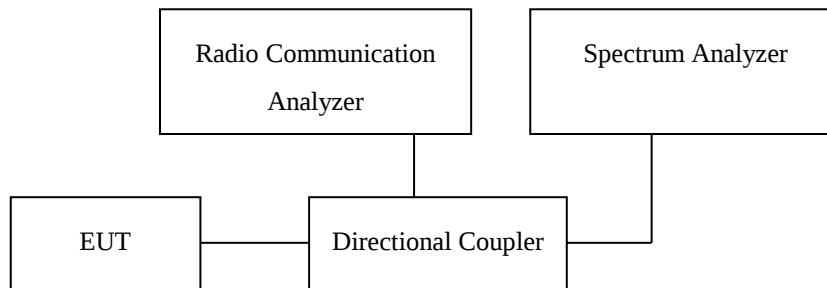


12. Conducted Band Edge

12.1 Operating environment

Temperature : 22 °C
Relative humidity : 45 % R.H.

12.2 Test set-up



(Configuration of conducted Emission measurement)

Conducted Spurious Emissions is tested in accordance with KDB971168 D01 Power Meas License Digital Systems v03, April 9, 2018, Section 6.

The EUT makes a call to the communication simulator. The power was measured with R&S Spectrum Analyzer. All measurements were done at 3 channels(low, middle and high operational range.)

The Conducted Spurious Emissions used the power splitter via EUT RF power connector between simulation base station and spectrum analyzer.

The communication simulator station system controlled a EUT to export maximum output power under transmission mode and specific channel frequency.

12.3 Methods of Measurement

1. All measurements were done at low and high operational frequency range.
2. Set spectrum analyzer with RMS detector.
3. The center frequency of spectrum is the band edge frequency and set RBW of the spectrum is 20 kHz and VBW of the spectrum is 50 kHz

12.4 Limits

LTE -12 Rule Part 27.53 (g) For operations in the 600 MHz band and the 698-746 MHz band, the power of any emission outside a licensee's frequency band(s) of operation shall be attenuated below the transmitter power (P) within the licensed band(s) of operation, measured in watts, by at least $43 + 10 \log (P)$ dB. Compliance with this provision is based on the use of measurement instrumentation employing a resolution bandwidth of 100 kilohertz or greater. However, in the 100 kilohertz bands immediately outside and adjacent to a licensee's frequency block, a resolution bandwidth of at least 30 kHz may be employed.

LTE Band 12 Limit

Limit	-13 dBm
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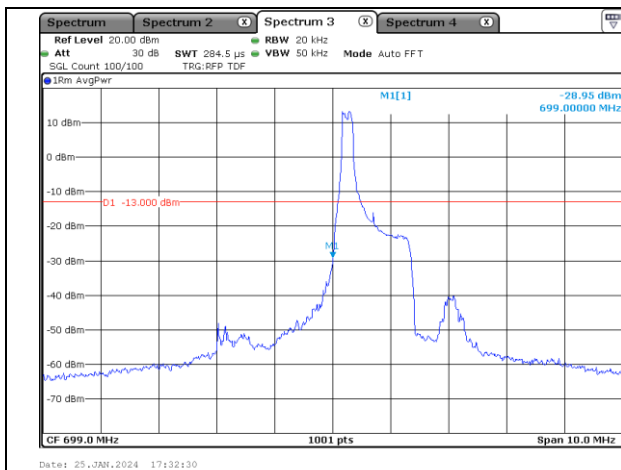
12.5 Test Date

January 15, 2024 ~ February 08, 2024

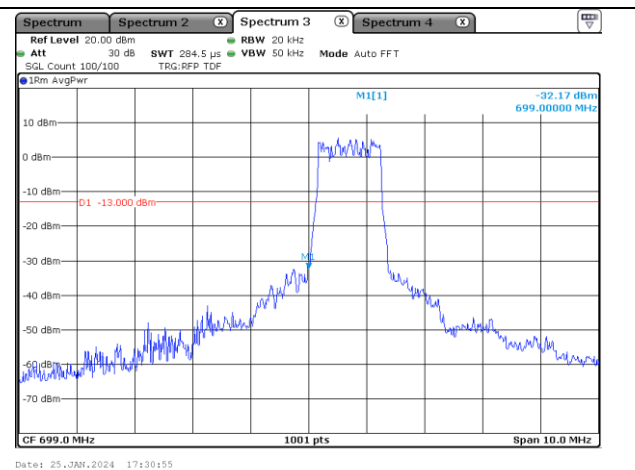
12.6 Test data for Band 12_Bandwidth 1.4 MHz

-. Test Result : Pass

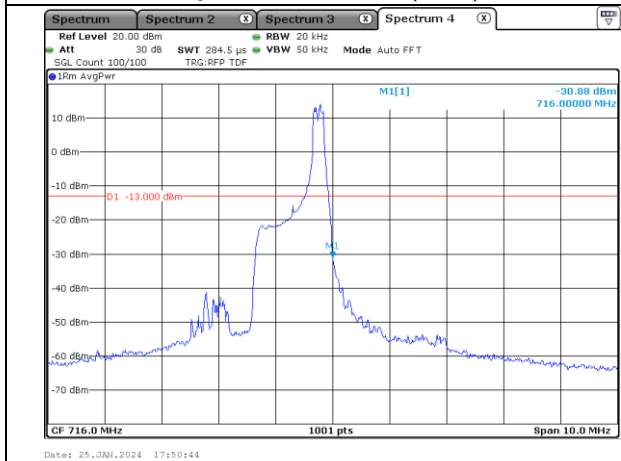
Test Mode	Channel	Edge Frequency	Measured Value (dBm)	Limit (dBm)	Result
LTE Band 12 QPSK					
1 RB	699.7 MHz	699.0 MHz	-28.95	-13.00	PASS
	715.3 MHz	716.0 MHz	-30.88	-13.00	PASS
6 RB	699.7 MHz	699.0 MHz	-32.17	-13.00	PASS
	715.3 MHz	716.0 MHz	-35.57	-13.00	PASS
LTE Band 12 16QAM					
1 RB	699.7 MHz	699.0 MHz	-29.61	-13.00	PASS
	715.3 MHz	716.0 MHz	-32.45	-13.00	PASS
6 RB	699.7 MHz	699.0 MHz	-30.73	-13.00	PASS
	715.3 MHz	716.0 MHz	-33.65	-13.00	PASS



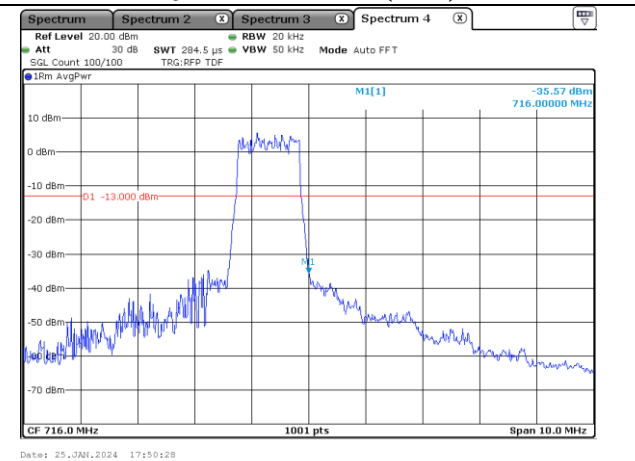
QPSK Low Channel (1 RB)



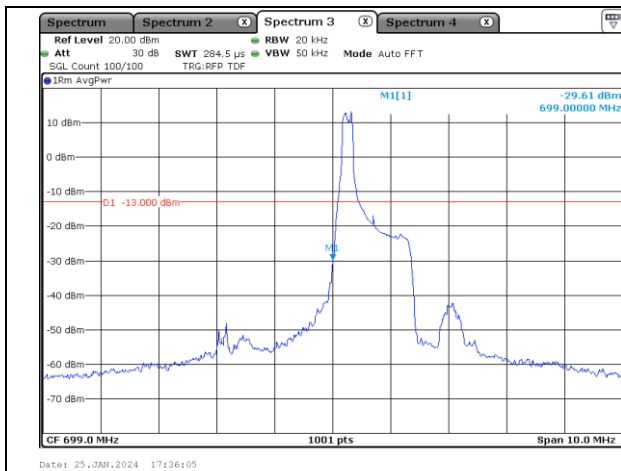
QPSK Low Channel (6 RB)



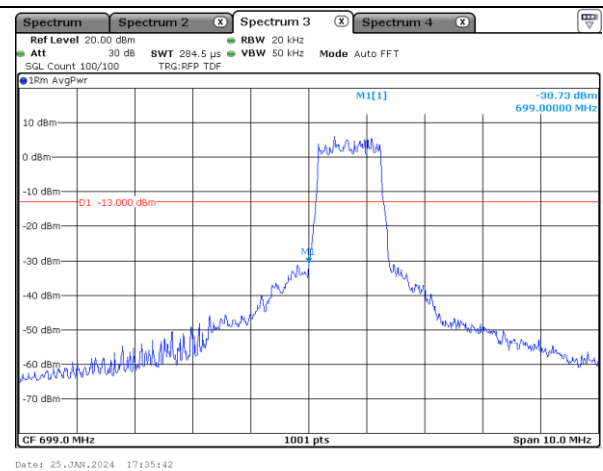
QPSK High Channel (1 RB)



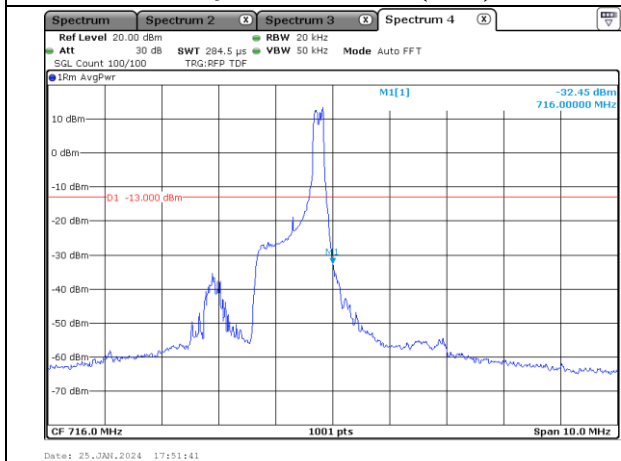
QPSK High Channel (6 RB)



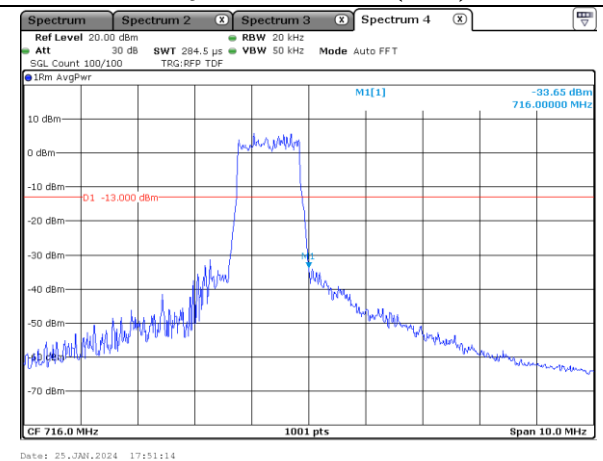
16QAM Low Channel (1 RB)



16QAM Low Channel (6 RB)



16QAM High Channel (1 RB)

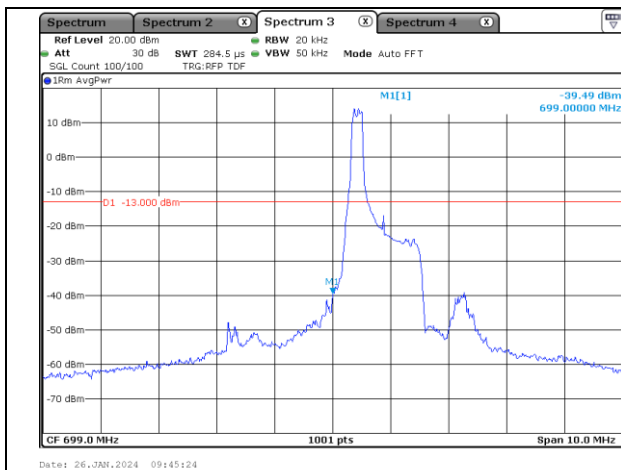


16QAM High Channel (6 RB)

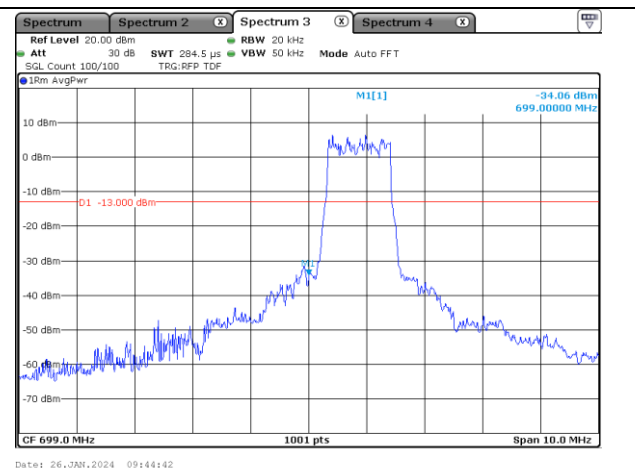
12.7 Test data for Band 12_Bandwidth 3 MHz

-. Test Result : Pass

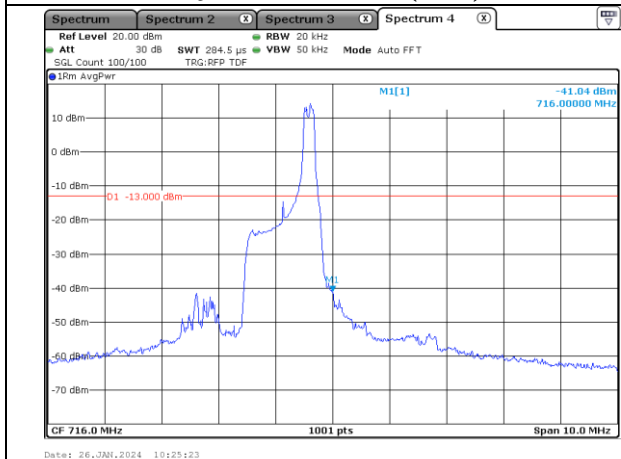
Test Mode	Channel	Edge Frequency	Measured Value (dBm)	Limit (dBm)	Result
LTE Band 12 QPSK					
1 RB	700.5 MHz	699.0 MHz	-39.49	-13.00	PASS
	714.5 MHz	716.0 MHz	-41.04	-13.00	PASS
6 RB	700.5 MHz	699.0 MHz	-34.06	-13.00	PASS
	714.5 MHz	716.0 MHz	-37.30	-13.00	PASS
LTE Band 12 16QAM					
1 RB	700.5 MHz	699.0 MHz	-41.97	-13.00	PASS
	714.5 MHz	716.0 MHz	-45.34	-13.00	PASS
6 RB	700.5 MHz	699.0 MHz	-33.62	-13.00	PASS
	714.5 MHz	716.0 MHz	-37.60	-13.00	PASS



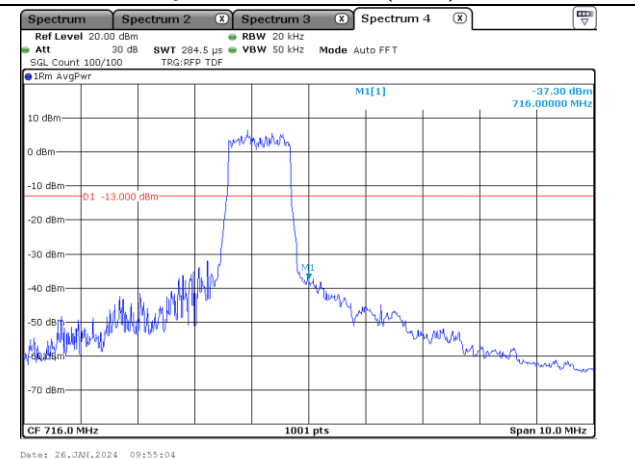
QPSK Low Channel (1 RB)



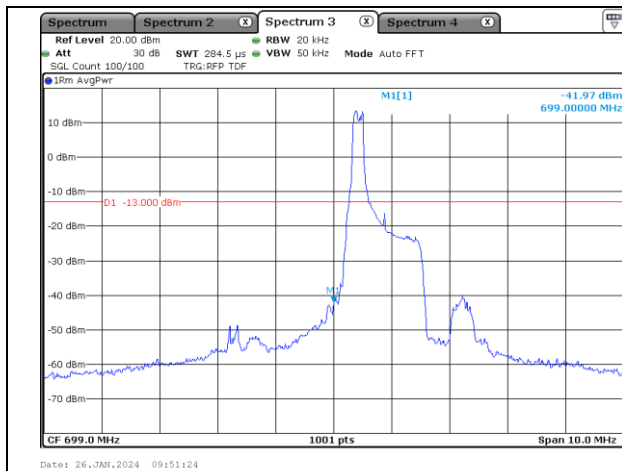
QPSK Low Channel (6 RB)



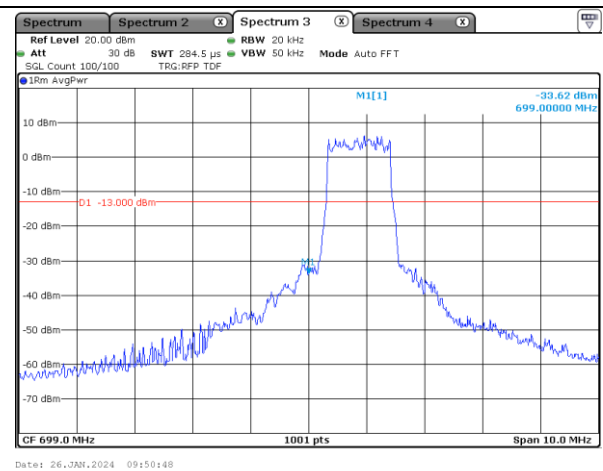
QPSK High Channel (1 RB)



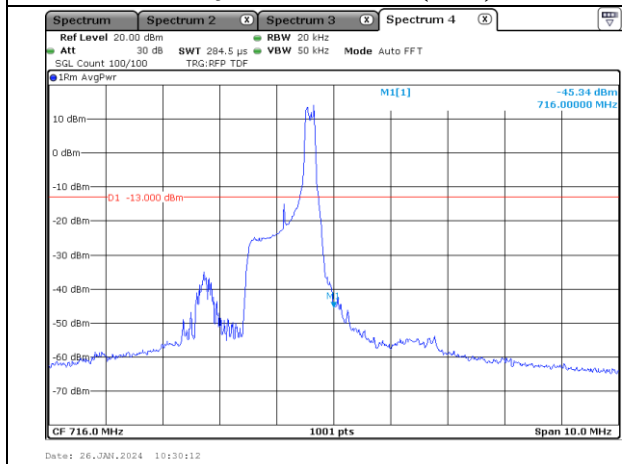
QPSK High Channel (6 RB)



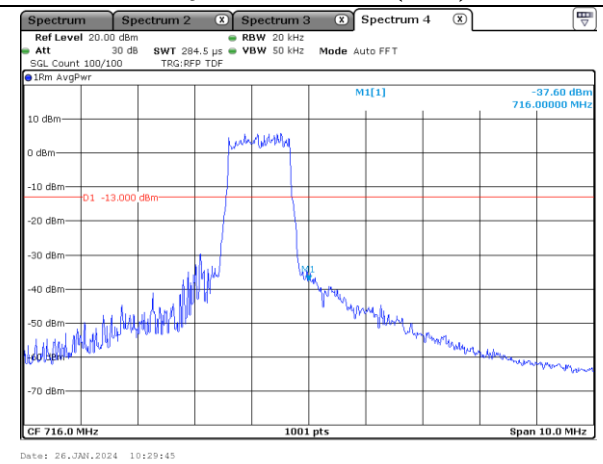
16QAM Low Channel (1 RB)



16QAM Low Channel (6 RB)



16QAM High Channel (1 RB)

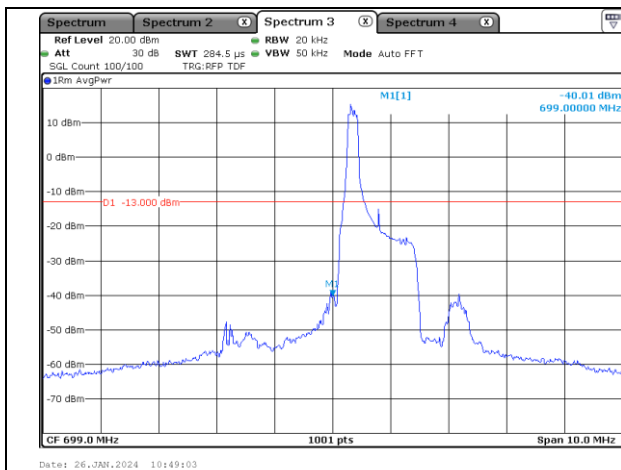


16QAM High Channel (6 RB)

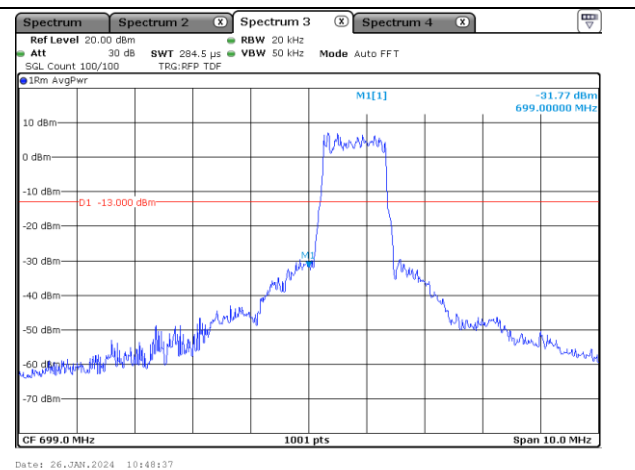
12.8 Test data for Band 12_Bandwidth 5 MHz

-. Test Result : Pass

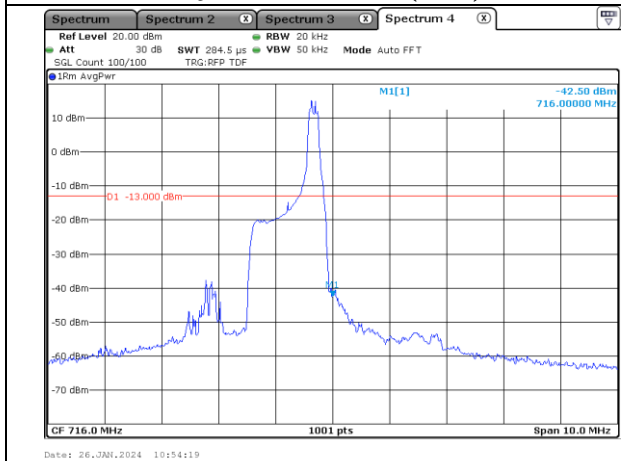
Test Mode	Channel	Edge Frequency	Measured Value (dBm)	Limit (dBm)	Result
LTE Band 12 QPSK					
1 RB	701.5 MHz	699.0 MHz	-40.01	-13.00	PASS
	713.5 MHz	716.0 MHz	-42.50	-13.00	PASS
6 RB	701.5 MHz	699.0 MHz	-31.77	-13.00	PASS
	713.5 MHz	716.0 MHz	-33.44	-13.00	PASS
LTE Band 12 16QAM					
1 RB	701.5 MHz	699.0 MHz	-39.19	-13.00	PASS
	713.5 MHz	716.0 MHz	-36.23	-13.00	PASS
6 RB	701.5 MHz	699.0 MHz	-30.96	-13.00	PASS
	713.5 MHz	716.0 MHz	-34.44	-13.00	PASS



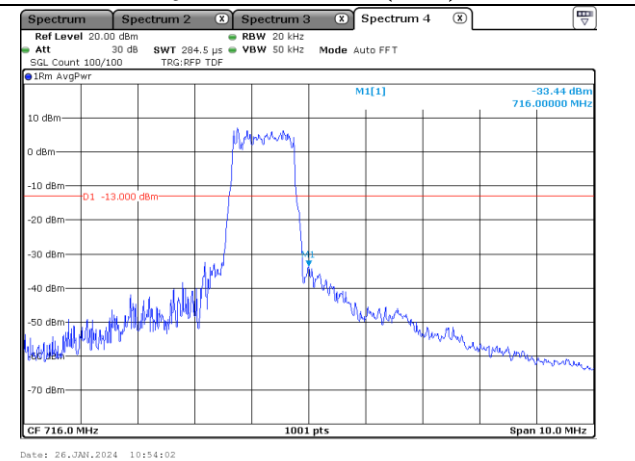
QPSK Low Channel (1 RB)



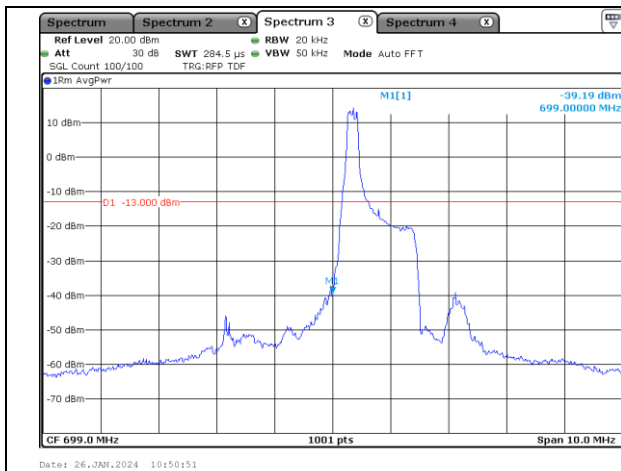
QPSK Low Channel (6 RB)



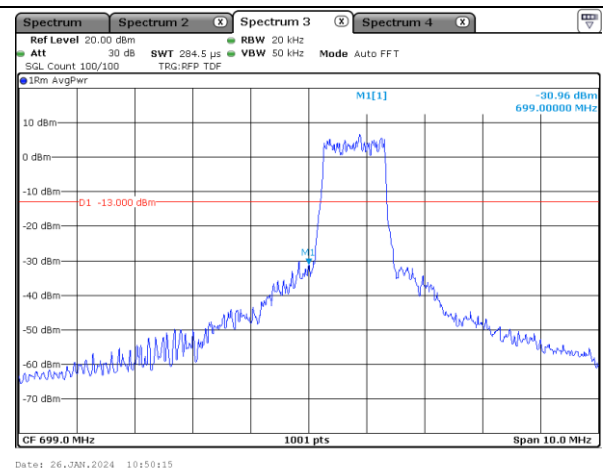
QPSK High Channel (1 RB)



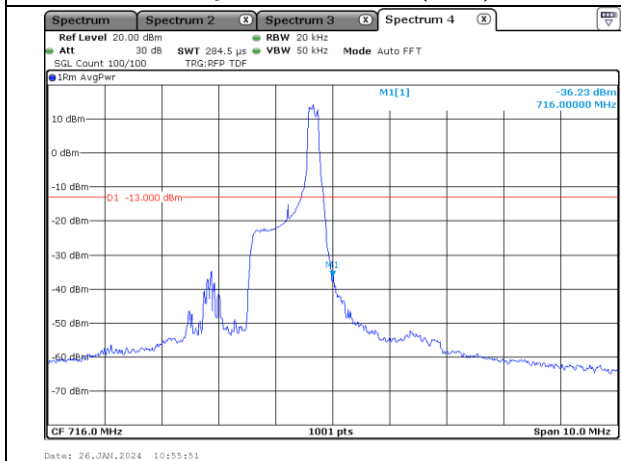
QPSK High Channel (6 RB)



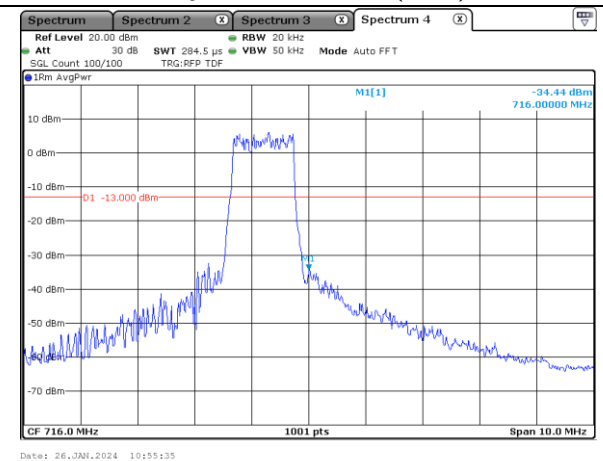
16QAM Low Channel (1 RB)



16QAM Low Channel (6 RB)



16QAM High Channel (1 RB)

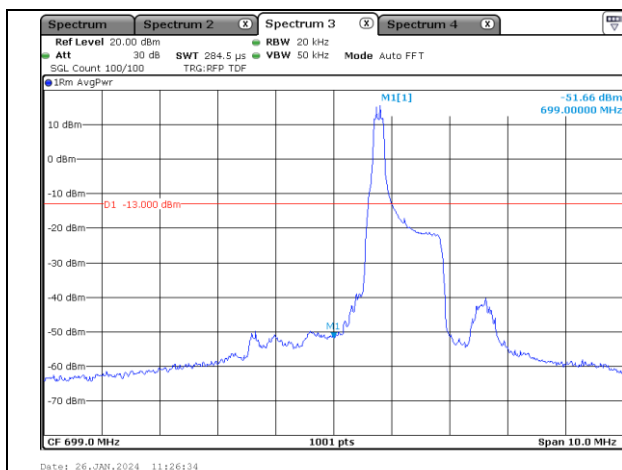


16QAM High Channel (6 RB)

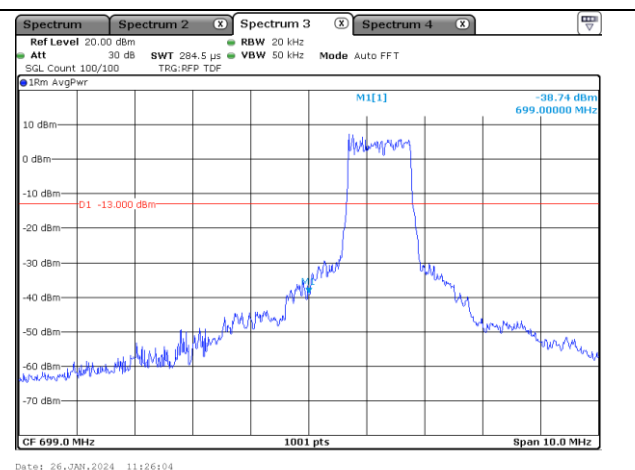
12.9 Test data for Band 12_Bandwidth 10 MHz

-. Test Result : Pass

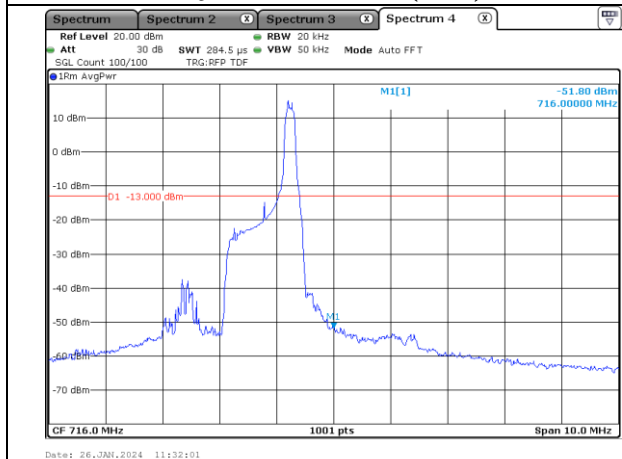
Test Mode	Channel	Edge Frequency	Measured Value (dBm)	Limit (dBm)	Result
LTE Band 12 QPSK					
1 RB	704.0 MHz	699.0 MHz	-51.66	-13.00	PASS
	711.0 MHz	716.0 MHz	-51.80	-13.00	PASS
6 RB	704.0 MHz	699.0 MHz	-38.74	-13.00	PASS
	711.0 MHz	716.0 MHz	-40.14	-13.00	PASS
LTE Band 12 16QAM					
1 RB	704.0 MHz	699.0 MHz	-50.49	-13.00	PASS
	711.0 MHz	716.0 MHz	-50.48	-13.00	PASS
6 RB	704.0 MHz	699.0 MHz	-37.76	-13.00	PASS
	711.0 MHz	716.0 MHz	-40.21	-13.00	PASS



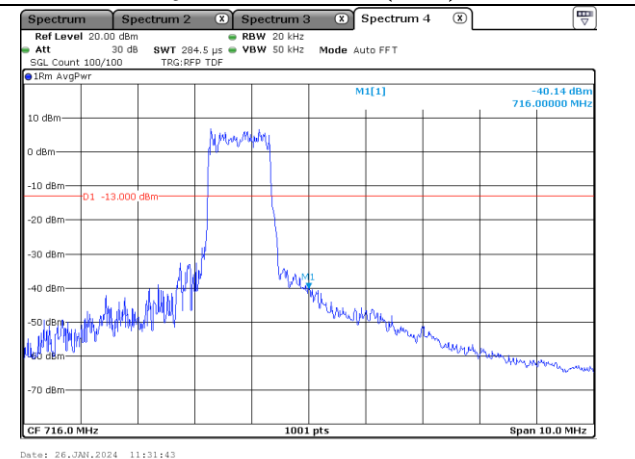
QPSK Low Channel (1 RB)



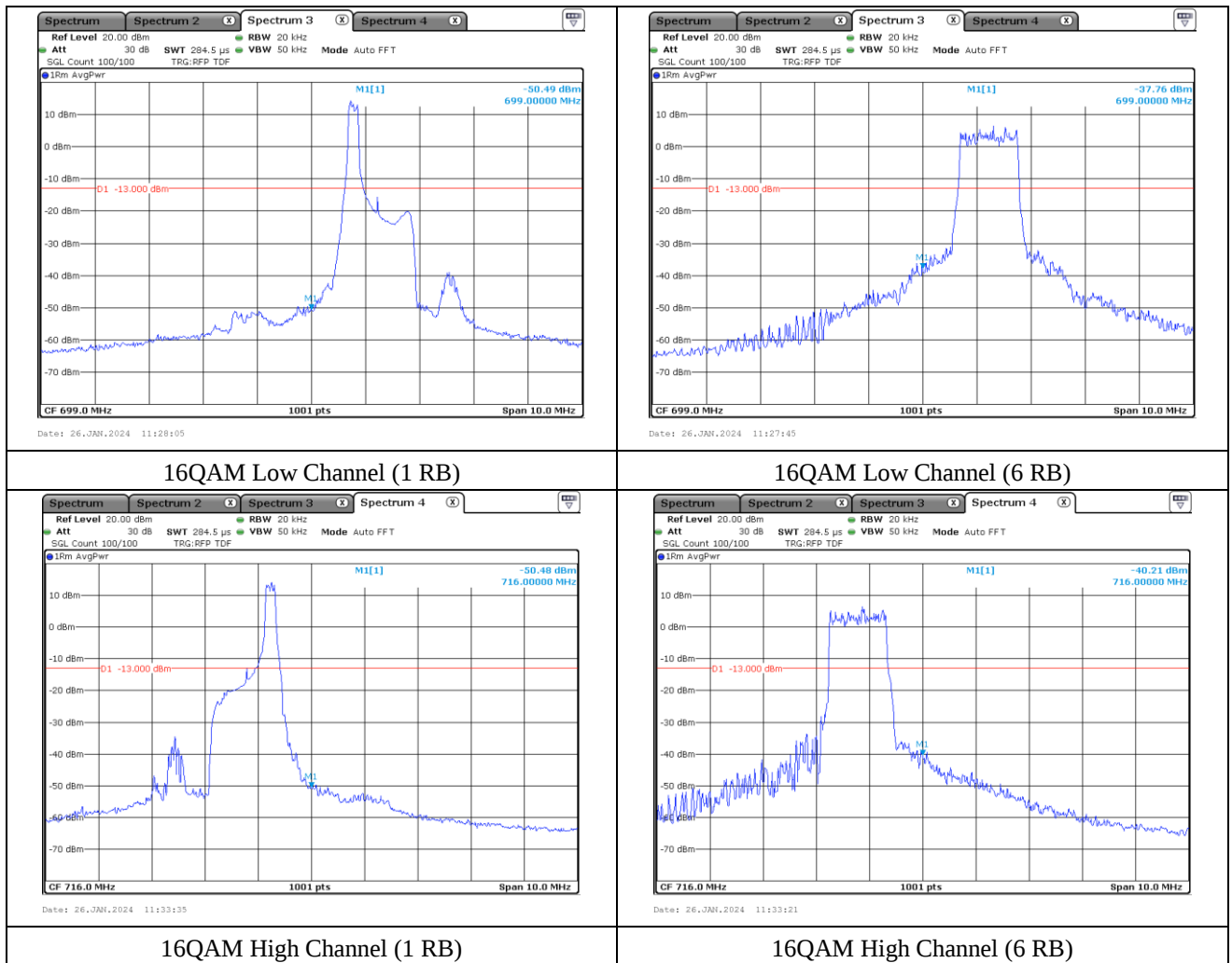
QPSK Low Channel (6 RB)



QPSK High Channel (1 RB)



QPSK High Channel (6 RB)

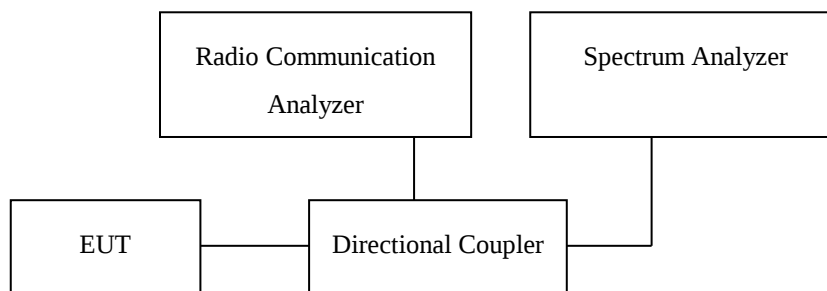


13. Conducted Spurious and Harmonic Emissions at Antenna Termianl

13.1 Operating environment

Temperature : 22 °C
Relative humidity : 45 % R.H.

13.2 Test set-up



(Configuration of conducted Emission measurement)

Conducted Spurious Emissions is tested in accordance with KDB971168 D01 Power Meas License Digital Systems v03, April 9, 2018, Section 6.

The EUT makes a call to the communication simulator. The power was measured with R&S Spectrum Analyzer. All measurements were done at 3 channels(low, middle and high operational range.)

The Conducted Spurious Emissions used the power splitter via EUT RF power connector between simulation base station and spectrum analyzer.

The communication simulator station system controlled a EUT to export maximum output power under transmission mode and specific channel frequency.

Conduced spurious emissions

The EUT was setup to maximum output power. The 100 kHz RBW and 300 kHz VBW was used to scan from 30 MHz to 1 GHz. Also, the 1 MHz RBW and 3 MHz VBW was used to scan from 1 GHz to 20 GHz. The high, low and a middle channel were tested for out of band measurements.

13.3 Limits

LTE -12 Rule Part 27.53 (g) For operations in the 600 MHz band and the 698-746 MHz band, the power of any emission outside a licensee's frequency band(s) of operation shall be attenuated below the transmitter power (P) within the licensed band(s) of operation, measured in watts, by at least $43 + 10 \log (P)$ dB. Compliance with this provision is based on the use of measurement instrumentation employing a resolution bandwidth of 100 kilohertz or greater. However, in the 100 kilohertz bands immediately outside and adjacent to a licensee's frequency block, a resolution bandwidth of at least 30 kHz may be employed.

LTE Band 12 Limit

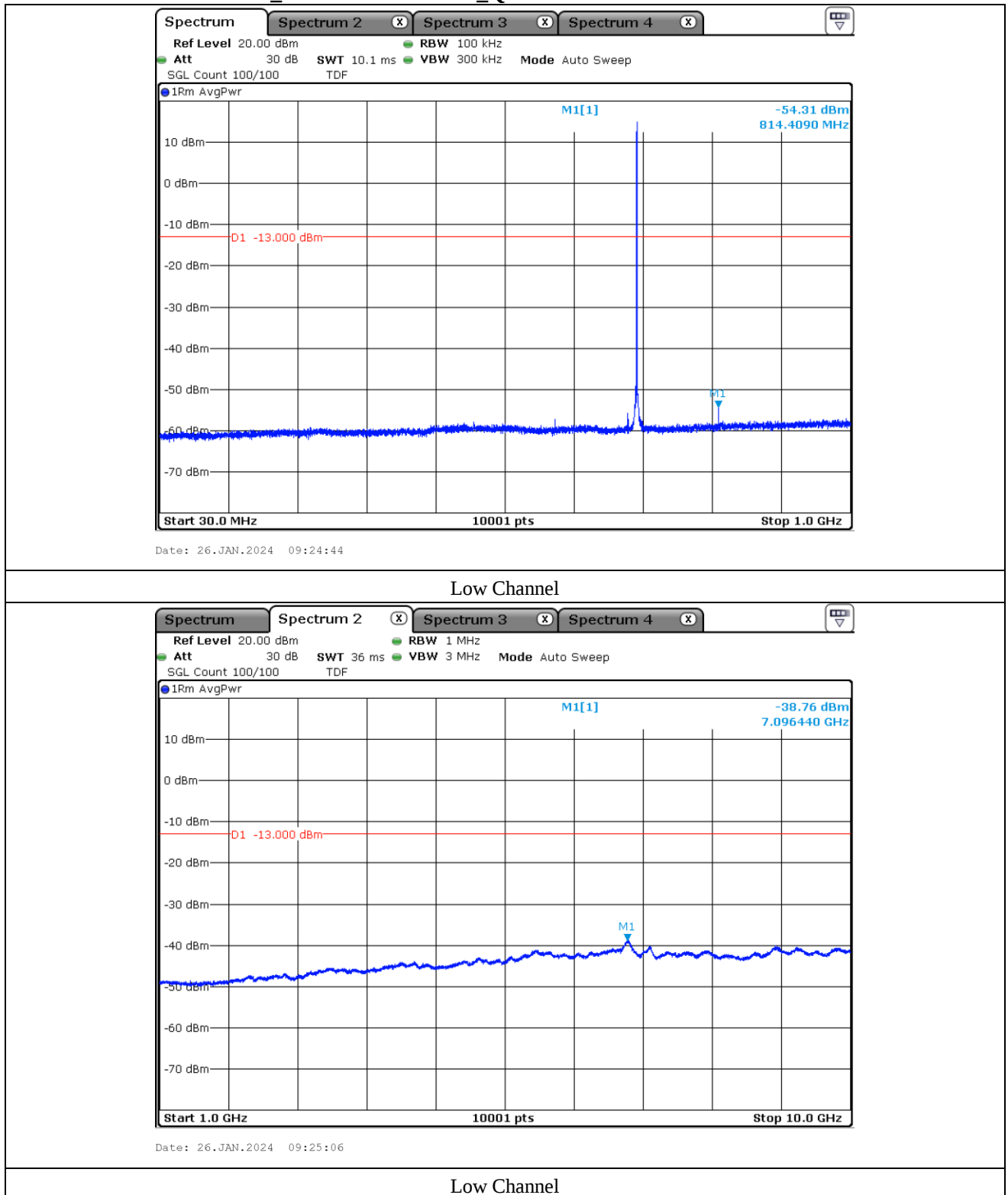
Limit	-13 dBm
-------	---------

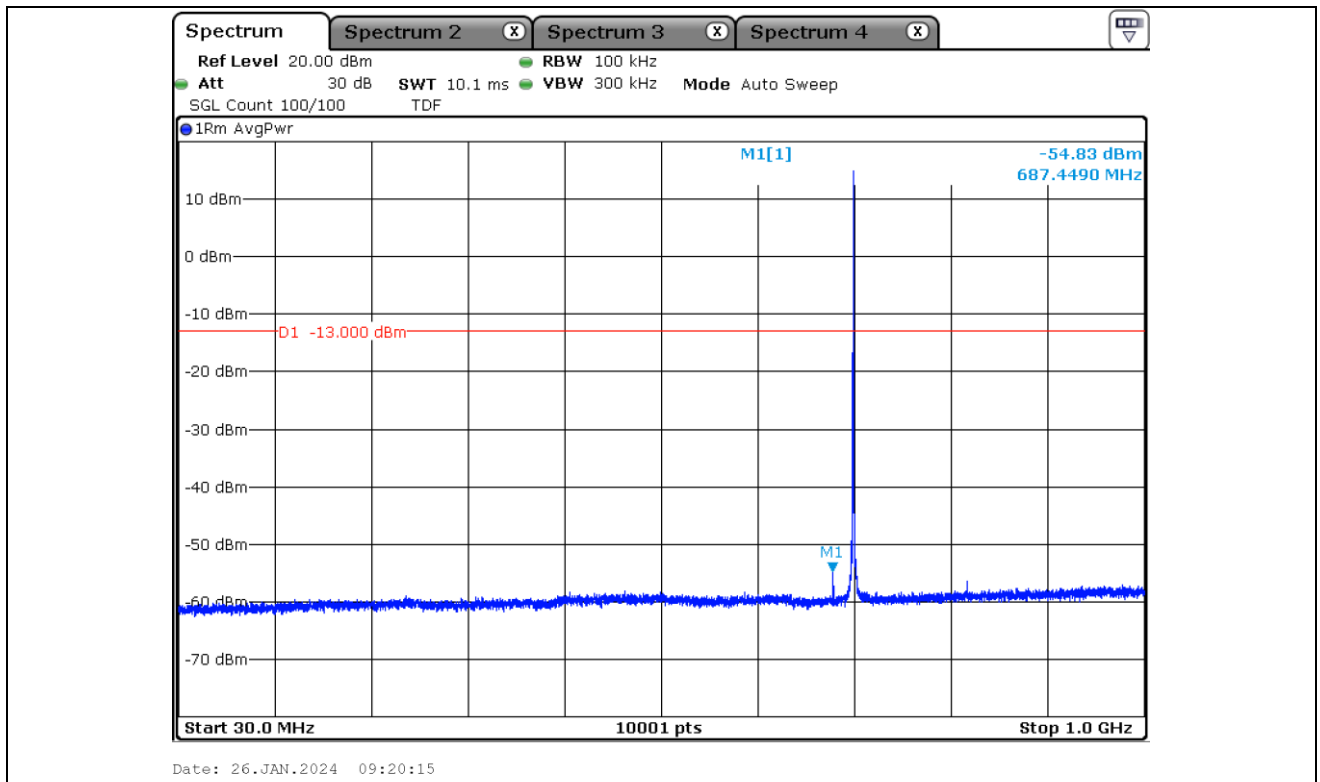
13.4 Test Date

January 15, 2024 ~ February 08, 2024

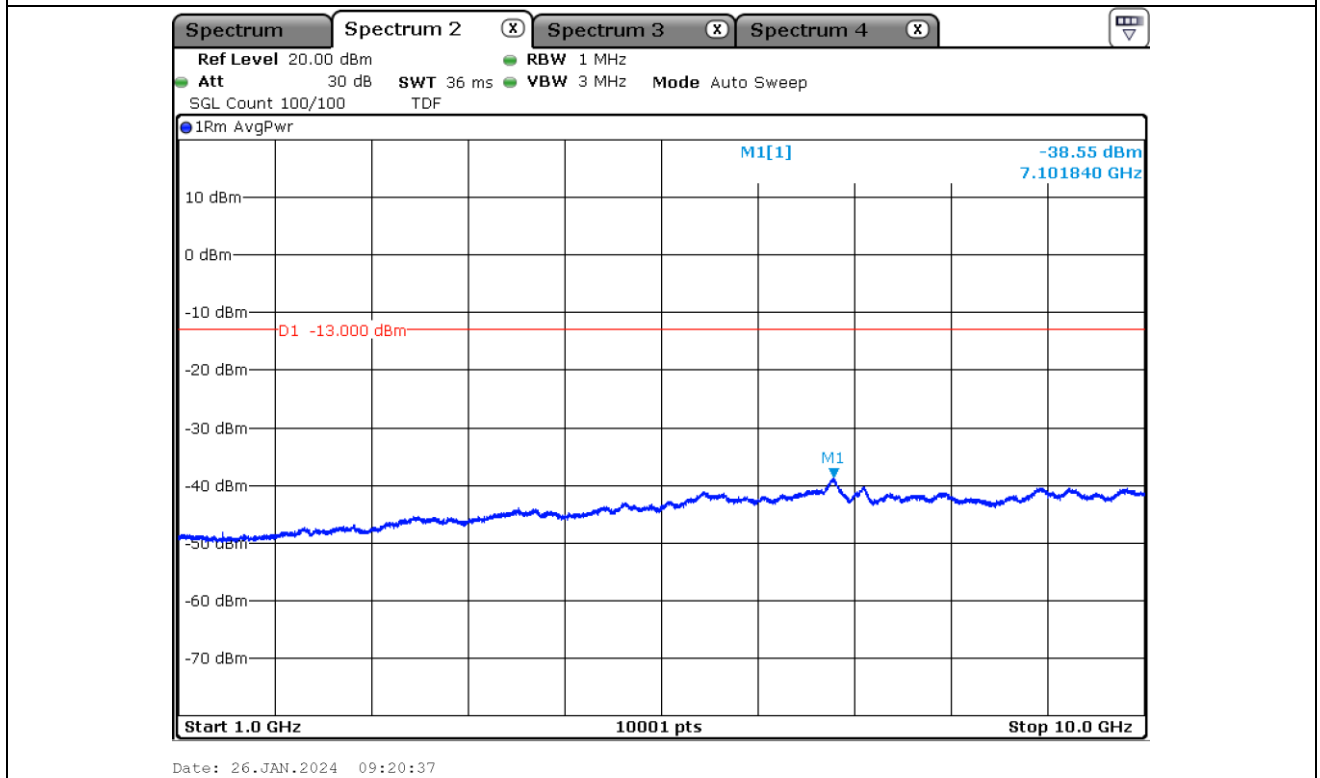
13.5 Test data

13.5.1 Test data for Band 12_Bandwidth 1.4 MHz_QPSK

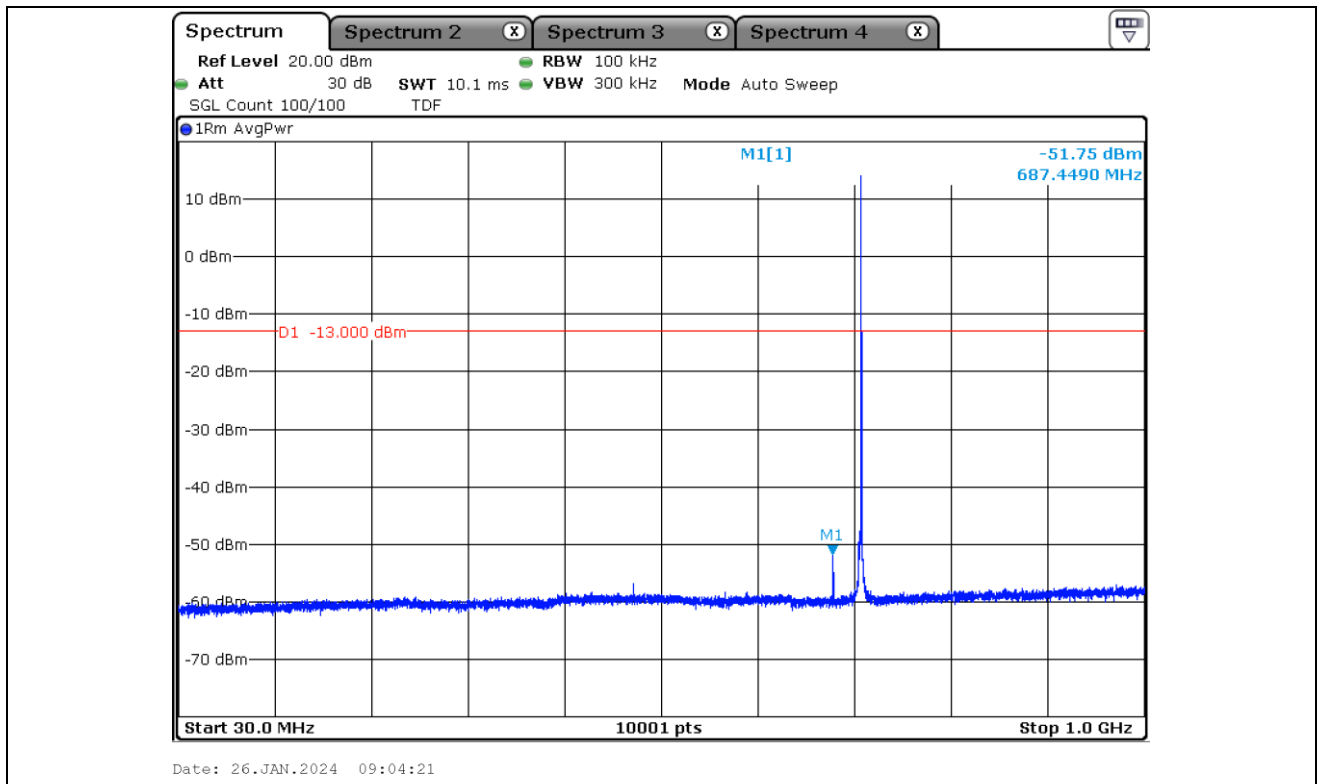




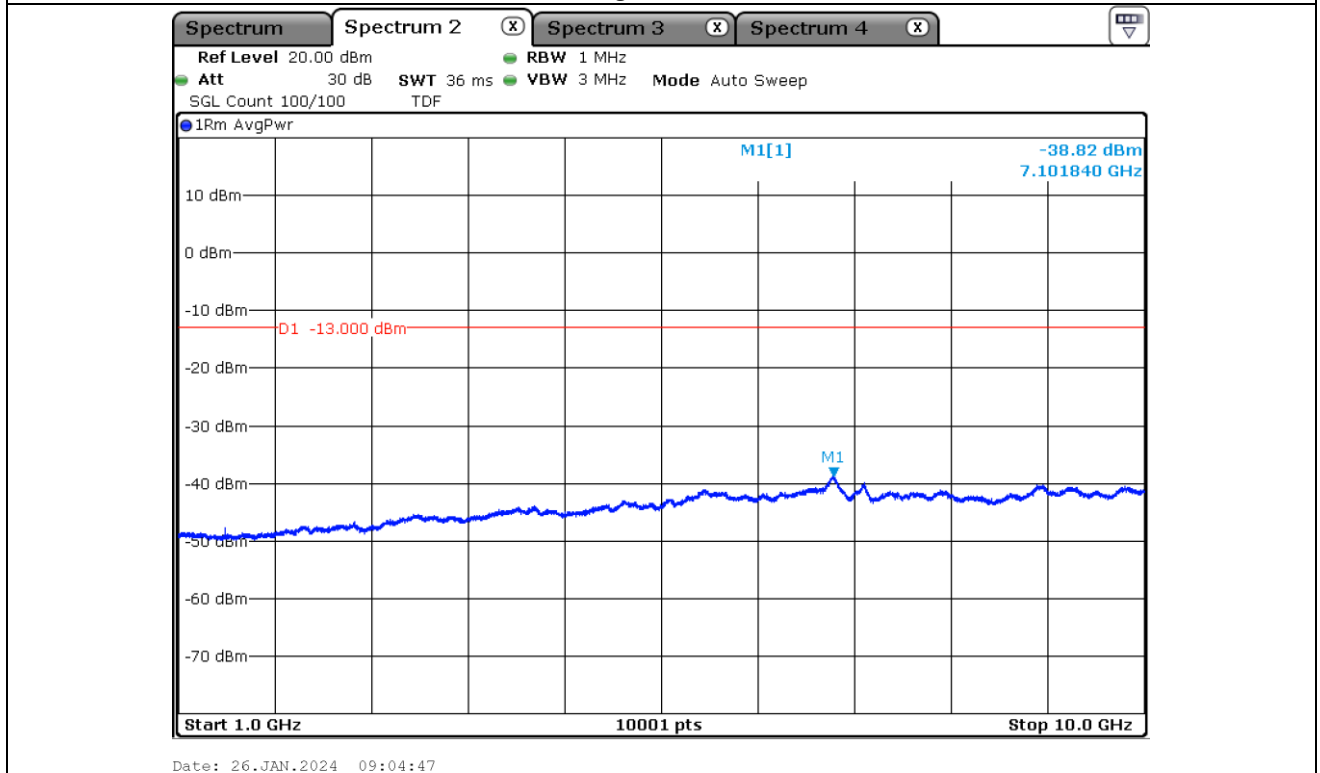
Midle Channel



Midle Channel

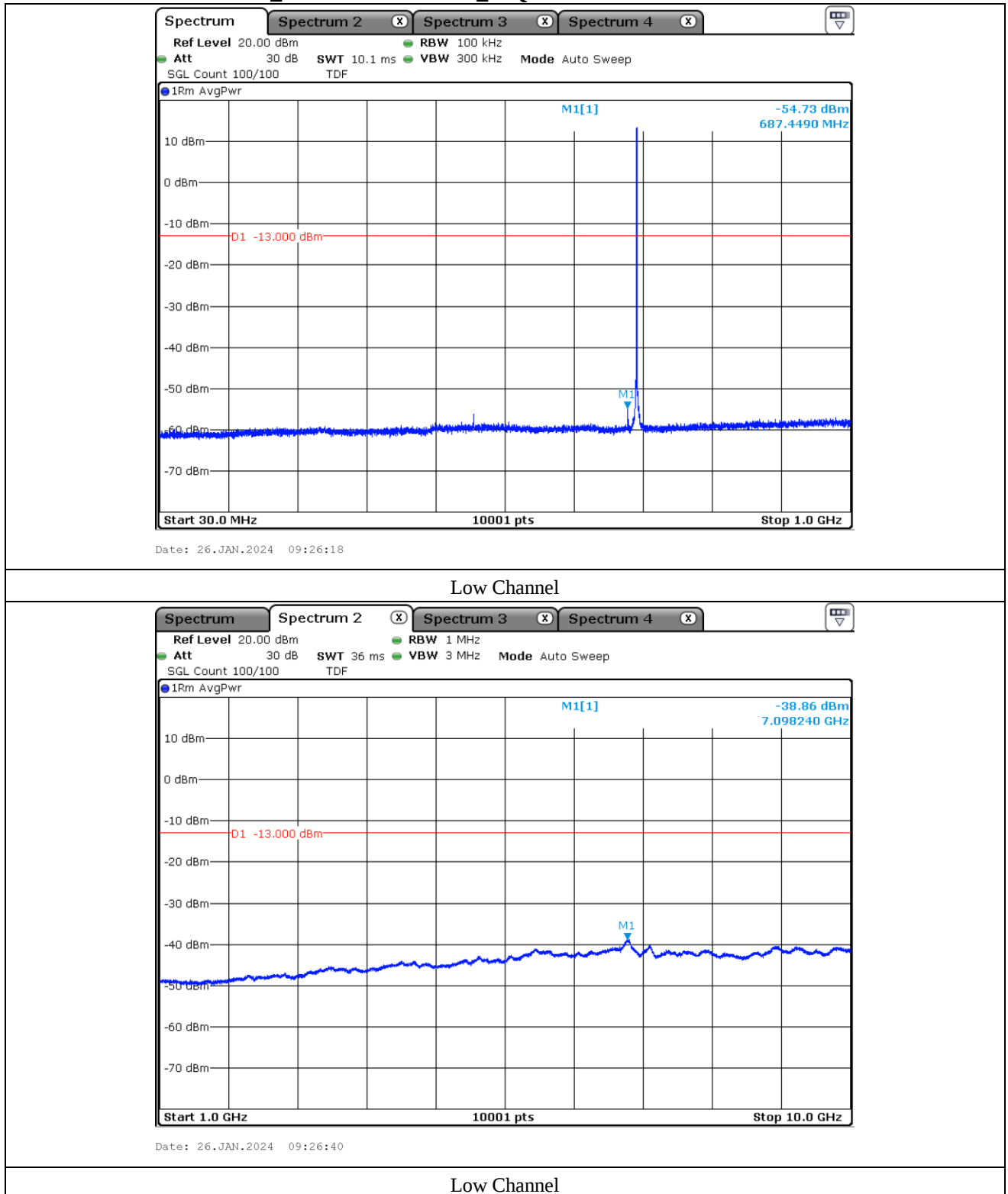


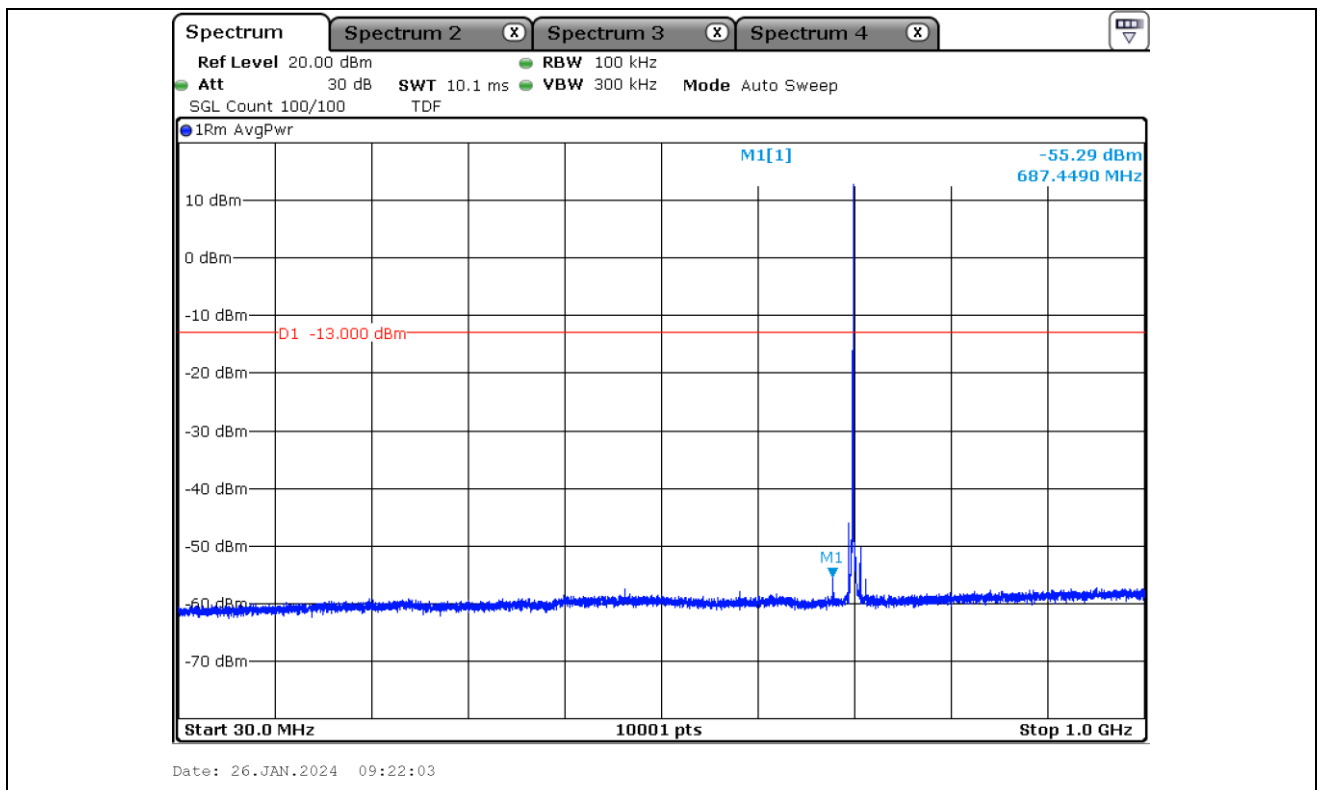
High Channel



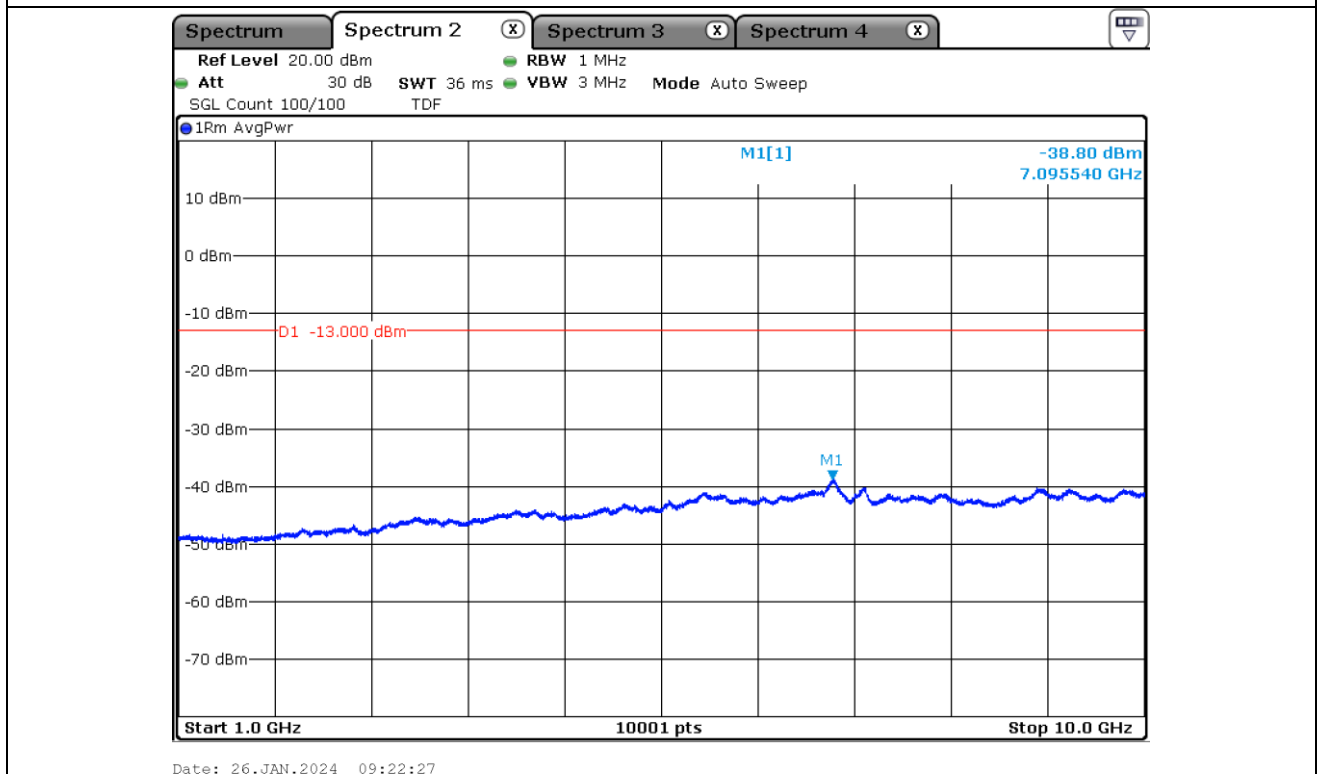
High Channel

13.5.2 Test data for Band 12_Bandwidth 1.4 MHz_16QAM

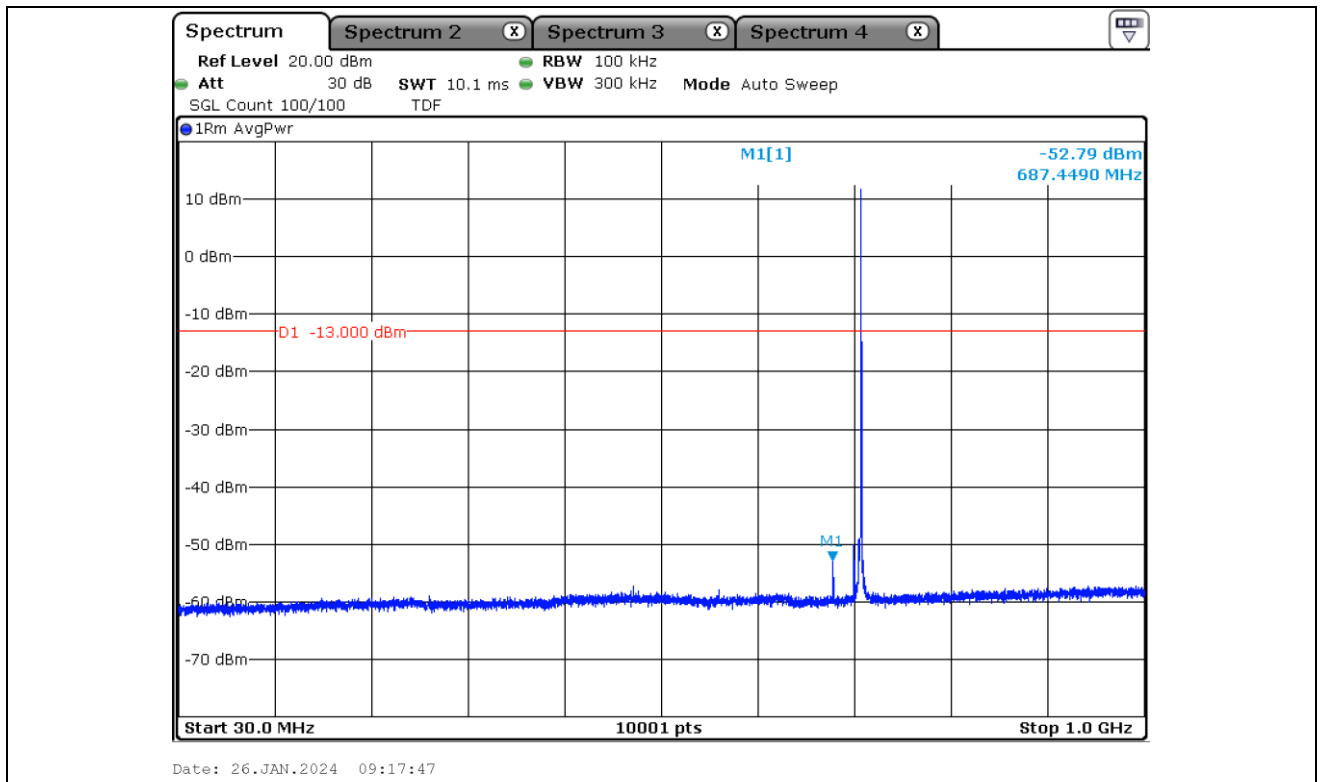




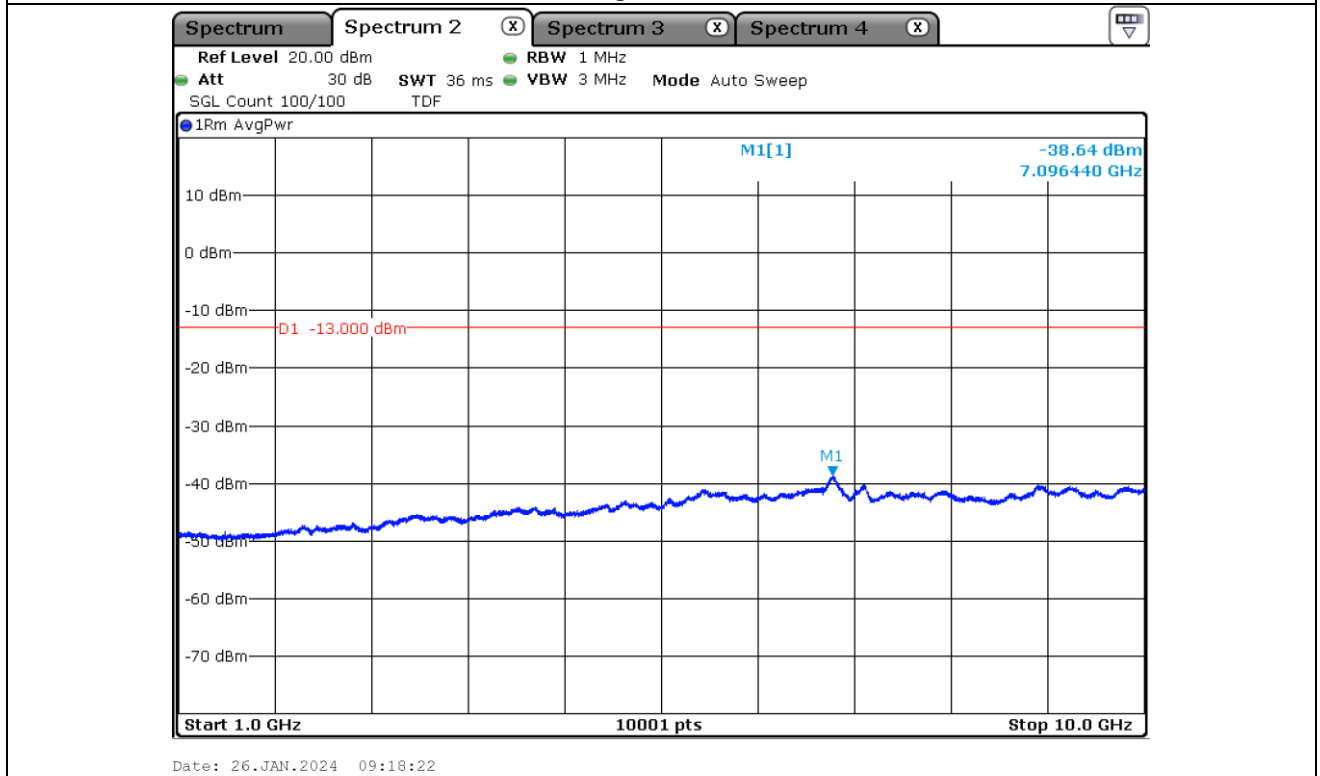
Midle Channel



Midle Channel

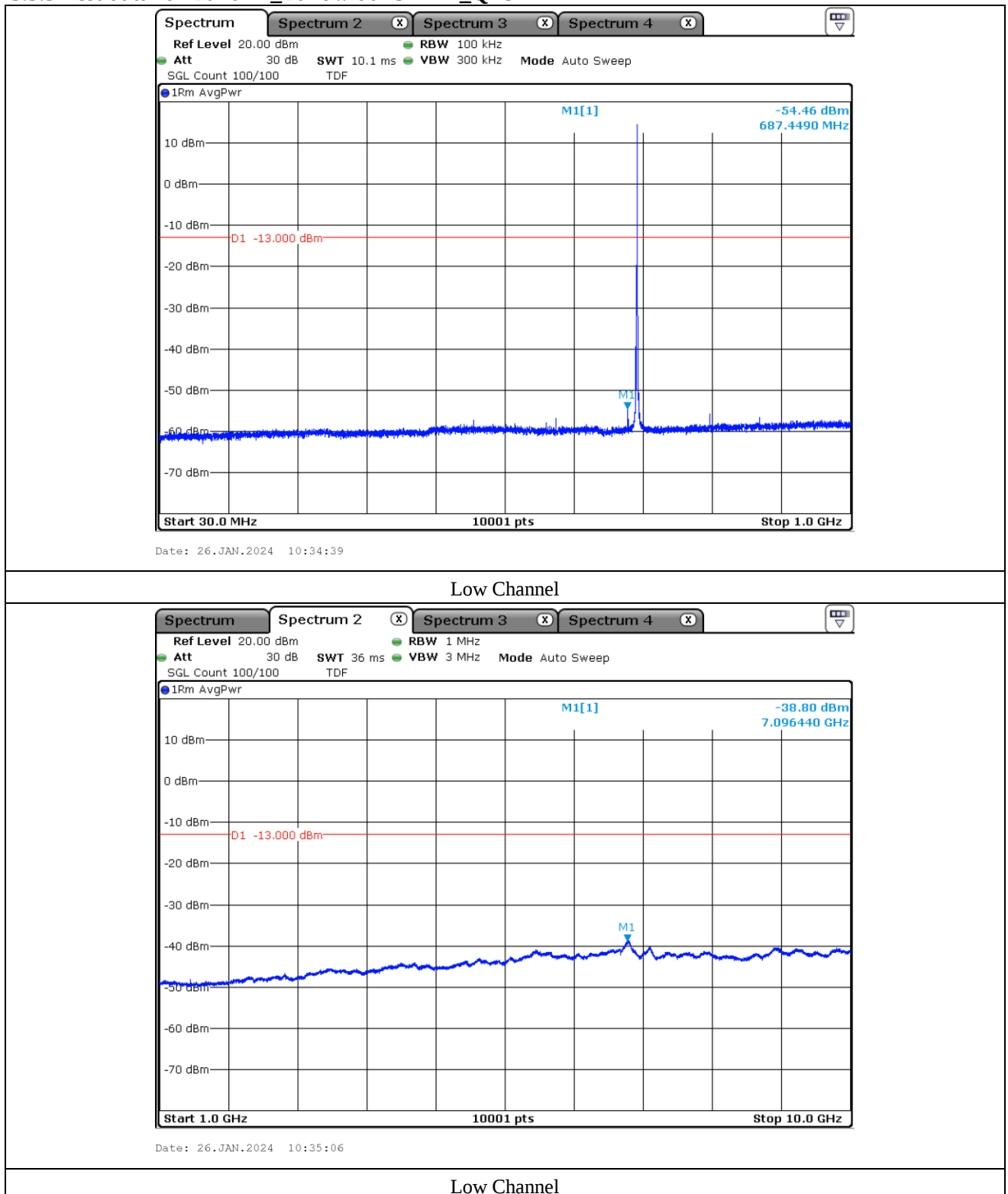


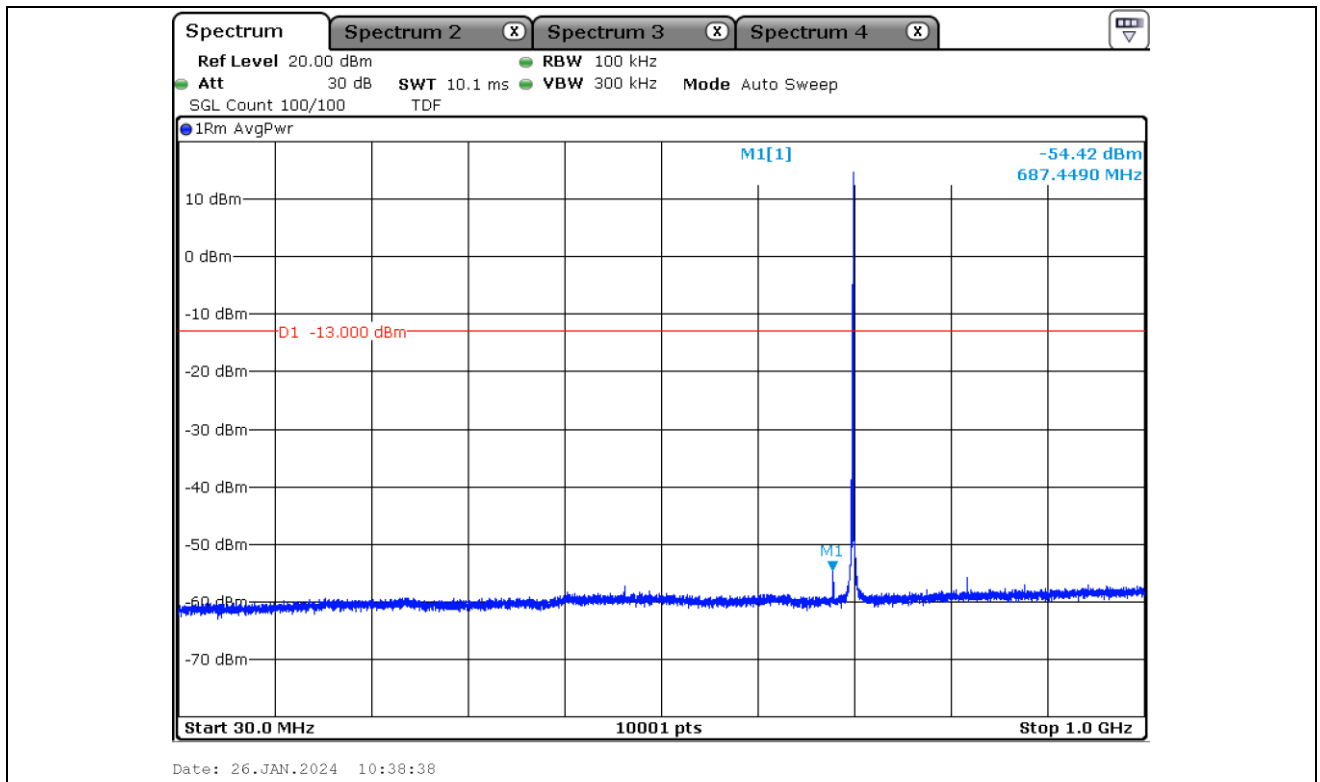
High Channel



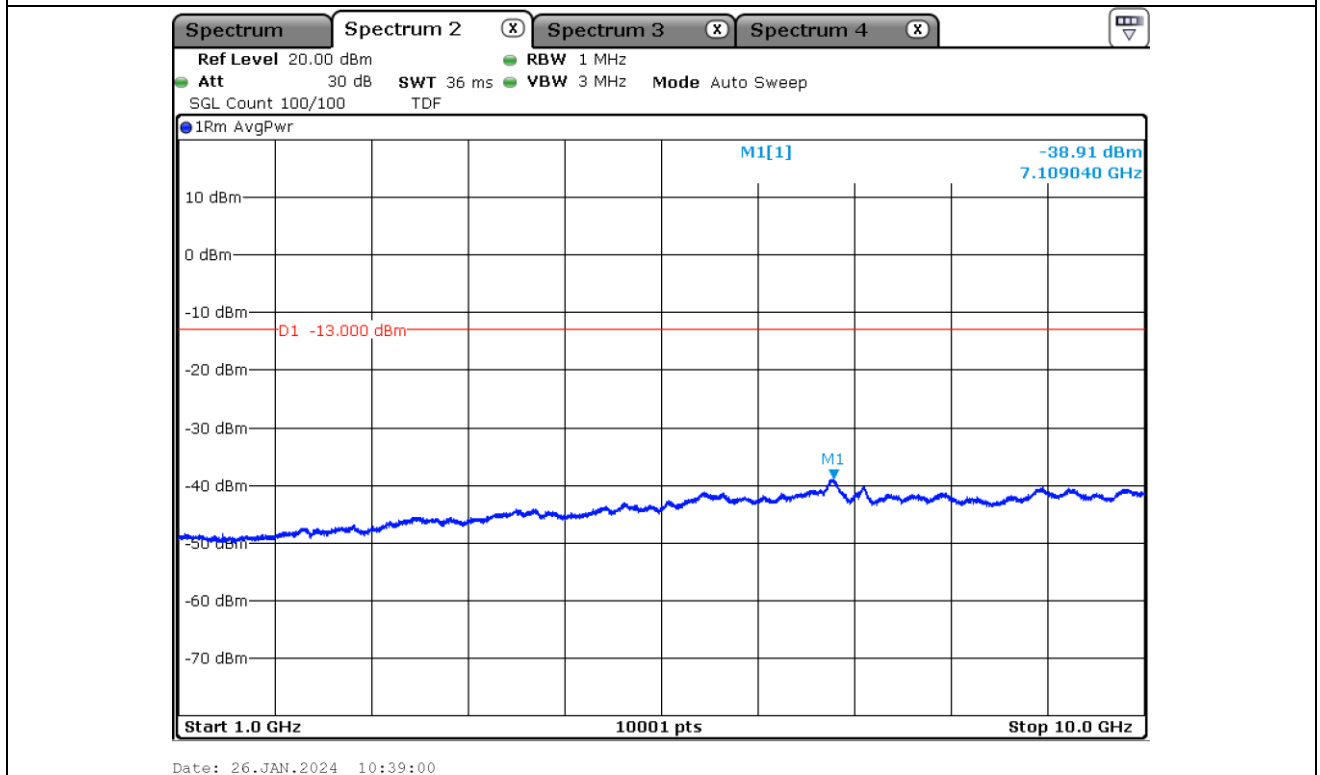
High Channel

13.5.3 Test data for Band 12_Bandwidth 3 MHz_QPSK

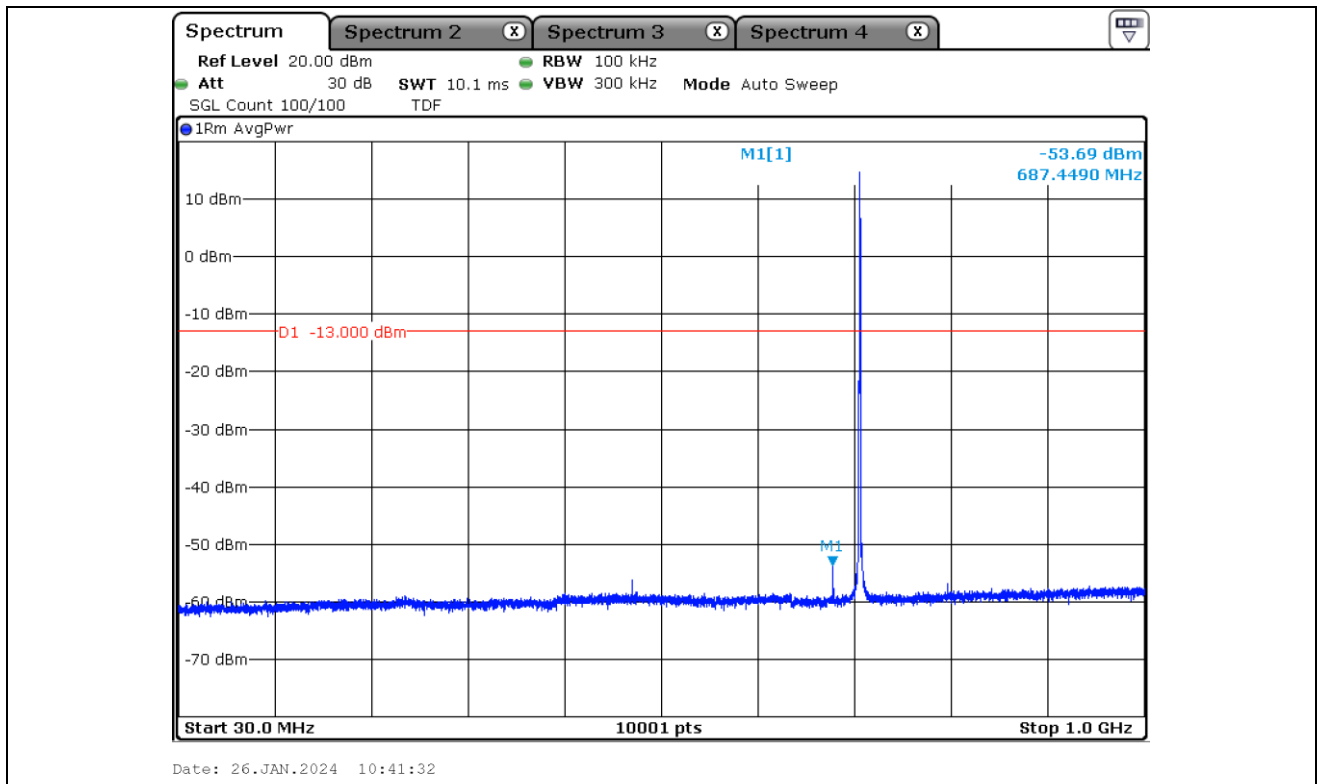




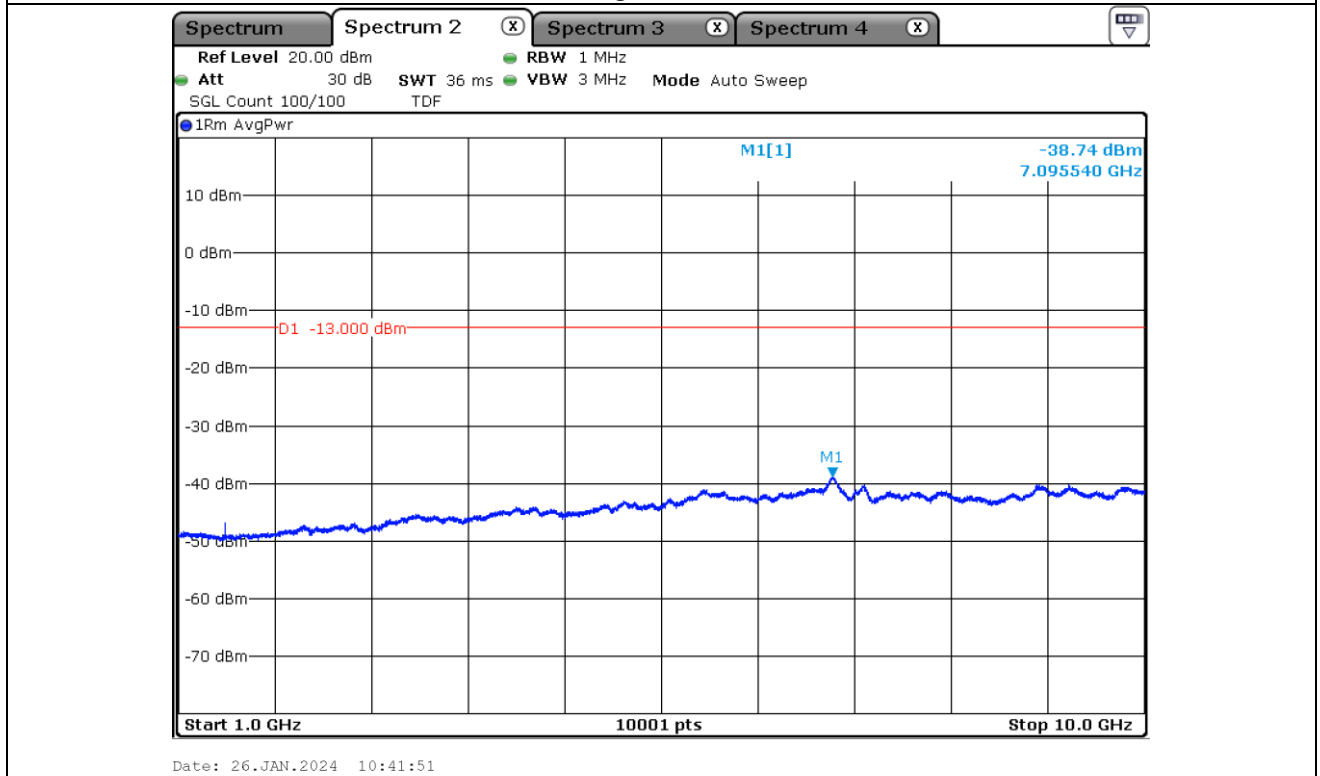
Midle Channel



Midle Channel

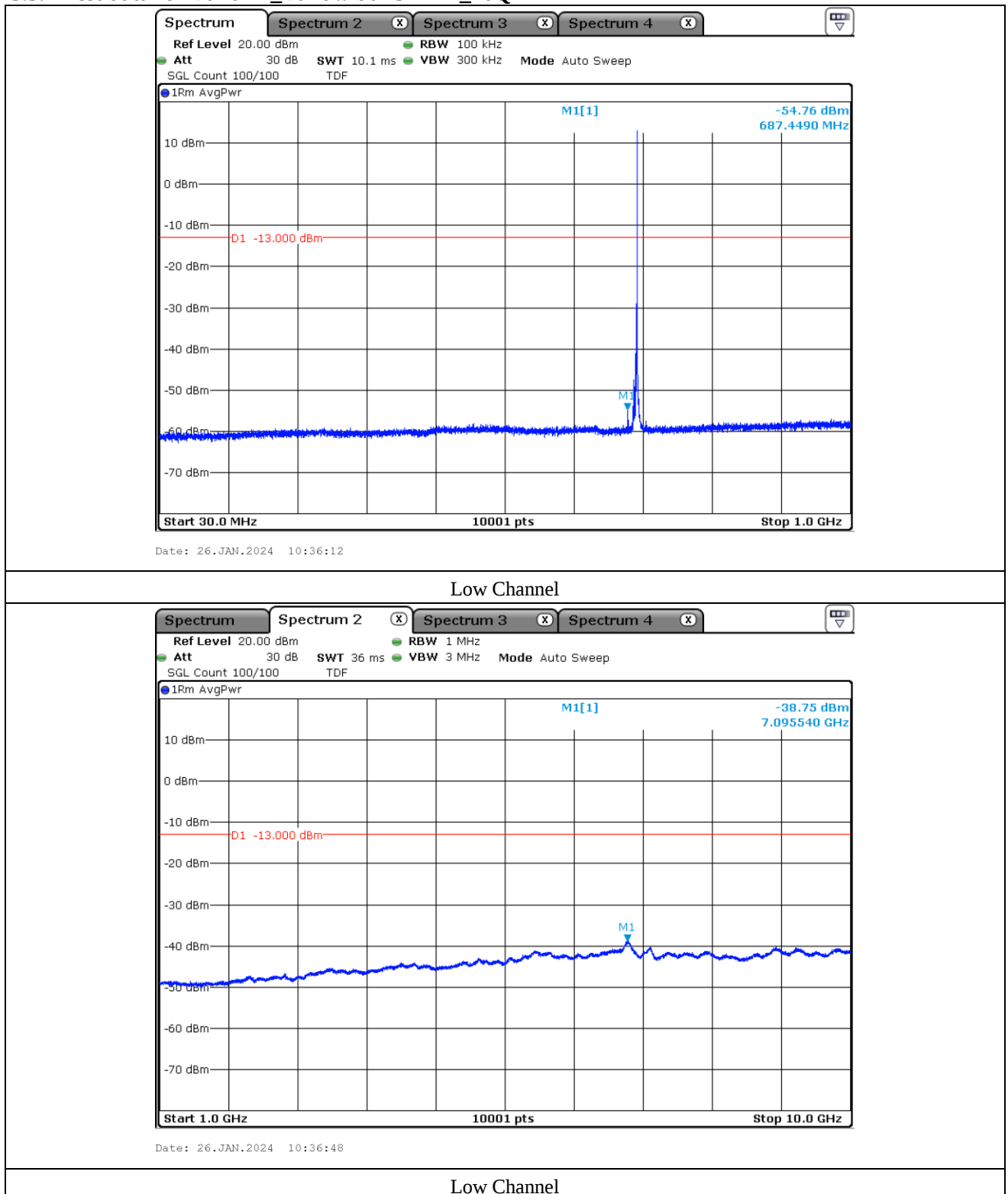


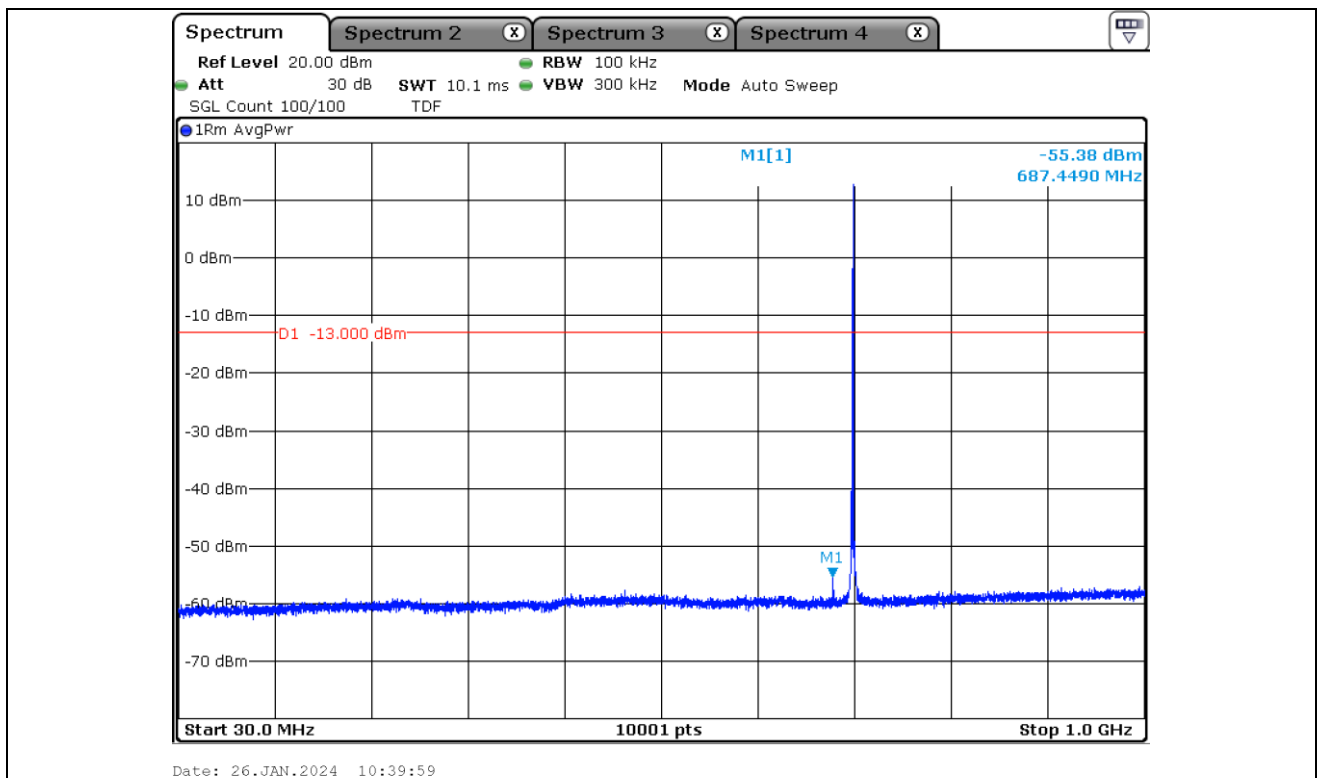
High Channel



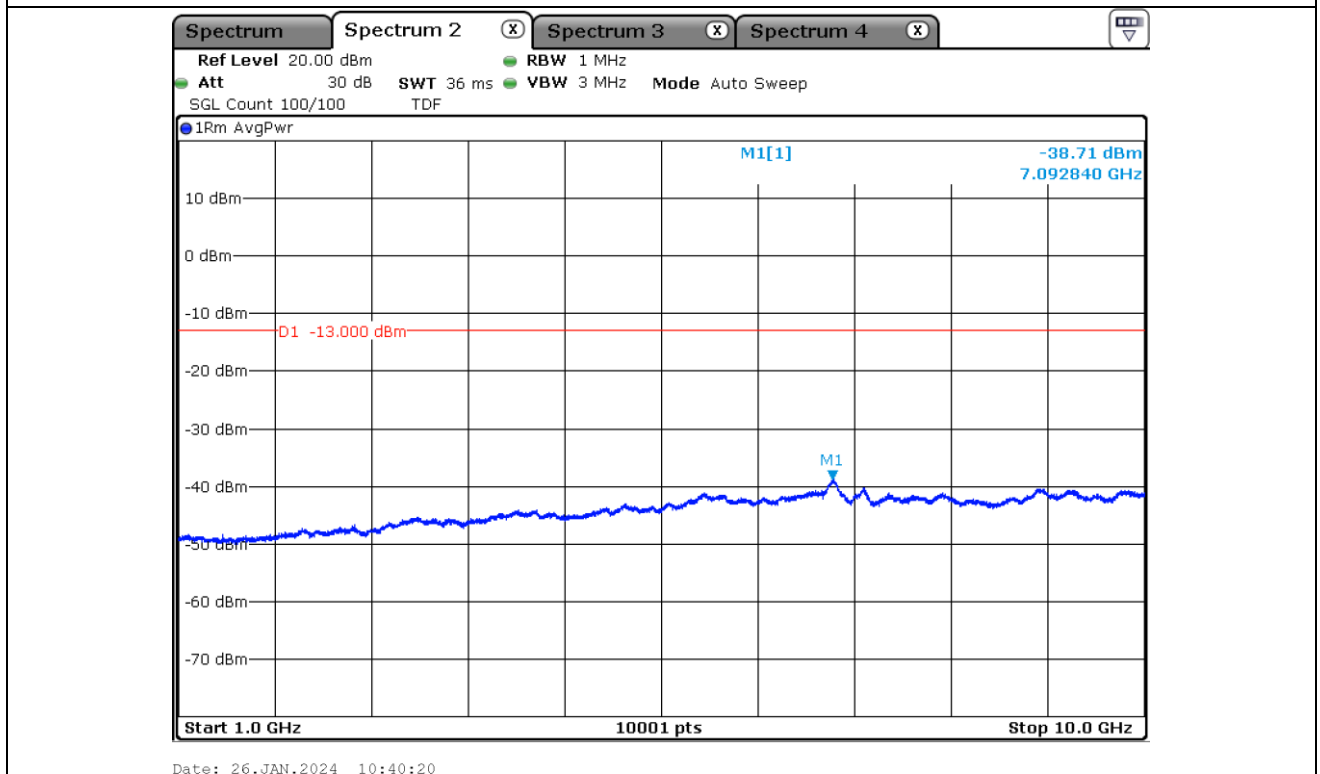
High Channel

13.5.4 Test data for Band 12_Bandwidth 3 MHz_16QAM

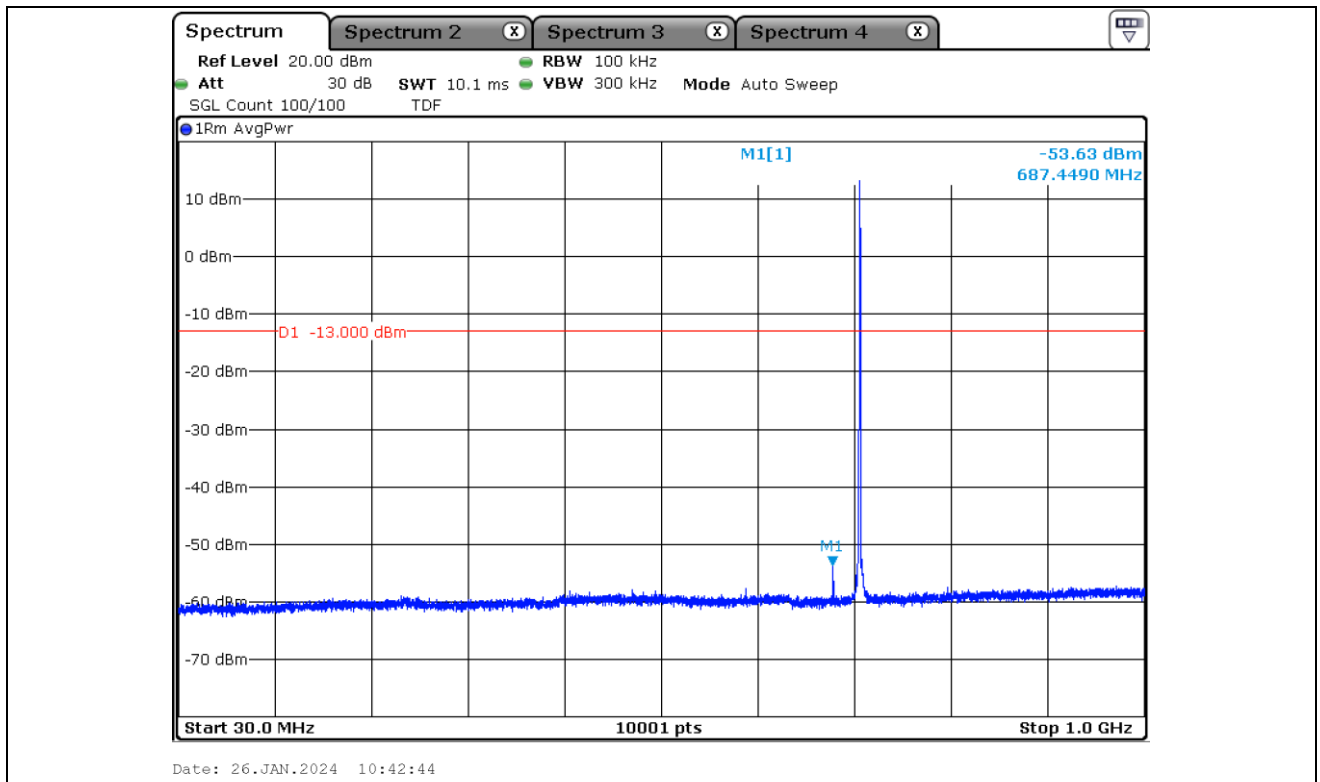




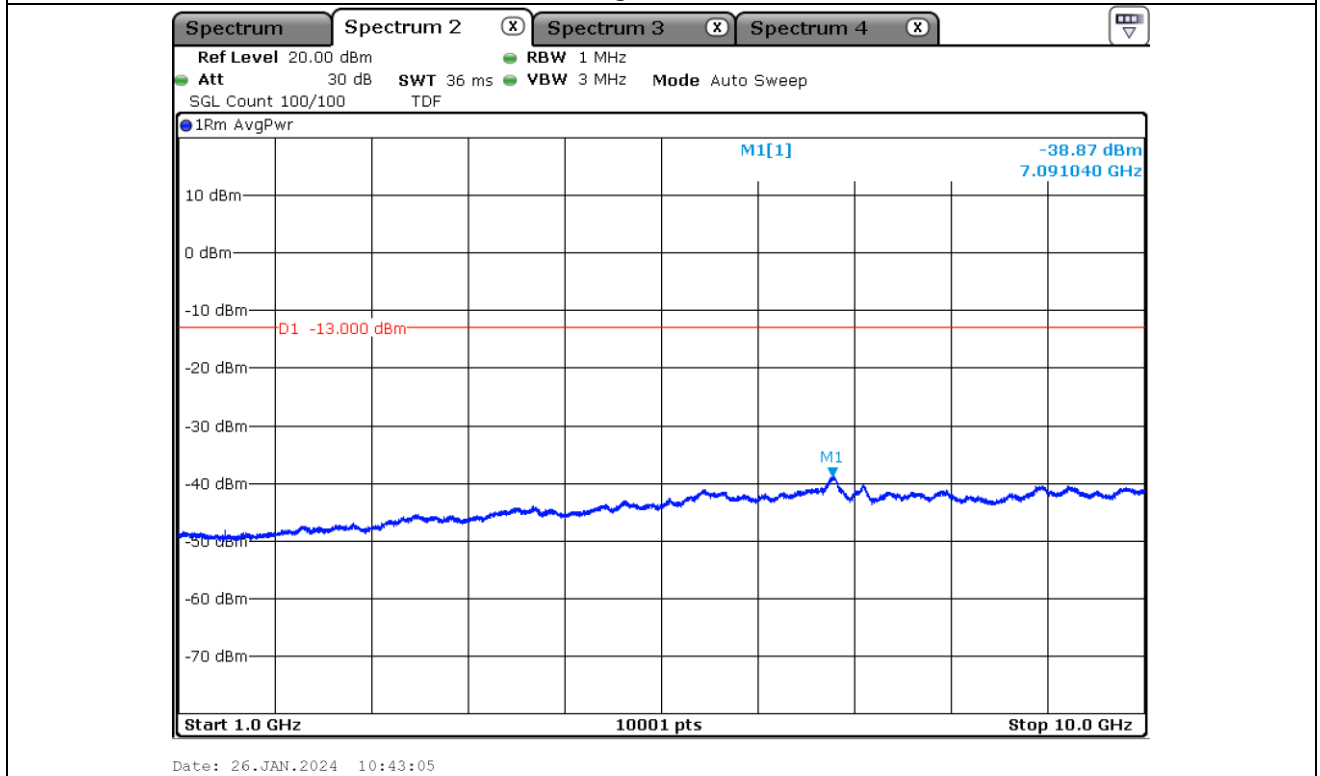
Midle Channel



Midle Channel

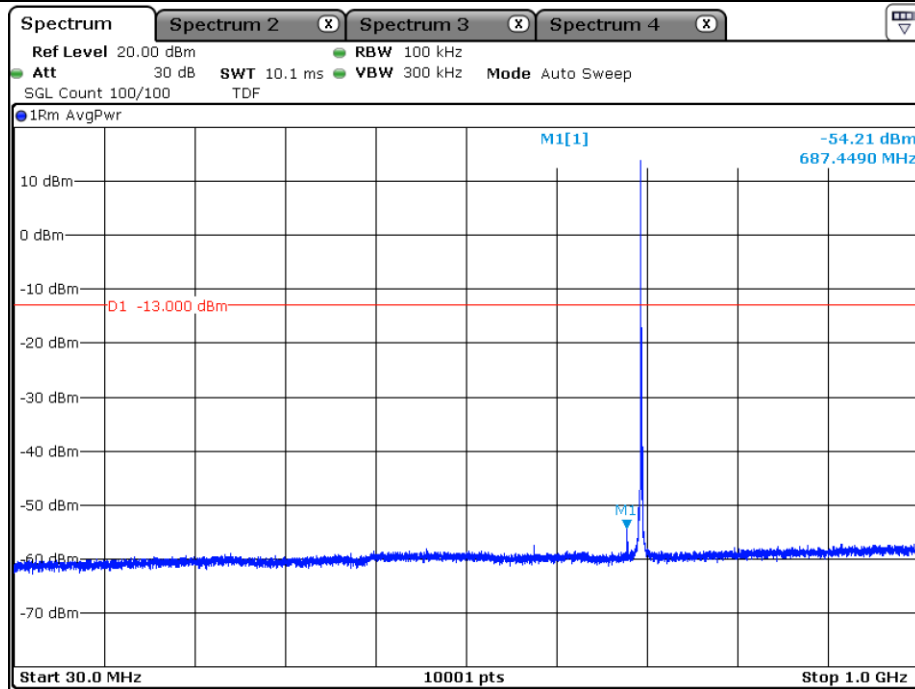


High Channel



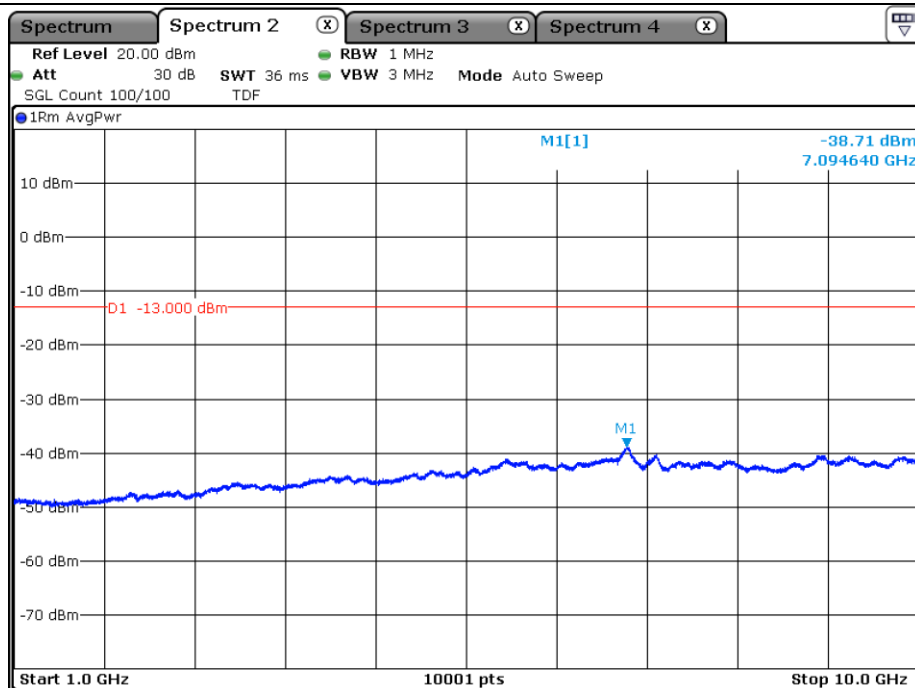
High Channel

13.5.5 Test data for Band 12_Bandwidth 5 MHz_QPSK



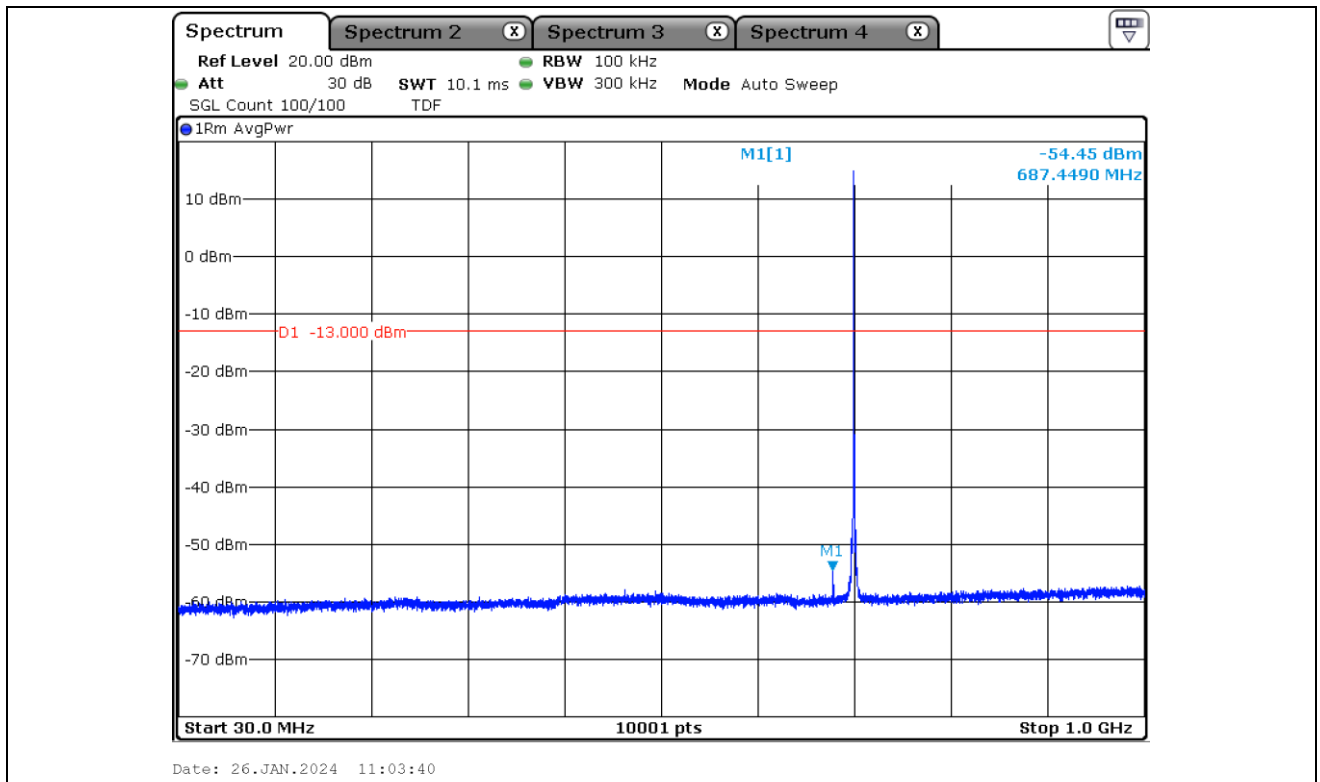
Date: 26.JAN.2024 11:00:15

Low Channel

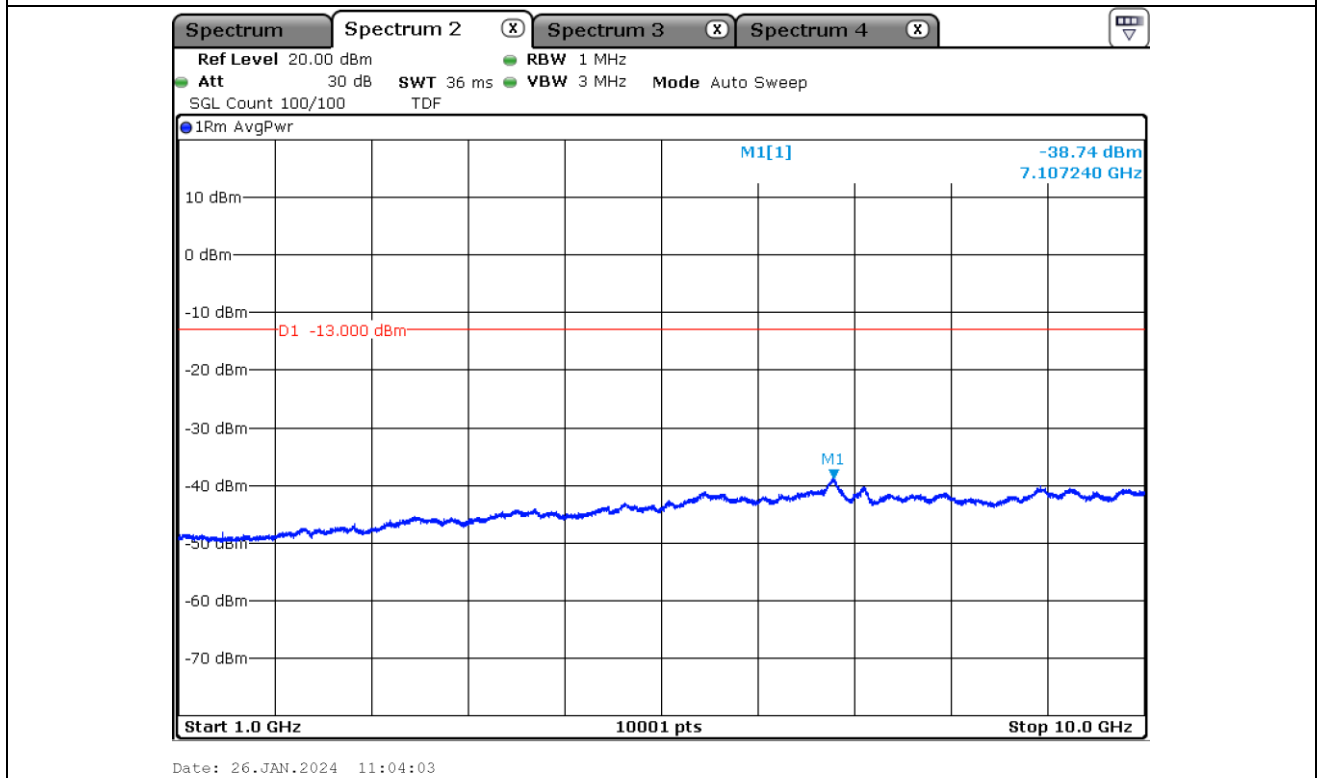


Date: 26.JAN.2024 11:00:51

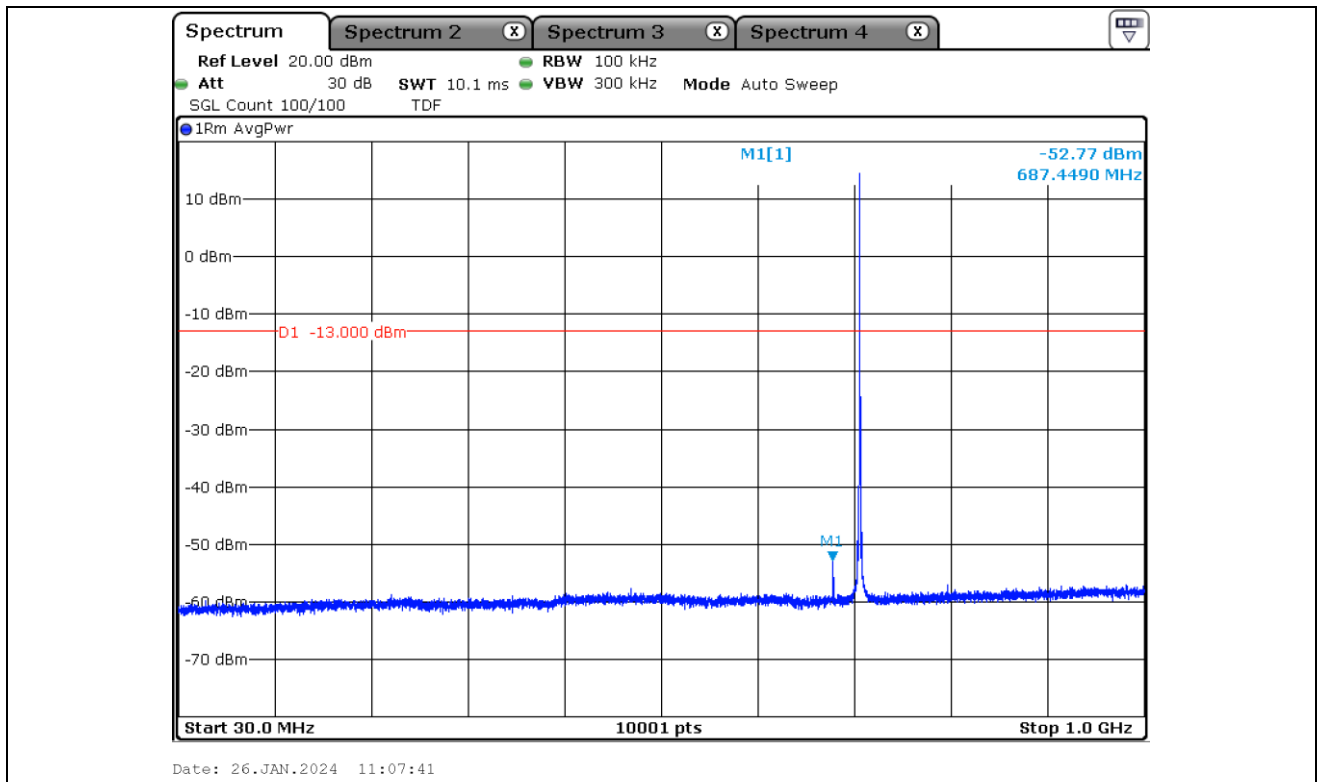
Low Channel



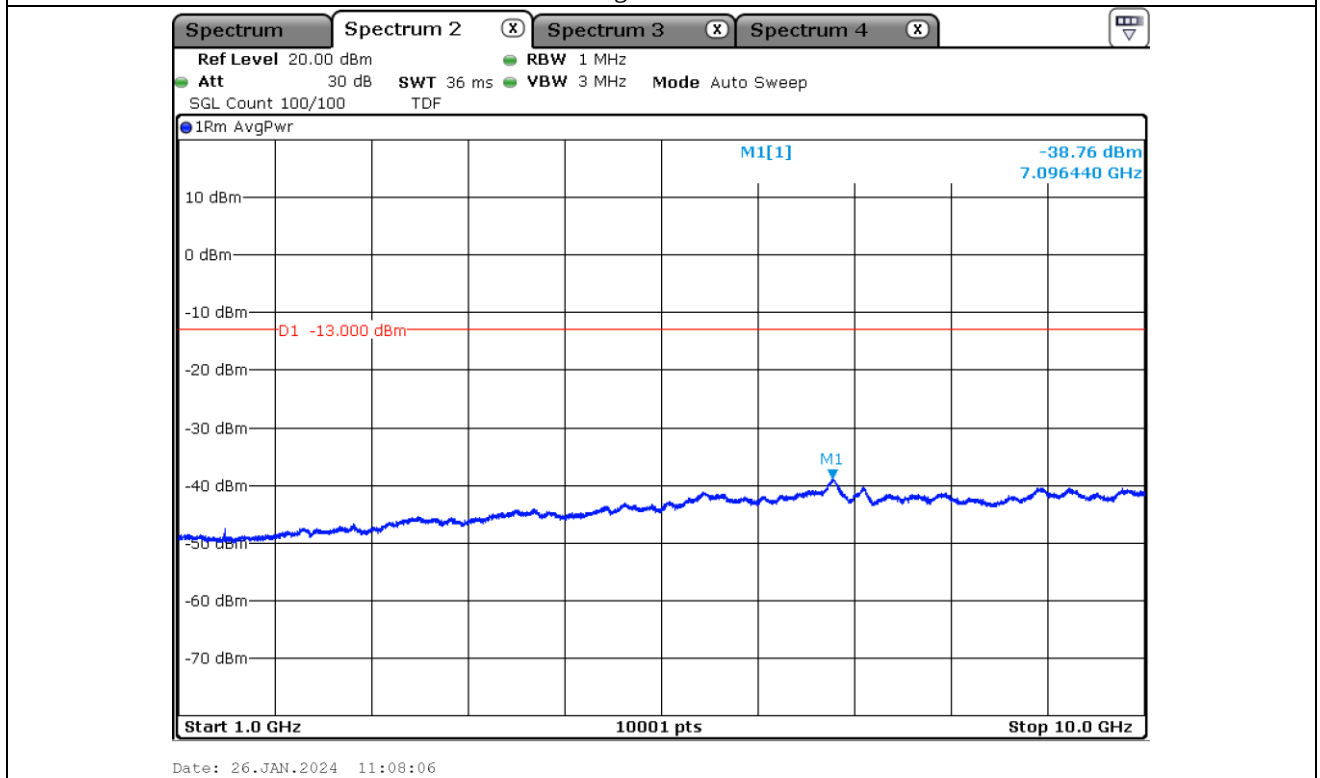
Midle Channel



Midle Channel

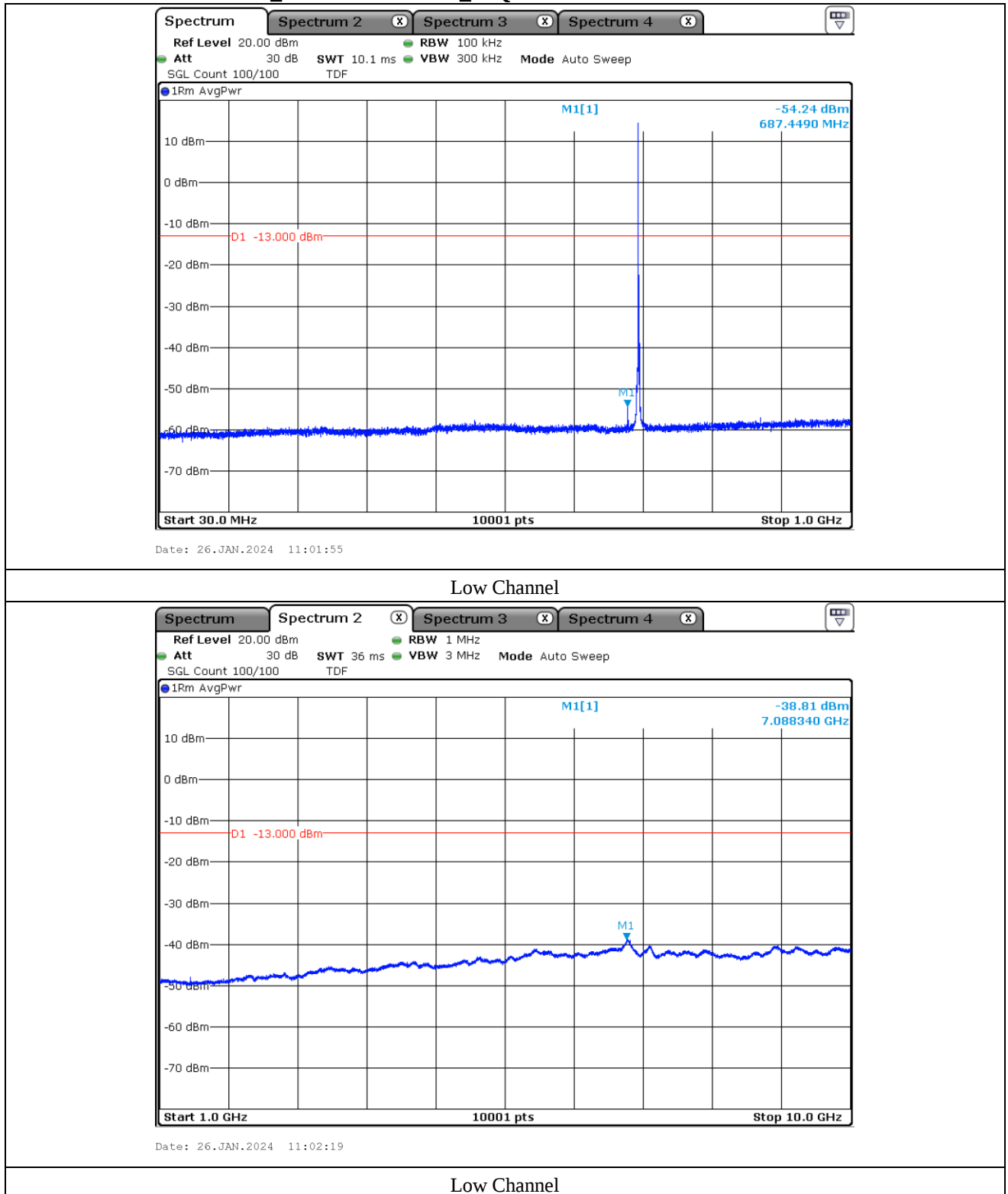


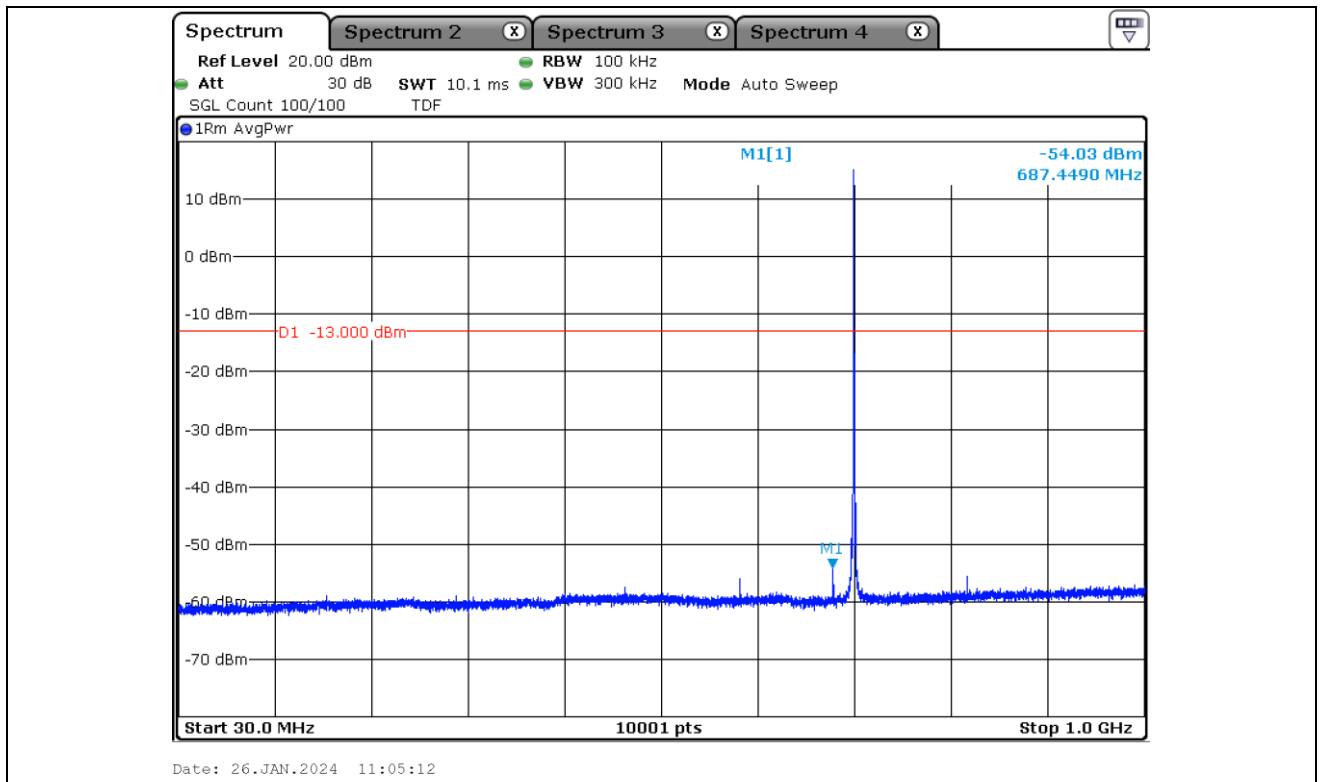
High Channel



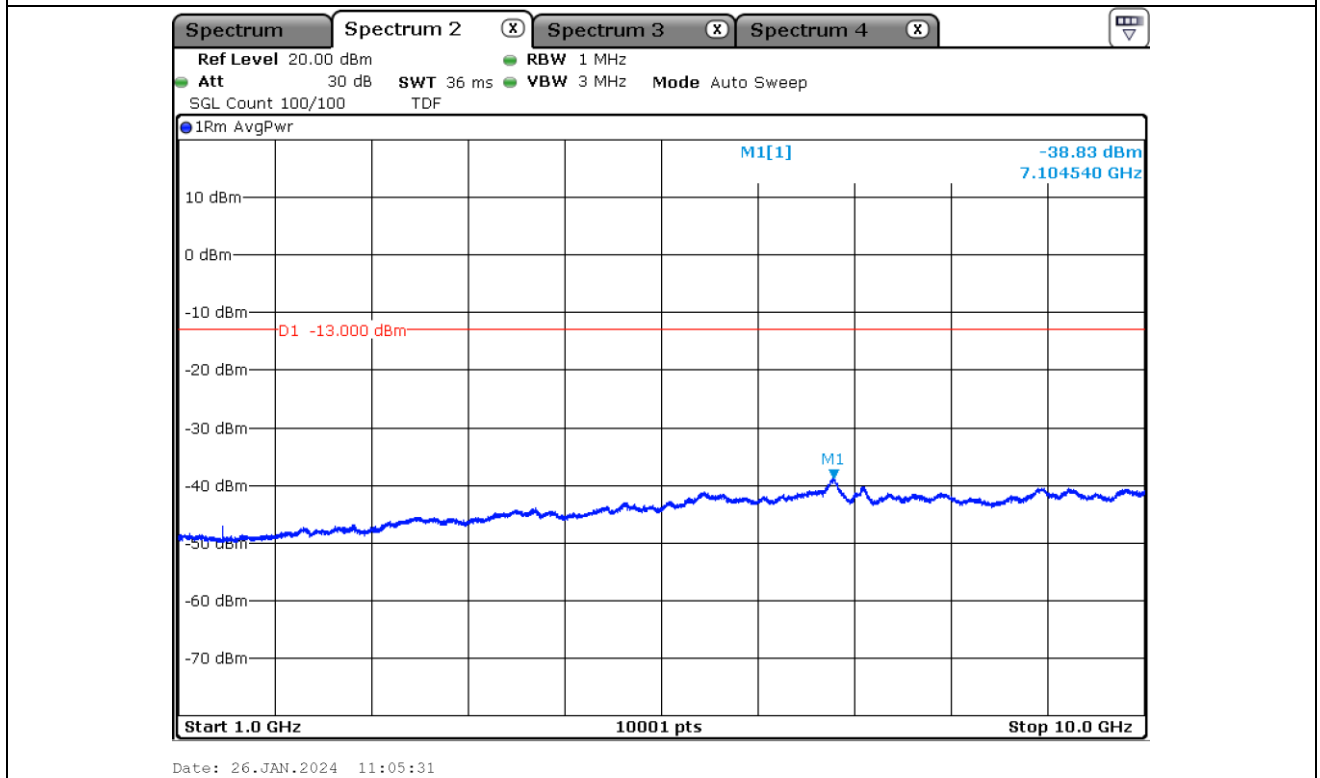
High Channel

13.5.6 Test data for Band 12_Bandwidth 5 MHz_16QAM

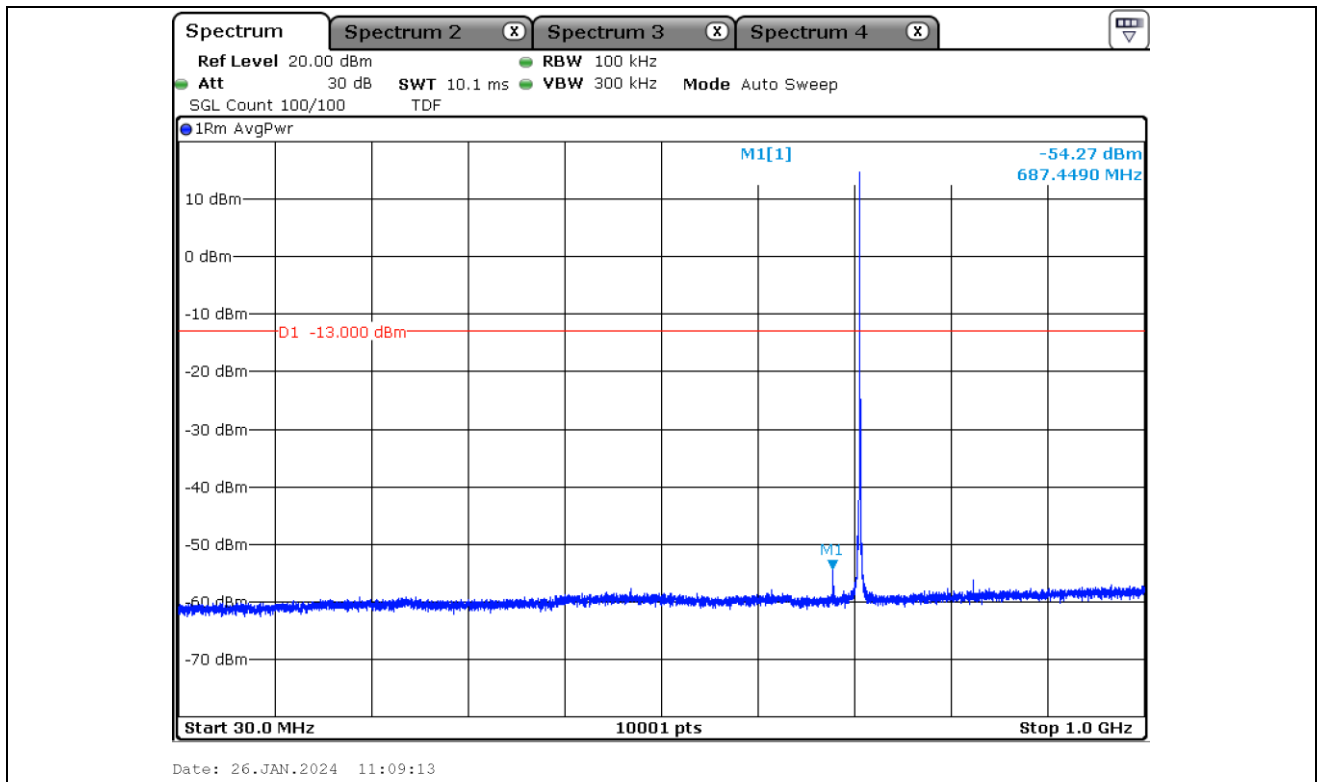




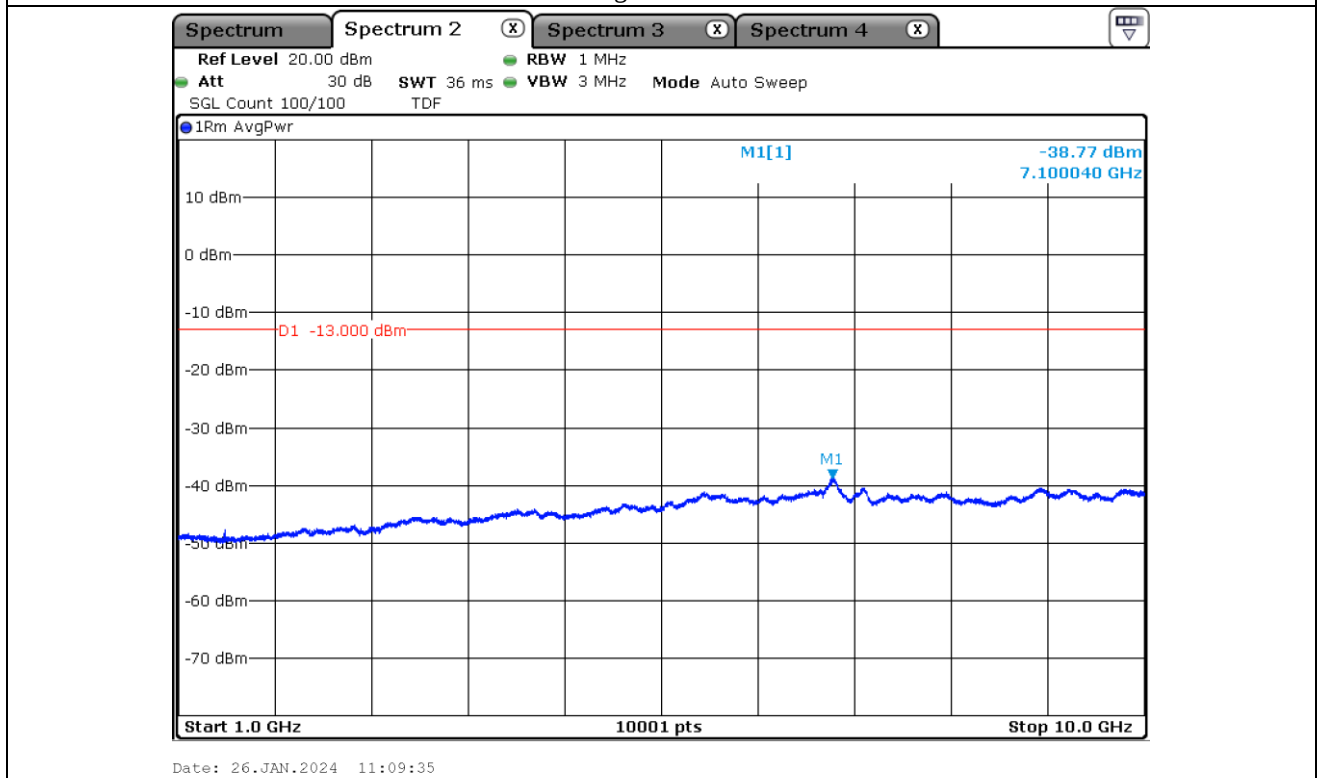
Midle Channel



Midle Channel

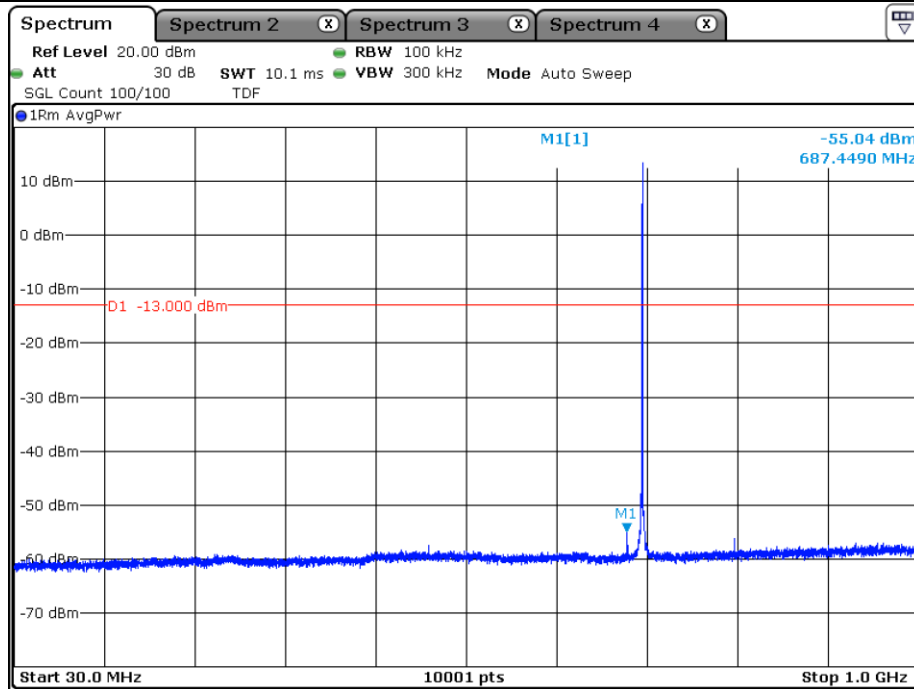


High Channel



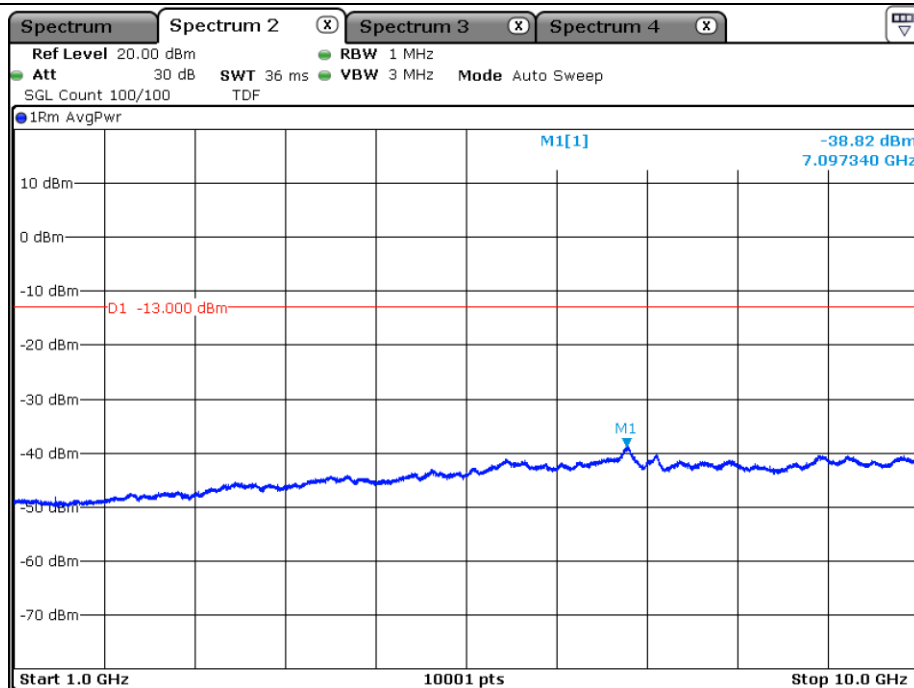
High Channel

13.5.7 Test data for Band 12_Bandwidth 10 MHz_QPSK



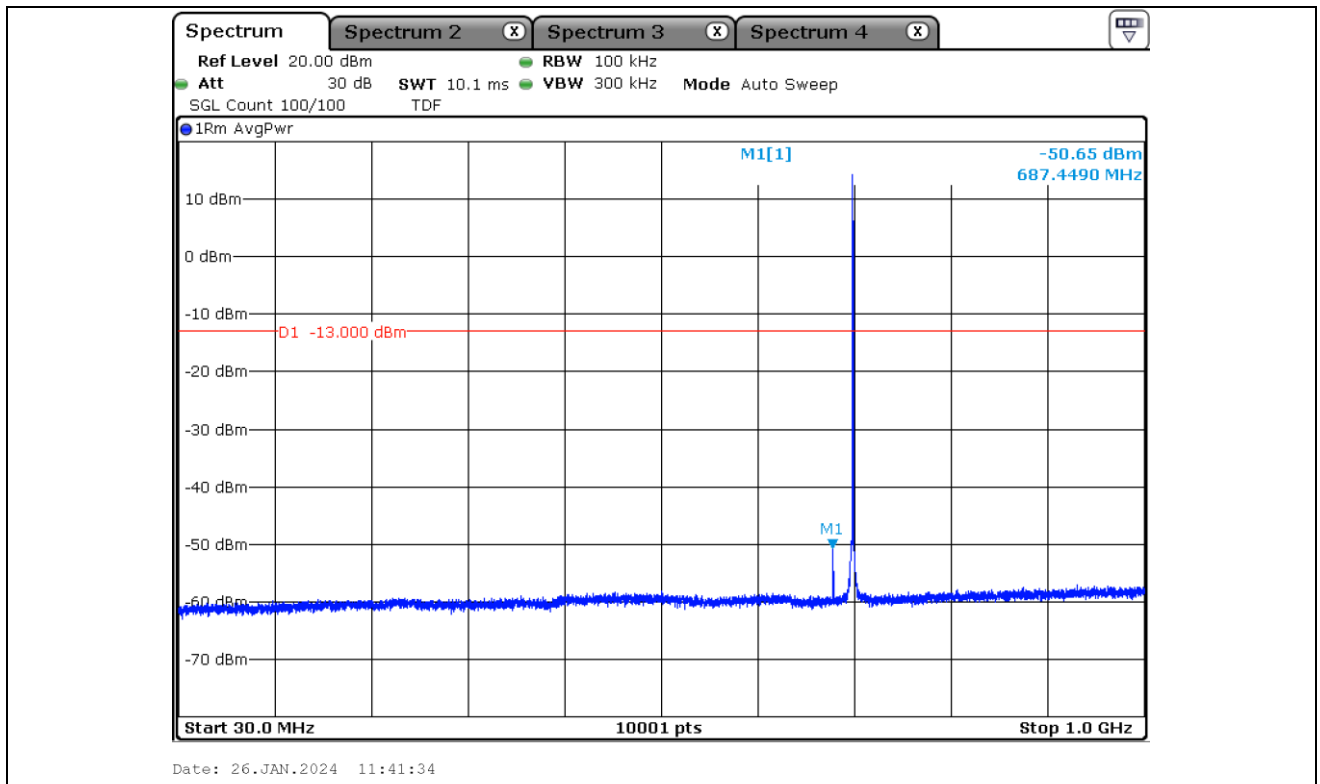
Date: 26.JAN.2024 11:38:13

Low Channel

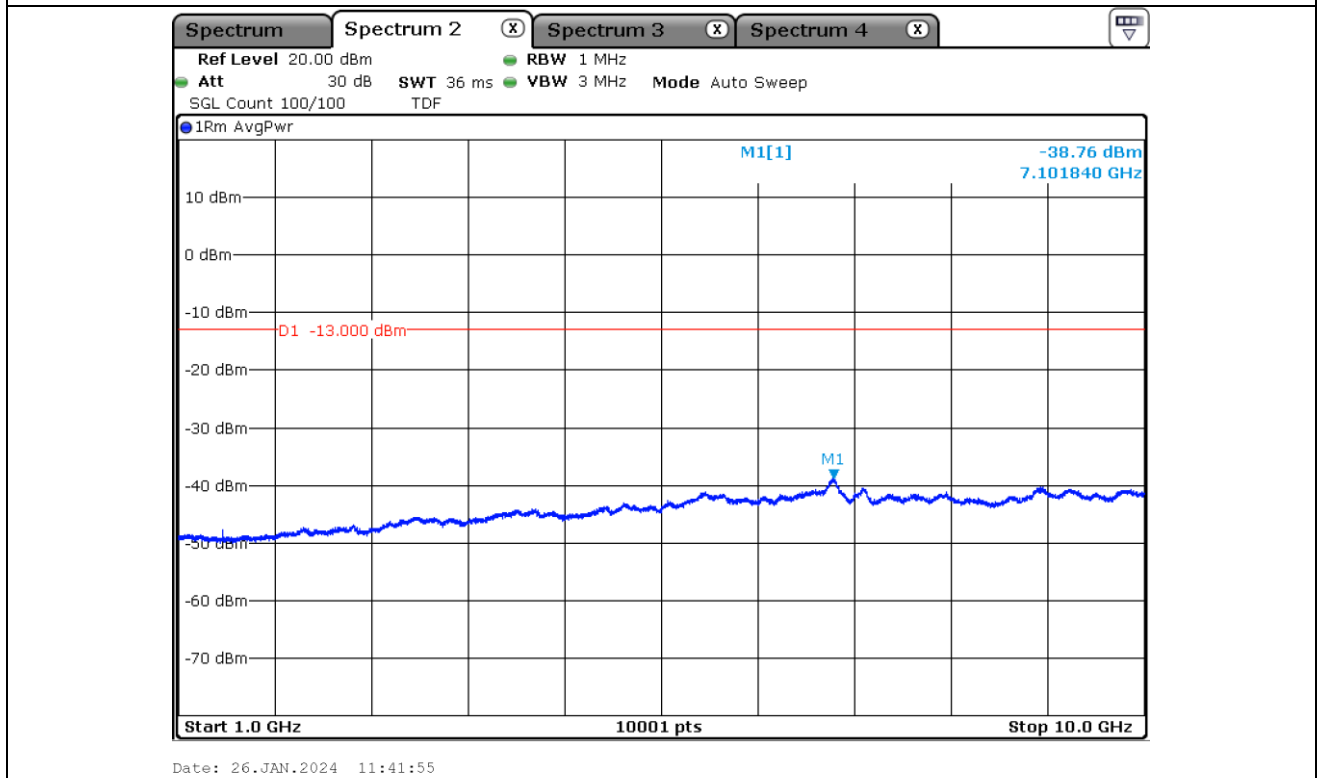


Date: 26.JAN.2024 11:38:41

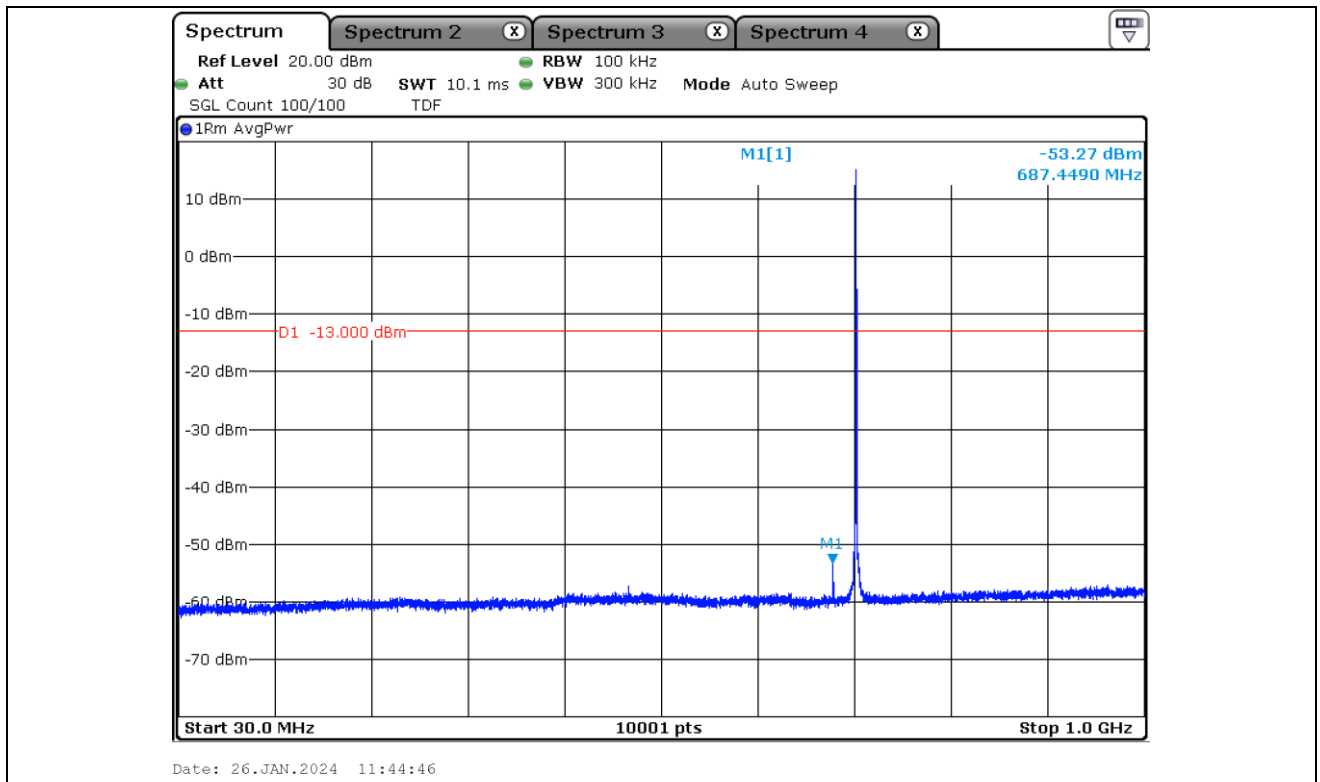
Low Channel



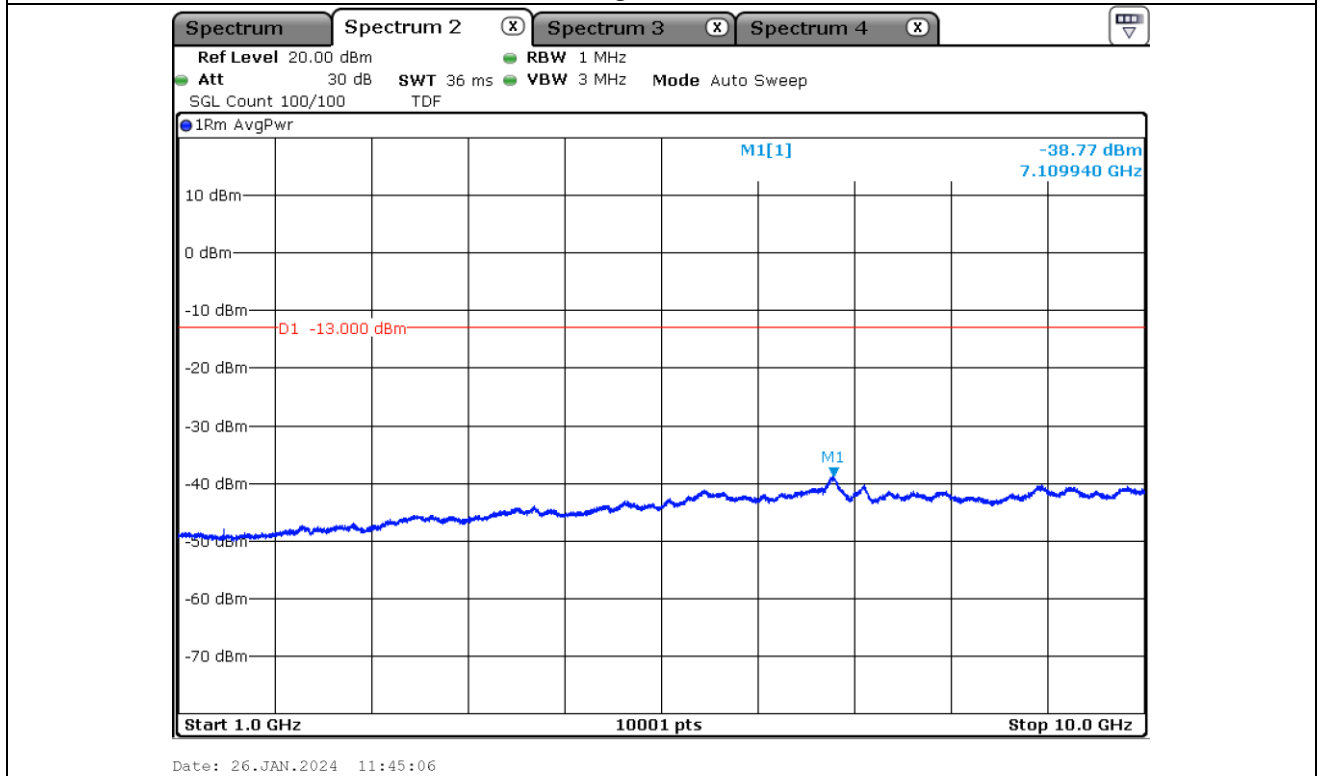
Midle Channel



Midle Channel

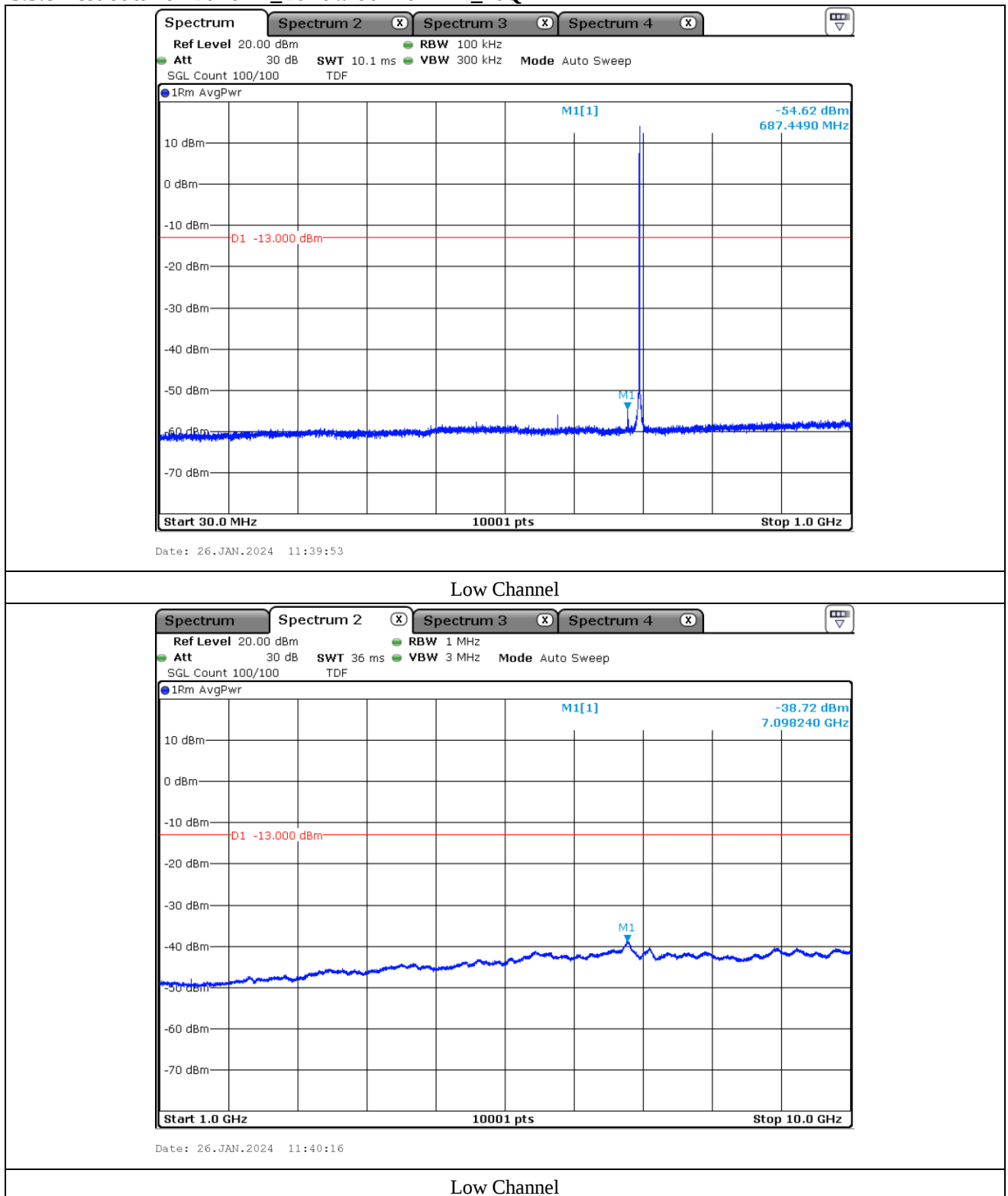


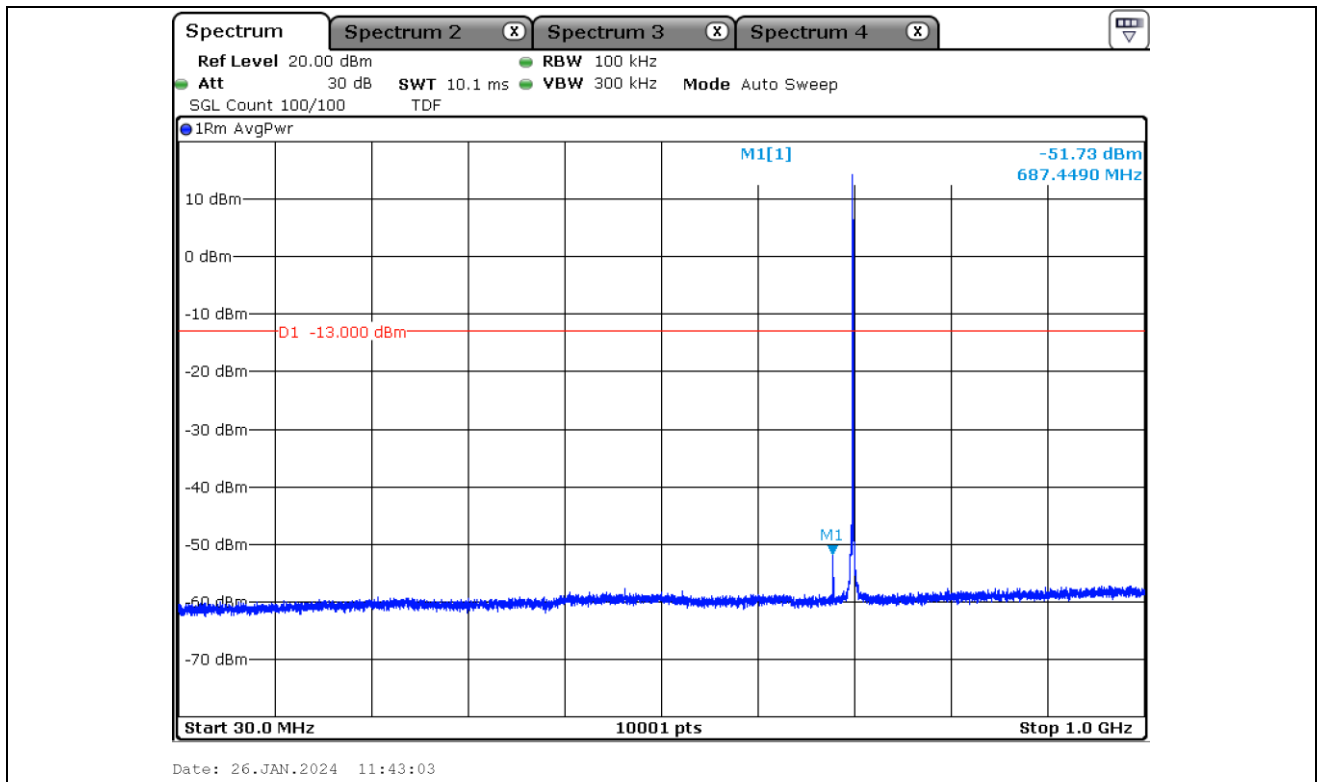
High Channel



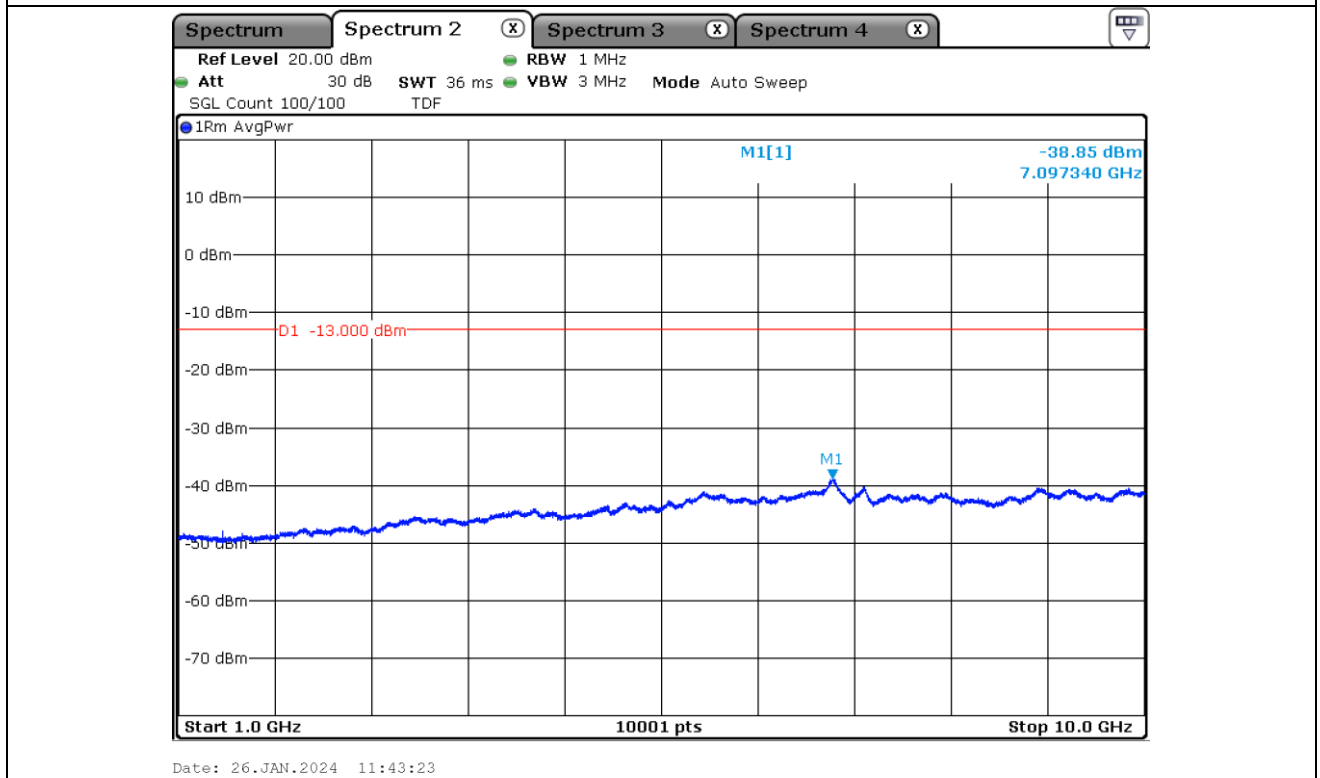
High Channel

13.5.8 Test data for Band 12_Bandwidth 10 MHz_16QAM

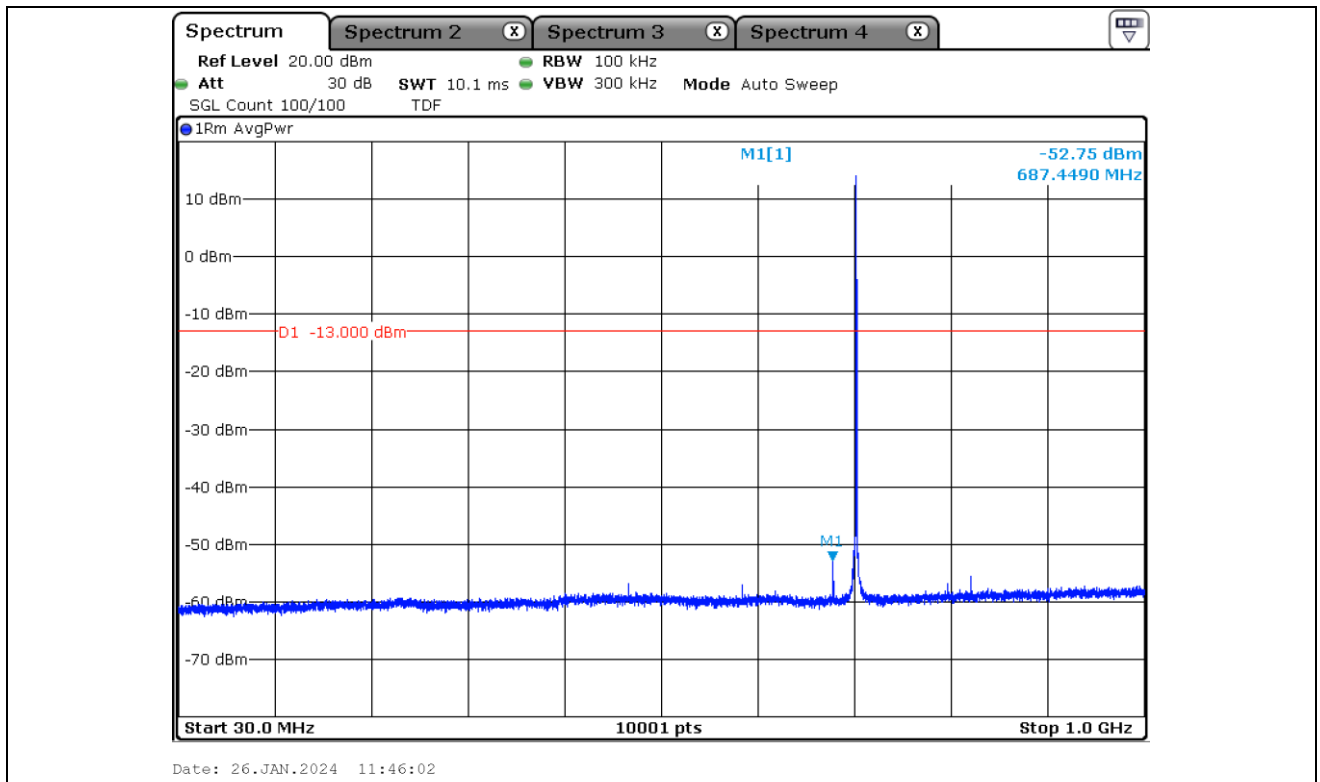




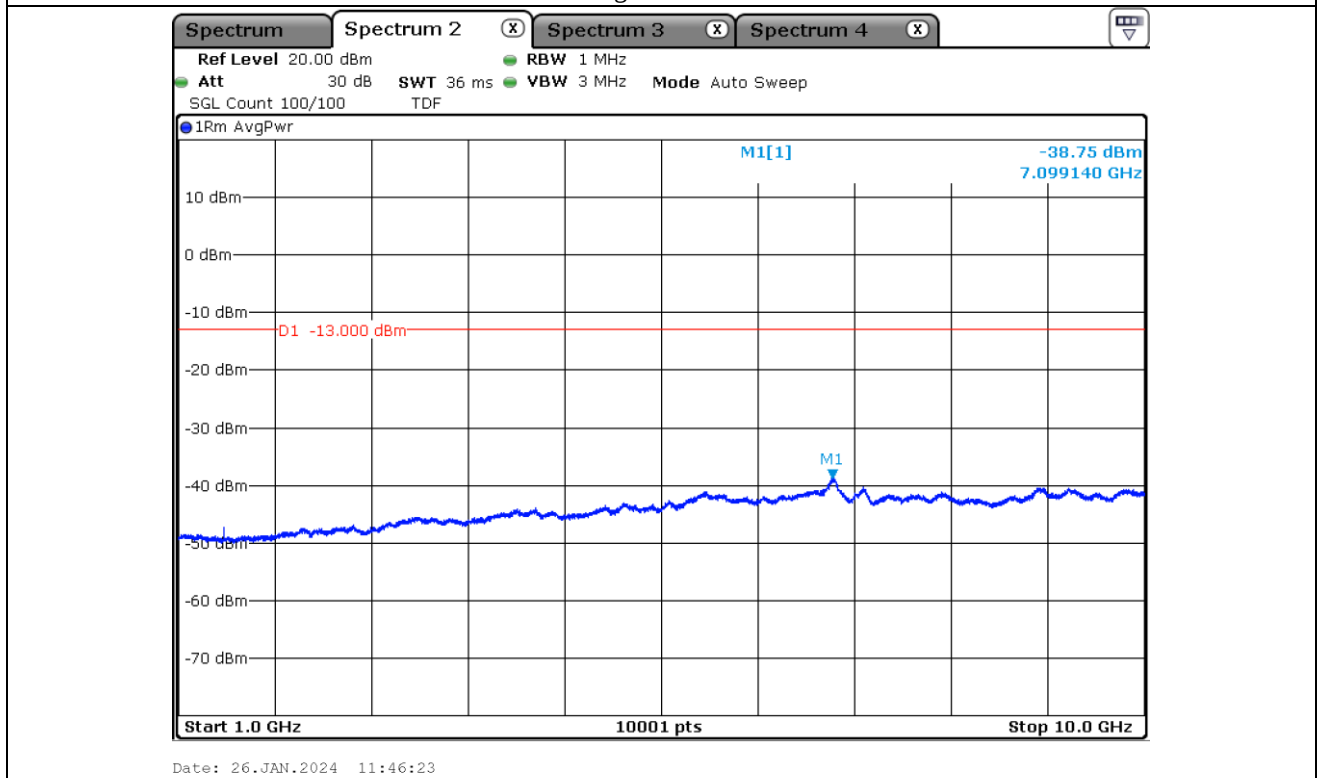
Midle Channel



Midle Channel



High Channel



High Channel

14. FREQUENCY STABILITY / VARIATION OF AMBIENT TEMPERATURE

14.1 Operating environment

Temperature : 22 °C
Relative humidity : 45 % R.H.

14.2 Test set-up

1. Frequency Stability (Voltage Variation)

+20 °C temperature and $\pm 15\%$ supply voltage variations. If a product is specified to operate over a range of input voltage then the -15% variation is applied to the lowermost voltage and the $+15\%$ is applied to the uppermost voltage.

- (1) Vary primary supply voltage from $\pm 15\%$ of the nominal value for other than hand carried battery equipment.
- (2) For hand carried, battery powered equipment, reduce primary supply voltage to the battery-operating end point which shall be specified by the manufacturer.

2. Frequency Stability (Temperature Variation)

Turn EUT off and set chamber temperature to $-30\text{ }^{\circ}\text{C}$ and then allow sufficient time (approximately 20 to 30 minutes after chamber reach the assigned temperature) for EUT to stabilize. Turn ON EUT and measure the EUT operating frequency and then turn off the EUT after the measurement. The temperature in the chamber was raised $10\text{ }^{\circ}\text{C}$ step from $-30\text{ }^{\circ}\text{C}$ to $+50\text{ }^{\circ}\text{C}$. Repeat above method for frequency measurements every $10\text{ }^{\circ}\text{C}$ step and then record all measured frequencies on each temperature step.

14.3 Test Date

January 15, 2024 ~ February 08, 2024

14.4 Test data for Voltage(V)

Power (VDC)	LTE Band 12			
	Channel Bandwidth : 1.4 MHz			
	Low Channel (MHz)		High Channel (MHz)	
	699.700 000		715.300 000	
	Frequency	Frequency Error	Frequency	Frequency Error
	(MHz)	(ppm)	(MHz)	(ppm)
3.80	699.699 989	-0.02	715.299 989	-0.02
3.23	699.699 991	-0.01	715.299 993	-0.01
4.37	699.699 993	-0.01	715.299 988	-0.02

Power (VDC)	LTE Band 12			
	Channel Bandwidth : 3 MHz			
	Low Channel (MHz)		High Channel (MHz)	
	700.500 000		714.500 000	
	Frequency	Frequency Error	Frequency	Frequency Error
	(MHz)	(ppm)	(MHz)	(ppm)
3.80	700.499 994	-0.01	714.499 993	-0.01
3.23	700.499 993	-0.01	714.499 992	-0.01
4.37	700.499 992	-0.01	714.499 991	-0.01

Power (VDC)	LTE Band 12			
	Channel Bandwidth : 5 MHz			
	Low Channel (MHz)		High Channel (MHz)	
	701.500 000		713.500 000	
	Frequency	Frequency Error	Frequency	Frequency Error
	(MHz)	(ppm)	(MHz)	(ppm)
3.80	701.499 996	-0.01	713.499 993	-0.01
3.23	701.499 995	-0.01	713.499 991	-0.01
4.37	701.499 996	-0.01	713.499 993	-0.01

Power (VDC)	LTE Band 12			
	Channel Bandwidth : 10 MHz			
	Low Channel (MHz)		High Channel (MHz)	
	704.000 000		711.000 000	
	Frequency	Frequency Error	Frequency	Frequency Error
	(MHz)	(ppm)	(MHz)	(ppm)
3.80	703.999 996	-0.01	710.999 985	-0.02
3.23	703.999 994	-0.01	710.999 986	-0.02
4.37	703.999 995	-0.01	710.999 991	-0.01

14.5 Test data for Temperature(°C)

Temperature (°C)	LTE Band 12			
	Channel Bandwidth: 1.4 MHz			
	Low Channel (MHz)		High Channel (MHz)	
	699.700 000		715.300 000	
	Frequency	Frequency Error	Frequency	Frequency Error
	(MHz)	(ppm)	(MHz)	(ppm)
-30	699.699 995	-0.01	715.299 994	-0.01
-20	699.699 997	0.00	715.299 997	0.00
-10	699.699 998	0.00	715.299 998	0.00
0	699.700 003	0.00	715.300 003	0.00
10	699.699 997	0.00	715.299 998	0.00
20	699.699 989	-0.02	715.299 989	-0.02
30	699.699 988	-0.02	715.299 991	-0.01
40	699.699 995	-0.01	715.299 998	0.00
50	699.699 998	0.00	715.300 003	0.00

Temperature (°C)	LTE Band 12			
	Channel Bandwidth: 3 MHz			
	Low Channel (MHz)		High Channel (MHz)	
	700.500 000		714.500 000	
	Frequency	Frequency Error	Frequency	Frequency Error
	(MHz)	(ppm)	(MHz)	(ppm)
-30	700.499 994	-0.01	714.499 988	-0.02
-20	700.500 011	0.02	714.499 998	0.00
-10	700.500 009	0.01	714.500 001	0.00
0	700.500 008	0.01	714.500 006	0.01
10	700.500 003	0.00	714.500 003	0.00
20	700.499 994	-0.01	714.499 993	-0.01
30	700.499 998	0.00	714.499 995	-0.01
40	700.500 001	0.00	714.500 001	0.00
50	700.500 005	0.01	714.500 006	0.01

Temperature (°C)	LTE Band 12			
	Channel Bandwidth: 5 MHz			
	Low Channel (MHz)		High Channel (MHz)	
	701.500 000		713.500 000	
	Frequency	Frequency Error	Frequency	Frequency Error
	(MHz)	(ppm)	(MHz)	(ppm)
-30	701.499 999	0.00	713.500 001	0.00
-20	701.500 013	0.02	713.500 002	0.00
-10	701.500 009	0.01	713.500 008	0.01
0	701.500 008	0.01	713.500 011	0.02
10	701.500 003	0.00	713.500 002	0.00
20	701.499 996	-0.01	713.499 993	-0.01
30	701.499 996	-0.01	713.499 980	-0.03
40	701.499 995	-0.01	713.499 989	-0.02
50	701.499 998	0.00	713.499 994	-0.01

Temperature (°C)	LTE Band 12			
	Channel Bandwidth: 10 MHz			
	Low Channel (MHz)		High Channel (MHz)	
	704.000 000		711.000 000	
	Frequency	Frequency Error	Frequency	Frequency Error
	(MHz)	(ppm)	(MHz)	(ppm)
-30	703.999 999	0.00	711.000 002	0.00
-20	703.999 998	0.00	710.999 996	-0.01
-10	704.000 004	0.01	711.000 005	0.01
0	704.000 014	0.02	711.000 012	0.02
10	704.000 006	0.01	711.000 004	0.01
20	703.999 996	-0.01	710.999 985	-0.02
30	703.999 986	-0.02	710.999 989	-0.02
40	703.999 993	-0.01	710.999 995	-0.01
50	704.000 009	0.01	711.000 009	0.01

15. LIST OF TEST EQUIPMENT

Model Number	Manufacturer	Description	Serial Number	Last Cal.(Interval)
FSVA40	Rohde & Schwarz	Signal Analyzer	101593	Jan. 15, 2024 (1Y)
152610	KRYTAR	Directional Coupler	214012	Jan. 17, 2024 (1Y)
MT8821C	ANRITSU	Radio Communication Analyzer	6261849029	Jul. 14, 2023 (1Y)
E3632A	Agilent	DC Power Supply	MY50370016	Jan. 15, 2024 (1Y)
PSL-2KP	ESPEC	Environmental Test Chamber	14009407	Jan. 15, 2024 (1Y)
ESU	Rohde & Schwarz	EMI Test Receiver	100261	Mar. 06, 2023 (1Y)
310N	Sonoma Instrument	AMPLIFIER	392756	Jan. 16, 2024 (1Y)
SCU18	Rohde & Schwarz	Signal Conditioning unit	102266	Jan. 16, 2024 (1Y)
SCU40A	Rohde & Schwarz	Signal Conditioning unit	100436	Jan. 23, 2024 (1Y)
FMZB1513	Schwarzbeck	Loop Antenna	50841	Mar. 24, 2022 (2Y)
VULB9163	Schwarzbeck	TRILOG Broadband Antenna	777	Jan. 26, 2024 (2Y)
HLP-2008	TDK RF Solutions	Hybrid Antenna	131316	Mar. 07, 2022 (2Y)
BBHA9120D	Schwarzbeck	Horn Antenna	9120D-1349	Jul. 04, 2023 (1Y)
BBHA9120D	Schwarzbeck	Horn Antenna	9120D-1366	Jun. 22, 2023 (1Y)
BBHA9170	Schwarzbeck	Horn Antenna	BBHA9170178	Jan. 04, 2024 (1Y)
BBHA9170	Schwarzbeck	Horn Antenna	BBHA9170179	Jan. 23, 2024 (1Y)
HPF 1.1 GHz	Rohde & Schwarz	High Pass Filter	N/A	Jan. 15, 2024 (1Y)
HPF 3GHz	Rohde & Schwarz	High Pass Filter	N/A	Jan. 15, 2024 (1Y)
MA-4640-XPET	Innco Systems GmbH	Antenna Master	MA4640/652	N/A
DT2000-2t	Innco Systems GmbH	Turn Table	N/A	N/A