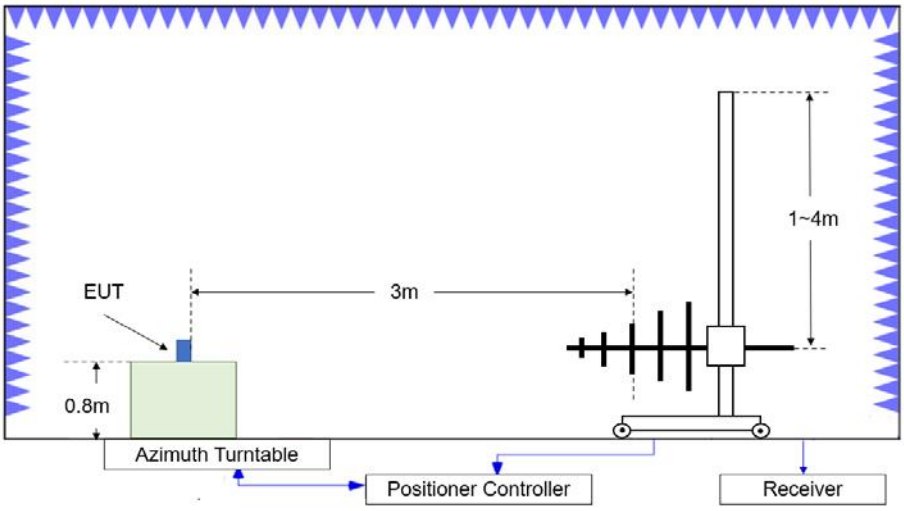


Figure B.5.2. Test Site Diagram (30MHz-1GHz)

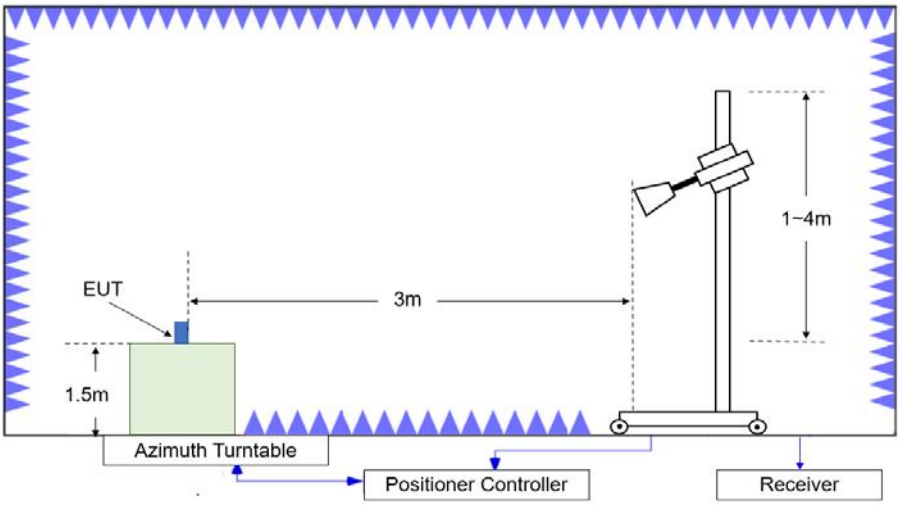


Figure B.5.3. Test Site Diagram (1GHz-40GHz)

Test Procedures

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

Test setting

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

Sample Calculation

A "reference path loss" is established and the A_{Rpl} is the attenuation of “reference path loss”, and including the gain of receive antenna, the gain of the preamplifier, the cable loss.

P_{Mea} is the field strength recorded from the instrument.

©Copyright. All rights reserved by CTTL.

The measurement results are obtained as described below:

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

Test note

1. Investigation has been done on all modes and modulations/data rates. Only the radiated emissions of the configuration that produced the worst case emissions are reported in this section.

2. Spurious emissions for all channels were investigated and almost the same below 1GHz. According to FCC 47 CFR §15.31, emission levels are not report much lower than the limit by over 20dB

3. Measurement frequencies were performed from 9 kHz to the 10th harmonic of highest fundamental frequency or 40GHz, whichever is lower.

Test Result

EUT ID: UT10a

Radiated Spurious Emission

GFSK Ch 0

Frequency (MHz)	Measurement Result (dBuV/m)	Cable Loss (dB)	Antenna Factor (dB/m)	Receiver Reading (dBuV)	Limit (dBuV/m)	Margin (dB)	Antenna Pol. (H/V)
17910.000	56.36	-25.90	46.00	36.26	74.00	17.64	V
13736.500	51.63	-29.10	41.10	39.63	74.00	22.37	H
4803.500	50.01	-36.90	33.00	53.91	74.00	23.99	H
12825.000	49.56	-30.30	39.90	39.96	74.00	24.44	H
8544.500	47.13	-33.80	37.40	43.53	74.00	26.87	H
2372.000	56.78	-19.30	28.20	47.88	74.00	17.22	H

GFSK Ch 39

Frequency (MHz)	Measurement Result (dBuV/m)	Cable Loss (dB)	Antenna Factor (dB/m)	Receiver Reading (dBuV)	Limit (dBuV/m)	Margin (dB)	Antenna Pol. (H/V)
17894.500	56.21	-25.90	46.00	36.11	74.00	17.79	H
13746.500	52.02	-29.10	41.10	40.02	74.00	21.98	V
12987.000	49.18	-29.40	40.10	38.48	74.00	24.82	H
4881.500	48.20	-36.90	33.40	51.70	74.00	25.80	H
9429.000	47.37	-33.50	37.90	42.97	74.00	26.63	V
7723.500	45.92	-34.70	36.40	44.22	74.00	28.08	H

GFSK Ch 78

Frequency (MHz)	Measurement Result (dBuV/m)	Cable Loss (dB)	Antenna Factor (dB/m)	Receiver Reading (dBuV)	Limit (dBuV/m)	Margin (dB)	Antenna Pol. (H/V)
17914.000	56.34	-25.90	46.00	36.24	74.00	17.66	H

©Copyright. All rights reserved by CTTL.

14099.500	51.72	-29.10	41.70	39.12	74.00	22.28	H
4959.500	51.37	-36.80	33.60	54.57	74.00	22.63	H
12770.000	49.26	-30.50	39.60	40.16	74.00	24.74	H
9544.500	48.00	-33.10	37.60	43.50	74.00	26.00	V
2498.700	56.64	-19.00	28.20	47.44	74.00	17.36	H

©Copyright. All rights reserved by CTTL.

π/4 DQPSK Ch 0

Frequency (MHz)	Measurement Result (dBuV/m)	Cable Loss (dB)	Antenna Factor (dB/m)	Receiver Reading (dBuV)	Limit (dBuV/m)	Margin (dB)	Antenna Pol. (H/V)
17939.500	56.27	-25.90	46.00	36.17	74.00	17.73	V
4804.000	52.87	-36.90	33.00	56.77	74.00	21.13	H
13740.000	52.27	-29.10	41.10	40.27	74.00	21.73	V
12937.000	49.16	-29.70	40.00	38.76	74.00	24.84	H
9803.000	46.99	-33.10	37.90	42.19	74.00	27.01	V
2388.600	56.28	-19.20	28.20	47.28	74.00	17.72	H

π/4 DQPSK Ch 39

Frequency (MHz)	Measurement Result (dBuV/m)	Cable Loss (dB)	Antenna Factor (dB/m)	Receiver Reading (dBuV)	Limit (dBuV/m)	Margin (dB)	Antenna Pol. (H/V)
17963.000	56.09	-25.90	46.00	35.99	74.00	17.91	V
4881.500	52.98	-36.90	33.40	56.48	74.00	21.02	H
14099.000	51.33	-29.10	41.70	38.73	74.00	22.67	H
12794.500	49.46	-30.60	39.80	40.26	74.00	24.54	V
9141.500	46.99	-33.70	37.70	42.99	74.00	27.01	V
7254.000	46.22	-34.90	36.40	44.72	74.00	27.78	V

π/4 DQPSK Ch 78

Frequency (MHz)	Measurement Result (dBuV/m)	Cable Loss (dB)	Antenna Factor (dB/m)	Receiver Reading (dBuV)	Limit (dBuV/m)	Margin (dB)	Antenna Pol. (H/V)
17892.000	56.06	-25.90	46.00	35.96	74.00	17.94	V
14160.000	51.64	-29.20	41.70	39.14	74.00	22.36	V
12958.000	49.55	-29.70	40.00	39.15	74.00	24.45	H
9591.000	47.07	-33.00	37.50	42.57	74.00	26.93	V
4960.000	46.64	-36.80	33.60	49.84	74.00	27.36	H
2499.200	56.46	-19.00	28.20	47.26	74.00	17.54	V

©Copyright. All rights reserved by CTTL.

8DPSK Ch 0

Frequency (MHz)	Measurement Result (dBuV/m)	Cable Loss (dB)	Antenna Factor (dB/m)	Receiver Reading (dBuV)	Limit (dBuV/m)	Margin (dB)	Antenna Pol. (H/V)
17935.000	56.09	-25.90	46.00	35.99	74.00	17.91	V
4803.500	52.25	-36.90	33.00	56.15	74.00	21.75	H
14078.000	51.73	-29.10	41.70	39.13	74.00	22.27	V
12405.000	49.51	-30.10	38.90	40.71	74.00	24.49	V
9567.000	47.64	-33.00	37.50	43.14	74.00	26.36	V
2343.000	56.30	-19.30	28.20	47.40	74.00	17.70	H

8DPSK Ch 39

Frequency (MHz)	Measurement Result (dBuV/m)	Cable Loss (dB)	Antenna Factor (dB/m)	Receiver Reading (dBuV)	Limit (dBuV/m)	Margin (dB)	Antenna Pol. (H/V)
17932.000	56.21	-25.90	46.00	36.11	74.00	17.79	H
13704.500	51.70	-29.30	41.00	40.00	74.00	22.30	V
4882.000	50.86	-36.90	33.40	54.36	74.00	23.14	H
12814.000	49.14	-30.60	39.80	39.94	74.00	24.86	H
8440.000	47.49	-33.80	37.40	43.89	74.00	26.51	V
7504.500	46.00	-34.70	36.40	44.30	74.00	28.00	H

8DPSK Ch 78

Frequency (MHz)	Measurement Result (dBuV/m)	Cable Loss (dB)	Antenna Factor (dB/m)	Receiver Reading (dBuV)	Limit (dBuV/m)	Margin (dB)	Antenna Pol. (H/V)
17827.000	56.01	-25.90	46.00	35.91	74.00	17.99	H
14192.500	52.55	-29.20	41.70	40.05	74.00	21.45	V
12972.000	49.43	-29.40	40.10	38.73	74.00	24.57	H
4960.000	47.19	-36.80	33.60	50.39	74.00	26.81	H
6951.000	47.12	-34.80	35.20	46.72	74.00	26.88	V
2491.200	56.76	-19.00	28.20	47.56	74.00	17.24	V

©Copyright. All rights reserved by CTTL.

Average Measurement results

GFSK Ch 0

Frequency (MHz)	Measurement Result (dBuV/m)	Cable Loss (dB)	Antenna Factor (dB/m)	Receiver Reading (dBuV)	Limit (dBuV/m)	Margin (dB)	Antenna Pol. (H/V)
4803.500	48.75	-36.90	33.00	52.65	54.00	5.25	H
17919.500	46.69	-25.90	46.00	26.59	54.00	7.31	V
14137.000	42.13	-29.40	41.70	29.83	54.00	11.87	H
11869.500	39.69	-31.10	39.10	31.69	54.00	14.31	V
9121.500	37.37	-33.70	37.70	33.37	54.00	16.63	V
2313.800	44.47	-19.20	28.10	35.57	54.00	9.53	H

GFSK Ch 39

Frequency (MHz)	Measurement Result (dBuV/m)	Cable Loss (dB)	Antenna Factor (dB/m)	Receiver Reading (dBuV)	Limit (dBuV/m)	Margin (dB)	Antenna Pol. (H/V)
17906.000	46.57	-25.90	46.00	26.47	54.00	7.43	H
4881.500	46.44	-36.90	33.40	49.94	54.00	7.56	H
13838.000	42.19	-28.90	41.20	29.89	54.00	11.81	H
12988.500	39.47	-29.40	40.10	28.77	54.00	14.53	H
9601.000	37.39	-33.00	37.50	32.89	54.00	16.61	H
7520.500	36.65	-34.70	36.40	34.95	54.00	17.35	H

GFSK Ch 78

Frequency (MHz)	Measurement Result (dBuV/m)	Cable Loss (dB)	Antenna Factor (dB/m)	Receiver Reading (dBuV)	Limit (dBuV/m)	Margin (dB)	Antenna Pol. (H/V)
4959.500	50.05	-36.80	33.60	53.25	54.00	3.95	H
17914.000	46.65	-25.90	46.00	26.55	54.00	7.35	V
14112.000	41.96	-29.40	41.70	29.66	54.00	12.04	V
12960.000	39.67	-29.70	40.00	29.27	54.00	14.33	H
9330.000	37.36	-34.00	37.80	33.56	54.00	16.64	H
2499.700	44.97	-19.00	28.20	35.77	54.00	9.03	V

©Copyright. All rights reserved by CTTL.

π/4 DQPSK Ch 0

Frequency (MHz)	Measurement Result (dBuV/m)	Cable Loss (dB)	Antenna Factor (dB/m)	Receiver Reading (dBuV)	Limit (dBuV/m)	Margin (dB)	Antenna Pol. (H/V)
4804.000	51.91	-36.90	33.00	55.81	54.00	2.09	H
17930.500	46.76	-25.90	46.00	26.66	54.00	7.24	V
13836.000	42.24	-28.90	41.20	29.94	54.00	11.76	V
12841.500	39.29	-30.30	39.90	29.69	54.00	14.71	V
8575.000	37.56	-34.10	37.50	34.16	54.00	16.44	V
2367.000	44.55	-19.30	28.20	35.65	54.00	9.45	V

π/4 DQPSK Ch 39

Frequency (MHz)	Measurement Result (dBuV/m)	Cable Loss (dB)	Antenna Factor (dB/m)	Receiver Reading (dBuV)	Limit (dBuV/m)	Margin (dB)	Antenna Pol. (H/V)
4882.000	49.20	-36.90	33.40	52.70	54.00	4.80	H
17924.000	46.75	-25.90	46.00	26.65	54.00	7.25	V
14083.500	42.14	-29.10	41.70	29.54	54.00	11.86	H
12953.500	39.87	-29.70	40.00	29.47	54.00	14.13	H
9637.000	37.53	-33.00	37.60	32.93	54.00	16.47	V
7403.000	36.48	-34.40	36.60	34.28	54.00	17.52	V

π/4 DQPSK Ch 78

Frequency (MHz)	Measurement Result (dBuV/m)	Cable Loss (dB)	Antenna Factor (dB/m)	Receiver Reading (dBuV)	Limit (dBuV/m)	Margin (dB)	Antenna Pol. (H/V)
17929.000	46.57	-25.90	46.00	26.47	54.00	7.43	V
4960.000	44.75	-36.80	33.60	47.95	54.00	9.25	H
13775.500	42.50	-29.00	41.20	30.30	54.00	11.50	V
12969.500	40.13	-29.70	40.00	29.73	54.00	13.87	H
9612.500	37.72	-33.00	37.60	33.12	54.00	16.28	H
2497.400	44.97	-19.00	28.20	35.77	54.00	9.03	H

©Copyright. All rights reserved by CTTL.

8DPSK Ch 0

Frequency (MHz)	Measurement Result (dBuV/m)	Cable Loss (dB)	Antenna Factor (dB/m)	Receiver Reading (dBuV)	Limit (dBuV/m)	Margin (dB)	Antenna Pol. (H/V)
4804.000	50.22	-36.90	33.00	54.12	54.00	3.78	H
17933.500	47.08	-25.90	46.00	26.98	54.00	6.92	H
13725.500	42.10	-29.10	41.10	30.10	54.00	11.90	H
12368.500	39.59	-30.10	39.00	30.79	54.00	14.41	V
9752.500	37.46	-33.10	38.00	32.56	54.00	16.54	V
2312.200	44.34	-19.20	28.10	35.44	54.00	9.66	V

8DPSK Ch 39

Frequency (MHz)	Measurement Result (dBuV/m)	Cable Loss (dB)	Antenna Factor (dB/m)	Receiver Reading (dBuV)	Limit (dBuV/m)	Margin (dB)	Antenna Pol. (H/V)
4882.000	48.55	-36.90	33.40	52.05	54.00	5.45	H
17924.000	46.52	-25.90	46.00	26.42	54.00	7.48	V
13643.500	42.21	-29.50	40.90	30.81	54.00	11.79	H
12973.500	39.57	-29.40	40.10	28.87	54.00	14.43	H
9225.500	37.17	-33.90	37.60	33.47	54.00	16.83	H
7505.000	37.00	-34.70	36.40	35.30	54.00	17.00	H

8DPSK Ch 78

Frequency (MHz)	Measurement Result (dBuV/m)	Cable Loss (dB)	Antenna Factor (dB/m)	Receiver Reading (dBuV)	Limit (dBuV/m)	Margin (dB)	Antenna Pol. (H/V)
17932.500	46.66	-25.90	46.00	26.56	54.00	7.34	V
4959.500	44.39	-36.80	33.60	47.59	54.00	9.61	H
14048.000	41.94	-28.90	41.60	29.24	54.00	12.06	H
12790.000	39.71	-30.60	39.80	30.51	54.00	14.29	H
9648.000	37.39	-33.00	37.60	32.79	54.00	16.61	H
2498.400	44.91	-19.00	28.20	35.71	54.00	9.09	V

Conclusion: Pass

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

Band edge compliance

Mode	Channel	Frequency Range	Test Results	Conclusion
GFSK	0	2.31GHz ~2.43GHz	Fig.58	P
	78	2.45GHz ~2.5GHz	Fig.59	P

©Copyright. All rights reserved by CTTL.

Mode	Channel	Frequency Range	Test Results	Conclusion
π/4 DQPSK	0	2.31GHz ~2.43GHz	Fig.60	P
	78	2.45GHz ~2.5GHz	Fig.61	P

Mode	Channel	Frequency Range	Test Results	Conclusion
8DPSK	0	2.31GHz ~2.43GHz	Fig.62	P
	78	2.45GHz ~2.5GHz	Fig.63	P

Conclusion: PASS

Test graphs as below

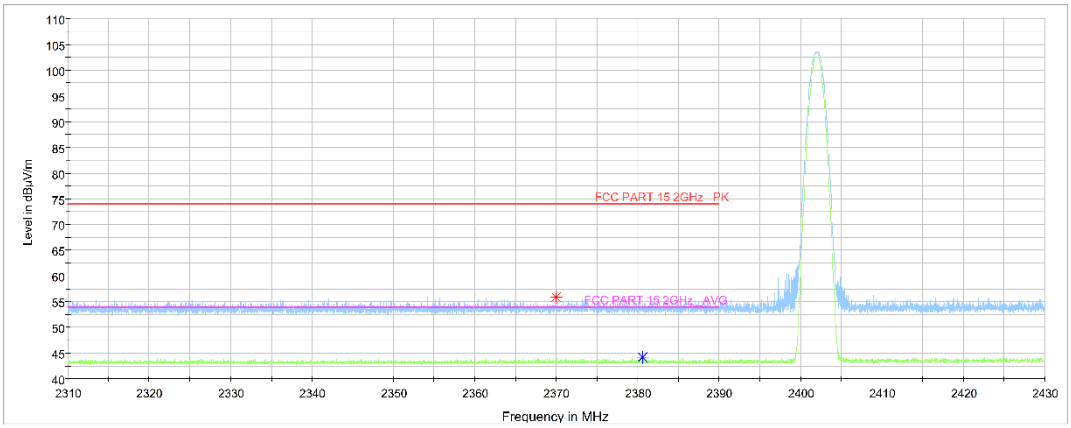


Fig.58. Frequency Band Edges: GFSK, Channel 0, Hopping Off, 2.31 GHz – 2.45GHz

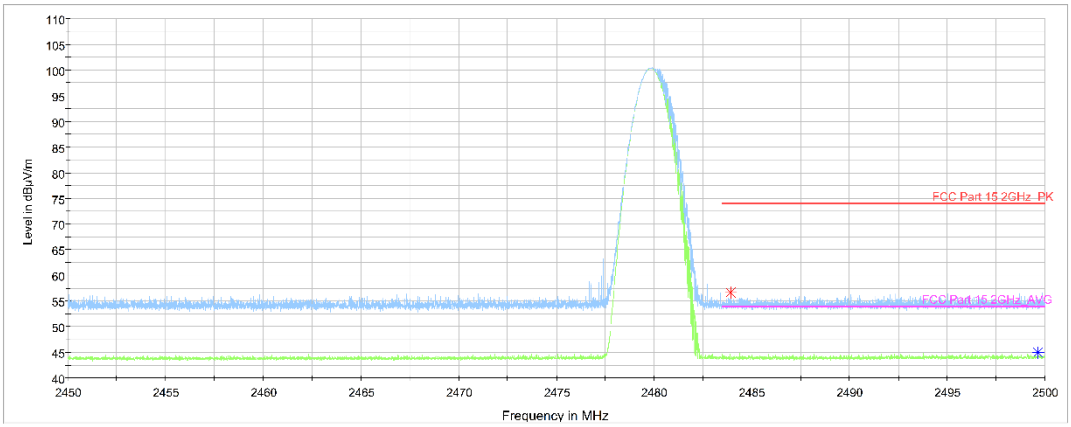


Fig.59. Frequency Band Edges: GFSK, Channel 78, Hopping Off, ch11, 2.45 GHz - 2.50GHz

©Copyright. All rights reserved by CTTL.

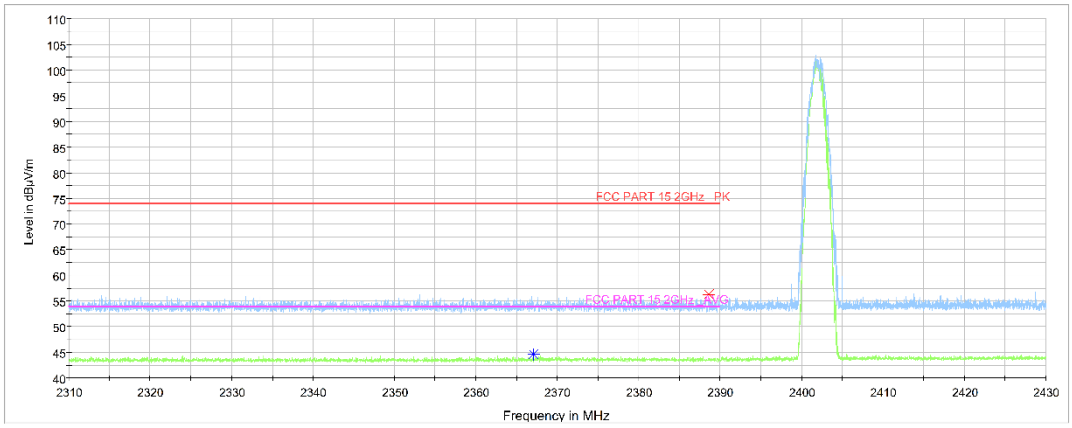


Fig.60. Frequency Band Edges: π/4 DQPSK, Channel 0, Hopping Off, 2.31 GHz - 2.45GHz

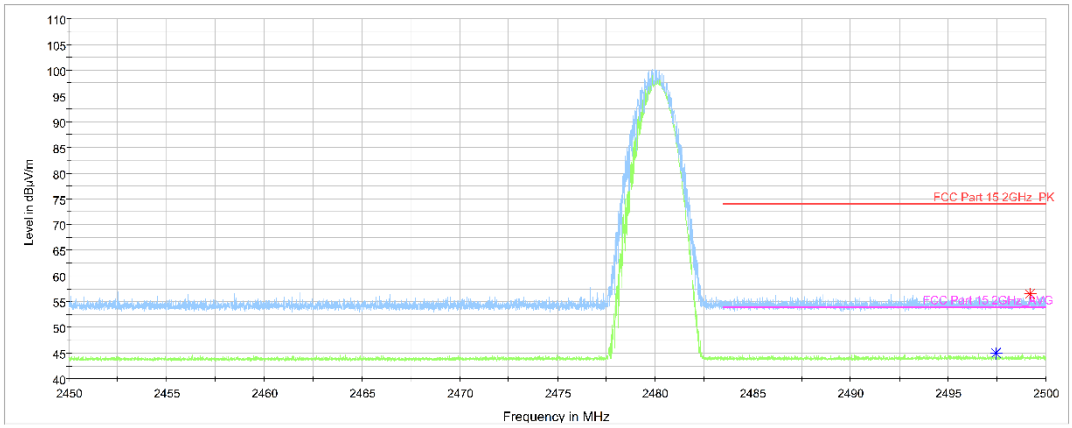


Fig.61. Frequency Band Edges: π/4 DQPSK, Channel 78, Hopping Off, 2.45 GHz - 2.50GHz

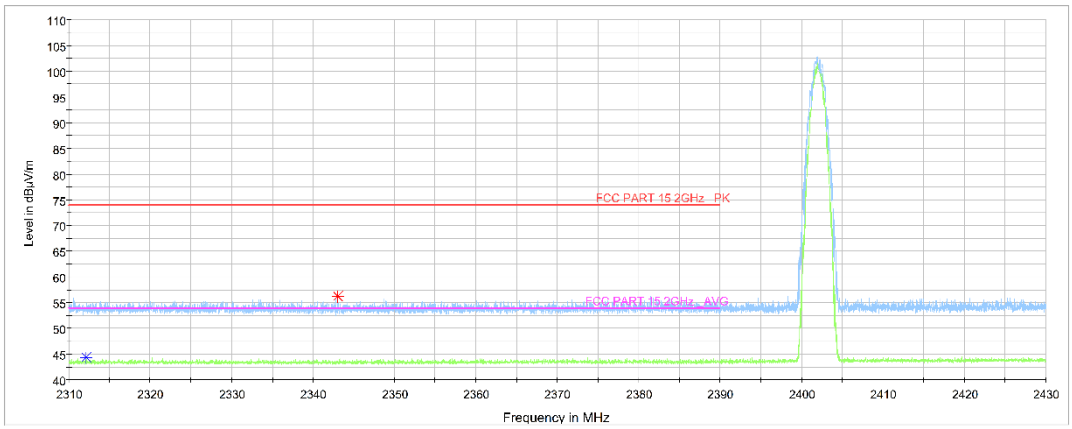


Fig.62. Frequency Band Edges: 8DPSK, Channel 0, 2.31 GHz - 2.45GHz

©Copyright. All rights reserved by CTTL.

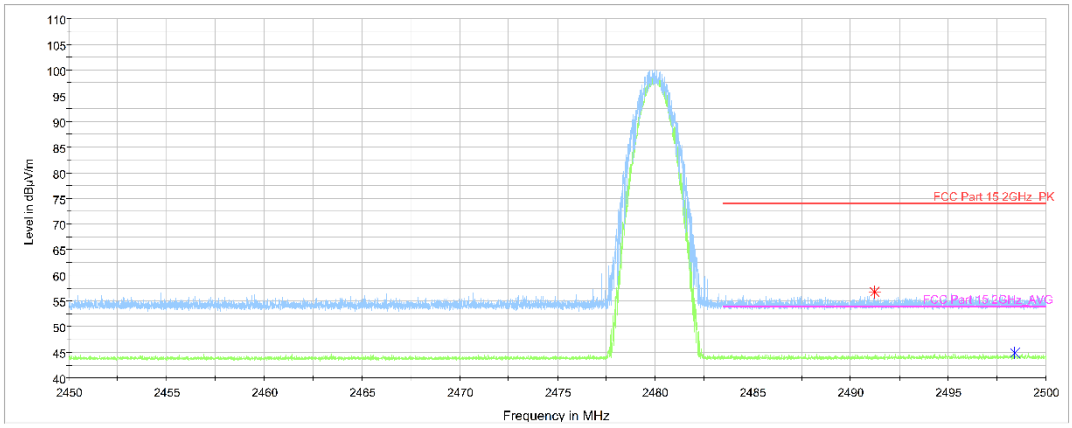


Fig.63. Frequency Band Edges: 8DPSK, Channel 78, 2.45 GHz - 2.50GHz

©Copyright. All rights reserved by CTTL.

B.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	Pulse time (ms)		Number of Transmissions		Dwell Time (ms)	Conclusion
39	DH1	Fig.64	0.38	Fig.65	320	121.6	P
	DH3	Fig.66	1.63	Fig.67	105	171.15	P
	DH5	Fig.68	2.88	Fig.69	61	175.68	P

For π/4 DQPSK

Channel	Packet	Pulse time (ms)		Number of Transmissions		Dwell Time (ms)	Conclusion
39	2DH1	Fig.70	0.38	Fig.71	318	120.84	P
	2DH3	Fig.72	1.64	Fig.73	105	172.2	P
	2DH5	Fig.74	2.89	Fig.75	61	176.29	P

©Copyright. All rights reserved by CTTL.

For 8DPSK

Channel	Packet	Pulse time (ms)		Number of Transmissions		Dwell Time (ms)	Conclusion
39	3DH1	Fig.76	0.38	Fig.77	318	120.84	P
	3DH3	Fig.78	1.63	Fig.79	106	172.78	P
	3DH5	Fig.80	2.89	Fig.81	73	210.97	P

Conclusion: PASS

Test graphs as below:

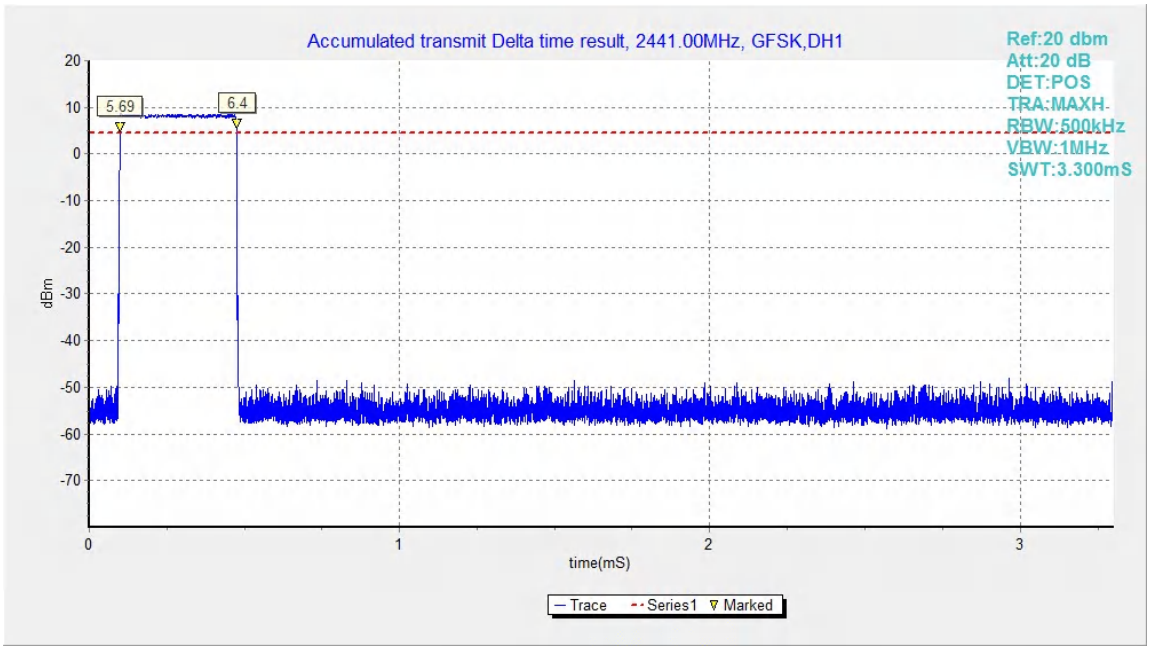


Fig.64. Time of occupancy (Dwell Time): Channel 39, Packet DH1

©Copyright. All rights reserved by CTTL.

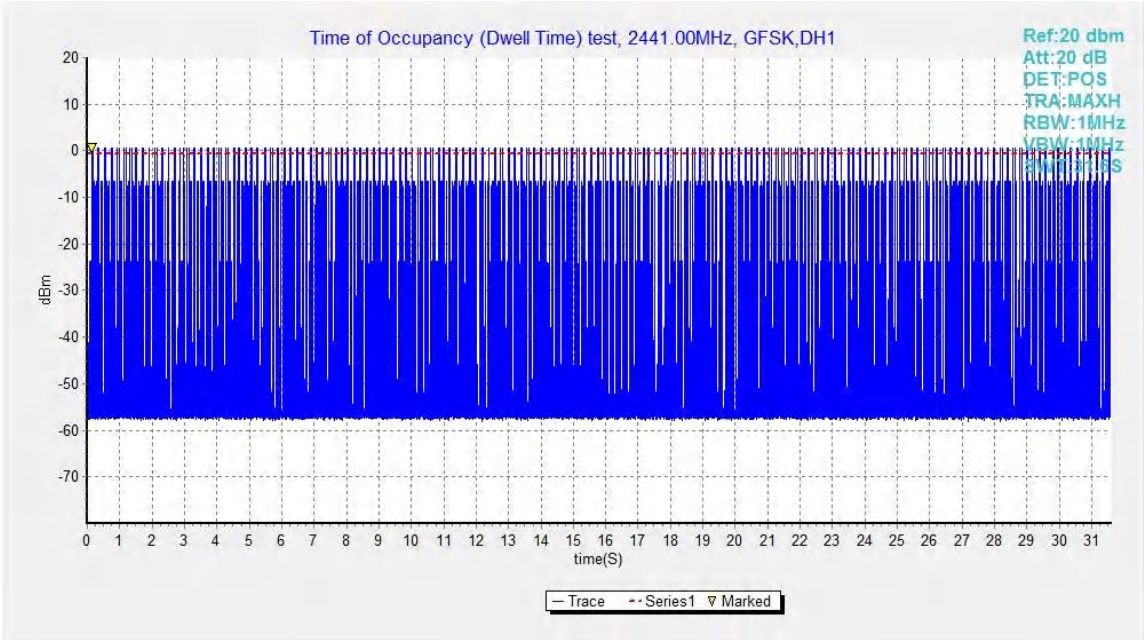


Fig.65. Number of Transmissions Measurement: Channel 39,Packet DH1

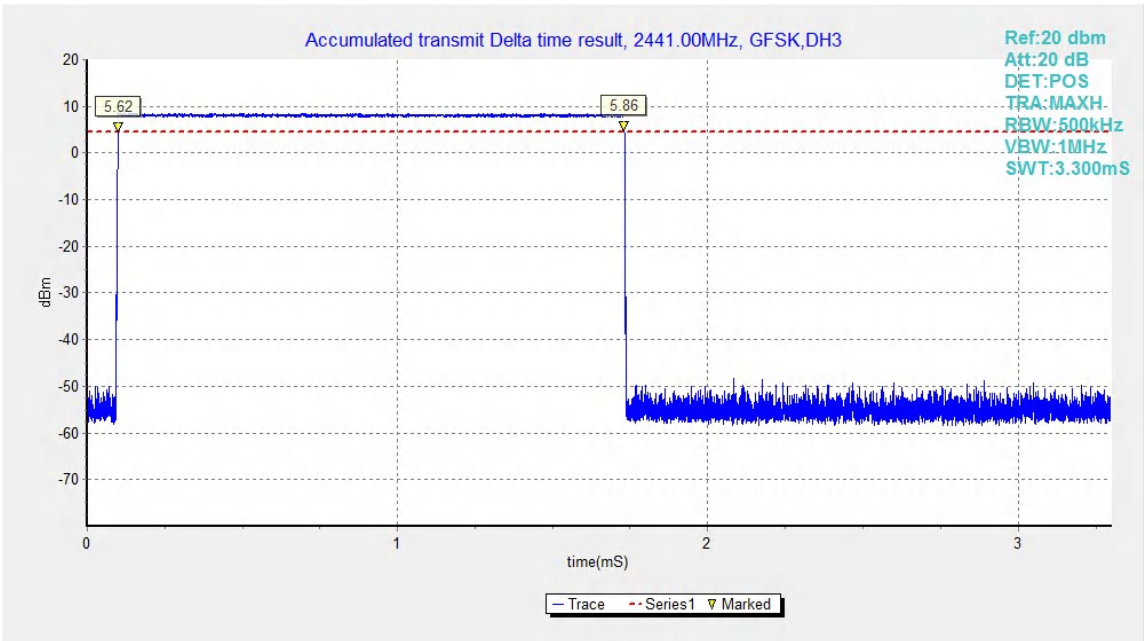


Fig.66. Time of occupancy (Dwell Time): Channel 39, Packet DH3

©Copyright. All rights reserved by CTTL.

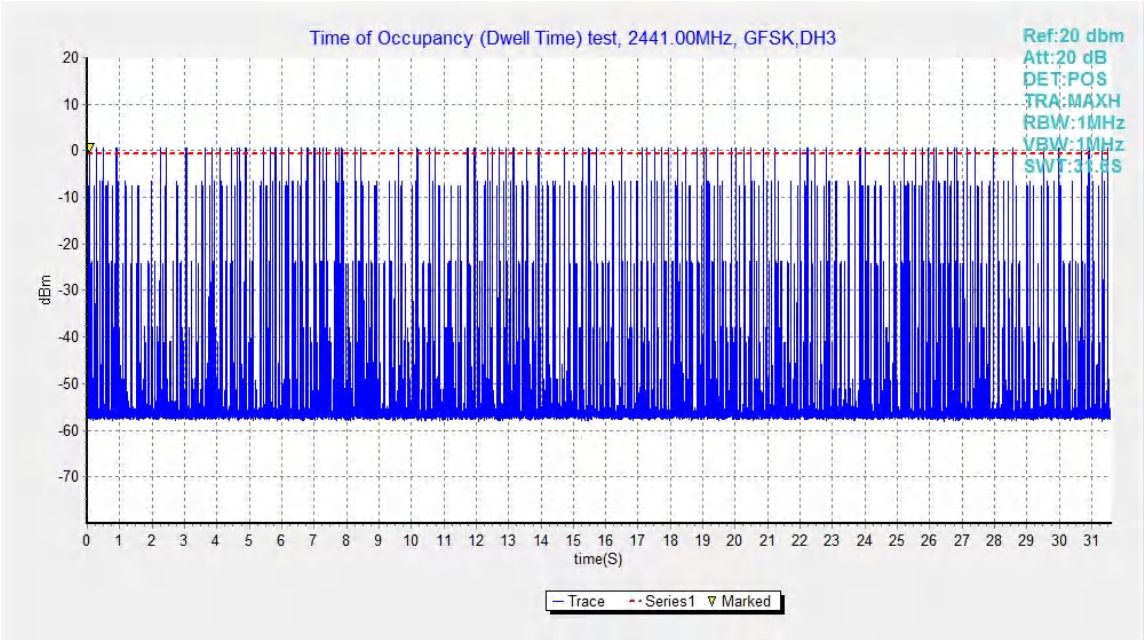


Fig.67. Number of Transmissions Measurement: Channel 39,Packet DH3

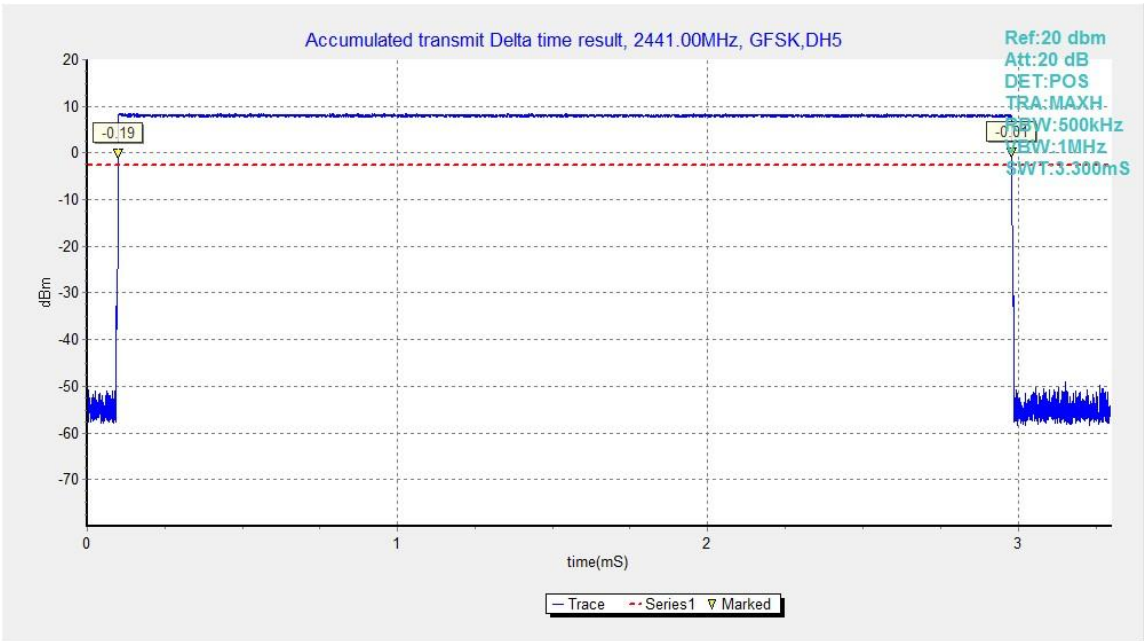


Fig.68. Time of occupancy (Dwell Time): Channel 39, Packet DH5

©Copyright. All rights reserved by CTTL.

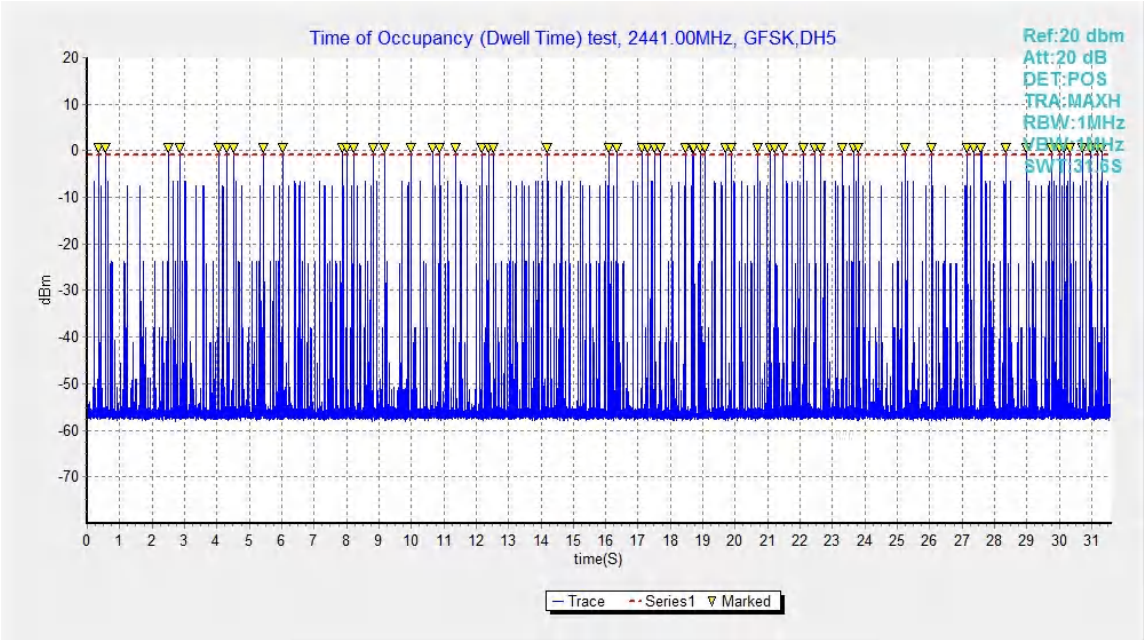


Fig.69. Number of Transmissions Measurement: Channel 39,Packet DH5

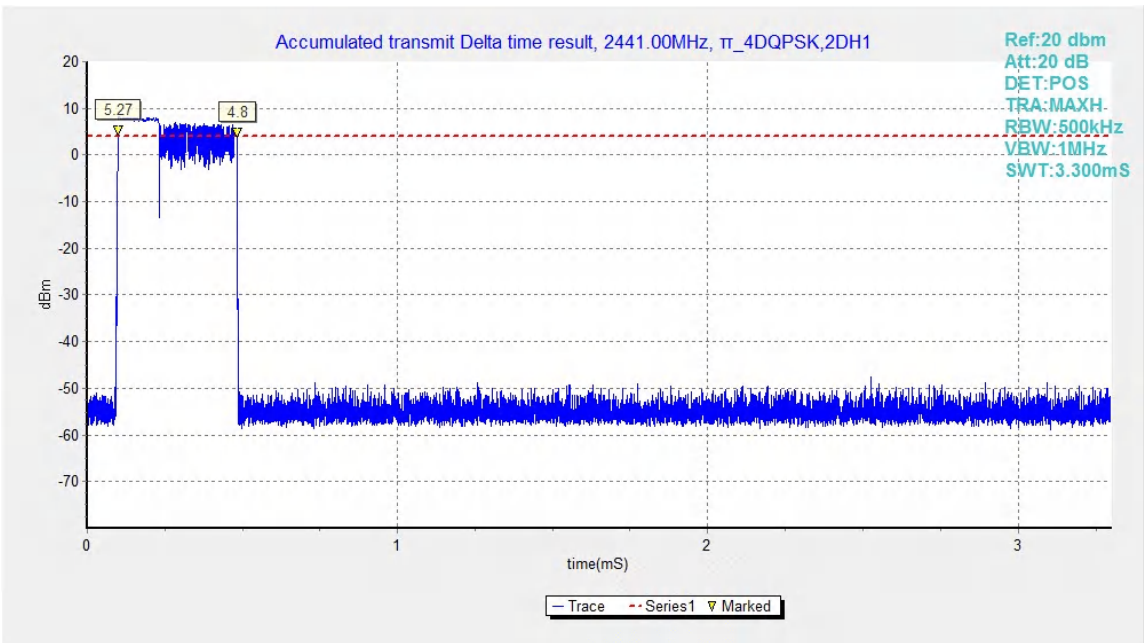


Fig.70. Time of occupancy (Dwell Time): Channel 39, Packet 2-DH1

©Copyright. All rights reserved by CTTL.

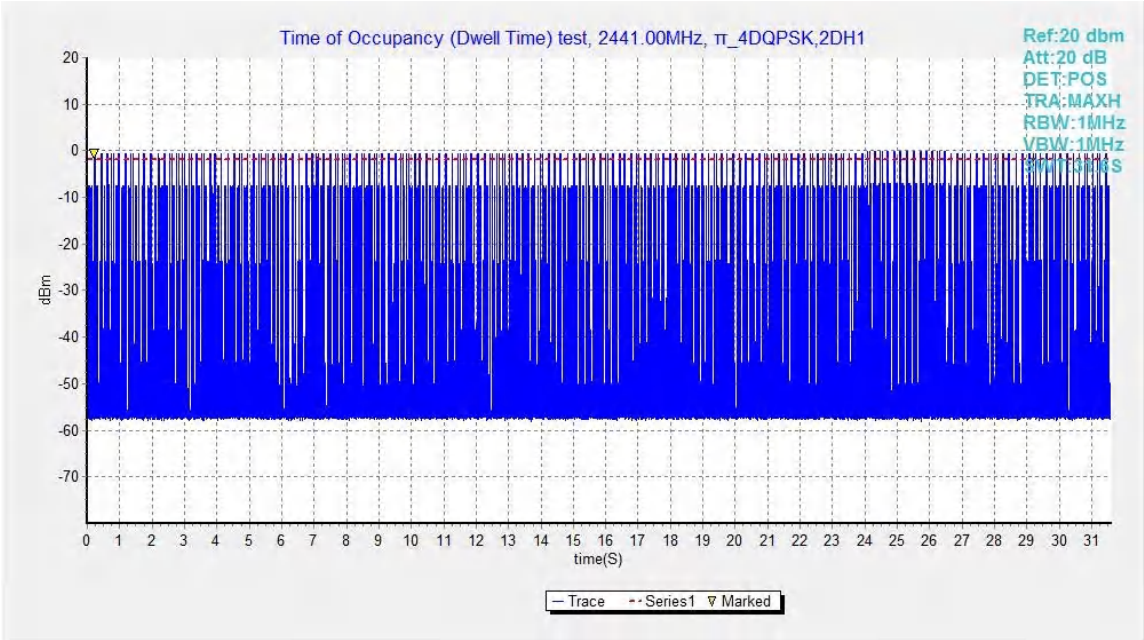


Fig.71. Number of Transmissions Measurement: Channel 39,Packet 2-DH1

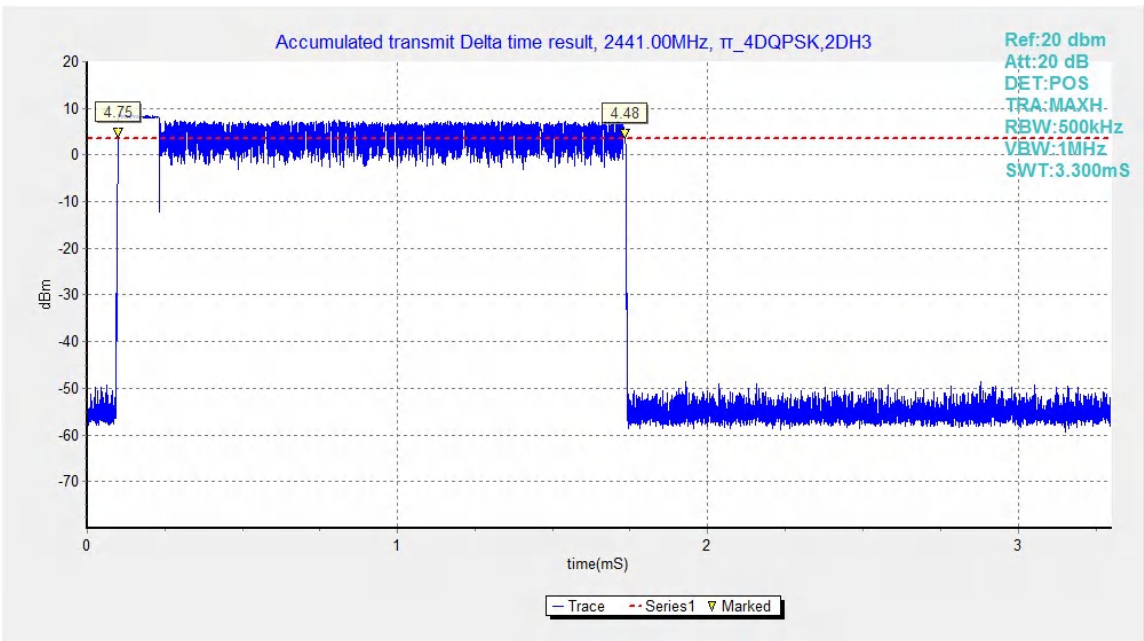


Fig.72. Time of occupancy (Dwell Time): Channel 39, Packet 2-DH3

©Copyright. All rights reserved by CTTL.

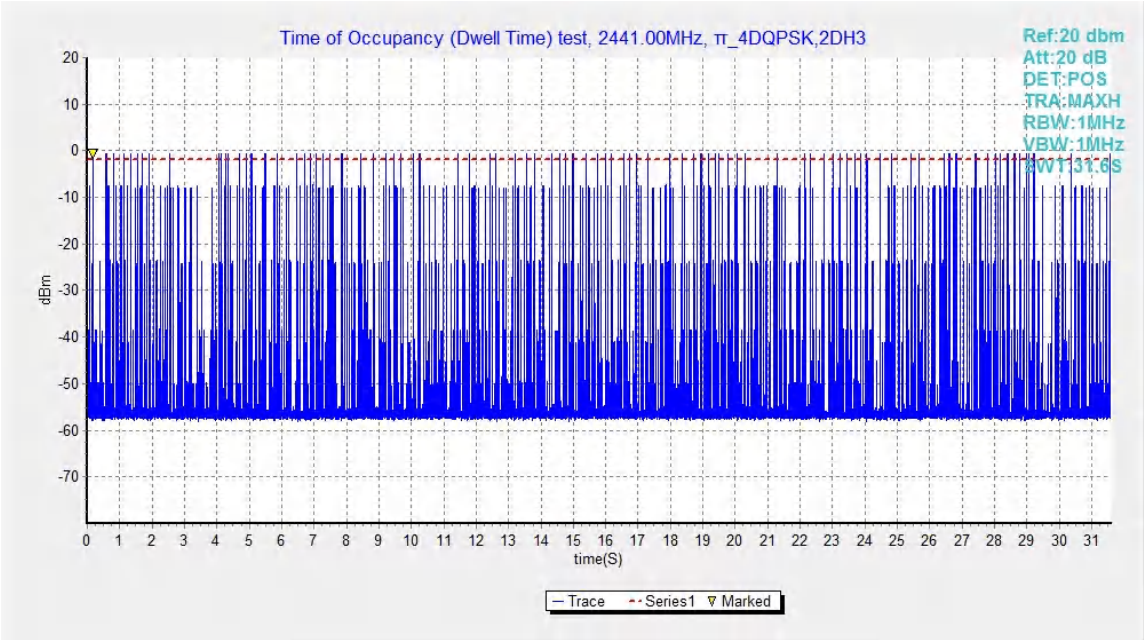


Fig.73. Number of Transmissions Measurement: Channel 39,Packet 2-DH3

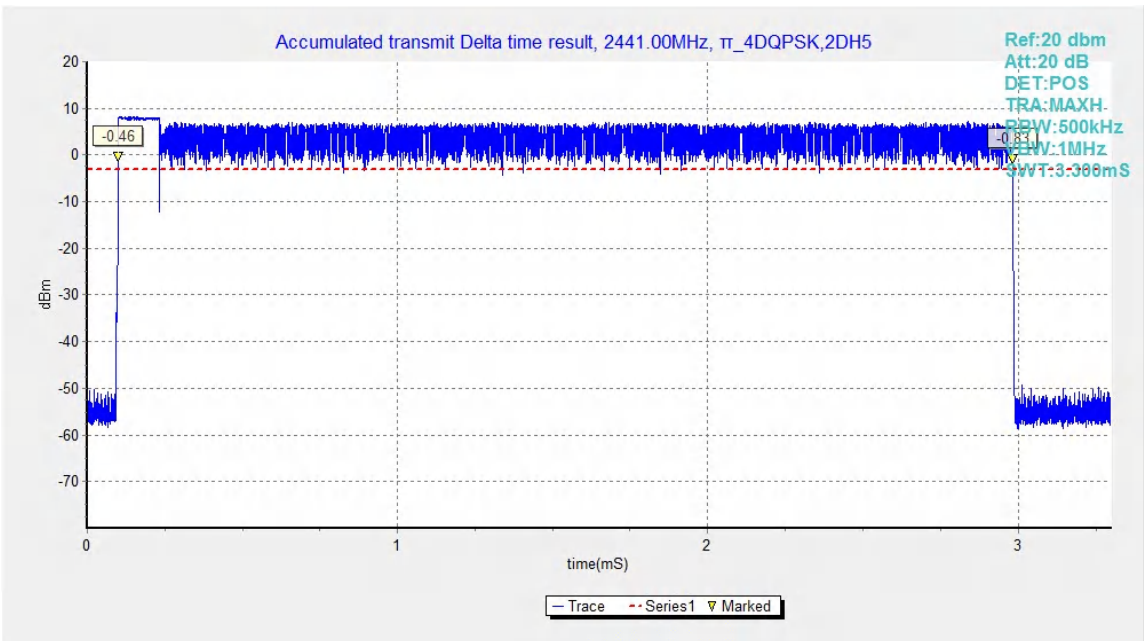


Fig.74. Time of occupancy (Dwell Time): Channel 39, Packet 2-DH5

©Copyright. All rights reserved by CTTL.

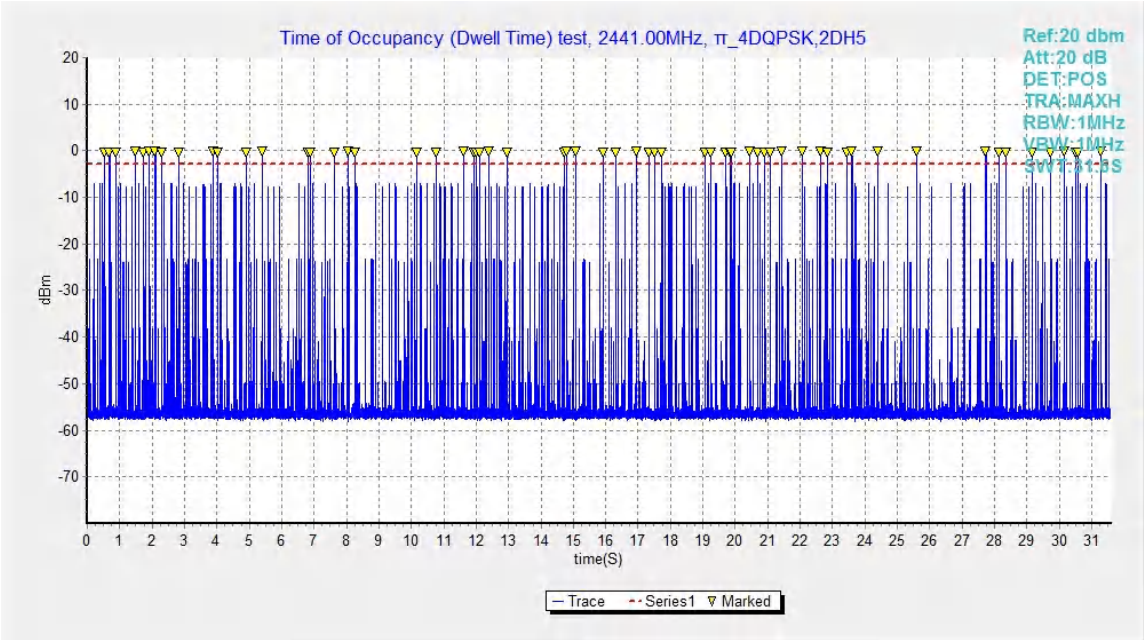


Fig.75. Number of Transmissions Measurement: Channel 39,Packet 2-DH5

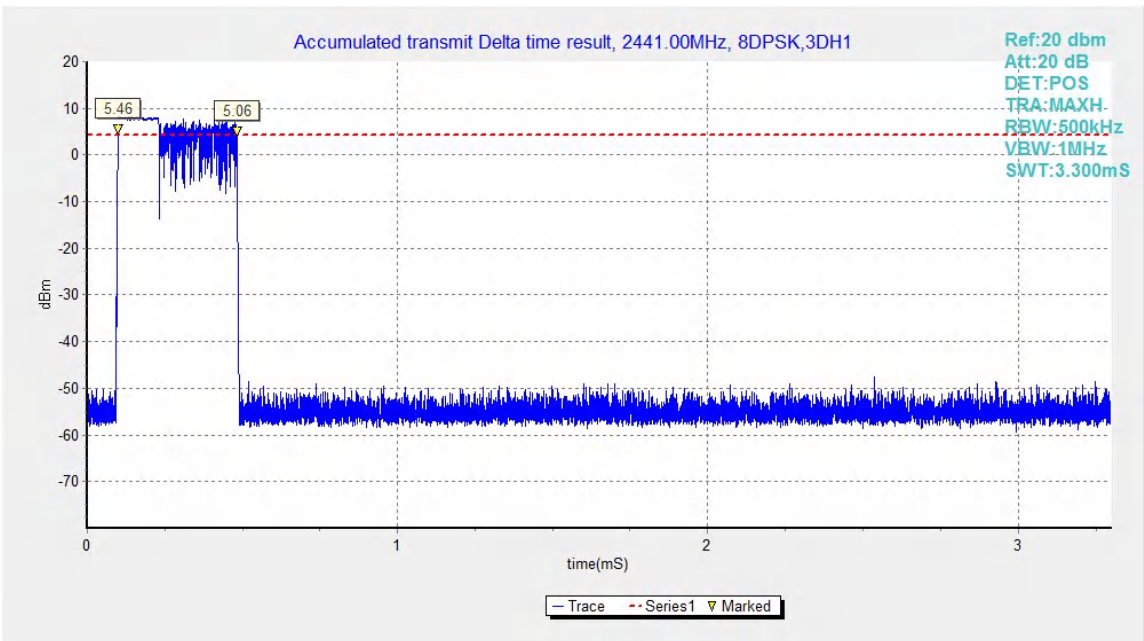


Fig.76. Time of occupancy (Dwell Time): Channel 39, Packet 3-DH1

©Copyright. All rights reserved by CTTL.

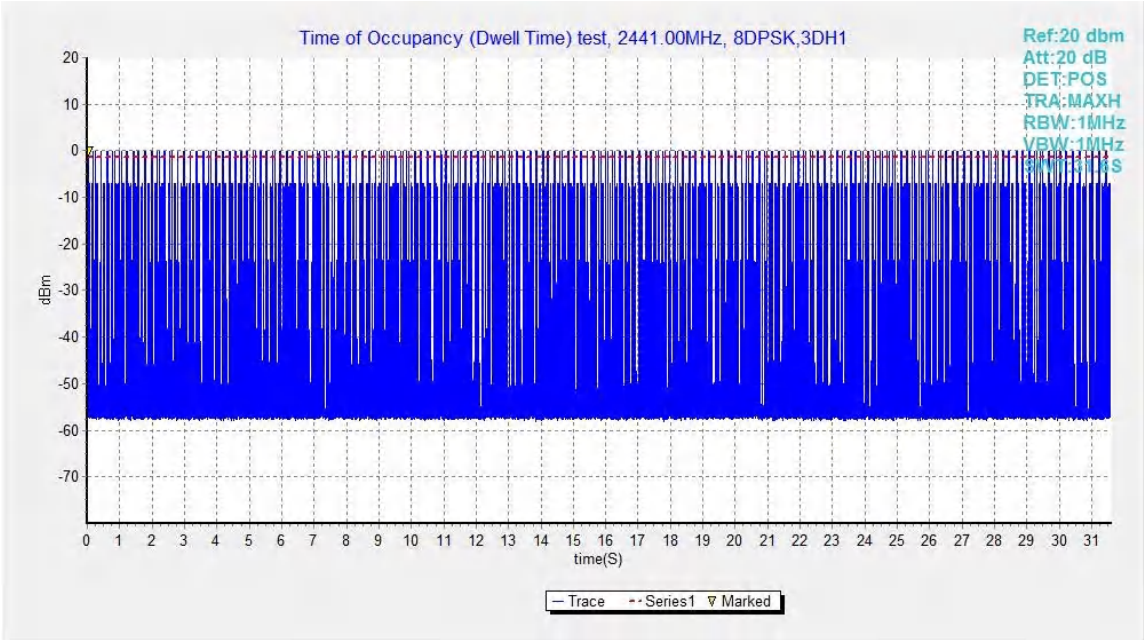


Fig.77. Number of Transmissions Measurement: Channel 39,Packet 3-DH1

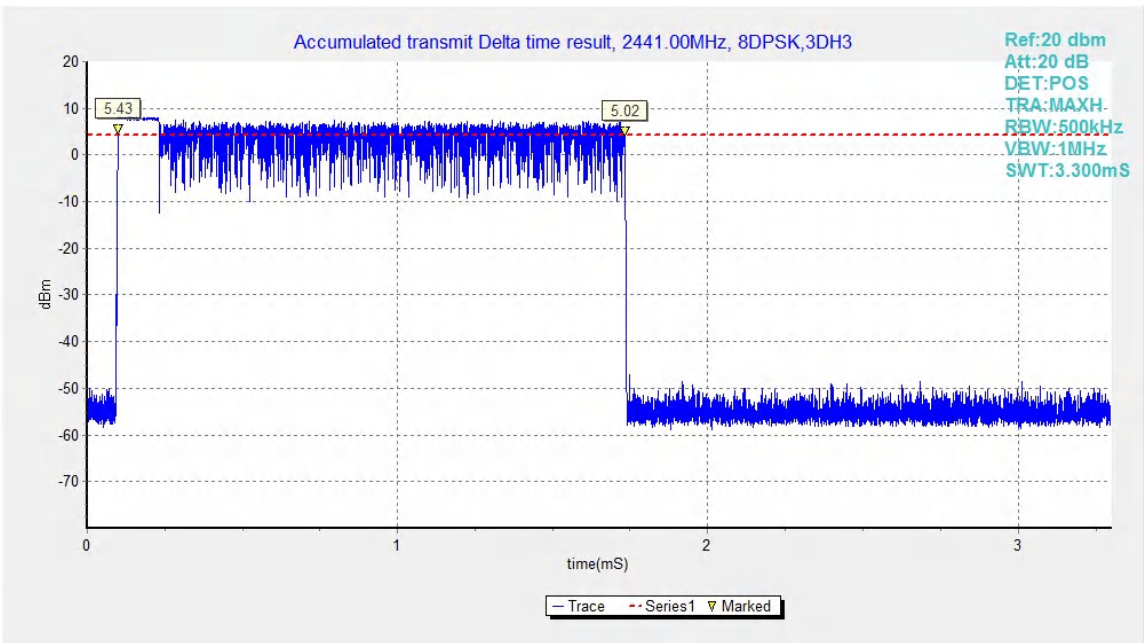


Fig.78. Time of occupancy (Dwell Time): Channel 39, Packet 3-DH3

©Copyright. All rights reserved by CTTL.

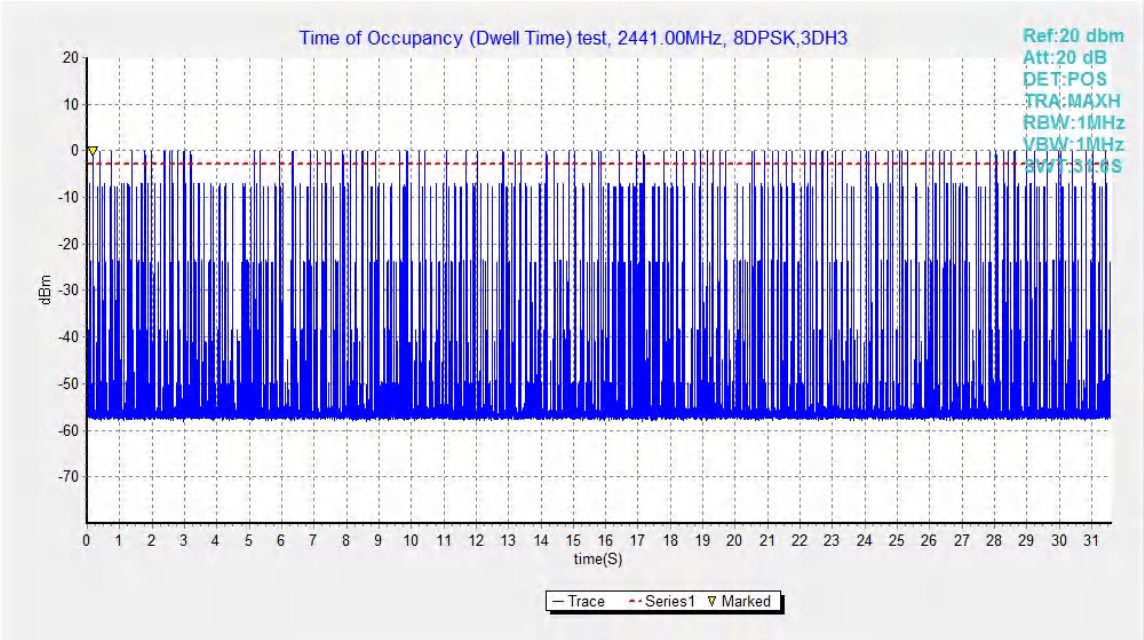


Fig.79. Number of Transmissions Measurement: Channel 39,Packet 3-DH3

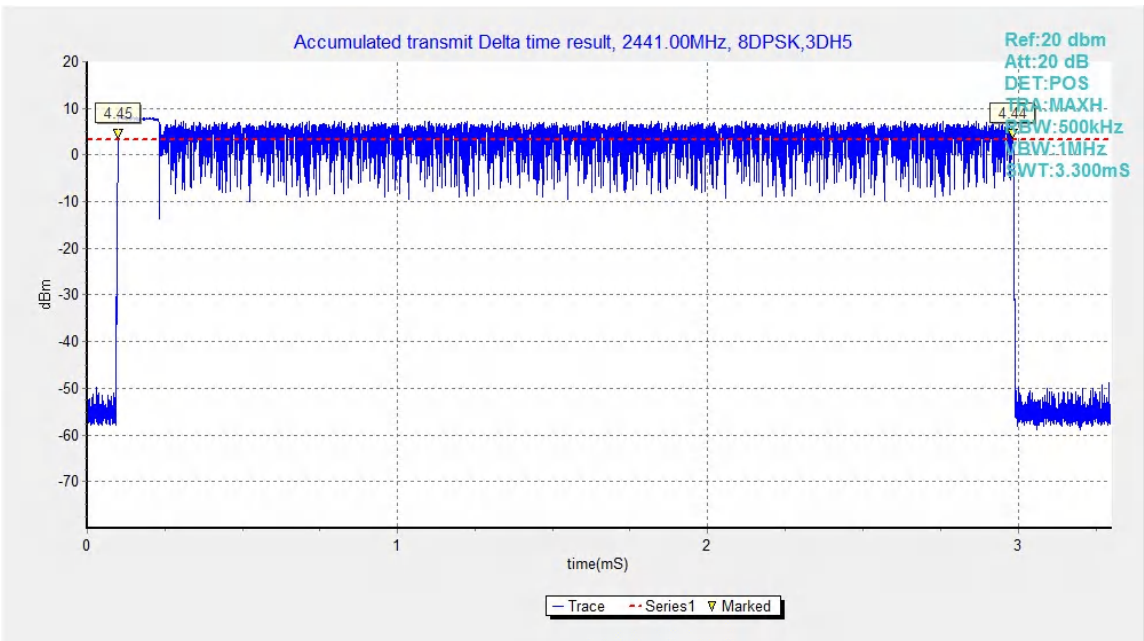


Fig.80. Time of occupancy (Dwell Time): Channel 39, Packet 3-DH5

©Copyright. All rights reserved by CTTL.

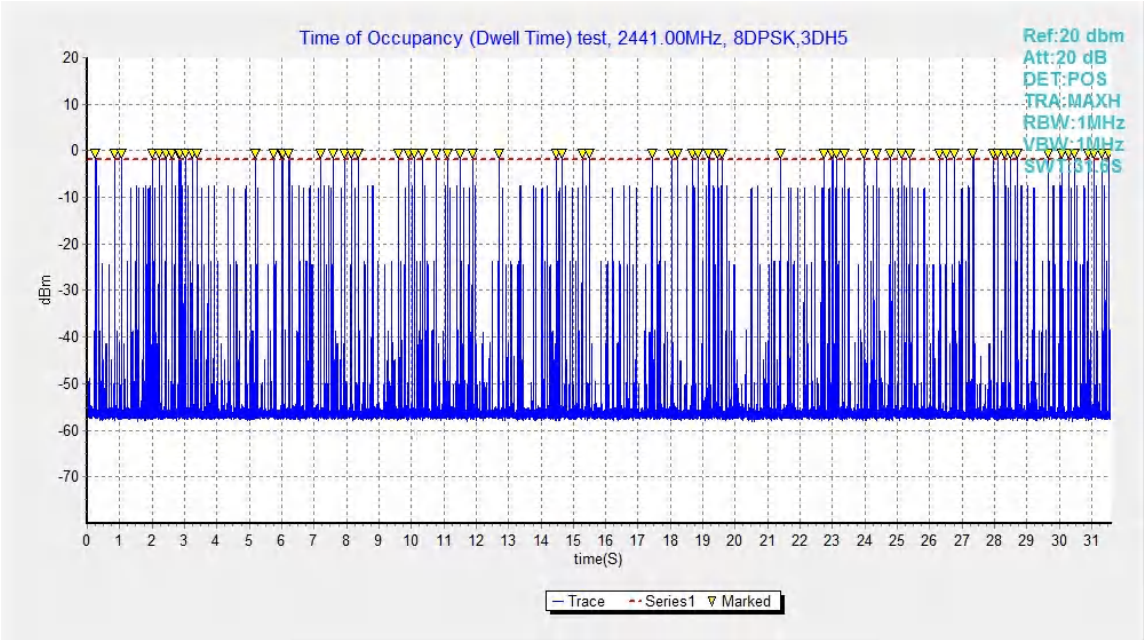


Fig.81. Number of Transmissions Measurement: Channel 39,Packet 3-DH5

©Copyright. All rights reserved by CTTL.

B.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	944.25	NA
39	Fig.83	947.25	NA
78	Fig.84	939.00	NA

For π/4 DQPSK

Channel	20dB Bandwidth (kHz)		Conclusion
0	Fig.85	1234.50	NA
39	Fig.86	1257.75	NA
78	Fig.87	1254.75	NA

For 8DPSK

Channel	20dB Bandwidth (kHz)		Conclusion
0	Fig.88	1264.50	NA
39	Fig.89	1204.50	NA
78	Fig.90	1257.75	NA

Conclusion: NA

Test graphs as below:

©Copyright. All rights reserved by CTTL.

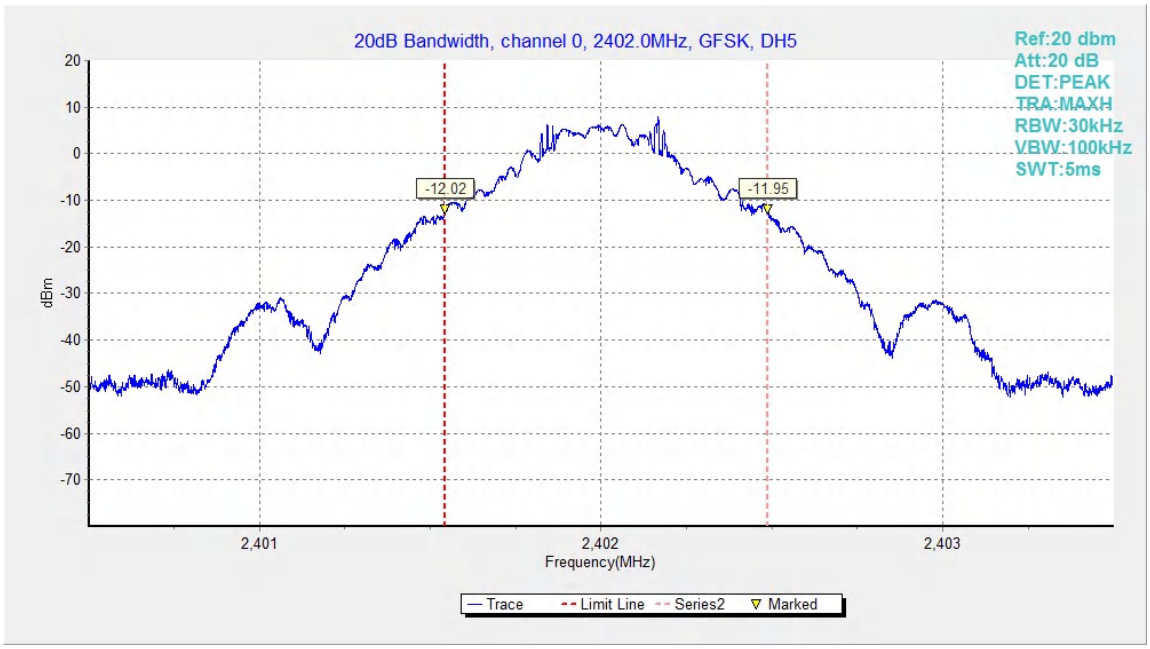


Fig.82. 20dB Bandwidth: GFSK, Channel 0

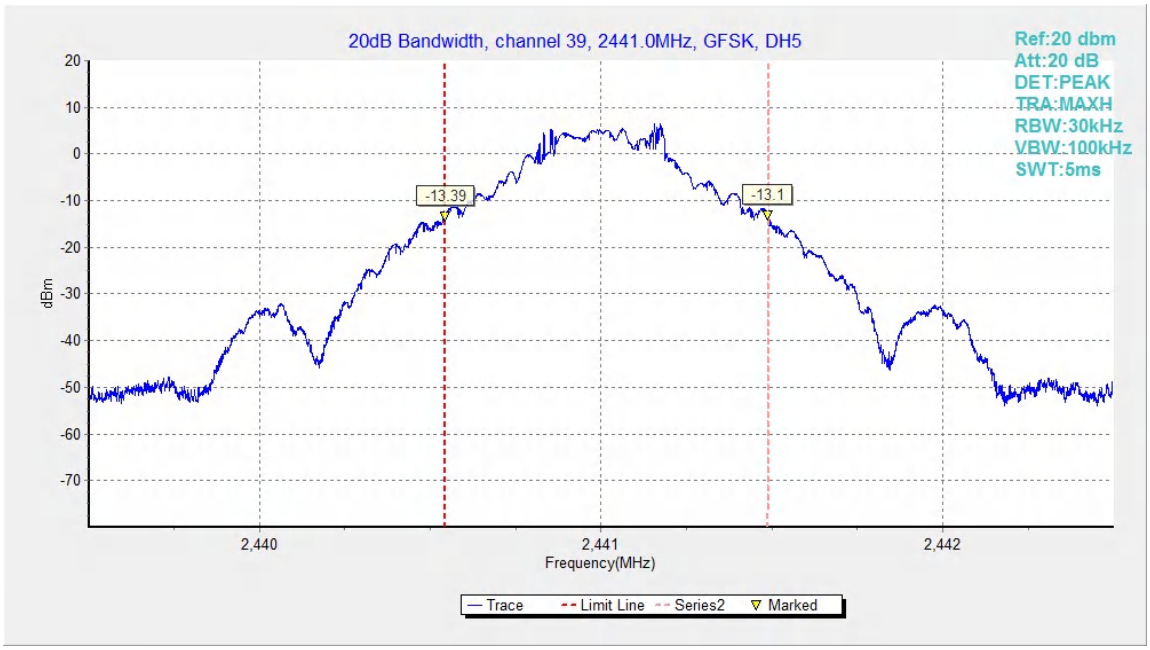


Fig.83. 20dB Bandwidth: GFSK, Channel 39

©Copyright. All rights reserved by CTTL.

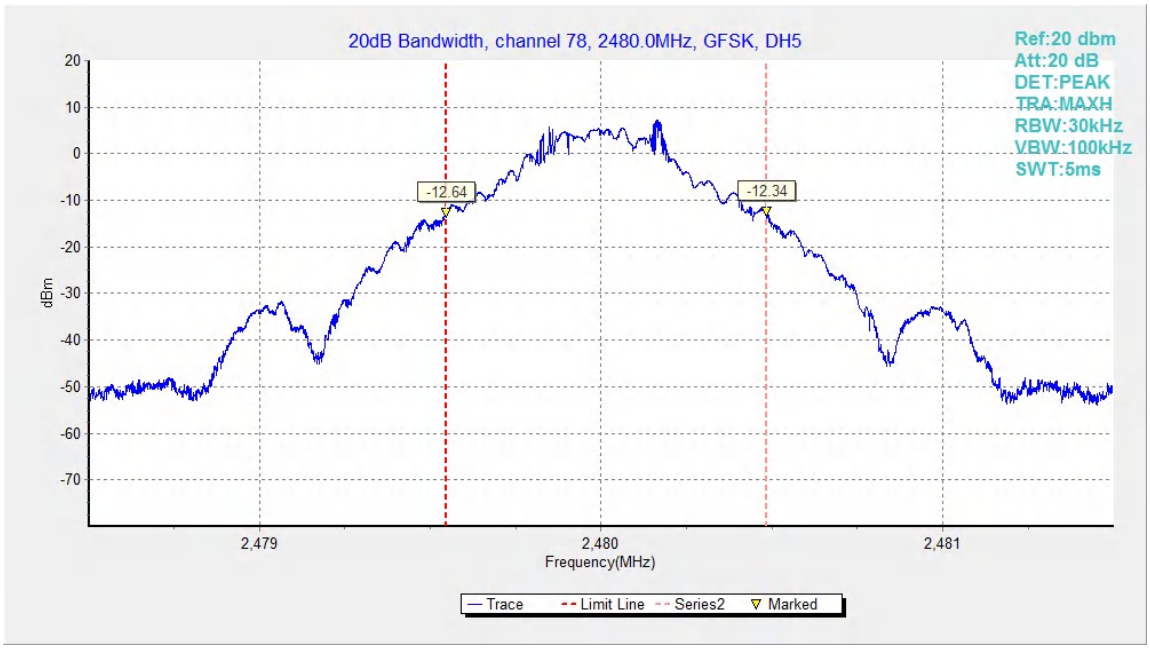


Fig.84. 20dB Bandwidth: GFSK, Channel 78

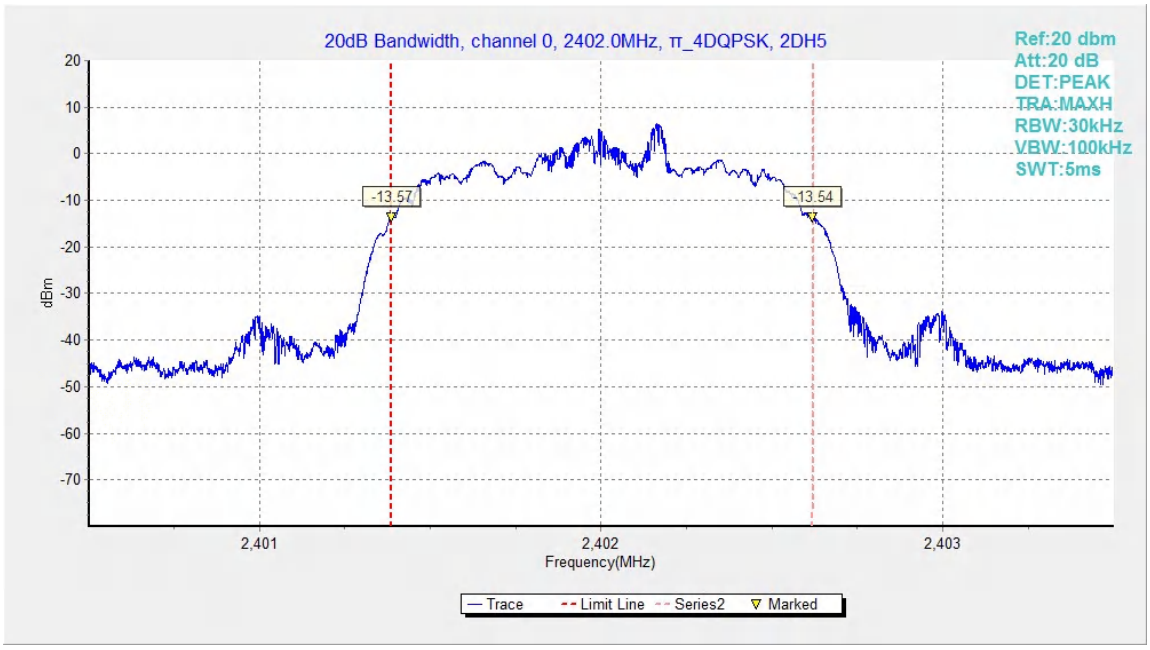


Fig.85. 20dB Bandwidth: π/4 DQPSK, Channel 0

©Copyright. All rights reserved by CTTL.

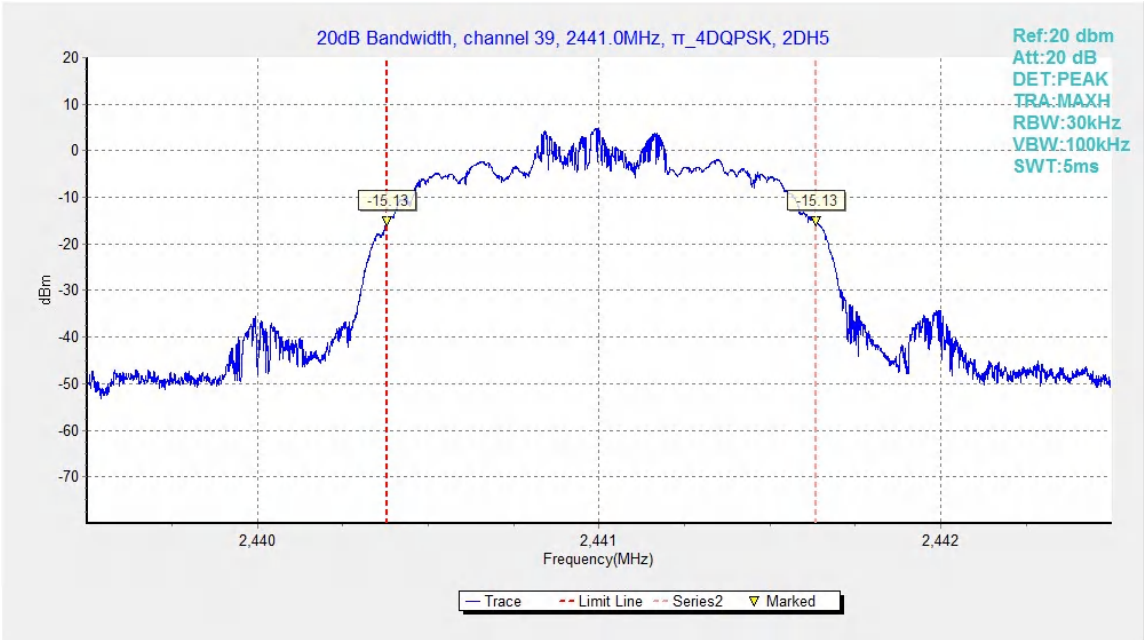


Fig.86. 20dB Bandwidth: π/4 DQPSK, Channel 39

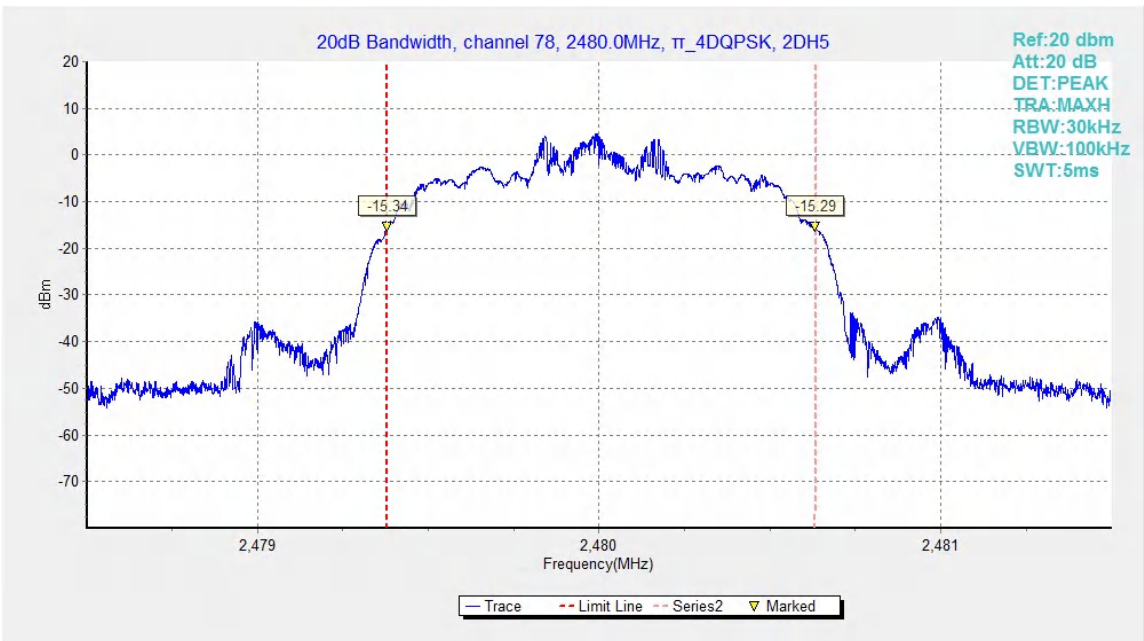


Fig.87. 20dB Bandwidth: π/4 DQPSK, Channel 78

©Copyright. All rights reserved by CTTL.

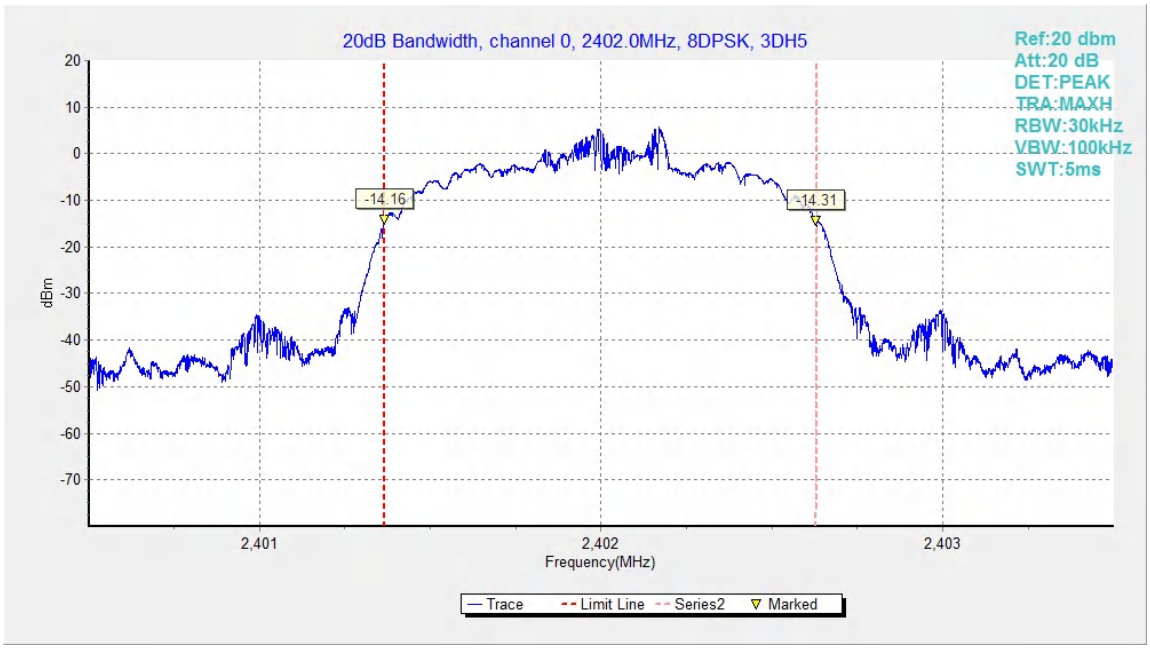


Fig.88. 20dB Bandwidth: 8DPSK, Channel 0

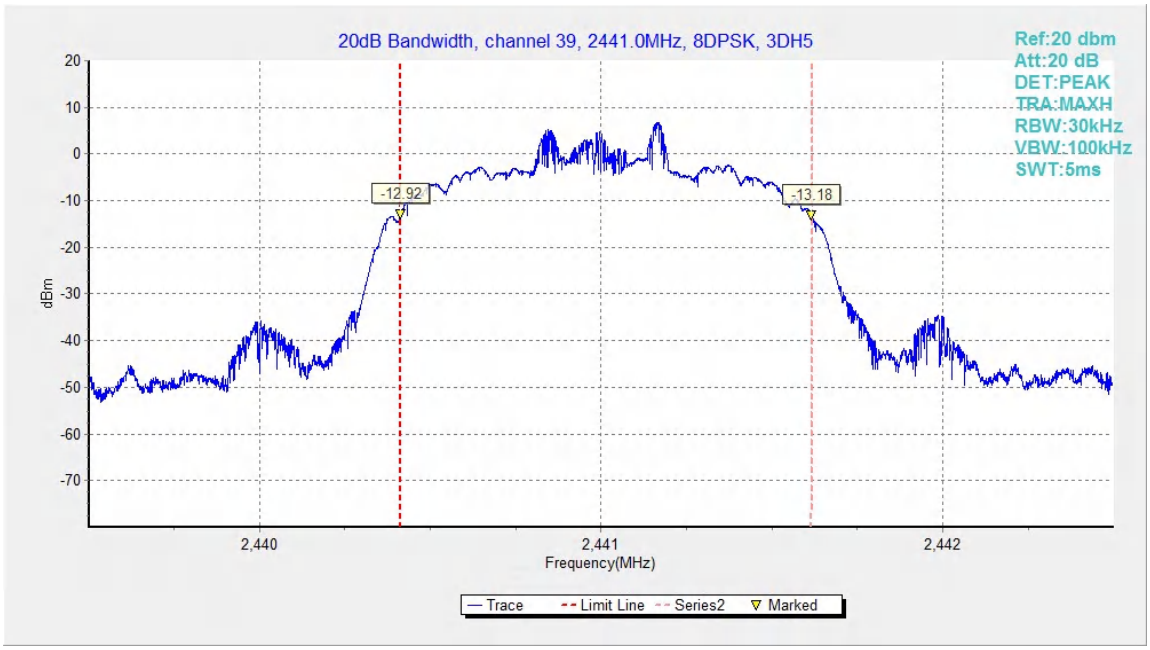


Fig.89. 20dB Bandwidth: 8DPSK, Channel 39

©Copyright. All rights reserved by CTTL.

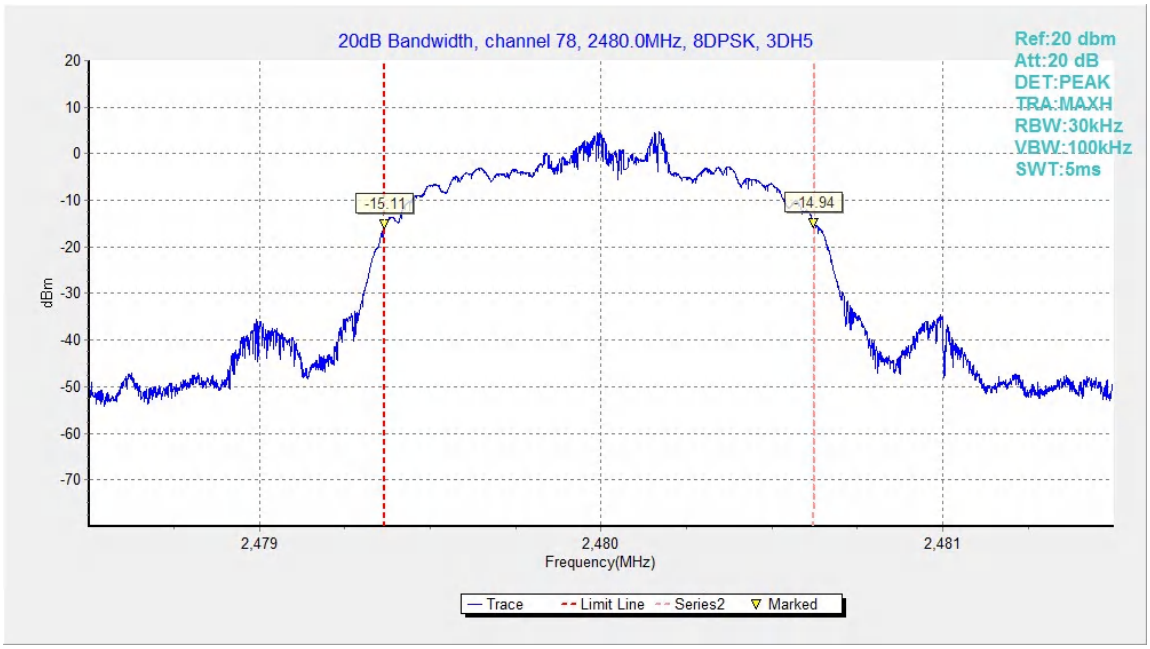


Fig.90. 20dB Bandwidth: 8DPSK, Channel 78

©Copyright. All rights reserved by CTTL.

B.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	1321.50	P

For π/4 DQPSK

Channel	Carrier frequency separation (kHz)		Conclusion
39	Fig.92	1016.25	P

For 8DPSK

Channel	Carrier frequency separation (kHz)		Conclusion
39	Fig.93	979.50	P

Conclusion: PASS

Test graphs as below:

©Copyright. All rights reserved by CTTL.

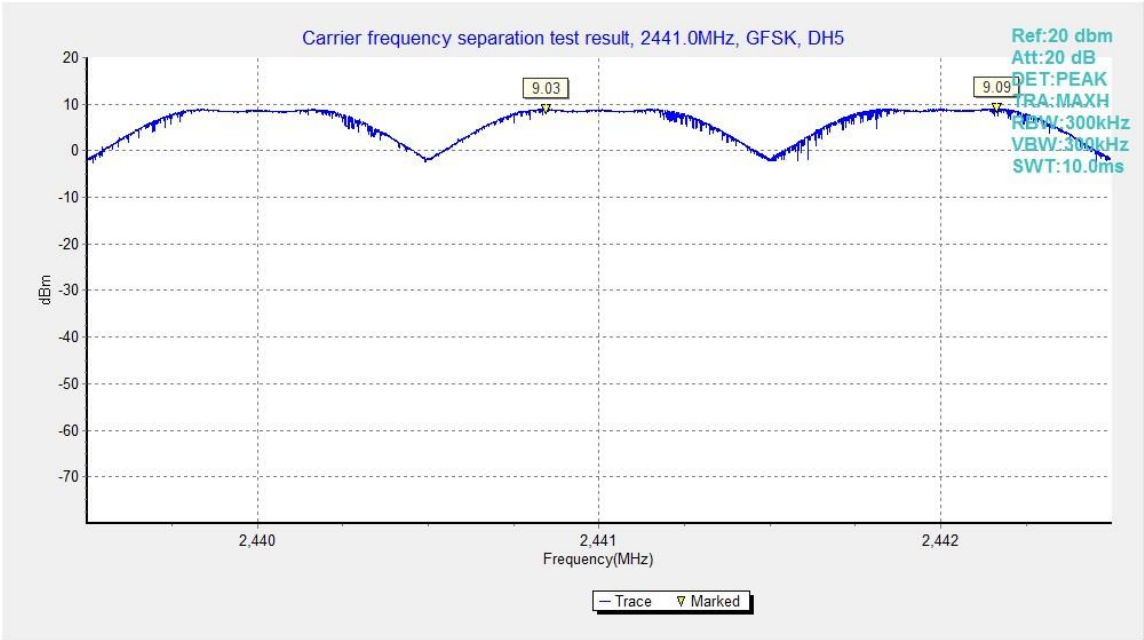


Fig.91. Carrier frequency separation measurement: GFSK, Channel 39

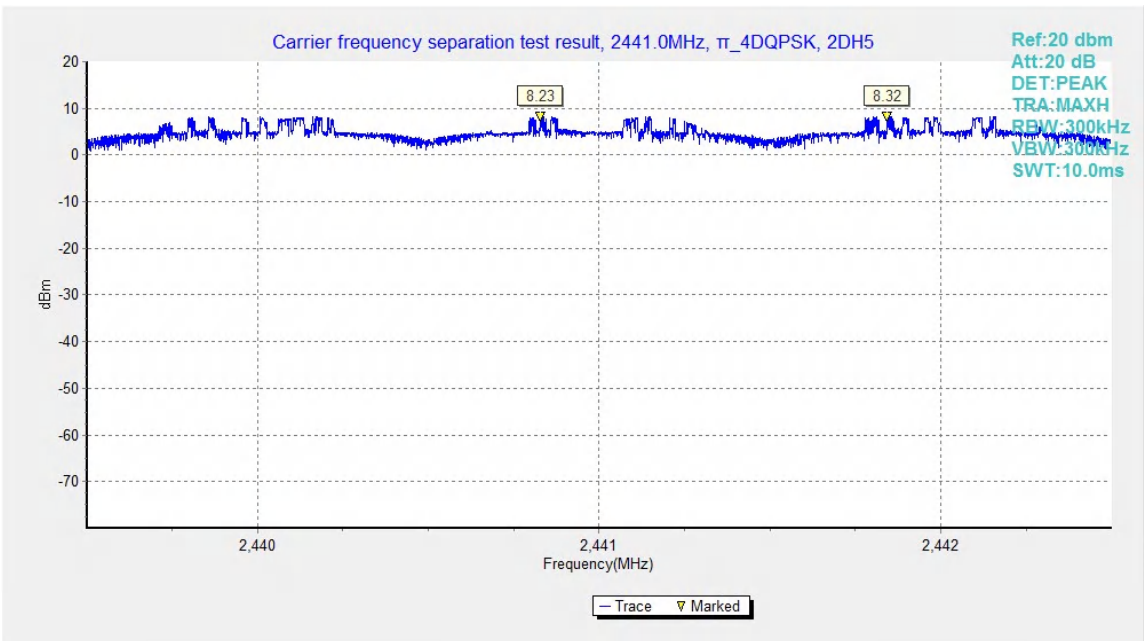


Fig.92. Carrier frequency separation measurement: π/4 DQPSK, Channel 39

©Copyright. All rights reserved by CTTL.

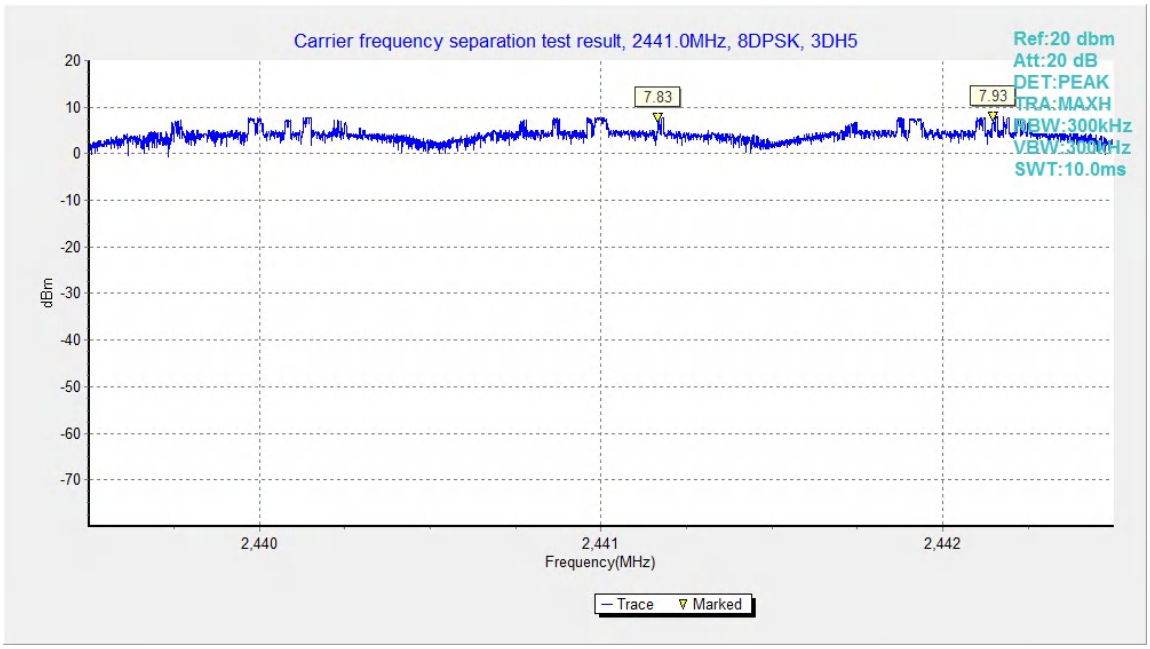


Fig.93. Carrier frequency separation measurement: 8DPSK, Channel 39

©Copyright. All rights reserved by CTTL.

B.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:

©Copyright. All rights reserved by CTTL.

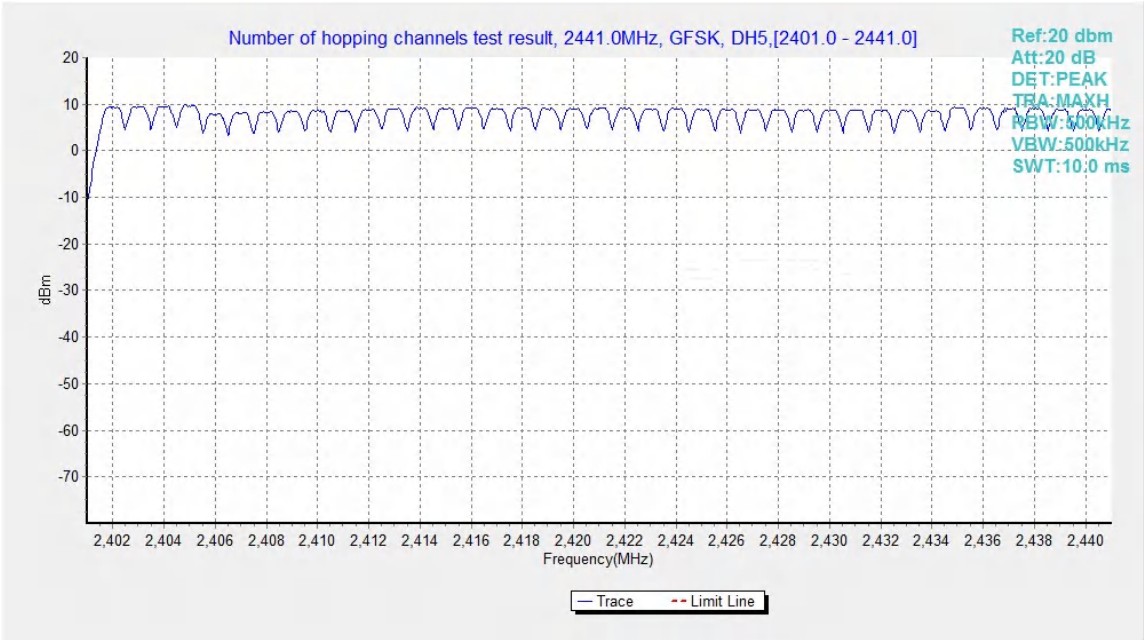


Fig.94. Number of hopping frequencies: GFSK, Channel 0 - 39

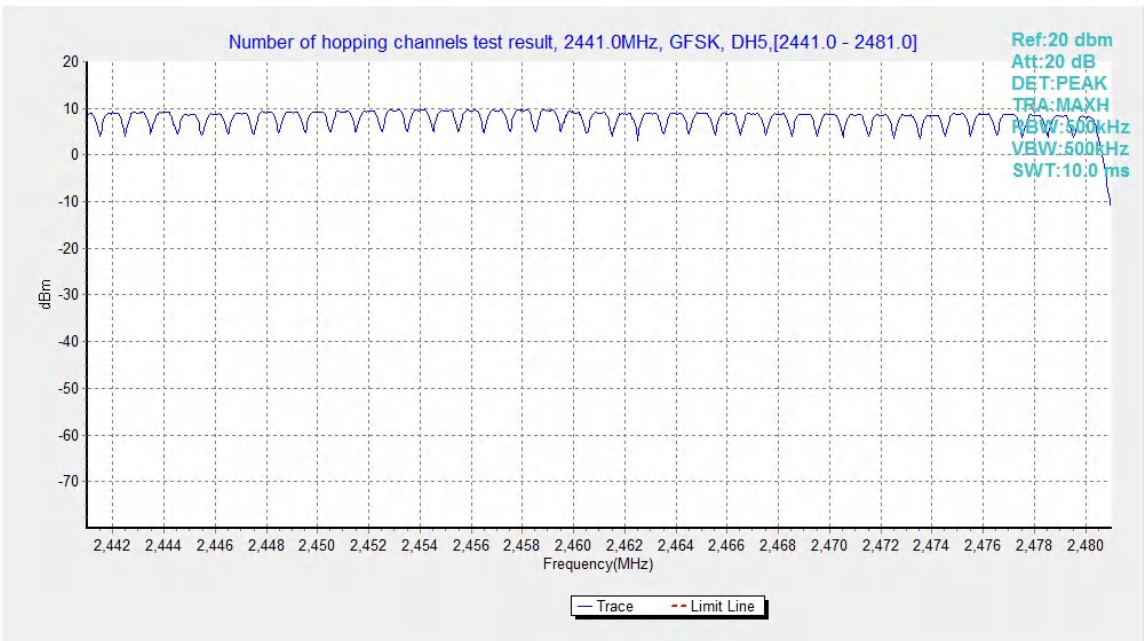


Fig.95. Number of hopping frequencies: GFSK, Channel 40 - 78

©Copyright. All rights reserved by CTTL.

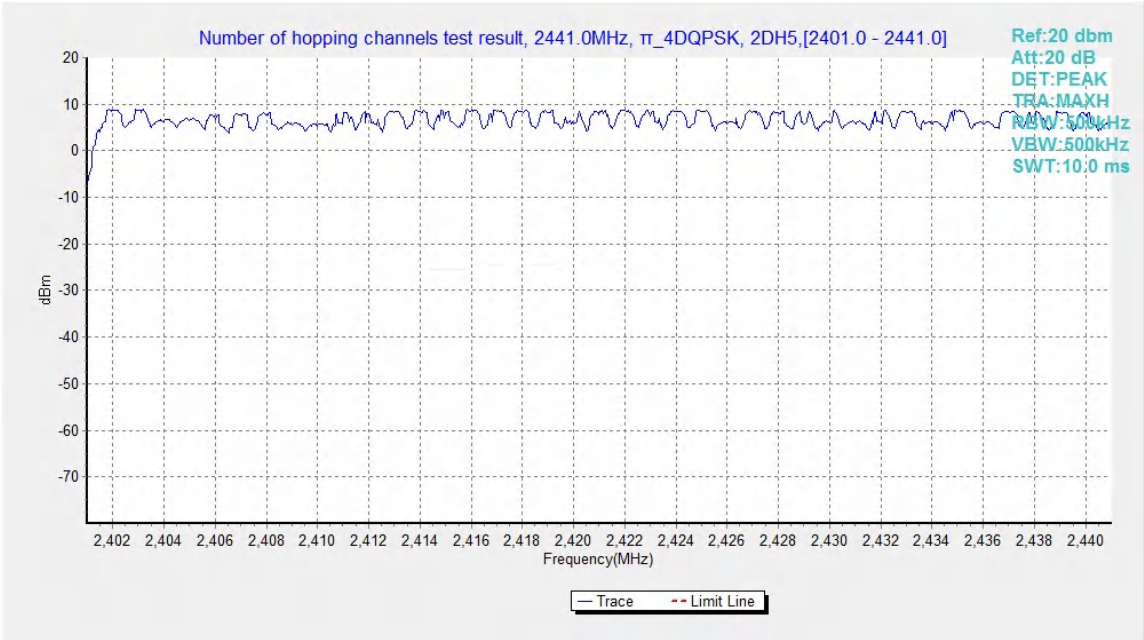


Fig.96. Number of hopping frequencies: π/4 DQPSK, Channel 0 - 39

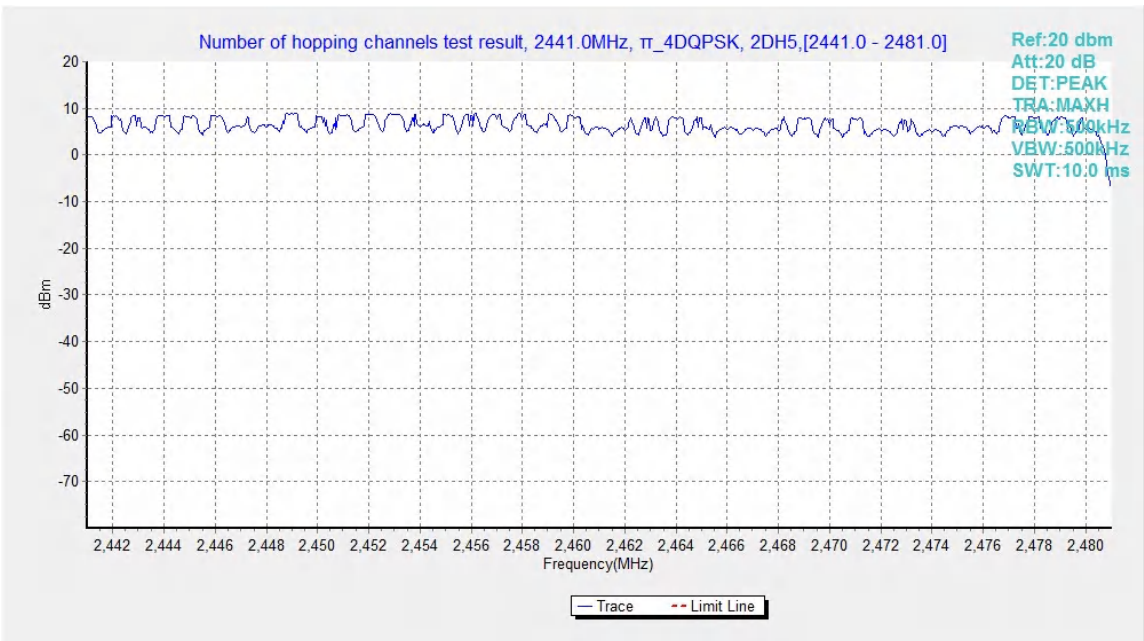


Fig.97. Number of hopping frequencies: π/4 DQPSK, Channel 40 - 78

©Copyright. All rights reserved by CTTL.

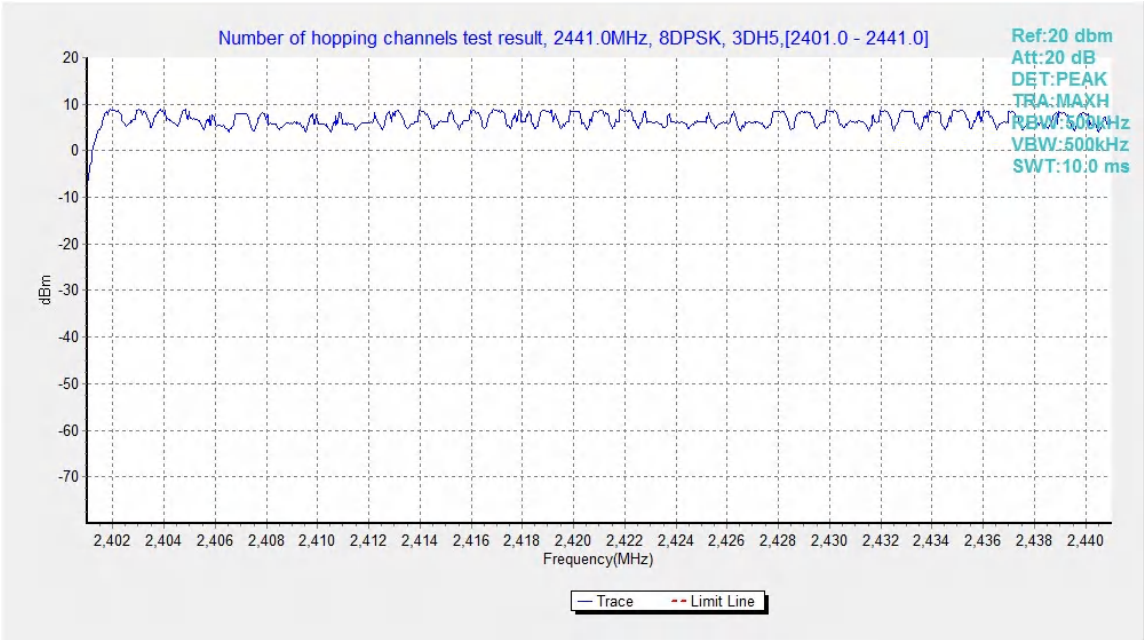


Fig.98. Number of hopping frequencies: 8DPSK, Channel 0 - 39

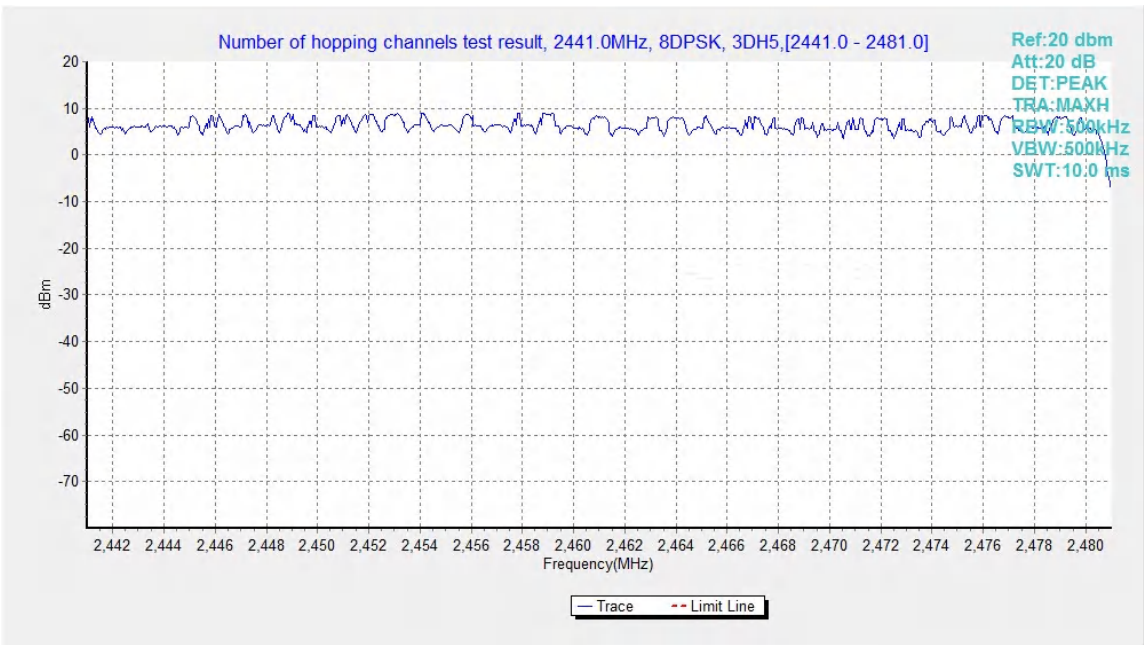


Fig.99. Number of hopping frequencies: 8DPSK, Channel 40 - 78

©Copyright. All rights reserved by CTTL.

B.10. AC Powerline Conducted Emission

Summary

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

Method of Measurement:

See Clause 6.2 of ANSI C63.10 specifically.

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

The conducted emissions from the AC port of the EUT are measured in a shielding room. The EUT is connected to a Line Impedance Stabilization Network (LISN). An overview sweep with peak detection was performed. The measurements were performed with a quasi-peak detector and if required, an average detector.

The conducted emission measurements were made with the following detector of the test receiver: Quasi-Peak / Average Detector.

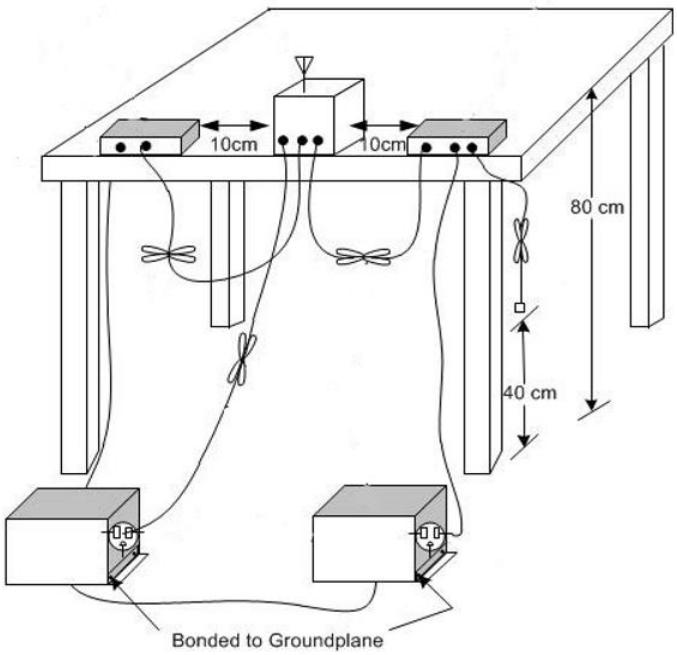
The measurement bandwidth is:

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

Test Condition:

Voltage（V）	Frequency（Hz）
120	60

Test setup



Measurement Result and limit:

©Copyright. All rights reserved by CTTL.

Bluetooth (Quasi-peak Limit)

Frequency range (MHz)	Quasi-peak Limit (dBμV)	Result (dBμV)		Conclusion
		With charger		
		bluetooth	Idle	
0.15 to 0.5	66 to 56	Fig.B.10.1	Fig. B.10.2	**P**
0.5 to 5	56			
5 to 30	60			
NOTE: The limit decreases linearly with the logarithm of the frequency in the range 0.15 MHz to 0.5 MHz.				

Bluetooth (Average Limit)

Frequency range (MHz)	Average Limit (dBμV)	Result (dBμV)		Conclusion
		With charger		
		bluetooth	Idle	
0.15 to 0.5	56 to 46	Fig.B.10.1	Fig. B.10.2	**P**
0.5 to 5	46			
5 to 30	50			
NOTE: The limit decreases linearly with the logarithm of the frequency in the range 0.15 MHz to 0.5 MHz.				

Conclusion: Pass

Test graphs as below:

©Copyright. All rights reserved by CTTL.

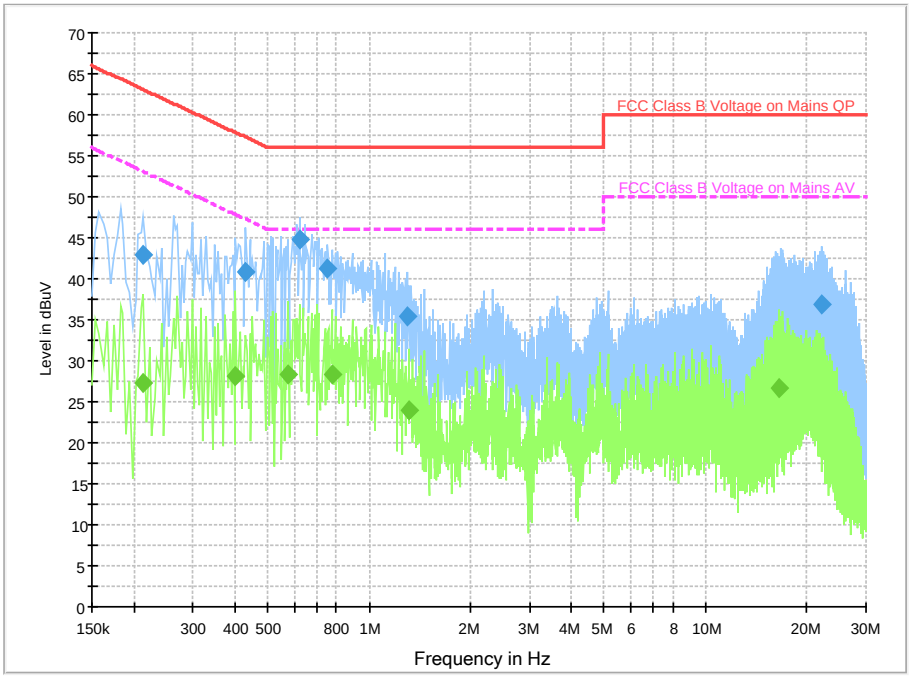


Fig.B.10.1 AC Powerline Conducted Emission- bluetooth

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

Final Result 1

Frequency (MHz)	QuasiPeak (dBµV)	Meas. Time	Bandwidth (kHz)	Filter	Line	Corr. (dB)	Margin (dB)	Limit (dBµV)	Comment
0.214000	**42.9**	**2000.0**	**9.000**	**On**	**N**	**19.8**	**20.2**	**63.0**	
0.430000	**40.8**	**2000.0**	**9.000**	**On**	**L1**	**20.0**	**16.5**	**57.3**	
0.622000	**44.7**	**2000.0**	**9.000**	**On**	**L1**	**20.0**	**11.3**	**56.0**	
0.754000	**41.2**	**2000.0**	**9.000**	**On**	**N**	**19.8**	**14.8**	**56.0**	
1.302000	**35.5**	**2000.0**	**9.000**	**On**	**N**	**19.7**	**20.5**	**56.0**	
22.246000	**36.9**	**2000.0**	**9.000**	**On**	**L1**	**20.1**	**23.1**	**60.0**	

Final Result 2

Frequency (MHz)	CAverage (dBµV)	Meas. Time	Bandwidth (kHz)	Filter	Line	Corr. (dB)	Margin (dB)	Limit (dBµV)	Comment
0.214000	**27.2**	**2000.0**	**9.000**	**On**	**N**	**19.8**	**25.8**	**53.0**	
0.402000	**28.0**	**2000.0**	**9.000**	**On**	**L1**	**20.0**	**19.8**	**47.8**	
0.574000	**28.3**	**2000.0**	**9.000**	**On**	**N**	**19.9**	**17.7**	**46.0**	
0.774000	**28.4**	**2000.0**	**9.000**	**On**	**L1**	**19.9**	**17.6**	**46.0**	
1.318000	**23.9**	**2000.0**	**9.000**	**On**	**N**	**19.7**	**22.1**	**46.0**	
16.558000	**26.7**	**2000.0**	**9.000**	**On**	**L1**	**20.0**	**23.3**	**50.0**	

©Copyright. All rights reserved by CTTL.

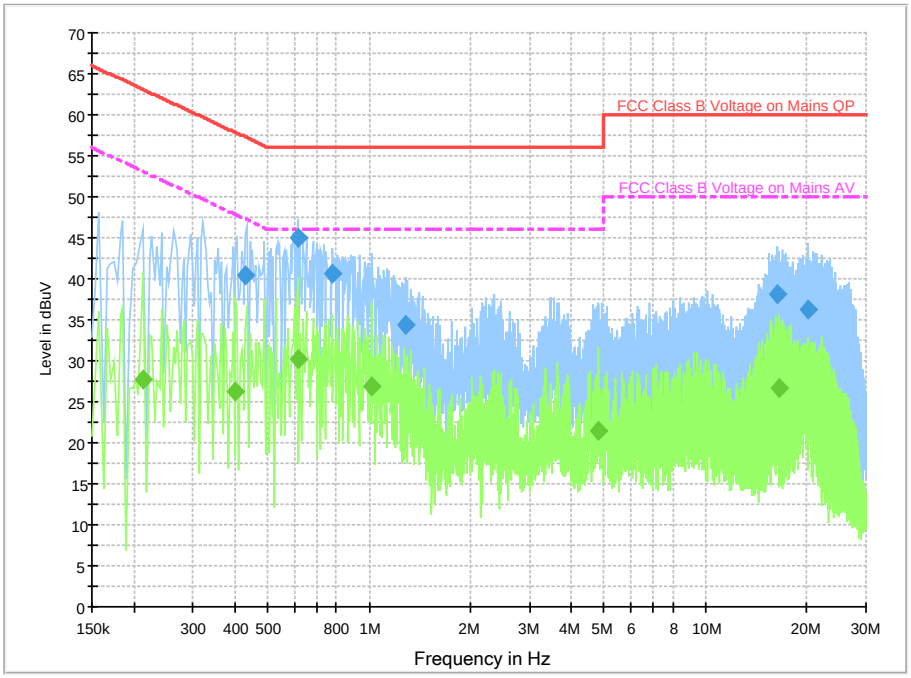


Fig.B.10.2 AC Powerline Conducted Emission-Idle

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

Final Result 1

Frequency (MHz)	QuasiPeak (dBµV)	Meas. Time	Bandwidth (kHz)	Filter	Line	Corr. (dB)	Margin (dB)	Limit (dBµV)	Comment
0.430000	**40.4**	**2000.0**	**9.000**	**On**	**N**	**19.9**	**16.9**	**57.3**	
0.614000	**45.1**	**2000.0**	**9.000**	**On**	**L1**	**20.0**	**10.9**	**56.0**	
0.774000	**40.6**	**2000.0**	**9.000**	**On**	**N**	**19.8**	**15.4**	**56.0**	
1.286000	**34.4**	**2000.0**	**9.000**	**On**	**L1**	**19.9**	**21.6**	**56.0**	
16.322000	**38.0**	**2000.0**	**9.000**	**On**	**L1**	**20.0**	**22.0**	**60.0**	
20.246000	**36.3**	**2000.0**	**9.000**	**On**	**L1**	**20.0**	**23.7**	**60.0**	

Final Result 2

Frequency (MHz)	CAverage (dBµV)	Meas. Time	Bandwidth (kHz)	Filter	Line	Corr. (dB)	Margin (dB)	Limit (dBµV)	Comment
0.214000	**27.7**	**2000.0**	**9.000**	**On**	**L1**	**19.8**	**25.3**	**53.0**	
0.402000	**26.3**	**2000.0**	**9.000**	**On**	**N**	**19.9**	**21.5**	**47.8**	
0.614000	**30.3**	**2000.0**	**9.000**	**On**	**L1**	**20.0**	**15.7**	**46.0**	
1.022000	**26.9**	**2000.0**	**9.000**	**On**	**N**	**19.7**	**19.1**	**46.0**	
4.810000	**21.5**	**2000.0**	**9.000**	**On**	**L1**	**19.8**	**24.5**	**46.0**	
16.590000	**26.6**	**2000.0**	**9.000**	**On**	**L1**	**20.0**	**23.4**	**50.0**	

©Copyright. All rights reserved by CTTL.

B.11. Antenna Requirement

The antenna of the device is permanently attached. There are no provisions for connection to an external antenna.
The unit complies with the requirement of FCC Part 15.203.

©Copyright. All rights reserved by CTTL.

ANNEX C: Accreditation Certificate

Accredited Laboratory

A2LA has accredited

TELECOMMUNICATION TECHNOLOGY LABS, CAICT

Beijing, People's Republic of China

for technical competence in the field of

Electrical Testing

This laboratory is accredited in accordance with the recognized International Standard ISO/IEC 17025:2017 *General requirements for the competence of testing and calibration laboratories*. This accreditation demonstrates technical competence for a defined scope and the operation of a laboratory quality management system (*refer to joint ISO-ILAC-IAF Communiqué dated April 2017*).

Presented this 23rd day of July 2024.

Mr. Trace McInturff, Vice President, Accreditation Services
For the Accreditation Council
Certificate Number 7049.01
Valid to July 31, 2026

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

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

©Copyright. All rights reserved by CTTL.