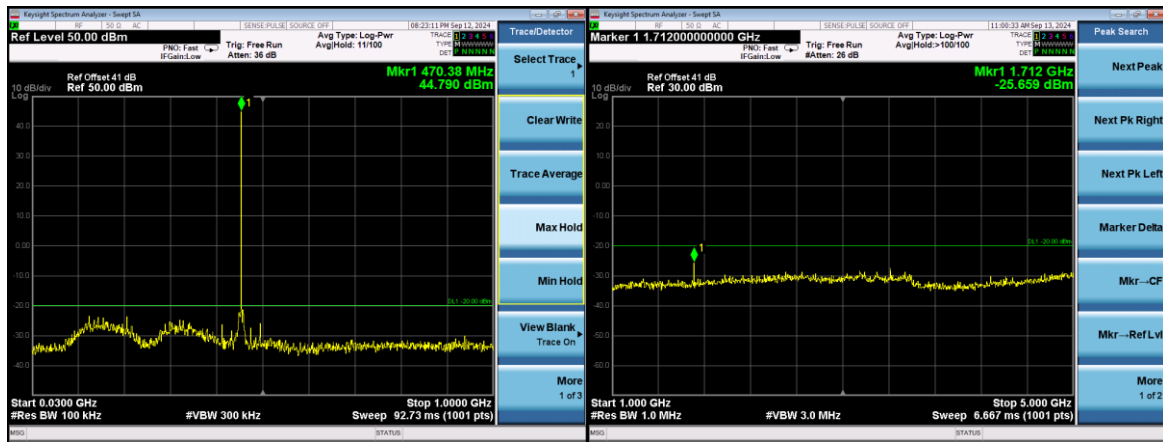
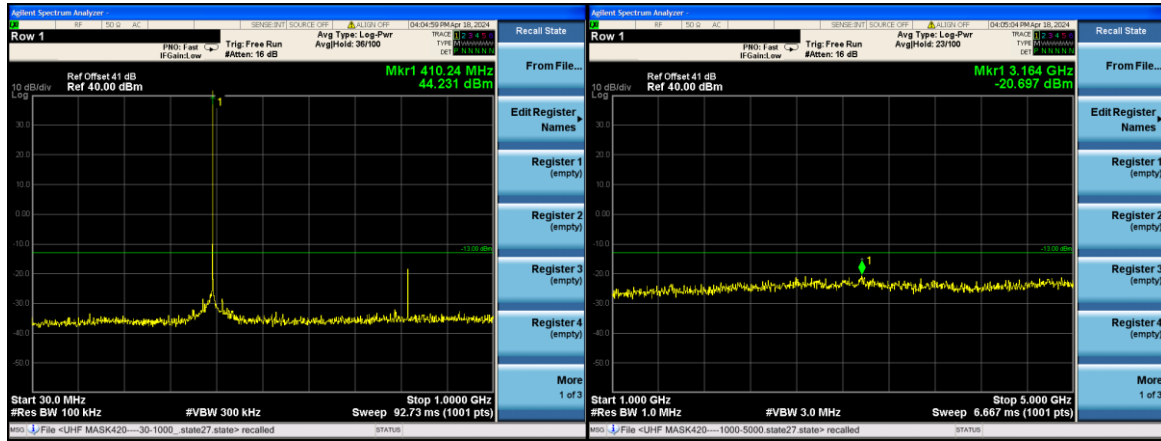


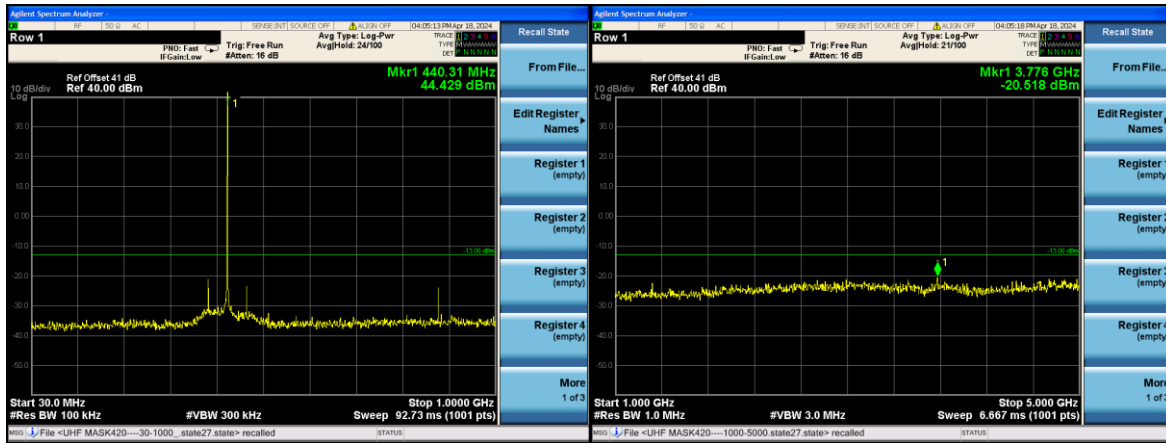


GMSK 25KHz Channel Spacing:

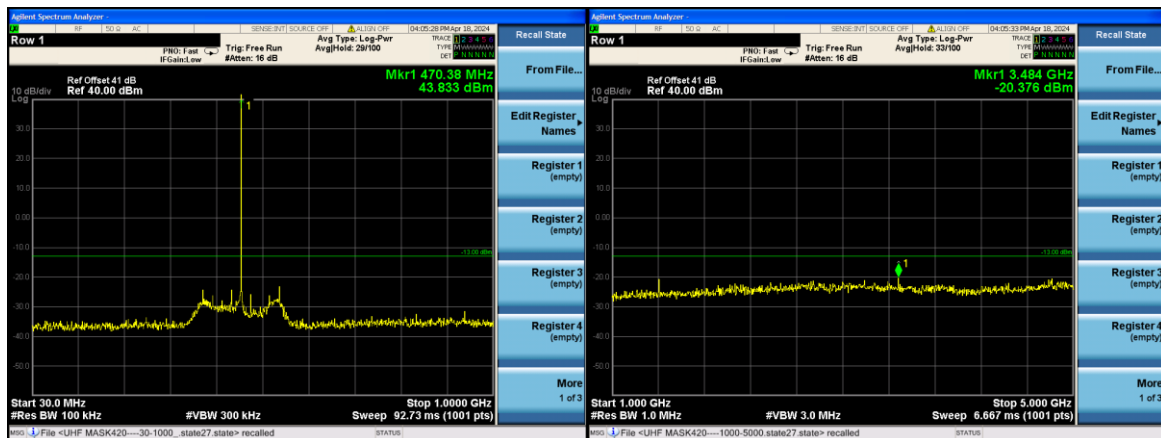
Low: 410.050MHz



Mid: 440.000MHz



High: 469.950MHz



3.4. Radiated Spurious Emission

3.4.1. Test Specification

Test Requirement:	FCC Part 90.210															
Test Method:	ANSI C63.26															
Measurement Distance:	3 m															
Antenna Polarization:	Horizontal & Vertical															
Operation mode:	Refer to item 4.1															
Receiver Setup:	<table><tr><td>Frequency</td><td>RBW</td><td>VBW</td></tr><tr><td>9kHz- 150kHz</td><td>200Hz</td><td>1kHz</td></tr><tr><td>150kHz- 30MHz</td><td>9kHz</td><td>30kHz</td></tr><tr><td>30MHz-1GHz</td><td>100KHz</td><td>300KHz</td></tr><tr><td>Above 1GHz</td><td>1MHz</td><td>3MHz</td></tr></table>	Frequency	RBW	VBW	9kHz- 150kHz	200Hz	1kHz	150kHz- 30MHz	9kHz	30kHz	30MHz-1GHz	100KHz	300KHz	Above 1GHz	1MHz	3MHz
Frequency	RBW	VBW														
9kHz- 150kHz	200Hz	1kHz														
150kHz- 30MHz	9kHz	30kHz														
30MHz-1GHz	100KHz	300KHz														
Above 1GHz	1MHz	3MHz														
Limit:	For equipment using 25 kHz channel spacing, on any frequency removed from the center of the authorized bandwidth by more than 250 percent of the authorized bandwidth: At least $43 + 10\log (P)$ dB. For equipment using 12.5 kHz channel spacing, on any frequency removed from the center of The authorized bandwidth by a displacement frequency (f_d in kHz) of more than 12.5 kHz: At least $50 + 10 \log(P)$ dB or 70 dB, whichever is the lesser attenuation. For equipment using 6.25 kHz channel spacing, On any frequency removed from the center of the authorized bandwidth by more than 4.6 kHz: At least $55 + 10 \log (P)$ or 65 dB, whichever is the lesser attenuation.															
Test setup:	Receiver Antenna Test Antenna RECEIVER UNDER TEST TURNTABLE SPECTRUM ANALYZER STANDARD TEST SITE															
Test Procedure:	The transmitter was placed on a wooden turntable, and it was transmitting into a non-radiating load, which was also placed on the turntable. The measurement antenna was placed at a distance of 3 meters from the EUT. During the tests, the antenna height and polarization as well as EUT azimuth were varied in order to identify the maximum level of emissions from the EUT .The test was performed by placing the EUT on 3-orthogonal axis.															

	The frequency range up to teeth harmonic of the fundamental frequency was investigated. Remove the EUT and replace it with substitution antenna. A signal generator was connected to the substitution antenna by a non-radiating cable. The absolute levels of the spurious emissions were measured by the substitution. Spurious emissions in dB =10, 1g (TXpwr in Watts/0.001)-the absolute level
Test results:	PASS

3.4.2.Test Data

GMSK:

Test Mode: Low: 410.050MHz, Channel Spacing 6.25KHz

Frequency (MHz)	Reading level (dBm)	Antenna Polarization	Cable loss (dB)	Ant.Gain (dBi)	Emission level (dBm)	Limit (dBm)	Margin (dB)
150.553	-95.46	V	0.24	31.35	-64.35	-20.69	-44.35
367.314	-89.04	V	0.26	31.34	-57.96	-20.69	-37.96
665.082	-91.77	V	0.42	31.24	-60.95	-20.69	-40.95
855.845	-94.95	V	0.58	30.71	-64.82	-20.69	-44.82
1260.594	-79.71	V	1.23	26.38	-54.56	-20.69	-34.56
3865.024	-79.06	V	1.68	25.47	-55.27	-20.69	-35.27
289.926	-94.76	H	0.43	31.24	-63.95	-20.69	-43.95
393.851	-96.27	H	0.45	30.68	-66.04	-20.69	-46.04
475.480	-92.21	H	0.64	30.85	-62.00	-20.69	-42.00
680.110	-97.87	H	0.79	31.12	-67.54	-20.69	-47.54
1376.217	-80.62	H	1.29	26.12	-55.79	-20.69	-35.79
3258.397	-79.47	H	1.62	25.41	-55.68	-20.69	-35.68

Test Mode: Mid: 440.000MHz, Channel Spacing 6.25KHz

Frequency (MHz)	Reading level (dBm)	Antenna Polarization	Cable loss (dB)	Ant.Gain (dBi)	Emission level (dBm)	Limit (dBm)	Margin (dB)
152.896	-93.36	V	0.24	31.35	-62.25	-20.69	-42.25
354.195	-88.59	V	0.26	31.34	-57.51	-20.69	-37.51
679.178	-93.57	V	0.42	31.24	-62.75	-20.69	-42.75
855.988	-94.77	V	0.58	30.71	-64.64	-20.69	-44.64
1265.661	-78.52	V	1.23	26.38	-53.37	-20.69	-33.37
3870.527	-79.83	V	1.68	25.47	-56.04	-20.69	-36.04
279.296	-94.21	H	0.43	31.24	-63.40	-20.69	-43.40
394.988	-95.39	H	0.45	30.68	-65.16	-20.69	-45.16
476.290	-95.77	H	0.64	30.85	-65.56	-20.69	-45.56
682.555	-98.13	H	0.79	31.12	-67.80	-20.69	-47.80
1361.845	-82.00	H	1.29	26.12	-57.17	-20.69	-37.17
3254.736	-78.13	H	1.62	25.41	-54.34	-20.69	-34.34

Test Mode: High: 469.950MHz, Channel Spacing 6.25KHz

Frequency (MHz)	Reading level (dBm)	Antenna Polarization	Cable loss (dB)	Ant.Gain (dBi)	Emission level (dBm)	Limit (dBm)	Margin (dB)
143.111	-92.79	V	0.24	31.35	-61.68	-20.69	-41.68
355.815	-90.55	V	0.26	31.34	-59.47	-20.69	-39.47
664.246	-91.89	V	0.42	31.24	-61.07	-20.69	-41.07
866.202	-92.92	V	0.58	30.71	-62.79	-20.69	-42.79
1270.799	-77.94	V	1.23	26.38	-52.79	-20.69	-32.79
3866.024	-76.09	V	1.68	25.47	-52.30	-20.69	-32.30
290.462	-95.45	H	0.43	31.24	-64.64	-20.69	-44.64
402.475	-96.02	H	0.45	30.68	-65.79	-20.69	-45.79
479.892	-95.02	H	0.64	30.85	-64.81	-20.69	-44.81
684.342	-97.66	H	0.79	31.12	-67.33	-20.69	-47.33
1369.032	-82.12	H	1.29	26.12	-57.29	-20.69	-37.29
3262.498	-77.65	H	1.62	25.41	-53.86	-20.69	-33.86

Test Mode: Low: 410.050MHz, Channel Spacing 12.5KHz

Frequency (MHz)	Reading level (dBm)	Antenna Polarization	Cable loss (dB)	Ant.Gain (dBi)	Emission level (dBm)	Limit (dBm)	Margin (dB)
143.111	-92.79	V	0.24	31.35	-61.68	-20	-41.68
355.815	-90.55	V	0.26	31.34	-59.47	-20	-39.47
664.246	-91.89	V	0.42	31.24	-61.07	-20	-41.07
866.202	-92.92	V	0.58	30.71	-62.79	-20	-42.79
1270.799	-77.94	V	1.23	26.38	-52.79	-20	-32.79
3866.024	-76.09	V	1.68	25.47	-52.30	-20	-32.30
290.462	-95.45	H	0.43	31.24	-64.64	-20	-44.64
402.475	-96.02	H	0.45	30.68	-65.79	-20	-45.79
479.892	-95.02	H	0.64	30.85	-64.81	-20	-44.81
684.342	-97.66	H	0.79	31.12	-67.33	-20	-47.33
1369.032	-82.12	H	1.29	26.12	-57.29	-20	-37.29
3262.498	-77.65	H	1.62	25.41	-53.86	-20	-33.86

Test Mode: Mid: 440.000MHz, Channel Spacing 12.5KHz

Frequency (MHz)	Reading level (dBm)	Antenna Polarization	Cable loss (dB)	Ant.Gain (dBi)	Emission level (dBm)	Limit (dBm)	Margin (dB)
154.158	-94.08	V	0.24	31.35	-62.97	-20	-42.97
354.317	-88.86	V	0.26	31.34	-57.78	-20	-37.78
677.184	-94.88	V	0.42	31.24	-64.06	-20	-44.06
862.825	-92.37	V	0.58	30.71	-62.24	-20	-42.24
1268.843	-77.65	V	1.23	26.38	-52.50	-20	-32.50
3863.232	-79.51	V	1.68	25.47	-55.72	-20	-35.72
287.944	-97.14	H	0.43	31.24	-66.33	-20	-46.33
404.791	-97.49	H	0.45	30.68	-67.26	-20	-47.26
479.096	-94.06	H	0.64	30.85	-63.85	-20	-43.85
683.193	-96.68	H	0.79	31.12	-66.35	-20	-46.35
1370.686	-81.23	H	1.29	26.12	-56.40	-20	-36.40
3253.011	-77.42	H	1.62	25.41	-53.63	-20	-33.63

Test Mode: High: 469.950MHz, Channel Spacing 12.5KHz

Frequency (MHz)	Reading level (dBm)	Antenna Polarization	Cable loss (dB)	Ant.Gain (dBi)	Emission level (dBm)	Limit (dBm)	Margin (dB)
152.831	-95.65	V	0.24	31.35	-64.54	-20	-44.54
352.321	-91.02	V	0.26	31.34	-59.94	-20	-39.94
666.689	-91.71	V	0.42	31.24	-60.89	-20	-40.89
860.934	-95.85	V	0.58	30.71	-65.72	-20	-45.72
1265.455	-79.33	V	1.23	26.38	-54.18	-20	-34.18
3861.201	-76.80	V	1.68	25.47	-53.01	-20	-33.01
280.789	-93.89	H	0.43	31.24	-63.08	-20	-43.08
405.158	-97.35	H	0.45	30.68	-67.12	-20	-47.12
481.711	-93.55	H	0.64	30.85	-63.34	-20	-43.34
679.411	-98.20	H	0.79	31.12	-67.87	-20	-47.87
1367.331	-81.51	H	1.29	26.12	-56.68	-20	-36.68
3253.445	-77.01	H	1.62	25.41	-53.22	-20	-33.22

Test Mode: Low: 410.050MHz, Channel Spacing 25KHz

Frequency (MHz)	Reading level (dBm)	Antenna Polarization	Cable loss (dB)	Ant.Gain (dBi)	Emission level (dBm)	Limit (dBm)	Margin (dB)
142.522	-94.83	V	0.24	31.35	-63.72	-13	-38.72
369.423	-92.44	V	0.26	31.34	-61.36	-13	-36.36
677.815	-93.51	V	0.42	31.24	-62.69	-13	-37.69
875.064	-91.99	V	0.58	30.71	-61.86	-13	-36.86
1261.232	-78.14	V	1.23	26.38	-52.99	-13	-27.99
3863.427	-78.85	V	1.68	25.47	-55.06	-13	-30.06
297.069	-95.17	H	0.43	31.24	-64.36	-13	-39.36
397.367	-94.39	H	0.45	30.68	-64.16	-13	-39.16
475.109	-94.58	H	0.64	30.85	-64.37	-13	-39.37
689.263	-99.75	H	0.79	31.12	-69.42	-13	-44.42
1364.367	-81.88	H	1.29	26.12	-57.05	-13	-32.05
3263.740	-75.94	H	1.62	25.41	-52.15	-13	-27.15

Test Mode; Mid: 440.000MHz, Channel Spacing 25KHz

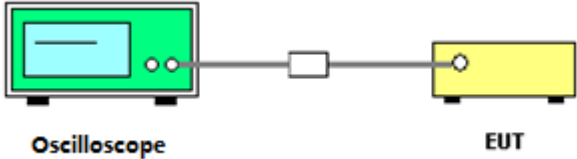
Frequency (MHz)	Reading level (dBm)	Antenna Polarization	Cable loss (dB)	Ant.Gain (dBi)	Emission level (dBm)	Limit (dBm)	Margin (dB)
149.377	-93.06	V	0.24	31.35	-61.95	-13	-36.95
358.219	-92.10	V	0.26	31.34	-61.02	-13	-36.02
668.419	-95.00	V	0.42	31.24	-64.18	-13	-39.18
867.190	-91.72	V	0.58	30.71	-61.59	-13	-36.59
1258.277	-78.64	V	1.23	26.38	-53.49	-13	-28.49
3864.833	-79.01	V	1.68	25.47	-55.22	-13	-30.22
290.949	-96.52	H	0.43	31.24	-65.71	-13	-40.71
393.066	-95.31	H	0.45	30.68	-65.08	-13	-40.08
481.652	-95.07	H	0.64	30.85	-64.86	-13	-39.86
683.870	-99.09	H	0.79	31.12	-68.76	-13	-43.76
1370.029	-82.62	H	1.29	26.12	-57.79	-13	-32.79
3254.843	-79.28	H	1.62	25.41	-55.49	-13	-30.49

Test Mode: High: 469.950MHz, Channel Spacing 25KHz

Frequency (MHz)	Reading level (dBm)	Antenna Polarization	Cable loss (dB)	Ant.Gain (dBi)	Emission level (dBm)	Limit (dBm)	Margin (dB)
148.885	-94.54	V	0.24	31.35	-63.43	-13	-38.43
356.880	-91.97	V	0.26	31.34	-60.89	-13	-35.89
671.766	-94.35	V	0.42	31.24	-63.53	-13	-38.53
874.697	-92.86	V	0.58	30.71	-62.73	-13	-37.73
1263.618	-77.51	V	1.23	26.38	-52.36	-13	-27.36
3852.122	-76.66	V	1.68	25.47	-52.87	-13	-27.87
290.717	-96.34	H	0.43	31.24	-65.53	-13	-40.53
394.586	-93.97	H	0.45	30.68	-63.74	-13	-38.74
470.144	-95.80	H	0.64	30.85	-65.59	-13	-40.59
676.394	-96.03	H	0.79	31.12	-65.70	-13	-40.70
1364.594	-80.84	H	1.29	26.12	-56.01	-13	-31.01
3257.004	-77.89	H	1.62	25.41	-54.10	-13	-29.10

3.5. Transient Frequency Behavior

3.5.1. Test Specification

Test Requirement:	FCC Part 90.214				
Test Setup:	 Oscilloscope EUT				
Test Limit	Channel Bandwidth (kHz)	Time Intervals (Notes 1, 2)	Maximum Frequency Difference (kHz)	Transient Duration Limit (ms)	
				138-174 MHz	406.1-512 MHz
	25	t ₁	±25	5	10
		t ₂	±12.5	20	25
		t ₃	±25	5	10
	12.5	t ₁	±12.5	5	10
		t ₂	±6.25	20	25
		t ₃	±12.5	5	10
	6.25	t ₁	±6.25	5	10
		t ₂	±3.125	20	25
		t ₃	±6.25	5	10
Test Procedure:	The EUT was set in the climate chamber and connected to an external DC power supply and AC power supply. The RF output was directly connected to Oscilloscope. The coupling loss of the additional cables was recorded and taken in account for all the measurements. The result was recorded.				
Test Result:	PASS				

3.5.2. Test data

Test Plots for channel spacing 25KHz, EUT power setting: Maximum.

Power On



Power Off



Remark: Only list the worst data for channel spacing 25KHz, modulation GMSK.

3.6. Behavior Frequency Stability

3.6.1. Test Specification

Test Requirement:	FCC Part 90.213
Test Method:	ANSI C63.26
Test Setup:	<pre> graph TD Laptop[Laptop] --- EUT[Equipment Under Test] EUT --- ACDC[AC/DC Adapter] EUT --- Att[Attenuator(s)] Att --- MC[Mini-Circuit Combiner] MC --- RFTS[RF Communication Test Set] MC --- MA[Modulation Analyzer] MC --- RFDR[RF Detector] RFDR --- HPO[Hewlett Packard Infinium Digitizing Oscilloscope] </pre>
Test Procedure:	Method of Measurement: After temperature stabilization (approx. 20 min for each stage), the frequency for the lower, the middle and the highest frequency range was recorded. For Frequency stability Vs. Voltage the EUT was connected to a DC power supply or AC power supply and the voltage was adjusted in the required ranges.
Test Result:	PASS

3.6.2. Test data

Conclusion: PASS			
Mode	Voltage (V)	Frequency error (Hz)	frequency error (ppm)
Middle Channel 6.25KHz Channel Spacing	10	2	0.0042
	11	4	0.0089
	12	6	0.0136
	13	6	0.0143
	14	7	0.0161
	15	7	0.0162
Limit	1.25ppm		
Middle Channel 12.5KHz Channel Spacing	10	8	0.0174
	11	1	0.0026
	12	4	0.0097
	13	5	0.0122
	14	6	0.0144
	15	7	0.0162
Limit	2.5ppm		
Middle Channel 25KHz Channel Spacing	10	2	0.0047
	11	7	0.0163
	12	3	0.0064
	13	2	0.0035
	14	1	0.0027
	15	8	0.0182
Limit	5ppm		

Mode	Temperature (°C)	Frequency error (Hz)	frequency error (ppm)
Middle Channel 6.25KHz Channel Spacing	-20	6	0.0132
	-10	3	0.0060
	0	3	0.0074
	10	4	0.0097
	20	4	0.0094
	30	3	0.0071
	40	4	0.0081
	50	8	0.0173
Limit	1.25ppm		
Middle Channel 12.5KHz Channel Spacing	-20	3	0.0070
	-10	6	0.0125
	0	3	0.0066
	10	2	0.0049
	20	6	0.0130
	30	4	0.0100
	40	9	0.0194
	50	5	0.0112
Limit	2.5ppm		
Middle Channel 25KHz Channel Spacing	-20	4	0.0080
	-10	7	0.0149
	0	2	0.0051
	10	4	0.0084
	20	7	0.0169
	30	3	0.0074
	40	4	0.0090
	50	9	0.0198
Limit	5ppm		

3.7. Modulation Characteristic

Test Requirement:	FCC Part 90.207
Test Result:	According to FCC § 2.1047(d), Part 22, 74, 90 there is no specific requirement for digital modulation, therefore modulation characteristic is not presented.

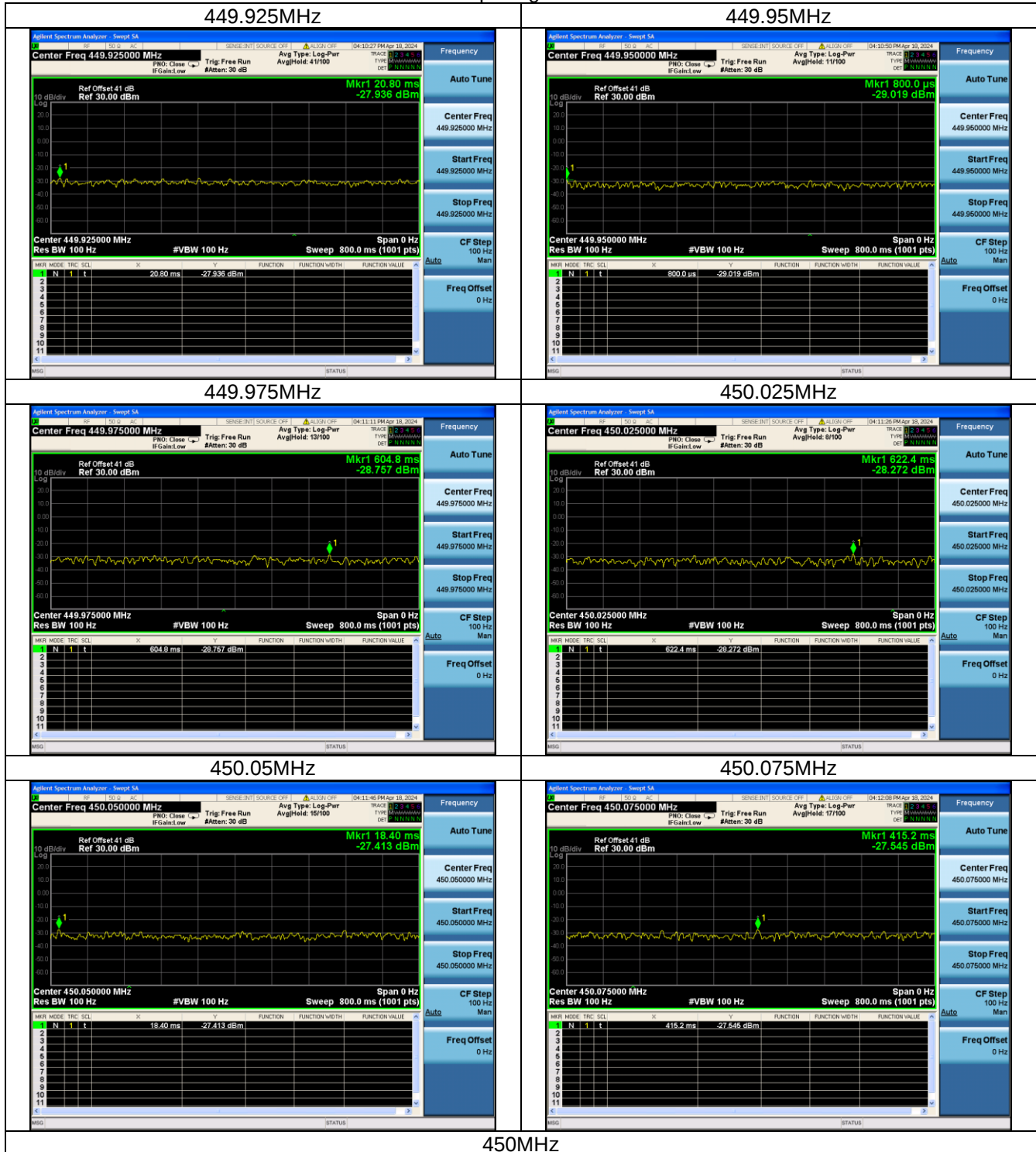
3.8. Adjacent channel power

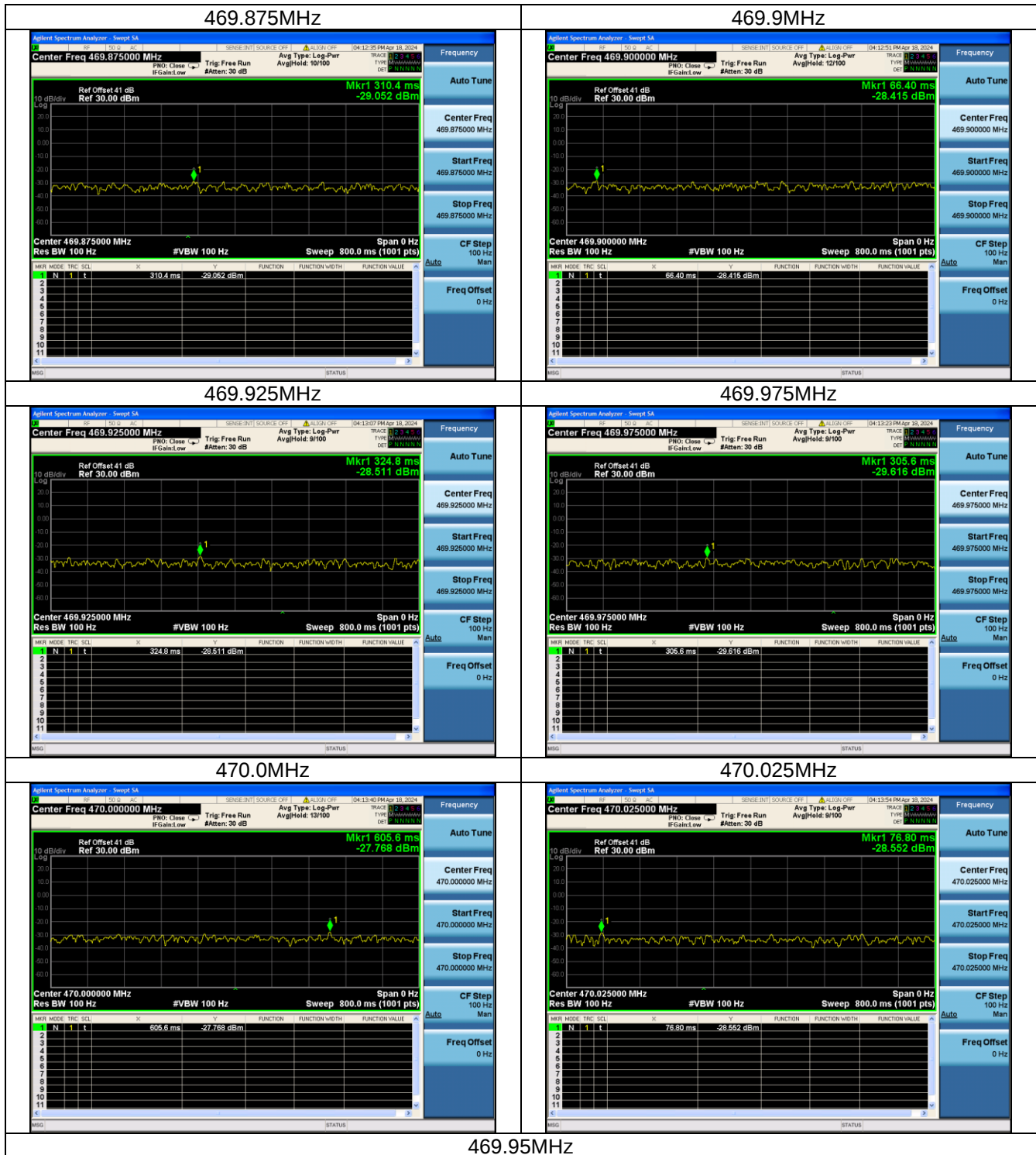
Test Requirement:	FCC Part 90.221												
Test Setup:	 Spectrum Analyzer EUT												
Test Limit:	Maximum adjacent power levels for frequencies in the 450–470 MHz band, no need compliance with below -36dBm: <table><tr><th>Frequency offset</th><th>Maximum ACP (dBc) for devices 1 watt and less</th><th>Maximum ACP (dBc) for devices above 1 watt</th></tr><tr><td>25 kHz</td><td>– 55 dBc</td><td>– 60 dBc</td></tr><tr><td>50 kHz</td><td>– 70 dBc</td><td>– 70 dBc</td></tr><tr><td>75 kHz</td><td>– 70 dBc</td><td>– 70 dBc</td></tr></table>	Frequency offset	Maximum ACP (dBc) for devices 1 watt and less	Maximum ACP (dBc) for devices above 1 watt	25 kHz	– 55 dBc	– 60 dBc	50 kHz	– 70 dBc	– 70 dBc	75 kHz	– 70 dBc	– 70 dBc
Frequency offset	Maximum ACP (dBc) for devices 1 watt and less	Maximum ACP (dBc) for devices above 1 watt											
25 kHz	– 55 dBc	– 60 dBc											
50 kHz	– 70 dBc	– 70 dBc											
75 kHz	– 70 dBc	– 70 dBc											
Test method:	The resolution bandwidth of the spectrum analyzer was set at 100 Hz and the spectrum was recorded in the Frequency band 0Kz from the wanted frequency												
Test result:	Pass.												

GMSK 25KHz spacing 450MHz-470MHz

Carrier frequency (MHz)	Test Frequency (MHz)	Test Value (dBm)	Limit (dBm)	Result
450.000	449.925	-27.936	44-70=-26	PASS
	449.95	-29.019	44-70=-26	PASS
	449.975	-28.757	44-60=-16	PASS
	450.025	-28.272	44-60=-16	PASS
	450.05	-27.413	44-70=-26	PASS
	450.075	-27.545	44-70=-26	PASS
469.950	469.875	-29.052	44-70=-26	PASS
	469.900	-28.415	44-70=-26	PASS
	469.925	-28.511	44-60=-16	PASS
	469.975	-29.616	44-60=-16	PASS
	470.000	-27.768	44-70=-26	PASS
	470.025	-28.552	44-70=-26	PASS

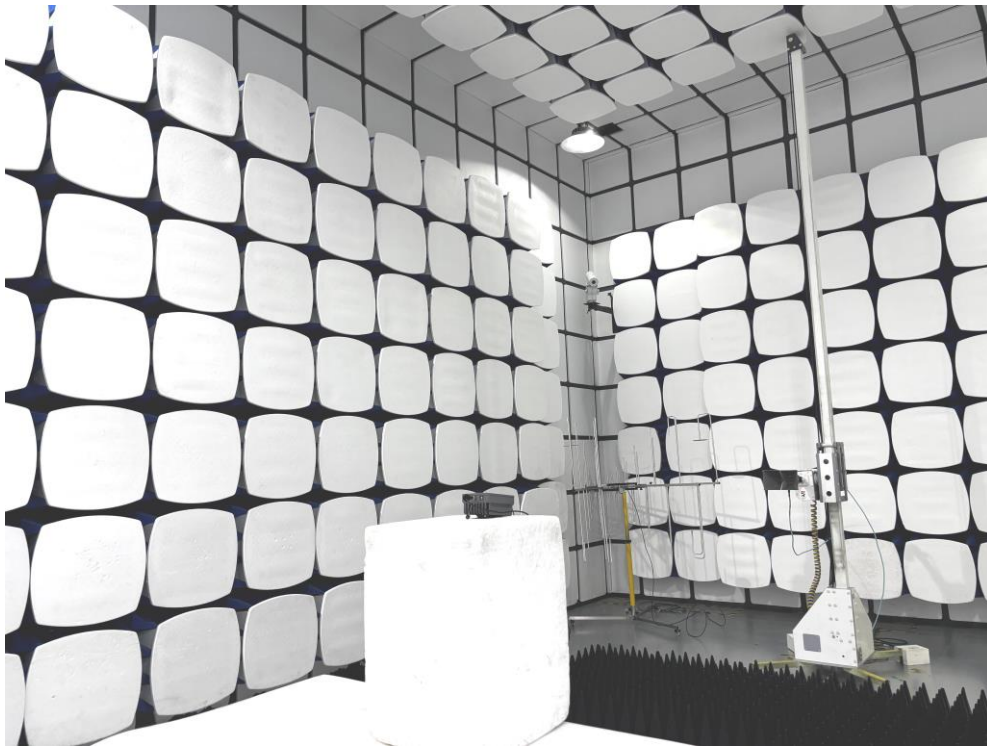
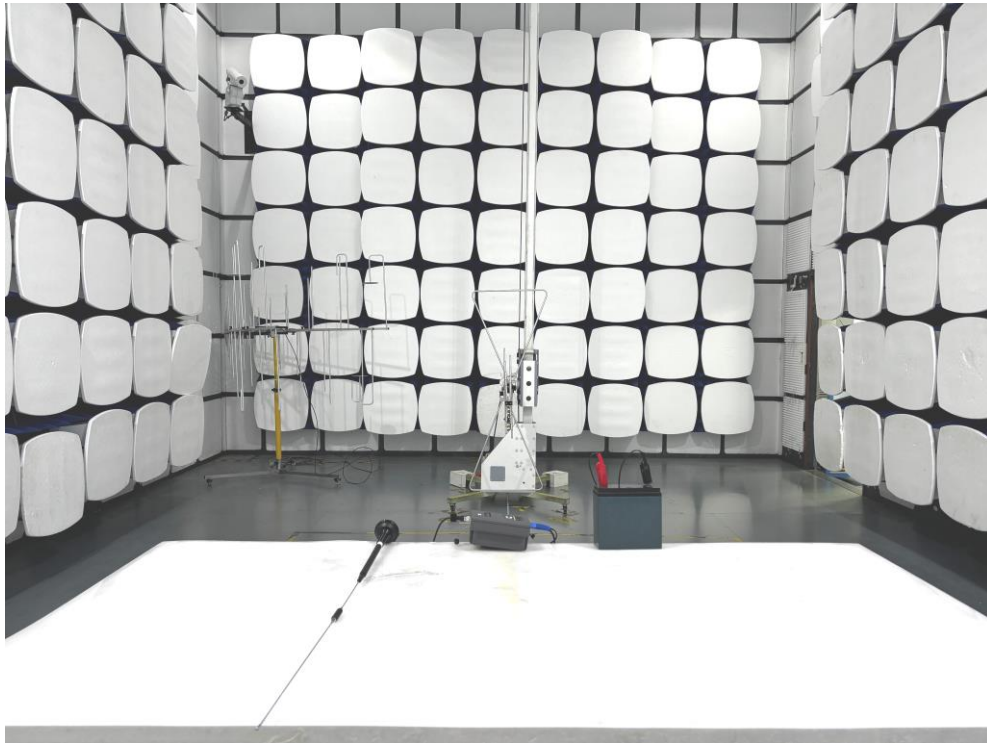
GMSK 25KHz spacing 450MHz-470MHz





4. Test Setup Photo

4.1. Photos of Radiated emission



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