FCC Test Report

Report No.: AGC11532250410FR01

FCC ID	:	2BH5X-1W03Q1
APPLICATION PURPOSE	:	Original Equipment
PRODUCT DESIGNATION	:	WINDOW CLEANING ROBOT
BRAND NAME	:	N/A
MODEL NAME	:	1W03Q1, 1W03J1
APPLICANT	:	Shanxi Amaisen Robot Technology Co., Ltd
DATE OF ISSUE	:	May 13, 2025
STANDARD(S)	:	FCC Part 15 Subpart C §15.247
REPORT VERSION	:	V1.0

Attestation Of Global Compliance (Shenzhen) Co., Ltd

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Report Revise Record

Report Version	Revise Time	Issued Date	Valid Version	Notes
V1.0	/	May 13, 2025	Valid	Initial Release

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1. General Information

Applicant	Shanxi Amaisen Robot Technology Co., Ltd
Address	17/F Huanneng tech block, No.17, Gaoxin street, Comprehensive reform demonstration area, Taiyuan city, Shanxi province, China.
Manufacturer	Shanxi Amaisen Robot Technology Co., Ltd
Address	17/F Huanneng tech block, No.17, Gaoxin street, Comprehensive reform demonstration area, Taiyuan city, Shanxi province, China.
Factory	Shanxi Amaisen Robot Technology Co., Ltd
Address	17/F Huanneng tech block, No.17, Gaoxin street, Comprehensive reform demonstration area, Taiyuan city, Shanxi province, China.
Product Designation	WINDOW CLEANING ROBOT
Brand Name	N/A
Test Model	1W03Q1
Series Model(s)	1W03J1
Difference Description	All the same except for the model name.
Date of receipt of test item	Apr. 18, 2025
Date of Test	Apr. 18, 2025 to May 13, 2025
Deviation from Standard	No any deviation from the test method
Condition of Test Sample	Normal
Test Result	Pass
Test Report Form No	AGCER-FCC-BLE-V1

Note: The test results of this report relate only to the tested sample identified in this report.

Prepared By	Thea Huang Thea Huang (Project Engineer)	May 13, 2025
Reviewed By	Bibo zhang Bibo Zhang (Reviewer)	May 13, 2025
Approved By	Angela Li Angela Li (Authorized Officer)	May 13, 2025

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2. Product Information

2.1 Product Technical Description

Technology Type	Bluetooth Low Energy
Frequency Band	2400MHz-2483.5MHz
Operation Frequency Range	2402MHz-2480MHz
Bluetooth Version	V5.0
Modulation Type	BLE ☒GFSK 1Mbps ☒GFSK 2Mbps
Number of channels	40
Carrier Frequency of Each Channel	40 Channels (37 Data channels + 3 Advertising channels)
Channel Separation	2 MHz
Maximum Transmitter Power	BLE GFSK 1Mbps: 3.421dBm; BLE GFSK 2Mbps: 3.358dBm
Hardware Version	v1.0
Software Version	v1.0
Antenna Designation	PCB Antenna
Antenna Gain	2.5dBi
Power Supply	DC 14.8V, 500mAh by battery or DC 24V 3A 72.0W by AC Power

2.2 Test Frequency List

Frequency Band	Channel Number	Test Frequency
2400~2483.5MHz	0	2402 MHz
	1	2404 MHz
	:	:
	19	2440MHz
	:	:
	38	2478 MHz
	39	2480 MHz
Note: f = 2402 + 2*k MHz, k = 0, …, 39 f is the operating frequency (MHz); k is the operating channel.		

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2.3 Related Submittal(S) / Grant (S)

This submittal(s) (test report) is intended for FCC ID: **2BH5X-1W03Q1,** filing to comply with Part 2, Part 15 of the Federal Communication Commission rules.

2.4 Test Methodology

The tests were performed according to following standards:

No.	Identity	Document Title
1	FCC 47 CFR Part 2	Frequency allocations and radio treaty matters; general rules and regulations
2	FCC 47 CFR Part 15	Radio Frequency Devices
3	ANSI C63.10-2013	American National Standard for Testing Unlicensed Wireless Devices
4	KDB 558074 D01 15.247 Meas Guidance v05r02	Guidance for compliance measurements on Digital Transmission Systems, Frequency Hopping Spread Spectrum system, and Hybrid system devices operating under Section 15.247 of the FCC rules

2.5 Special Accessories

Not available for this EUT intended for grant.

2.6 Equipment Modifications

Not available for this EUT intended for grant.

2.7 Antenna Requirement

Standard Requirement
15.203 requirement: An intentional radiator shall be designed to ensure that no antenna other than that furnished by the responsible party shall be used with the device. The use of a permanently attached antenna or of an antenna that uses a unique coupling to the intentional radiator, the manufacturer may design the unit so that a broken antenna can be replaced by the user, but the use of a standard antenna jack or electrical connector is prohibited. **15.247(b) (4) requirement:** The conducted output power limit specified in paragraph (b) of this section is based on the use of antennas with directional gains that do not exceed 6 dBi. Except as shown in paragraph (c) of this section, if transmitting antennas of directional gain greater than 6 dBi are used, the conducted output power from the intentional radiator shall be reduced below the stated values in paragraphs (b)(1), (b)(2), and (b)(3) of this section, as appropriate, by the amount in dB that the directional gain of the antenna exceeds 6 dBi
EUT Antenna
The non-detachable antenna inside the device cannot be replaced by the user at will. The gain of the antenna is 2.5dBi.

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3. Test Environment

3.1 Address of the Test Laboratory

Laboratory: Attestation of Global Compliance (Shenzhen) Co., Ltd.

Address: 1-2/F, Building 19, Junfeng Industrial Park, Chongqing Road, Heping Community, Fuhai Street, Bao'an District, Shenzhen, Guangdong, China

3.2 Test Facility

The test facility is recognized, certified, or accredited by the following organizations:

CNAS-Lab Code: L5488

Attestation of Global Compliance (Shenzhen) Co., Ltd. has been assessed and proved to follow CNAS-CL01 Accreditation Criteria for Testing and Calibration Laboratories (identical to ISO/IEC17025: 2017 General Requirements for the Competence of Testing and Calibration Laboratories).

A2LA-Lab Cert. No.: 5054.02

Attestation of Global Compliance (Shenzhen) Co., Ltd. EMC Laboratory has been accredited by A2LA for technical competence in the field of electrical testing, and proved to follow ISO/IEC 17025: 2017 General Requirements for the Competence of Testing and Calibration Laboratories and any additional program requirements in the identified field of testing.

FCC-Registration No.: 975832

Attestation of Global Compliance (Shenzhen) Co., Ltd. EMC Laboratory has been registered and fully described in a report filed with the FCC (Federal Communications Commission). The acceptance letter from the FCC is maintained in our files with Registration 975832.

IC-Registration No.: 24842 (CAB identifier: CN0063)

Attestation of Global Compliance (Shenzhen) Co., Ltd. EMC Laboratory has been registered and fully described in a report filed with the Certification and Engineering Bureau of Industry Canada. The acceptance letter from the IC is maintained in our files with Registration 24842.

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3.3 Environmental Conditions

	Normal Conditions
Temperature range (℃)	15 - 35
Relative humidity range	20 % - 75 %
Pressure range (kPa)	86 - 106
Power supply	DC 14.8V, 500mAh by battery or DC 24V 3A 72.0W by AC Power

3.4 Measurement Uncertainty

The reported uncertainty of measurement y ±U, where expended uncertainty U is based on a standard uncertainty multiplied by a coverage factor of k=2, providing a level of confidence of approximately 95%.

Item	Measurement Uncertainty
Uncertainty of Conducted Emission for AC Port	U_c = ±2.9 dB
Uncertainty of Radiated Emission below 1GHz	U_c = ±3.9 dB
Uncertainty of Radiated Emission above 1GHz	U_c = ±4.9 dB
Uncertainty of total RF Power, Conducted	U_c = ±0.8 dB
Uncertainty of RF Power Density, Conducted	U_c = ±2.6 dB
Uncertainty of Spurious Emissions, Conducted	U_c = ±2 %
Uncertainty of Occupied Channel Bandwidth	U_c = ±2 %
Uncertainty of Dwell Time	U_c = ±2 %

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3.5 List of Equipment Use

● RF Conducted Test System							
Used	Equipment No.	Test Equipment	Manufacturer	Model No.	Serial No.	Last Cal. Date (YY-MM-DD)	Next Cal. Date (YY-MM-DD)
☒	AGC-ER-E036	Spectrum Analyzer	Agilent	N9020A	MY49100060	2024-05-24	2025-05-23
☒	AGC-ER-E062	Power Sensor	Agilent	U2021XA	MY54110007	2025-01-31	2026-01-13
☒	AGC-ER-E063	Power Sensor	Agilent	U2021XA	MY54110009	2025-01-31	2026-01-13
☒	AGC-ER-A007	6dB Fixed Attenuator	Mini circuits	BW-S6-2W263A+	N/A	2025-01-30	2026-01-29
☐	AGC-ER-E083	Signal Generator	Agilent	E4421B	US39340815	2024-05-23	2025-05-22
☒	N/A	RF Connection Cable	N/A	1#	N/A	Each time	N/A
☒	N/A	RF Connection Cable	N/A	2#	N/A	Each time	N/A

● Radiated Spurious Emission							
Used	Equipment No.	Test Equipment	Manufacturer	Model No.	Serial No.	Last Cal. Date (YY-MM-DD)	Next Cal. Date (YY-MM-DD)
☒	AGC-EM-E046	EMI Test Receiver	R&S	ESCI	10096	2025-01-31	2026-01-13
☐	AGC-EM-E116	EMI Test Receiver	R&S	ESCI	100034	2024-05-24	2025-05-23
☒	AGC-EM-E061	Spectrum Analyzer	Agilent	N9010A	MY53470504	2024-05-28	2025-05-27
☒	AGC-EM-E086	Loop Antenna	ZHINAN	ZN30900C	18051	2024-03-05	2026-03-04
☒	AGC-EM-E001	Wideband Antenna	SCHWARZBECK	VULB9168	D69250	2025-03-14	2027-03-13
☒	AGC-EM-E029	Broadband Ridged Horn Antenna	ETS	3117	00034609	2025-03-27	2026-03-26
☒	AGC-EM-E082	Horn Antenna	SCHWARZBECK	BBHA 9170	#768	2023-09-24	2025-09-23
☒	AGC-EM-E146	Pre-amplifier	ETS	3117-PA	00246148	2024-07-24	2026-07-23
☒	AGC-EM-A119	2.4G Filter	SongYi	N/A	N/A	2024-05-23	2025-05-22
☒	AGC-EM-A138	6dB Attenuator	Eeatsheep	LM-XX-6-5W	N/A	2023-06-09	2025-06-08
☐	AGC-EM-A139	6dB Attenuator	Eeatsheep	LM-XX-6-5W	N/A	2023-06-09	2025-06-08

● AC Power Line Conducted Emission							
Used	Equipment No.	Test Equipment	Manufacturer	Model No.	Serial No.	Last Cal. Date (YY-MM-DD)	Next Cal. Date (YY-MM-DD)
☒	AGC-EM-E045	EMI Test Receiver	R&S	ESPI	101206	2024-05-28	2025-05-27
☒	AGC-EM-A130	6dB Attenuator	Eeatsheep	LM-XX-6-5W	DC-6GZ	2023-06-09	2025-06-08
☒	AGC-EM-E023	AMN	R&S	100086	ESH2-Z5	2024-05-28	2025-05-27

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● Test Software					
Used	Equipment No.	Test Equipment	Manufacturer	Model No.	Version Information
☒	AGC-EM-S001	CE Test System	R&S	ES-K1	V1.71
☒	AGC-EM-S003	RE Test System	FARA	EZ-EMC	VRA-03A
☐	AGC-EM-S004	RE Test System	Tonscend	TS+ Ver2.1(JS32-RE)	4.0.0.0
☒	AGC-ER-S012	BT/WIFI Test System	Tonscend	JS1120-2	2.6
☒	AGC-EM-S011	RSE Test System	Tonscend	TS+-Ver2.1(JS36-RSE)	4.0.0.0

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4. System Test Configuration

4.1 EUT Configuration

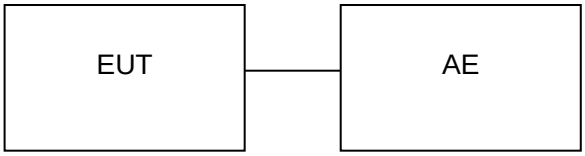
The EUT configuration for testing is installed on RF field strength measurement to meet the Commission's requirement and operating in a manner which intends to maximize its emission characteristics in a continuous normal application.

4.2 EUT Exercise

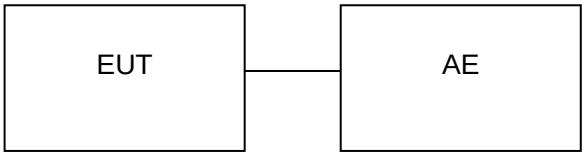
The Transmitter was operated in the normal operating mode. The TX frequency was fixed which was for the purpose of the measurements.

4.3 Configuration of Tested System

Radiated Emission Configure:



Conducted Emission Configure:



4.4 Equipment Used In Tested System

The following peripheral devices and interface cables were connected during the measurement:

☒ Test Accessories Come From The Laboratory

No.	Equipment	Manufacturer	Model No.	Specification Information	Cable
1	Control Box	N/A	Telink	--	--

☐ Test Accessories Come From The Manufacturer

No.	Equipment	Manufacturer	Model No.	Specification Information	Cable
1	--	--	--	--	--

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4.5 Summary of Test Results

Item	FCC Rules	Description of Test	Result
1	§15.203&15.247(b)(4)	Antenna Equipment	Pass
2	§15.247 (b)(3)	RF Output Power	Pass
3	§15.247 (a)(2)	6 dB Bandwidth	Pass
4	§15.247 (e)	Power Spectral Density	Pass
5	§15.247 (d)	Conducted Band Edge and Out-of-Band Emissions	Pass
6	§15.209	Radiated Emission& Band Edge	Pass
7	§15.207	AC Power Line Conducted Emission	Pass

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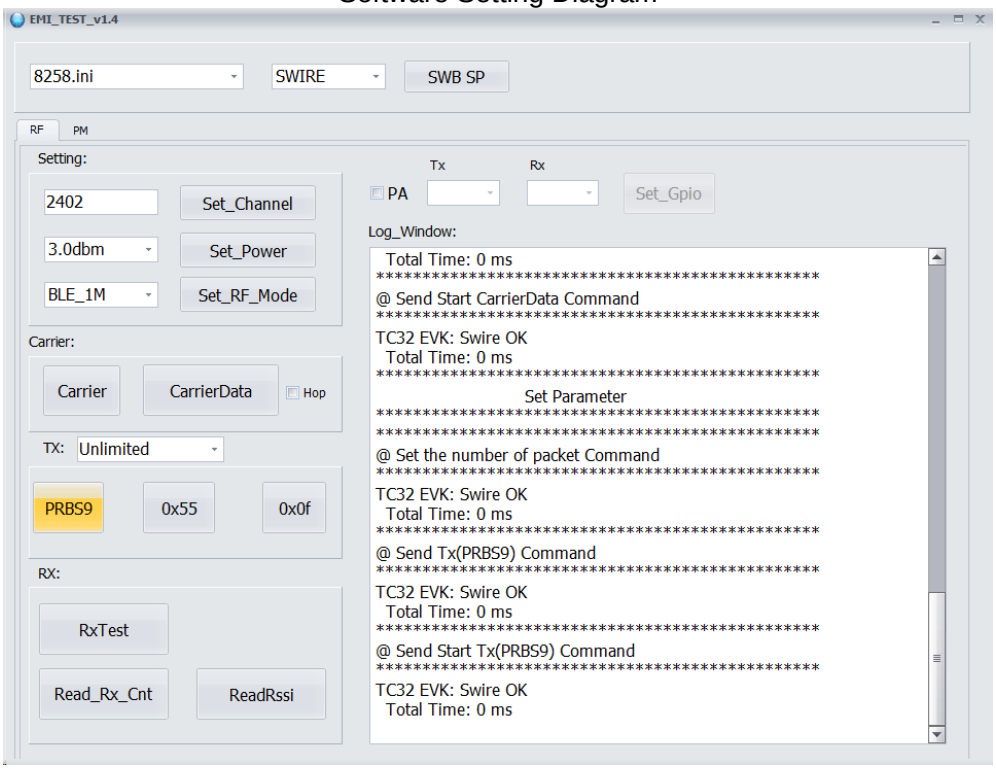
5. Description of Test Modes

Summary Table of Test Cases	
Test Item	Data Rate / Modulation
	Bluetooth–LE(1Mbps/2Mbps)/GFSK
Radiated & Conducted Test Cases	Mode 1: Bluetooth Tx CH00_2402 MHz_1Mbps(Battery powered or AC Power) Mode 2: Bluetooth Tx CH19_2440 MHz_1Mbps(Battery powered or AC Power) Mode 3: Bluetooth Tx CH39_2480 MHz_1Mbps(Battery powered or AC Power) Mode 4: Bluetooth Tx CH00_2402 MHz_2Mbps(Battery powered or AC Power) Mode 5: Bluetooth Tx CH19_2440 MHz_2Mbps(Battery powered or AC Power) Mode 6: Bluetooth Tx CH39_2480 MHz_2Mbps(Battery powered or AC Power)
AC Conducted Emission	Mode 1: Bluetooth Link + Battery + AC Power

Note:
1. Only the result of the worst case was recorded in the report, if no other cases.
2. The battery is full-charged during the test.
3. For Radiated Emission, 3axis were chosen for testing for each applicable mode.
4. For Conducted Test method, a temporary antenna connector is provided by the manufacture.

Software Setting Diagram



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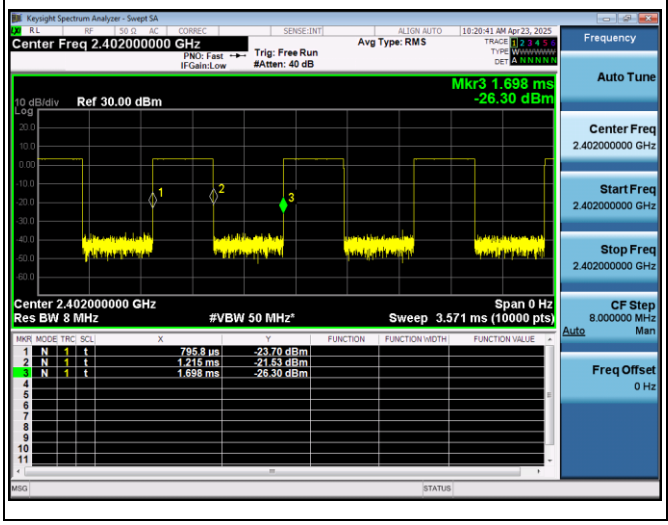
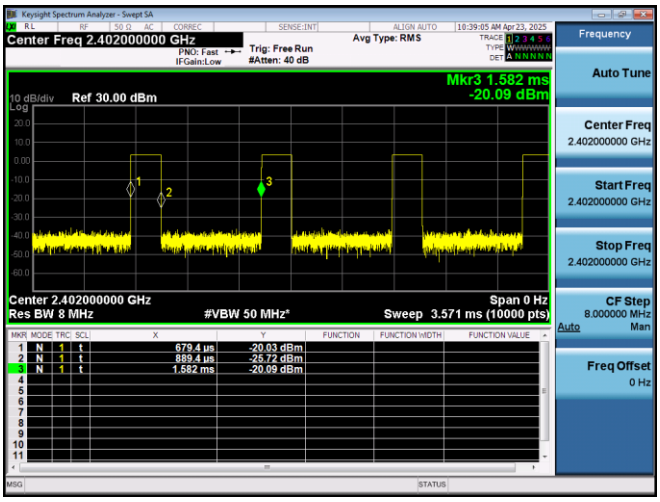
6. Duty Cycle Measurement

The maximum achievable duty cycles for all modes were determined based on measurements performed on a spectrum analyzer in zero-span mode with RBW = 8MHz, VBW = 50MHz, and detector = Peak. The RBW and VBW were both greater than 50/T, where T is the minimum transmission duration, and the number of sweep points across T was greater than 100. The duty cycles are as follows:

Operating mode	T(μs)	Duty Cycle (%)	Duty Cycle Factor (dB)	1/ T Minimum VBW (kHz)
BLE_1Mbps	419.2	46.46	3.33	2.39
BLE_2Mbps	210	23.27	6.33	4.76

Remark:
1. Duty Cycle factor = 10 * log (1/ Duty cycle)
2. The duty cycle of each frequency band mode reflects the determination requirements of the low channel measurement value

- The test plots as follows:

Bluetooth–LE for 1Mbps	Bluetooth–LE for 2Mbps
	

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7. RF Output Power Measurement

7.1 Provisions Applicable

For DTSs employing digital modulation techniques operating in the bands 2400-2483.5 MHz, the maximum peak conducted output power shall not exceed 1 W.

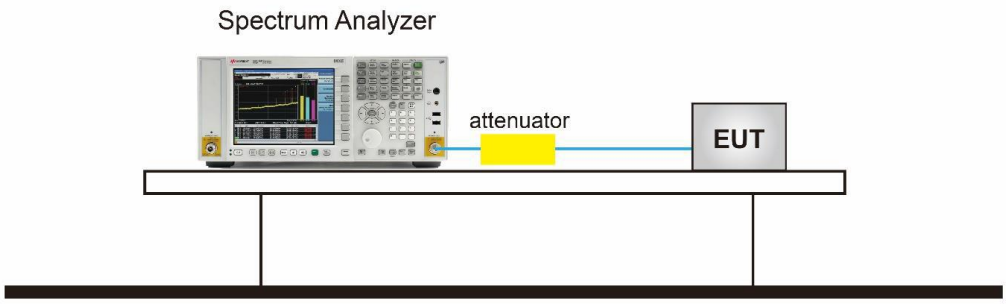
7.2 Measurement Procedure

☒ For Peak Power, the testing follows ANSI C63.10 Section 11.9.1.1 Method Max peak power:

1. Connect EUT RF output port to the Spectrum Analyzer through an RF attenuator
2. Set the RBW≥DTS bandwidth
3. Set the VBW≥[3 × RBW].
4. Span≥[3 × RBW].
5. Sweep= auto couple.
6. Detector Function= Peak.
7. Trace mode= Max hold.
8. Allow trace to stabilize. Use the marker-to-peak function to set the marker to the peak of the emission. The indicated level is the peak output power, after any corrections for external attenuators and cables.

7.3 Measurement Setup (Block Diagram of Configuration)

☒For peak power test setup



7.4 Measurement Result

Test Data of Conducted Output Power				
Test Mode	Test Frequency (MHz)	Peak Power (dBm)	Limits (dBm)	Pass or Fail
GFSK_1Mbps	2402	3.244	≤30	Pass
	2440	3.407	≤30	Pass
	2480	3.421	≤30	Pass
GFSK_2Mbps	2402	3.288	≤30	Pass
	2440	3.349	≤30	Pass
	2480	3.358	≤30	Pass

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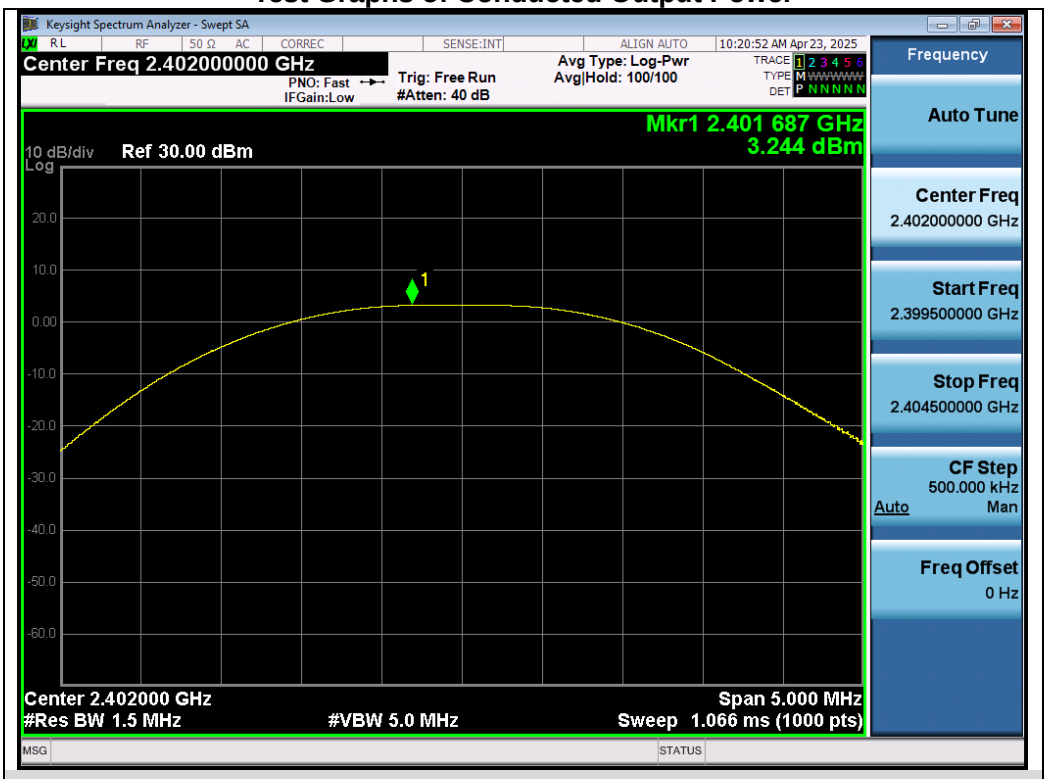
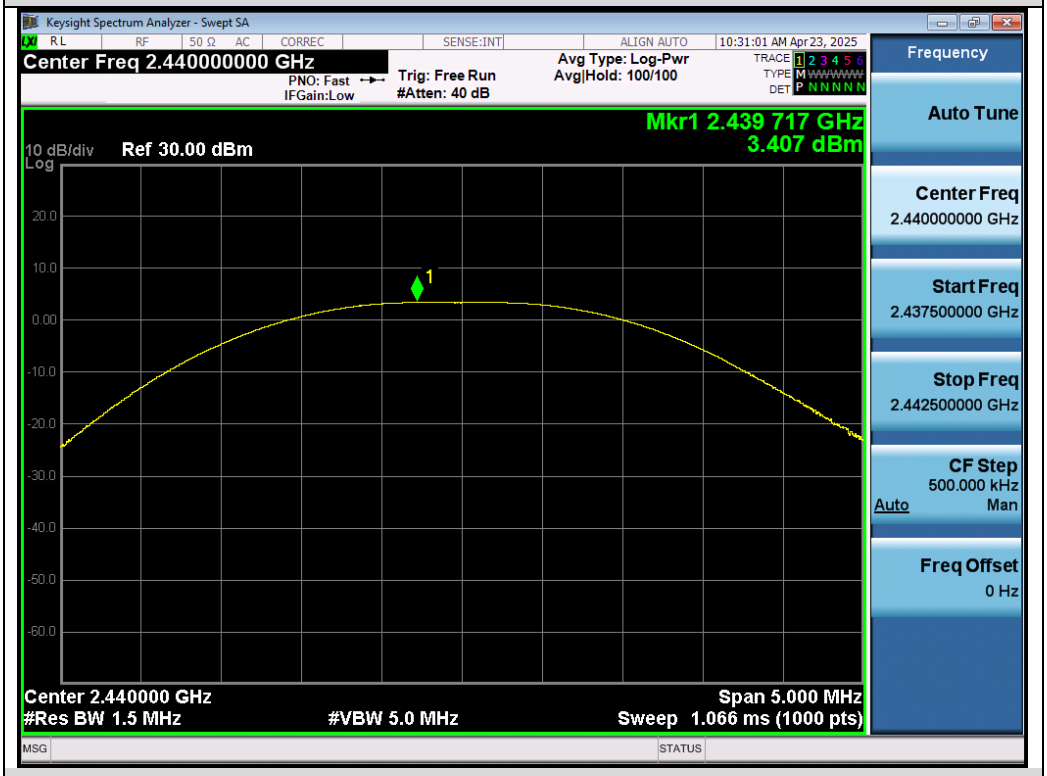
Test Graphs of Conducted Output Power



Test_Graph_LE1M_ANT1_2402_1Mbps_Peak Power



Test_Graph_LE1M_ANT1_2440_1Mbps_Peak Power

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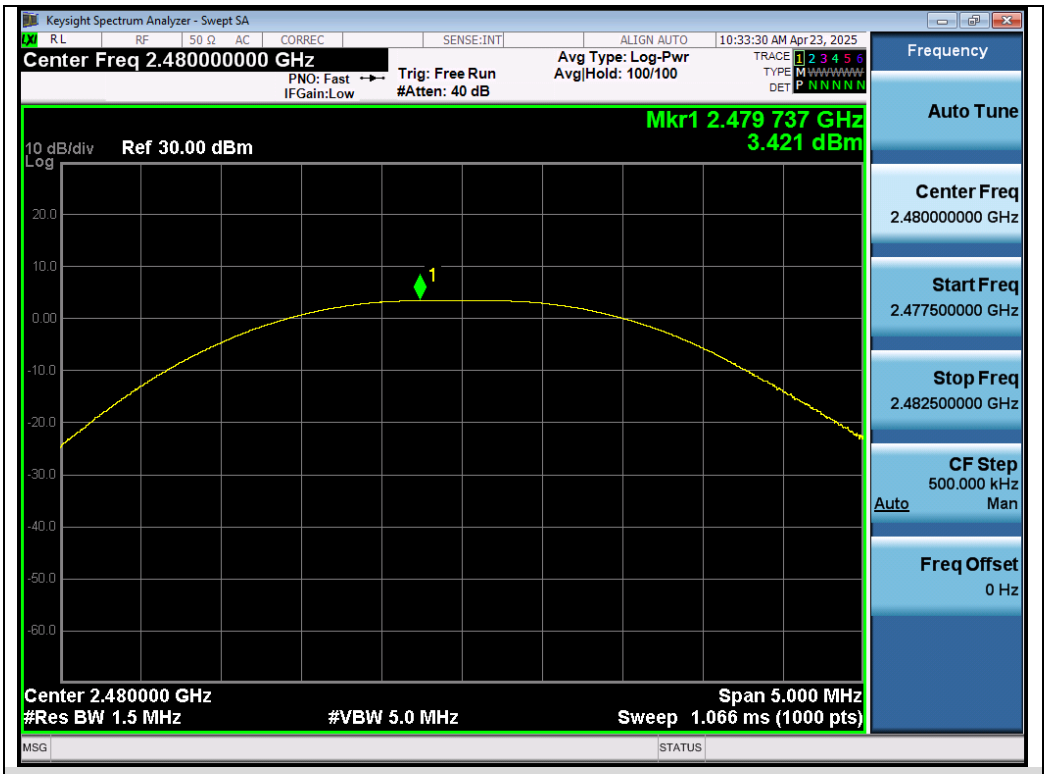
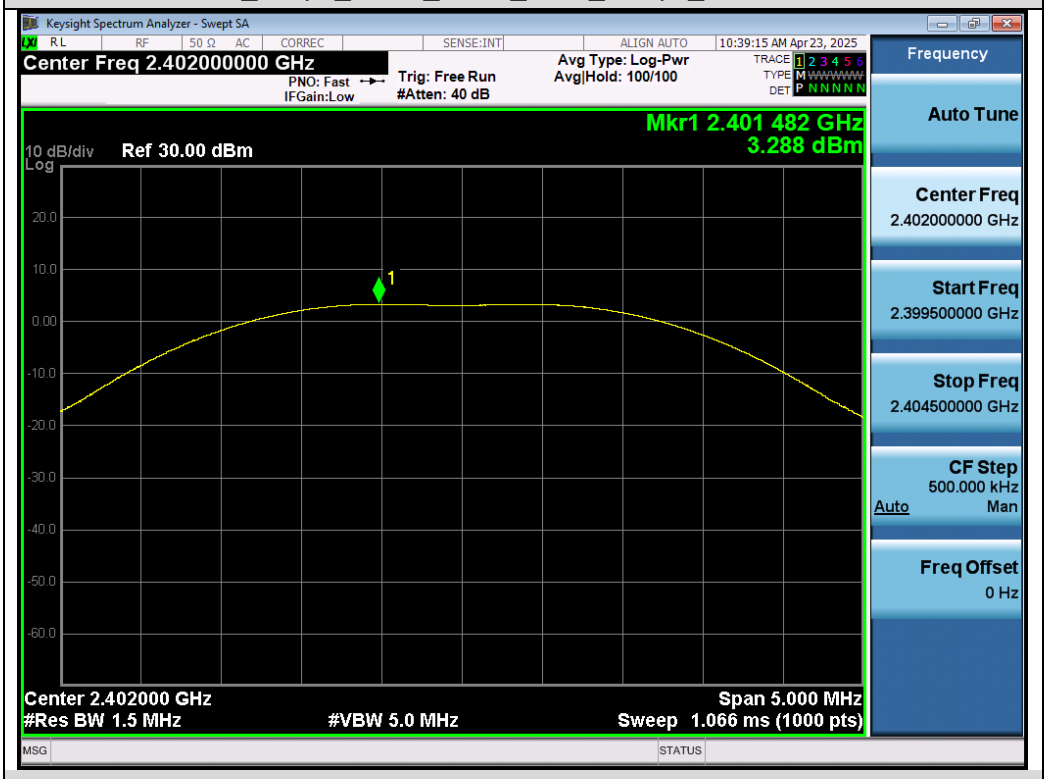


Test_Graph_LE1M_ANT1_2480_1Mbps_Peak Power



Test_Graph_LE2M_ANT1_2402_2Mbps_Peak Power

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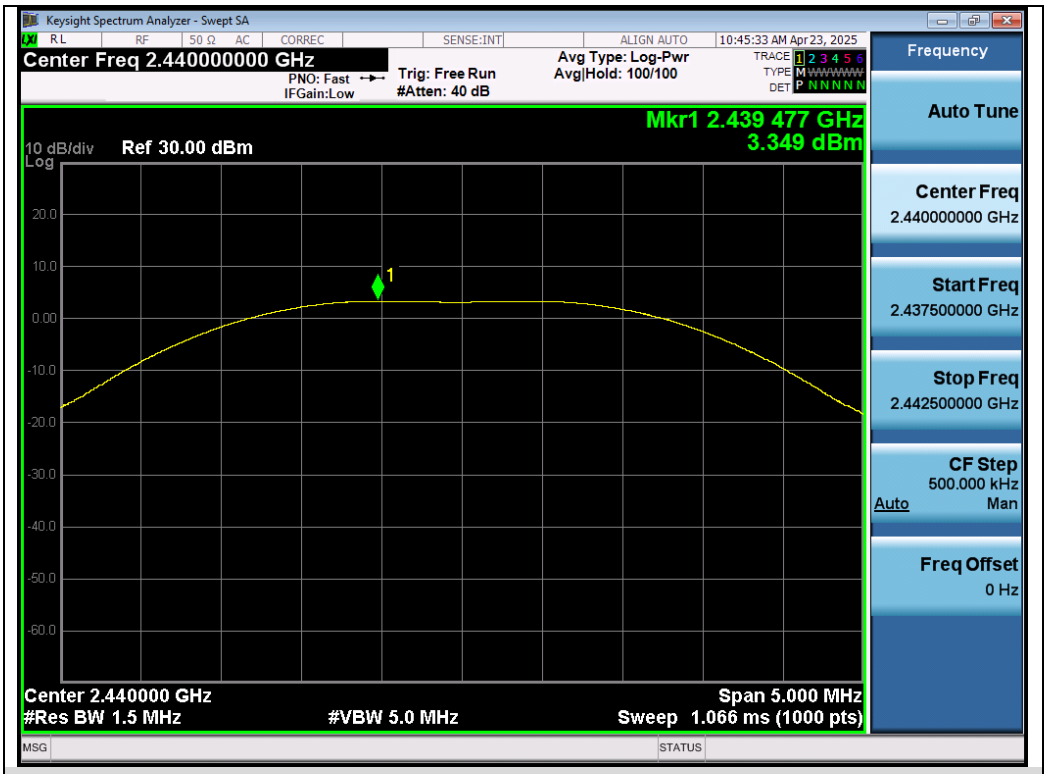
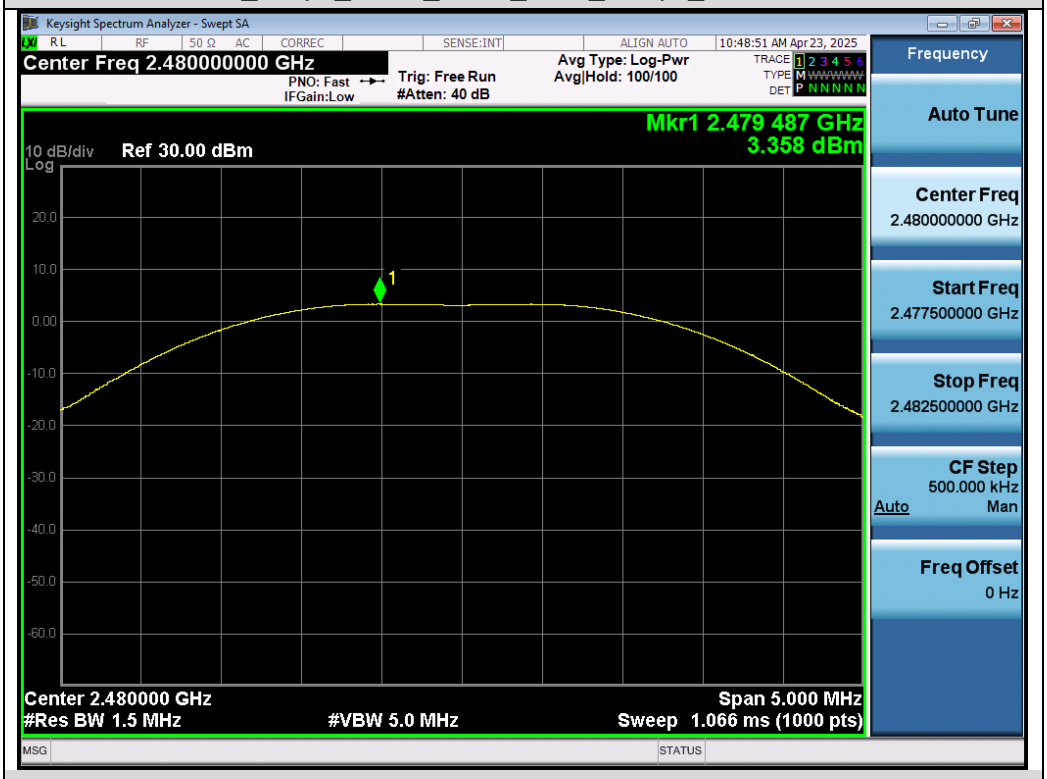


Test_Graph_LE2M_ANT1_2440_2Mbps_Peak Power



Test_Graph_LE2M_ANT1_2480_2Mbps_Peak Power

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8. 6dB Bandwidth Measurement

8.1 Provisions Applicable

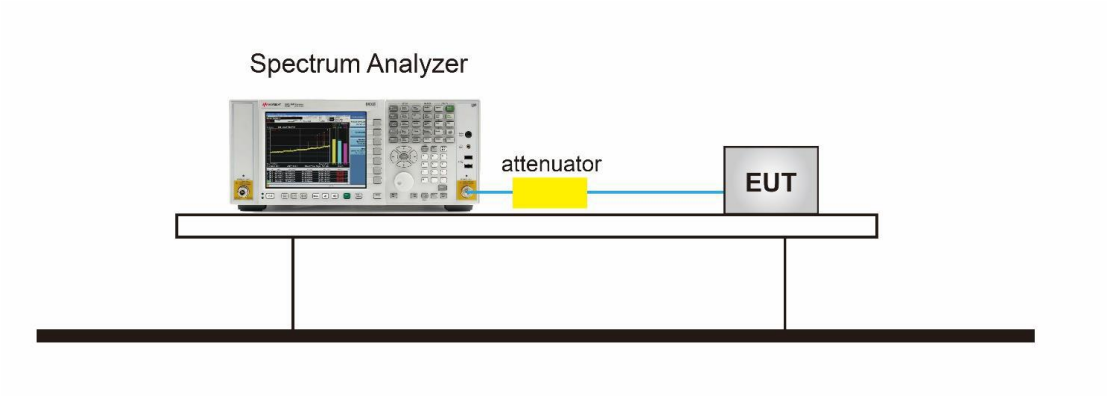
The minimum 6dB bandwidth shall be 500 kHz.

8.2 Measurement Procedure

■ The testing follows the ANSI C63.10 Section 6.9.3 (OBW) and 11.8.1 (6dB BW).

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. Make the measurement with the spectrum analyzer's resolution bandwidth (RBW) = 100 kHz. Set the Video bandwidth (VBW) = 300 kHz. In order to make an accurate measurement. The 6 dB bandwidth must be greater than 500 kHz.
4. For 99% Bandwidth Measurement, the spectrum analyzer's resolution bandwidth (RBW) is set 1-5% of the OBW and set the Video bandwidth (VBW) ≥ 3 * RBW.
5. Measure and record the results in the test report.

8.3 Measurement Setup (Block Diagram of Configuration)



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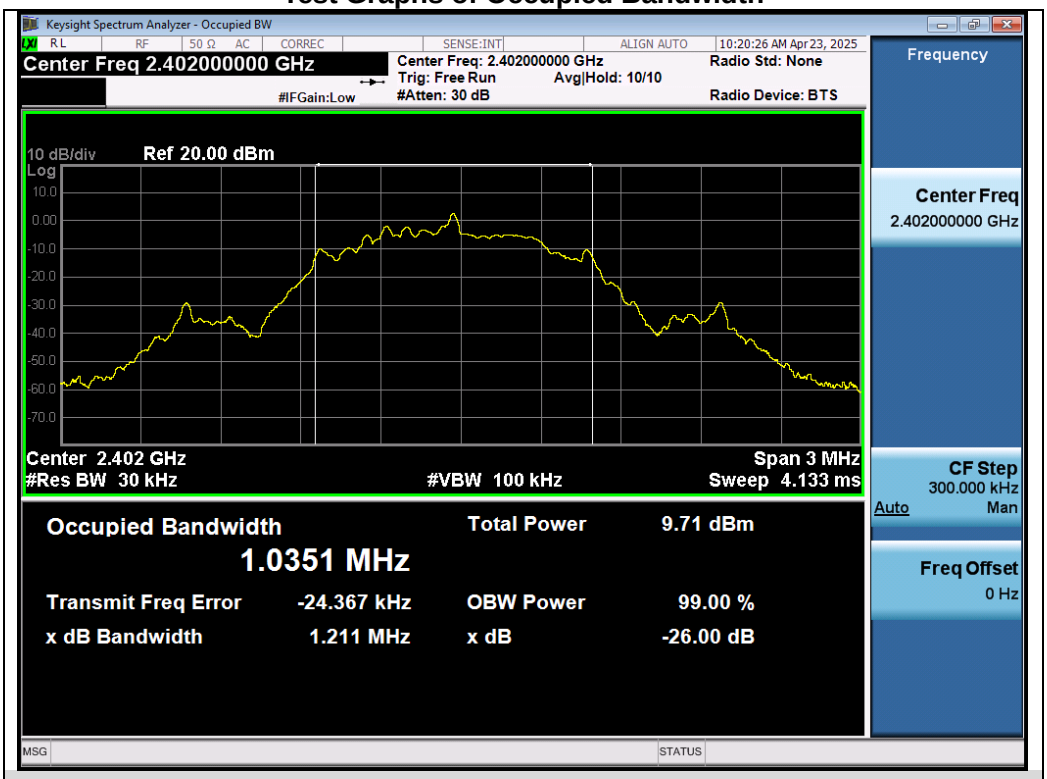
8.4 Measurement Results

Test Data of Occupied Bandwidth and DTS Bandwidth					
Test Mode	Test Frequency (MHz)	Occupied Bandwidth (MHz)	DTS BW (MHz)	DTS BW Limits	Pass or Fail
GFSK_1Mbps	2402	1.035	0.682	≥0.5	Pass
	2440	1.035	0.679	≥0.5	Pass
	2480	1.036	0.673	≥0.5	Pass
GFSK_2Mbps	2402	2.060	1.145	≥0.5	Pass
	2440	2.059	1.150	≥0.5	Pass
	2480	2.059	1.148	≥0.5	Pass

Test Graphs of Occupied Bandwidth



Test_Graph_LE1M_ANT1_2402_1Mbps_OBW

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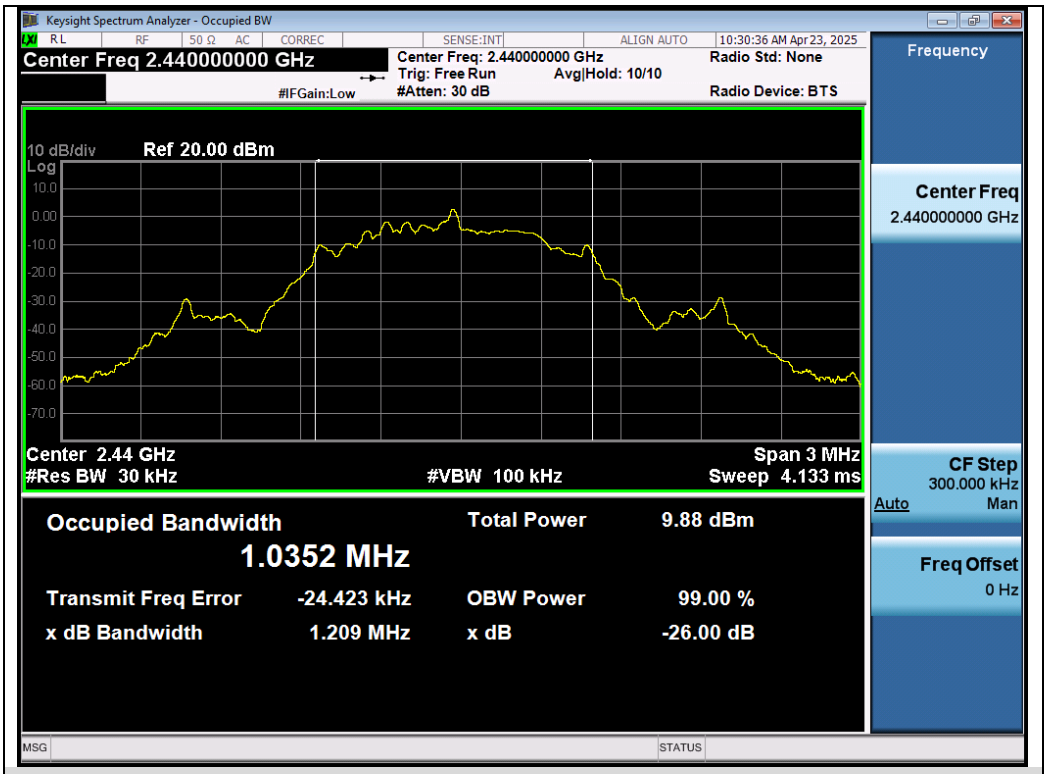
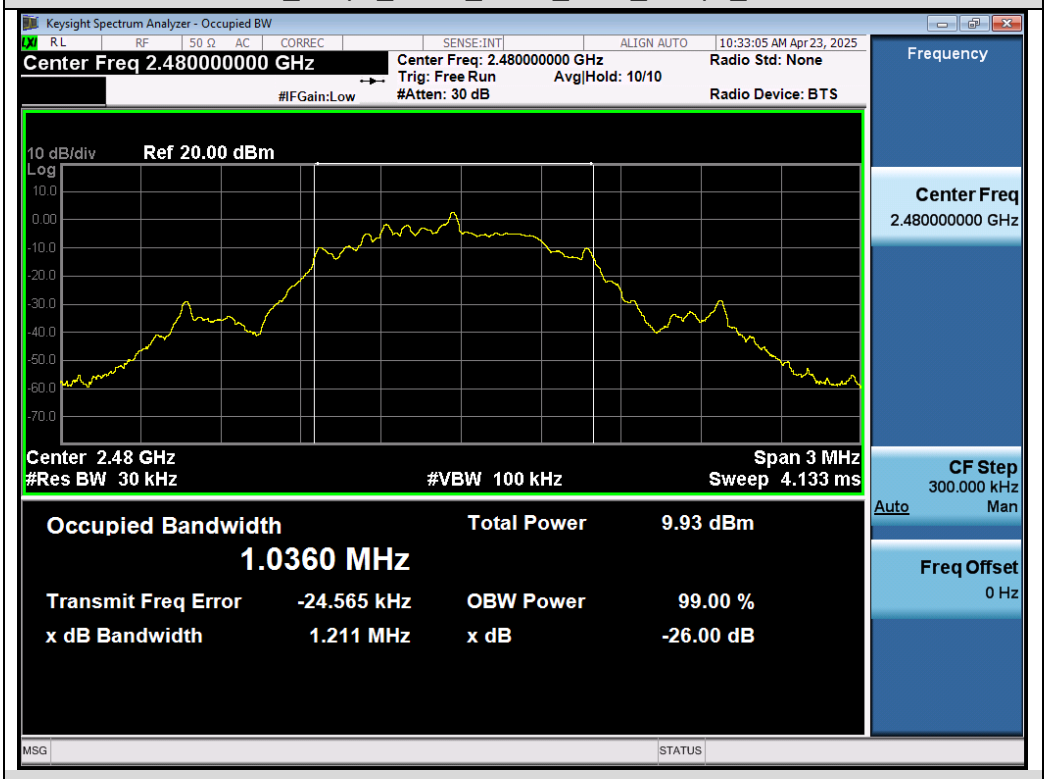


Test_Graph_LE1M_ANT1_2440_1Mbps_OBW



Test_Graph_LE1M_ANT1_2480_1Mbps_OBW

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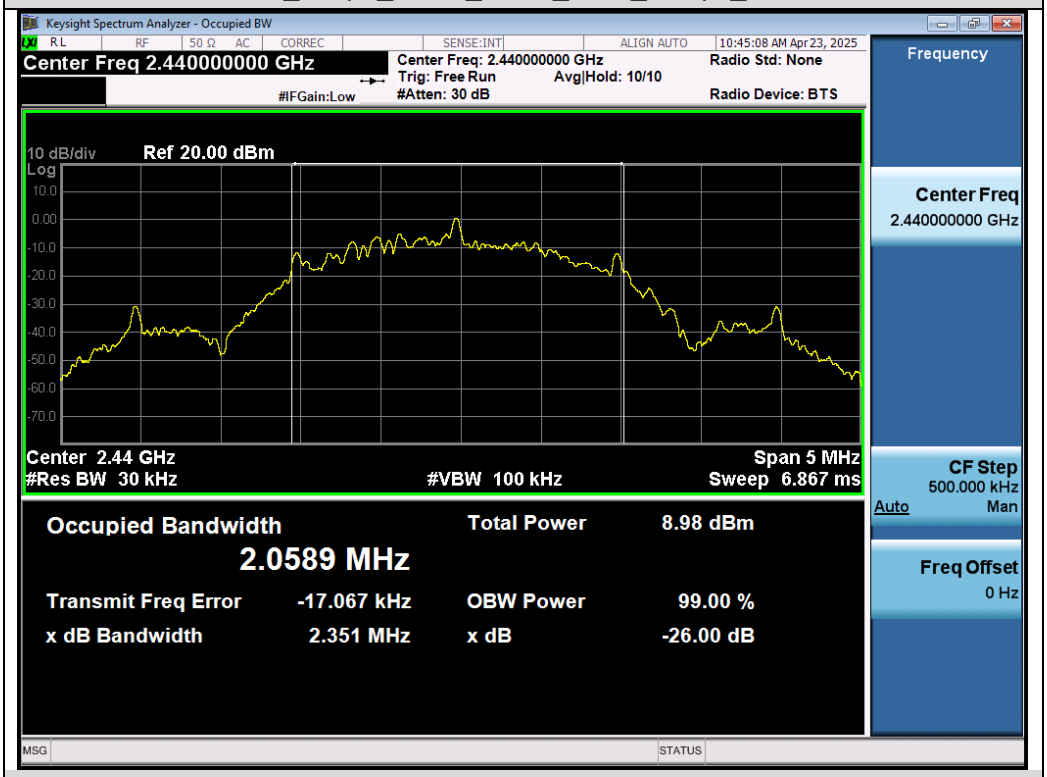
Test_Graph_LE2M_ANT1_2402_2Mbps_OBW



Test_Graph_LE2M_ANT1_2440_2Mbps_OBW

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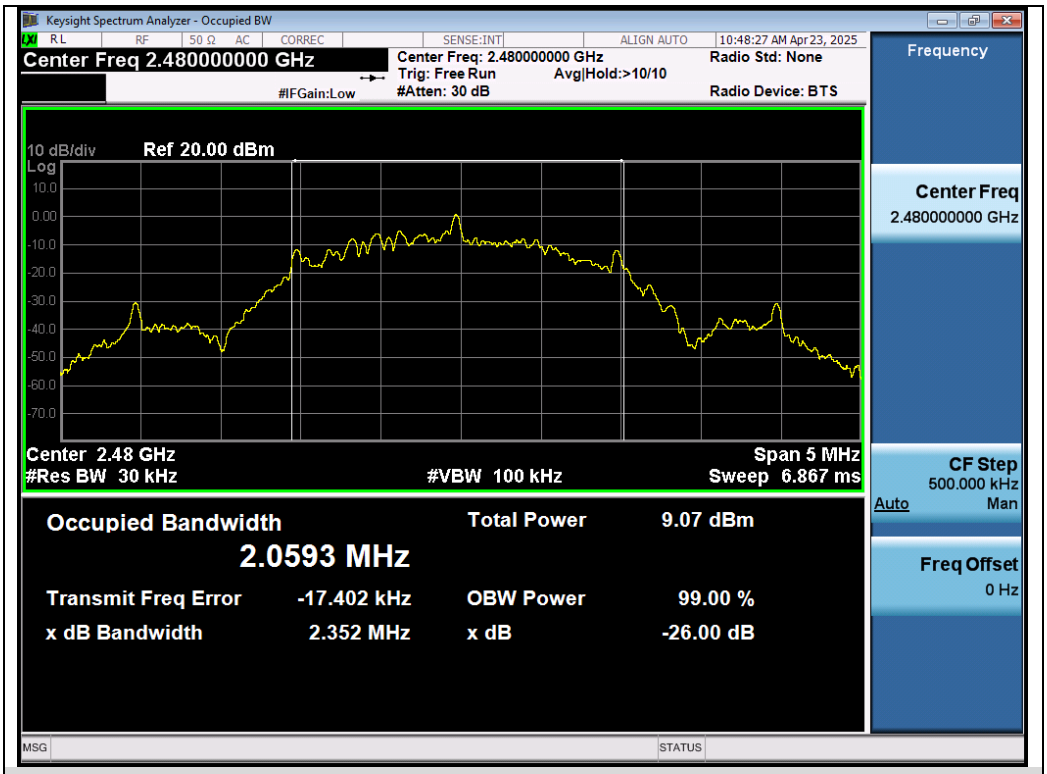
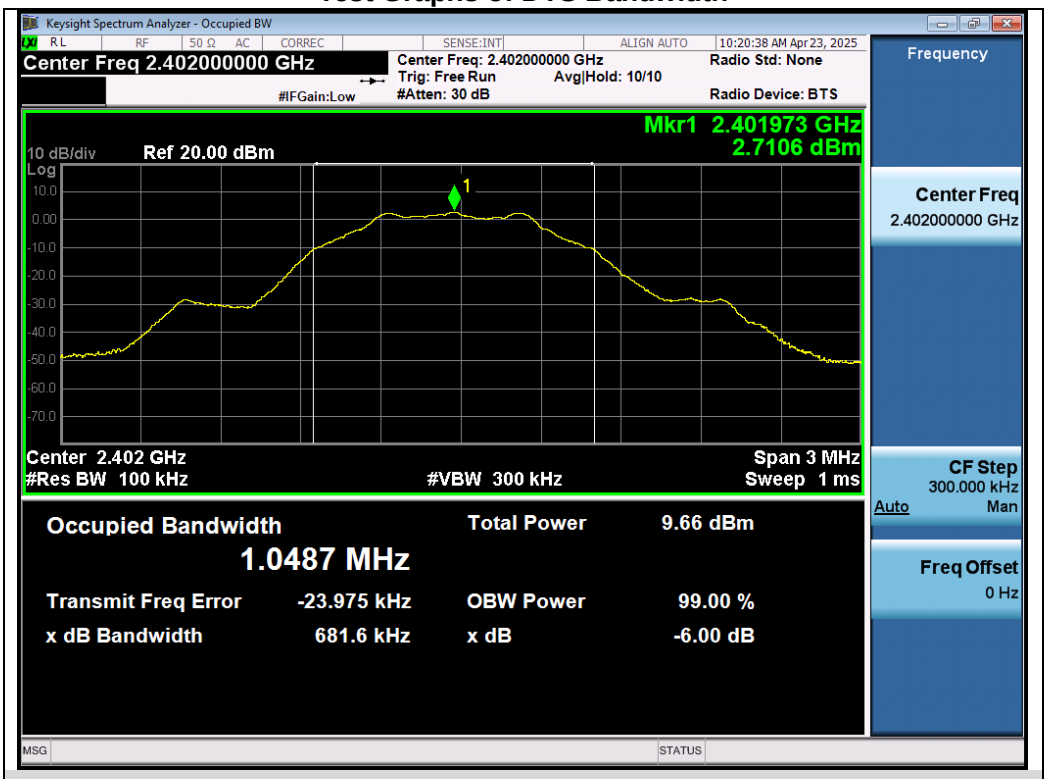


Test_Graph_LE2M_ANT1_2480_2Mbps_OBW

Test Graphs of DTS Bandwidth



Test_Graph_LE1M_ANT1_2402_1Mbps_DTSBW

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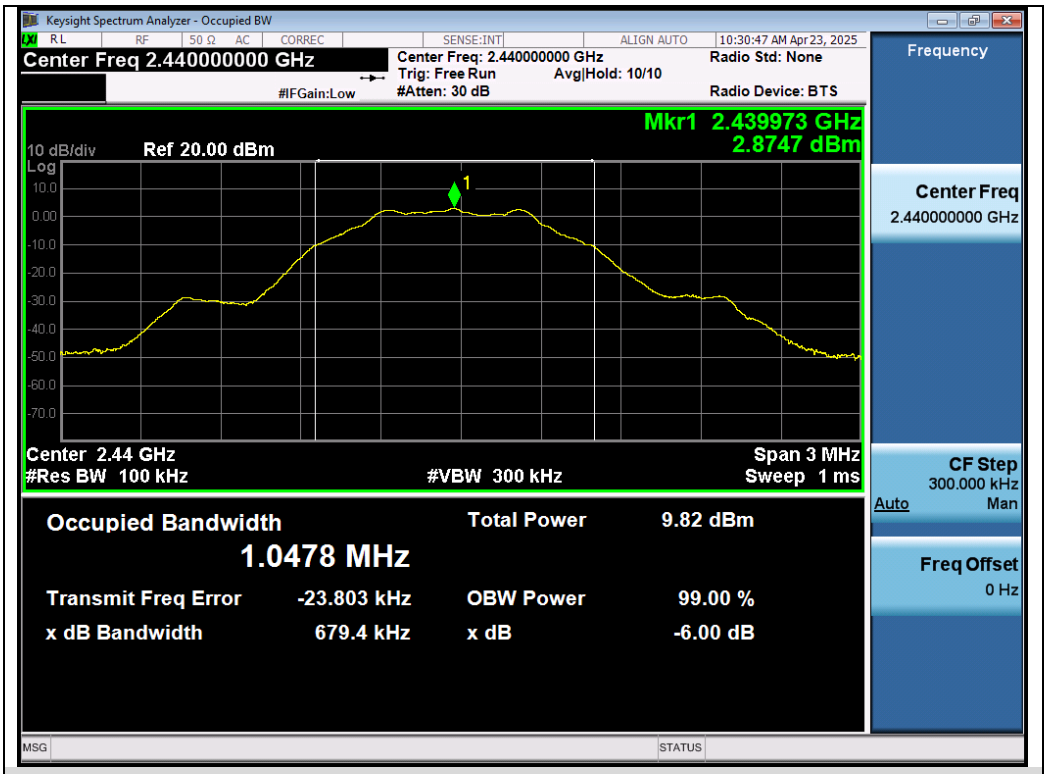
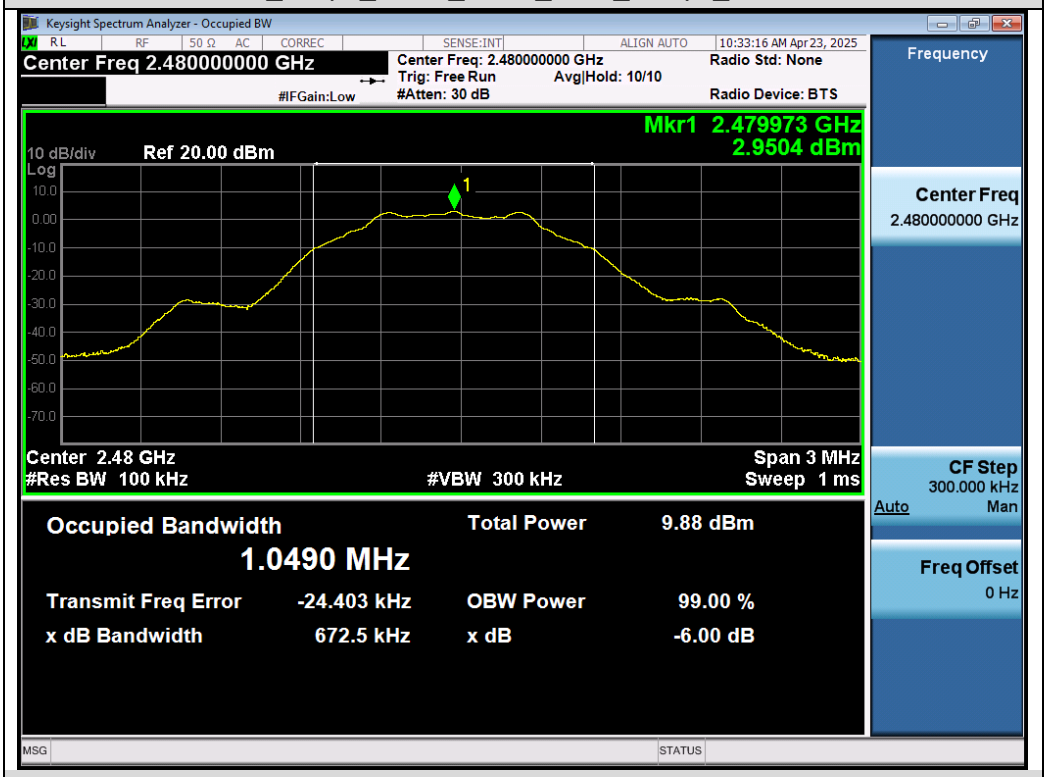


Test_Graph_LE1M_ANT1_2440_1Mbps_DTSBW



Test_Graph_LE1M_ANT1_2480_1Mbps_DTSBW

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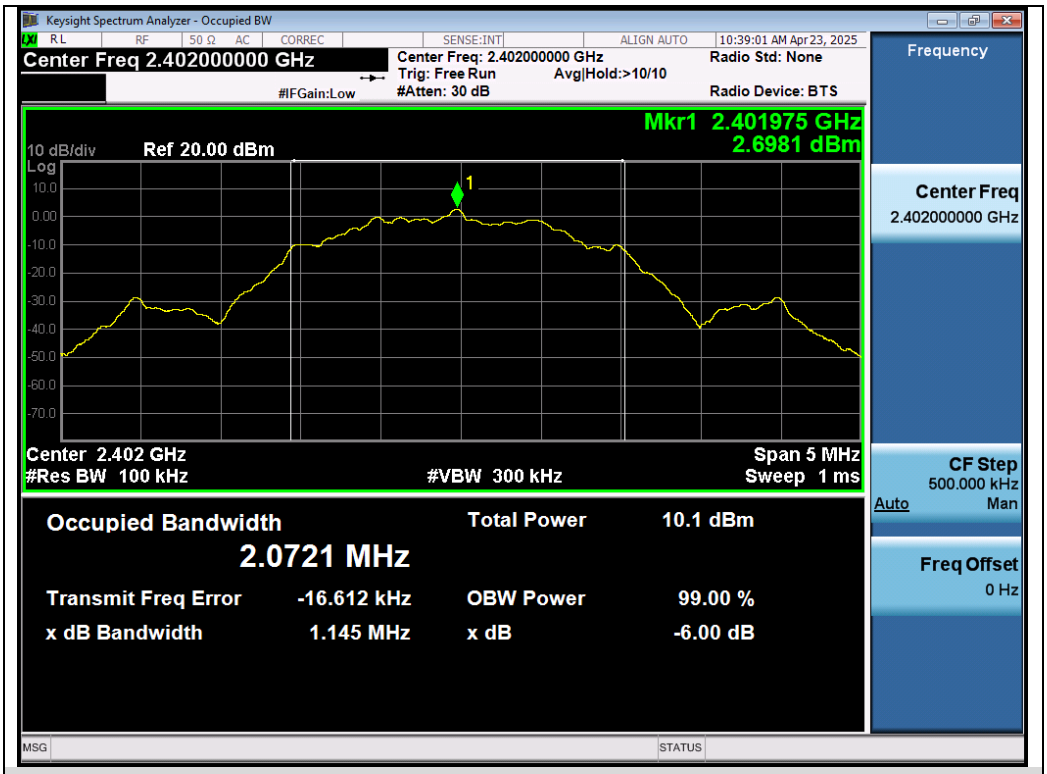
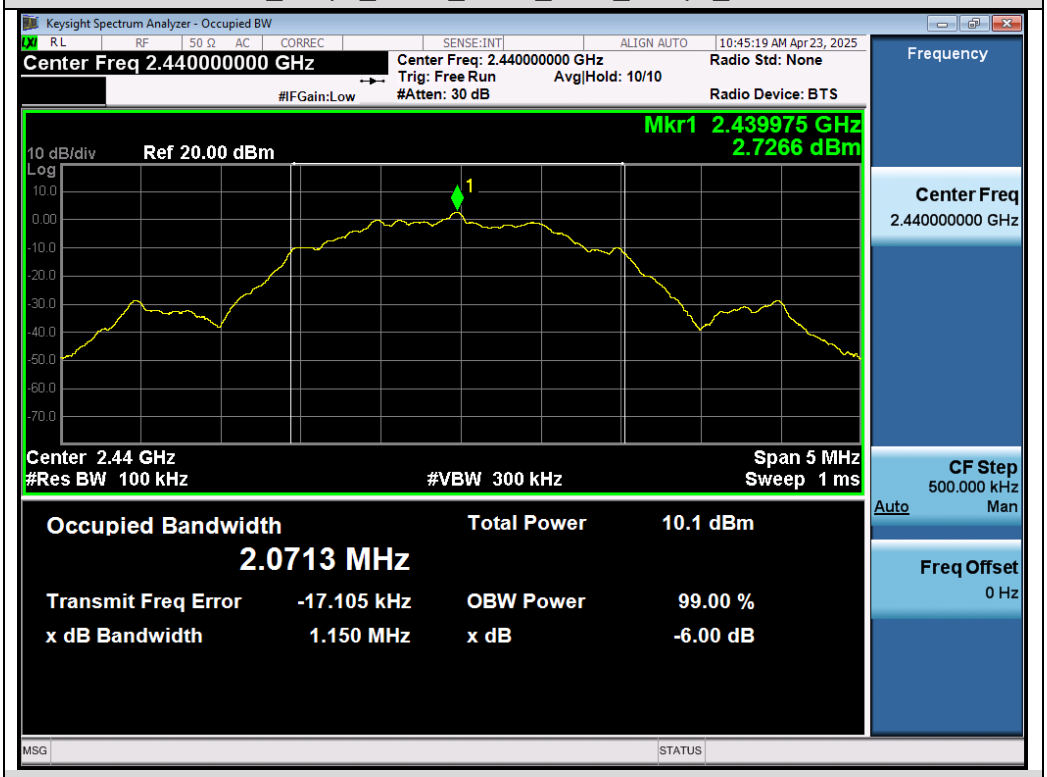


Test_Graph_LE2M_ANT1_2402_2Mbps_DTSBW



Test_Graph_LE2M_ANT1_2440_2Mbps_DTSBW

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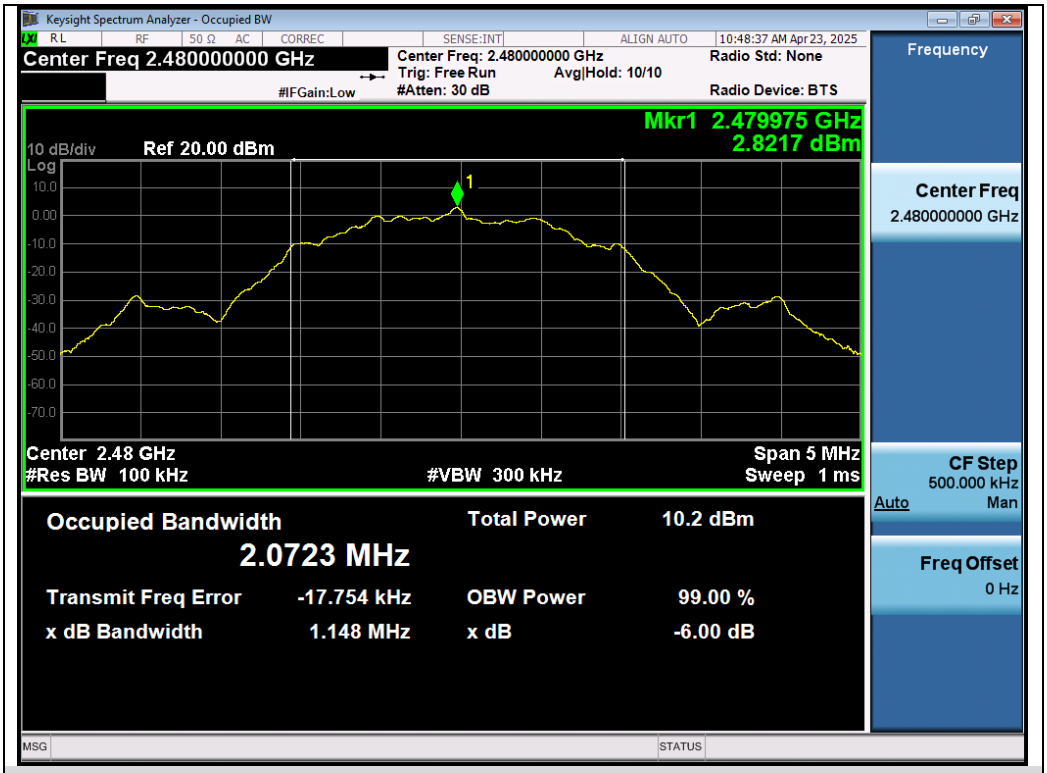

Test_Graph_LE2M_ANT1_2480_2Mbps_DTSBW

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9. Power Spectral Density Measurement

9.1 Provisions Applicable

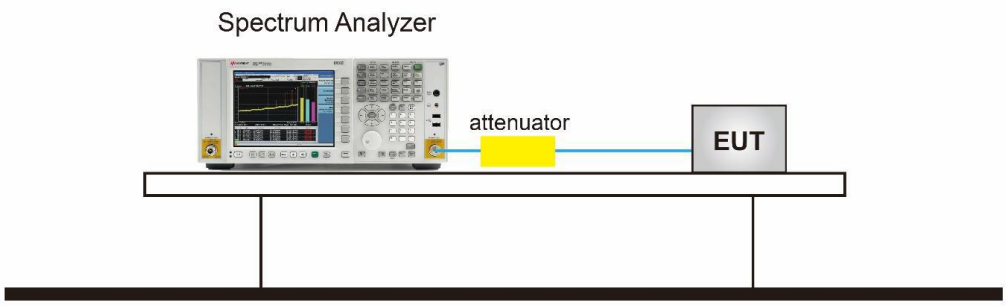
The transmitter power spectral density conducted from the transmitter to the antenna shall not be greater than 8 dBm in any 3 kHz band during any time interval of continuous transmission.

9.2 Measurement Procedure

■ The testing follows the ANSI C63.10 Section 11.10.2 Method PKPSD.

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. Make the measurement with the spectrum analyzer's resolution bandwidth (RBW) = 3 kHz. Video bandwidth VBW = 10 kHz in order to make an accurate measurement, set the span to 1.5 times DTS Channel Bandwidth. (6dB BW)
4. Detector = peak, Sweep time = auto couple, Trace mode = max hold, Allow trace to fully stabilize. Use the peak marker function to determine the maximum power level.
5. Measure and record the results in the test report.
6. The Measured power density (dBm)/ 100kHz is a reference level and used as 20dBc down limit line for Conducted Band Edges and Conducted Spurious Emission.

9.3 Measurement Setup (Block Diagram of Configuration)



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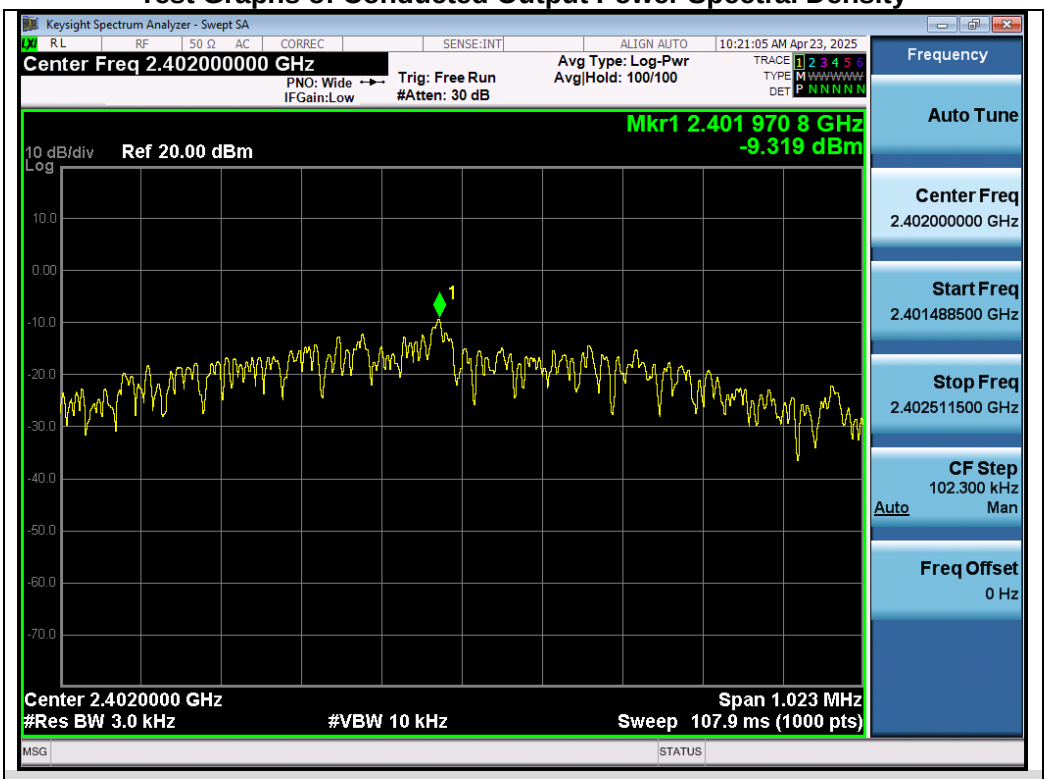
9.4 Measurement Results

Test Data of Conducted Output Power Spectral Density				
Test Mode	Test Frequency (MHz)	Power density (dBm/3kHz)	Limit (dBm/3kHz)	Pass or Fail
GFSK_1Mbps	2402	-9.319	≤8	Pass
	2440	-9.150	≤8	Pass
	2480	-9.088	≤8	Pass
GFSK_2Mbps	2402	-13.484	≤8	Pass
	2440	-13.408	≤8	Pass
	2480	-13.388	≤8	Pass

Test Graphs of Conducted Output Power Spectral Density



Test_Graph_LE1M_ANT1_2402_1Mbps_PSD

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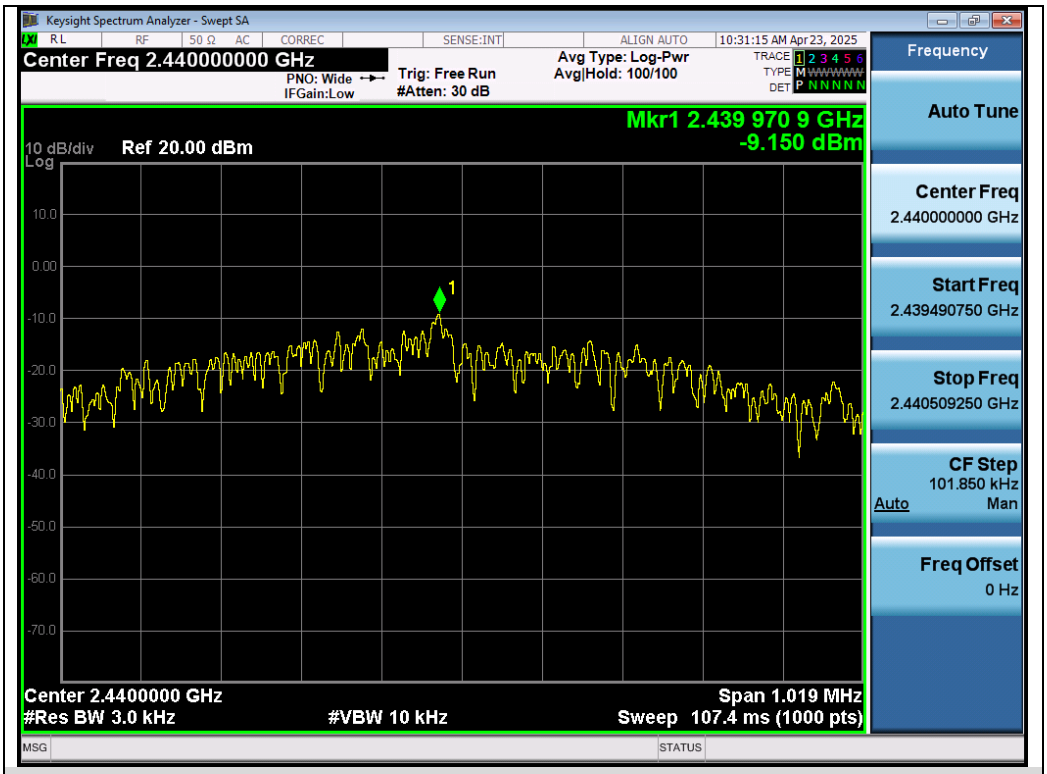
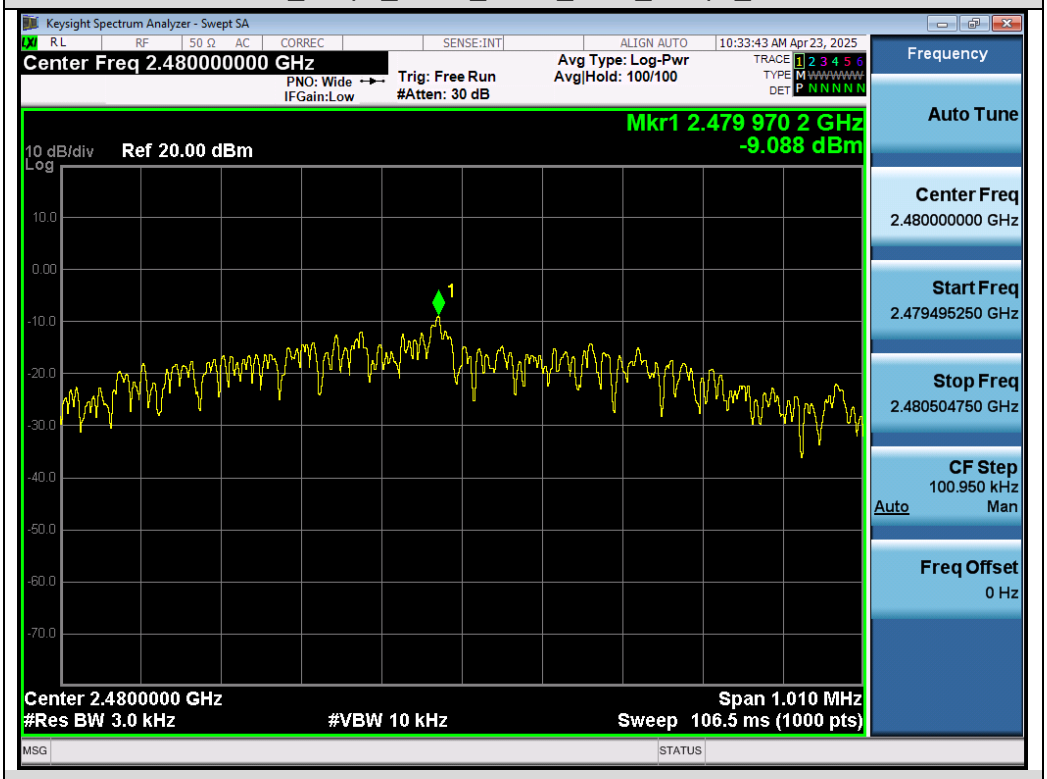


Test_Graph_LE1M_ANT1_2440_1Mbps_PSD



Test_Graph_LE1M_ANT1_2480_1Mbps_PSD

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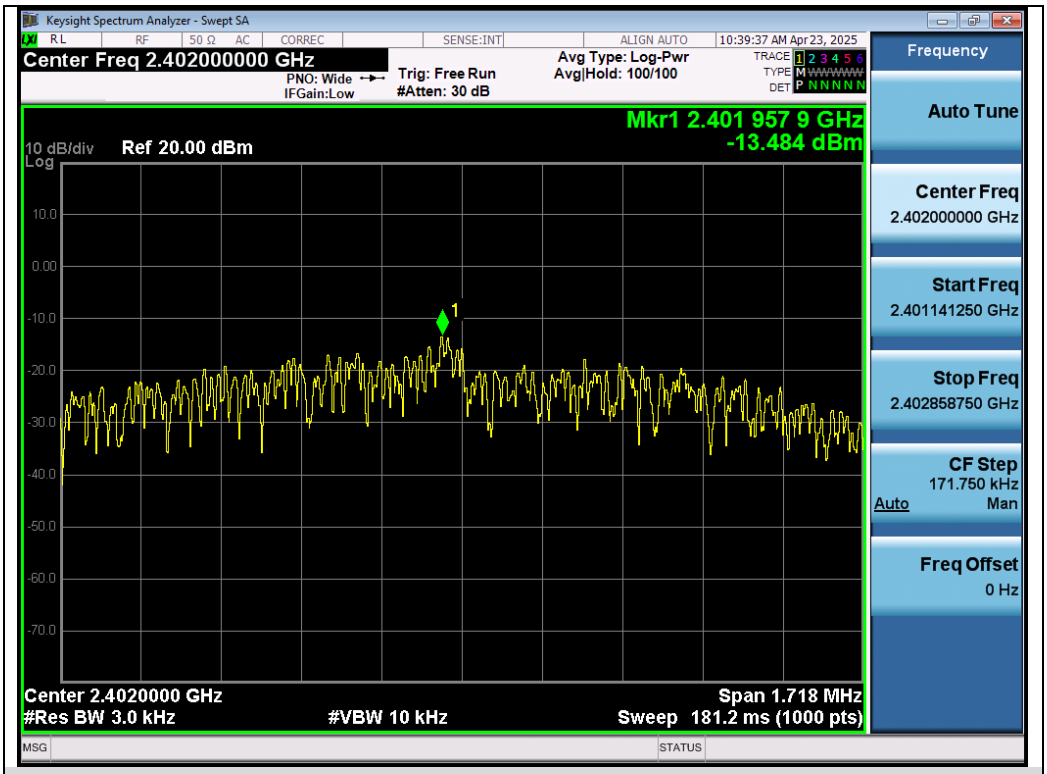
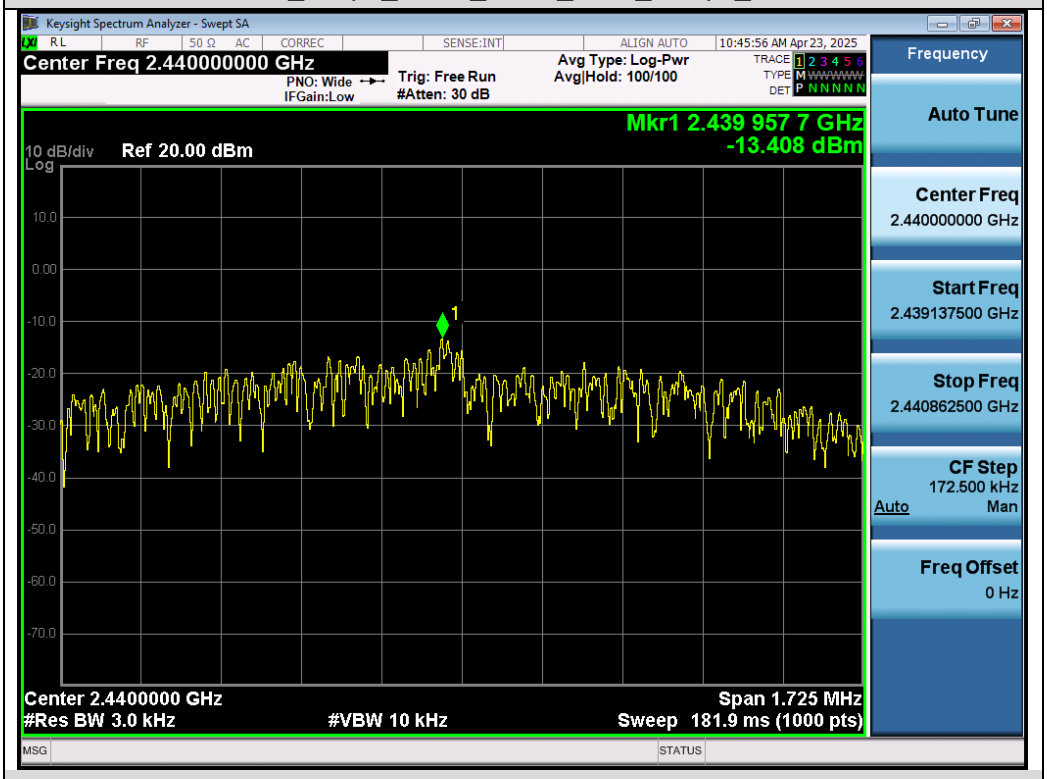


Test_Graph_LE2M_ANT1_2402_2Mbps_PSD



Test_Graph_LE2M_ANT1_2440_2Mbps_PSD

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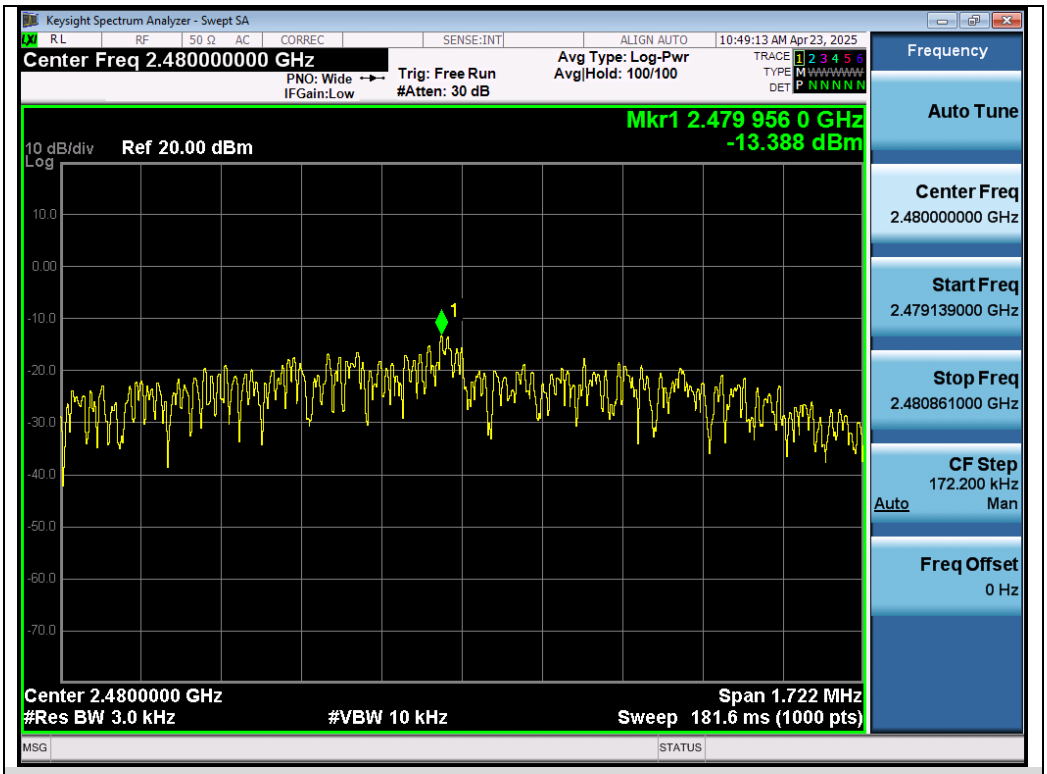

Test_Graph_LE2M_ANT1_2480_2Mbps_PSD

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10. Conducted Band Edge and Out-of-Band Emissions

10.1 Provisions Applicable

The limit for out-of-band spurious emissions at the band edge is 20dB below the fundamental emission level, as determined from the in-band power measurement of the DTS channel performed in a 100kHz bandwidth per the PSD procedure.

10.2 Measurement Procedure

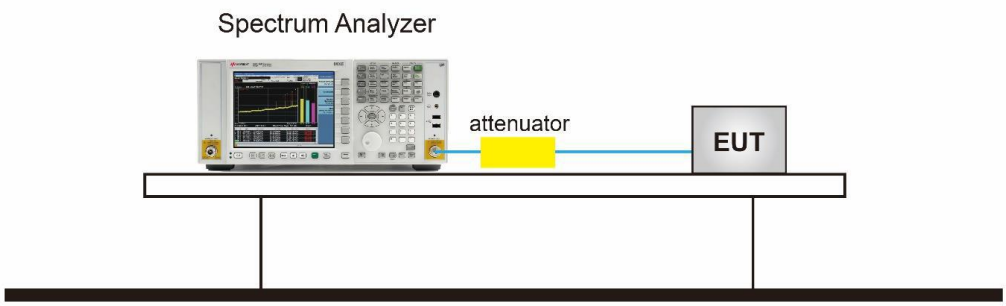
- Reference level measurement

1. Set instrument center frequency to DTS channel center frequency
2. Set the span to ≥ 1.5 times the DTS bandwidth
3. Set the RBW = 100 kHz
4. Set the VBW ≥ 3 x RBW
5. Detector = peak
6. Sweep time = auto couple
7. Trace mode = max hold
8. Allow trace to fully stabilize

- Emission level measurement

1. Set the center frequency and span to encompass frequency range to be measured
2. RBW = 100kHz
3. VBW = 300kHz
4. Detector = Peak
5. Trace mode = max hold
6. Sweep time = auto couple
7. The trace was allowed to stabilize

10.3 Measurement Setup (Block Diagram of Configuration)



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10.4 Measurement Results

Test Graphs of Spurious Emissions in Non-Restricted Frequency Bands

Test_Graph_LE1M_ANT1_2402_1Mbps_Reference Level

Test_Graph_LE1M_ANT1_2402_1Mbps_Lower Band Emissions

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Test_Graph_LE1M_ANT1_2402_1Mbps_Higher Band Emissions

Test_Graph_LE1M_ANT1_2440_1Mbps_Reference Level

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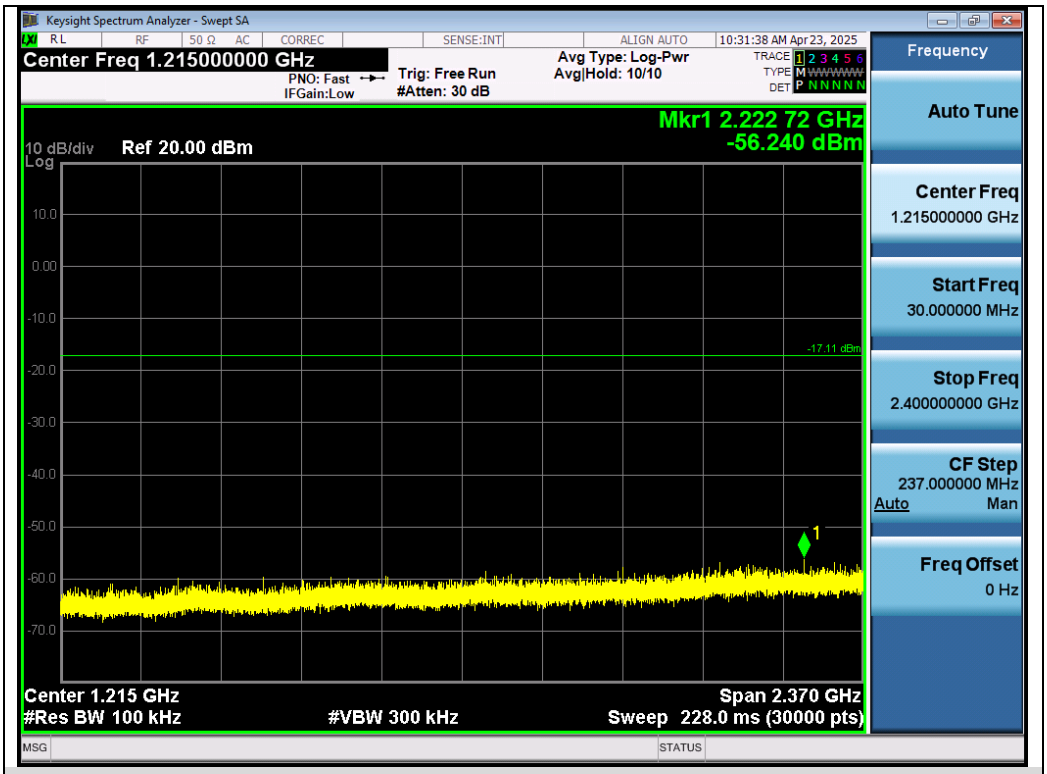

Test_Graph_LE1M_ANT1_2440_1Mbps_Lower Band Emissions

Test_Graph_LE1M_ANT1_2440_1Mbps_Higher Band Emissions

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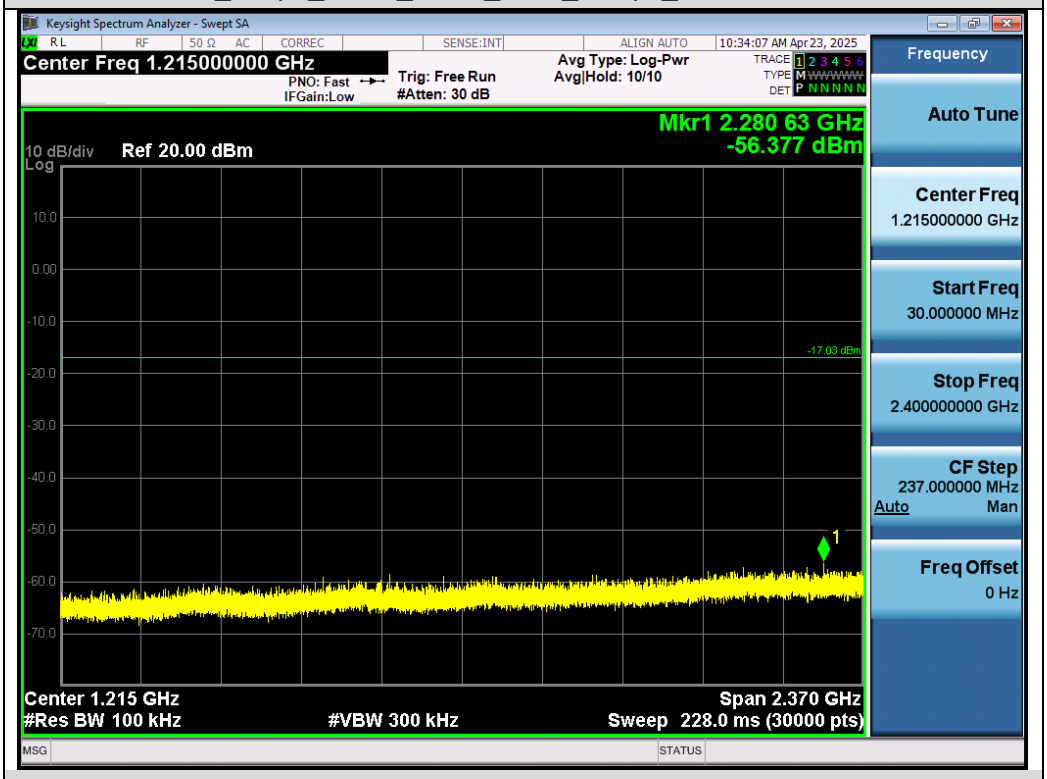
Test_Graph_LE1M_ANT1_2480_1Mbps_Reference Level



Test_Graph_LE1M_ANT1_2480_1Mbps_Lower Band Emissions

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Test_Graph_LE1M_ANT1_2480_1Mbps_Higher Band Emissions

Test_Graph_LE2M_ANT1_2402_2Mbps_Reference Level

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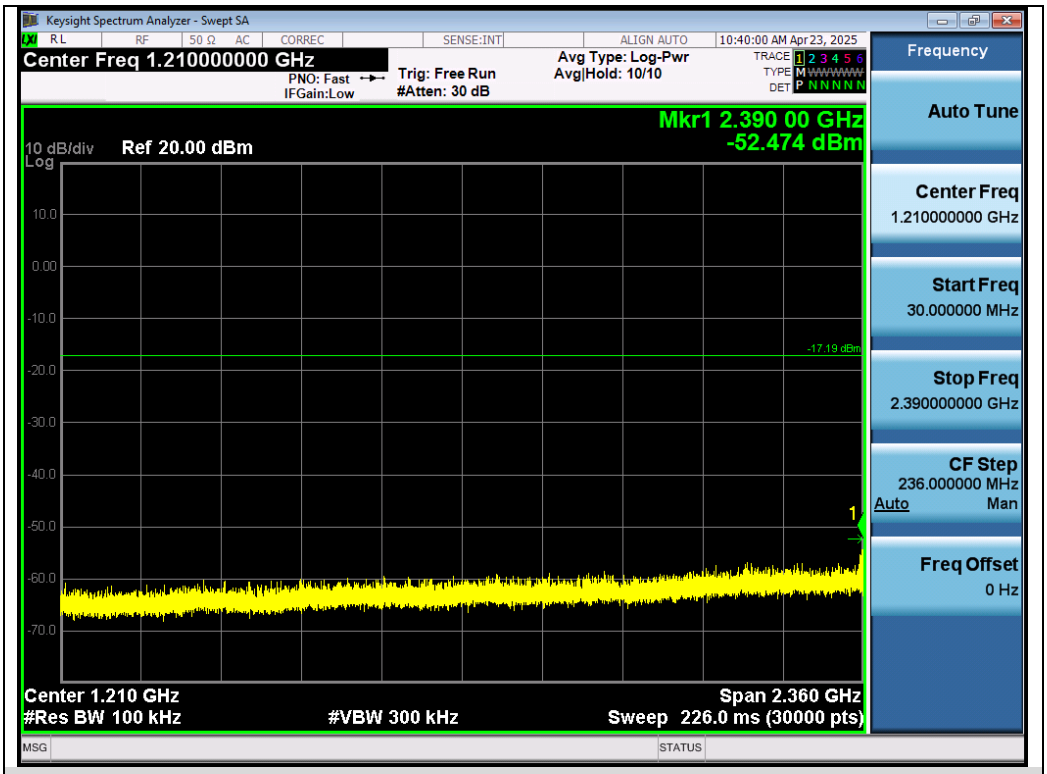

Test_Graph_LE2M_ANT1_2402_2Mbps_Lower Band Emissions

Test_Graph_LE2M_ANT1_2402_2Mbps_Higher Band Emissions

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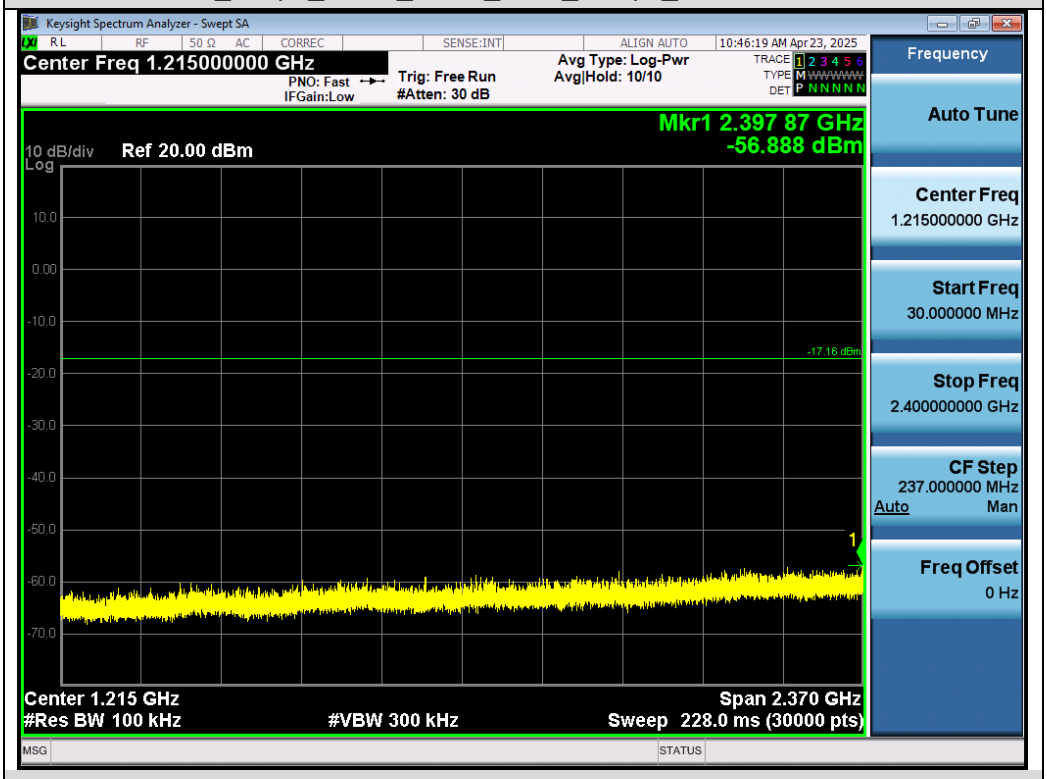
Test_Graph_LE2M_ANT1_2440_2Mbps_Reference Level



Test_Graph_LE2M_ANT1_2440_2Mbps_Lower Band Emissions

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Test_Graph_LE2M_ANT1_2440_2Mbps_Higher Band Emissions

Test_Graph_LE2M_ANT1_2480_2Mbps_Reference Level

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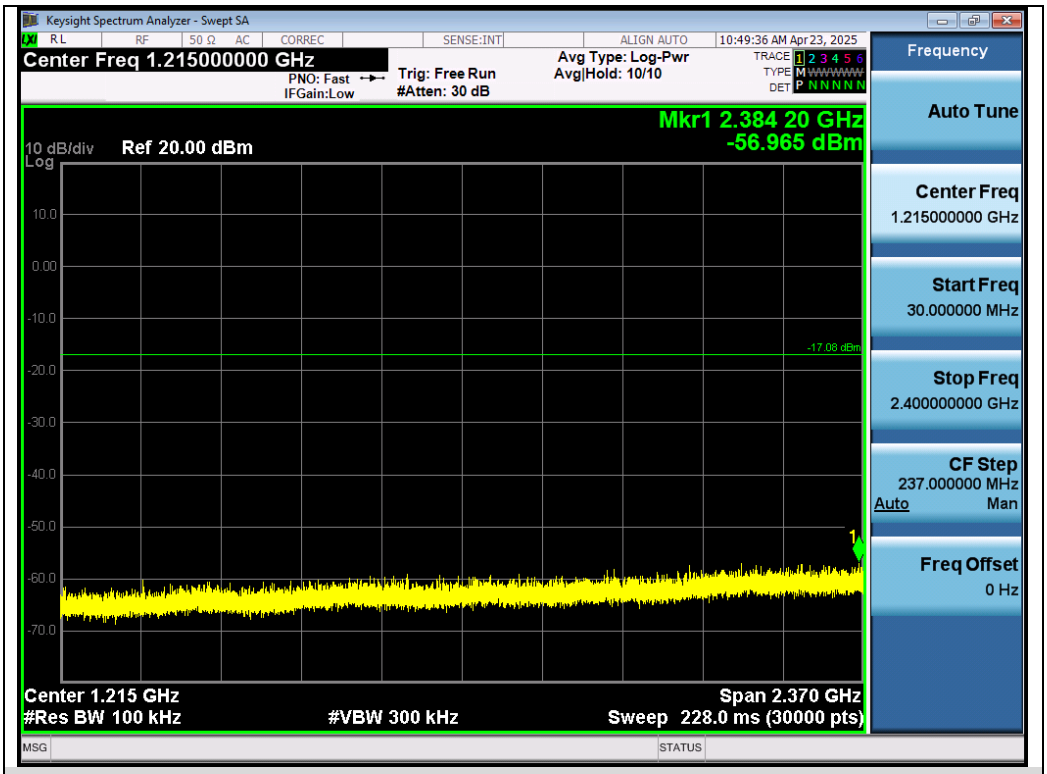

Test_Graph_LE2M_ANT1_2480_2Mbps_Lower Band Emissions

Test_Graph_LE2M_ANT1_2480_2Mbps_Higher Band Emissions

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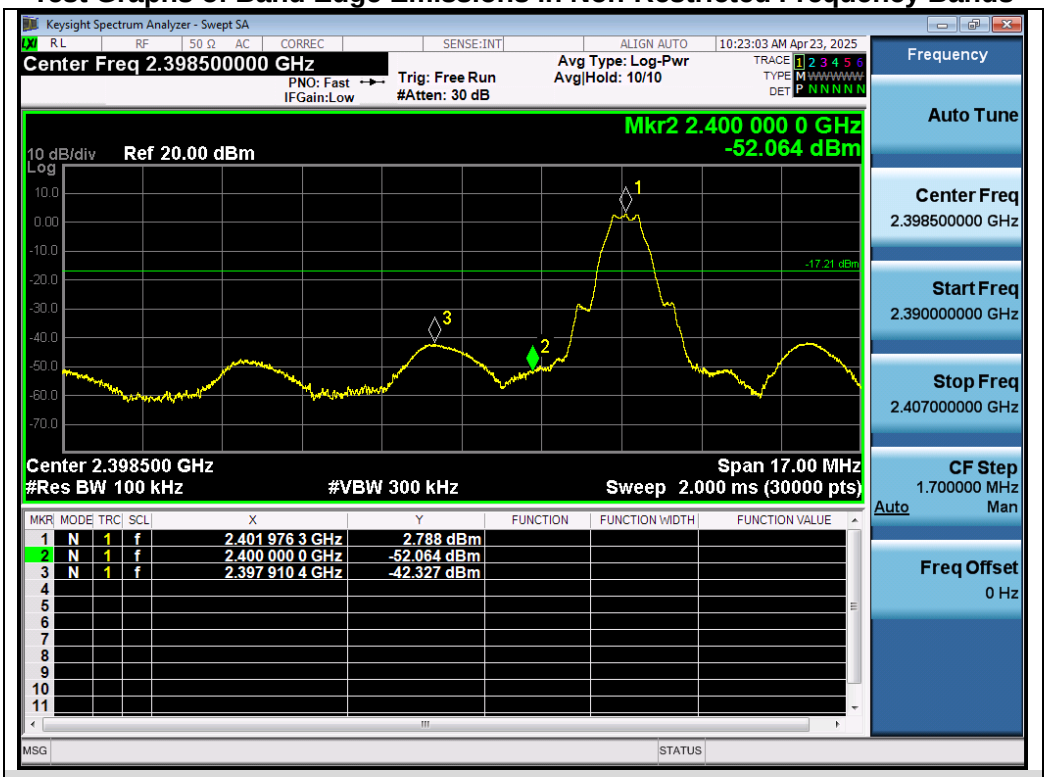
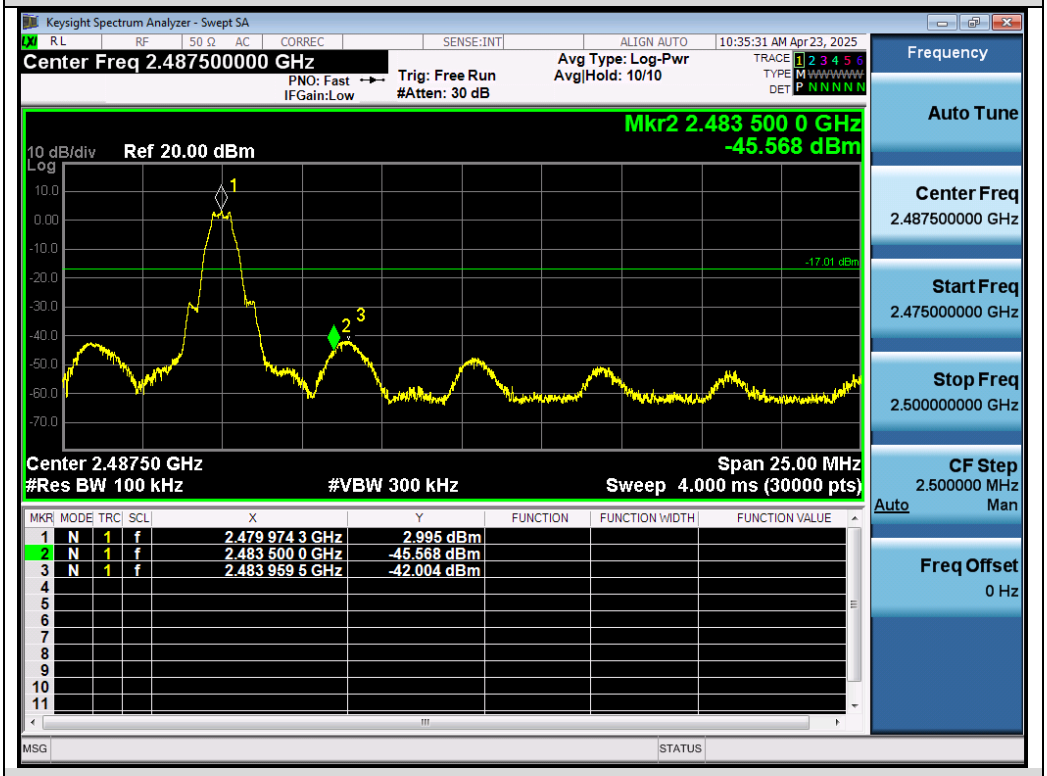
Test Graphs of Band Edge Emissions in Non-Restricted Frequency Bands



Test_Graph_LE1M_ANT1_2402_1Mbps_Lower Band Edge Emissions



Test_Graph_LE1M_ANT1_2480_1Mbps_Higher Band Edge Emissions

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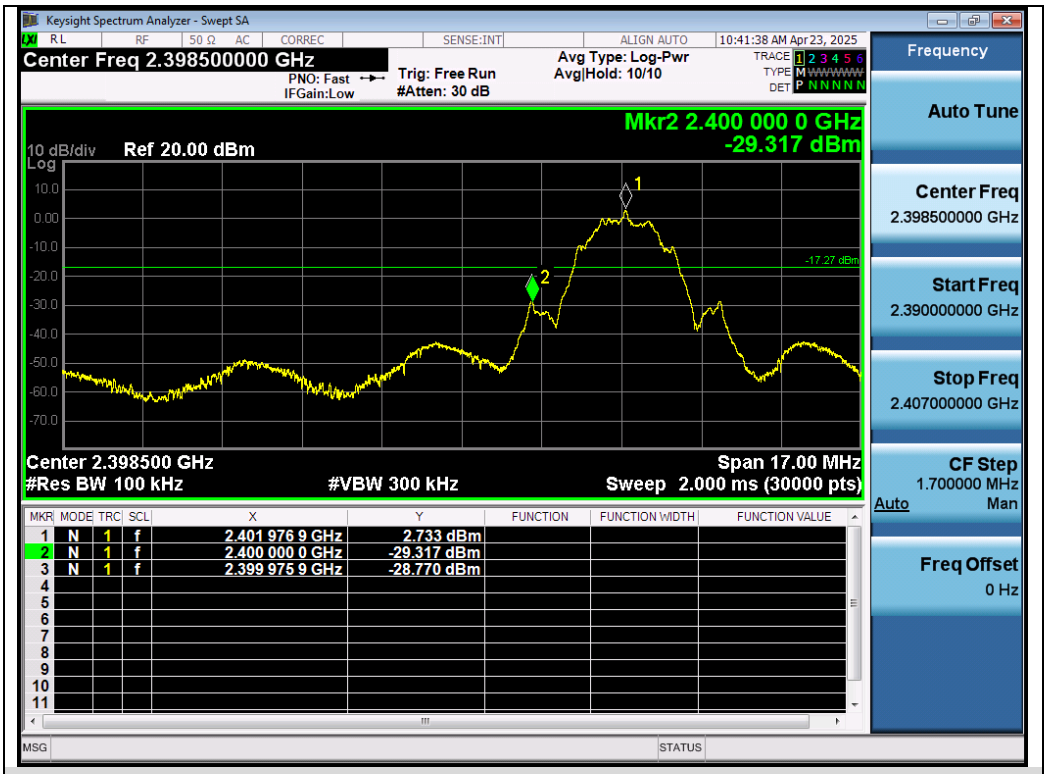
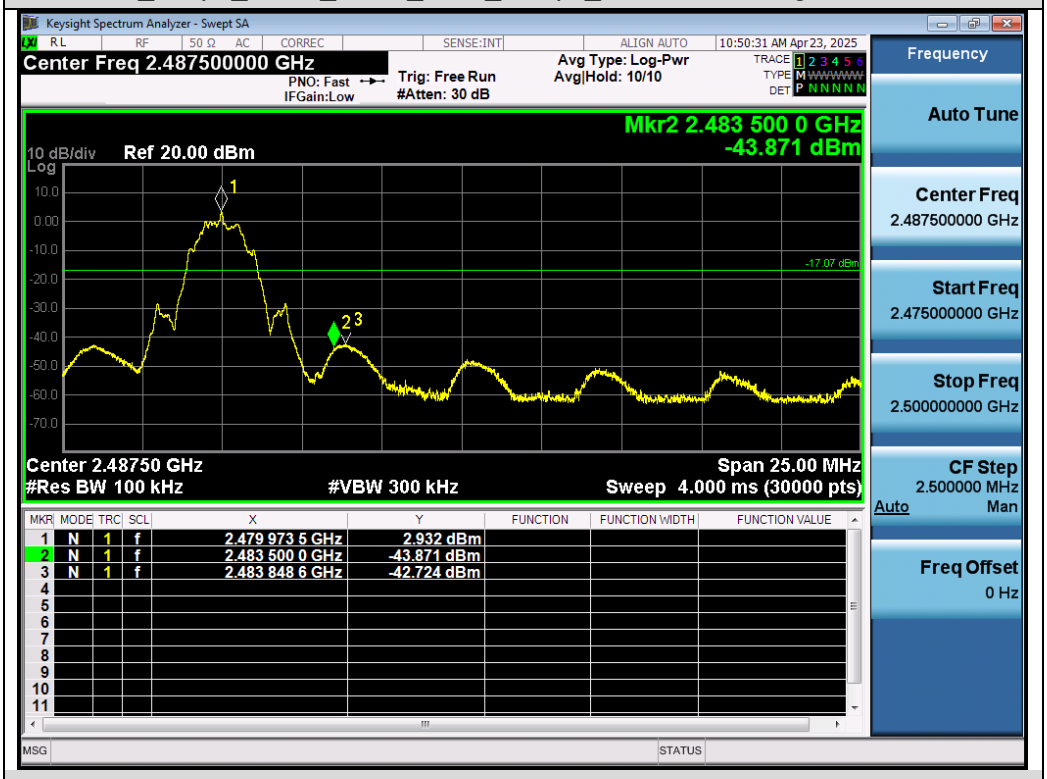


Test_Graph_LE2M_ANT1_2402_2Mbps_Lower Band Edge Emissions



Test_Graph_LE2M_ANT1_2480_2Mbps_Higher Band Edge Emissions

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11. Radiated Spurious Emission

11.1 Measurement Limit

- FCC Part 15.209 Limit in the below table to be followed

Frequencies (MHz)	Field Strength (microvolts/meter)	Measurement Distance (meters)
0.009~0.490	2400/F(kHz)	300
0.490~1.705	24000/F(kHz)	30
1.705~30.0	30	30
30~88	100	3
88~216	150	3
216~960	200	3
Above 960	500	3

Note: All modes were tested for restricted band radiated emission, the test records reported below are the worst result compared to other modes.

11.2 Measurement Procedure

1. The EUT was placed on the top of the turntable 0.8 or 1.5 meter above ground. The phase center of the receiving antenna mounted on the top of a height-variable antenna tower was placed 3 meters far away from the turntable.
2. Power on the EUT and all the supporting units. The turntable was rotated by 360 degrees to determine the position of the highest radiation.
3. The height of the broadband receiving antenna was varied between one meter and four meters above ground to find the maximum emissions field strength of both horizontal and vertical polarization.
4. For each suspected emission, the antenna tower was scan (from 1 M to 4 M) and then the turntable was rotated (from 0 degree to 360 degrees) to find the maximum reading.
5. Set the test-receiver system to Peak or CISPR quasi-peak Detect Function with specified bandwidth under Maximum Hold Mode.
6. For emissions above 1GHz, use 1MHz RBW and 3MHz VBW for peak reading. Place the measurement antenna 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.

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7. When the radiated emissions limits are expressed in terms of the average value of the emissions, and pulsed operation is employed, the measurement field strength shall be determined by averaging over one complete pulse train, including blanking intervals, as long as the pulse train does not exceed 0.1 seconds.
8. As an alternative (provided the transmitter operates for longer than 0.1 seconds) or in cases where the pulse train exceeds 0.1 seconds, the measured field strength shall be determined from the average absolute voltage during a 0.1 second interval during which the field strength is at its maximum values.
9. If the emissions level of the EUT in peak mode was 3 dB lower than the average limit specified, then testing will be stopped and peak values of EUT will be reported, otherwise, the emissions which do not have 3 dB margin will be repeated one by one using the quasi-peak method for below 1GHz.
10. For testing above 1GHz, the emissions level of the EUT in peak mode was lower than average limit (that means the emissions level in peak mode also complies with the limit in average mode), then testing will be stopped and peak values of EUT will be reported, otherwise, the emissions will be measured in average mode again and reported.
11. In case the emission is lower than 30MHz, loop antenna has to be used for measurement and the recorded data should be QP measured by receiver. High - Low scan is not required in this case.

The following table is the setting of spectrum analyzer and receiver.

Spectrum Parameter	Setting
Start ~Stop Frequency	9kHz~150kHz/RB 200Hz for QP
Start ~Stop Frequency	150kHz~30MHz/RB 9kHz for QP
Start ~Stop Frequency	30MHz~1000MHz/RB 120kHz for QP
Start ~Stop Frequency	1GHz~26.5GHz 1MHz/3MHz for Peak, 1MHz/3MHz for Average

Receiver Parameter	Setting
Start ~Stop Frequency	9kHz~150kHz/RB 200Hz for QP
Start ~Stop Frequency	150kHz~30MHz/RB 9kHz for QP
Start ~Stop Frequency	30MHz~1000MHz/RB 120kHz for QP

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- **Quasi-Peak Measurements below 1GHz**

1. Analyzer center frequency was set to the frequency of the radiated spurious emission of interest
2. Span was set greater than 1MHz
3. RBW = as shown in the table above
4. Detector = CISPR quasi-peak
5. Sweep time = auto couple
6. Trace was allowed to stabilize

- **Peak Measurements above 1GHz**

1. Analyzer center frequency was set to the frequency of the radiated spurious emission of interest
2. RBW = 1MHz
3. VBW = 3MHz
4. Detector = peak
5. Sweep time = auto couple
6. Trace mode = max hold
7. Trace was allowed to stabilize

- **Average Measurements above 1GHz**

1. Analyzer center frequency was set to the frequency of the radiated spurious emission of interest
2. RBW = 1MHz
3. VBW ≥ [3 × RBW]
4. Detector = Power averaging (rms)
5. Averaging type = power (i.e., rms)
6. Sweep time = auto
7. Perform a trace average of at least 100 traces.
8. The applicable correction factor is [10*log (1 / D)], where D is the duty cycle. The factor had been edited in the “Input Correction” of the Spectrum Analyzer.

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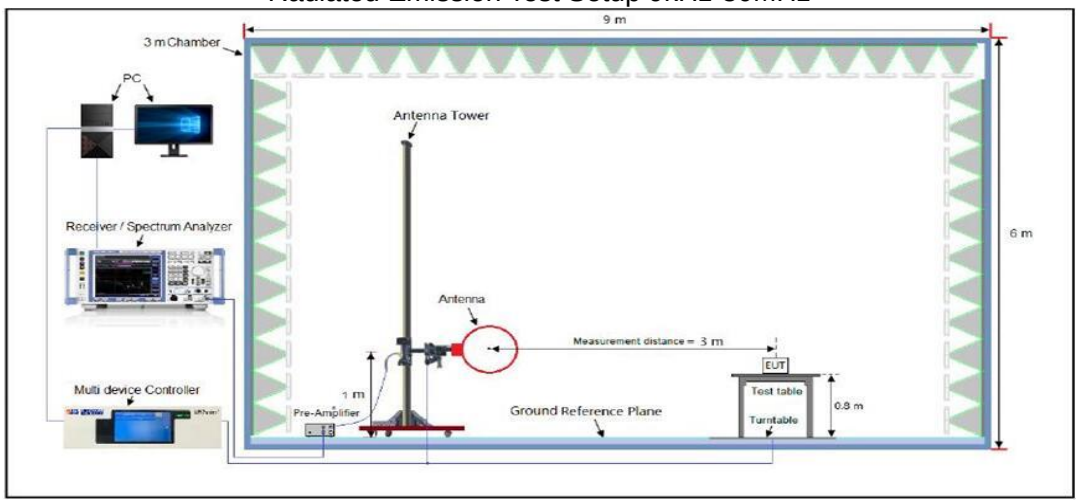
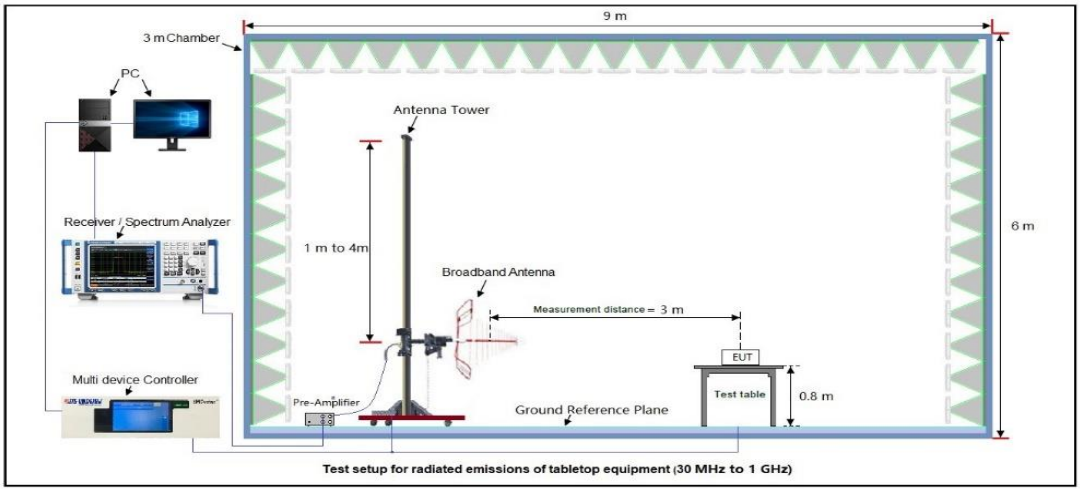
11.3 Measurement Setup (Block Diagram of Configuration)

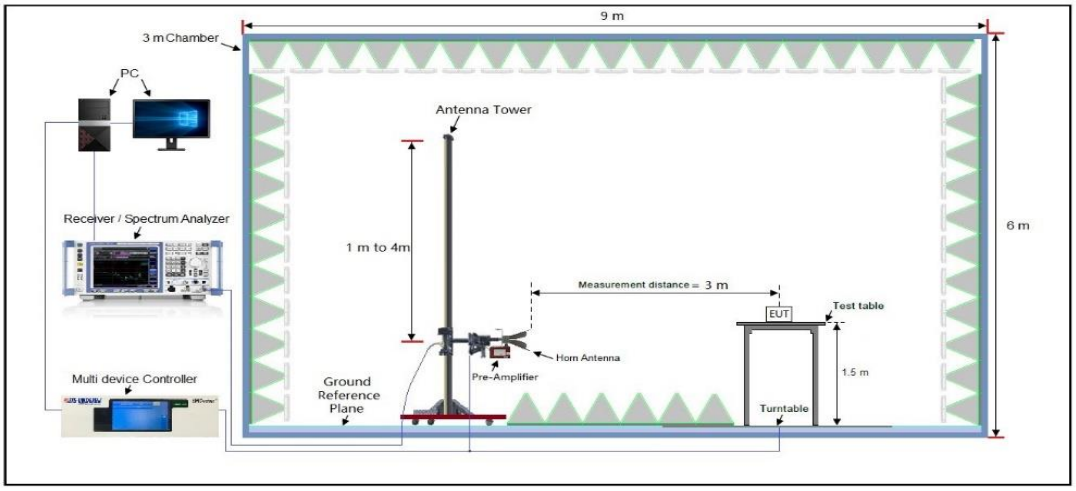
Radiated Emission Test Setup 9kHz-30MHz



Radiated Emission Test Setup 30MHz-1000MHz



Radiated Emission Test Setup Above 1000MHz



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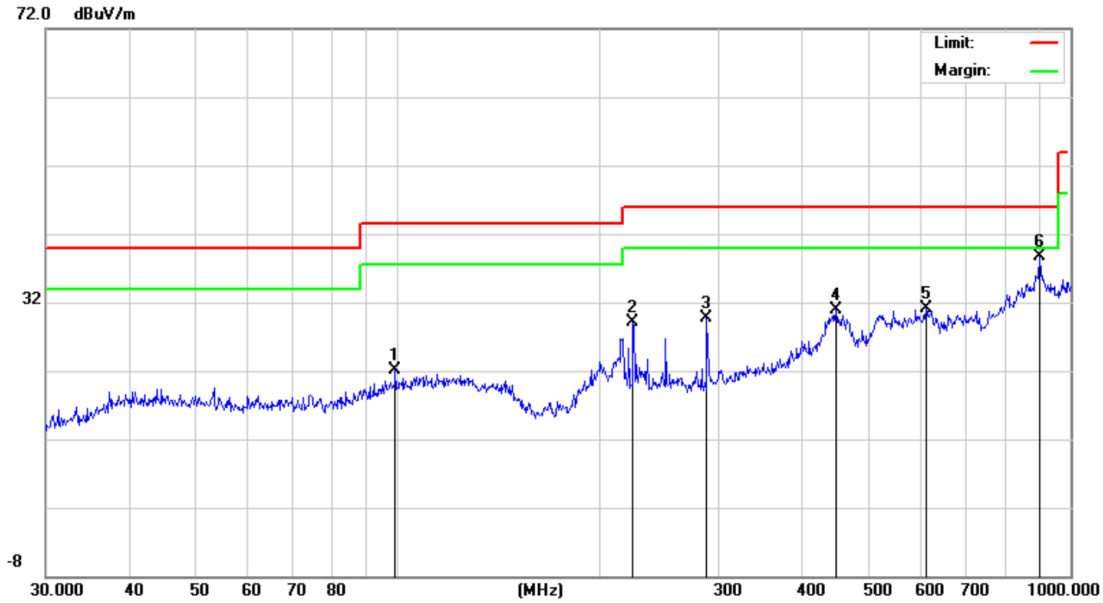
11.4 Measurement Result

Radiated Emission Below 30MHz

The amplitude of spurious emissions from 9kHz to 30MHz which are attenuated more than 20 dB below the permissible value need not be reported.

Radiated Emission Test Results at 30MHz-1GHz			
EUT Name	WINDOW CLEANING ROBOT	**Model Name**	1W03Q1
Temperature	22.5℃	**Relative Humidity**	51.8%
Pressure	960hPa	**Test Voltage**	Normal Voltage
Test Mode	Mode 3	**Antenna Polarity**	Horizontal



Final Data List

NO.	Freq. [MHz]	Level [dBμV/m]	Factor [dB]	Limit [dBμV/m]	Margin [dB]	Height [cm]	Angle [°]	Polarity
1	99.1797	22.18	16.07	43.50	21.32	100	185	Horizontal
2	223.7334	29.03	14.59	46.00	16.97	100	142	Horizontal
3	287.9904	29.61	15.54	46.00	16.39	100	136	Horizontal
4	447.9822	30.95	24.82	46.00	15.05	100	217	Horizontal
5	609.9217	31.11	25.15	46.00	14.89	100	158	Horizontal
6	900.1474	38.66	31.78	46.00	7.34	100	214	Horizontal

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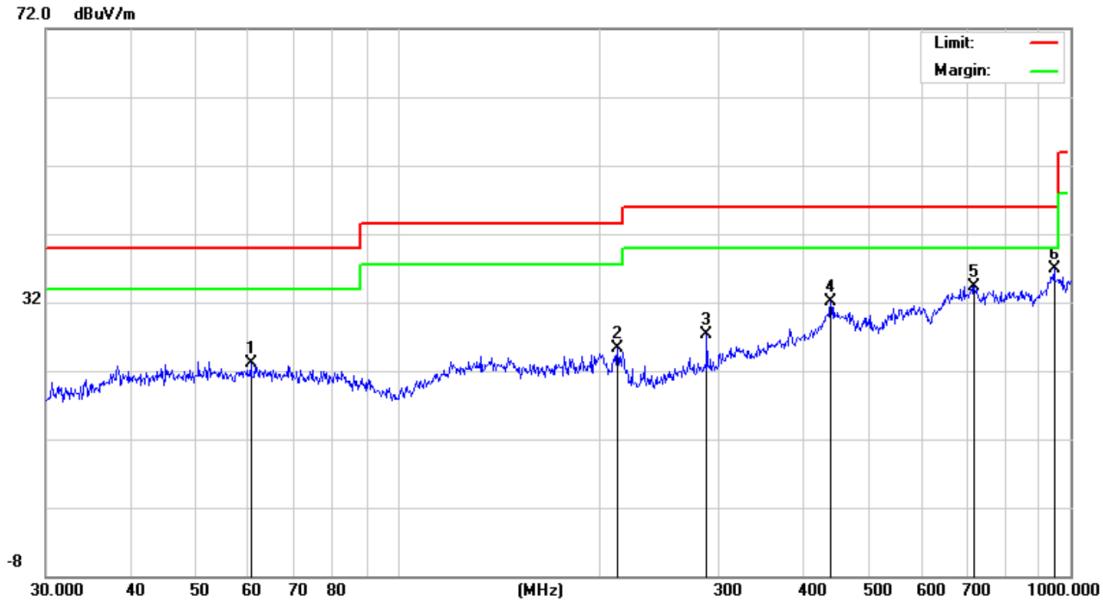
Radiated Emission Test Results at 30MHz-1GHz			
EUT Name	WINDOW CLEANING ROBOT	**Model Name**	1W03Q1
Temperature	22.5℃	**Relative Humidity**	51.8%
Pressure	960hPa	**Test Voltage**	Normal Voltage
Test Mode	Mode 3	**Antenna Polarity**	Vertical



Final Data List

NO.	Freq. [MHz]	Level [dBμV/m]	Factor [dB]	Limit [dBμV/m]	Margin [dB]	Height [cm]	Angle [°]	Polarity
1	60.4919	23.01	17.10	40.00	16.99	100	129	Vertical
2	212.2695	25.34	16.98	43.50	18.16	100	141	Vertical
3	287.9904	27.23	18.60	46.00	18.77	100	89	Vertical
4	440.1963	32.10	26.09	46.00	13.9	100	216	Vertical
5	719.1995	34.26	28.77	46.00	11.74	100	225	Vertical
6	945.4399	36.98	30.78	46.00	9.02	100	147	Vertical

RESULT: PASS

Note: 1. Factor=Antenna Factor + Cable loss, Margin= Limit-Level.

2. All test modes had been pre-tested. The mode 3 is the worst case and recorded in the report.

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Radiated Emissions Test Results for Above 1GHz

EUT Name	WINDOW CLEANING ROBOT	**Model Name**	1W03Q1
Temperature	22.5℃	**Relative Humidity**	51.8%
Pressure	960hPa	**Test Voltage**	Normal Voltage
Test Mode	Mode 1	**Antenna Polarity**	Horizontal

Frequency (MHz)	Meter Reading (dBμV)	Factor (dB)	Emission Level (dBμV/m)	Limits (dBμV/m)	Margin (dB)	Value Type
4804.000	45.82	0.08	45.9	74	-28.1	peak
4804.000	38.62	0.08	38.7	54	-15.3	AVG
7206.000	42.17	2.21	44.38	74	-29.62	peak
7206.000	33.56	2.21	35.77	54	-18.23	AVG

Remark:
Factor = Antenna Factor + Cable Loss – Pre-amplifier.

EUT Name	WINDOW CLEANING ROBOT	**Model Name**	1W03Q1
Temperature	22.5℃	**Relative Humidity**	51.8%
Pressure	960hPa	**Test Voltage**	Normal Voltage
Test Mode	Mode 1	**Antenna Polarity**	Vertical

Frequency (MHz)	Meter Reading (dBμV)	Factor (dB)	Emission Level (dBμV/m)	Limits (dBμV/m)	Margin (dB)	Value Type
4804.000	45.84	0.08	45.92	74	-28.08	peak
4804.000	37.29	0.08	37.37	54	-16.63	AVG
7206.000	42.45	2.21	44.66	74	-29.34	peak
7206.000	33.68	2.21	35.89	54	-18.11	AVG

Remark:
Factor = Antenna Factor + Cable Loss – Pre-amplifier.

RESULT: PASS

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Radiated Emissions Test Results for Above 1GHz

EUT Name	WINDOW CLEANING ROBOT	**Model Name**	1W03Q1
Temperature	22.5℃	**Relative Humidity**	51.8%
Pressure	960hPa	**Test Voltage**	Normal Voltage
Test Mode	Mode 2	**Antenna Polarity**	Horizontal

Frequency (MHz)	Meter Reading (dBμV)	Factor (dB)	Emission Level (dBμV/m)	Limits (dBμV/m)	Margin (dB)	Value Type
4880.000	45.85	0.14	45.99	74	-28.01	peak
4880.000	39.71	0.14	39.85	54	-14.15	AVG
7320.000	42.58	2.36	44.94	74	-29.06	peak
7320.000	32.64	2.36	35	54	-19	AVG

Remark:
Factor = Antenna Factor + Cable Loss – Pre-amplifier.

EUT Name	WINDOW CLEANING ROBOT	**Model Name**	1W03Q1
Temperature	22.5℃	**Relative Humidity**	51.8%
Pressure	960hPa	**Test Voltage**	Normal Voltage
Test Mode	Mode 2	**Antenna Polarity**	Vertical

Frequency (MHz)	Meter Reading (dBμV)	Factor (dB)	Emission Level (dBμV/m)	Limits (dBμV/m)	Margin (dB)	Value Type
4880.000	46.41	0.14	46.55	74	-27.45	peak
4880.000	38.75	0.14	38.89	54	-15.11	AVG
7320.000	41.24	2.36	43.6	74	-30.4	peak
7320.000	33.95	2.36	36.31	54	-17.69	AVG

Remark:
Factor = Antenna Factor + Cable Loss – Pre-amplifier.

RESULT: Pass

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Radiated Emissions Test Results for Above 1GHz

EUT Name	WINDOW CLEANING ROBOT	**Model Name**	1W03Q1
Temperature	22.5℃	**Relative Humidity**	51.8%
Pressure	960hPa	**Test Voltage**	Normal Voltage
Test Mode	Mode 3	**Antenna Polarity**	Horizontal

Frequency (MHz)	Meter Reading (dBμV)	Factor (dB)	Emission Level (dBμV/m)	Limits (dBμV/m)	Margin (dB)	Value Type
4960.000	45.48	0.22	45.7	74	-28.3	peak
4960.000	37.26	0.22	37.48	54	-16.52	AVG
7440.000	42.31	2.64	44.95	74	-29.05	peak
7440.000	32.85	2.64	35.49	54	-18.51	AVG

Remark:
Factor = Antenna Factor + Cable Loss – Pre-amplifier.

EUT Name	WINDOW CLEANING ROBOT	**Model Name**	1W03Q1
Temperature	22.5℃	**Relative Humidity**	51.8%
Pressure	960hPa	**Test Voltage**	Normal Voltage
Test Mode	Mode 3	**Antenna Polarity**	Vertical

Frequency (MHz)	Meter Reading (dBμV)	Factor (dB)	Emission Level (dBμV/m)	Limits (dBμV/m)	Margin (dB)	Value Type
4960.000	46.26	0.22	46.48	74	-27.52	peak
4960.000	38.84	0.22	39.06	54	-14.94	AVG
7440.000	41.47	2.64	44.11	74	-29.89	peak
7440.000	31.28	2.64	33.92	54	-20.08	AVG

Remark:
Factor = Antenna Factor + Cable Loss – Pre-amplifier.

RESULT: Pass

Note:

1. The amplitude of other spurious emissions from 1G to 25 GHz which are attenuated more than 20 dB below the permissible value need not be reported.
2. Factor = Antenna Factor + Cable loss – Pre-amplifier gain, Margin =Emission Level-Limit.
3. The “Factor” value can be calculated automatically by software of measurement system.
4. All test modes had been pre-tested. The BLE GFSK 1Mbps is the worst case and recorded in the report.

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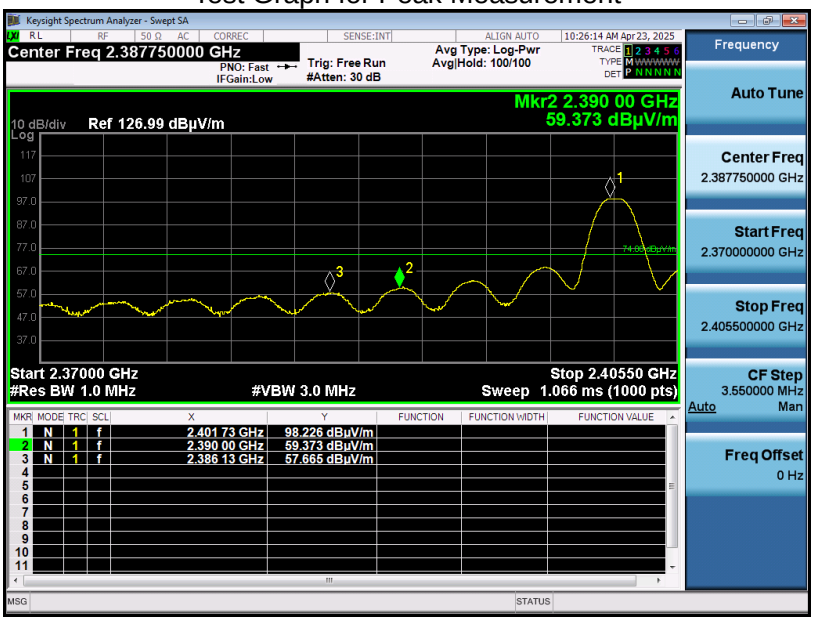
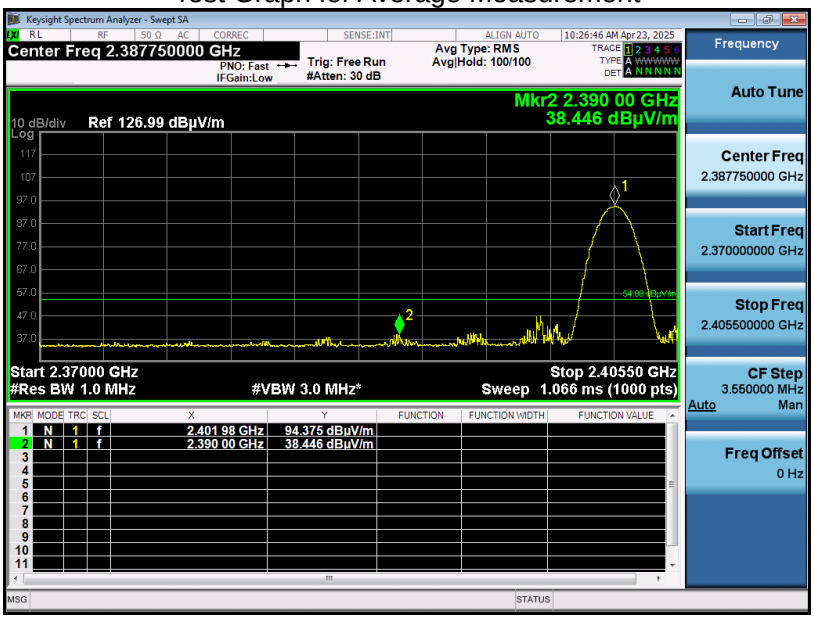
Band Edge Emission Test Results for Restricted Bands

EUT Name	WINDOW CLEANING ROBOT	Model Name	1W03Q1
Temperature	26.2℃	Relative Humidity	62.0%
Pressure	960hPa	Test Voltage	Normal Voltage
Test Mode	Mode 1	Antenna Polarity	Horizontal

Test Graph for Peak Measurement



Test Graph for Average Measurement



RESULT: PASS

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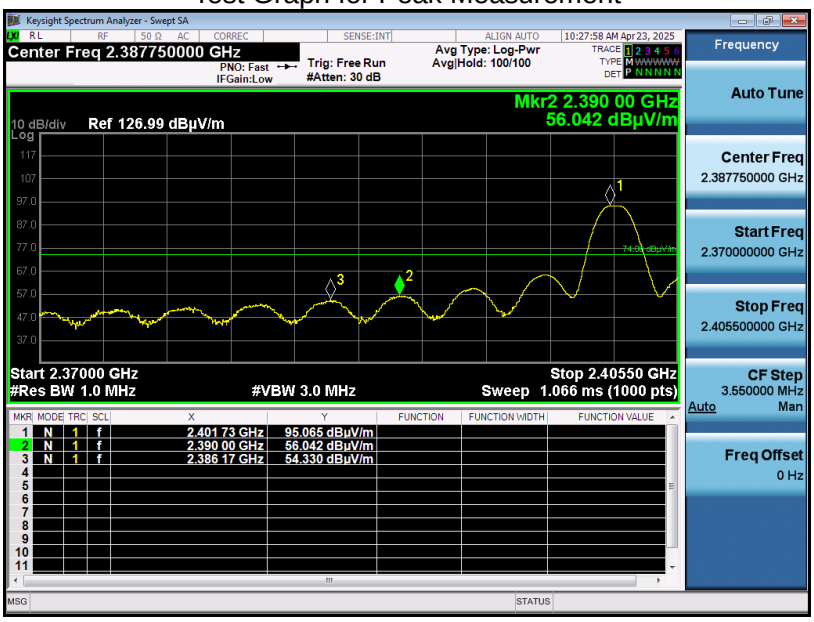
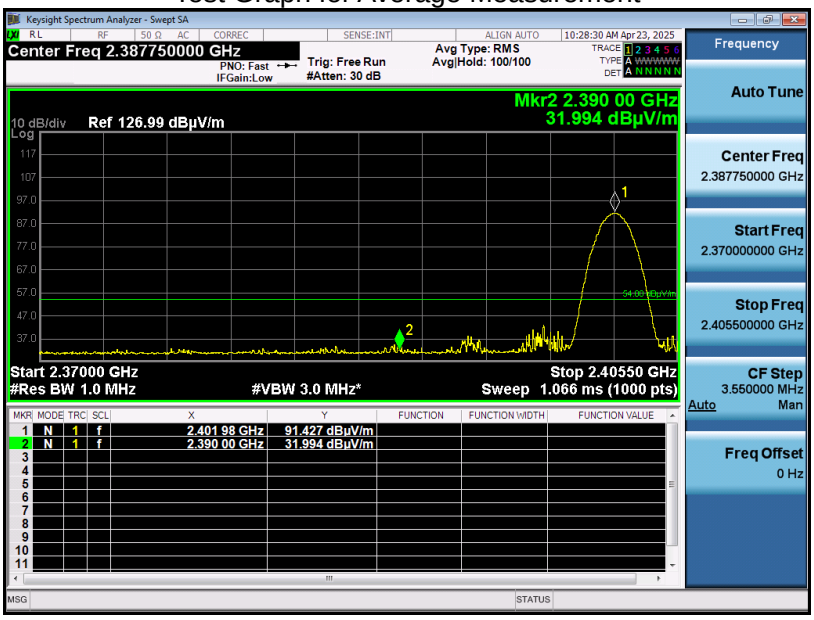
Band Edge Emission Test Results for Restricted Bands

EUT Name	WINDOW CLEANING ROBOT	**Model Name**	1W03Q1
Temperature	26.2℃	**Relative Humidity**	62.0%
Pressure	960hPa	**Test Voltage**	Normal Voltage
Test Mode	Mode 1	**Antenna Polarity**	Vertical

Test Graph for Peak Measurement



Test Graph for Average Measurement



RESULT: PASS

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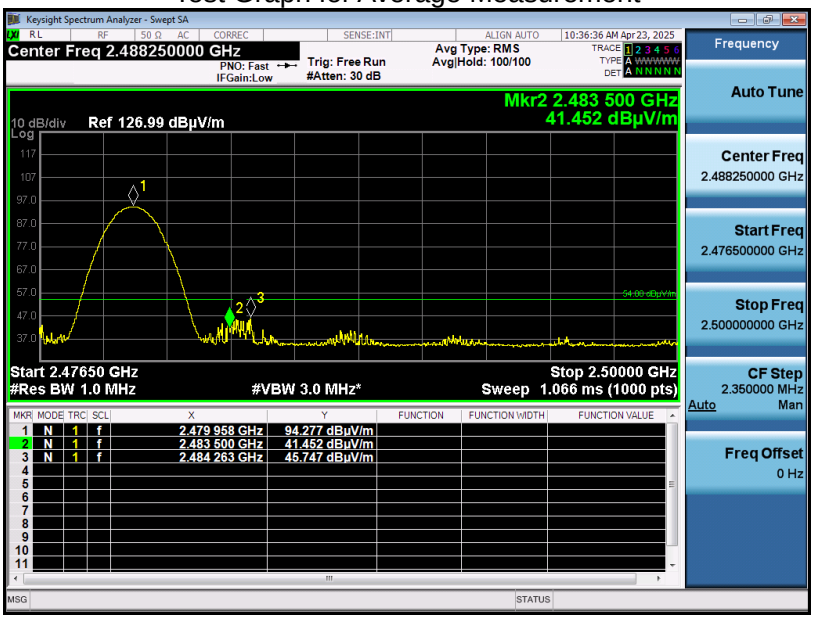
Band Edge Emission Test Results for Restricted Bands

EUT Name	WINDOW CLEANING ROBOT	**Model Name**	1W03Q1
Temperature	26.2℃	**Relative Humidity**	62.0%
Pressure	960hPa	**Test Voltage**	Normal Voltage
Test Mode	Mode 3	**Antenna Polarity**	Horizontal

Test Graph for Peak Measurement

Test Graph for Average Measurement



RESULT: PASS

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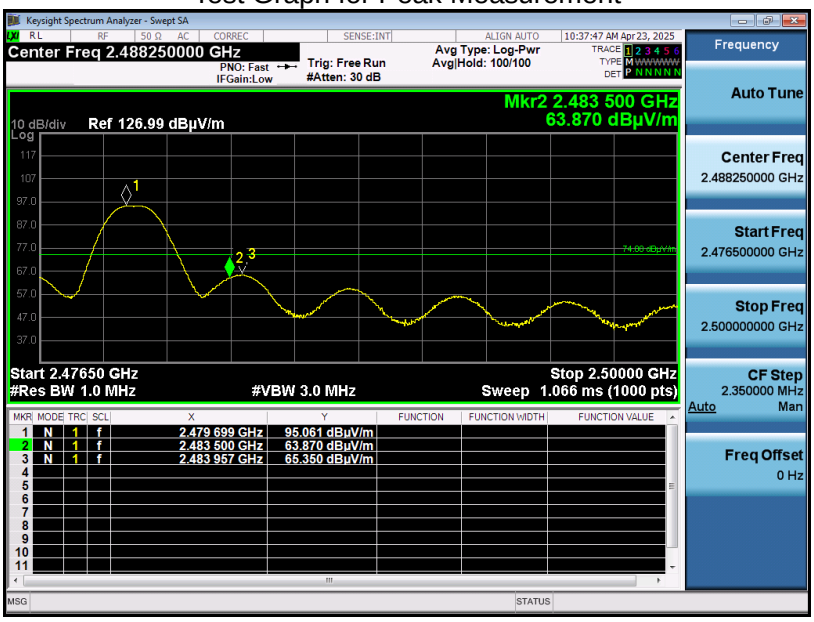
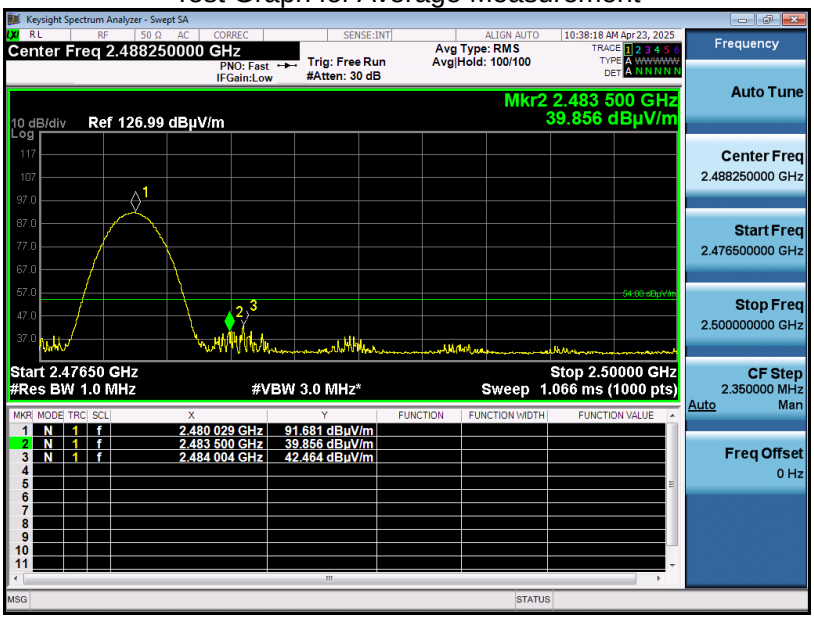
Band Edge Emission Test Results for Restricted Bands

EUT Name	WINDOW CLEANING ROBOT	**Model Name**	1W03Q1
Temperature	26.2℃	**Relative Humidity**	62.0%
Pressure	960hPa	**Test Voltage**	Normal Voltage
Test Mode	Mode 3	**Antenna Polarity**	Vertical

Test Graph for Peak Measurement



Test Graph for Average Measurement



RESULT: PASS

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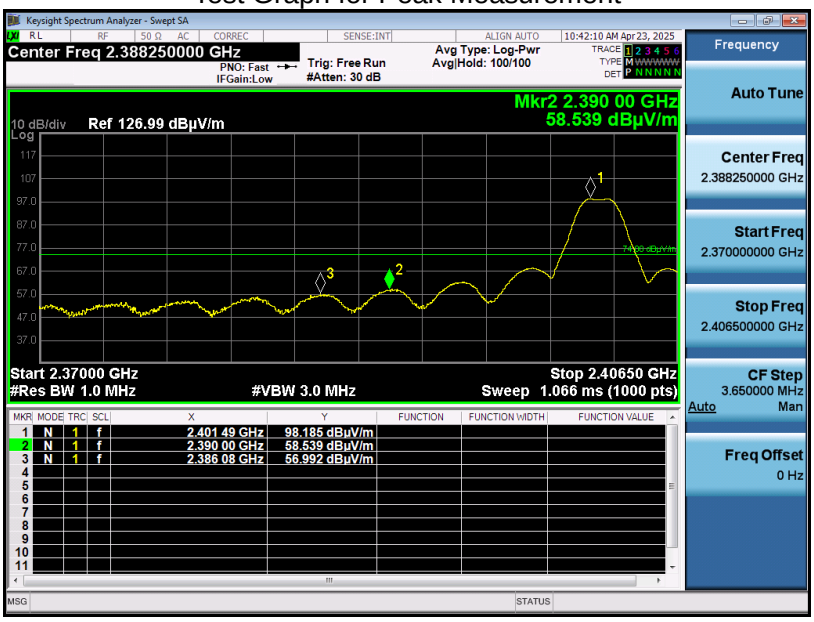
Band Edge Emission Test Results for Restricted Bands

EUT Name	WINDOW CLEANING ROBOT	**Model Name**	1W03Q1
Temperature	26.2℃	**Relative Humidity**	62.0%
Pressure	960hPa	**Test Voltage**	Normal Voltage
Test Mode	Mode 4	**Antenna Polarity**	Horizontal

Test Graph for Peak Measurement



Test Graph for Average Measurement

RESULT: PASS

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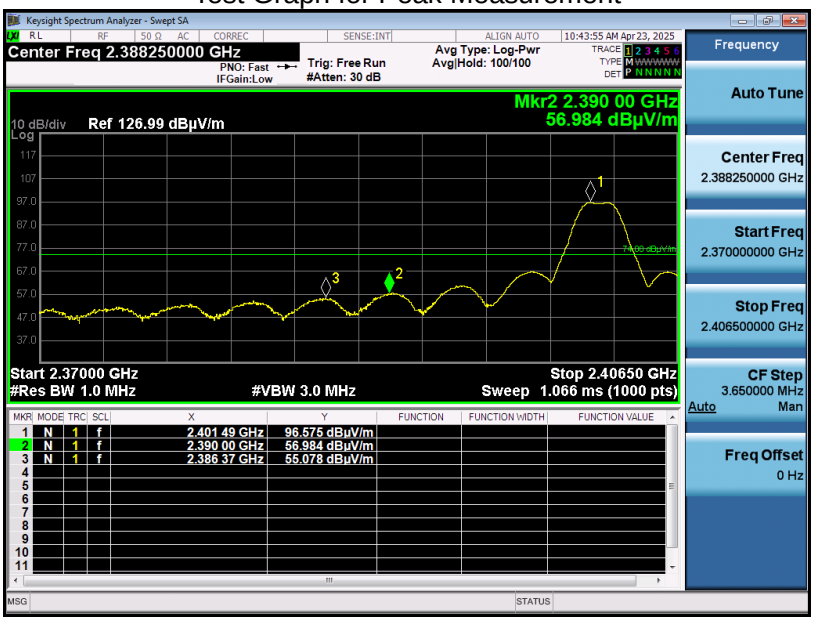
Band Edge Emission Test Results for Restricted Bands

EUT Name	WINDOW CLEANING ROBOT	Model Name	1W03Q1
Temperature	26.2℃	Relative Humidity	62.0%
Pressure	960hPa	Test Voltage	Normal Voltage
Test Mode	Mode 4	Antenna Polarity	Vertical

Test Graph for Peak Measurement



Test Graph for Average Measurement

RESULT: PASS

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Band Edge Emission Test Results for Restricted Bands

EUT Name	WINDOW CLEANING ROBOT	**Model Name**	1W03Q1
Temperature	26.2℃	**Relative Humidity**	62.0%
Pressure	960hPa	**Test Voltage**	Normal Voltage
Test Mode	Mode 6	**Antenna Polarity**	Horizontal

Test Graph for Peak Measurement

Test Graph for Average Measurement

RESULT: PASS

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Band Edge Emission Test Results for Restricted Bands

EUT Name	WINDOW CLEANING ROBOT	**Model Name**	1W03Q1
Temperature	26.2℃	**Relative Humidity**	62.0%
Pressure	960hPa	**Test Voltage**	Normal Voltage
Test Mode	Mode 6	**Antenna Polarity**	Vertical

Test Graph for Peak Measurement

Test Graph for Average Measurement

RESULT: PASS

Note: The factor had been edited in the “Input Correction” of the Spectrum Analyzer.

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12. AC Power Line Conducted Emission Test

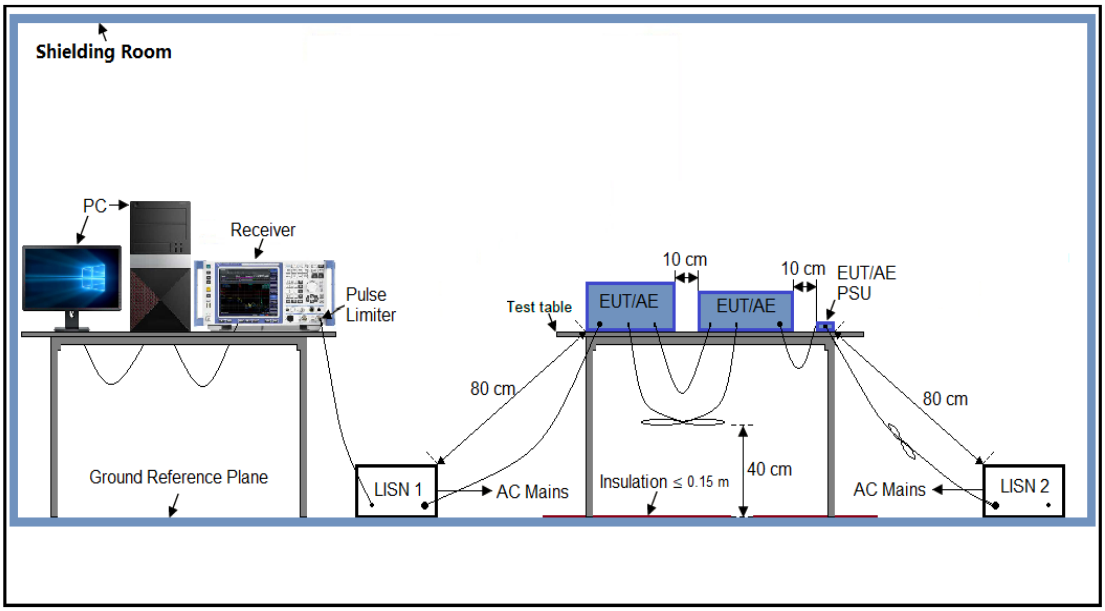
12.1 Measurement Limit

Frequency	Maximum RF Line Voltage	
	Q.P. (dBμV)	Average (dBμV)
150kHz~500kHz	66-56	56-46
500kHz~5MHz	56	46
5MHz~30MHz	60	50

Note:

1. The lower limit shall apply at the transition frequency.
2. The limit decreases linearly with the logarithm of the frequency in the range 0.15 MHz to 0.50 MHz

12.2 Measurement Setup (Block Diagram of Configuration)



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12.3 Preliminary Procedure of Line Conducted Emission Test

1. The equipment was set up as per the test configuration to simulate typical actual usage per the user's manual. When the EUT is a tabletop system, a wooden table with a height of 0.8 meters is used and is placed on the ground plane as per ANSI C63.10 (see Test Facility for the dimensions of the ground plane used). When the EUT is a floor-standing equipment, it is placed on the ground plane which has a 3-12 mm non-conductive covering to insulate the EUT from the ground plane.
2. Support equipment, if needed, was placed as per ANSI C63.10.
3. All I/O cables were positioned to simulate typical actual usage as per ANSI C63.10.
4. All support equipment received AC120V/60Hz power from a LISN, if any.
5. The EUT received DC 24V power from adapter which received AC120V/60Hz power from a LISN.
6. The test program was started. Emissions were measured on each current carrying line of the EUT using a spectrum Analyzer / Receiver connected to the LISN powering the EUT. The LISN has two monitoring points: Line 1 (Hot Side) and Line 2 (Neutral Side).
7. Two scans were taken: one with Line 1 connected to Analyzer / Receiver and Line 2 connected to a 50 ohm load; the second scan had Line 1 connected to a 50 ohm load and Line 2 connected to the Analyzer / Receiver.
8. Analyzer / Receiver scanned from 150 kHz to 30MHz for emissions in each of the test modes.
9. During the above scans, the emissions were maximized by cable manipulation.
10. The test mode(s) were scanned during the preliminary test.
11. Then, the EUT configuration and cable configuration of the above highest emission level were recorded for reference of final testing.

12.4 Final Procedure of Line Conducted Emission Test

1. EUT and support equipment was set up on the test bench as per step 2 of the preliminary test.
2. A scan was taken on both power lines, Line 1 and Line 2, recording at least the six highest emissions. Emission frequency and amplitude were recorded into a computer in which correction factors were used to calculate the emission level and compare reading to the applicable limit.
3. If EUT emission level was less –2dB to the A.V. limit in Peak mode, then the emission signal was re-checked using Q.P and Average detector.
4. The test data of the worst case condition(s) was reported on the Summary Data page.
5. A conducted emission is calculated by the following equation:
   - Measurement Level (dBμV) = Receiver reading (dBμV) + Transd (dB)
   - Transd (dB)= AMN Factor(dB)+Cable Loss(dB)+Attenuation(dB)
   - Margin= Limit-Level

12.5 Measurement Result

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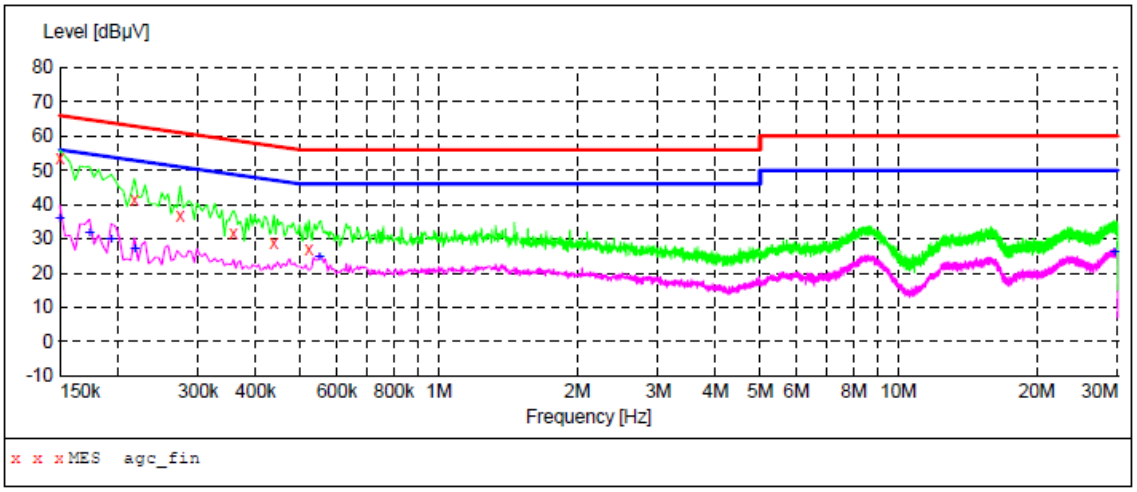
AC Power Line Conducted Emission Test			
Test Mode	Mode 1	LISN Line	Hot Side



MEASUREMENT RESULT: "agc_fin"

2025/4/24 9:51

Frequency MHz	Level dBµV	Transd dB	Limit dBµV	Margin dB	Detector	Line
0.150000	53.70	10.3	66	12.3	QP	L1
0.218000	41.60	10.3	63	21.3	QP	L1
0.274000	36.60	10.3	61	24.4	QP	L1
0.358000	31.70	10.3	59	27.1	QP	L1
0.438000	28.70	10.3	57	28.4	QP	L1
0.522000	27.00	10.3	56	29.0	QP	L1

MEASUREMENT RESULT: "agc_fin2"

2025/4/24 9:51

Frequency MHz	Level dBµV	Transd dB	Limit dBµV	Margin dB	Detector	Line
0.150000	35.90	10.3	56	20.1	AV	L1
0.174000	31.80	10.3	55	23.0	AV	L1
0.194000	29.60	10.3	54	24.3	AV	L1
0.218000	27.20	10.3	53	25.7	AV	L1
0.550000	24.50	10.3	46	21.5	AV	L1
29.474000	25.90	18.0	50	24.1	AV	L1

RESULT: PASS

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