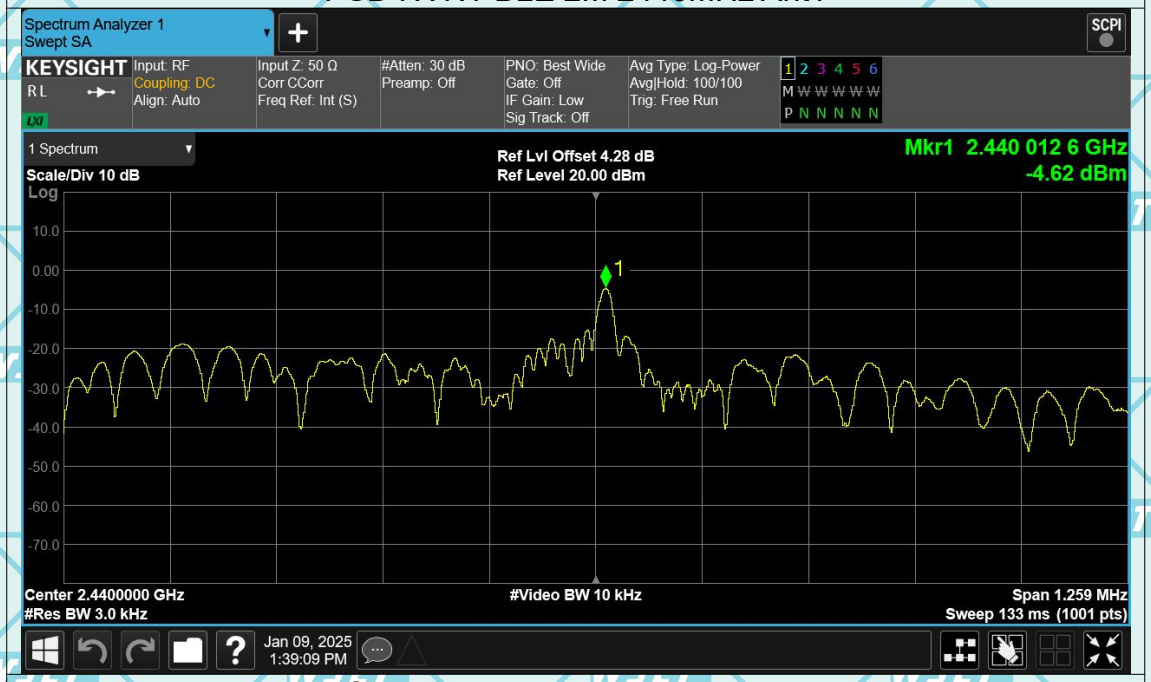
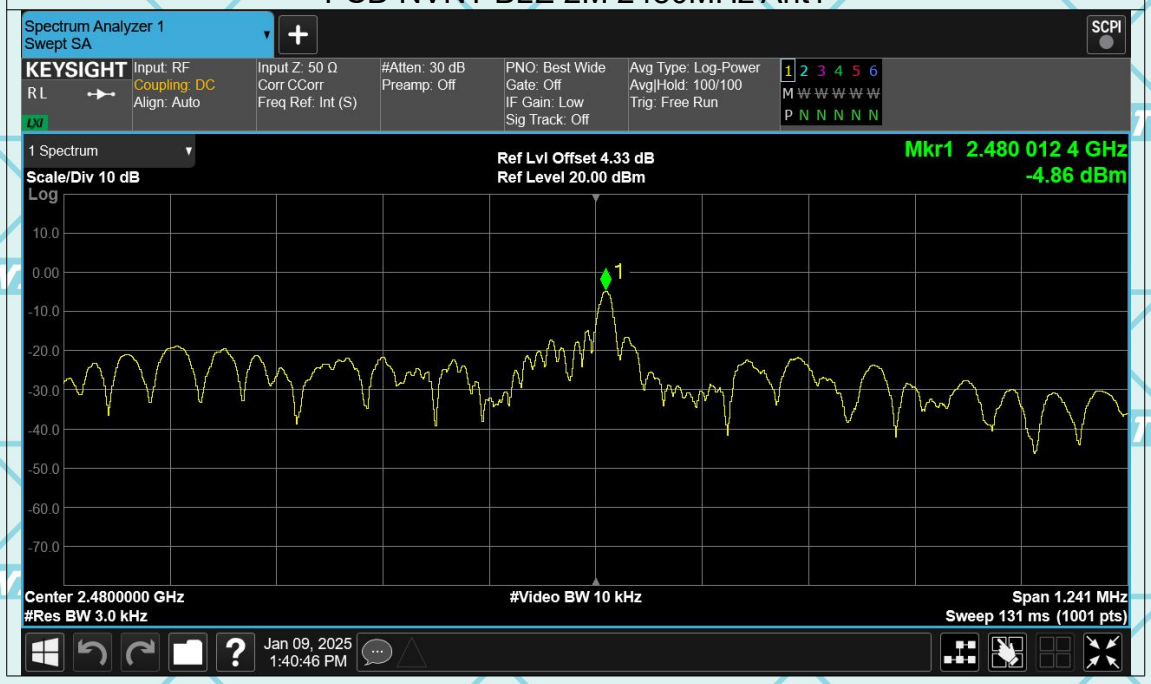
PSD NVNT BLE 2M 2440MHz Ant1

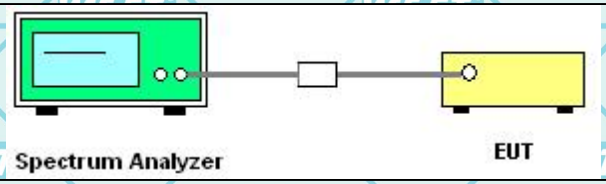


PSD NVNT BLE 2M 2480MHz Ant1



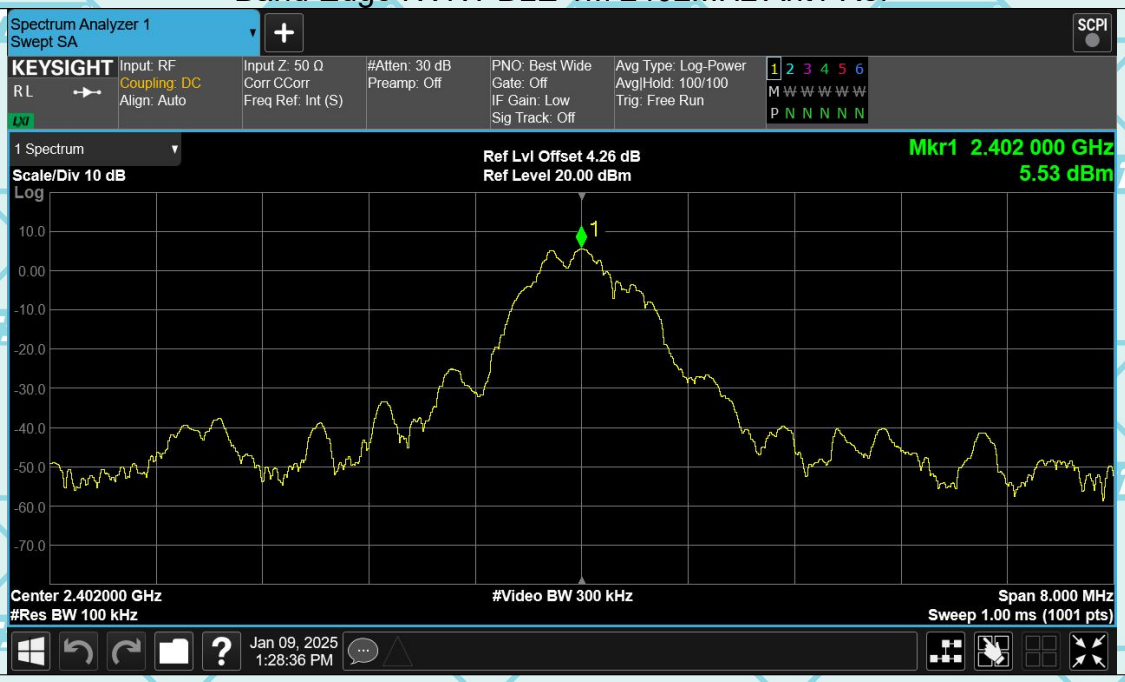
6.6. Conducted Band Edge and Spurious Emission Measurement

6.6.1. Test Specification

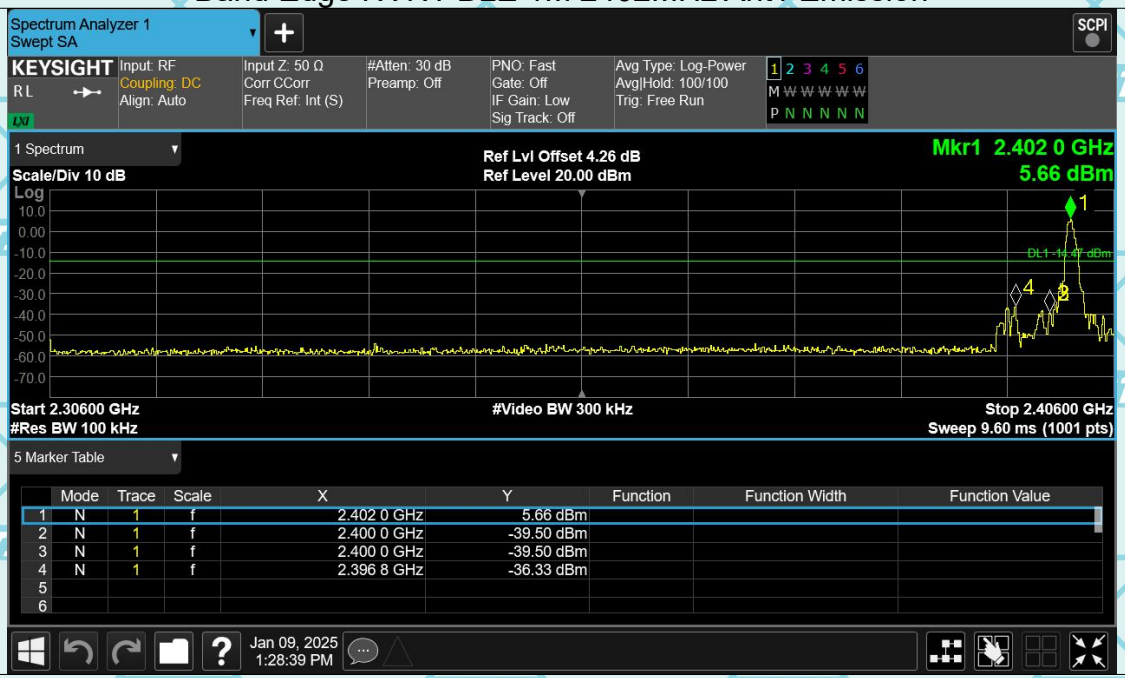
Test Requirement:	FCC Part15 C Section 15.247 (d)
Test Method:	KDB558074
Limit:	In any 100 kHz bandwidth outside of the authorized frequency band, the emissions which fall in the non-restricted bands shall be attenuated at least 20 dB / 30dB relative to the maximum PSD level in 100 kHz by RF conducted measurement and radiated emissions which fall in the restricted bands, as defined in Section 15.205(a), must also comply with the radiated emission limits specified in Section 15.209(a).
Test Setup:	
Test Mode:	Refer to item 4.1
Test Procedure:	1. The RF output of EUT was connected to the spectrum analyzer by RF cable and attenuator. The path loss was compensated to the results for each measurement. 2. Set to the maximum power setting and enable the EUT transmit continuously. 3. Set RBW = 100 kHz, VBW=300 kHz, Peak Detector. Unwanted Emissions measured in any 100 kHz bandwidth outside of the authorized frequency band shall be attenuated by at least 20 dB relative to the maximum in-band peak PSD level in 100 kHz when maximum peak conducted output power procedure is used. If the transmitter complies with the conducted power limits based on the use of RMS averaging over a time interval, the attenuation required under this paragraph shall be 30 dB instead of 20 dB per 15.247(d). 4. Measure and record the results in the test report. 5. The RF fundamental frequency should be excluded against the limit line in the operating frequency band.
Test Result:	PASS

Test Graphs

Band Edge NVNT BLE 1M 2402MHz Ant1 Ref



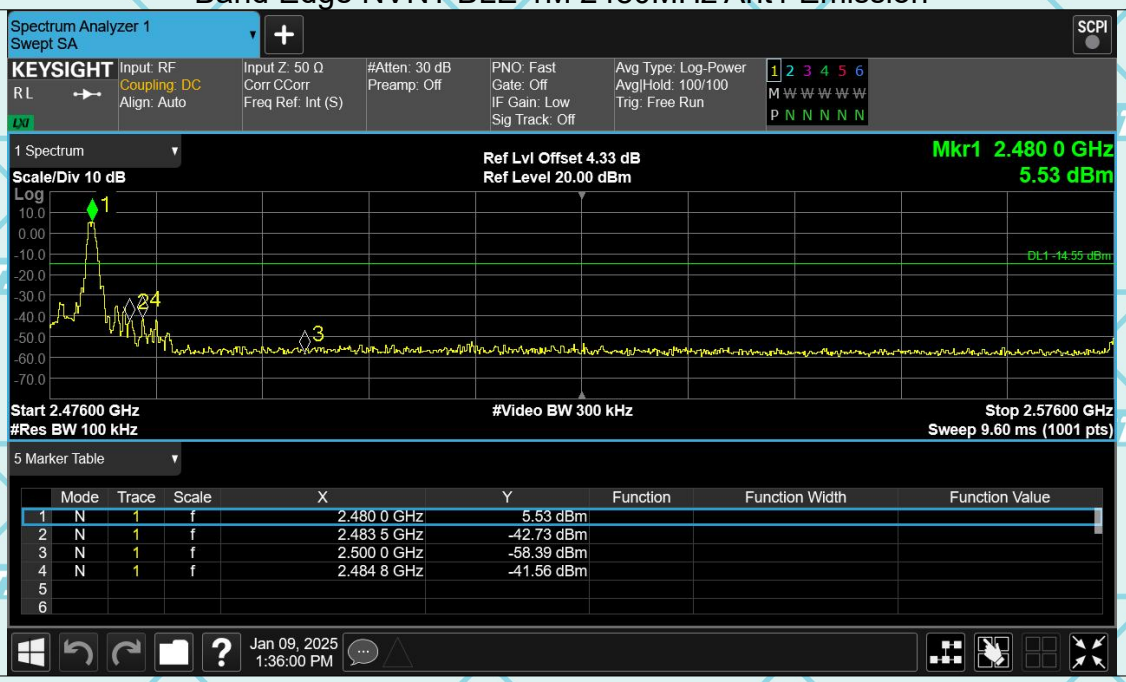
Band Edge NVNT BLE 1M 2402MHz Ant1 Emission



	Mode	Trace	Scale	X	Y	Function	Function Width	Function Value
1	N	1	f	2.402 0 GHz	5.66 dBm			
2	N	1	f	2.400 0 GHz	-39.50 dBm			
3	N	1	f	2.400 0 GHz	-39.50 dBm			
4	N	1	f	2.396 8 GHz	-36.33 dBm			
5								
6								

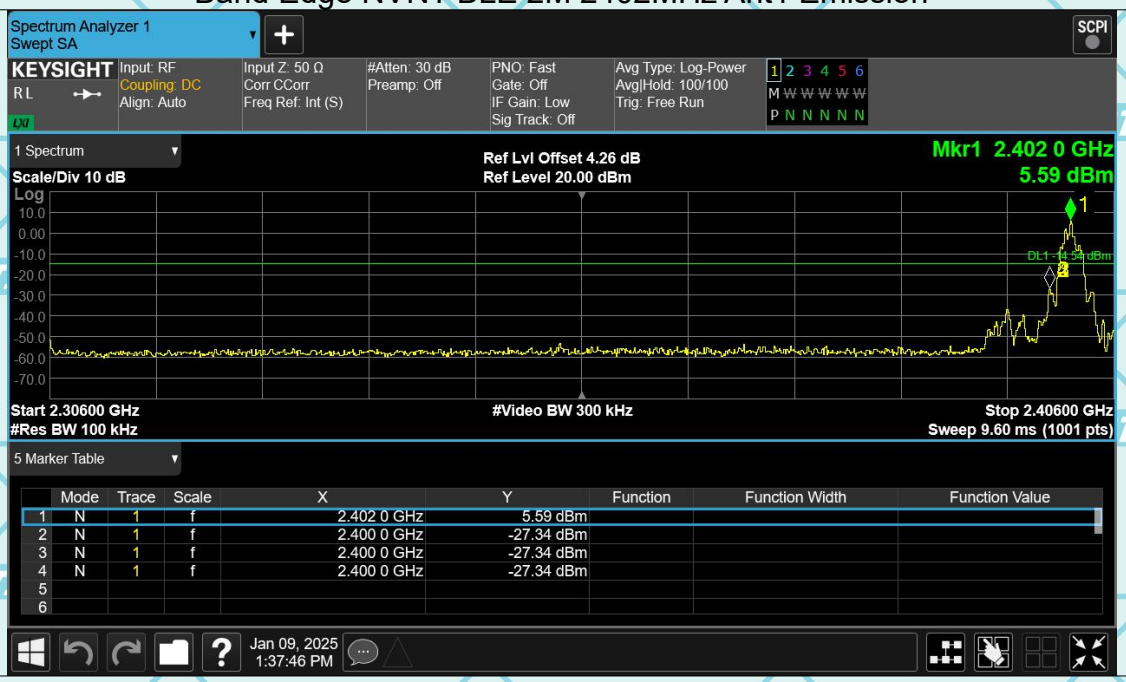
Band Edge NVNT BLE 1M 2480MHz Ant1 Ref

Band Edge NVNT BLE 1M 2480MHz Ant1 Emission



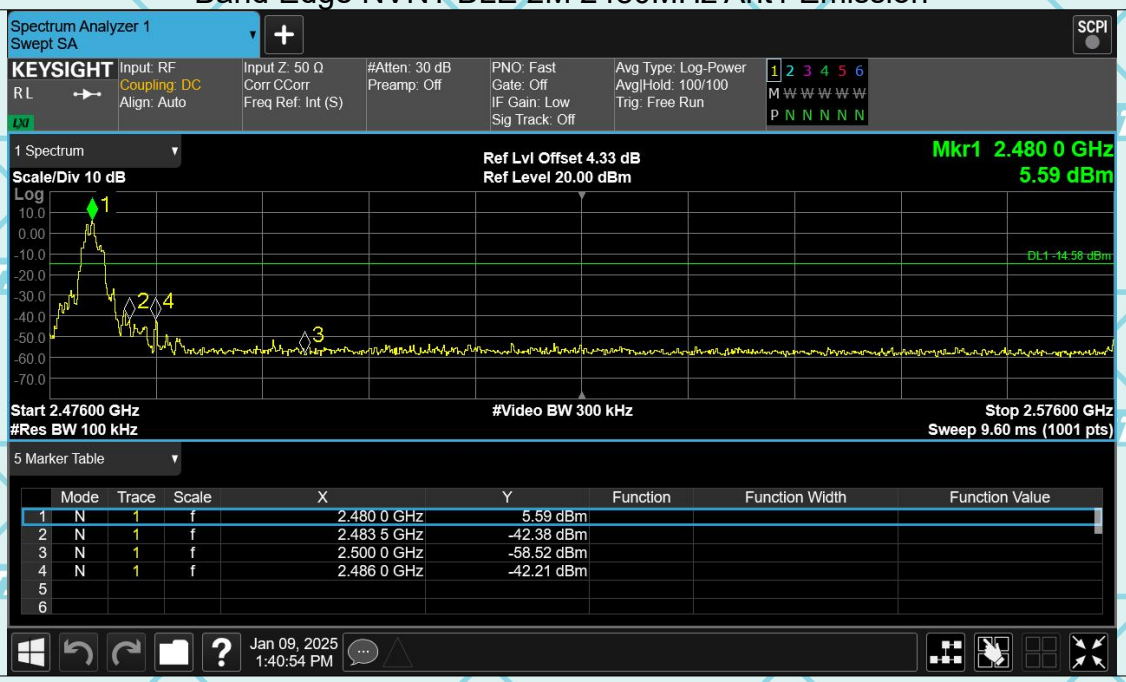
Band Edge NVNT BLE 2M 2402MHz Ant1 Ref

Band Edge NVNT BLE 2M 2402MHz Ant1 Emission



Band Edge NVNT BLE 2M 2480MHz Ant1 Ref

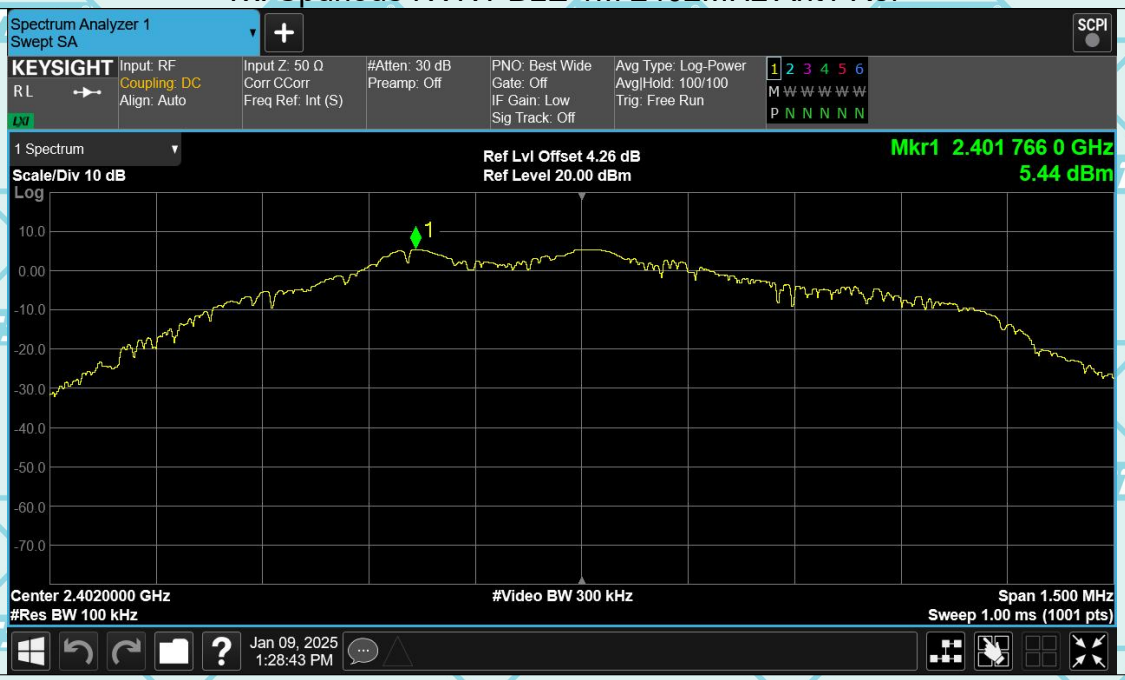
Band Edge NVNT BLE 2M 2480MHz Ant1 Emission



Conducted RF Spurious Emission

Test Graphs

Tx. Spurious NVNT BLE 1M 2402MHz Ant1 Ref



Tx. Spurious NVNT BLE 1M 2402MHz Ant1 Emission

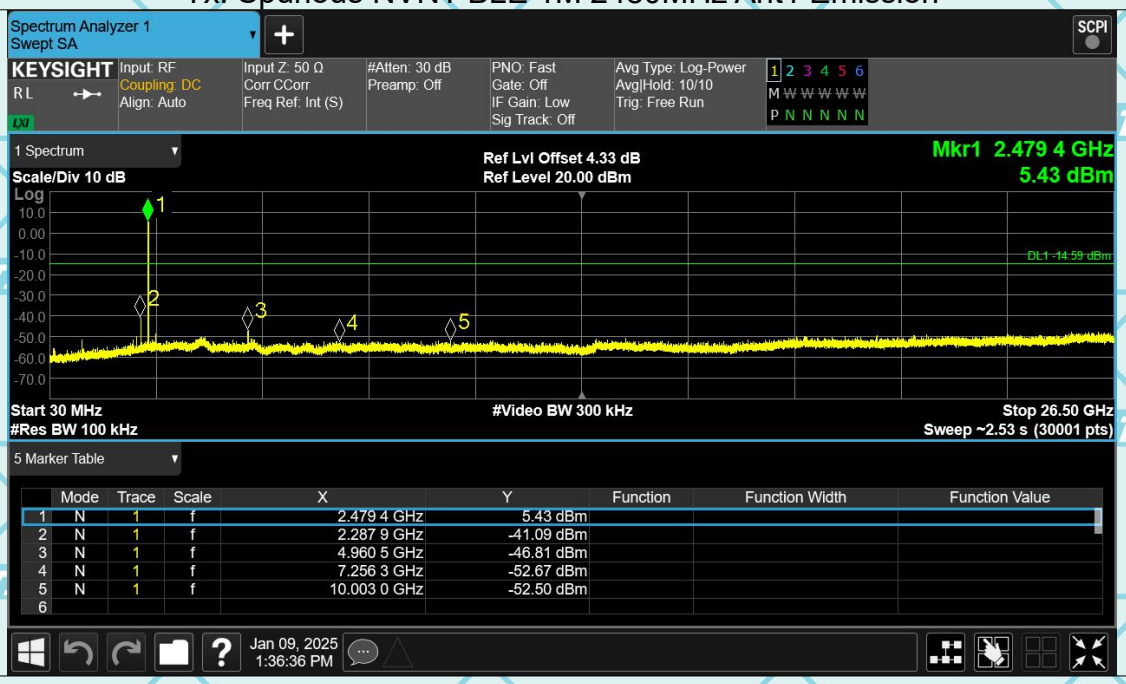
Tx. Spurious NVNT BLE 1M 2440MHz Ant1 Ref

Tx. Spurious NVNT BLE 1M 2440MHz Ant1 Emission

	Mode	Trace	Scale	X	Y	Function	Function Width	Function Value
1	N	1	f	2.439 7 GHz	-15.54 dBm			
2	N	1	f	2.248 2 GHz	-46.08 dBm			
3	N	1	f	4.879 3 GHz	-48.21 dBm			
4	N	1	f	7.319 8 GHz	-51.35 dBm			
5	N	1	f	9.797 4 GHz	-52.69 dBm			
6								

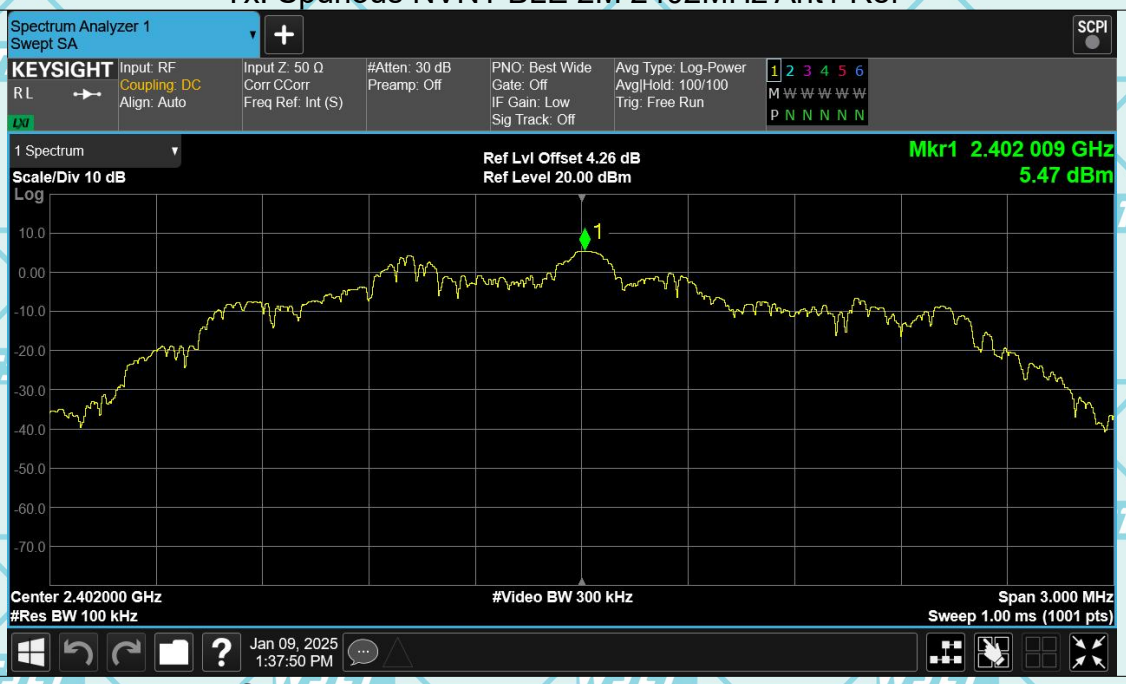
Tx. Spurious NVNT BLE 1M 2480MHz Ant1 Ref

Tx. Spurious NVNT BLE 1M 2480MHz Ant1 Emission



	Mode	Trace	Scale	X	Y	Function	Function Width	Function Value
1	N	1	f	2.479 4 GHz	5.43 dBm			
2	N	1	f	2.287 9 GHz	-41.09 dBm			
3	N	1	f	4.960 5 GHz	-46.81 dBm			
4	N	1	f	7.256 3 GHz	-52.67 dBm			
5	N	1	f	10.003 0 GHz	-52.50 dBm			
6								

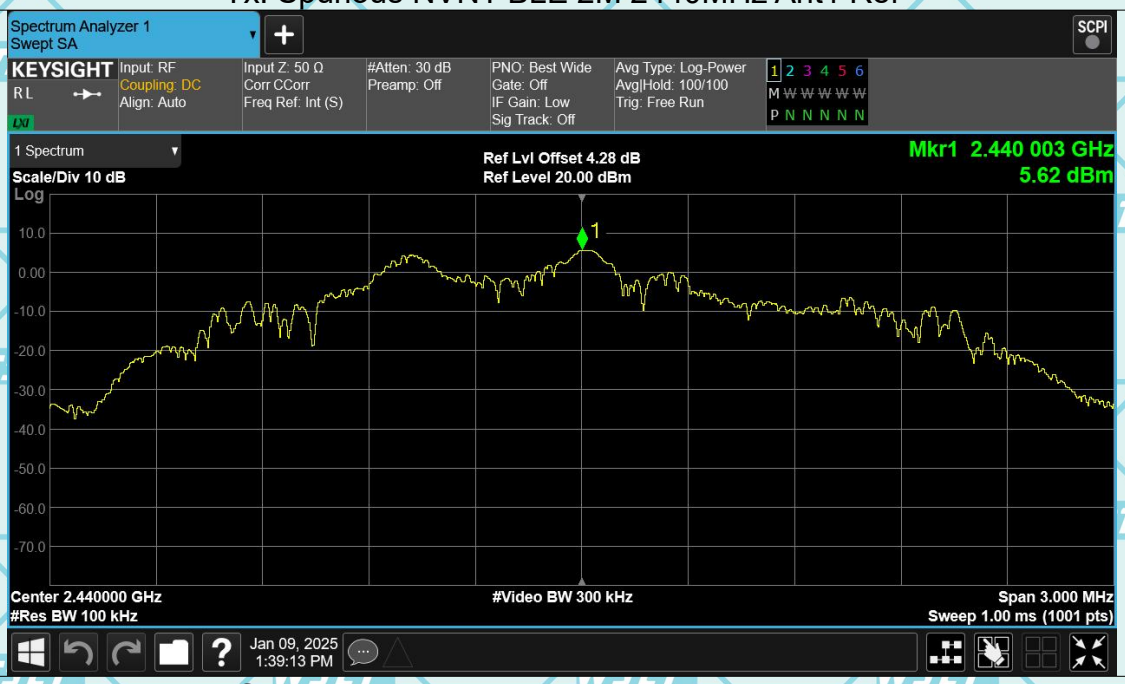
Tx. Spurious NVNT BLE 2M 2402MHz Ant1 Ref



Tx. Spurious NVNT BLE 2M 2402MHz Ant1 Emission

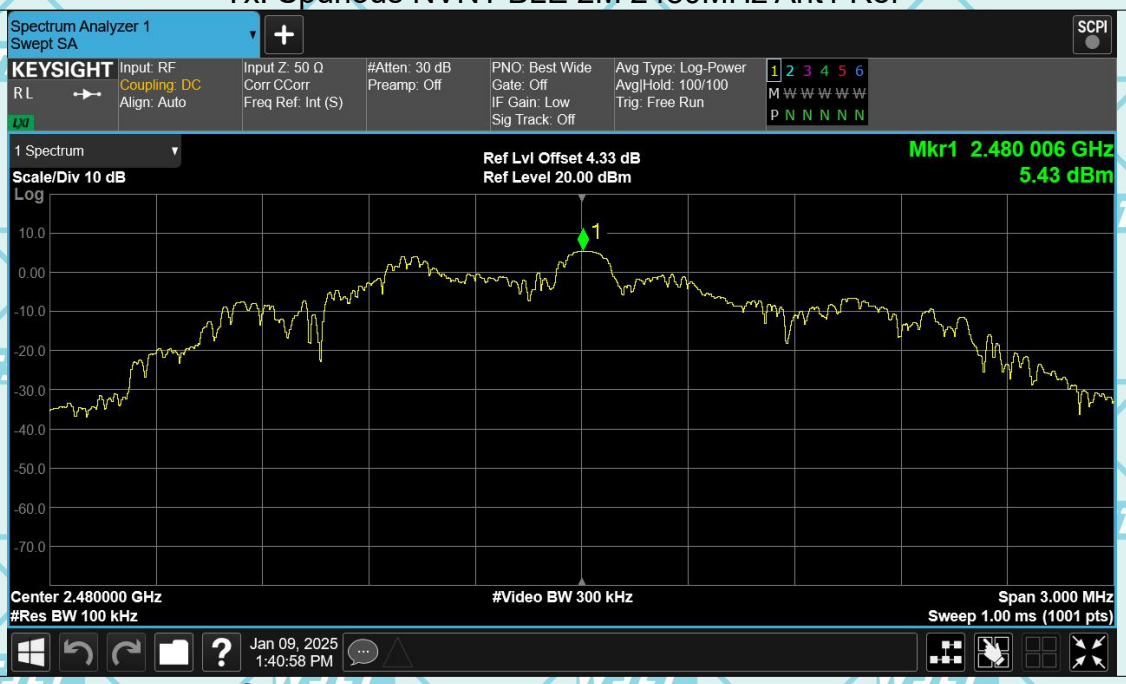
	Mode	Trace	Scale	X	Y	Function	Function Width	Function Value
1	N	1	f	2.401 7 GHz	5.50 dBm			
2	N	1	f	3.597 3 GHz	-37.86 dBm			
3	N	1	f	4.803 4 GHz	-47.73 dBm			
4	N	1	f	7.206 0 GHz	-51.98 dBm			
5	N	1	f	9.602 4 GHz	-51.11 dBm			
6								

Tx. Spurious NVNT BLE 2M 2440MHz Ant1 Ref



Tx. Spurious NVNT BLE 2M 2440MHz Ant1 Emission

Tx. Spurious NVNT BLE 2M 2480MHz Ant1 Ref

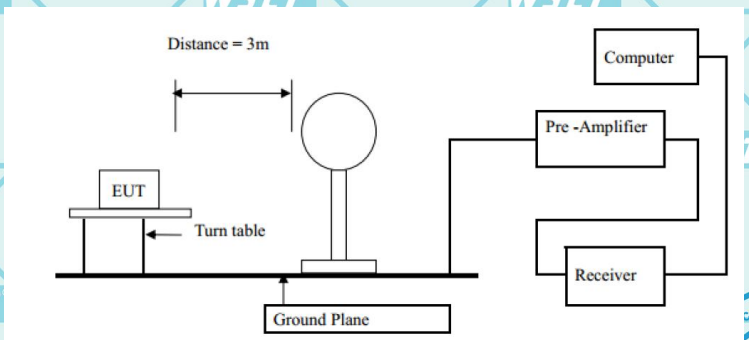


Tx. Spurious NVNT BLE 2M 2480MHz Ant1 Emission

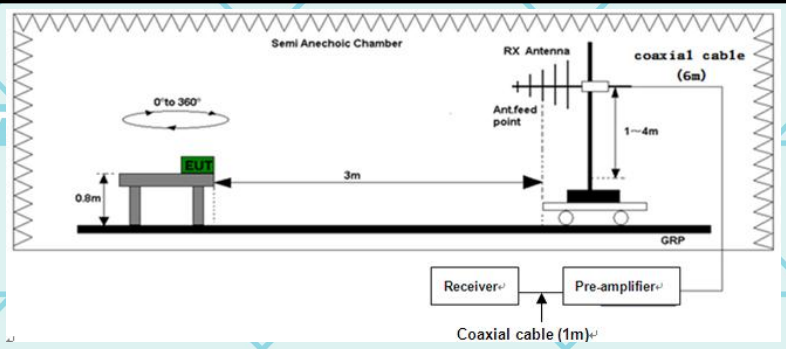
	Mode	Trace	Scale	X	Y	Function	Function Width	Function Value
1	N	1	f	2.480 2 GHz	5.39 dBm			
2	N	1	f	2.287 9 GHz	-43.83 dBm			
3	N	1	f	4.958 7 GHz	-49.04 dBm			
4	N	1	f	7.246 6 GHz	-52.70 dBm			
5	N	1	f	9.816 0 GHz	-52.45 dBm			
6								

6.7. Radiated Spurious Emission Measurement

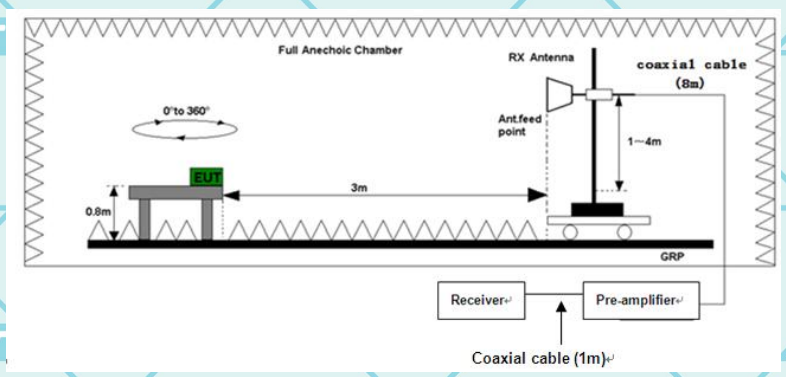
6.7.1. Test Specification

<table>
<tr><td>Test Requirement:</td><td>FCC Part15 C Section 15.209</td></tr>
<tr><td>Test Method:</td><td>ANSI C63.10:2014</td></tr>
<tr><td>Frequency Range:</td><td>9 kHz to 25 GHz</td></tr>
<tr><td>Measurement Distance:</td><td>3 m</td></tr>
<tr><td>Antenna Polarization:</td><td>Horizontal & Vertical</td></tr>
<tr><td>Operation mode:</td><td>Refer to item 4.1</td></tr>
<tr><td>Receiver Setup:</td><td>
<table>
<tr><th>Frequency</th><th>Detector</th><th>RBW</th><th>VBW</th><th>Remark</th></tr>
<tr><td>9kHz- 150kHz</td><td>Quasi-peak</td><td>200Hz</td><td>1kHz</td><td>Quasi-peak Value</td></tr>
<tr><td>150kHz-30MHz</td><td>Quasi-peak</td><td>9kHz</td><td>30kHz</td><td>Quasi-peak Value</td></tr>
<tr><td>30MHz-1GHz</td><td>Quasi-peak</td><td>100KHz</td><td>300KHz</td><td>Quasi-peak Value</td></tr>
<tr><td rowspan="2">Above 1GHz</td><td>Peak</td><td>1MHz</td><td>3MHz</td><td>Peak Value</td></tr>
<tr><td>Peak</td><td>1MHz</td><td>10Hz</td><td>Average Value</td></tr>
</table>
</td></tr>
<tr><td>Limit:</td><td>
<table>
<tr><th>Frequency</th><th>Field Strength (microvolts/meter)</th><th>Measurement Distance (meters)</th></tr>
<tr><td>0.009-0.490</td><td>2400/F(KHz)</td><td>300</td></tr>
<tr><td>0.490-1.705</td><td>24000/F(KHz)</td><td>30</td></tr>
<tr><td>1.705-30</td><td>30</td><td>30</td></tr>
<tr><td>30-88</td><td>100</td><td>3</td></tr>
<tr><td>88-216</td><td>150</td><td>3</td></tr>
<tr><td>216-960</td><td>200</td><td>3</td></tr>
<tr><td>Above 960</td><td>500</td><td>3</td></tr>
</table>
<table>
<tr><th>Frequency</th><th>Field Strength (microvolts/meter)</th><th>Measurement Distance (meters)</th><th>Detector</th></tr>
<tr><td rowspan="2">Above 1GHz</td><td>500</td><td>3</td><td>Average</td></tr>
<tr><td>5000</td><td>3</td><td>Peak</td></tr>
</table>
</td></tr>
<tr><td>Test setup:</td><td>For radiated emissions below 30MHz
 

30MHz to 1GHz</td></tr>
</table>



Above 1GHz



Test Procedure:

1. For the radiated emission test below 1GHz:
The EUT was placed on a turntable with 0.1 meter above ground. The EUT was set 3 meters from the interference receiving antenna, which was mounted on the top of a variable height antenna tower. The EUT was arranged to its worst case and then tune the antenna tower (from 1 m to 4 m) and turntable (from 0 degree to 360 degrees) to find the maximum reading. A pre-amp and a high PASS filter are used for the test in order to get better signal level.
For the radiated emission test above 1GHz:
Place the measurement antenna on a turntable with 1.5 meter above ground, which is away from each area of the EUT determined to be a source of emissions at the specified measurement distance, while keeping the measurement antenna aimed at the source of emissions at each frequency of significant emissions, with polarization oriented for maximum response. The measurement antenna may have to be higher or lower than the EUT,

	depending on the radiation pattern of the emission and staying aimed at the emission source for receiving the maximum signal. The final measurement antenna elevation shall be that which maximizes the emissions. The measurement antenna elevation for maximum emissions shall be restricted to a range of heights of from 1 m to 4 m above the ground or reference ground plane. 2. Corrected Reading: Antenna Factor + Cable Loss + Read Level - Preamp Factor = Level 3. For measurement below 1GHz, If the emission level of the EUT measured by the peak detector is 3 dB lower than the applicable limit, the peak emission level will be reported. Otherwise, the emission measurement will be repeated using the quasi-peak detector and reported. 4. Use the following spectrum analyzer settings: (1) Span shall wide enough to fully capture the emission being measured; (2) Set RBW=100 kHz for f < 1 GHz; VBW ≥RBW; Sweep = auto; Detector function = peak; Trace = max hold; (3) Set RBW = 1 MHz, VBW= 3MHz for f 1 GHz for peak measurement. For average measurement: VBW = 10 Hz, when duty cycle is no less than 98 percent. VBW ≥ 1/T, when duty cycle is less than 98 percent where T is the minimum transmission duration over which the transmitter is on and is transmitting at its maximum power control level for the tested mode of operation.
Test mode:	Refer to section 4.1 for details
Test results:	PASS

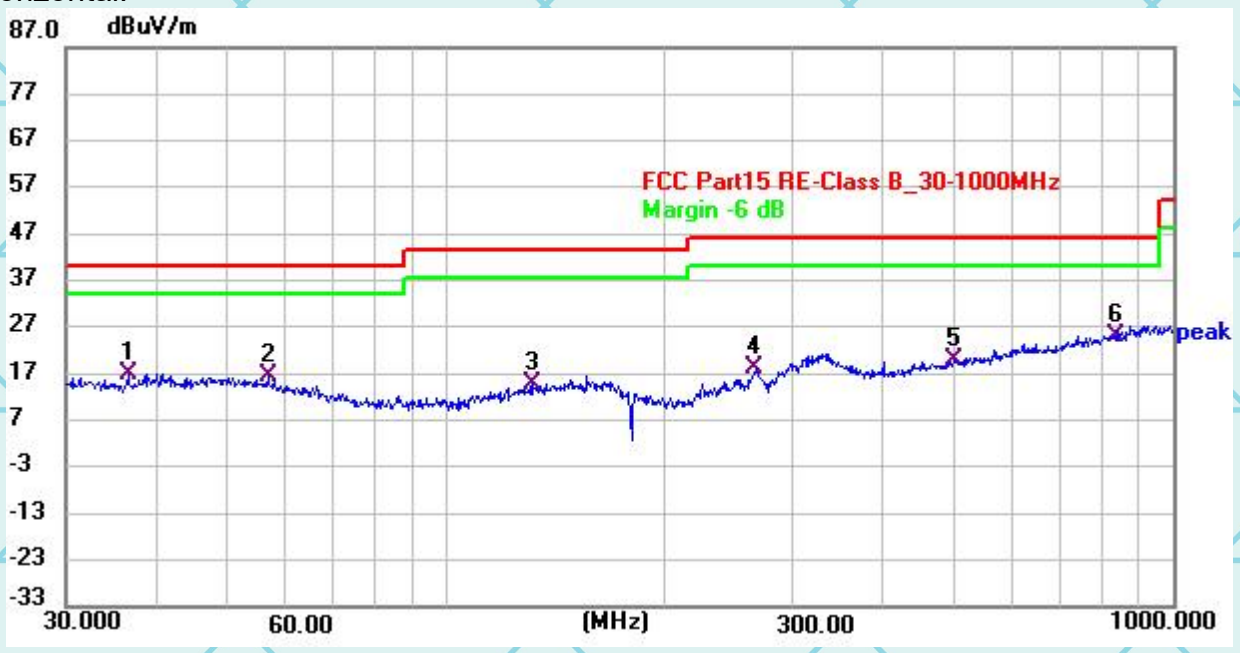
Note: Freq. = Emission frequency in MHz
Reading level (dBμV) = Receiver reading
Corr. Factor (dB) = Attenuation factor + Cable loss
Level (dBμV) = Reading level (dBμV) + Corr. Factor (dB)
Limit (dBμV) = Limit stated in standard
Margin (dB) = Level (dBμV) – Limits (dBμV)

6.7.2. Test Data

Please refer to following diagram for individual

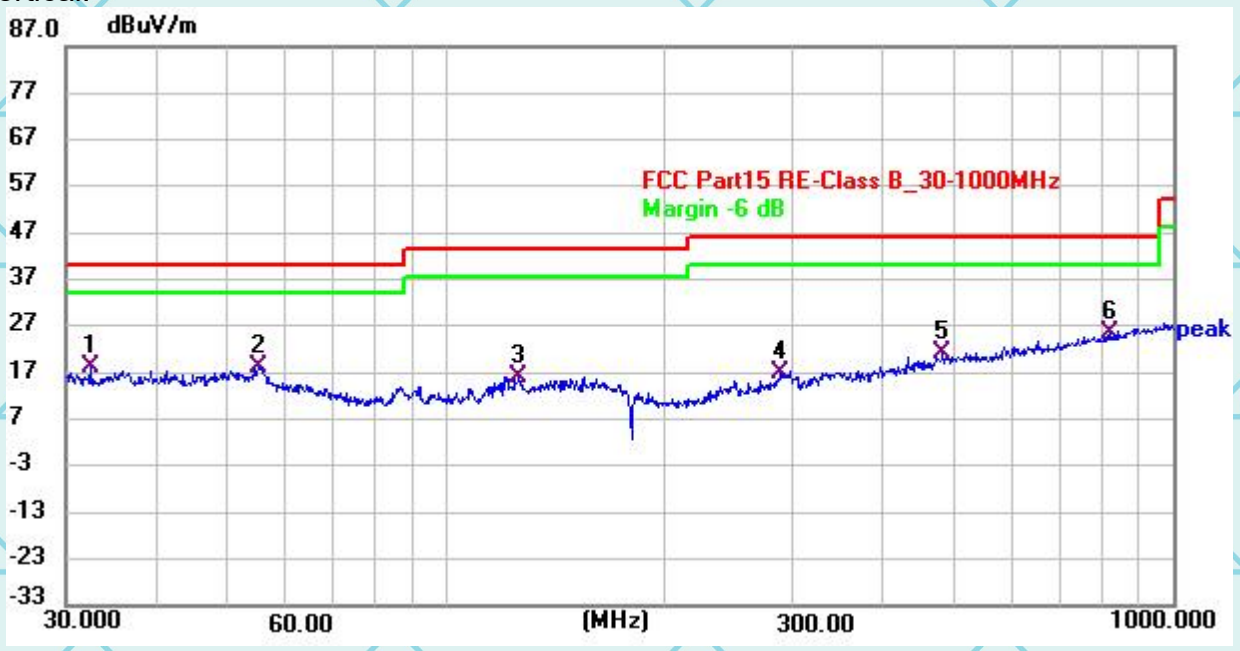
Below 1GHz

Horizontal:



No.	Frequency (MHz)	Reading (dBuV)	Factor (dB/m)	Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Detector
1	36.6054	36.46	-19.42	17.04	40.00	-22.96	QP
2	57.1664	36.72	-20.01	16.71	40.00	-23.29	QP
3	132.0468	34.86	-20.21	14.65	43.50	-28.85	QP
4	266.6089	39.57	-21.47	18.10	46.00	-27.90	QP
5	502.2786	35.41	-15.43	19.98	46.00	-26.02	QP
6 *	834.7794	35.69	-10.55	25.14	46.00	-20.86	QP

Vertical:



No.	Frequency (MHz)	Reading (dBuV)	Factor (dB/m)	Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Detector
1	32.4486	37.65	-19.60	18.05	40.00	-21.95	QP
2	55.2207	37.71	-19.62	18.09	40.00	-21.91	QP
3	125.8864	37.05	-20.89	16.16	43.50	-27.34	QP
4	289.5092	37.45	-20.60	16.85	46.00	-29.15	QP
5	482.8501	37.16	-15.81	21.35	46.00	-24.65	QP
6 *	820.9904	35.96	-10.67	25.29	46.00	-20.71	QP

Note1:
Freq. = Emission frequency in MHz
Reading level (dBμV) = Receiver reading
Corr. Factor (dB) = Antenna factor + Cable loss - Amplifier factor.
Measurement (dBμV) = Reading level (dBμV) + Corr. Factor (dB)
Limit (dBμV) = Limit stated in standard
Margin (dB) = Measurement (dBμV) – Limits (dBμV)

Above 1GHz

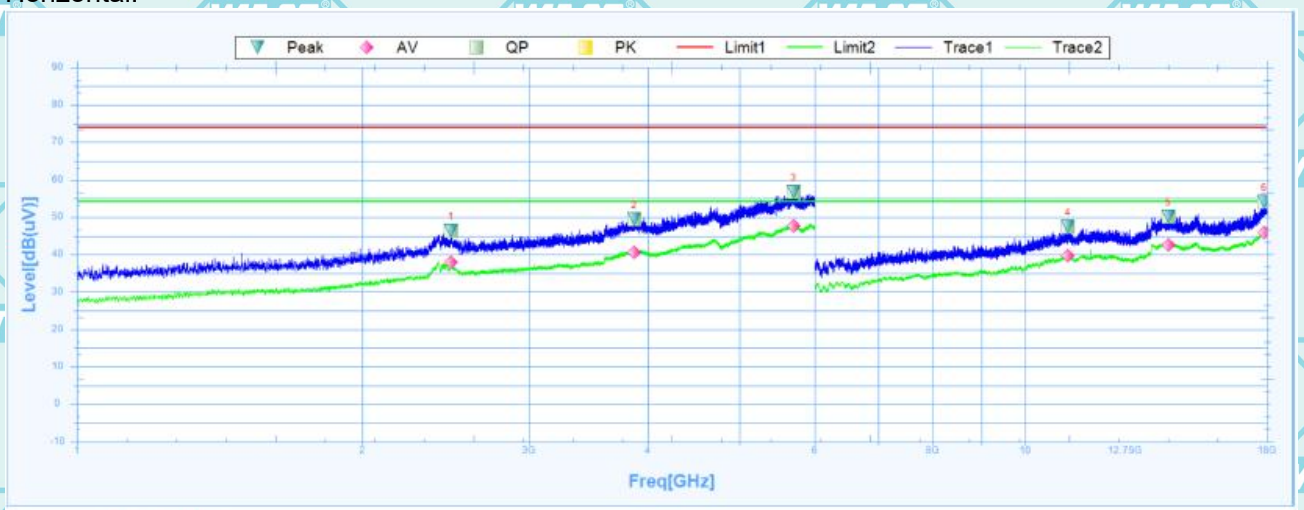
Note 1: The marked spikes near 2400 MHz with circle should be ignored because they are Fundamental signal.

Note 2: The spurious above 18G is noise only, do not show on the report.

GFSK

Low channel: 2402MHz

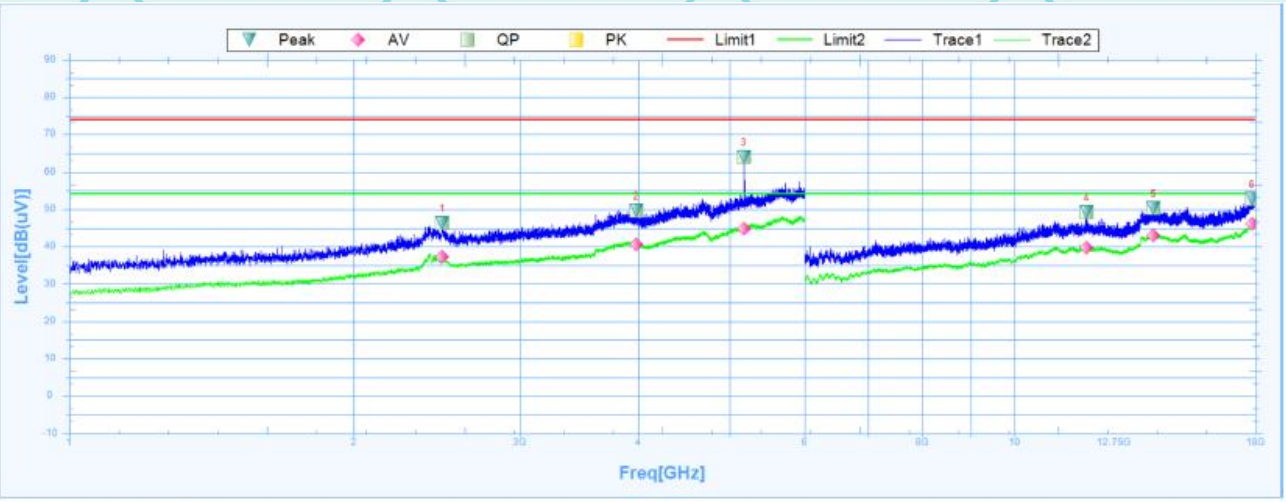
Horizontal:



Susputed Data List

NO.	Freq. [MHz]	Reading [dB(uV)]	Factor [dB]	Level [dB(uV)]	Limit [dB]	Margin [dB]	Deg [°]	Polarity	Trace	Verdict
1	2480.0000	46.41	7.84	38.57	74	-27.59	215.7	Horizontal	PK	Pass
1	2480.0000	37.9	7.84	30.06	54	-16.1	215.7	Horizontal	AV	Pass
2	3872.5000	49.38	11.5	37.88	74	-24.62	313.8	Horizontal	PK	Pass
2	3872.5000	40.68	11.5	29.18	54	-13.32	313.8	Horizontal	AV	Pass
3	5703.1250	56.7	21.29	35.41	74	-17.3	15.7	Horizontal	PK	Pass
3	5703.1250	47.67	21.29	26.38	54	-6.33	15.7	Horizontal	AV	Pass
4	11097.0000	47.43	39.41	8.02	74	-26.57	101.4	Horizontal	PK	Pass
4	11097.0000	39.7	39.41	0.29	54	-14.3	101.4	Horizontal	AV	Pass
5	14167.5000	49.99	41.28	8.71	74	-24.01	-0.1	Horizontal	PK	Pass
5	14167.5000	42.62	41.28	1.34	54	-11.38	-0.1	Horizontal	AV	Pass
6	17874.0000	54.16	45.66	8.5	74	-19.84	248.3	Horizontal	PK	Pass
6	17874.0000	45.99	45.66	0.33	54	-8.01	248.3	Horizontal	AV	Pass

Vertical:



Susputed Data List

NO.	Freq. [MHz]	Reading [dB(uV)]	Factor [dB]	Level [dB(uV)]	Limit [dB]	Margin [dB]	Deg [°]	Polarity	Trace	Verdict
1	2481.2500	46.26	7.85	38.41	74	-27.74	359.9	Vertical	PK	Pass
1	2481.2500	37.2	7.85	29.35	54	-16.8	359.9	Vertical	AV	Pass
2	3980.6250	49.72	11.93	37.79	74	-24.28	134.2	Vertical	PK	Pass
2	3980.6250	40.67	11.93	28.74	54	-13.33	134.2	Vertical	AV	Pass
3	5178.1250	64.04	17.81	46.23	74	-9.96	53	Vertical	PK	Pass
3	5178.1250	44.86	17.81	27.05	54	-9.14	53	Vertical	AV	Pass
4	11931.0000	49.12	38.66	10.46	74	-24.88	180.2	Vertical	PK	Pass
4	11931.0000	39.64	38.66	0.98	54	-14.36	180.2	Vertical	AV	Pass
5	14041.5000	50.24	41.45	8.79	74	-23.76	359.6	Vertical	PK	Pass
5	14041.5000	42.94	41.45	1.49	54	-11.06	359.6	Vertical	AV	Pass
6	17845.5000	52.76	45.46	7.3	74	-21.24	165.9	Vertical	PK	Pass
6	17845.5000	46.05	45.46	0.59	54	-7.95	165.9	Vertical	AV	Pass