

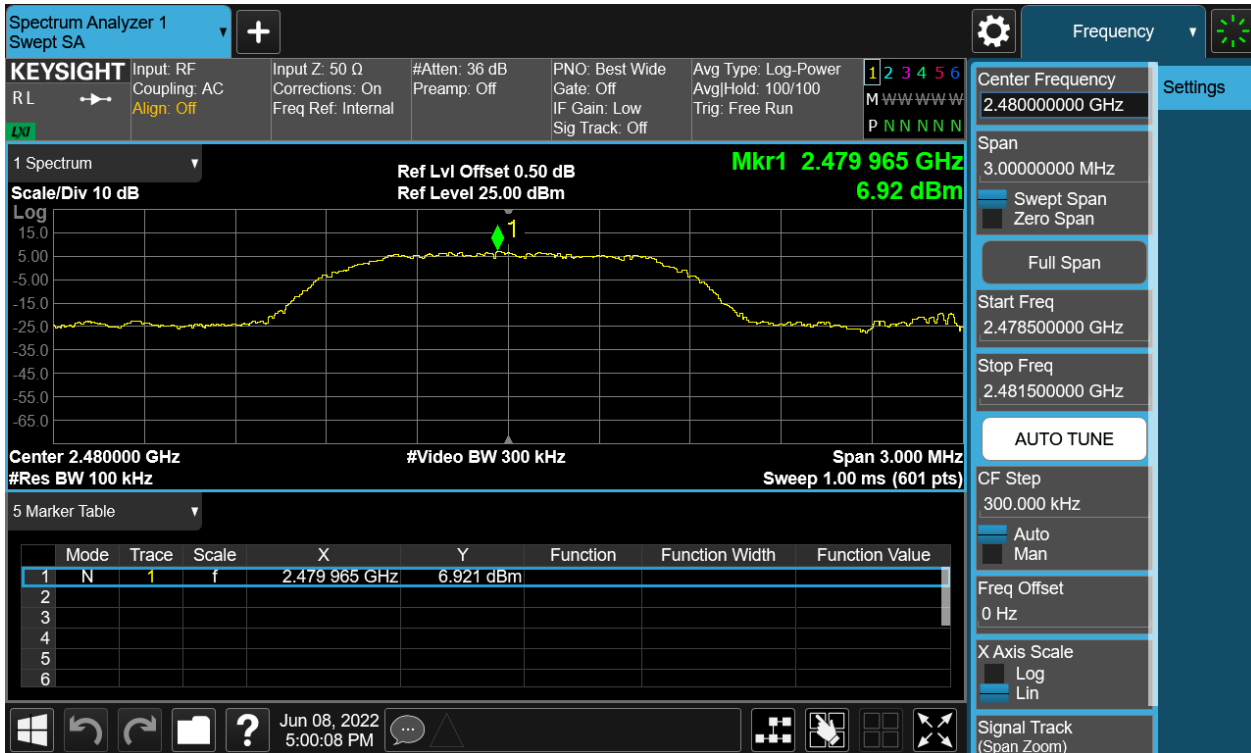
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Figure 21: Conducted Spurious Emission & Authorized-band band-edge, 2480MHz, 8-DPSK Carrier Level



Band Edge



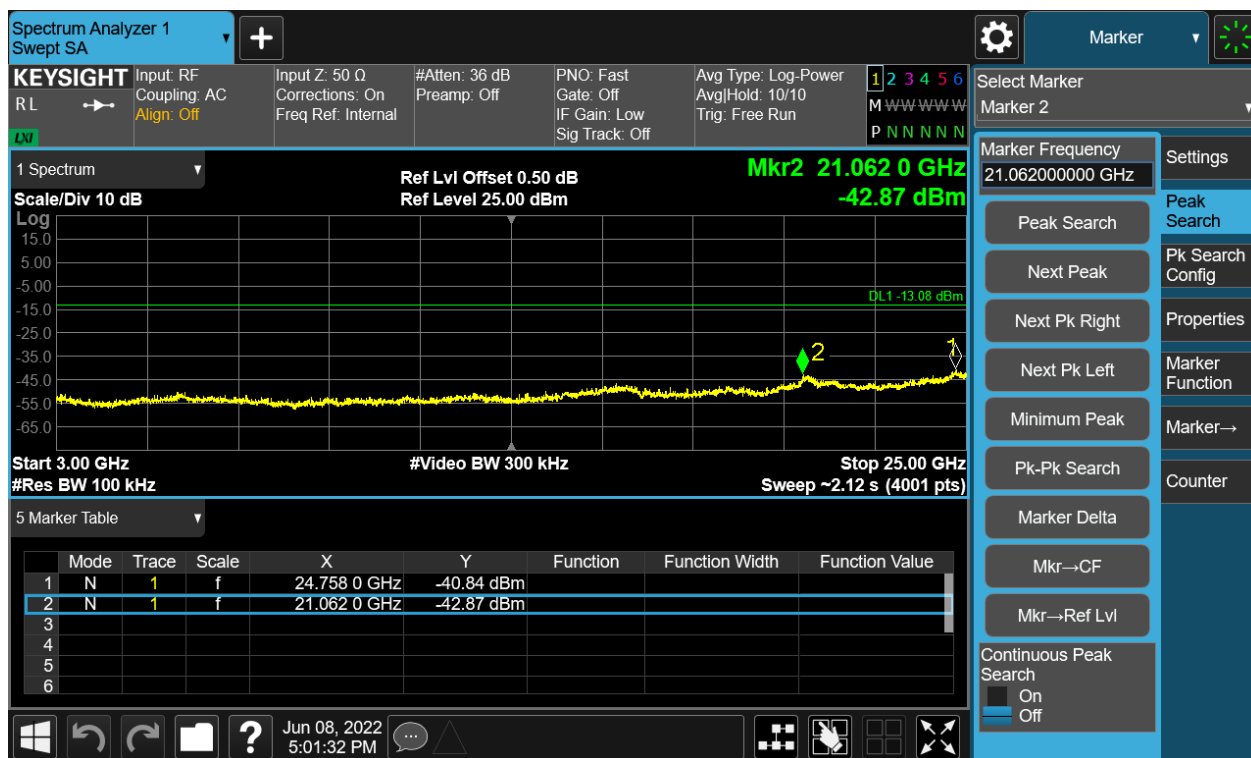
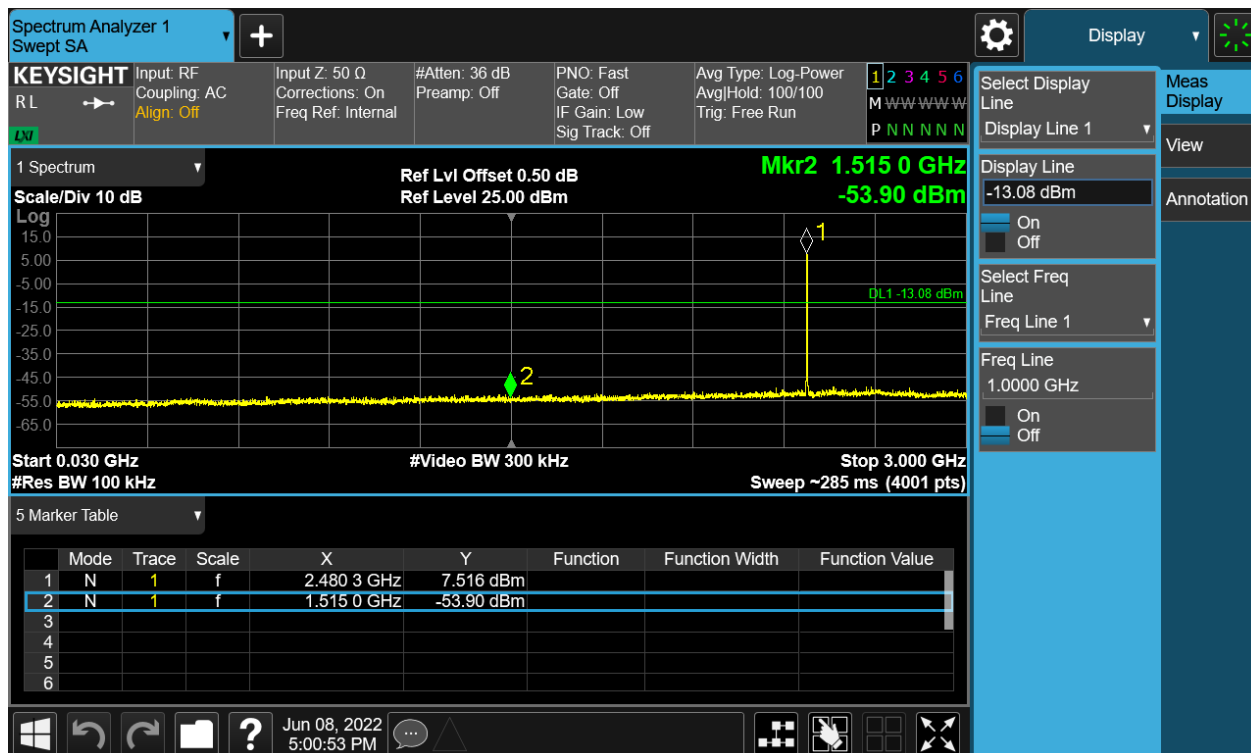
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Conducted spurious emissions 30MHz-25GHz



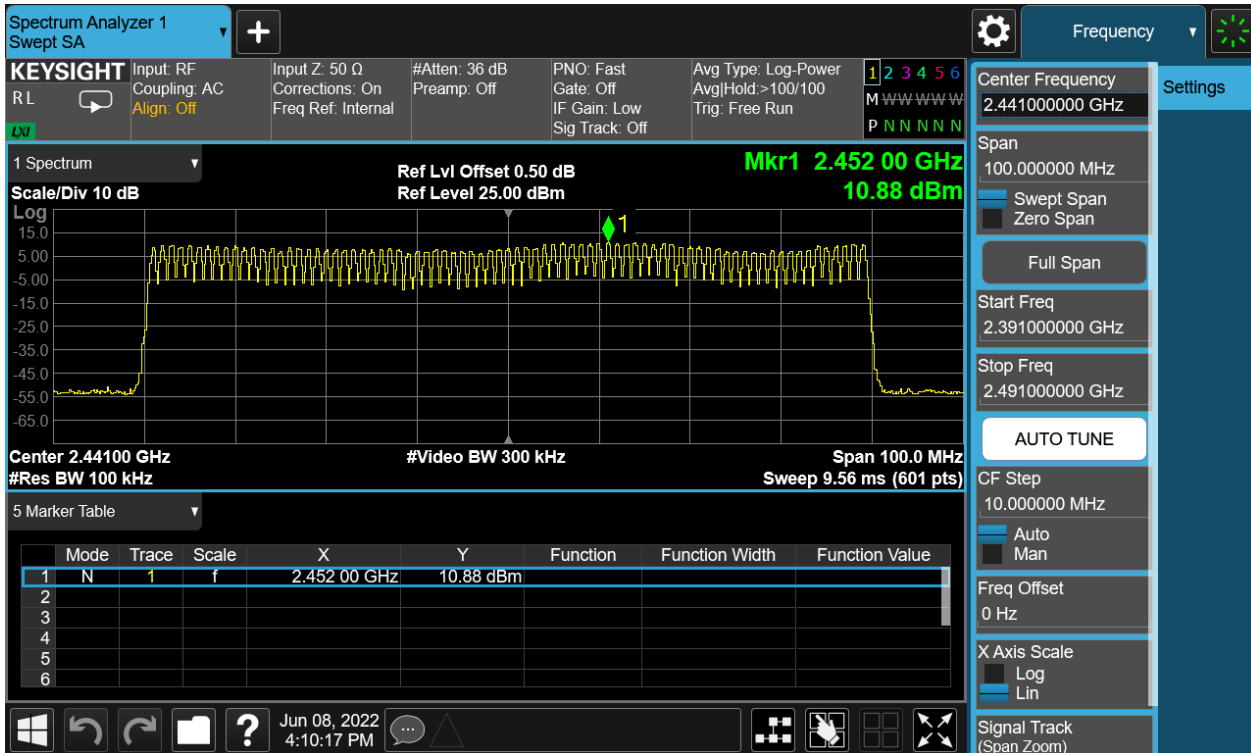
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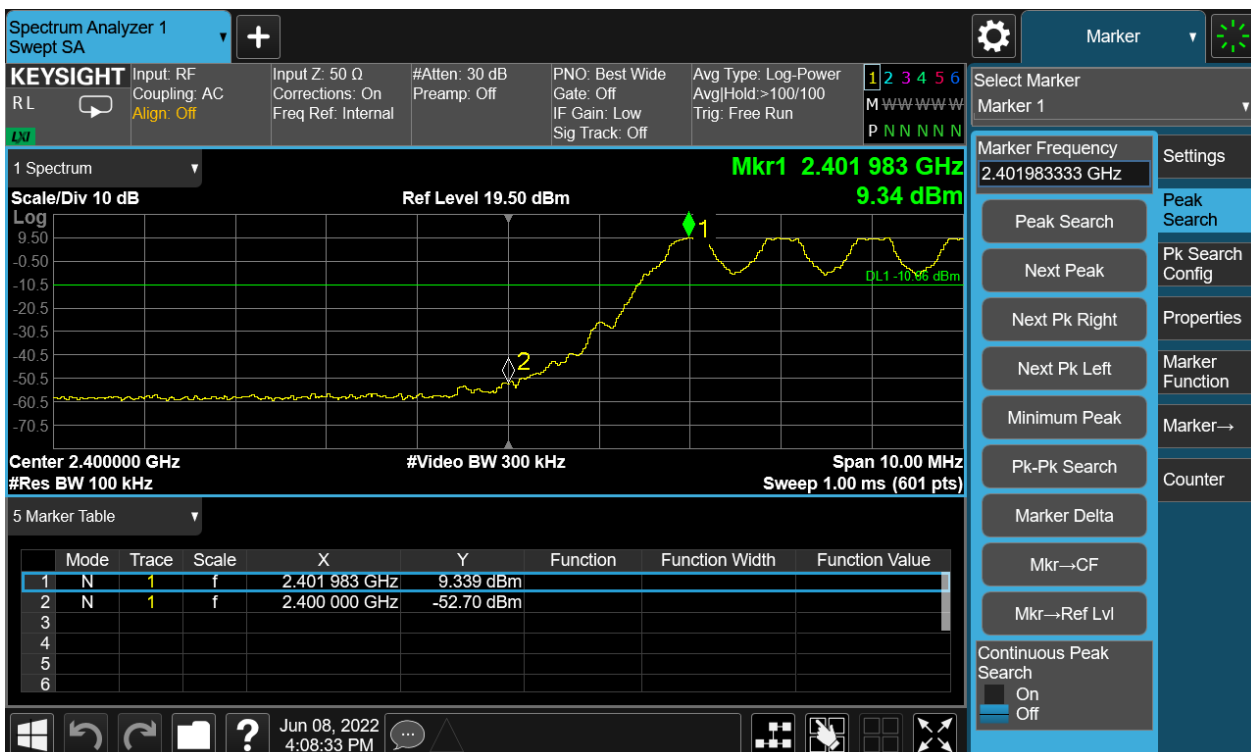
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Figure 22: Conducted Spurious Emission & Authorized-band band-edge, Hopping Mode, GFSK Carrier Level



Band Edge(Low)



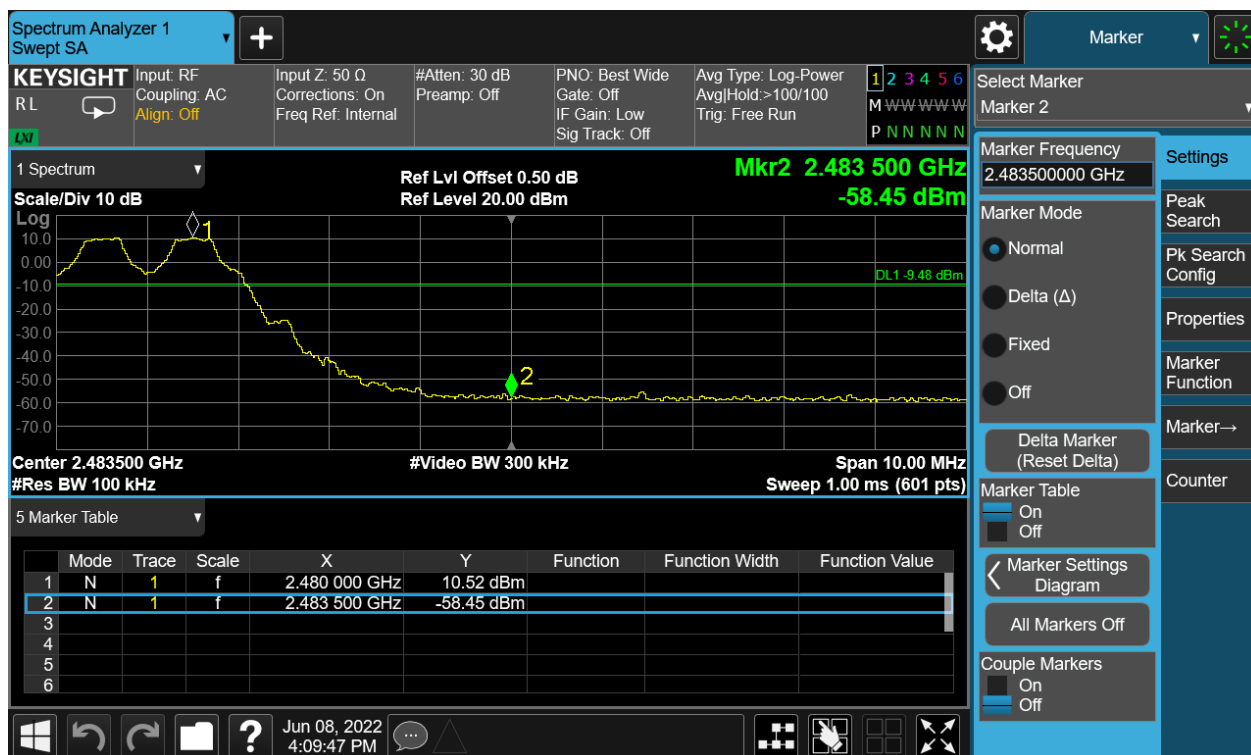
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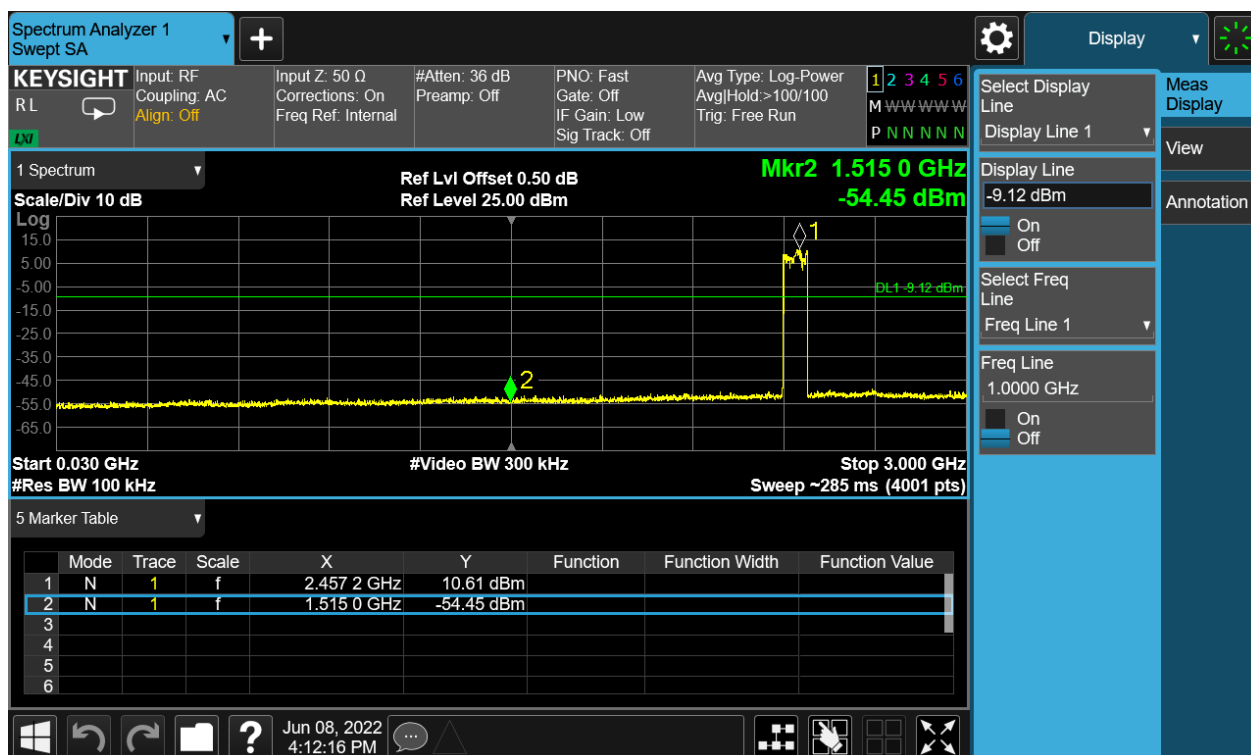
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Band Edge(High)



Conducted spurious emissions 30MHz-25GHz



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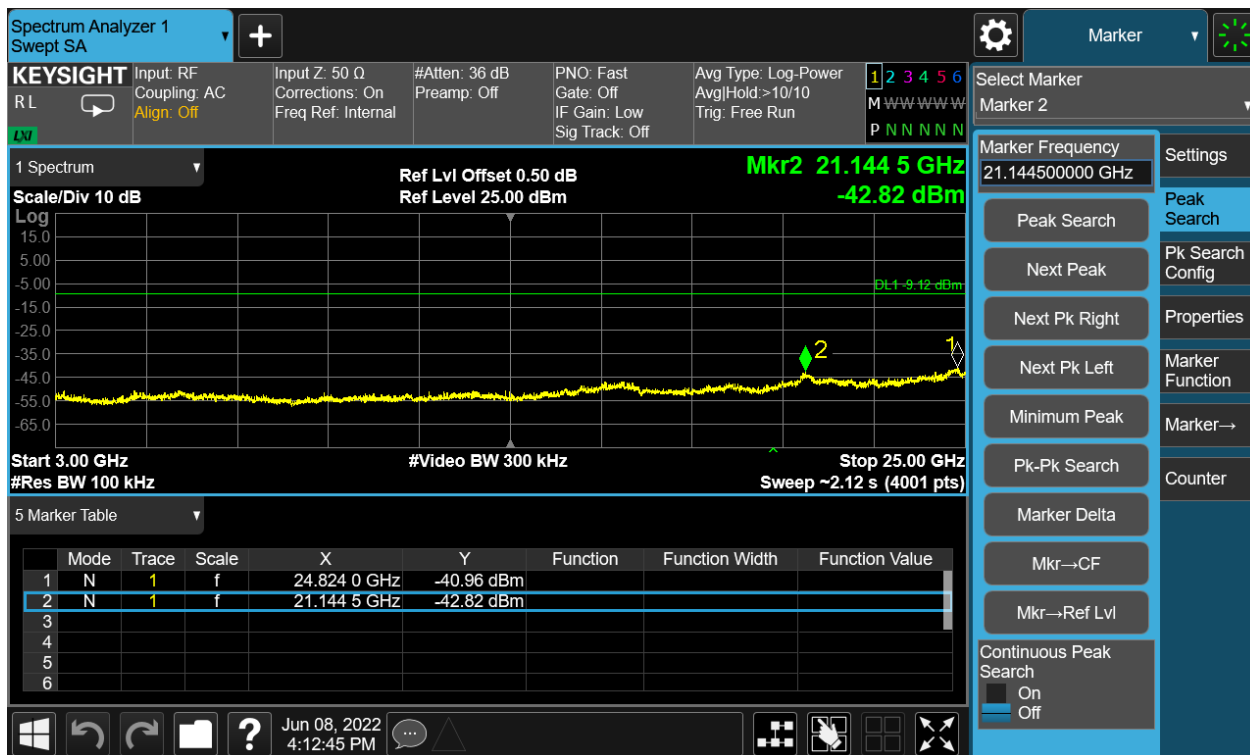
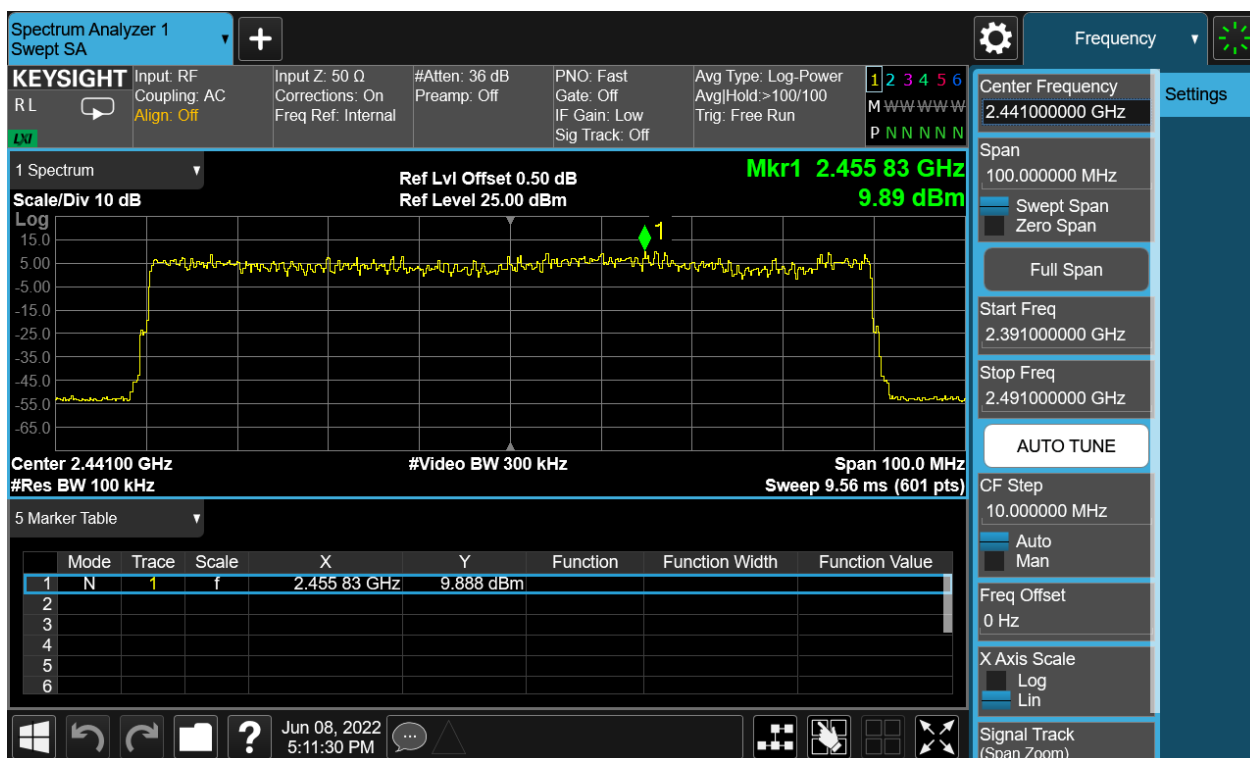


Figure 23: Conducted Spurious Emission & Authorized-band band-edge, Hopping Mode, 8-DPSK Carrier Level



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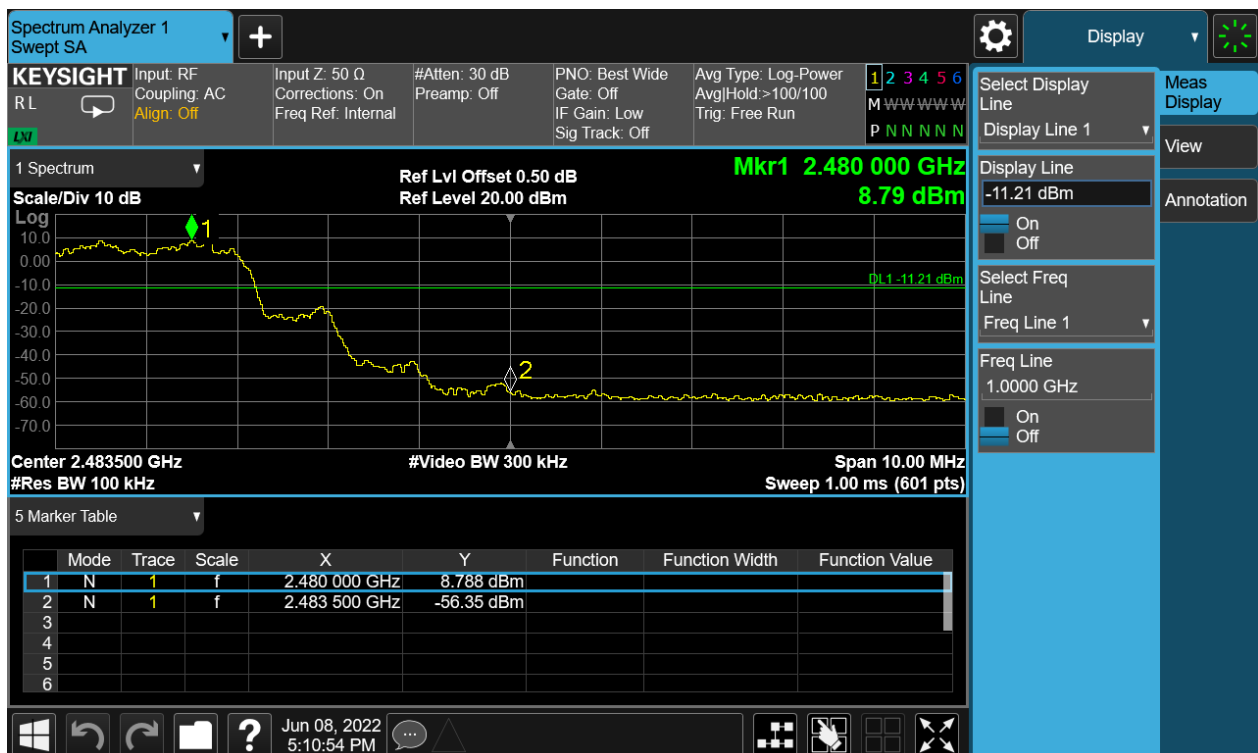
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Band Edge(Low)



Band Edge(High)



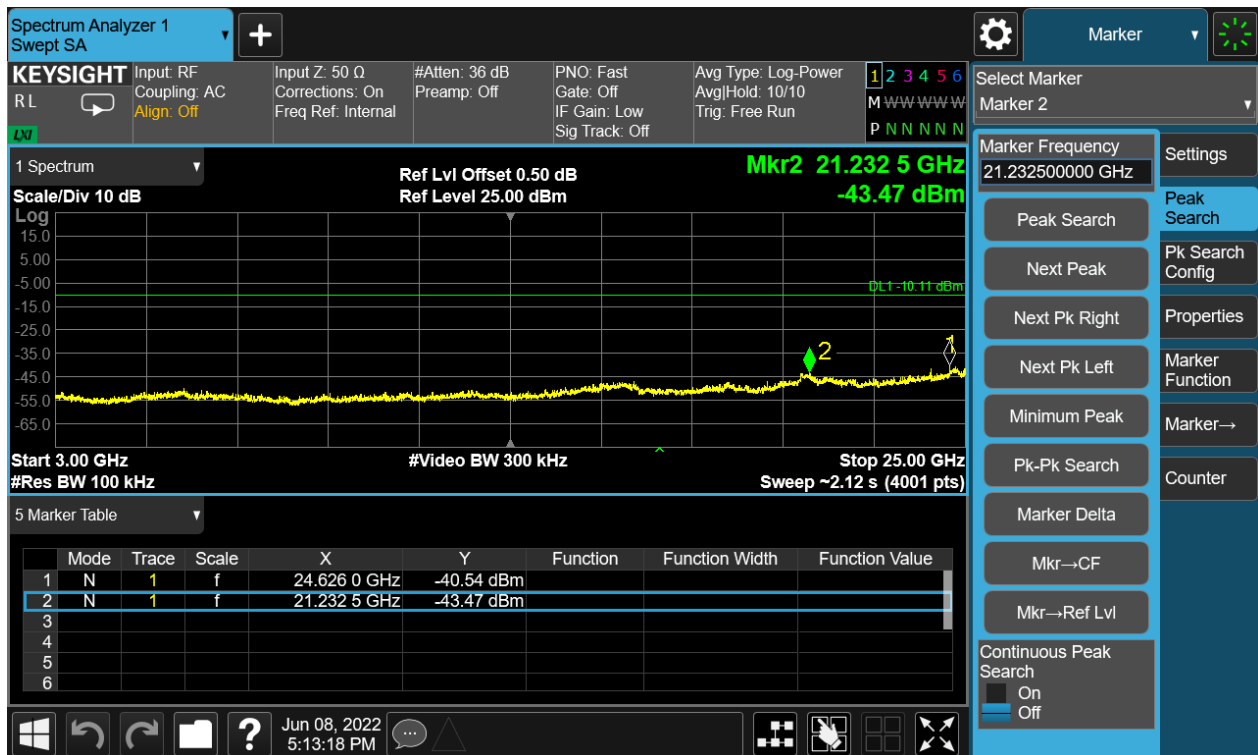
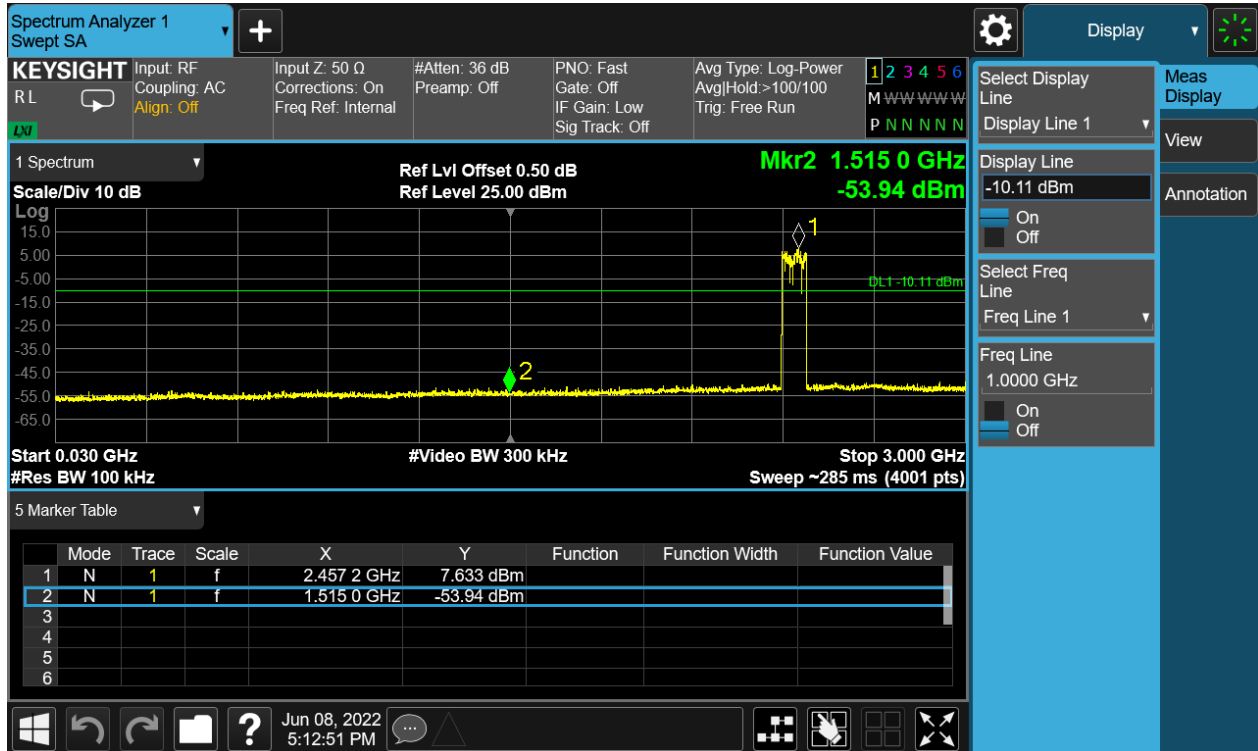
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Conducted spurious emissions 30MHz-25GHz



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4.1.5 Radiated Spurious Emission

RESULT:

PASS

Test standard	: FCC Part 15.247(d), 15.205, 15.209
Requirement	: ANSI C63.10-2013
Kind of test site	: 3m Semi-Anechoic Chamber

Test setup

Test Channel	: Low/Middle/High
Operation Mode	: A
Ambient temperature	: 23°C
Relative humidity	: 54%

Notes

Test plots please refer to the annex document "SHH22020028-01CE DATA BDED-R-TX EXHIBIT A".

1. For 9 kHz ~ 30 MHz, the amplitude of spurious emissions that are attenuated by more than 20dB below the permissible. The value has no need to be reported.
2. The spurious above 18GHz is noise only and 20dB below the limit. The value has no need to be reported.
3. All test modes had been pre-test below 1 GHz, Only the worst mode data of GFSK-hopping mode was recorded in the report.
4. The EUT was pretested with 3 orientations placed on the table for the radiated emission measurement –X, Y, and Z-plane. The X-plane results were found as the worst case and were shown in this report.

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4.1.6 Band Edge (Restricted-band band-edge)

RESULT:

PASS

Test standard	: FCC Part 15.247(d), 15.205, 15.209
Requirement	: ANSI C63.10-2013
Kind of test site	: 3m Semi-Anechoic Chamber

Test setup

Test Channel	: Low/Middle/High
Operation Mode	: A.1
Ambient temperature	: 23°C
Relative humidity	: 54%

Notes

Test plots please refer to the annex document "SHH22020028-01CE DATA BDED-R-TX EXHIBIT A".

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4.1.7 Hopping Frequency Separation

RESULT:

PASS

Test standard : FCC Part 15.247(a)(1)
Requirement : ANSI C63.10-2013
Kind of test site : Shielded room

Test setup

Test Channel : Hopping
Operation Mode : A.1.a.iv
Ambient temperature : 24.8°C
Relative humidity : 52%

Table 3: Hopping Frequency Separation

Mode	Frequency (MHz)	Channel Separation (MHz)	Limit (MHz)
GFSK	2441	1.105	≥ 25kHz or two-thirds of 20dB bandwidth
8-DPSK	2441	1.115	

*Note: The systems operate with an output power no greater than 125mW.

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Spectrum Analyzer 1
Swept SA

KEYSIGHT Input: RF
Coupling: AC
Align: Off

RL →

LN

Input Z: 50 Ω
Corrections: On
Freq Ref: Internal

#Atten: 30 dB
Preamp: Off

PNO: Best Wide
Gate: Off
IF Gain: Low
Sig Track: Off

Avg Type: Log-Power
Avg/Hold: 1000/1000
Trig: Free Run

1 2 3 4 5 6
M WWWWWW
P NNNNN

Center Frequency
2.441000000 GHz

Span
3.000000000 MHz

☒ Swept Span
☐ Zero Span

Full Span

Start Freq
2.439500000 GHz

Stop Freq
2.442500000 GHz

AUTO TUNE

CF Step
300.000 kHz

☒ Auto
☐ Man

Freq Offset
0 Hz

X Axis Scale
☐ Log
☒ Lin

Signal Track
(Span Zoom)

Settings

1 Spectrum

Scale/Div 10 dB

Ref Level 20.00 dBm

Mkr2 2.439 925 GHz
7.24 dBm

Center 2.441000 GHz
#Res BW 100 kHz

#Video BW 300 kHz

Span 3.000 MHz
#Sweep 1.00 ms (601 pts)

5 Marker Table

	Mode	Trace	Scale	X	Y	Function	Function Width	Function Value
1	N	1	f	2.441 030 GHz	7.738 dBm			
2	N	1	f	2.439 925 GHz	7.239 dBm			
3								
4								
5								
6								

Jun 08, 2022
4:04:27 PM

Spectrum Analyzer 1
Swept SA

KEYSIGHT L

Input: RF
Coupling: AC
Align: Auto

Input Z: 50 Ω
Corrections: Off
Freq Ref: Internal

#Atten: 30 dB
Preamp: Off

PNO: Best Wide
Gate: Off
IF Gain: Low
Sig Track: Off

Avg Type: Log-Power
AglHold: 1000/1000
Trig: Free Run

1 2 3 4 5 6
M W W W W W
P N N N N N

Select Marker
Marker 2

Marker Frequency
2.439860000 GHz

Settings
Peak Search
Pk Search Config
Properties
Marker Function
Marker→
Counter

1 Spectrum

Scale/Div 10 dB

Ref Level 20.00 dBm

Mkr2 2.439 860 GHz
3.98 dBm

Center 2.441000 GHz
#Res BW 100 kHz

#Video BW 300 kHz

Span 3.000 MHz
#Sweep 1.00 ms (601 pts)

5 Marker Table

	Mode	Trace	Scale	X	Y	Function	Function Width	Function Value
1	N	1	f	2.440 975 GHz	5.676 dBm			
2	N	1	f	2.439 860 GHz	3.983 dBm			
3								
4								
5								
6								

Continuous Peak Search
On
Off

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4.1.8 Number of Hopping Frequency

RESULT:

PASS

Test standard : FCC Part 15.247(a)(1)(iii)
RSS-247 5.1(4)
Requirement : ANSI C63.10-2013
Kind of test site : Shielded room

Test setup

Test Channel : Hopping
Operation Mode : A.1.a.iv
Ambient temperature : 24.8°C
Relative humidity : 52%

Table 2: Number of Hopping Frequency

Mode	Frequency Range	Measured Quantity of Hopping Channel	Limit
GFSK	2400 – 2483.5	79	≥15
8-DPSK	2400 – 2483.5	79	≥15

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Figure 26: Number of Hopping Frequency, Hopping Mode, GFSK

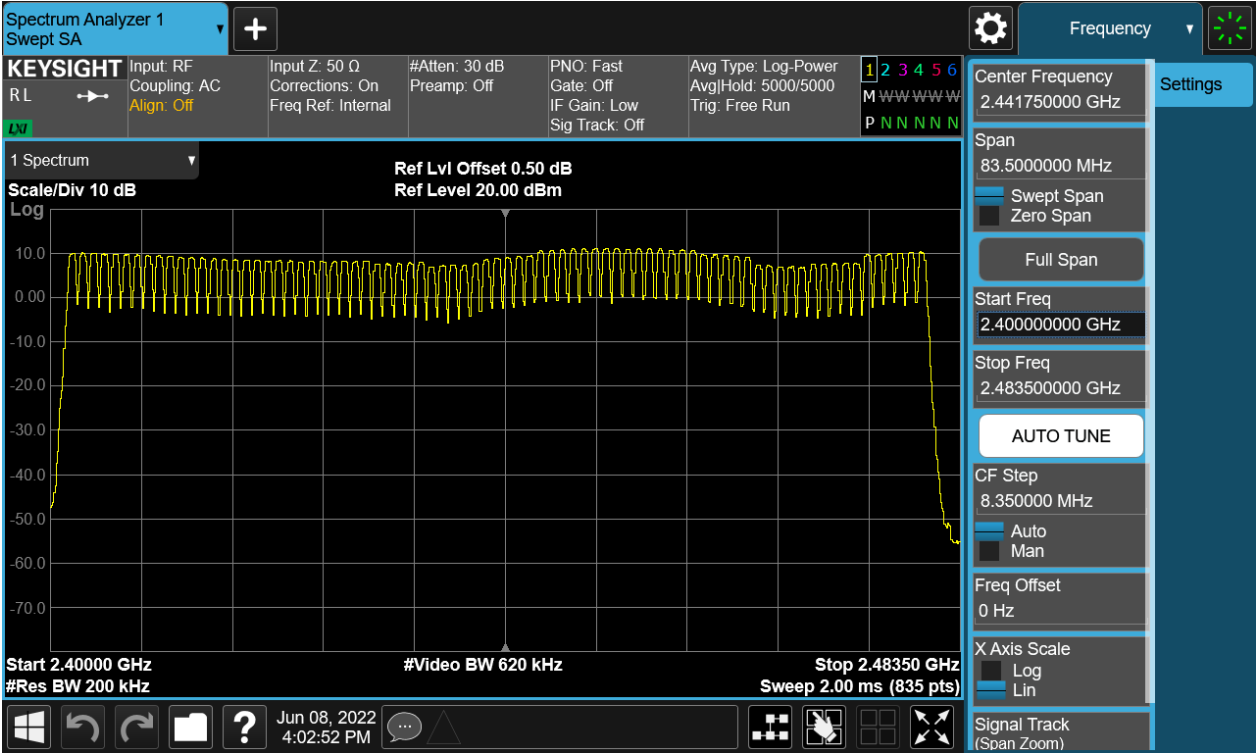
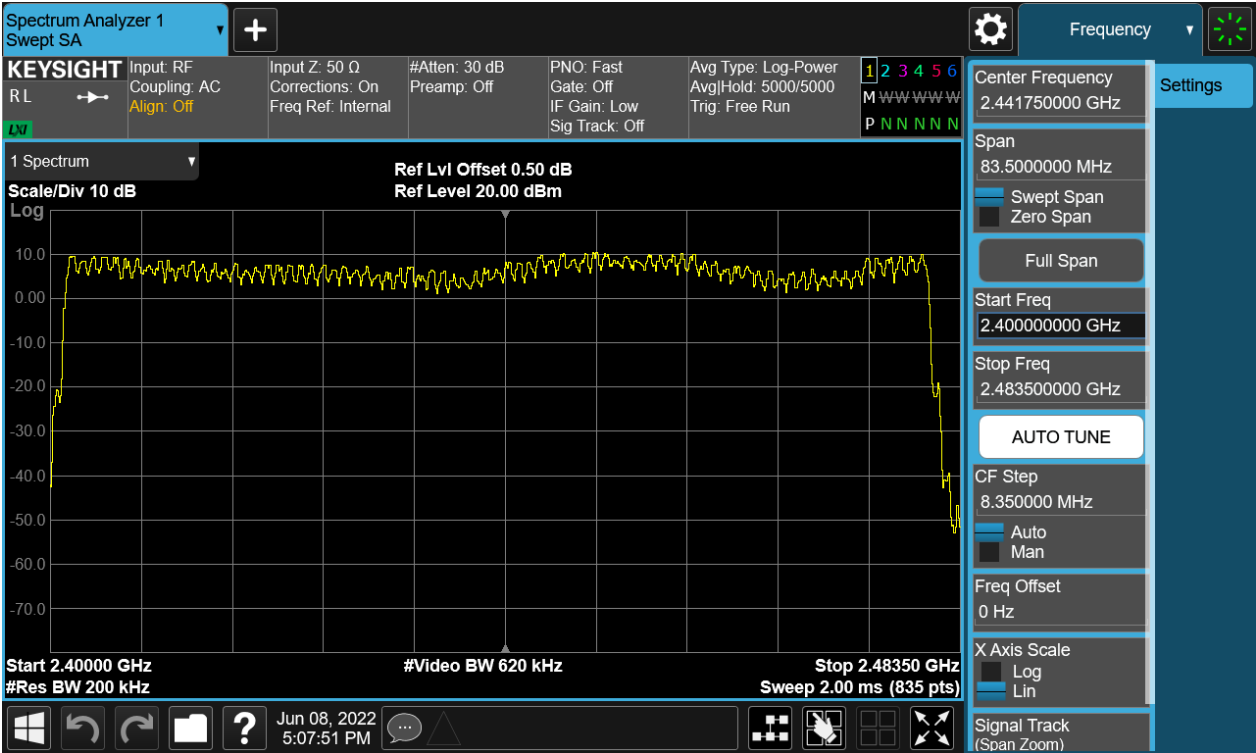


Figure 27: Number of Hopping Frequency, Hopping Mode, 8-DPSK



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4.1.9 Time of Occupancy

RESULT:

PASS

Test standard : FCC Part 15.247(a)(1)(iii)
Requirement : ANSI C63.10-2013
Kind of test site : Shielded room

Test setup

Test Channel : Middle
Operation Mode : A.1.a
Ambient temperature : 24.8°C
Relative humidity : 52%

Table 3: Time of Occupancy

Mode	Packet Type	Pulse Time (ms)	Total of Dwell (ms)	Limit (s)
GFSK	DH1	0.3900	124.80	0.4
	DH3	1.6550	264.80	0.4
	DH5	2.9070	310.08	0.4
8-DPSK	DH1	0.3983	127.46	0.4
	DH3	1.6550	264.80	0.4
	DH5	2.9200	311.47	0.4

Note:

For DH1 package type:

Total of Dwell = {Pulse Time*(1600/2)/Number of Hopping Frequency}*Period

Period = 0.4* Number of Hopping Frequency

For DH3 package type:

Total of Dwell = {Pulse Time*(1600/4)/Number of Hopping Frequency}*Period

Period = 0.4* Number of Hopping Frequency

For DH5 package type:

Total of Dwell = {Pulse Time*(1600/6)/Number of Hopping Frequency}*Period

Period = 0.4* Number of Hopping Frequency

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Figure 28: Time of Occupancy, 2441MHz, GFSK DH1

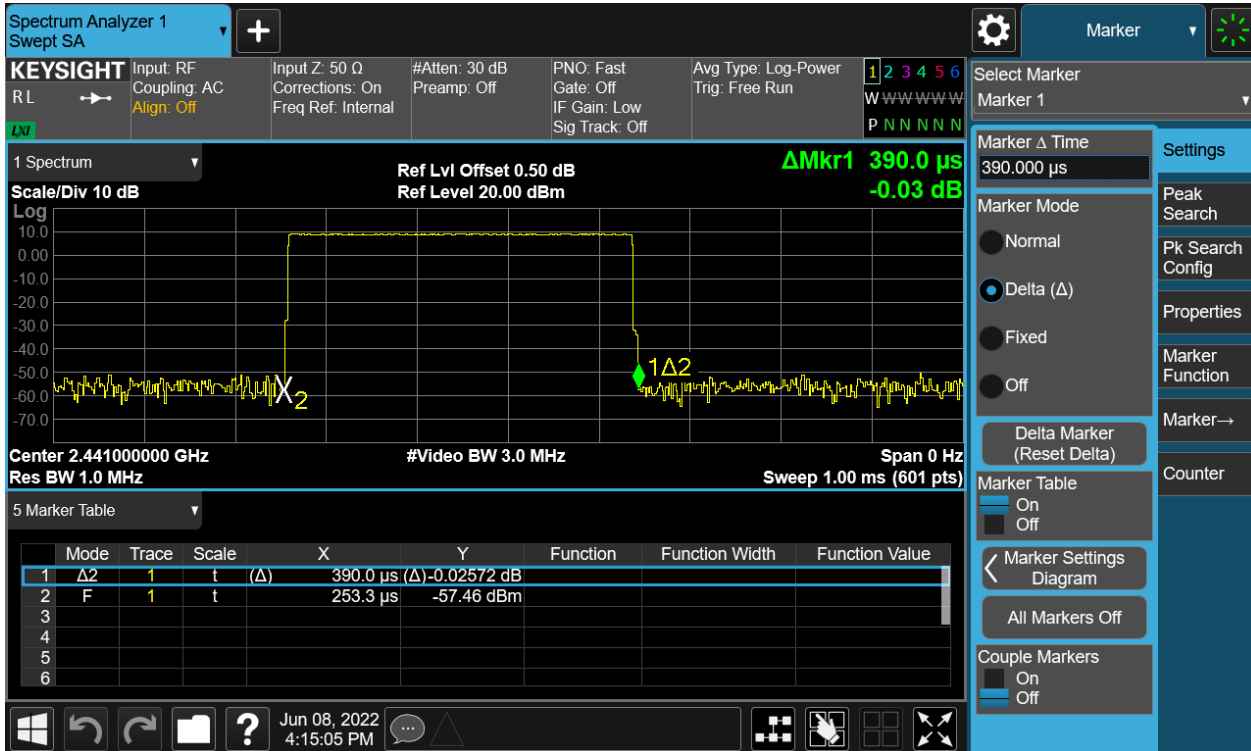
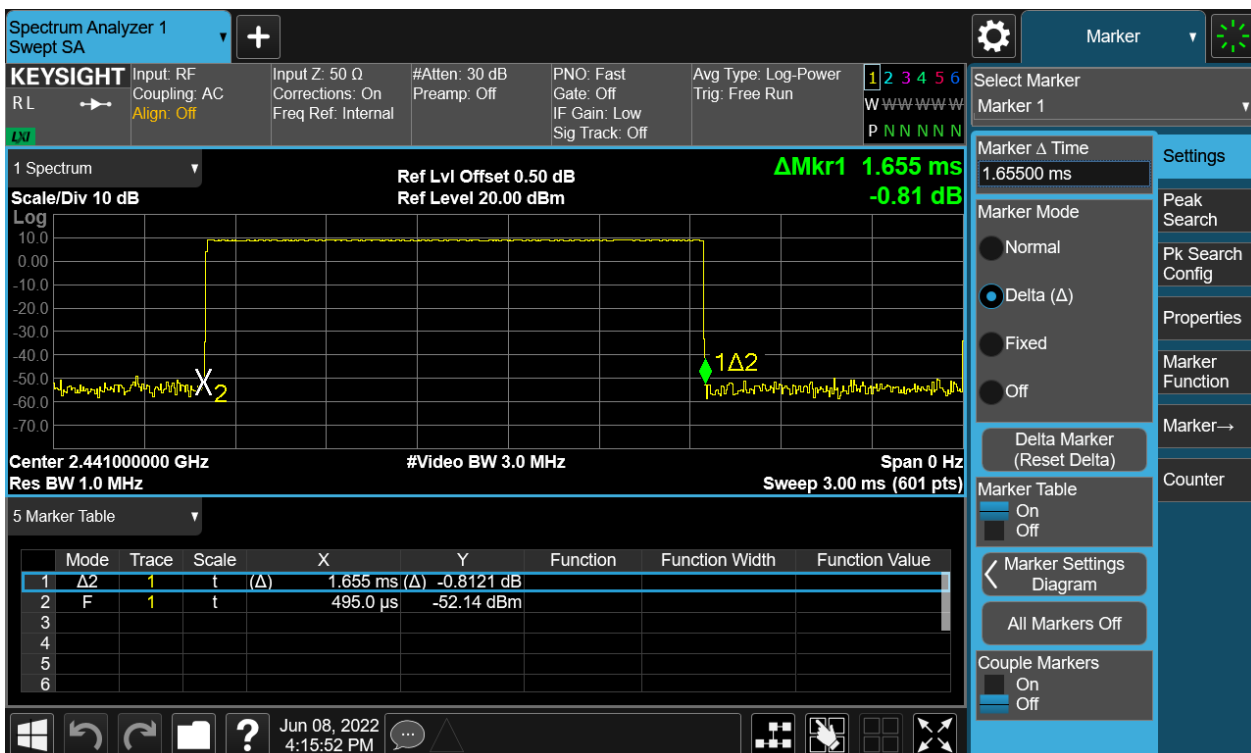


Figure 26: Time of Occupancy, 2441MHz, GFSK DH3



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Figure 30: Time of Occupancy, 2441MHz, GFSK DH5

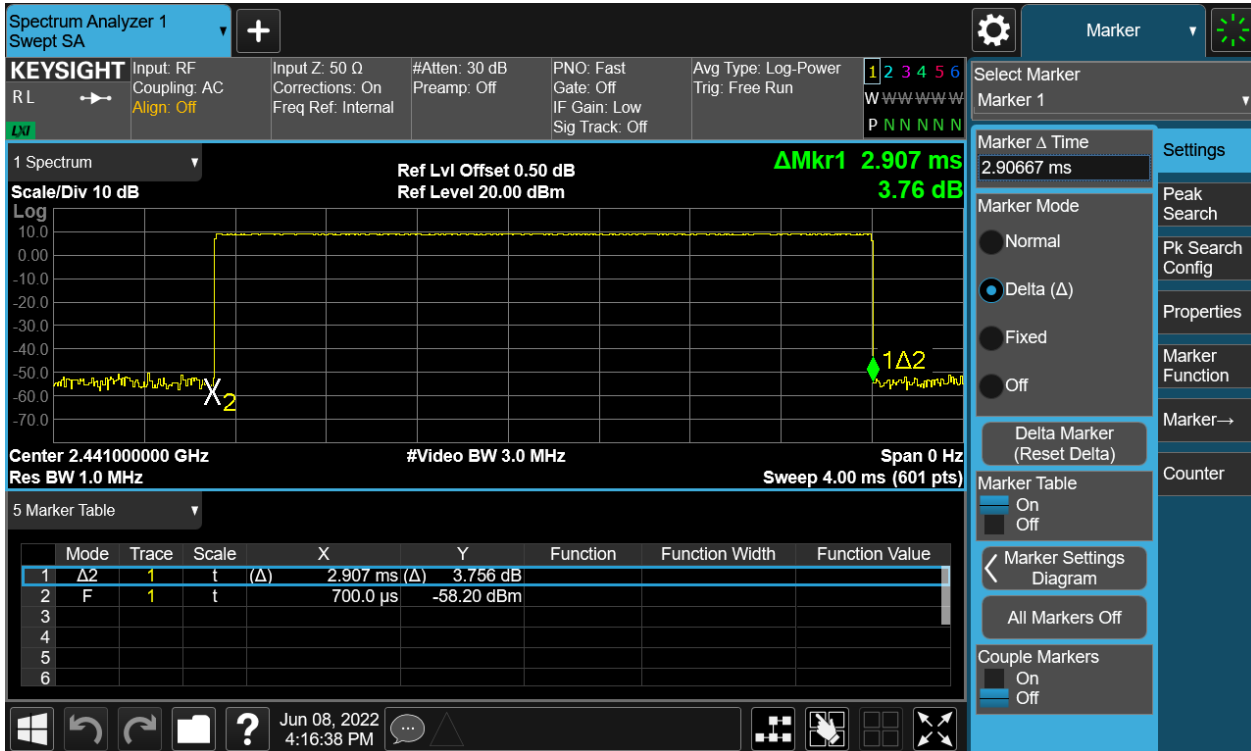
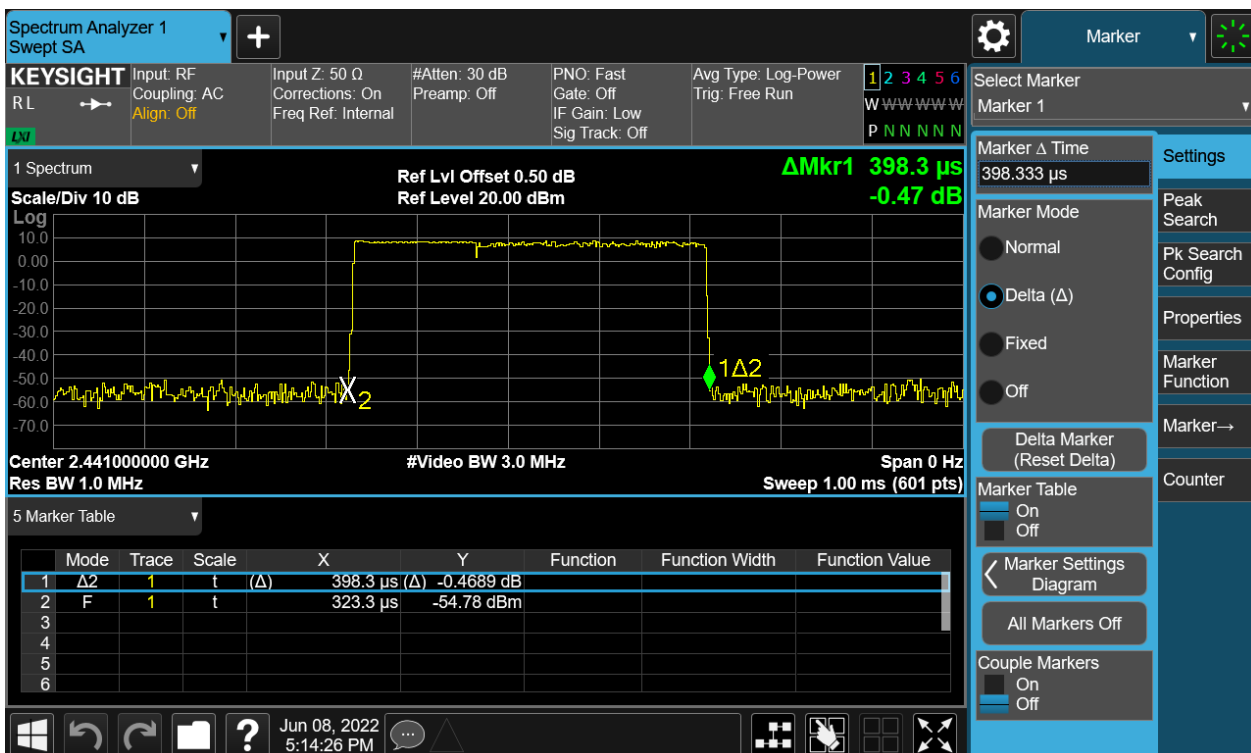


Figure 31: Time of Occupancy, 2441MHz, 8-DPSK DH1



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Figure 32: Time of Occupancy, 2441MHz, 8-DPSK DH3

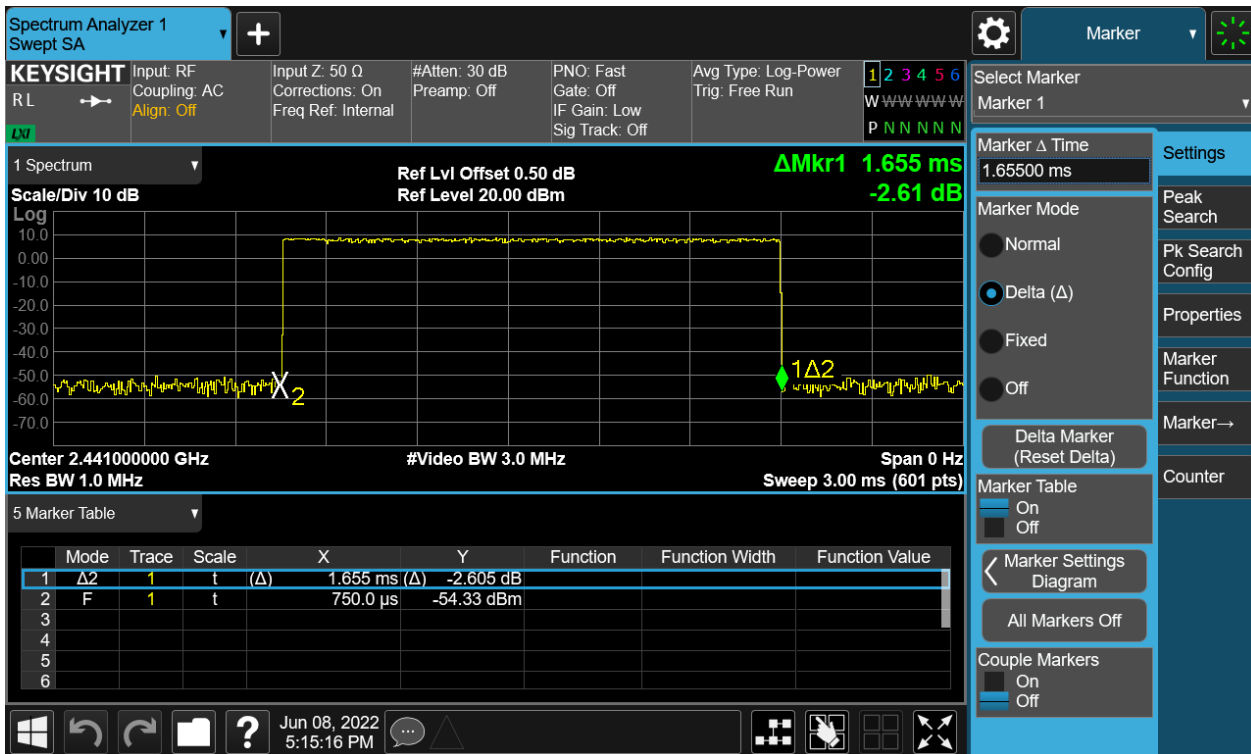
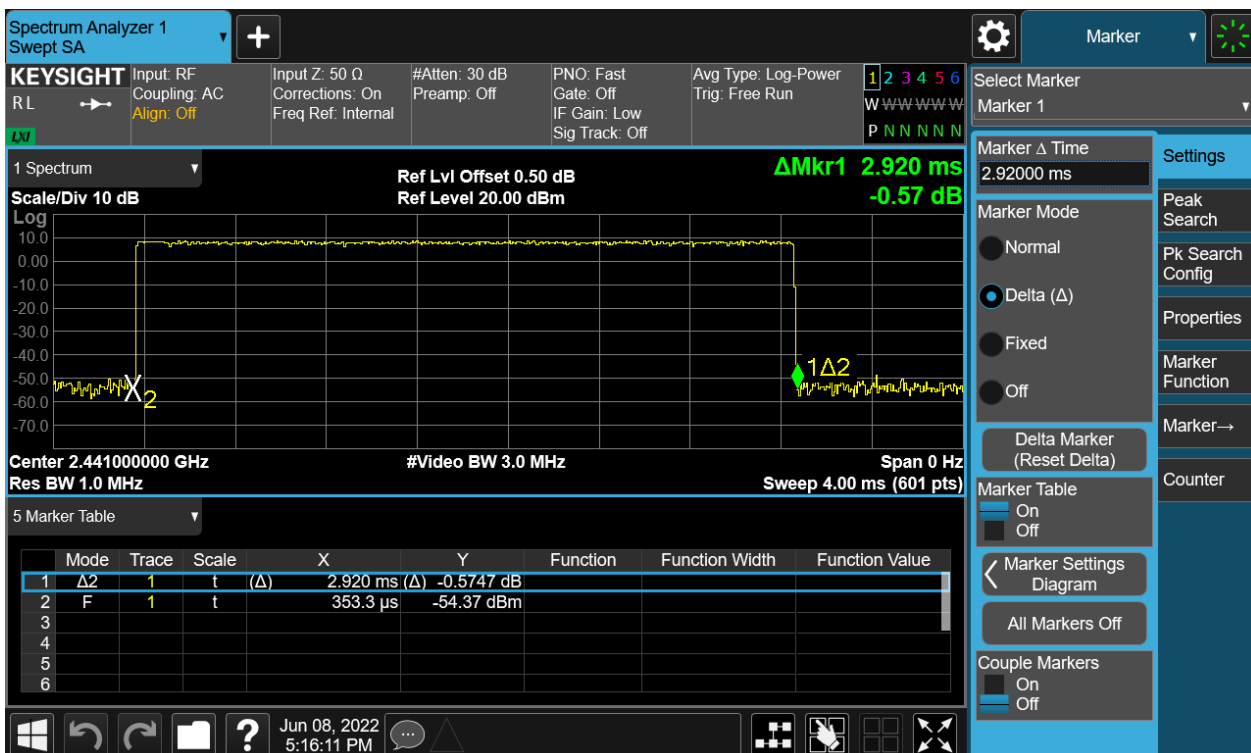


Figure 33: Time of Occupancy, 2441MHz, 8-DPSK DH5



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4.2 Mains Emissions

4.2.1 Conducted Emission on AC Mains

RESULT:

PASS

Test standard	: FCC Part 15.207(a)
Requirement	: ANSI C63.10-2013
Kind of test site	: Shielded room

Test setup

Input Voltage	: AC 120V, 60Hz
Operation Mode	: A.1.a
Earthing	: Not Connected
Ambient temperature	: 23°C
Relative humidity	: 51%

For details refer to following test plot.

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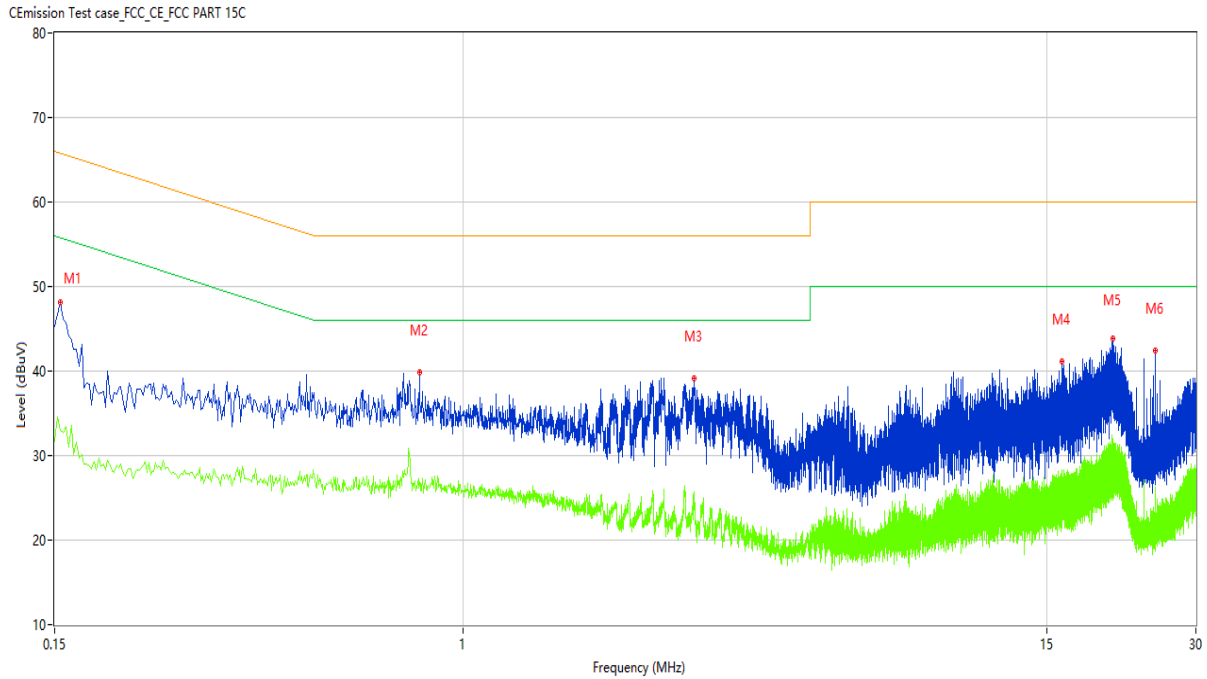
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Note:

The all configurations were tested respectively, but only the worst configuration(GFSK-hopping mode) shown here.

Figure 34: Conducted Emission on AC Mains, L Phase



No.	Frequency (MHz)	Results (dBuV)	Factor (dB)	Limit (dBuV)	Over Limit (dB)	Detector	Line	Verdict
1	0.150	47.90	10.26	66.00	-18.10	Peak	L	Pass
1*	0.150	40.56	10.26	66.00	-25.44	QP	L	Pass
1**	0.150	31.78	10.26	56.00	-24.22	AV	L	Pass
2	0.816	34.49	10.31	56.00	-21.51	Peak	L	Pass
2*	0.816	25.32	10.31	56.00	-30.68	QP	L	Pass
2**	0.816	26.79	10.31	46.00	-19.21	AV	L	Pass
3	2.916	38.92	10.16	56.00	-17.08	Peak	L	Pass
3*	2.916	34.78	10.16	56.00	-21.22	QP	L	Pass
3**	2.916	25.63	10.16	46.00	-20.37	AV	L	Pass
4	16.144	42.20	10.57	60.00	-17.80	Peak	L	Pass
4*	16.144	33.06	10.57	60.00	-26.94	QP	L	Pass
4**	16.144	26.79	10.57	50.00	-23.21	AV	L	Pass
5	20.410	44.58	10.96	60.00	-15.42	Peak	L	Pass
5*	20.410	35.86	10.96	60.00	-24.14	QP	L	Pass
5**	20.410	30.31	10.96	50.00	-19.69	AV	L	Pass
6	24.902	44.64	11.02	60.00	-15.36	Peak	L	Pass
6*	24.902	27.60	11.02	60.00	-32.40	QP	L	Pass
6**	24.902	26.33	11.02	50.00	-23.67	AV	L	Pass

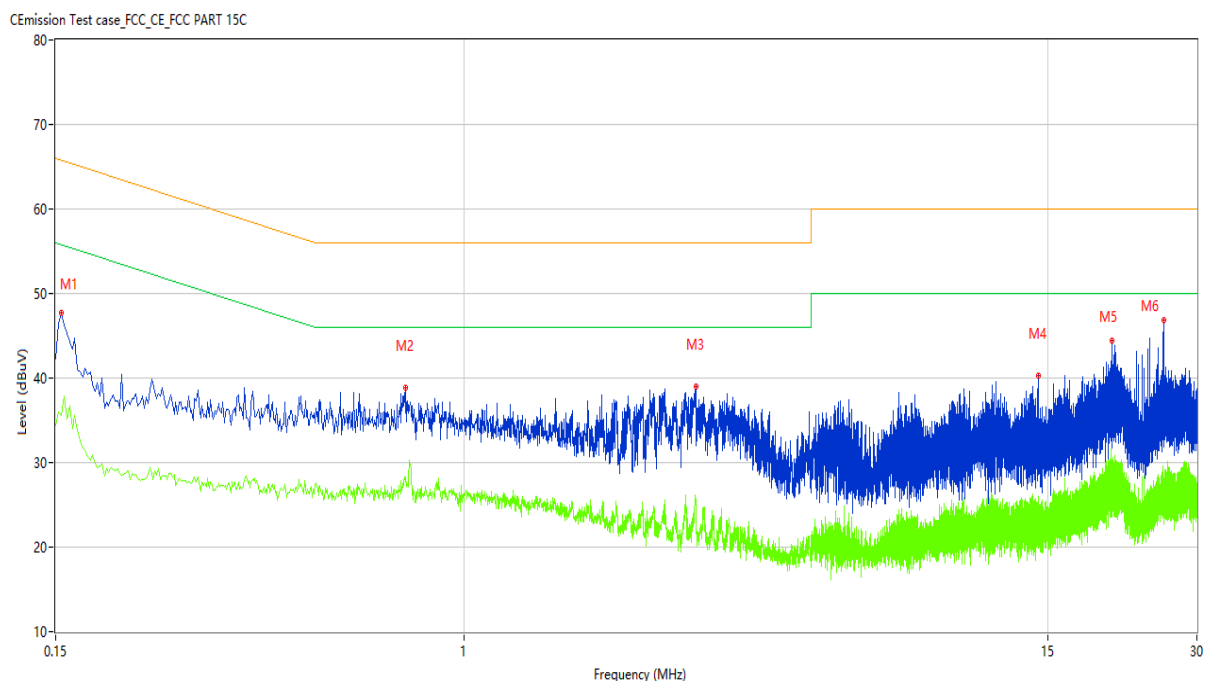
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Figure 35: Conducted Emission on AC Mains, N Phase



No.	Frequency (MHz)	Results (dBuV)	Factor (dB)	Limit (dBuV)	Over Limit (dB)	Detector	Line	Verdict
1	0.150	46.69	10.26	66.00	-19.31	Peak	N	Pass
1*	0.150	40.11	10.26	66.00	-25.89	QP	N	Pass
1**	0.150	34.47	10.26	56.00	-21.53	AV	N	Pass
2	0.762	43.65	10.31	56.00	-12.35	Peak	N	Pass
2*	0.762	32.18	10.31	56.00	-23.82	QP	N	Pass
2**	0.762	28.34	10.31	46.00	-17.66	AV	N	Pass
3	2.928	38.47	10.16	56.00	-17.53	Peak	N	Pass
3*	2.928	34.12	10.16	56.00	-21.88	QP	N	Pass
3**	2.928	25.66	10.16	46.00	-20.34	AV	N	Pass
4	14.366	39.45	10.43	60.00	-20.55	Peak	N	Pass
4*	14.366	30.09	10.43	60.00	-29.91	QP	N	Pass
4**	14.366	25.96	10.43	50.00	-24.04	AV	N	Pass
5	20.248	44.38	10.95	60.00	-15.62	Peak	N	Pass
5*	20.248	35.47	10.95	60.00	-24.53	QP	N	Pass
5**	20.248	28.81	10.95	50.00	-21.19	AV	N	Pass
6	25.784	46.35	11.03	60.00	-13.65	Peak	N	Pass
6*	25.784	33.72	11.03	60.00	-26.28	QP	N	Pass
6**	25.784	27.37	11.03	50.00	-22.63	AV	N	Pass

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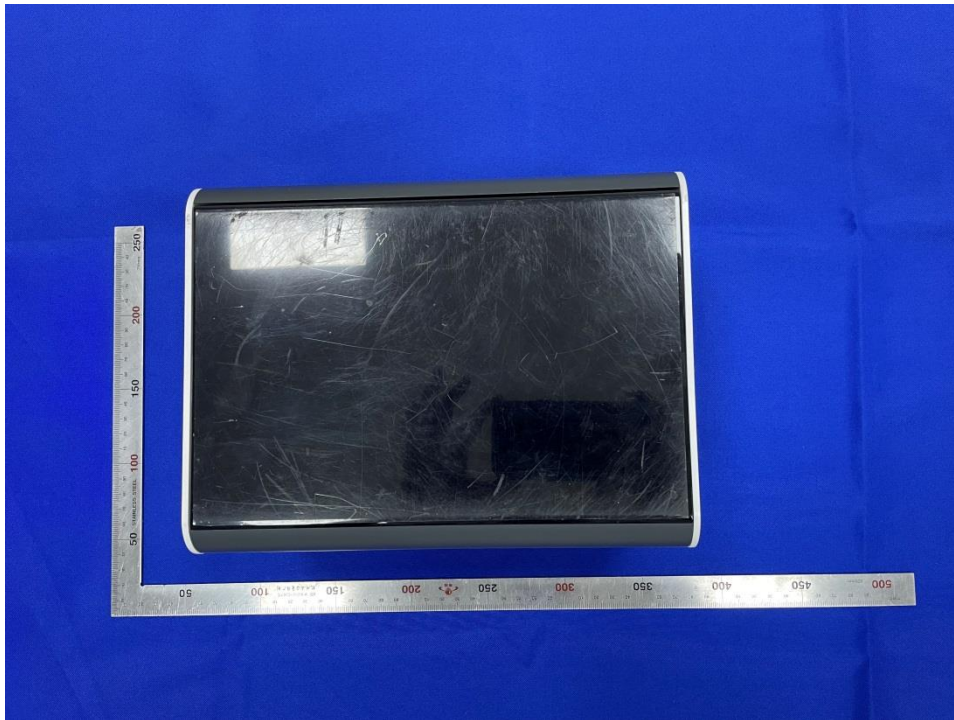
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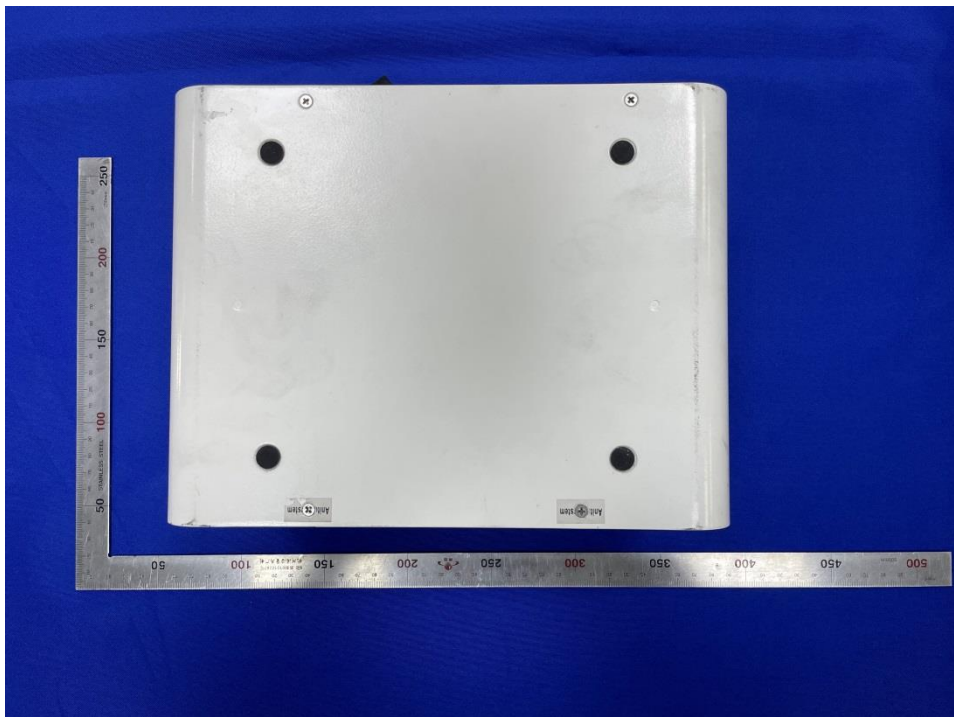
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5 Appendixes

5.1 Photographs of the Sample



Front of the sample



Back of the sample

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5.2 Set-up for Conducted Emission



5.3 Set-up for Conducted RF test at Antenna Port



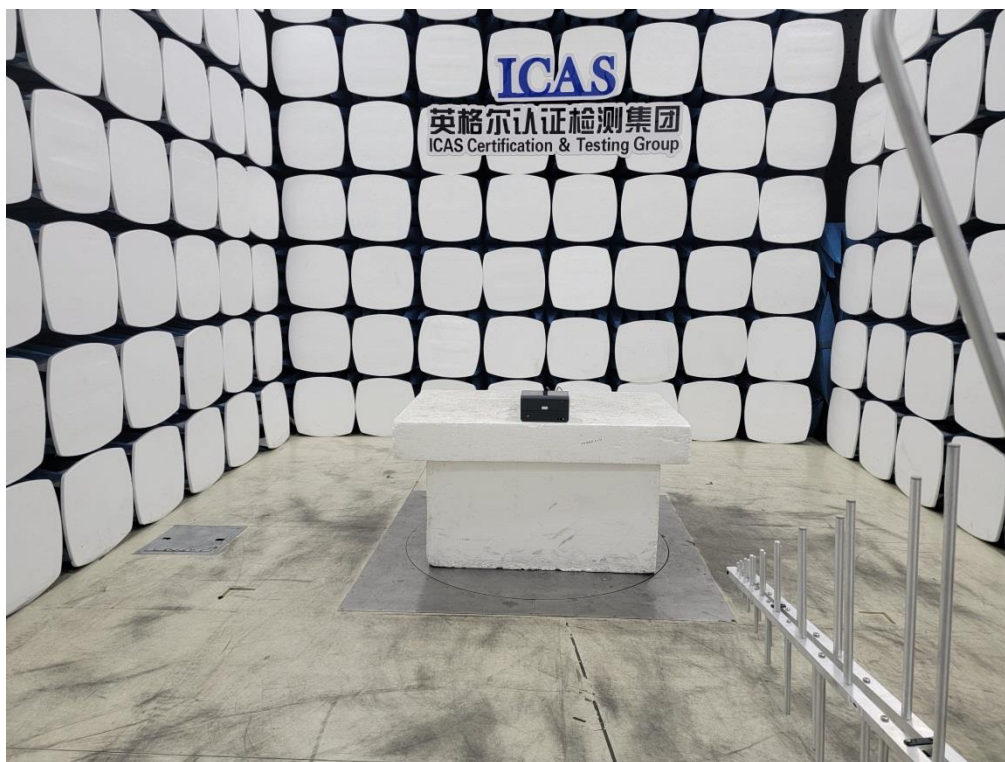
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5.4 Set-up for Spurious Emission below 1GHz



5.5 Set-up for Spurious Emission above 1GHz



End of the report