8DPSK Ch 0 - Average

Frequency (MHz)	Result (dBuv/m)	Cable loss (dB)	Antenna Factor (dB/m)	Receiver Reading (dBµV)	Polarization
17985	35.4	-25.5	43.4	17.5	H
17989.5	35.4	-25.5	43.4	17.5	H
17986.5	35.3	-25.5	43.4	17.4	V
17992.5	35.3	-25.5	43.4	17.4	H
17890.5	35.2	-25.5	43.4	17.3	H
2384.1	39.6	-14.2	27.2	26.6	H

8DPSK Ch 39 - Average

Frequency (MHz)	Result (dBuv/m)	Cable loss (dB)	Antenna Factor (dB/m)	Receiver Reading (dBµV)	Polarization
17985	35.4	-25.5	43.4	17.5	H
17986.5	35.4	-25.5	43.4	17.5	H
17989.5	35.4	-25.5	43.4	17.5	H
17991	35.4	-25.5	43.4	17.5	V
17881.5	35.3	-25.5	43.4	17.4	V
17974.5	35.3	-25.5	43.4	17.4	H

8DPSK Ch 78 - Average

Frequency (MHz)	Result (dBuv/m)	Cable loss (dB)	Antenna Factor (dB/m)	Receiver Reading (dBµV)	Polarization
17995.5	35.6	-25.5	43.4	17.7	V
17877	35.4	-25.5	43.4	17.5	V
17962.5	35.4	-25.5	43.4	17.5	V
17982	35.4	-25.5	43.4	17.5	V
17983.5	35.4	-25.5	43.4	17.5	H
2489.8	39.6	-14.2	27.2	26.6	H

GFSK Ch 0 – Peak

Frequency (MHz)	Result (dBuv/m)	Cable loss (dB)	Antenna Factor (dB/m)	Receiver Reading (dBµV)	Polarization
17967	48.6	-25.5	43.4	30.7	V
17806.5	48.3	-25.5	43.4	30.4	H
17826	48	-25.5	43.4	30.1	V
17704.5	47.6	-25.7	43.4	29.9	V
17728.5	47.6	-25.7	43.4	29.9	V
2310.5	52.2	-14.5	27.2	39.5	V

GFSK Ch 39 - Peak

Frequency (MHz)	Result (dBuv/m)	Cable loss (dB)	Antenna Factor (dB/m)	Receiver Reading (dBµV)	Polarization
17991	48.2	-25.5	43.4	30.3	V
17935.5	47.6	-25.5	43.4	29.7	V
17901	47.3	-25.5	43.4	29.4	V
17961	47.3	-25.5	43.4	29.4	V
17988	47.2	-25.5	43.4	29.3	V
17518.5	47.1	-26.9	43.4	30.6	H

GFSK Ch 78 - Peak

Frequency (MHz)	Result (dBuv/m)	Cable loss (dB)	Antenna Factor (dB/m)	Receiver Reading (dBµV)	Polarization
17991	48.3	-25.5	43.4	30.4	V
17970	47.3	-25.5	43.4	29.4	H
17836.5	47.2	-25.5	43.4	29.3	H
17572.5	47.1	-25.7	43.4	29.4	H
17914.5	47.1	-25.5	43.4	29.2	H
2492.3	52.2	-14.2	27.2	39.2	V

π/4 DQPSK Ch 0 - Peak

Frequency (MHz)	Result (dBuv/m)	Cable loss (dB)	Antenna Factor (dB/m)	Receiver Reading (dBµV)	Polarization
17908.5	48.2	-25.5	43.4	30.3	V
17809.5	47.7	-25.5	43.4	29.8	H
17865	47.7	-25.5	43.4	29.8	H
17461.5	47.6	-26.9	43.4	31.1	V
17905.5	47.5	-25.5	43.4	29.6	H
2311.6	52.3	-14.5	27.2	39.6	H

π/4 DQPSK Ch 39 - Peak

Frequency (MHz)	Result (dBuv/m)	Cable loss (dB)	Antenna Factor (dB/m)	Receiver Reading (dBµV)	Polarization
17844	48	-25.5	43.4	30.1	V
17934	47.9	-25.5	43.4	30	V
17728.5	47.8	-25.7	43.4	30.1	H
17769	47.8	-25.5	43.4	29.9	H
17920.5	47.8	-25.5	43.4	29.9	V
17475	47.6	-26.9	43.4	31.1	V

π/4 DQPSK Ch 78 - Peak

Frequency (MHz)	Result (dBuv/m)	Cable loss (dB)	Antenna Factor (dB/m)	Receiver Reading (dBµV)	Polarization
17992.5	48.6	-25.5	43.4	30.7	H
17973	48.2	-25.5	43.4	30.3	V
17983.5	48	-25.5	43.4	30.1	V
17794.5	47.9	-25.5	43.4	30	H
17779.5	47.7	-25.5	43.4	29.8	V
2485.2	52.2	-14.2	27.2	39.2	H

8DPSK Ch 0 - Peak

Frequency (MHz)	Result (dBuv/m)	Cable loss (dB)	Antenna Factor (dB/m)	Receiver Reading (dBµV)	Polarization
17847	47.9	-25.5	43.4	30	V
17733	47.4	-25.7	43.4	29.7	H
17914.5	47.3	-25.5	43.4	29.4	H
17968.5	47.3	-25.5	43.4	29.4	H
17980.5	47.3	-25.5	43.4	29.4	V
2379	52.6	-14.2	27.2	39.6	H

8DPSK Ch 39 - Peak

Frequency (MHz)	Result (dBuv/m)	Cable loss (dB)	Antenna Factor (dB/m)	Receiver Reading (dBµV)	Polarization
17896.5	48.1	-25.5	43.4	30.2	V
17959.5	48.1	-25.5	43.4	30.2	H
17994	48	-25.5	43.4	30.1	V
17805	47.8	-25.5	43.4	29.9	H
17716.5	47.6	-25.7	43.4	29.9	H
17797.5	47.6	-25.5	43.4	29.7	V

8DPSK Ch 78 - Peak

Frequency (MHz)	Result (dBuv/m)	Cable loss (dB)	Antenna Factor (dB/m)	Receiver Reading (dBµV)	Polarization
17991	48.2	-25.5	43.4	30.3	H
17890.5	48	-25.5	43.4	30.1	H
17965.5	48	-25.5	43.4	30.1	H
17968.5	47.9	-25.5	43.4	30	H
17865	47.7	-25.5	43.4	29.8	V
2489.7	52.6	-14.2	27.2	39.6	H

Sample calculation: Peak detector, 2489.7MHz

Result =Receiver Reading(39.6dBµV)+Antenna Factor(27.2dB/m)+Cable loss(-14.2dB) =52.6 dBµV/m

Conclusion: EUT1 PASS

Test graphs as below:

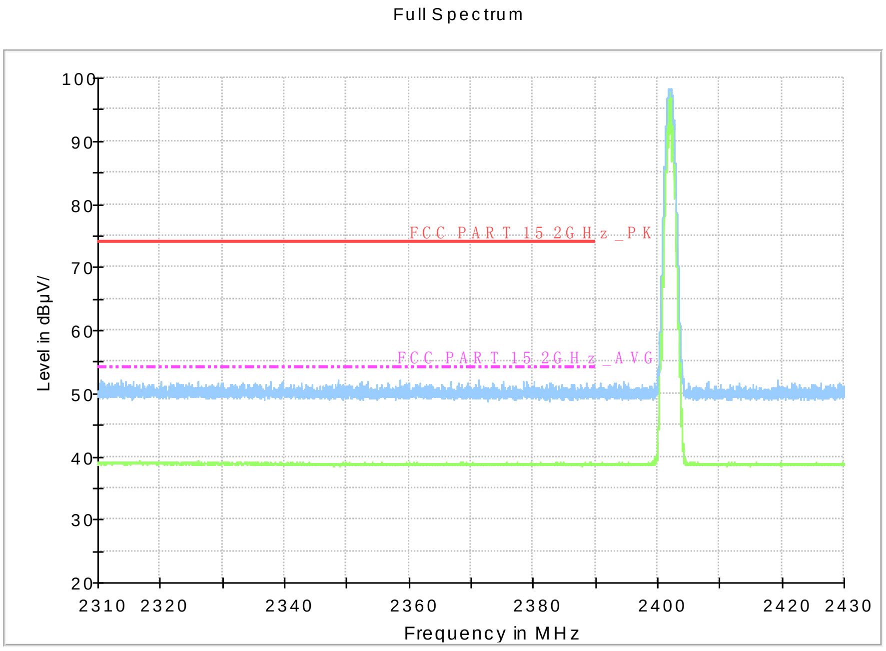


Fig.58. Radiated emission (Power): GFSK, low channel

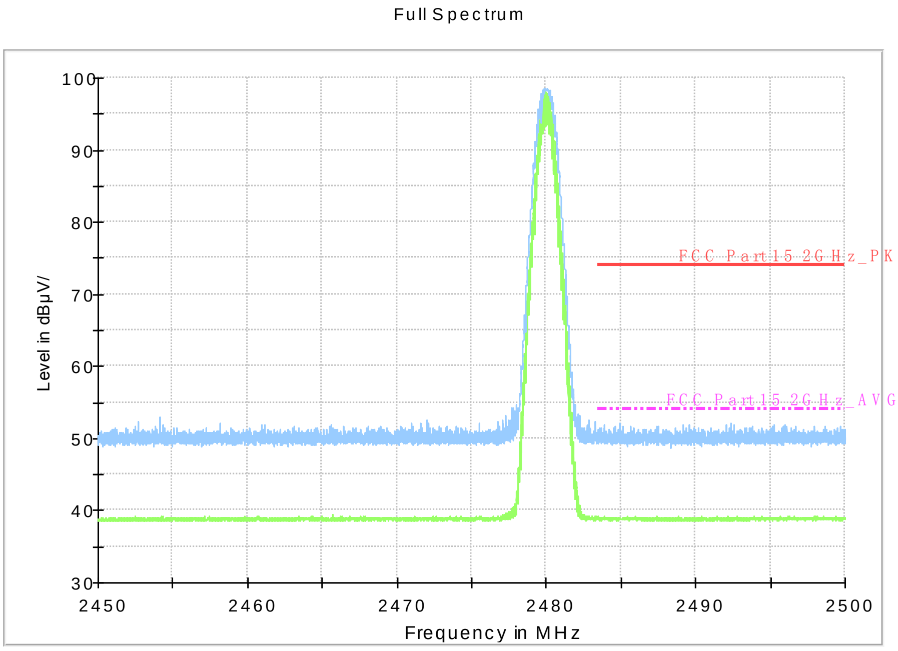


Fig.59. Radiated emission (Power) GFSK, high channel

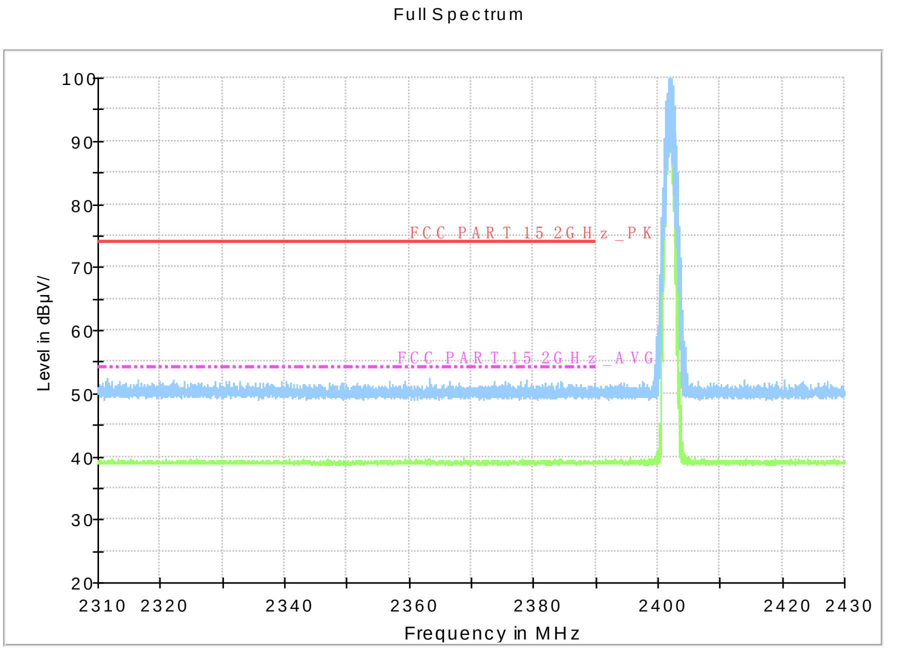


Fig.60. Radiated emission (Power): π/4 DQPSK, low channel

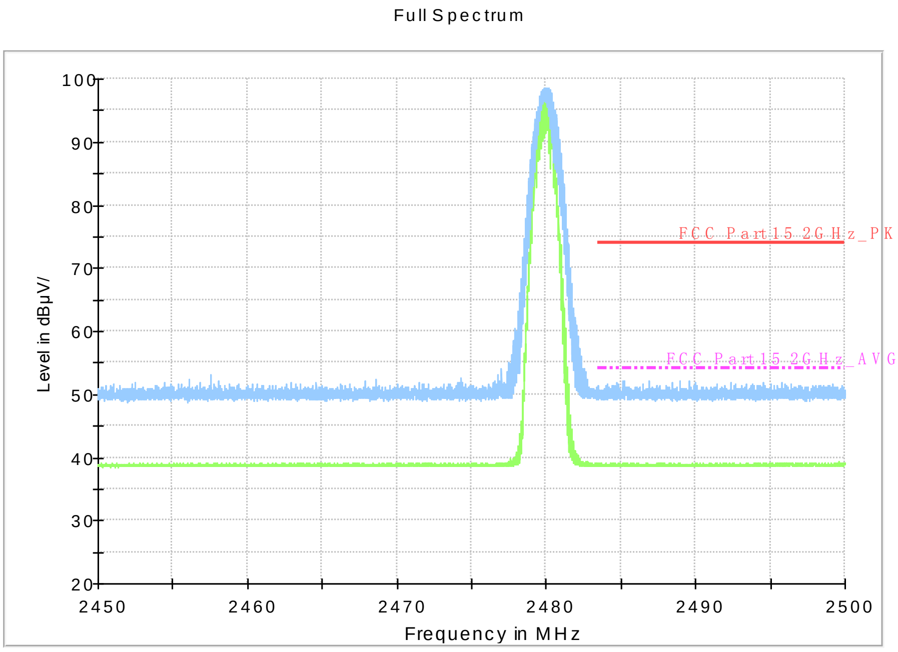


Fig.61. Radiated emission (Power): π/4 DQPSK, high channel

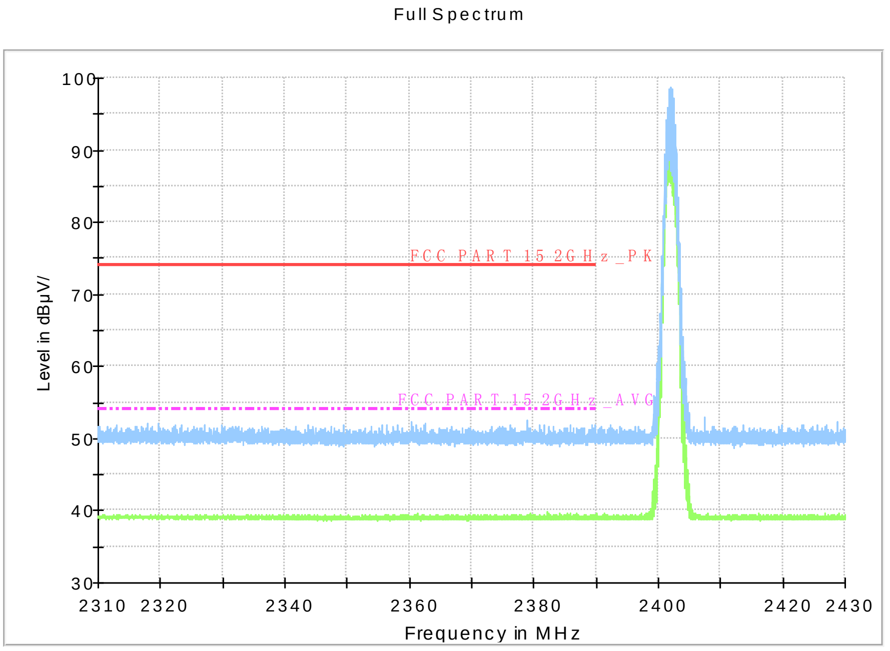


Fig.62. Radiated emission (Power): 8DPSK, low channel

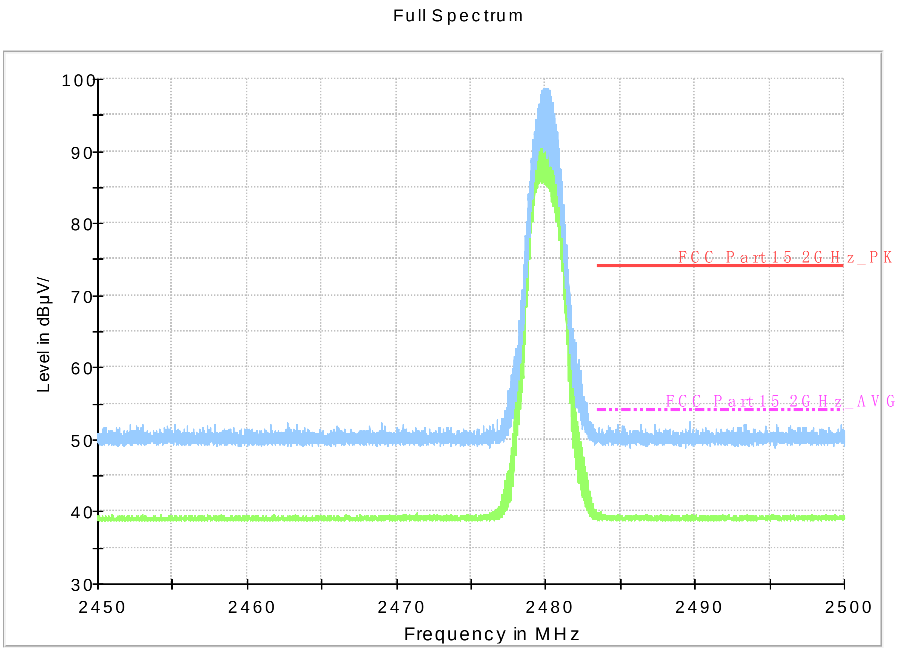


Fig.63. Radiated emission (Power): 8DPSK, high channel

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	119.62	P
		Fig.65		
	DH3	Fig.66	176.40	P
		Fig.67		
	DH5	Fig.68	178.65	P
		Fig.69		

For π/4 DQPSK

Channel	Packet	Dwell Time (ms)		Conclusion
39	2DH1	Fig.70	122.59	P
		Fig.71		
	2DH3	Fig.72	139.09	P
		Fig.73		
	2DH5	Fig.74	225.01	P
		Fig.75		

For 8DPSK

Channel	Packet	Dwell Time (ms)		Conclusion
39	3DH1	Fig.76	121.47	P
		Fig.77		

	3DH3	Fig.78	184.81	P
		Fig.79		
	3DH5	Fig.80	170.30	P
		Fig.81		

Conclusion: PASS

Test graphs as below:

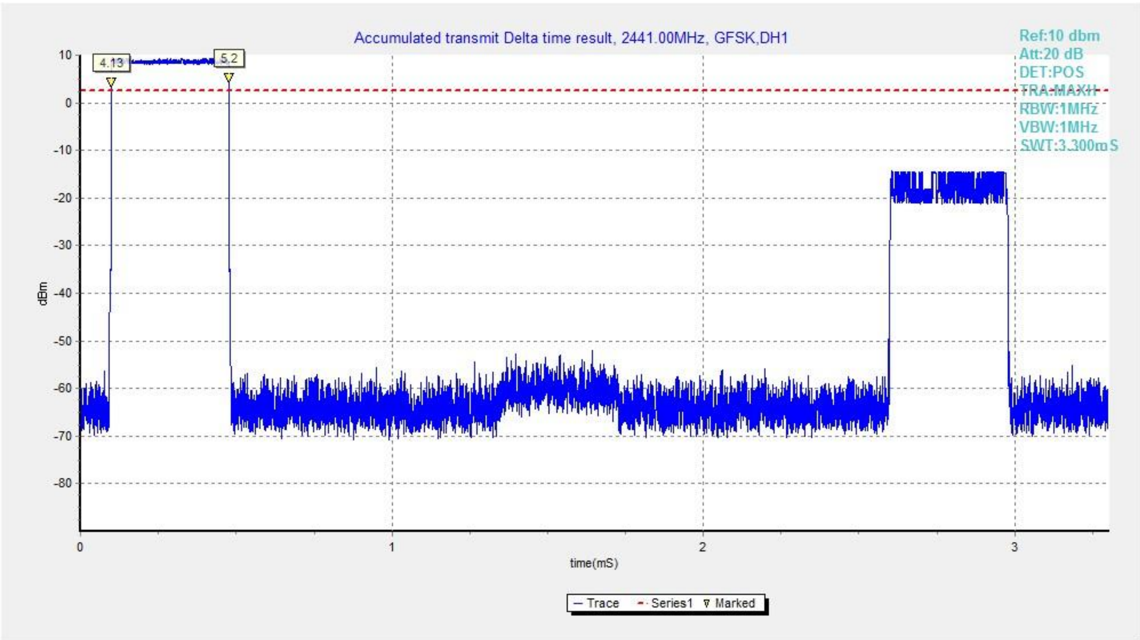


Fig.64. Time of occupancy (Dwell Time): Channel 39, Packet DH1

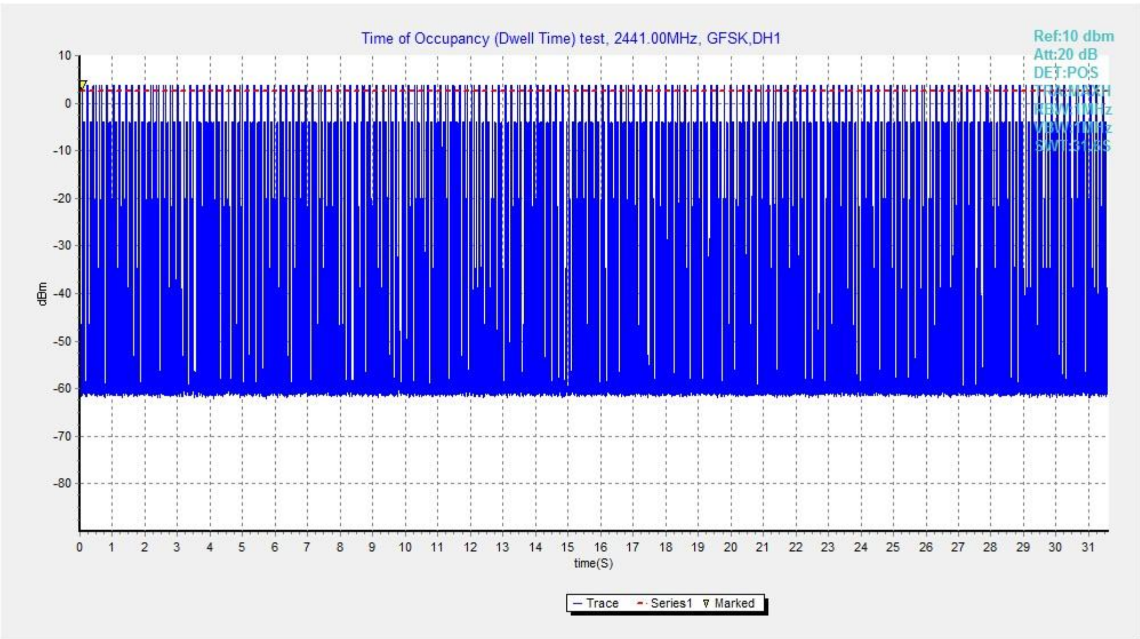


Fig.65. Number of Transmissions Measurement: Channel 39,Packet DH1

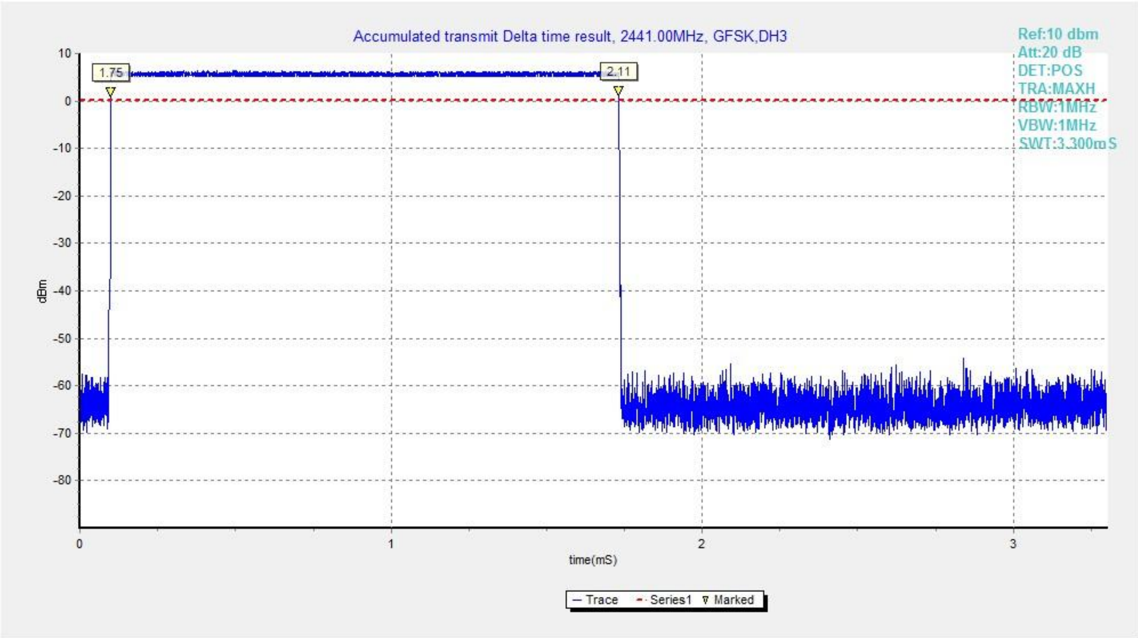


Fig.66. Time of occupancy (Dwell Time): Channel 39, Packet DH3

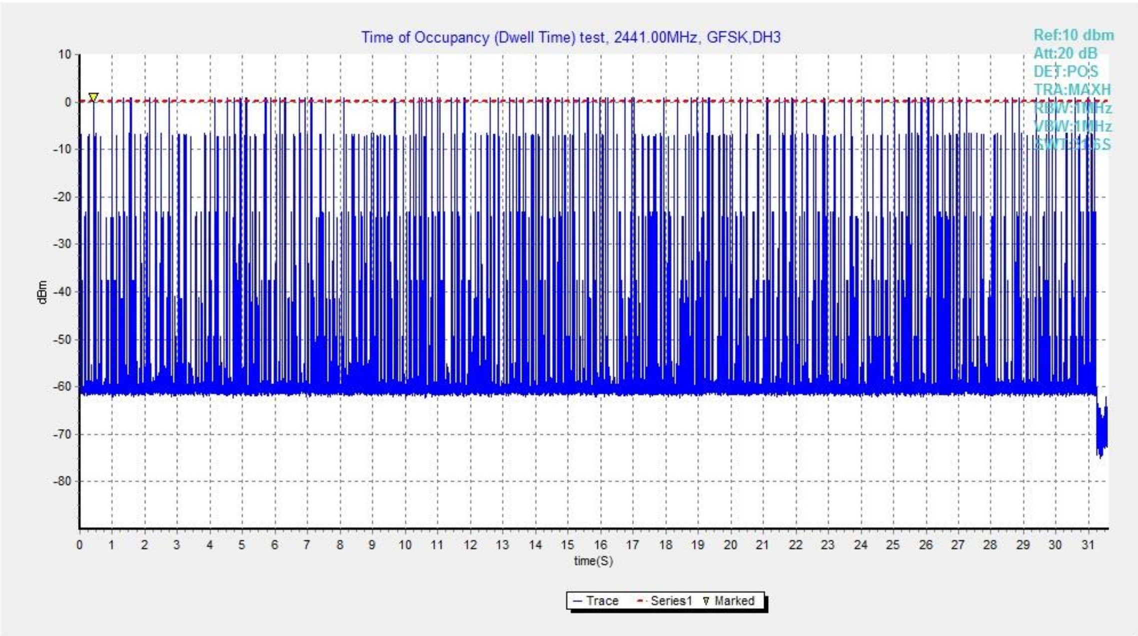


Fig.67. Number of Transmissions Measurement: Channel 39,Packet DH3

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

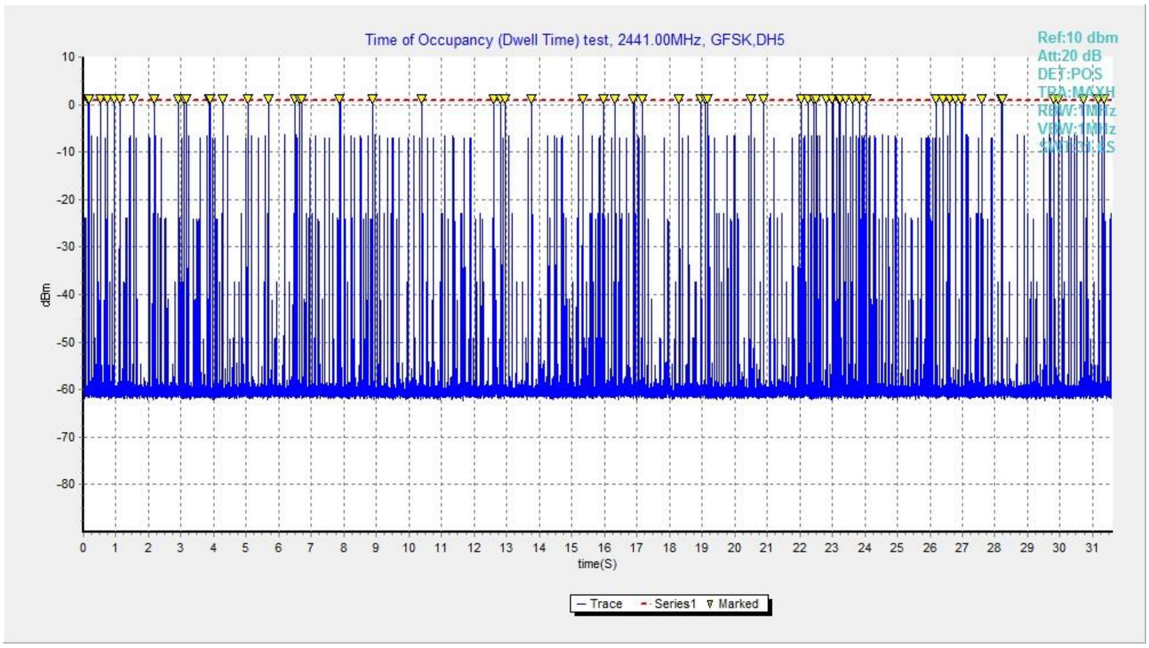


Fig.69. Number of Transmissions Measurement: Channel 39,Packet DH5

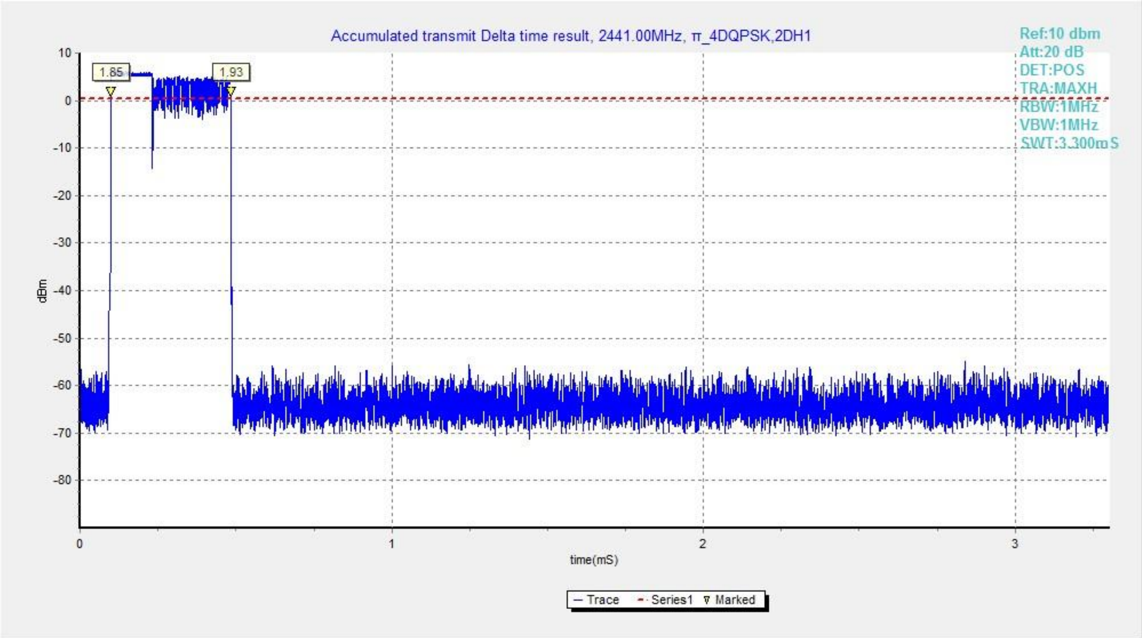


Fig.70. Time of occupancy (Dwell Time): Channel 39, Packet 2-DH1

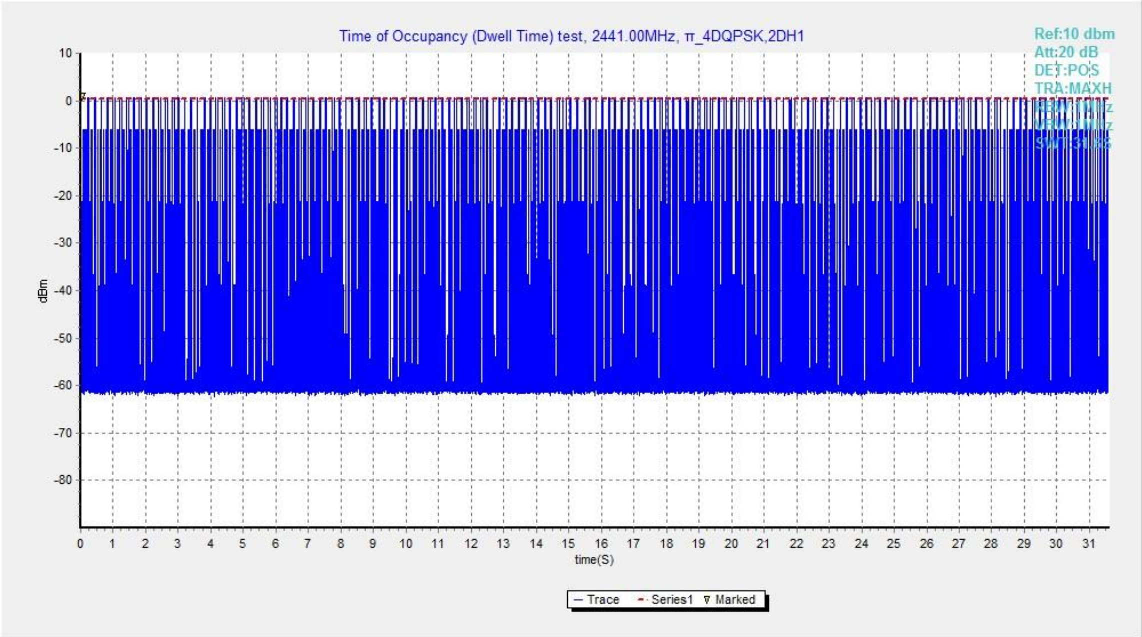


Fig.71. Number of Transmissions Measurement: Channel 39,Packet 2-DH1

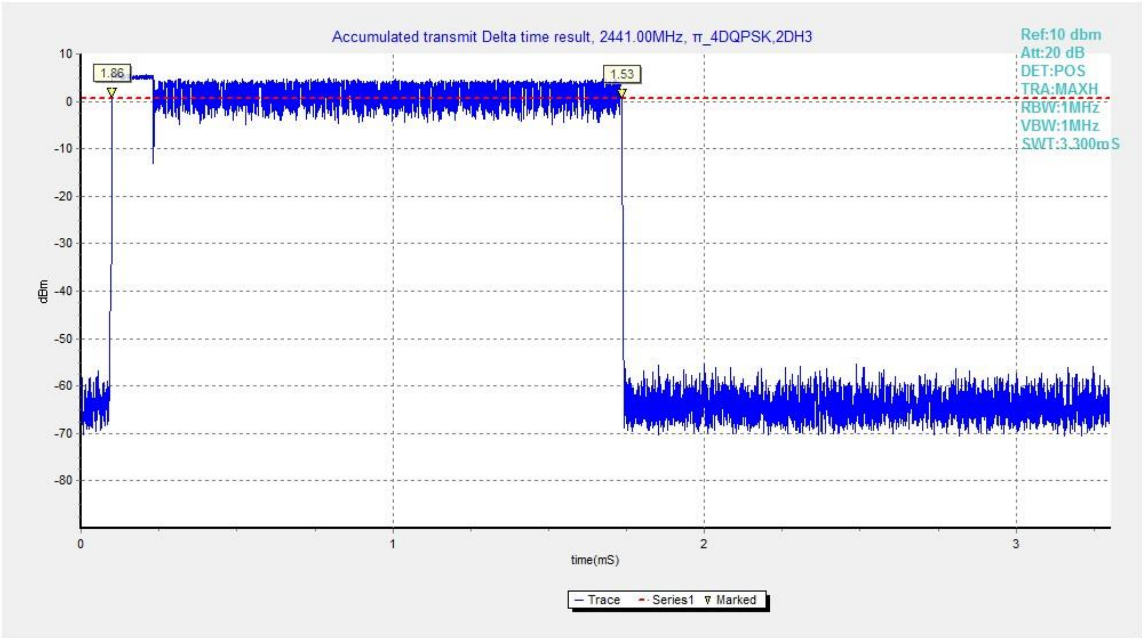


Fig.72. Time of occupancy (Dwell Time): Channel 39, Packet 2-DH3

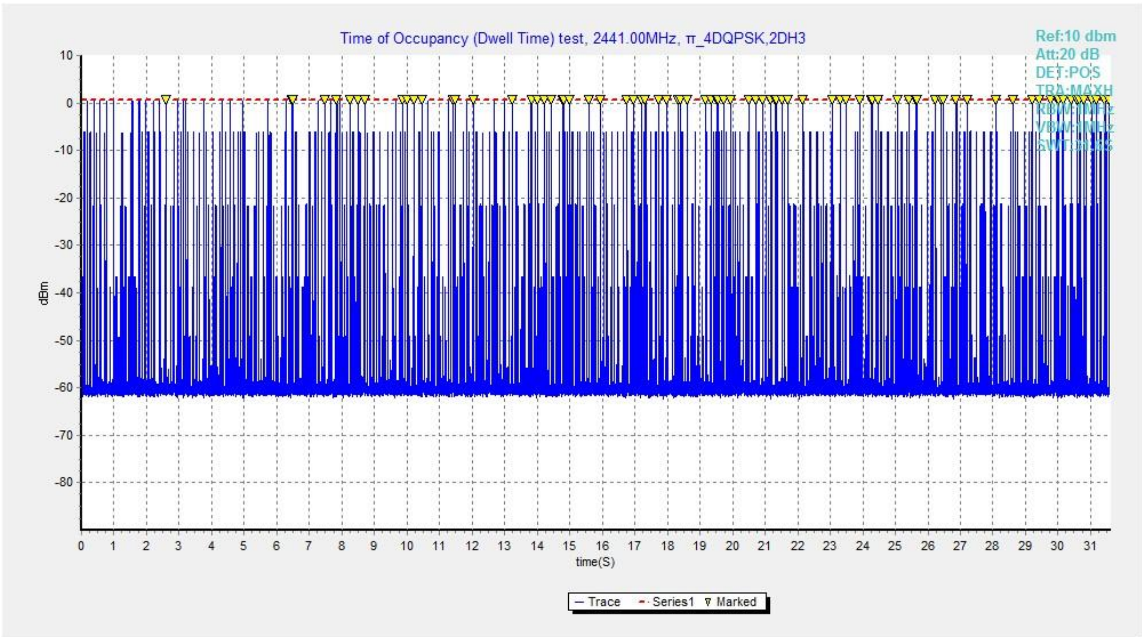


Fig.73. Number of Transmissions Measurement: Channel 39,Packet 2-DH3

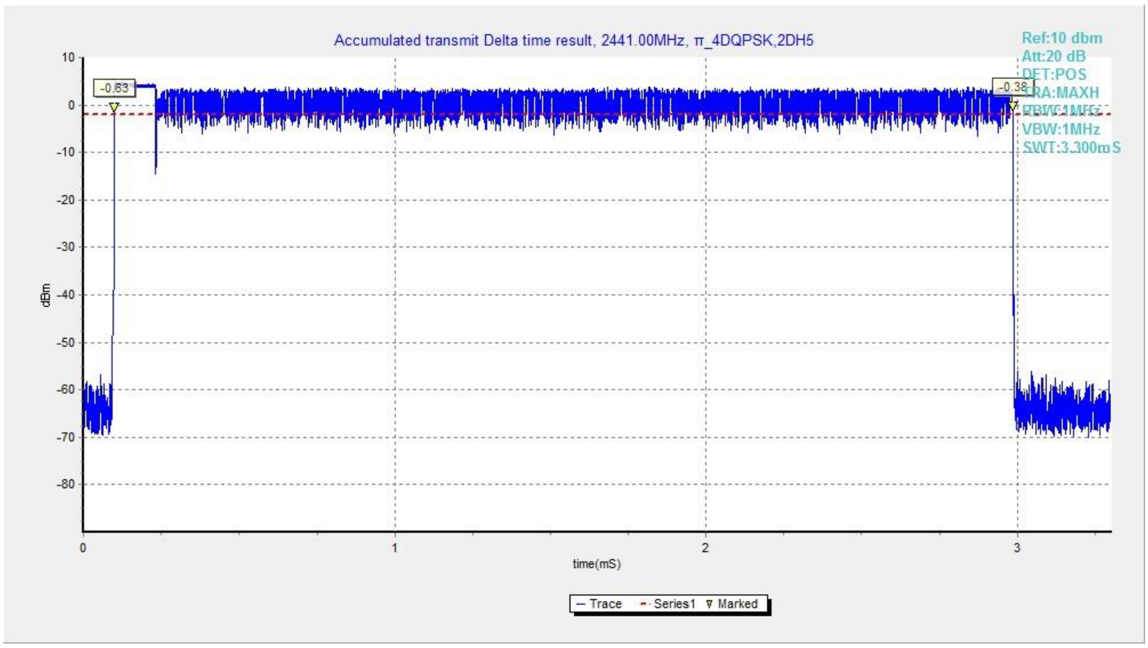


Fig.74. Time of occupancy (Dwell Time): Channel 39, Packet 2-DH5

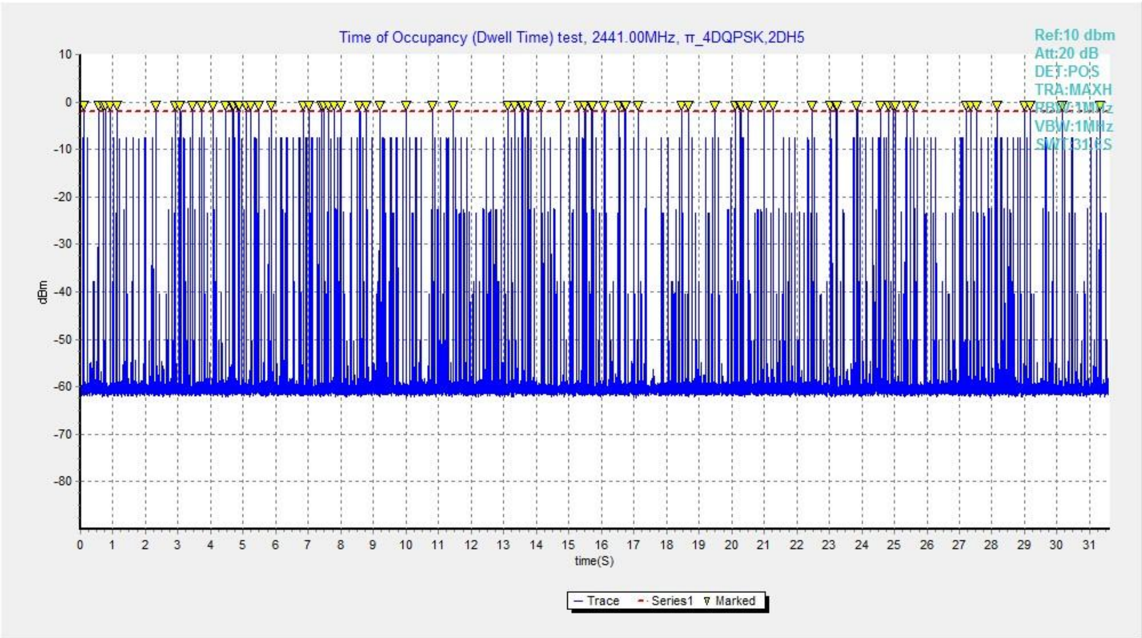


Fig.75. Number of Transmissions Measurement: Channel 39,Packet 2-DH5

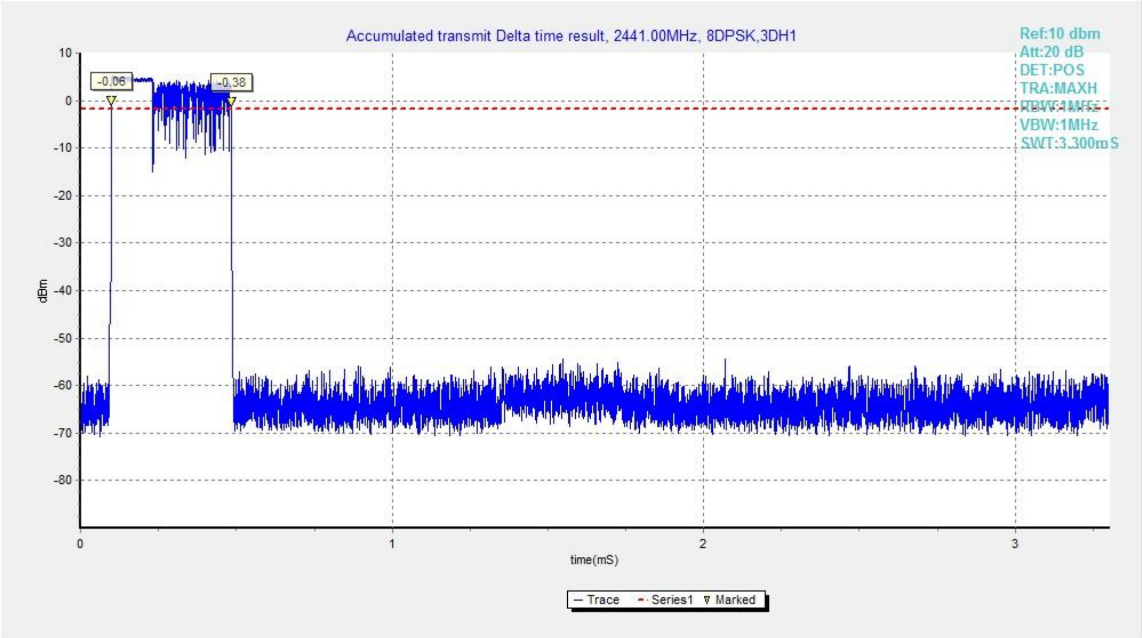


Fig.76. Time of occupancy (Dwell Time): Channel 39, Packet 3-DH1

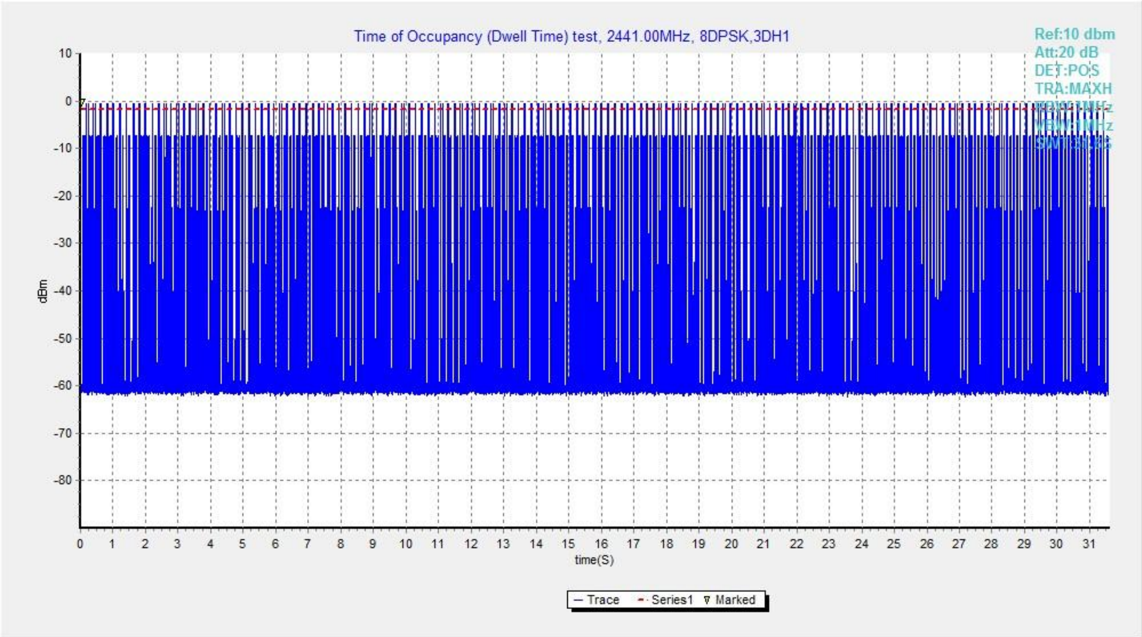


Fig.77. Number of Transmissions Measurement: Channel 39,Packet 3-DH1

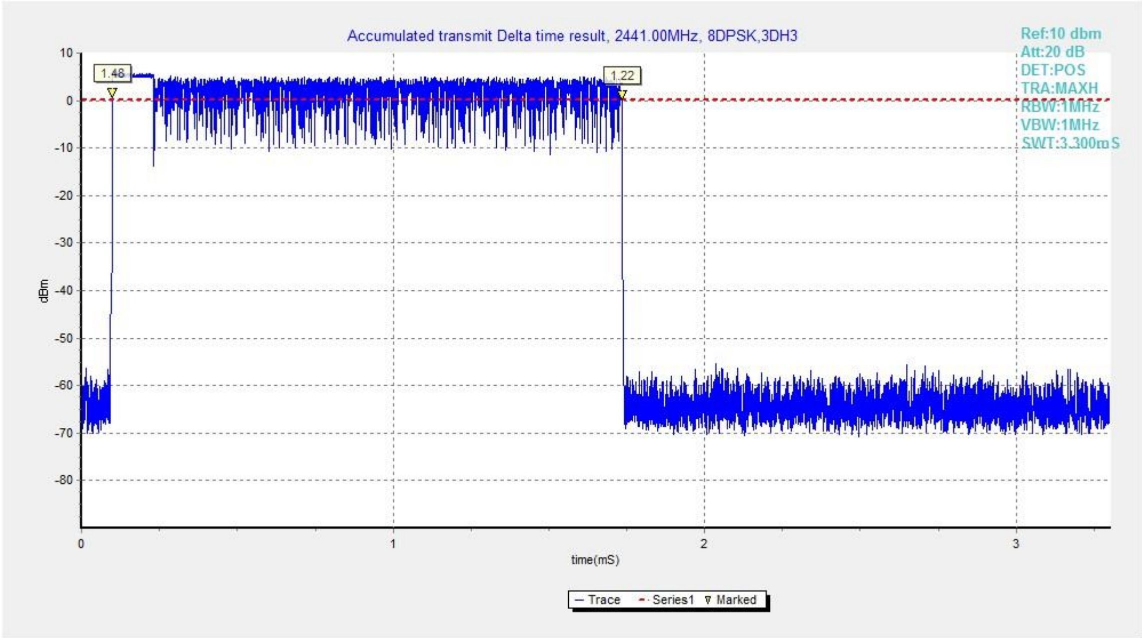


Fig.78. Time of occupancy (Dwell Time): Channel 39, Packet 3-DH3

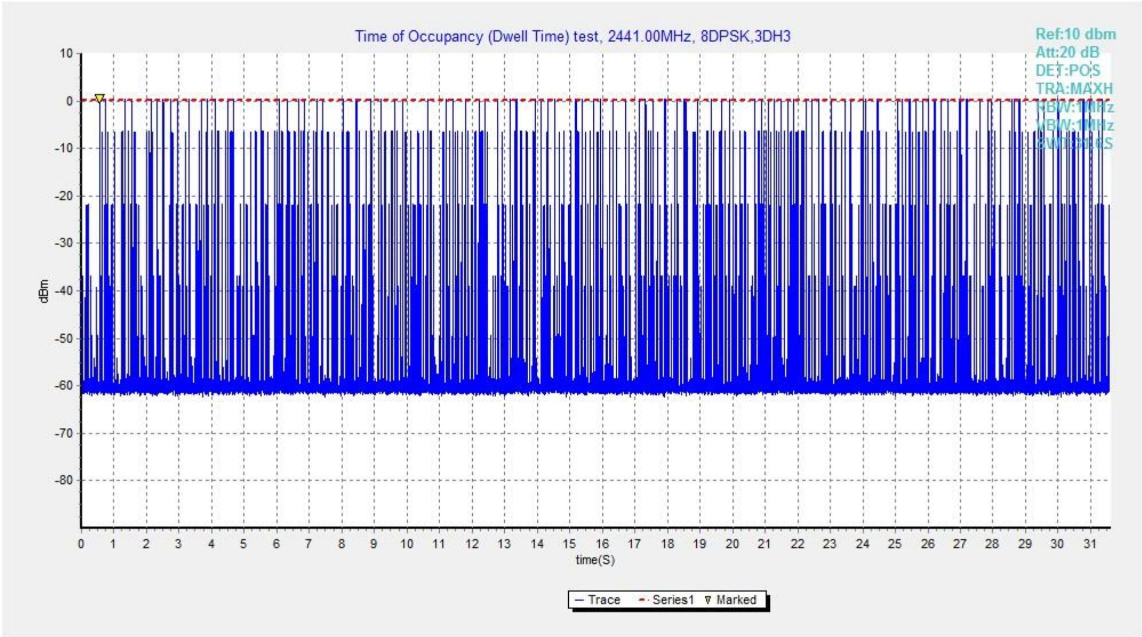


Fig.79. Number of Transmissions Measurement: Channel 39,Packet 3-DH3

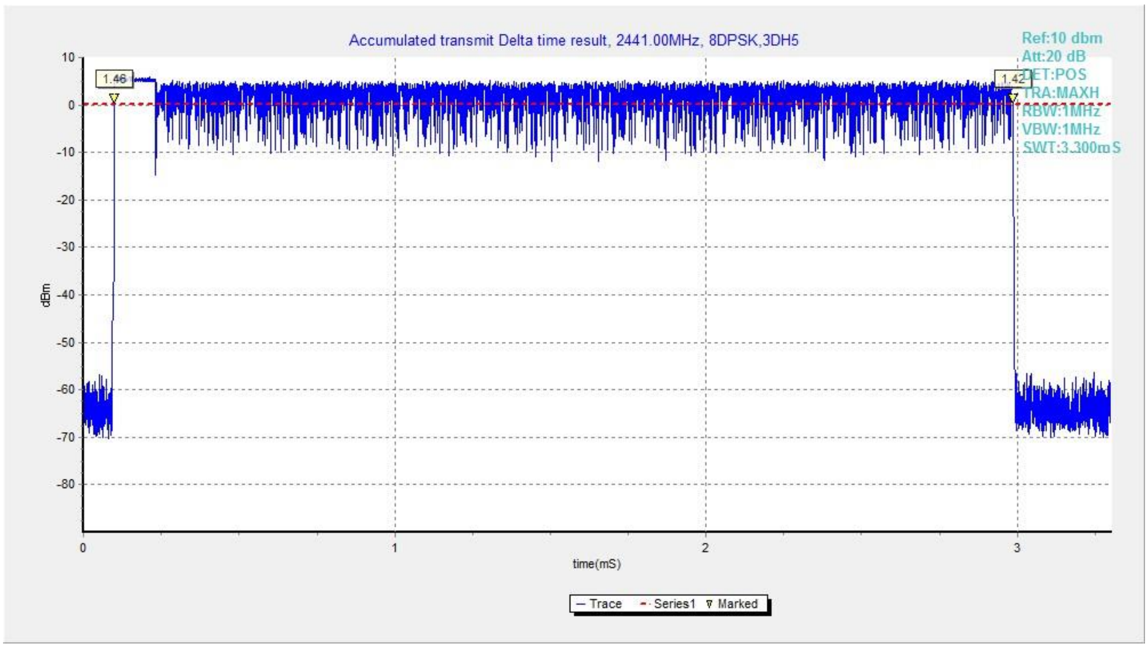


Fig.80. Time of occupancy (Dwell Time): Channel 39, Packet 3-DH5

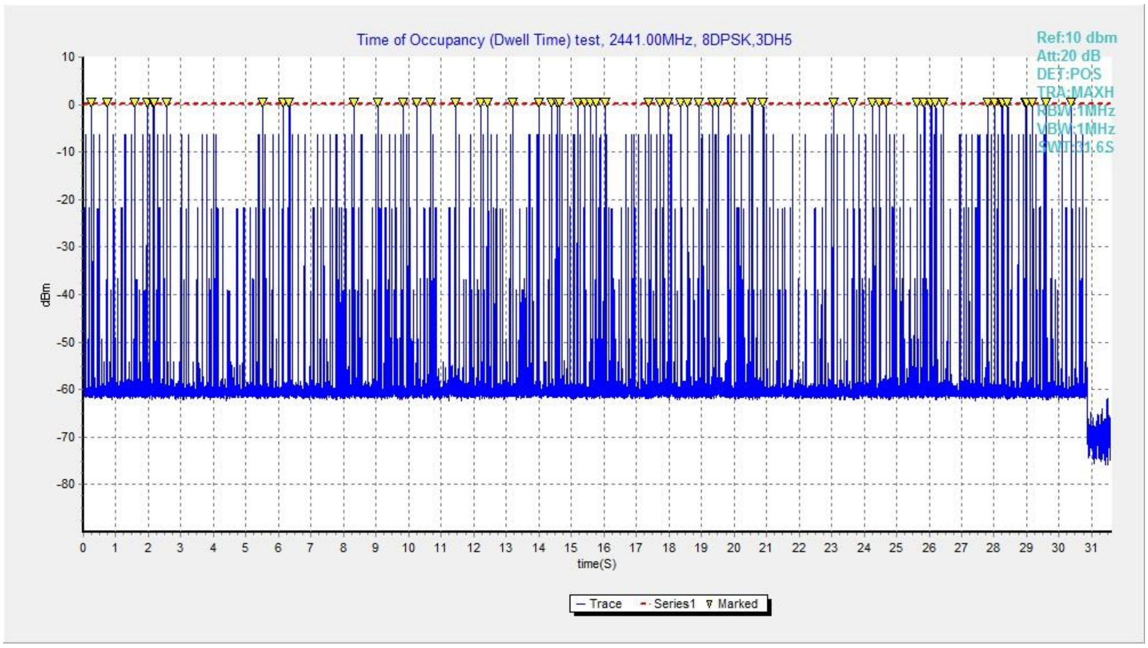


Fig.81. Number of Transmissions Measurement: Channel 39,Packet 3-DH5

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	1000.50	NA
39	Fig.83	994.50	NA
78	Fig.84	1003.50	NA

For π/4 DQPSK

Channel	20dB Bandwidth (kHz)		Conclusion
0	Fig.85	1271.25	NA
39	Fig.86	1251.00	NA
78	Fig.87	1250.25	NA

For 8DPSK

Channel	20dB Bandwidth (kHz)		Conclusion
0	Fig.88	1252.50	NA
39	Fig.89	1281.00	NA
78	Fig.90	1290.00	NA

Conclusion: NA

Test graphs as below:

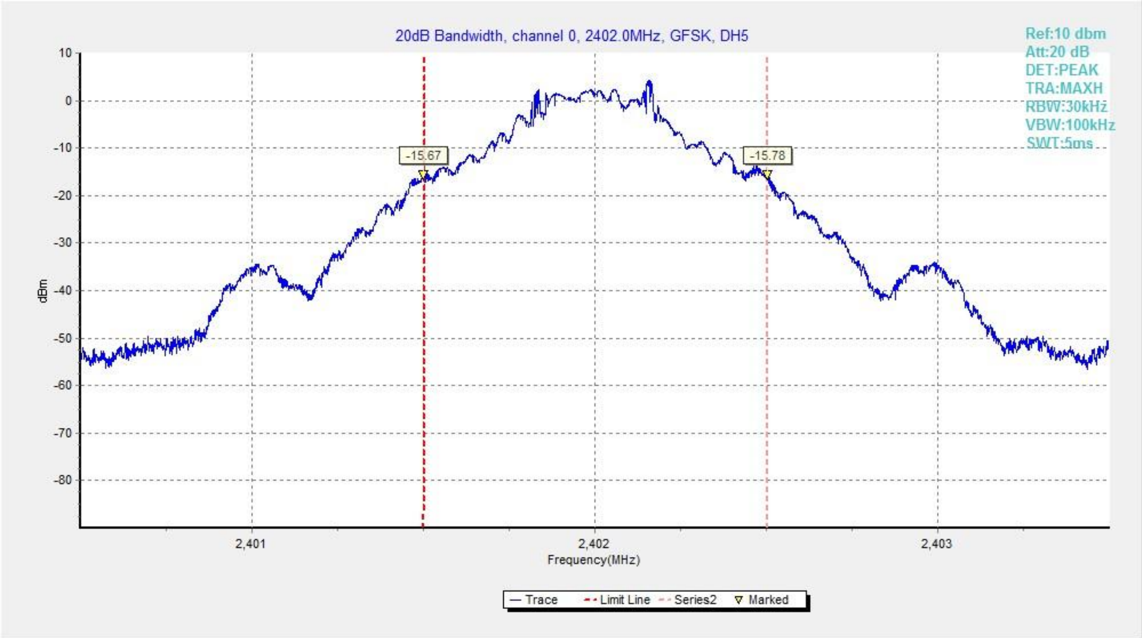


Fig.82. 20dB Bandwidth: GFSK, Channel 0

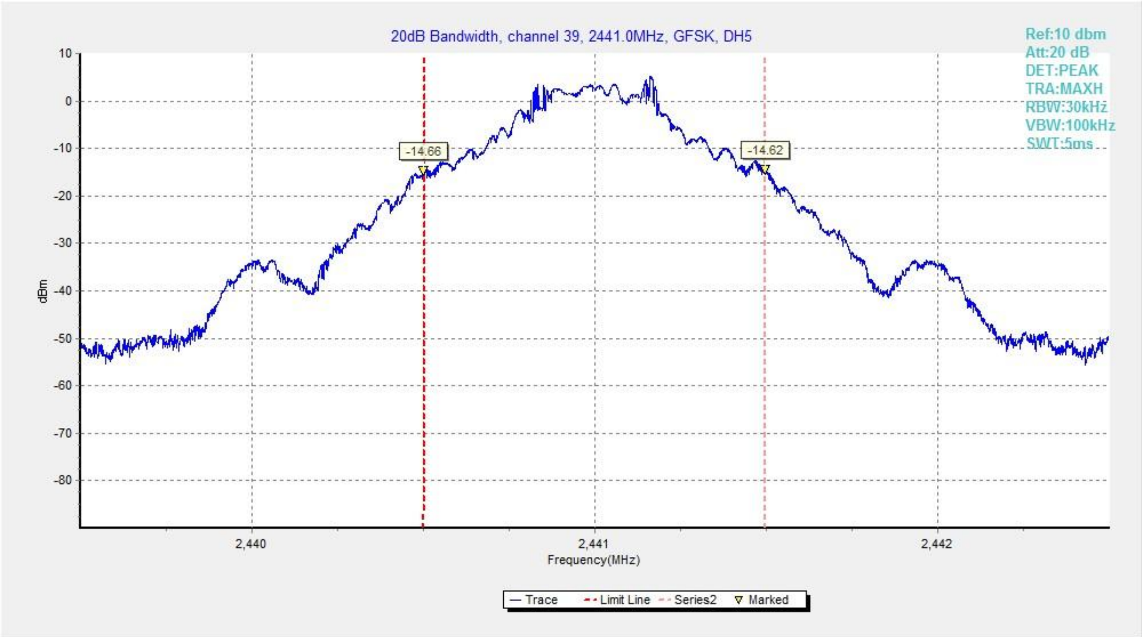


Fig.83. 20dB Bandwidth: GFSK, Channel 39

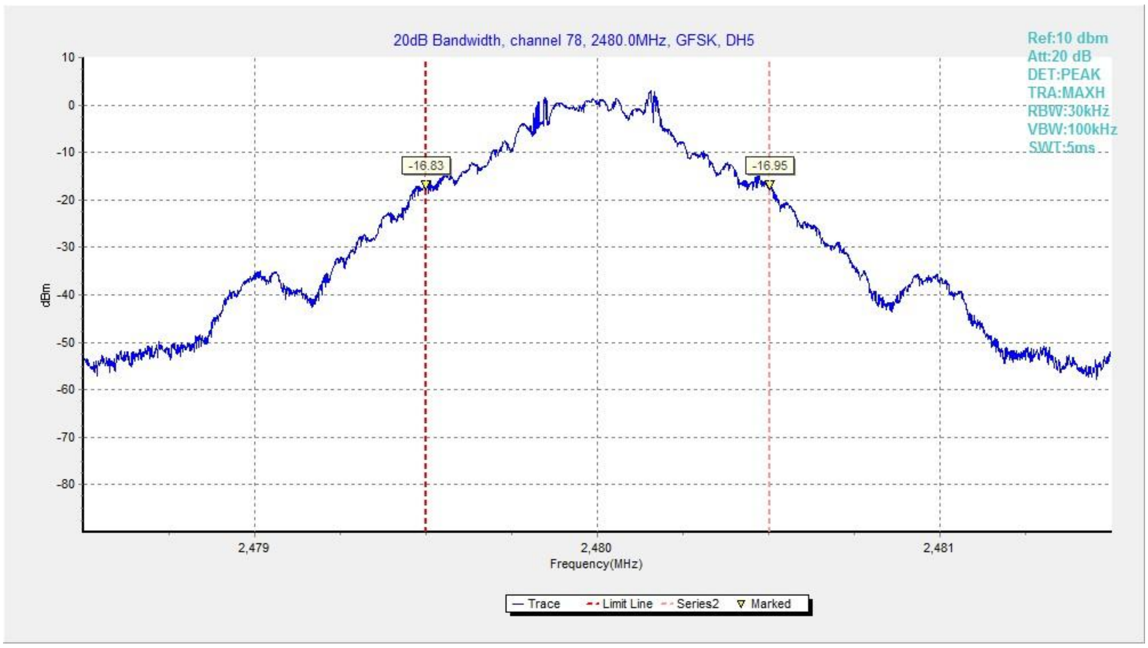


Fig.84. 20dB Bandwidth: GFSK, Channel 78

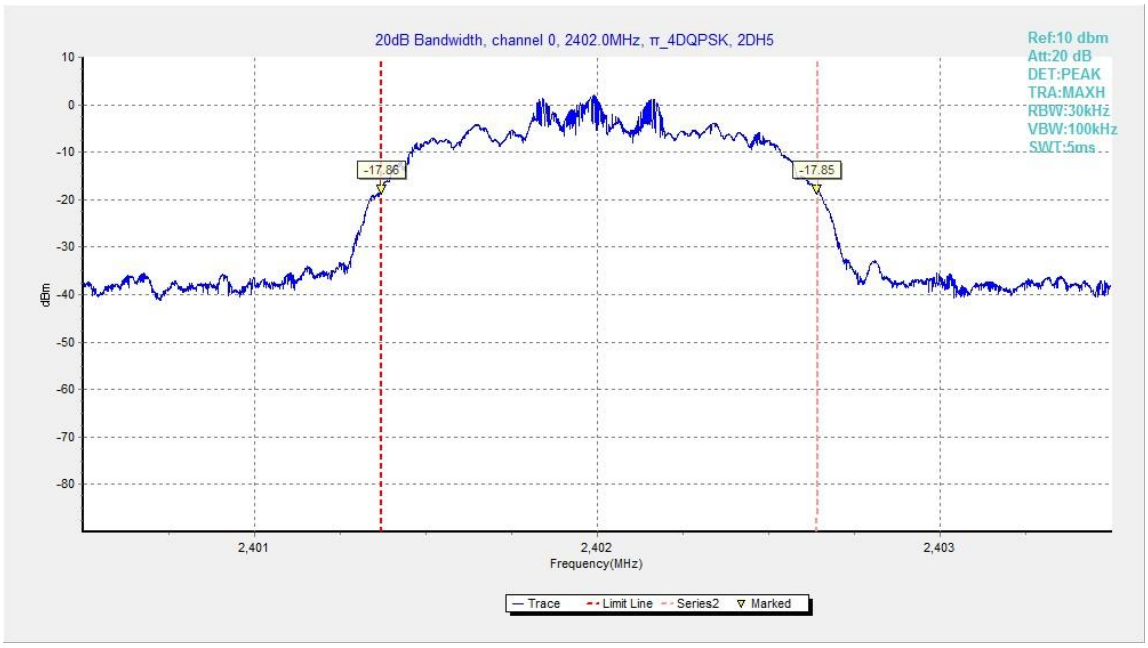


Fig.85. 20dB Bandwidth: π/4 DQPSK, Channel 0

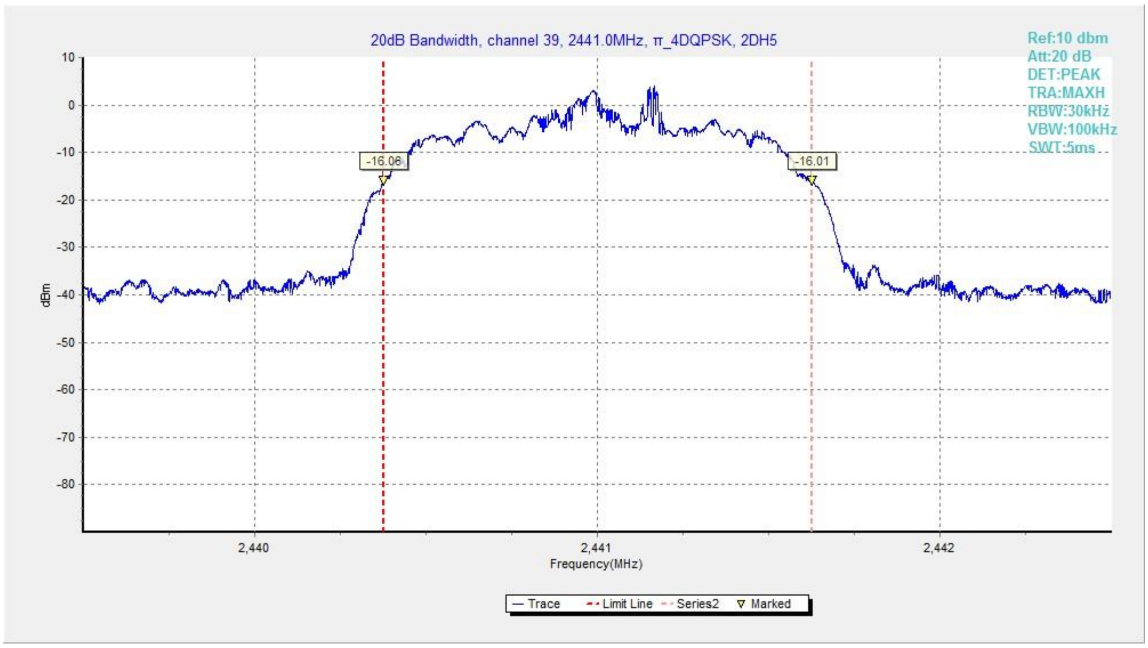


Fig.86. 20dB Bandwidth: π/4 DQPSK, Channel 39

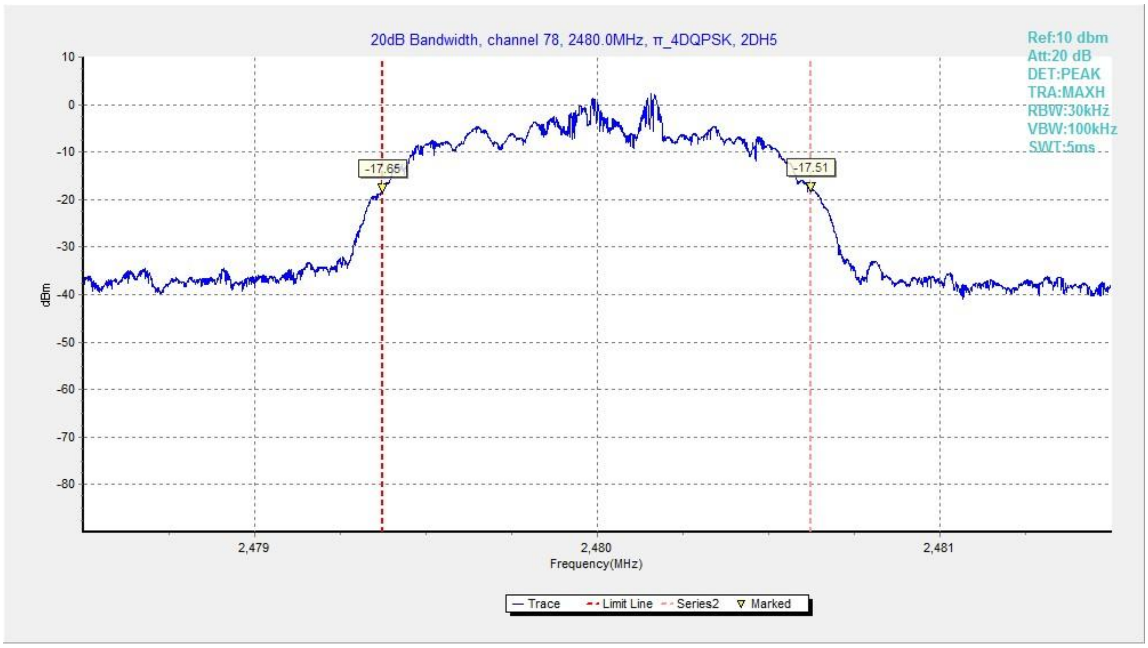


Fig.87. 20dB Bandwidth: π/4 DQPSK, Channel 78

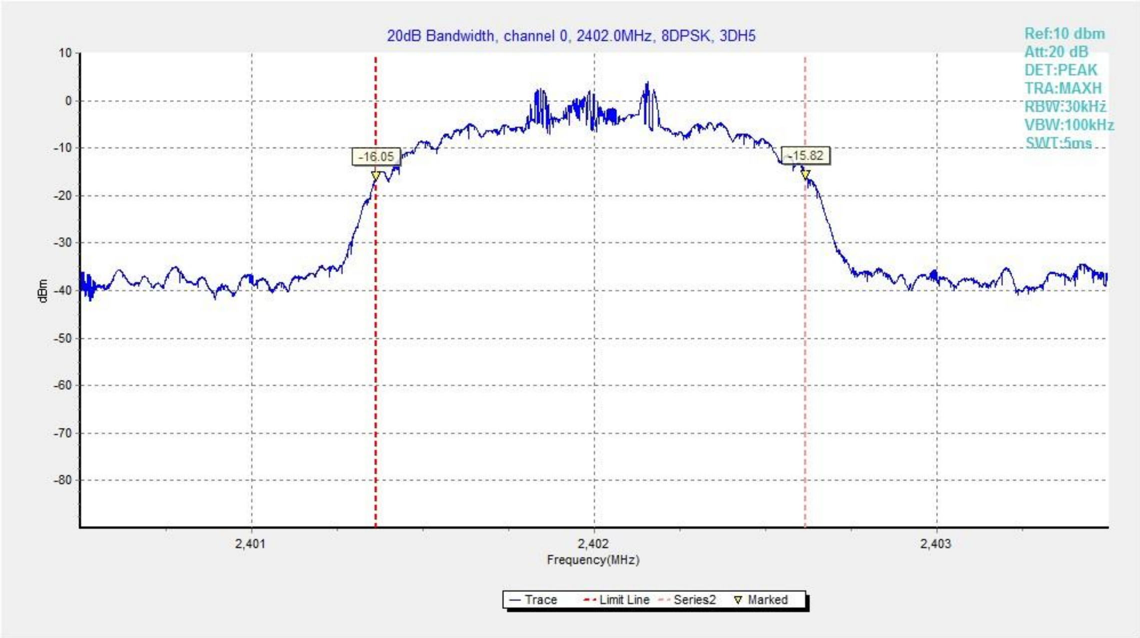


Fig.88. 20dB Bandwidth: 8DPSK, Channel 0

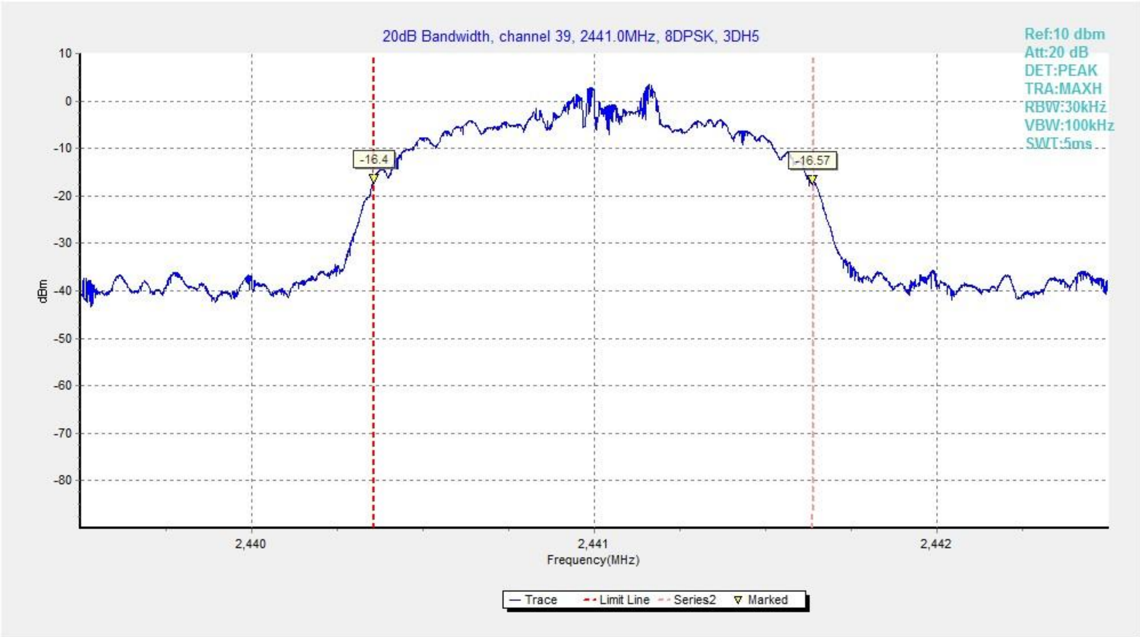


Fig.89. 20dB Bandwidth: 8DPSK, Channel 39

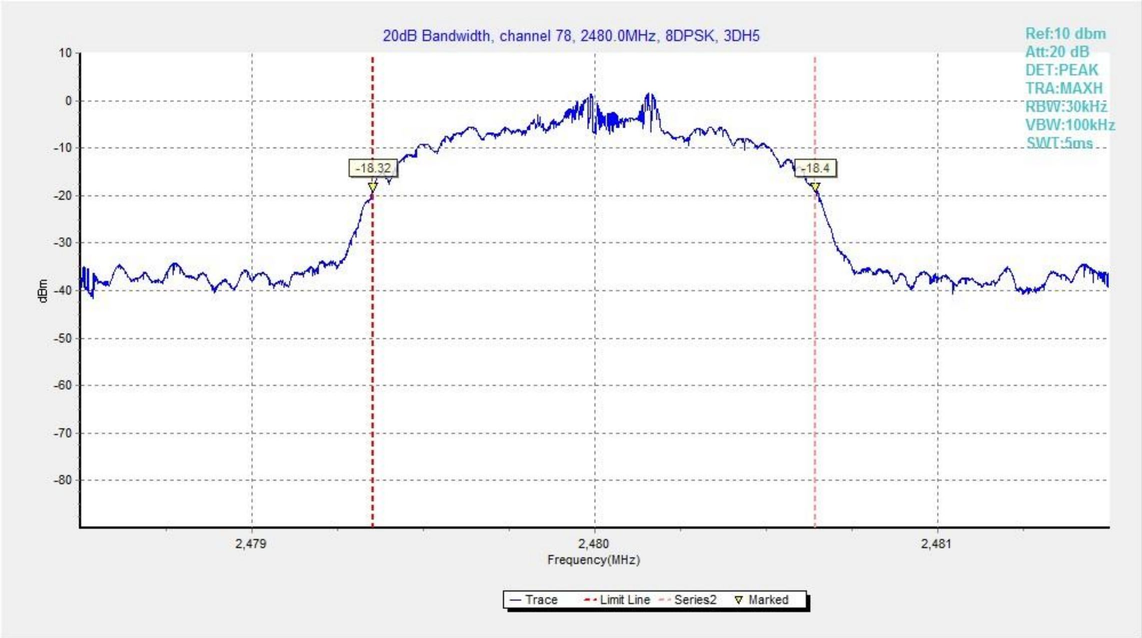


Fig.90. 20dB Bandwidth: 8DPSK, Channel 78

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	974.25	P

For π/4 DQPSK

Channel	Carrier frequency separation (kHz)		Conclusion
39	Fig.92	1167.00	P

For 8DPSK

Channel	Carrier frequency separation (kHz)		Conclusion
39	Fig.93	1149.75	P

Conclusion: PASS

Test graphs as below:

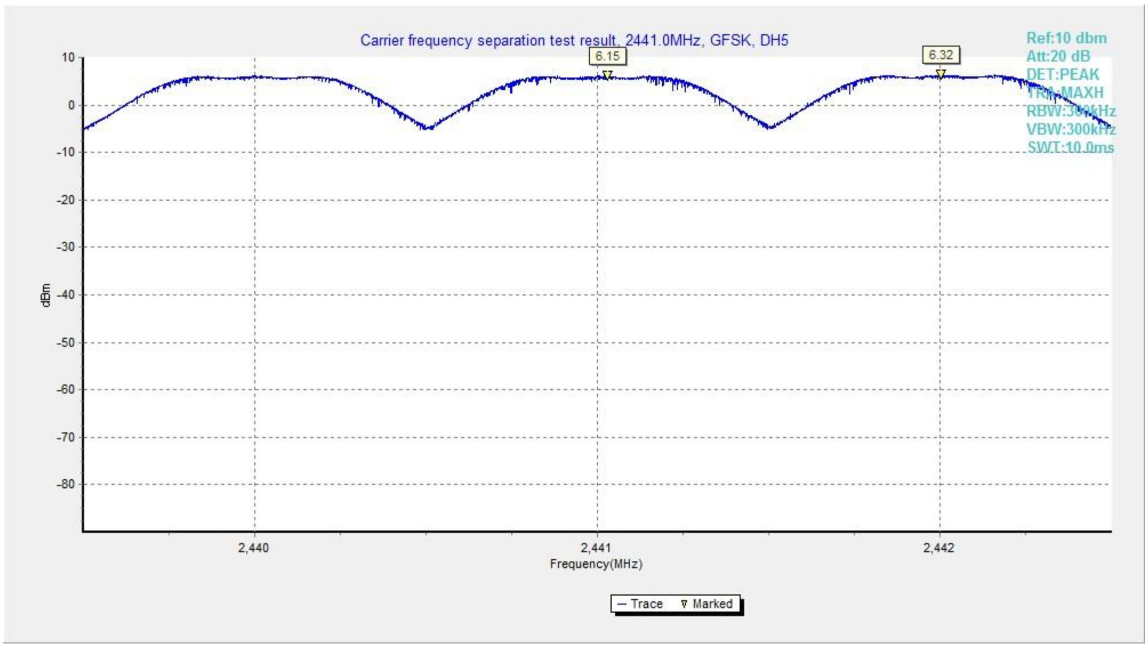


Fig.91. Carrier frequency separation measurement: GFSK, Channel 39

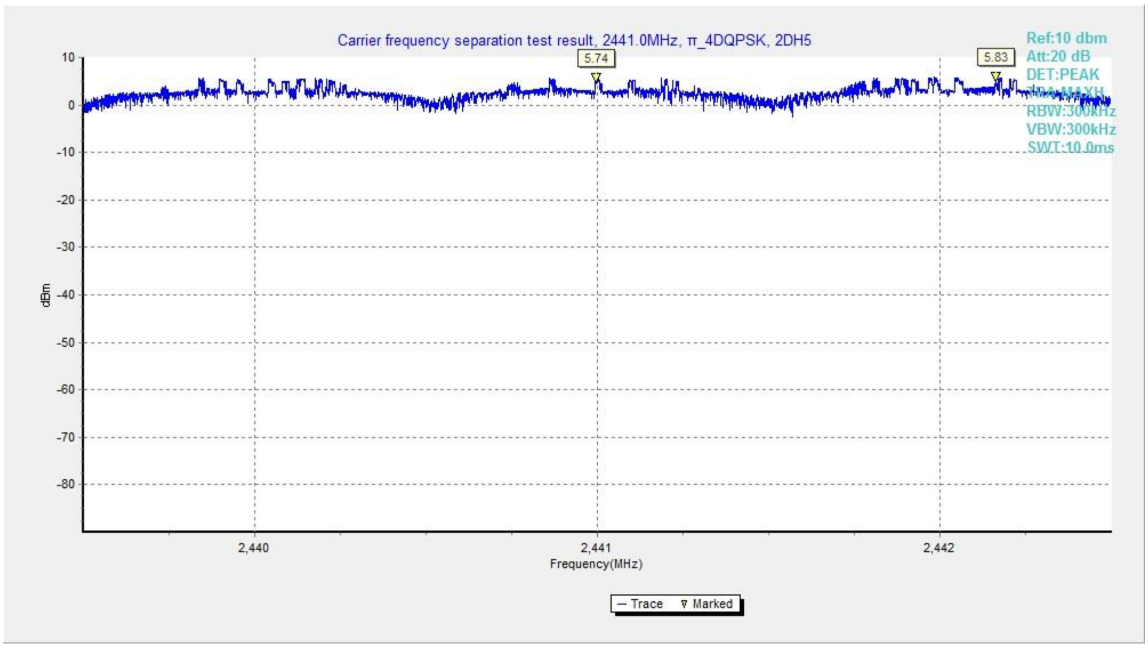


Fig.92. Carrier frequency separation measurement: π/4 DQPSK, Channel 39

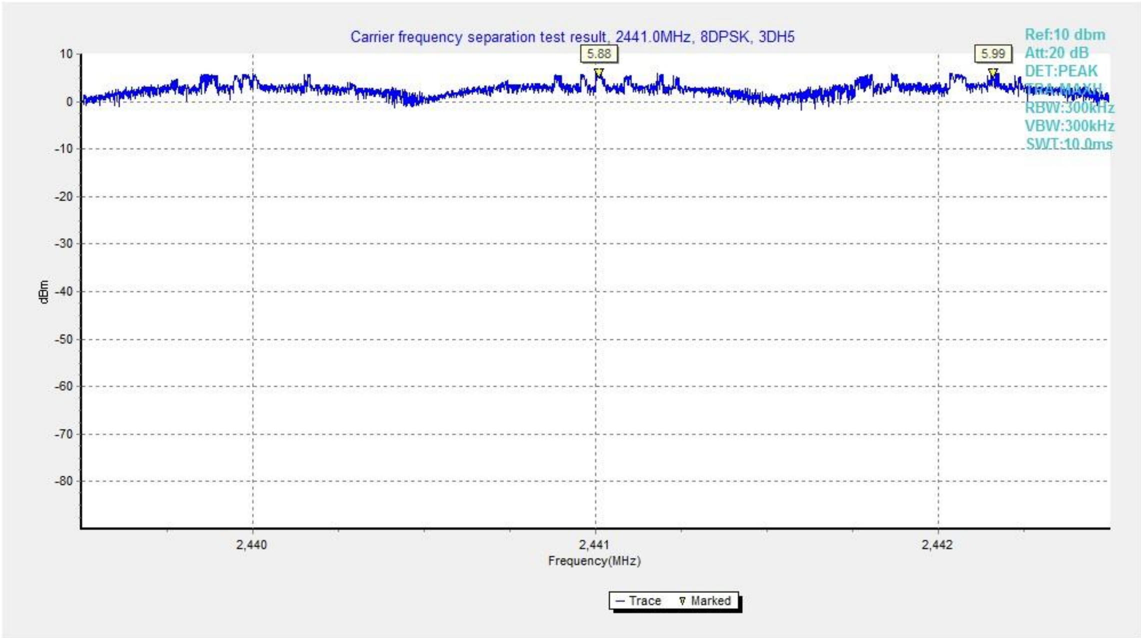


Fig.93. Carrier frequency separation measurement: 8DPSK, Channel 39

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:

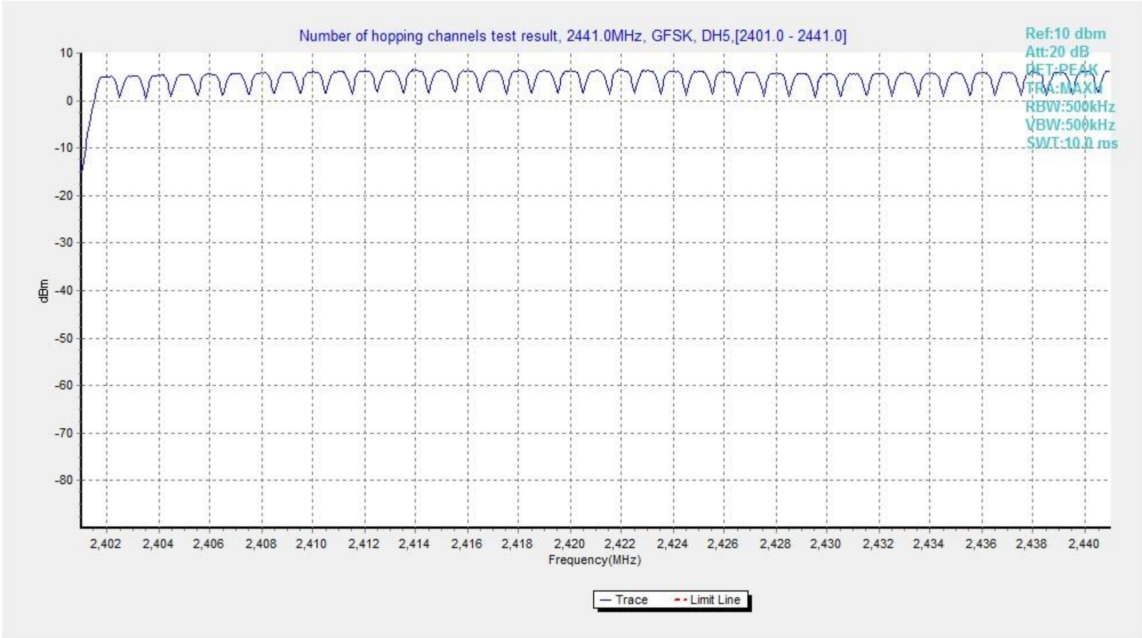


Fig.94. Number of hopping frequencies: GFSK, Channel 0 - 39

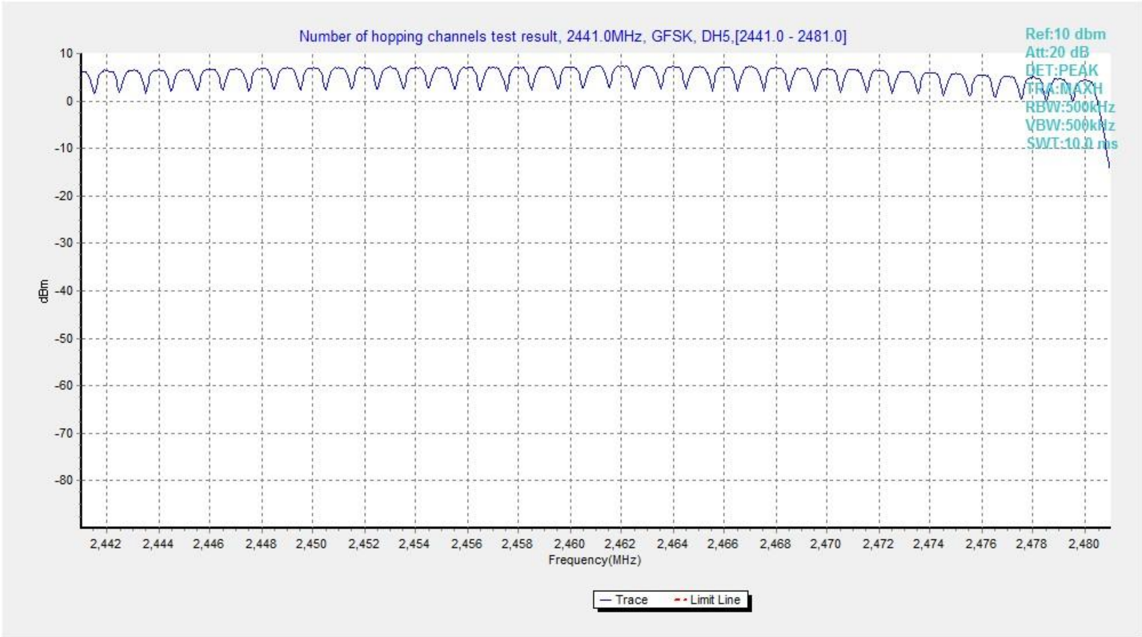


Fig.95. Number of hopping frequencies: GFSK, Channel 40 - 78

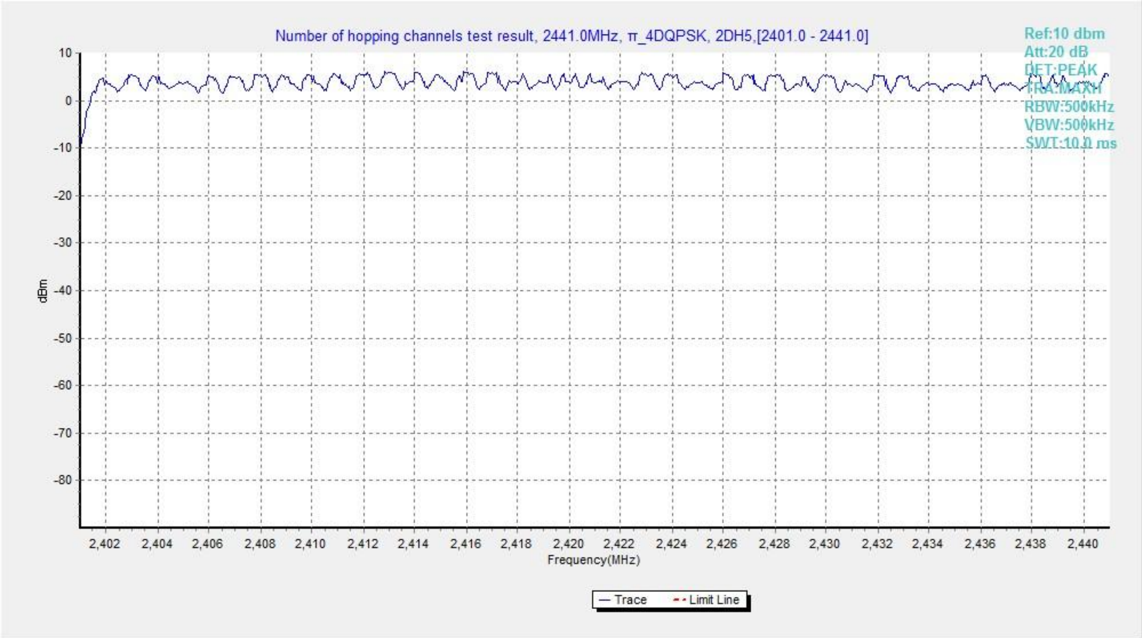


Fig.96. Number of hopping frequencies: π/4 DQPSK, Channel 0 - 39

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

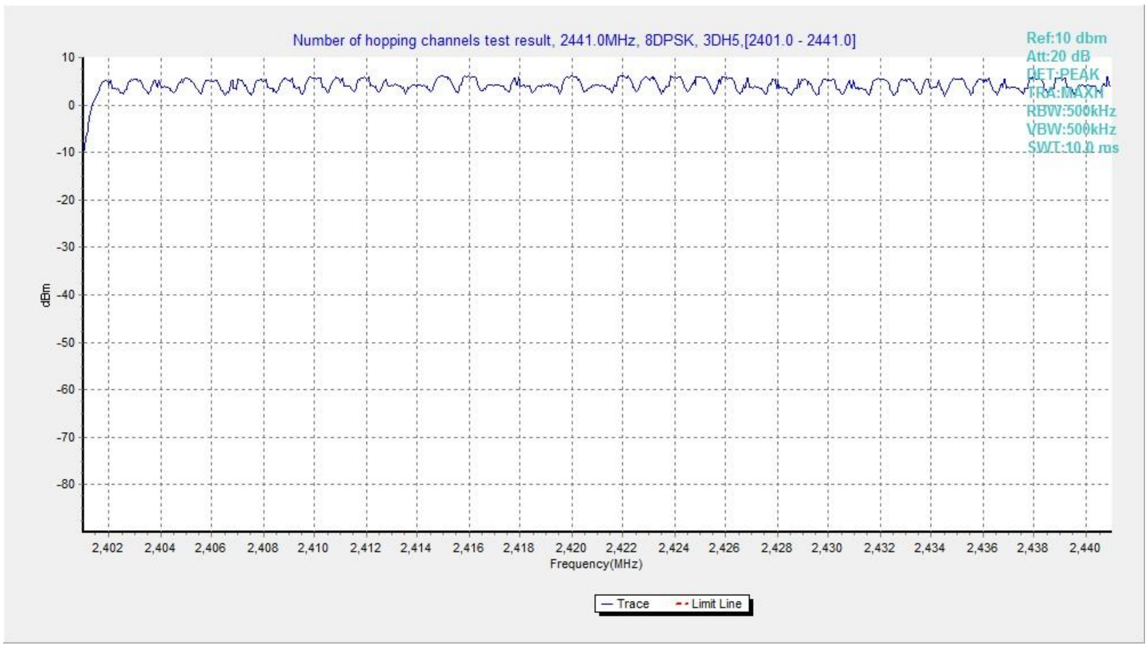


Fig.98. Number of hopping frequencies: 8DPSK, Channel 0 - 39

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

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)

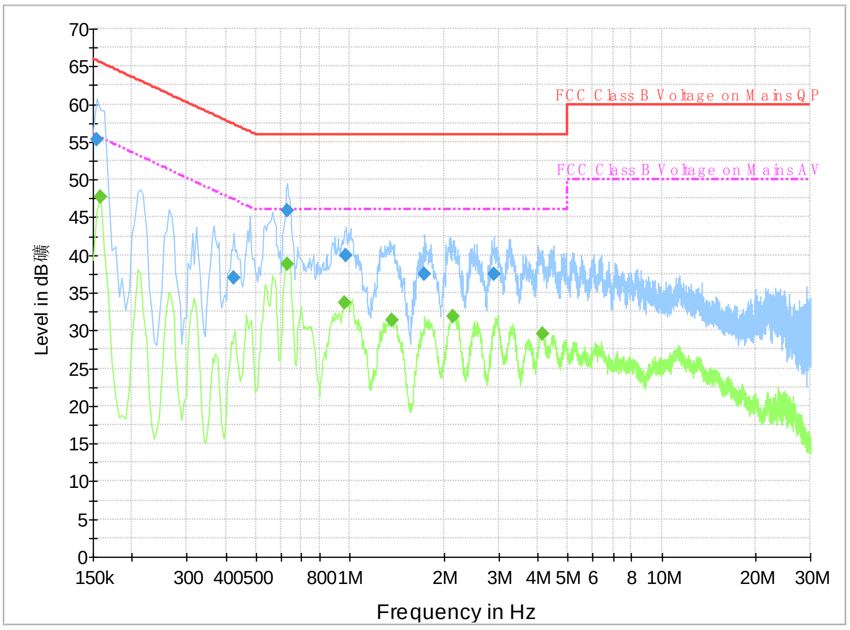
Frequency range (MHz)	Average Limit (dBμV)	Conclusion
0.15 to 0.5	56 to 46	P
0.5 to 5	46	
5 to 30	50	
NOTE: The limit decreases linearly with the logarithm of the frequency in the range 0.15 MHz to 0.5 MHz.		

The measurement is made according to ANSI C63.10

Conclusion: EUT1 PASS

Test graphs as below:

Traffic:



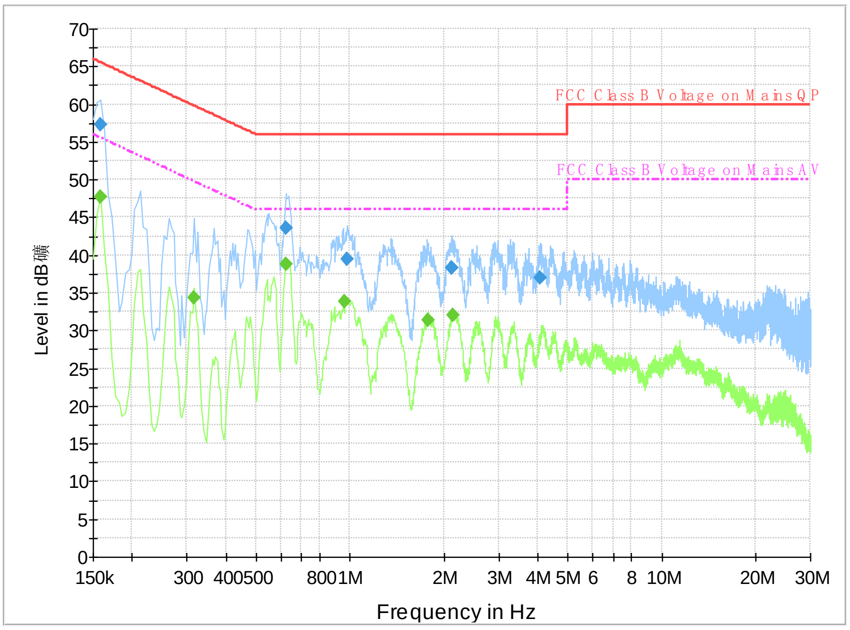
Final Result 1

Frequency (MHz)	QuasiPeak (dBµV)	Line	Corr. (dB)	Margin (dB)	Limit (dBµV)
0.154500	55.3	L1	29.7	10.5	65.8
0.424500	37.0	L1	19.8	20.3	57.4
0.631500	45.9	N	19.8	10.1	56.0
0.973500	39.9	N	19.7	16.1	56.0
1.738500	37.5	N	19.6	18.5	56.0
2.895000	37.5	N	19.6	18.5	56.0

Final Result 2

Frequency (MHz)	Average (dBµV)	Line	Corr. (dB)	Margin (dB)	Limit (dBµV)
0.159000	47.6	N	28.7	7.9	55.5
0.631500	38.8	N	19.8	7.2	46.0
0.964500	33.7	N	19.7	12.3	46.0
1.369500	31.4	N	19.6	14.6	46.0
2.143500	31.9	N	19.6	14.1	46.0
4.168500	29.6	N	19.6	16.4	46.0

Idle :



Final Result 1

Frequency (MHz)	QuasiPeak (dBµV)	Line	Corr. (dB)	Margin (dB)	Limit (dBµV)
0.159000	57.3	N	28.7	8.2	65.5
0.622500	43.6	N	19.8	12.4	56.0
0.982500	39.5	N	19.7	16.5	56.0
2.112000	38.3	N	19.6	17.7	56.0
2.130000	38.3	N	19.6	17.7	56.0
4.069500	36.9	N	19.6	19.1	56.0

Final Result 2

Frequency (MHz)	Average (dBµV)	Line	Corr. (dB)	Margin (dB)	Limit (dBµV)
0.159000	47.6	N	28.7	7.9	55.5
0.316500	34.4	N	19.8	15.4	49.8
0.622500	38.8	N	19.8	7.2	46.0
0.964500	33.8	N	19.7	12.2	46.0
1.783500	31.3	N	19.6	14.7	46.0
2.143500	31.9	N	19.6	14.1	46.0

ANNEX B: 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).

2019-09-26 through 2020-09-30
Effective Dates

DEPARTMENT OF COMMERCE · UNITED STATES OF AMERICA

For the National Voluntary Laboratory Accreditation Program

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