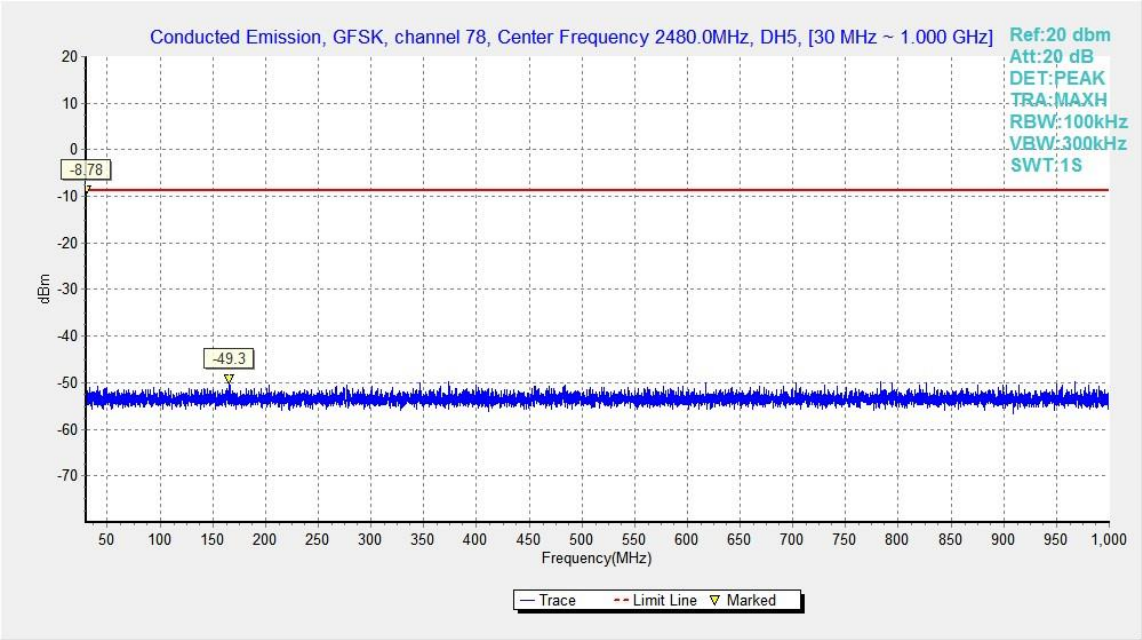

Fig.42. Conducted spurious emission: GFSK, Channel 78, 30MHz - 1GHz

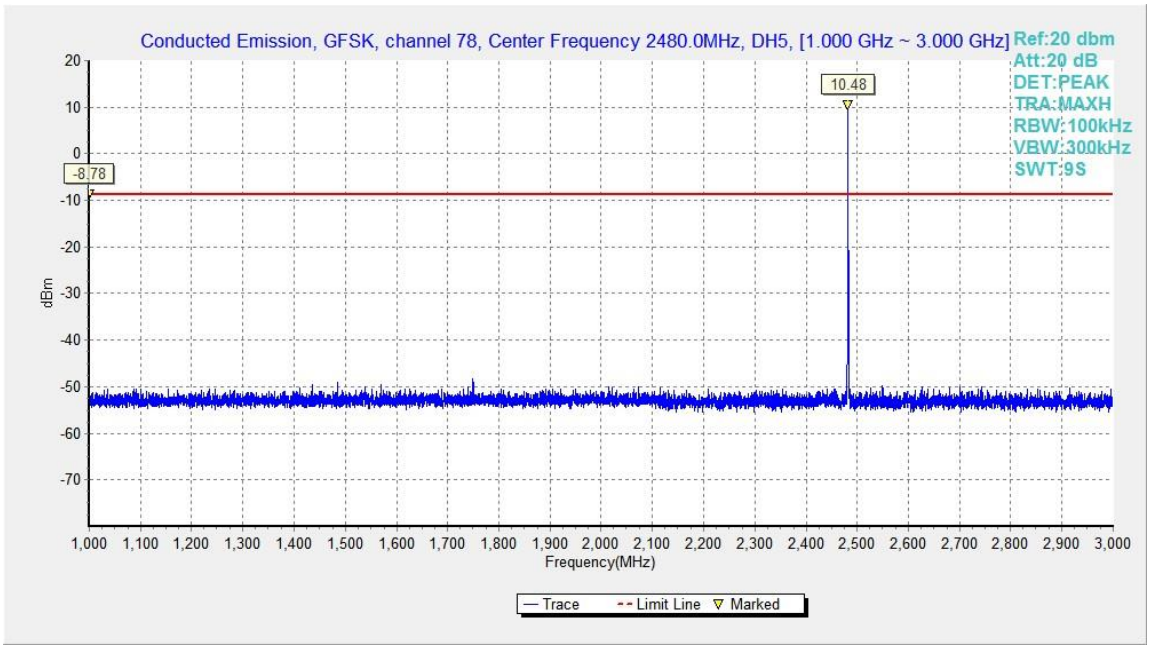

Fig.43. Conducted spurious emission: GFSK, Channel 78, 1GHz - 3GHz

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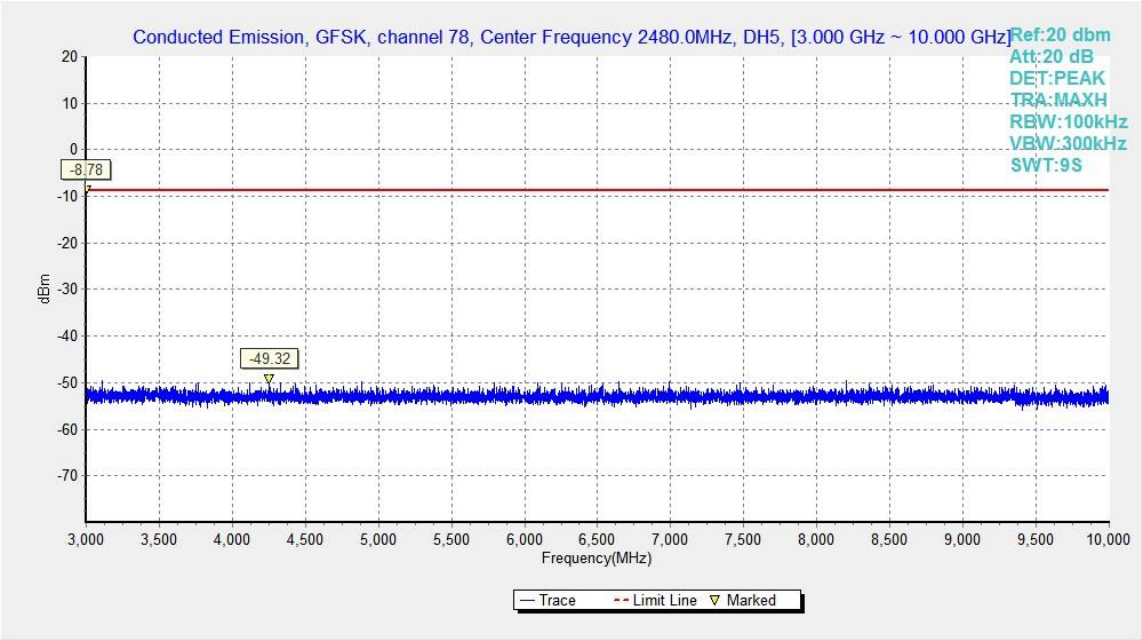

Fig.44. Conducted spurious emission: GFSK, Channel 78, 3GHz - 10GHz

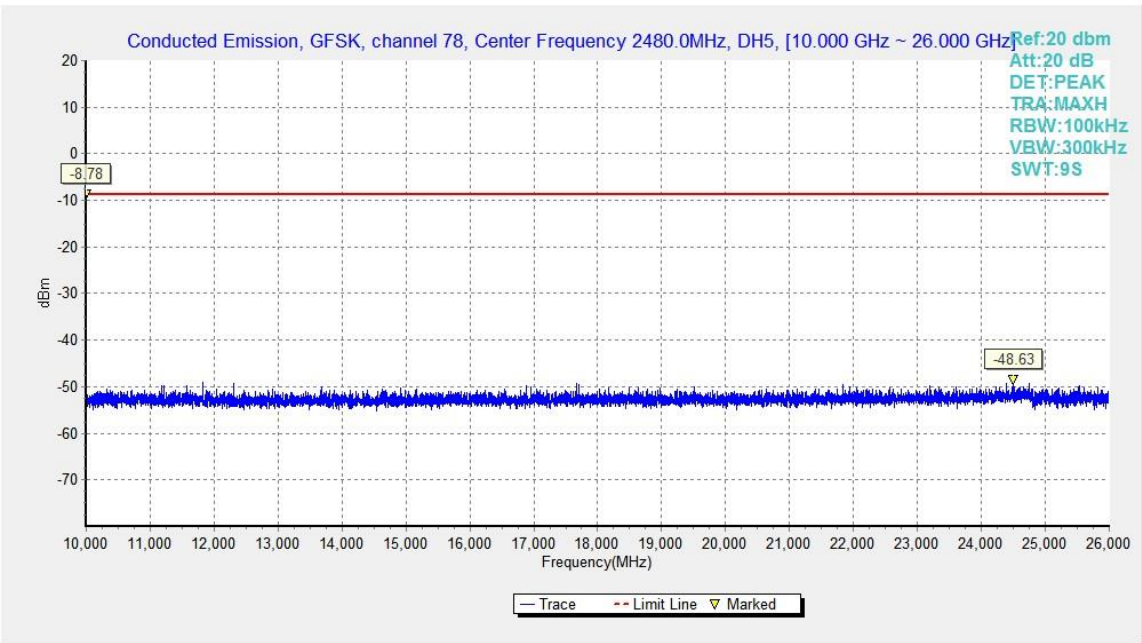

Fig.45. Conducted spurious emission: GFSK, Channel 78, 10GHz - 26GHz

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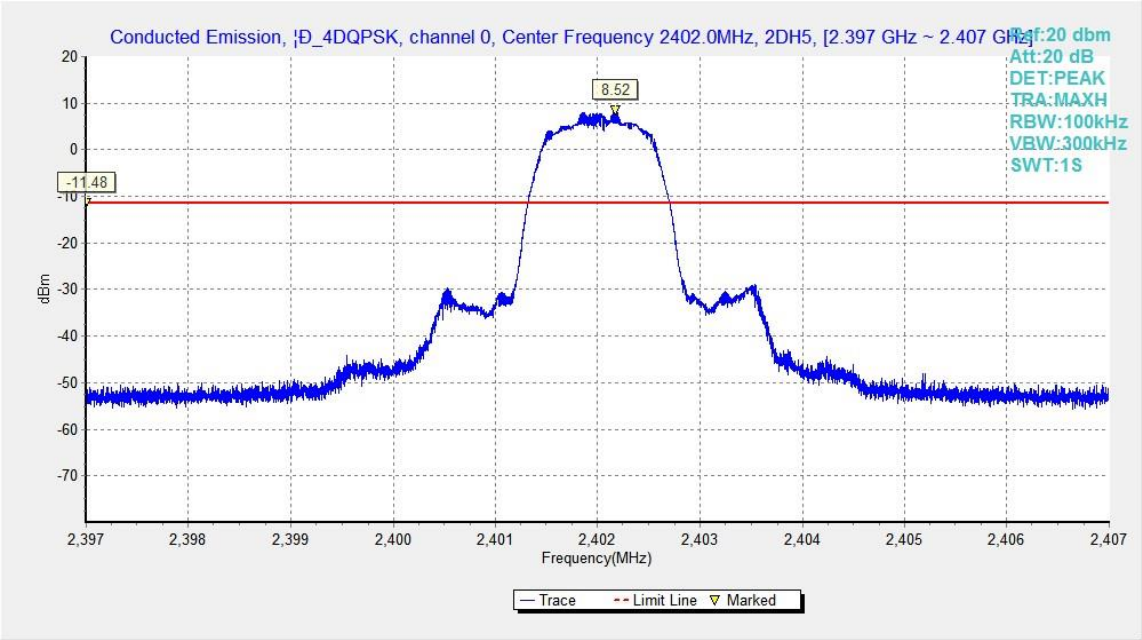

Fig.46. Conducted spurious emission: π/4 DQPSK, Channel 0,2402MHz

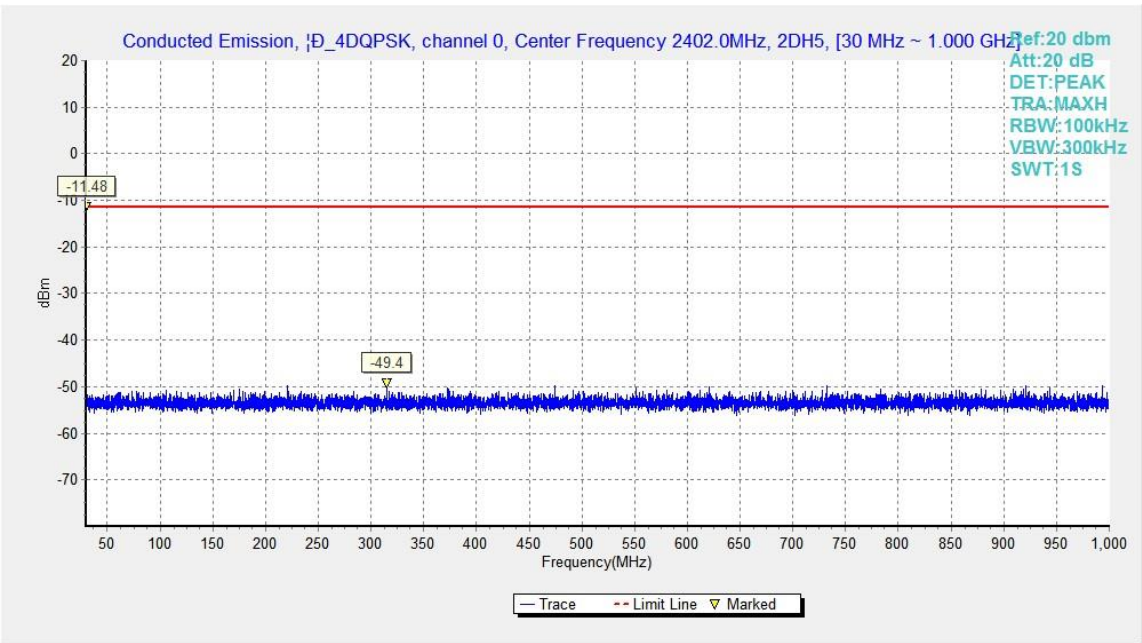

Fig.47. Conducted spurious emission: π/4 DQPSK, Channel 0, 30MHz - 1GHz

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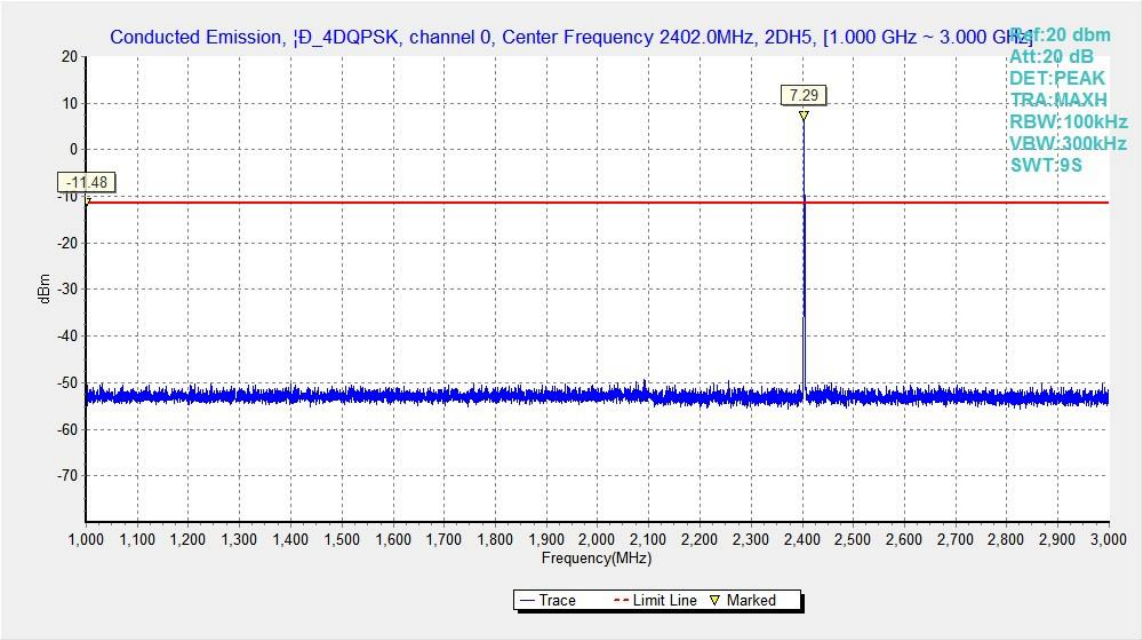

Fig.48. Conducted spurious emission: π/4 DQPSK, Channel 0, 1GHz - 3GHz

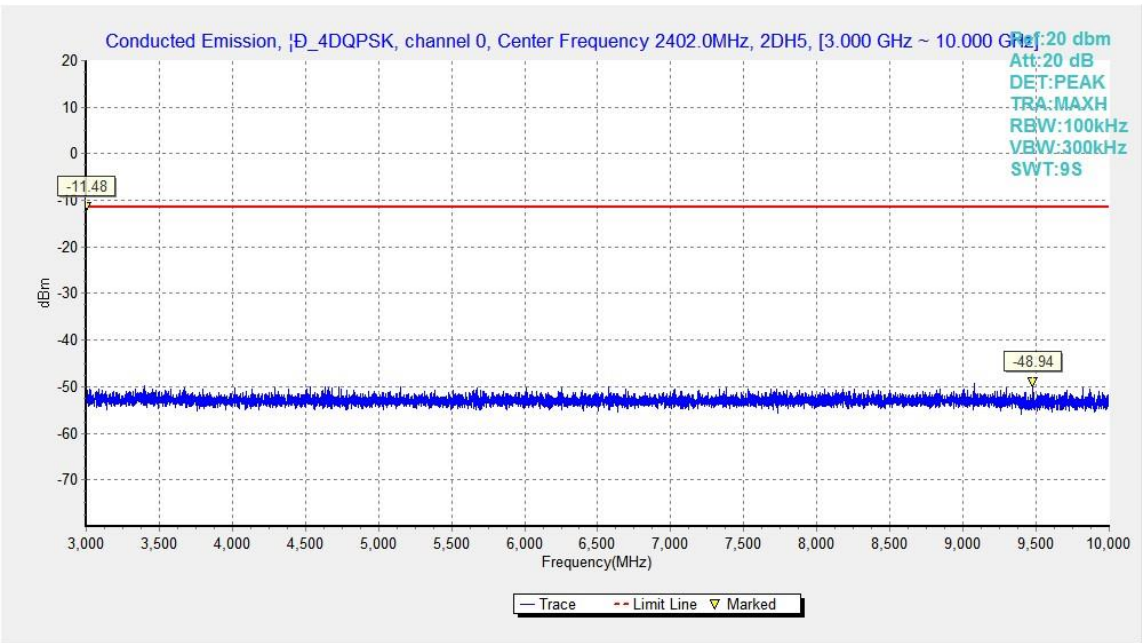

Fig.49. Conducted spurious emission: π/4 DQPSK, Channel 0, 3GHz - 10GHz

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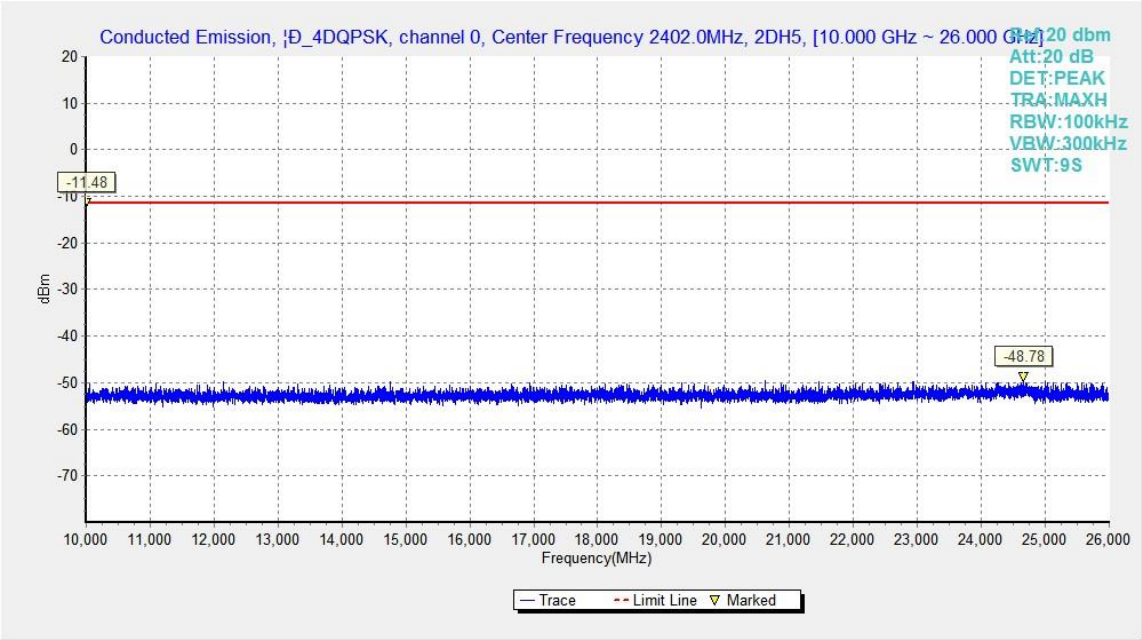

Fig.50. Conducted spurious emission: π/4 DQPSK, Channel 0,10GHz - 26GHz

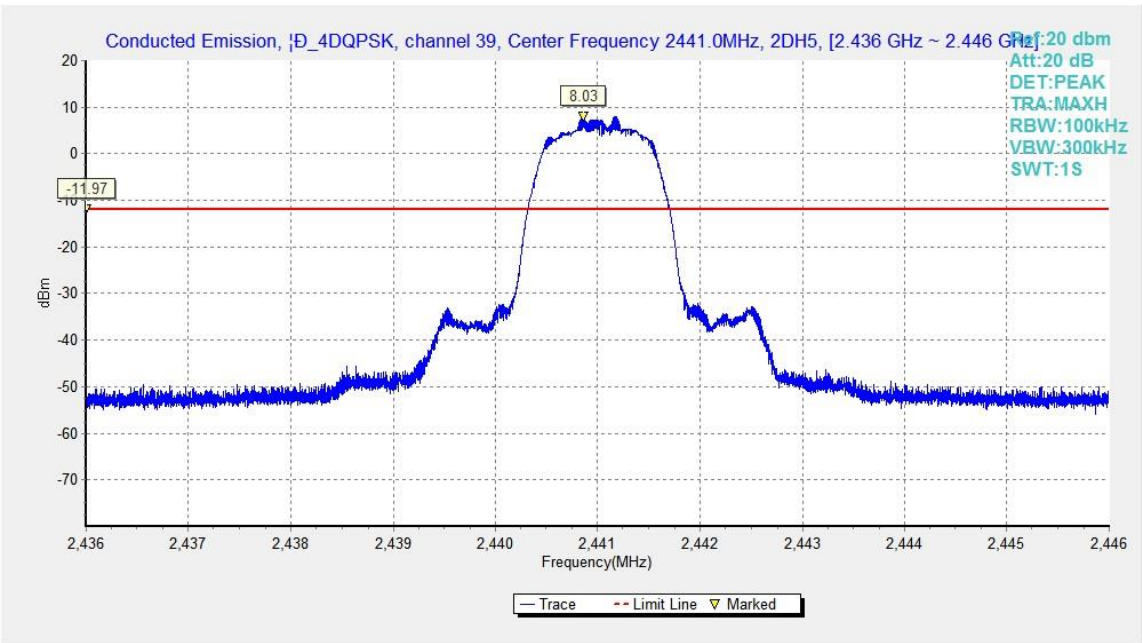

Fig.51. Conducted spurious emission: π/4 DQPSK, Channel 39, 2441MHz

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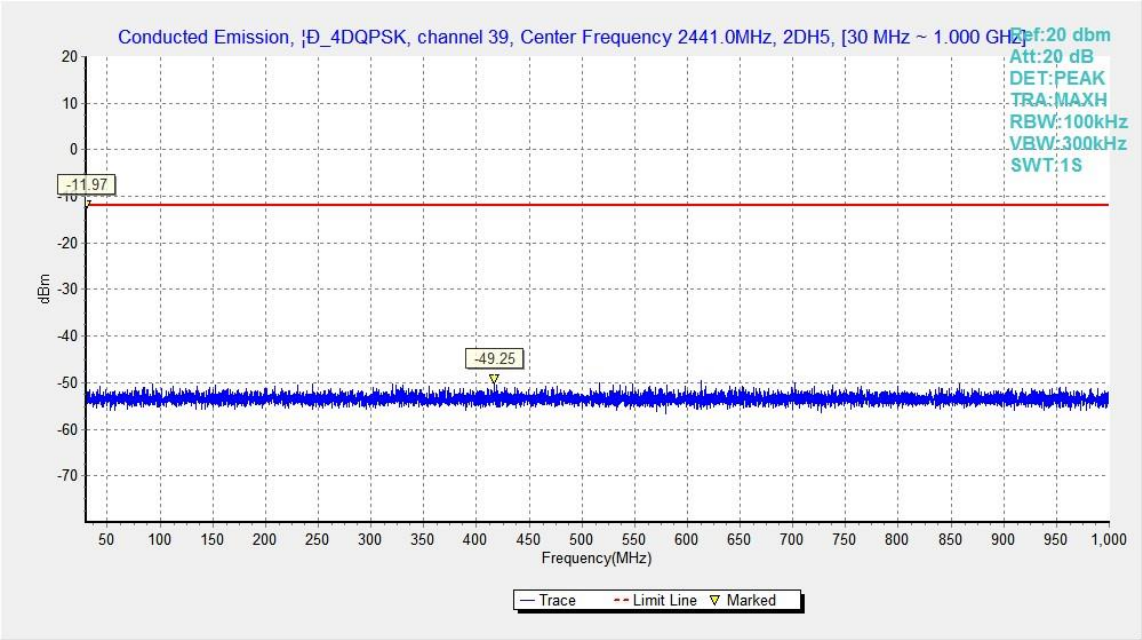

Fig.52. Conducted spurious emission: π/4 DQPSK, Channel 39, 30MHz - 1GHz

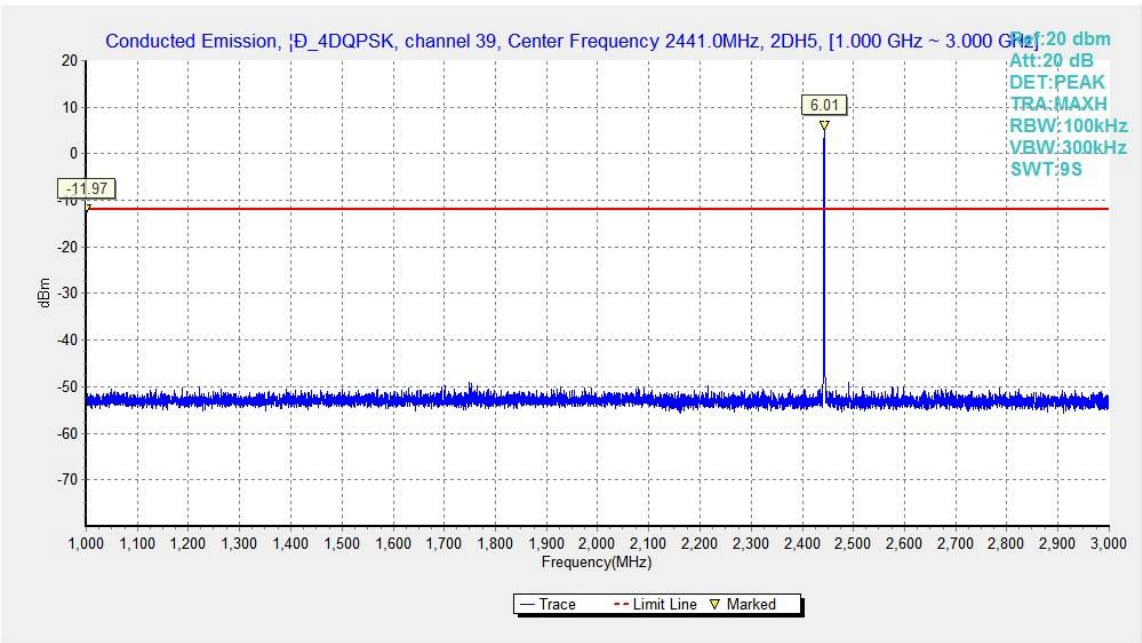

Fig.53. Conducted spurious emission: π/4 DQPSK, Channel 39, 1GHz - 3GHz

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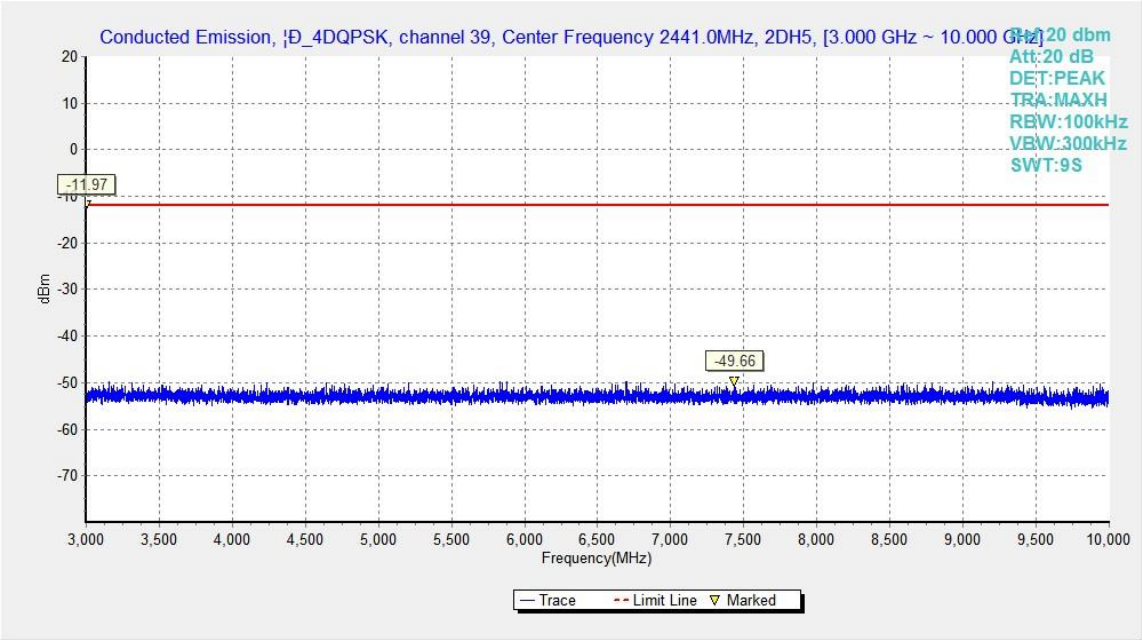

Fig.54. Conducted spurious emission: π/4 DQPSK, Channel 39, 3GHz - 10GHz

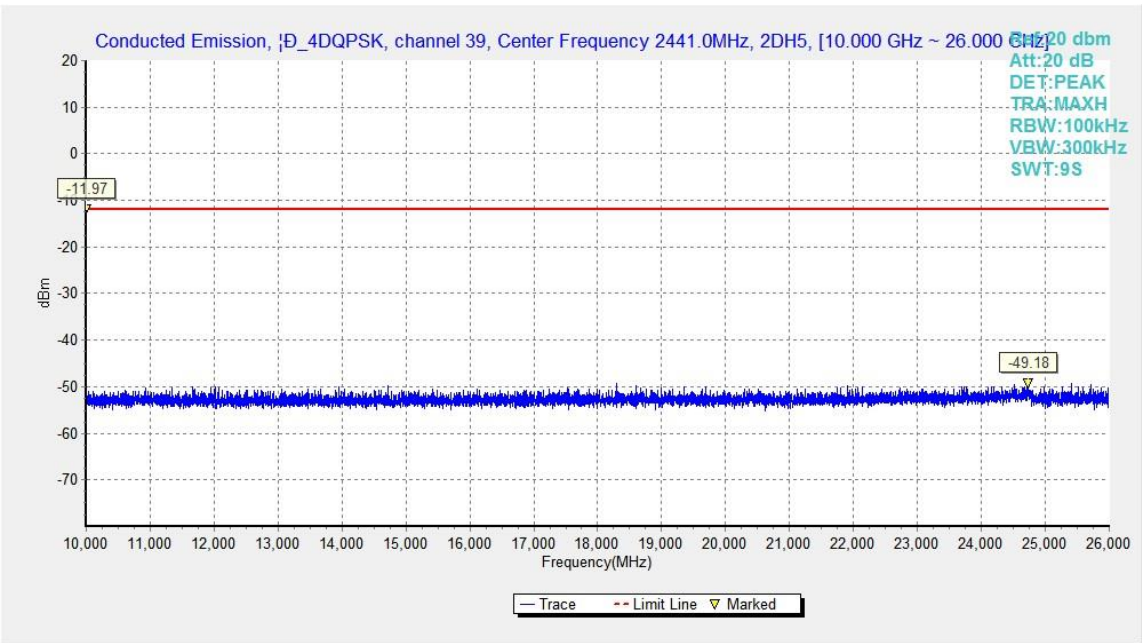

Fig.55. Conducted spurious emission: π/4 DQPSK, Channel 39, 10GHz – 26GHz

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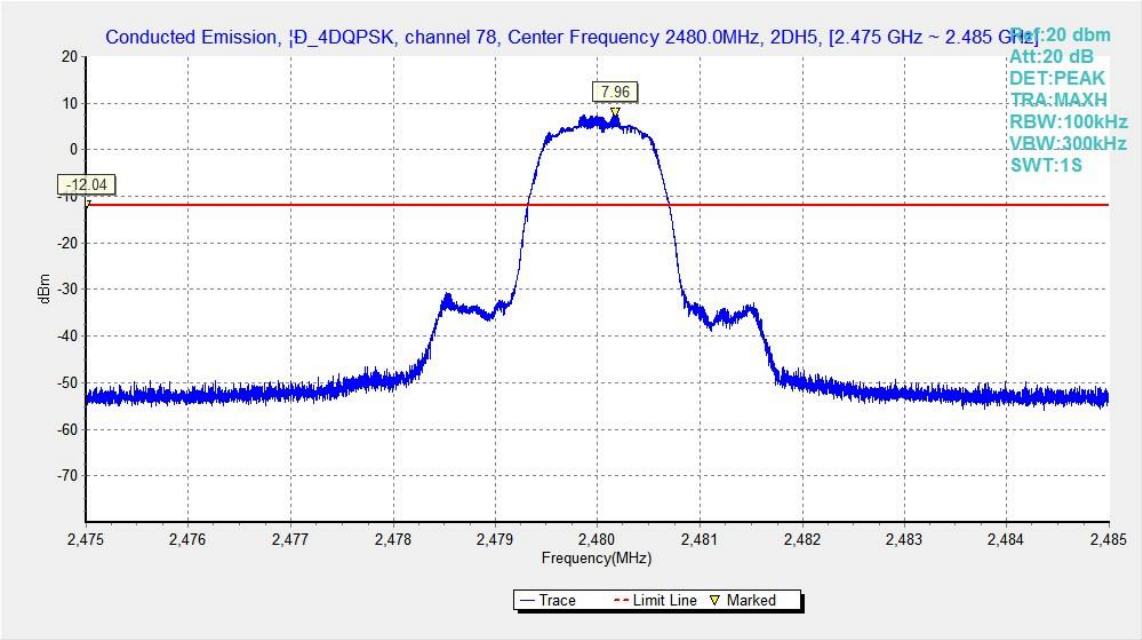

Fig.56. Conducted spurious emission: π/4 DQPSK, Channel 78, 2480MHz

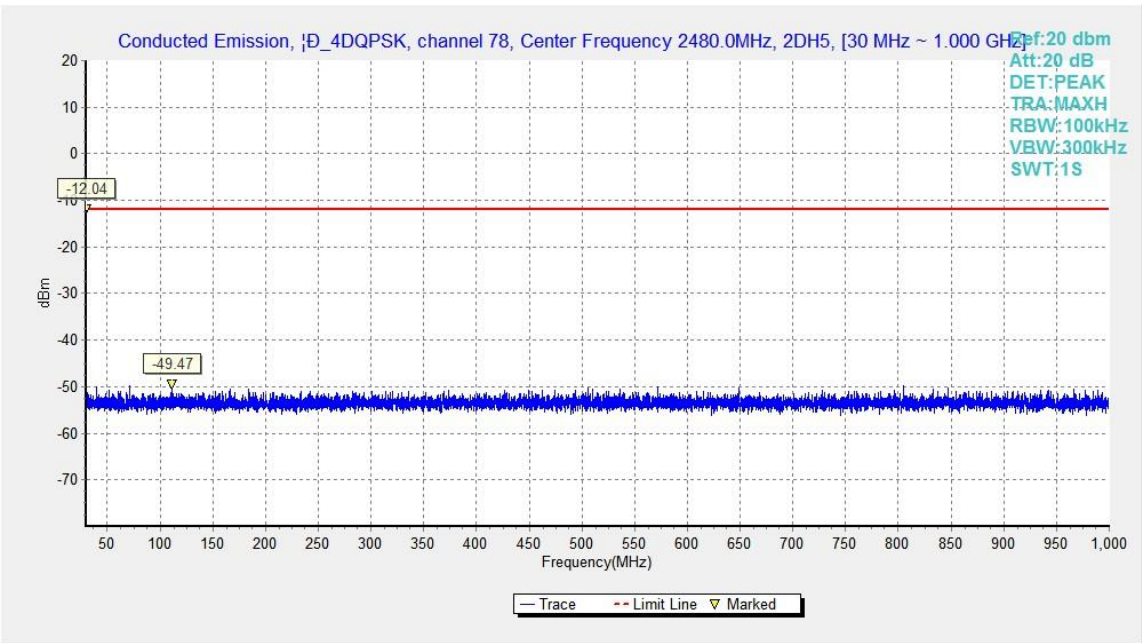

Fig.57. Conducted spurious emission: π/4 DQPSK, Channel 78, 30MHz - 1GHz

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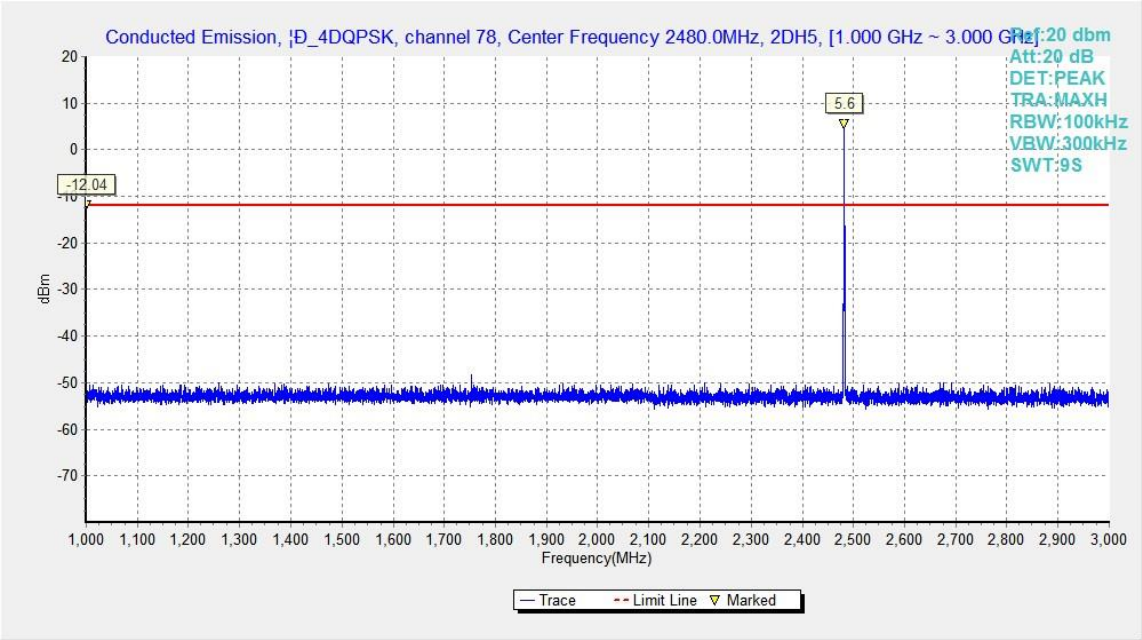

Fig.58. Conducted spurious emission: π/4 DQPSK, Channel 78, 1GHz - 3GHz

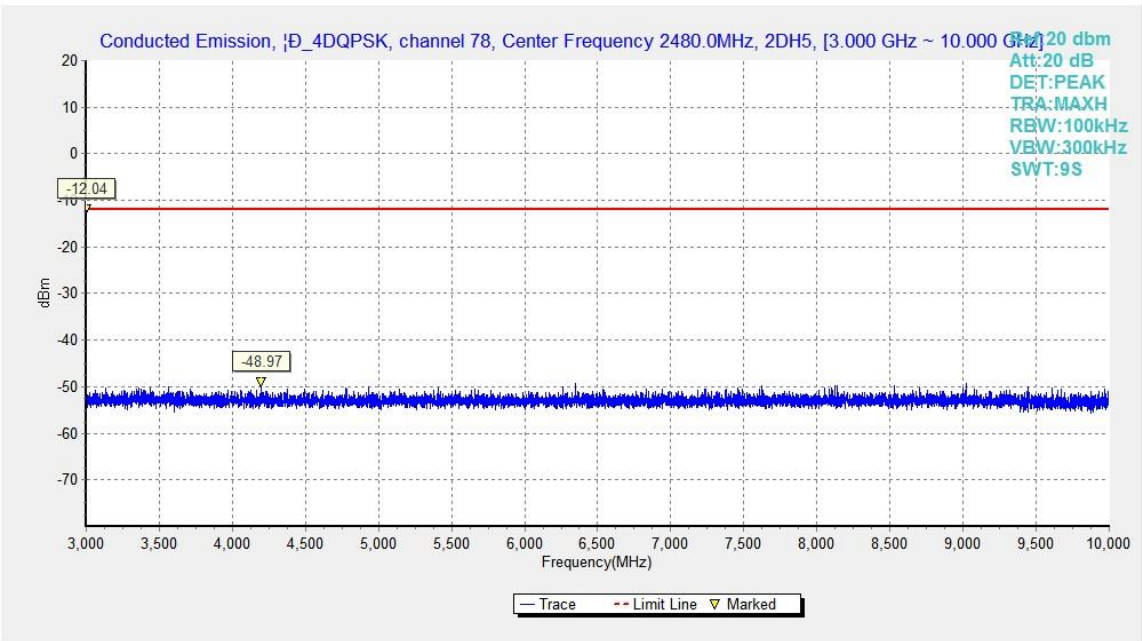

Fig.59. Conducted spurious emission: π/4 DQPSK, Channel 78, 3GHz - 10GHz

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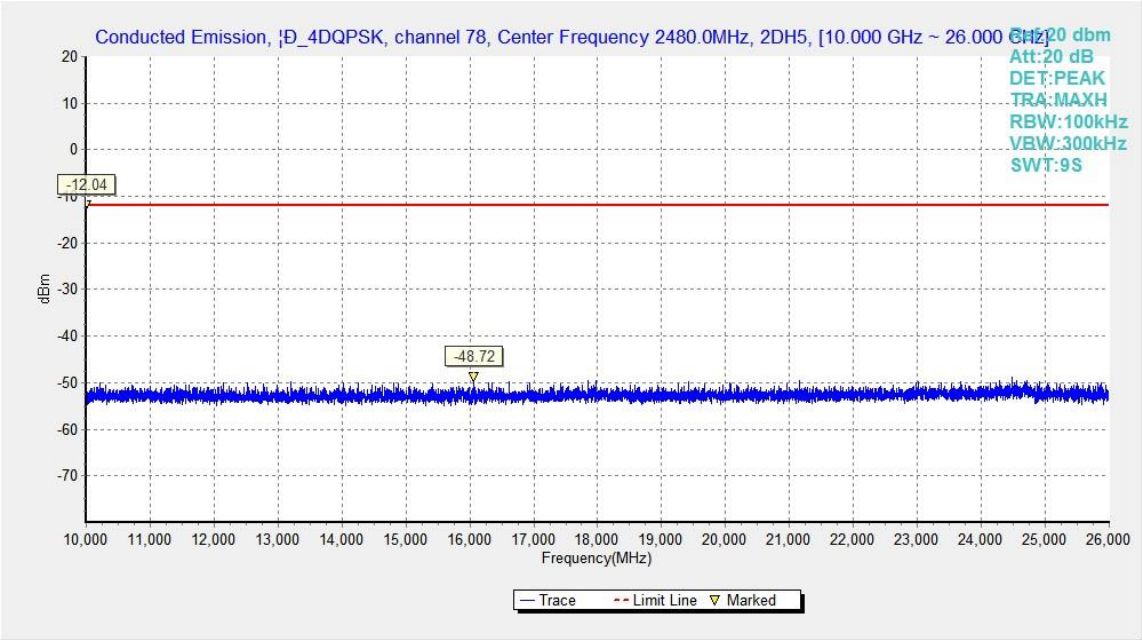

Fig.60. Conducted spurious emission: π/4 DQPSK, Channel 78, 10GHz - 26GHz

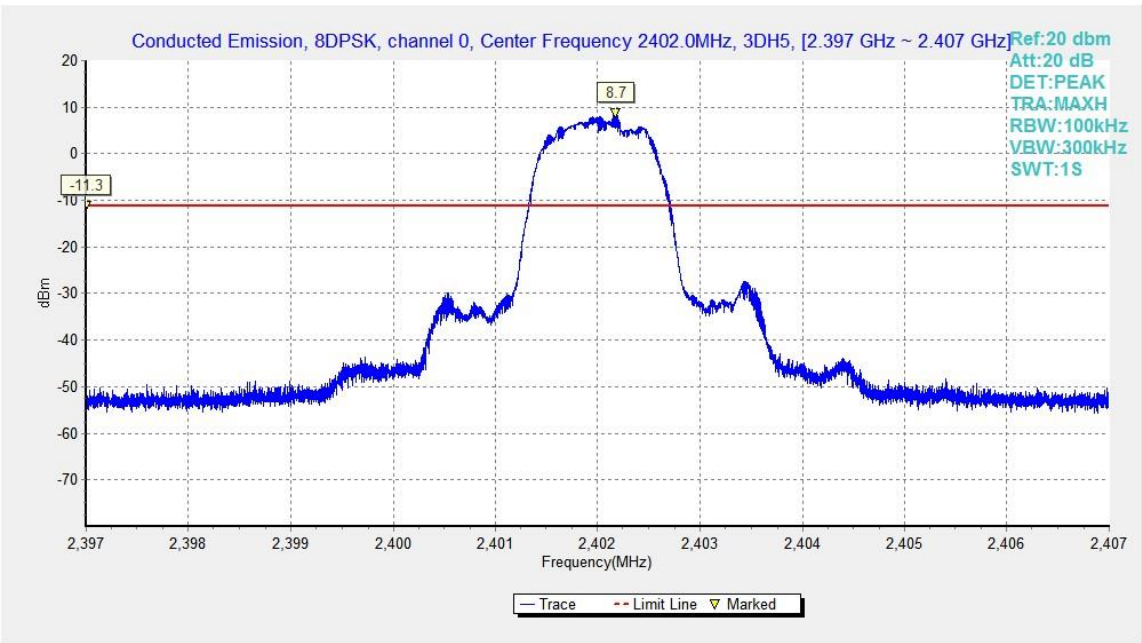

Fig.61. Conducted spurious emission: 8DPSK, Channel 0,2402MHz

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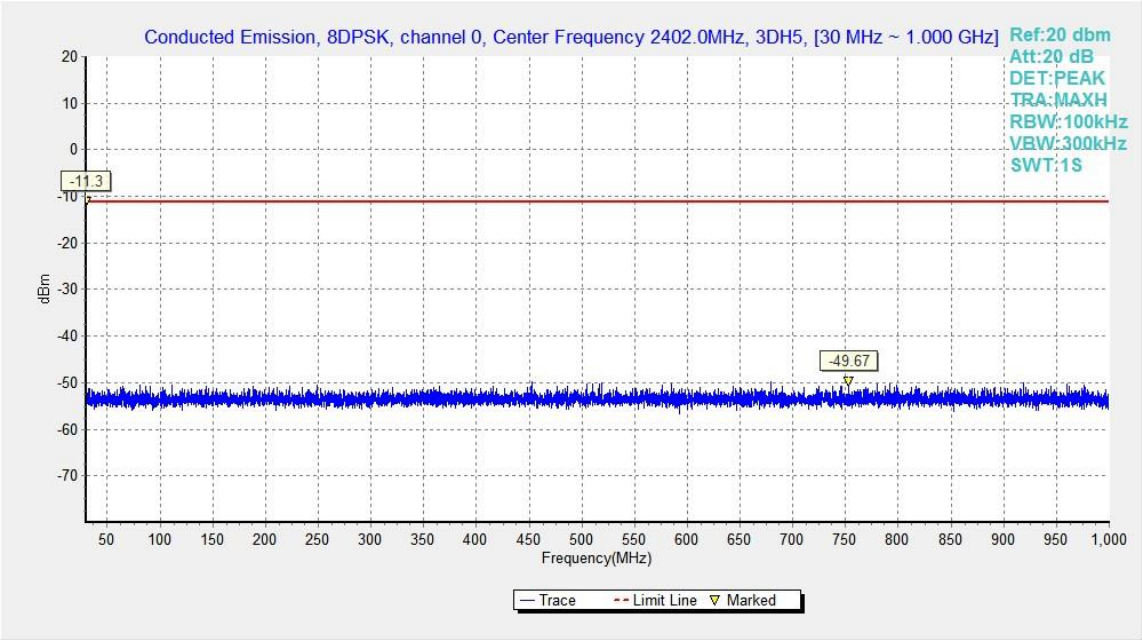

Fig.62. Conducted spurious emission: 8DPSK, Channel 0, 30MHz - 1GHz

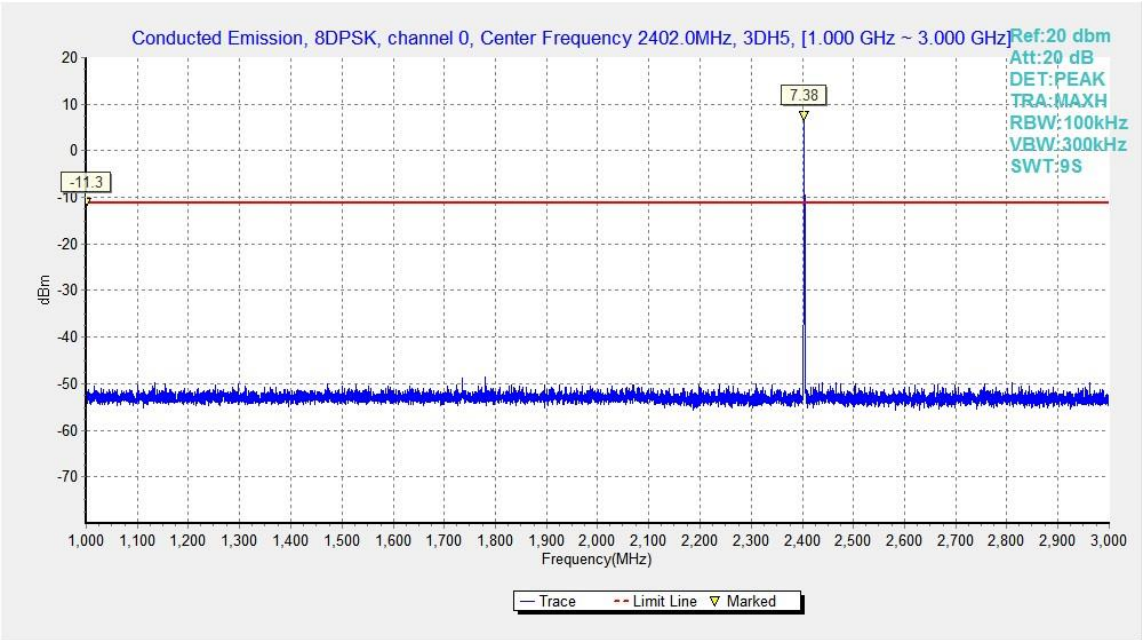

Fig.63. Conducted spurious emission: 8DPSK, Channel 0, 1GHz - 3GHz

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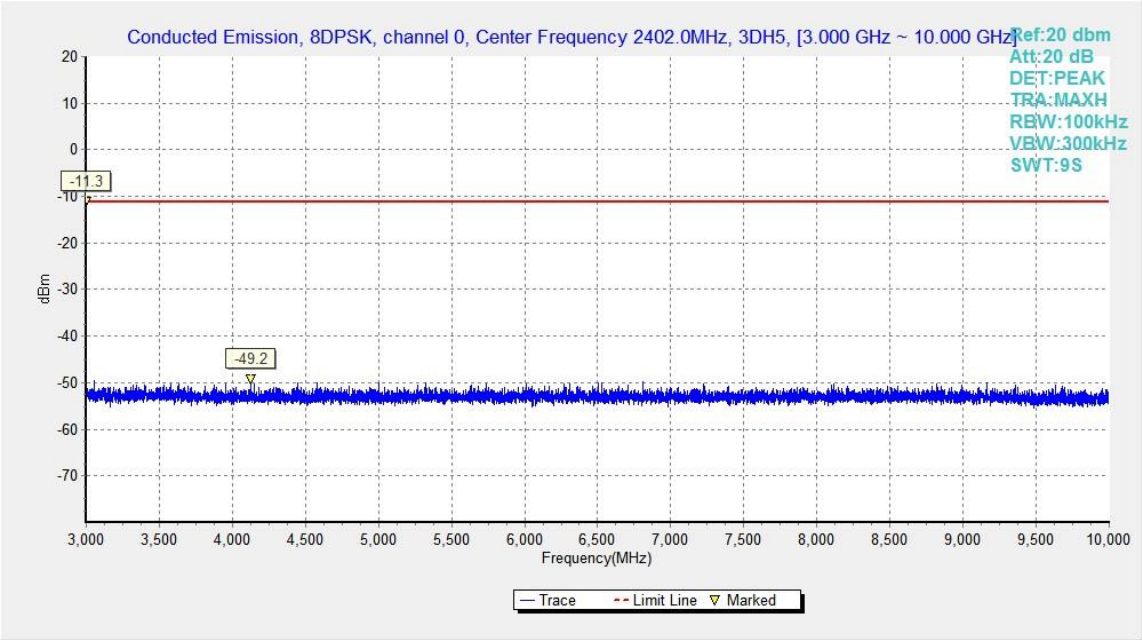

Fig.64. Conducted spurious emission: 8DPSK, Channel 0, 3GHz - 10GHz

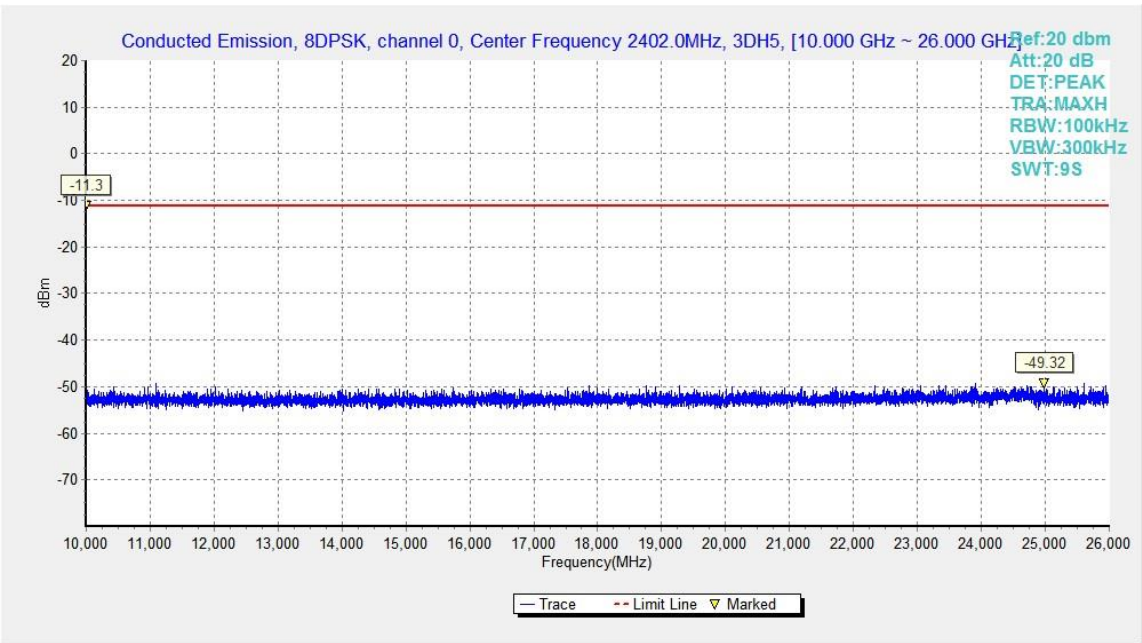

Fig.65. Conducted spurious emission: 8DPSK, Channel 0,10GHz - 26GHz

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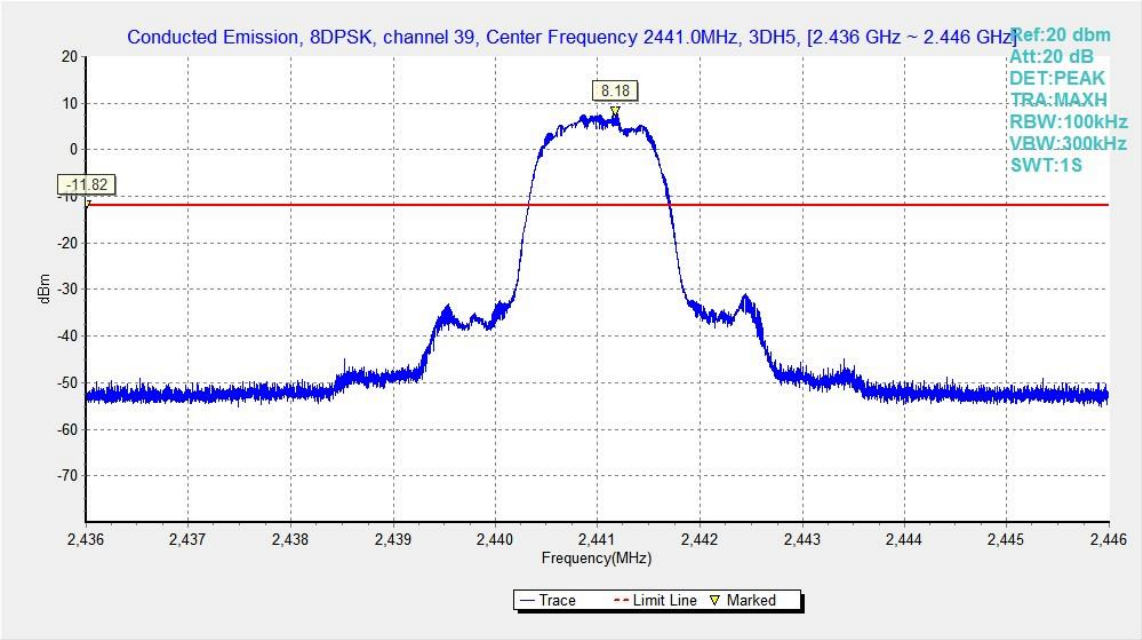

Fig.66. Conducted spurious emission: 8DPSK, Channel 39, 2441MHz

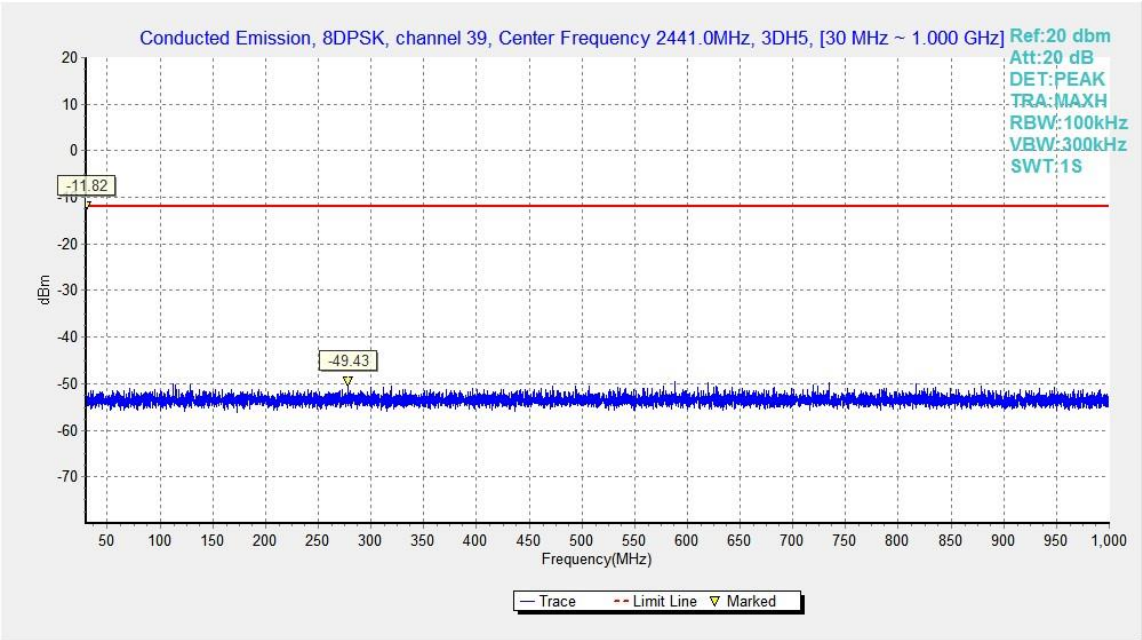

Fig.67. Conducted spurious emission: 8DPSK, Channel 39, 30MHz - 1GHz

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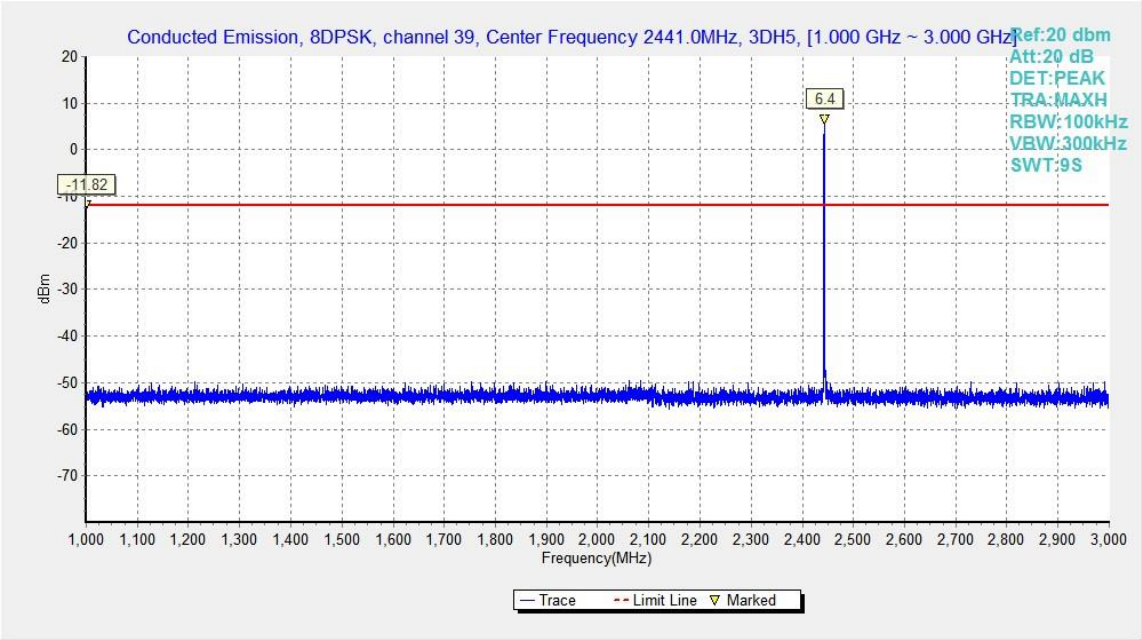

Fig.68. Conducted spurious emission: 8DPSK, Channel 39, 1GHz - 3GHz

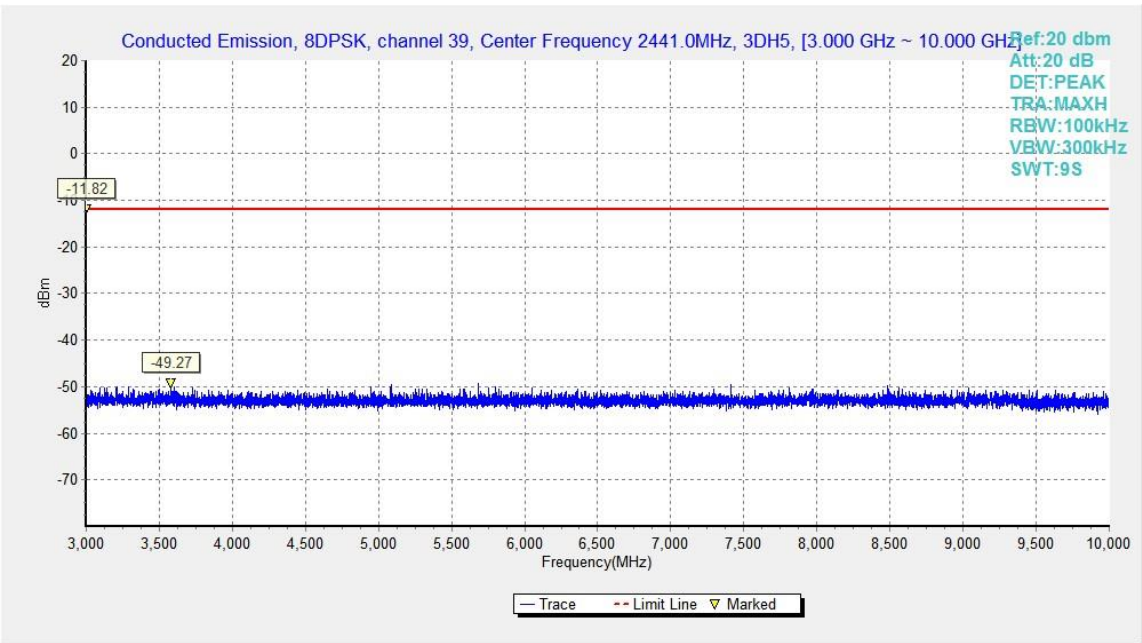

Fig.69. Conducted spurious emission: 8DPSK, Channel 39, 3GHz - 10GHz

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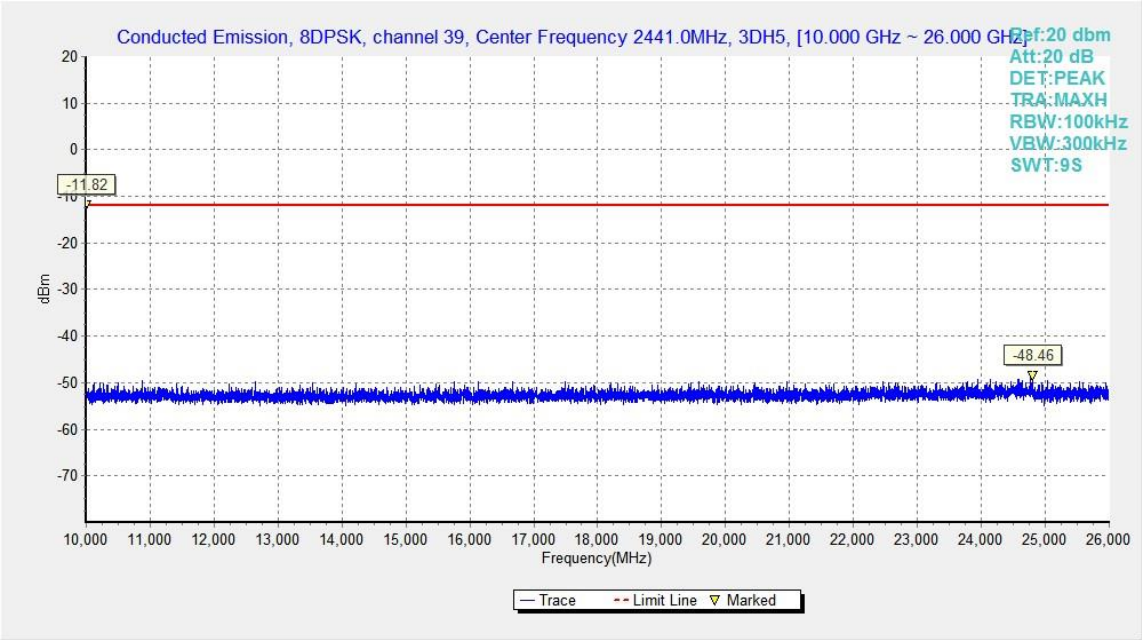

Fig.70. Conducted spurious emission: 8DPSK, Channel 39, 10GHz – 26GHz

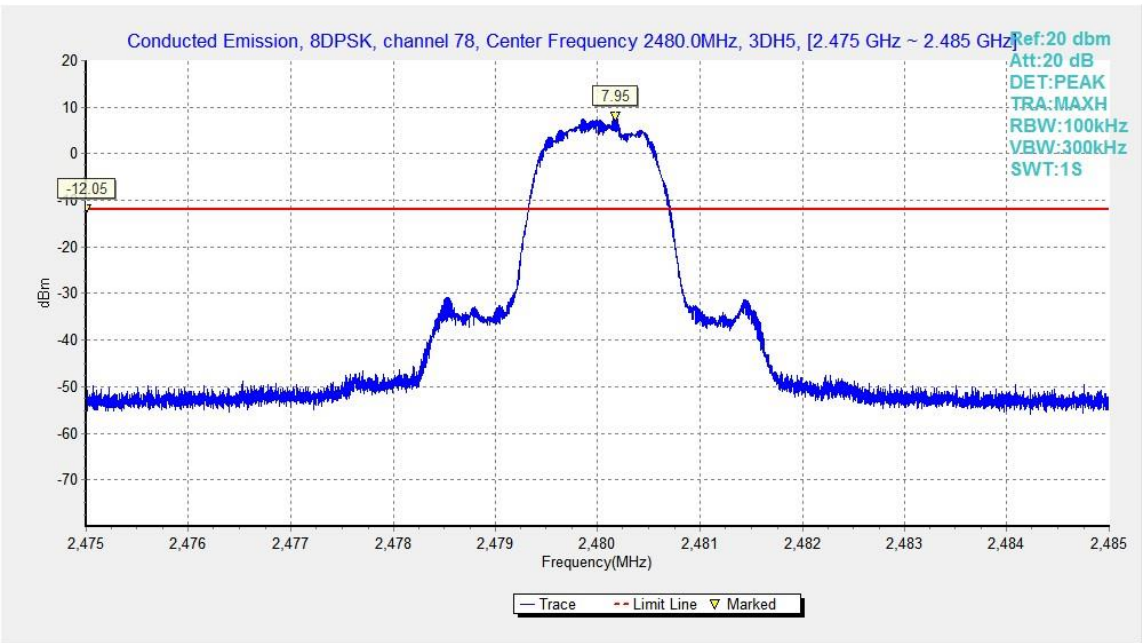

Fig.71. Conducted spurious emission: 8DPSK, Channel 78, 2480MHz

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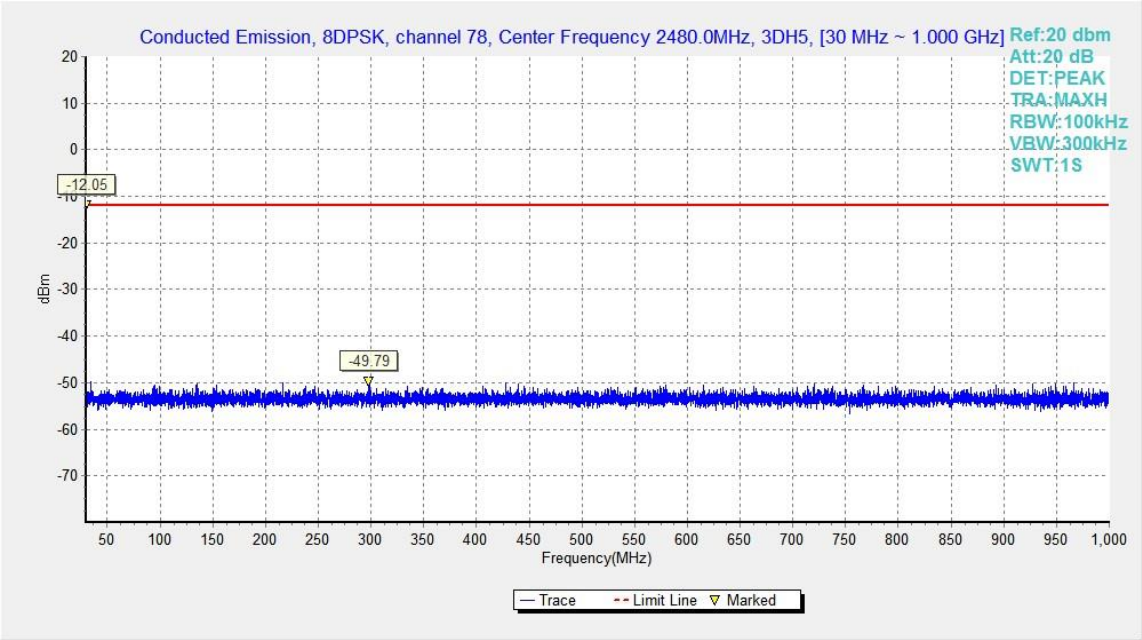

Fig.72. Conducted spurious emission: 8DPSK, Channel 78, 30MHz - 1GHz

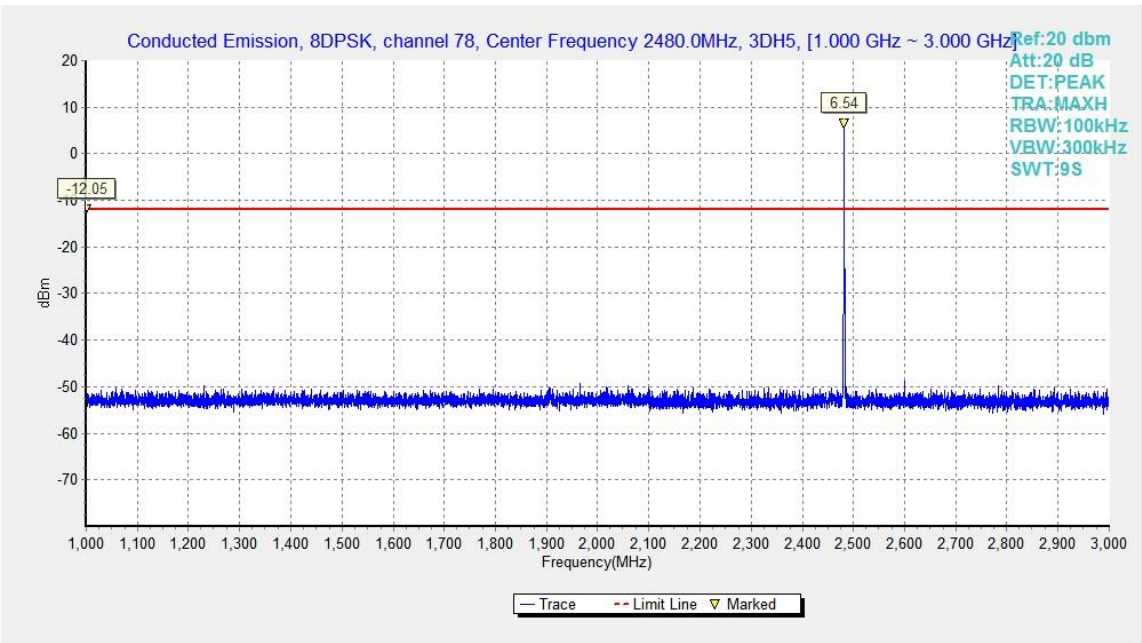

Fig.73. Conducted spurious emission: 8DPSK, Channel 78, 1GHz - 3GHz

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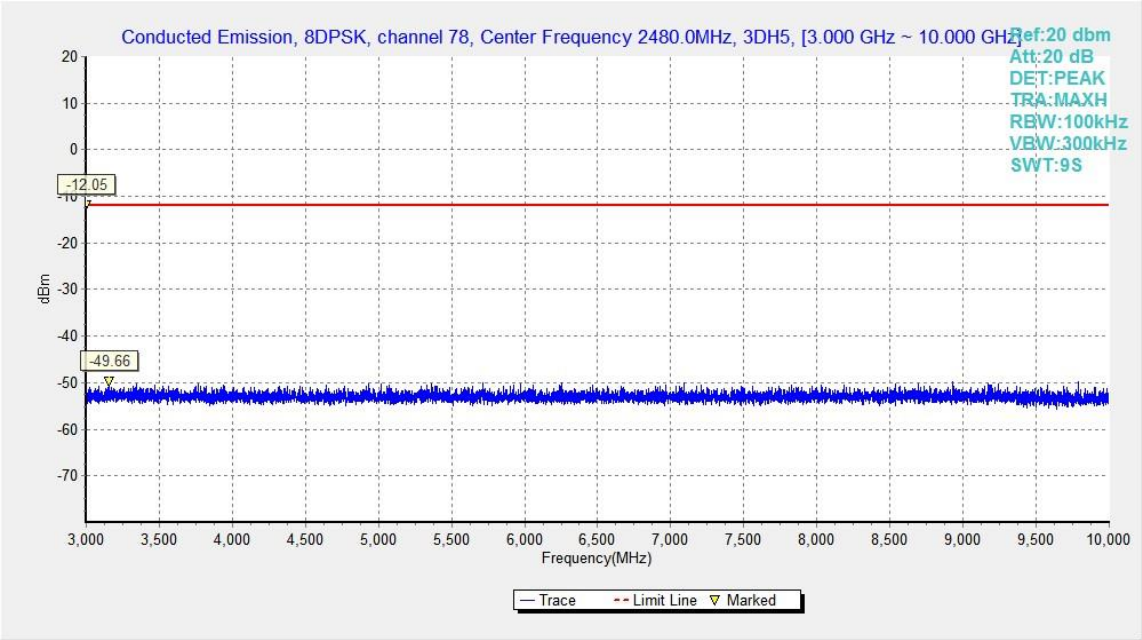

Fig.74. Conducted spurious emission: 8DPSK, Channel 78, 3GHz - 10GHz

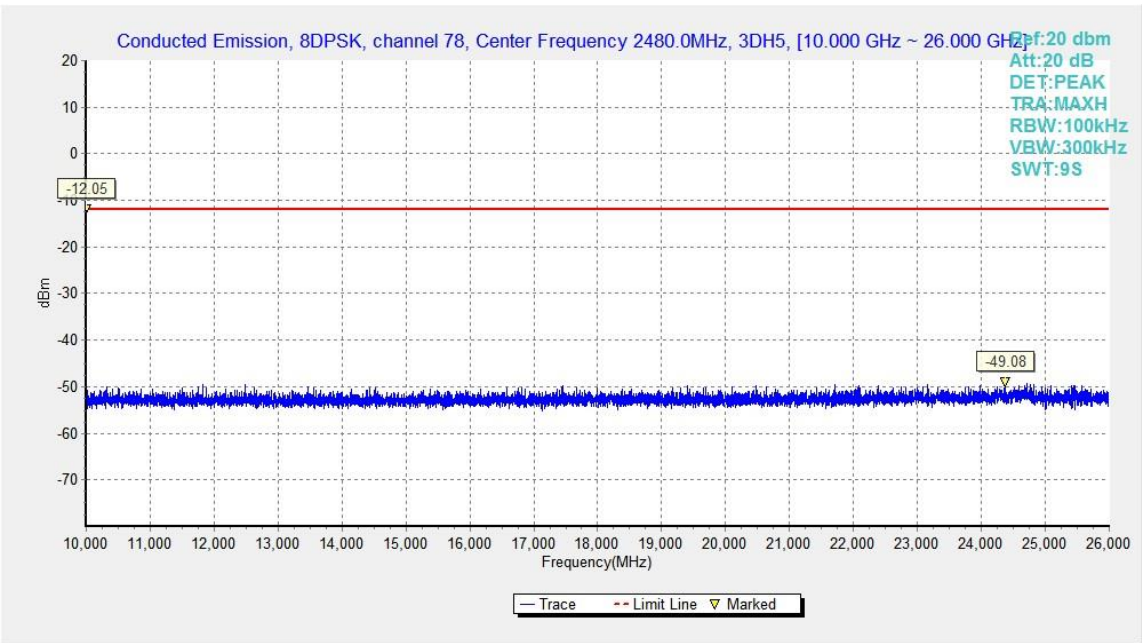

Fig.75. Conducted spurious emission: 8DPSK, Channel 78, 10GHz - 26GHz

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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

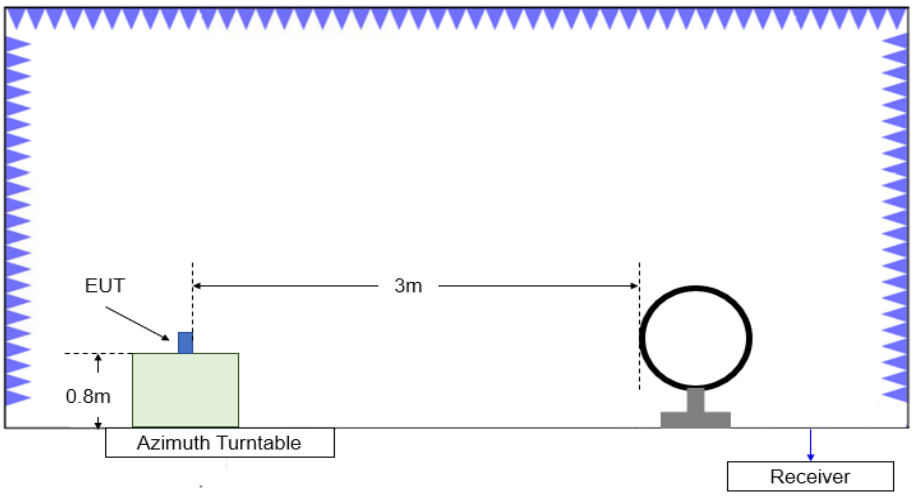

Figure B.5.1. Test Site Diagram (9kHz-30MHz)

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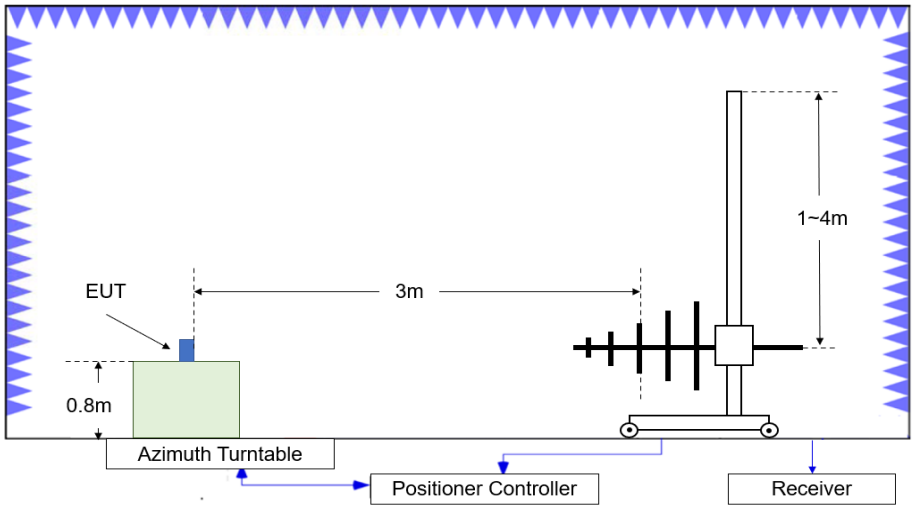

Figure B.5.2. Test Site Diagram (30MHz-1GHz)

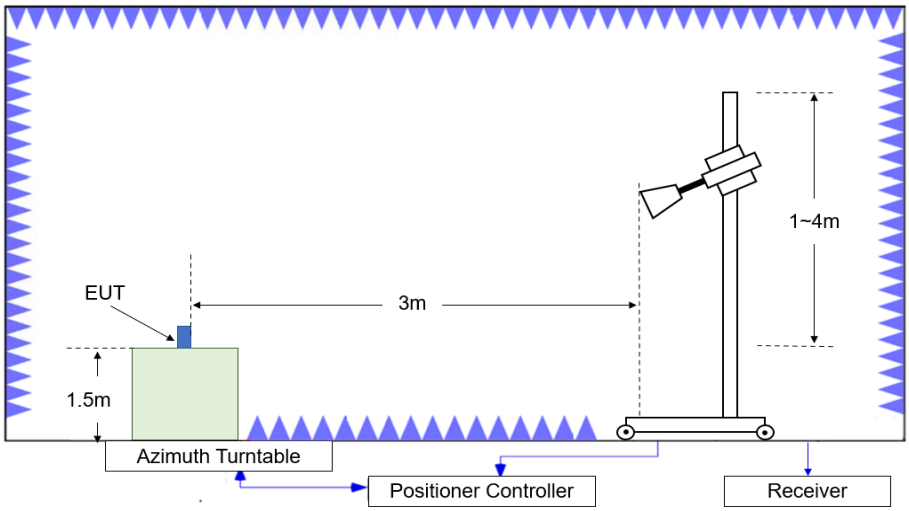

Figure B.5.3. Test Site Diagram (1GHz-40GHz)

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:

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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: EUT1/EUT2

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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)
17972.500	54.38	-29.40	46.00	37.78	74.00	19.62	V
14587.000	48.50	-29.00	41.90	35.60	74.00	25.50	V
11802.000	44.75	-32.00	39.20	37.55	74.00	29.25	V
9298.000	42.21	-34.50	37.60	39.11	74.00	31.79	V
7234.500	40.15	-35.60	36.40	39.35	74.00	33.85	V
2372.600	55.33	-19.60	28.20	46.73	74.00	18.67	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)
17976.000	55.30	-29.40	46.00	38.70	74.00	18.70	H
14435.000	48.83	-30.10	41.90	37.03	74.00	25.17	H
12539.000	44.16	-31.20	39.20	36.16	74.00	29.84	V
9496.500	41.73	-34.60	37.70	38.63	74.00	32.27	V
7865.500	40.12	-35.20	36.60	38.72	74.00	33.88	V
4945.500	37.79	-37.60	33.30	42.09	74.00	36.21	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)
17962.000	54.37	-29.40	46.00	37.77	74.00	19.63	V
14550.000	48.85	-30.60	41.90	37.55	74.00	25.15	V
12648.000	44.25	-31.80	39.40	36.65	74.00	29.75	V
9000.000	42.46	-34.70	37.70	39.46	74.00	31.54	V
7268.500	39.94	-35.60	36.40	39.14	74.00	34.06	H
2487.300	54.28	-19.70	28.20	45.78	74.00	19.72	V

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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)
17984.000	54.37	-29.40	46.00	37.77	74.00	19.63	V
13941.500	47.71	-30.60	41.40	36.91	74.00	26.29	H
11834.000	43.80	-32.80	39.10	37.40	74.00	30.20	H
9843.000	41.69	-34.10	37.90	37.89	74.00	32.31	V
7968.000	39.93	-35.40	36.80	38.53	74.00	34.07	H
2354.100	54.21	-19.60	28.20	45.61	74.00	19.79	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)
17995.500	54.46	-29.40	46.00	37.86	74.00	19.54	V
14530.500	48.42	-30.60	41.90	37.12	74.00	25.58	H
11870.500	44.65	-32.80	39.10	38.25	74.00	29.35	V
8719.500	41.82	-34.80	37.90	38.72	74.00	32.18	V
7251.500	39.81	-35.60	36.40	39.01	74.00	34.19	V
4943.000	37.02	-37.60	33.30	41.32	74.00	36.98	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)
17967.000	55.19	-29.40	46.00	38.59	74.00	18.81	H
14092.500	48.19	-30.20	41.70	36.69	74.00	25.81	V
12239.500	44.73	-32.50	39.00	38.23	74.00	29.27	H
8734.000	42.06	-34.80	37.90	38.96	74.00	31.94	H
7931.000	40.51	-35.40	36.80	39.11	74.00	33.49	V
2493.700	54.41	-19.70	28.20	45.91	74.00	19.59	V

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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)
17941.500	53.93	-29.40	46.00	37.33	74.00	20.07	V
14189.000	48.39	-30.20	41.70	36.89	74.00	25.61	V
11929.500	44.26	-32.40	39.10	37.56	74.00	29.74	H
9002.500	42.31	-34.70	37.70	39.31	74.00	31.69	V
7414.000	40.11	-35.10	36.60	38.61	74.00	33.89	H
2312.300	54.65	-19.90	28.10	46.45	74.00	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)
17981.500	54.53	-29.40	46.00	37.93	74.00	19.47	H
14604.500	48.96	-30.80	41.70	38.06	74.00	25.04	V
11900.000	45.17	-32.40	39.10	38.47	74.00	28.83	H
9005.500	42.75	-34.70	37.70	39.75	74.00	31.25	V
7294.500	40.70	-35.40	36.60	39.50	74.00	33.30	H
4769.500	37.53	-37.50	33.10	41.93	74.00	36.47	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)
17994.000	55.02	-29.40	46.00	38.42	74.00	18.98	V
14162.500	49.68	-30.20	41.70	38.18	74.00	24.32	H
12651.500	44.71	-31.80	39.40	37.11	74.00	29.29	V
8995.000	42.11	-34.70	37.70	39.11	74.00	31.89	V
7878.500	40.31	-35.20	36.70	38.81	74.00	33.69	V
2497.600	54.12	-19.70	28.20	45.62	74.00	19.88	H

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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)
17988.000	44.79	-29.40	46.00	28.19	54.00	9.21	V
14548.500	38.84	-30.60	41.90	27.54	54.00	15.16	V
11894.000	34.72	-32.40	39.10	28.02	54.00	19.28	V
9503.000	31.93	-34.60	37.70	28.83	54.00	22.07	V
7958.000	30.67	-35.40	36.80	29.27	54.00	23.33	H
2375.700	42.77	-19.80	28.20	34.37	54.00	11.23	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)
17949.000	44.87	-29.40	46.00	28.27	54.00	9.13	V
14168.000	38.82	-30.20	41.70	27.32	54.00	15.18	V
12943.000	34.98	-31.40	40.00	26.38	54.00	19.02	V
9509.000	32.32	-33.80	37.60	28.52	54.00	21.68	V
7943.500	30.39	-35.40	36.80	28.99	54.00	23.61	H
4930.500	27.57	-37.60	33.30	31.87	54.00	26.43	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)
17958.000	45.09	-29.40	46.00	28.49	54.00	8.91	H
14197.000	38.56	-30.20	41.70	27.06	54.00	15.44	H
12659.000	34.72	-31.80	39.40	27.12	54.00	19.28	V
9733.500	32.21	-34.50	37.80	28.91	54.00	21.79	V
7996.000	30.42	-35.40	36.90	28.92	54.00	23.58	V
2491.800	42.41	-19.70	28.20	33.91	54.00	11.59	V

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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)
17992.000	44.85	-29.40	46.00	28.25	54.00	9.15	H
14093.000	38.20	-30.20	41.70	26.70	54.00	15.80	V
12656.500	34.22	-31.80	39.40	26.62	54.00	19.78	H
8988.000	31.78	-34.70	37.70	28.78	54.00	22.22	H
7311.500	30.28	-35.40	36.60	29.08	54.00	23.72	V
2387.600	42.35	-19.80	28.20	33.95	54.00	11.65	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)
17962.500	45.25	-29.40	46.00	28.65	54.00	8.75	V
14189.000	39.07	-30.20	41.70	27.57	54.00	14.93	V
12990.500	34.52	-31.90	40.10	26.32	54.00	19.48	V
9378.500	32.31	-34.10	37.90	28.51	54.00	21.69	H
7948.000	31.16	-35.40	36.80	29.76	54.00	22.84	V
4775.000	27.94	-37.50	33.10	32.34	54.00	26.06	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)
17984.500	45.68	-29.40	46.00	29.08	54.00	8.32	V
14171.500	38.80	-30.20	41.70	27.30	54.00	15.20	V
11878.500	34.47	-32.80	39.10	28.07	54.00	19.53	V
8733.000	32.89	-34.80	37.90	29.79	54.00	21.11	V
7489.500	30.79	-35.10	36.40	29.49	54.00	23.21	V
2487.200	42.42	-19.70	28.20	33.92	54.00	11.58	V

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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)
17996.000	45.56	-29.40	46.00	28.96	54.00	8.44	H
14162.000	38.61	-30.20	41.70	27.11	54.00	15.39	V
11854.500	34.76	-32.80	39.10	28.36	54.00	19.24	V
8945.500	32.01	-33.90	37.70	28.21	54.00	21.99	H
7955.000	30.39	-35.40	36.80	28.99	54.00	23.61	V
2356.900	42.29	-19.60	28.20	33.69	54.00	11.71	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)
17963.000	45.28	-29.40	46.00	28.68	54.00	8.72	V
14281.500	38.79	-29.90	41.80	26.89	54.00	15.21	V
12767.500	35.19	-31.80	39.60	27.29	54.00	18.81	V
8728.000	32.57	-34.80	37.90	29.47	54.00	21.43	V
7936.500	30.65	-35.40	36.80	29.25	54.00	23.35	V
4946.000	27.90	-37.60	33.30	32.20	54.00	26.10	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)
17990.500	45.40	-29.40	46.00	28.80	54.00	8.60	H
14608.000	39.15	-30.80	41.70	28.25	54.00	14.85	V
11745.500	34.85	-32.90	39.20	28.55	54.00	19.15	V
9505.500	33.13	-33.80	37.60	29.33	54.00	20.87	V
7225.000	30.66	-35.40	36.20	29.86	54.00	23.34	V
2485.300	42.42	-19.70	28.20	33.92	54.00	11.58	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.76	P
	78	2.45GHz ~2.5GHz	Fig.77	P

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