FCC Test Report

Report No.: AGC10732260303FR01

FCC ID	:	2BFKC-MA-1
APPLICATION PURPOSE	:	Original Equipment
PRODUCT DESIGNATION	:	Amplifier
BRAND NAME	:	HIPPO, Coolbox
MODEL NAME	:	MA1, MA2, MA3, MA4, MA5, A6, MA6, MA7, MA8, MA9, MA10, MA11, MA12, MA13, MA14, MA15, MA16, MA17, MA18, MA19, MA20, MA21, MA22, MA23, MA24, MA24, MA25, MA26, MA27, MA28, MA29, MA30, MA31, MA32, MA33, MA34, MA35, MA36, MA37, MA38, MA39, MA40, MA41, MA42, MA43, MA44, MA45, MA46, MA47, MA48, MA49, MA50, KY03, D21, A3, M20, KY01, KY02, KY04, KY04, KY05, KY06, KY07, KY08, KY09, KY300, S1
APPLICANT	:	Shenzhen HIPPO Digital Co., Ltd
DATE OF ISSUE	:	Apr. 28, 2026
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	/	Apr. 28, 2026	Valid	Initial Release

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1. General Information

Applicant	Shenzhen HIPPO Digital Co., Ltd
Address	7th Floor, Building A, Shanghe Industrial Park, Nanchang Road, Sanwei Community, Hangcheng Street, Bao'an District, ShenZhen 518126 China
Manufacturer	Shenzhen HIPPO Digital Co., Ltd
Address	7th Floor, Building A, Shanghe Industrial Park, Nanchang Road, Sanwei Community, Hangcheng Street, Bao'an District, ShenZhen 518126 China
Factory	Shenzhen HIPPO Digital Co., Ltd
Address	7th Floor, Building A, Shanghe Industrial Park, Nanchang Road, Sanwei Community, Hangcheng Street, Bao'an District, ShenZhen 518126 China
Product Designation	Amplifier
Brand Name	HIPPO, Coolbox
Test Model	MA1
Series Model	MA2, MA3, MA4, MA5, A6, MA6, MA7, MA8, MA9, MA10, MA11, MA12, MA13, MA14, MA15, MA16, MA17, MA18, MA19, MA20, MA21, MA22, MA23, MA24, MA24, MA25, MA26, MA27, MA28, MA29, MA30, MA31, MA32, MA33, MA34, MA35, MA36, MA37, MA38, MA39, MA40, MA41, MA42, MA43, MA44, MA45, MA46, MA47, MA48, MA49, MA50, KY03, D21, A3, M20, KY01, KY02, KY04, KY04, KY05, KY06, KY07, KY08, KY09, KY300, S1
Difference Description	All the same except for the model name
Date of receipt of test item	Mar. 17, 2026
Date of Test	Mar. 17, 2026 to Apr. 28, 2026
Deviation from Standard	No any deviation from the test method
Condition of Test Sample	Normal
Test Result	Pass
Test Report Form No	AGCER-FCC-BR_EDR-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)	Apr. 15, 2026
Reviewed By	Bibo zhang Bibo Zhang (Reviewer)	Apr. 15, 2026
Approved By	Angela Li Angela Li (Authorized Officer)	Apr. 15, 2026

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2. Product Information

2.1 Product Technical Description

Technology Type	Classic Bluetooth
Frequency Band	2400M-2483.5MHz
Operation Frequency Range	2402MHz-2480MHz
Bluetooth Version	V5.4
Modulation Type	BR ☒GFSK, EDR ☒π /4-DQPSK, ☒8DPSK
Number of channels	79 of Channels
Channel Separation	1 MHz
Maximum Transmitter Power	1.051dBm
Hardware Version	V1.3
Software Version	V1.0
Antenna Designation	PCB Antenna
Antenna Gain	3.0dBi
Power Supply	DC 3.7V by battery or DC 5V by adapter

2.2 Test Frequency List

Frequency Band	Channel Number	Test Frequency
2400~2483.5MHz	0	2402 MHz
	1	2403 MHz
	:	:
	39	2441MHz
	:	:
	77	2479 MHz
	78	2480 MHz
Note: f = 2402+1*k MHz, k=0, …, 78; “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: 2BFKC-MA-1, 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 C63.10-2020+Cor.1-2023	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 Receiver Input Bandwidth

The input bandwidth of the receiver is 1.3MHz, in every connection one Bluetooth device is the master and the other one is slave. The master determines the hopping sequence. The slave follows this sequence. Both devices shift between RX and TX time slot according to the clock of the master. Additionally, the type of connection (e.g. single of multi slot packet) is set up at the beginning of the connection. The master adapts its hopping frequency and its TX/RX timing according to the packet type of the connection. Also, the slave of the connection will use these settings. Repeating of a packet has no influence on the hopping sequence. The hopping sequence generated by the master of the connection will be followed in any case. That means, a repeated packet will not be send on the same frequency, it is send on the next frequency of the hopping sequence.

2.6 Equally Average Use of Frequencies and Behaviour.

The generation of the hopping sequence in connection mode depends essentially on two input values:
1. LAP/UAP of the master of the connection.
2. Internal master clock.
The LAP (lower address part) are the 24 LSB's of the 48 BD_ADDRESS. The BD_ADDRESS is an unambiguous number of every Bluetooth unit. The UAP (upper address part) are the 24MSB's of the 48BD_ADDRESS
The internal clock of a Bluetooth unit is derived from a free running clock which is never adjusted and is never turned off. For behavior action with other units only offset is used. It has no relation to the time of the day. Its resolution is at least half the RX/TX slot length of 312.5us. The clock has a cycle of about one day(23h30).
In most case it is implemented as 28 bits counter. For the deriving of the hopping sequence the entire. LAP (24 bits),4LSB's(4bits) (Input 1) and the 27MSB's of the clock (Input 2) are used. With this input values different mathematical procedures (permutations, additions, XOR-operations) are performed to generate the Sequence. This will be done at the beginning of every new transmission.
Regarding short transmissions the Bluetooth system has the following behavior:
The first connection between the two devices is established, a hopping sequence was generated. For Transmitting the wanted data the complete hopping sequence was not used. The connection ended.
The second connection will be established. A new hopping sequence is generated. Due to the fact the Bluetooth clock has a different value, because the period between the two transmission is longer (and it Cannot be shorter) than the minimum resolution of the clock(312.5us). The hopping sequence will always differ from the first one.

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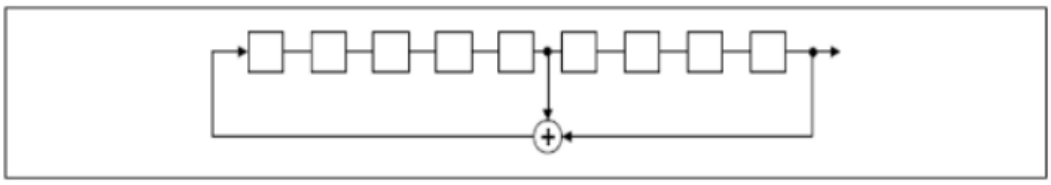
2.7 Pseudorandom Frequency Hopping Sequence

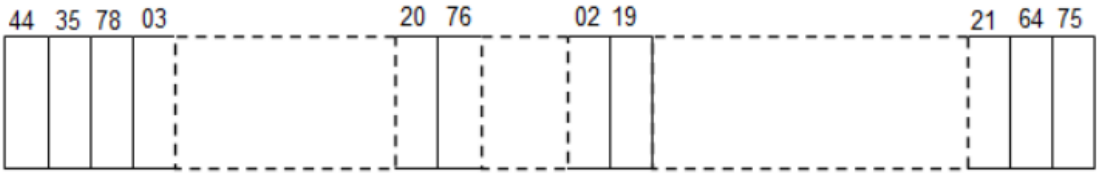
The pseudorandom sequence may be generated in a nine-stage shift register whose 5th and 9th stage outputs are added in a modulo-two addition stage. And the result is fed back to the input of the first stage. The sequence begins with the first ONE of 9 consecutive ONEs; i.e. the shift register is initialized with nine ones.

- Number of shift register stages: 9
- Length of pseudo-random sequence: 29 - 1 = 511 bits
- Longest sequence of zeros: 8 (non-inverted signal)



Linear Feedback Shift Register for Generation of The PRBS Sequence

An example of Pseudorandom Frequency Hopping Sequence as follow:



Each frequency used equally on the average by each transmitter.

The system receivers have input bandwidths that match the hopping channel bandwidths of their Corresponding transmitters and shift frequencies in synchronization with the transmitted signals.

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2.8 Special Accessories

Not available for this EUT intended for grant.

2.9 Equipment Modifications

Not available for this EUT intended for grant.

2.10 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 3dBi.

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3. Test Environment

3.1 Address of The Test Laboratory

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

Address: 101 & 201, Building 19(B5), Junfeng Industrial Park, Chongqing Road, P.R.C.

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

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 Used

● 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	2025-05-08	2026-05-07
☒	AGC-ER-A007	6dB Fixed Attenuator	Mini circuits	BW-S6-2W263A+	N/A	2026-01-31	2028-01-30
☒	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
☐	AGC-ER-E091	DC Power Supply	AIDEKESI	IT6720	800103030787810080	2026-03-13	2028-03-12

● 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	100096	2026-01-13	2027-01-12
☐	AGC-EM-E116	EMI Test Receiver	R&S	ESCI	100034	2025-05-08	2026-05-07
☒	AGC-EM-E061	Spectrum Analyzer	Agilent	N9010A	MY53470504	2025-05-08	2026-05-07
☒	AGC-EM-E086	Loop Antenna	ZHINAN	ZN30900C	18051	2026-01-14	2028-01-13
☒	AGC-EM-E001	Wideband Antenna	SCHWARZBECK	VULB9168	D69250	2025-03-14	2027-03-13
☒	AGC-EM-E029	Broadband Ridged Horn Antenna	ETS	3117	00034609	2026-03-14	2027-03-13
☒	AGC-EM-E082	Horn Antenna	SCHWARZBECK	BBHA 9170	#768	2025-09-10	2027-09-09
☒	AGC-EM-E146	Pre-amplifier	ETS	3117-PA	00246148	2024-07-24	2026-07-23
☒	AGC-EM-A119	2.4GHz Filter	SongYi	N/A	N/A	2025-05-16	2026-05-15
☒	AGC-EM-A138	6dB Attenuator	Eeatsheep	LM-XX-6-5W	N/A	2025-05-16	2027-05-15
☐	AGC-EM-A139	6dB Attenuator	Eeatsheep	LM-XX-6-5W	N/A	2025-05-16	2027-05-15
☐	AGC-ER-E091	DC Power Supply	AIDEKESI	IT6720	800103030787810080	2026-03-13	2028-03-12

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● 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-E116	EMI Test Receiver	R&S	ESCI	100034	2025-05-08	2026-05-07
☒	AGC-EM-A171	Attenuator	Mini-Circuits	UNAT-10A+	DC-6GZ	2026-01-13	2028-01-12
☒	AGC-EM-E023	AMN	R&S	ESH2-Z5	100086	2025-05-08	2026-05-07

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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

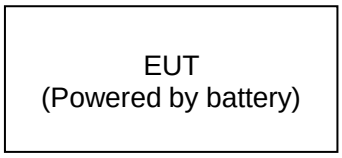
The EUT configuration for testing is installed on RF field strength measurement to meet the Commission's requirement and operating in a manner which intends to maximize its emission characteristics in a continuous normal application.

4.2 EUT Exercise

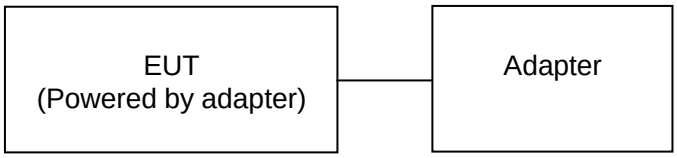
The Transmitter was operated in the normal operating mode. The TX frequency was fixed which was for the purpose of the measurements.

4.3 Configuration of Tested System

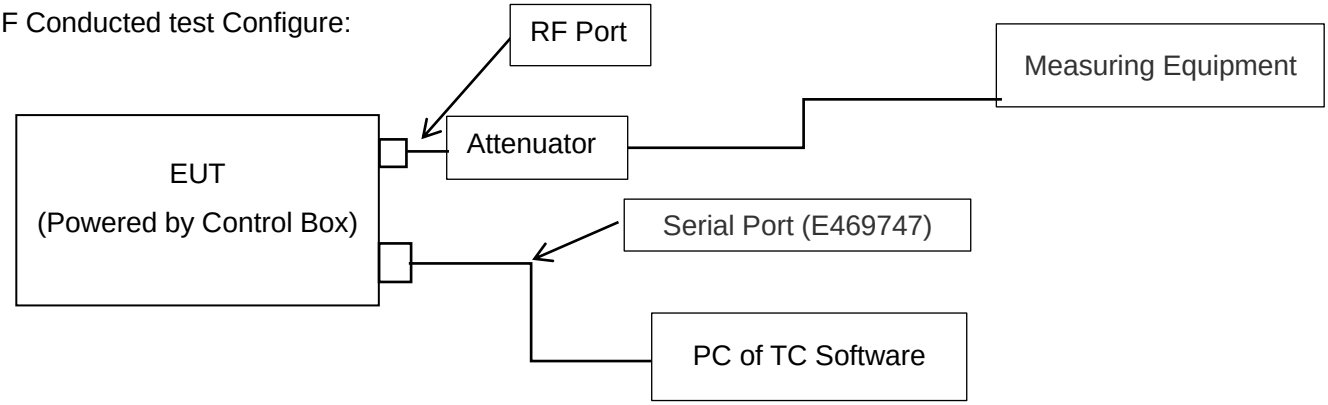
Radiated Emission Configure:



Conducted Emission Configure:



RF Conducted test Configure:



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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.	Serial No.	Specification Information	Cable
1	Redmi Notebook PC	Redmi	XMA2002 -AG	39173/82 SC06732	N/A	1.2m,unshielded
2	Control Box	RISYM	USB-TTL	N/A	N/A	N/A
3	Adapter	Apple	A2452	N/A	USB-C/140W	N/A

☐ Test Accessories Come From The Manufacturer

No.	Equipment	Manufacturer	Model No.	Serial No.	Specification Information	Cable
1	N/A	N/A	N/A	N/A	N/A	N/A

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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)(1)	RF Output Power	Pass
3	§15.247 (a)(1)	20 dB Bandwidth	Pass
4	§15.247 (d)	Conducted Band Edge and Out-of-Band Emissions	Pass
5	§15.209	Radiated Spurious Emission	Pass
6	§15.247 (a)(1)(iii)	Number of Hopping Frequency	Pass
7	§15.247 (a)(1)(iii)	Time of Occupancy	Pass
8	§15.247 (a)(1)	Frequency Separation	Pass
9	§15.207	AC Power Line Conducted Emission	Pass

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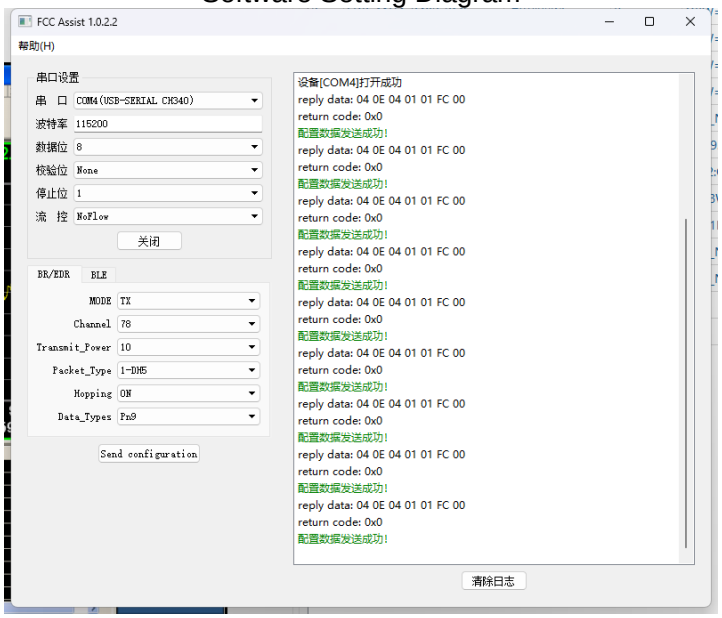
5. Description of Test Modes

Summary table of Test Cases	
Test Item	Data Rate / Modulation
	Bluetooth – BR_EDR (GFSK/π /4-DQPSK/8DPSK)
Radiated & Conducted Test Cases	Mode 1: Bluetooth Tx CH00_2402 MHz_1Mbps (Battery powered or AC/DC adapter) Mode 2: Bluetooth Tx CH39_2441 MHz_1Mbps (Battery powered or AC/DC adapter) Mode 3: Bluetooth Tx CH78_2480 MHz_1Mbps (Battery powered or AC/DC adapter) Mode 4: Bluetooth Tx CH00_2402 MHz_2Mbps (Battery powered or AC/DC adapter) Mode 5: Bluetooth Tx CH39_2441 MHz_2Mbps (Battery powered or AC/DC adapter) Mode 6: Bluetooth Tx CH78_2480 MHz_2Mbps (Battery powered or AC/DC adapter) Mode 7: Bluetooth Tx CH00_2402 MHz_3Mbps (Battery powered or AC/DC adapter) Mode 8: Bluetooth Tx CH39_2441 MHz_3Mbps (Battery powered or AC/DC adapter) Mode 9: Bluetooth Tx CH78_2480 MHz_3Mbps (Battery powered or AC/DC adapter) Mode10: Bluetooth Tx Hopping-1Mbps (Battery powered or AC/DC adapter) Mode11: Bluetooth Tx Hopping-2Mbps (Battery powered or AC/DC adapter) Mode12: Bluetooth Tx Hopping-3Mbps (Battery powered or AC/DC adapter)
AC Conducted Emission	Mode 1: Bluetooth Link + Battery + USB Cable (Charging from AC Adapter)

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.
5. The manufacturer of RF external cable claims that the cable loss is 0.5dB, and the cable loss and attenuator have been compensated into the Corrections Configuration of measuring equipment.
6. Input correction factor includes external cable loss and attenuator amplitude compensation. The formula is: Input compensation coefficient (dB) = Cable Loss (dB) + Attenuator attenuation value (dB)

Software Setting Diagram



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6. RF Output Power Measurement

6.1 Provisions Applicable

The maximum out power permissible output power is 1 Watt for all frequency hopping systems operating in the 2400-2483.5 MHz band employing at least 75 non-overlapping hopping channels.
The maximum out power permissible output power is 0.125 watts for all other frequency hopping systems in the 2400-2483.5 MHz band.

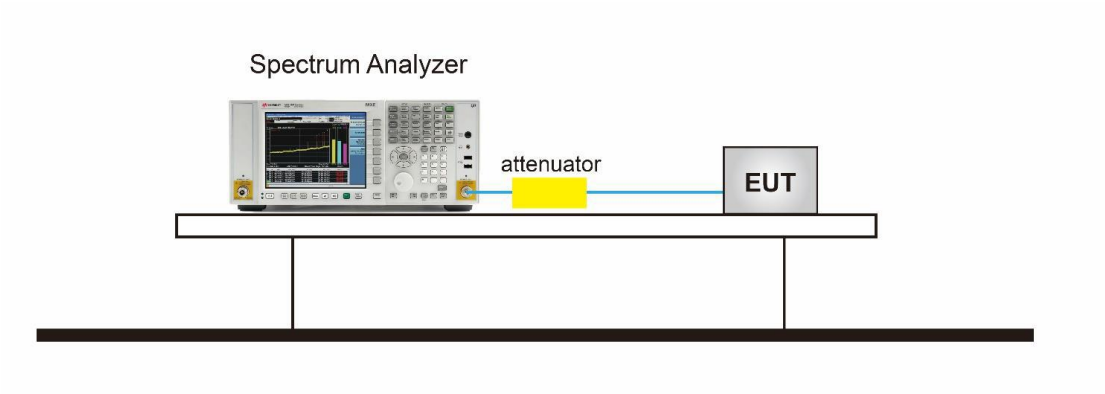
6.2 Measurement Procedure

☒For Peak power test:

1. Connect EUT RF output port to the Spectrum Analyzer through an RF attenuator
2. Span: Approximately five times the 20 dB bandwidth, centered on a hopping channel.
3. RBW > 20 dB bandwidth of the emission being measured.
4. VBW ⩾RBW.
5. Sweep: Auto.
6. Detector function: Peak.
7. Trace: 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.

6.3 Measurement Setup (Block Diagram of Configuration)

☒For peak power test setup



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6.4 Measurement Result

Test Data of Conducted Output Power				
Test Mode	Test Frequency (MHz)	Peak Power (dBm)	Limits (dBm)	Pass or Fail
GFSK	2402	-0.202	≤21	Pass
	2441	-0.581	≤21	Pass
	2480	-1.304	≤21	Pass
π /4-DQPSK	2402	0.633	≤21	Pass
	2441	0.286	≤21	Pass
	2480	-0.486	≤21	Pass
8DPSK	2402	1.051	≤21	Pass
	2441	0.783	≤21	Pass
	2480	0.046	≤21	Pass

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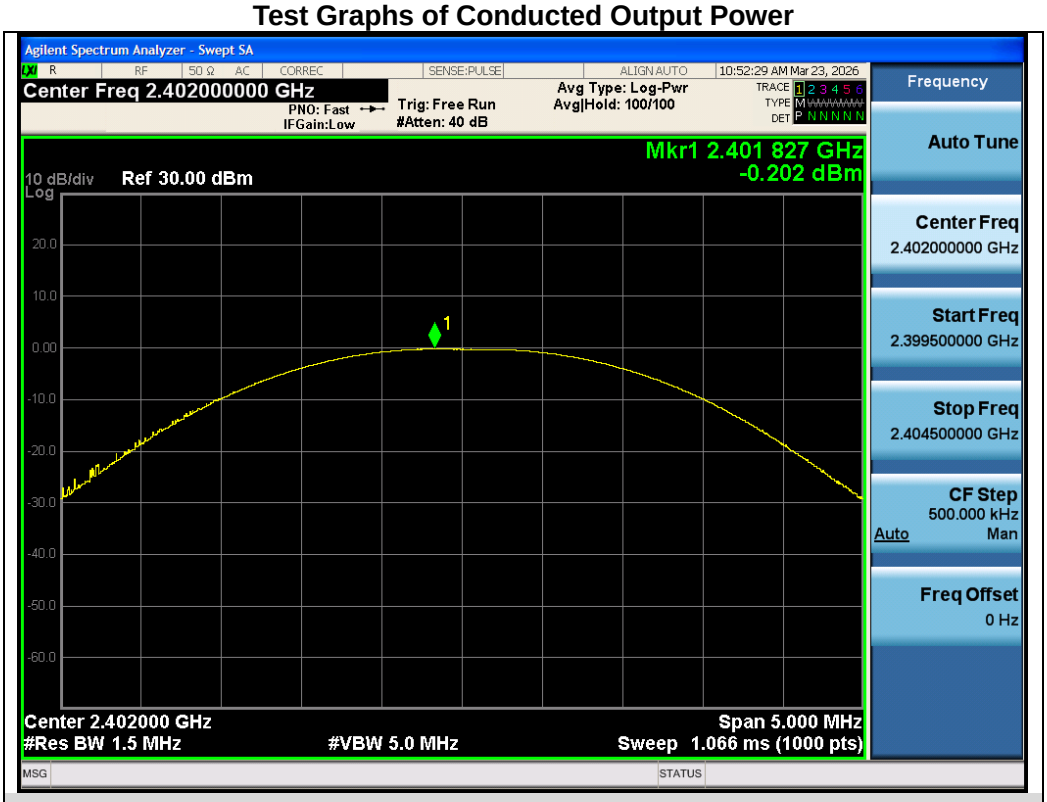
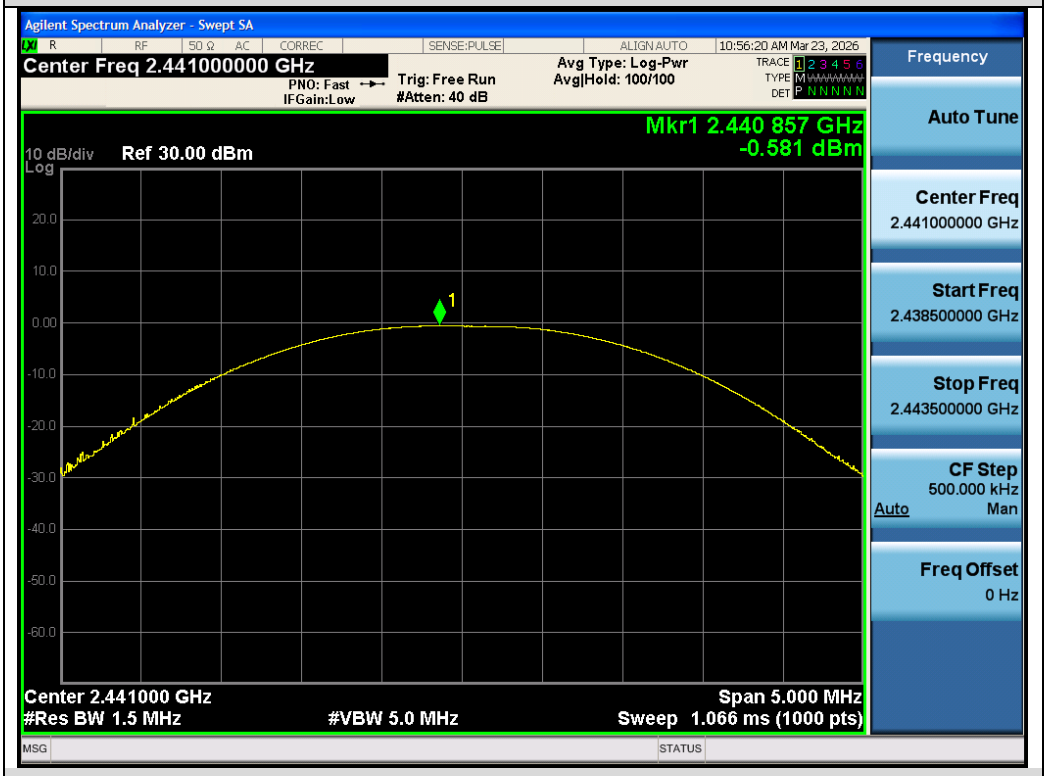
Test Graphs of Conducted Output Power



Test_Graph_BR_ANT1_2402_1Mbps_Peak Power



Test_Graph_BR_ANT1_2441_1Mbps_Peak Power

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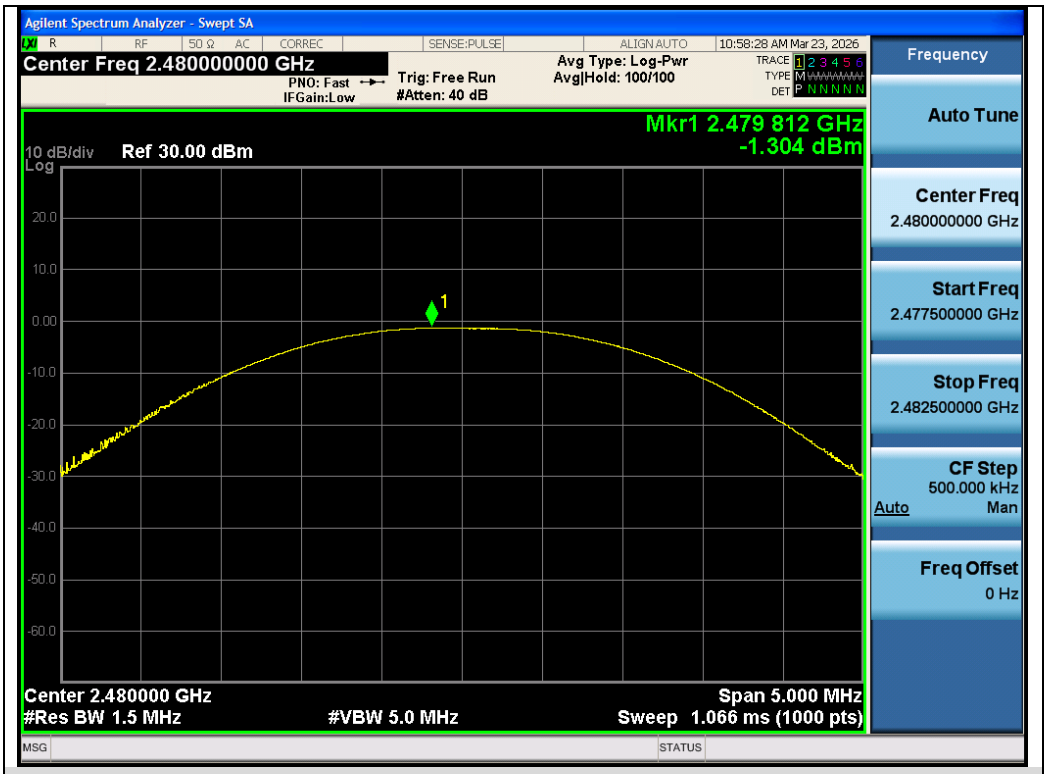
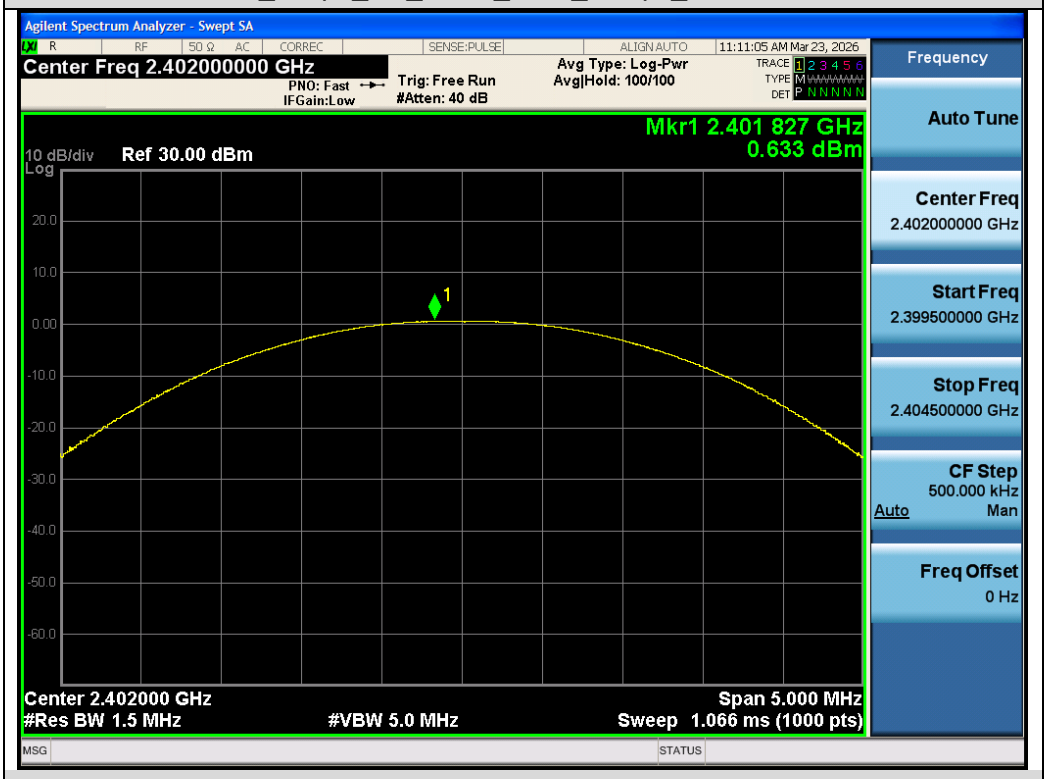


Test_Graph_BR_ANT1_2480_1Mbps_Peak Power



Test_Graph_EDR_ANT1_2402_2Mbps_Peak Power

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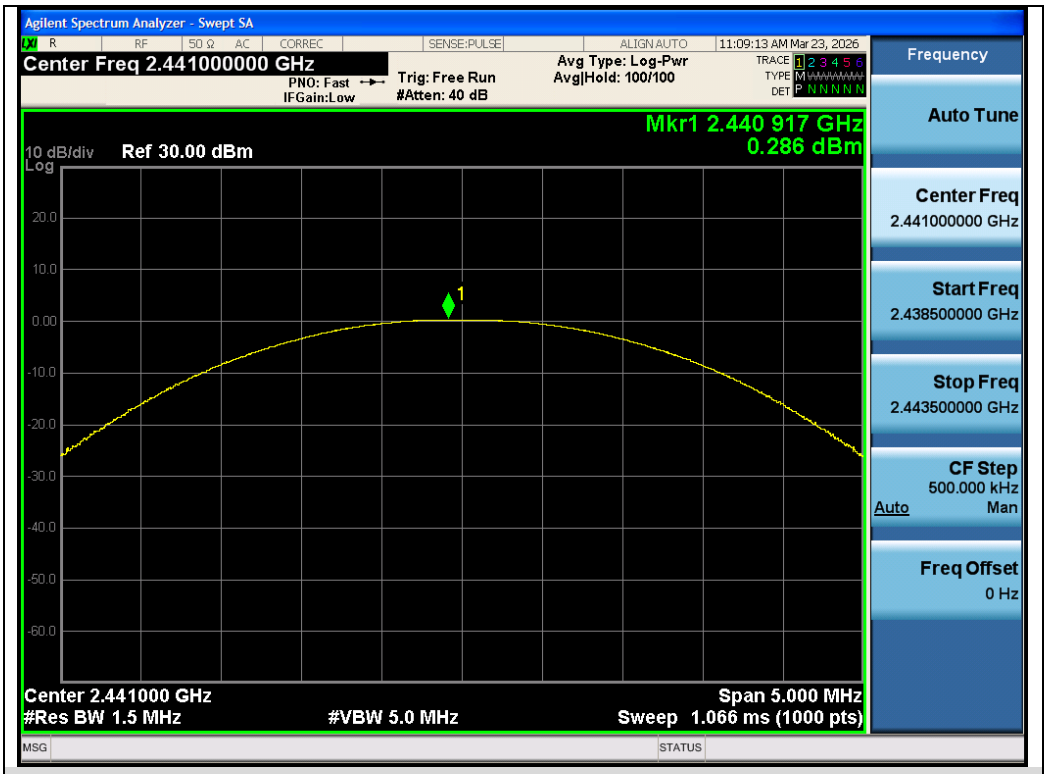
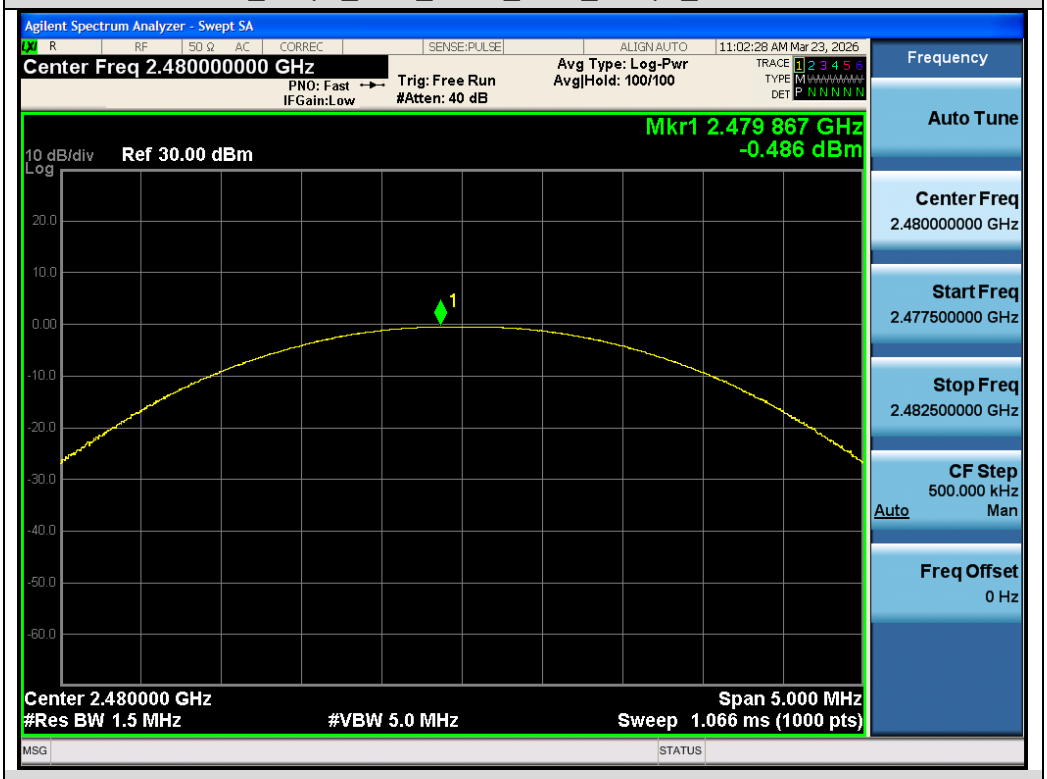


Test_Graph_EDR_ANT1_2441_2Mbps_Peak Power



Test_Graph_EDR_ANT1_2480_2Mbps_Peak Power

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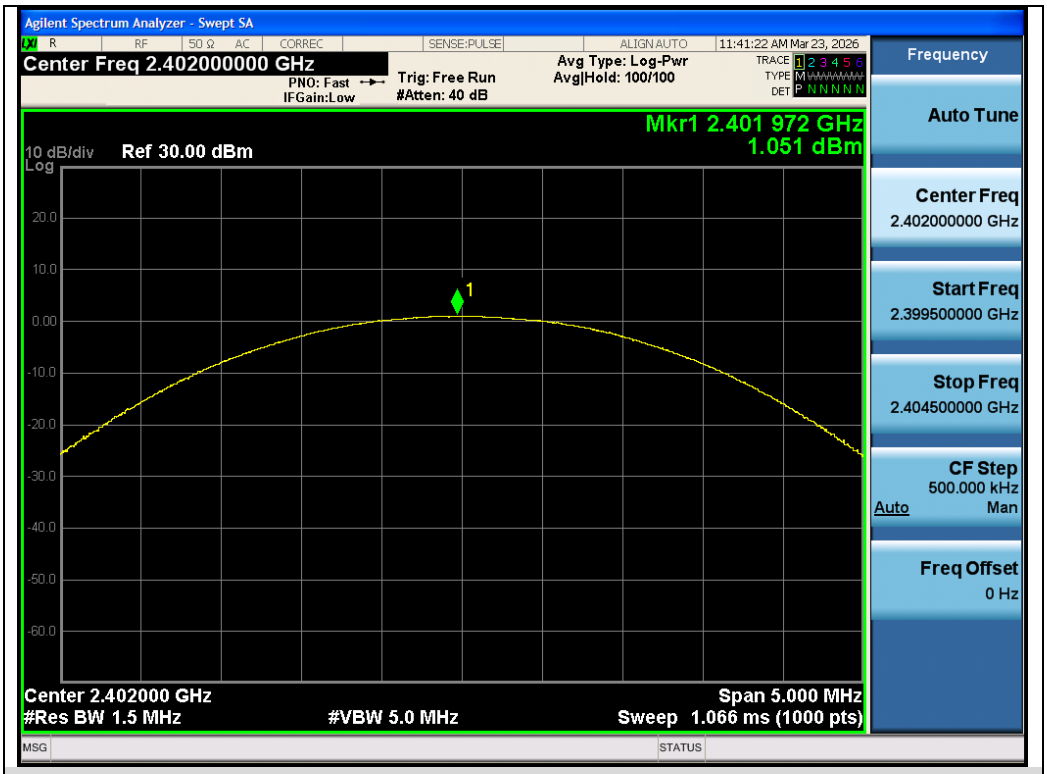
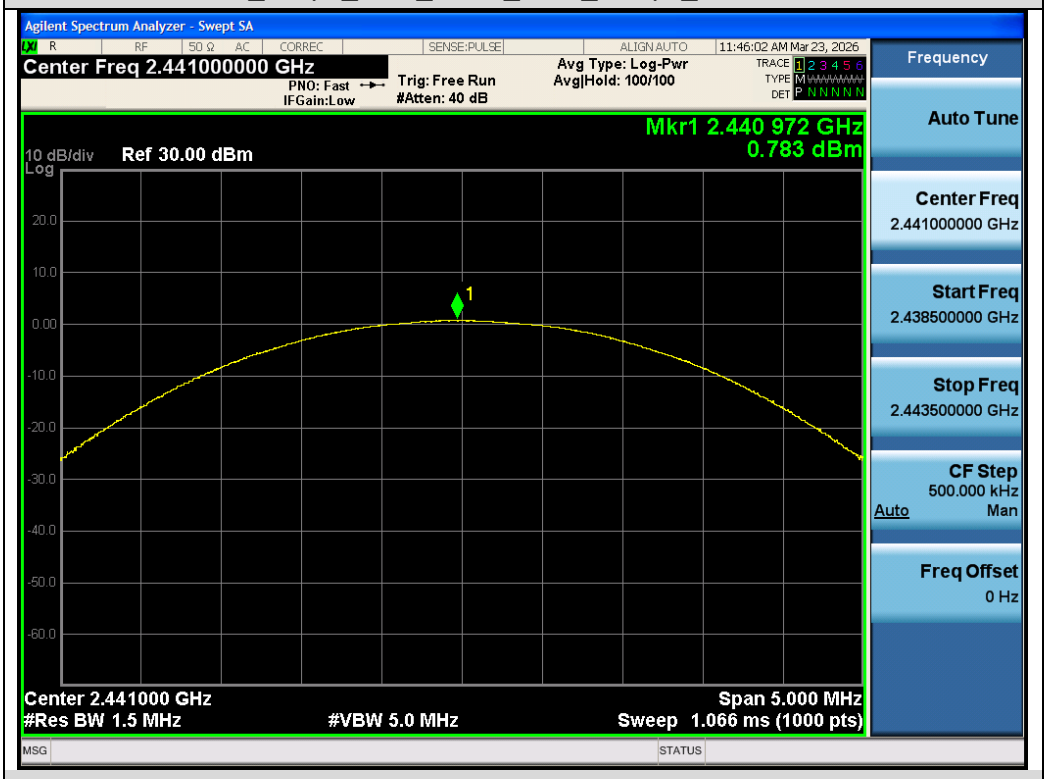


Test_Graph_EDR_ANT1_2402_3Mbps_Peak Power



Test_Graph_EDR_ANT1_2441_3Mbps_Peak Power

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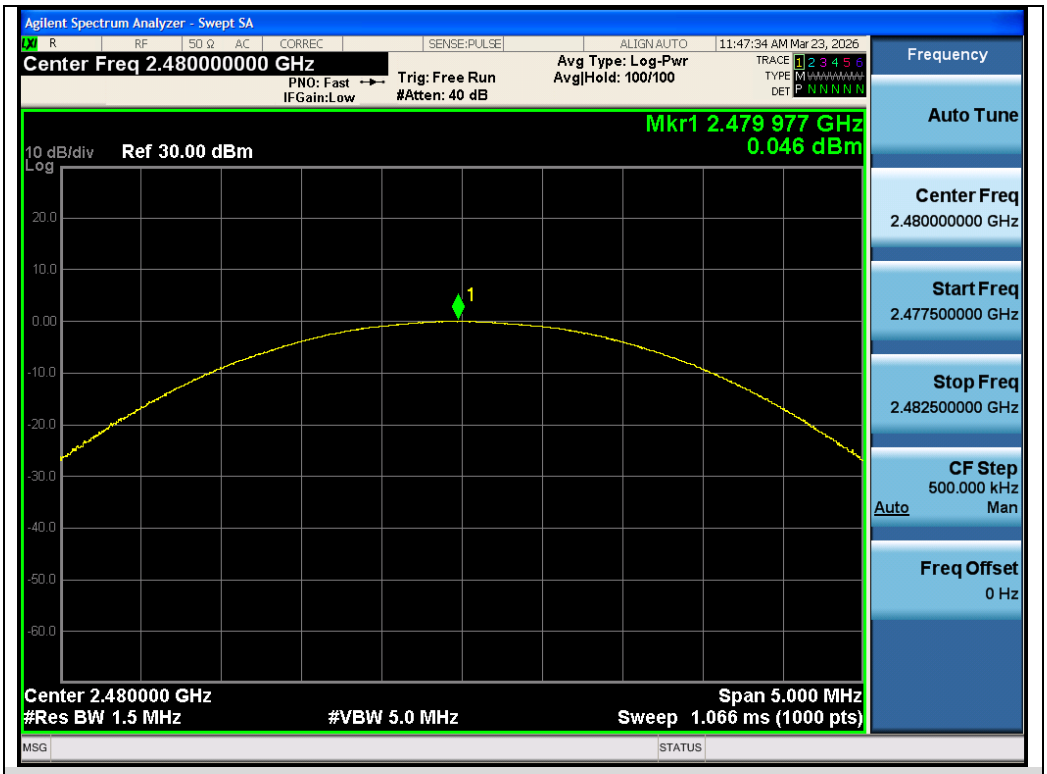

Test_Graph_EDR_ANT1_2480_3Mbps_Peak Power

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7. 20dB Bandwidth and 99% Occupied Bandwidth Measurement

7.1 Provisions Applicable

There is no corresponding limit requirement for this test item.

7.2 Measurement Procedure

The testing follows the ANSI C63.10 Section 6.9.3 (OBW) and 6.9.2 (20dB BW).

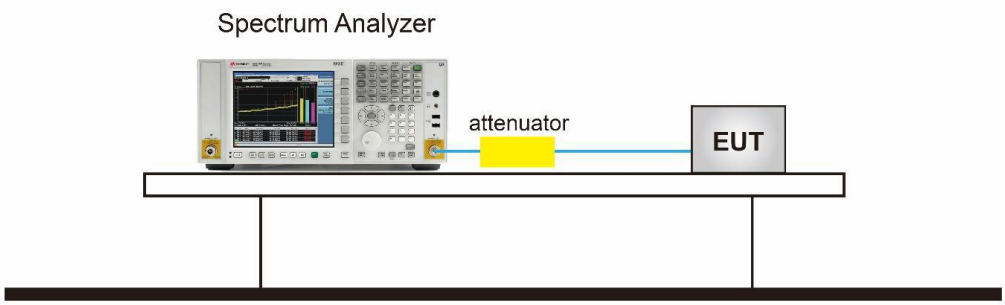
- The 20dB bandwidth spectrum analyzer setting reference is as follows:

1. Set RBW ≥ 1% to 5% of the 20dB bandwidth
2. VBW = Approximately three times RBW
3. Span = Approximately 2 to 5 times the 20dB bandwidth, centered on a hopping channel
4. Detector = Peak
5. Trace mode = Max hold
6. Sweep = Auto couple
7. Allow the trace to stabilize
8. Measure the maximum width of the emission that is constrained by the frequencies associated
9. with the two outermost amplitude points (upper and lower frequencies) that are attenuated by 20
10. dB relative to the maximum level in the fundamental emission.

- The 99% bandwidth spectrum analyzer setting reference is as follows:

1. Span = 1.5 times to 5 times the OBW
2. Set RBW = 1% to 5% the OBW
3. VBW ≥ 3 × RBW
4. Detector = Peak
5. Trace mode = Max hold
6. Sweep = Auto couple
7. Allow the trace was allowed to stabilize

7.3 Measurement Setup (Block Diagram of Configuration)



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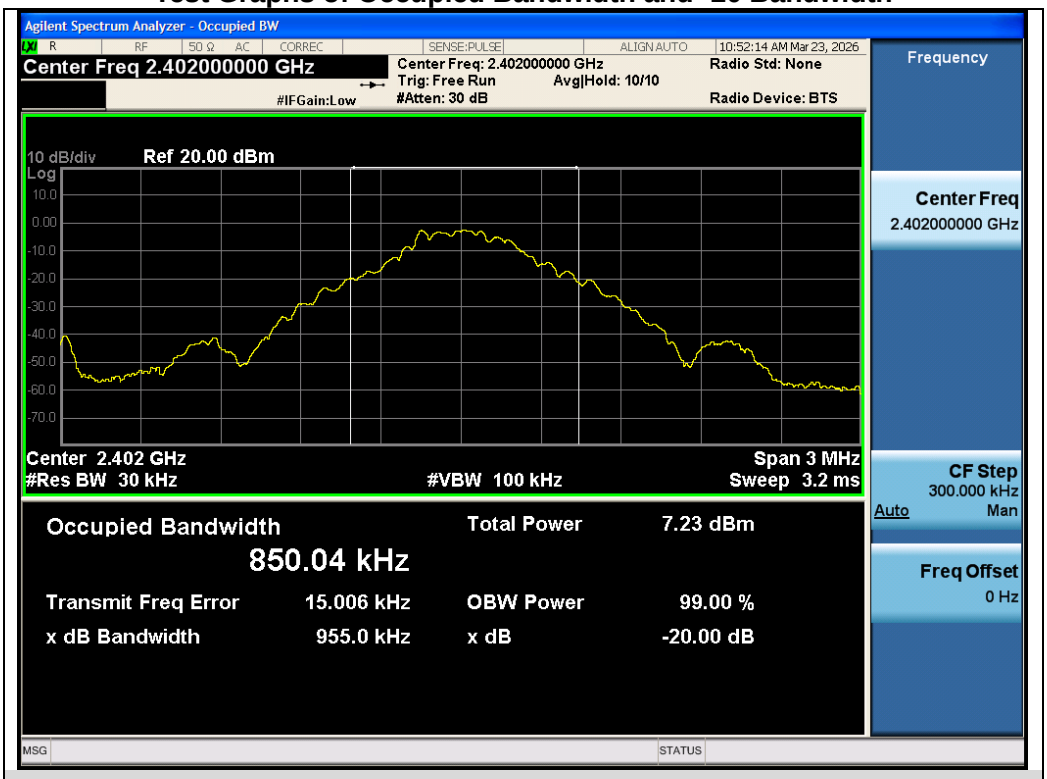
7.4 Measurement Results

Test Data of Occupied Bandwidth and -20dB Bandwidth					
Test Mode	Test Frequency (MHz)	99% Occupied Bandwidth (MHz)	-20dB Bandwidth (MHz)	Limits	Pass or Fail
GFSK	2402	0.850	0.955	N/A	Pass
	2441	0.850	0.956	N/A	Pass
	2480	0.852	0.960	N/A	Pass
π /4-DQPSK	2402	1.169	1.283	N/A	Pass
	2441	1.169	1.283	N/A	Pass
	2480	1.169	1.283	N/A	Pass
8DPSK	2402	1.178	1.299	N/A	Pass
	2441	1.177	1.301	N/A	Pass
	2480	1.178	1.301	N/A	Pass

Test Graphs of Occupied Bandwidth and -20 Bandwidth



Test_Graph_BR_ANT1_2402_1Mbps_OBW

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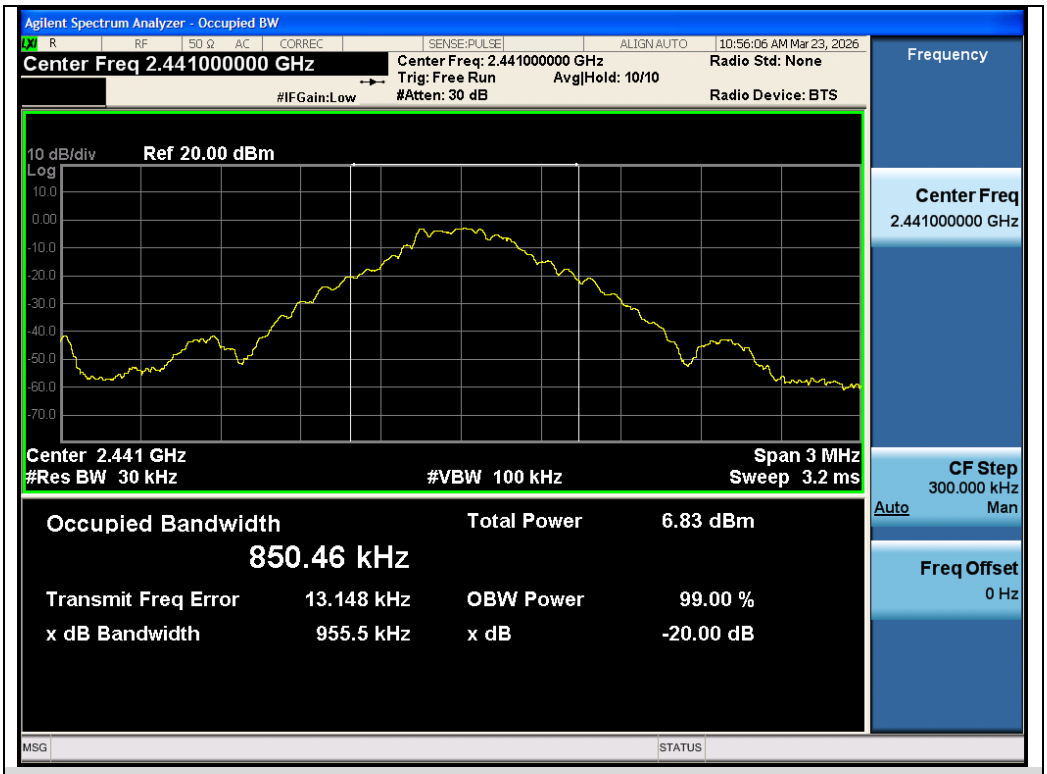
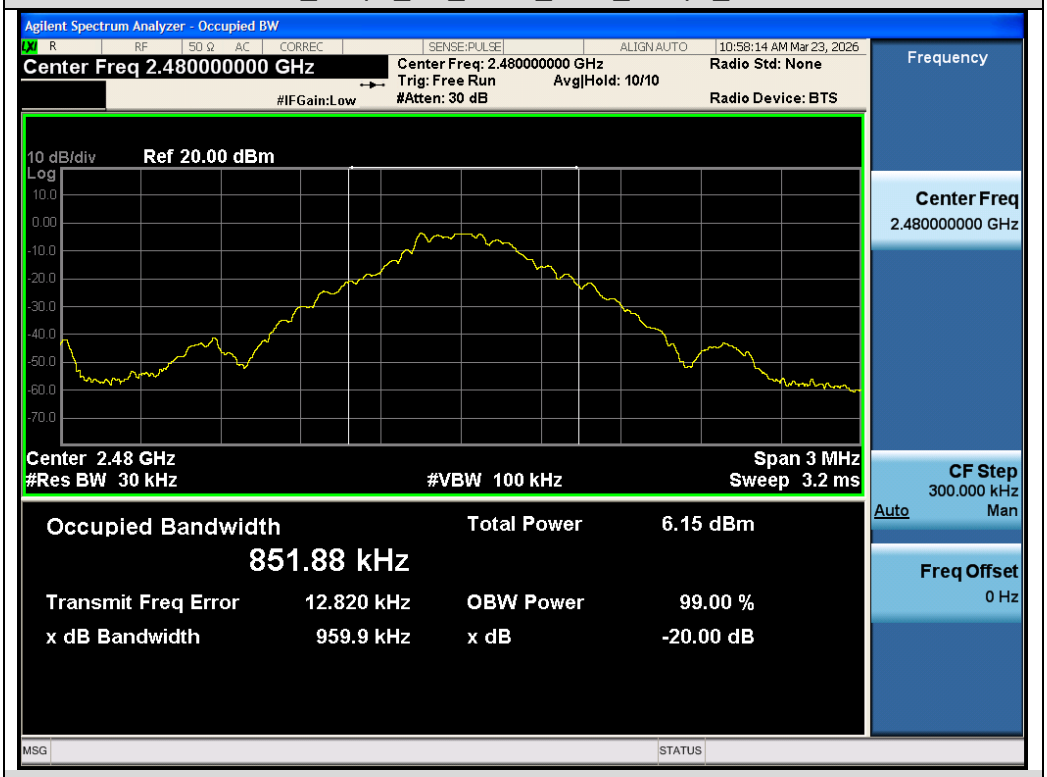


Test_Graph_BR_ANT1_2441_1Mbps_OBW



Test_Graph_BR_ANT1_2480_1Mbps_OBW

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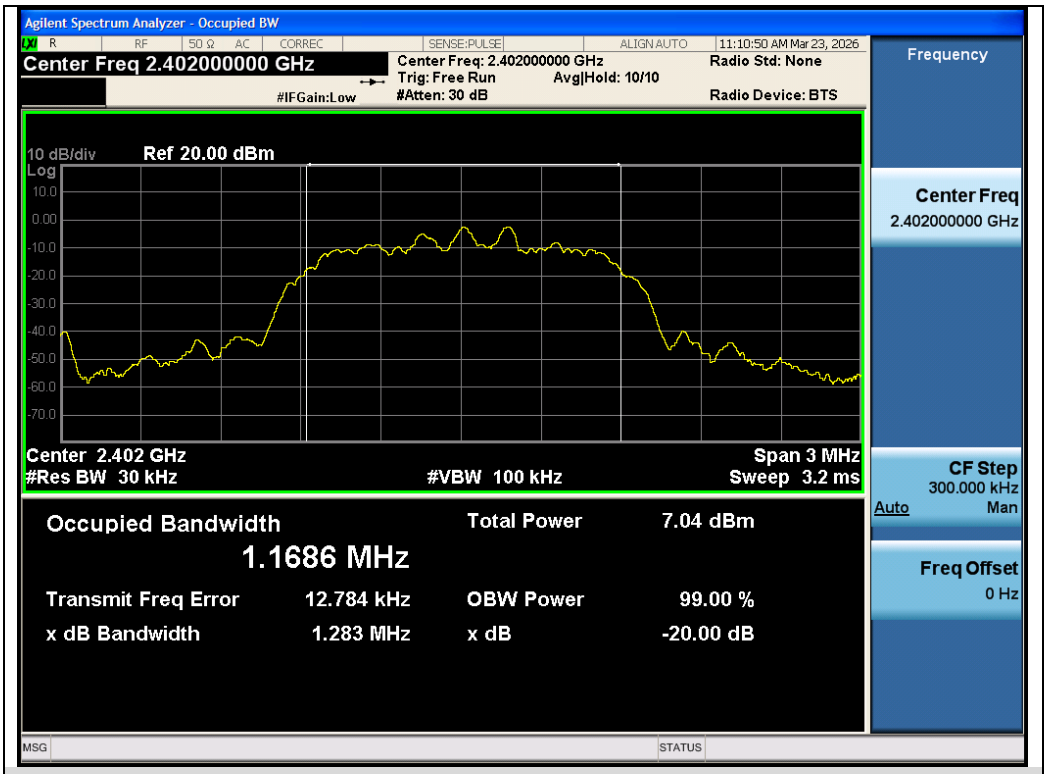
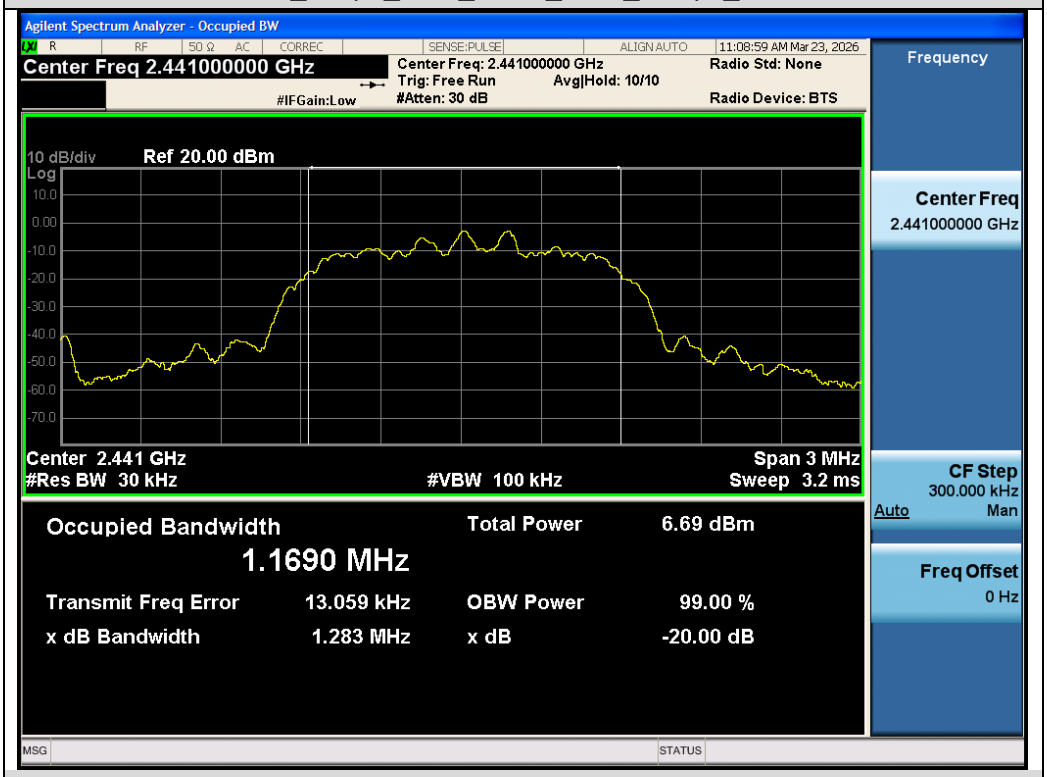


Test_Graph_EDR_ANT1_2402_2Mbps_OBW



Test_Graph_EDR_ANT1_2441_2Mbps_OBW

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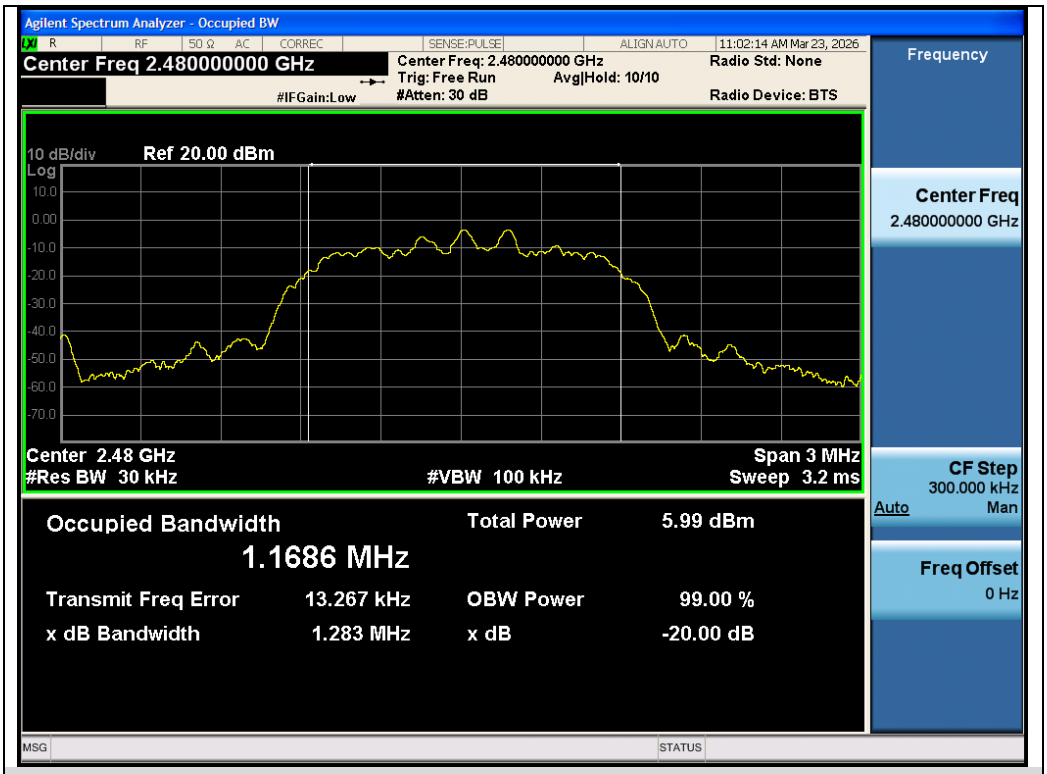
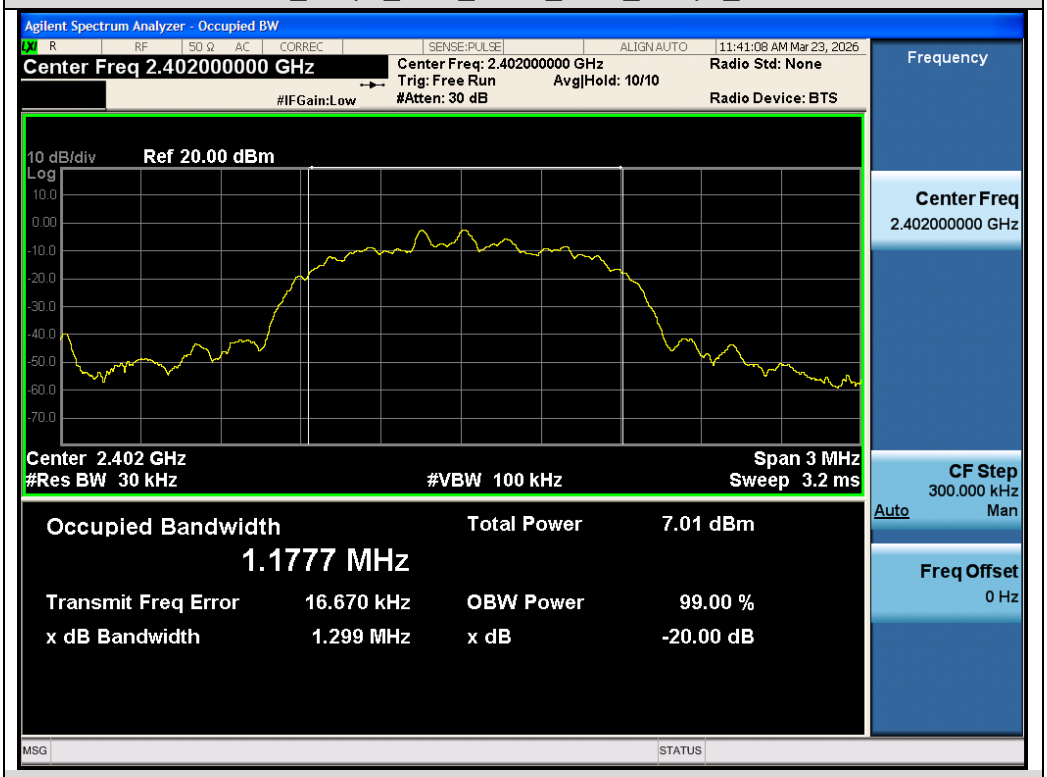


Test_Graph_EDR_ANT1_2480_2Mbps_OBW



Test_Graph_EDR_ANT1_2402_3Mbps_OBW

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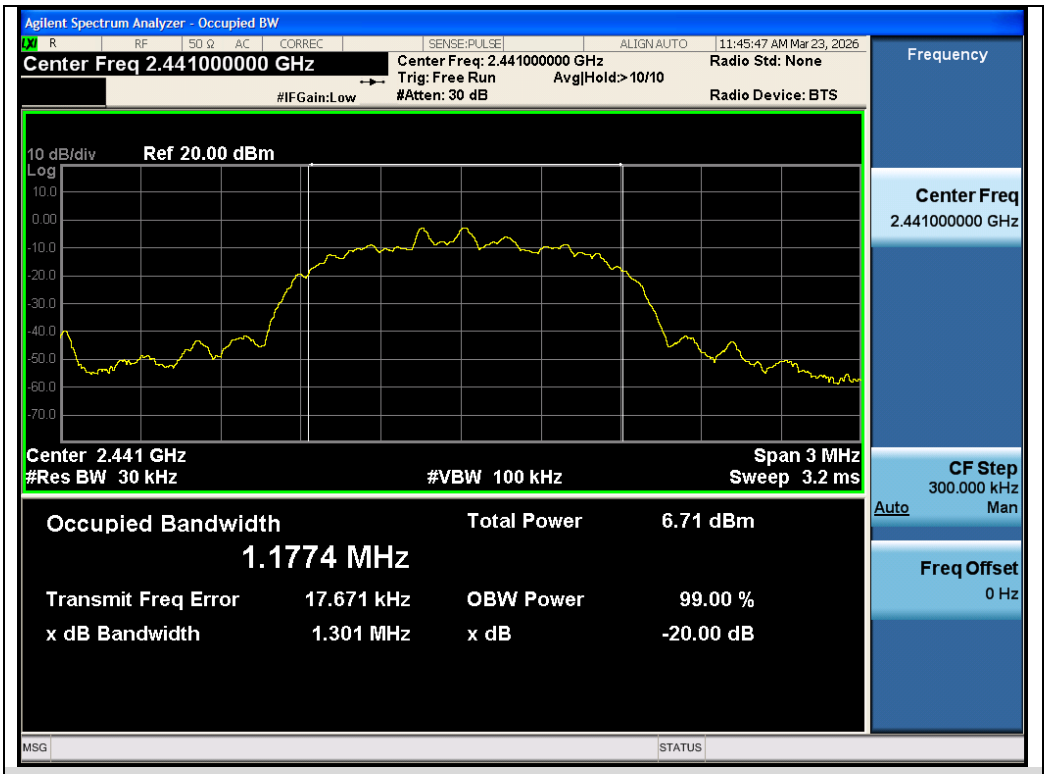
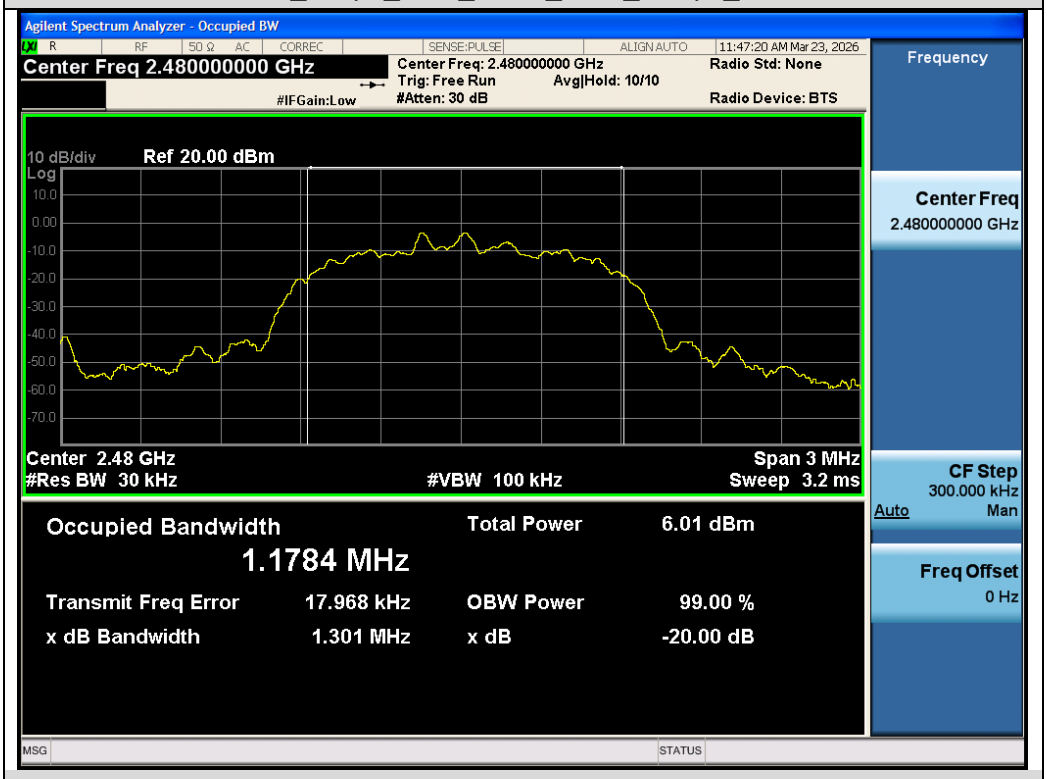


Test_Graph_EDR_ANT1_2441_3Mbps_OBW



Test_Graph_EDR_ANT1_2480_3Mbps_OBW

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

8.1 Provisions Applicable

In any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated intentional radiator is operating, the radio frequency power that is produced by the intentional radiator 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 the transmitter demonstrates compliance with the peak conducted or a radiated measurement, provided 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, the attenuation required under this paragraph shall be 30dB instead of 20dB

8.2 Measurement Procedure

The testing follows the ANSI C63.10 Section 6.10.4 and 7.8.7:

- Reference level measurement

1. Span = Wide enough to capture the peak level of the emission operating on the channel closest to the band edge, as well as any modulation products which fall outside of the authorized band of operation.
2. RBW = 100kHz
3. VBW = 300kHz
4. Detector = Peak
5. Sweep time = Auto couple
6. Trace mode = Max hold
7. Allow the trace to stabilize. Set the marker on the emission at the band edge, or on the highest modulation product outside of the band, if this level is greater than that at the band edge. Enable the marker-delta function, then use the marker-to-peak function to move the marker to the peak of the in-band emission.
8. Input compensation coefficient (dB) = Cable Loss (dB) + Attenuator attenuation value (dB)

- Emission level measurement

1. 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.
2. RBW = 100kHz
3. VBW = 300kHz
4. Detector = Peak
5. Sweep time = Auto couple
6. Trace mode = Max hold
7. Trace was allowed to stabilize
8. Set the marker on the peak of any spurious emission recorded. The level displayed must comply with the limit specified in this section.
9. Input compensation coefficient (dB) = Cable Loss (dB) + Attenuator attenuation value (dB)

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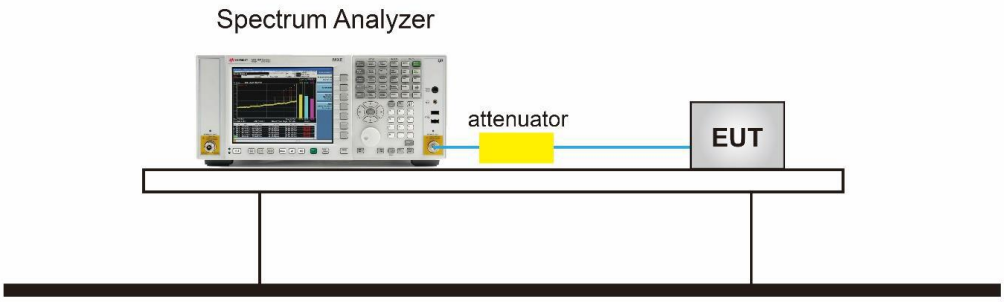
8.3 Measurement Setup (Block Diagram of Configuration)



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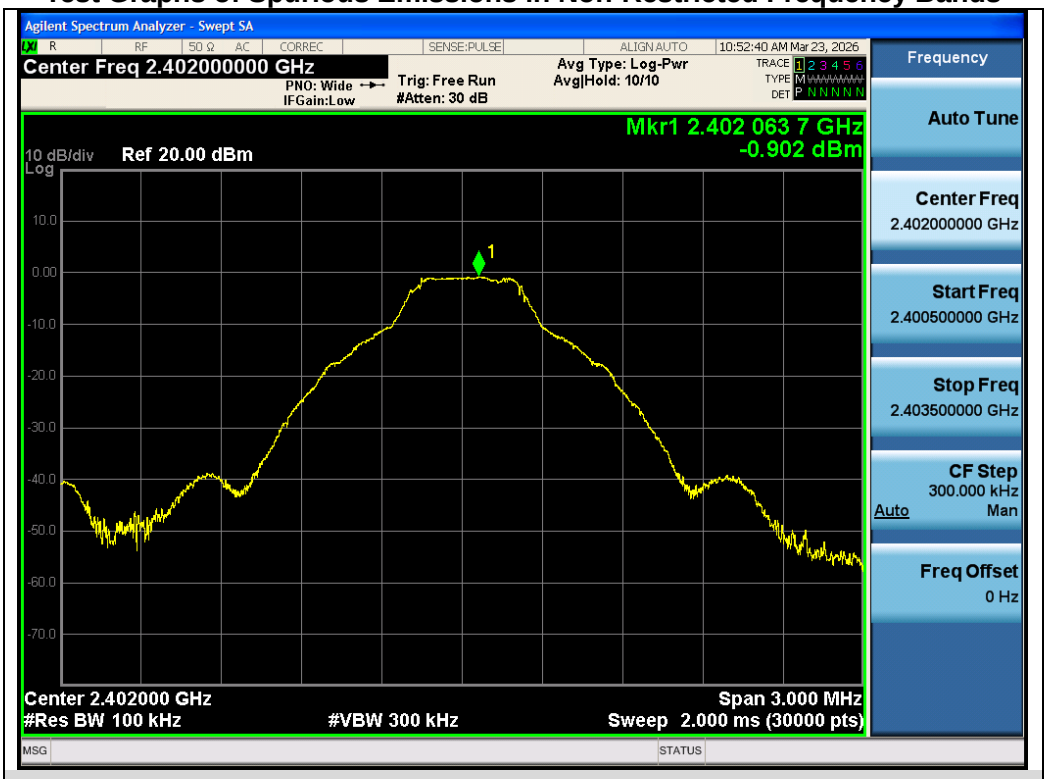
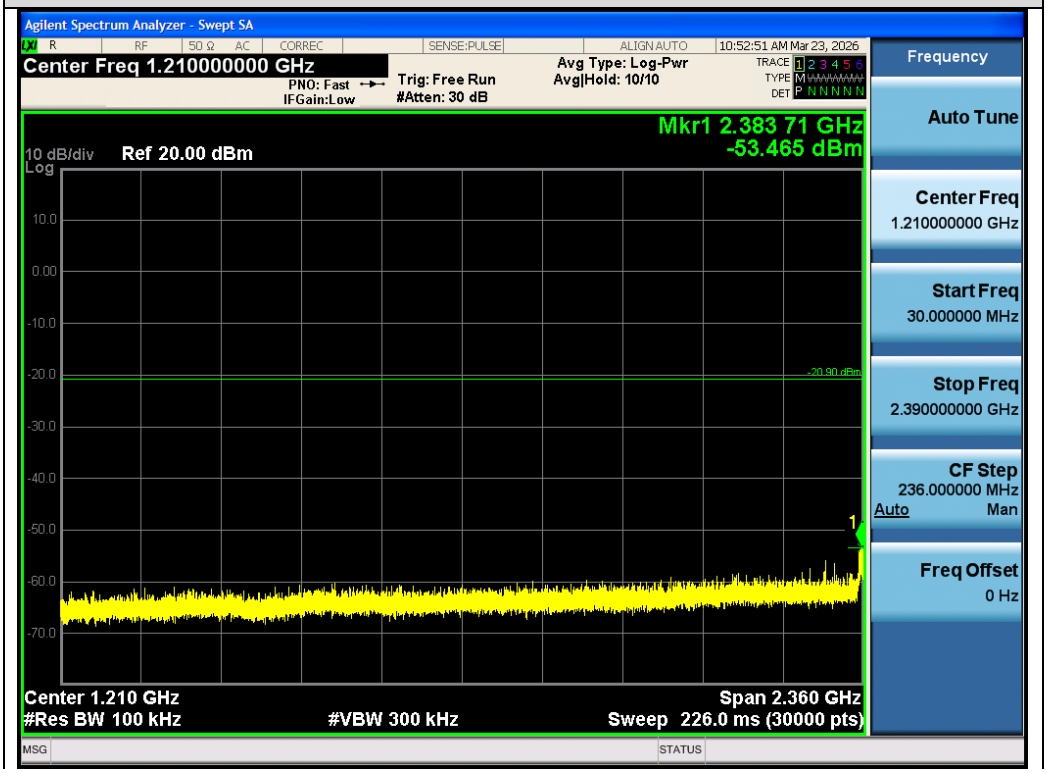
8.4 Measurement Results

Test Graphs of Spurious Emissions in Non-Restricted Frequency Bands



Test_Graph_BR_ANT1_2402_1Mbps_Reference Level



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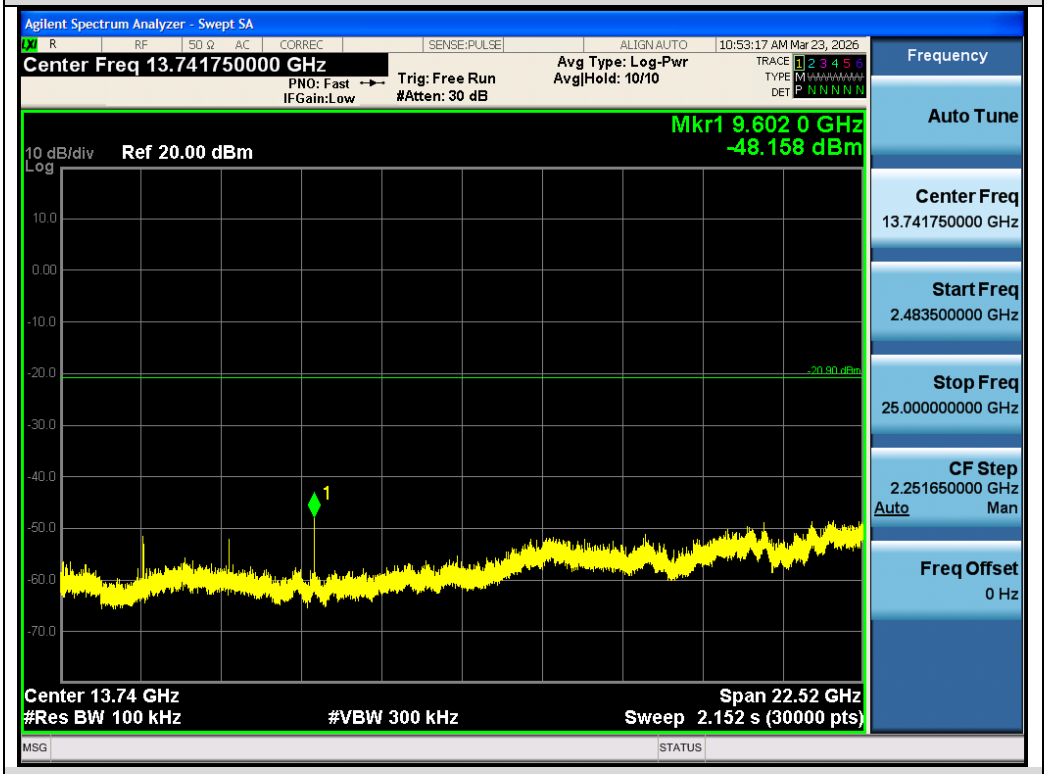
Test_Graph_BR_ANT1_2402_1Mbps_Lower Band Emissions



Test_Graph_BR_ANT1_2402_1Mbps_Higher Band Emissions

Test_Graph_BR_ANT1_2441_1Mbps_Reference Level

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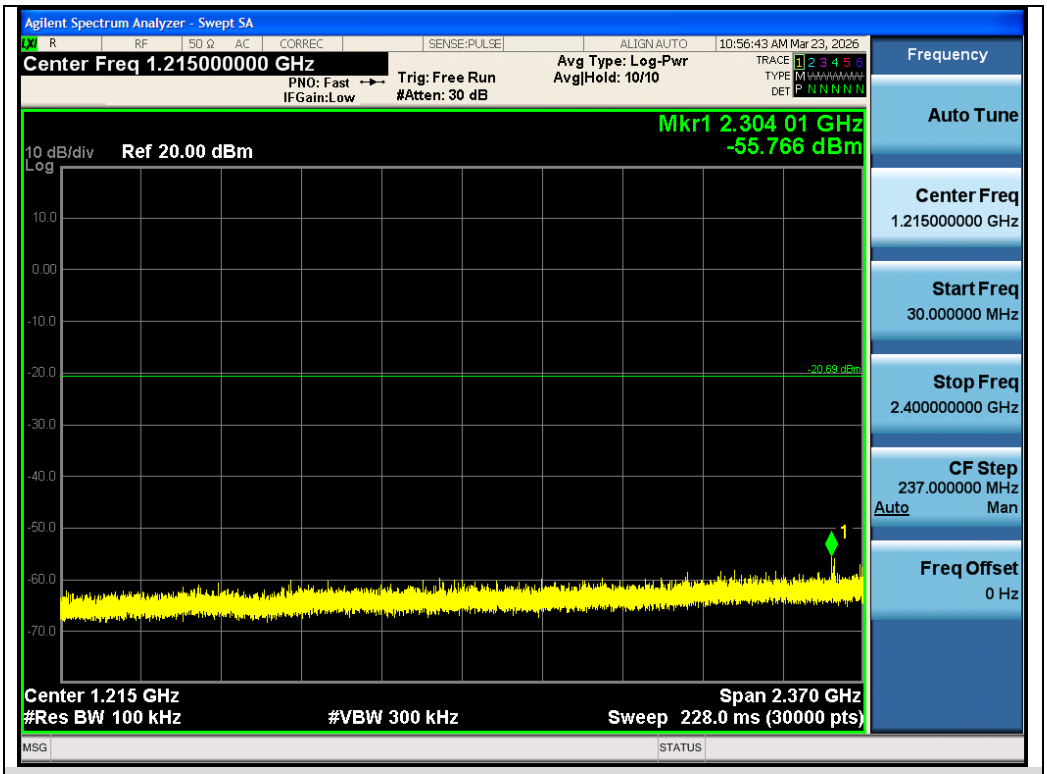
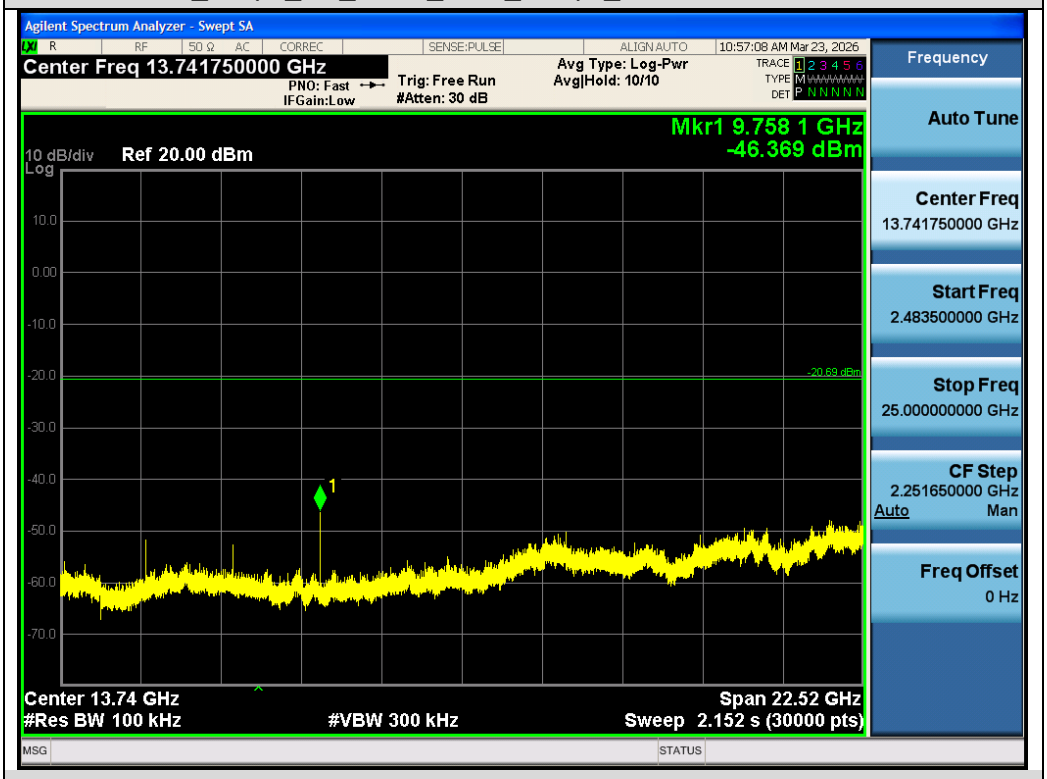


Test_Graph_BR_ANT1_2441_1Mbps_Lower Band Emissions



Test_Graph_BR_ANT1_2441_1Mbps_Higher Band Emissions

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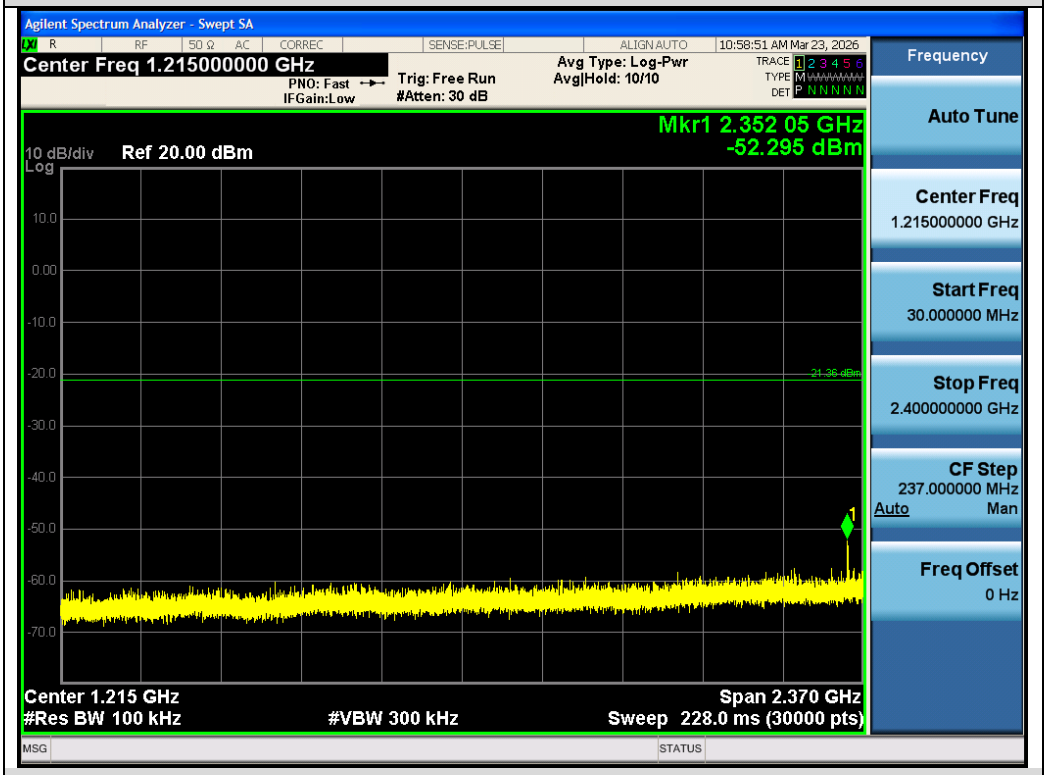
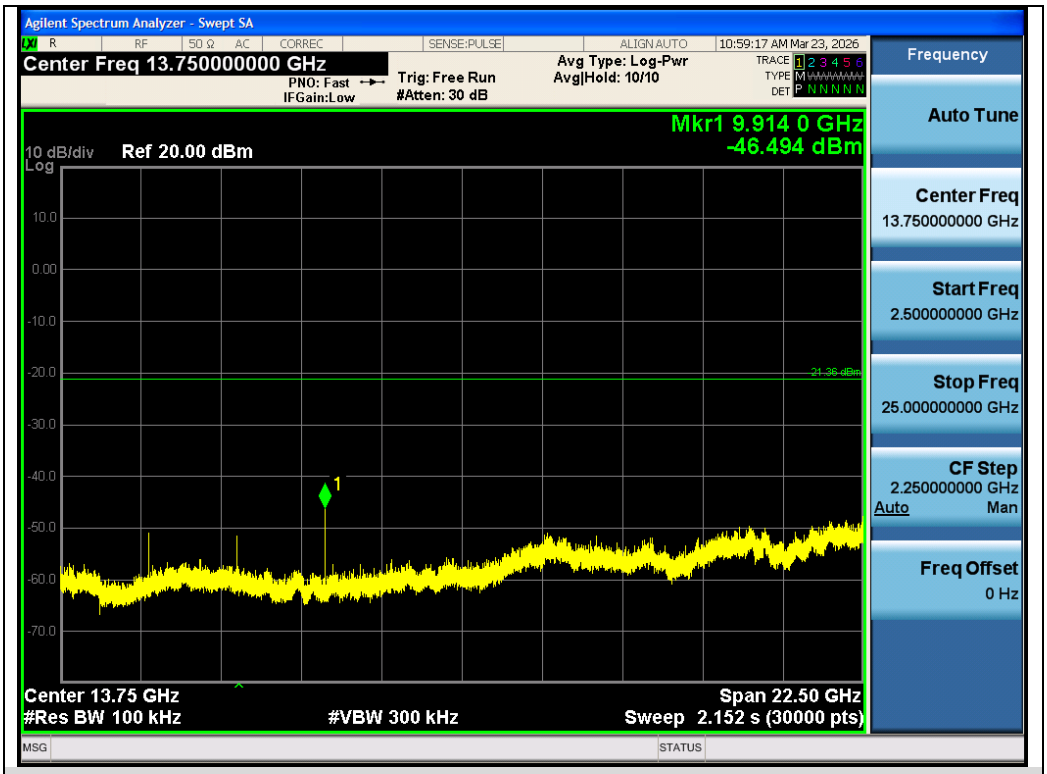
Test_Graph_BR_ANT1_2480_1Mbps_Reference Level

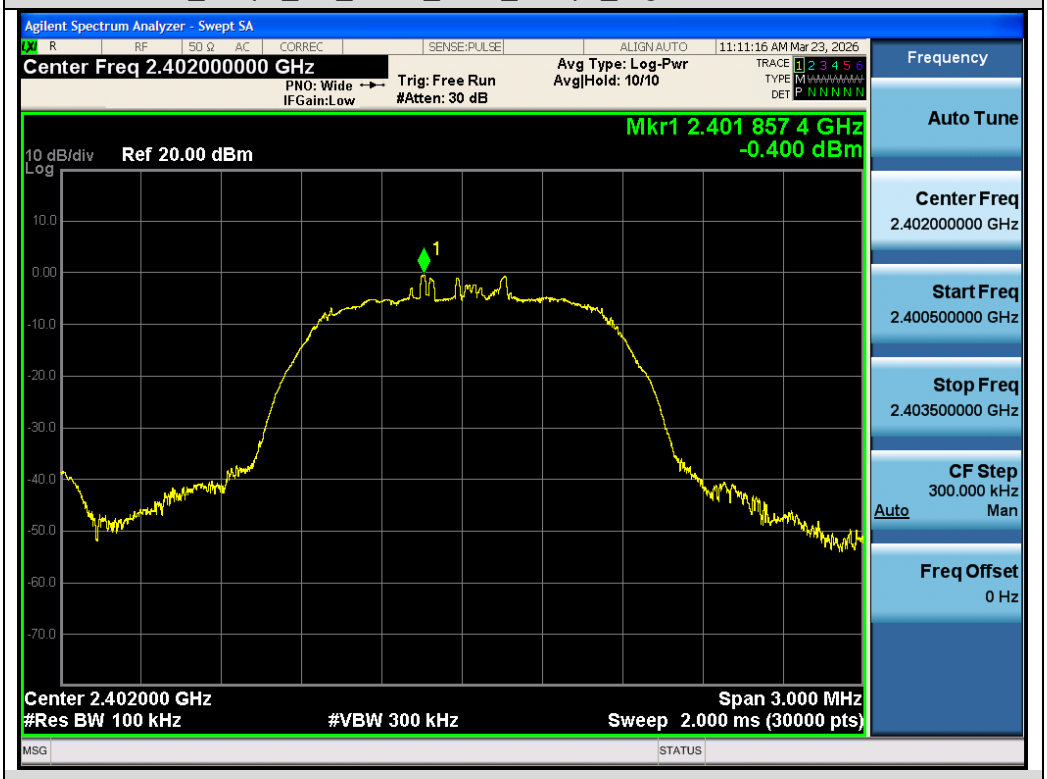


Test_Graph_BR_ANT1_2480_1Mbps_Lower Band Emissions

Any report having not been signed by authorized approver, or having been altered without authorization, or having not been stamped by the "Dedicated Testing/Inspection Stamp" is deemed to be invalid. Copying or excerpting portion of, or altering the content of the report is not permitted without the written authorization of AGC. The test results presented in the report apply only to the tested sample. Any objections to report issued by AGC should be submitted to AGC within 15days after the issuance of the test report. Further enquiry of validity or verification of the test report should be addressed to AGC by agc01@agccert.com.



Test_Graph_BR_ANT1_2480_1Mbps_Higher Band Emissions



Test_Graph_EDR_ANT1_2402_2Mbps_Reference Level

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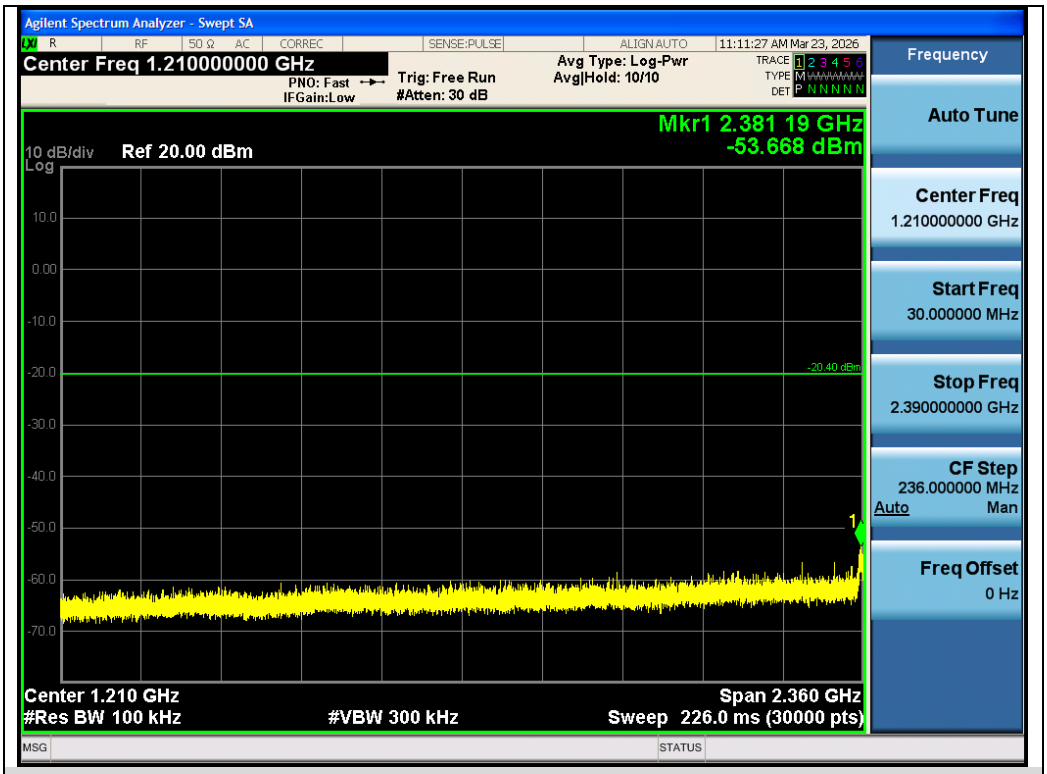
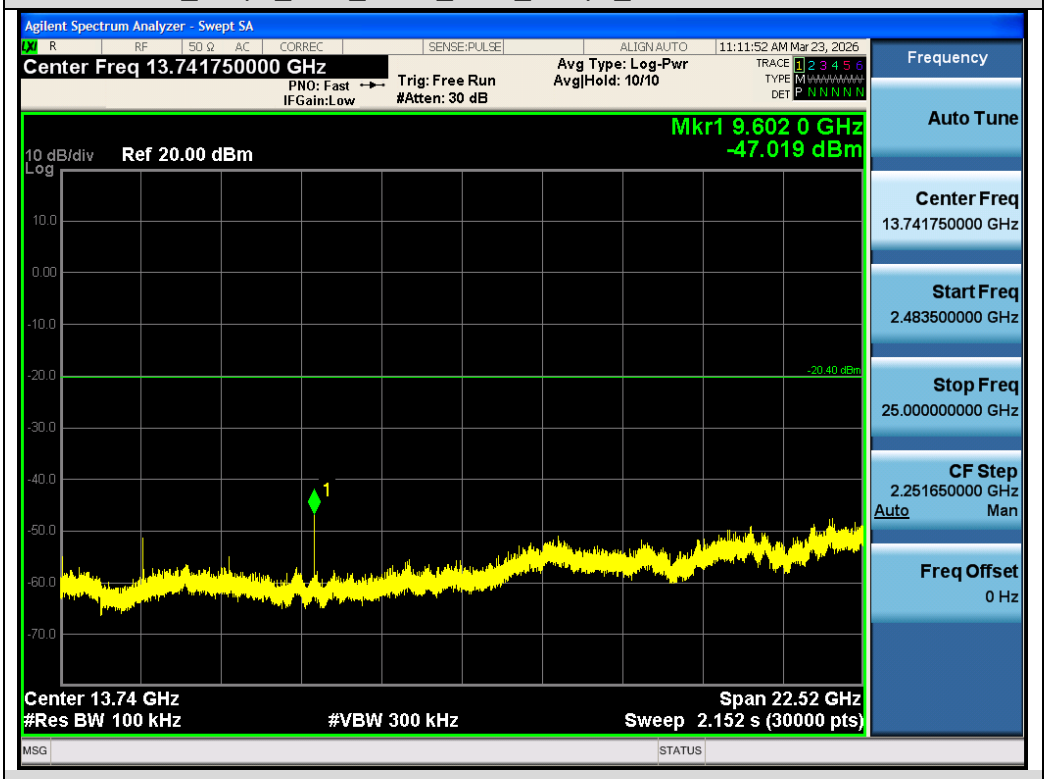


Test_Graph_EDR_ANT1_2402_2Mbps_Lower Band Emissions



Test_Graph_EDR_ANT1_2402_2Mbps_Higher Band Emissions

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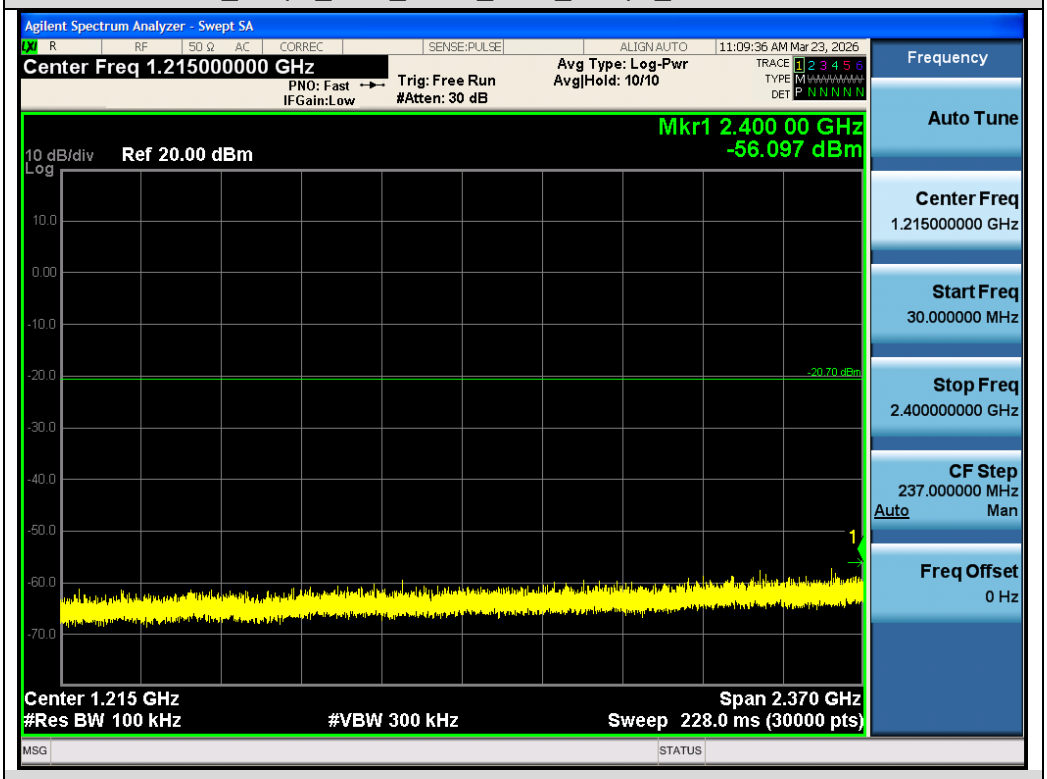
Test_Graph_EDR_ANT1_2441_2Mbps_Reference Level



Test_Graph_EDR_ANT1_2441_2Mbps_Lower Band Emissions

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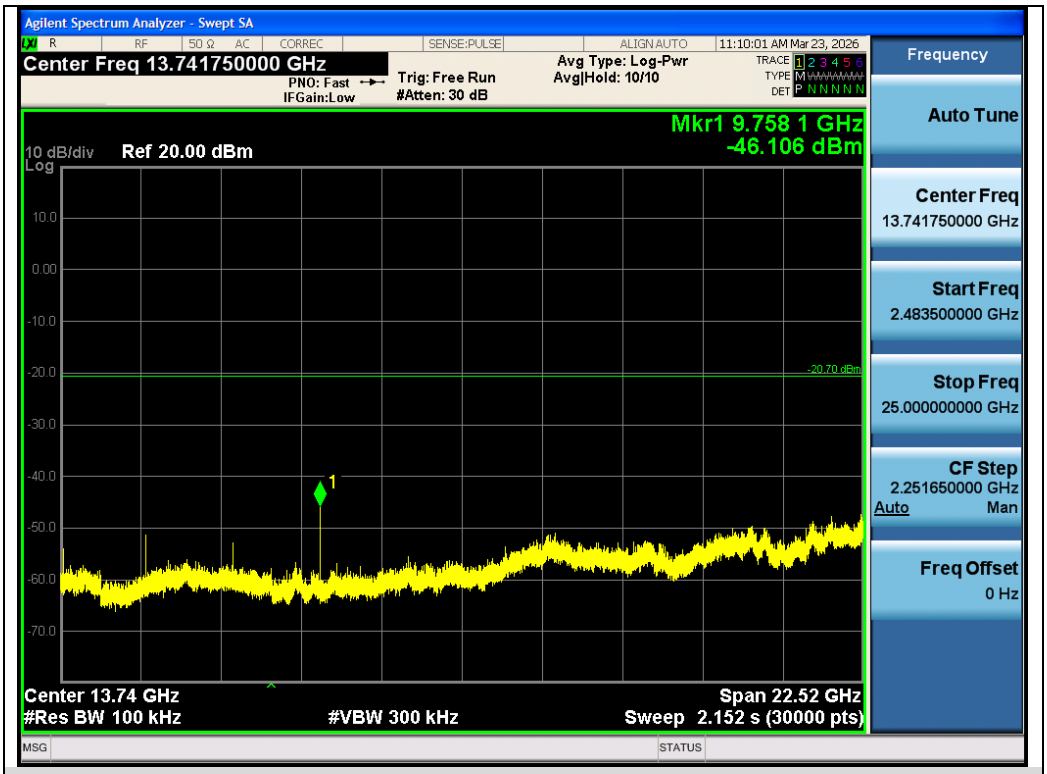
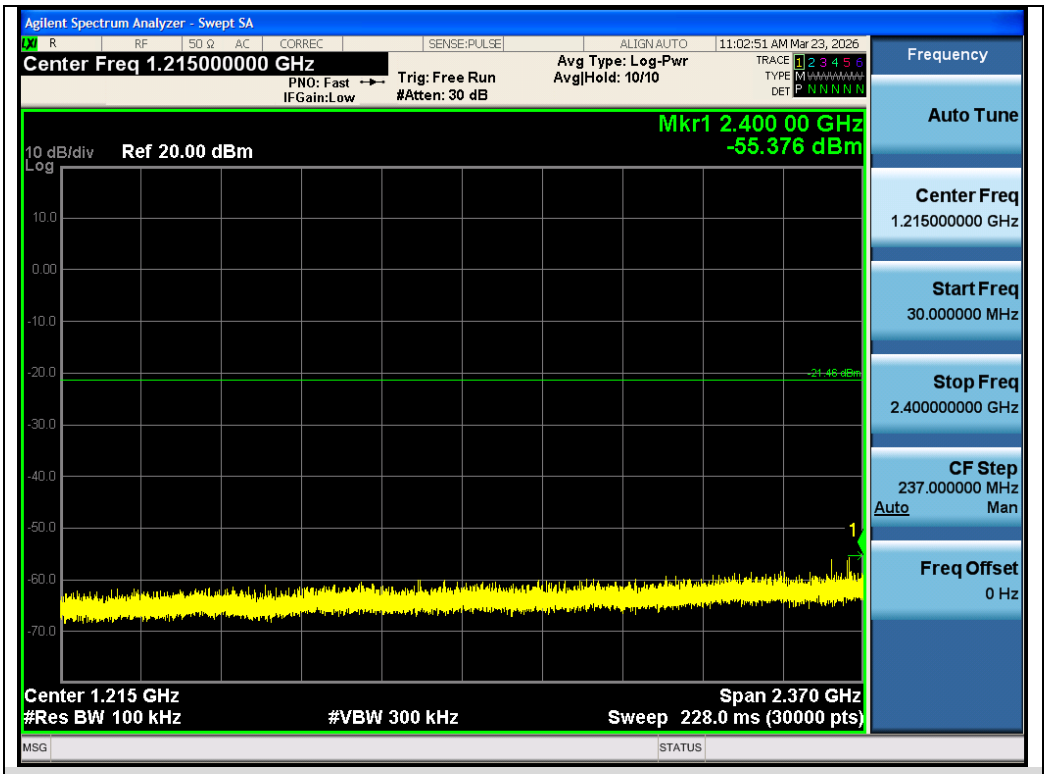


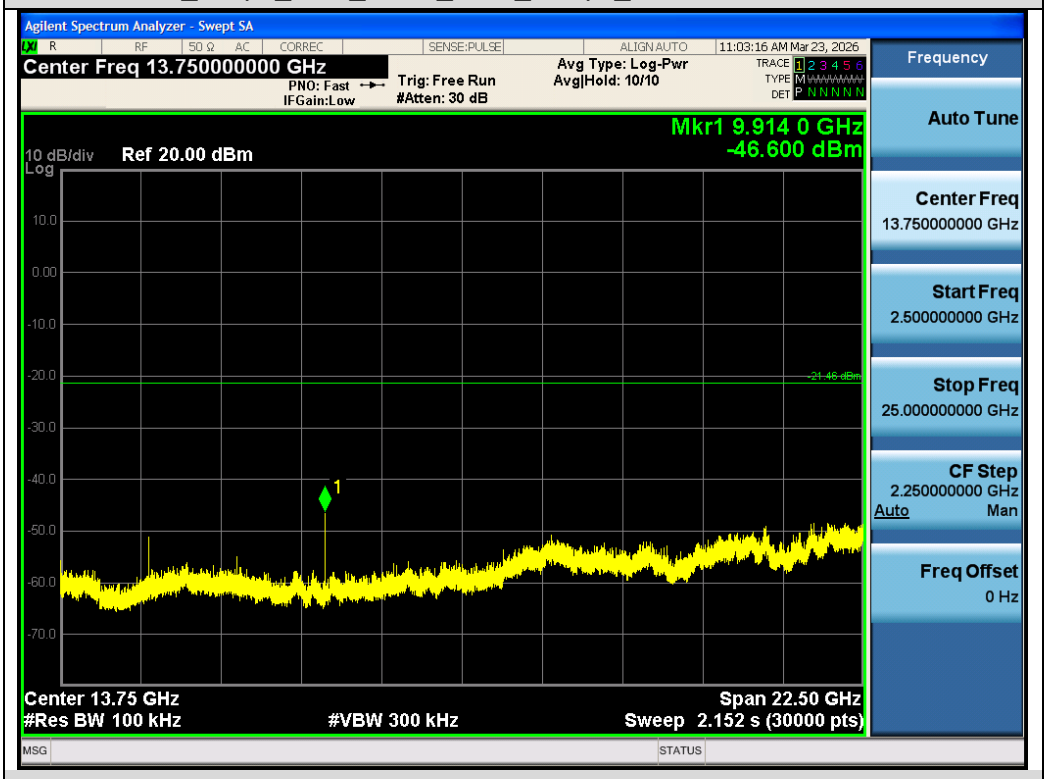
Test_Graph_EDR_ANT1_2441_2Mbps_Higher Band Emissions

Test_Graph_EDR_ANT1_2480_2Mbps_Reference Level

Any report having not been signed by authorized approver, or having been altered without authorization, or having not been stamped by the "Dedicated Testing/Inspection Stamp" is deemed to be invalid. Copying or excerpting portion of, or altering the content of the report is not permitted without the written authorization of AGC. The test results presented in the report apply only to the tested sample. Any objections to report issued by AGC should be submitted to AGC within 15days after the issuance of the test report. Further enquiry of validity or verification of the test report should be addressed to AGC by agc01@agccert.com.



Test_Graph_EDR_ANT1_2480_2Mbps_Lower Band Emissions



Test_Graph_EDR_ANT1_2480_2Mbps_Higher Band Emissions

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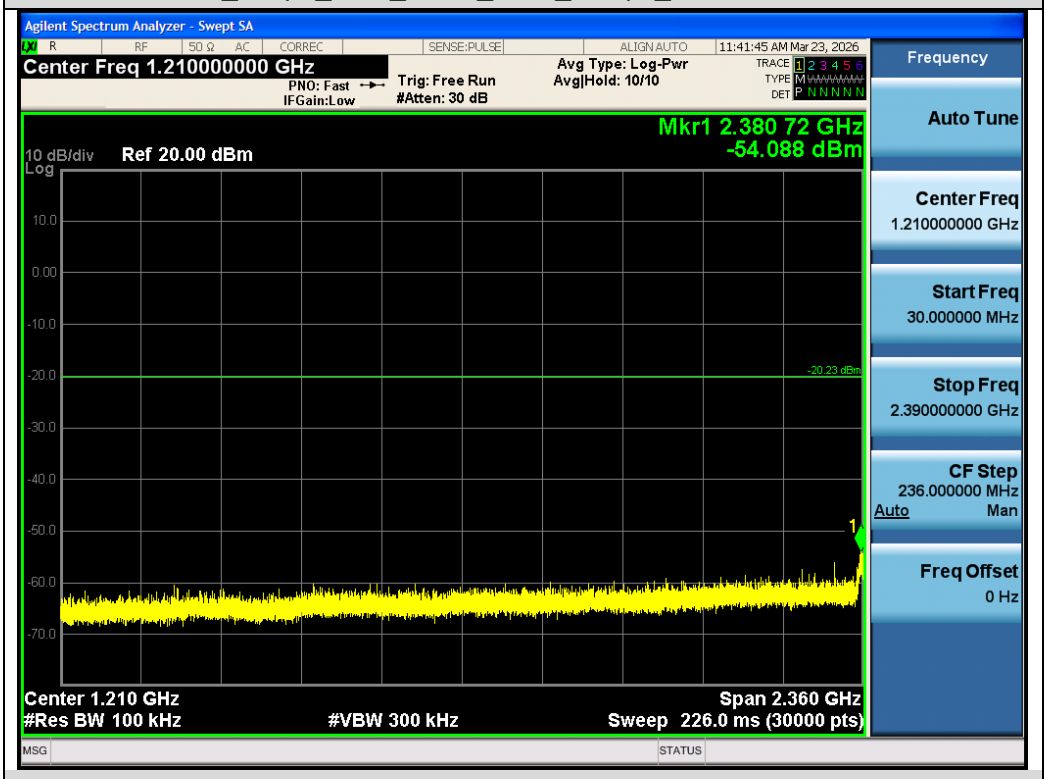
Test_Graph_EDR_ANT1_2402_3Mbps_Reference Level



Test_Graph_EDR_ANT1_2402_3Mbps_Lower Band Emissions

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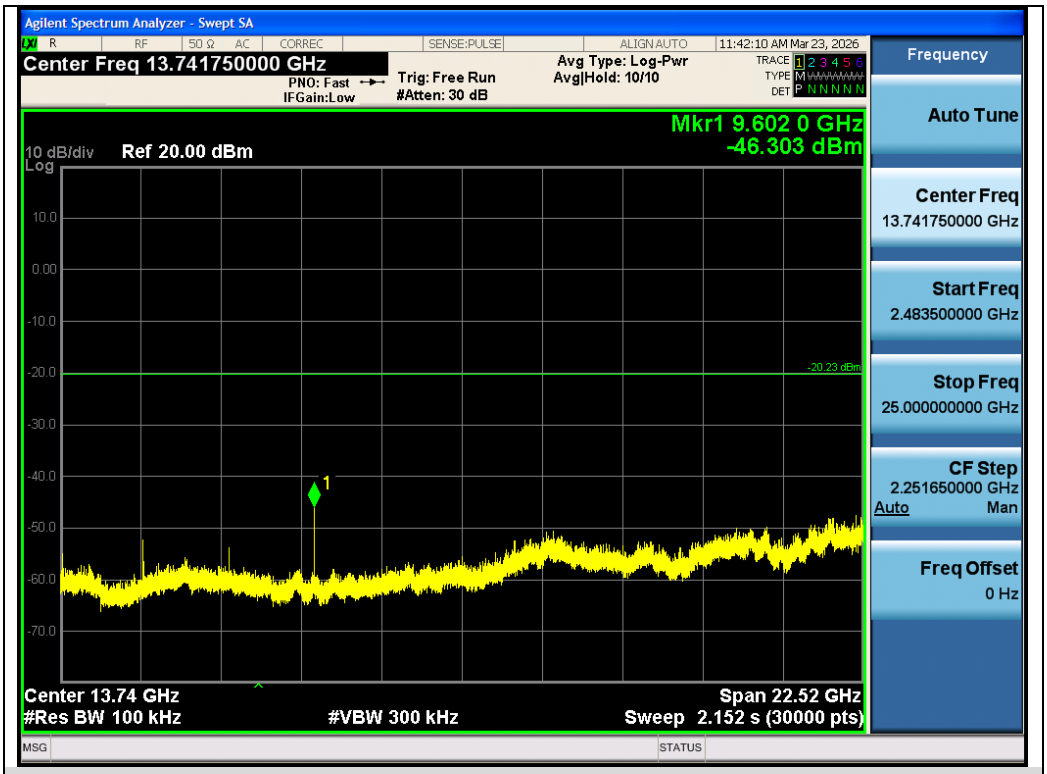
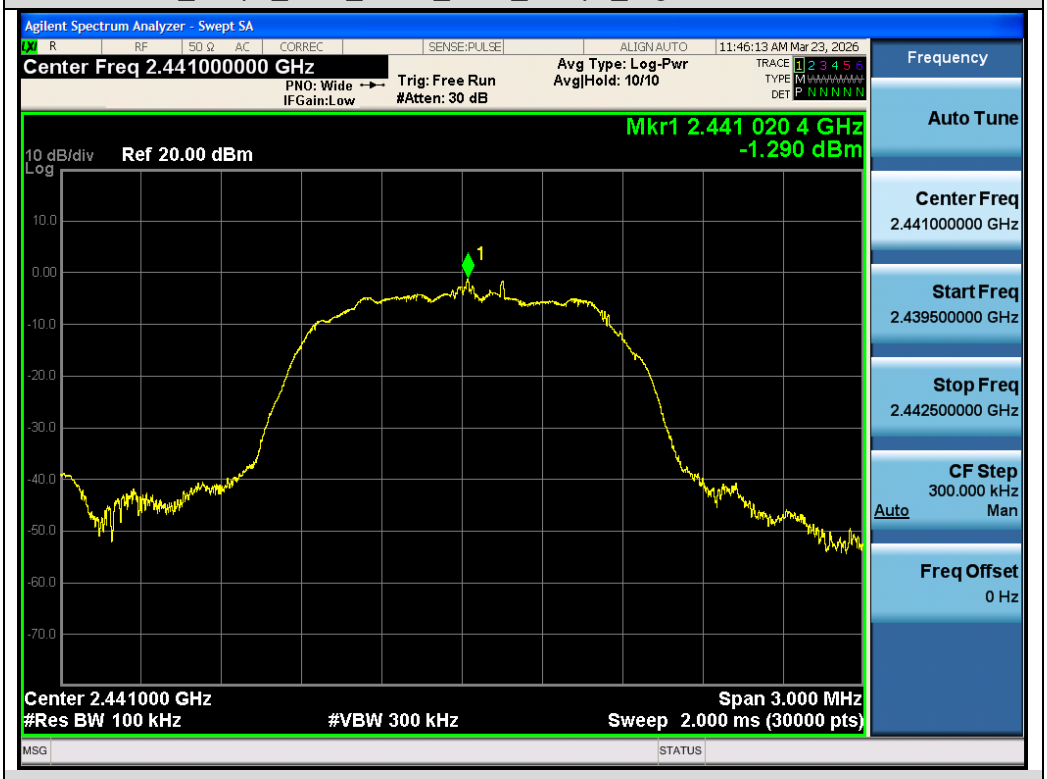


Test_Graph_EDR_ANT1_2402_3Mbps_Higher Band Emissions



Test_Graph_EDR_ANT1_2441_3Mbps_Reference Level

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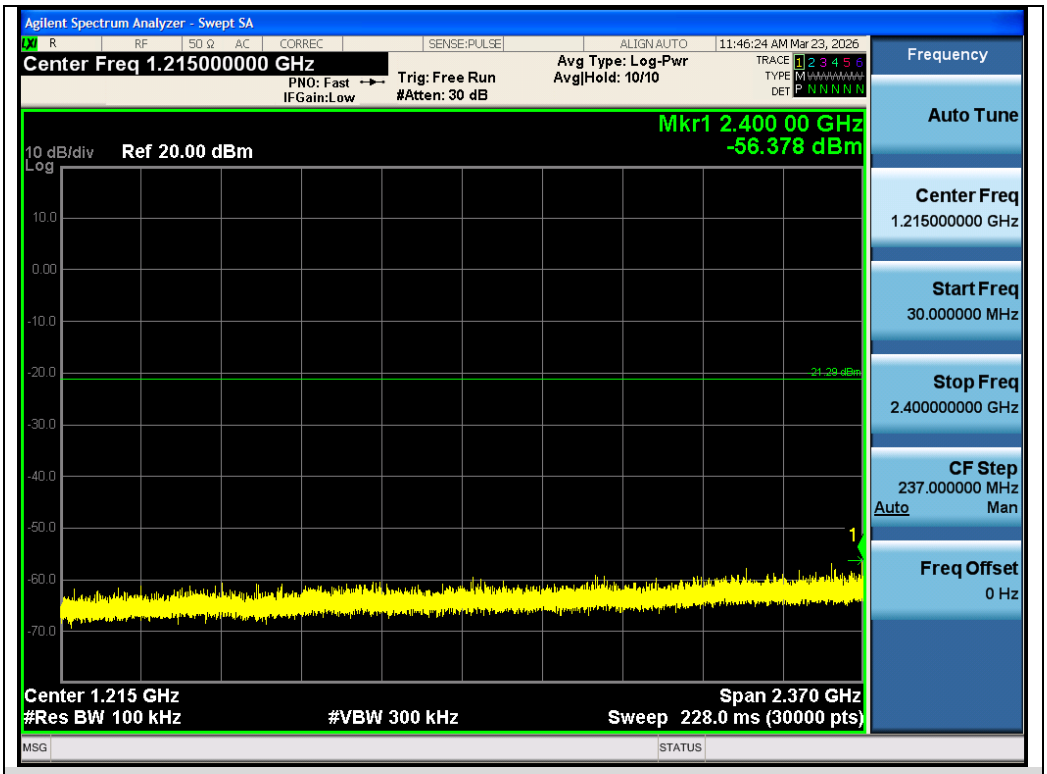
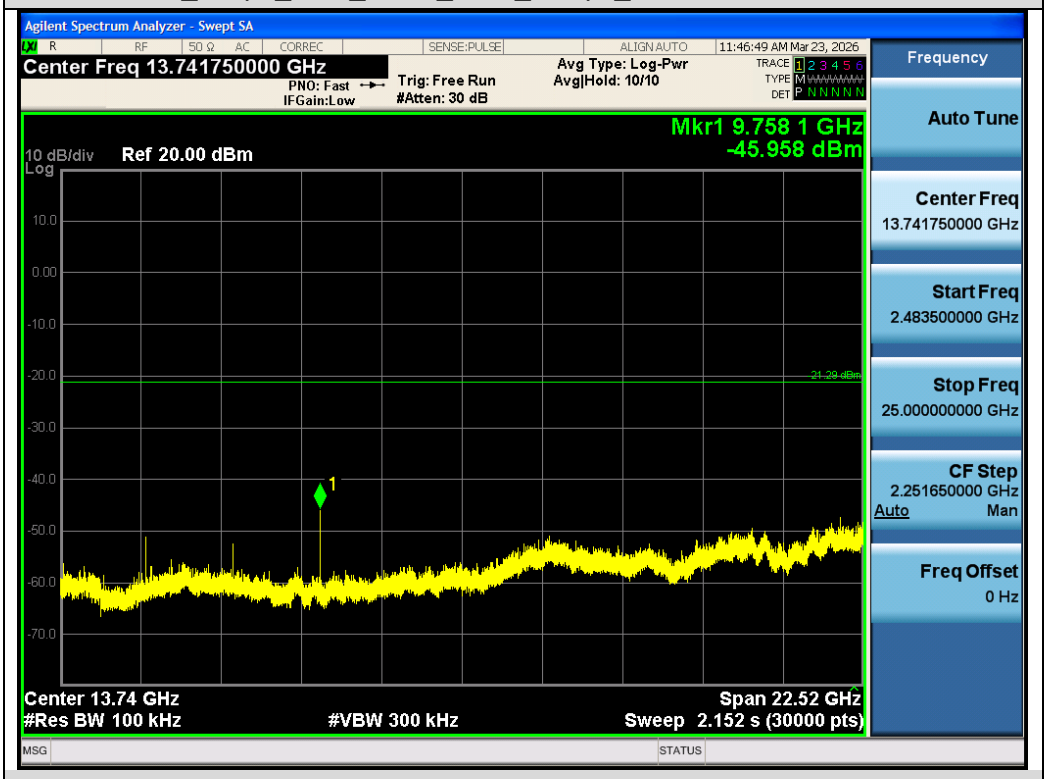


Test_Graph_EDR_ANT1_2441_3Mbps_Lower Band Emissions



Test_Graph_EDR_ANT1_2441_3Mbps_Higher Band Emissions

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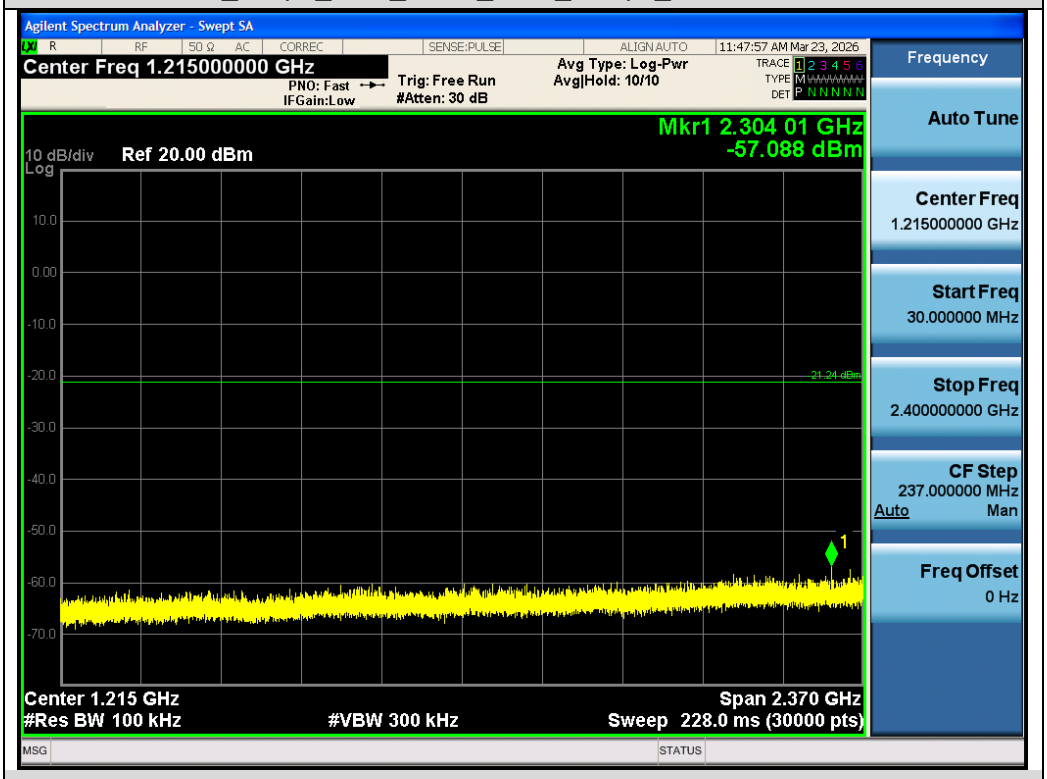
Test_Graph_EDR_ANT1_2480_3Mbps_Reference Level



Test_Graph_EDR_ANT1_2480_3Mbps_Lower Band Emissions

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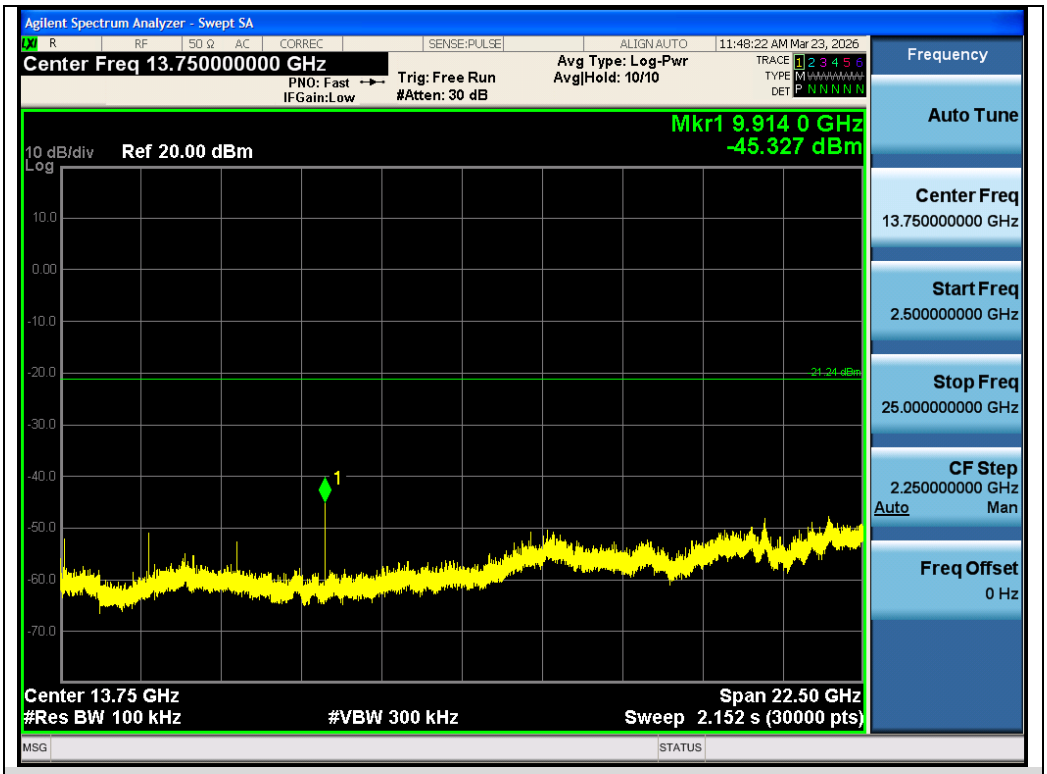

Test_Graph_EDR_ANT1_2480_3Mbps_Higher Band Emissions

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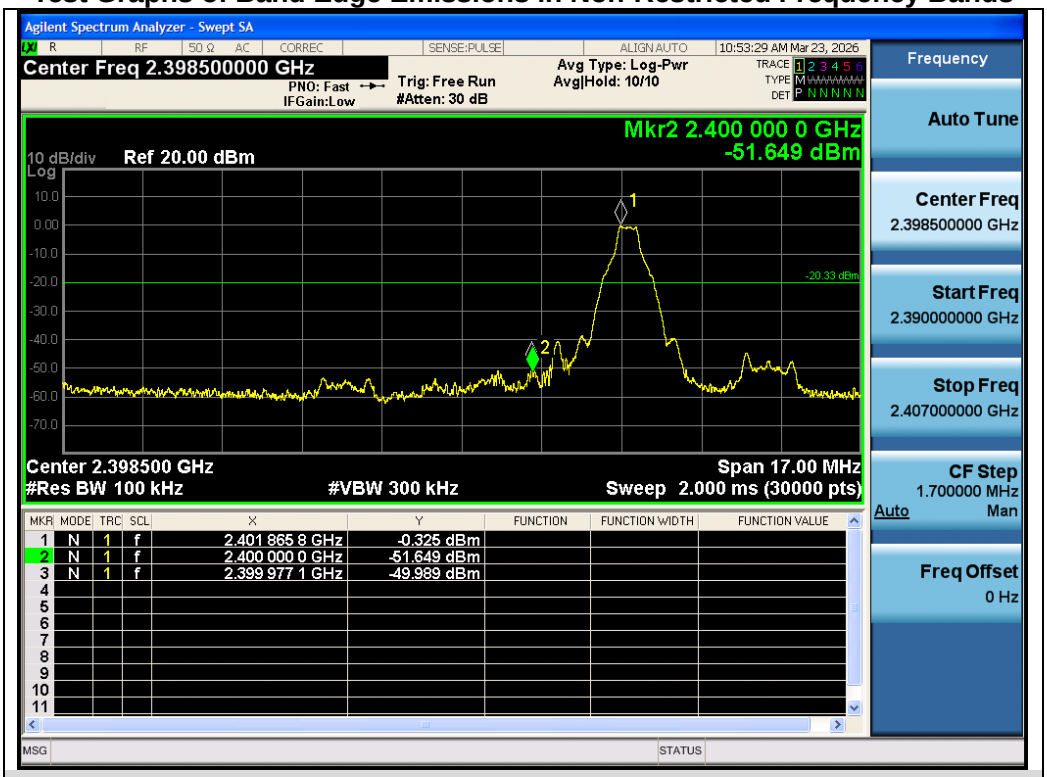
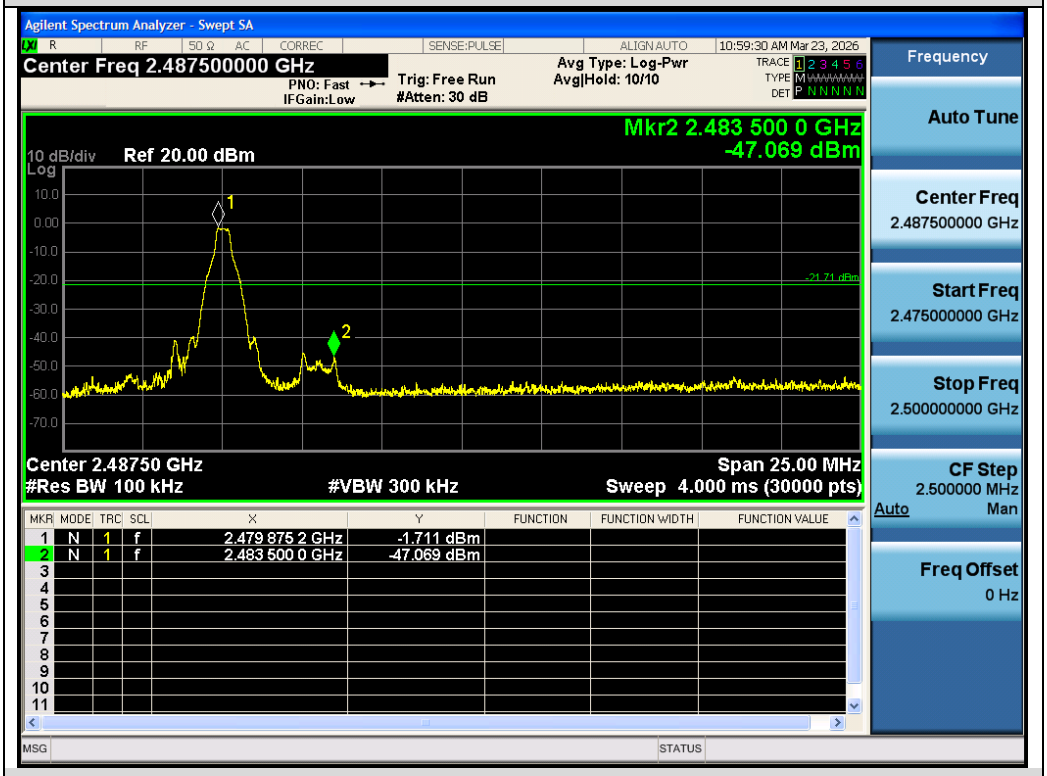
Test Graphs of Band Edge Emissions in Non-Restricted Frequency Bands



Test_Graph_BR_ANT1_2402_1Mbps_Lower Band Edge Emissions



Test_Graph_BR_ANT1_2480_1Mbps_Higher Band Edge Emissions

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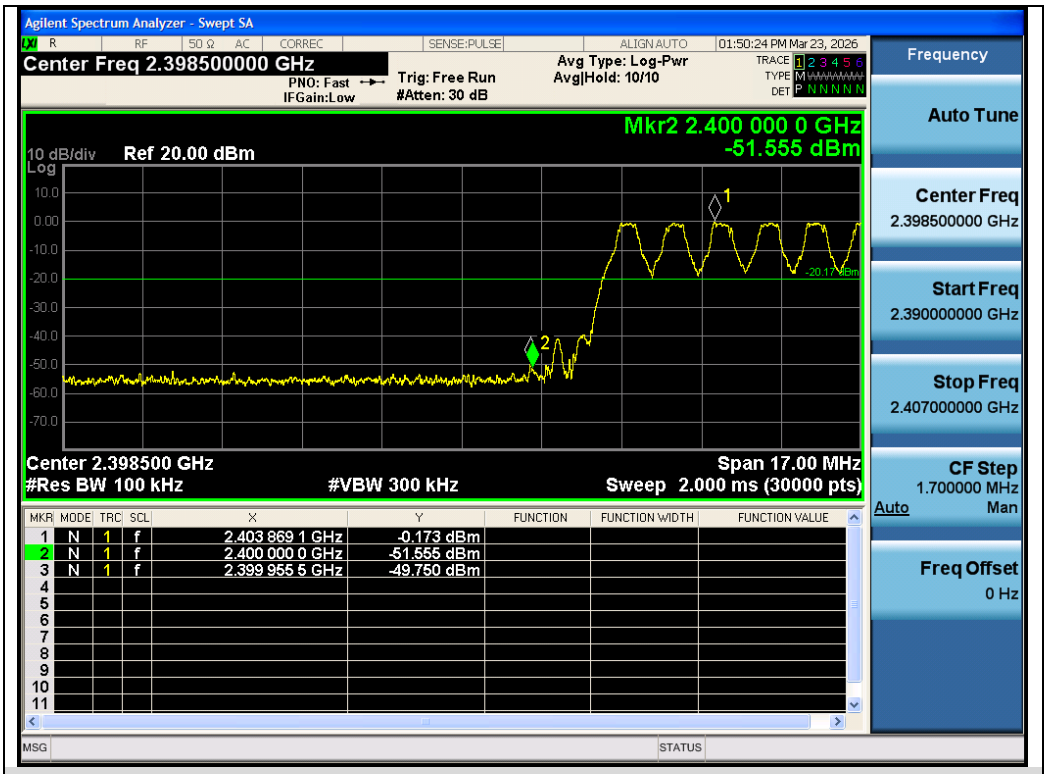
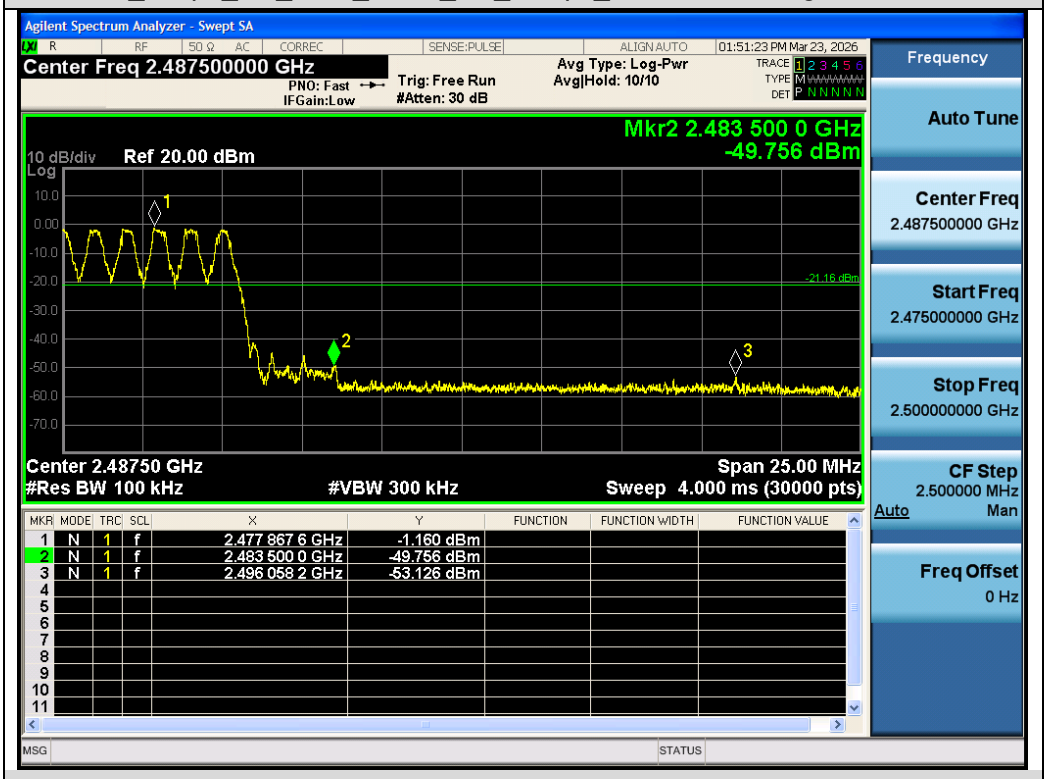


Test_Graph_BR_HOP_ANT1_NA_1Mbps_Lower Band Edge Emissions



Test_Graph_BR_HOP_ANT1_NA_1Mbps_Higher Band Edge Emissions

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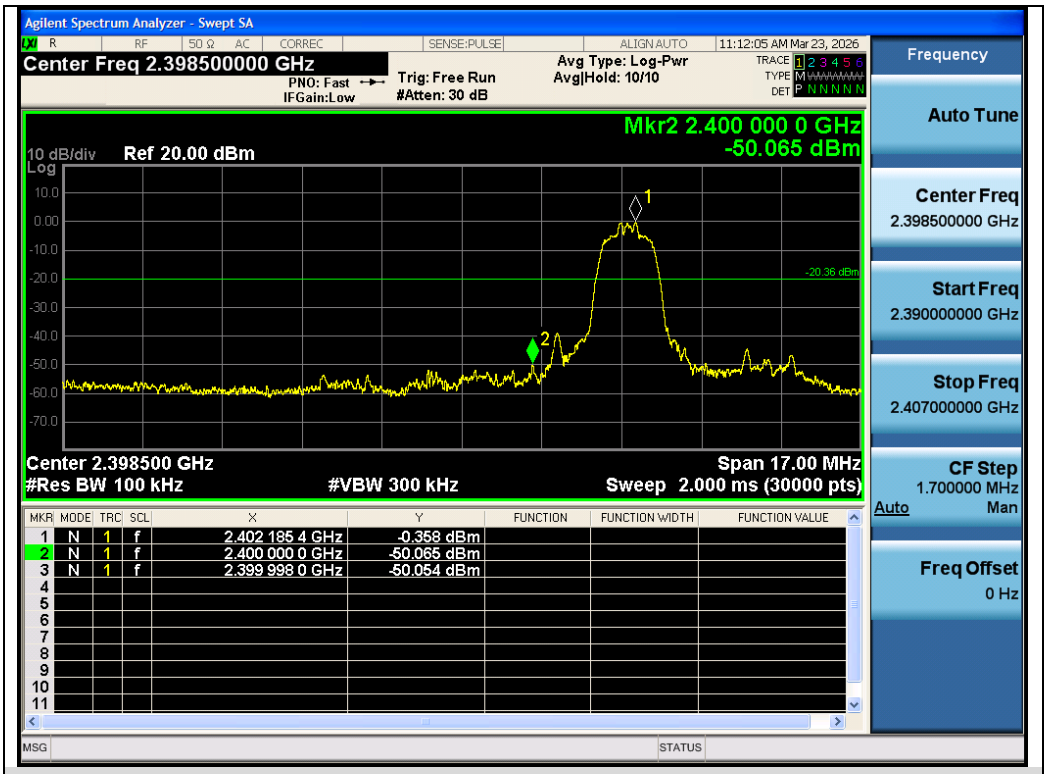
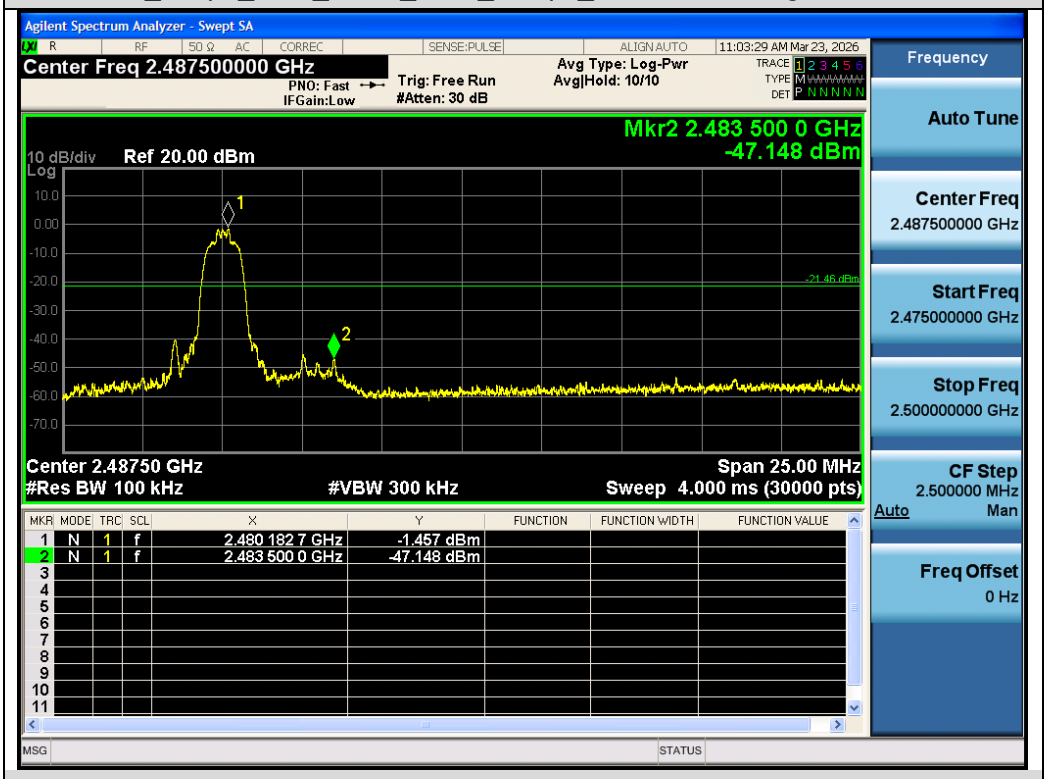


Test_Graph_EDR_ANT1_2402_2Mbps_Lower Band Edge Emissions



Test_Graph_EDR_ANT1_2480_2Mbps_Higher Band Edge Emissions

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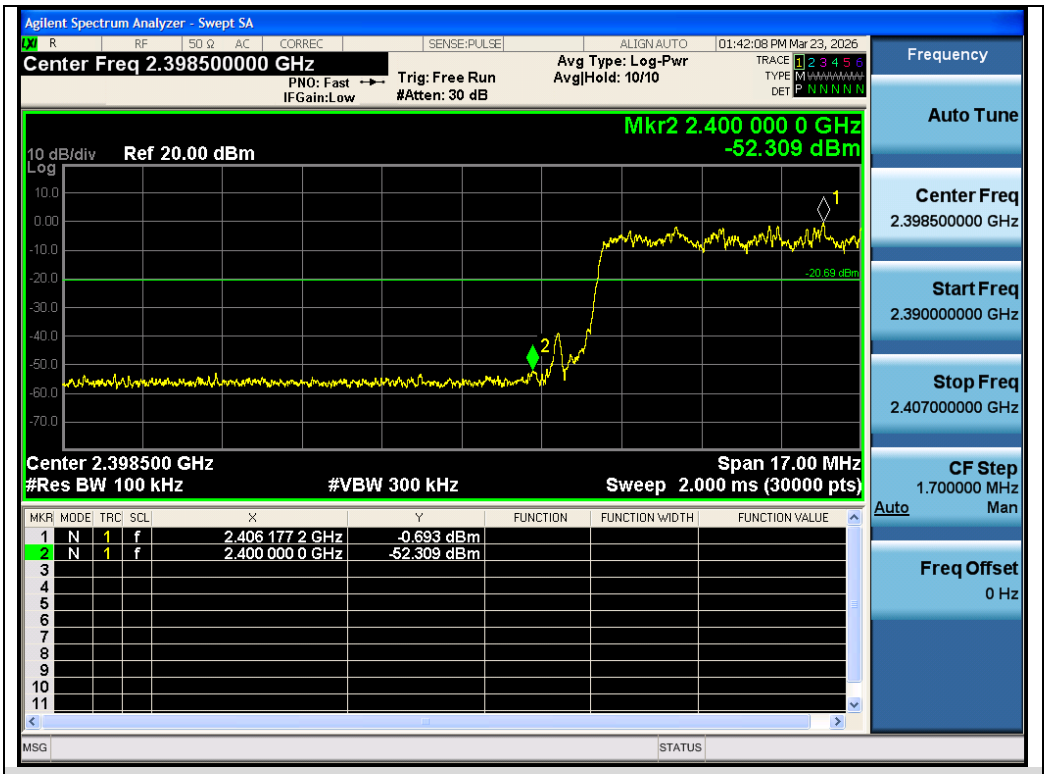
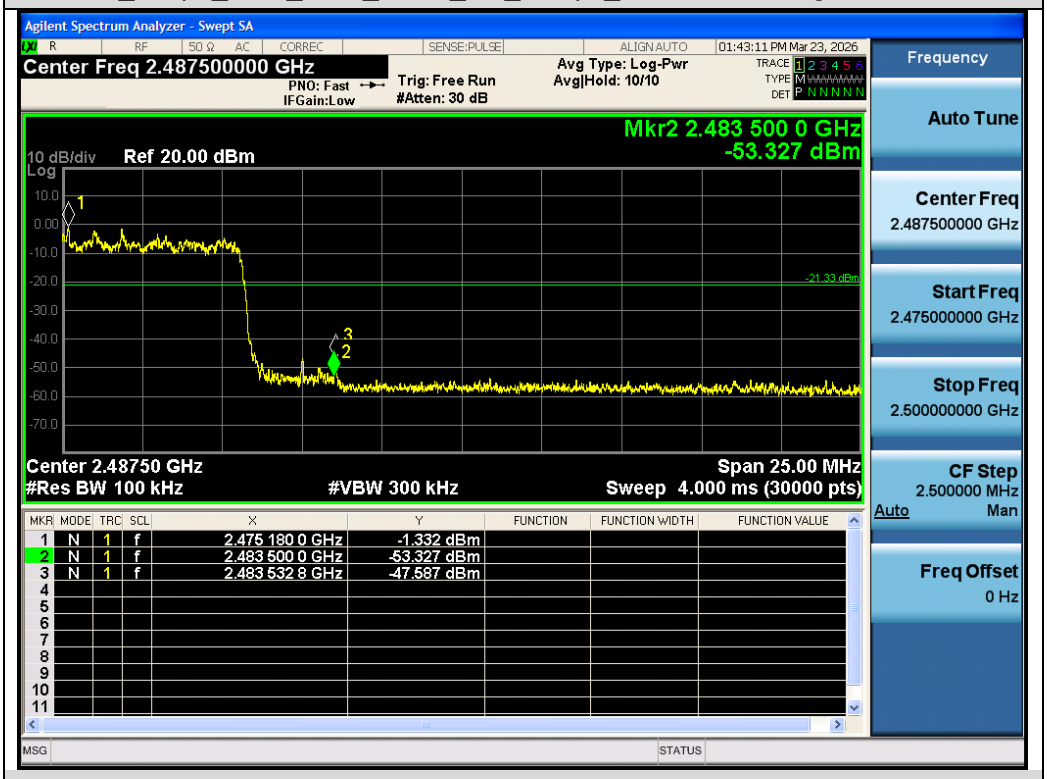


Test_Graph_EDR_HOP_ANT1_NA_2Mbps_Lower Band Edge Emissions



Test_Graph_EDR_HOP_ANT1_NA_2Mbps_Higher Band Edge Emissions

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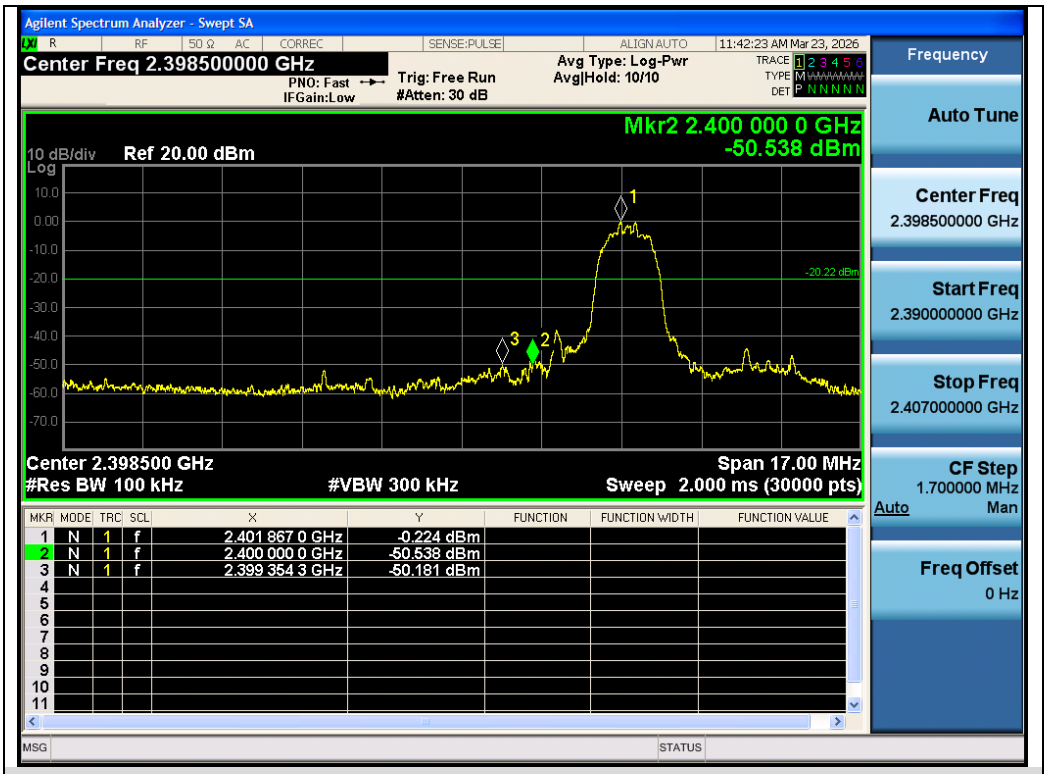
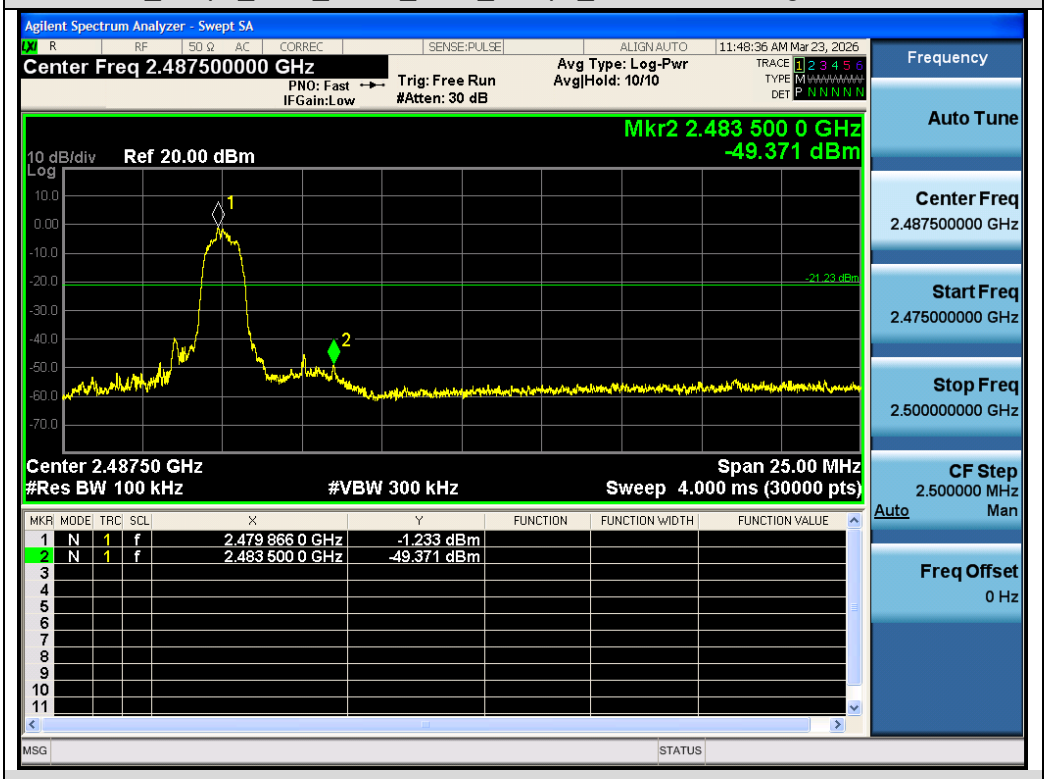


Test_Graph_EDR_ANT1_2402_3Mbps_Lower Band Edge Emissions



Test_Graph_EDR_ANT1_2480_3Mbps_Higher Band Edge Emissions

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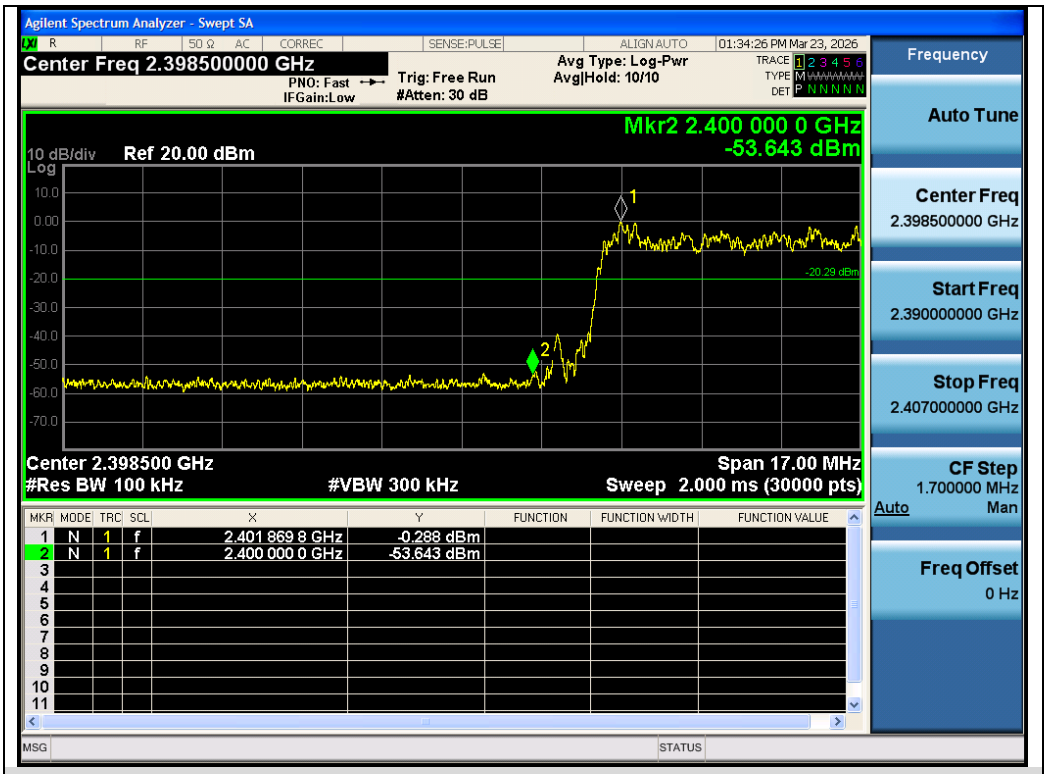
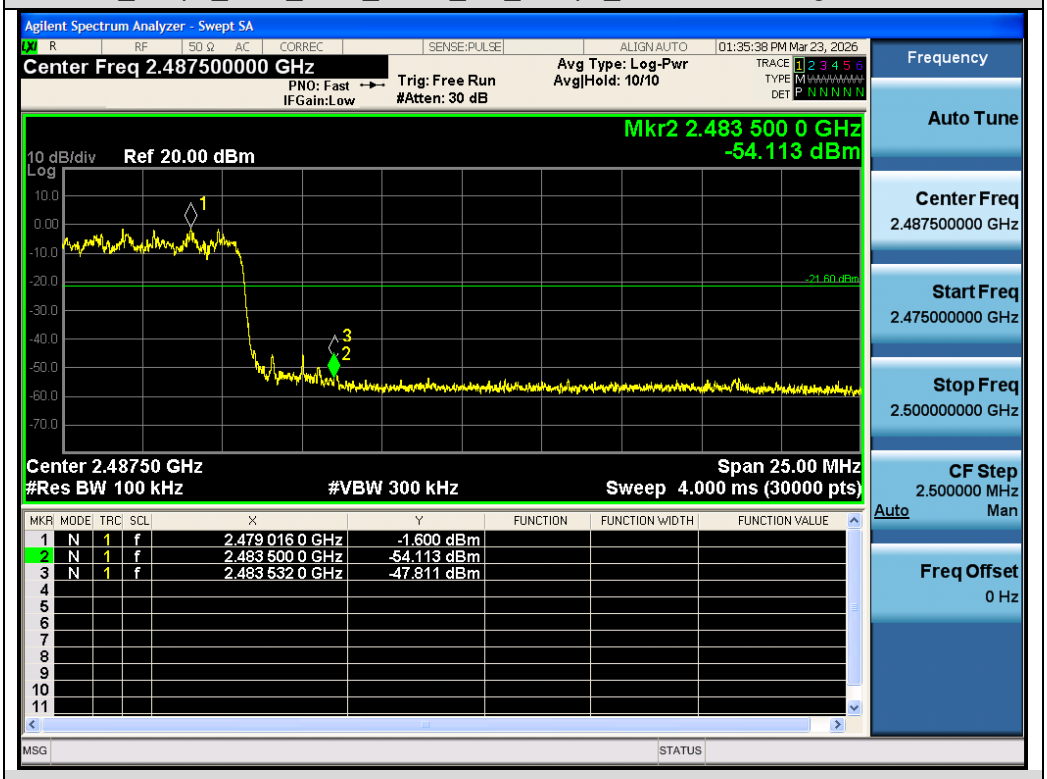


Test_Graph_EDR_HOP_ANT1_NA_3Mbps_Lower Band Edge Emissions



Test_Graph_EDR_HOP_ANT1_NA_3Mbps_Higher Band Edge Emissions

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9. Radiated Spurious Emission

9.1 Measurement Limit

- 15.209 Limit in the below table has 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.

9.2 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, insert the 2.4G filter between the receiving antenna and the Pre-amplifier(only for Radiated Spurious Emission). 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. 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.
8. 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.
9. 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.
10. 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.

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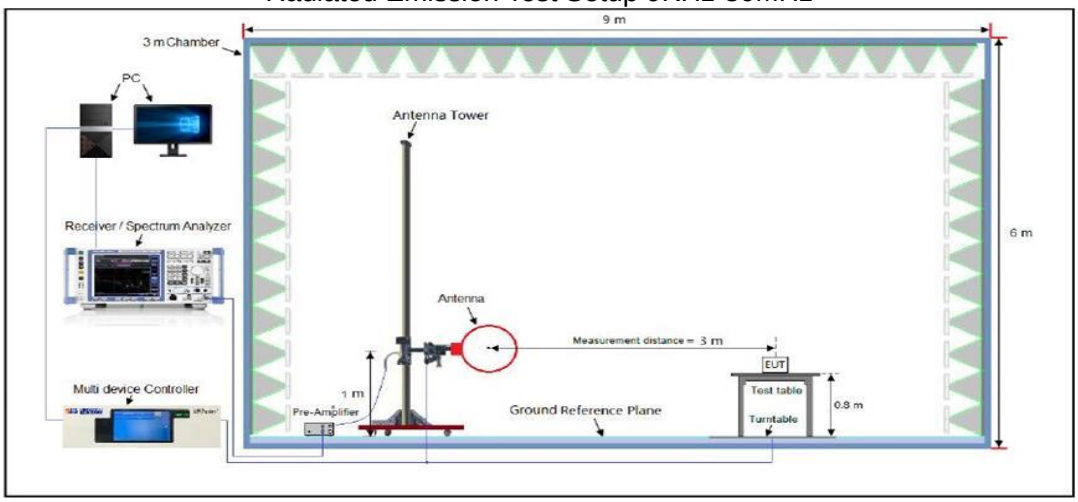
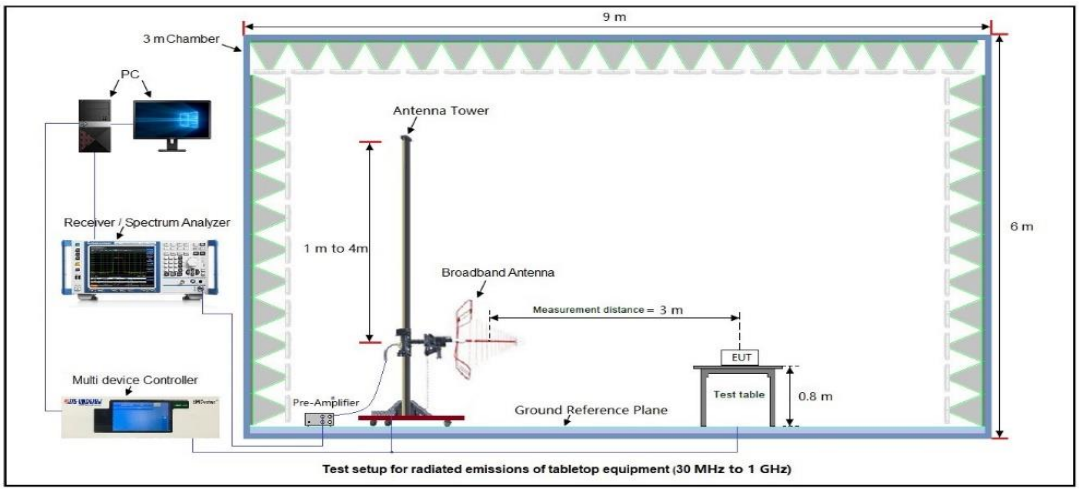
9.3 Measurement Setup (Block Diagram of Configuration)

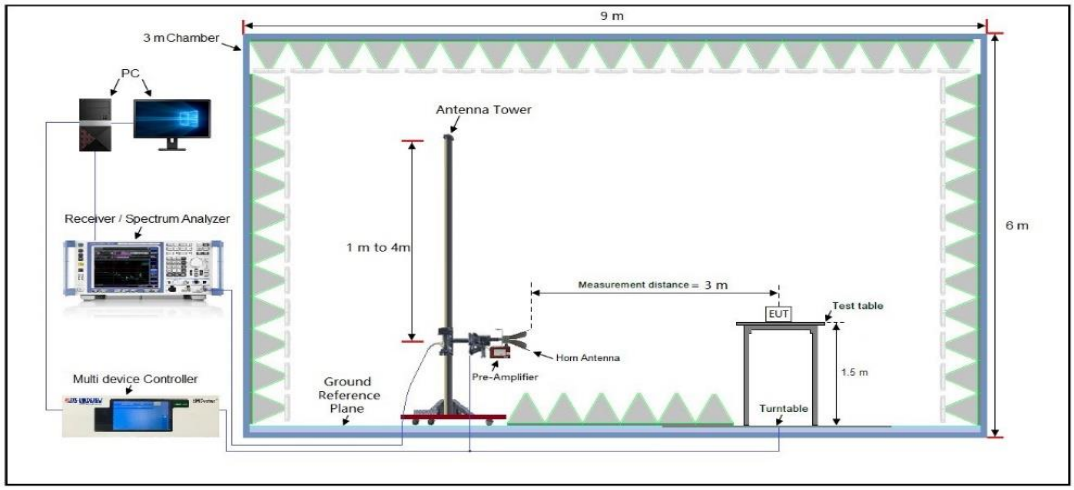
Radiated Emission Test Setup 9KHz-30MHz



Radiated Emission Test Setup 30MHz-1000MHz



Radiated Emission Test Setup Above 1000MHz



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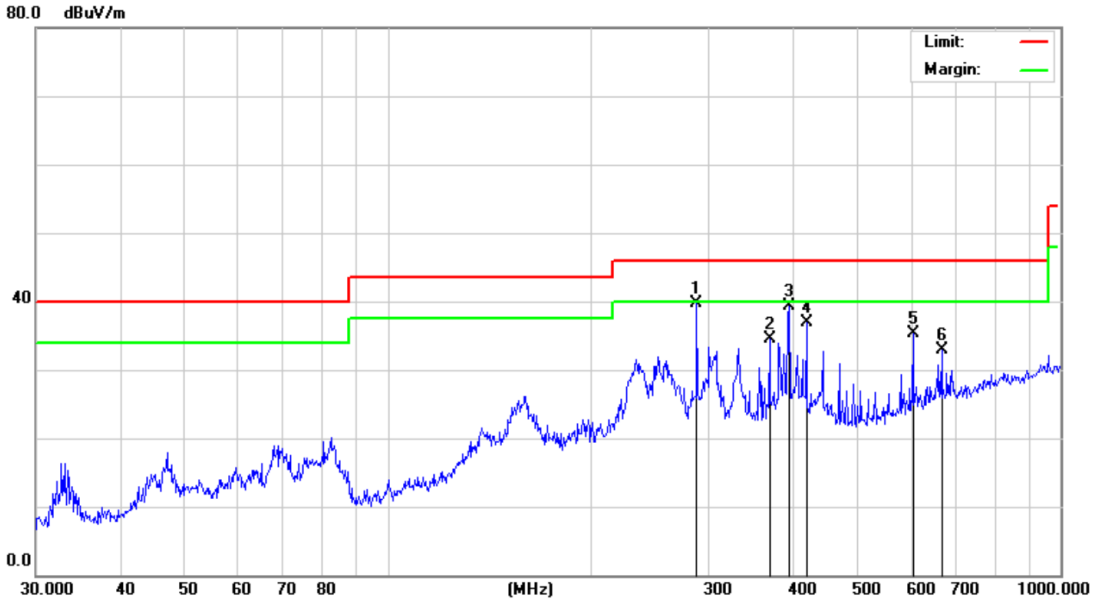
9.4 Measurement Result

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	Amplifier	**Model Name**	MA1
Temperature	21.3 ℃	**Relative Humidity**	52.4 %
Pressure	960hPa	**Test Voltage**	DC 3.7V by battery
Test Mode	Mode 7	**Antenna Polarity**	Horizontal



Final Data List

NO.	Freq. [MHz]	Level [dBμV/m]	Factor [dB]	Limit [dBμV/m]	Margin [dB]	Height [cm]	Angle [°]	Polarity
1	287.9904	39.71	-19.83	46.00	6.29	100	320	Horizontal
2	369.4047	34.42	-17.94	46.00	11.58	100	240	Horizontal
3	394.8545	39.37	-17.56	46.00	6.63	100	100	Horizontal
4	419.1081	36.83	-18.45	46.00	9.17	100	240	Horizontal
5	603.5392	35.30	-13.89	46.00	10.7	100	280	Horizontal
6	665.8035	32.86	-12.79	46.00	13.14	100	90	Horizontal

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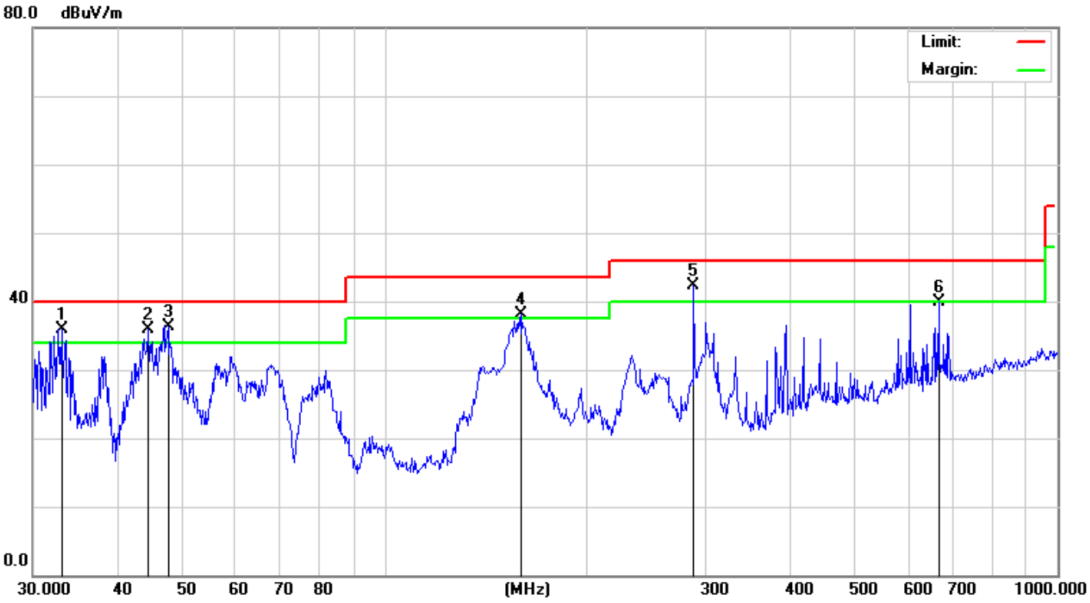
Radiated Emission Test Results at 30MHz-1GHz			
EUT Name	Amplifier	**Model Name**	MA1
Temperature	21.3 ℃	**Relative Humidity**	52.4 %
Pressure	960hPa	**Test Voltage**	DC 3.7V by battery
Test Mode	Mode 7	**Antenna Polarity**	Vertical



Final Data List

NO.	Freq. [MHz]	Level [dBμV/m]	Factor [dB]	Limit [dBμV/m]	Margin [dB]	Height [cm]	Angle [°]	Polarity
1	33.0949	35.98	-23.21	40.00	4.02	100	20	Vertical
2	44.5867	35.90	-21.47	40.00	4.1	100	290	Vertical
3	47.6584	36.33	-21.27	40.00	3.67	100	110	Vertical
4	159.7844	38.10	-19.80	43.50	5.4	100	210	Vertical
5	287.9904	42.32	-19.06	46.00	3.68	100	150	Vertical
6	665.8034	39.90	-10.43	46.00	6.1	100	10	Vertical

ESULT: Pass

Note:

1. Factor=Antenna Factor + Cable loss - Pre-amplifier, Margin=Limit-Level.
2. All test modes had been pre-tested. The mode 7 is the worst case and recorded in the report.

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Radiated Emissions Test Results Above 1GHz

EUT Name	Amplifier	**Model Name**	MA1
Temperature	21.3 ℃	**Relative Humidity**	52.4 %
Pressure	960hPa	**Test Voltage**	DC 3.7V by battery
Test Mode	Mode 7	**Antenna Polarity**	Horizontal

Frequency (MHz)	Meter Reading (dBμV)	Factor (dB)	Emission Level (dBμV/m)	Limits (dBμV/m)	Margin (dB)	Value Type
4804.000	49.01	0.08	49.09	74	-24.91	peak
4804.000	40.26	0.08	40.34	54	-13.66	AVG
7206.000	43.37	2.21	45.58	74	-28.42	peak
7206.000	35.58	2.21	37.79	54	-16.21	AVG

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

EUT Name	Amplifier	**Model Name**	MA1
Temperature	21.3 ℃	**Relative Humidity**	52.4 %
Pressure	960hPa	**Test Voltage**	DC 3.7V by battery
Test Mode	Mode 7	**Antenna Polarity**	Vertical

Frequency (MHz)	Meter Reading (dBμV)	Factor (dB)	Emission Level (dBμV/m)	Limits (dBμV/m)	Margin (dB)	Value Type
4804.000	47.54	0.08	47.62	74	-26.38	peak
4804.000	36	0.08	36.08	54	-17.92	AVG
7206.000	43.29	2.21	45.5	74	-28.5	peak
7206.000	34.23	2.21	36.44	54	-17.56	AVG

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

RESULT: PASS

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Radiated Emissions Test Results for Above 1GHz

EUT Name	Amplifier	**Model Name**	MA1
Temperature	21.3 ℃	**Relative Humidity**	52.4 %
Pressure	960hPa	**Test Voltage**	DC 3.7V by battery
Test Mode	Mode 8	**Antenna Polarity**	Horizontal

Frequency (MHz)	Meter Reading (dBμV)	Factor (dB)	Emission Level (dBμV/m)	Limits (dBμV/m)	Margin (dB)	Value Type
4882.000	49	0.14	49.14	74	-24.86	peak
4882.000	37.75	0.14	37.89	54	-16.11	AVG
7323.000	43.88	2.36	46.24	74	-27.76	peak
7323.000	36.43	2.36	38.79	54	-15.21	AVG

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

EUT Name	Amplifier	**Model Name**	MA1
Temperature	21.3 ℃	**Relative Humidity**	52.4 %
Pressure	960hPa	**Test Voltage**	DC 3.7V by battery
Test Mode	Mode 8	**Antenna Polarity**	Vertical

Frequency (MHz)	Meter Reading (dBμV)	Factor (dB)	Emission Level (dBμV/m)	Limits (dBμV/m)	Margin (dB)	Value Type
4882.000	46.9	0.14	47.04	74	-26.96	peak
4882.000	35.43	0.14	35.57	54	-18.43	AVG
7323.000	44.72	2.36	47.08	74	-26.92	peak
7323.000	34.7	2.36	37.06	54	-16.94	AVG

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

RESULT: PASS

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Radiated Emissions Test Results for Above 1GHz

EUT Name	Amplifier	**Model Name**	MA1
Temperature	21.3 ℃	**Relative Humidity**	52.4 %
Pressure	960hPa	**Test Voltage**	DC 3.7V by battery
Test Mode	Mode 9	**Antenna Polarity**	Horizontal

Frequency (MHz)	Meter Reading (dBμV)	Factor (dB)	Emission Level (dBμV/m)	Limits (dBμV/m)	Margin (dB)	Value Type
4960.000	49.26	0.22	49.48	74	-24.52	peak
4960.000	38.74	0.22	38.96	54	-15.04	AVG
7440.000	45.87	2.64	48.51	74	-25.49	peak
7440.000	34.5	2.64	37.14	54	-16.86	AVG

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

EUT Name	Amplifier	**Model Name**	MA1
Temperature	21.3 ℃	**Relative Humidity**	52.4 %
Pressure	960hPa	**Test Voltage**	DC 3.7V by battery
Test Mode	Mode 9	**Antenna Polarity**	Vertical

Frequency (MHz)	Meter Reading (dBμV)	Factor (dB)	Emission Level (dBμV/m)	Limits (dBμV/m)	Margin (dB)	Value Type
4960.000	46.87	0.22	47.09	74	-26.91	peak
4960.000	38.12	0.22	38.34	54	-15.66	AVG
7440.000	45.62	2.64	48.26	74	-25.74	peak
7440.000	36.33	2.64	38.97	54	-15.03	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 8DPSK mode is the worst case and recorded in the report.

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Band Edge Emission Test Results for Restricted Bands

EUT Name	Amplifier	Model Name	MA1
Temperature	21.3 ℃	Relative Humidity	52.4 %
Pressure	960hPa	Test Voltage	DC 3.7V by battery

Bluetooth Tx CH00_2402 MHz_1Mbps										
Item (Mark)	Freq. MHz	Reading dBµV	Ant. Fac. dB/m	PRM Factor dB	Cable Loss dB	Level dBµV/m	Limit dBµV/m	Margin dB	Detector	Pol.
1	2390.00	41.89	29.99	30.21	8.35	50.02	74	23.98	Peak	Horizontal
2	2390.00	31.13	29.99	30.21	8.35	39.26	54	14.74	AV	Horizontal
3	2390.00	39.28	29.99	30.21	8.35	47.41	74	26.59	Peak	Vertical
4	2390.00	28.93	29.99	30.21	8.35	37.06	54	16.94	AV	Vertical
Bluetooth Tx CH78_2480 MHz_1Mbps										
Item (Mark)	Freq. MHz	Reading dBµV	Ant. Fac. dB/m	PRM Factor dB	Cable Loss dB	Level dBµV/m	Limit dBµV/m	Margin dB	Detector	Pol.
1	2483.5	44.02	30.25	30.25	8.5	52.52	74	21.48	Peak	Horizontal
2	2483.5	36.84	30.25	30.25	8.5	45.34	54	8.66	AV	Horizontal
3	2483.5	41.36	30.25	30.25	8.5	49.86	74	24.14	Peak	Vertical
4	2483.5	33.56	30.25	30.25	8.5	42.06	54	11.94	AV	Vertical

Bluetooth Tx CH00_2402 MHz_2Mbps										
Item (Mark)	Freq. MHz	Reading dBµV	Ant. Fac. dB/m	PRM Factor dB	Cable Loss dB	Level dBµV/m	Limit dBµV/m	Margin dB	Detector	Pol.
1	2390.00	45.07	29.99	30.21	8.35	53.2	74	20.80	Peak	Horizontal
2	2390.00	30.57	29.99	30.21	8.35	38.7	54	15.30	AV	Horizontal
3	2390.00	42.47	29.99	30.21	8.35	50.6	74	23.40	Peak	Vertical
4	2390.00	28.28	29.99	30.21	8.35	36.41	54	17.59	AV	Vertical
Bluetooth Tx CH78_2480 MHz_2Mbps										
Item (Mark)	Freq. MHz	Reading dBµV	Ant. Fac. dB/m	PRM Factor dB	Cable Loss dB	Level dBµV/m	Limit dBµV/m	Margin dB	Detector	Pol.
1	2483.5	44.73	30.25	30.25	8.5	53.23	74	20.77	Peak	Horizontal
2	2483.5	34.13	30.25	30.25	8.5	42.63	54	11.37	AV	Horizontal
3	2483.5	41.66	30.25	30.25	8.5	50.16	74	23.84	Peak	Vertical
4	2483.5	30.04	30.25	30.25	8.5	38.54	54	15.46	AV	Vertical

Bluetooth Tx CH00_2402 MHz_3Mbps										
Item	Freq.	Reading	Ant.	PRM	Cable	Level	Limit	Margin	Detector	Pol.

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(Mark)	MHz	dBµV	Fac. dB/m	Factor dB	Loss dB	dBµV/m	dBµV/m	dB		
1	2390.00	44.95	29.99	30.21	8.35	53.08	74	20.92	Peak	Horizontal
2	2390.00	30.29	29.99	30.21	8.35	38.42	54	15.58	AV	Horizontal
3	2390.00	38.66	29.99	30.21	8.35	46.79	74	27.21	Peak	Vertical
4	2390.00	28.46	29.99	30.21	8.35	36.59	54	17.41	AV	Vertical
Bluetooth Tx CH78_2480 MHz_3Mbps										
Item (Mark)	Freq. MHz	Reading dBµV	Ant. Fac. dB/m	PRM Factor dB	Cable Loss dB	Level dBµV/m	Limit dBµV/m	Margin dB	Detector	Pol.
1	2483.5	45.17	30.25	30.25	8.5	53.67	74	20.33	Peak	Horizontal
2	2483.5	34.25	30.25	30.25	8.5	42.75	54	11.25	AV	Horizontal
3	2483.5	39.57	30.25	30.25	8.5	48.07	74	25.93	Peak	Vertical
4	2483.5	30.15	30.25	30.25	8.5	38.65	54	15.35	AV	Vertical

Remark:

1. Result Level = Read Level + Antenna Factor + Cable loss - PRM Factor.
2. Margin = Limit- Emission Level

RESULT: Pass

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10. Number of Hopping Frequency Measurement

10.1 Provisions Applicable

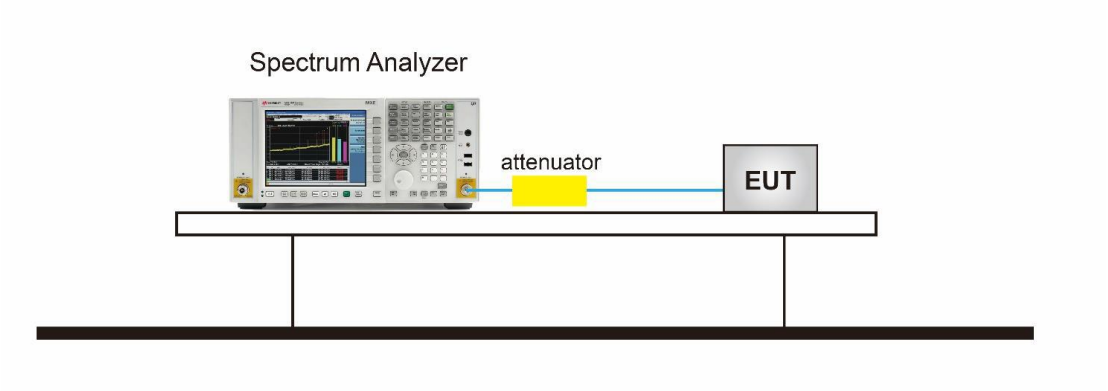
This frequency hopping system must employ a minimum of 15 hopping channels.

10.2 Measurement Procedure

The EUT shall have its hopping function enabled. Use the following spectrum analyzer settings:

1. Span = The frequency band of operation. Depending on the number of channels the device
2. supports, it may be necessary to divide the frequency range of operation across multiple spans, to allow the individual channels to be clearly seen.
3. RBW: To identify clearly the individual channels, set the RBW to less than 30% of the channel spacing or the 20 dB bandwidth, whichever is smaller.
4. VBW ⩾ RBW
5. Sweep time = Auto couple
6. Detector = Peak
7. Trace mode = Max hold
8. Allow the trace to stabilize

10.3 Measurement Setup (Block Diagram of Configuration)



10.4 Measurement Result

Test Data of Number of Hopping Frequency			
Test Mode	Number of Hopping Frequency	Limits	Pass or Fail
GFSK Hopping	79	>=15	Pass
π /4-DQPSK Hopping	79	>=15	Pass
8DPSK Hopping	79	>=15	Pass

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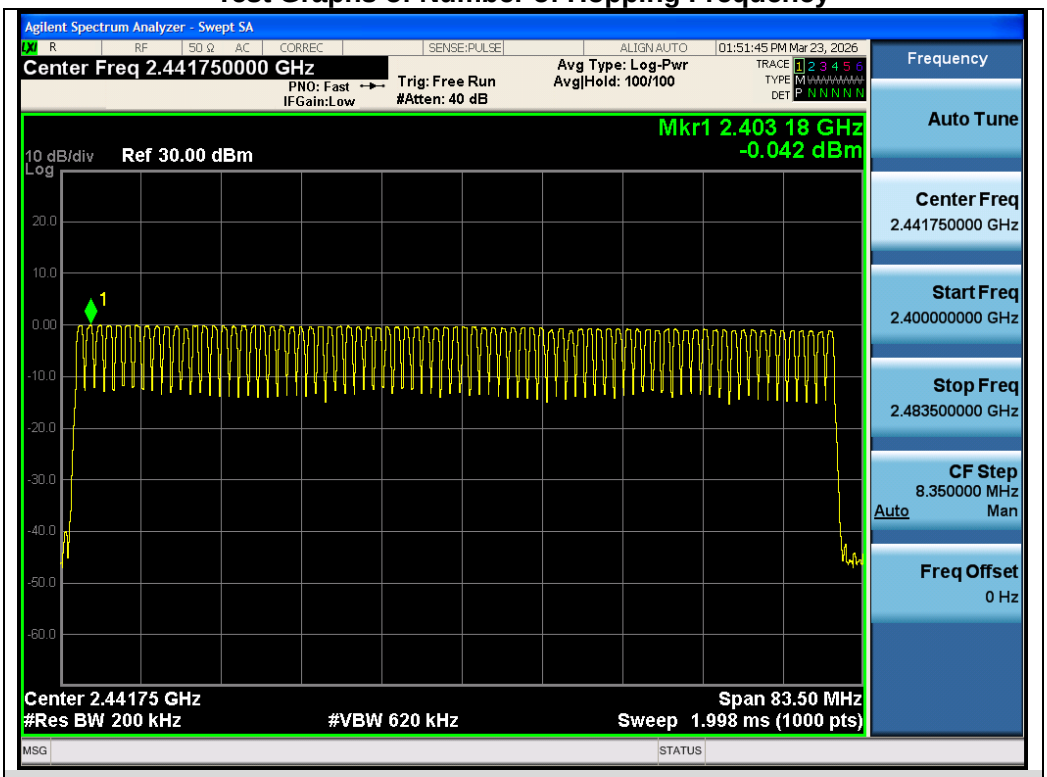
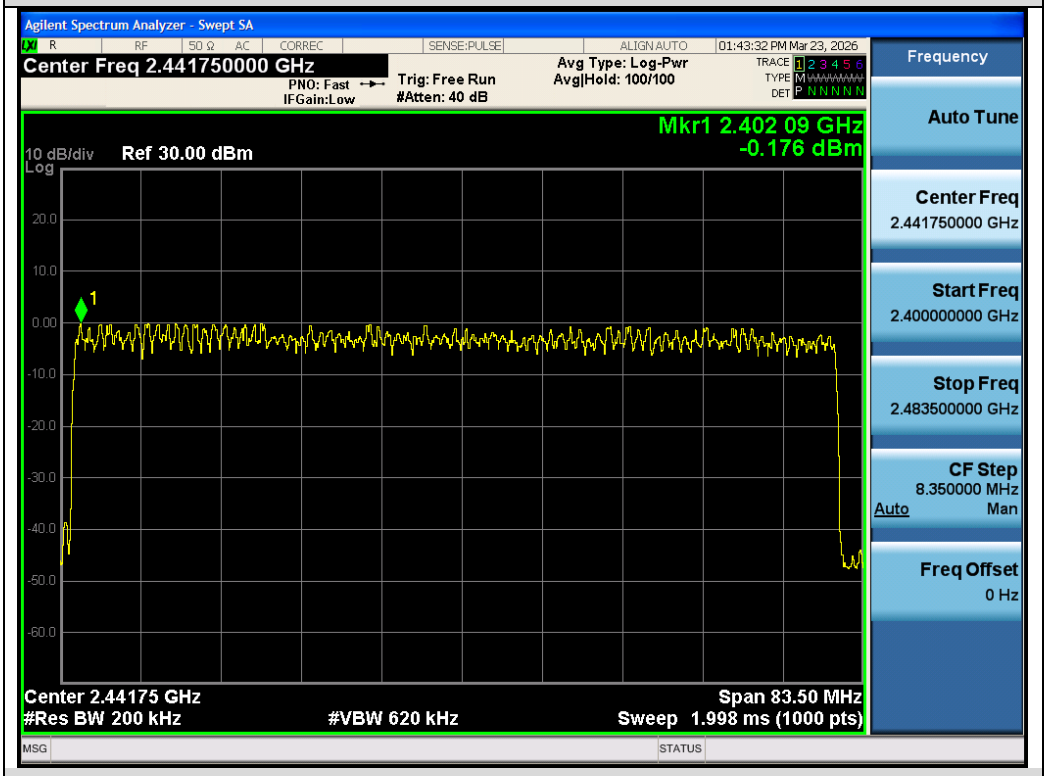
Test Graphs of Number of Hopping Frequency



Test_Graph_BR_HOP_ANT1_NA_1Mbps_Number of Hopping



Test_Graph_EDR_HOP_ANT1_NA_2Mbps_Number of Hopping

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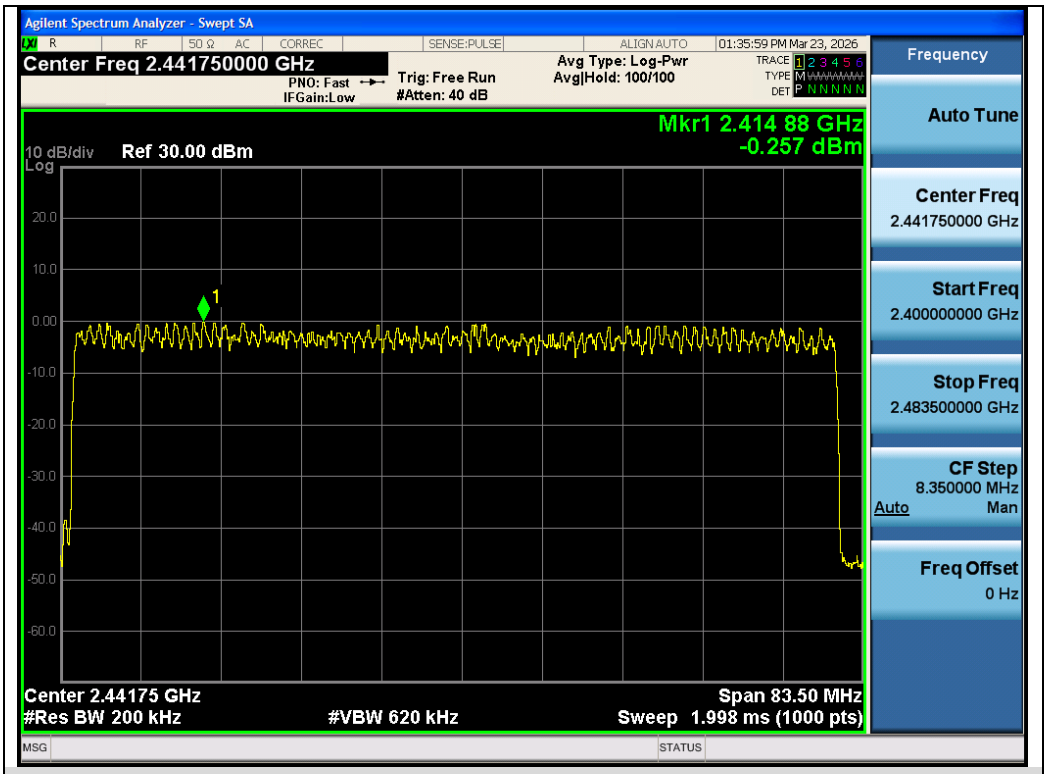

Test_Graph_EDR_HOP_ANT1_NA_3Mbps_Number of Hopping

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11. Time of Occupancy (Dwell Time) Measurement

11.1 Provisions Applicable

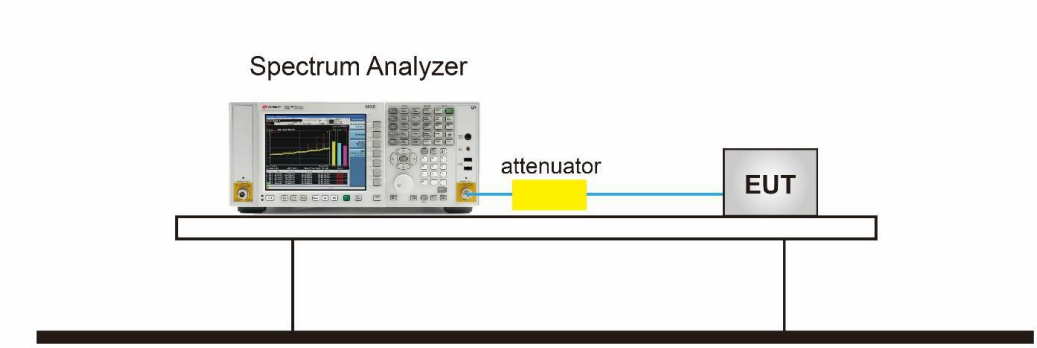
The maximum permissible time of occupancy is 400ms within a period of 400ms multiplied by the number of hopping channels employed.

11.2 Measurement Procedure

The EUT shall have its hopping function enabled. Use the following spectrum analyzer settings:

1. Span = Zero span, centered on a hopping channel.
2. RBW shall be ≤ channel spacing and where possible RBW should be set >> 1 / T, where T is the expected dwell time per channel.
3. VBW ≥ RBW
4. Sweep time = As necessary to capture the entire dwell time per hopping channel
5. Detector = Peak
6. Trace mode = Free Run
7. Use the marker-delta function to determine the transmit time per hop. If this value varies with different modes of operation (data rate, modulation format, number of hopping channels, etc.), then repeat this test for each variation in transmit time. An oscilloscope may be used instead of a spectrum analyzer. The EUT shall show compliance with the appropriate regulatory limit for the number of hopping channels. A plot of the data shall be included in the test report.

11.3 Measurement Setup (Block Diagram of Configuration)



11.4 Measurement Result

Test Data of Dwell Time					
Channel	Time of Pulse for 3DH5 (ms)	Number of hops in the period specified in the requirements	Dwell Time (ms)	Limit (ms)	Pass or Fail
2402	2.886	26.0*4	300.144	400	Pass
2441	2.886	28.0*4	323.232	400	Pass
2480	2.886	32.0*4	369.408	400	Pass

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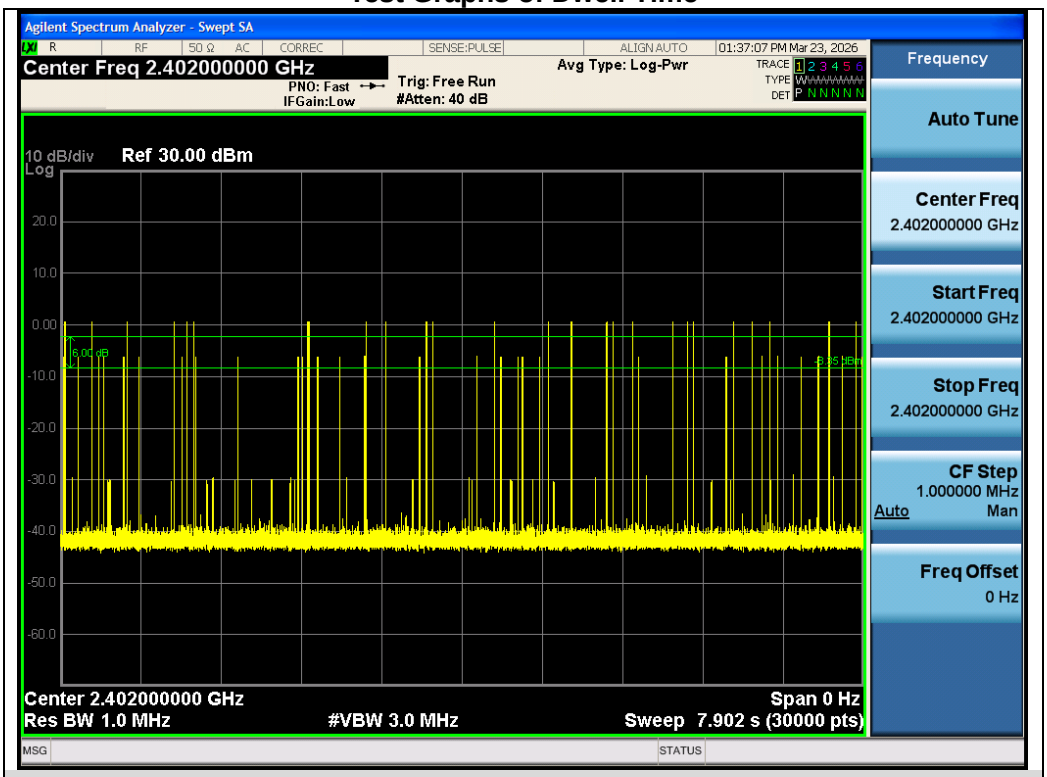
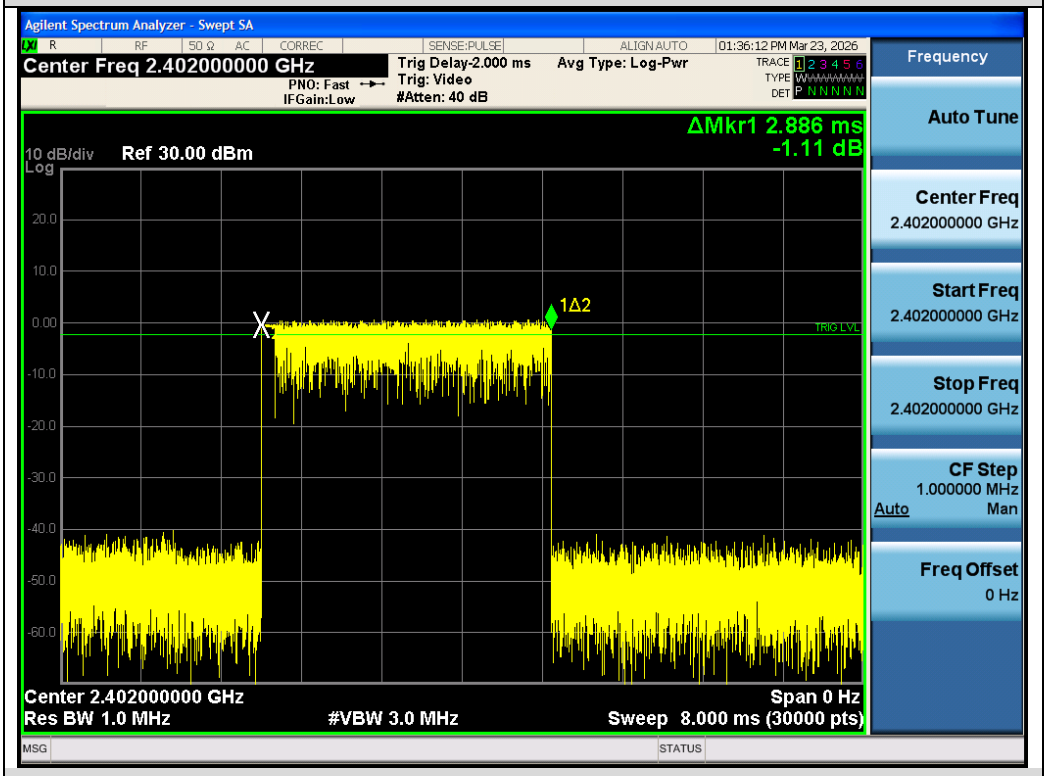
Test Graphs of Dwell Time



Test_Graph_EDR_HOP_ANT1_NA_3Mbps_2402_Number of Busrt



Test_Graph_EDR_HOP_ANT1_NA_3Mbps_2402_Time per Burst

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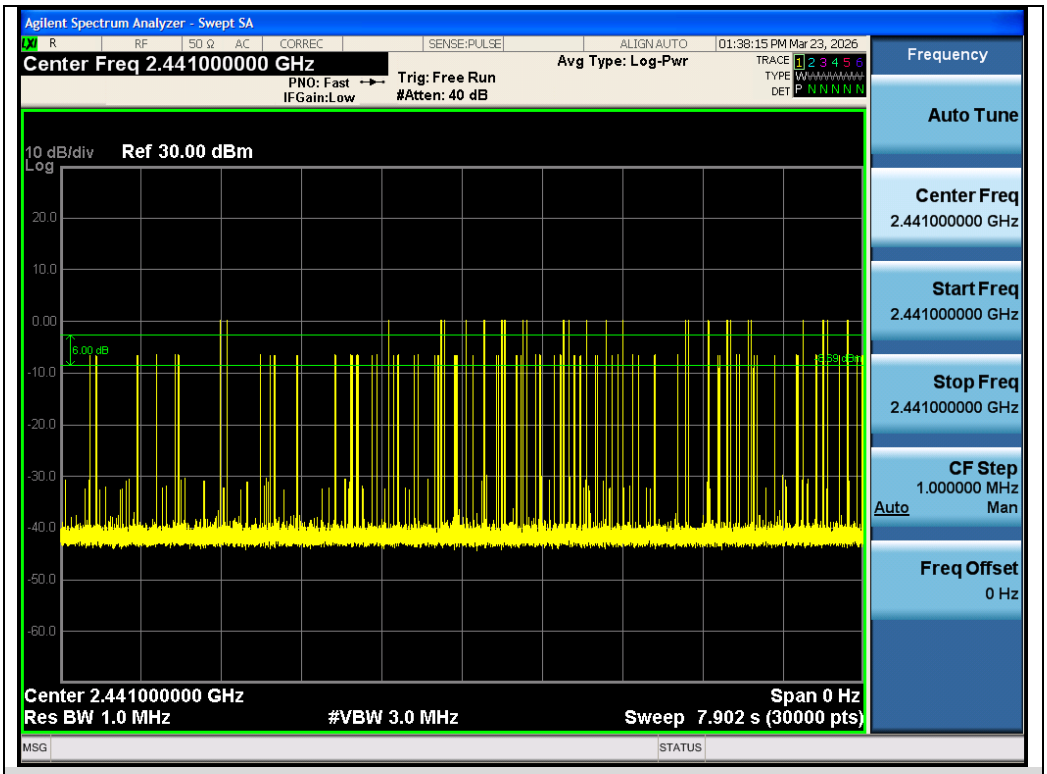
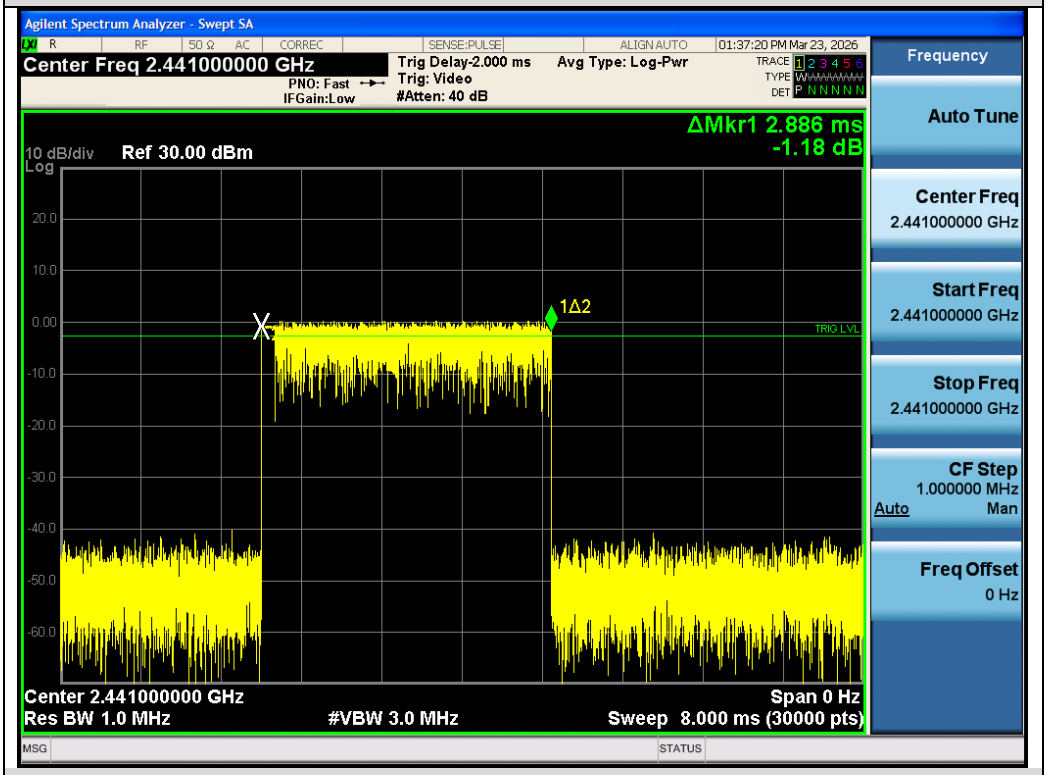


Test_Graph_EDR_HOP_ANT1_NA_3Mbps_2441_Number of Busrt



Test_Graph_EDR_HOP_ANT1_NA_3Mbps_2441_Time per Burst

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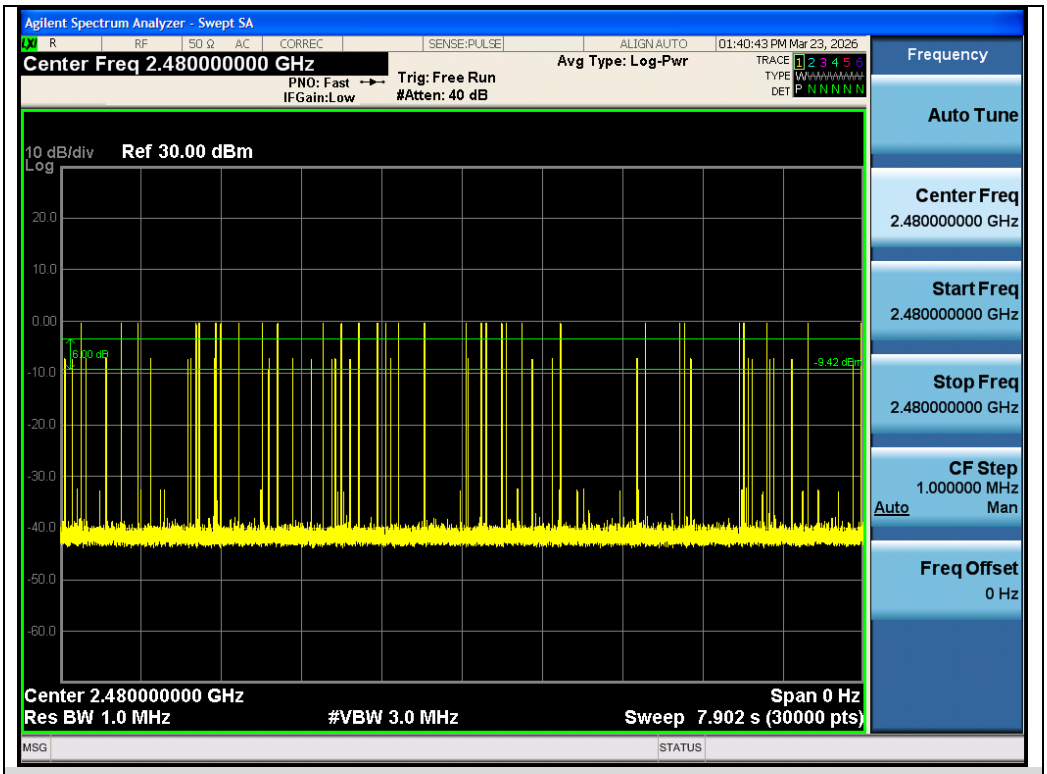
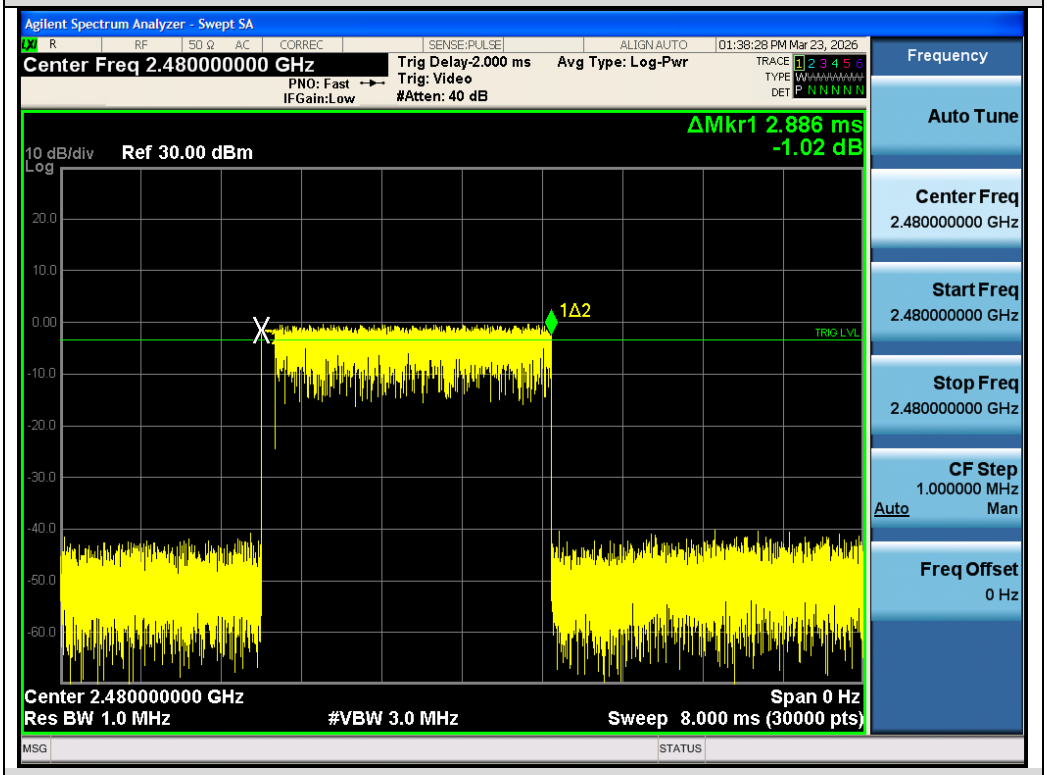


Test_Graph_EDR_HOP_ANT1_NA_3Mbps_2480_Number of Busrt



Test_Graph_EDR_HOP_ANT1_NA_3Mbps_2480_Time per Burst

Note: All mode rates are tested and evaluated, 8DPSK modulated 3DH5 mode is the worst case and documented in the report.

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12. Frequency Separation Measurement

12.1 Provisions Applicable

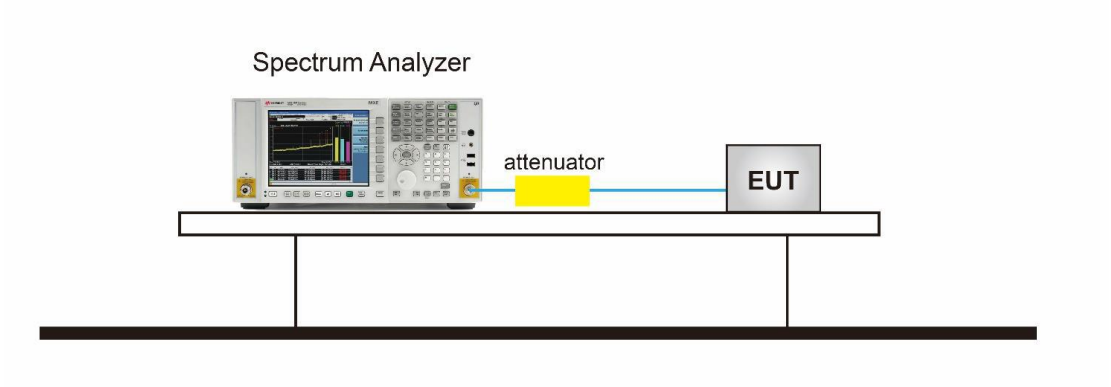
When the power is less than 0.125W: The minimum permissible channel separation for this system is 2/3 the value of the 20dB BW.
When the power is less than 1W: The minimum permissible channel separation for this system is 20dB BW.

12.2 Measurement Procedure

The EUT shall have its hopping function enabled. Use the following spectrum analyzer settings:

1. Span: Wide enough to capture the peaks of two adjacent channels.
2. RBW: Start with the RBW set to approximately 30% of the channel spacing; adjust as necessary to best identify the center of each individual channel.
3. Video (or average) bandwidth (VBW) ⩾ RBW.
4. Sweep: Auto.
5. Detector function: Peak.
6. Trace: Max hold. g) Allow the trace to stabilize.
7. Use the marker-delta function to determine the separation between the peaks of the adjacent channels.

12.3 Measurement Setup (Block Diagram of Configuration)



12.4 Measurement Result

Test Data of Frequency Separation			
Test Mode	Channel Separation (MHz)	Limits (MHz)	Pass or Fail
GFSK Hopping	0.977	≥0.637	Pass
π /4-DQPSK Hopping	1.009	≥0.855	Pass
8DPSK Hopping	0.957	≥0.867	Pass

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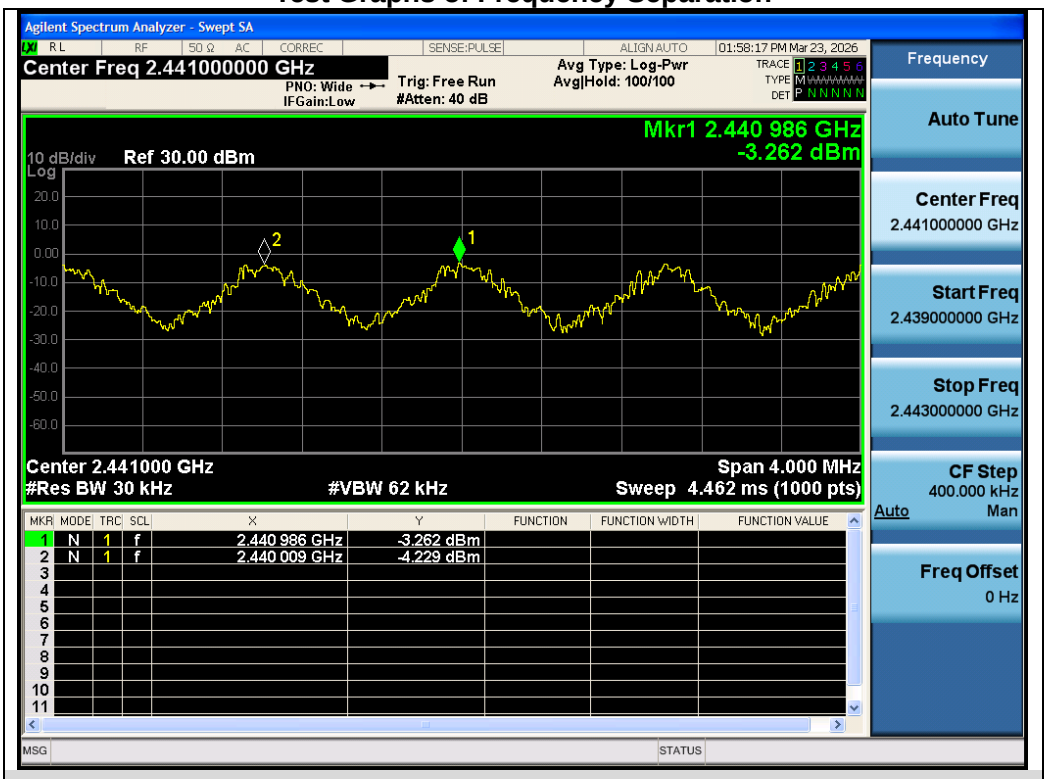
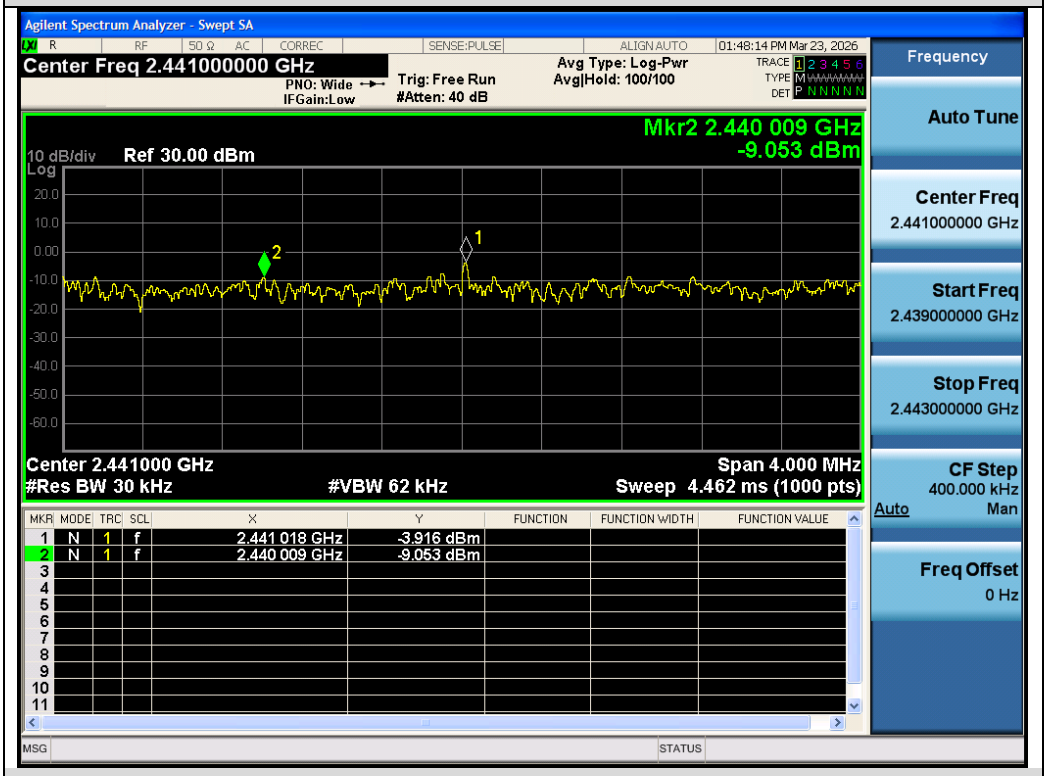
Test Graphs of Frequency Separation



Test_Graph_BR_HOP_ANT1_NA_1Mbps_Hopping Separation



Test_Graph_EDR_HOP_ANT1_NA_2Mbps_Hopping Separation

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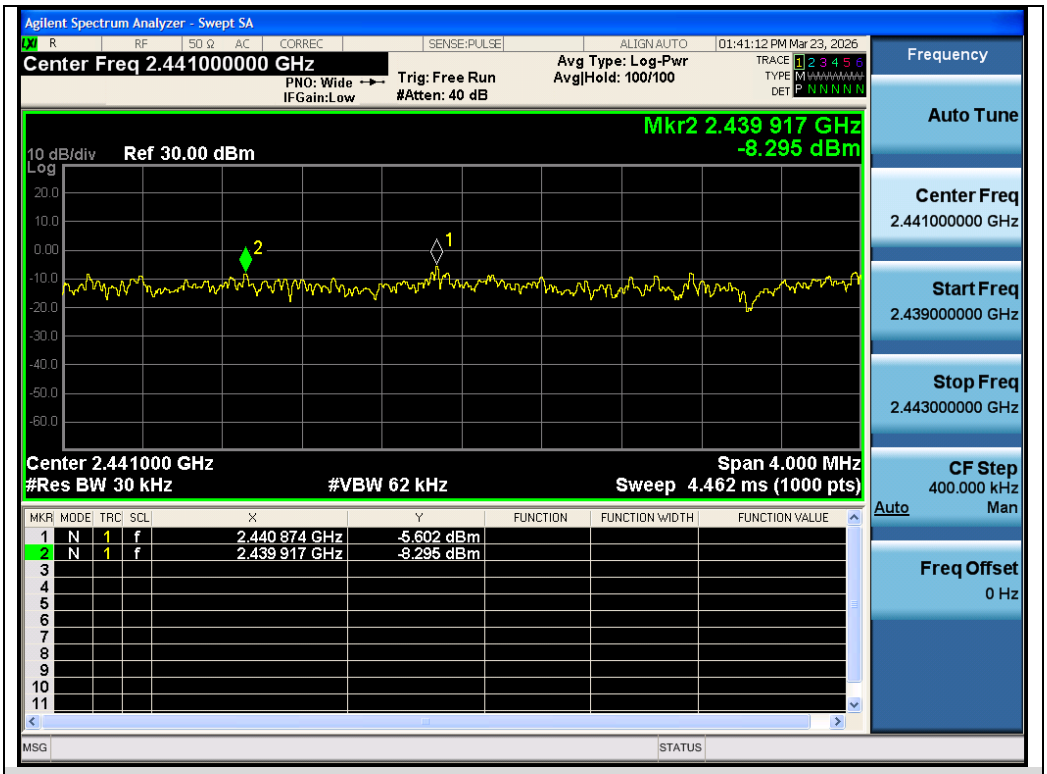

Test_Graph_EDR_HOP_ANT1_NA_3Mbps_Hopping Separation

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13. AC Power Line Conducted Emission Test

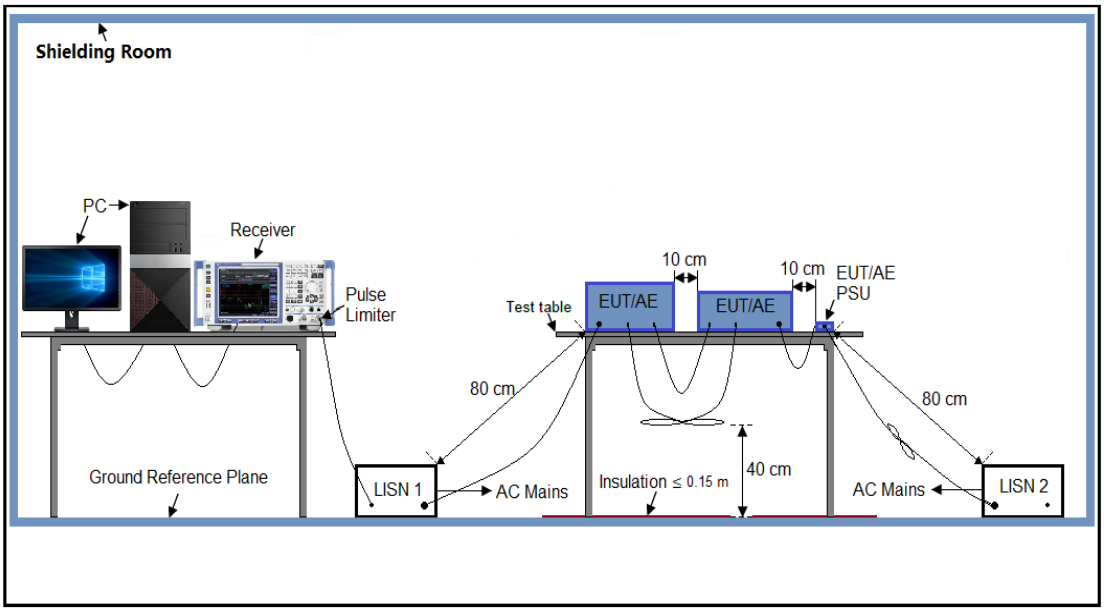
13.1 Measurement Limit

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.

13.2 Measurement Setup (Block Diagram of Configuration)



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13.3 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 5V 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.

13.4 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

13.5 Measurement Result

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