

FCC/ISED - TEST REPORT

Report Number : **709502409836-00B** Date of Issue: December 26,2024

Model : TYAUX-F2

Product Type : Wi-Fi and Bluetooth Module

Applicant : Hangzhou Tuya Information Technology Co.,Ltd

Address : Room 301,Building 1,Huace Center,Xihu District,
Hangzhou,Zhejiang, China

Manufacturer : Hangzhou Tuya Information Technology Co.,Ltd

Address : Room 301,Building 1,Huace Center,Xihu District,
Hangzhou,Zhejiang, China

Test Result : Positive Negative

Total pages including Appendices : 45



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2 Report Modification Record

Alterations and additions to this report will be issued to the holders of each copy in the form of a complete document.

Issue	Description of Change	Date of Issue
709502409836-00B	First Issue	12/26/2024

3 Details about the Test Laboratory

Test Site 1

Company name: TÜV SÜD Certification and Testing (China) Co., Ltd. Shanghai Branch
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FCC Registration No.: 820234

FCC Designation Number: CN1183

ISED CAB identifier CN0101

IC Registration No.: 31668

4 Description of the Equipment under Test

Product: Wi-Fi and Bluetooth Module

PMN / HVIN / Model no.: TYAUX-F2

FCC ID: 2ANDL-TYAUX-F2

IC: 23243- TYAUXF2

Rating: 3.0-3.6V DC

RF Transmission Frequency: Wi-Fi:2412-2462MHz
Bluetooth LE:2402~2480MHz

No. of Operated Channel: 2.4GHz WIFI: 11 for 802.11b/g/n(HT20)
2.4GHz BLE: 40

Modulation: Direct Sequence Spread Spectrum (DSSS) for 802.11b
Orthogonal Frequency Division Multiplexing (OFDM) for
802.11g/n; 2.4GHz BLE: GFSK

Channel list:

802.11b/g/n(HT20)			
Ch	Fre(MHz)	Ch	Fre(MHz)
1	2412	7	2442
2	2417	8	2447
3	2422	9	2452
4	2427	10	2457
5	2432	11	2462
6	2437		

Bluetooth Low Energy							
Ch	Fre(MHz)	Ch	Fre(MHz)	Ch	Fre(MHz)	Ch	Fre(MHz)
0	2402	10	2422	20	2442	30	2462
1	2404	11	2424	21	2444	31	2464
2	2406	12	2426	22	2446	32	2466
3	2408	13	2428	23	2448	33	2468
4	2410	14	2430	24	2450	34	2470
5	2412	15	2432	25	2452	35	2472
6	2414	16	2434	26	2454	36	2474
7	2416	17	2436	27	2456	37	2476
8	2418	18	2438	28	2458	38	2478
9	2420	19	2440	29	2460	39	2480



Hardware Version: V1.0.0
Software Version: V3.5.0
Antenna type: Onboard PCB antenna
Antenna Gain: 1.68dBi
Description of the EUT: The Equipment Under Test (EUT) is a Wi-Fi and Bluetooth module which support 2.4GHz Wi-Fi and BLE 4.2(support 1Mbps data rate). We tested it and listed the worst data in this report.
Test sample no.: SHA-866932-1 (RF radiated); SHA-866932-2 (RF conducted)

The sample's mentioned in this report is/are submitted/ supplied/ manufactured by client. The laboratory therefore assumes no responsibility for accuracy of information on the brand name, model number, origin of manufacture, consignment or any information supplied.



5 Summary of Test Standards

Test Standards	
FCC Part 15 Subpart C 10-1-2023 Edition	PART 15 - RADIO FREQUENCY DEVICES Subpart C - Intentional Radiators
RSS-Gen Issue 5 April 2018 + Amendment 1 March 2019 + Amendment 2 February 2021	General Requirements for Compliance of Radio Apparatus
RSS-247 Issue 3 August 2023	Digital Transmission Systems (DTSS), Frequency Hopping Systems (FHSS) and License-Exempt Local Area Network (LE- LAN) Devices

All the test methods were according to KDB 558074 D01 15.247 Meas Guidance v05r02 Measurement Guidance and ANSI C63.10-2020.

6 Summary of Test Results

Technical Requirements							
FCC Part 15 Subpart C & RSS-247 Issue 3/RSS-Gen Issue 5							
Test Condition			Pages	Test Site	Test Result		
					Pass	Fail	N/A
§15.207	RSS-GEN 8.8	Conducted emission AC power port	13-17	Site 1	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
§15.247 (b) (3)	RSS-247 5.4(d)	Conducted peak output power & e.i.r.p	18-19	Site 1	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
§15.247(a)(1)	RSS-247 5.1(a) & RSS-Gen 6.7	20dB bandwidth and 99% Occupied Bandwidth	---	---	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
§15.247(a)(1)	RSS-247 5.1(b)	Carrier frequency separation	---	---	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
§15.247(a)(1)(iii)	RSS-247 5.1(d)	Number of hopping frequencies	---	---	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
§15.247(a)(1)(iii)	RSS-247 5.1(d)	Dwell Time - Average Time of Occupancy	---	---	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
§15.247(a)(2)	RSS-247 5.2(a) & RSS-GEN 6.7	6dB bandwidth and 99% Occupied Bandwidth	20-22	Site 1	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
§15.247(e)	RSS-247 5.2(b)	Power spectral density	23-24	Site 1	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
§15.247(e)	RSS-247 5.5	Spurious RF conducted emissions	25-28	Site 1	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
§15.247(d)	RSS-247 5.5	Band edge	29-31	Site 1	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
§15.247(d) & §15.209 & §15.205	RSS-247 5.5 & RSS-Gen 6.13	Spurious radiated emissions for transmitter	32-42	Site 1	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
§15.203	RSS-Gen 6.8	Antenna requirement	See note 1		<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

Remark 1: N/A – Not Applicable.

Note 1: The EUT uses PCB antenna, which gain is 1.68dBi. In accordance to §15.203 and RSS-Gen 6.8, it is considered sufficiently to comply with the provisions of this section.



7 General Remarks

Remarks

This submittal(s) (test report) is intended for FCC ID: 2ANDL-TYAUX-F2, IC: 23243-TYAUXF2 complies with Section 15.207,15.209,15.231,15.247 of the FCC Part 15, Subpart C Rules and RSS-247, RSS-GEN.

This report is only for the 2.4GHz BLE test report, for the 2.4GHz Wi-Fi test report please refer to 709502409836-00A.

SUMMARY:

All tests according to the regulations cited on page 5 were

■ - Performed

□ - **Not** Performed

The Equipment under Test

■ - **Fulfills** the general approval requirements.

□ - **Does not** fulfill the general approval requirements.

Sample Received Date: November 22, 2024

Testing Start Date: November 25, 2024

Testing End Date: December 4, 2024

-TÜV SÜD Certification and Testing (China) Co., Ltd. Shanghai Branch

Reviewed by:

Hui TONG
Review Engineer



Prepared by:

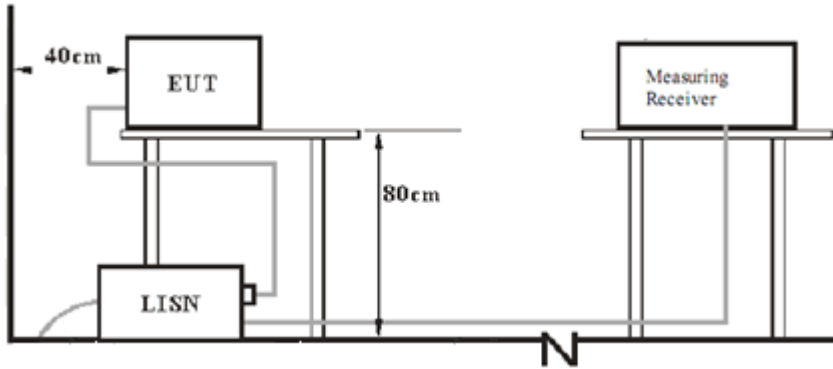
Jiayi XU
Project Engineer

Tested by:

Chengjie GUO
Test Engineer

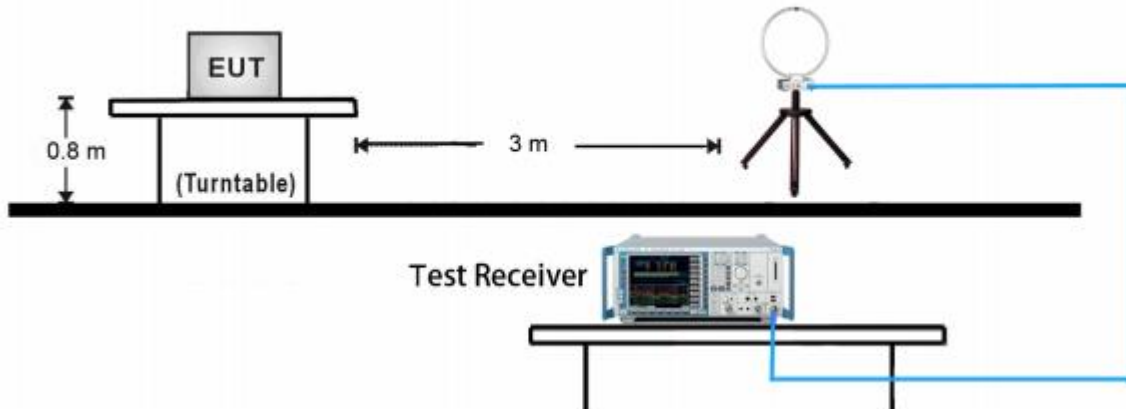
8 Test Setups

8.1 AC Power Line Conducted Emission test setups

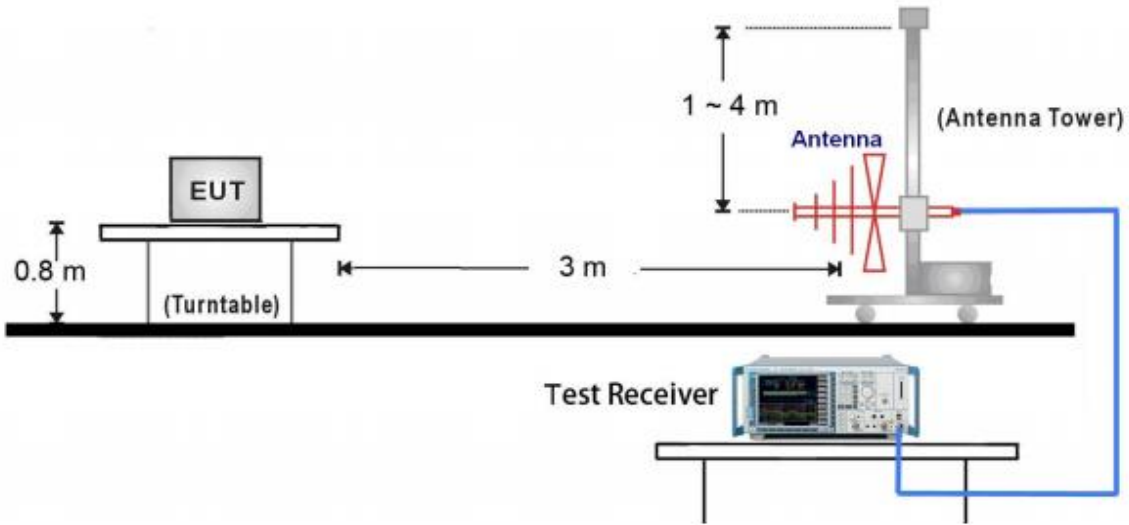


8.2 Radiated test setups

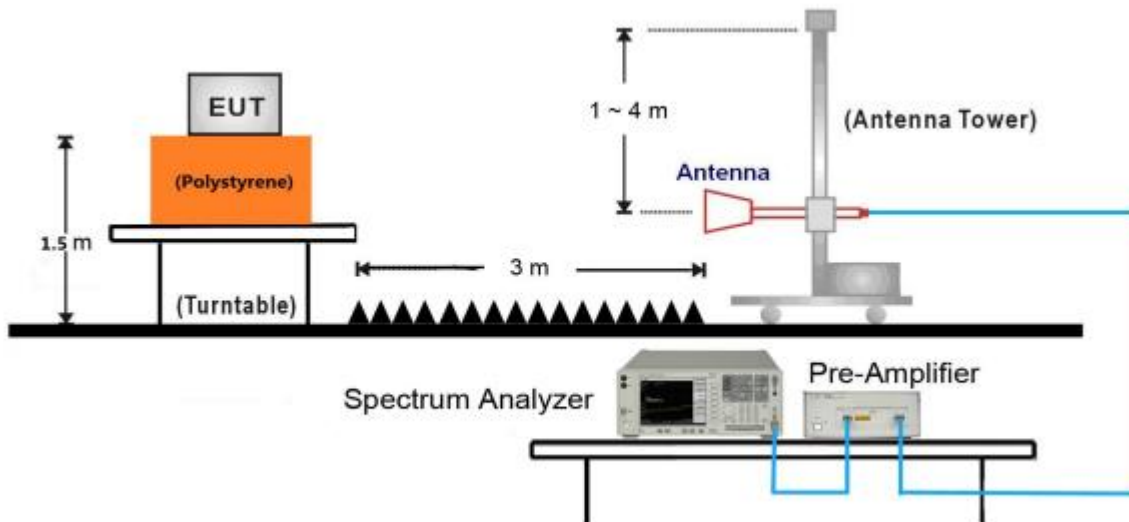
9kHz ~ 30MHz Test Setup:



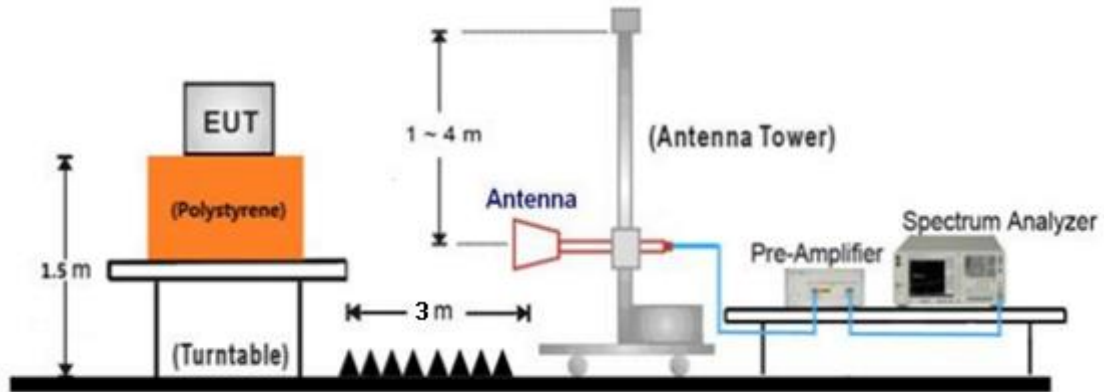
30MHz ~ 1GHz Test Setup:



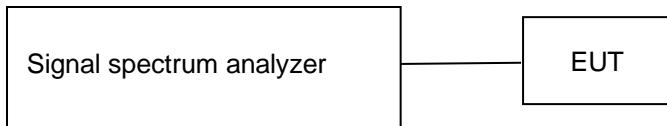
1GHz ~ 18GHz Test Setup:



18GHz ~ 25GHz Test Setup:



7.3 Conducted RF test setups



9 Systems test configuration

Auxiliary Equipment Used during Test:

DESCRIPTION	MANUFACTURER	MODEL NO.(SHIELD)	S/N(LENGTH)
Notebook	Lenovo	E470	PF-OU5TS7 17/09

Test software: RTLBTAPP.exe, which used to control the EUT in continues transmitting mode

The system was configured to channel 0, 19, and 39 for the test.

Test Mode Applicability and Tested Channel Detail:

Mode	Tested Channel	Data Rate (Mbps)	Modulation	Power level setting
Bluetooth LE	0	1	GFSK	06
	19	1	GFSK	06
	39	1	GFSK	06

The system was configured to channel 0, 19, and 39 for the test.

Non-hopping mode: The system was configured to operate at a signal channel transmitting. The test software allows the configuration and operation at the worst-case duty and the highest transmit power.

10 Technical Requirement

10.1 Conducted Emission

Test Method

1. The EUT was placed on a table, which is 0.8m above ground plane
2. The power line of the EUT is connected to the AC mains through a Artificial Mains Network (A.M.N.).
3. Maximum procedure was performed to ensure EUT compliance
4. A EMI test receiver is used to test the emissions from both sides of AC line

Limit

According to §15.207 & RSS-GEN 8.8, conducted emissions limit as below:

Frequency MHz	QP Limit dB μ V	AV Limit dB μ V
0.150-0.500	66-56*	56-46*
0.500-5	56	46
5-30	60	50

Decreasing linearly with logarithm of the frequency

Conducted Emission

150k-30MHz Conducted Emission Test

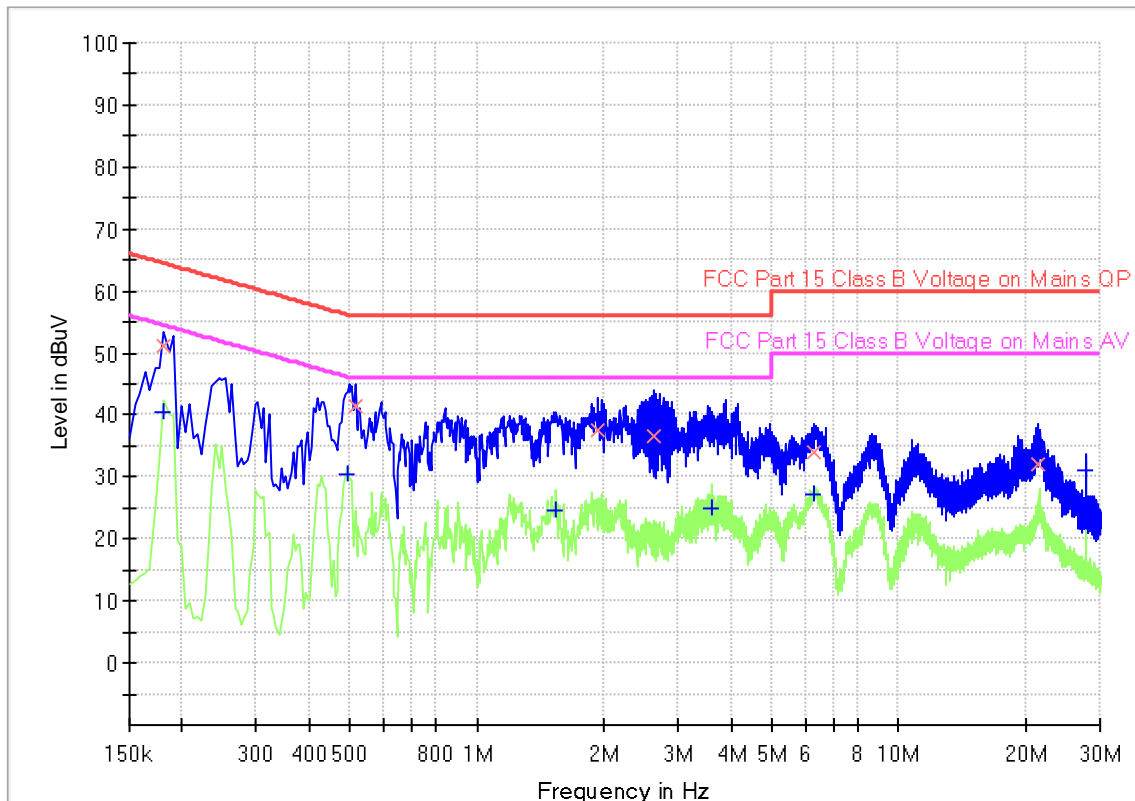
EUT Information

EUT Name: Wi-Fi and BLE Module
 Model: TYAUX-F2
 Client: Hangzhou Tuya Information Co., Ltd
 Op Cond: Power on, TX_2440MHz, AC 120V/60Hz
 Operator: Chengjie Guo
 Standard: FCC Part 15.207(a)
 Comment: Phase L
 Sample No.: SHA-866932-2

Scan Setup: Voltage with 2-Line-LISN pre [EMI conducted]

Hardware Setup: Voltage with 2-Line-LISN
 Receiver: [ESR 3]
 Level Unit: dBuV

Subrange	Step Size	Detectors	IF BW	Meas. Time	Preamp
9 kHz - 150 kHz	100 Hz	PK+	200 Hz	0.02 s	0 dB
150 kHz - 30 MHz	4.5 kHz	PK+; AVG	9 kHz	0.01 s	0 dB



Final Result

Frequency (MHz)	QuasiPeak (dBuV)	CAverage (dBuV)	Limit (dBuV)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Line	Corr. (dB)
0.181500	---	40.60	54.42	13.82	1000.0	9.000	L1	19.5
0.181500	51.20	---	64.42	13.22	1000.0	9.000	L1	19.5
0.492000	---	30.41	46.13	15.72	1000.0	9.000	L1	19.5
0.514500	41.28	---	56.00	14.72	1000.0	9.000	L1	19.5
1.536000	---	24.50	46.00	21.50	1000.0	9.000	L1	19.5
1.927500	37.72	---	56.00	18.28	1000.0	9.000	L1	19.5
2.638500	36.68	---	56.00	19.32	1000.0	9.000	L1	19.5
3.615000	---	25.08	46.00	20.92	1000.0	9.000	L1	19.5
6.315000	34.04	---	60.00	25.96	1000.0	9.000	L1	19.7
6.315000	---	27.15	50.00	22.85	1000.0	9.000	L1	19.7
21.340500	32.09	---	60.00	27.91	1000.0	9.000	L1	20.7
27.649500	---	31.13	50.00	18.87	1000.0	9.000	L1	21.0

Note 1: Measure Level (dBuV/m) = Reading Level (dBuV) + Factor (dB)

Factor (dB) = Cable Loss (dB) + LISN Factor (dB) + 10dB Attenuator



150k-30MHz Conducted Emission Test

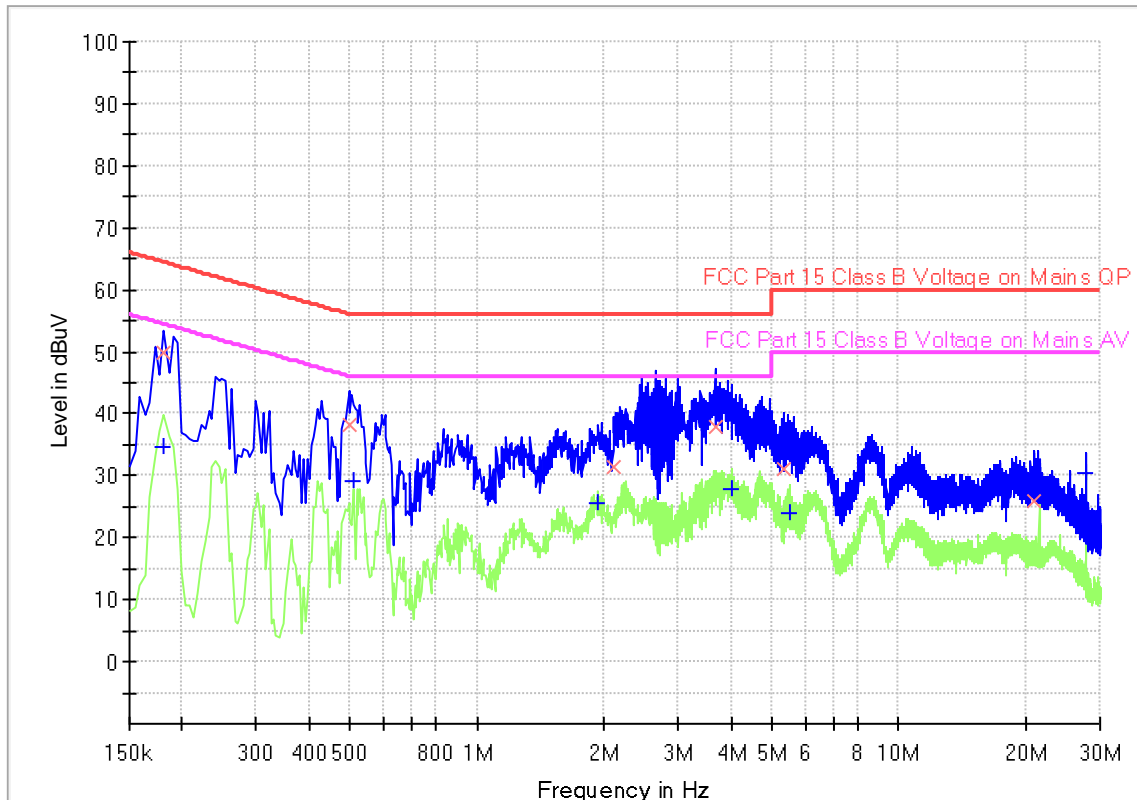
EUT Information

EUT Name: Wi-Fi and BLE Module
 Model: TYAUX-F2
 Client: Hangzhou Tuya Information Co., Ltd
 Op Cond: Power on, TX_2440MHz, AC 120V/60Hz
 Operator: Chengjie Guo
 Standard: FCC Part 15.207(a)
 Comment: Phase N
 Sample No.: SHA-866932-2

Scan Setup: Voltage with 2-Line-LISN pre [EMI conducted]

Hardware Setup: Voltage with 2-Line-LISN
 Receiver: [ESR 3]
 Level Unit: dBuV

Subrange	Step Size	Detectors	IF BW	Meas. Time	Preamp
9 kHz - 150 kHz	100 Hz	PK+	200 Hz	0.02 s	0 dB
150 kHz - 30 MHz	4.5 kHz	PK+; AVG	9 kHz	0.01 s	0 dB





Final Result

Frequency (MHz)	QuasiPeak (dBuV)	CAverage (dBuV)	Limit (dBuV)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Line	Corr. (dB)
0.181500	---	34.52	54.42	19.90	1000.0	9.000	N	19.5
0.181500	49.99	---	64.42	14.43	1000.0	9.000	N	19.5
0.496500	38.21	---	56.06	17.85	1000.0	9.000	N	19.5
0.510000	---	29.03	46.00	16.97	1000.0	9.000	N	19.5
1.941000	---	25.47	46.00	20.53	1000.0	9.000	N	19.5
2.116500	31.38	---	56.00	24.62	1000.0	9.000	N	19.5
3.664500	37.92	---	56.00	18.08	1000.0	9.000	N	19.6
4.029000	---	27.77	46.00	18.23	1000.0	9.000	N	19.6
5.320500	31.17	---	60.00	28.83	1000.0	9.000	N	19.6
5.527500	---	24.04	50.00	25.96	1000.0	9.000	N	19.6
21.025500	25.84	---	60.00	34.16	1000.0	9.000	N	20.3
27.649500	---	30.44	50.00	19.56	1000.0	9.000	N	20.8

Note 1: Measure Level (dBuV/m) = Reading Level (dBuV) + Factor (dB)
 Factor (dB) = Cable Loss (dB) + LISN Factor (dB) + 10dB Attenuator

10.2 Conducted peak output power and e.i.r.p.

Test Method

1. Use the following spectrum analyzer settings:
RBW > the 6 dB bandwidth of the emission being measured, VBW \geq 3RBW, Span \geq 3RBW
Sweep = auto, Detector function = peak, Trace = max hold.
2. Add a correction factor to the display.
3. Use a power meter to measure the conducted peak output power.

Limits

According to §15.247 (b) (3) & RSS-247 5.4(d) conducted peak output power limit as below:

	Frequency Range	Limit	Limit
	MHz	W	dBm
Conducted peak output power	2400-2483.5	≤ 1	≤ 30
e.i.r.p.	2400-2483.5	≤ 4	≤ 36

Test result as below table

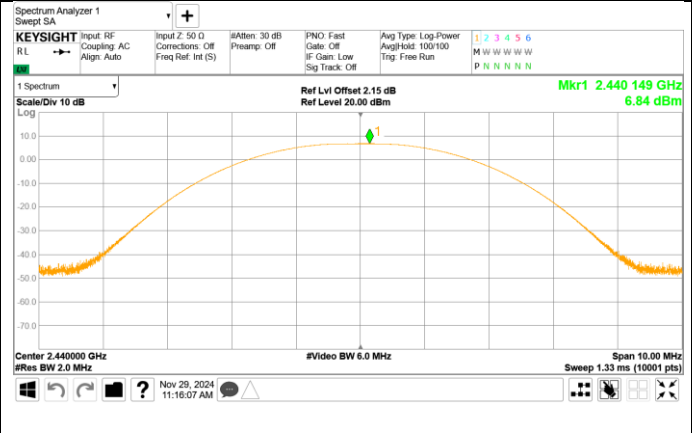
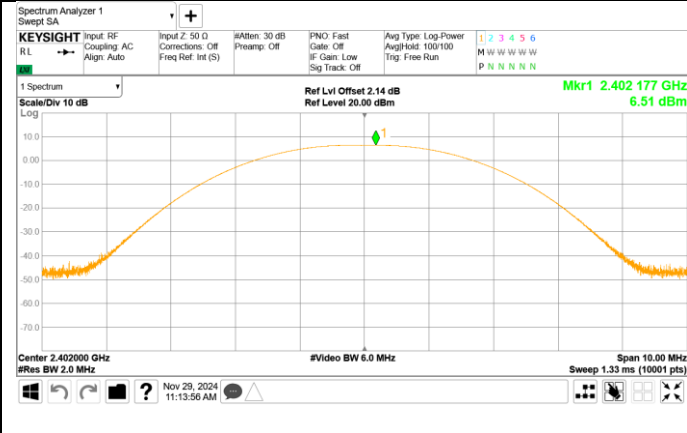
Antenna gain=1.68dBi				
Frequency MHz	Conducted Peak Output Power(dBm) §15.247 (b) (3)	Result	e.i.r.p.(dBm) RSS-247 5.4(d)	Result
2402MHz	6.51	Pass	8.19	Pass
2440MHz	6.84	Pass	8.52	Pass
2480MHz	6.61	Pass	8.29	Pass



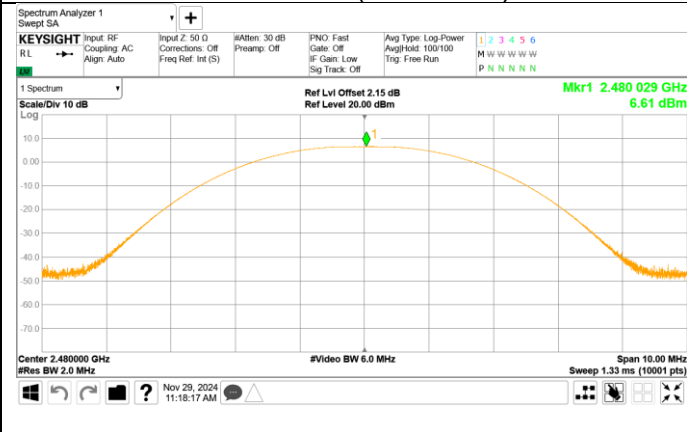
Peak output power (1Mbps)

Channel 0 (2402MHz)

Channel 19 (2440MHz)



Channel 39 (2480MHz)





10.3 6dB bandwidth and 99% Occupied Bandwidth

Test Method

1. The RF output of EUT was connected to the spectrum analyzer. The path loss was compensated to the results for each measurement.
2. Set to the maximum power setting, the instrument center frequency is set to the nominal EUT channel center frequency enable the EUT transmit continuously.
3. Use the following spectrum analyzer settings:
RBW=100KHz, VBW≥3RBW, Sweep = auto, Detector function = peak, Trace = max hold
4. Use the automatic bandwidth measurement capability of an instrument, use the X dB bandwidth mode with X set to 6 dB.
5. Allow the trace to stabilize, record the 6 dB Bandwidth value.

Test Method for 99 % Bandwidth

1. Connect EUT test port to spectrum analyzer.
Use the following spectrum analyzer settings:
RBW=1% to 5% of the actual occupied, VBW≥3RBW, Sweep = auto,
Detector function = peak, Trace = max hold
2. Use the occupied bandwidth measurement capability of test receiver.
3. Allow the trace to stabilize, record the occupied bandwidth value.

Limit

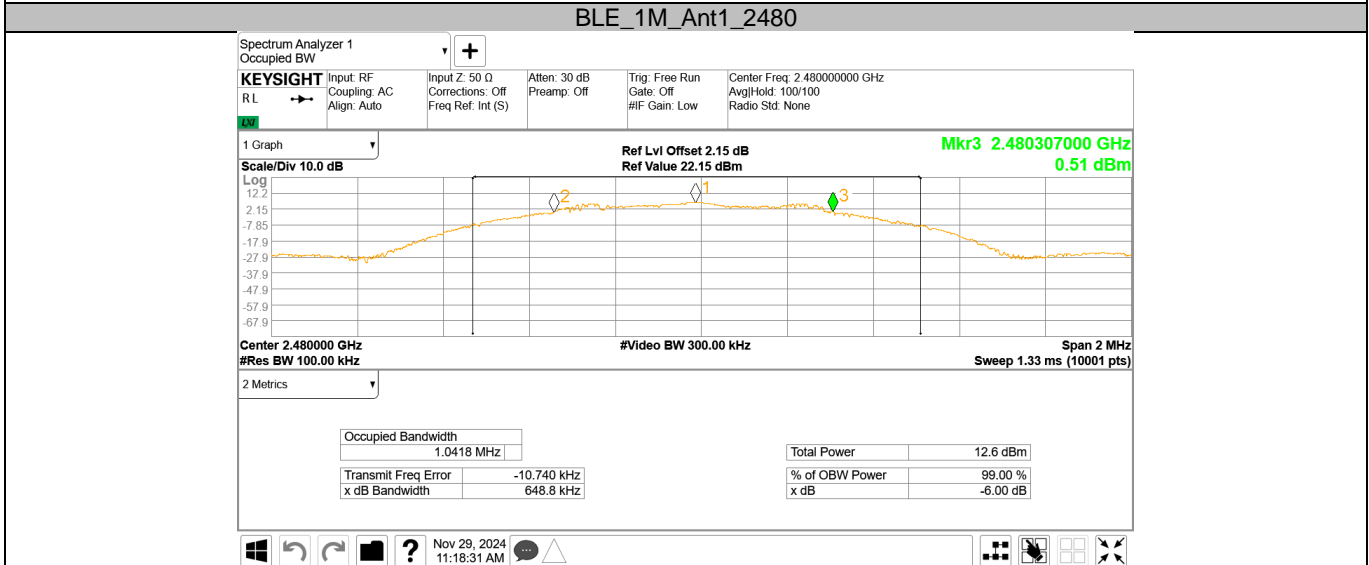
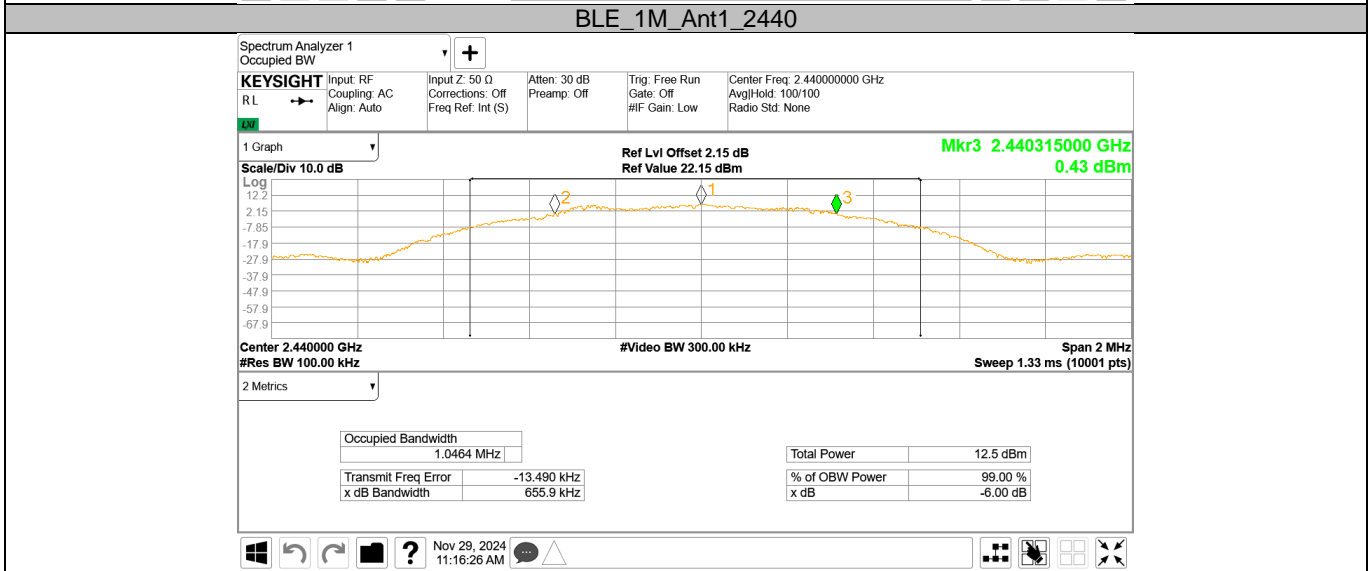
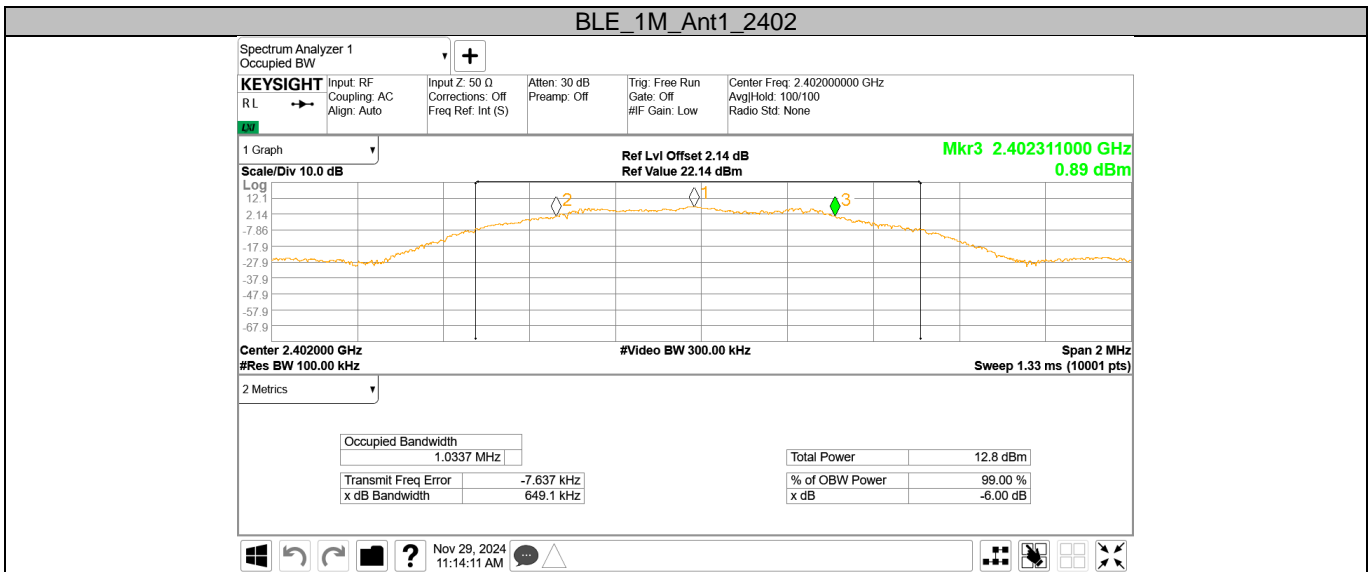
6dB bandwidth Limit [kHz]	99% bandwidth Limit [kHz]
≥500	--

Test result

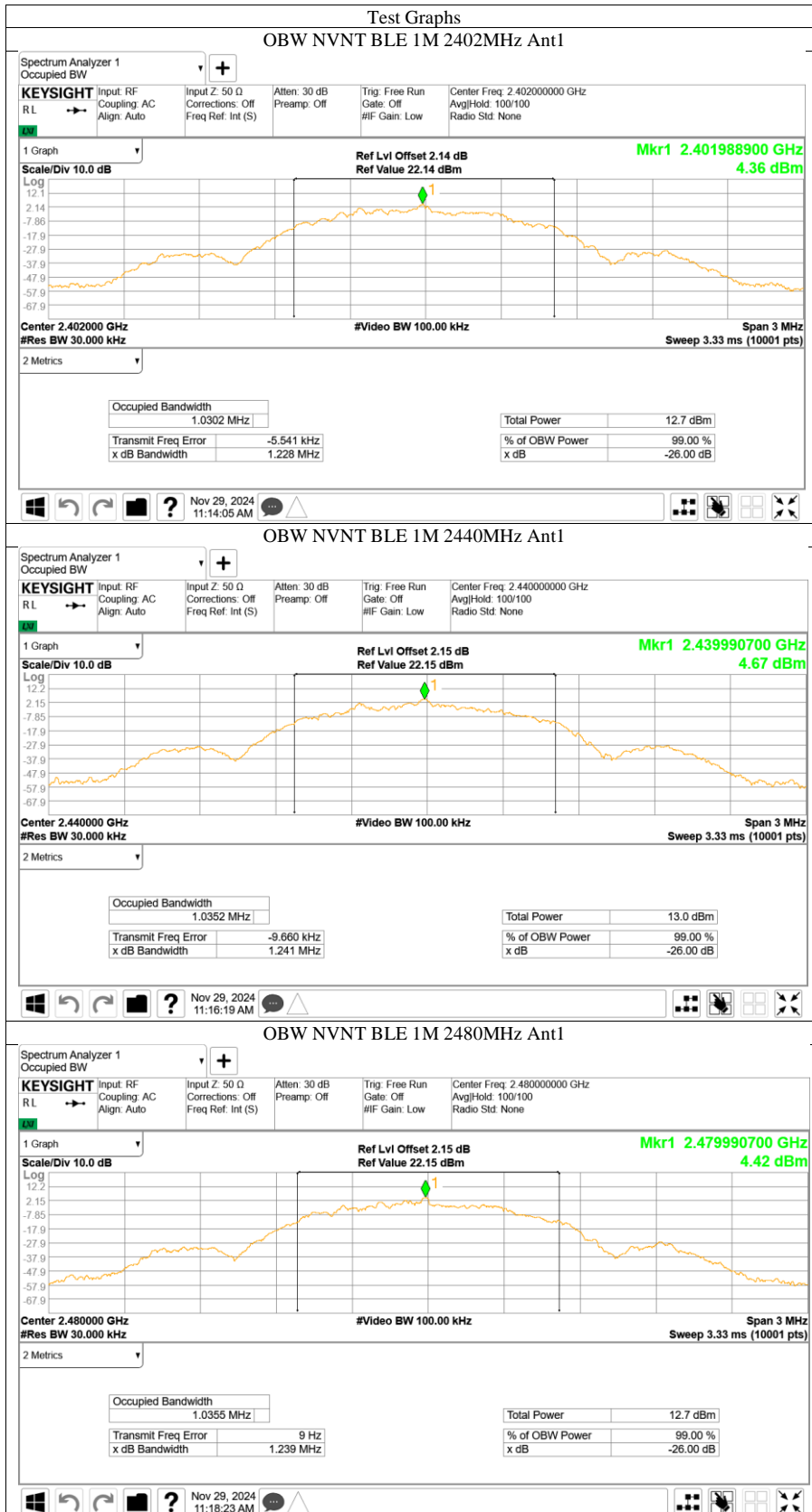
Frequency MHz	6dB bandwidth (MHz)		Result verdict	99% occupied bandwidth MHz
	result	limit		
2402	0.649	≥0.5	Pass	1.030
2440	0.656	≥0.5	Pass	1.035
2480	0.649	≥0.5	Pass	1.035



6dB Bandwidth



99% Occupied Bandwidth



10.4 Power spectral density

Test Method

This procedure shall be used if maximum peak conducted output power was used to demonstrate compliance:

1. The RF output of EUT was connected to the spectrum analyzer. The path loss was compensated to the results for each measurement.
2. Set to the maximum power setting, the instrument center frequency is set to the nominal EUT channel center frequency enable the EUT transmit continuously.
3. Use the following spectrum analyzer settings:
4. Set analyzer center frequency to DTS channel center frequency. RBW=3kHz, VBW \geq 3RBW, Span=1.5 times DTS bandwidth, Detector=Peak, Sweep=auto, Trace= max hold.
5. Allow trace to fully stabilize, use the peak marker function to determine the maximum amplitude level within the RBW.
6. Repeat above procedures until other frequencies measured were completed.

Limit

Limit [dBm/3kHz]

≤8

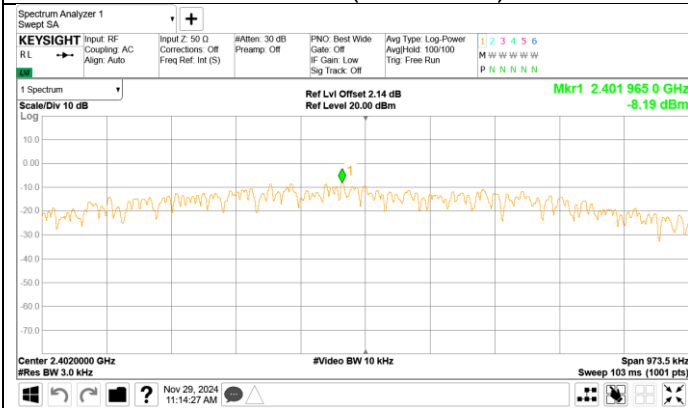
Test result

Data transmission rate	Frequency	Power spectral density	Result
1Mbps	MHz	dBm/3kHz	
	Top channel 2402MHz	-8.19	Pass
	Middle channel 2440MHz	-7.48	Pass
	Bottom channel 2480MHz	-8.96	Pass

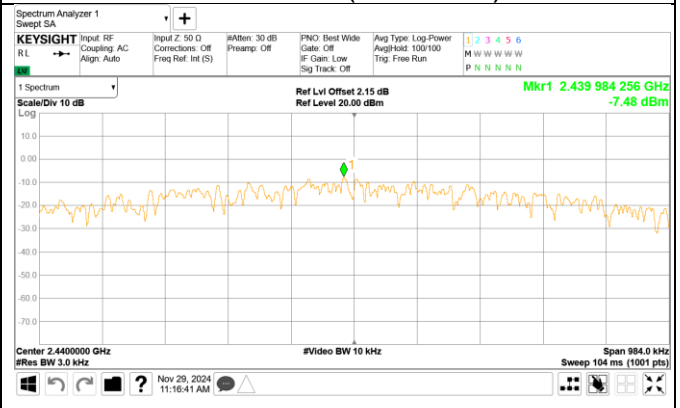


PK PSD (1Mbps)

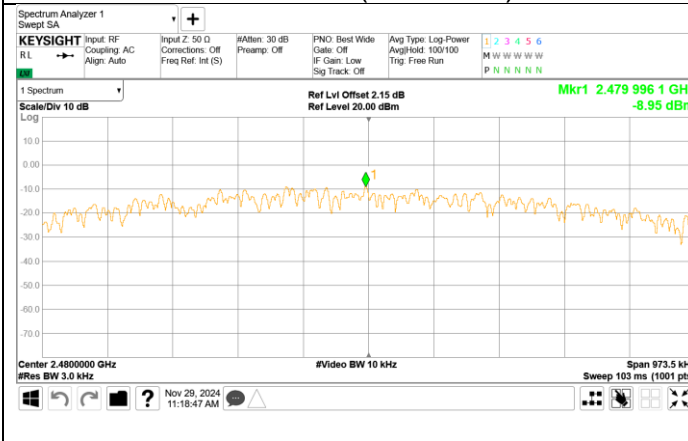
Channel 0 (2402MHz)



Channel 19 (2440MHz)



Channel 39 (2480MHz)



10.5 Spurious RF conducted emissions

Test Method

1. The RF output of EUT was connected to the spectrum analyzer by RF cable. The path loss was compensated to the results for each measurement.
2. Set to the maximum power setting, the instrument center frequency is set to the nominal EUT channel center frequency enable the EUT transmit continuously.
3. Use the following spectrum analyzer settings:
Span = wide enough to capture the peak level of the in-band emission and all spurious emissions (e.g., harmonics) from the lowest frequency generated in the EUT up through the 10th harmonic. Typically, several plots are required to cover this entire span.
RBW = 100 kHz, VBW \geq 3RBW, Sweep = auto, Detector function = peak, Trace = max hold
4. Allow the trace to stabilize. Set the marker on the peak of any spurious emission recorded.
5. The level displayed must comply with the limit specified in this Section. Submit these plots.
6. Repeat above procedures until all frequencies measured were complete.

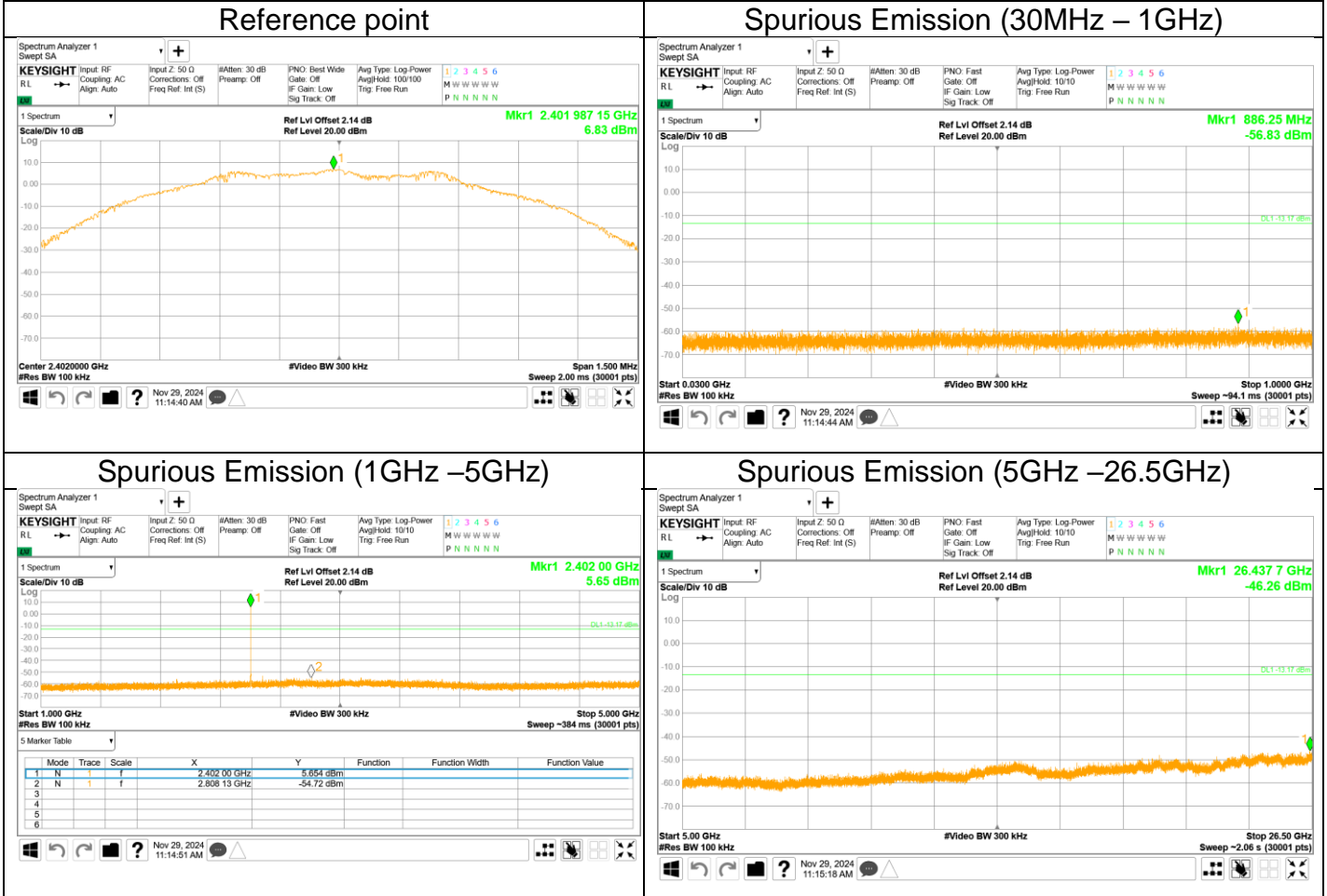
Limit

Frequency Range MHz	Limit (dBc)
30-25000	-20



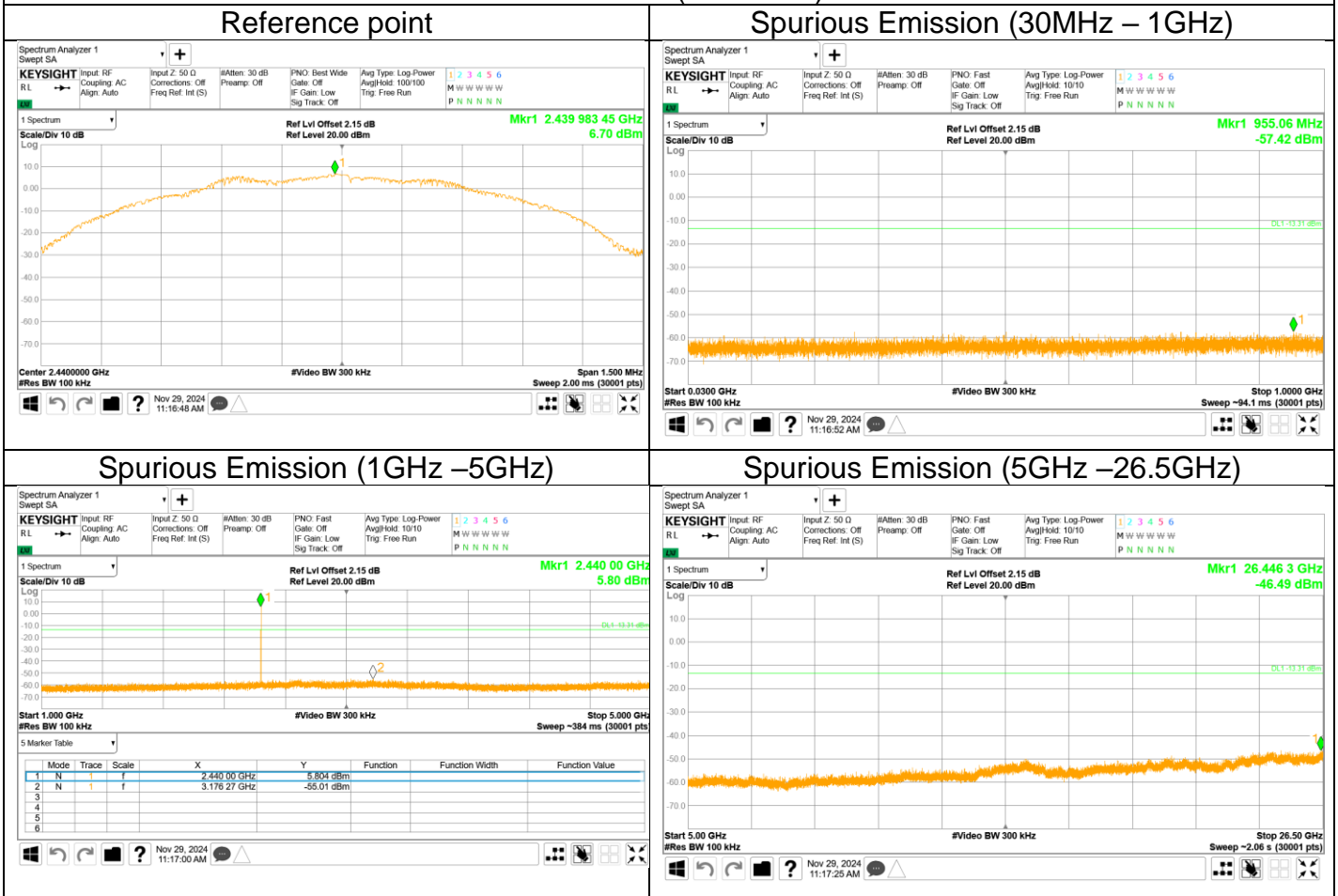
Spurious RF conducted emissions

**Out-of-Band Emissions (1Mbps)
Channel 0 (2402MHz)**



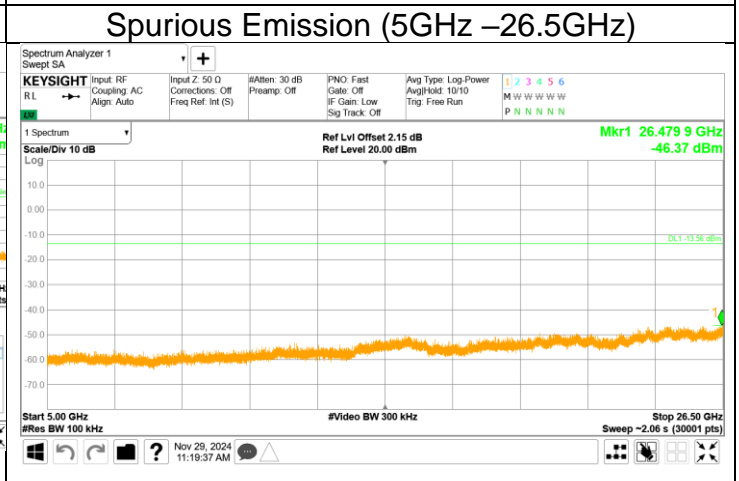
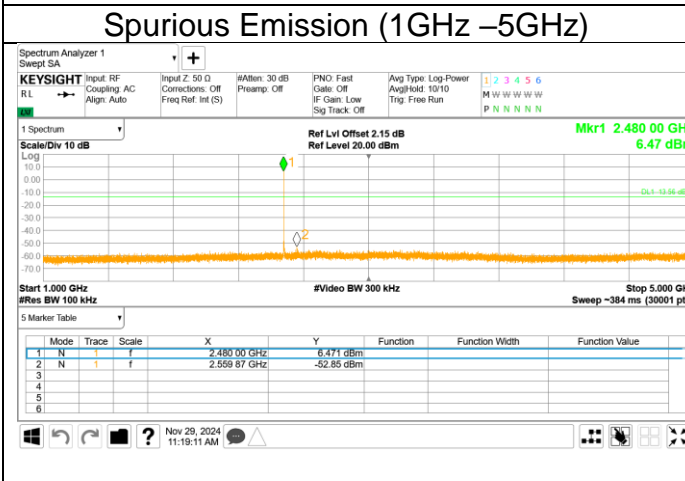
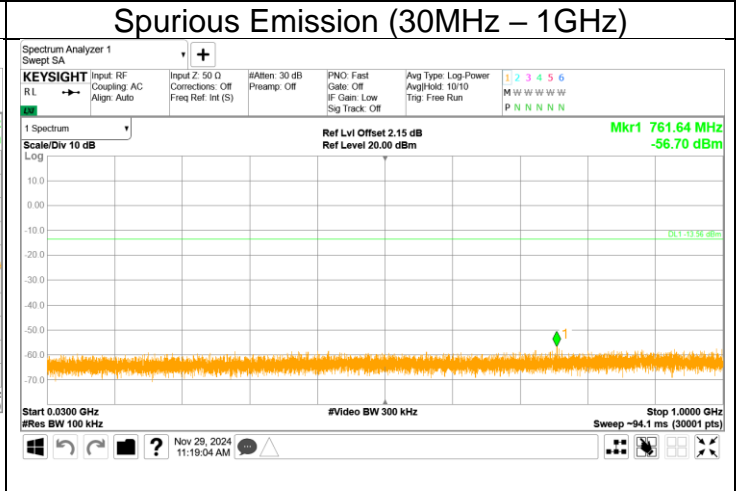
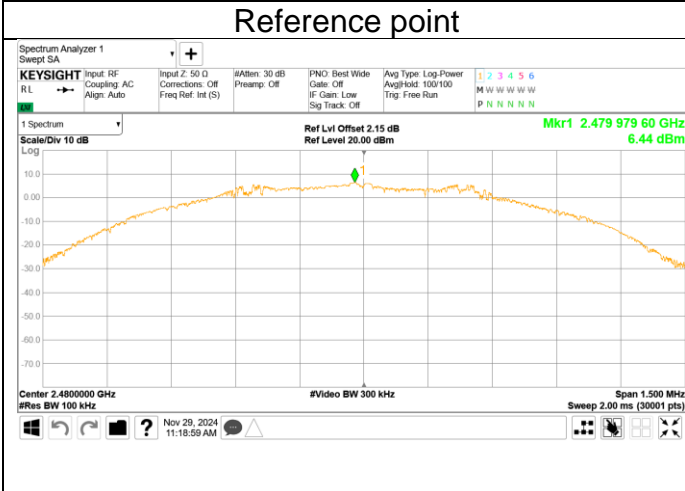


Out-of-Band Emissions (1Mbps) Channel 19 (2440MHz)





Out-of-Band Emissions (1Mbps) Channel 39 (2480MHz)



10.6 Band edge

Test Method

1. The RF output of EUT was connected to the spectrum analyzer by RF cable. The path loss was compensated to the results for each measurement.
2. Set to the maximum power setting, the instrument center frequency is set to the nominal EUT channel center frequency enable the EUT transmit continuously.
3. Use the following spectrum analyzer settings:
Span = wide enough to capture the peak level of the in-band emission and all spurious
RBW = 100 kHz, VBW \geq 3RBW, Sweep = auto, Detector function = peak, Trace = max hold
4. Allow the trace to stabilize, use the peak and delta measurement to record the result.
5. The level displayed must comply with the limit specified in this Section.
6. Repeat above procedures until all frequencies measured were complete and submit all the plots.

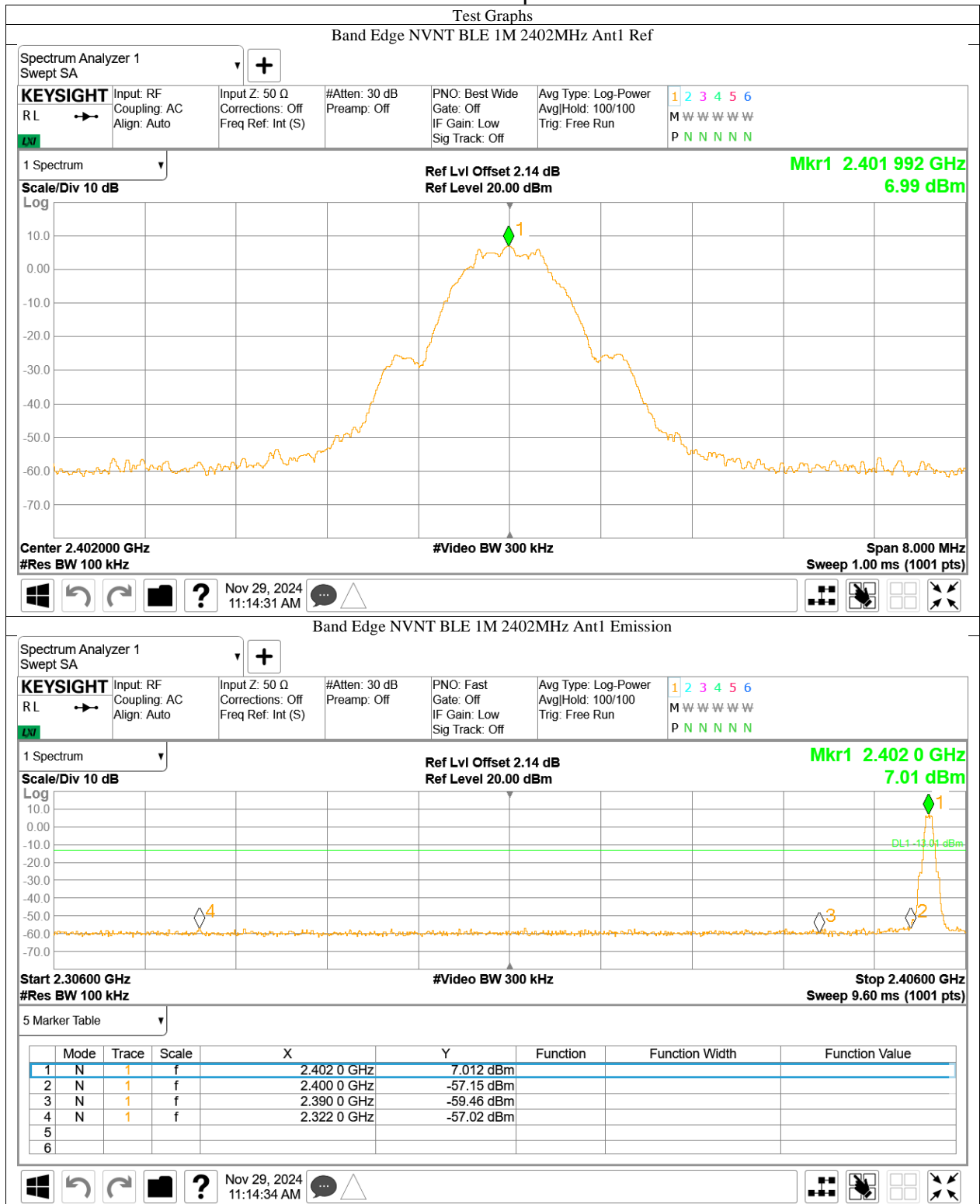
Limit

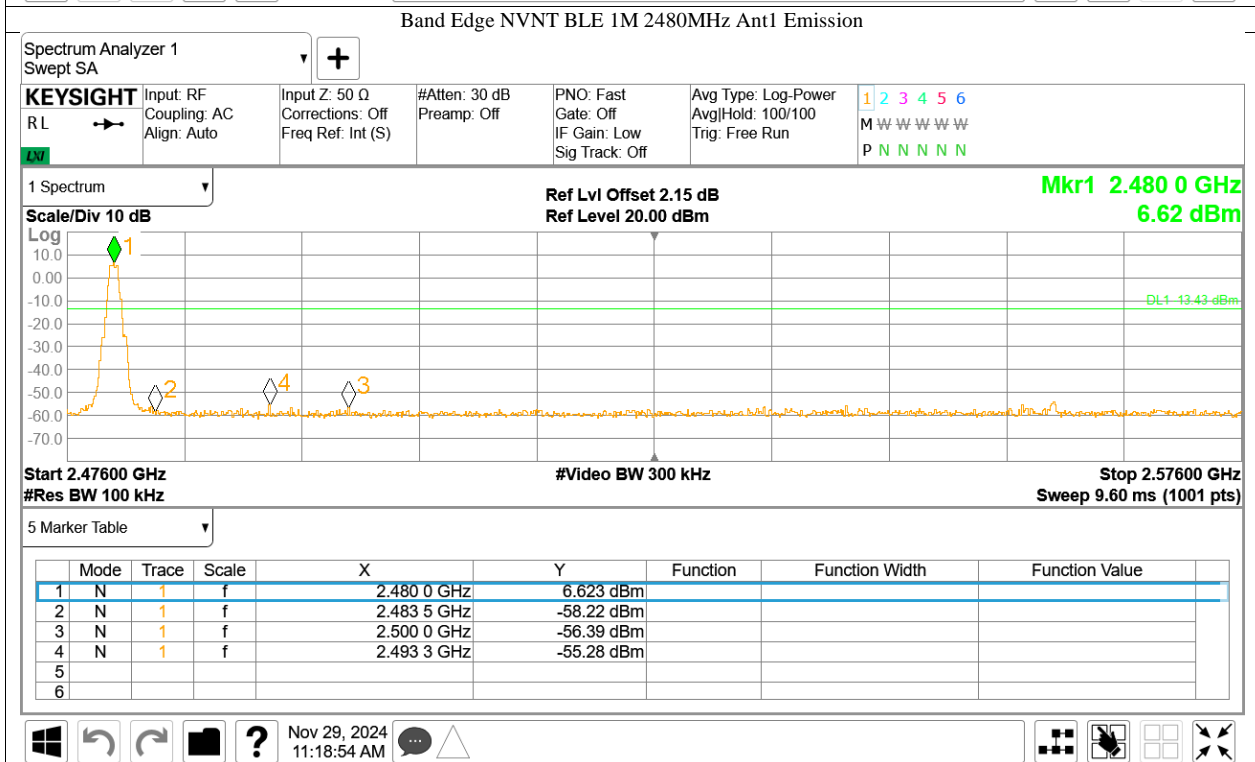
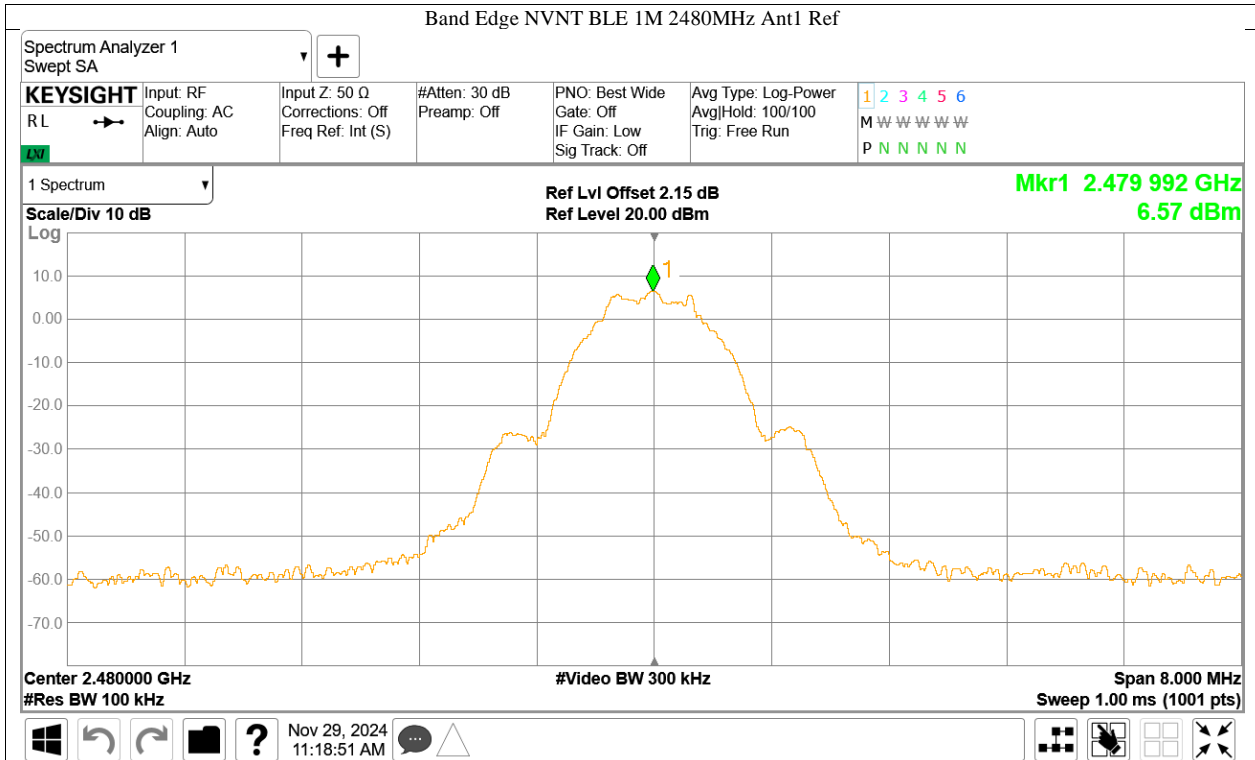
In any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated device is operating, the RF power that is produced shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power, based on either an RF conducted or a radiated measurement, provided that the transmitter demonstrates compliance with the peak conducted power limits. If the transmitter complies with the conducted power limits based on the use of RMS averaging over a time interval, as permitted under § 15.247(b)(3) and RSS-247 section 5.4(d), the attenuation required shall be 30 dB instead of 20 dB.



Test result

1Mbps





10.7 Spurious radiated emissions for transmitter

Test Method

1. The EUT was placed on a turn table which is 1.5m above ground plane for above 1GHz and 0.8m above ground for below 1GHz at 3 meter chamber room for test. The table was rotated 360 degrees to determine the position of the highest radiation.
2. The EUT was set 3 meters away from the interference – receiving antenna, which was mounted on the top of a variable – height antenna tower.
3. The height of antenna is varied from one meter to four meters above the ground to determine the maximum value of the field strength. Both horizontal and vertical polarizations of the antenna are set to make the measurement.
4. For each suspected emission, the EUT was arranged to its worst case and then the antenna was tuned to heights from 1 meter to 4 meters and the rotatable table was turned from 0 degrees to 360 degrees to find the maximum reading.
5. Use the following spectrum analyzer settings According to C63.10
 - 1) Procedure for Unwanted Emissions Measurements Below 1000 MHz
Span = wide enough to capture the peak level of the in-band emission and all spurious
RBW = 100 kHz to 120kHz, VBW \geq RBW for peak measurement, Sweep = auto, Detector function = peak, Trace = max hold.
 - 2) For Peak unwanted emissions Above 1GHz:
Span = wide enough to capture the peak level of the in-band emission and all spurious
RBW = 1MHz, VBW \geq RBW for peak measurement, Sweep = auto, Detector function = peak, Trace = max hold.
Procedures for average unwanted emissions measurements above 1GHz
 - a) RBW = 1MHz.
 - b) VBW \ [3 \times RBW].
 - c) Detector = RMS (power averaging), if [span / (# of points in sweep)] \ RBW / 2.
Satisfying this condition can require increasing the number of points in the sweep or reducing the span. If the condition is not satisfied, then the detector mode shall be set to peak.
 - d) Averaging type = power (i.e., rms) (As an alternative, the detector and averaging type may be set for linear voltage averaging. Some instruments require linear display mode to use linear voltage averaging. Log or dB averaging shall not be used.)
 - e) Sweep time = auto.
 - f) Perform a trace average of at least 100 traces if the transmission is continuous. If the transmission is not continuous, then the number of traces shall be increased by a factor of 1 / D, where D is the duty cycle. For example, with 50% duty cycle, at least 200 traces shall be averaged. (If a specific emission is demonstrated to be continuous—i.e., 100% duty cycle—then rather than turning ON and OFF with the transmit cycle, at least 100 traces shall be averaged.)
 - g) If tests are performed with the EUT transmitting at a duty cycle less than 98%, then a correction factor shall be added to the measurement results prior to comparing with the emission limit, to compute the emission level that would have been measured had the test been performed at 100% duty cycle. The correction factor is computed as follows:
 - 1) If power averaging (rms) mode was used in the preceding step e), then the correction factor is [10 log (1 / D)], where D is the duty cycle. For example, if the transmit duty cycle was 50%, then 3 dB shall be added to the measured emission levels.

2) If linear voltage averaging mode was used in the preceding step e), then the correction factor is $[20 \log (1 / D)]$, where D is the duty cycle. For example, if the transmit duty cycle was 50%, then 6 dB shall be added to the measured emission levels.

3) If a specific emission is demonstrated to be continuous (100% duty cycle) rather than turning ON and OFF with the transmit cycle, then no duty cycle correction is required for that emission (AV) at frequency above 1GHz.

Limit

In any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated device is operating, the RF power that is produced shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power, based on either an RF conducted or a radiated measurement, provided that the transmitter demonstrates compliance with the peak conducted power limits. If the transmitter complies with the conducted power limits based on the use of RMS averaging over a time interval, as permitted under § 15.247(b)(3) and RSS 247 section 5.4(d), the attenuation required shall be 30 dB instead of 20 dB. Attenuation below the general field strength limits specified in § 15.209(a) and RSS-Gen is not required. In addition, radiated emissions which fall in the restricted bands, as defined in § 15.205(a) and RSS-Gen section 8.9, must also comply with the radiated emission limits specified in § 15.209(a) and RSS-Gen section 8.10.

Frequency MHz	Field Strength $\mu\text{V/m}$	Field Strength $\text{dB}\mu\text{V/m}$	Detector	Measurement distance meters
0.009-0.490	2400/F(kHz)	48.5-13.8	AV	300
0.490-1.705	24000/F(kHz)	33.8-23.0	QP	30
1.705-30	30	29.5	QP	30
30-88	100	40	QP	3
88-216	150	43.5	QP	3
216-960	200	46	QP	3
960-1000	500	54	QP	3
Above 1000	500	54	AV	3
Above 1000	5000	74	PK	3

Note 1: Limit $3\text{m}(\text{dB}\mu\text{V/m}) = \text{Limit } 300\text{m}(\text{dB}\mu\text{V/m}) + 40\text{Log}(300\text{m}/3\text{m})$ (Below 30MHz)

Note 2: Limit $3\text{m}(\text{dB}\mu\text{V/m}) = \text{Limit } 30\text{m}(\text{dB}\mu\text{V/m}) + 40\text{Log}(30\text{m}/3\text{m})$ (Below 30MHz)

Spurious radiated emissions for transmitter

According to C63.10, if the peak (or quasi-peak) measured value complies with the average limit, it is unnecessary to perform an average measurement, so AV emission value did not show in below table if the peak value complies with average limit.

Data of measurement within frequency range 9kHz-30MHz and 18-25GHz are the noise floor or attenuated more than 20dB below the permissible limits or the field strength is too small to be measured, so test data does not present in this report.



Test result

Pre-scan with three orthogonal axis and worst case as X axis listed below:30-1GHz.

30-1000MHz Radiated Emission

EUT Information

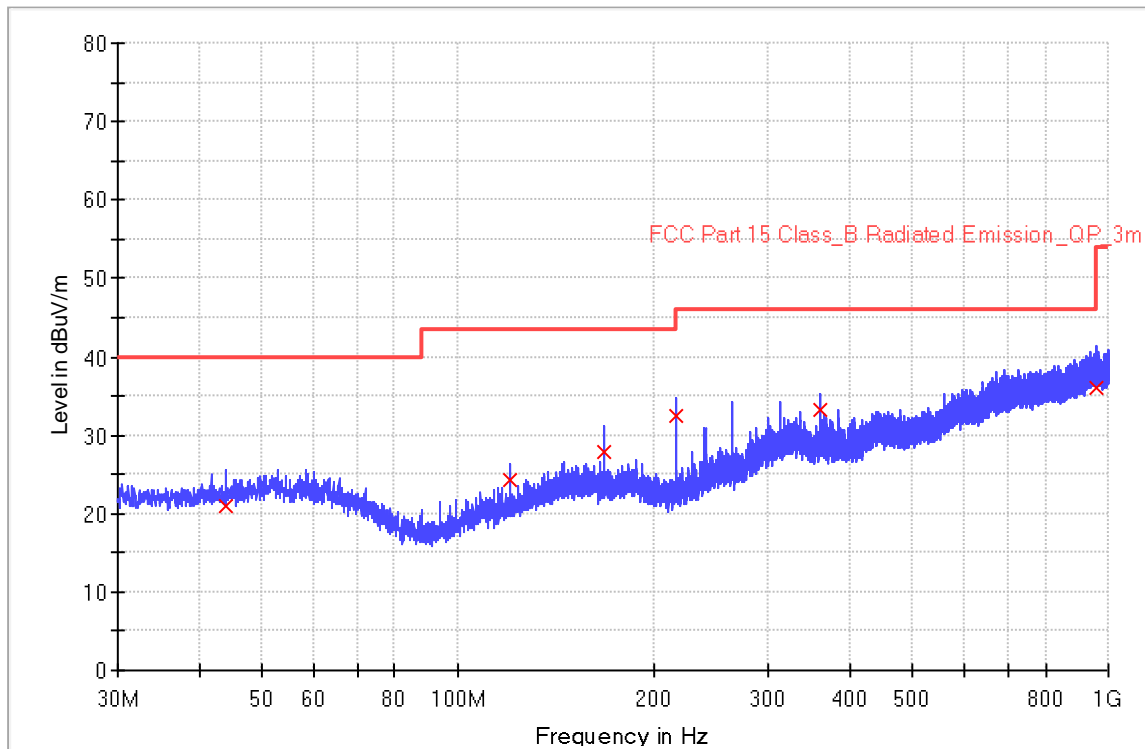
EUT Name: Wi-Fi and BLE Module
 Model: TYAUX-F2
 Client: Hangzhou Tuya Information Technology Co., Ltd
 Op Cond: Power on and TX at 2440MHz
 Operator: Chengjie Guo
 Test Spec: FCC Part 15.209(a)
 Comment: Horizontal
 Sample No: SHA-866932-2

Sweep Setup: RE_VULB9168_pre_Cont_30-1000 [EMI radiated]

Hardware Setup: RE_VULB9168
 Receiver: [ESR 3]
 Level Unit: dBuV/m

Subrange	Step Size	Detectors	Bandwidth	Sweep Time	Preamp
30 MHz - 1 GHz	48.5 kHz	PK+	120 kHz	0.2 s	20 dB

RE_VULB9168_pre_Cont_30-1000



Limit and Margin

Frequency (MHz)	QuasiPeak (dBuV/m)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB/m)	Margin - QPK (dB)
43.960000	21.1	1000.0	120.000	196.0	H	182.0	20.3	18.9
119.960000	24.4	1000.0	120.000	174.0	H	174.0	18.4	19.1
168.000000	27.7	1000.0	120.000	102.0	H	168.0	20.5	15.8
216.000000	32.4	1000.0	120.000	135.0	H	235.0	17.7	13.6
360.000000	33.3	1000.0	120.000	214.0	H	45.0	23.2	12.7
956.720000	36.1	1000.0	120.000	268.0	H	217.0	34.7	9.9

(continuation of the "Limit and Margin" table from column 16 ...)

Frequency (MHz)	Limit - QPK (dBuV/m)	Comment
43.960000	40.0	
119.960000	43.5	
168.000000	43.5	
216.000000	46.0	
360.000000	46.0	
956.720000	46.0	



30-1000MHz Radiated Emission

EUT Information

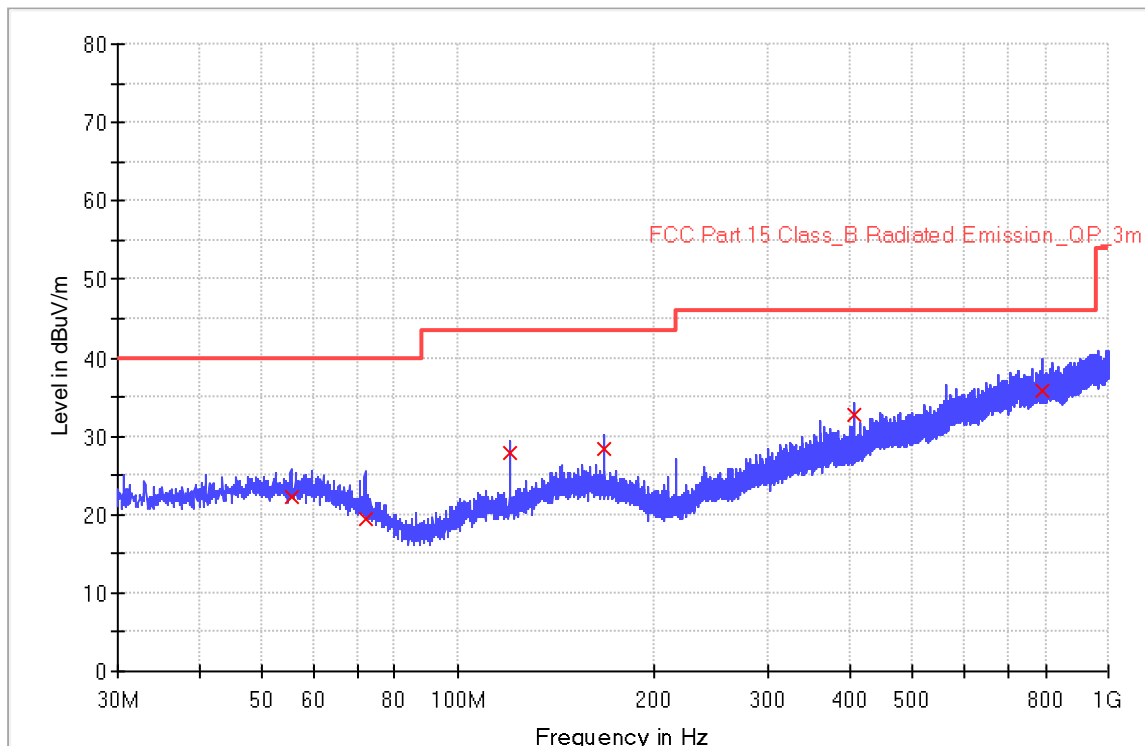
EUT Name: Wi-Fi and BLE Module
 Model: TYAUX-F2
 Client: Hangzhou Tuya Information Technology Co., Ltd
 Op Cond: Power on and TX at 2440MHz
 Operator: Chengjie Guo
 Test Spec: FCC Part 15.209(a)
 Comment: Vertical
 Sample No: SHA-866932-2

Sweep Setup: RE_VULB9168_pre_Cont_30-1000 [EMI radiated]

Hardware Setup: RE_VULB9168
 Receiver: [ESR 3]
 Level Unit: dBuV/m

Subrange	Step Size	Detectors	Bandwidth	Sweep Time	Preamp
30 MHz - 1 GHz	48.5 kHz	PK+	120 kHz	0.2 s	20 dB

RE_VULB9168_pre_Cont_30-1000



Limit and Margin

Frequency (MHz)	QuasiPeak (dBuV/m)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB/m)	Margin - QPK (dB)
55.400000	22.2	1000.0	120.000	136.0	V	287.0	20.9	17.8
72.000000	19.5	1000.0	120.000	174.0	V	241.0	18.4	20.5
119.960000	27.8	1000.0	120.000	184.0	V	221.0	18.4	15.7
168.000000	28.5	1000.0	120.000	216.0	V	162.0	20.5	15.0
408.000000	32.8	1000.0	120.000	254.0	V	157.0	24.5	13.2
791.680000	35.7	1000.0	120.000	236.0	V	174.0	32.7	10.3

(continuation of the "Limit and Margin" table from column 16 ...)

Frequency (MHz)	Limit - QPK (dBuV/m)	Comment
55.400000	40.0	
72.000000	40.0	
119.960000	43.5	
168.000000	43.5	
408.000000	46.0	
791.680000	46.0	

Remark:

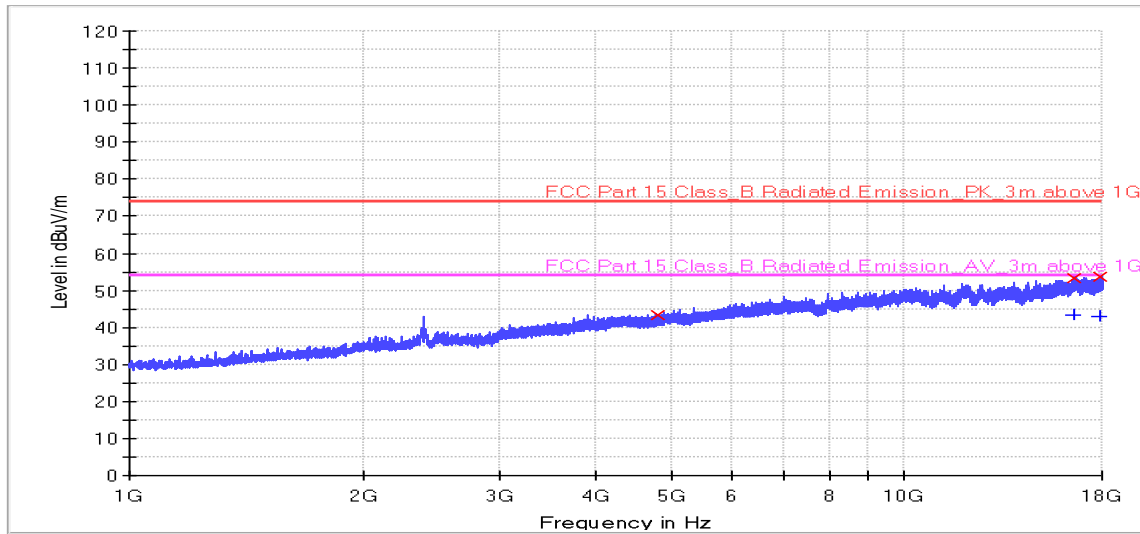
- (1) Emission level= Original Receiver Reading + Correct Factor
- (2) Correct Factor = Antenna Factor + Cable Loss -Amplifier gain
- (3) Margin = limit – Corrected Reading



Radiated Emission 1-18 GHz

Frequency:2402MHz

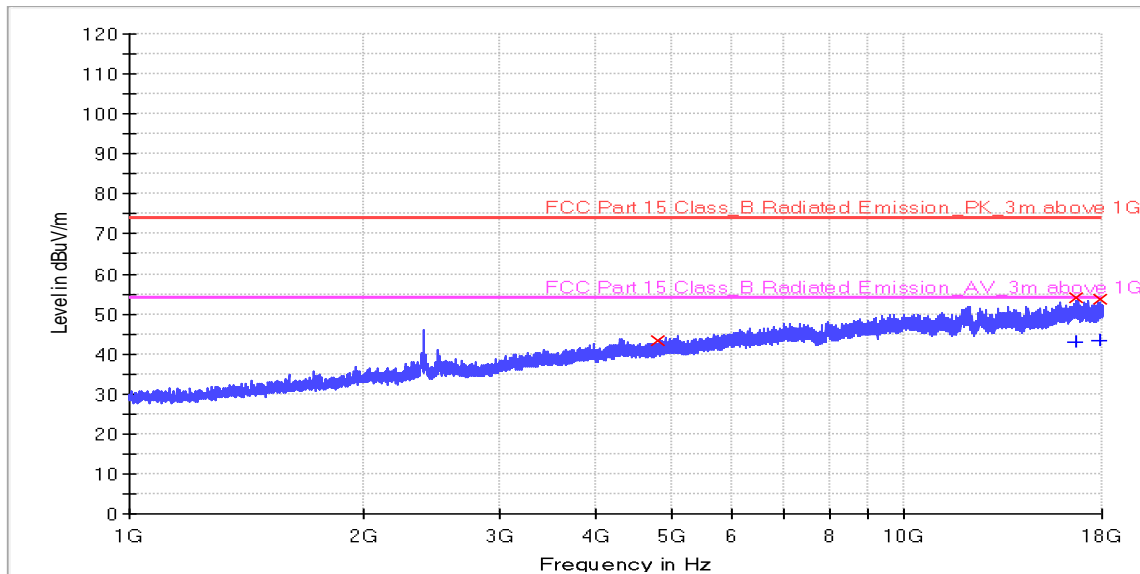
RE_HF907_BRF_Pre



Limit and Margin

Frequency (MHz)	MaxPeak (dBuV/m)	AV (dBuV/m)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB/m)	Margin - PK+	Limit - PK+	Margin - AV	Limit - AV
4804.000000	43.3	---	1000.000	150.0	H	113.0	-1.5	30.8	74.0	---	---
16557.100000	53.1	43.1	1000.000	150.0	H	214.0	7.4	20.9	74.0	10.9	54.0
17859.700000	53.5	42.8	1000.000	150.0	H	231.0	8.4	20.5	74.0	11.2	54.0

RE_HF907_BRF_Pre

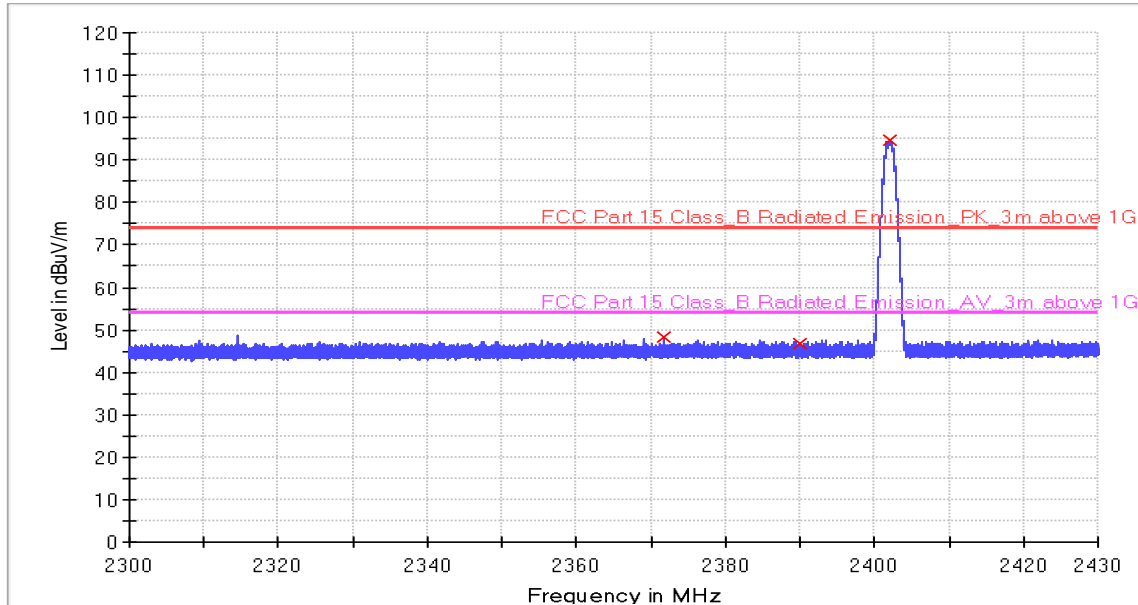


Limit and Margin

Frequency (MHz)	MaxPeak (dBuV/m)	AV (dBuV/m)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB/m)	Margin - PK+	Limit - PK+	Margin - AV	Limit - AV
4804.000000	43.2	---	1000.000	201.0	V	78.0	-3.2	30.8	74.0	---	---
16612.300000	54.1	43.1	1000.000	113.0	V	32.0	7.6	19.9	74.0	10.9	54.0
17899.600000	53.8	43.3	1000.000	126.0	V	1.0	8.4	20.2	74.0	10.7	54.0



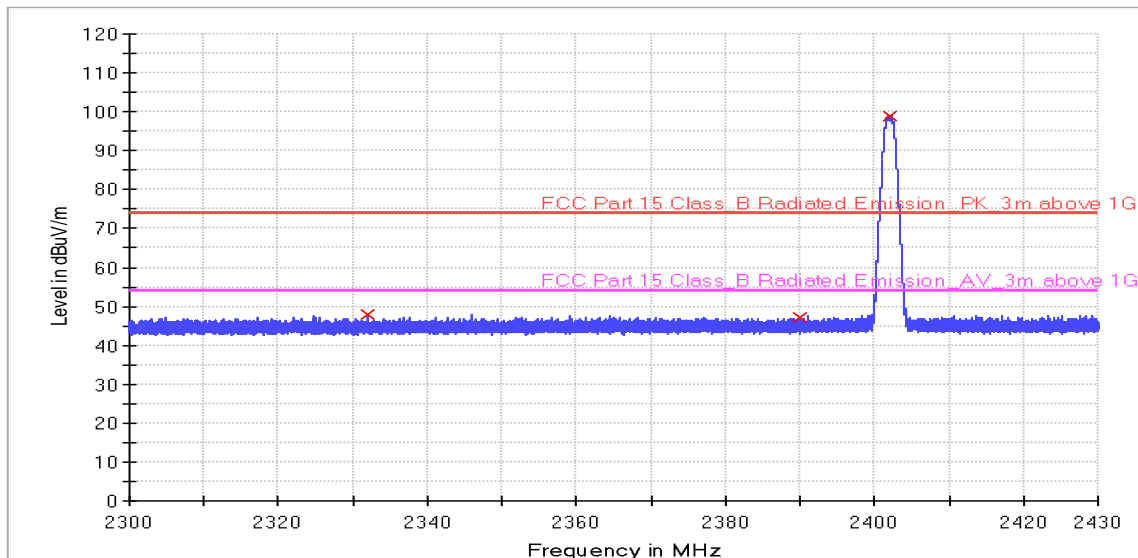
RE_HF907_BRF_Pre



Limit and Margin

Frequency (MHz)	MaxPeak (dBuV/m)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB/m)	Margin - PK+ (dB)	Limit - PK+ (dBuV/m)
2371.600000	48.2	1000.0	1000.000	123.0	H	359.0	-0.8	25.8	74.0
2390.000000	46.9	1000.0	1000.000	182.0	H	179.0	-0.8	27.1	74.0

RE_HF907_BRF_Pre



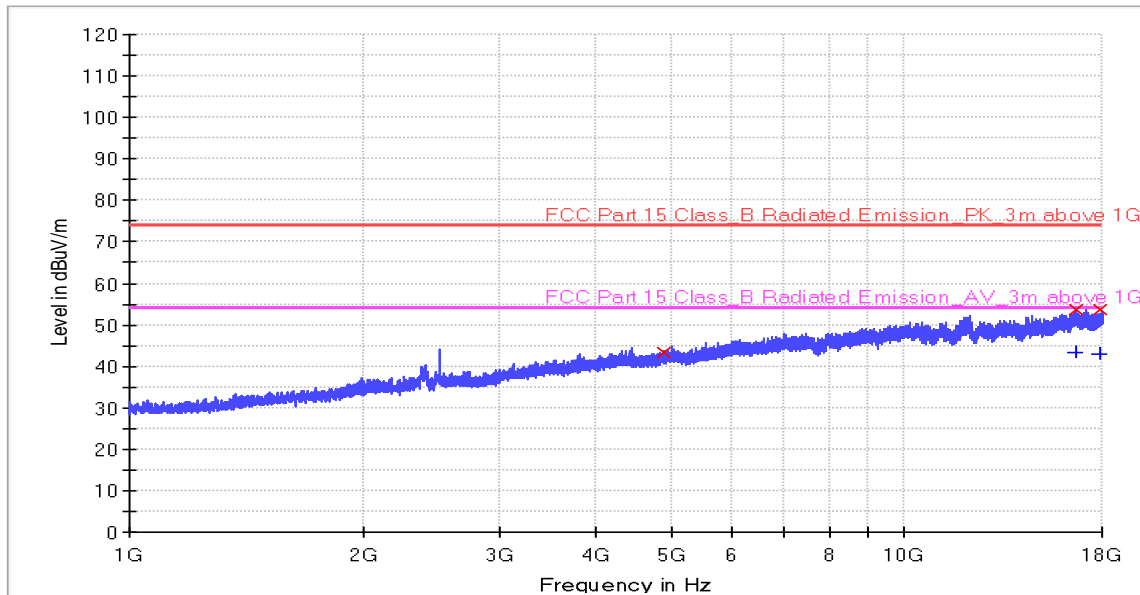
Limit and Margin

Frequency (MHz)	MaxPeak (dBuV/m)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB/m)	Margin - PK+ (dB)	Limit - PK+ (dBuV/m)
2332.000000	47.8	1000.0	1000.000	136.0	V	95.0	-1.1	26.2	74.0
2390.000000	47.0	1000.0	1000.000	128.0	V	66.0	-0.8	27.0	74.0



Frequency:2440MHz

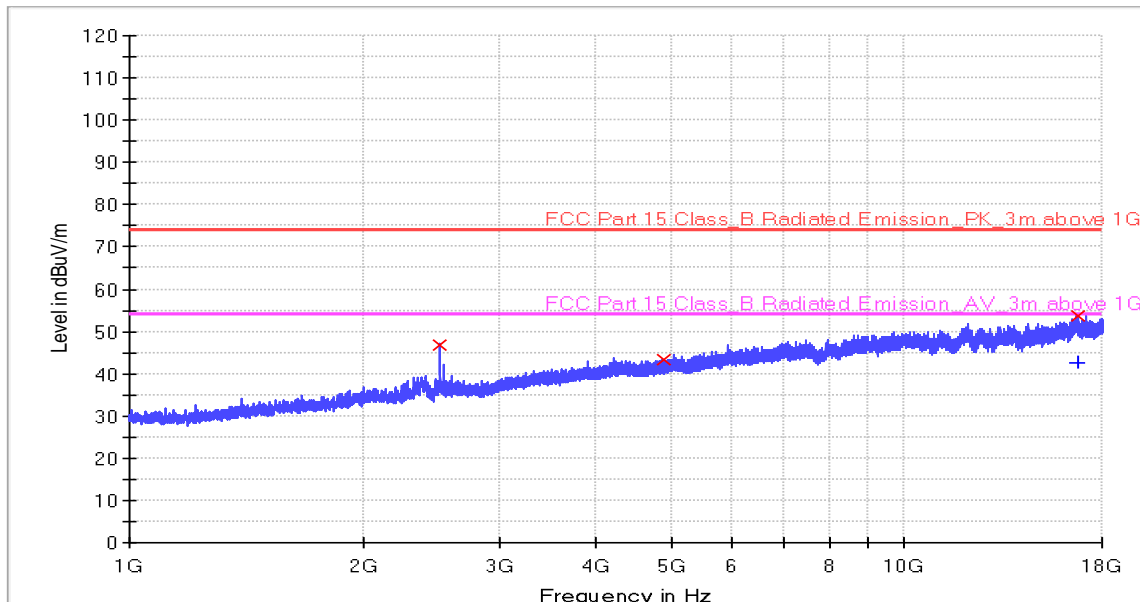
RE_HF907_BRF_Pre



Limit and Margin

Frequency (MHz)	MaxPeak (dBuV/m)	AV (dBuV/m)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB/m)	Margin - PK+	Limit - PK+	Margin - AV	Limit - AV
4880.000000	43.2	---	1000.000	120.0	H	307.0	-3.1	30.8	74.0	---	---
16669.300000	53.5	43.4	1000.000	115.0	H	0.0	7.7	20.5	74.0	10.6	54.0
17857.600000	53.8	42.8	1000.000	132.0	H	145.0	8.4	20.3	74.0	11.3	54.0

RE_HF907_BRF_Pre



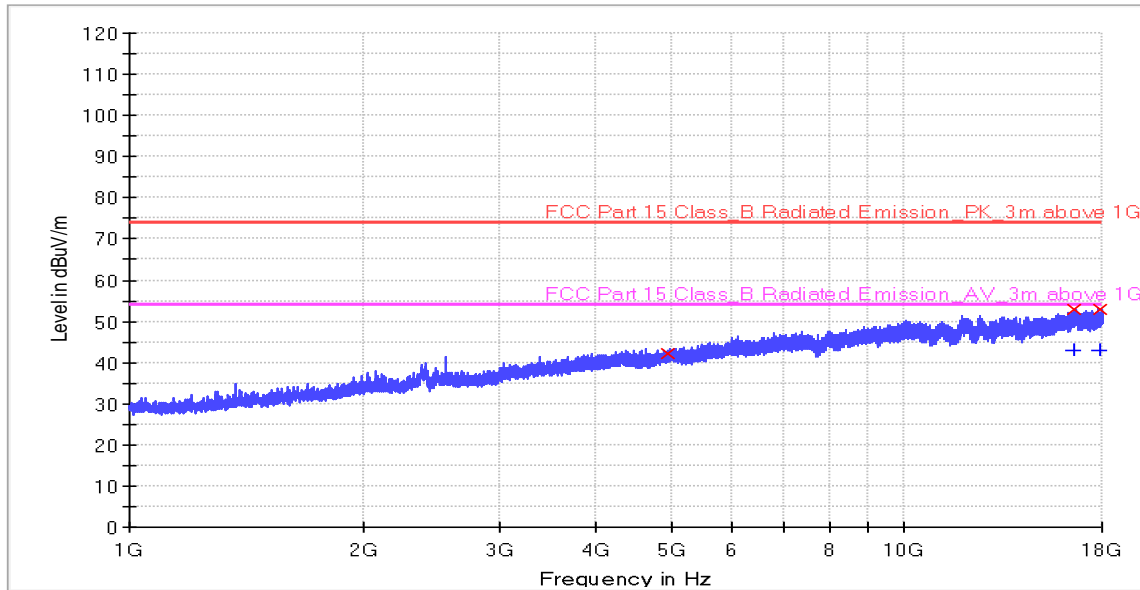
Limit and Margin

Frequency (MHz)	MaxPeak (dBuV/m)	AV (dBuV/m)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB/m)	Margin - PK+	Limit - PK+	Margin - AV	Limit - AV
2519.800000	46.9	---	1000.000	241.0	V	136.0	-9.2	27.1	74.0	---	---
4880.000000	43.3	---	1000.000	244.0	V	213.0	-1.7	30.7	74.0	---	---
16789.900000	53.8	42.6	1000.000	133.0	V	133.0	7.7	20.2	74.0	11.4	54.0



Frequency:2480MHz

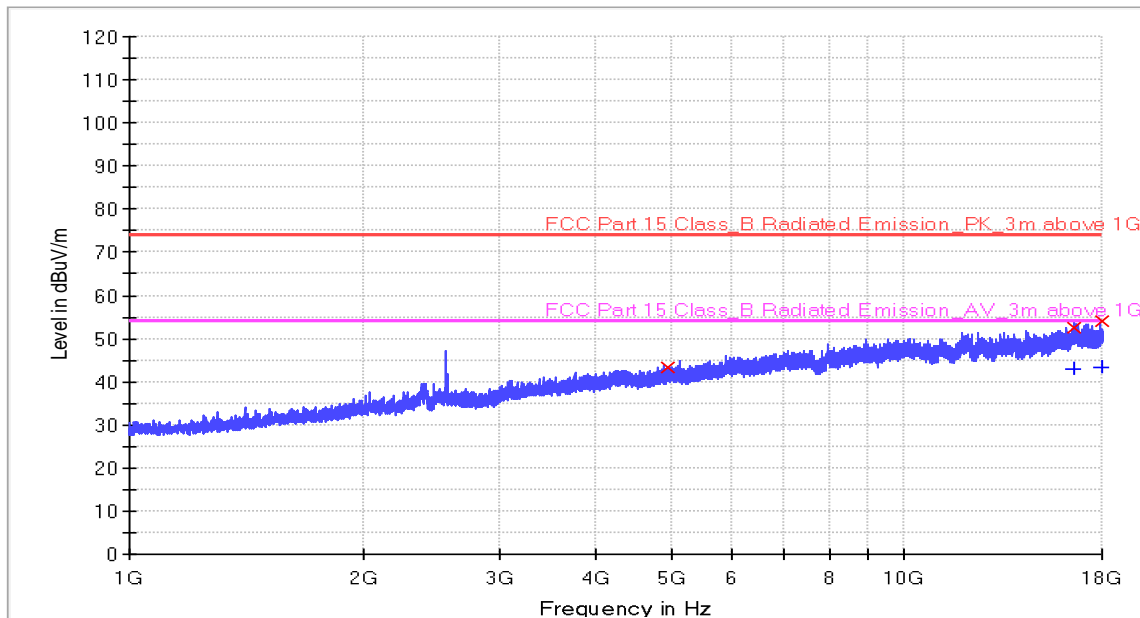
RE_HF907_BRF_Pre



Limit and Margin

Frequency (MHz)	MaxPeak (dBuV/m)	AV (dBuV/m)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB/m)	Margin - PK+	Limit - PK+	Margin - AV	Limit - AV
4960.000000	42.2	---	1000.000	267.0	H	351.0	-3.2	31.8	74.0	---	---
16574.800000	52.9	43.0	1000.000	226.0	H	24.0	7.5	21.1	74.0	11.0	54.0
17885.800000	53.1	42.9	1000.000	136.0	H	145.0	8.4	20.9	74.0	11.1	54.0

RE_HF907_BRF_Pre

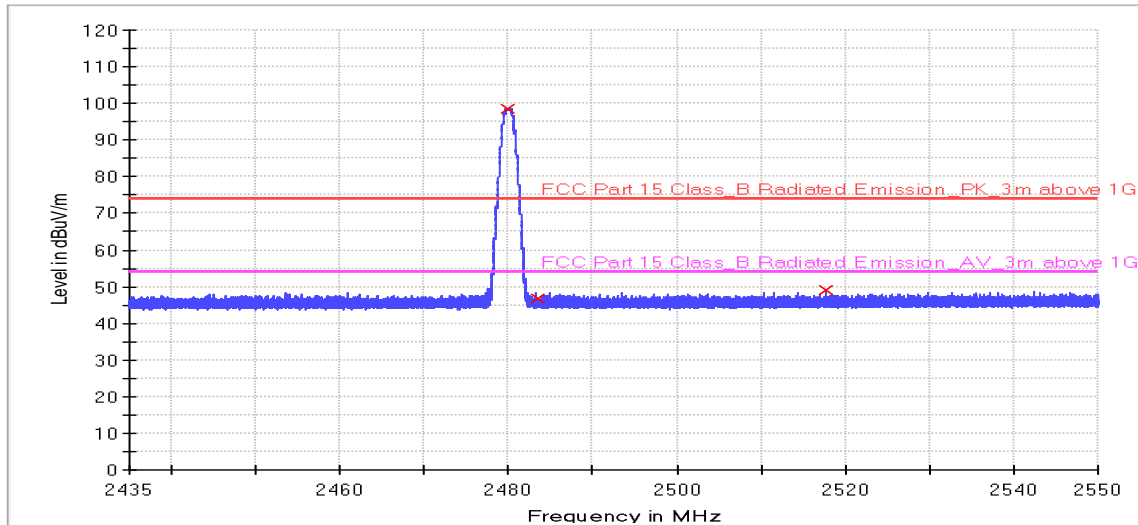


Limit and Margin

Frequency (MHz)	MaxPeak (dBuV/m)	AV (dBuV/m)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB/m)	Margin - PK+	Limit - PK+	Margin - AV	Limit - AV
4960.000000	43.2	---	1000.000	269.0	V	71.0	-1.9	30.8	74.0	---	---
16530.100000	52.6	42.9	1000.000	267.0	V	32.0	7.4	21.4	74.0	11.1	54.0
17957.500000	54.1	43.4	1000.000	285.0	V	2.0	8.5	19.9	74.0	10.6	54.0



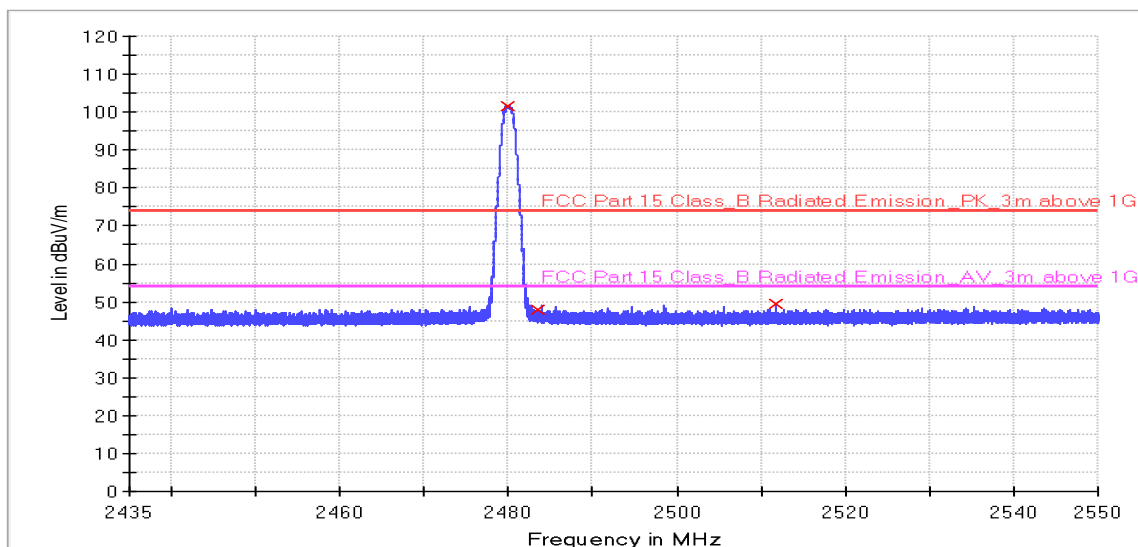
RE_HF907_BRF_Pre



Limit and Margin

Frequency (MHz)	MaxPeak (dBuV/m)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB/m)	Margin - PK+ (dB)	Limit - PK+ (dBuV/m)
2483.500000	46.6	1000.0	1000.000	119.0	H	214.0	-0.3	27.4	74.0
2517.700000	49.0	1000.0	1000.000	258.0	H	189.0	-0.1	25.0	74.0

RE_HF907_BRF_Pre



Limit and Margin

Frequency (MHz)	MaxPeak (dBuV/m)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB/m)	Margin - PK+ (dB)	Limit - PK+ (dBuV/m)
2483.500000	48.0	1000.0	1000.000	111.0	V	47.0	-0.3	26.0	74.0
2511.700000	49.6	1000.0	1000.000	178.0	V	145.0	-0.2	24.4	74.0

Remark:

- (1) Emission level= Original Receiver Reading + Correct Factor
- (2) Correct Factor = Antenna Factor + Cable Loss -Amplifier gain
- (3) Margin = limit – Corrected Reading



11 Test Equipment List

List of Test Instruments
Test Site1

	DESCRIPTION	MANUFACTURER	MODEL NO.	SERIAL NO.	CAL. DATE	CAL. DUE DATE
C	Signal spectrum analyzer	Agilent	N9020B	MY59050168	2024-2-19	2025-2-18
RE	EMI Test Receiver	Rohde & Schwarz	ESR3	101906	2024-8-1	2025-7-31
	Signal Analyzer	Rohde & Schwarz	FSV40	101091	2024-8-1	2025-7-31
	Trilog Super Broadband Test Antenna	Schwarzbeck	VULB 9168	961	2024-8-30	2025-8-29
	Double-ridged waveguide horn antenna	Rohde & Schwarz	HF907	102868	2024-4-14	2025-4-13
	Pre-amplifier	Shenzhen HzEMC	HPA-081843	HYP A23026	2024-4-16	2025-4-15
	Loop antenna	Rohde & Schwarz	HFH2-Z2	100443	2024-6-26	2025-6-25
	Double Ridged Horn Antenna	ETS-Lindgren	3116C	00246076	2023-7-7	2026-7-6
3m Semi-anechoic chamber	TDK	9X6X6	----	2024-5-8	2027-5-7	
CE	EMI Test Receiver	Rohde & Schwarz	ESR3	101907	2024-8-1	2025-7-31
	LISN	Rohde & Schwarz	ENV216	101924	2024-8-1	2025-7-31

Measurement Software Information			
Test Item	Software	Manufacturer	Version
C	MTS 8310	MWR Ftest	3.0.0.0
RE	EMC 32	Rohde & Schwarz	V10.50.40
CE	EMC 32	Rohde & Schwarz	V9.15.03

C - Conducted RF tests

- Conducted peak output power
- 6dB bandwidth and 99% Occupied Bandwidth
- Power spectral density
- Spurious RF conducted emissions
- Band edge

12 System Measurement Uncertainty

For a 95% confidence level, the measurement expanded uncertainties for defined systems, in accordance with the recommendations of ISO 17025 were:

Items	Extended Uncertainty
Conducted Disturbance at Mains Terminals	150kHz to 30MHz, LISN, 3.16dB
Radiated Disturbance	9kHz to 30MHz, 3.52dB 30MHz to 1GHz, 5.03dB (Horizontal) 5.12dB (Vertical) 1GHz to 18GHz, 5.49dB 18GHz to 40GHz, 5.63dB
RF Conducted Measurement	Power related: 1.16dB Frequency related: 6.00×10^{-8}

Measurement Uncertainty Decision Rule:

Determination of conformity with the specification limits is based on the decision rule according to IEC Guide 115: 2021, clause 4.4.3 and 4.5.1.



13 Photographs of Test Set-ups

Refer to the < Test Setup photos >.

14 Photographs of EUT

Refer to the < External Photos > & < Internal Photos >.

-----End of Test Report-----