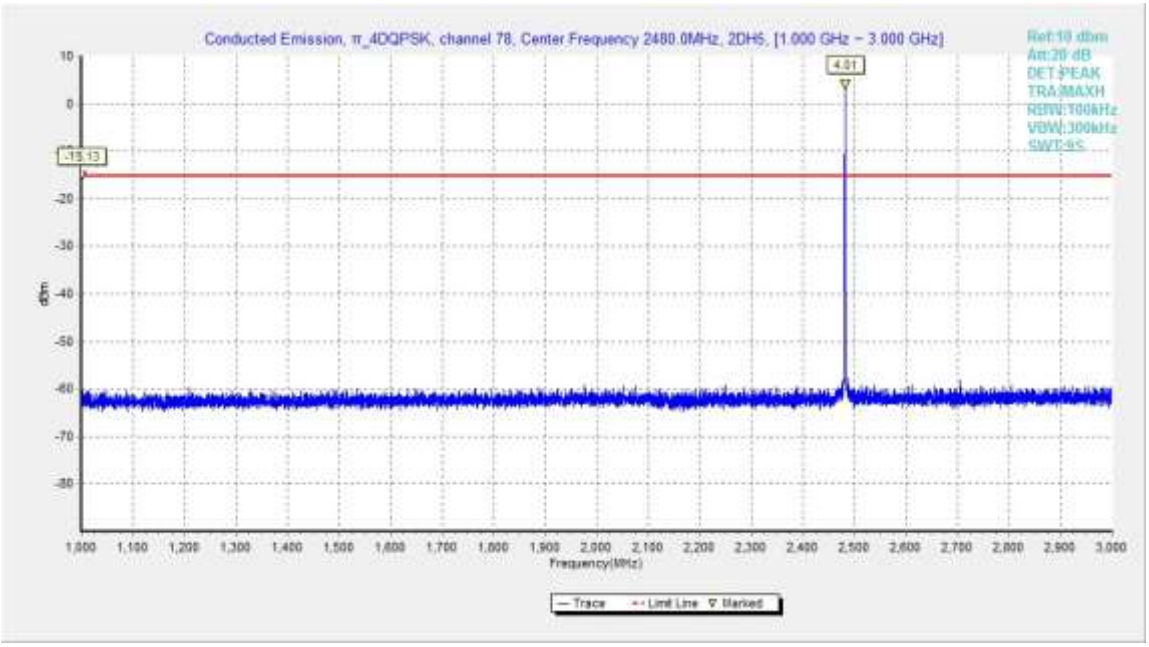


Fig.40. Conducted spurious emission: π/4 DQPSK, Channel 78, 1GHz - 3GHz

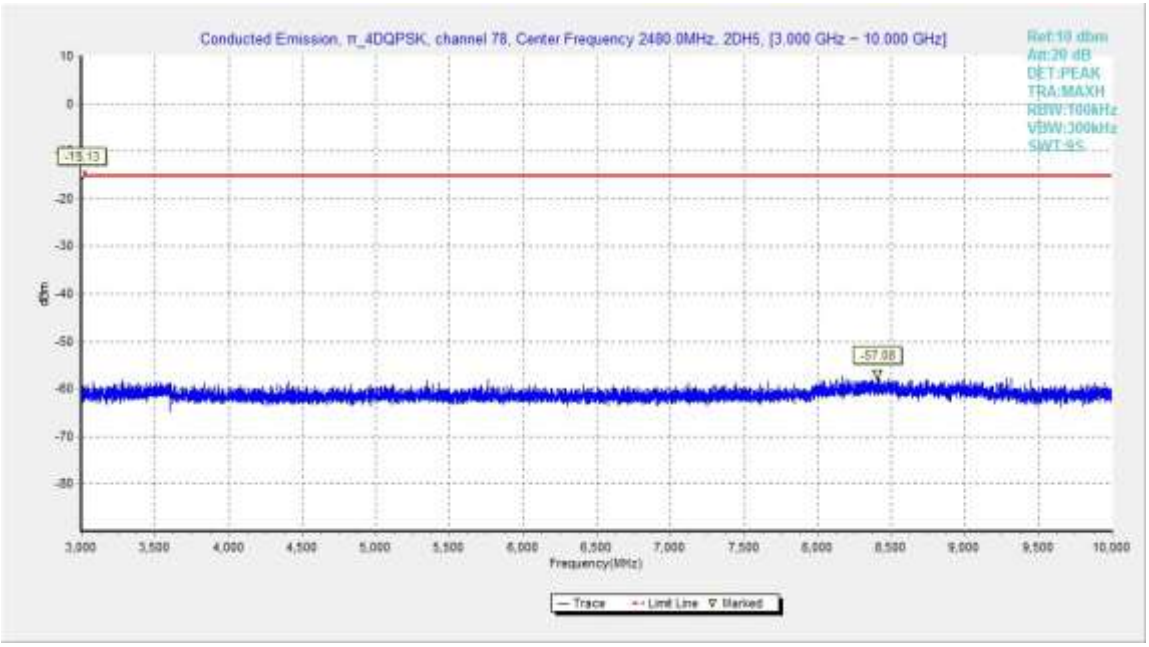


Fig.41. Conducted spurious emission: π/4 DQPSK, Channel 78, 3GHz - 10GHz

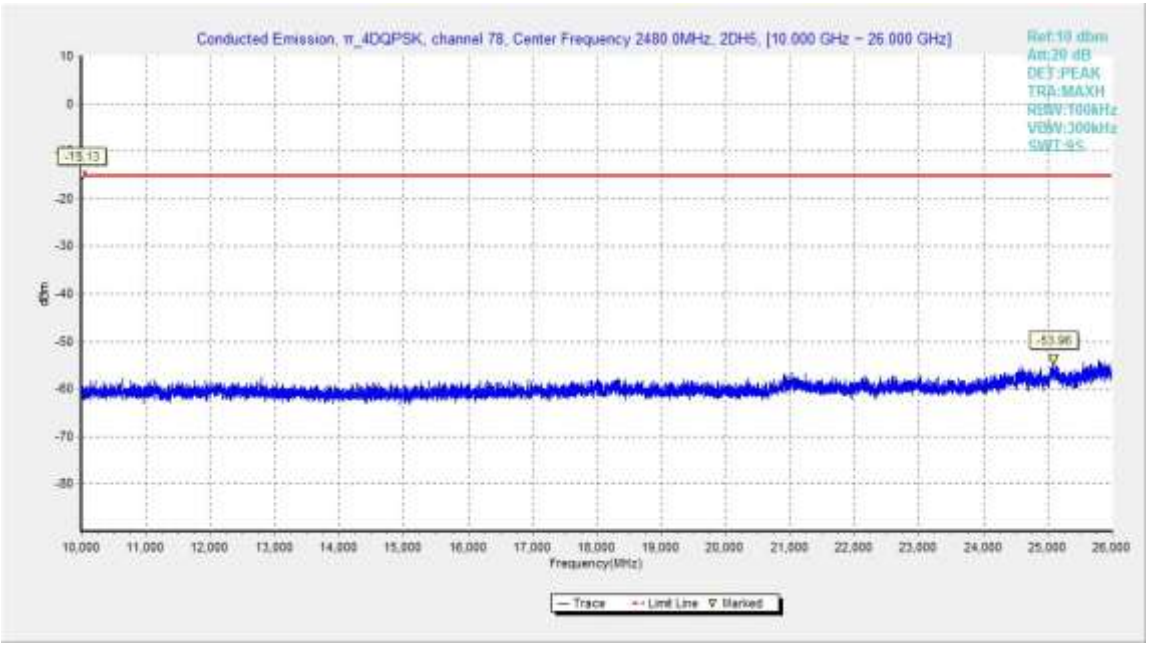


Fig.42. Conducted spurious emission: π/4 DQPSK, Channel 78, 10GHz - 26GHz

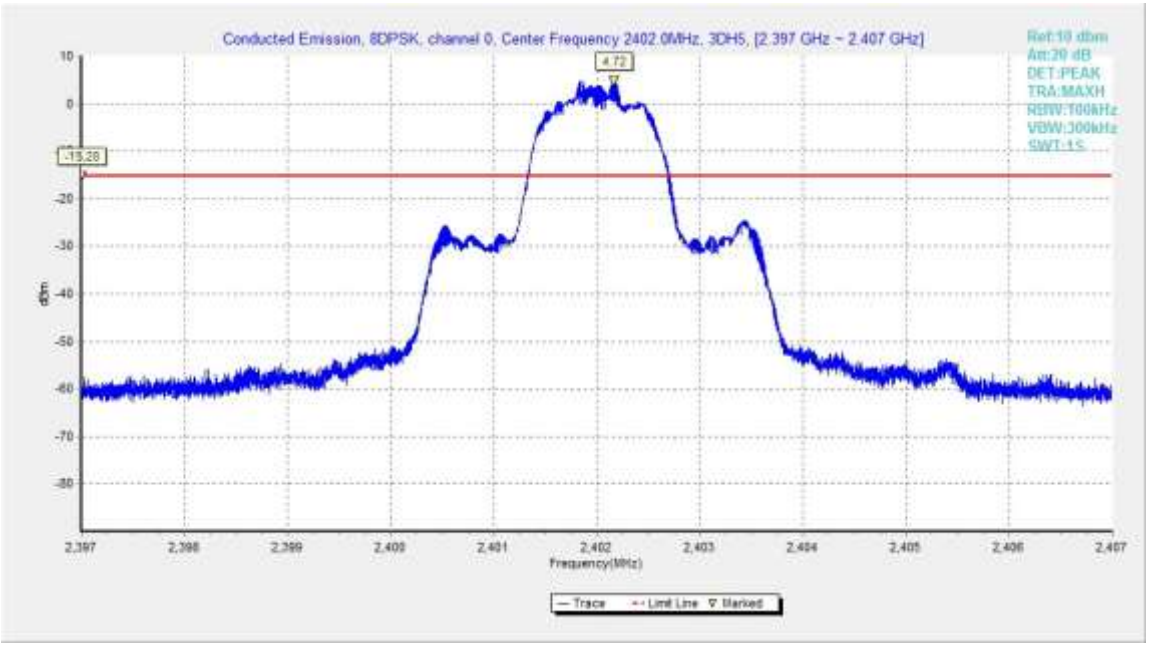


Fig.43. Conducted spurious emission: 8DPSK, Channel 0,2402MHz

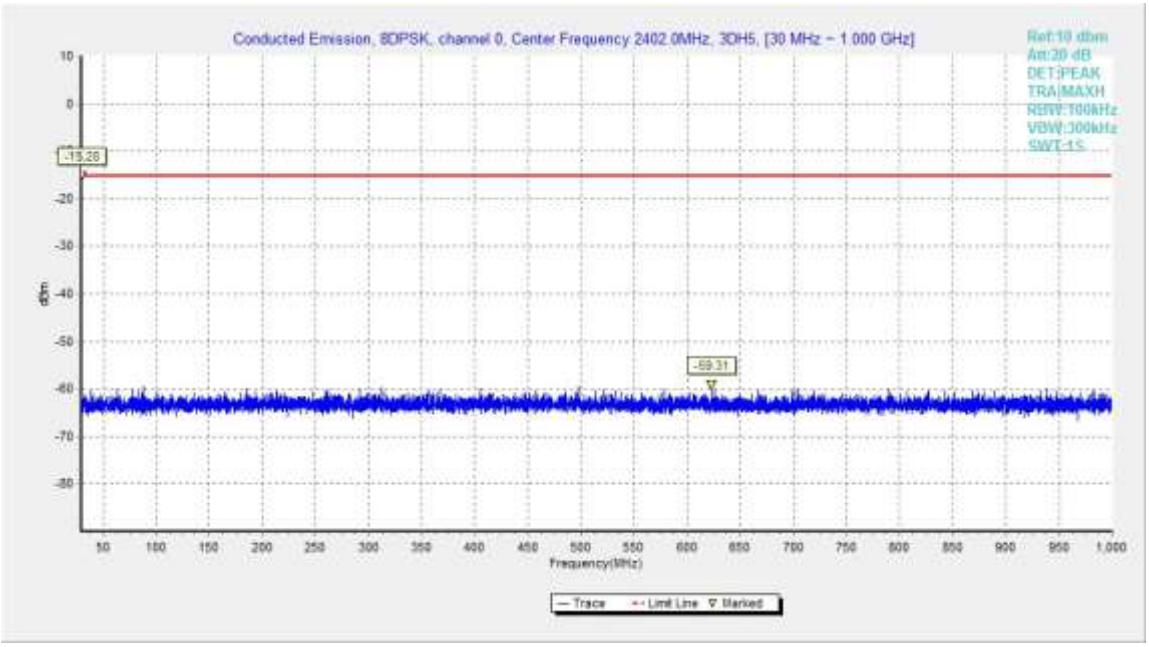


Fig.44. Conducted spurious emission: 8DPSK, Channel 0, 30MHz - 1GHz

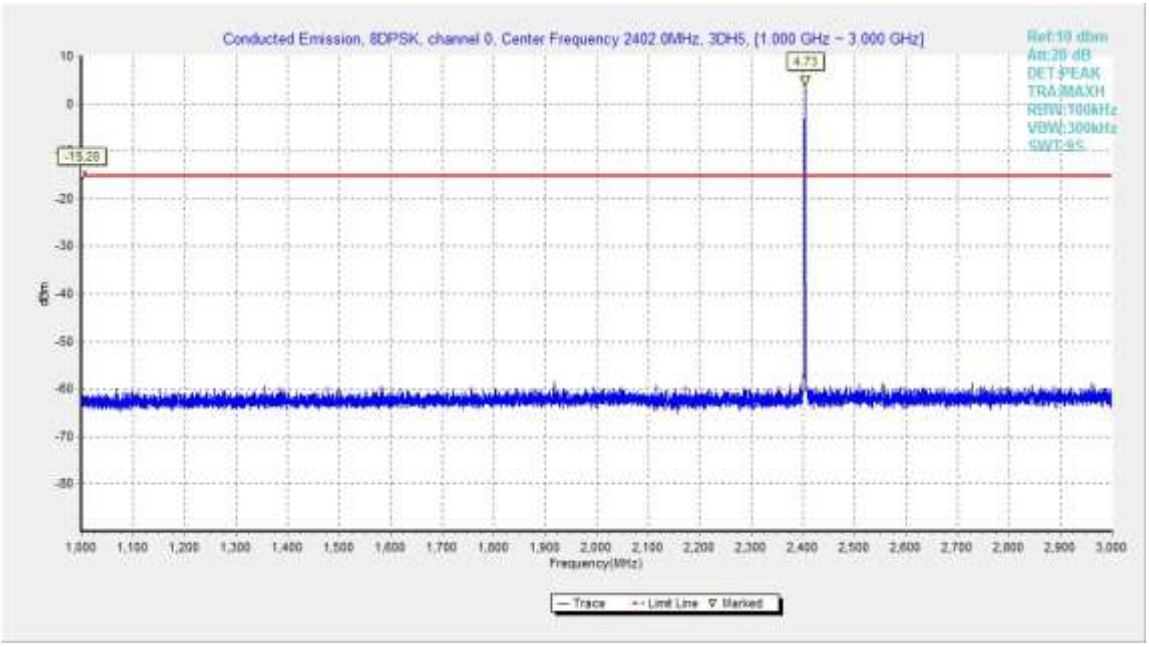


Fig.45. Conducted spurious emission: 8DPSK, Channel 0, 1GHz - 3GHz

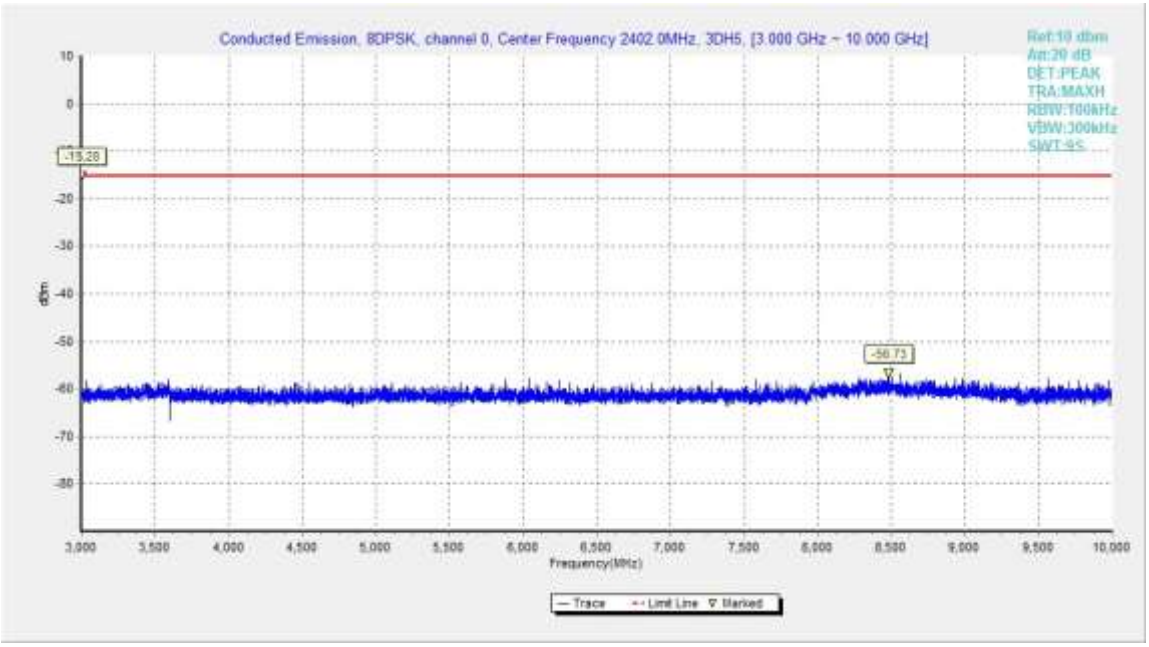


Fig.46. Conducted spurious emission: 8DPSK, Channel 0, 3GHz - 10GHz

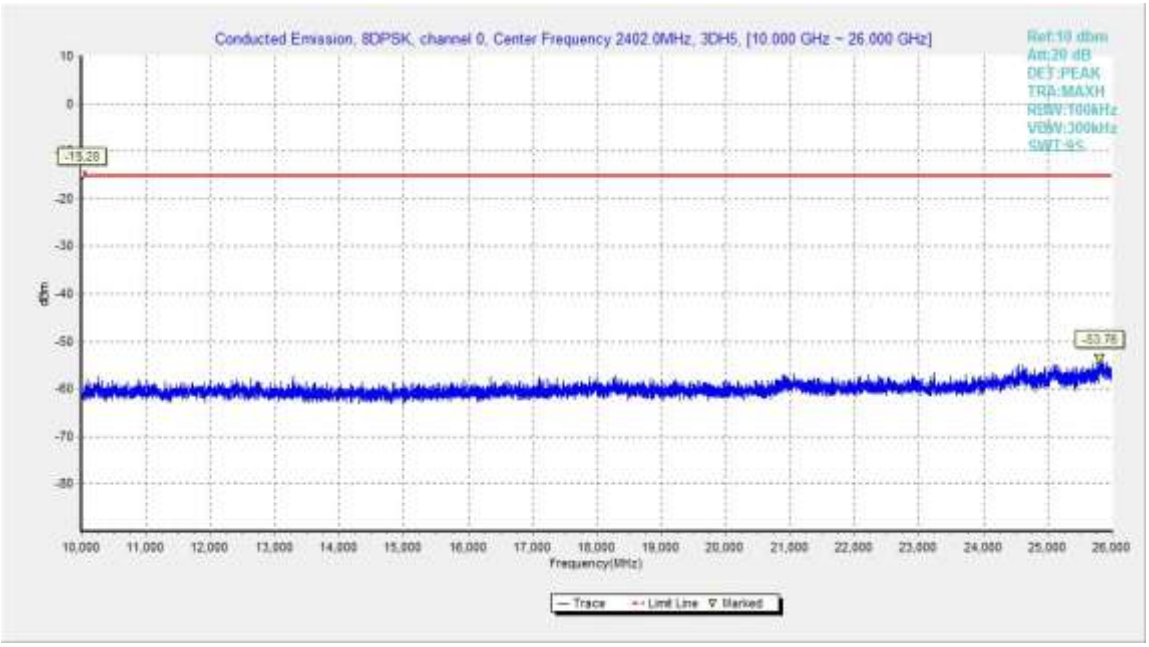


Fig.47. Conducted spurious emission: 8DPSK, Channel 0,10GHz - 26GHz

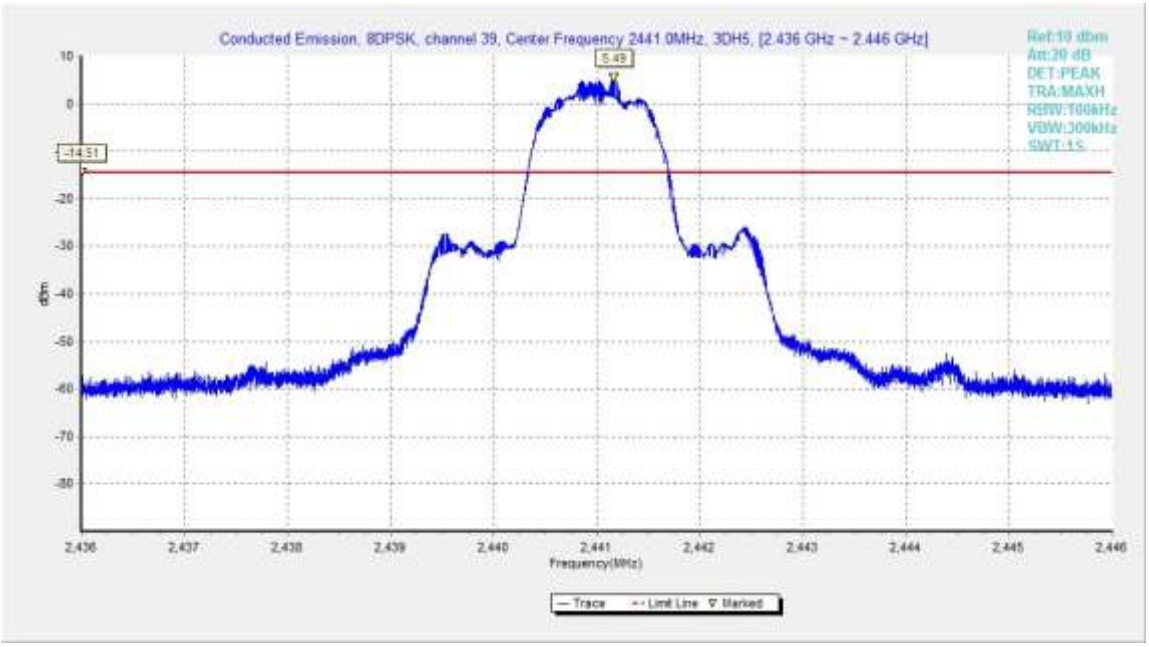


Fig.48. Conducted spurious emission: 8DPSK, Channel 39, 2441MHz

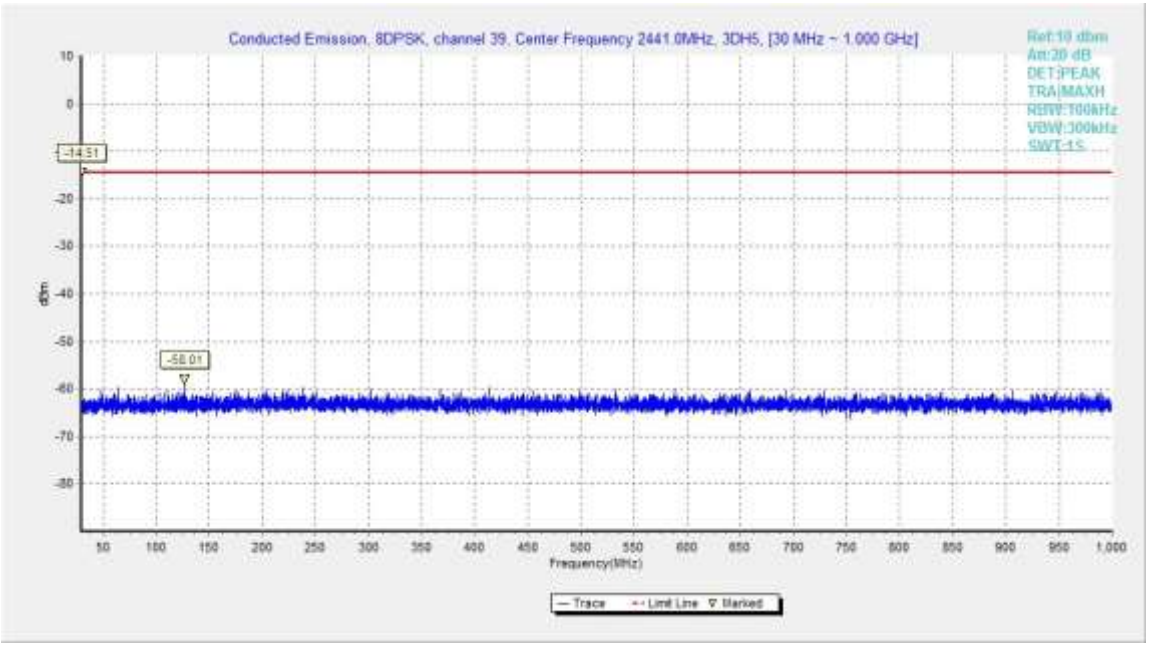


Fig.49. Conducted spurious emission: 8DPSK, Channel 39, 30MHz - 1GHz

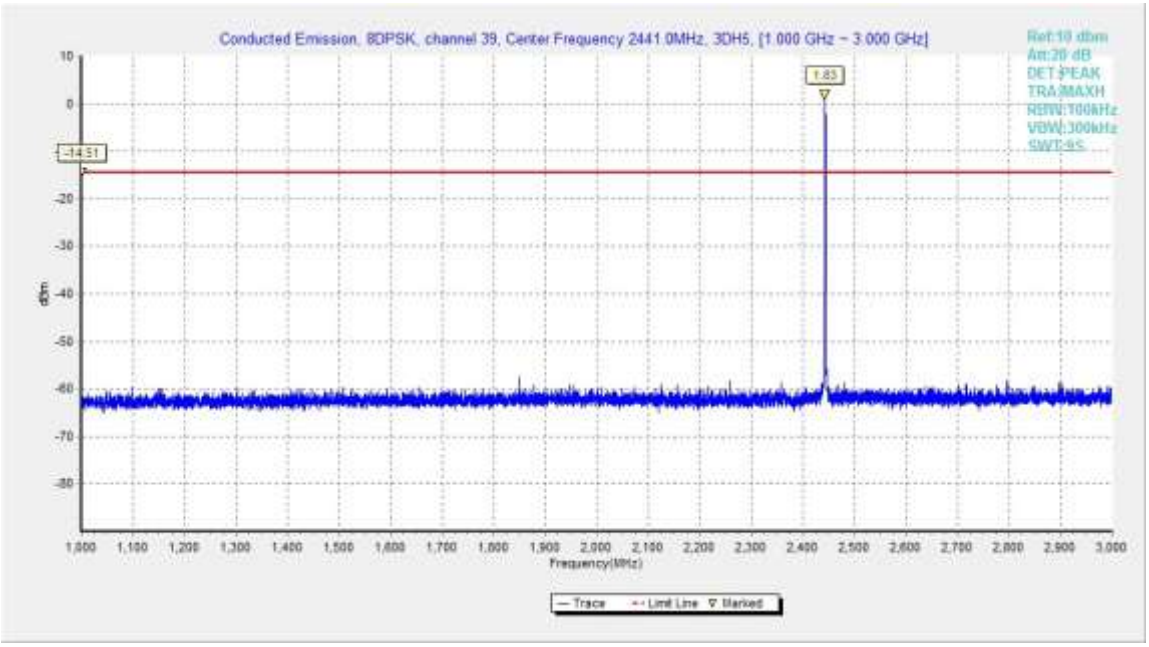


Fig.50. Conducted spurious emission: 8DPSK, Channel 39, 1GHz - 3GHz

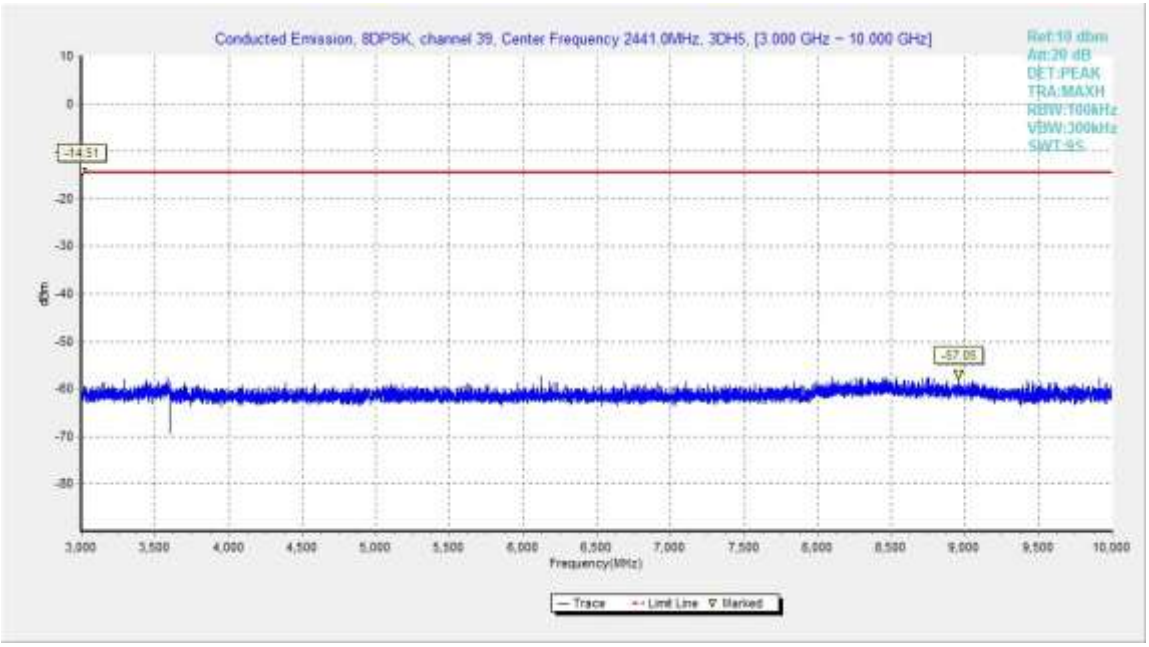


Fig.51. Conducted spurious emission: 8DPSK, Channel 39, 3GHz - 10GHz

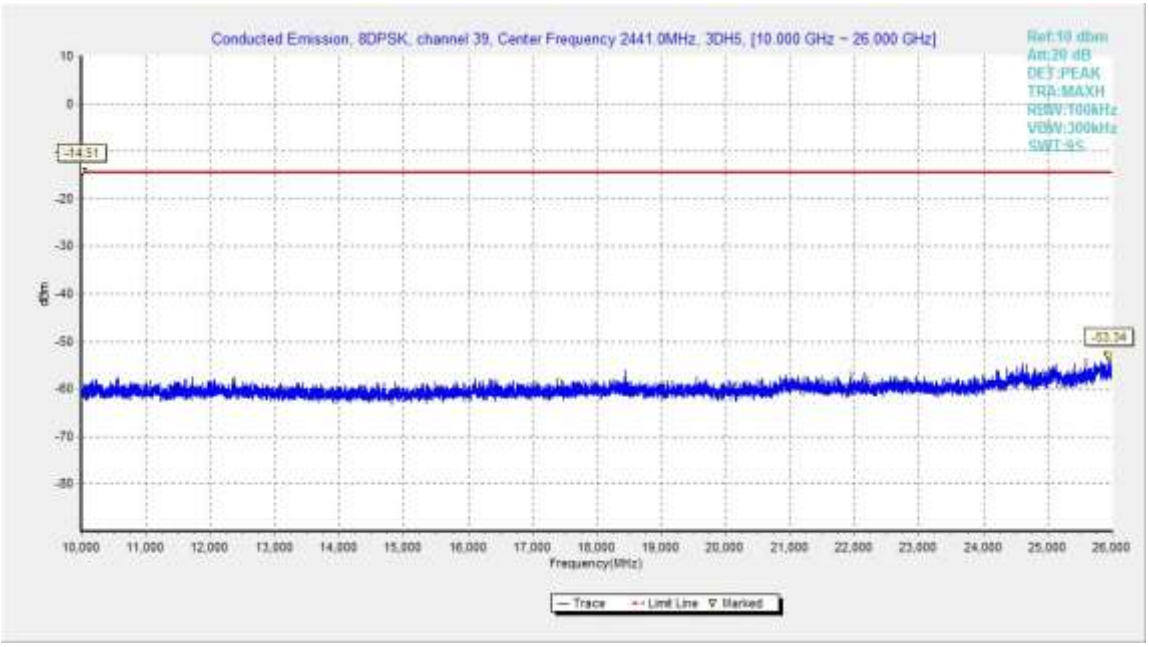


Fig.52. Conducted spurious emission: 8DPSK, Channel 39, 10GHz – 26GHz

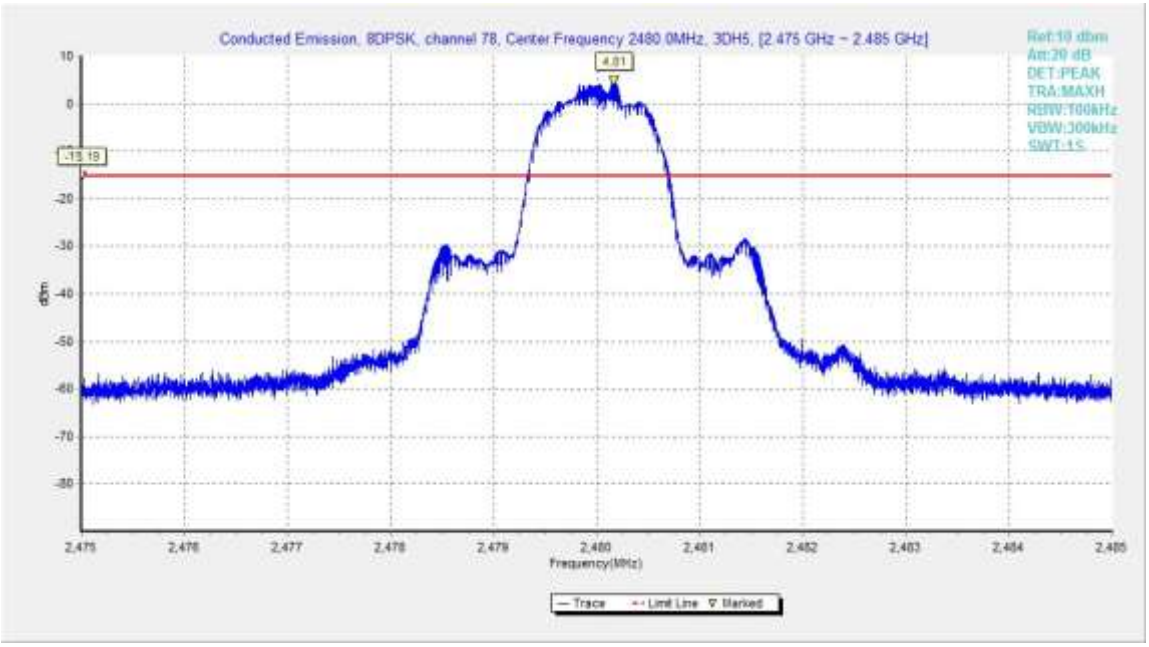


Fig.53. Conducted spurious emission: 8DPSK, Channel 78, 2480MHz

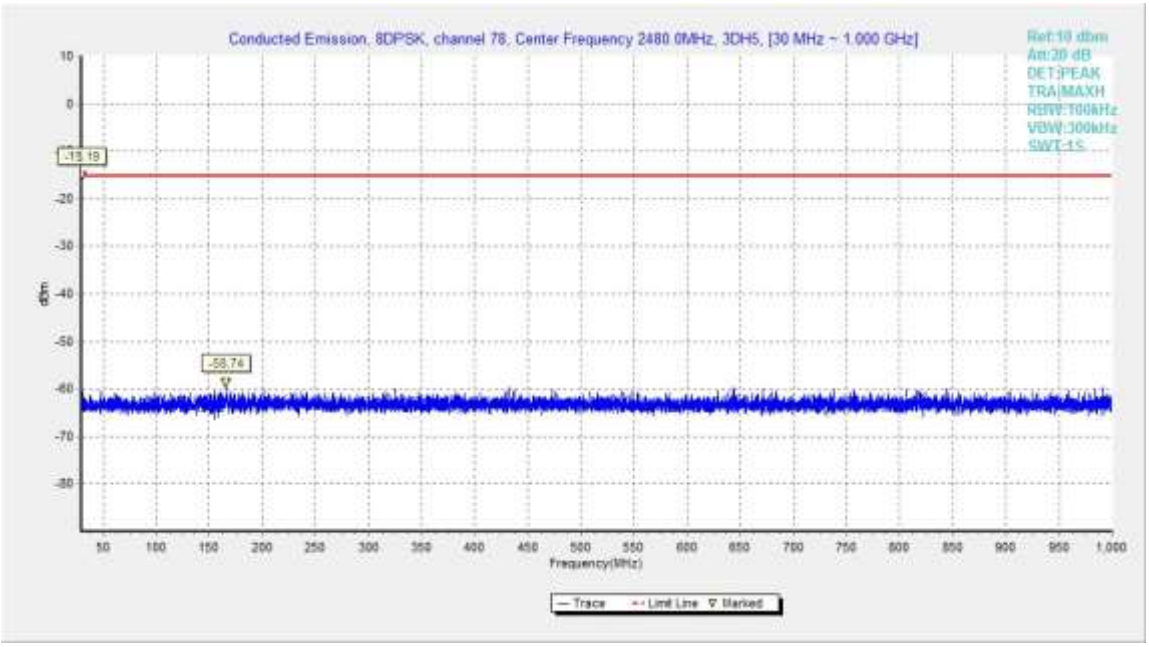


Fig.54. Conducted spurious emission: 8DPSK, Channel 78, 30MHz - 1GHz

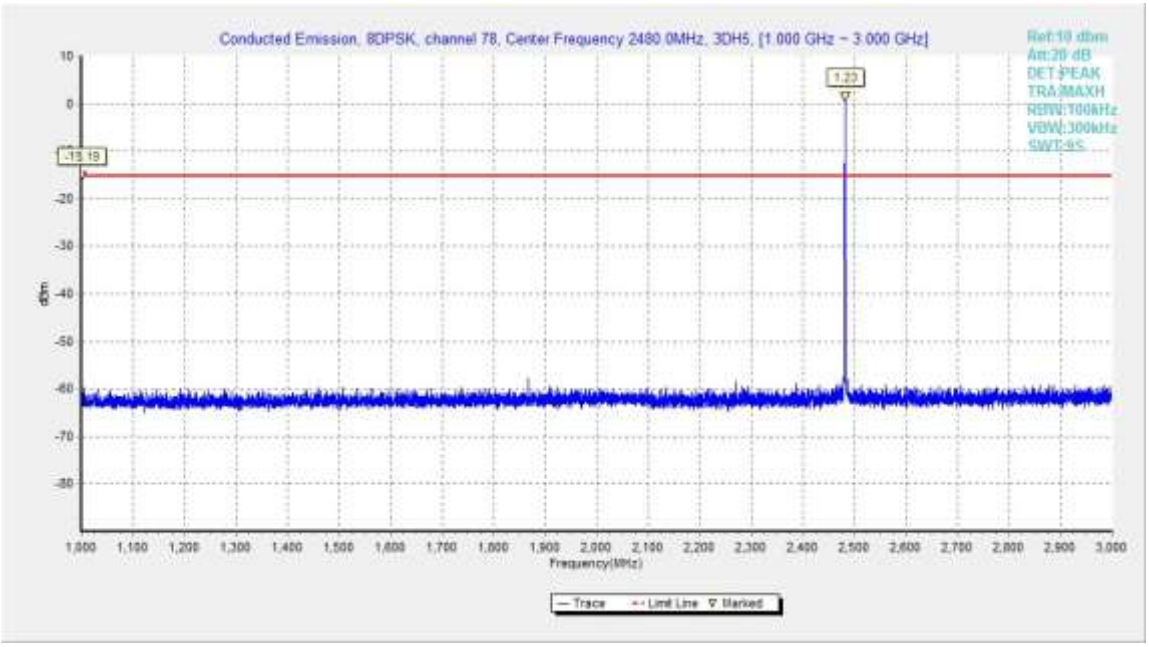


Fig.55. Conducted spurious emission: 8DPSK, Channel 78, 1GHz - 3GHz

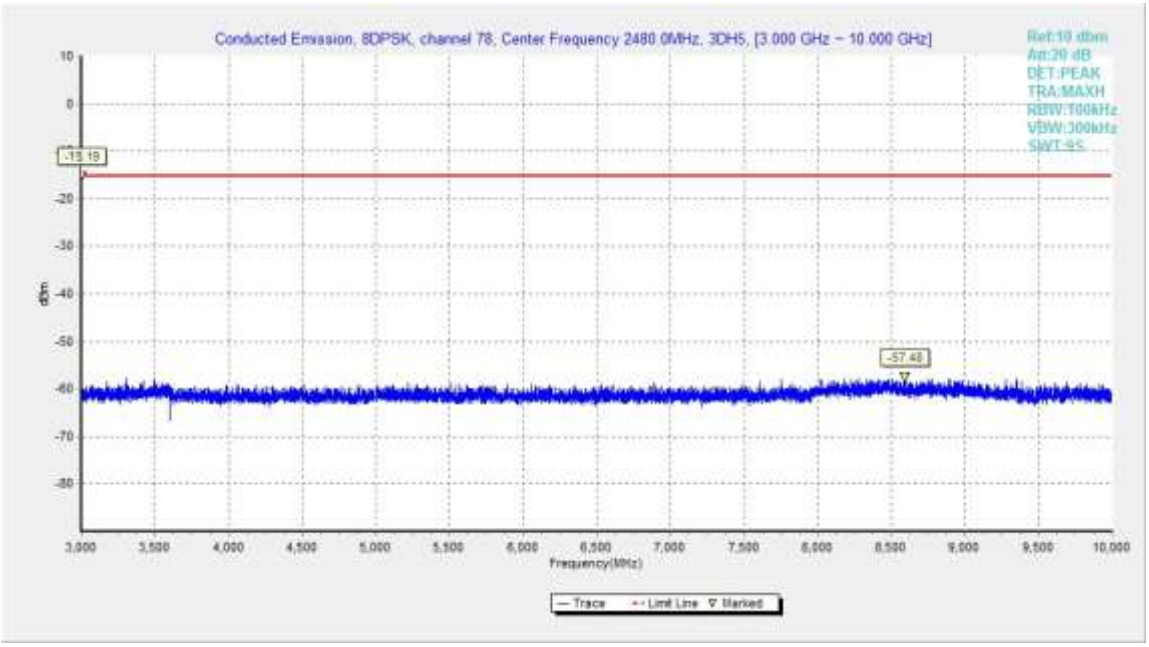


Fig.56. Conducted spurious emission: 8DPSK, Channel 78, 3GHz - 10GHz

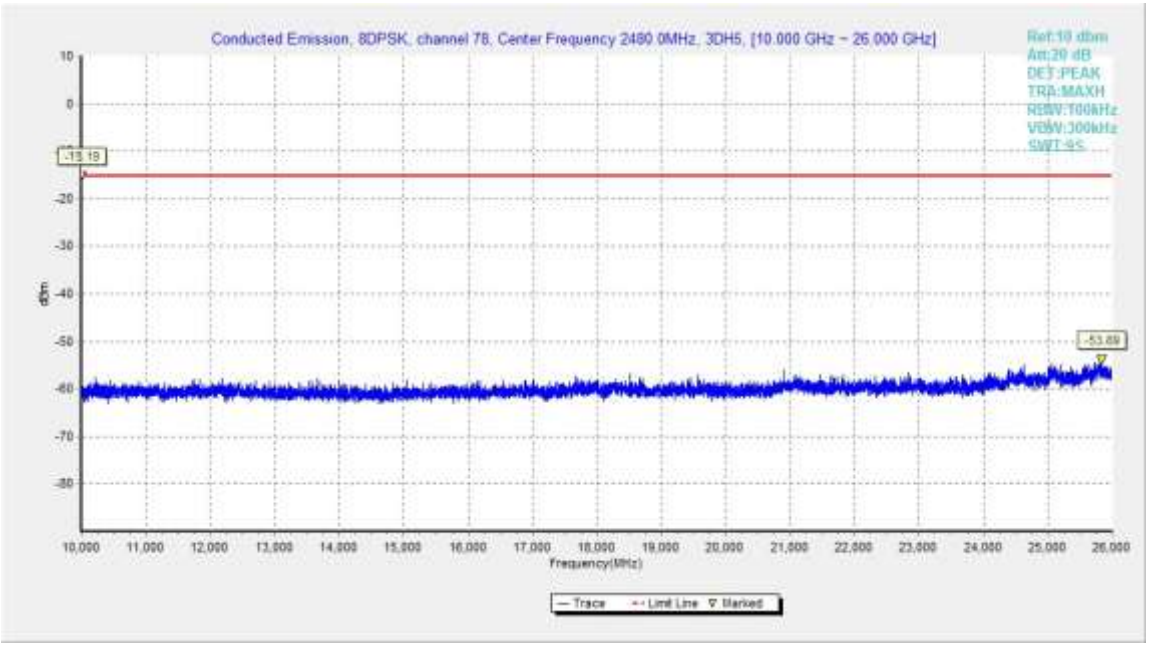


Fig.57. Conducted spurious emission: 8DPSK, Channel 78, 10GHz - 26GHz

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:

Result=P_{Mea}+ARPL

For GFSK

Channel	Frequency Range	Test Results	Conclusion
Ch 0 2402 MHz	1 GHz ~ 3 GHz	--	P
	3 GHz ~ 18 GHz	--	P
Ch 39 2440 MHz	9 kHz ~ 30 MHz	--	P
	30 MHz ~ 1 GHz	--	P
	1 GHz ~ 3 GHz	--	P
	3 GHz ~ 18 GHz	--	P
Ch 78 2480 MHz	1 GHz ~ 3 GHz	--	P
	3 GHz ~ 18 GHz	--	P
Power	2.38GHz~2.4GHz---L	Fig.58	P
Power	2.45GHz~2.5GHz---H	Fig.59	P
For all channels	18 GHz ~ 26 GHz	--	P

Forπ/4 DQPSK

Channel	Frequency Range	Test Results	Conclusion
Ch 0 2402 MHz	1 GHz ~ 3 GHz	--	P
	3 GHz ~ 18 GHz	--	P
Ch 39 2440 MHz	30 MHz ~ 1 GHz	--	P
	1 GHz ~ 3 GHz	--	P
	3 GHz ~ 18 GHz	--	P
Ch 78 2480 MHz	1 GHz ~ 3 GHz	--	P
	3 GHz ~ 18 GHz	--	P
Power	2.38GHz~2.4GHz---L	Fig.60	P
Power	2.45GHz~2.5GHz---H	Fig.61	P
For all channels	18 GHz ~ 26 GHz	--	P

For 8DPSK

Channel	Frequency Range	Test Results	Conclusion
Ch 0 2402 MHz	1 GHz ~ 3 GHz	--	P
	3 GHz ~ 18 GHz	--	P
Ch 39 2440 MHz	30 MHz ~ 1 GHz	--	P
	1 GHz ~ 3 GHz	--	P
	3 GHz ~ 18 GHz	--	P
Ch 78 2480 MHz	1 GHz ~ 3 GHz	--	P
	3 GHz ~ 18 GHz	--	P
Power	2.38GHz~2.4GHz---L	Fig.62	P
Power	2.45GHz~2.5GHz---H	Fig.63	P
For all channels	18 GHz ~ 26 GHz	--	P

GFSK Ch 0 - Average

Frequency (MHz)	Measurement Result (dBμV/m)	Cable loss (dB)	Antenna Factor (dB/m)	Receiver Reading (dBμV)	Limit (dBμV/m)	Margin (dB)	Antenna Pol. (H/V)	Antenna Height (cm)	Turntable angle (deg)
2388.400	46.91	2.9	32.0	12.06	54.0	7.1	H	155	16
2390.000	46.92	2.9	32.0	12.07	54.0	7.1	H	155	48
4804.000	36.41	-32.9	34.5	34.76	54.0	17.6	H	155	80
7206.000	38.67	-31.6	36.1	34.20	54.0	15.3	H	155	8
9608.000	38.80	-30.0	37.0	31.85	54.0	15.2	H	155	102
12010.000	44.15	-29.8	39.3	34.67	54.0	9.9	H	155	118

GFSK Ch 39 - Average

Frequency (MHz)	Measurement Result (dBμV/m)	Cable loss (dB)	Antenna Factor (dB/m)	Receiver Reading (dBμV)	Limit (dBμV/m)	Margin (dB)	Antenna Pol. (H/V)	Antenna Height (cm)	Turntable angle (deg)
2434.600	47.29	2.9	32.0	12.44	54.0	6.7	H	155	28
2448.400	47.38	2.9	32.3	12.16	54.0	6.6	H	155	46
4882.000	36.51	-32.7	34.5	34.72	54.0	17.5	H	155	8
7323.000	38.69	-31.9	36.1	34.54	54.0	15.3	H	155	6
9764.000	38.91	-30.6	37.2	32.28	54.0	15.1	H	155	24
12205.000	44.09	-29.4	39.2	34.30	54.0	9.9	H	155	185

GFSK Ch 78 - Average

Frequency (MHz)	Measurement Result (dBμV/m)	Cable loss (dB)	Antenna Factor (dB/m)	Receiver Reading (dBμV)	Limit (dBμV/m)	Margin (dB)	Antenna Pol. (H/V)	Antenna Height (cm)	Turntable angle (deg)
2483.500	48.02	2.9	32.8	12.32	54.0	6.0	H	155	28
2483.900	47.68	2.9	32.7	12.00	54.0	6.3	H	155	248
4960.000	36.76	-33.4	34.5	35.63	54.0	17.2	H	155	38
7440.000	38.94	-31.8	36.0	34.68	54.0	15.1	H	155	98
9920.000	38.98	-29.9	37.4	31.51	54.0	15.0	H	155	183
12400.000	44.12	-29.5	39.1	34.49	54.0	9.9	H	155	356

GFSK Ch 0 – Peak

Frequency (MHz)	Measurement Result (dBμV/m)	Cable loss (dB)	Antenna Factor (dB/m)	Receiver Reading (dBμV)	Limit (dBμV/m)	Margin (dB)	Antenna Pol. (H/V)	Antenna Height (cm)	Turntable angle (deg)
2381.372	60.17	2.9	32.0	25.26	74.0	13.8	H	155	22
2386.706	59.82	2.9	32.0	24.95	74.0	14.2	H	155	44
4804.000	41.56	-32.9	34.5	39.91	74.0	32.4	V	155	88
7206.000	42.57	-31.6	36.1	38.10	74.0	31.4	V	155	0
9608.000	43.42	-30.0	37.0	36.46	74.0	30.6	H	155	110
12010.000	47.24	-29.8	39.3	37.76	74.0	26.8	H	155	132

GFSK Ch 39 - Peak

Frequency (MHz)	Measurement Result (dBμV/m)	Cable loss (dB)	Antenna Factor (dB/m)	Receiver Reading (dBμV)	Limit (dBμV/m)	Margin (dB)	Antenna Pol. (H/V)	Antenna Height (cm)	Turntable angle (deg)
2376.842	50.58	-26.5	32.1	45.02	74.0	23.4	H	155	22
2537.623	50.37	-26.8	32.9	44.28	74.0	23.6	H	155	44
4882.000	41.63	-32.7	34.5	39.84	74.0	32.4	V	155	0
7323.000	42.62	-31.9	36.1	38.47	74.0	31.4	H	155	0
9764.000	43.44	-30.6	37.2	36.81	74.0	30.6	V	155	22
12205.000	47.36	-29.4	39.2	37.57	74.0	26.6	H	155	176

GFSK Ch 78 - Peak

Frequency (MHz)	Measurement Result (dBμV/m)	Cable loss (dB)	Antenna Factor (dB/m)	Receiver Reading (dBμV)	Limit (dBμV/m)	Margin (dB)	Antenna Pol. (H/V)	Antenna Height (cm)	Turntable angle (deg)
2486.920	60.84	2.9	32.7	25.24	74.0	13.2	H	155	22
2489.000	60.74	2.9	32.6	25.20	74.0	13.3	H	155	242
4960.000	41.76	-33.4	34.5	40.63	74.0	32.2	V	155	44
7440.000	42.89	-31.8	36.0	38.63	74.0	31.1	H	155	88
9920.000	43.51	-29.9	37.4	36.04	74.0	30.5	V	155	176
12400.000	47.48	-29.5	39.1	37.85	74.0	26.5	H	155	0

π/4 DQPSK Ch 0 - Average

Frequency (MHz)	Measurement Result (dBμV/m)	Cable loss (dB)	Antenna Factor (dB/m)	Receiver Reading (dBμV)	Limit (dBμV/m)	Margin (dB)	Antenna Pol. (H/V)	Antenna Height (cm)	Turntable angle (deg)
2387.500	46.91	2.9	32.0	12.04	54.0	7.1	H	155	354
2390.000	46.99	2.9	32.0	12.15	54.0	7.0	H	155	28
4804.000	36.73	-32.9	34.5	35.08	54.0	17.3	H	155	348
7206.000	38.79	-31.6	36.1	34.32	54.0	15.2	H	155	345
9608.000	38.93	-30.0	37.0	31.98	54.0	15.1	H	155	184
12010.000	44.23	-29.8	39.3	34.76	54.0	9.8	H	155	182

π/4 DQPSK Ch 39 - Average

Frequency (MHz)	Measurement Result (dBμV/m)	Cable loss (dB)	Antenna Factor (dB/m)	Receiver Reading (dBμV)	Limit (dBμV/m)	Margin (dB)	Antenna Pol. (H/V)	Antenna Height (cm)	Turntable angle (deg)
2435.200	47.29	2.9	32.0	12.43	54.0	6.7	H	155	142
2447.700	47.36	2.9	32.3	12.16	54.0	6.6	H	155	168
4882.000	36.87	-32.7	34.5	35.08	54.0	17.1	H	155	90
7323.000	38.94	-31.9	36.1	34.79	54.0	15.1	H	155	102
9764.000	39.02	-30.6	37.2	32.39	54.0	15.0	H	155	118
12205.000	44.31	-29.4	39.2	34.52	54.0	9.7	H	155	94

π/4 DQPSK Ch 78 - Average

Frequency (MHz)	Measurement Result (dBμV/m)	Cable loss (dB)	Antenna Factor (dB/m)	Receiver Reading (dBμV)	Limit (dBμV/m)	Margin (dB)	Antenna Pol. (H/V)	Antenna Height (cm)	Turntable angle (deg)
2483.500	47.90	2.9	32.8	12.21	54.0	6.1	H	155	98
2483.800	47.64	2.9	32.8	11.96	54.0	6.4	H	155	135
4960.000	36.83	-33.4	34.5	35.70	54.0	17.2	H	155	4
7440.000	38.79	-31.8	36.0	34.53	54.0	15.2	H	155	74
9920.000	39.16	-29.9	37.4	31.69	54.0	14.8	H	155	48
12400.000	44.43	-29.5	39.1	34.80	54.0	9.6	H	155	246

π/4 DQPSK Ch 0 – Peak

Frequency (MHz)	Measurement Result (dBμV/m)	Cable loss (dB)	Antenna Factor (dB/m)	Receiver Reading (dBμV)	Limit (dBμV/m)	Margin (dB)	Antenna Pol. (H/V)	Antenna Height (cm)	Turntable angle (deg)
2384.676	61.23	2.9	32.0	26.34	74.0	12.8	H	155	0
2386.720	60.24	2.9	32.0	25.37	74.0	13.8	H	155	22
4804.000	41.87	-32.9	34.5	40.22	74.0	32.1	V	155	352
7206.000	42.86	-31.6	36.1	38.39	74.0	31.1	V	155	352
9608.000	43.52	-30.0	37.0	36.57	74.0	30.5	V	155	176
12010.000	47.54	-29.8	39.3	38.07	74.0	26.5	V	155	176

π/4 DQPSK Ch 39 - Peak

Frequency (MHz)	Measurement Result (dBμV/m)	Cable loss (dB)	Antenna Factor (dB/m)	Receiver Reading (dBμV)	Limit (dBμV/m)	Margin (dB)	Antenna Pol. (H/V)	Antenna Height (cm)	Turntable angle (deg)
2371.020	49.81	-26.9	32.0	44.70	74.0	24.2	H	155	132
2824.843	52.98	-26.0	33.4	45.62	74.0	21.0	V	155	154
4882.000	41.86	-32.7	34.5	40.07	74.0	32.1	H	155	88
7323.000	42.77	-31.9	36.1	38.61	74.0	31.2	V	155	110
9764.000	43.56	-30.6	37.2	36.93	74.0	30.4	V	155	110
12205.000	47.53	-29.4	39.2	37.74	74.0	26.5	V	155	88

π/4 DQPSK Ch 78 - Peak

Frequency (MHz)	Measurement Result (dBμV/m)	Cable loss (dB)	Antenna Factor (dB/m)	Receiver Reading (dBμV)	Limit (dBμV/m)	Margin (dB)	Antenna Pol. (H/V)	Antenna Height (cm)	Turntable angle (deg)
2492.510	60.91	2.9	32.5	25.46	74.0	13.1	H	155	88
2497.650	61.03	2.9	32.4	25.72	74.0	13.0	H	155	132
4960.000	41.82	-33.4	34.5	40.69	74.0	32.2	H	155	0
7440.000	42.84	-31.8	36.0	38.58	74.0	31.2	V	155	66
9920.000	43.60	-29.9	37.4	36.13	74.0	30.4	V	155	44
12400.000	47.54	-29.5	39.1	37.91	74.0	26.5	H	155	242

8DPSK Ch 0 - Average

Frequency (MHz)	Measurement Result (dBμV/m)	Cable loss (dB)	Antenna Factor (dB/m)	Receiver Reading (dBμV)	Limit (dBμV/m)	Margin (dB)	Antenna Pol. (H/V)	Antenna Height (cm)	Turntable angle (deg)
2387.100	46.99	2.9	32.0	12.12	54.0	7.0	H	155	28
2390.000	47.01	2.9	32.0	12.16	54.0	7.0	H	155	49
4804.000	36.79	-32.9	34.5	35.14	54.0	17.2	H	155	246
7206.000	38.83	-31.6	36.1	34.36	54.0	15.2	H	155	182
9608.000	39.21	-30.0	37.0	32.26	54.0	14.8	H	155	94
12010.000	44.52	-29.8	39.3	35.05	54.0	9.5	H	155	42

8DPSK Ch 39 - Average

Frequency (MHz)	Measurement Result (dBμV/m)	Cable loss (dB)	Antenna Factor (dB/m)	Receiver Reading (dBμV)	Limit (dBμV/m)	Margin (dB)	Antenna Pol. (H/V)	Antenna Height (cm)	Turntable angle (deg)
2434.900	47.36	2.9	32.0	12.50	54.0	6.6	H	155	26
2446.600	47.43	2.9	32.3	12.26	54.0	6.6	H	155	48
4882.000	36.68	-32.7	34.5	34.89	54.0	17.3	H	155	68
7323.000	38.94	-31.9	36.1	34.79	54.0	15.1	H	155	44
9764.000	39.16	-30.6	37.2	32.53	54.0	14.8	H	155	8
12205.000	44.48	-29.4	39.2	34.69	54.0	9.5	H	155	102

8DPSK Ch 78 - Average

Frequency (MHz)	Measurement Result (dBμV/m)	Cable loss (dB)	Antenna Factor (dB/m)	Receiver Reading (dBμV)	Limit (dBμV/m)	Margin (dB)	Antenna Pol. (H/V)	Antenna Height (cm)	Turntable angle (deg)
2483.500	47.80	2.9	32.8	12.11	54.0	6.2	H	155	132
2484.000	47.59	2.9	32.7	11.91	54.0	6.4	H	155	28
4960.000	36.75	-33.4	34.5	35.62	54.0	17.3	H	155	38
7440.000	39.01	-31.8	36.0	34.75	54.0	15.0	H	155	65
9920.000	39.23	-29.9	37.4	31.76	54.0	14.8	H	155	4
12400.000	44.62	-29.5	39.1	34.99	54.0	9.4	H	155	24

8DPSK Ch 0 – Peak

Frequency (MHz)	Measurement Result (dBμV/m)	Cable loss (dB)	Antenna Factor (dB/m)	Receiver Reading (dBμV)	Limit (dBμV/m)	Margin (dB)	Antenna Pol. (H/V)	Antenna Height (cm)	Turntable angle (deg)
2384.928	60.17	2.9	32.0	25.29	74.0	13.8	H	155	22
2389.212	60.26	2.9	32.0	25.40	74.0	13.7	H	155	44
4804.000	41.79	-32.9	34.5	40.14	74.0	32.2	V	155	242
7206.000	42.86	-31.6	36.1	38.39	74.0	31.1	H	155	176
9608.000	43.86	-30.0	37.0	36.91	74.0	30.1	V	155	88
12010.000	47.62	-29.8	39.3	38.15	74.0	26.4	V	155	22

8DPSK Ch 39 - Peak

Frequency (MHz)	Measurement Result (dBμV/m)	Cable loss (dB)	Antenna Factor (dB/m)	Receiver Reading (dBμV)	Limit (dBμV/m)	Margin (dB)	Antenna Pol. (H/V)	Antenna Height (cm)	Turntable angle (deg)
2376.253	49.76	-26.6	32.1	44.23	74.0	24.2	H	155	22
2888.680	53.53	-25.5	33.8	45.21	74.0	20.5	H	155	44
4882.000	42.31	-32.7	34.5	40.52	74.0	31.7	V	155	66
7323.000	43.02	-31.9	36.1	38.87	74.0	31.0	V	155	22
9764.000	43.91	-30.6	37.2	37.28	74.0	30.1	V	155	0
12205.000	48.02	-29.4	39.2	38.23	74.0	26.0	V	155	88

8DPSK Ch 78 - Peak

Frequency (MHz)	Measurement Result (dBμV/m)	Cable loss (dB)	Antenna Factor (dB/m)	Receiver Reading (dBμV)	Limit (dBμV/m)	Margin (dB)	Antenna Pol. (H/V)	Antenna Height (cm)	Turntable angle (deg)
2490.100	60.65	2.9	32.6	25.14	74.0	13.4	H	155	110
2491.630	60.69	2.9	32.5	25.22	74.0	13.3	H	155	22
4960.000	42.38	-33.4	34.5	41.25	74.0	31.6	V	155	44
7440.000	43.16	-31.8	36.0	38.90	74.0	30.8	V	155	66
9920.000	44.03	-29.9	37.4	36.56	74.0	30.0	V	155	0
12400.000	48.34	-29.5	39.1	38.71	74.0	25.7	H	155	22

Conclusion: PASS

Test graphs as below for Set.10:

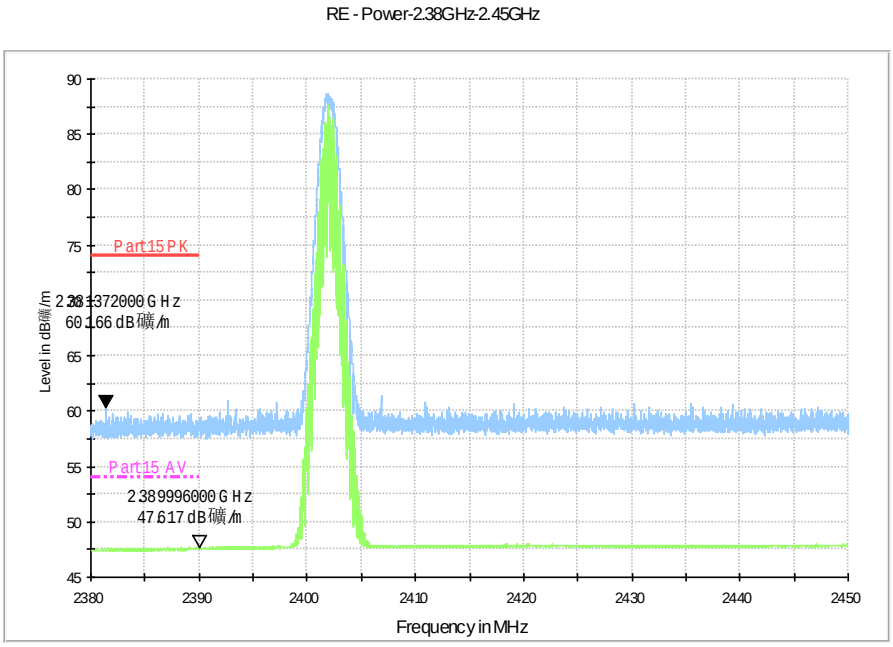


Fig.58. Radiated emission (Power): GFSK, low channel

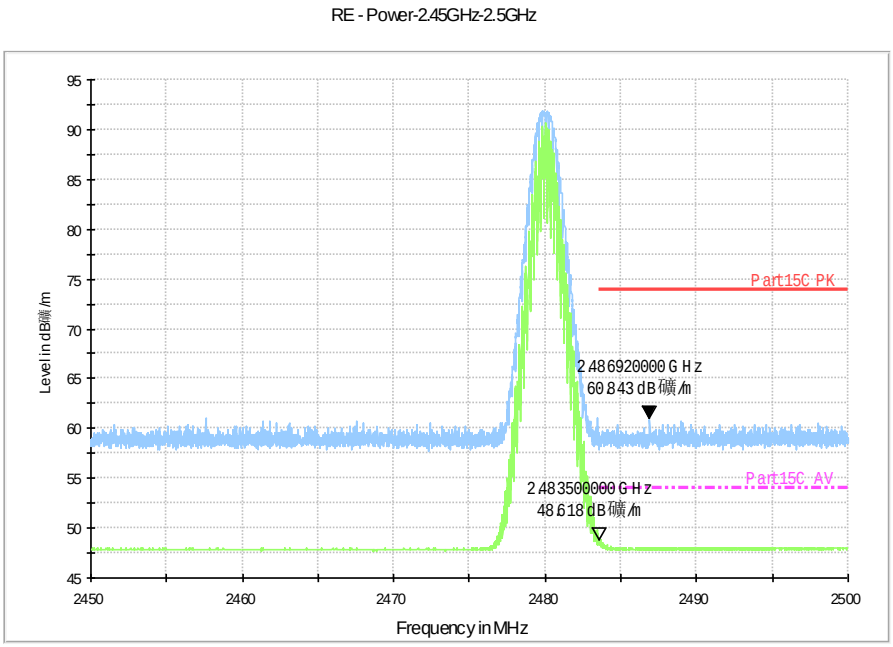


Fig.59. Radiated emission (Power) GFSK, high channel

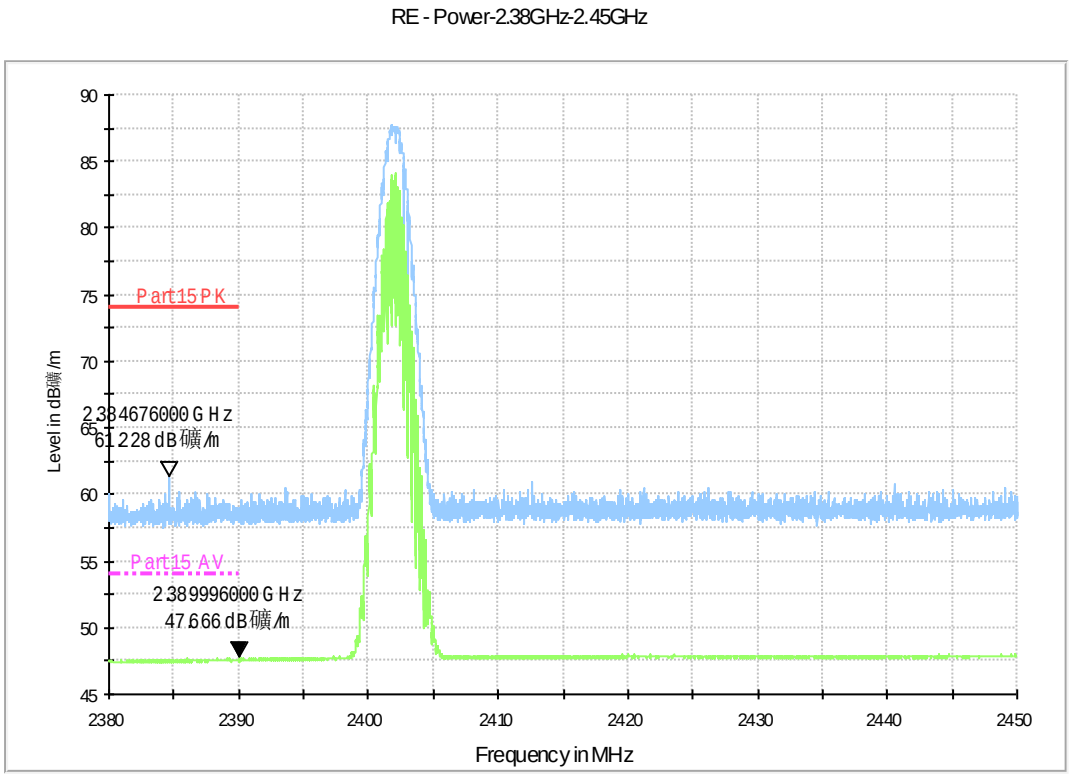


Fig.60. Radiated emission (Power): π/4 DQPSK, low channel

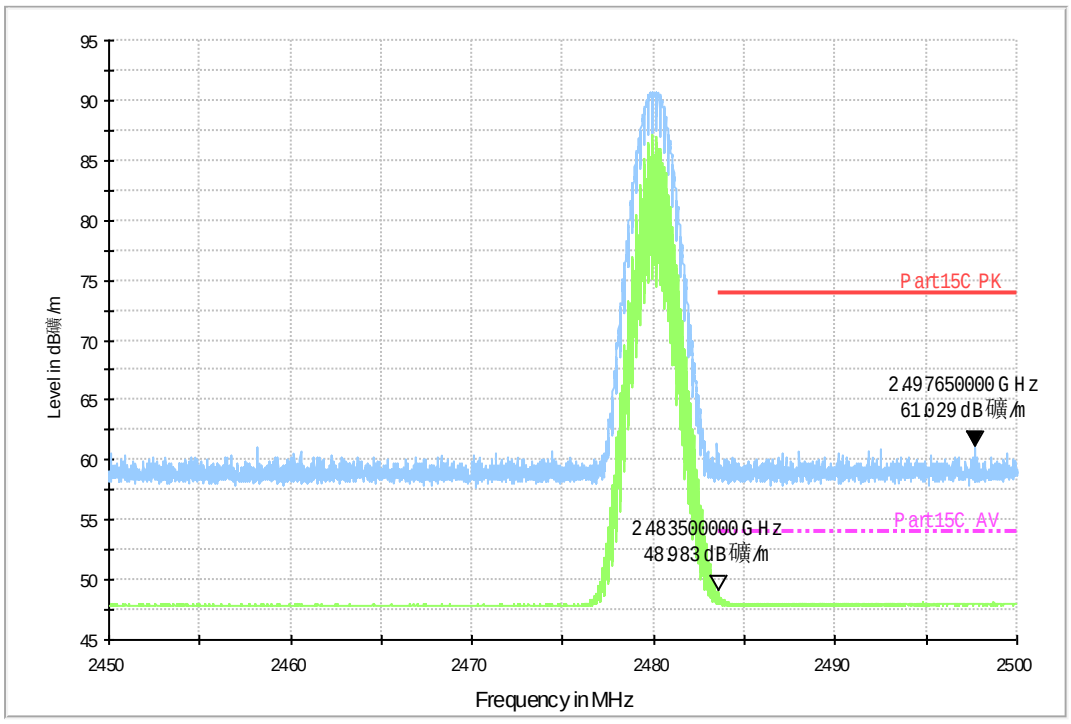


Fig.61. Radiated emission (Power): π/4 DQPSK, high channel

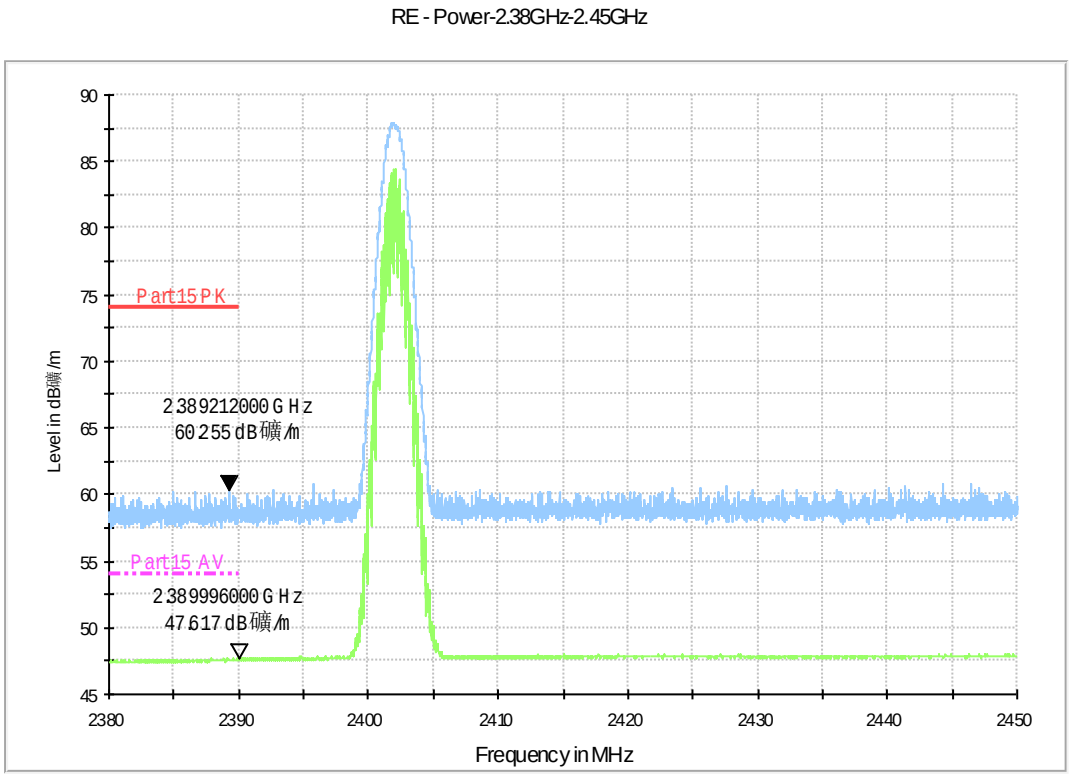


Fig.62. Radiated emission (Power): 8DPSK, low channel

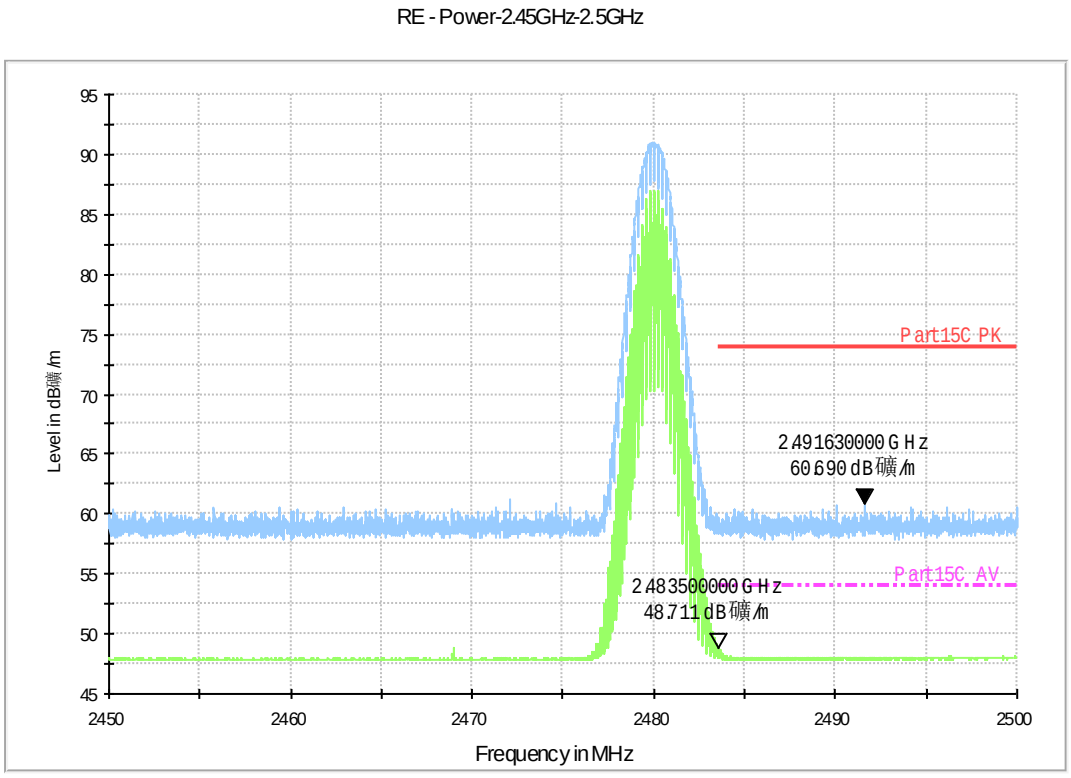


Fig.63. Radiated emission (Power): 8DPSK, high channel

Fig.64.

A.6. Time of Occupancy (Dwell Time)

Method of Measurement: See ANSI C63.10-clause 7.8.4

The EUT must have its hopping function enabled. Use the following spectrum analyzer settings:

- Span = zero span, centered on a hopping channel
- RBW = 1 MHz
- VBW ≥ RBW
- Sweep = as necessary to capture the entire dwell time per hopping channel
- Detector function = peak
- Trace = max hold

Measure a pulse time in time domain at middle frequency and then count the hopping number in 31.6s(which equals with 0.4 multiply 79) of middle frequency ,then multiply the pulse time and hopping number and record them.

Measurement Limit:

Standard	Limit (ms)
FCC 47 CFR Part 15.247(a) (1)(iii)	< 400

Measurement Result:

For GFSK

Channel	Packet	Dwell Time (ms)		Conclusion
39	DH1	Fig.64	119.80	P
		Fig.65		
	DH3	Fig.66	169.56	P
		Fig.67		
	DH5	Fig.68	204.37	P
		Fig.69		

For π/4 DQPSK

Channel	Packet	Dwell Time (ms)		Conclusion
39	DH1	Fig.70	121.69	P
		Fig.71		
	DH3	Fig.72	160.08	P
		Fig.73		
	DH5	Fig.74	213.25	P
		Fig.75		

For 8DPSK

Channel	Packet	Dwell Time (ms)		Conclusion
39	DH1	Fig.76	122.39	P
		Fig.77		
	DH3	Fig.78	163.27	P

		Fig.79		
	DH5	Fig.80	173.02	P
		Fig.81		

Conclusion: PASS

Test graphs as below:

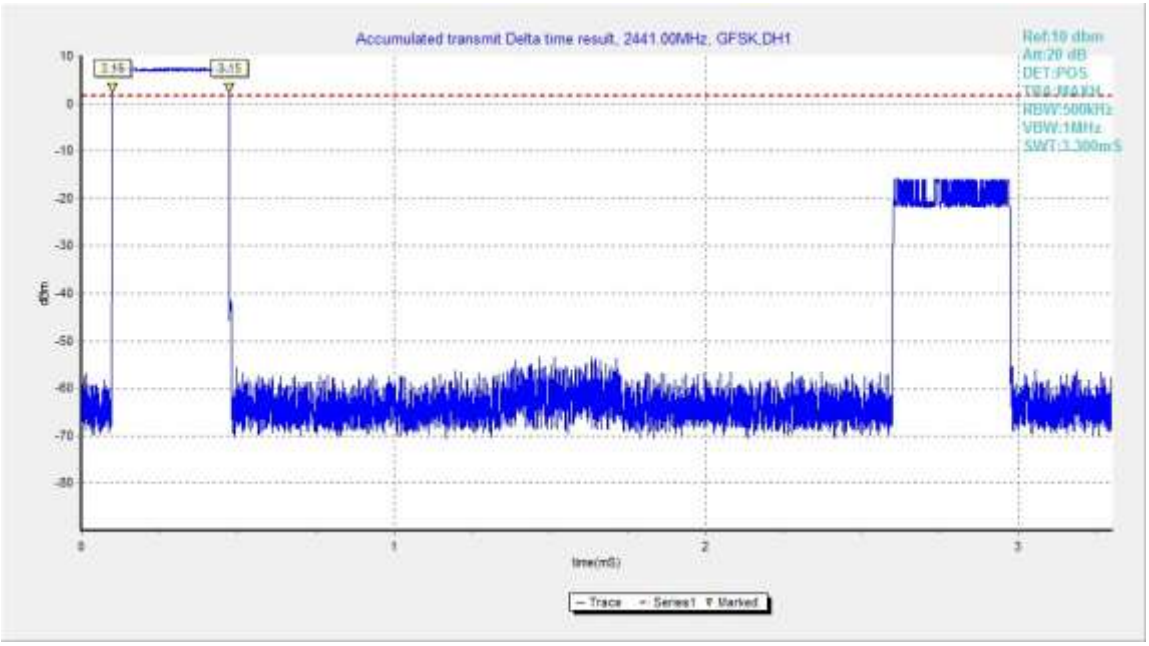


Fig.65. Time of occupancy (Dwell Time): Channel 39, Packet DH1

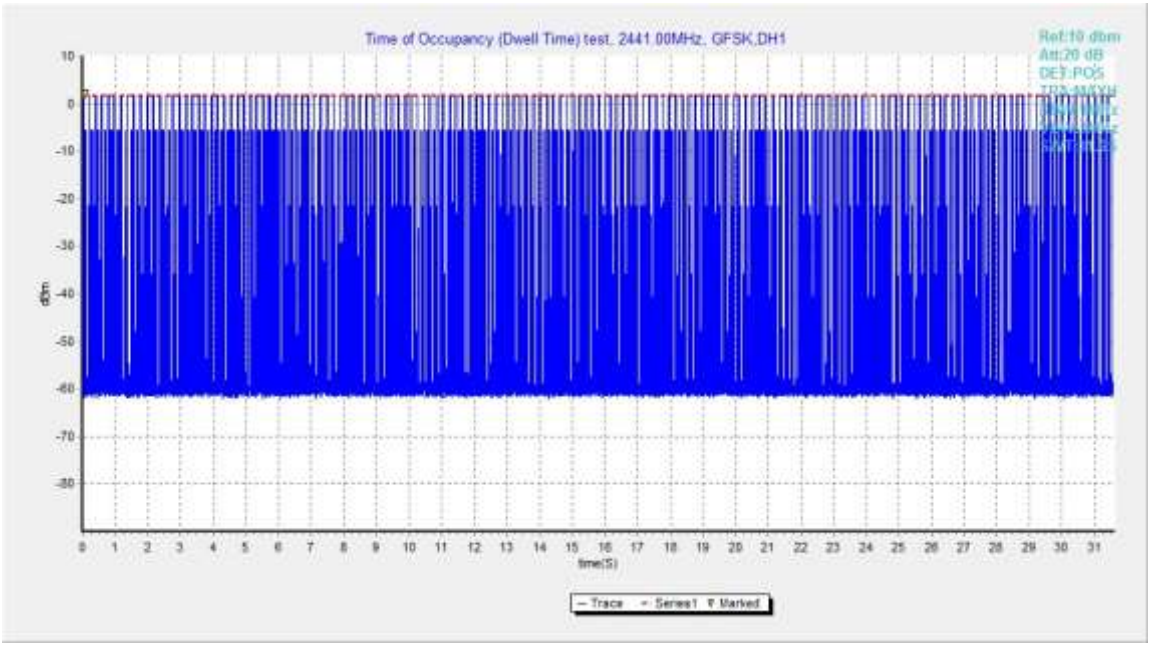


Fig.66. Number of Transmissions Measurement: Channel 39,Packet DH1

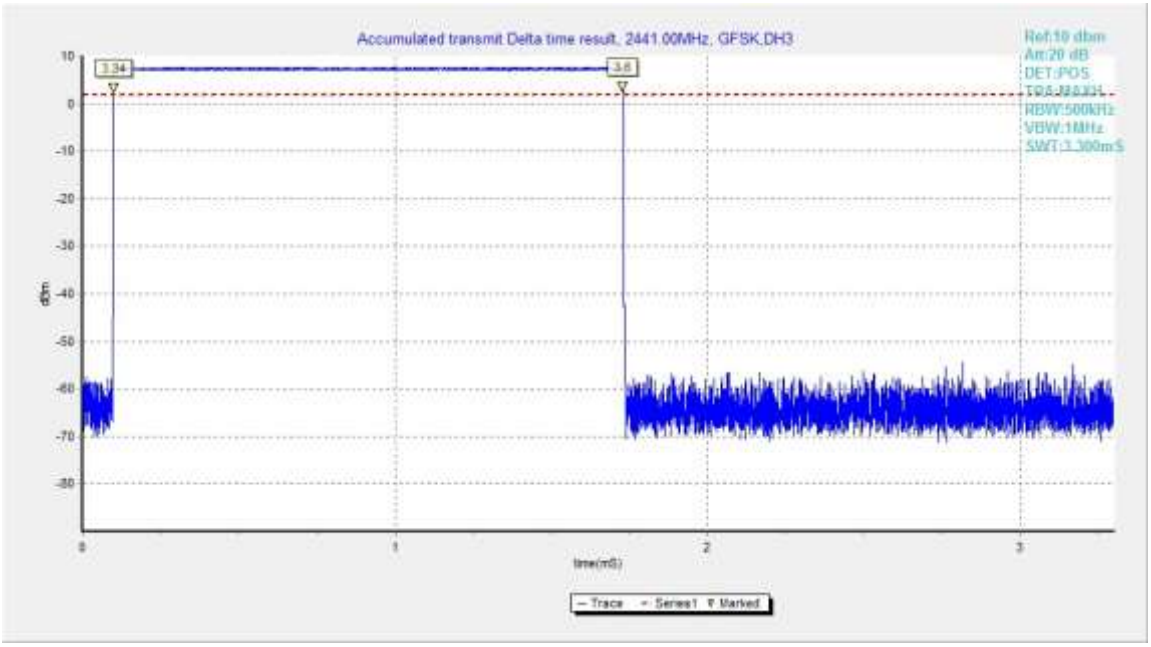


Fig.67. Time of occupancy (Dwell Time): Channel 39, Packet DH3

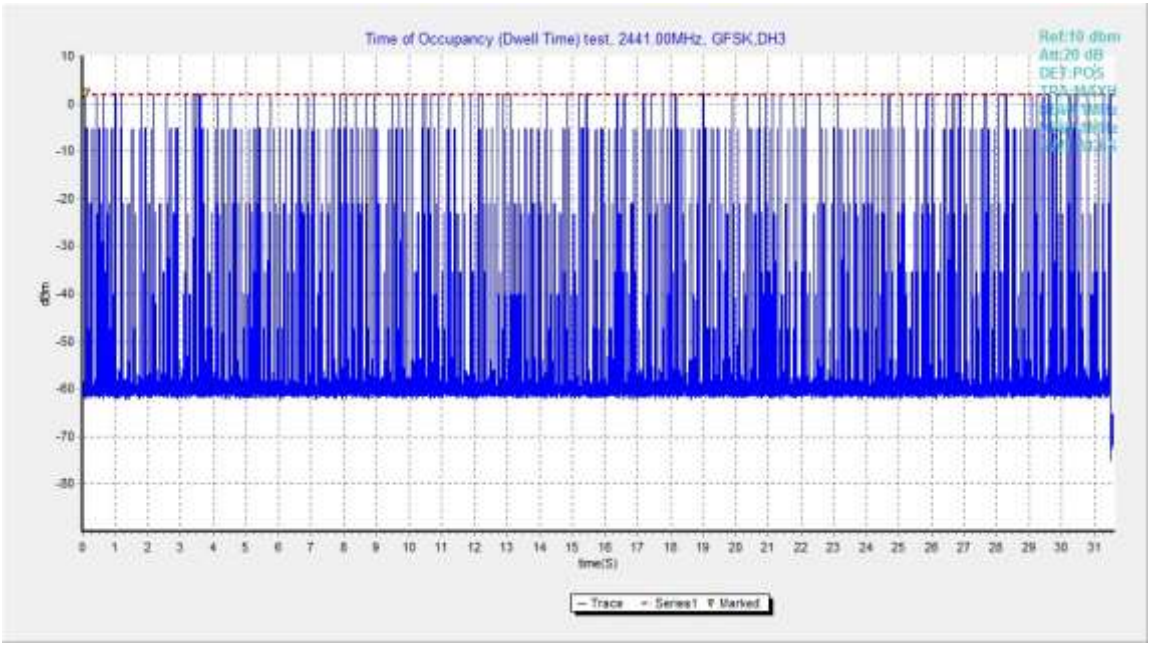


Fig.68. Number of Transmissions Measurement: Channel 39,Packet DH3

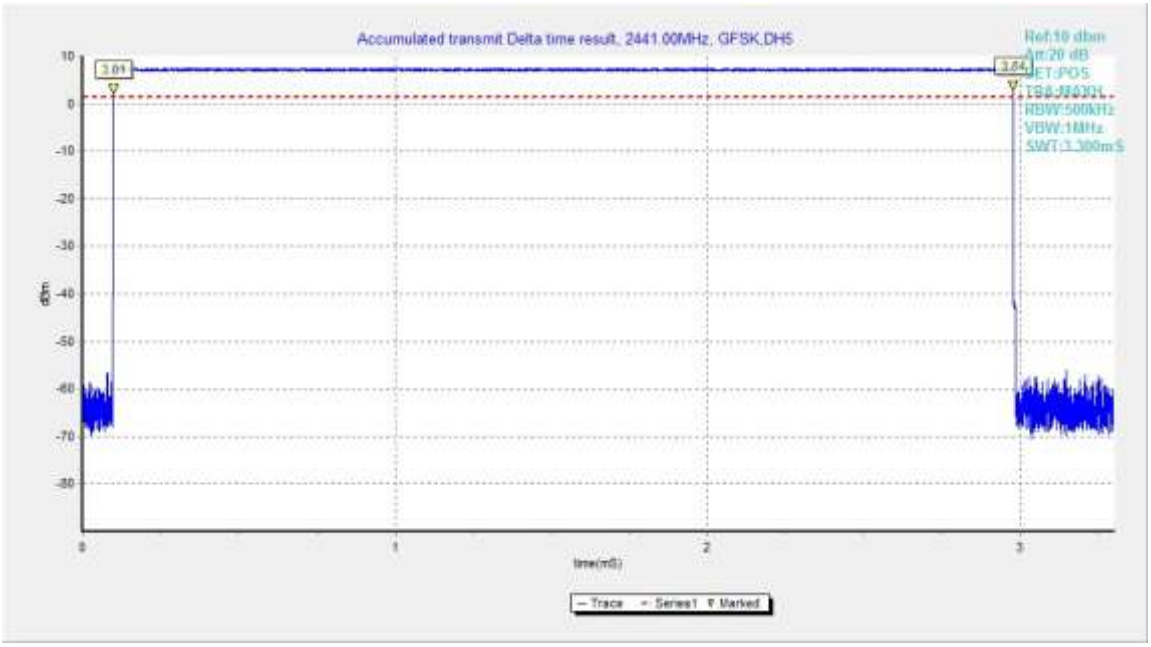


Fig.69. Time of occupancy (Dwell Time): Channel 39, Packet DH5

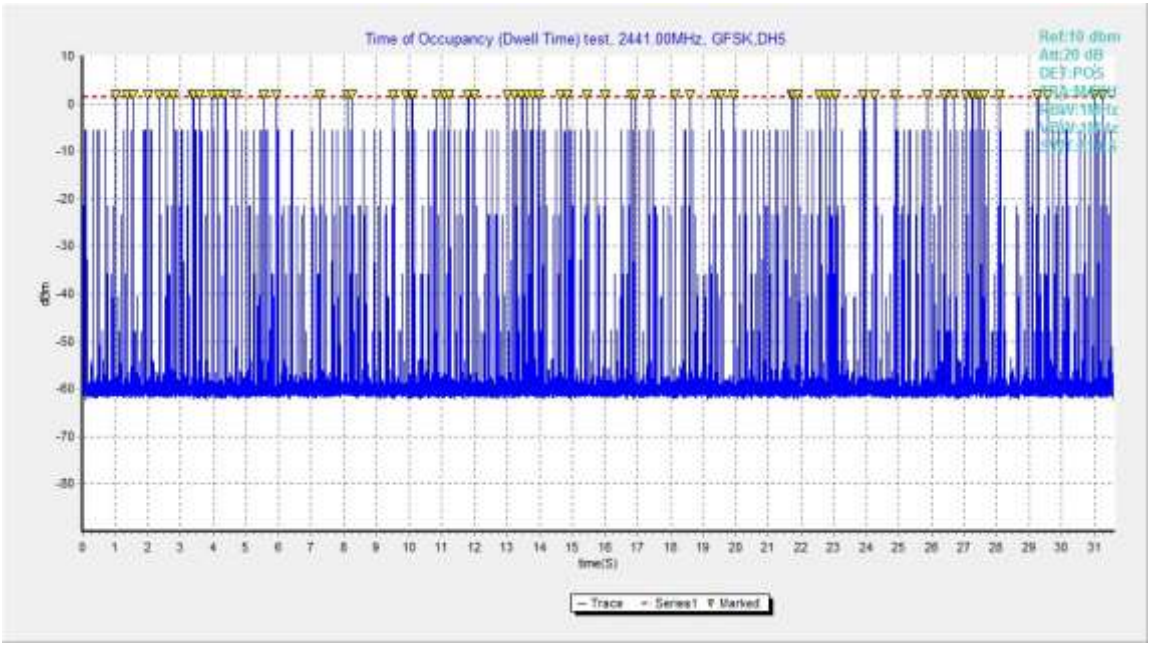


Fig.70. Number of Transmissions Measurement: Channel 39,Packet DH5

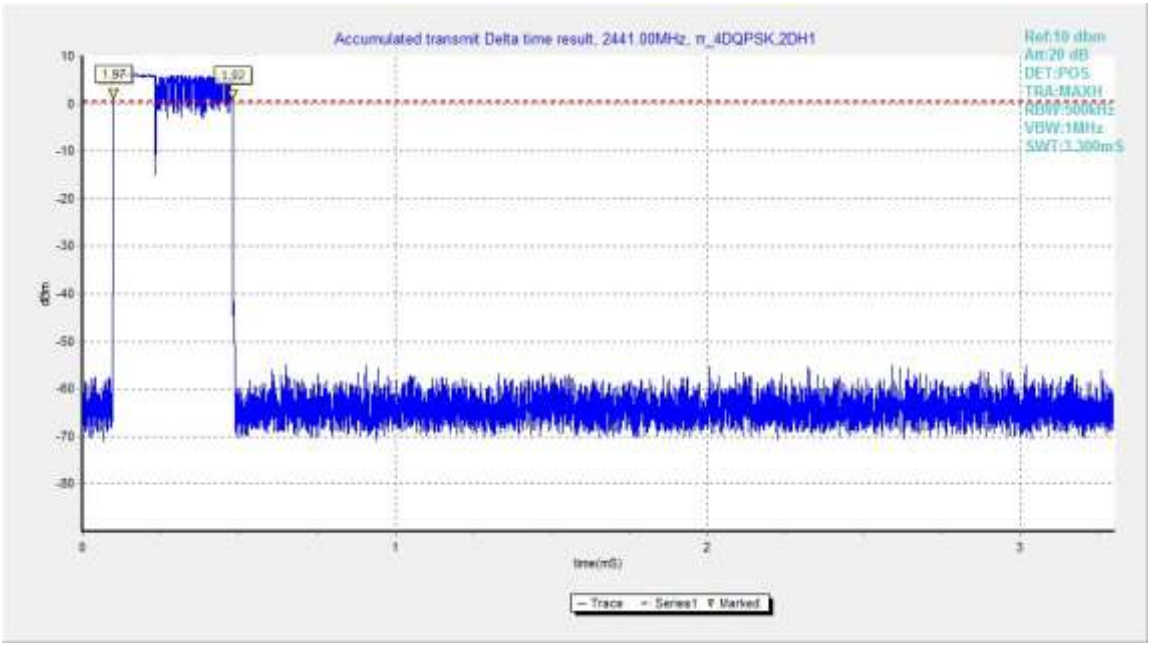


Fig.71. Time of occupancy (Dwell Time): Channel 39, Packet 2-DH1

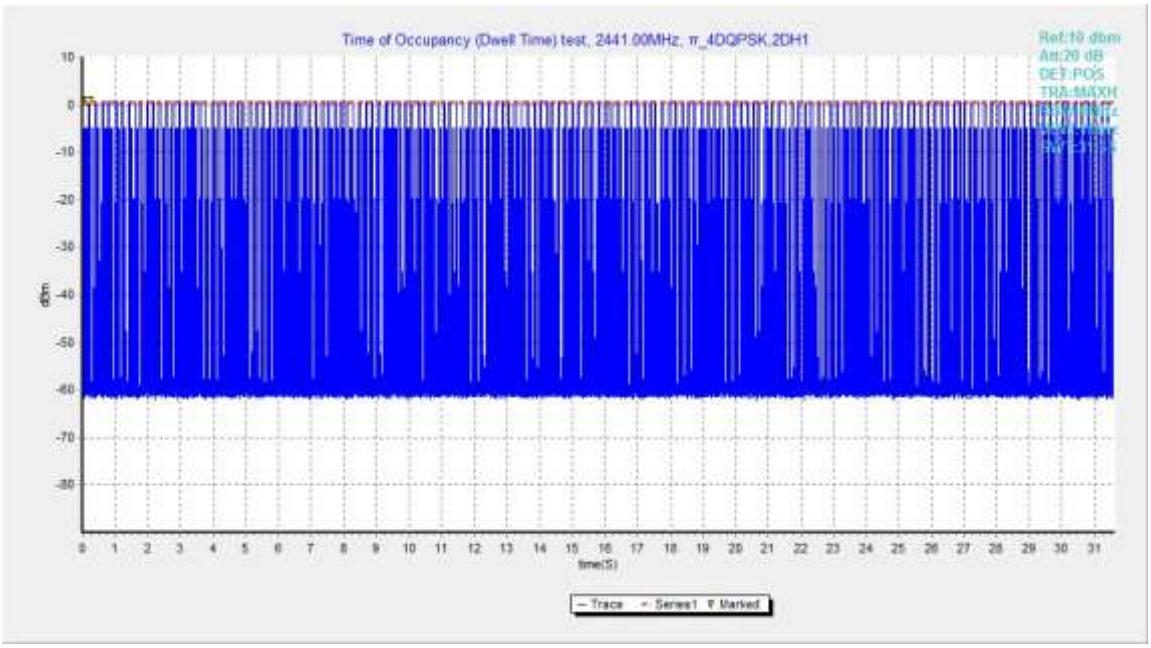


Fig.72. Number of Transmissions Measurement: Channel 39,Packet 2-DH1

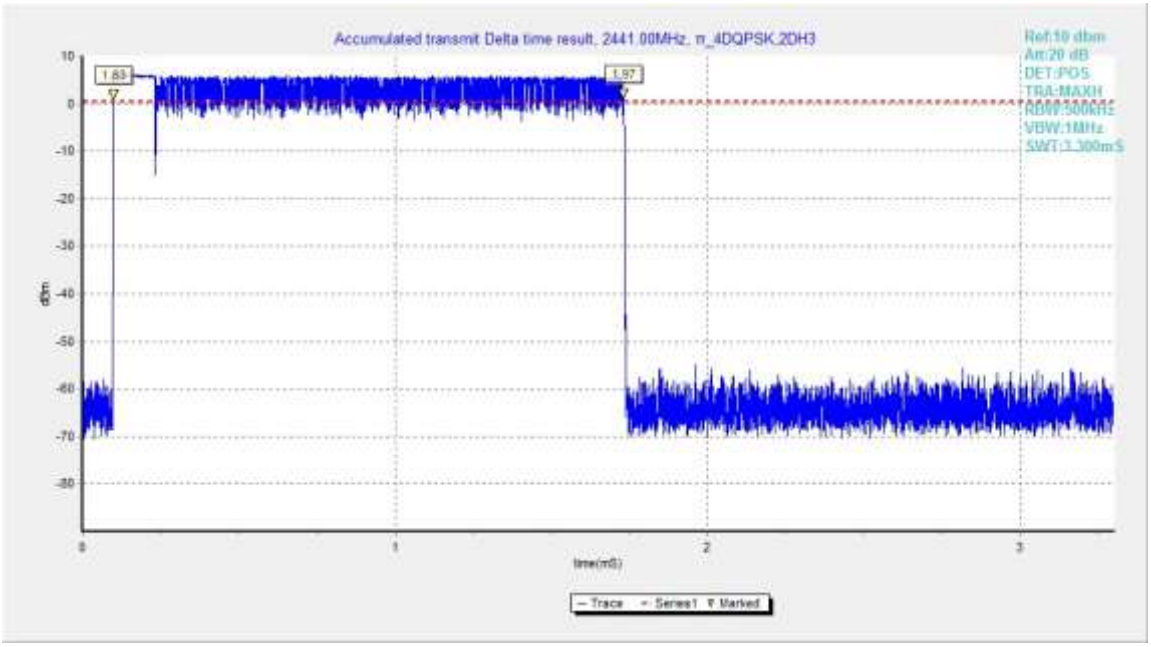


Fig.73. Time of occupancy (Dwell Time): Channel 39, Packet 2-DH3

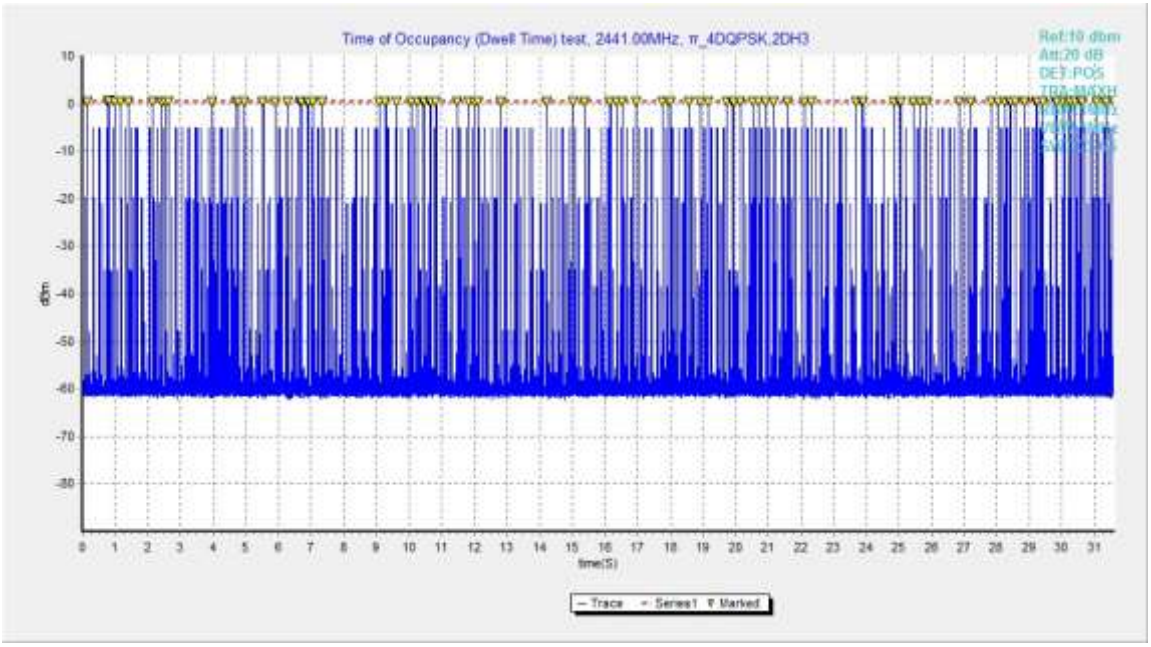


Fig.74. Number of Transmissions Measurement: Channel 39,Packet 2-DH3

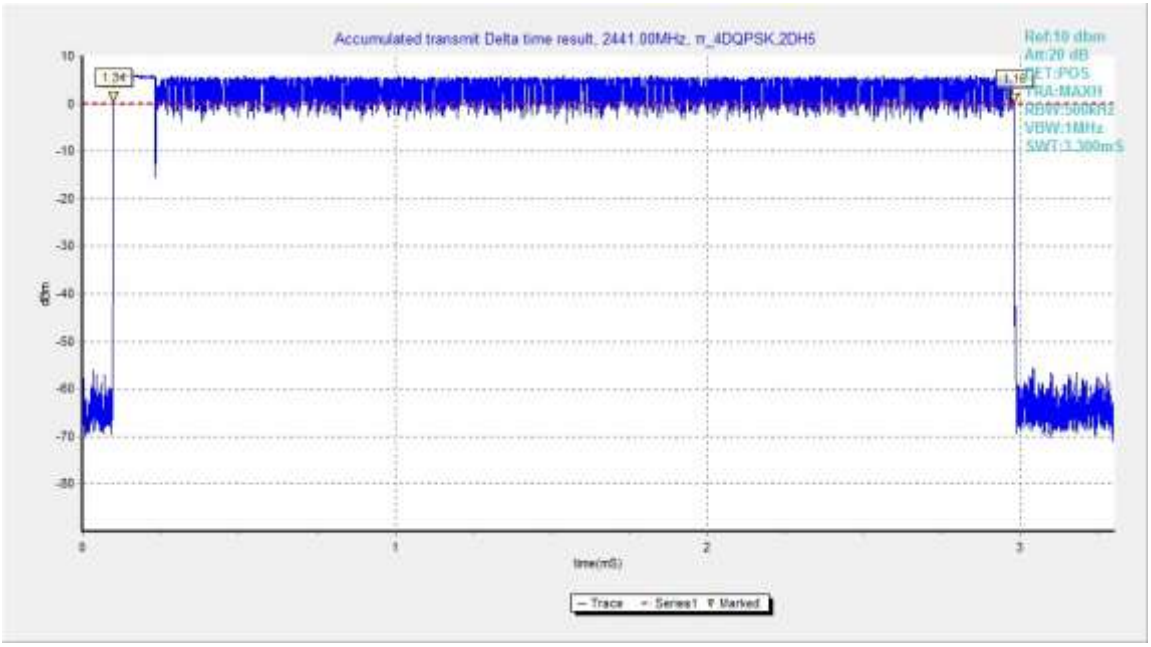


Fig.75. Time of occupancy (Dwell Time): Channel 39, Packet 2-DH5

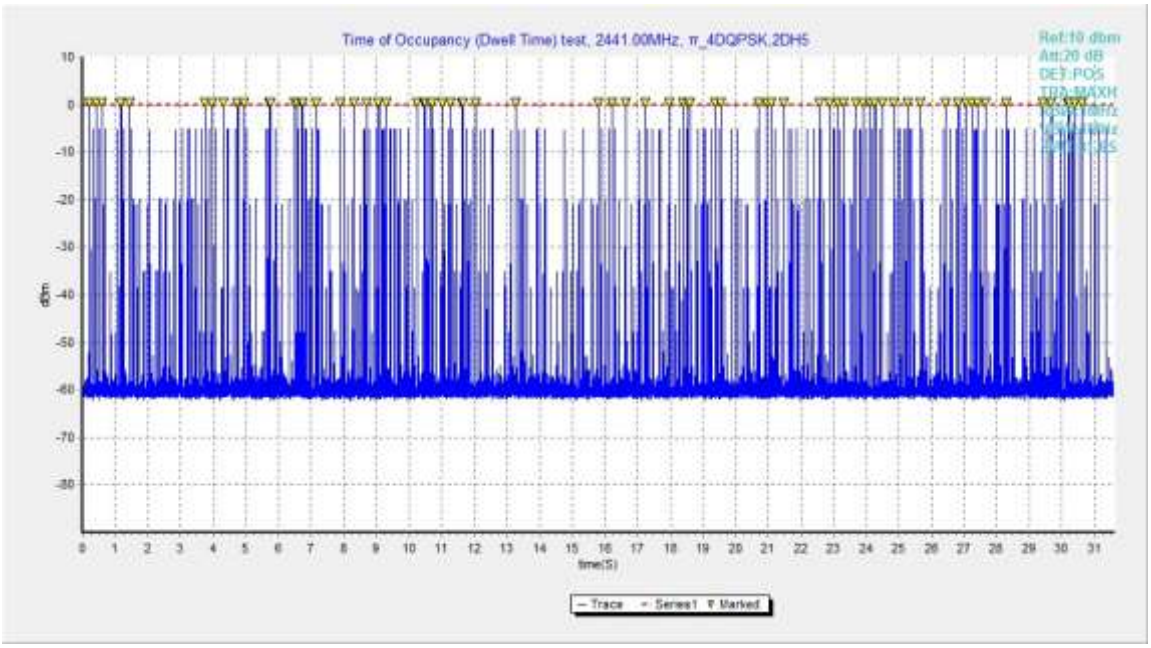


Fig.76. Number of Transmissions Measurement: Channel 39,Packet 2-DH5

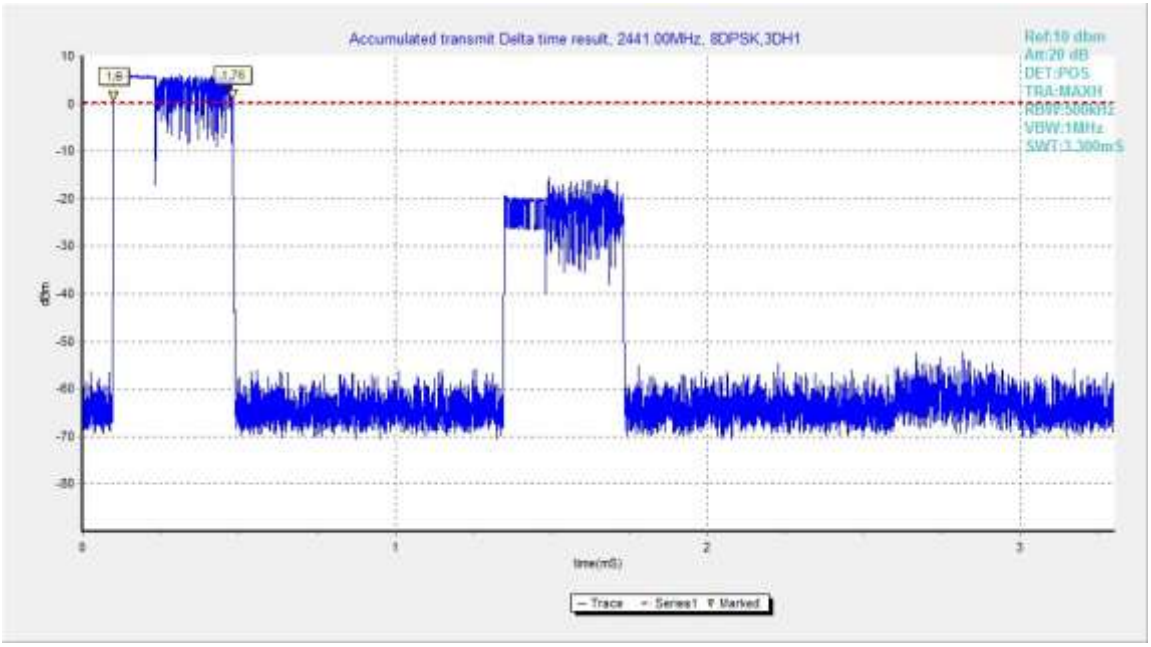


Fig.77. Time of occupancy (Dwell Time): Channel 39, Packet 3-DH1

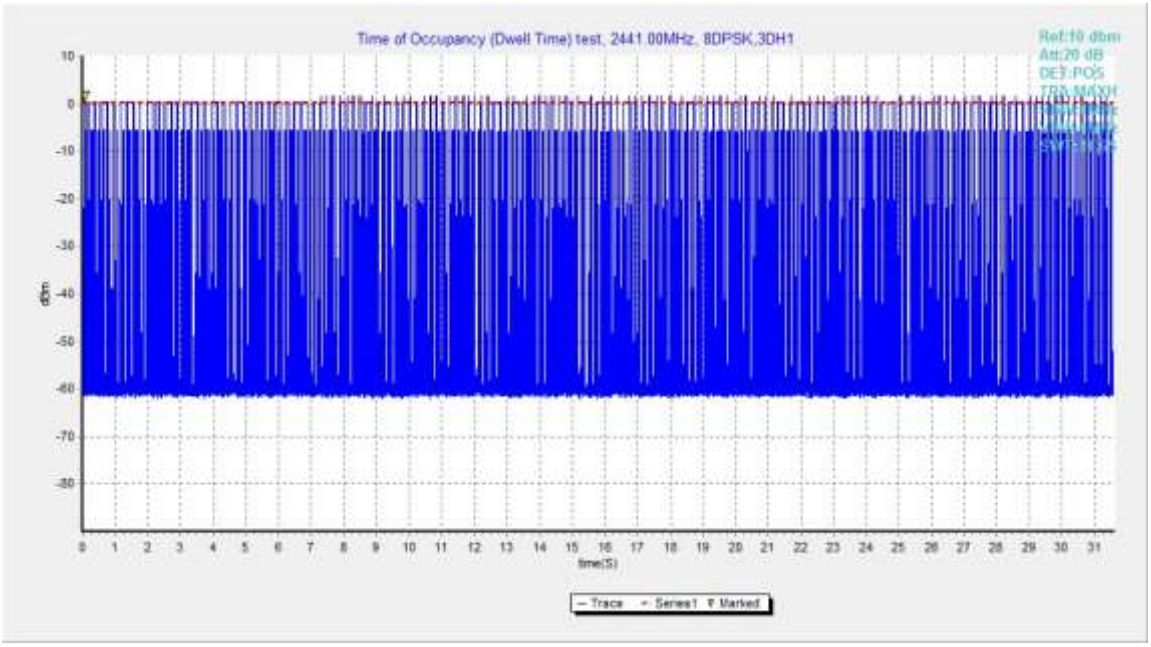


Fig.78. Number of Transmissions Measurement: Channel 39,Packet 3-DH1

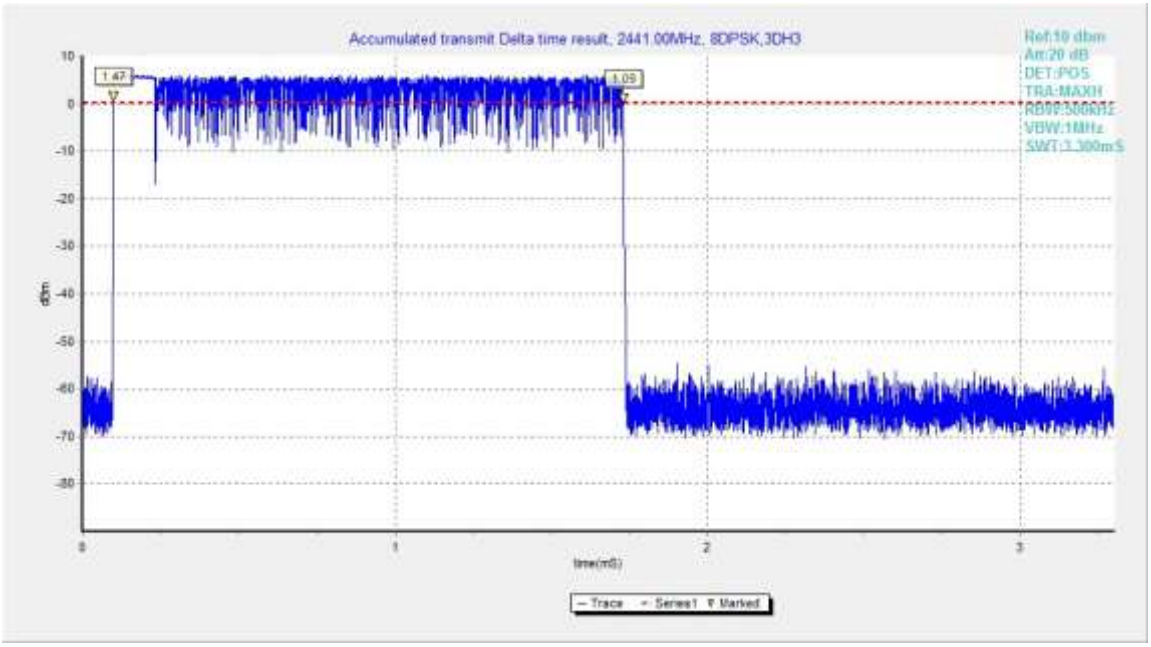


Fig.79. Time of occupancy (Dwell Time): Channel 39, Packet 3-DH3

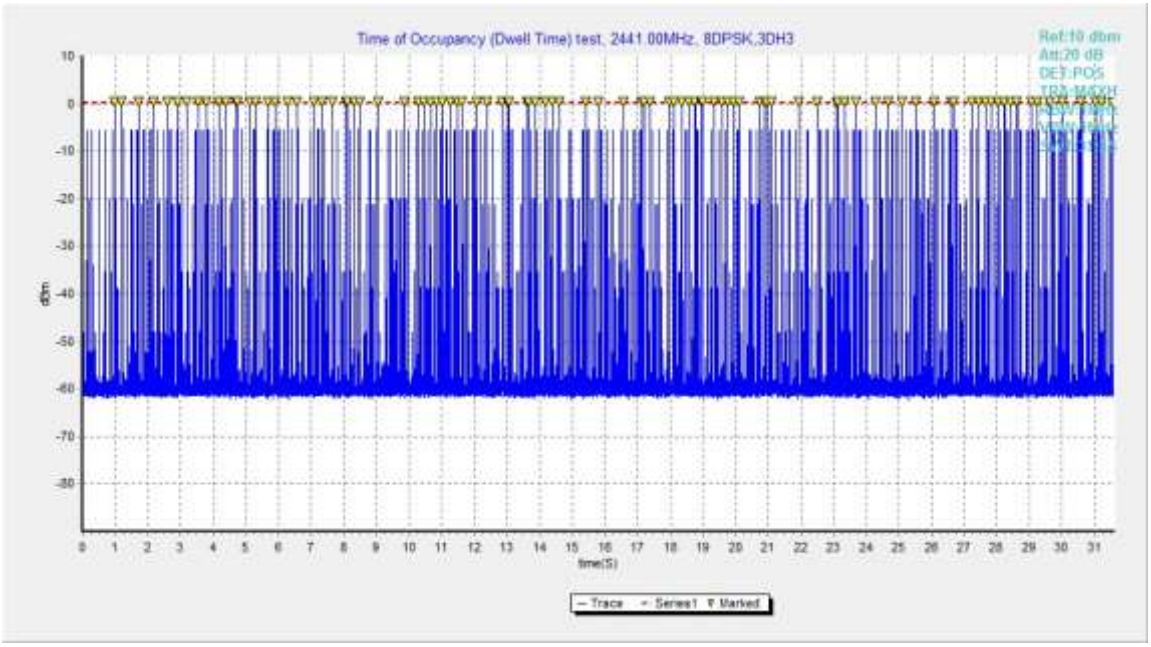


Fig.80. Number of Transmissions Measurement: Channel 39,Packet 3-DH3

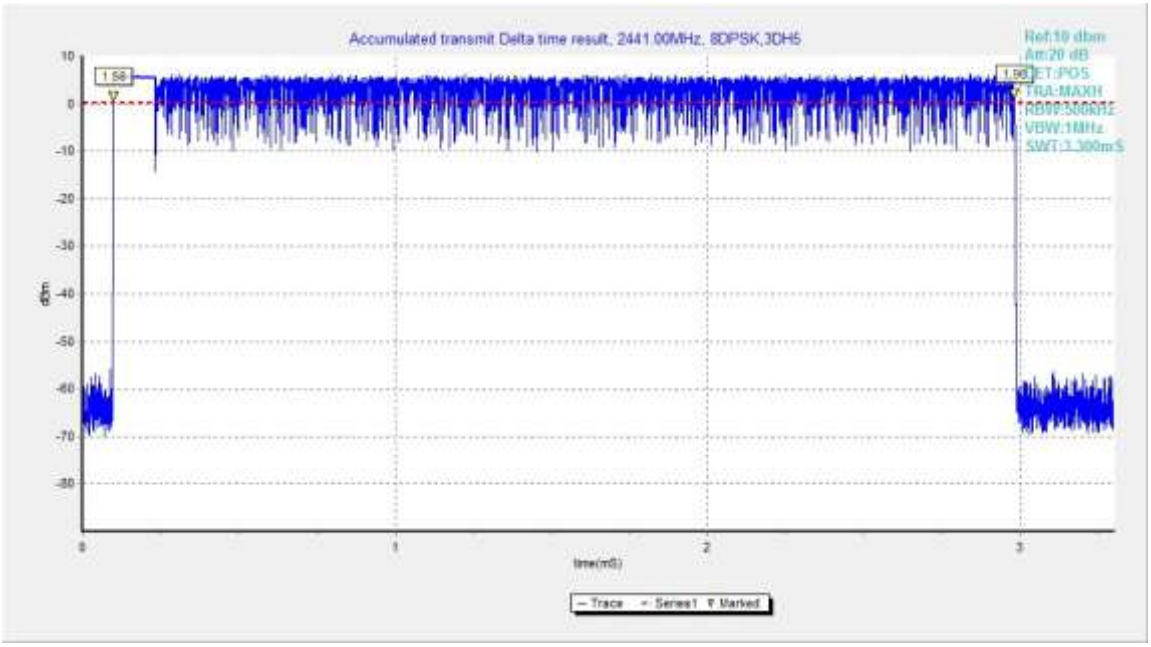


Fig.81. Time of occupancy (Dwell Time): Channel 39, Packet 3-DH5

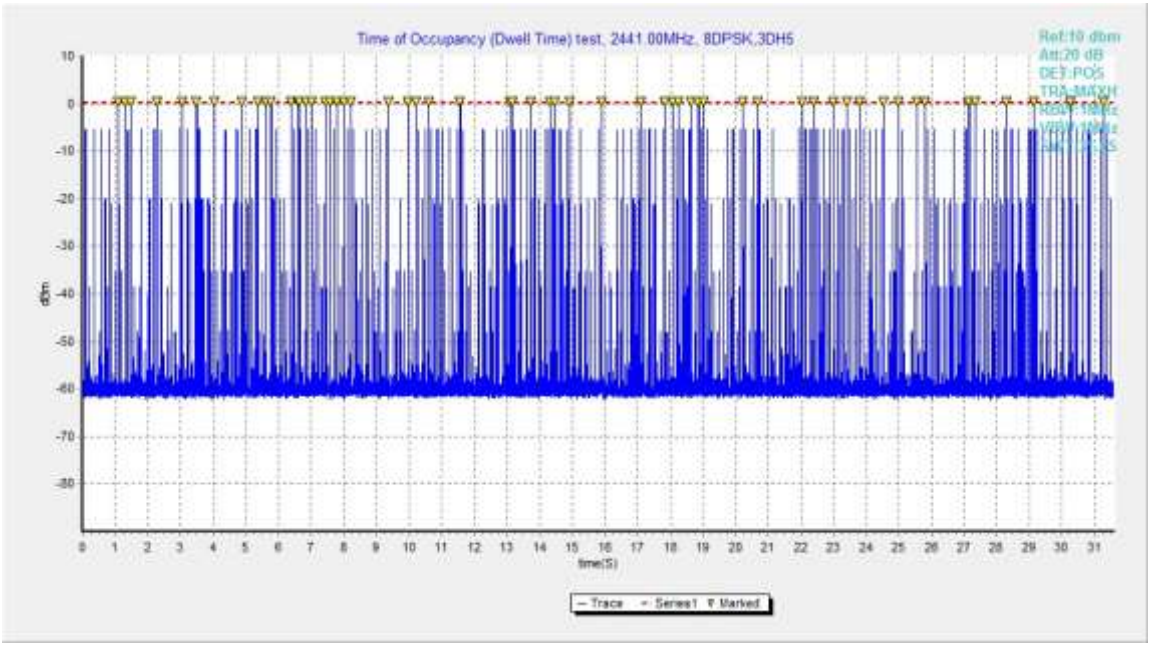


Fig.82. Number of Transmissions Measurement: Channel 39,Packet 3-DH5

A.7. 20dB Bandwidth

Method of Measurement: See ANSI C63.10-clause 6.9.2

Measurement Procedure - Unwanted Emissions

1. Set RBW = 30kHz.

2. Set VBW = 100 kHz.

3. Set span to 3MHz

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).

Measurement Limit:

Standard	Limit
FCC 47 CFR Part 15.247(a)(1)	NA *

Use NdB Down function of the SA to measure the 20dB Bandwidth

* Comment: This test case is not required according to the latest FCC 47 CFR Part 15.247. But the test results are necessary for “carrier frequency separation” test case, in Annex A.8.

Measurement Results:

For GFSK

Channel	20dB Bandwidth (kHz)		Conclusion
0	Fig.82	948.75	NA
39	Fig.83	946.50	NA
78	Fig.84	1017.75	NA

For π/4 DQPSK

Channel	20dB Bandwidth (kHz)		Conclusion
0	Fig.85	1272.00	NA
39	Fig.86	1268.25	NA
78	Fig.87	1268.25	NA

For 8DPSK

Channel	20dB Bandwidth (kHz)		Conclusion
0	Fig.88	1277.25	NA
39	Fig.89	1276.50	NA
78	Fig.90	1275.00	NA

Conclusion: NA

Test graphs as below:

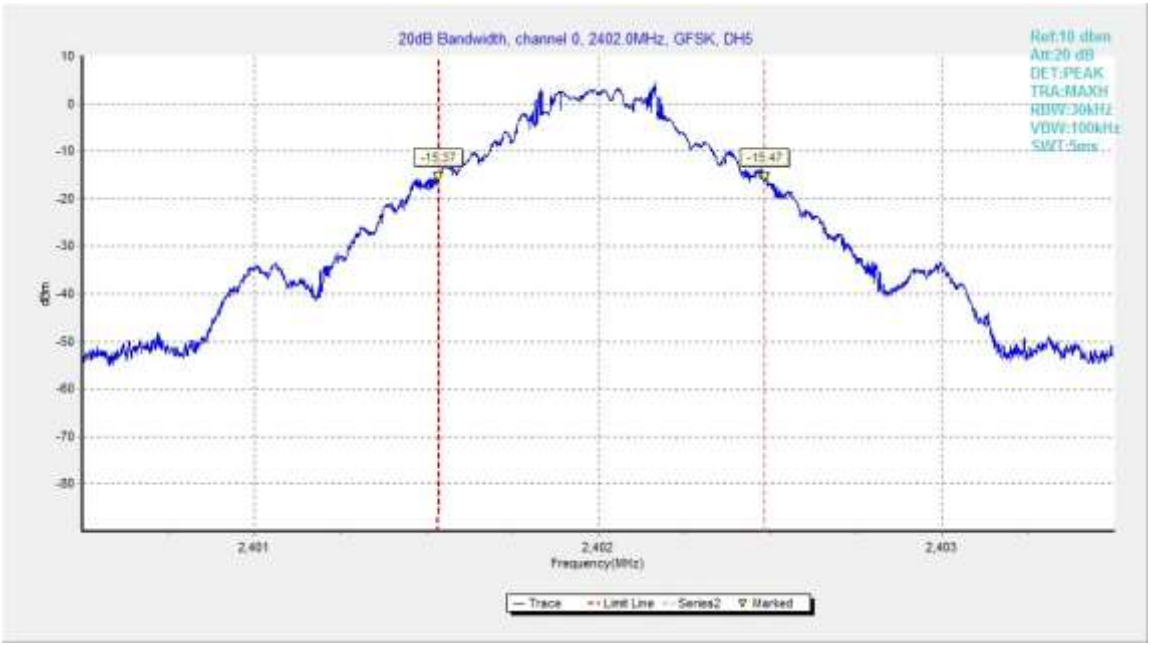


Fig.83. 20dB Bandwidth: GFSK, Channel 0

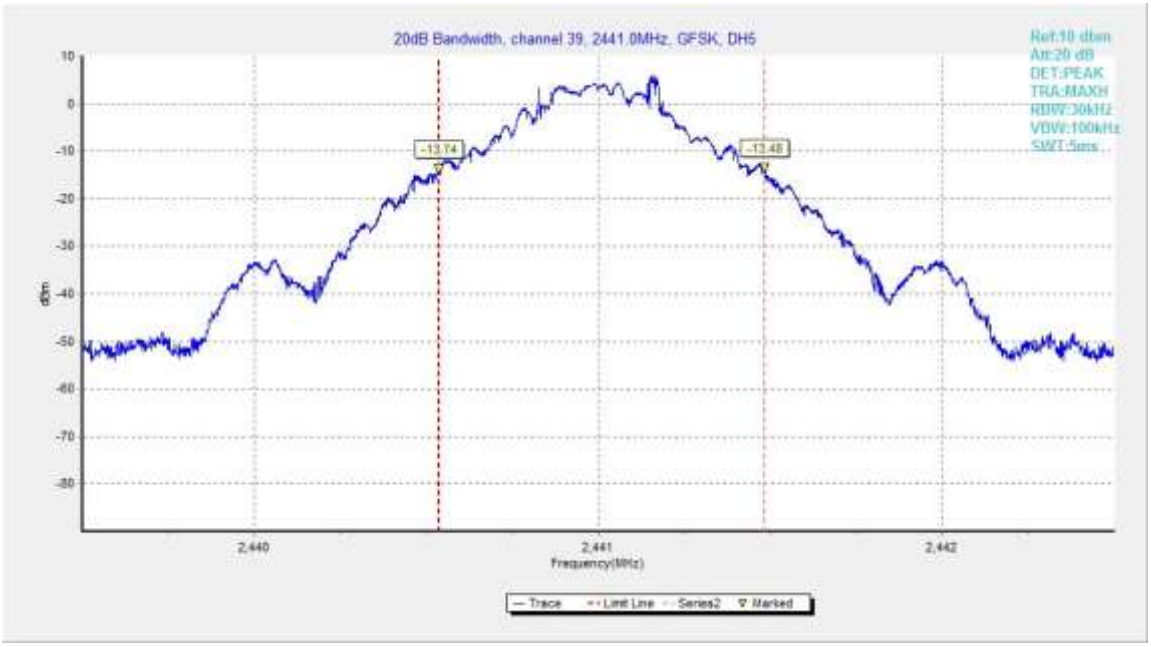


Fig.84. 20dB Bandwidth: GFSK, Channel 39

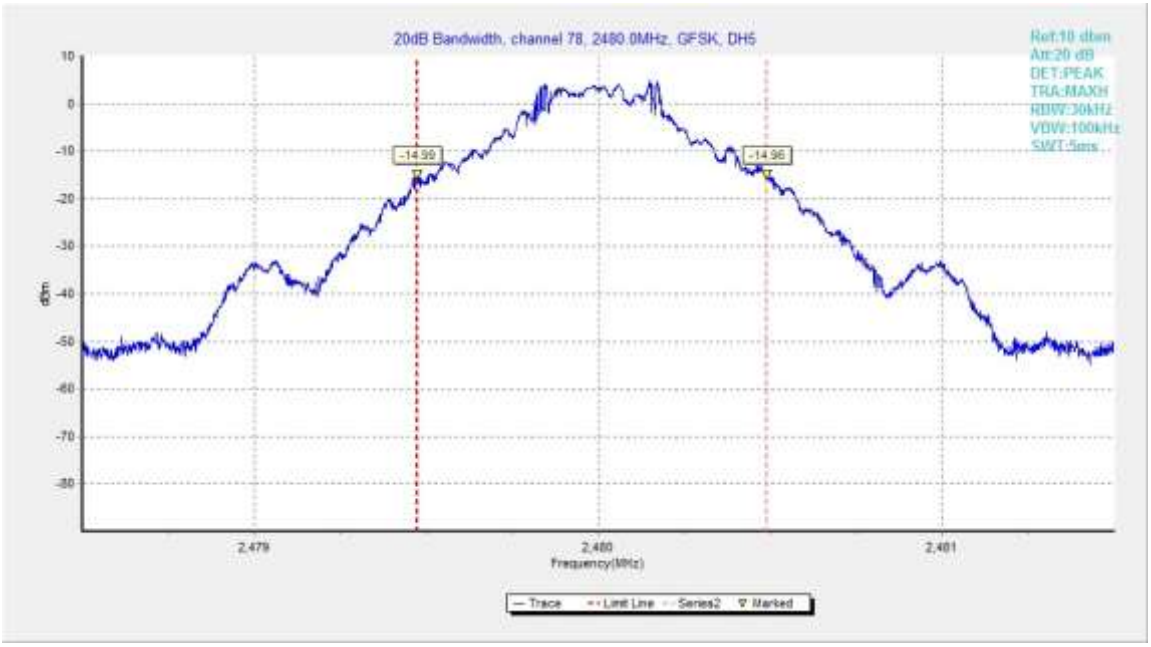


Fig.85. 20dB Bandwidth: GFSK, Channel 78

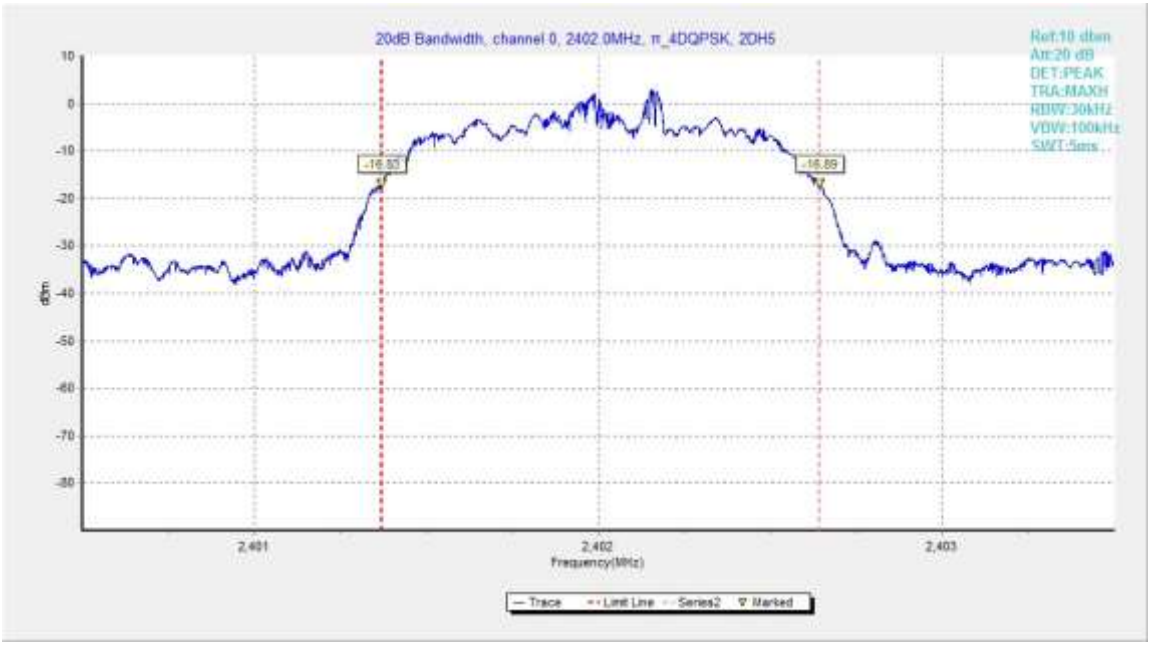


Fig.86. 20dB Bandwidth: π/4 DQPSK, Channel 0

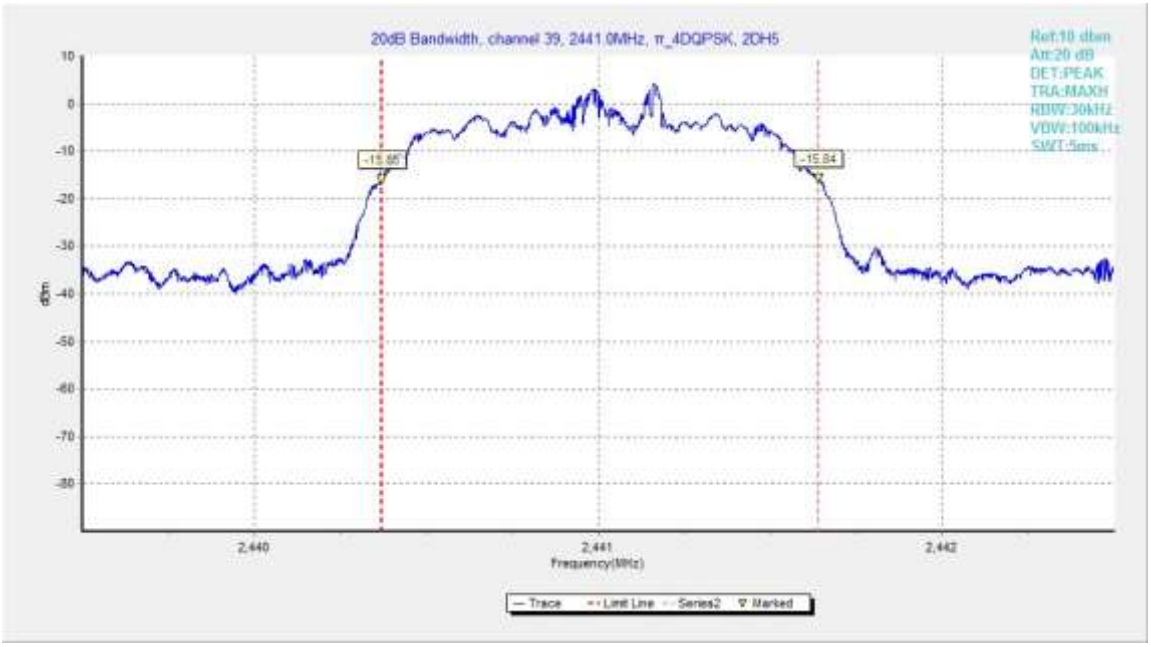


Fig.87. 20dB Bandwidth: π/4 DQPSK, Channel 39

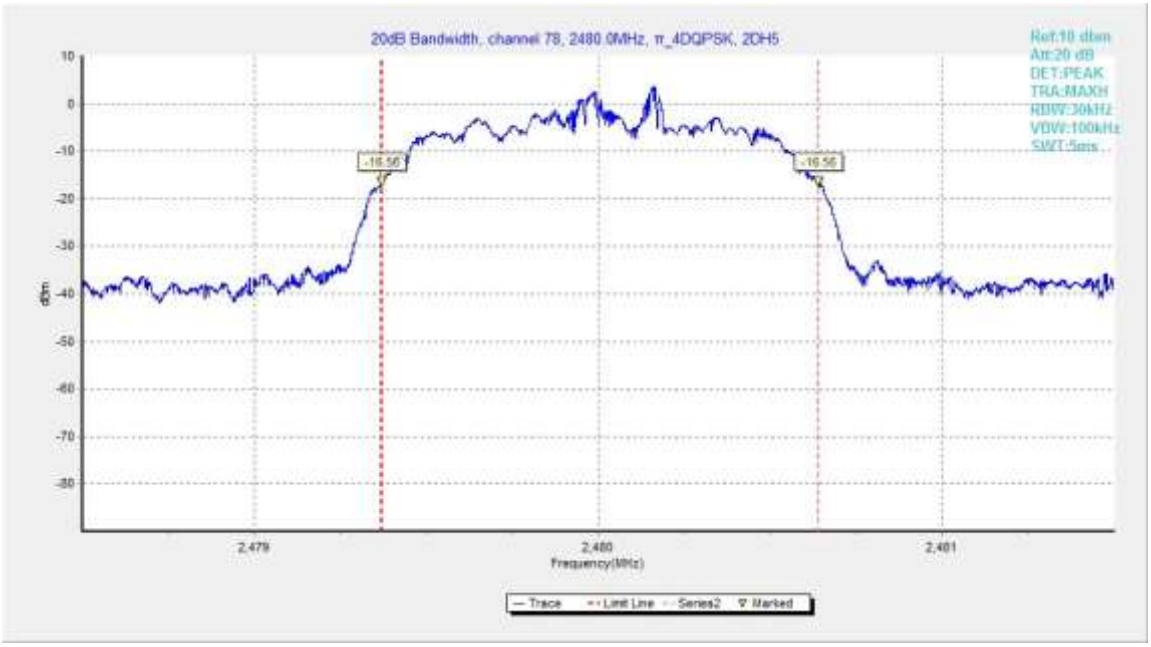


Fig.88. 20dB Bandwidth: π/4 DQPSK, Channel 78

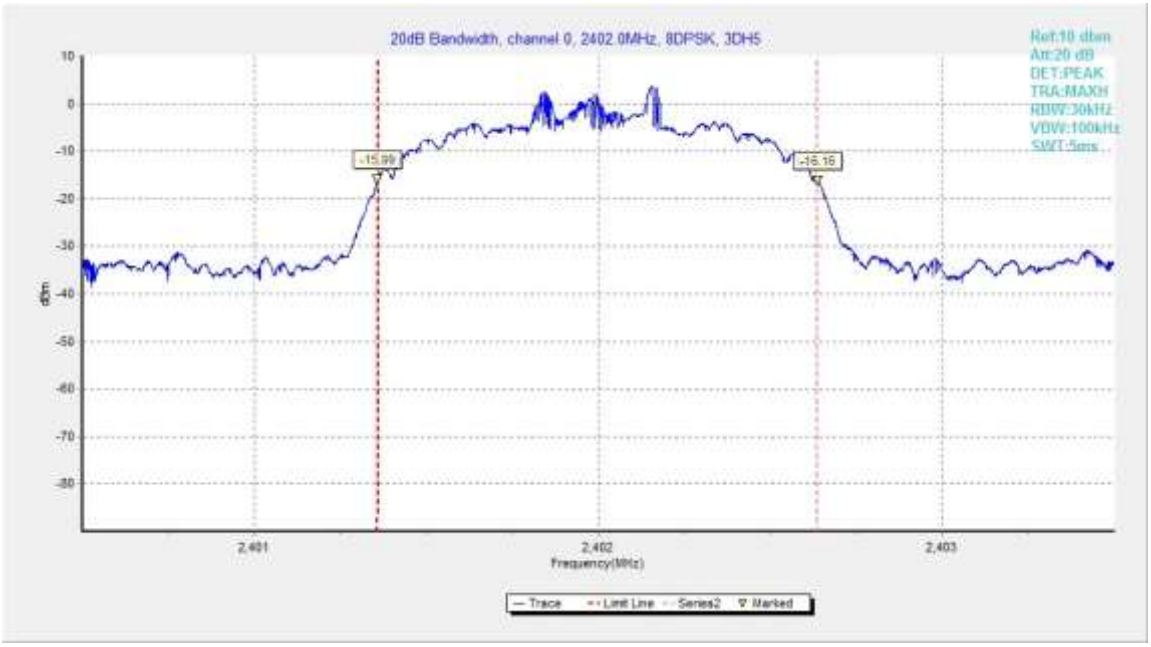


Fig.89. 20dB Bandwidth: 8DPSK, Channel 0

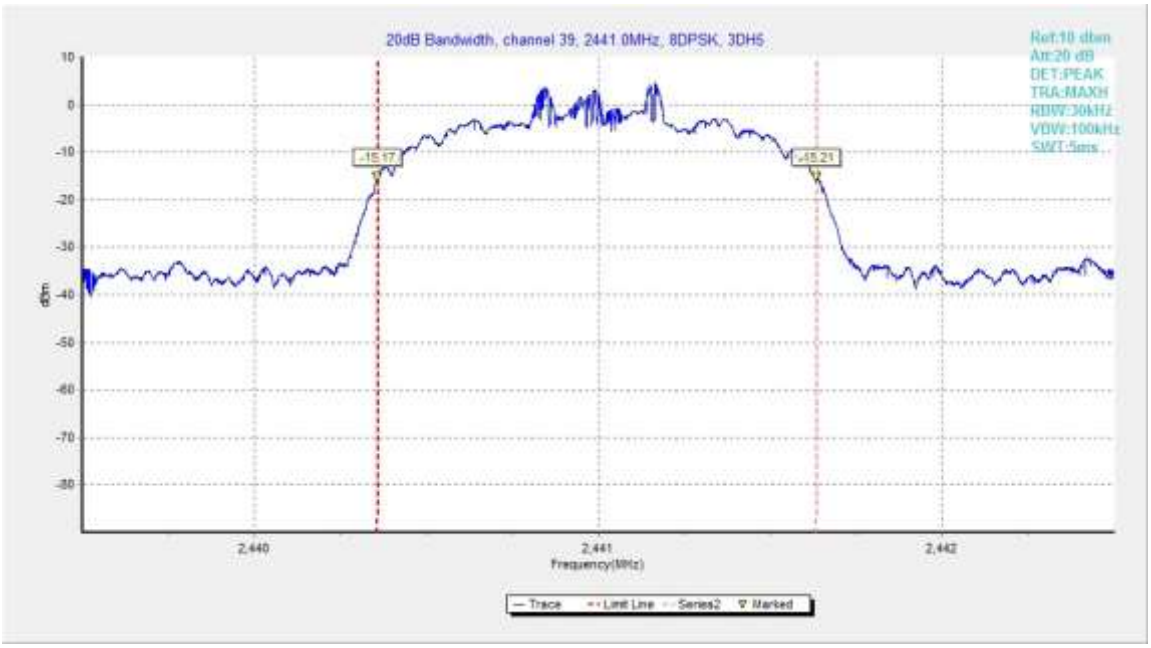


Fig.90. 20dB Bandwidth: 8DPSK, Channel 39

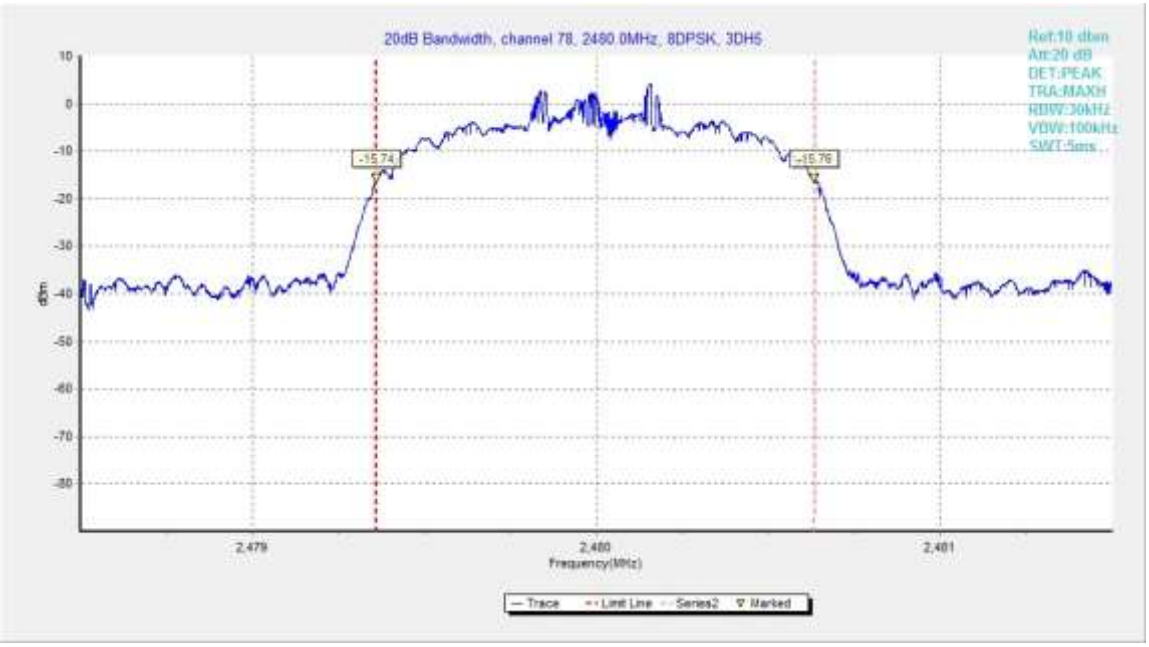


Fig.91. 20dB Bandwidth: 8DPSK, Channel 78

A.8. Carrier Frequency Separation

Method of Measurement: See ANSI C63.10-clause 7.8.2

The EUT must have its hopping function enabled. Use the following spectrum analyzer settings:

- Span = 3MHz
- RBW=300kHz
- VBW=300kHz
- Sweep = auto
- Detector function = peak
- Trace = max hold
- Allow the trace to stabilize

Search the peak marks of the middle frequency and adjacent channel, then record the separation between them.

* Comment: This limit should be over 25 kHz or (2/3) * 20dB bandwidth, whichever is greater.

Measurement Limit:

Standard	Limit(kHz)
FCC 47 CFR Part 15.247(a)(1)	over 25 kHz or (2/3) * 20dB bandwidth

Measurement Result:

For GFSK

Channel	Carrier frequency separation (kHz)		Conclusion
39	Fig.91	981.75	P

For π/4 DQPSK

Channel	Carrier frequency separation (kHz)		Conclusion
39	Fig.92	1047.00	P

For 8DPSK

Channel	Carrier frequency separation (kHz)		Conclusion
39	Fig.93	1023.00	P

Conclusion: PASS

Test graphs as below:

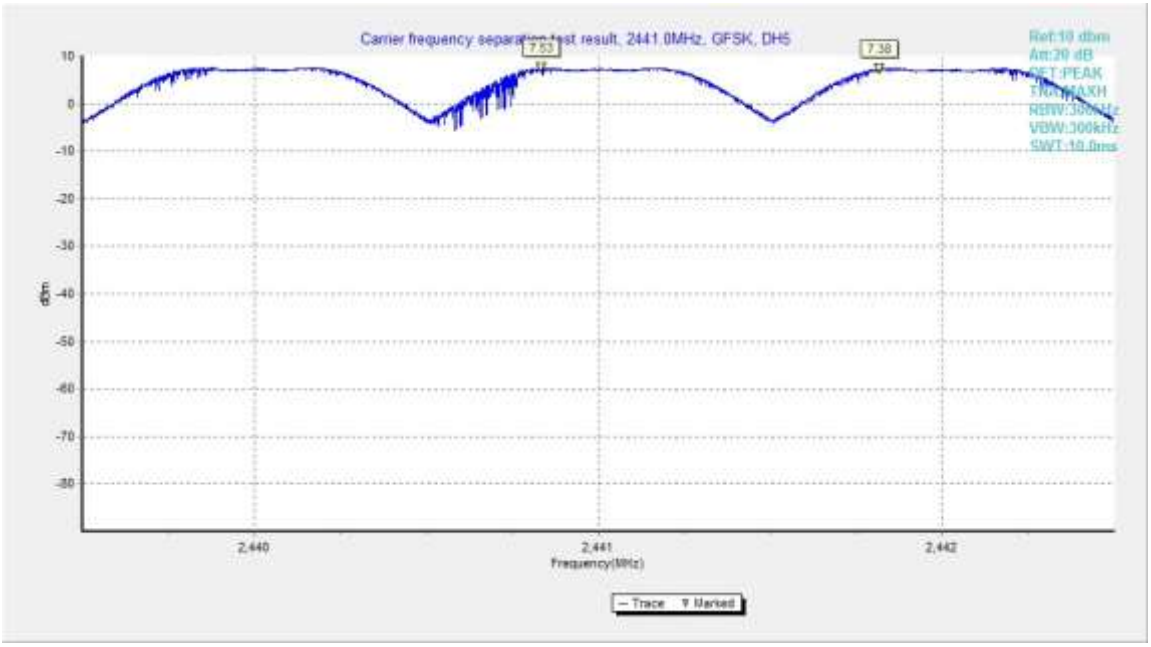


Fig.92. Carrier frequency separation measurement: GFSK, Channel 39

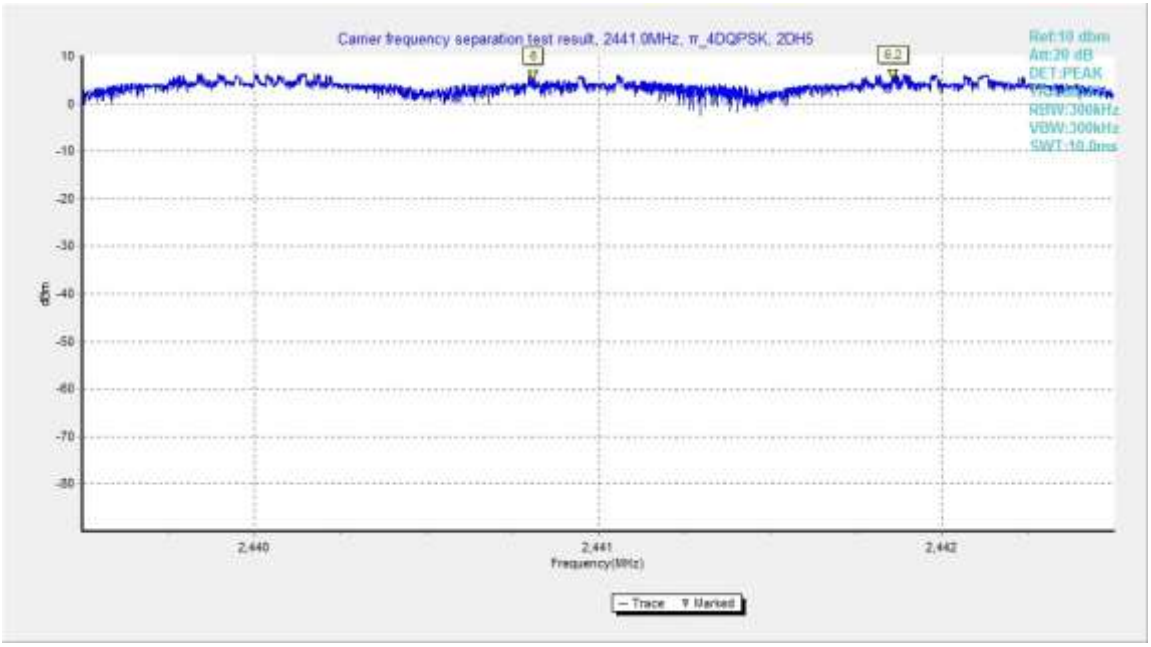


Fig.93. Carrier frequency separation measurement: π/4 DQPSK, Channel 39

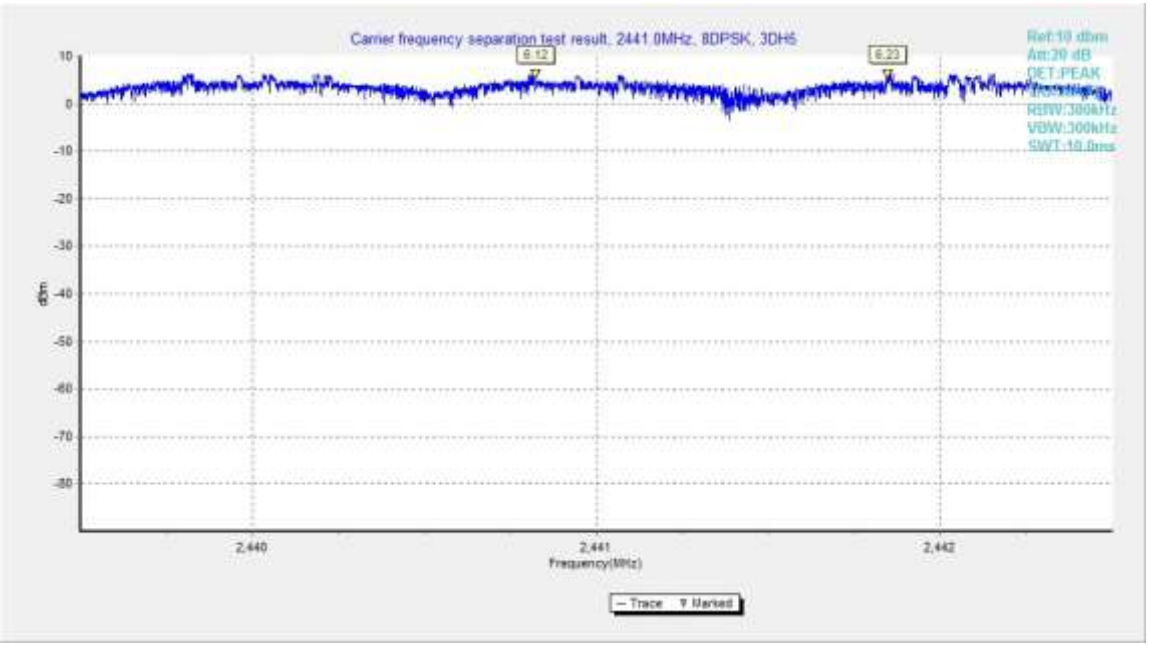


Fig.94. Carrier frequency separation measurement: 8DPSK, Channel 39

A.9. Number of Hopping Channels

Method of Measurement: See ANSI C63.10-clause 7.8.3

The EUT must have its hopping function enabled. Use the following spectrum analyzer settings:

- Span = the frequency band of operation
- RBW = 500kHz
- VBW = 500kHz
- Sweep = auto
- Detector function = peak
- Trace = max hold
- Allow the trace to stabilize

It might prove necessary to break the span up into subranges to show clearly all of the hopping frequencies. Compliance of an EUT with the appropriate regulatory limit shall be determined for the number of hopping channels. A plot of the data shall be included in the test report.

Measurement Limit:

Standard	Limit
FCC 47 CFR Part 15.247(a) (1)(iii)	At least 15 non-overlapping channels

Measurement Result:

For GFSK

Channel	Number of hopping channels		Conclusion
0~39	Fig.94	79	P
40~78	Fig.95		

Forπ/4 DQPSK

Channel	Number of hopping channels		Conclusion
0~39	Fig.96	79	P
40~78	Fig.97		

For 8DPSK

Channel	Number of hopping channels		Conclusion
0~39	Fig.98	79	P
40~78	Fig.99		

Conclusion: PASS

Test graphs as below:

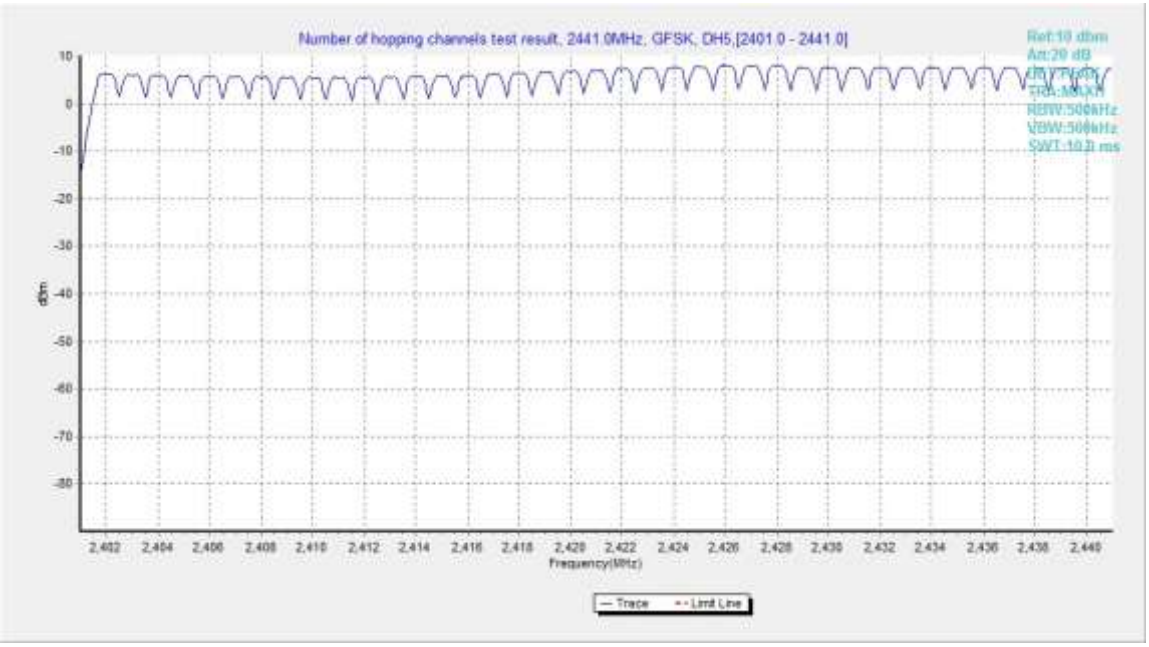


Fig.95. Number of hopping frequencies: GFSK, Channel 0 - 39

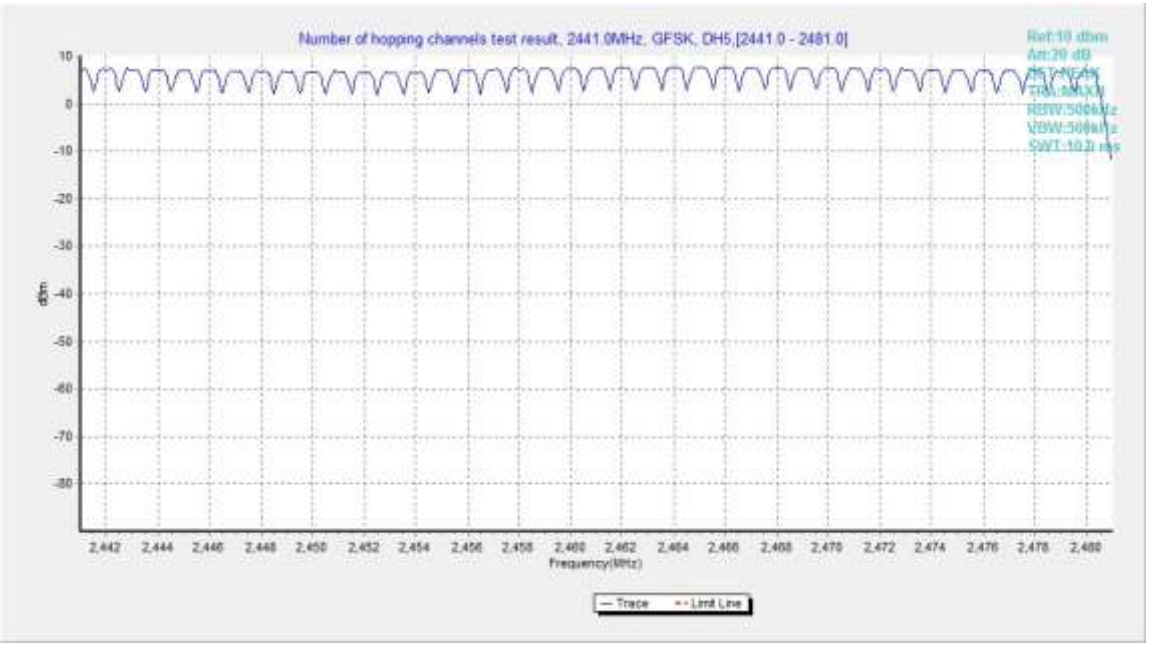


Fig.96. Number of hopping frequencies: GFSK, Channel 40 - 78

Fig.97. Number of hopping frequencies: π/4 DQPSK, Channel 0 - 39

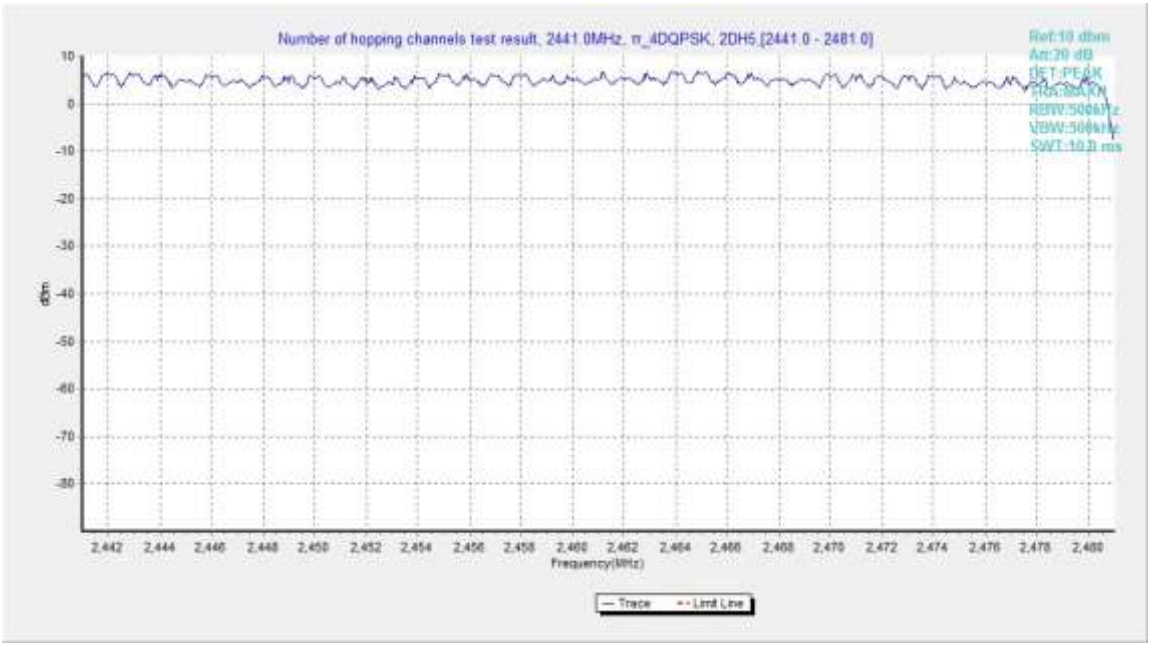


Fig.98. Number of hopping frequencies: π/4 DQPSK, Channel 40 - 78

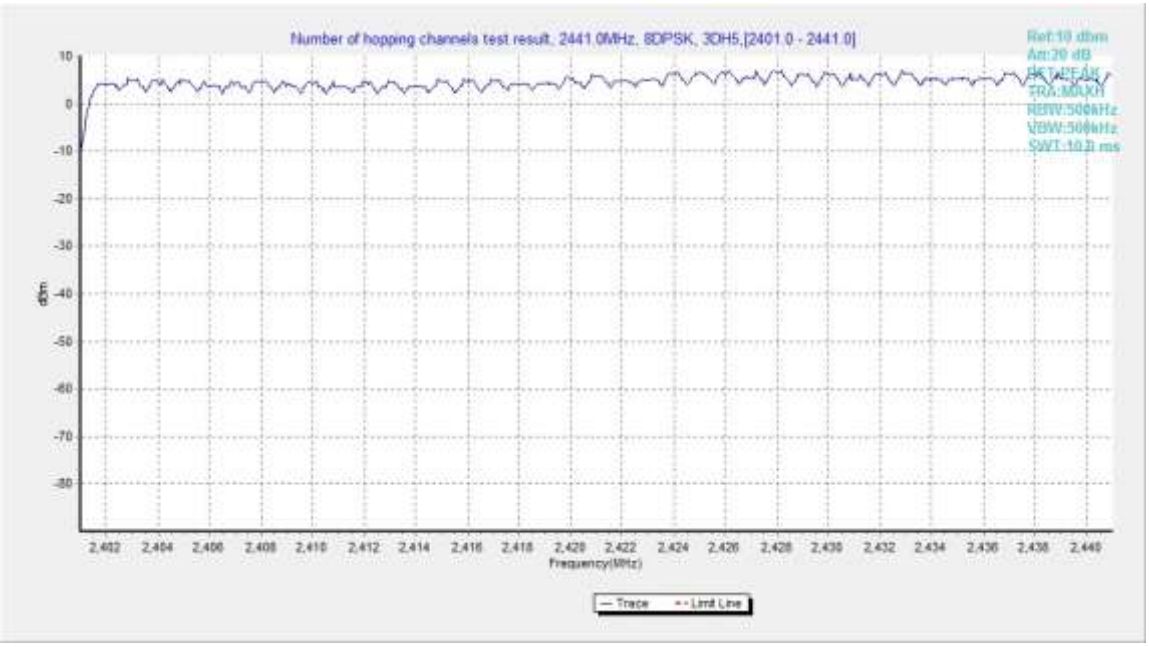


Fig.99. Number of hopping frequencies: 8DPSK, Channel 0 - 39

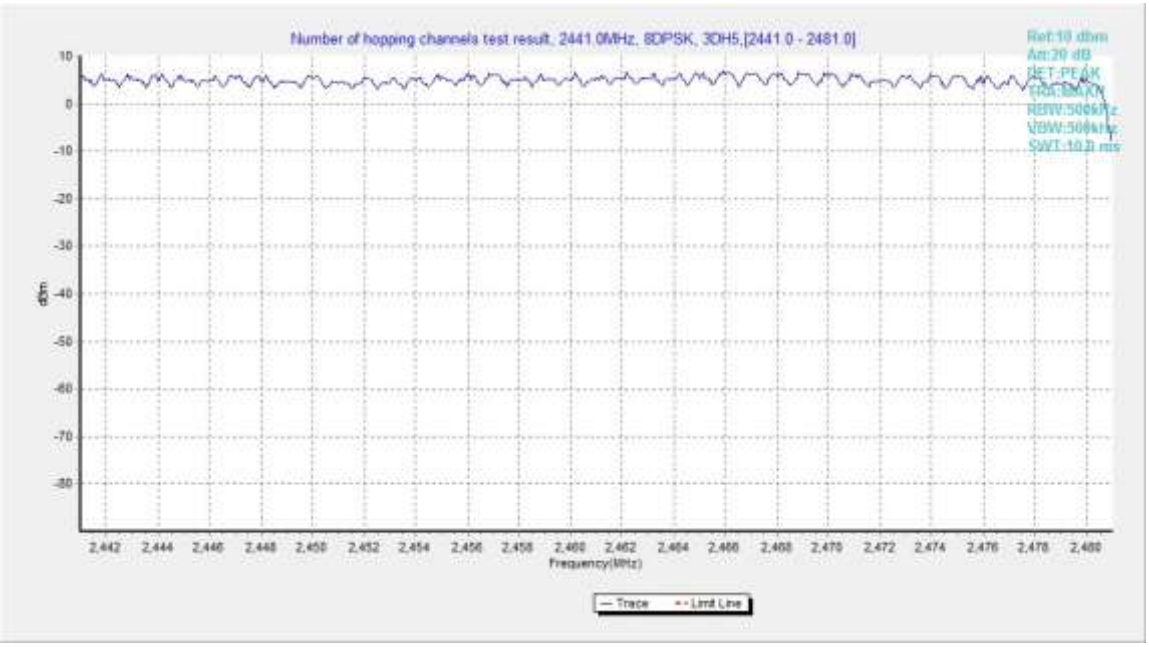


Fig.100. Number of hopping frequencies: 8DPSK, Channel 40 - 78

A.10. AC Powerline Conducted Emission

Method of Measurement: See ANSI C63.10-clause 6.2

1. the one EUT cable configuration and arrangement and mode of operation that produced the emission with the highest amplitude relative to the limit is selected for the final measurement, while applying the appropriate modulating signal to the EUT.
2. If the EUT is relocated from an exploratory test site to a final test site, the highest emissions shall be remaximized at the final test location before final ac power-line conducted emission measurements are performed.
3. The final test on all current-carrying conductors of all of the power cords to the equipment that comprises the EUT (but not the cords associated with other non-EUT equipment in the system) is then performed for the full frequency range for which the EUT is being tested for compliance without further variation of the EUT arrangement, cable positions, or EUT mode of operation.
4. If the EUT is comprised of equipment units that have their own separate ac power connections, e.g., floor-standing equipment with independent power cords for each shelf that are able to connect directly to the ac power network, each current-carrying conductor of one unit is measured while the other units are connected to a second (or more) LISN(s). All units shall be separately measured. If a power strip is provided by the manufacturer, to supply all of the units making up the EUT, only the conductors in the power cord of the power strip shall be measured.
5. If the EUT uses a detachable antenna, these measurements shall be made with a suitable dummy load connected to the antenna output terminals; otherwise, the tests shall be made with the antenna connected and, if adjustable, fully extended. When measuring the ac conducted emissions from a device that operates between 150 kHz and 30 MHz a non-detachable antenna may be replaced with a dummy load for the measurements within the fundamental emission band of the transmitter, but only for those measurements.36 Record the six highest EUT emissions relative to the limit of each of the current-carrying conductors of the power cords of the equipment that comprises the EUT over the frequency range specified by the procuring or regulatory agency. Diagram or photograph the test setup that was used. See Clause 8 for full reporting requirements.

Test Condition

Voltage（V）	Frequency（Hz）
120	60

Measurement Result and limit:

Bluetooth (Quasi-peak Limit)

Frequency range (MHz)	Quasi-peak Limit (dBμV)	Conclusion
0.15 to 0.5	66 to 56	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)

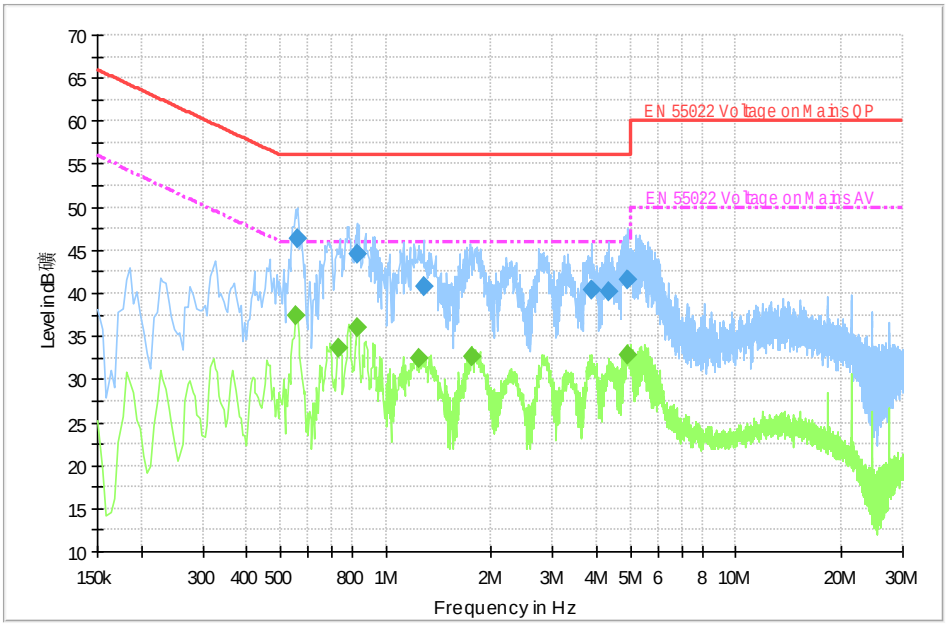
Frequency range (MHz)	Average Limit (dBμV)	Conclusion
0.15 to 0.5	56 to 46	P
0.5 to 5	46	
5 to 30	50	
NOTE: The limit decreases linearly with the logarithm of the frequency in the range 0.15 MHz to 0.5 MHz.		

The measurement is made according to ANSI C63.10

Conclusion: PASS

Test graphs as below:

Set.10 Traffic:



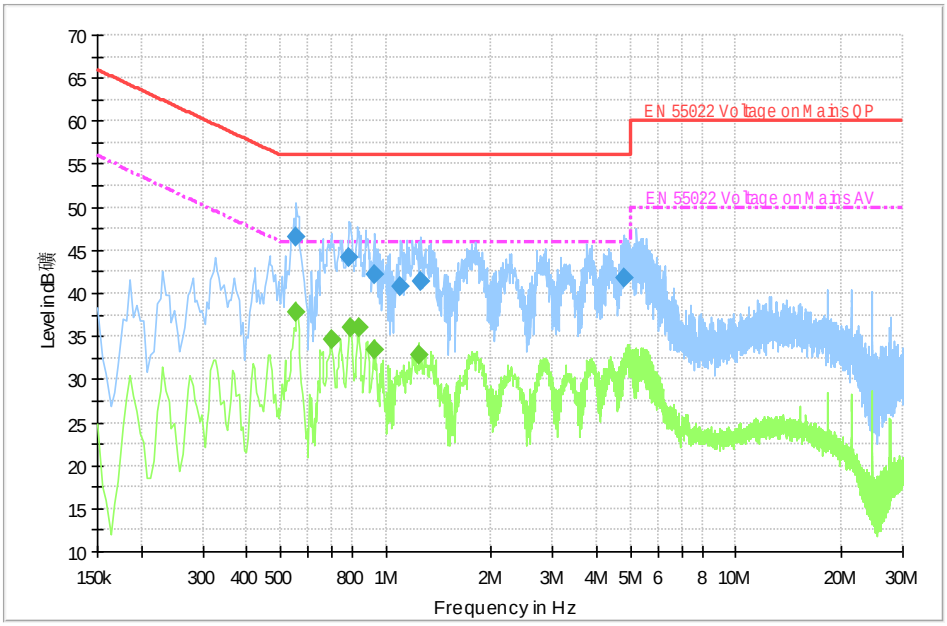
Final Result 1

Frequency (MHz)	QuasiPeak (dBµV)	Meas. Time (ms)	Bandwidth (kHz)	Line	Corr. (dB)	Margin (dB)	Limit (dBµV)
0.559500	46.3	2000.0	9.000	L1	10.2	9.7	56.0
0.825000	44.5	2000.0	9.000	L1	10.2	11.5	56.0
1.288500	40.8	2000.0	9.000	L1	10.2	15.2	56.0
3.862500	40.5	2000.0	9.000	L1	10.3	15.5	56.0
4.330500	40.2	2000.0	9.000	L1	10.3	15.8	56.0
4.897500	41.7	2000.0	9.000	L1	10.3	14.3	56.0

Final Result 2

Frequency (MHz)	Average (dBµV)	Meas. Time (ms)	Bandwidth (kHz)	Line	Corr. (dB)	Margin (dB)	Limit (dBµV)
0.550500	37.5	2000.0	9.000	L1	10.2	8.5	46.0
0.730500	33.7	2000.0	9.000	L1	10.2	12.3	46.0
0.825000	36.1	2000.0	9.000	L1	10.2	9.9	46.0
1.239000	32.4	2000.0	9.000	L1	10.2	13.6	46.0
1.770000	32.6	2000.0	9.000	L1	10.2	13.4	46.0
4.906500	32.8	2000.0	9.000	L1	10.3	13.2	46.0

Set.10 Idle:



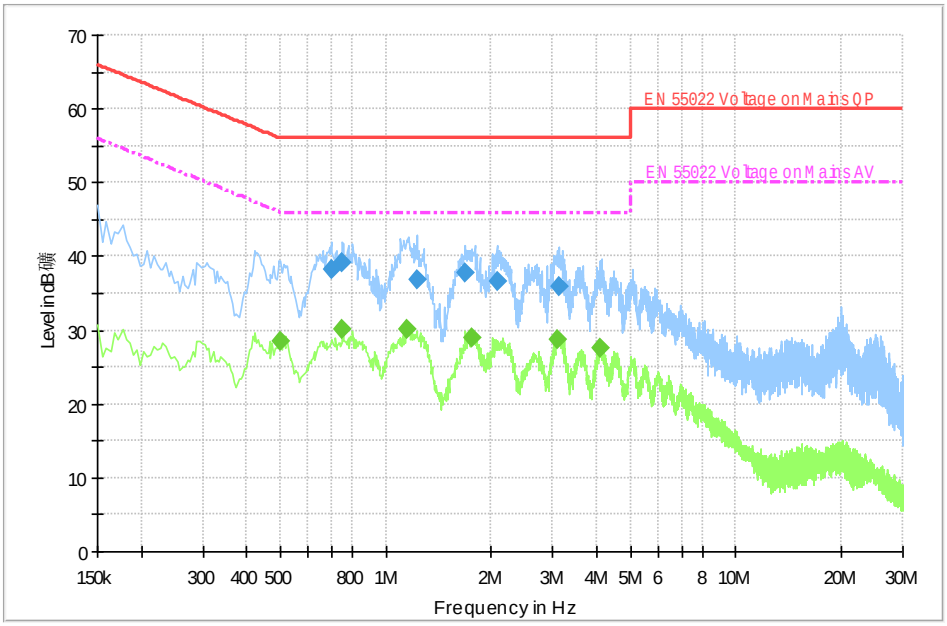
Final Result 1

Frequency (MHz)	QuasiPeak (dBµV)	Meas. Time (ms)	Bandwidth (kHz)	Line	Corr. (dB)	Margin (dB)	Limit (dBµV)
0.555000	46.5	2000.0	9.000	L1	10.2	9.5	56.0
0.784500	44.3	2000.0	9.000	L1	10.2	11.7	56.0
0.933000	42.2	2000.0	9.000	L1	10.2	13.8	56.0
1.104000	40.9	2000.0	9.000	L1	10.2	15.1	56.0
1.261500	41.3	2000.0	9.000	L1	10.2	14.7	56.0
4.798500	41.8	2000.0	9.000	L1	10.3	14.2	56.0

Final Result 2

Frequency (MHz)	Average (dBµV)	Meas. Time (ms)	Bandwidth (kHz)	Line	Corr. (dB)	Margin (dB)	Limit (dBµV)
0.555000	37.8	2000.0	9.000	L1	10.2	8.2	46.0
0.699000	34.6	2000.0	9.000	L1	10.2	11.4	46.0
0.793500	36.1	2000.0	9.000	L1	10.2	9.9	46.0
0.838500	36.0	2000.0	9.000	L1	10.2	10.0	46.0
0.933000	33.3	2000.0	9.000	L1	10.2	12.7	46.0
1.243500	32.8	2000.0	9.000	L1	10.2	13.2	46.0

Set.13 Traffic:



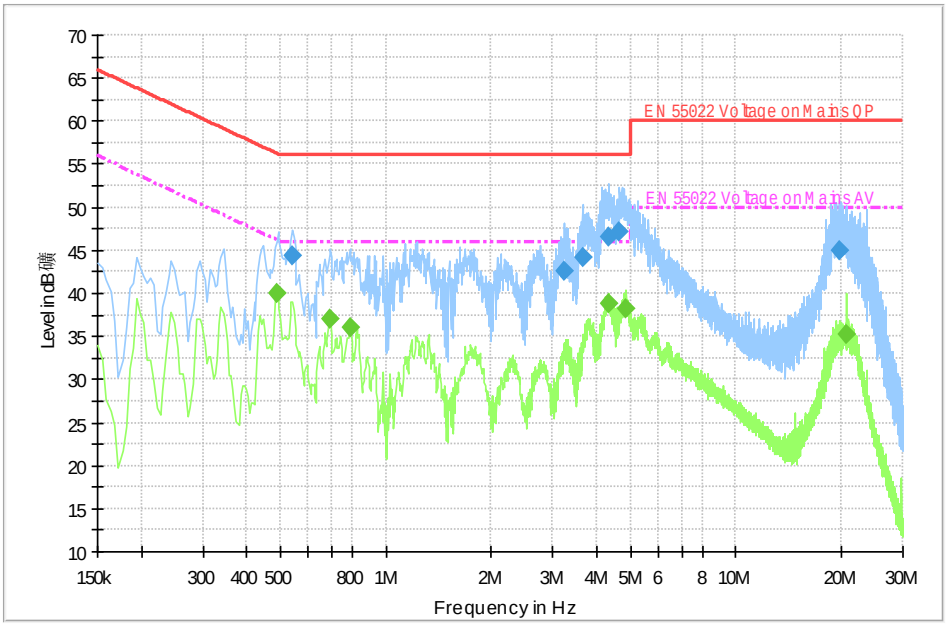
Final Result 1

Frequency (MHz)	QuasiPeak (dBµV)	Meas. Time (ms)	Bandwidth (kHz)	Line	Corr. (dB)	Margin (dB)	Limit (dBµV)
0.699000	38.3	2000.0	9.000	L1	10.2	17.7	56.0
0.753000	39.1	2000.0	9.000	L1	10.2	16.9	56.0
1.230000	36.9	2000.0	9.000	L1	10.2	19.1	56.0
1.680000	37.7	2000.0	9.000	L1	10.3	18.3	56.0
2.076000	36.7	2000.0	9.000	L1	10.3	19.3	56.0
3.129000	36.0	2000.0	9.000	L1	10.1	20.0	56.0

Final Result 2

Frequency (MHz)	Average (dBµV)	Meas. Time (ms)	Bandwidth (kHz)	Line	Corr. (dB)	Margin (dB)	Limit (dBµV)
0.501000	28.5	2000.0	9.000	L1	10.2	17.5	46.0
0.753000	30.2	2000.0	9.000	L1	10.2	15.8	46.0
1.144500	30.1	2000.0	9.000	L1	10.2	15.9	46.0
1.756500	29.0	2000.0	9.000	L1	10.3	17.0	46.0
3.088500	28.6	2000.0	9.000	L1	10.1	17.4	46.0
4.105500	27.7	2000.0	9.000	L1	10.2	18.3	46.0

Set.15 Traffic:



Final Result 1

Frequency (MHz)	QuasiPeak (dBµV)	Meas. Time (ms)	Bandwidth (kHz)	Line	Corr. (dB)	Margin (dB)	Limit (dBµV)
0.541500	44.3	2000.0	9.000	N	10.2	11.7	56.0
3.228000	42.6	2000.0	9.000	L1	10.2	13.4	56.0
3.642000	44.2	2000.0	9.000	L1	10.2	11.8	56.0
4.335000	46.6	2000.0	9.000	L1	10.2	9.4	56.0
4.659000	47.1	2000.0	9.000	L1	10.2	8.9	56.0
19.707000	44.9	2000.0	9.000	L1	10.8	15.1	60.0

Final Result 2

Frequency (MHz)	Average (dBµV)	Meas. Time (ms)	Bandwidth (kHz)	Line	Corr. (dB)	Margin (dB)	Limit (dBµV)
0.487500	39.9	2000.0	9.000	N	10.2	6.3	46.2
0.694500	37.1	2000.0	9.000	N	10.2	8.9	46.0
0.789000	36.0	2000.0	9.000	N	10.2	10.0	46.0
4.317000	38.7	2000.0	9.000	L1	10.2	7.3	46.0
4.875000	38.1	2000.0	9.000	L1	10.2	7.9	46.0
20.787000	35.2	2000.0	9.000	L1	10.9	14.8	50.0

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).

2016-09-29 through 2017-09-30
Effective Dates

For the National Voluntary Laboratory Accreditation Program

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