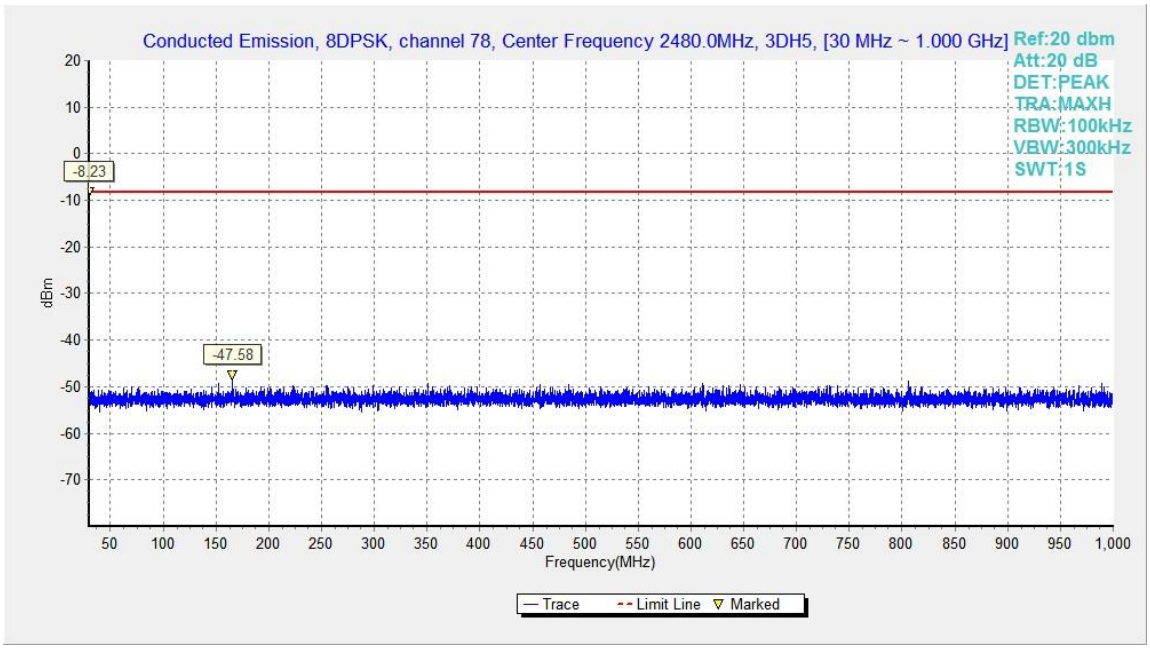


Fig.54. Conducted spurious emission: 8DPSK, Channel 78, 30MHz - 1GHz

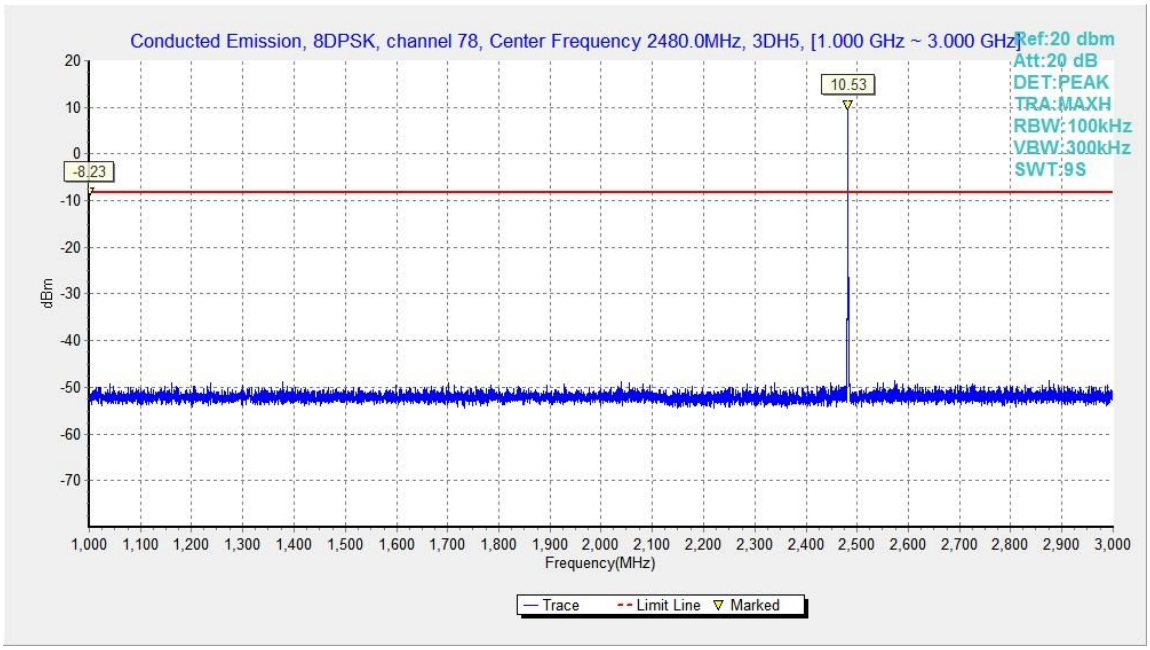


Fig.55. Conducted spurious emission: 8DPSK, Channel 78, 1GHz - 3GHz

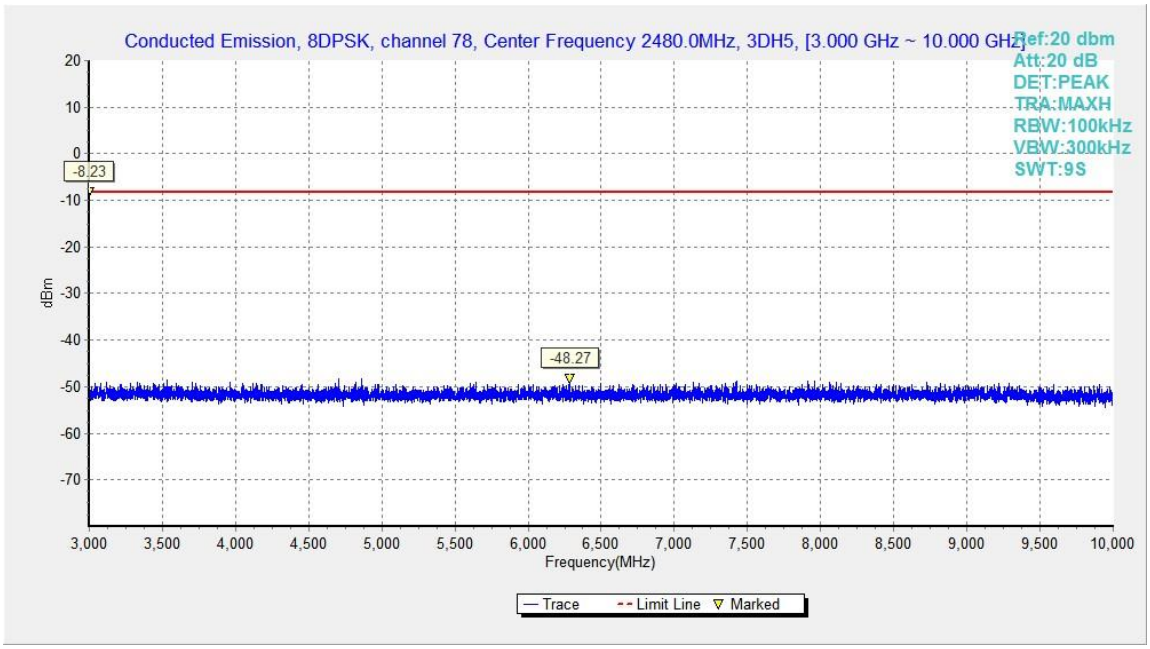


Fig.56. Conducted spurious emission: 8DPSK, Channel 78, 3GHz - 10GHz

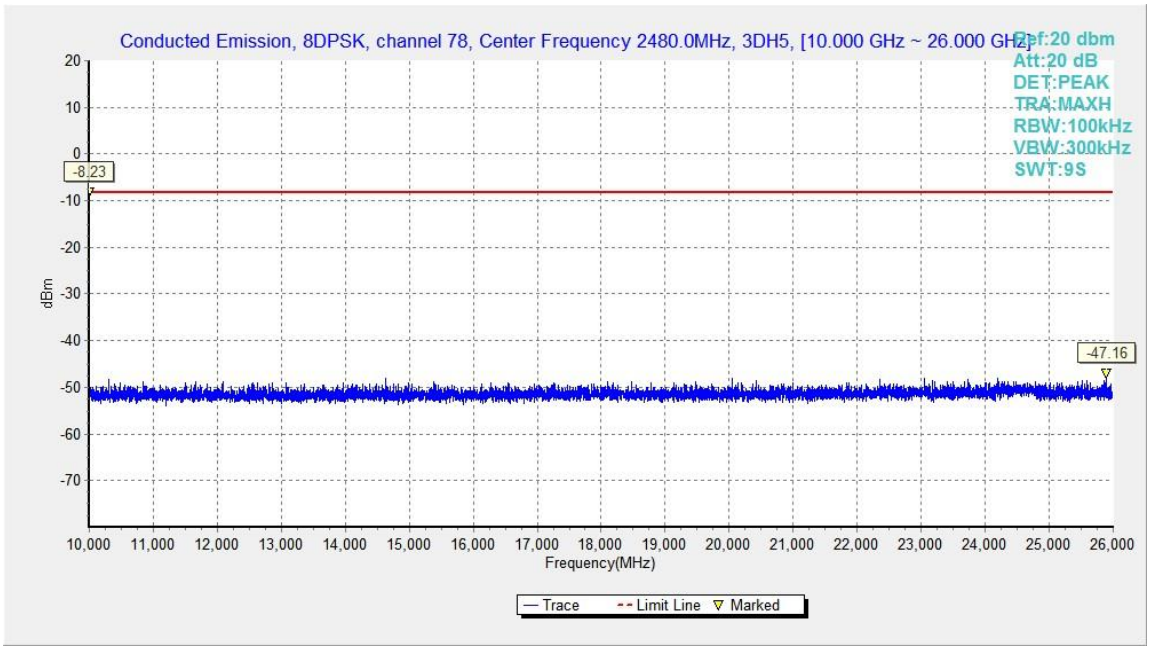


Fig.57. Conducted spurious emission: 8DPSK, Channel 78, 10GHz - 26GHz

B.5. Radiated Unwanted Emission

Limits

Measurement Limit

Standard	Limit
FCC 47 CFR Part 15.247, 15.205, 15.209	20dB below peak output power

In addition, radiated emissions which fall in the restricted bands, as defined in § 15.205(a), must also comply with the radiated emission limits specified in § 15.209(a) (see § 15.205(c)).

Limit in restricted band

Frequency (MHz)	Field strength(μV/m)	Measurement distance (m)
0.009 - 0.490	2400/F(kHz)	300
0.490 - 1.705	24000/F(kHz)	30
1.705 – 30.0	30	30

Frequency of emission (MHz)	Field strength (uV/m)	Field strength (dBuV/m)	Measurement distance (m)
30-88	100	40	3
88-216	150	43.5	3
216-960	200	46	3
Above 960	500	54	3

Note: When performing measurements at a distance other than that specified, the results shall be extrapolated to the specified distance using an extrapolation factor.

Test setup

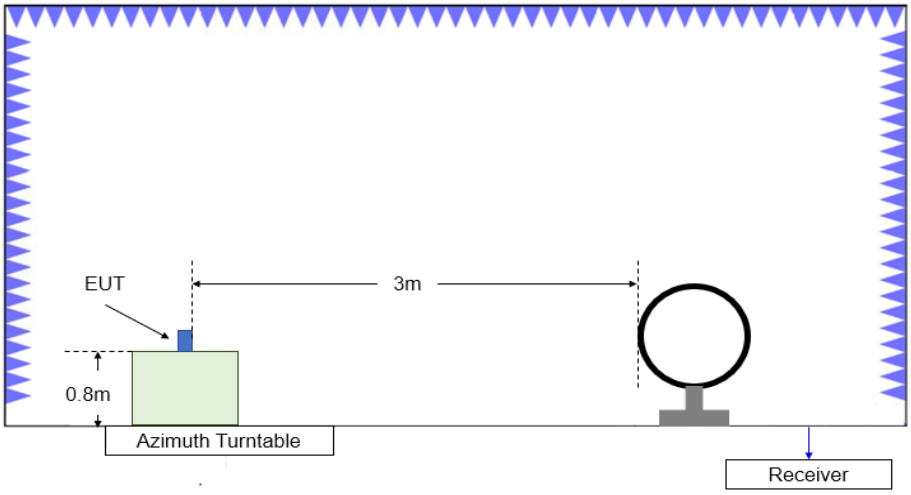


Figure B.5.1. Test Site Diagram (9kHz-30MHz)

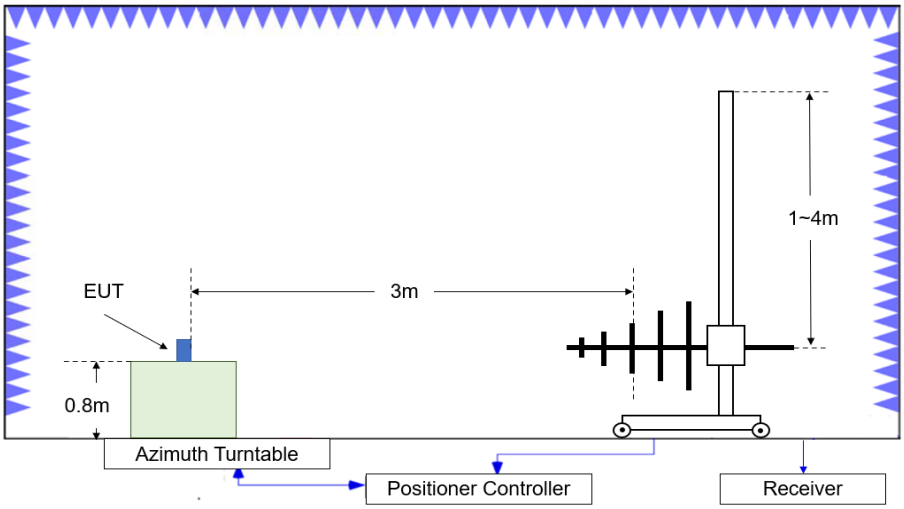


Figure B.5.2. Test Site Diagram (30MHz-1GHz)

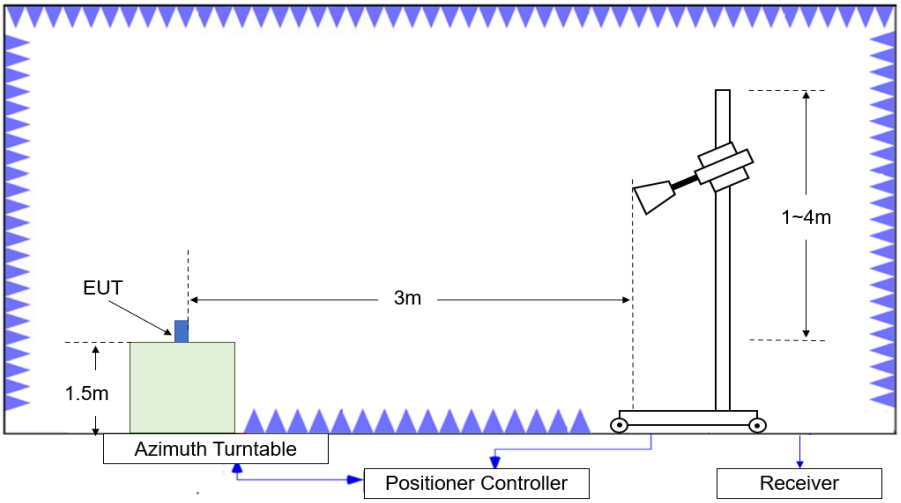


Figure B.5.3. Test Site Diagram (1GHz-40GHz)

Test Procedures

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

Test setting

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

Sample Calculation

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

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

The measurement results are obtained as described below:

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. In total, three EUT elevation positions are measured. 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 10^{th} harmonic of highest fundamental frequency or 40GHz, whichever is lower.

Test Result

EUT ID: UT02a

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)
2388.234	60.20	4.61	27.48	28.11	74.00	13.80	V
2388.846	60.30	4.61	27.48	28.21	74.00	13.70	V
4804.000	41.66	-35.05	33.98	42.73	74.00	32.34	H
7205.500	44.55	-33.04	35.52	42.06	74.00	29.45	V
9609.500	45.15	-32.21	36.32	41.04	74.00	28.85	V
12010.500	46.75	-30.19	38.80	38.14	74.00	27.25	V

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)
2364.200	46.13	-35.69	31.37	50.45	74.00	27.87	V
2510.200	46.75	-35.79	32.44	50.10	74.00	27.25	H
4882.000	41.52	-34.37	33.83	42.06	74.00	32.48	V
7323.000	43.20	-33.03	35.40	40.82	74.00	30.80	V
9764.000	45.07	-31.87	36.57	40.38	74.00	28.93	V
12205.000	47.10	-29.39	38.79	37.70	74.00	26.90	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)
2483.647	61.15	4.65	27.80	28.70	74.00	12.85	V
2483.919	61.25	4.65	27.80	28.80	74.00	12.75	V
4960.500	42.05	-34.41	33.80	42.67	74.00	31.95	V
7439.000	43.15	-32.79	35.42	40.52	74.00	30.85	H
9920.000	45.15	-32.04	36.84	40.35	74.00	28.85	H
12400.500	47.16	-29.42	38.60	37.97	74.00	26.84	H

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)
2384.620	61.36	4.60	27.47	29.29	74.00	12.64	V
2387.455	60.80	4.61	27.48	28.71	74.00	13.20	H
4804.000	41.92	-35.05	33.98	42.99	74.00	32.08	H
7205.500	43.12	-33.04	35.52	40.64	74.00	30.88	V
9608.500	44.07	-32.21	36.32	39.97	74.00	29.93	V
12010.000	47.44	-30.19	38.80	38.83	74.00	26.56	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)
2355.600	45.80	-35.86	31.27	50.40	74.00	28.20	H
2510.000	46.26	-35.78	32.44	49.59	74.00	27.74	V
4881.500	41.84	-34.38	33.83	42.39	74.00	32.16	V
7322.500	43.73	-33.03	35.40	41.36	74.00	30.27	H
9763.500	46.33	-31.87	36.57	41.63	74.00	27.67	V
12205.000	47.69	-29.39	38.79	38.29	74.00	26.31	H

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)
2483.988	62.18	4.65	27.80	29.73	74.00	11.82	H
2485.050	61.85	4.65	27.80	29.40	74.00	12.15	V
4959.500	42.23	-34.43	33.80	42.86	74.00	31.77	H
7439.500	42.77	-32.79	35.42	40.14	74.00	31.23	H
9920.000	43.92	-32.04	36.84	39.11	74.00	30.08	H
12400.000	46.97	-29.42	38.60	37.79	74.00	27.03	V

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)
2386.213	60.68	4.61	27.47	28.60	74.00	13.32	H
2388.391	60.52	4.61	27.48	28.43	74.00	13.48	V
4804.500	42.62	-35.05	33.97	43.69	74.00	31.38	V
7205.000	44.26	-33.04	35.52	41.77	74.00	29.74	V
9608.500	44.63	-32.21	36.32	40.52	74.00	29.37	V
12010.000	46.54	-30.19	38.80	37.93	74.00	27.46	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)
2361.200	45.78	-35.75	31.34	50.20	74.00	28.22	V
2506.400	46.81	-35.61	32.43	50.00	74.00	27.19	V
4881.500	41.59	-34.38	33.83	42.14	74.00	32.41	H
7323.000	43.67	-33.03	35.40	41.30	74.00	30.33	V
9763.500	44.84	-31.87	36.57	40.14	74.00	29.16	H
12205.000	48.30	-29.39	38.79	38.89	74.00	25.70	V

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)
2483.578	61.46	4.65	27.80	29.01	74.00	12.54	H
2483.834	61.34	4.65	27.80	28.89	74.00	12.66	V
4960.000	42.62	-34.42	33.80	43.24	74.00	31.38	V
7439.500	43.14	-32.79	35.42	40.51	74.00	30.86	V
9920.000	44.47	-32.04	36.84	39.66	74.00	29.53	H
12400.500	48.16	-29.42	38.60	38.97	74.00	25.84	V

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)
2389.537	46.32	4.61	27.48	14.22	54.00	7.68	V
2389.856	46.30	4.62	27.48	14.21	54.00	7.70	V
4803.667	31.31	-35.05	33.98	32.38	54.00	22.69	V
7206.000	30.76	-33.04	35.52	28.27	54.00	23.24	H
9608.000	31.68	-32.21	36.32	27.57	54.00	22.32	V
12010.000	34.29	-30.19	38.80	25.68	54.00	19.71	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)
2388.713	46.33	4.61	27.48	14.24	54.00	7.67	V
2485.575	47.29	4.65	27.80	14.84	54.00	6.71	V
4882.000	30.41	-34.37	33.83	30.96	54.00	23.59	V
7323.000	30.72	-33.03	35.40	28.34	54.00	23.28	H
9764.000	31.86	-31.87	36.57	27.17	54.00	22.14	H
12205.000	34.76	-29.39	38.79	25.35	54.00	19.24	V

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)
2485.669	47.38	4.65	27.80	14.94	54.00	6.62	V
2486.325	47.37	4.65	27.80	14.93	54.00	6.63	V
4960.000	30.13	-34.42	33.80	30.76	54.00	23.87	V
7440.000	30.44	-32.79	35.42	27.81	54.00	23.56	V
9920.000	32.11	-32.04	36.84	27.31	54.00	21.89	H
12400.000	34.75	-29.42	38.60	25.57	54.00	19.25	V

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)
2388.113	46.32	4.61	27.48	14.23	54.00	7.68	V
2388.900	46.34	4.61	27.48	14.25	54.00	7.66	V
4803.333	29.60	-35.05	33.98	30.67	54.00	24.40	H
7206.000	31.17	-33.04	35.52	28.69	54.00	22.83	V
9608.000	32.03	-32.21	36.32	27.92	54.00	21.97	H
12010.000	34.72	-30.19	38.80	26.11	54.00	19.28	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)
2384.062	46.40	4.60	27.47	14.33	54.00	7.60	V
2489.231	47.12	4.64	27.80	14.68	54.00	6.88	V
4882.000	29.95	-34.37	33.83	30.49	54.00	24.05	V
7323.000	30.90	-33.03	35.40	28.53	54.00	23.10	V
9764.000	32.25	-31.87	36.57	27.55	54.00	21.75	H
12205.000	35.05	-29.39	38.79	25.65	54.00	18.95	H

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)
2485.425	47.43	4.65	27.80	14.98	54.00	6.57	V
2485.594	47.41	4.65	27.80	14.97	54.00	6.59	V
4960.000	29.77	-34.42	33.80	30.39	54.00	24.23	V
7440.000	30.38	-32.79	35.42	27.76	54.00	23.62	V
9920.000	32.16	-32.04	36.84	27.36	54.00	21.84	V
12400.000	34.88	-29.42	38.60	25.70	54.00	19.12	H

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)
2387.850	46.38	4.61	27.48	14.29	54.00	7.62	V
2388.863	46.45	4.61	27.48	14.35	54.00	7.55	V
4803.333	29.69	-35.05	33.98	30.76	54.00	24.31	V
7206.000	31.26	-33.04	35.52	28.78	54.00	22.74	V
9608.000	32.03	-32.21	36.32	27.92	54.00	21.97	H
12010.000	34.65	-30.19	38.80	26.04	54.00	19.35	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)
2385.431	46.38	4.60	27.47	14.30	54.00	7.62	V
2491.988	47.23	4.63	27.80	14.80	54.00	6.77	V
4882.000	29.79	-34.37	33.83	30.33	54.00	24.21	V
7323.000	31.11	-33.03	35.40	28.74	54.00	22.89	V
9764.000	32.22	-31.87	36.57	27.52	54.00	21.78	H
12205.000	35.11	-29.39	38.79	25.70	54.00	18.89	V

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)
2485.350	47.30	4.65	27.80	14.85	54.00	6.70	V
2485.894	47.33	4.65	27.80	14.88	54.00	6.67	V
4960.000	29.84	-34.42	33.80	30.47	54.00	24.16	H
7440.000	30.54	-32.79	35.42	27.92	54.00	23.46	V
9920.000	32.28	-32.04	36.84	27.47	54.00	21.72	H
12400.000	34.96	-29.42	38.60	25.77	54.00	19.04	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

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

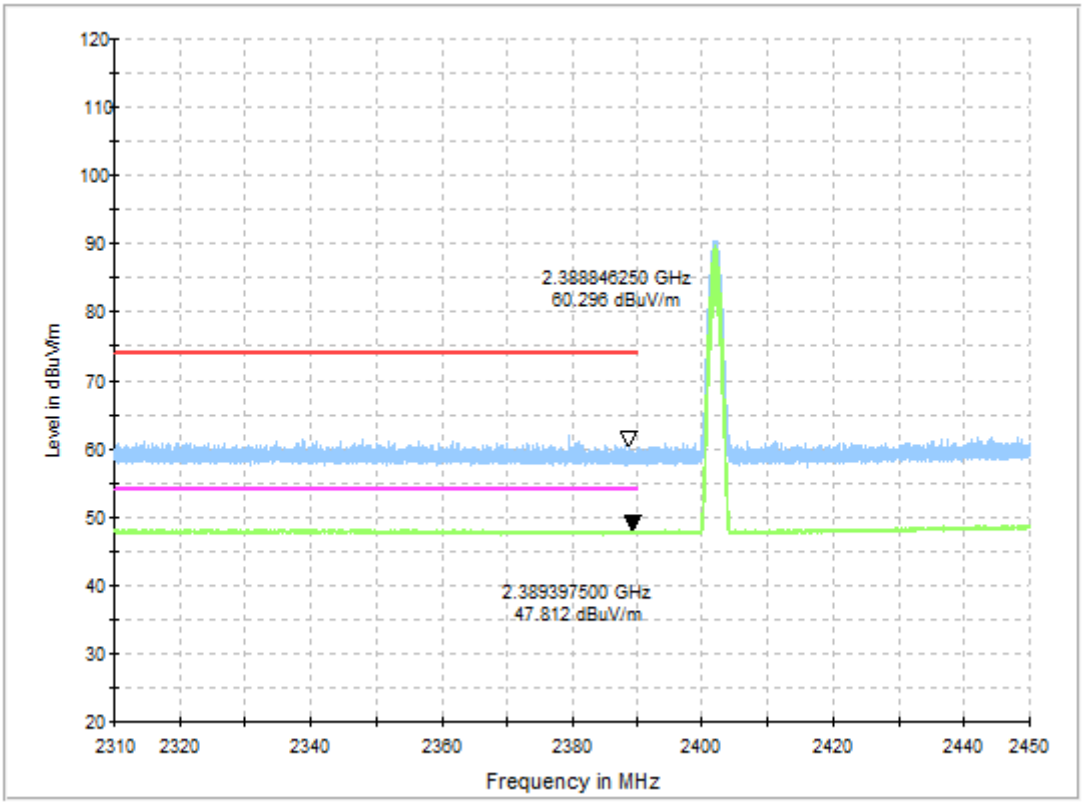


Fig.58. Frequency Band Edges: GFSK, Channel 0, Hopping Off, 2.31 GHz – 2.45GHz

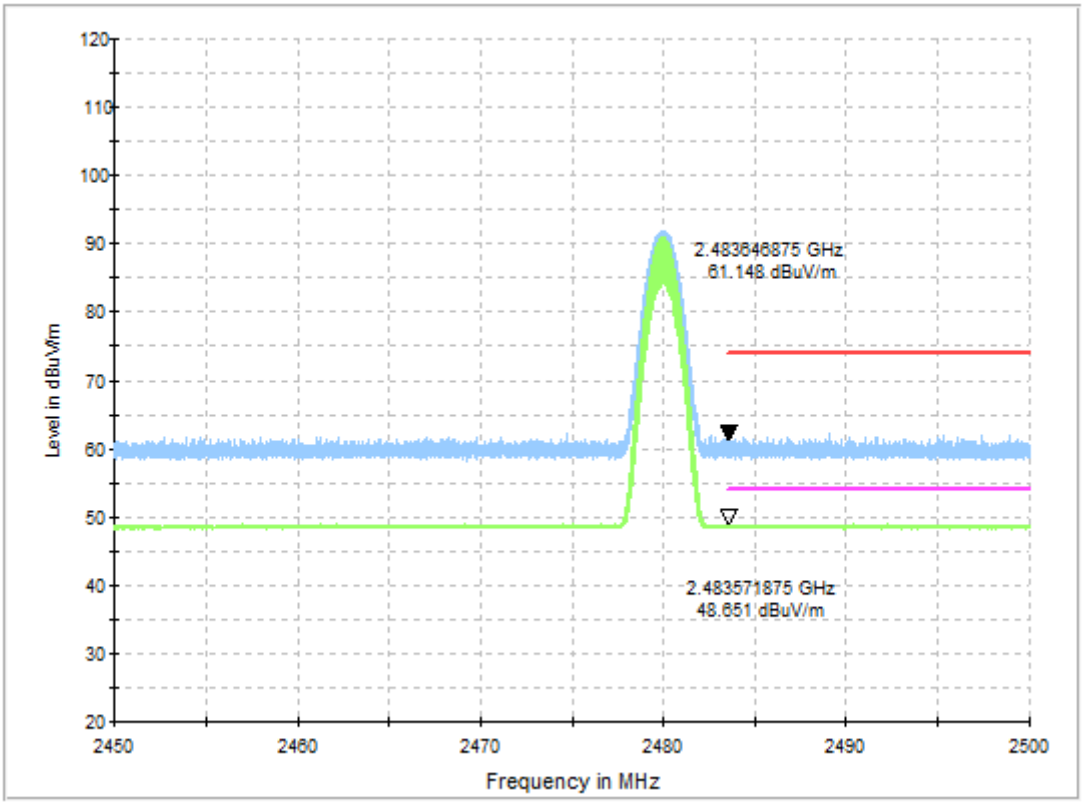


Fig.59. Frequency Band Edges: GFSK, Channel 78, Hopping Off, ch11, 2.45 GHz - 2.50GHz

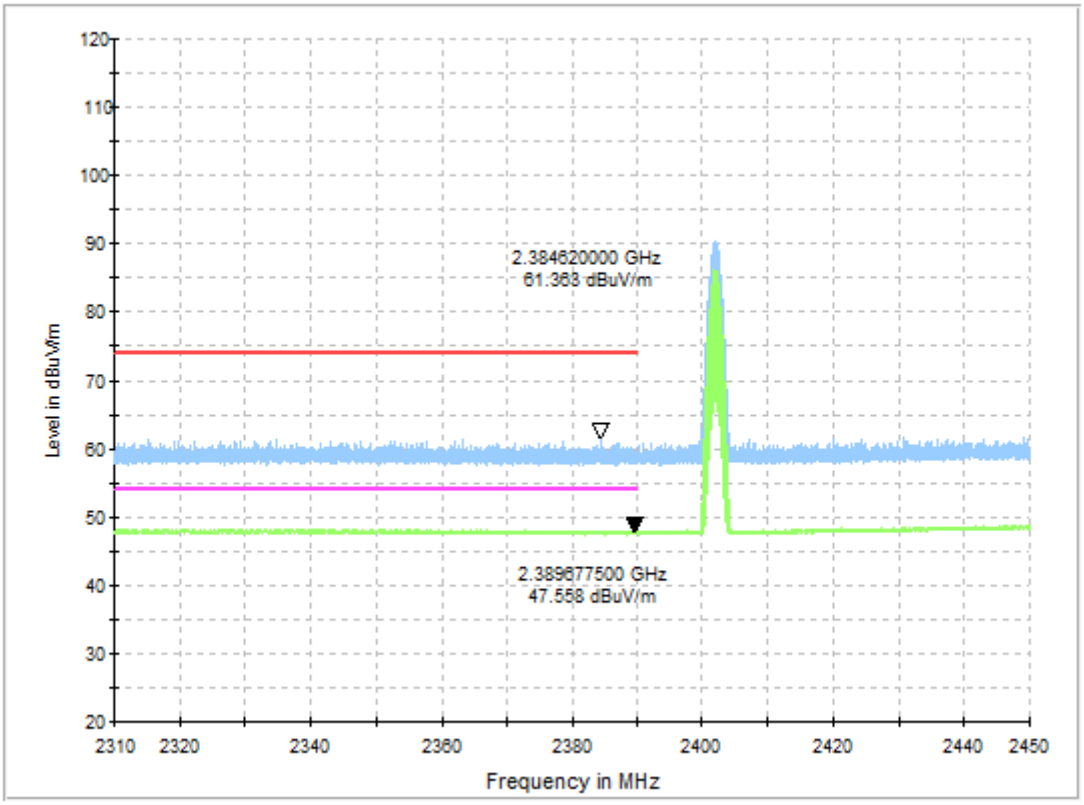


Fig.60. Frequency Band Edges: π/4 DQPSK, Channel 0, Hopping Off, 2.31 GHz - 2.45GHz

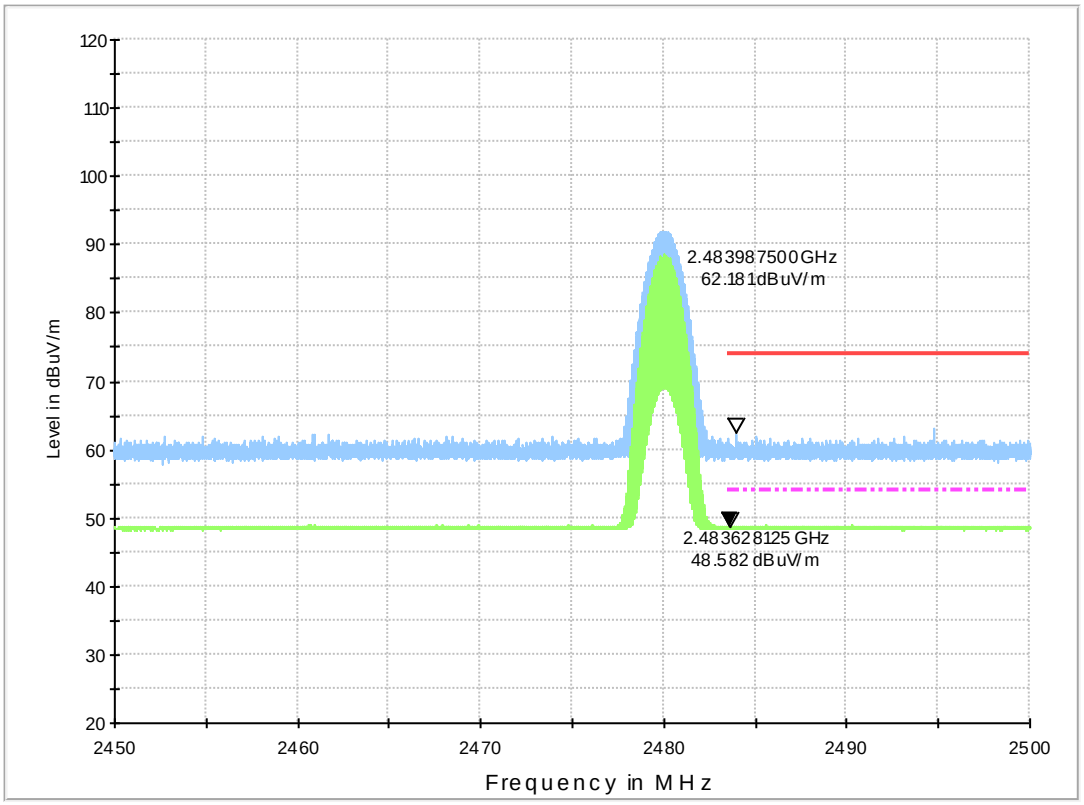


Fig.61. Frequency Band Edges: π/4 DQPSK, Channel 78, Hopping Off, 2.45 GHz - 2.50GHz

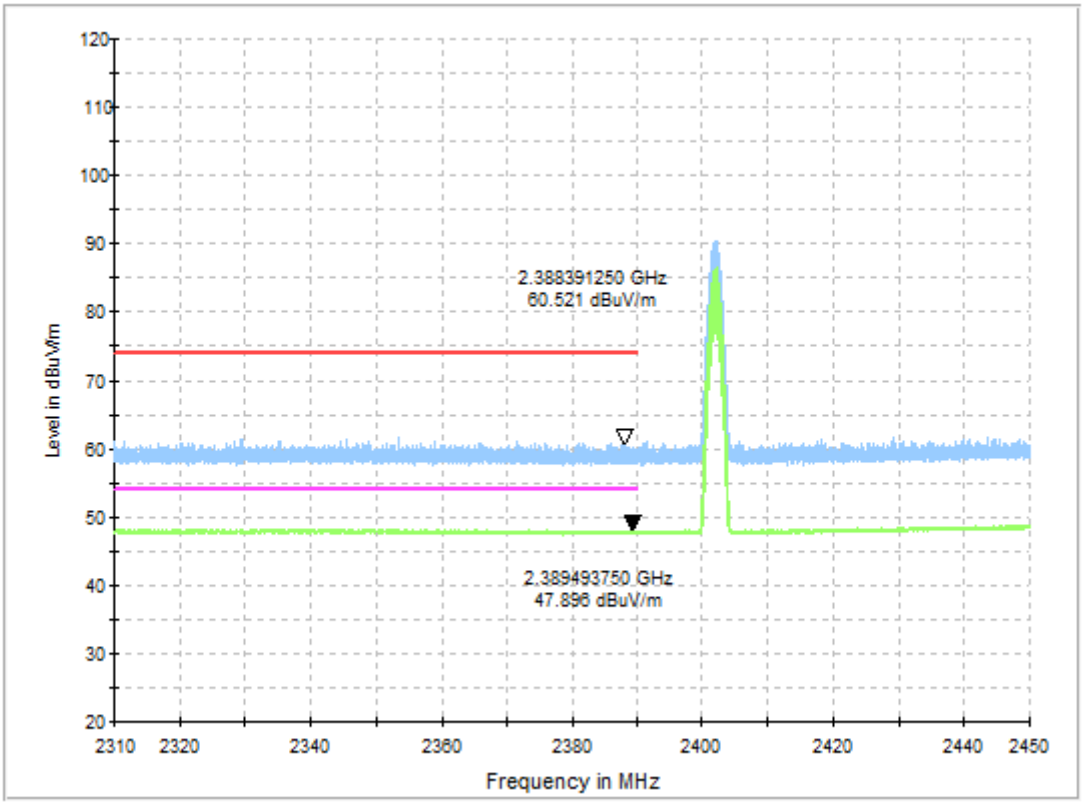


Fig.62. Frequency Band Edges: 8DPSK, Channel 0, 2.31 GHz - 2.45GHz

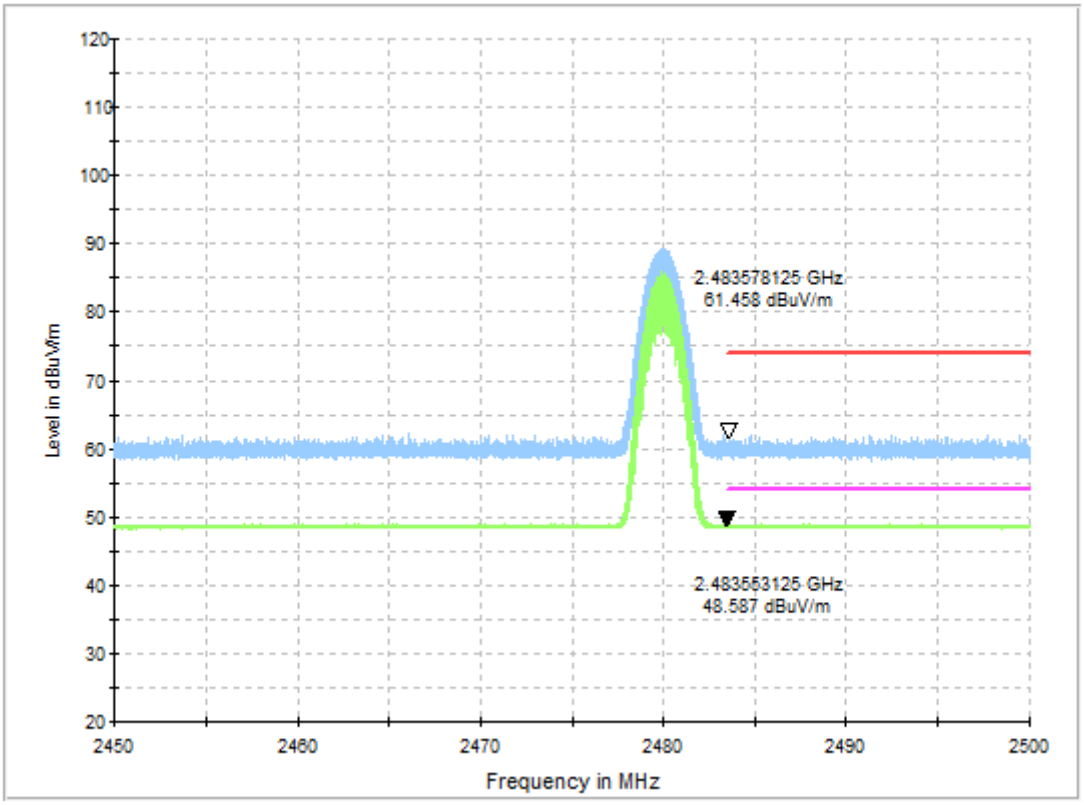


Fig.63. Frequency Band Edges: 8DPSK, Channel 78, 2.45 GHz - 2.50GHz

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	321	121.98	P
	DH3	Fig.66	1.63	Fig.67	96	156.48	P
	DH5	Fig.68	2.88	Fig.69	72	207.36	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	320	121.6	P
	2DH3	Fig.72	1.64	Fig.73	96	157.44	P
	2DH5	Fig.74	2.88	Fig.75	61	175.68	P

For 8DPSK

Channel	Packet	Pulse time (ms)		Number of Transmissions		Dwell Time (ms)	Conclusion
39	3DH1	Fig.76	0.38	Fig.77	319	121.22	P
	3DH3	Fig.78	1.63	Fig.79	103	167.89	P
	3DH5	Fig.80	2.89	Fig.81	58	167.62	P

Conclusion: PASS

Test graphs as below:

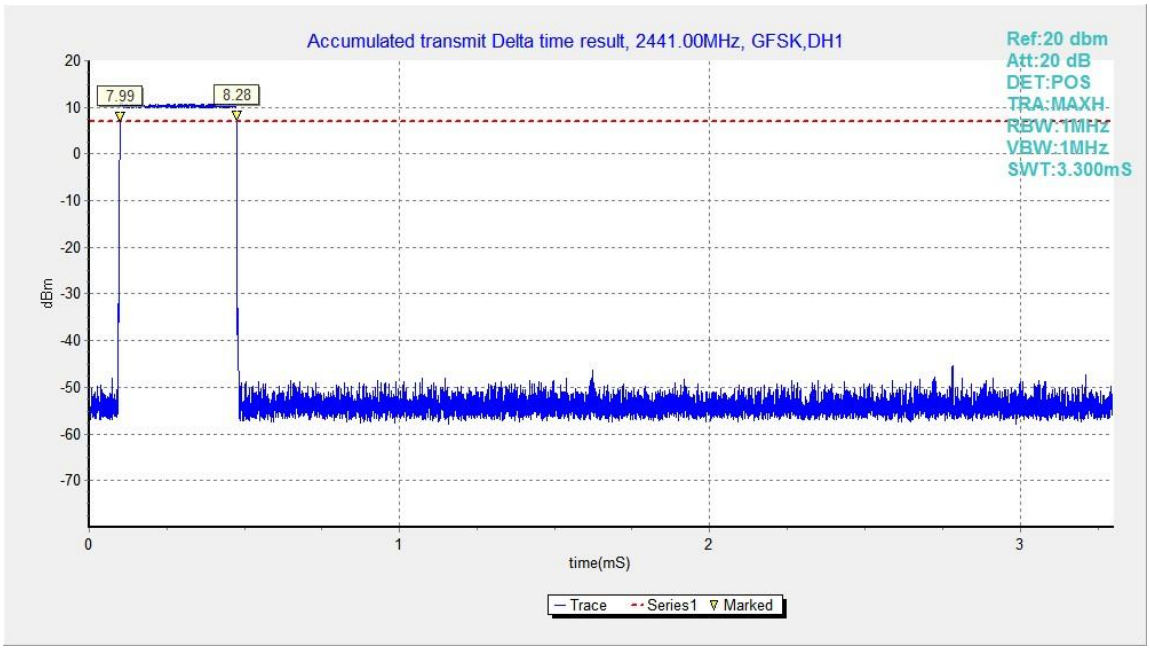


Fig.64. Time of occupancy (Dwell Time): Channel 39, Packet DH1

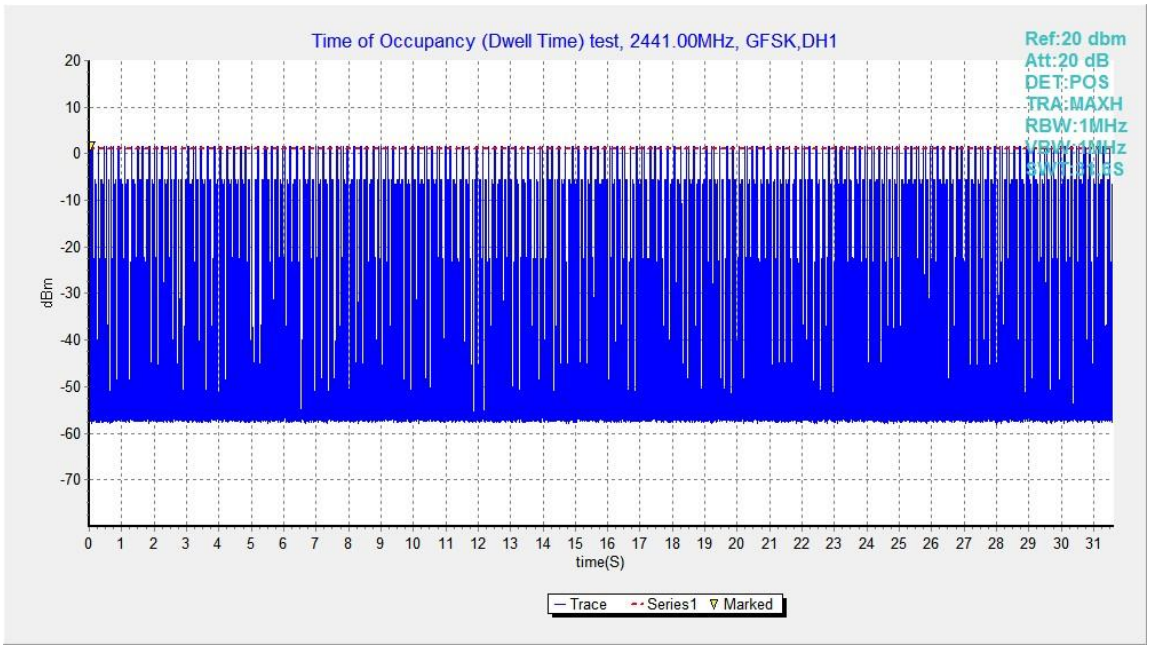


Fig.65. Number of Transmissions Measurement: Channel 39,Packet DH1

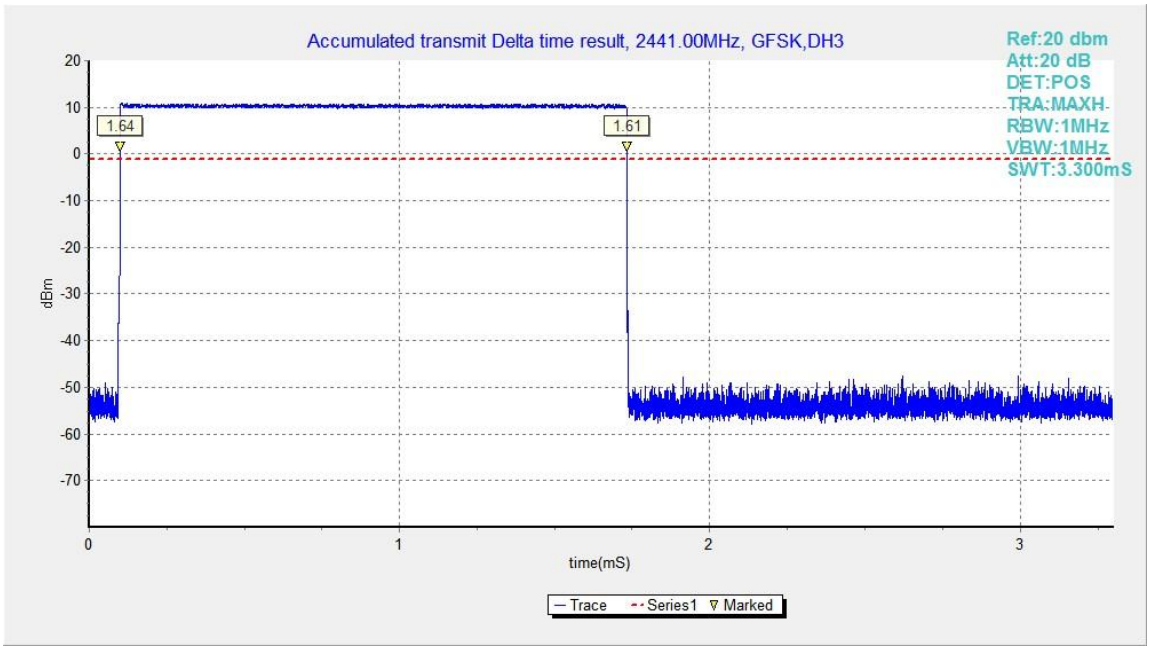


Fig.66. Time of occupancy (Dwell Time): Channel 39, Packet DH3

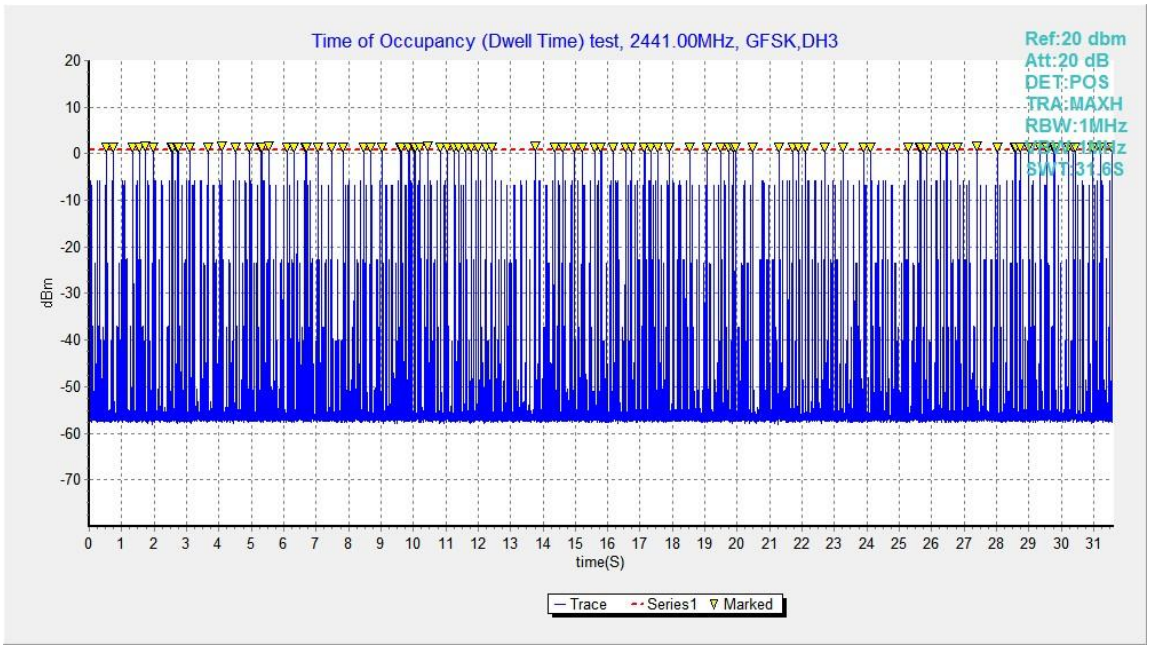


Fig.67. Number of Transmissions Measurement: Channel 39,Packet DH3

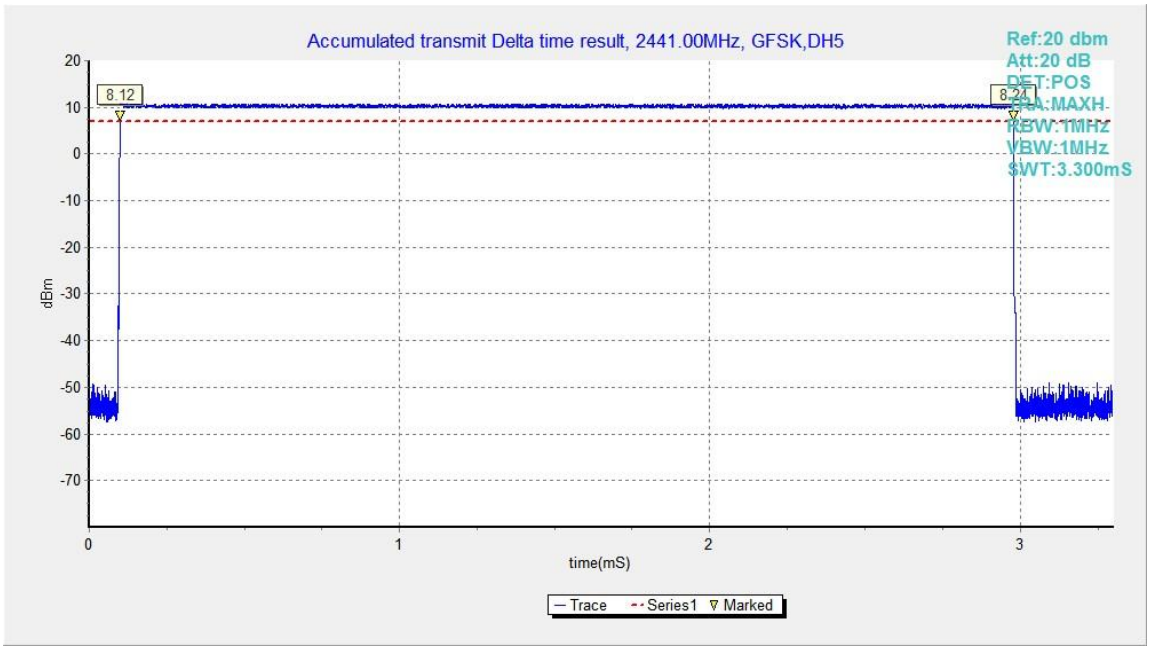


Fig.68. Time of occupancy (Dwell Time): Channel 39, Packet DH5

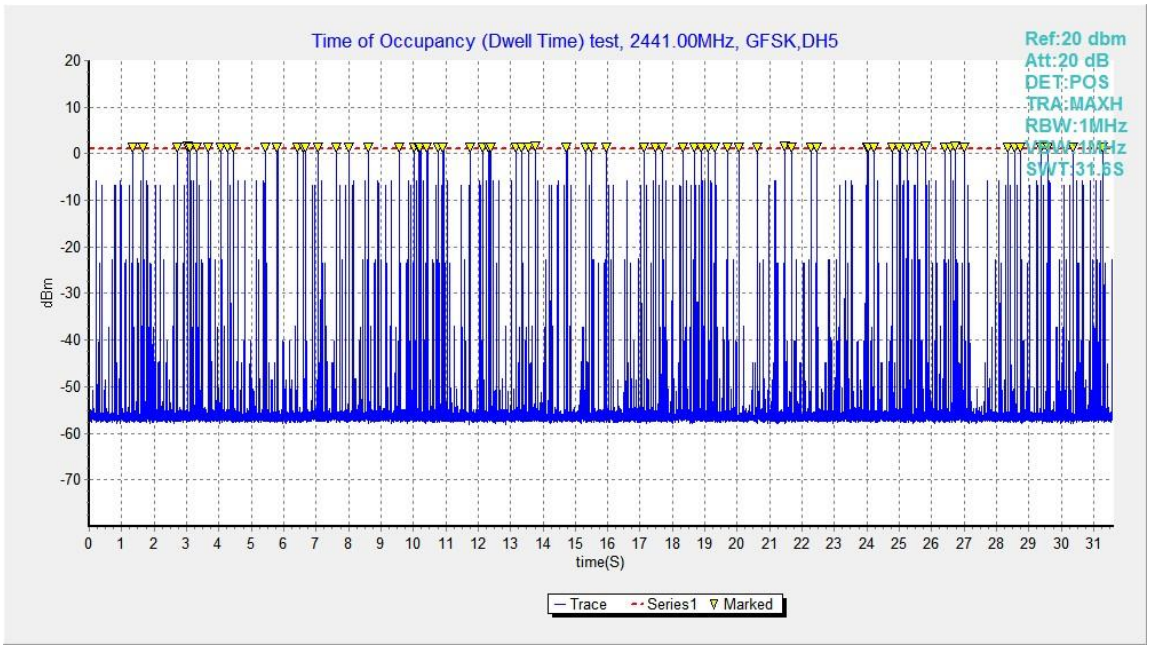


Fig.69. Number of Transmissions Measurement: Channel 39,Packet DH5

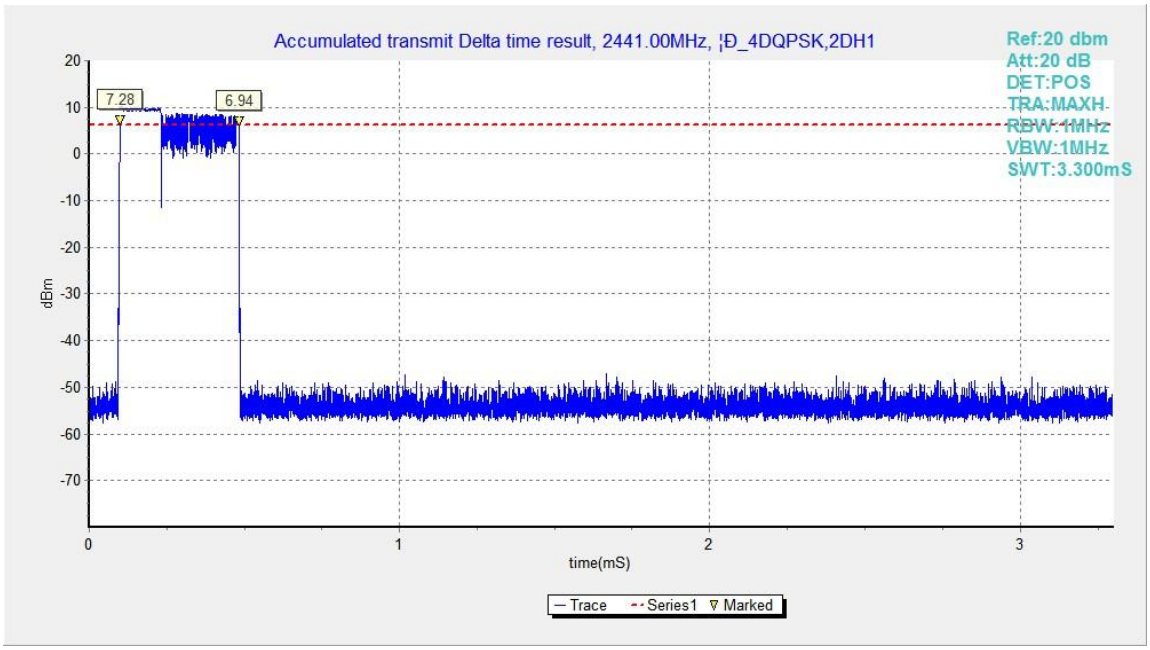


Fig.70. Time of occupancy (Dwell Time): Channel 39, Packet 2-DH1

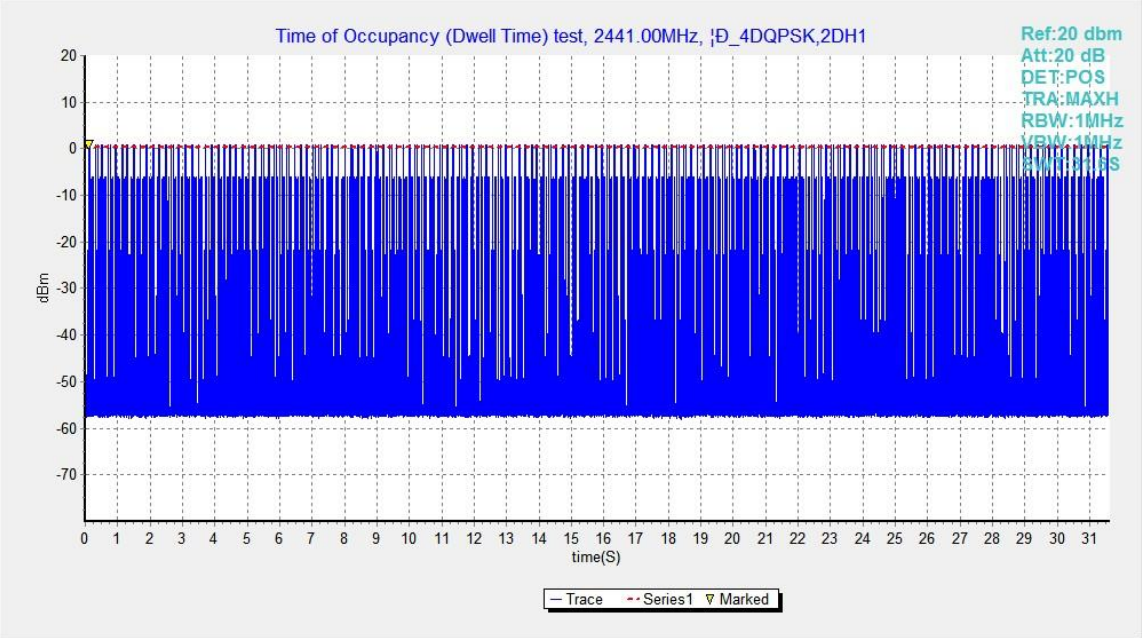


Fig.71. Number of Transmissions Measurement: Channel 39,Packet 2-DH1

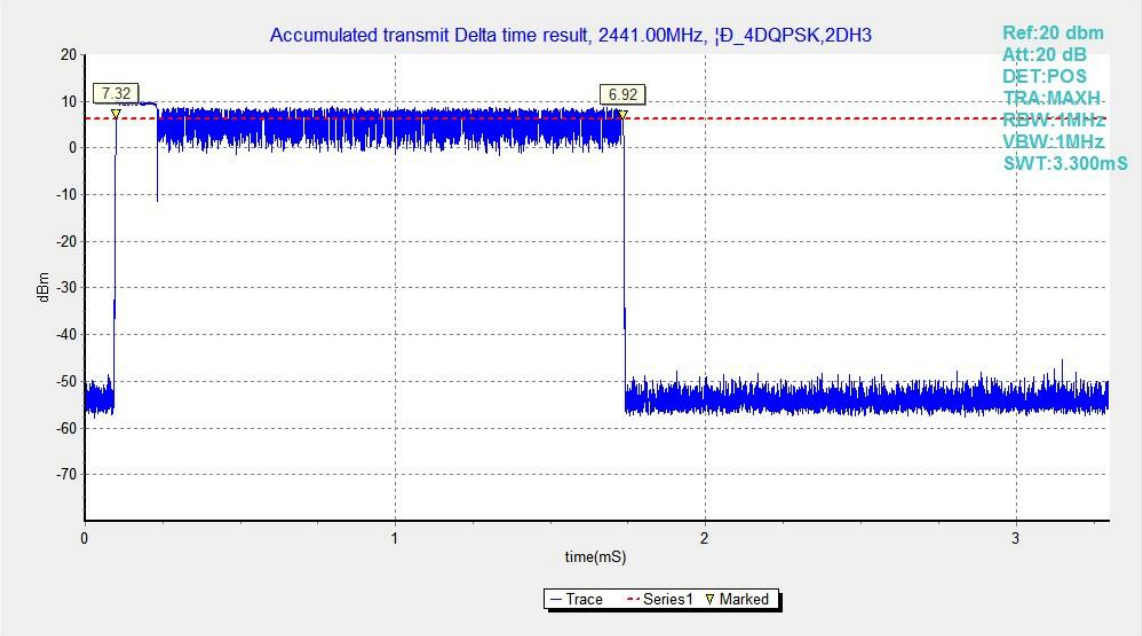


Fig.72. Time of occupancy (Dwell Time): Channel 39, Packet 2-DH3

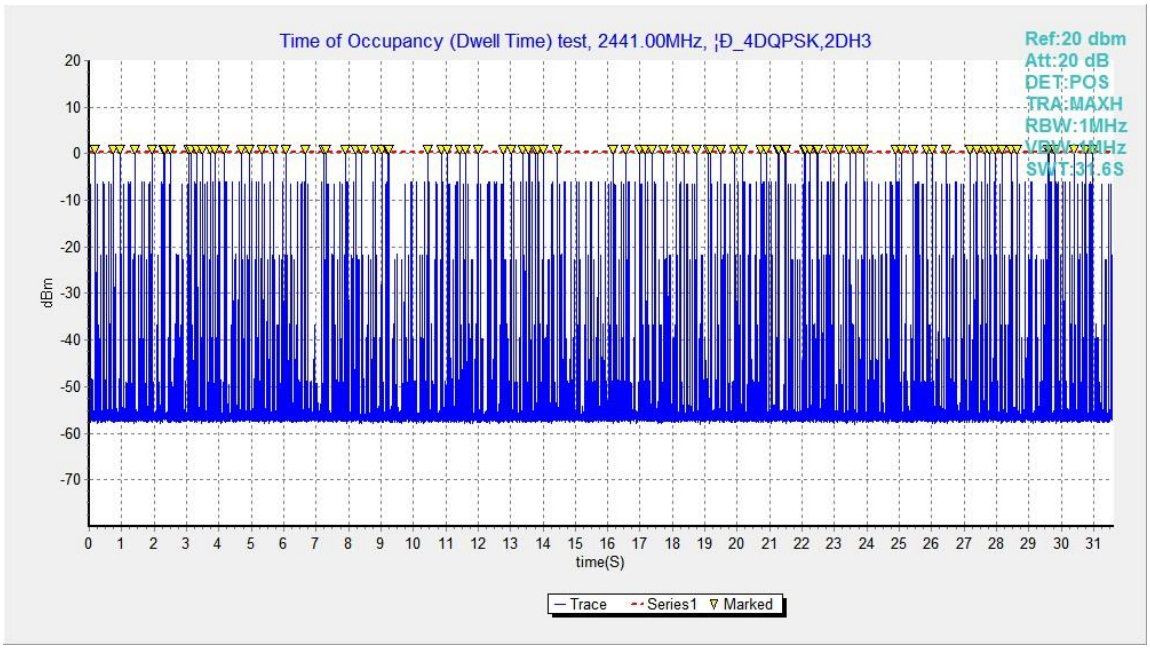


Fig.73. Number of Transmissions Measurement: Channel 39,Packet 2-DH3

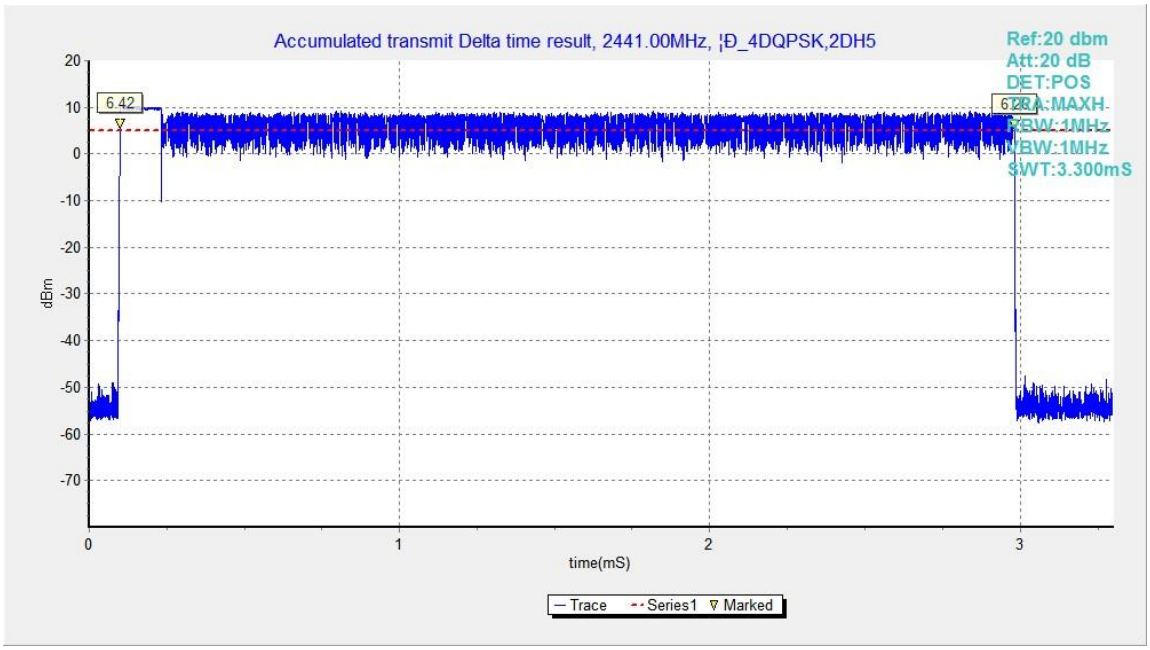


Fig.74. Time of occupancy (Dwell Time): Channel 39, Packet 2-DH5

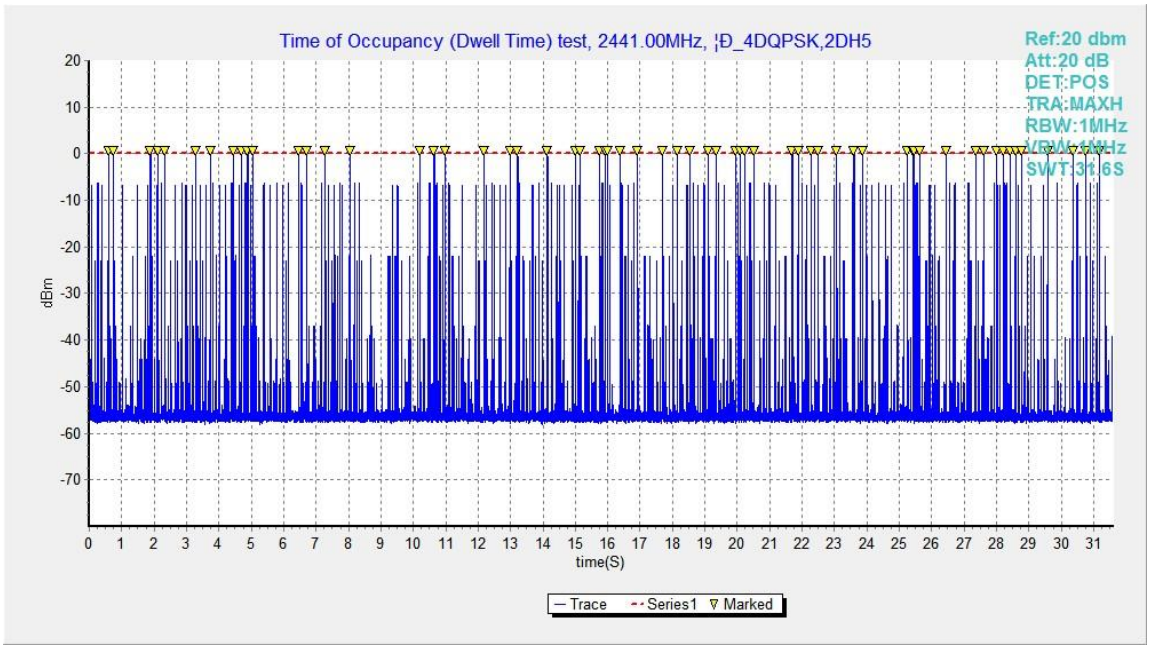


Fig.75. Number of Transmissions Measurement: Channel 39,Packet 2-DH5

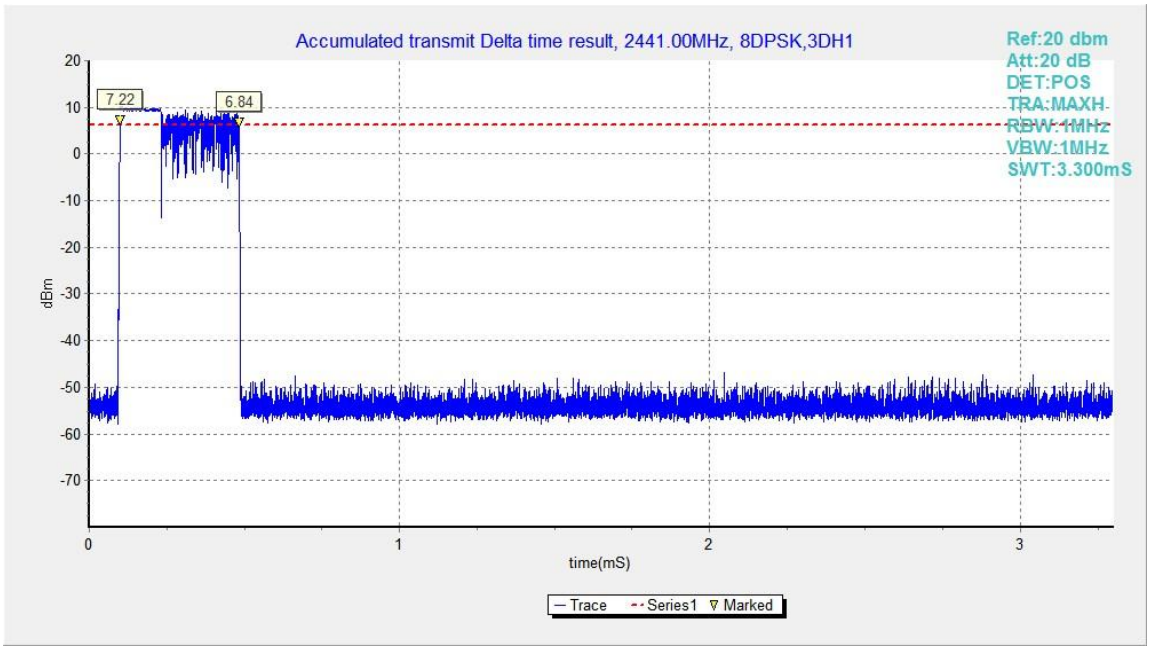


Fig.76. Time of occupancy (Dwell Time): Channel 39, Packet 3-DH1

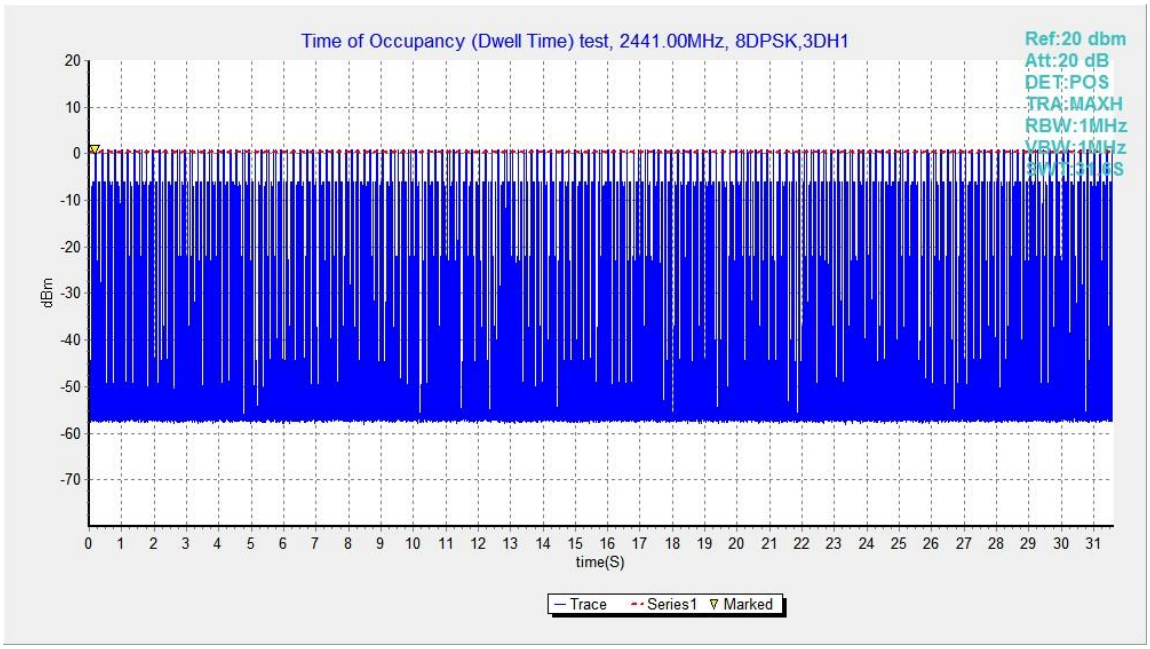


Fig.77. Number of Transmissions Measurement: Channel 39,Packet 3-DH1

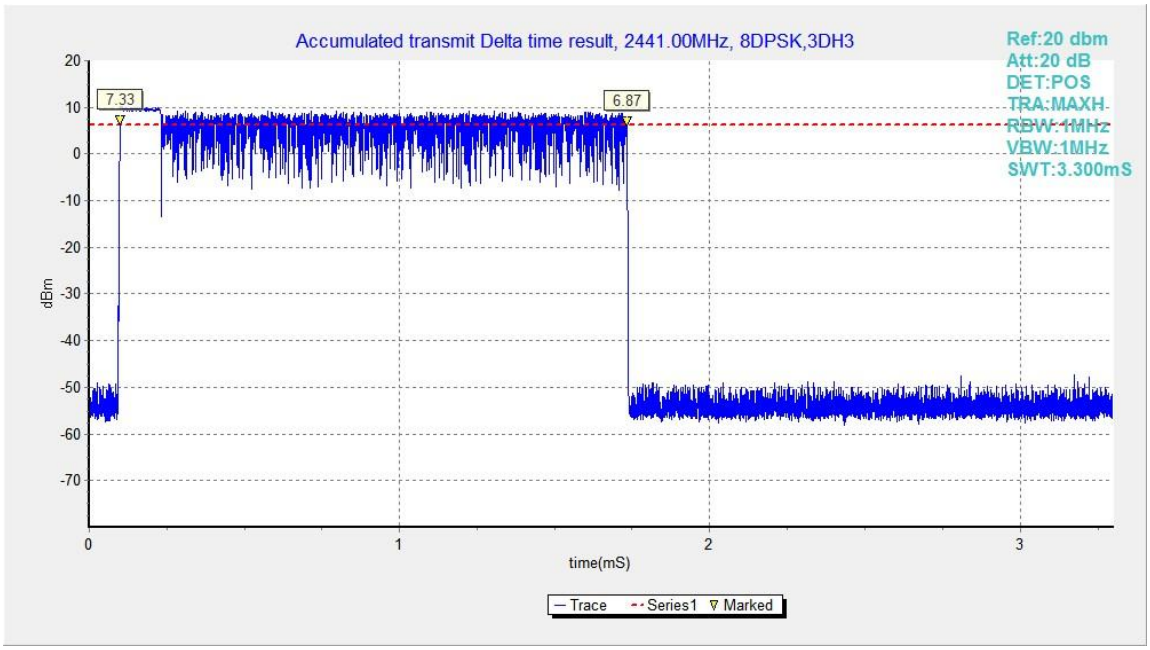


Fig.78. Time of occupancy (Dwell Time): Channel 39, Packet 3-DH3

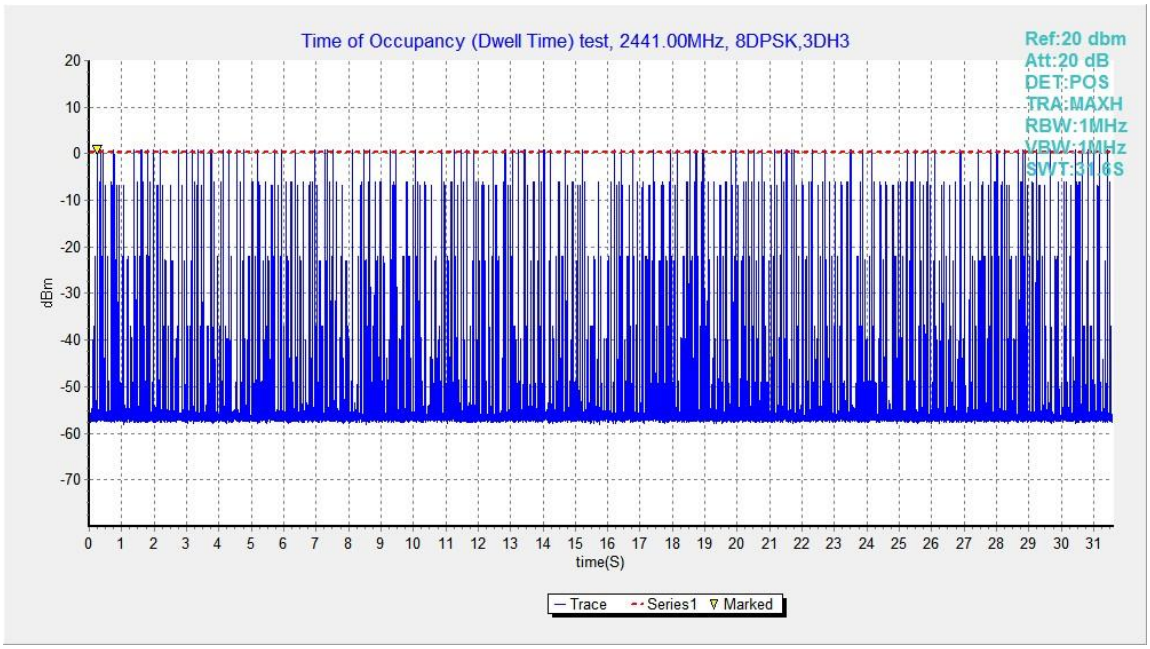


Fig.79. Number of Transmissions Measurement: Channel 39,Packet 3-DH3

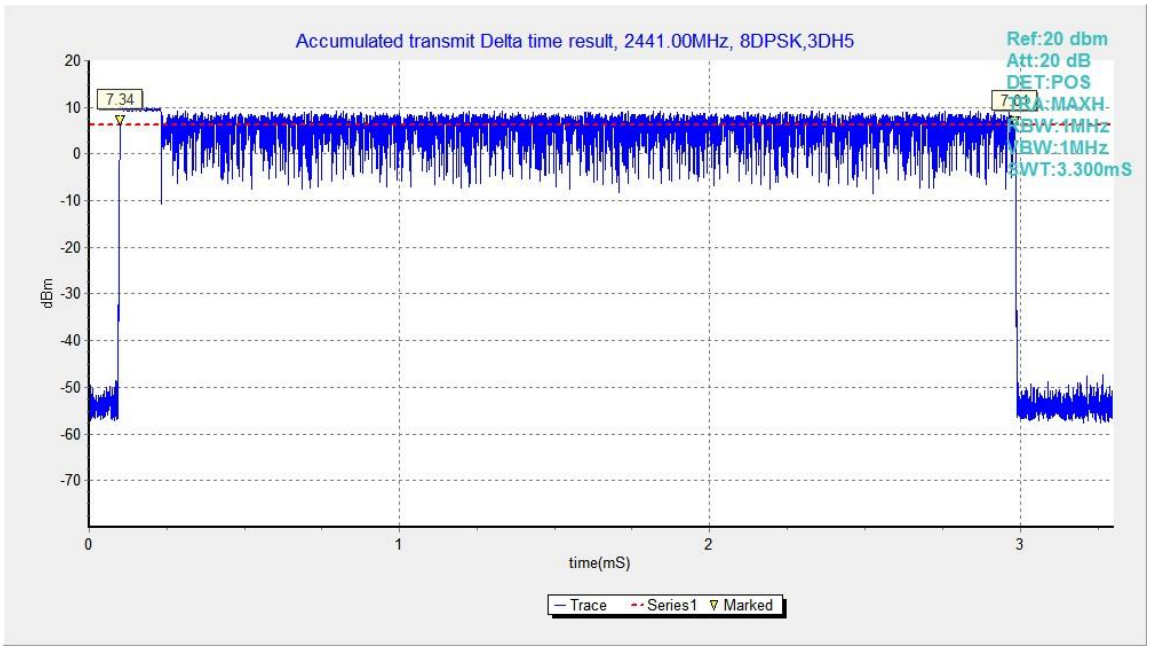


Fig.80. Time of occupancy (Dwell Time): Channel 39, Packet 3-DH5

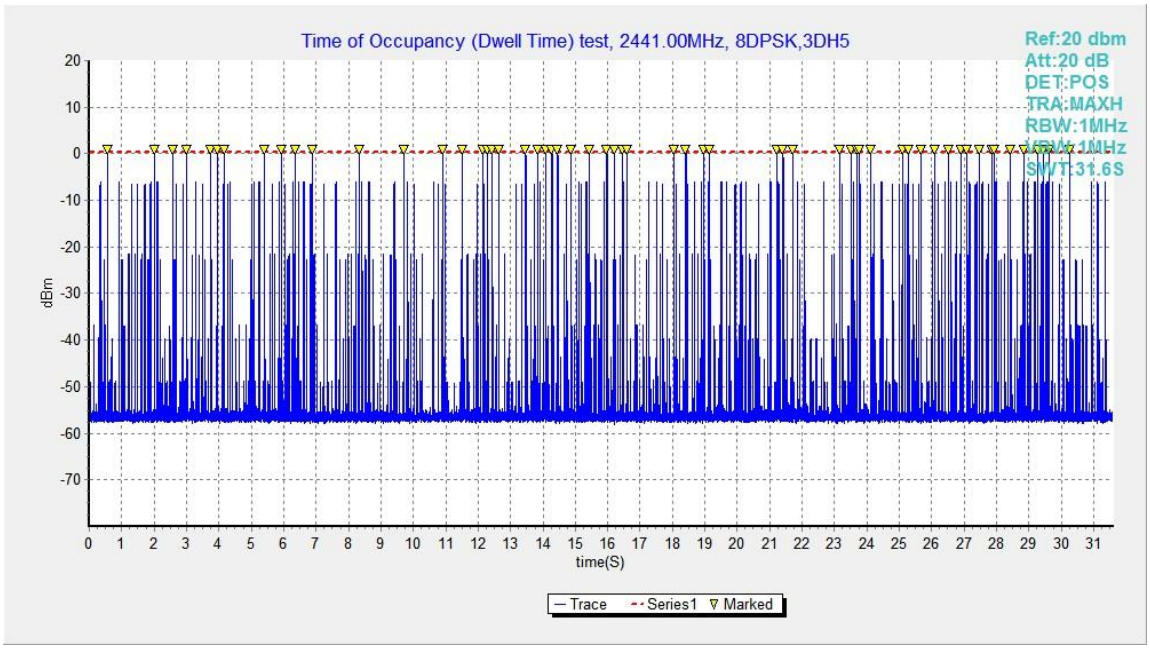


Fig.81. Number of Transmissions Measurement: Channel 39,Packet 3-DH5

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	959.25	NA
39	Fig.83	948.75	NA
78	Fig.84	941.25	NA

For π/4 DQPSK

Channel	20dB Bandwidth (kHz)		Conclusion
0	Fig.85	1237.50	NA
39	Fig.86	1260.75	NA
78	Fig.87	1232.25	NA

For 8DPSK

Channel	20dB Bandwidth (kHz)		Conclusion
0	Fig.88	1272.00	NA
39	Fig.89	1274.25	NA
78	Fig.90	1264.50	NA

Conclusion: NA

Test graphs as below:

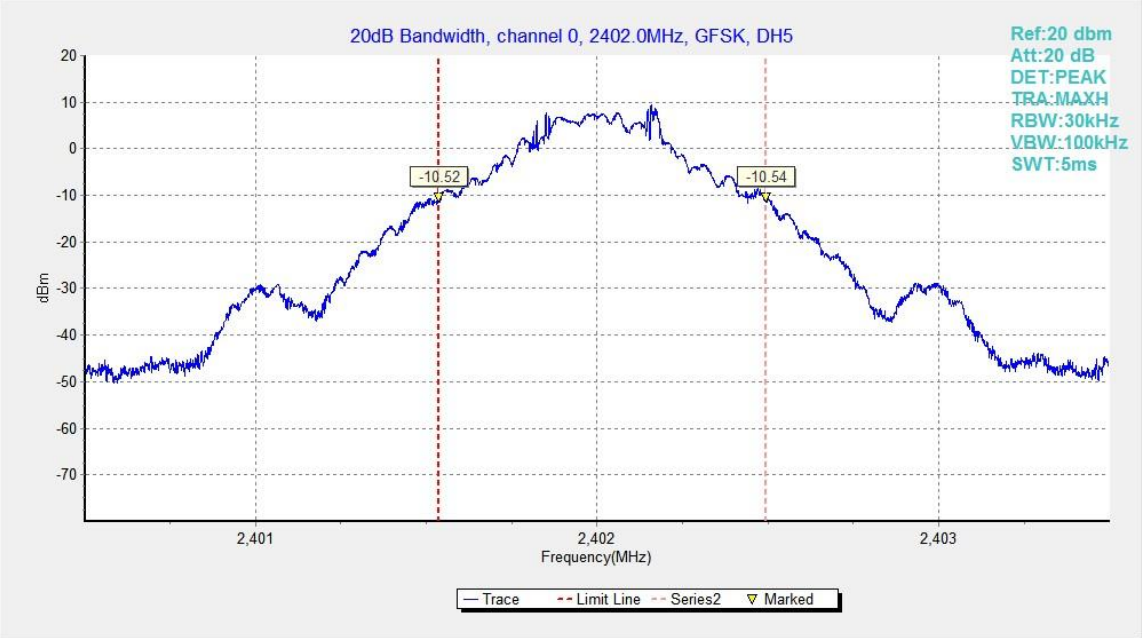


Fig.82. 20dB Bandwidth: GFSK, Channel 0

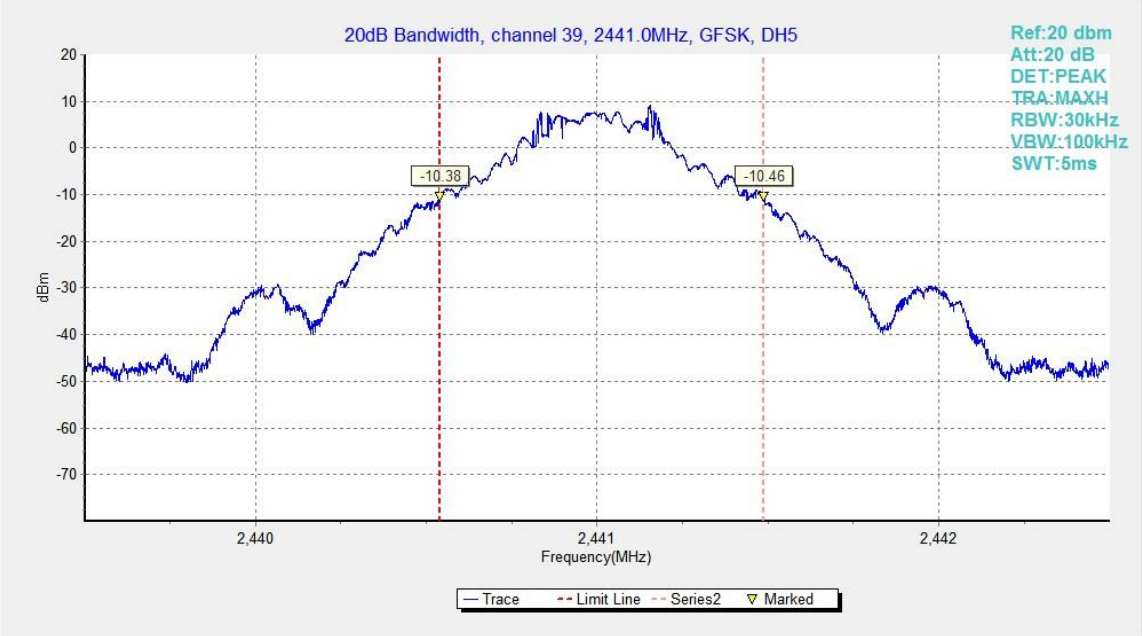


Fig.83. 20dB Bandwidth: GFSK, Channel 39

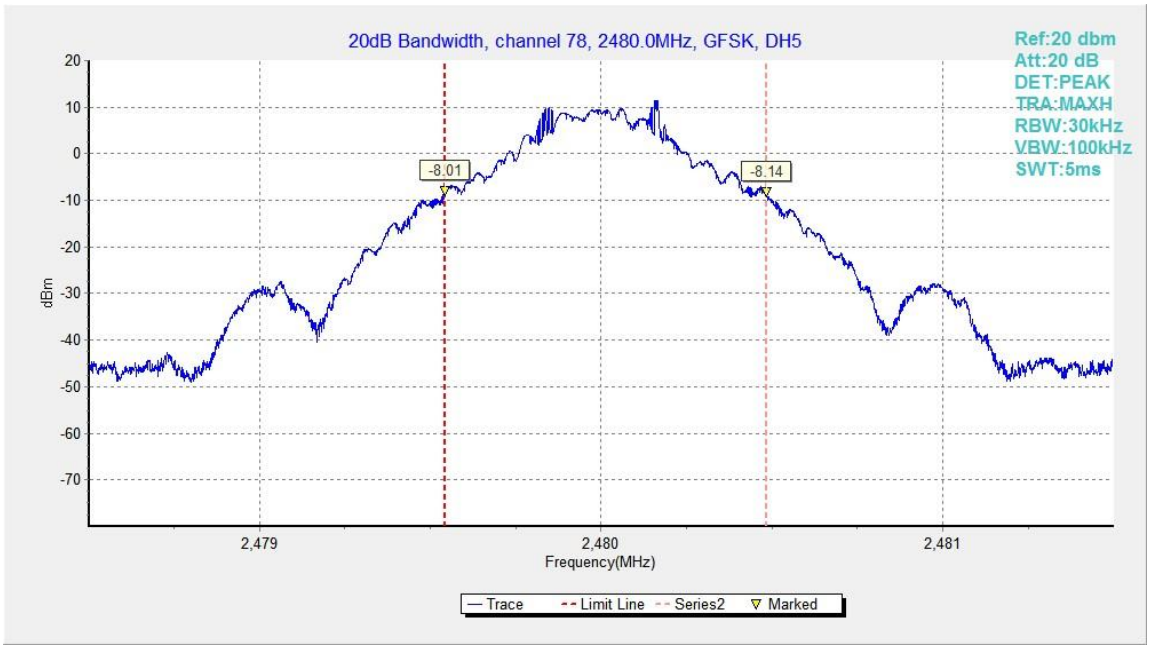


Fig.84. 20dB Bandwidth: GFSK, Channel 78

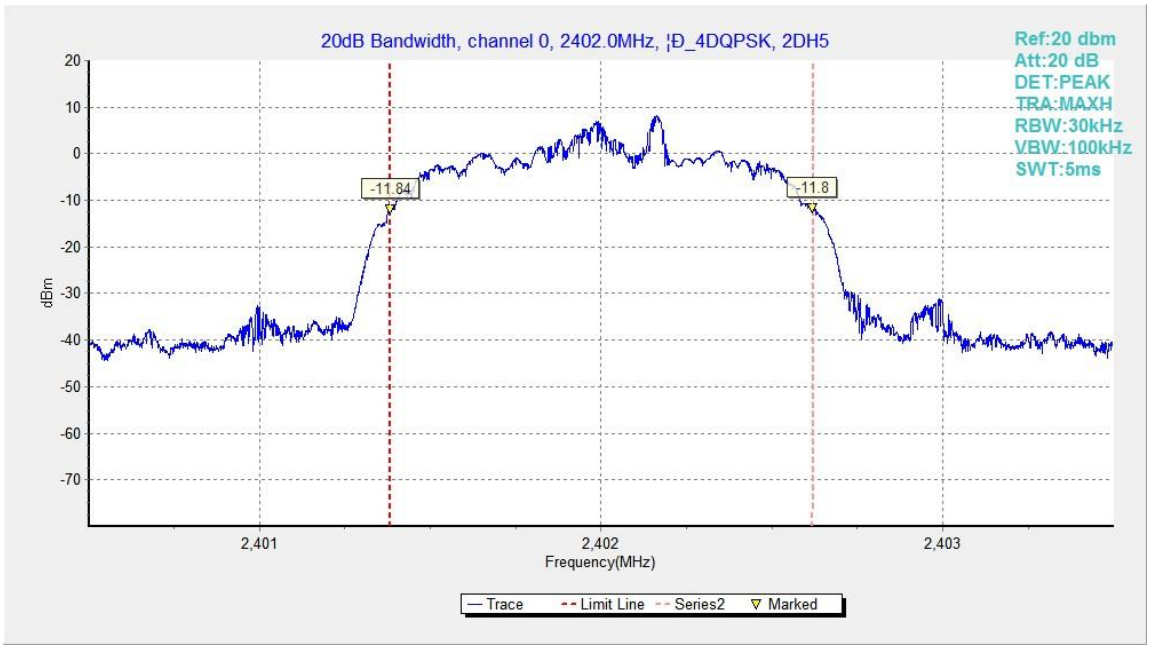


Fig.85. 20dB Bandwidth: π/4 DQPSK, Channel 0

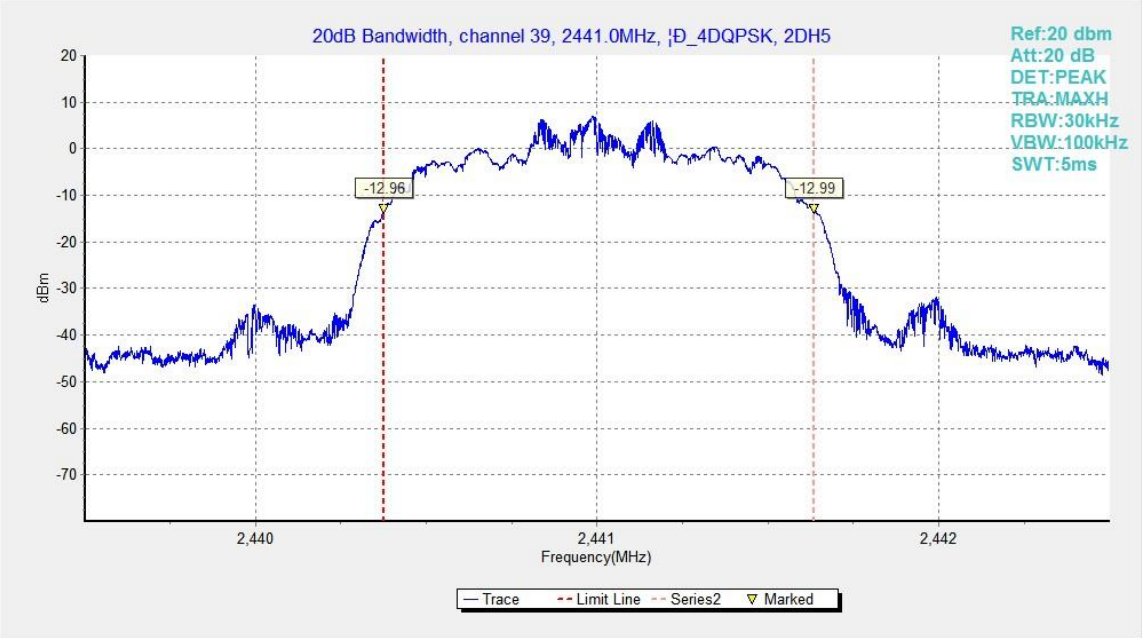


Fig.86. 20dB Bandwidth: π/4 DQPSK, Channel 39

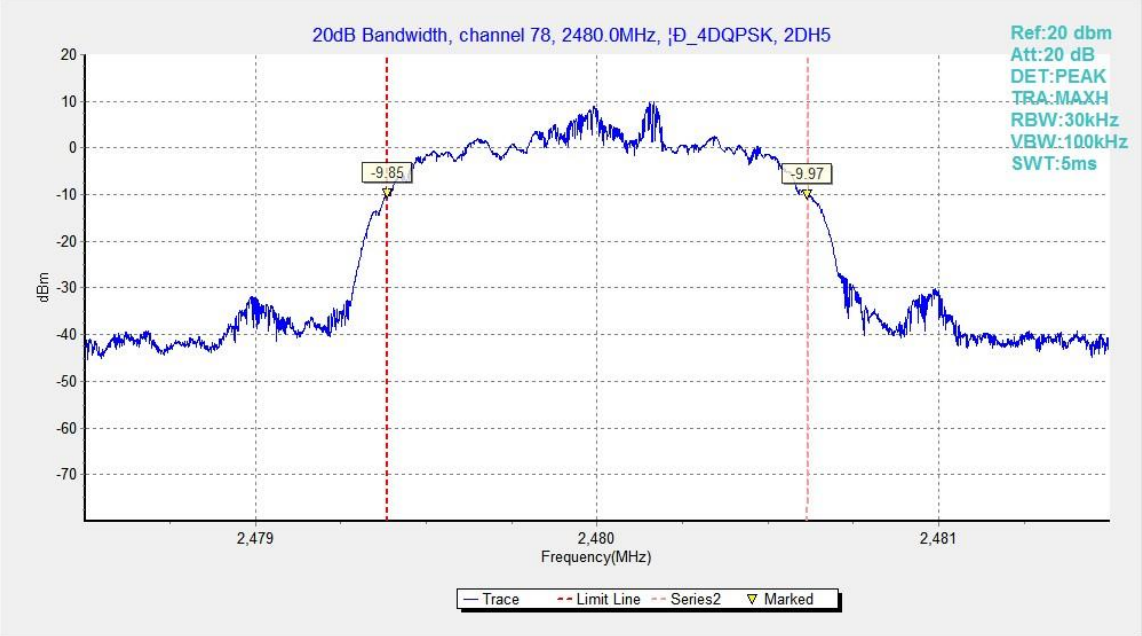


Fig.87. 20dB Bandwidth: π/4 DQPSK, Channel 78

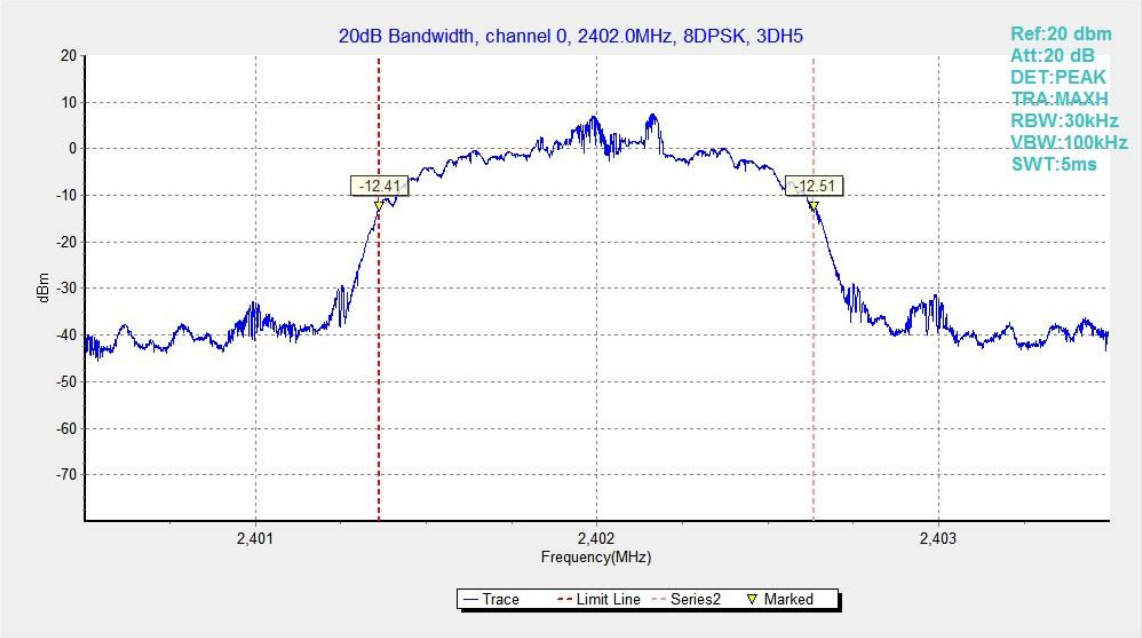


Fig.88. 20dB Bandwidth: 8DPSK, Channel 0

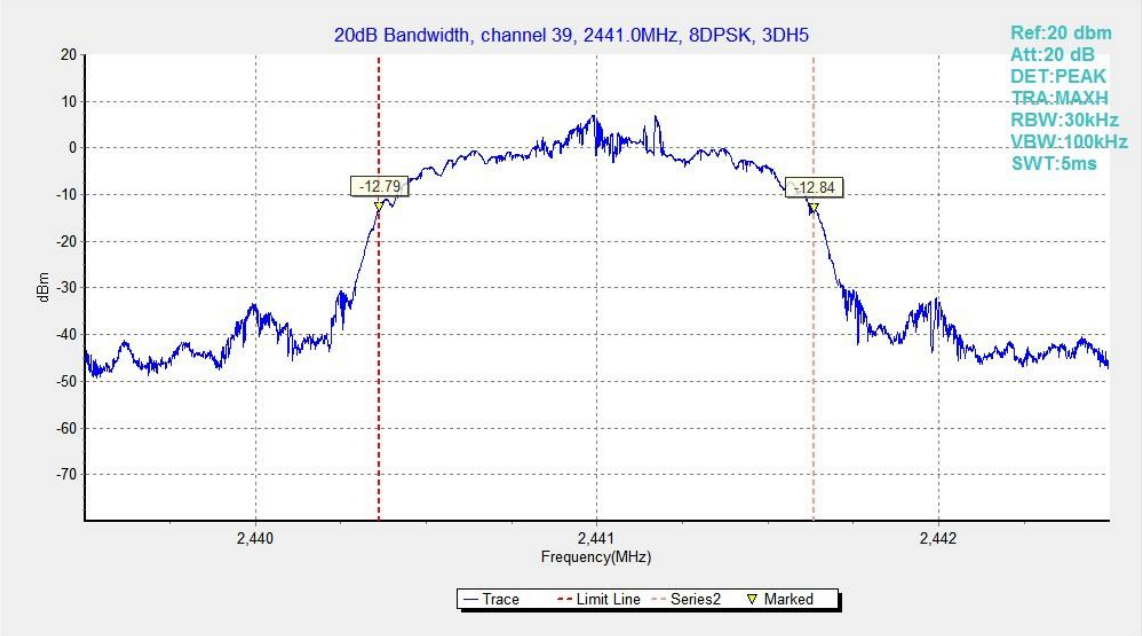


Fig.89. 20dB Bandwidth: 8DPSK, Channel 39

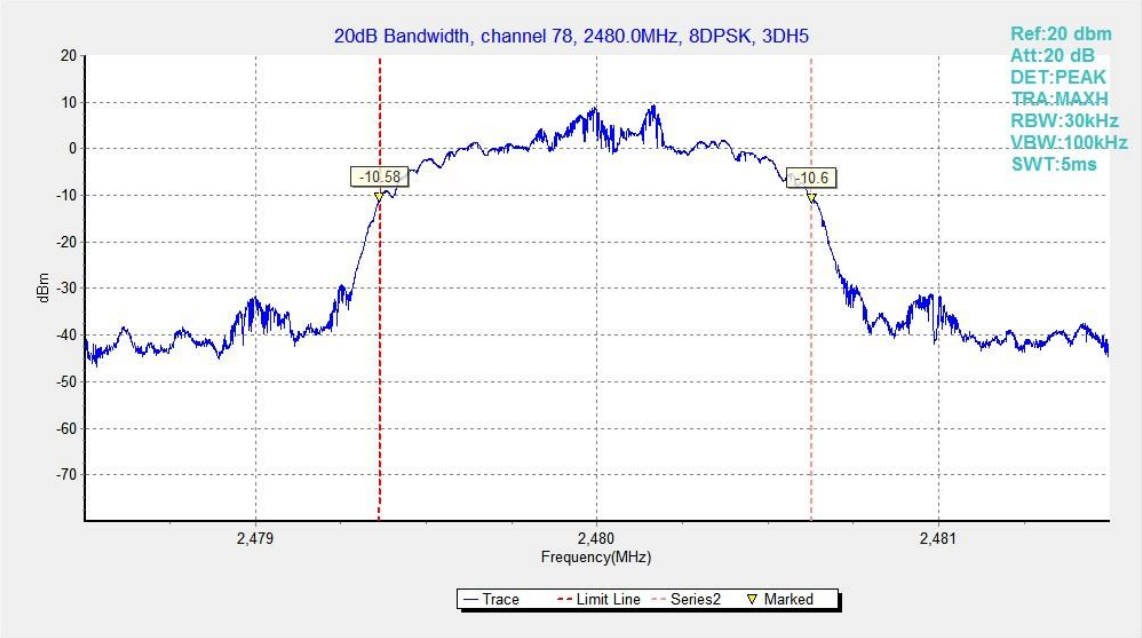


Fig.90. 20dB Bandwidth: 8DPSK, Channel 78

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	1013.25	P

For π/4 DQPSK

Channel	Carrier frequency separation (kHz)		Conclusion
39	Fig.92	1005.75	P

For 8DPSK

Channel	Carrier frequency separation (kHz)		Conclusion
39	Fig.93	1154.25	P

Conclusion: PASS

Test graphs as below:

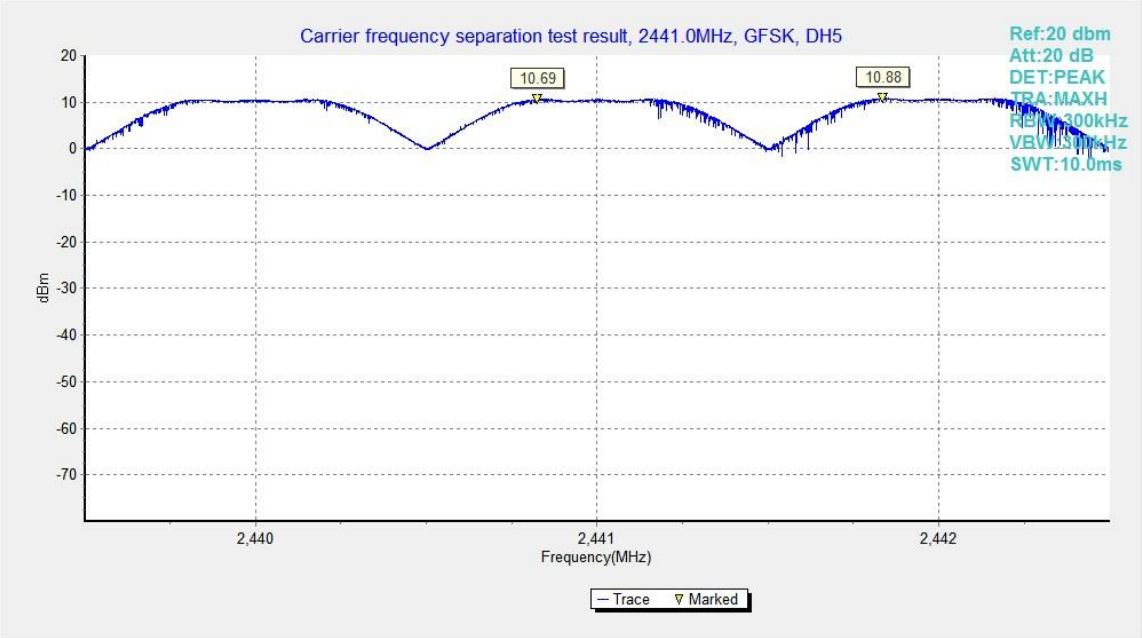


Fig.91. Carrier frequency separation measurement: GFSK, Channel 39

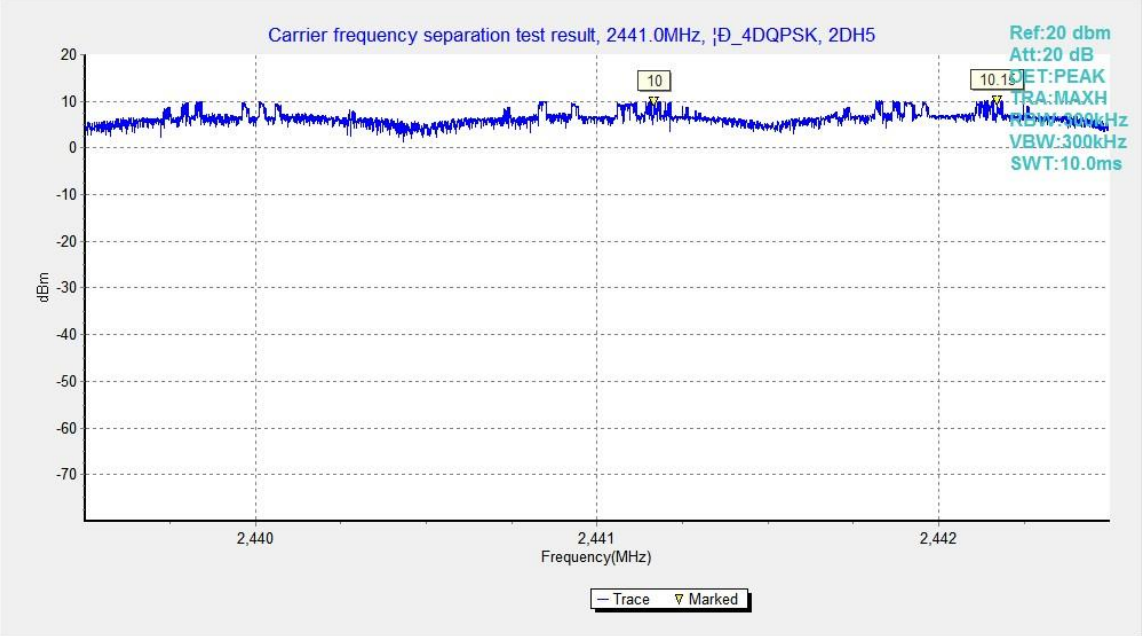


Fig.92. Carrier frequency separation measurement: π/4 DQPSK, Channel 39

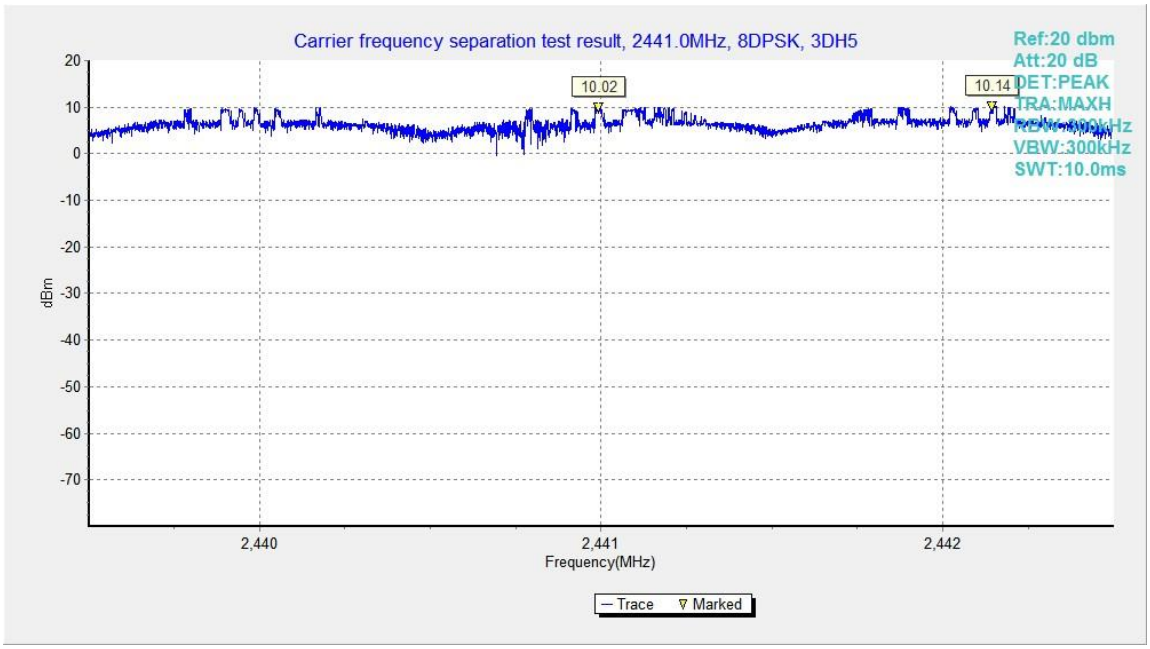


Fig.93. Carrier frequency separation measurement: 8DPSK, Channel 39

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:

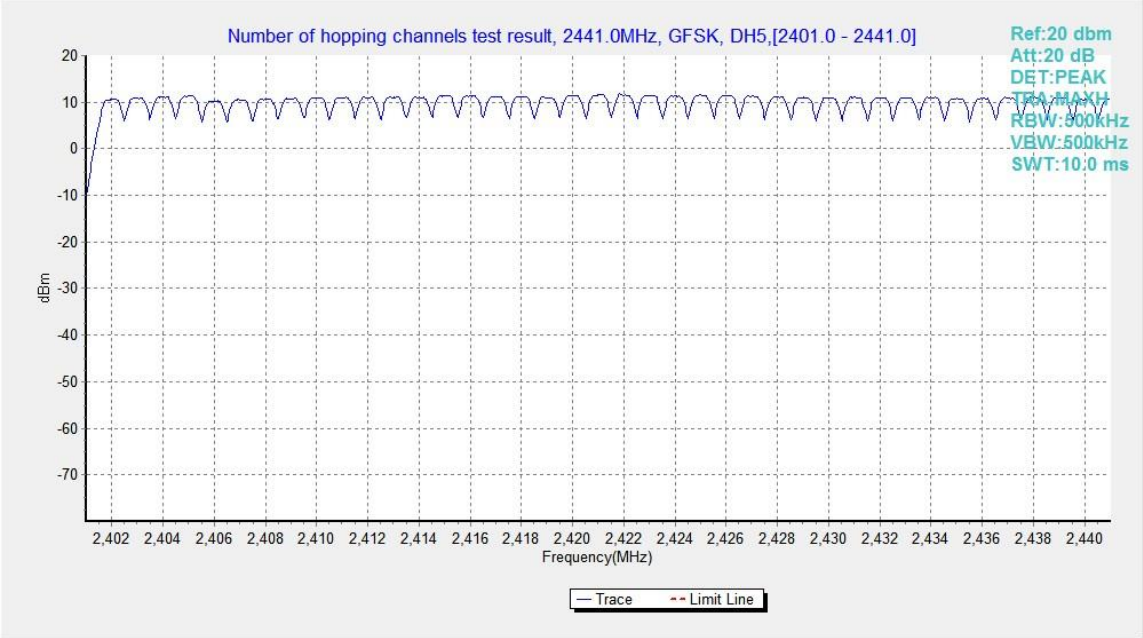


Fig.94. Number of hopping frequencies: GFSK, Channel 0 - 39

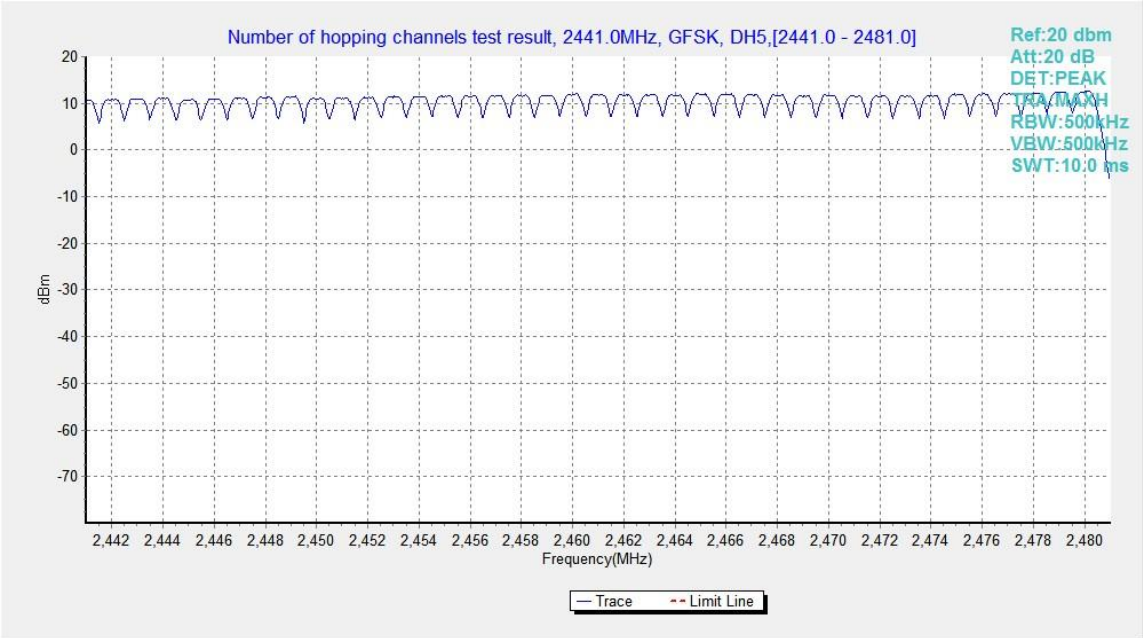


Fig.95. Number of hopping frequencies: GFSK, Channel 40 - 78

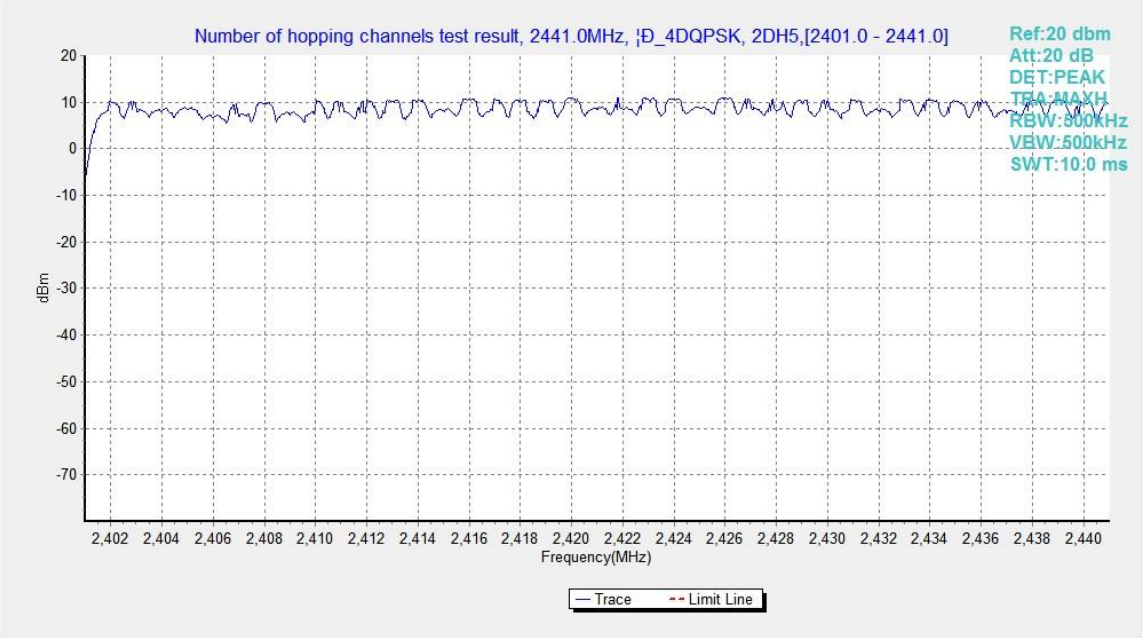


Fig.96. Number of hopping frequencies: π/4 DQPSK, Channel 0 - 39

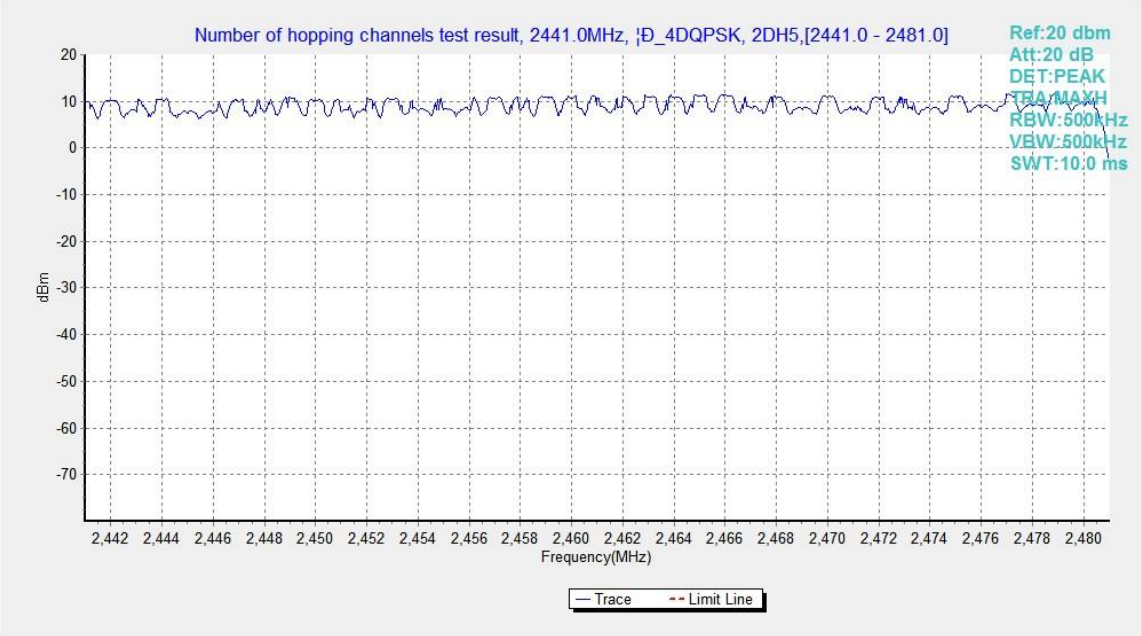


Fig.97. Number of hopping frequencies: π/4 DQPSK, Channel 40 - 78

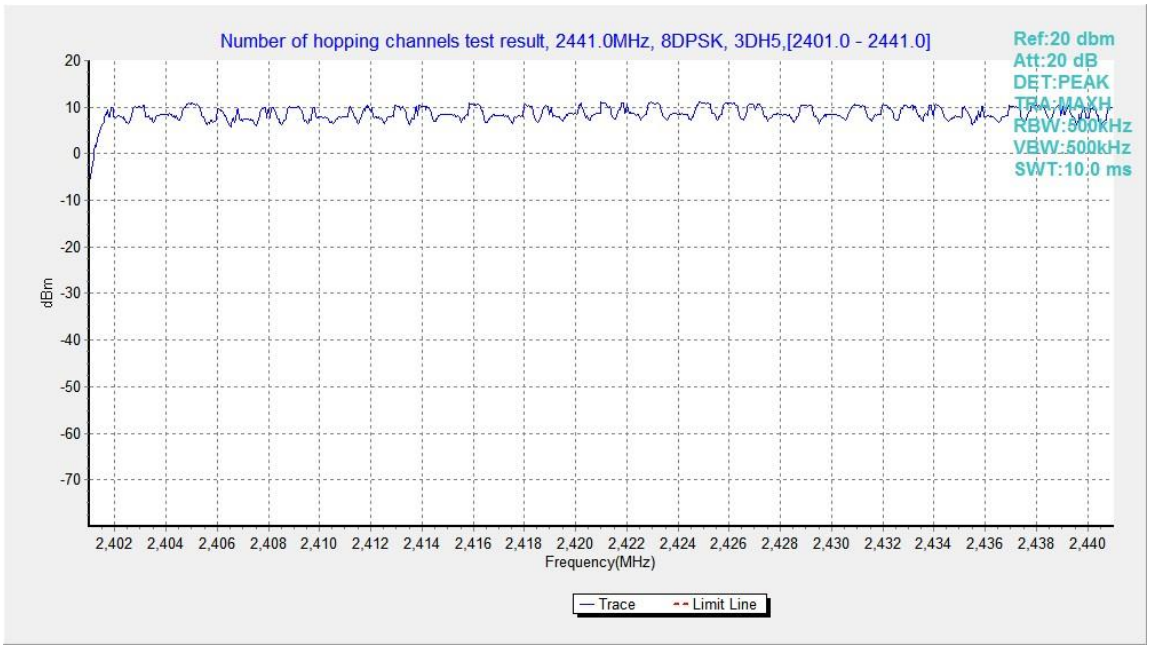


Fig.98. Number of hopping frequencies: 8DPSK, Channel 0 - 39

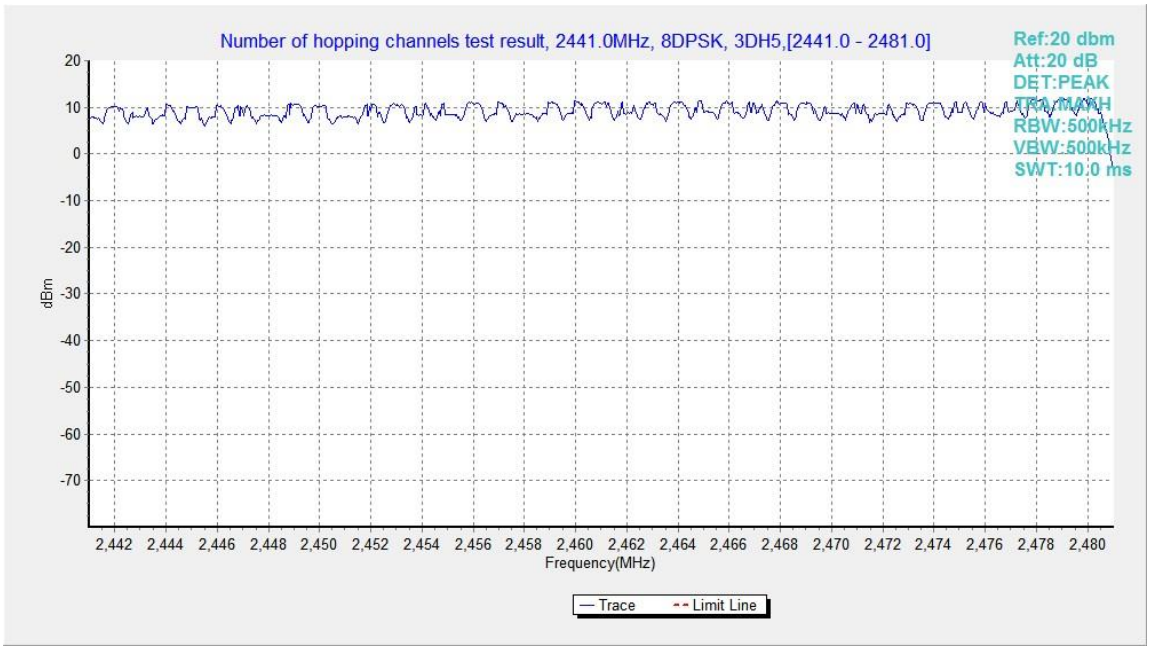


Fig.99. Number of hopping frequencies: 8DPSK, Channel 40 - 78

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.

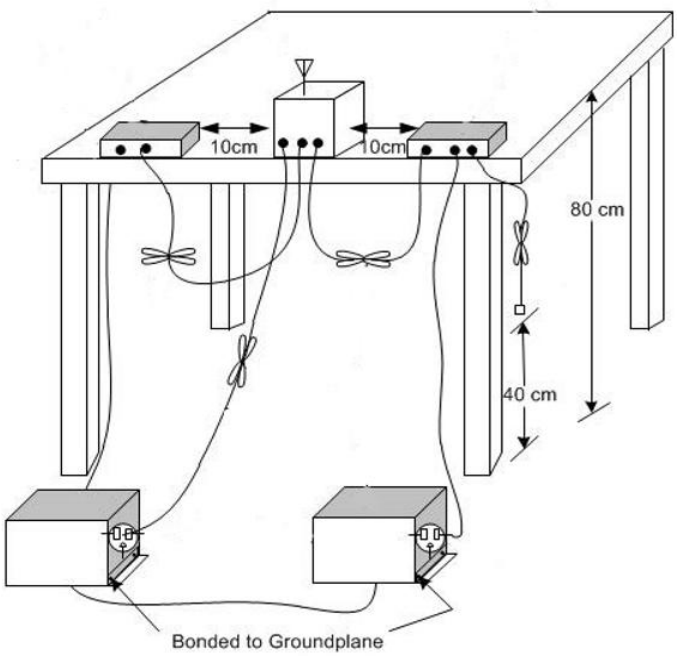
The measurement bandwidth is:

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:

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:

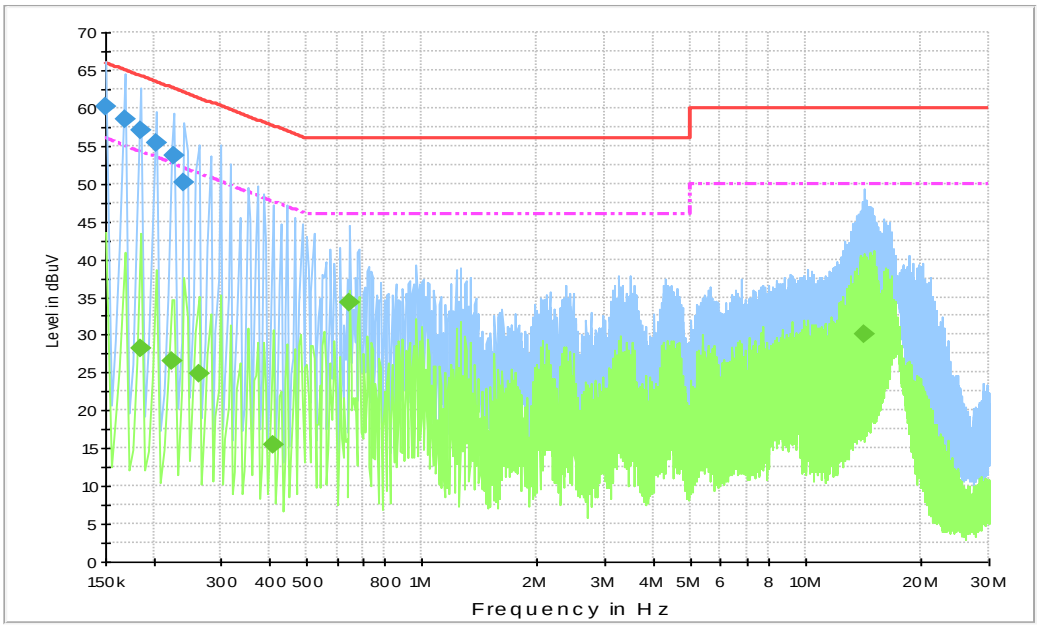


Fig.B.10.1 AC Powerline Conducted Emission- bluetooth

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)
0.150000	60.2	2000.0	9.000	Off	L1	19.4	5.8	66.0
0.168000	58.5	2000.0	9.000	Off	L1	19.5	6.6	65.1
0.186000	57.0	2000.0	9.000	Off	L1	19.5	7.3	64.2
0.204000	55.4	2000.0	9.000	Off	L1	19.4	8.0	63.4
0.226500	53.7	2000.0	9.000	Off	L1	19.5	8.8	62.6
0.240000	50.1	2000.0	9.000	Off	N	19.5	12.0	62.1

Final Result 2

Frequency (MHz)	CAverage (dBµV)	Meas. Time	Bandwidth (kHz)	Filter	Line	Corr. (dB)	Margin (dB)	Limit (dBµV)
0.186000	28.2	2000.0	9.000	Off	L1	19.5	26.0	54.2
0.222000	26.6	2000.0	9.000	Off	L1	19.5	26.1	52.7
0.262500	24.8	2000.0	9.000	Off	L1	19.5	26.6	51.4
0.411000	15.4	2000.0	9.000	Off	N	19.5	32.2	47.6
0.649500	34.4	2000.0	9.000	Off	L1	19.5	11.6	46.0
14.167500	30.2	2000.0	9.000	Off	L1	19.8	19.8	50.0

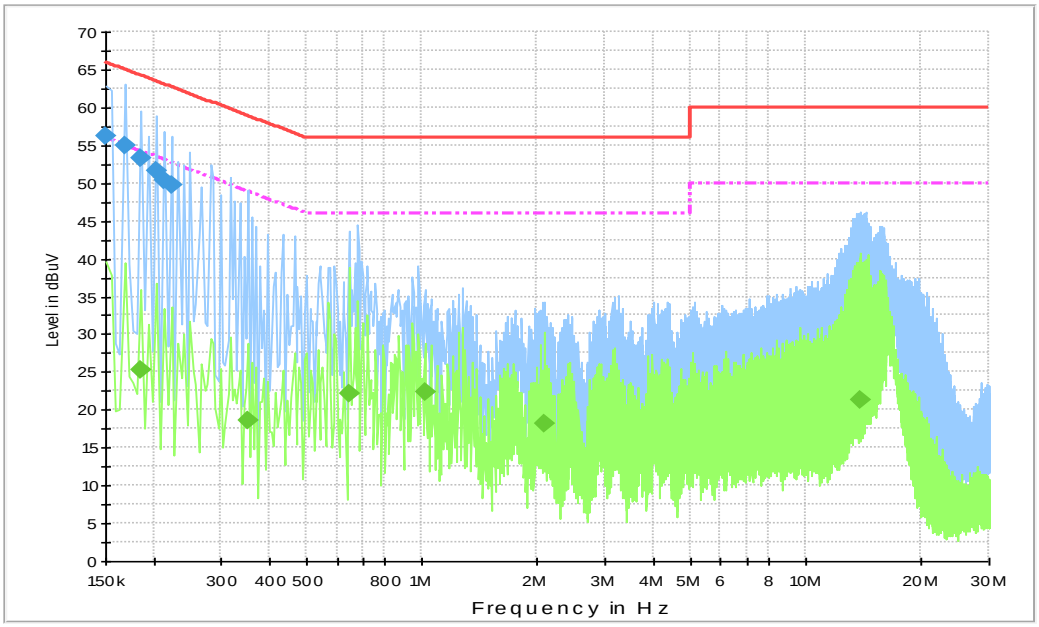


Fig.B.10.2 AC Powerline Conducted Emission-Idle

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)
0.150000	56.3	2000.0	9.000	Off	N	19.4	9.7	66.0
0.168000	54.9	2000.0	9.000	Off	L1	19.5	10.2	65.1
0.186000	53.3	2000.0	9.000	Off	N	19.5	10.9	64.2
0.204000	51.7	2000.0	9.000	Off	N	19.4	11.8	63.4
0.213000	50.3	2000.0	9.000	Off	N	19.4	12.8	63.1
0.222000	49.7	2000.0	9.000	Off	N	19.5	13.1	62.7

Final Result 2

Frequency (MHz)	CAverage (dBµV)	Meas. Time	Bandwidth (kHz)	Filter	Line	Corr. (dB)	Margin (dB)	Limit (dBµV)
0.186000	25.4	2000.0	9.000	Off	L1	19.5	28.9	54.2
0.352500	18.7	2000.0	9.000	Off	L1	19.4	30.2	48.9
0.645000	22.2	2000.0	9.000	Off	L1	19.5	23.8	46.0
1.018500	22.4	2000.0	9.000	Off	L1	19.5	23.6	46.0
2.089500	18.2	2000.0	9.000	Off	L1	19.5	27.8	46.0
13.870500	21.3	2000.0	9.000	Off	N	19.8	28.7	50.0

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.

B.12. RX Input Bandwidth

This EUT uses Bluetooth technology, so it complies with the requirement of RX Input Bandwidth in FCC Part 15.247 (a)(1).

B.13. Hopping Capability

This EUT uses Bluetooth technology, so it complies with the requirement of Hopping Capability in FCC Part 15.247 (a)(1).

ANNEX C: Accreditation Certificate

Accredited Laboratory

A2LA has accredited

TELECOMMUNICATION TECHNOLOGY LABS, CAICT

Beijing, People's Republic of China

for technical competence in the field of

Electrical Testing

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

Presented this 26th day of June 2023.

Mr. Trace McInturff, Vice President, Accreditation Services
For the Accreditation Council
Certificate Number 7049.01
Valid to July 31, 2024

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

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