



Test report No.: 22A0288R-RFUSV01S-A

TEST REPORT

Product Name	Internet Gateway
Trademark	Verizon
Model and /or type reference	WNC-CR200A
FCC ID	NKR-LV65C-T3
Applicant's name / address	Wistron NeWeb Corporation 20 Park Avenue II, Hsinchu Science Park, Hsinchu 308, Taiwan
Manufacturer's name	Wistron NeWeb Corporation
Test method requested, standard	FCC CFR Title 47 Part 15 Subpart C ANSI C63.4: 2014, ANSI C63.10: 2013
Verdict Summary	IN COMPLIANCE
Documented By (Senior Project Specialist / Ida Tung)	<i>Ida Tung</i>
Tested By (Senior Engineer / Ivan Chuang)	<i>Ivan Chuang</i>
Approved By (Senior Engineer / Jack Hsu)	<i>Jack Hsu</i>
Date of Receipt	2022/10/13
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Report Version	V1.0

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Appendix 1: EUT Test Photographs

Appendix 2: Product Photos-Please refer to the file: 22A0288R-Product Photos

Competences and Guarantees

DEKRA is a testing laboratory competent to carry out the tests described in this report.

In order to assure the traceability to other national and international laboratories, DEKRA has a calibration and maintenance program for its measurement equipment.

DEKRA guarantees the reliability of the data presented in this report, which is the result of the measurements and the tests performed to the item under test on the date and under the conditions stated in the report and it is based on the knowledge and technical facilities available at DEKRA at the time of performance of the test.

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The results presented in this Test Report apply only to the particular item under test established in this document.

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General conditions

1. The test results relate only to the samples tested.
2. The test results shown in the test report are traceable to the national/international standard through the calibration report of the equipment and evaluated measurement uncertainty herein.
3. This report must not be used to claim product endorsement by TAF or any agency of the government.
4. The test report shall not be reproduced without the written approval of DEKRA Testing and Certification Co., Ltd.
5. Measurement uncertainties evaluated for each testing system and associated connections are given here to provide the system information for reference. Compliance determinations do not take into account measurement uncertainties for each testing system, but are based on the results of the compliance measurement.

Revision History

Report No.	Version	Description	Issued Date
22A0288R-RFUSV01S-A	V1.0	Initial issue of report.	2023/06/09

1. General Information

1.1. EUT Description

Product Name	Internet Gateway
Trademark	Verizon
Model and /or type reference	WNC-CR200A
EUT Rated Voltage	AC 100-120V / 60Hz
EUT Test Voltage	AC 120V / 60Hz
Frequency Range	802.11b/g/n/ac/ax-20: 2412-2462 MHz, 802.11n/ac/ax-40: 2422-2452 MHz
Number of Channels	802.11b/g/n/ac/ax-20 MHz: 11CH, 802.11n/ac/ax-40 MHz: 7CH
Data Speed	802.11b: 1-11 Mbps, 802.11g: 6-54 Mbps, 802.11n: MCS0-MCS31 802.11ac: MCS0-MCS9, 802.11ax: MCS0-MCS11
Type of Modulation	DSSS (DBPSK, DQPSK, CCK) OFDM, OFDMA (BPSK, QPSK, 16QAM, 64QAM, 256QAM,1024QAM)
Channel Control	Auto
Adapter (1)	MFR: Lucent Trans, M/N: 1A100-US1230 Input: AC 100 - 120V~ 60Hz, 1.0A Output: 12.0V= 3.0A, 36.0W Cable out: Non-shielded, 1.8m
Adapter (2)	MFR: Delta, M/N: ADH-36NW B Input: AC 100 - 120V~ 60Hz, 0.9A Output: 12.0V= 3.0A Cable out: Non-shielded, 1.7m

Antenna List

No.	Manufacturer	Part No.	Antenna Type	Peak Gain
1	WNC	LV65C-WiFi-S9H	Dipole	1.28 dBi for 2400 MHz
2	WNC	LV65C-WiFi-S9V	Dipole	1.28 dBi for 2400 MHz
3	WNC	LV65C-WiFi-S10H	Dipole	2.64 dBi for 2400 MHz
4	WNC	LV65C-WiFi-S10V	Dipole	1.88 dBi for 2400 MHz

Note: The antenna of EUT is conforming to FCC 15.203.

Directional gain for CDD Power: 2.64 dBi for 2400 MHz

(Directional gain = $G_{ANT\ MAX} + \text{Array Gain}$, Array Gain = 0 dB for $N_{ANT} \leq 4$)

Directional gain for Beamforming Power and PSD: 3.49 dBi for 2400 MHz

(Directional gain refer to antenna report provided by customer)

802.11b/g/n/ac/ax-20 MHz Center Frequency of Each Channel:

Channel	Frequency	Channel	Frequency	Channel	Frequency	Channel	Frequency
01	2412	02	2417	03	2422	04	2427
05	2432	06	2437	07	2442	08	2447
09	2452	10	2457	11	2462	--	--

802.11n/ac/ax-40 MHz Center Frequency of Each Channel:

Channel	Frequency	Channel	Frequency	Channel	Frequency	Channel	Frequency
03	2422	04	2427	05	2432	06	2437
07	2442	08	2447	09	2452	--	--

Note:

1. The EUT is an Internet Gateway with a built-in WLAN and WWAN transceiver, this report for 2400 MHz WLAN.
2. Regarding to the operation frequency, the lowest, middle and highest frequency are selected to perform the test. The other channels are for reference only.
3. After evaluation and investigation, the worst case for Adapter (1) and Adapter (2) is Adapter (1), so it was used to perform all testing and record in the test report.
4. Lowest data rates are tested in each mode. Only worst case is shown in the report. (802.11b is 1 Mbps, 802.11g is 6 Mbps, 802.11ax-20 MHz/40 MHz is MCS0)
5. The spectrum plot for conducted items only shows the worst case.
6. This device does not support partial RU function.
7. These tests are conducted on a sample for the purpose of demonstrating compliance of 802.11b/g/n/ac/ax transmitter with Part 15 Subpart C Paragraph 15.247 of spread spectrum devices.

Test Mode	Transmit (802.11b)-CDD
	Transmit (802.11g)-CDD
	Transmit (802.11ax-20 MHz)-CDD
	Transmit (802.11ax-40 MHz)-CDD
	Transmit (802.11ax-20 MHz)-Beamforming
	Transmit (802.11ax-40 MHz)-Beamforming
	Transmit Co-location for WLAN + WWAN

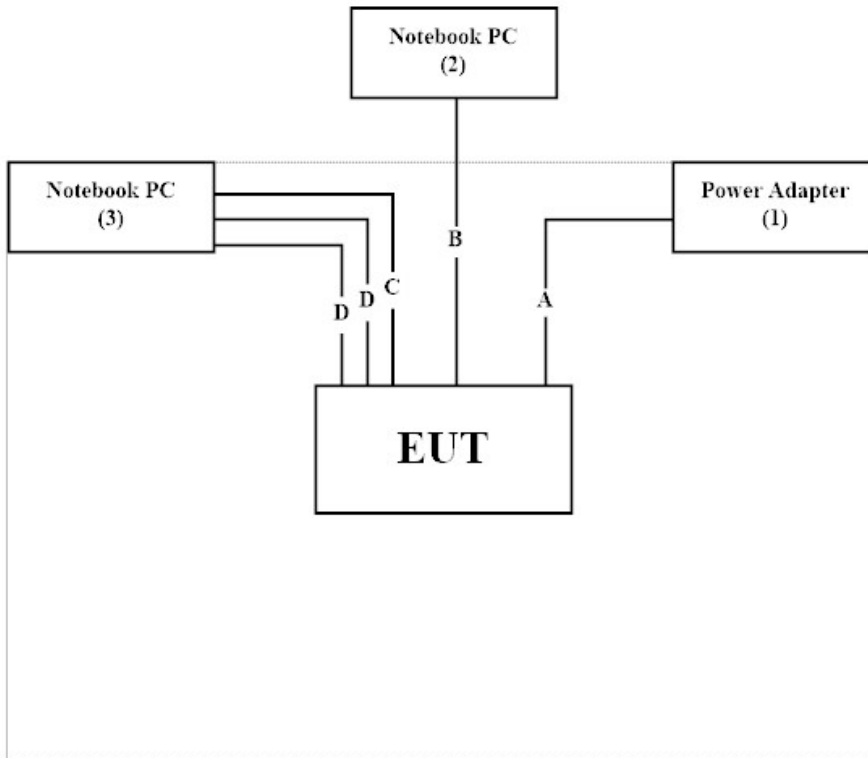
1.2. Tested System Details

The types for all equipment, plus descriptions of all cables used in the tested system are:

Product	Manufacturer	Model No.	Serial No.	Power Cord
1 Power Adapter	Lucent Trans	1A100-US1230	N/A	N/A
2 Notebook PC	DELL	Latitude 5580	GDZN7H2	N/A
3 Notebook PC	DELL	Latitude E5440	FS9TK32	N/A

Cable Type	Cable Description
A Power Cable	Non-shielded, 1.8m
B LAN Cable	Non-shielded, 10m
C LAN Cable	Non-shielded, 2m
D USB Cable	Shielded, 1m, 2pcs

1.3. Configuration of Tested System



1.4. EUT Exercise Software

1.	Setup the EUT as shown in Section 1.3.
2.	Execute software “QSPR Version 5.0-00202” on the Notebook PC.
3.	Configure the test mode, test channel, and data rate.
4.	Press “OK” to start the continuous transmit.
5.	Verify that the EUT works properly.

1.5. Test Facility

Ambient conditions in the laboratory:

Performed Item	Items	Required	Actual
Conducted Emission	Temperature (°C)	10~40 °C	22.3 °C
	Humidity (%RH)	10~90 %	58.8 %
Radiated Emission	Temperature (°C)	10~40 °C	24.3 °C
	Humidity (%RH)	10~90 %	66.3 %
Conductive	Temperature (°C)	10~40 °C	23.8 °C
	Humidity (%RH)	10~90 %	55.0 %

USA	FCC Registration Number: TW0033
Canada	CAB Identifier Number: TW3023 / Company Number: 26930

Site Description	Accredited by TAF
	Accredited Number: 3023

Test Laboratory	DEKRA Testing and Certification Co., Ltd.
	Linkou Laboratory
Address	No.5-22, Ruishukeng Linkou District, New Taipei City, 24451, Taiwan, R.O.C.
Performed Location	No. 26, Huaya 1st Rd., Guishan Dist., Taoyuan City 333411, Taiwan, R.O.C.
Phone Number	+886-3-275-7255
Fax Number	+886-3-327-8031

1.6. List of Test Item and Equipment

For Conduction Measurements / HY-SR01

	Equipment	Manufacturer	Model No.	Serial No.	Cal. Date	Due Date
V	EMI Test Receiver	R&S	ESR7	101601	2022/06/23	2023/06/22
V	Two-Line V-Network	R&S	ENV216	101307	2022/07/04	2023/07/03
V	Coaxial Cable	SUHNER	RG400_BNC	RF001	2023/01/10	2024/01/09

Note:

1. The test instruments marked with “V” are used to measure the final test results.
2. Test Software Version: e3 230303 dekra.

For Conducted Measurements / HY-SR02

	Equipment	Manufacturer	Model No.	Serial No.	Cal. Date	Due Date
V	Spectrum Analyzer	R&S	FSV30	103466	2022/12/20	2023/12/21
V	Power Sensor	KEYSIGHT	N1923A	MY59240002	2022/08/05	2023/08/04
V	Power Sensor	KEYSIGHT	N1923A	MY59240003	2022/08/05	2023/08/04

Note:

1. The test instruments marked with “V” are used to measure the final test results.
2. Test Software Version: RF Conducted Test Tools Ver3.0.1.14

For Radiated Measurements / HY-CB01

	Equipment	Manufacturer	Model No.	Serial No.	Cal. Date	Due Date
V	Loop Antenna	AMETEK	HLA6121	49611	2023/02/21	2024/02/20
V	Bi-Log Antenna	SCHWARZBECK	VULB9168	9168-0675	2021/08/11	2023/08/10
V	Horn Antenna	RF SPIN	DRH18-E	210507A18ES	2022/06/08	2023/06/07
V	Horn Antenna	Com-Power	AH-840	101101	2021/11/30	2023/11/29
V	Pre-Amplifier	SGH	0301	20211007-7	2023/01/10	2024/01/09
V	Pre-Amplifier	EMCI	EMC051845SE	980632	2023/01/10	2024/01/09
V	Pre-Amplifier	EMCI	EMC05820SE	980361	2023/01/10	2024/01/09
V	Pre-Amplifier	EMCI	EMC184045SE	980369	2023/01/10	2024/01/09
	Coaxial Cable	EMCI	EMC102-KM-KM-600	1160314		
	Coaxial Cable	EMCI	EMC102-KM-KM-7000	170242		
V	EMI Test Receiver	R&S	ESR3	102792	2022/12/29	2023/12/28
V	Spectrum Analyzer	R&S	FSVA40	101435	2022/06/04	2023/06/03
V	Spectrum Analyzer	R&S	FSV3044	101115	2023/01/06	2024/01/05
V	UXM 5G Wireless Test Platform	Keysight	E7515B	MY59321672	2022/05/31	2023/05/30
V	Universal Radio Communication Tester	Anritsu	MT8820C	6201465467	2022/08/10	2023/08/09
V	Coaxial Cable	SUHNER	SUCOFLEX 106	25450/6	2023/01/10	2024/01/09
	Coaxial Cable	SGH	HA800	GD20110222-8		
	Coaxial Cable	SGH	SGH18	2021003-8		
	Coaxial Cable	EMCI	EMC106	151113		

Note:

1. The test instruments marked with “V” are used to measure the final test results.
2. Test Software Version: e3 230303 dekra.

1.7. Uncertainty

Uncertainties have been calculated according to the DEKRA internal document.

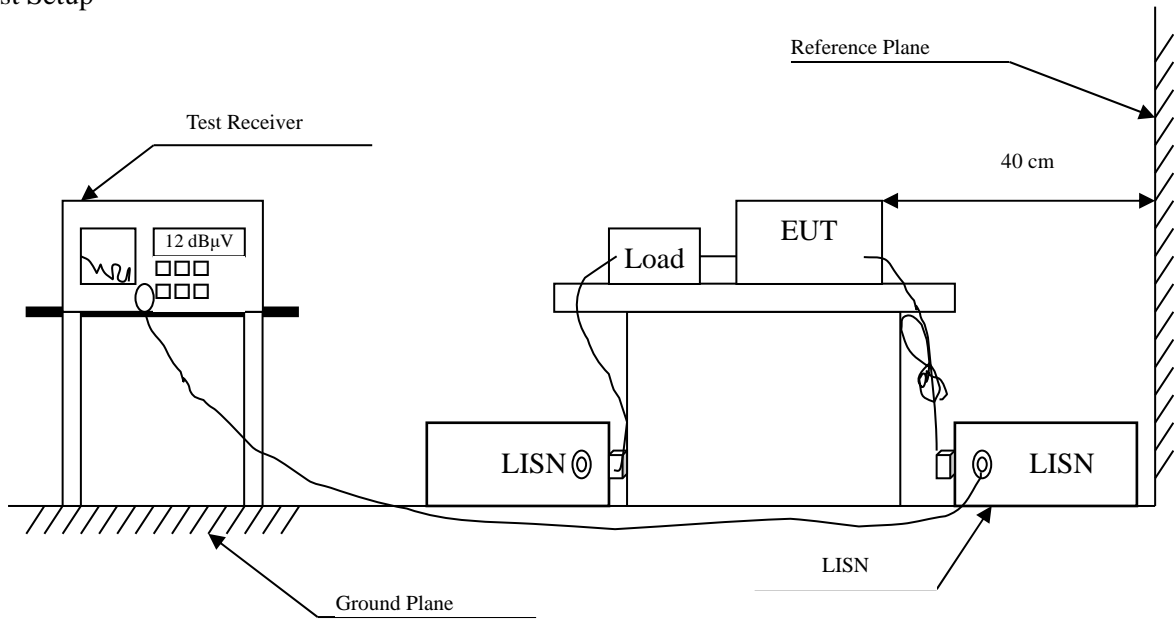
The reported expanded uncertainties are based on a standard uncertainty multiplied by a coverage factor of $k=2$, providing a level of confidence of approximately 95 %.

Measurement uncertainties evaluated for each testing system and associated connections are given here to provide the system information for reference. Compliance determinations do not take into account measurement uncertainties for each testing system, but are based on the results of the compliance measurement.

Test Item	Uncertainty
Conducted Emission	± 3.50 dB
Peak Power Output	± 1.05 dB
Radiated Emission	9k Hz~30 MHz: ± 3.88 dB 30 MHz~1 GHz: ± 4.42 dB 1 GHz~18 GHz: ± 4.28 dB 18 GHz~40 GHz: ± 3.90 dB
RF Antenna Conducted Test	± 2.14 dB
Band Edge	± 4.28 dB
6 dB Bandwidth	± 1580.61 Hz
Power Density	± 2.14 dB
Duty Cycle	± 0.53 %

2. Conducted Emission

2.1. Test Setup



2.2. Limits

FCC Part 15 Subpart C Paragraph 15.207 (dB μ V) Limit		
Frequency MHz	Limits	
	QP	AVG
0.15 - 0.50	66-56	56-46
0.50 - 5.0	56	46
5.0 - 30	60	50

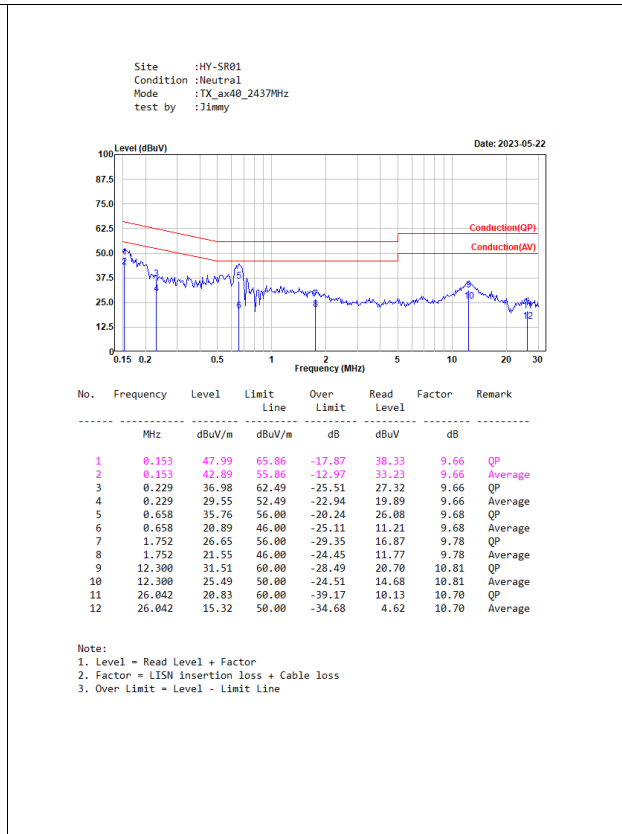
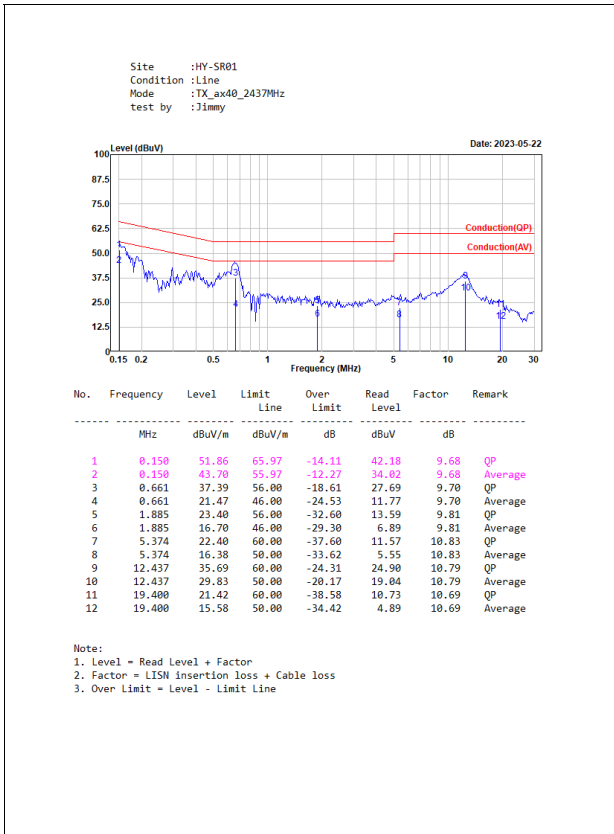
2.3. Test Procedure

The EUT and simulators are connected to the main power through a line impedance stabilization network (L.I.S.N.). This provides a 50 ohm / 50 μ H coupling impedance for the measuring equipment. The peripheral devices are also connected to the main power through a LISN that provides a 50 ohm /50 μ H coupling impedance with 50 ohm termination. (Please refers to the block diagram of the test setup and photographs.)

Both sides of A.C. line are checked for maximum conducted interference. In order to find the maximum emission, the relative positions of equipment and all of the interface cables must be changed according to ANSI C63.4: 2014 on conducted measurement.

Conducted emissions were invested over the frequency range from 0.15 MHz to 30 MHz using a receiver bandwidth of 9 kHz.

2.4. Test Result of Conducted Emission



3. Maximum Power Output

3.1. Test Setup



3.2. Limits

The maximum peak power shall be less 1 Watt.

3.3. Test Procedure

The EUT was tested according to C63.10:2013 for compliance to FCC 47CFR 15.247 requirements. The maximum peak conducted output power using C63.10:2013 Section 11.9.1.3 PKPM1 Peak power meter method. The maximum average conducted output power using C63.10:2013 Section 11.9.2.3 Measurement using a power meter (PM). (Measurement using a gated RF average-reading power meter). The maximum conducted output power shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6 dBi.

3.4. Test Result of Maximum Power Output

Product : Internet Gateway
 Test Item : Maximum Power Output Data
 Test Mode : Transmit (802.11b)-CDD
 Test Date : 2023/03/28

Chain A+B+C+D

Channel No.	Frequency (MHz)	Data Rate (Mbps)	Chain A Power (dBm)	Chain B Power (dBm)	Chain C Power (dBm)	Chain D Power (dBm)	Chain A+B+C+D Power (dBm)	Limit (dBm)	Result
01	2412	1	23.54	23.60	23.47	23.64	29.58	<30	Pass
06	2437	1	23.86	23.85	23.67	23.69	29.79	<30	Pass
11	2462	1	24.05	23.54	23.77	23.72	29.79	<30	Pass

Note: Maximum Power Output Value (dBm) = $10 \cdot \text{LOG} (\text{Chain A (mW)} + \text{Chain B (mW)} + \text{Chain C (mW)} + \text{Chain D (mW)})$

Product : Internet Gateway
 Test Item : Maximum Power Output Data
 Test Mode : Transmit (802.11g)-CDD
 Test Date : 2023/03/28

Chain A+B+C+D

Channel No.	Frequency (MHz)	Data Rate (Mbps)	Chain A Power (dBm)	Chain B Power (dBm)	Chain C Power (dBm)	Chain D Power (dBm)	Chain A+B+C+D Power (dBm)	Limit (dBm)	Result
01	2412	6	23.56	23.68	23.56	23.75	29.66	<30	Pass
06	2437	6	23.50	23.64	23.55	23.58	29.59	<30	Pass
11	2462	6	23.44	23.50	23.48	23.34	29.46	<30	Pass

Note: Maximum Power Output Value (dBm) = $10 \cdot \text{LOG} (\text{Chain A (mW)} + \text{Chain B (mW)} + \text{Chain C (mW)} + \text{Chain D (mW)})$

Product : Internet Gateway
Test Item : Maximum Power Output Data
Test Mode : Transmit (802.11ax-20 MHz)-CDD
Test Date : 2023/03/28

Chain A+B+C+D

Channel No.	Frequency (MHz)	Data Rate (Mbps)	Chain A Power (dBm)	Chain B Power (dBm)	Chain C Power (dBm)	Chain D Power (dBm)	Chain A+B+C+D Power (dBm)	Limit (dBm)	Result
01	2412	MCS0	23.37	22.31	23.29	22.45	28.90	<30	Pass
06	2437	MCS0	23.67	23.67	23.65	23.63	29.68	<30	Pass
11	2462	MCS0	22.78	22.70	22.63	22.64	28.71	<30	Pass

Note: Maximum Power Output Value (dBm) = $10 \cdot \text{LOG} (\text{Chain A (mW)} + \text{Chain B (mW)} + \text{Chain C (mW)} + \text{Chain D (mW)})$

Product : Internet Gateway
 Test Item : Maximum Power Output Data
 Test Mode : Transmit (802.11ax-40 MHz)-CDD
 Test Date : 2023/03/28

Chain A+B+C+D

Channel No.	Frequency (MHz)	Data Rate (Mbps)	Chain A Power (dBm)	Chain B Power (dBm)	Chain C Power (dBm)	Chain D Power (dBm)	Chain A+B+C+D Power (dBm)	Limit (dBm)	Result
03	2422	MCS0	23.68	23.89	23.76	23.70	29.78	<30	Pass
06	2437	MCS0	23.89	23.98	23.87	23.90	29.93	<30	Pass
09	2452	MCS0	21.87	21.94	21.89	21.95	27.93	<30	Pass

Note: Maximum Power Output Value (dBm) = $10 \cdot \text{LOG} (\text{Chain A (mW)} + \text{Chain B (mW)} + \text{Chain C (mW)} + \text{Chain D (mW)})$

Product : Internet Gateway
 Test Item : Maximum Power Output Data
 Test Mode : Transmit (802.11ax-20 MHz)-Beamforming
 Test Date : 2023/05/03

Chain A+B+C+D

Channel No.	Frequency (MHz)	Data Rate (Mbps)	Chain A Power (dBm)	Chain B Power (dBm)	Chain C Power (dBm)	Chain D Power (dBm)	Chain A+B+C+D Power (dBm)	Limit (dBm)	Result
01	2412	MCS0	24.39	23.36	24.27	23.33	29.89	<30	Pass
06	2437	MCS0	23.52	23.45	23.30	23.49	29.46	<30	Pass
11	2462	MCS0	23.93	23.71	23.81	23.69	29.81	<30	Pass

Note: Maximum Power Output Value (dBm) = 10*LOG (Chain A (mW) + Chain B (mW) + Chain C (mW) + Chain D (mW))

Product : Internet Gateway
 Test Item : Maximum Power Output Data
 Test Mode : Transmit (802.11ax-40 MHz)-Beamforming
 Test Date : 2023/05/03

Chain A+B+C+D

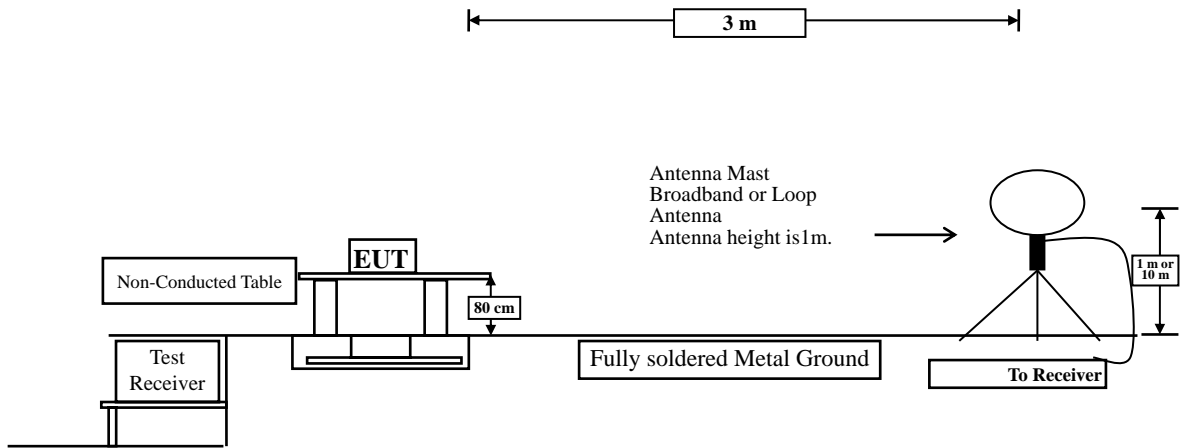
Channel No.	Frequency (MHz)	Data Rate (Mbps)	Chain A Power (dBm)	Chain B Power (dBm)	Chain C Power (dBm)	Chain D Power (dBm)	Chain A+B+C+D Power (dBm)	Limit (dBm)	Result
03	2422	MCS0	23.47	23.71	23.65	23.47	29.60	<30	Pass
06	2437	MCS0	23.69	23.83	23.69	23.73	29.76	<30	Pass
09	2452	MCS0	22.89	22.89	22.95	23.06	28.97	<30	Pass

Note: Maximum Power Output Value (dBm) = 10*LOG (Chain A (mW) + Chain B (mW) + Chain C (mW) + Chain D (mW))

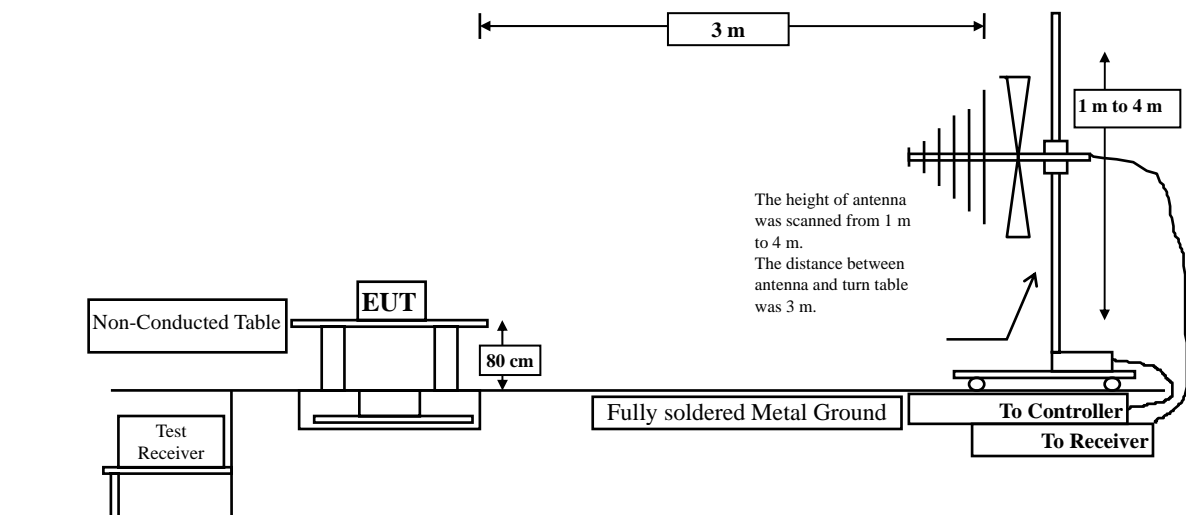
4. Radiated Emission

4.1. Test Setup

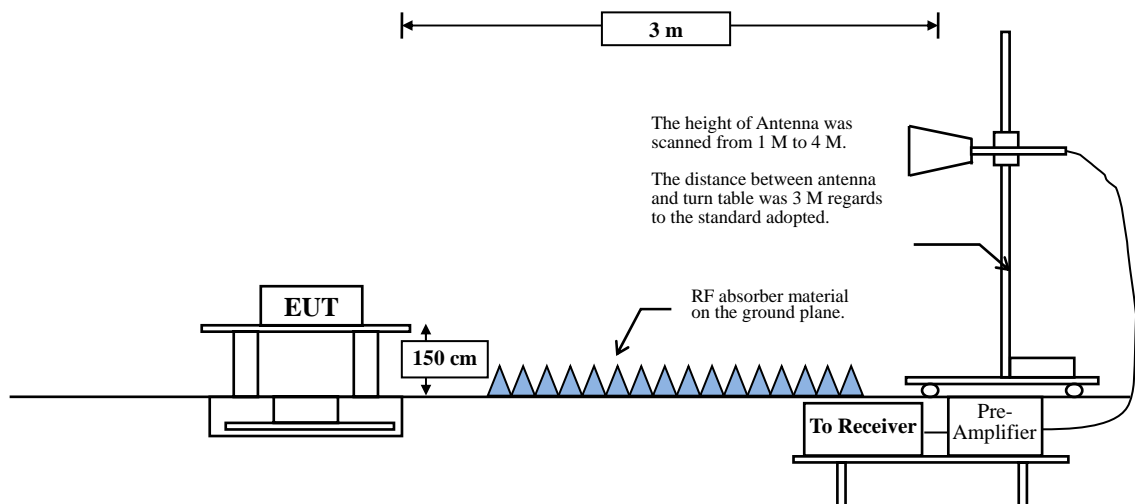
Radiated Emission Under 30 MHz



Radiated Emission Below 1 GHz



Radiated Emission Above 1 GHz



4.2. Limits

➤ **General Radiated Emission Limits**

Emissions radiated outside of the specified frequency bands, except for harmonics, shall be attenuated by at least 20 dB below the level of the fundamental or to the general radiated emission limits in paragraph 15.209, whichever is the lesser attenuation.

FCC Part 15 Subpart C Paragraph 15.209 Limits		
Frequency MHz	Field strength (microvolts/meter)	Measurement distance (meter)
0.009-0.490	2400/F(kHz)	300
0.490-1.705	24000/F(kHz)	30
1.705-30	30	30
30-88	100	3
88-216	150	3
216-960	200	3
Above 960	500	3

Remarks:

1. RF Voltage (dB μ V) = 20 log RF Voltage (μ V)
2. In the Above Table, the tighter limit applies at the band edges.
3. Distance refers to the distance in meters between the measuring instrument antenna and the closed point of any part of the device or system.

4.3. Test Procedure

The EUT was setup according to ANSI C63.10: 2013 and tested according to C63.10:2013 Section 11.12.1 for compliance to FCC 47CFR 15.247 requirements.

Measuring the frequency range below 1 GHz, the EUT is placed on a turn table which is 0.8 meter above ground, when measuring the frequency range above 1GHz, the EUT is placed on a turn table which is 1.5 meter above ground.

The turn table is rotated 360 degrees to determine the position of the maximum emission level.

The EUT was positioned such that the distance from antenna to the EUT was 3 meters.

The antenna is scanned between 1 meter and 4 meters to find out the maximum emission level. This is repeated for both horizontal and vertical polarization of the antenna. In order to find the maximum emission, all of the interface cables were manipulated according to ANSI C63.10: 2013 on radiated measurement.

The resolution bandwidth below 30 MHz setting on the field strength meter is 9 kHz and 30 MHz~1 GHz is 120 kHz and above 1 GHz is 1 MHz.

Radiated emission measurements below 30 MHz are made using Loop Antenna and 30 MHz~1 GHz are made using broadband Bilog antenna and above 1 GHz are made using Horn Antennas.

The measurement is divided into the Preliminary Measurement and the Final Measurement.

The suspected frequencies are searched for in Preliminary Measurement with the measurement antenna kept pointed at the source of the emission both in azimuth and elevation, with the polarization of the antenna oriented for maximum response. The antenna is pointed at an angle towards the source of the emission, and the EUT is rotated in both height and polarization to maximize the measured emission. The emission is kept within the illumination area of the 3 dB bandwidth of the antenna.

The measurement frequency range form 9 kHz - 10th Harmonic of fundamental was investigated.

RBW and VBW Parameter setting:

According to C63.10 Section 11.12.2.4 Peak measurement procedure.

RBW = as specified in Table 1.

VBW \geq 3 x RBW.

Table 1 - RBW as a function of frequency

Frequency	RBW
9-150 kHz	200-300 Hz
0.15-30 MHz	9-10 kHz
30-1000 MHz	100-120 kHz
> 1000 MHz	1 MHz

According to C63.10 Section 11.12.2.5 Average measurement procedure.

RBW = 1 MHz.

VBW = 10 Hz, when duty cycle \geq 98 %

VBW \geq 1/T, when duty cycle < 98 %

(T refers to the minimum transmission duration over which the transmitter is on and is transmitting at its maximum power control level for the tested mode of operation.)

CDD:

2.4GHz band	Duty Cycle (%)	T (ms)	1/T (Hz)	VBW (Hz)
802.11b	92.27	17.3000	58	100
802.11g	93.46	1.4300	699	1000
802.11ax-20 MHz	93.14	5.4300	184	200
802.11ax-40 MHz	93.12	5.4100	185	200

Note: Duty Cycle Refer to Section 9.

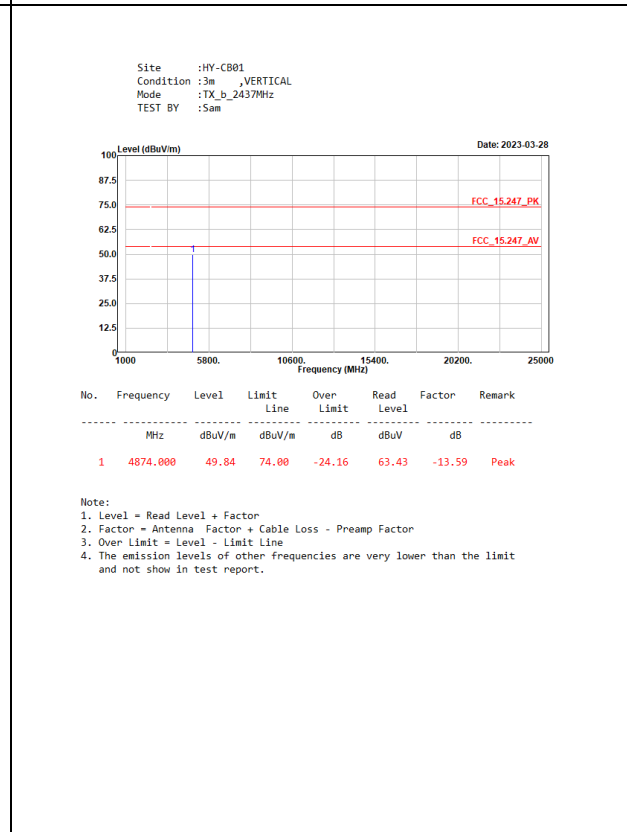
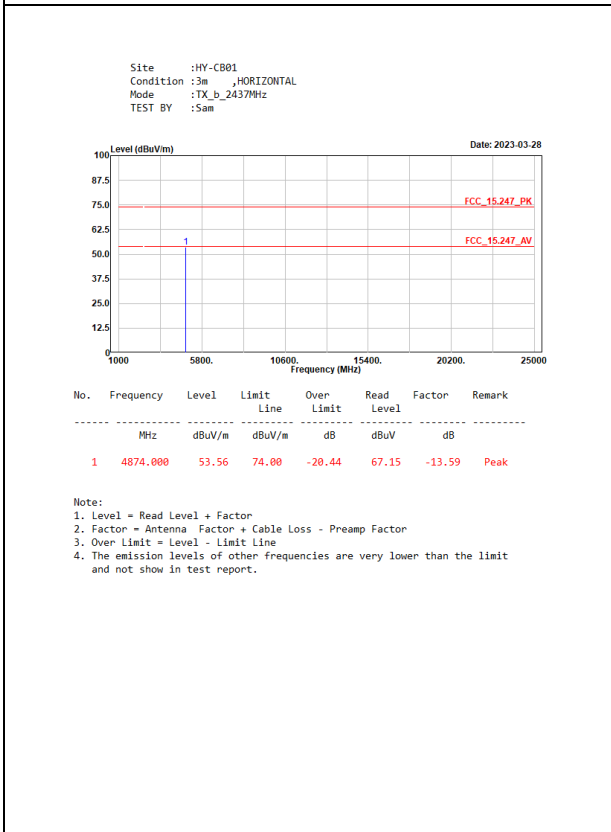
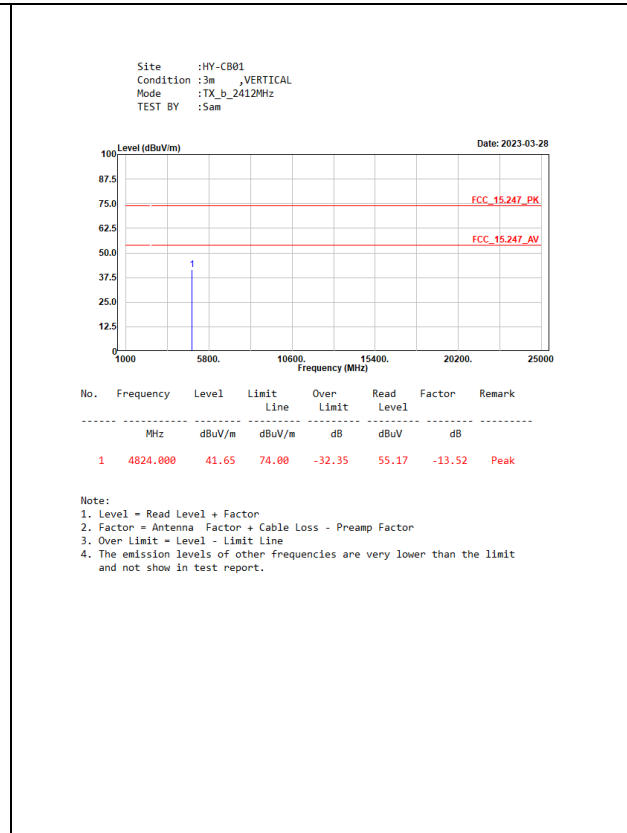
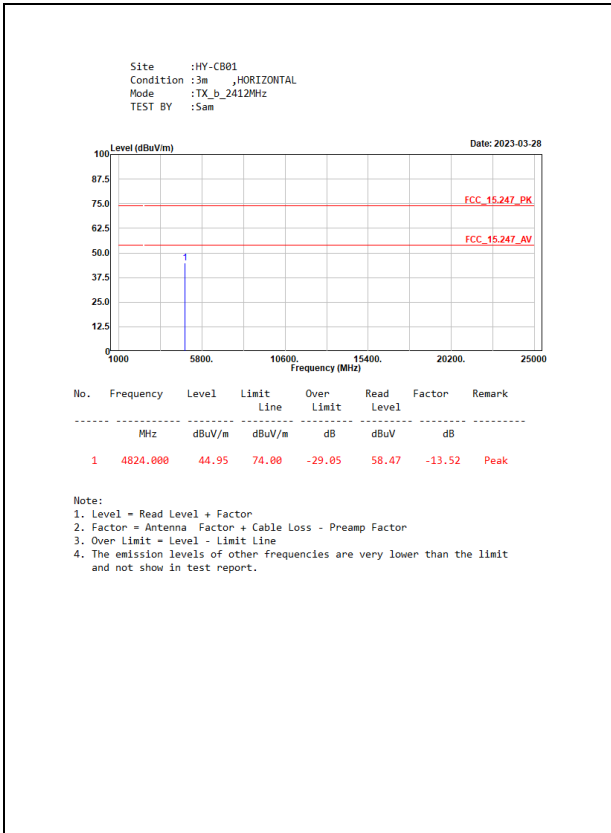
Beamforming:

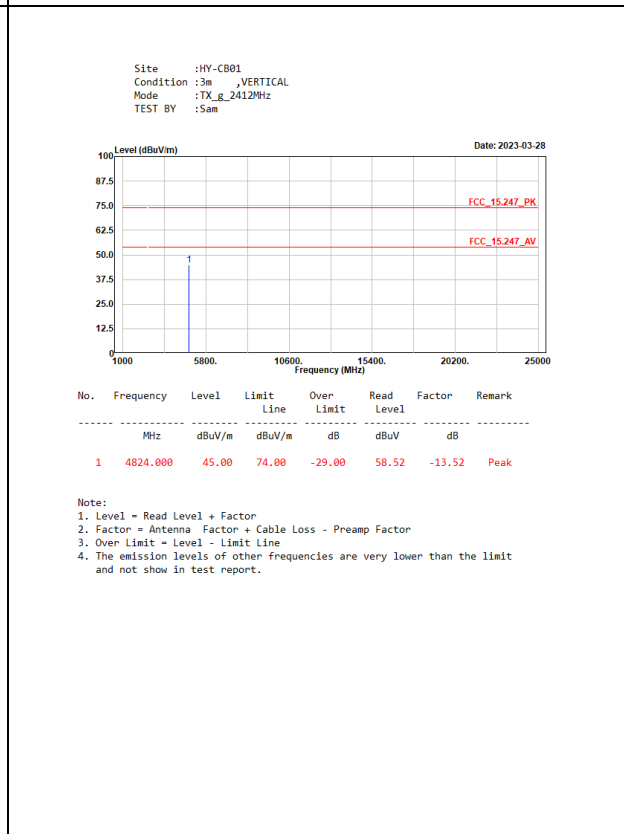
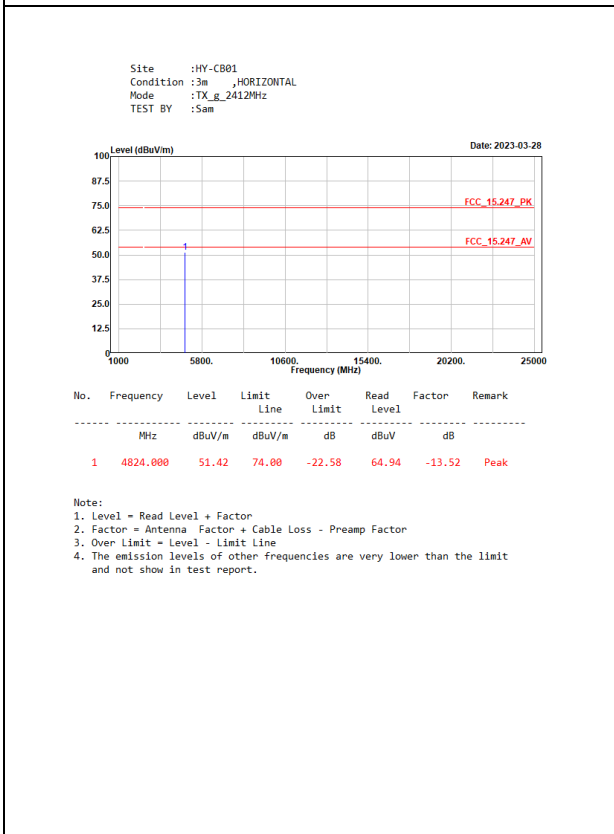
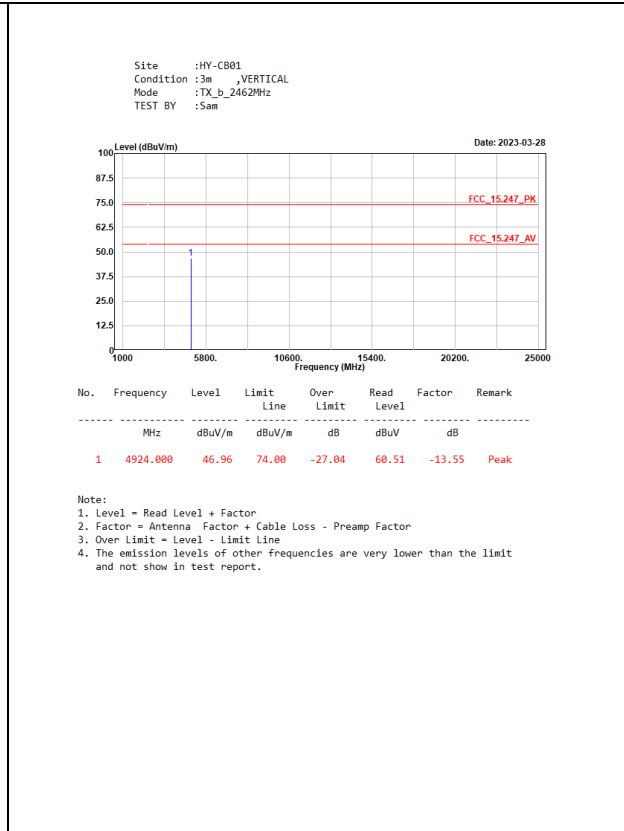
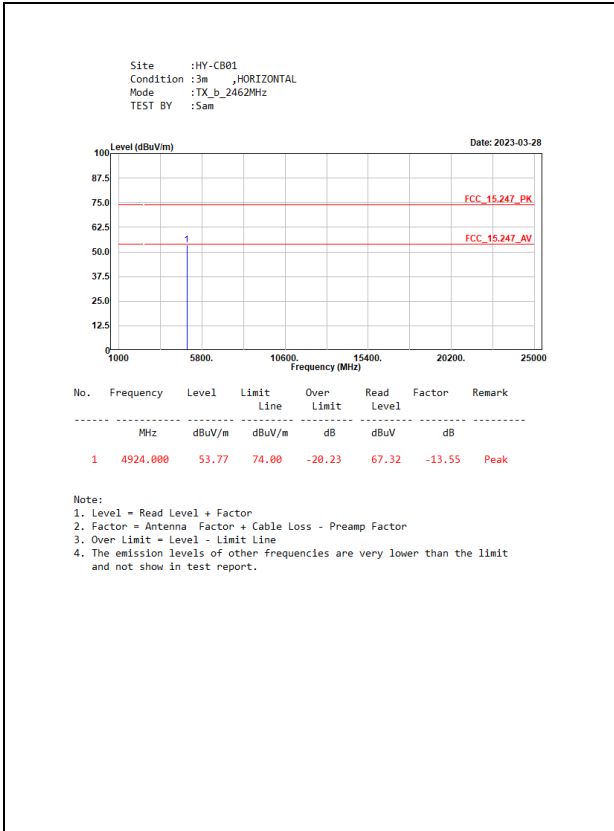
2.4GHz band	Duty Cycle (%)	T (ms)	1/T (Hz)	VBW (Hz)
802.11ax-20 MHz	92.07	6.7300	149	200
802.11ax-40 MHz	93.69	6.8300	146	200

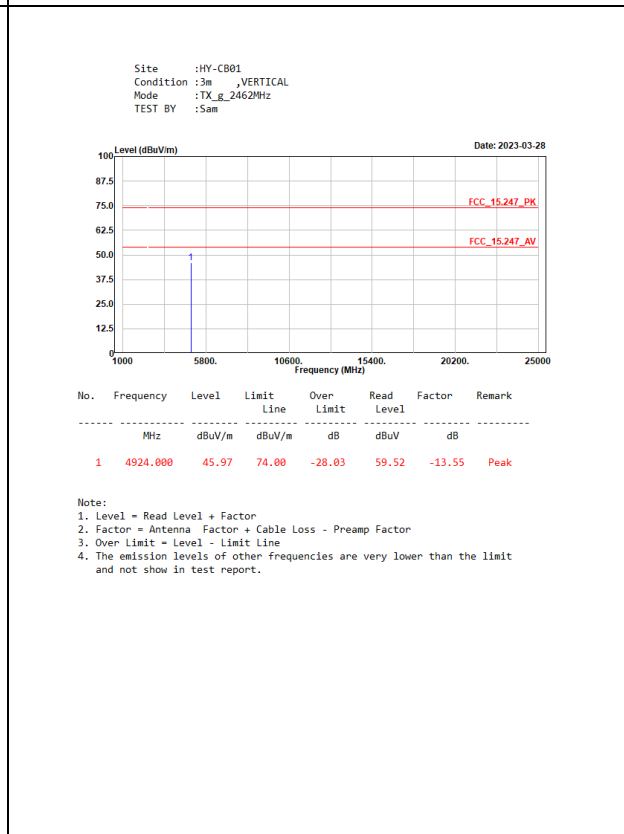
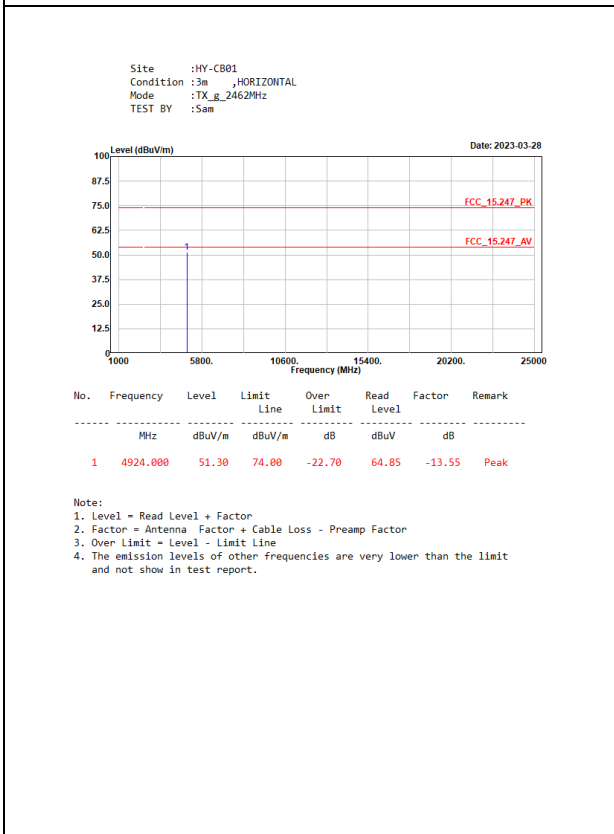
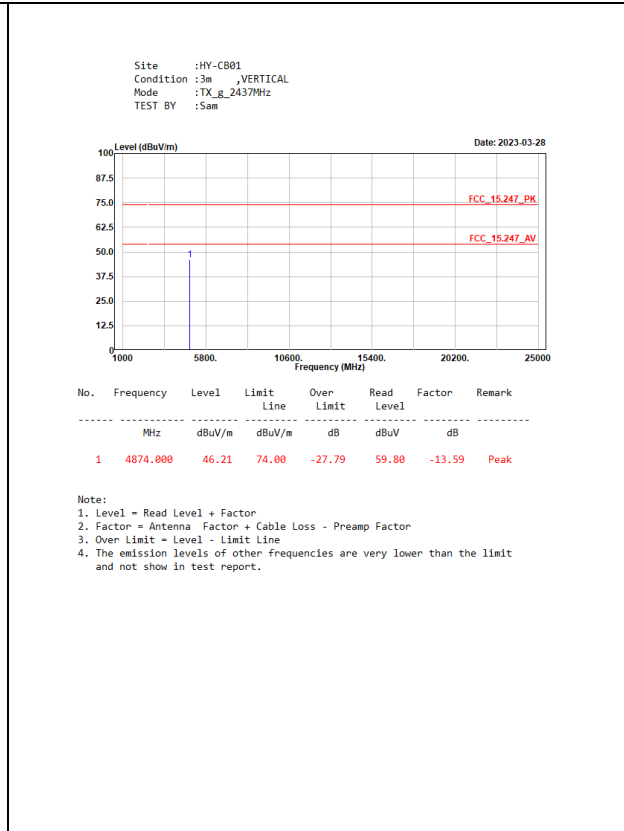
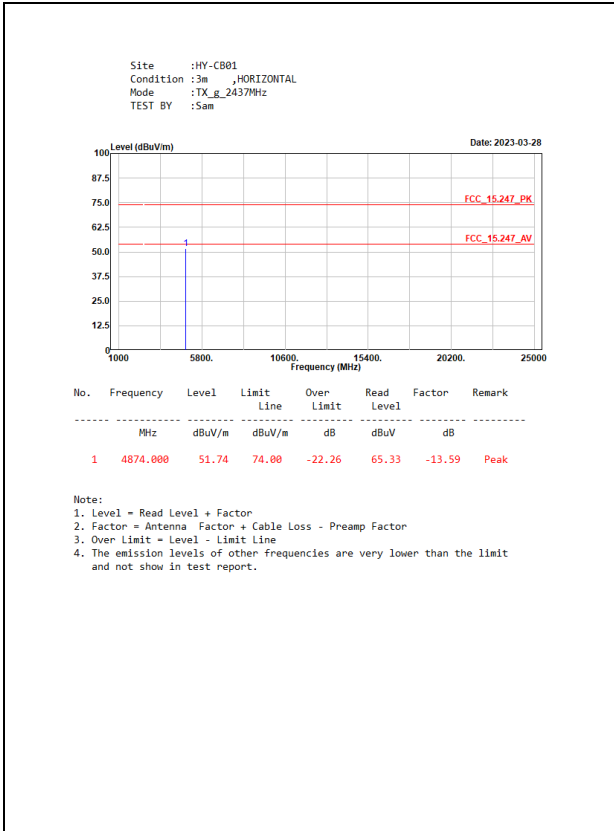
Note: Duty Cycle Refer to Section 9.

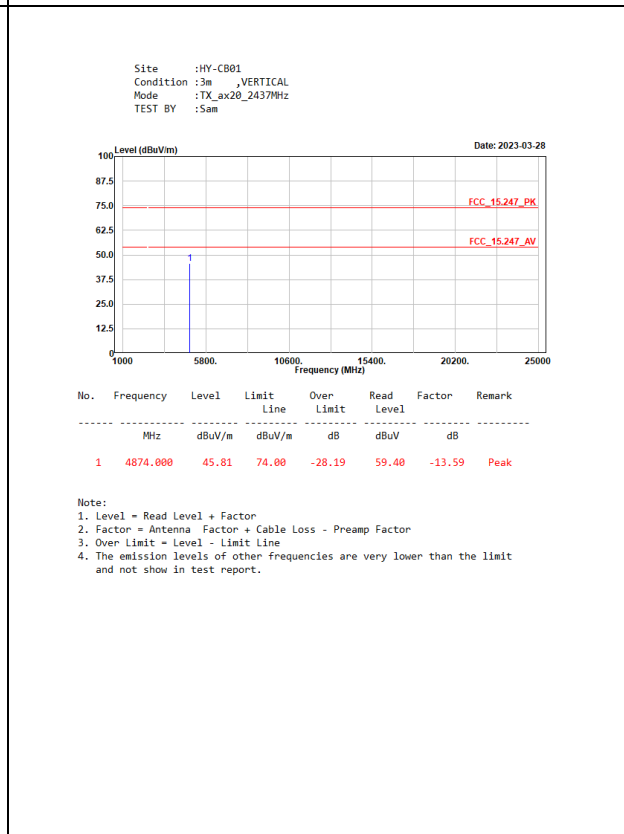
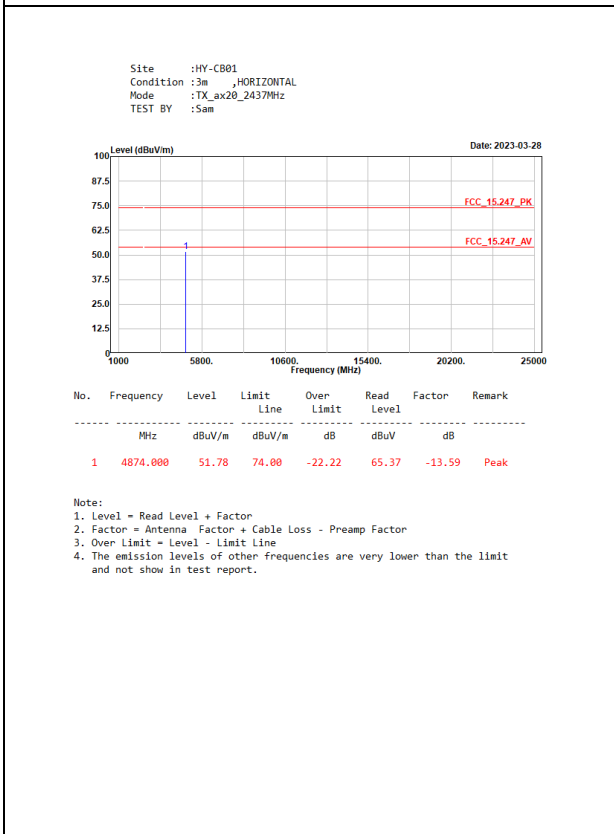
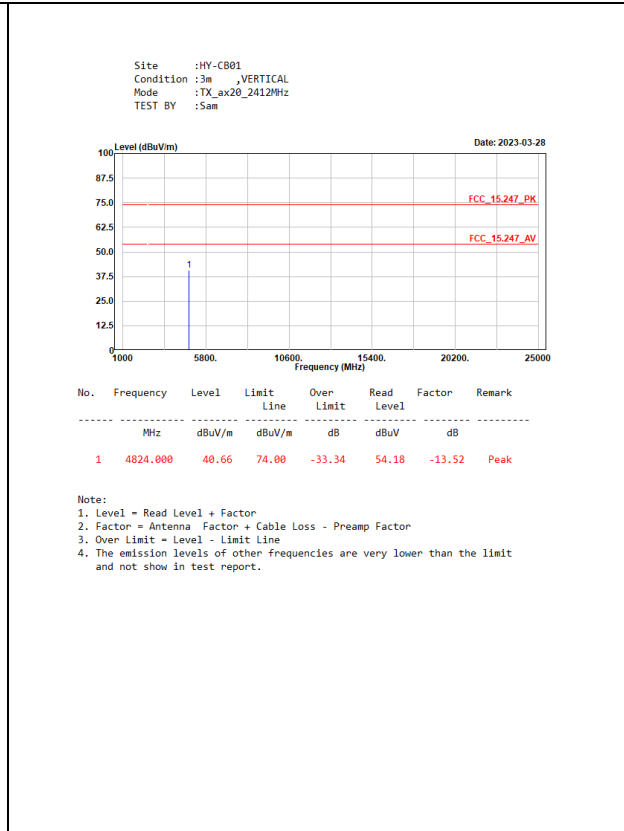
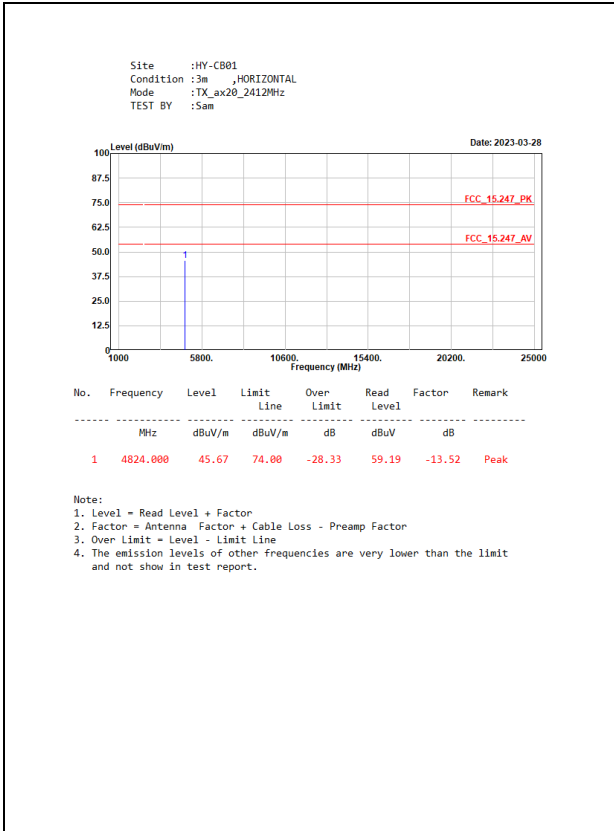
4.4. Test Result of Radiated Emission

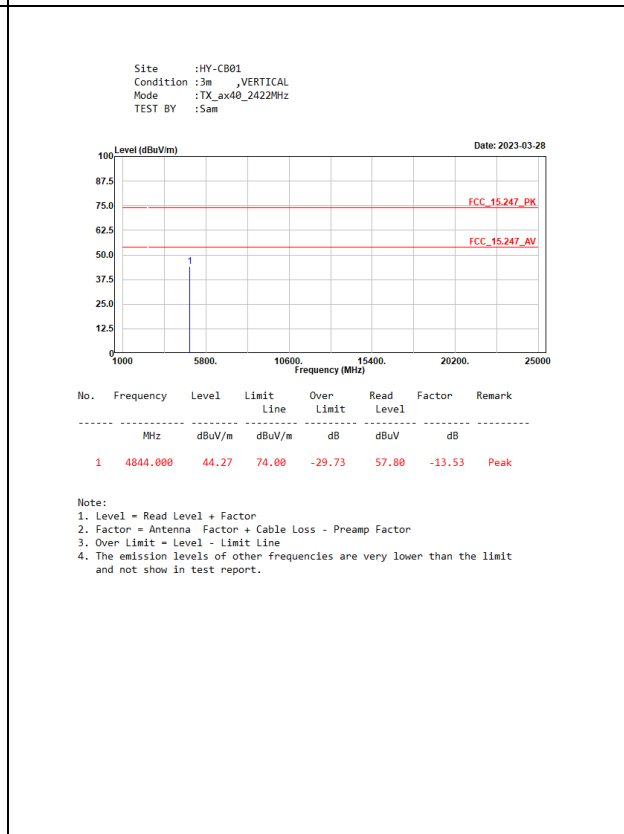
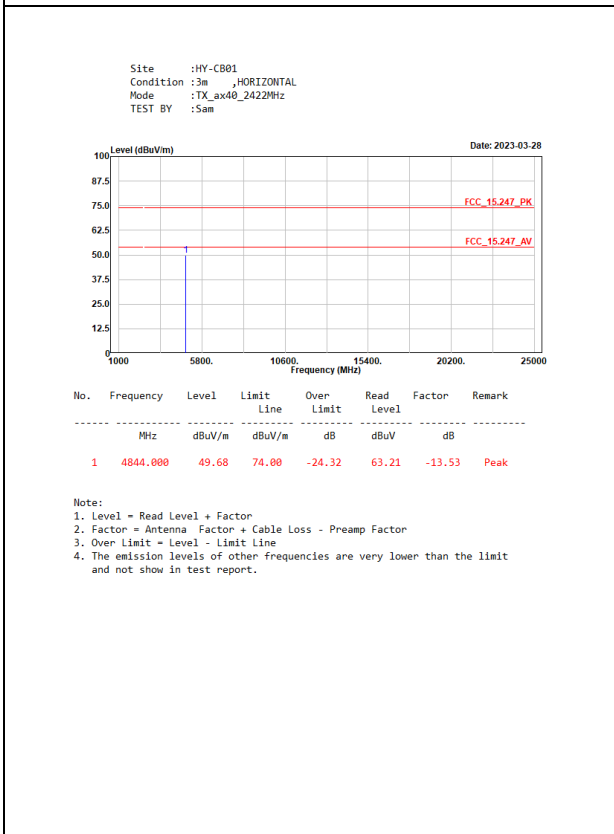
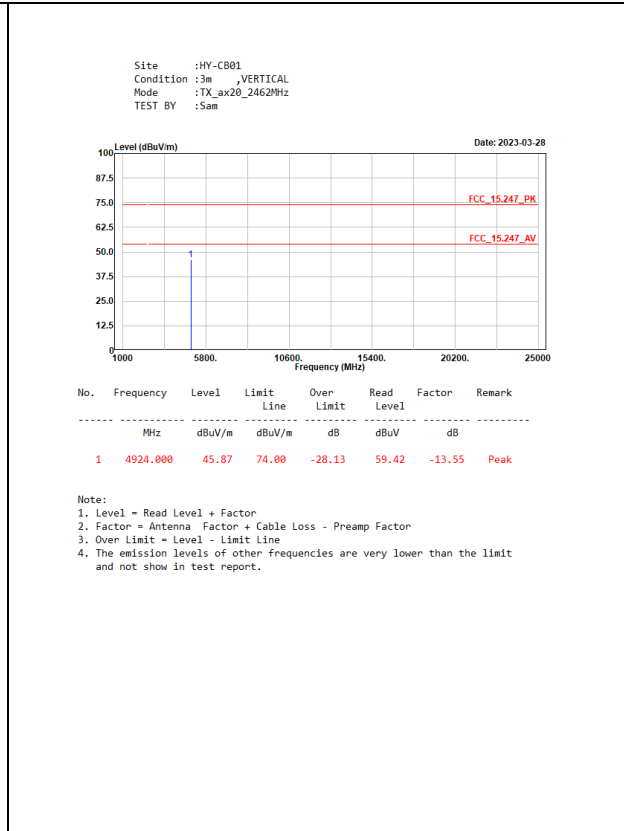
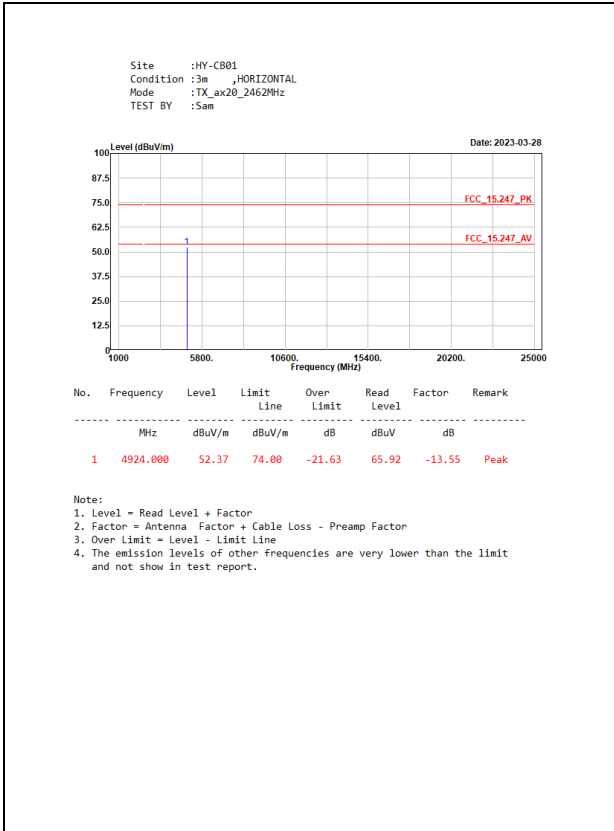
CDD

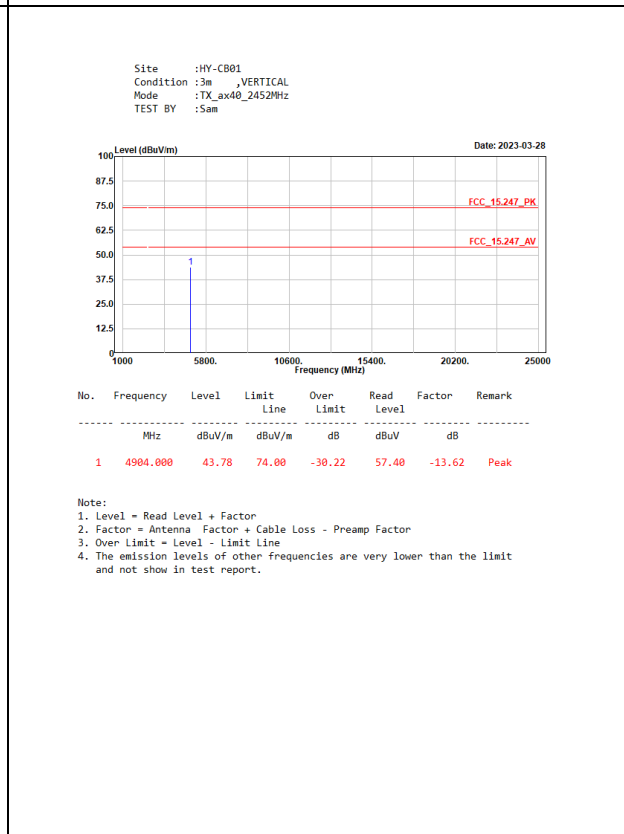
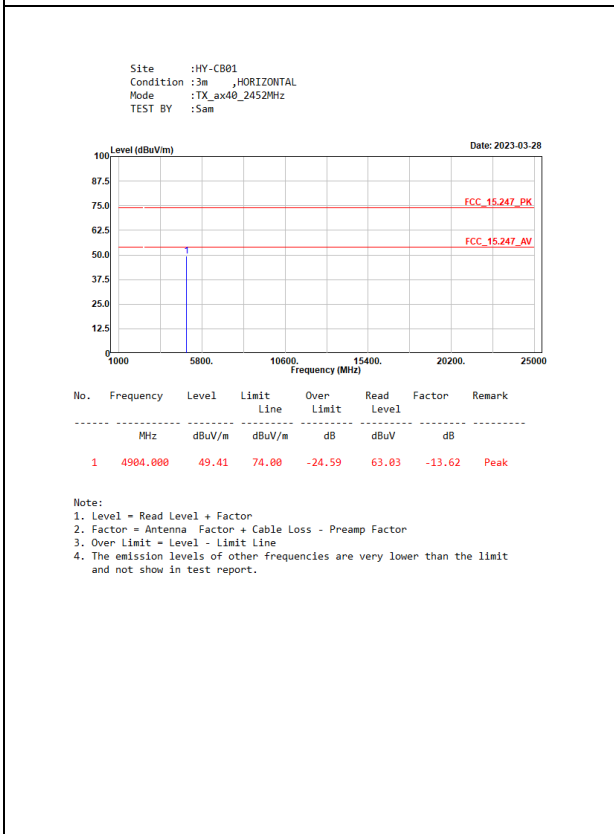
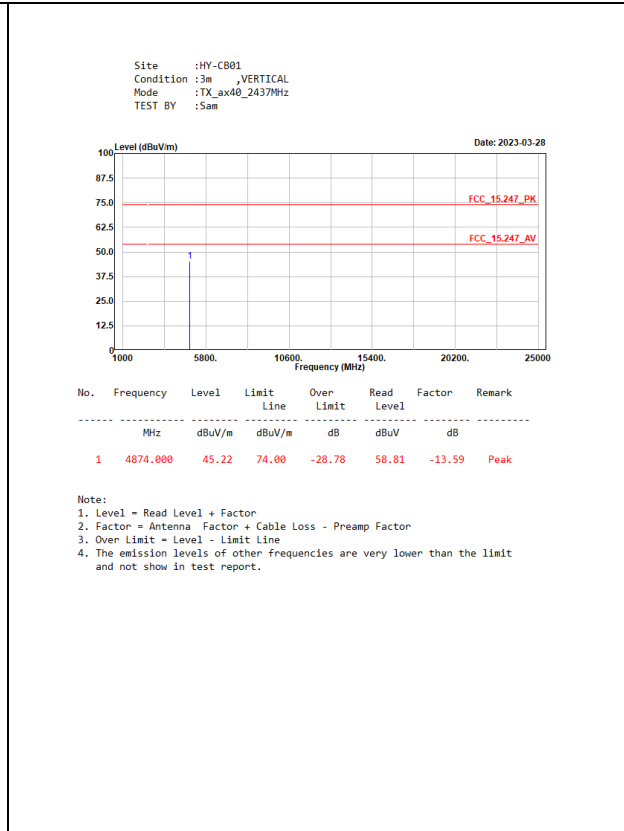
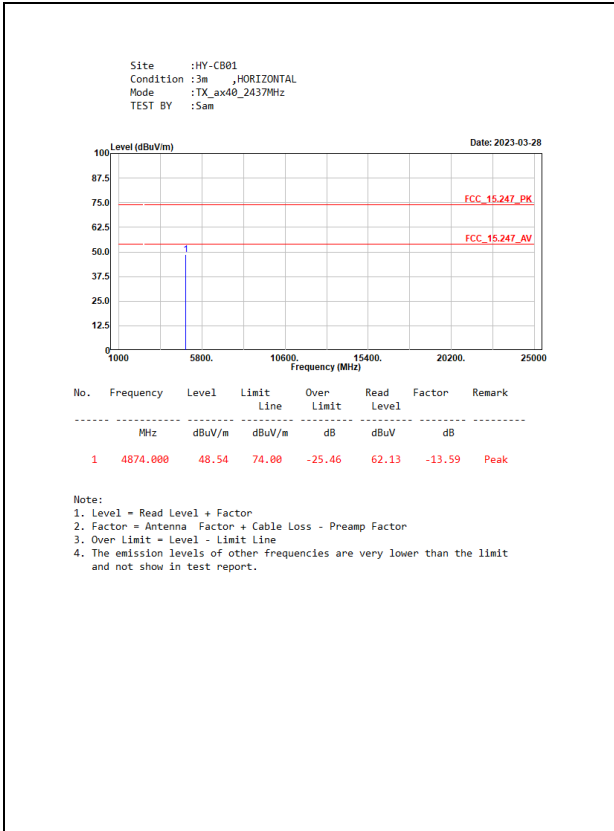


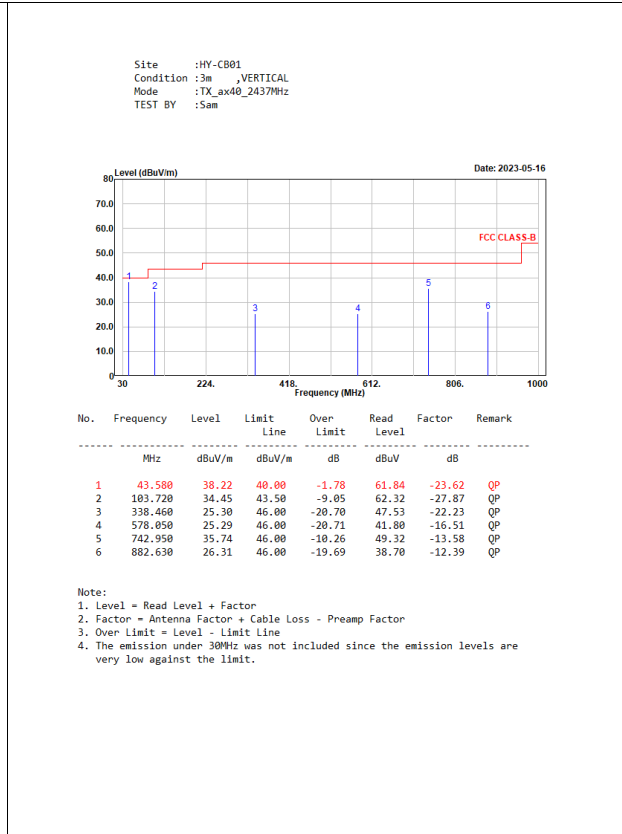
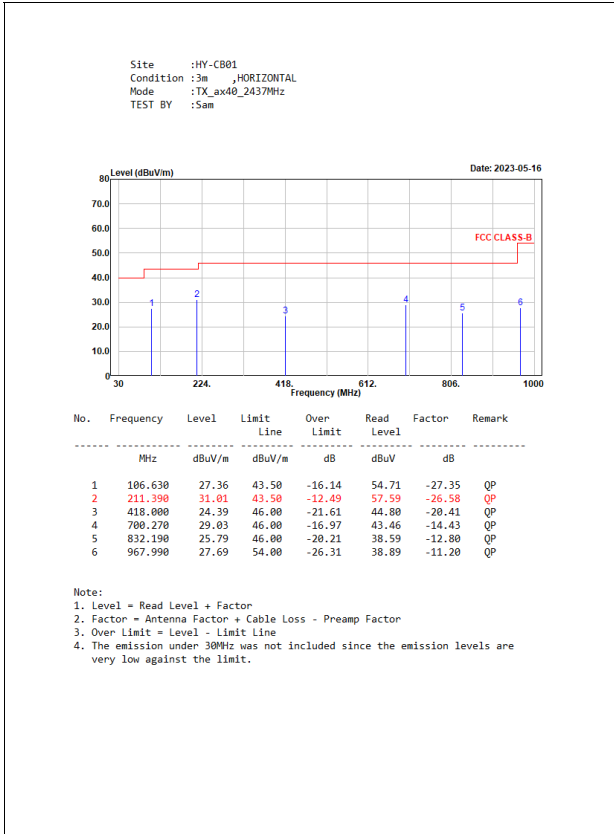




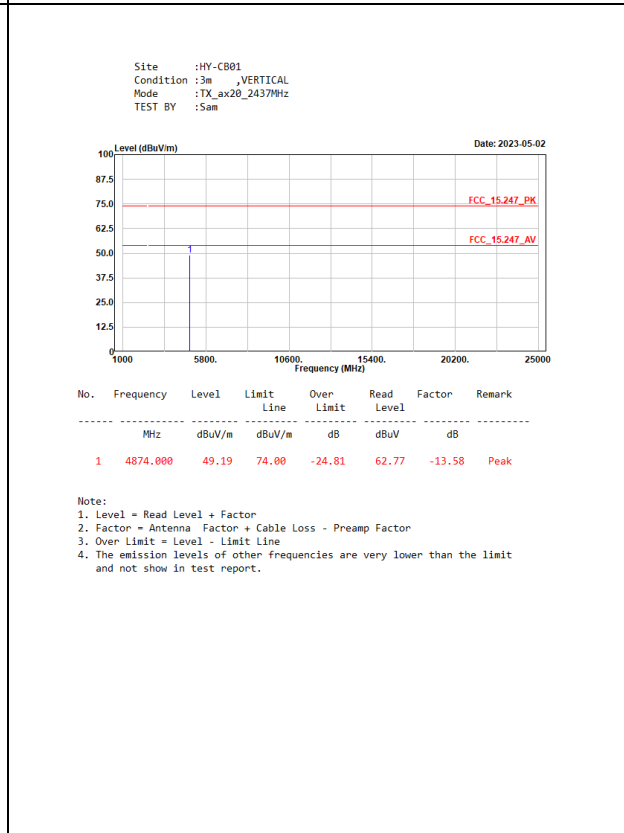
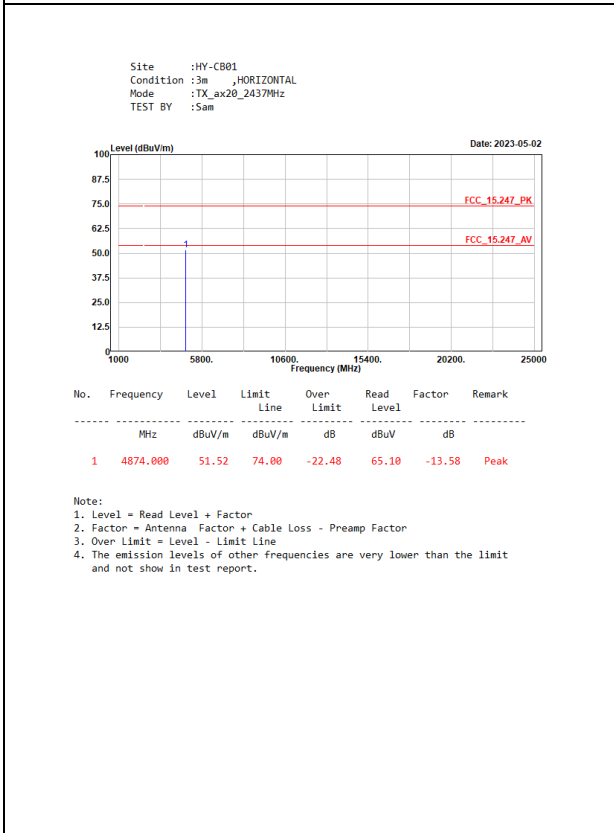
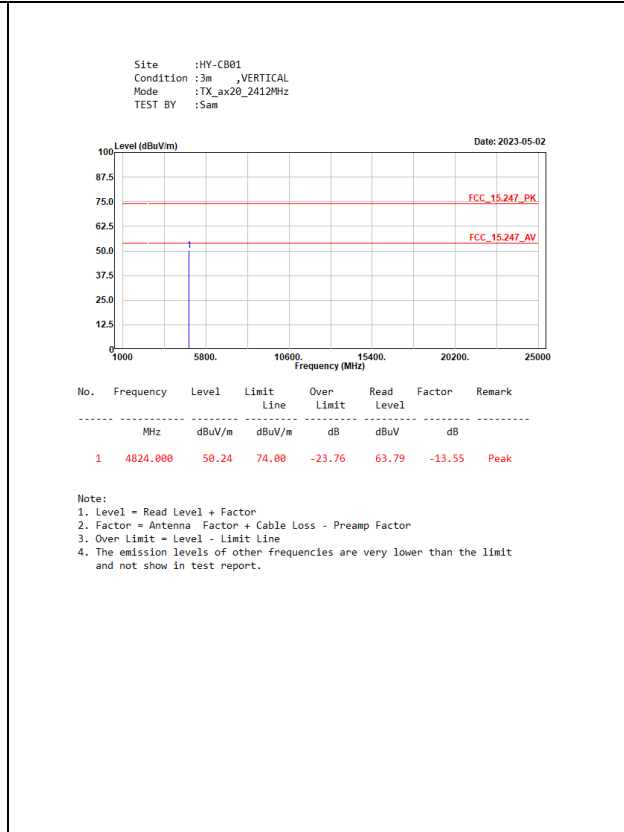
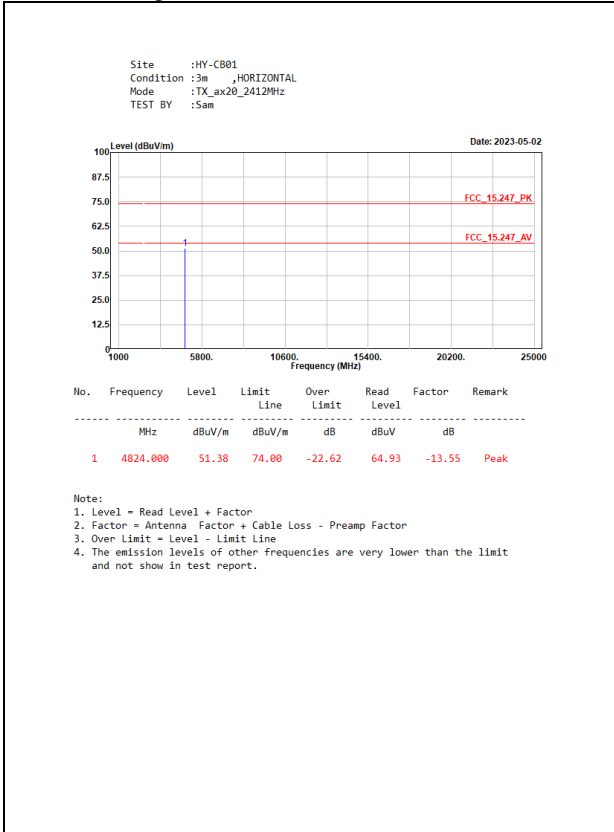


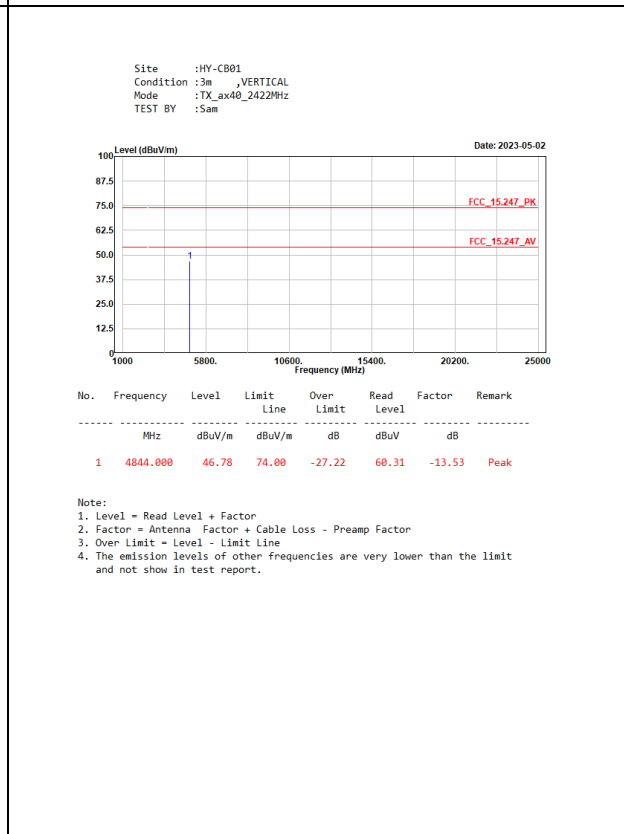
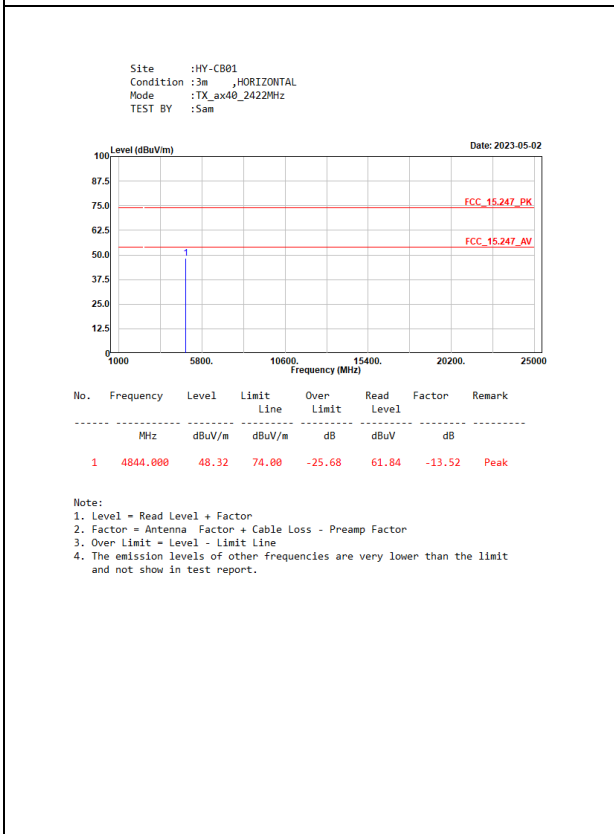
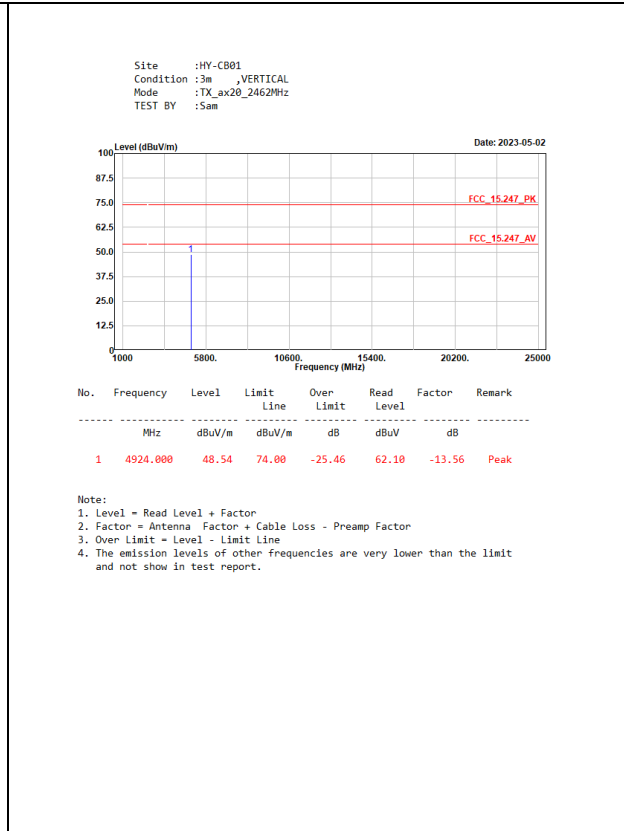
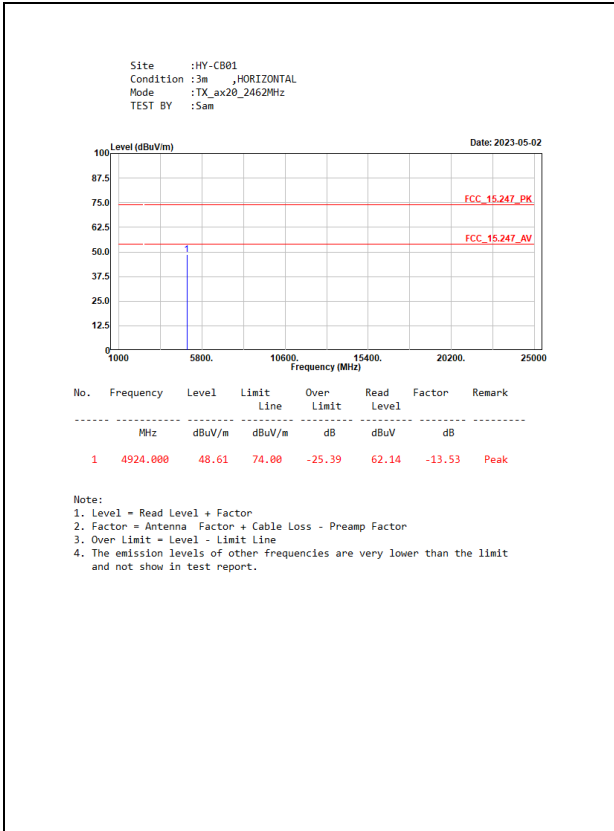


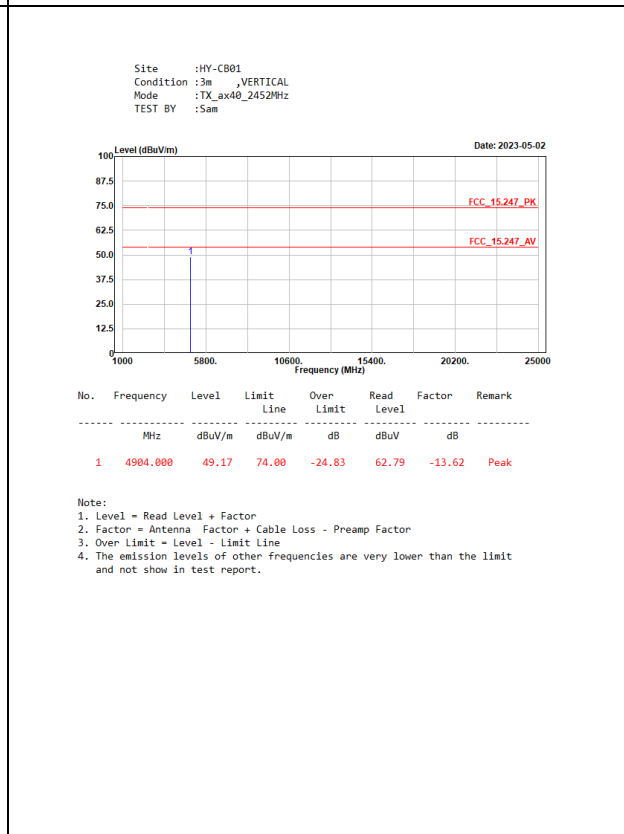
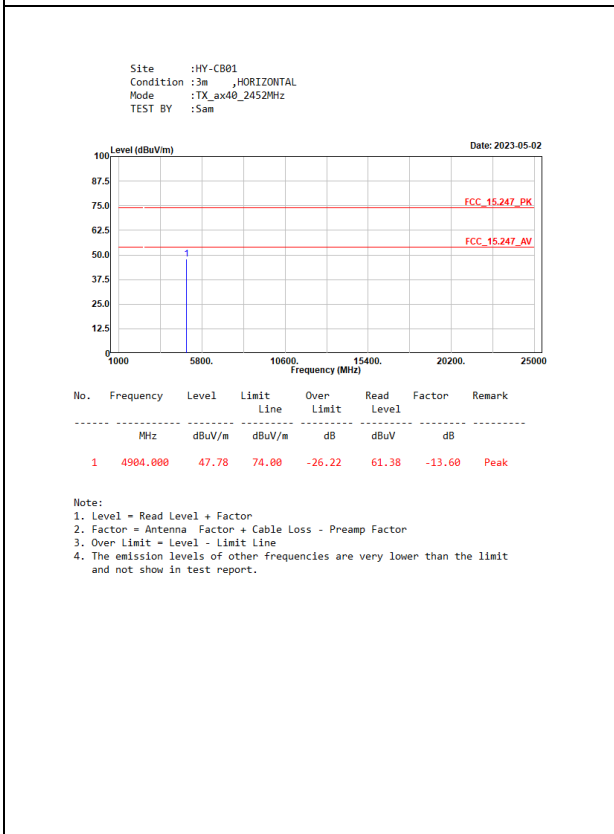
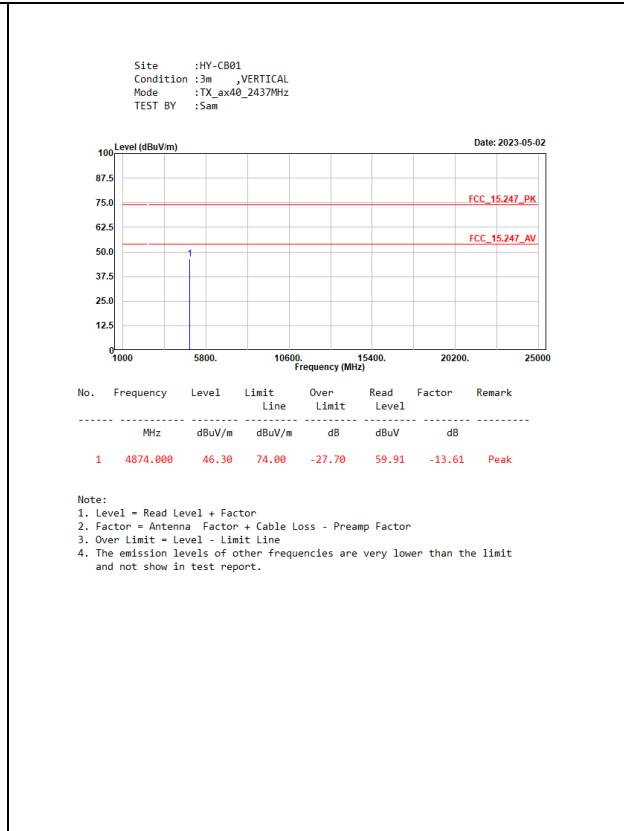
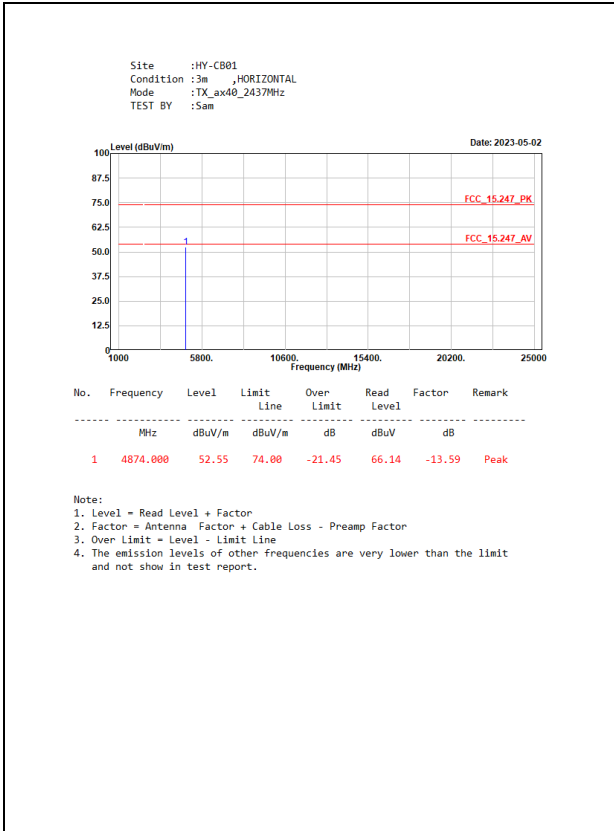




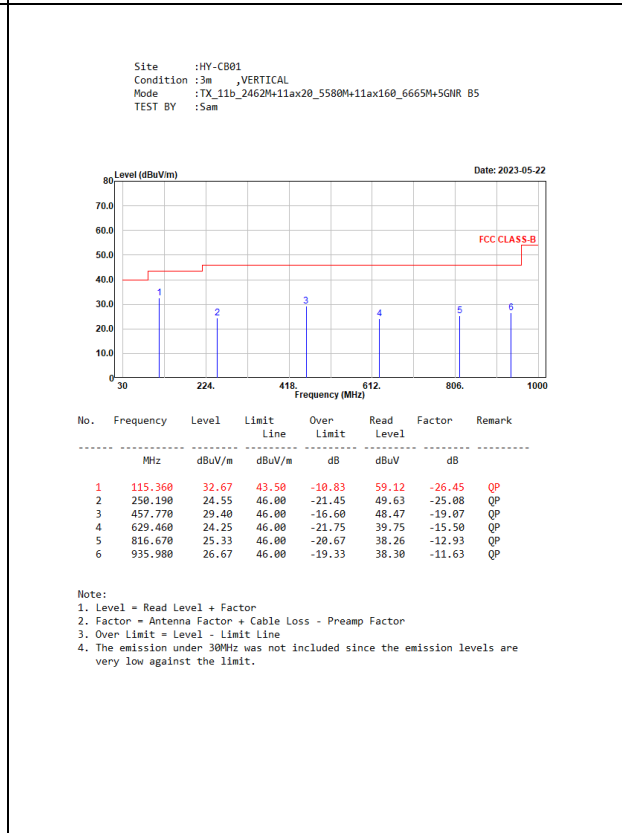
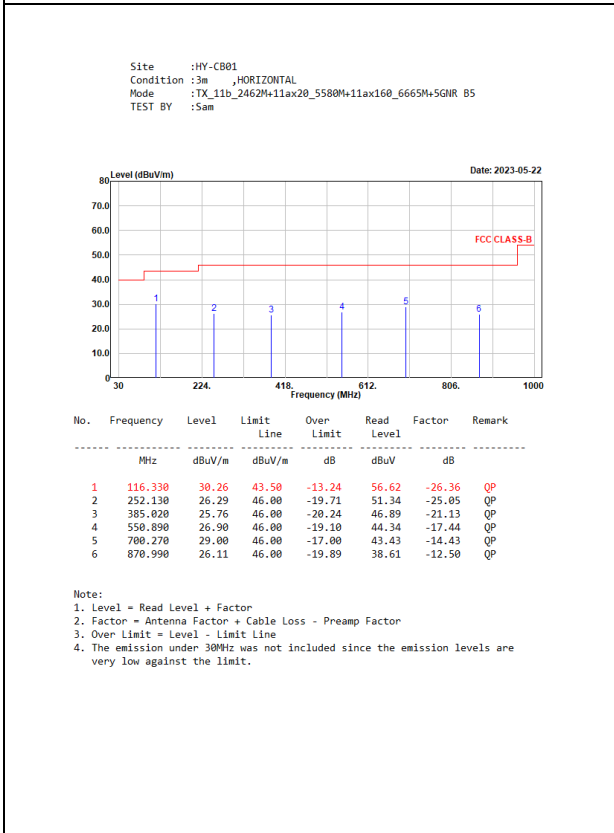
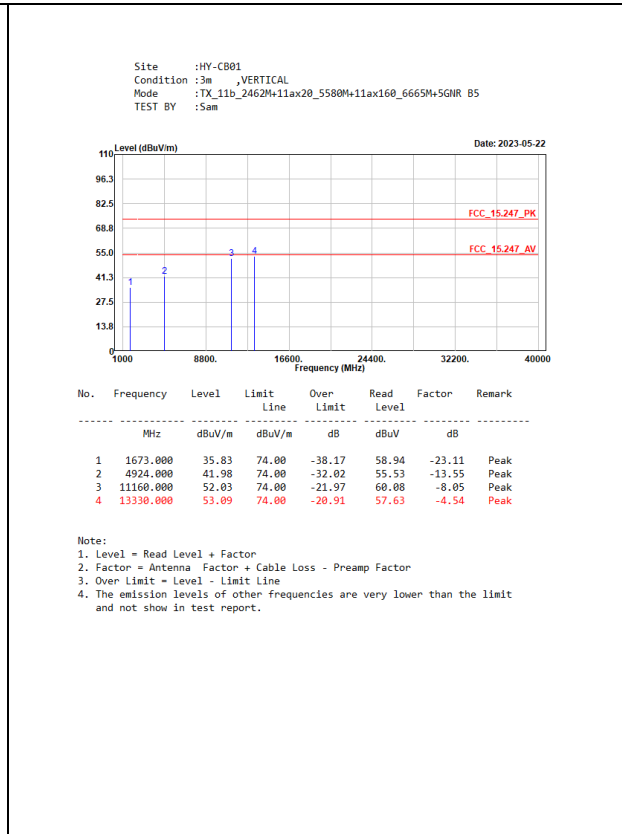
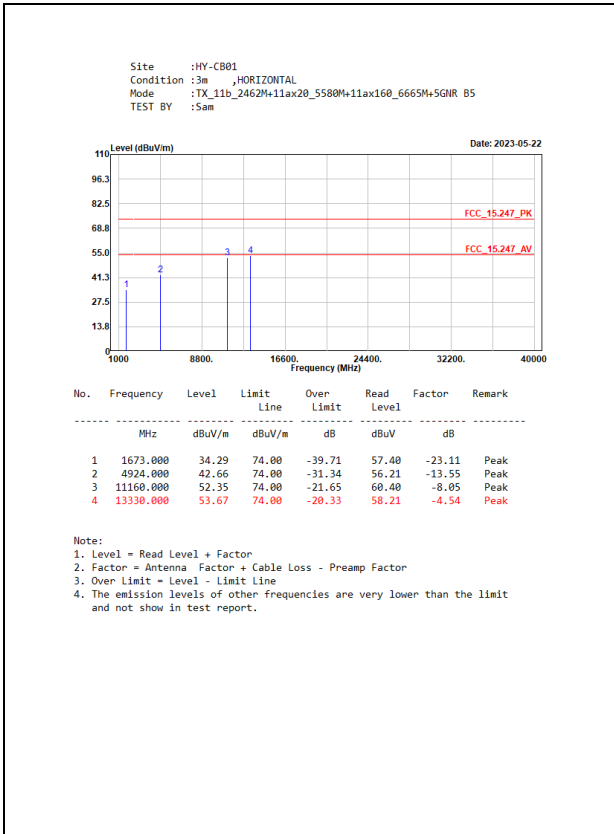
Beamforming

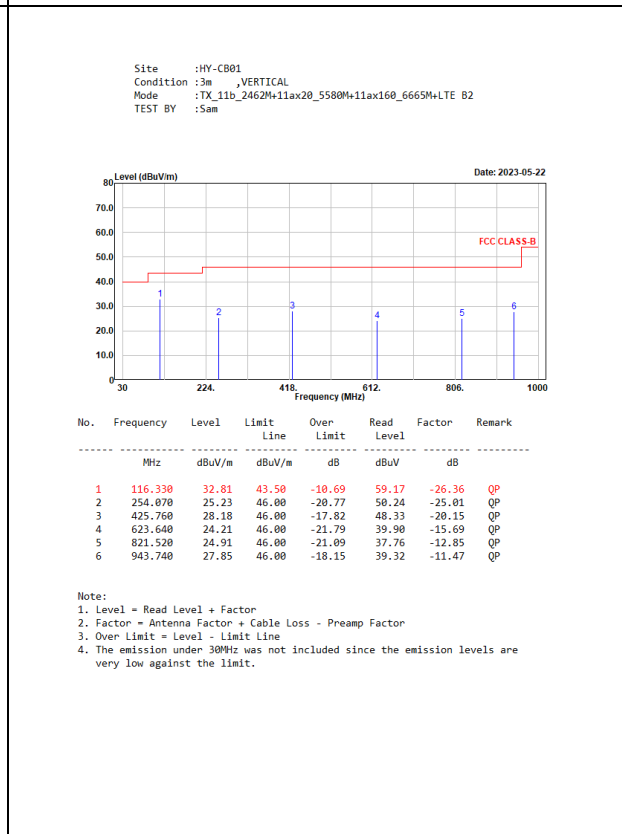
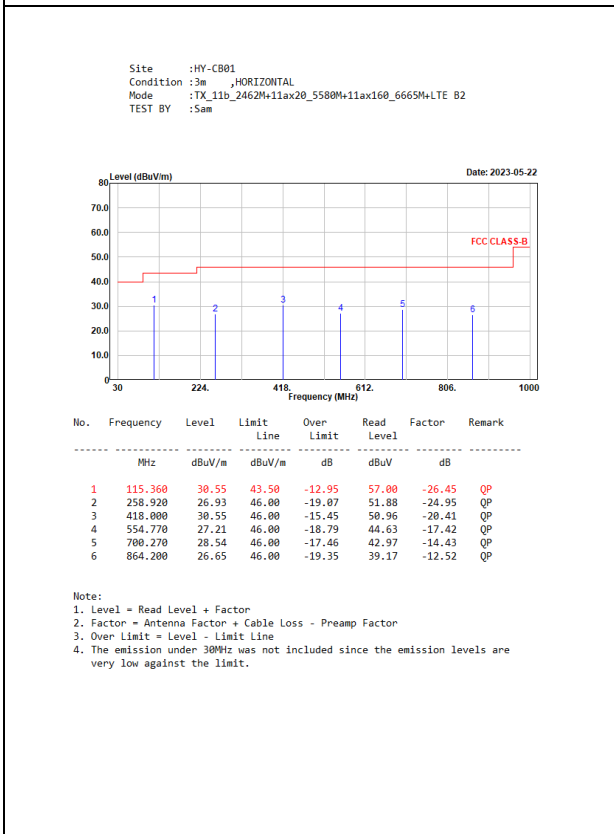
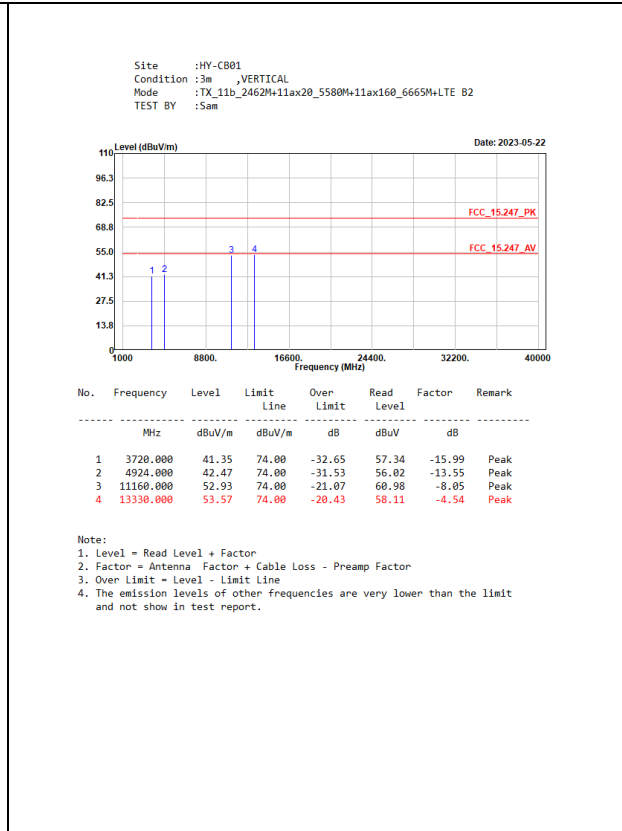
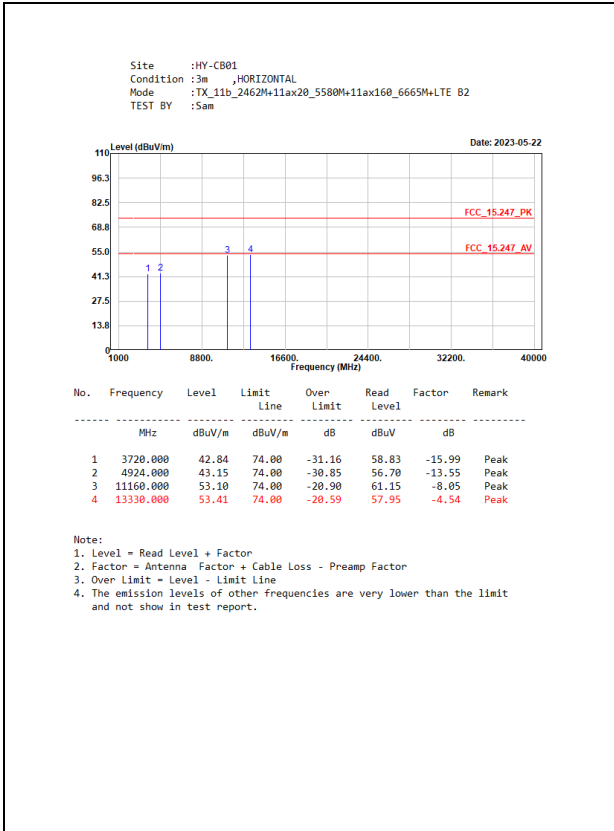


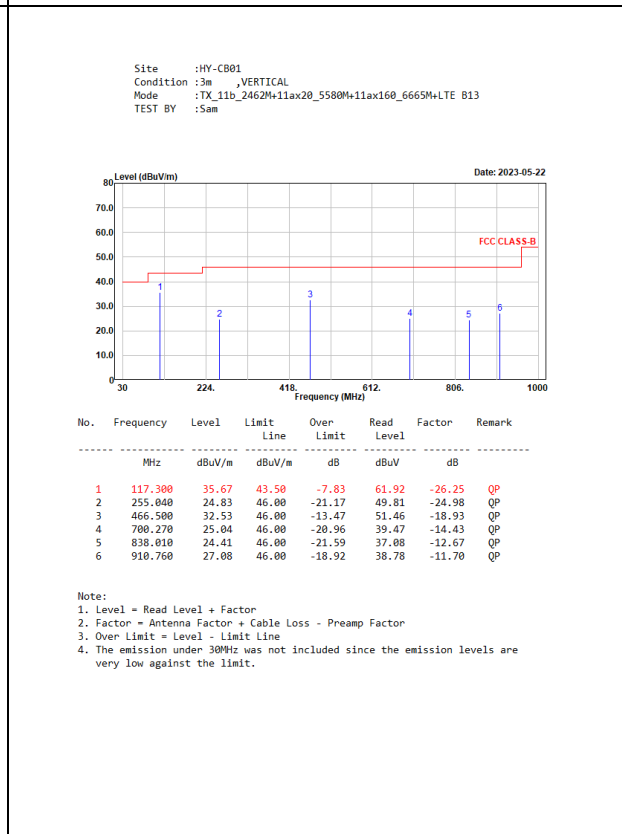
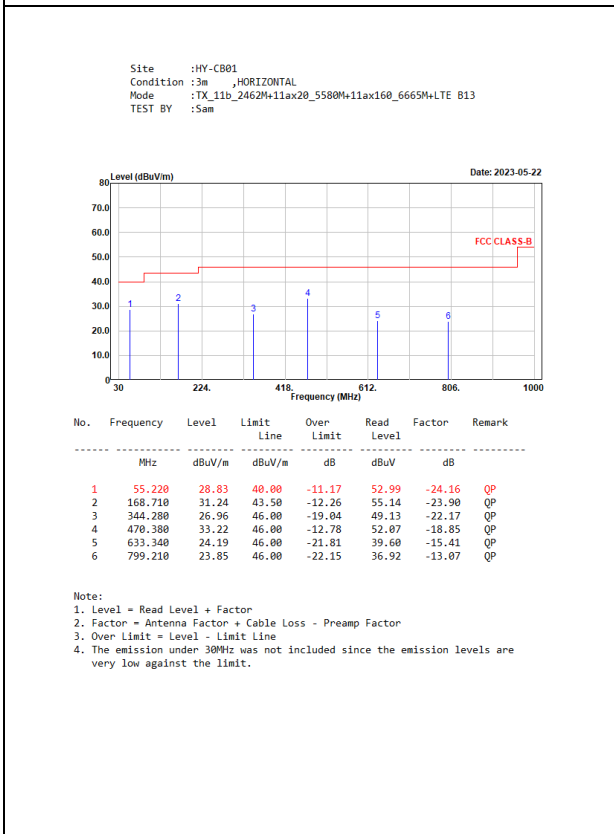
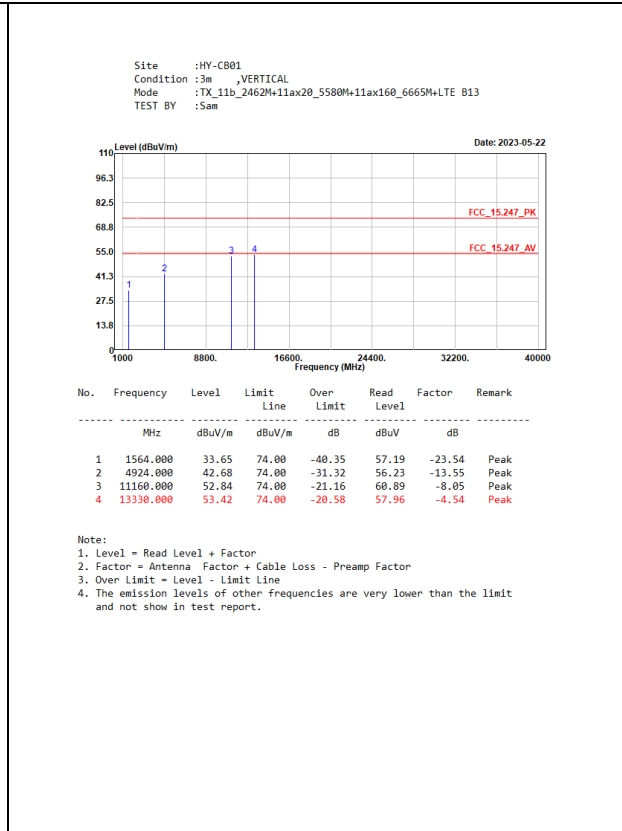
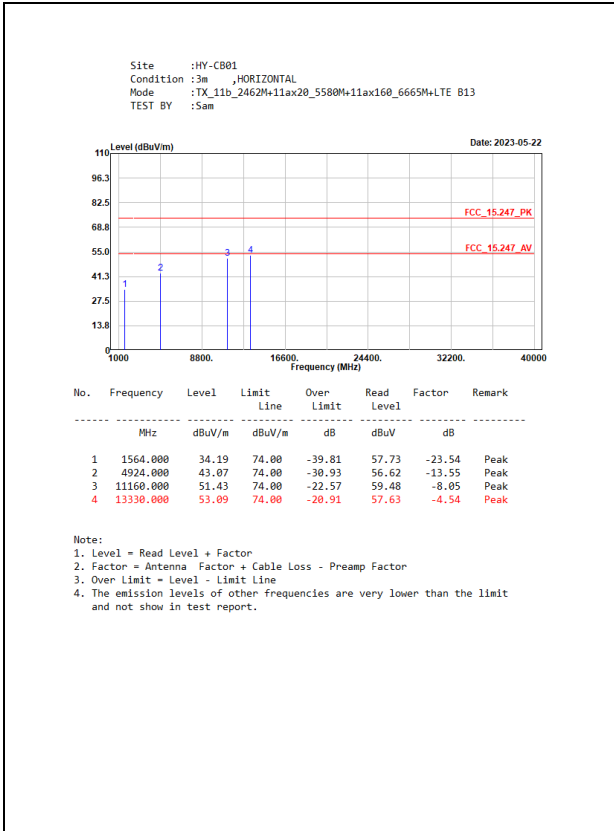


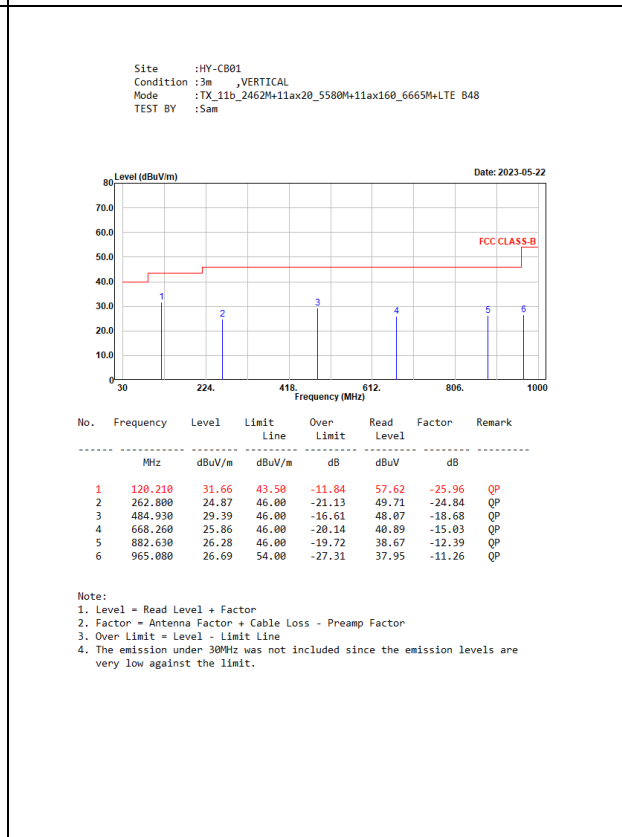
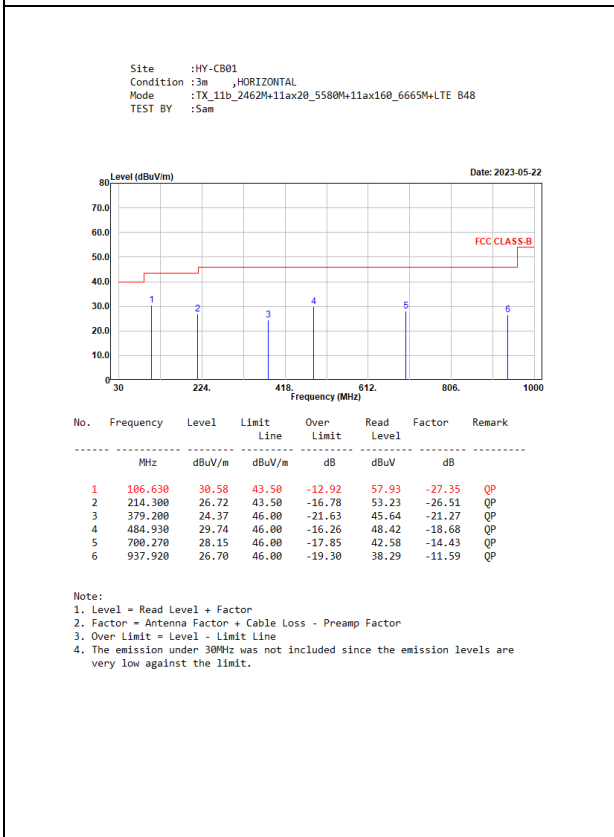
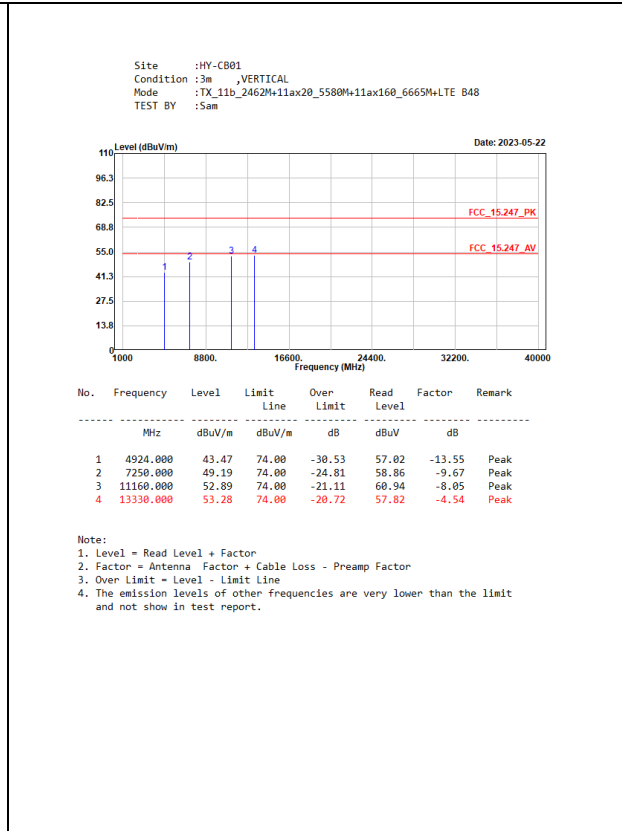
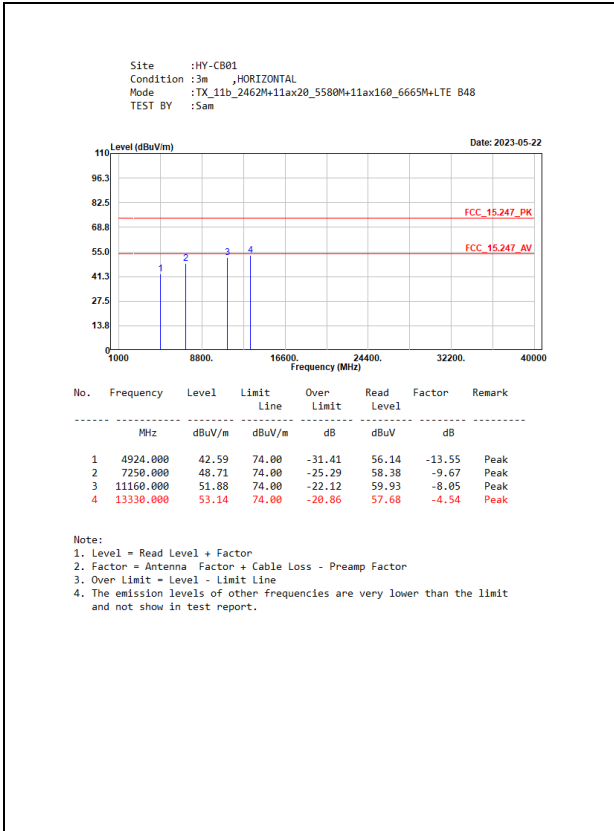


Co-location





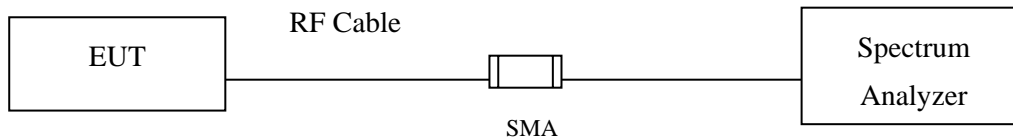




5. RF Antenna Conducted Test

5.1. Test Setup

RF antenna Conducted Measurement:



5.2. Limits

In any 100 kHz bandwidth outside the frequency band in which the spread spectrum 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. Attenuation below the general limits specified in Section 15.209(a) is not required. In addition, radiated emissions which fall in the restricted bands, as defined in Section 15.205(a), must also comply with the radiated emission limits specified in Section 15.209(a) (see Section 15.205(c)).

5.3. Test Procedure

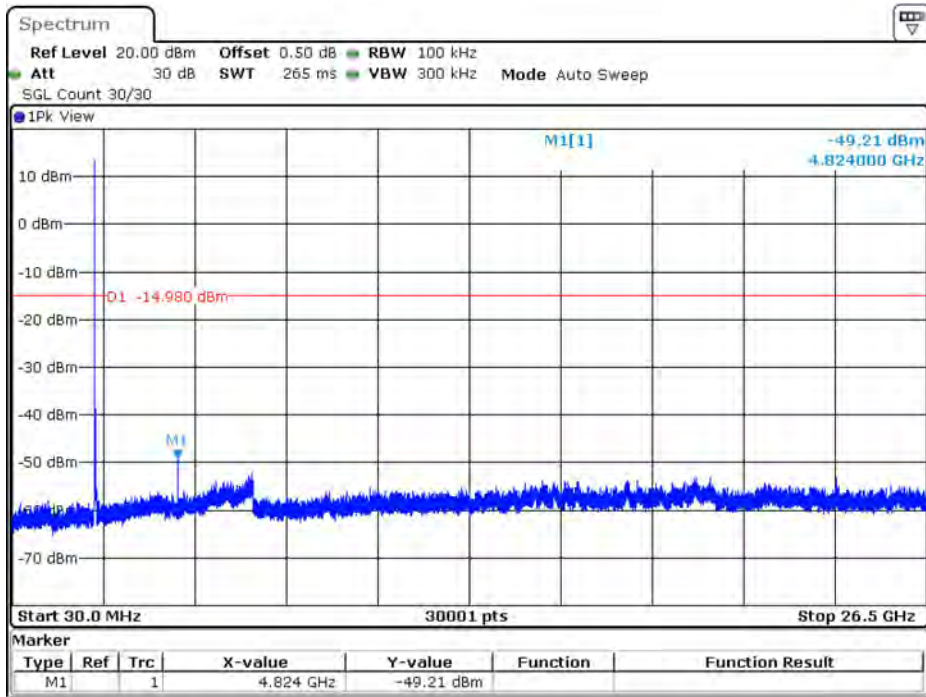
The EUT was tested according to C63.10:2013 Section 11.11 for compliance to FCC 47CFR 15.247 requirements.

Set RBW = 100 kHz, Set VBW > RBW, scan up through 10th harmonic.

5.4. Test Result of RF antenna conducted test

Product : Internet Gateway
 Test Item : RF antenna conducted test
 Test Mode : Transmit (802.11b)-CDD
 Test Date : 2023/03/28

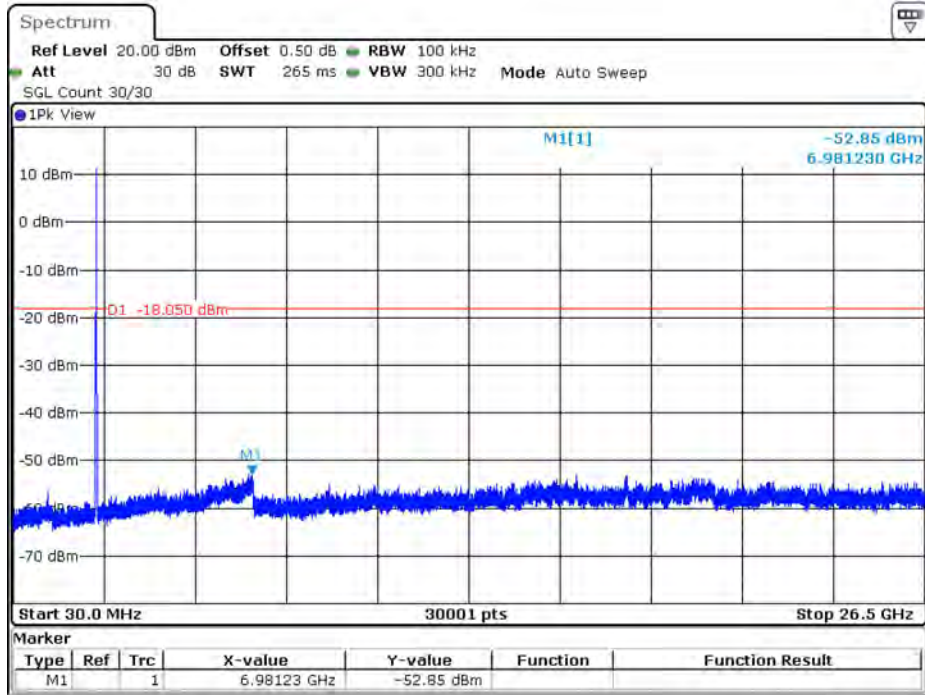
Channel 01 (2412 MHz) (Chain B)



Date: 28.MAR.2023 17:39:20

Product : Internet Gateway
 Test Item : RF Antenna Conducted Spurious
 Test Mode : Transmit (802.11g)-CDD
 Test Date : 2023/03/28

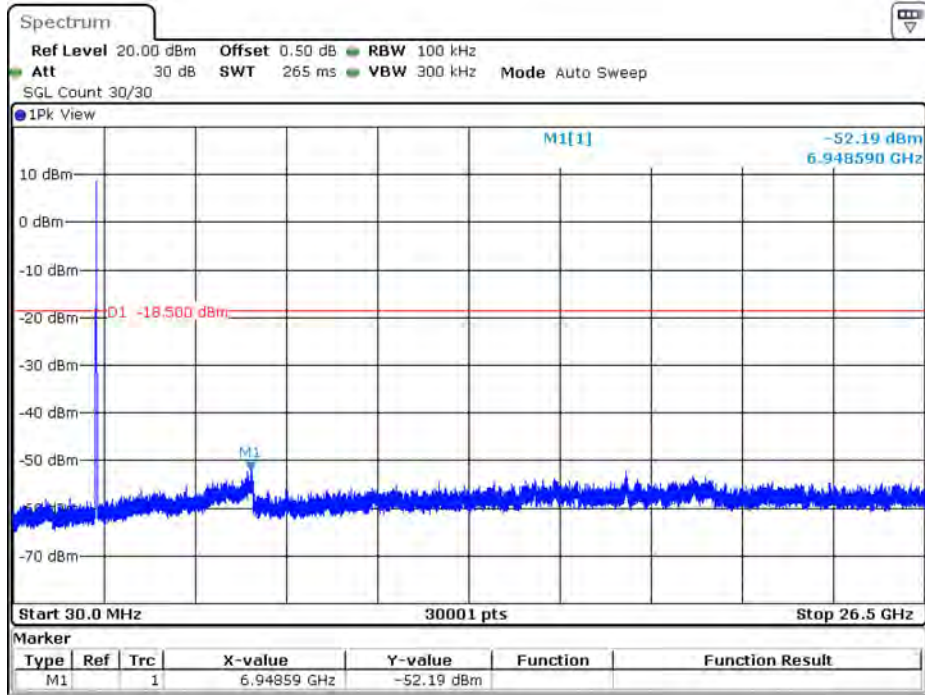
Channel 06 (2437 MHz) (Chain B)



Date: 28.MAR.2023 19:19:48

Product : Internet Gateway
 Test Item : RF Antenna Conducted Spurious
 Test Mode : Transmit (802.11ax-20 MHz)-CDD
 Test Date : 2023/03/28

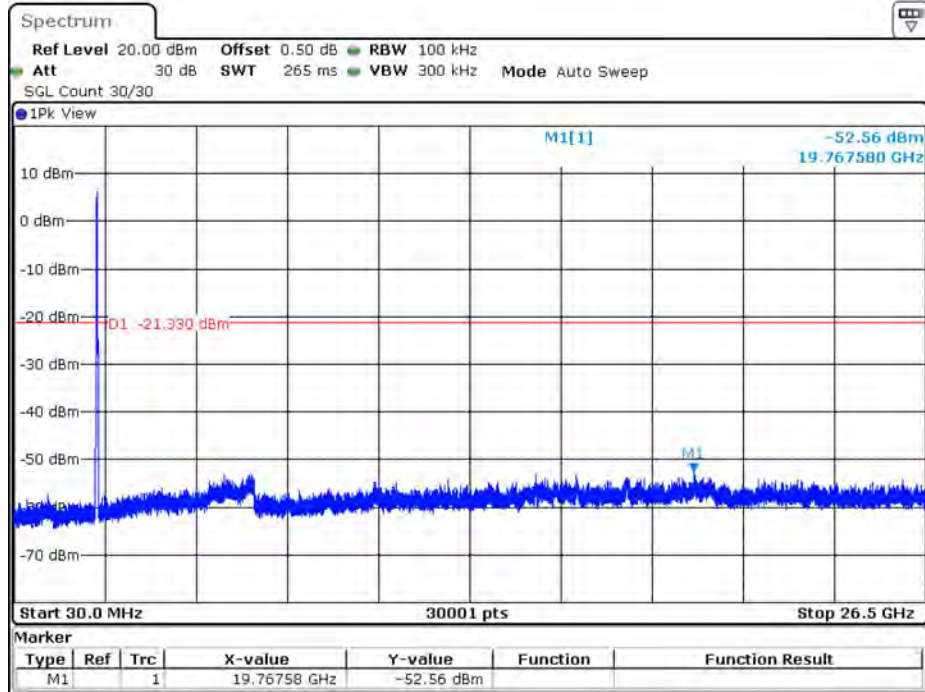
Channel 06 (2437 MHz) (Chain C)



Date: 28.MAR.2023 19:50:45

Product : Internet Gateway
 Test Item : RF Antenna Conducted Spurious
 Test Mode : Transmit (802.11ax-40 MHz)-CDD
 Test Date : 2023/03/28

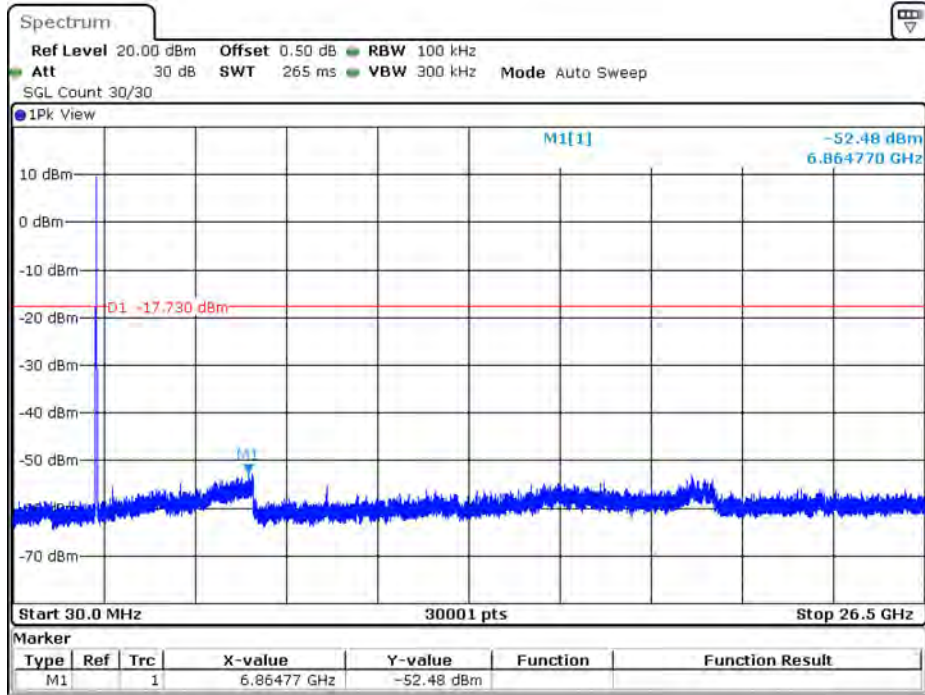
Channel 03 (2422 MHz) (Chain A)



Date: 28. MAR. 2023 20:09:42

Product : Internet Gateway
 Test Item : RF Antenna Conducted Spurious
 Test Mode : Transmit (802.11ax-20 MHz)-Beamforming
 Test Date : 2023/05/03

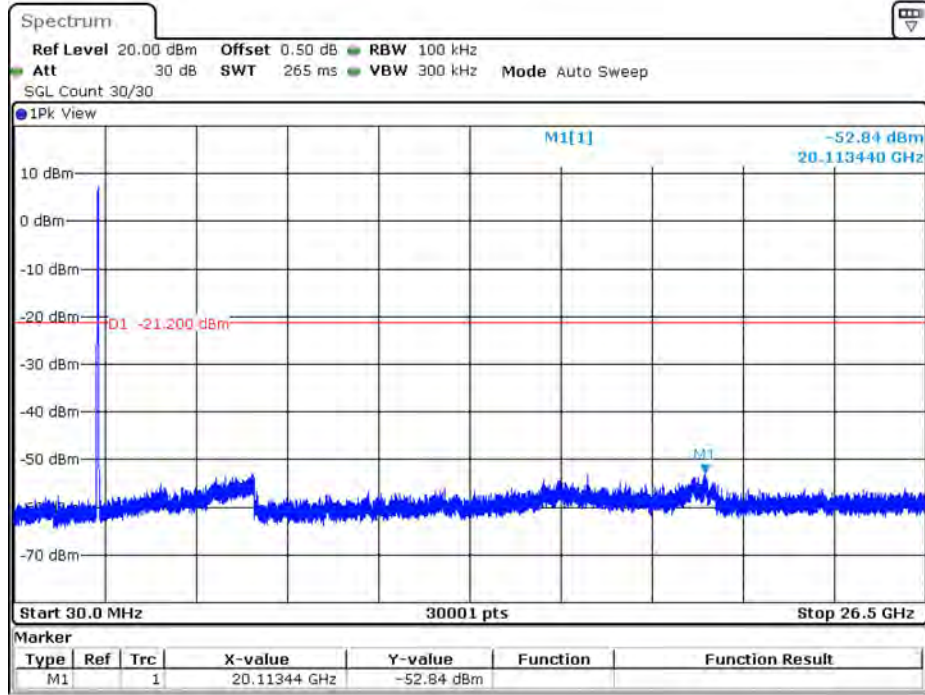
Channel 06 (2437 MHz) (Chain A)



Date: 3.MAY.2023 18:26:54

Product : Internet Gateway
 Test Item : RF Antenna Conducted Spurious
 Test Mode : Transmit (802.11ax-40 MHz)-Beamforming
 Test Date : 2023/05/03

Channel 09 (2452 MHz) (Chain A)

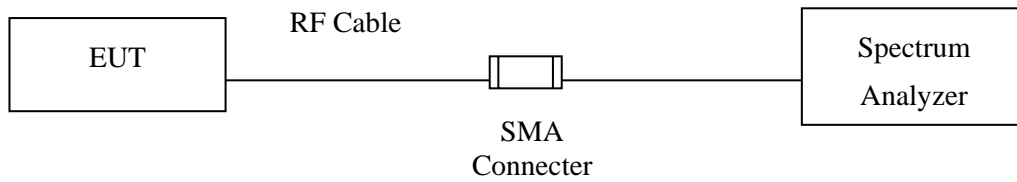


Date: 3.MAY.2023 19:28:44

6. Band Edge

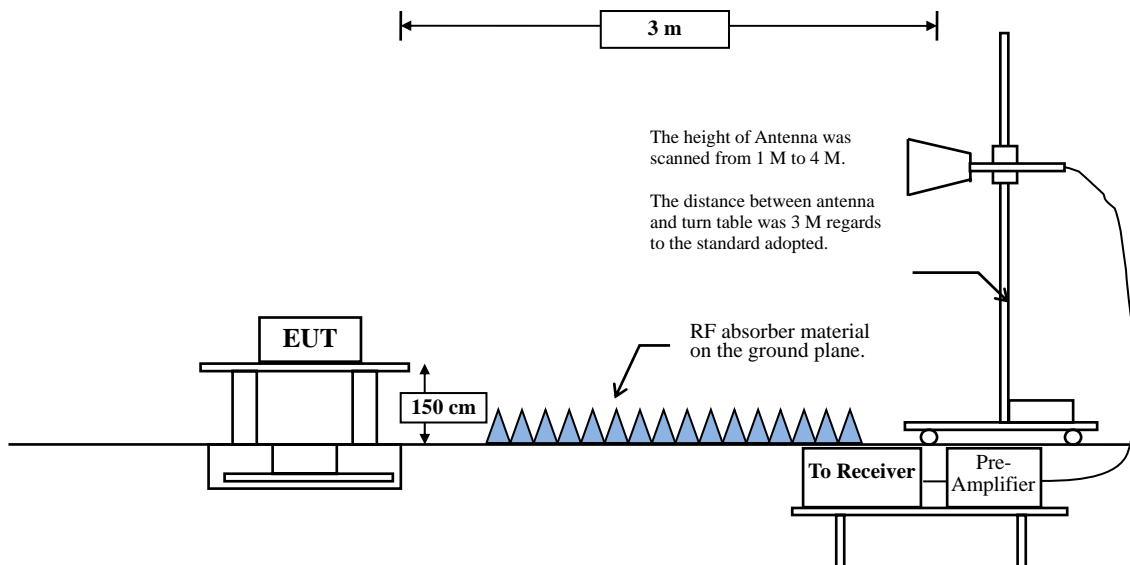
6.1. Test Setup

RF Conducted Measurement



RF Radiated Measurement:

Above 1 GHz



6.2. Limits

According to FCC Section 15.247(d). 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 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 30 dB instead of 20 dB. Attenuation below the general limits specified in Section 15.209(a) is not required. In addition, radiated emissions which fall in the restricted bands, as defined in Section 15.205(a), must also comply with the radiated emission limits specified in Section 15.209(a) (see Section 15.205(c)).

6.3. Test Procedure

The EUT was setup according to ANSI C63.10, 2013 and tested according to C63.10:2013 Section 11.12.1 for compliance to FCC 47CFR 15.247 requirements.

The EUT is placed on a turn table which is 1.5 meter above ground. The turn table is rotated 360 degrees to determine the position of the maximum emission level. The EUT was positioned such that the distance from antenna to the EUT was 3 meters.

The antenna is scanned from 1 meter to 4 meters to find out the maximum emission level. This is repeated for both horizontal and vertical polarization of the antenna. In order to find the maximum emission, all of the interface cables were manipulated according to ANSI C63.10:2013 on radiated measurement.

RBW and VBW Parameter setting:

According to C63.10 Section 11.12.2.4 Peak measurement procedure.

RBW = as specified in Table 1.

VBW \geq 3 x RBW.

Table 1 - RBW as a function of frequency

Frequency	RBW
9-150 kHz	200-300 Hz
0.15-30 MHz	9-10 kHz
30-1000 MHz	100-120 kHz
> 1000 MHz	1 MHz

According to C63.10 Section 11.12.2.5 Average measurement procedure.

RBW = 1 MHz.

VBW = 10 Hz, when duty cycle \geq 98 %

VBW \geq 1/T, when duty cycle < 98 %

(T refers to the minimum transmission duration over which the transmitter is on and is transmitting at its maximum power control level for the tested mode of operation.)

CDD:

2.4GHz band	Duty Cycle (%)	T (ms)	1/T (Hz)	VBW (Hz)
802.11b	92.27	17.3000	58	100
802.11g	93.46	1.4300	699	1000
802.11ax-20 MHz	93.14	5.4300	184	200
802.11ax-40 MHz	93.12	5.4100	185	200

Note: Duty Cycle Refer to Section 9.

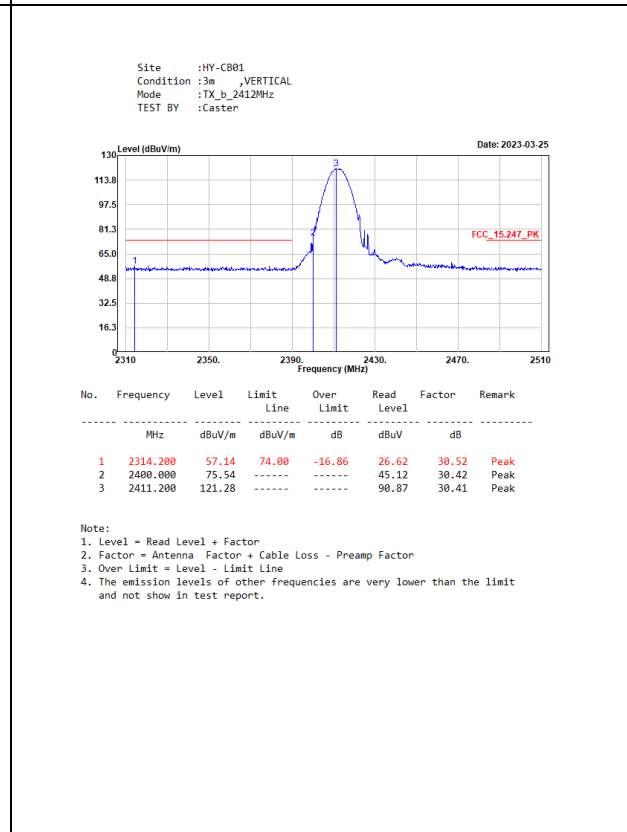
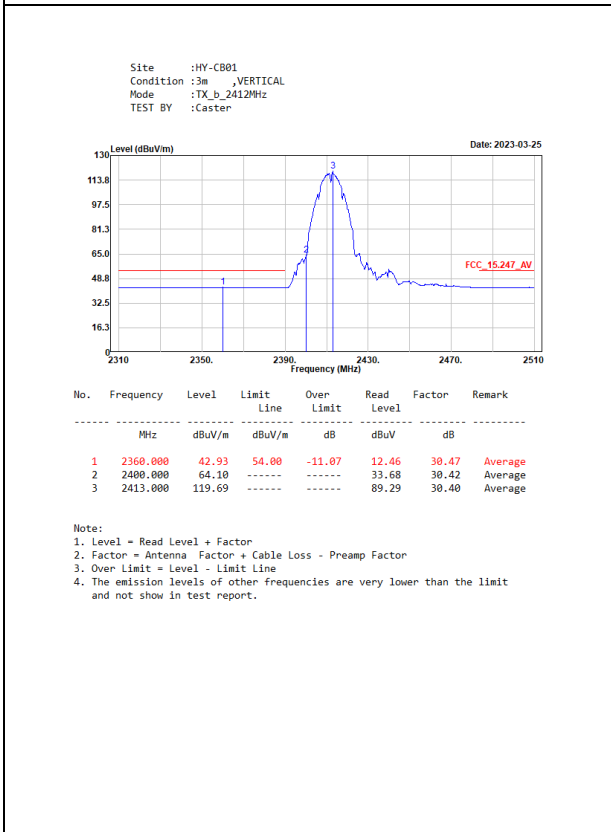
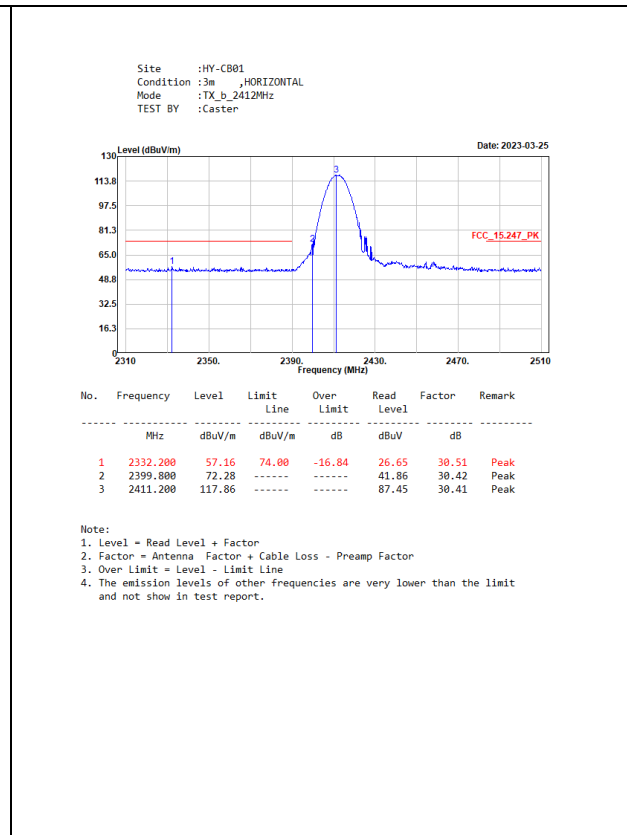
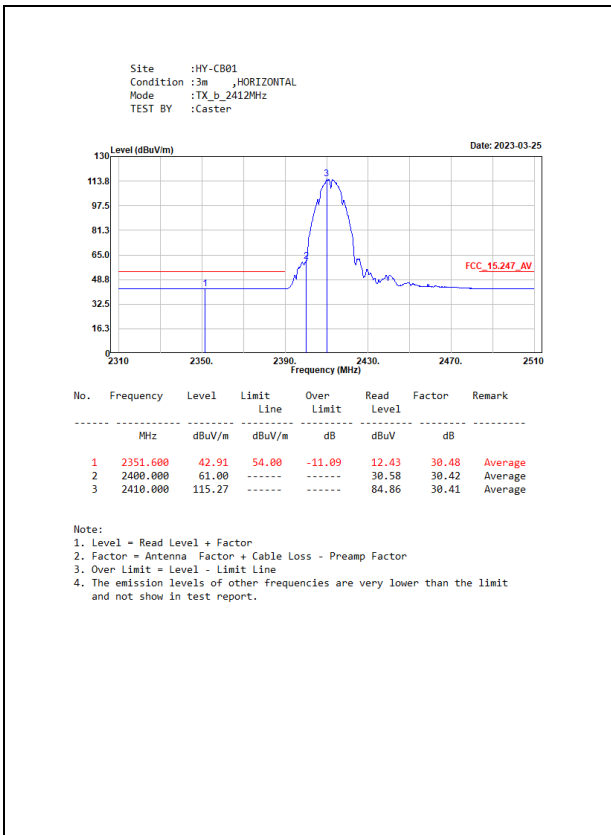
Beamforming:

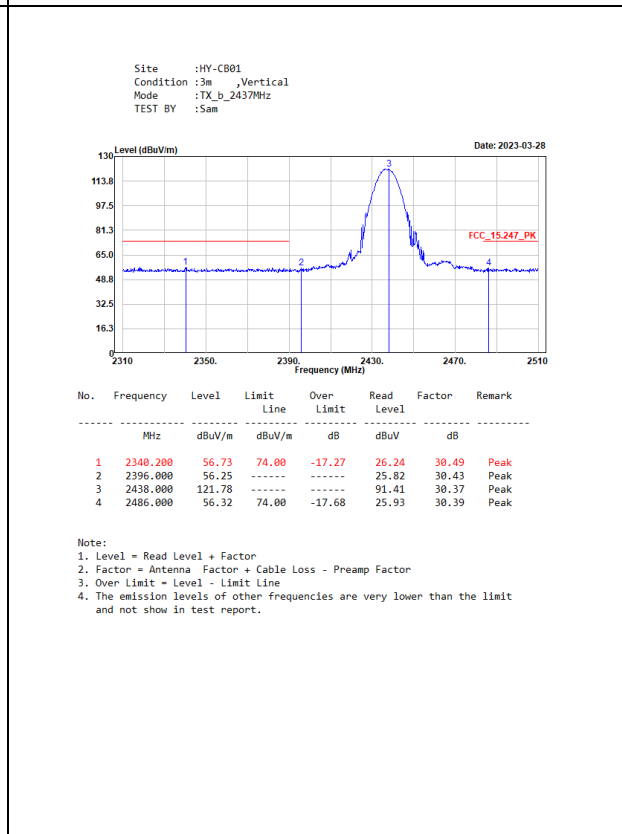
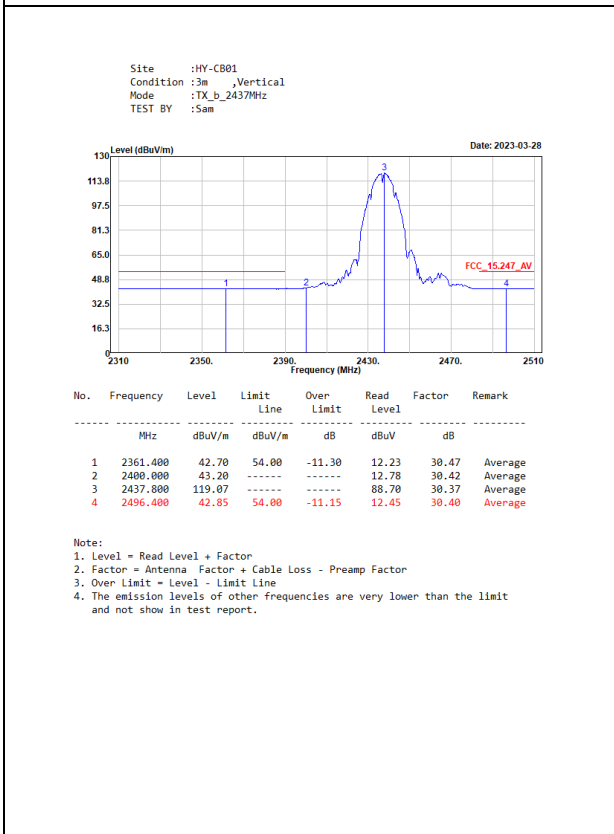
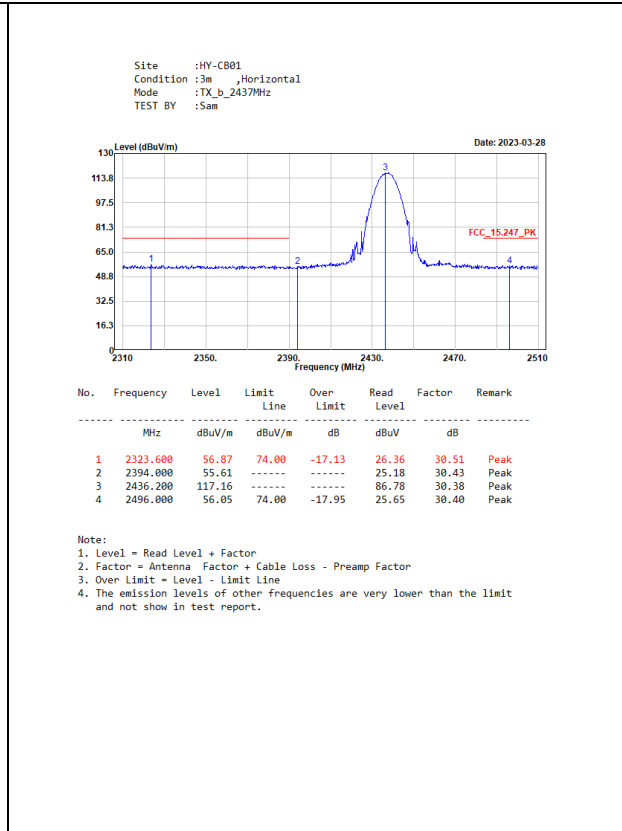
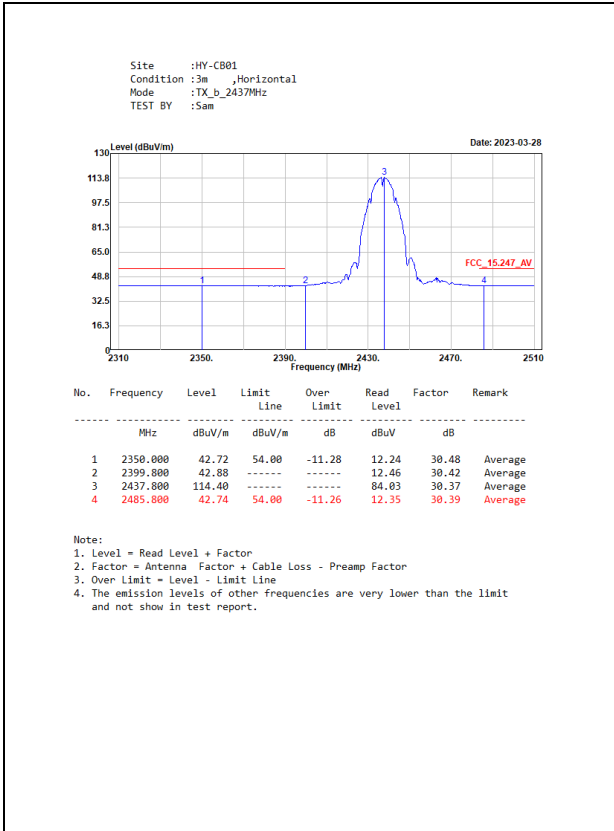
2.4GHz band	Duty Cycle (%)	T (ms)	1/T (Hz)	VBW (Hz)
802.11ax-20 MHz	92.07	6.7300	149	200
802.11ax-40 MHz	93.69	6.8300	146	200

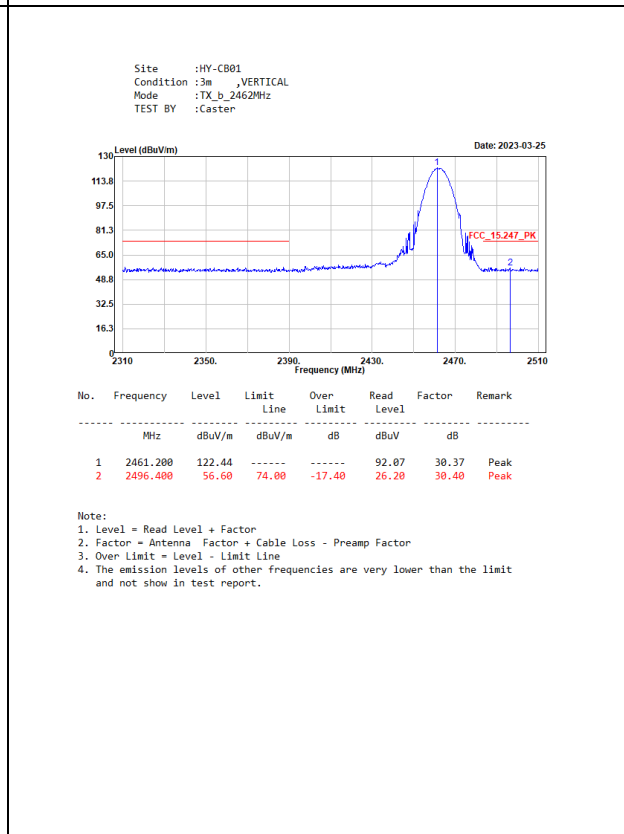
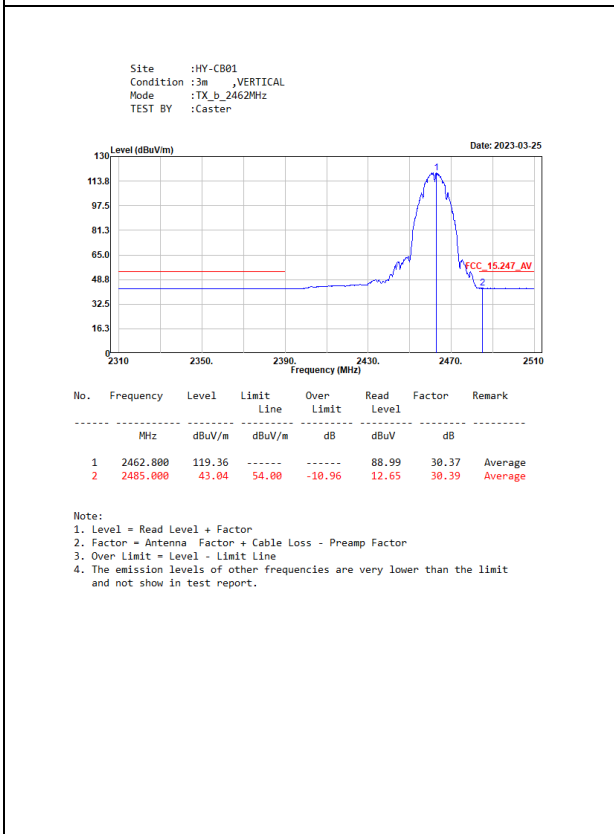
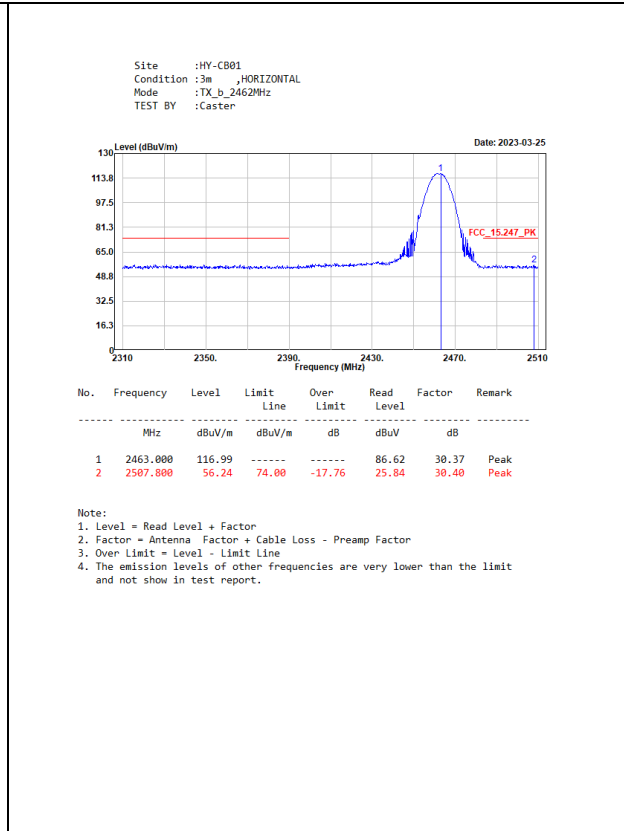
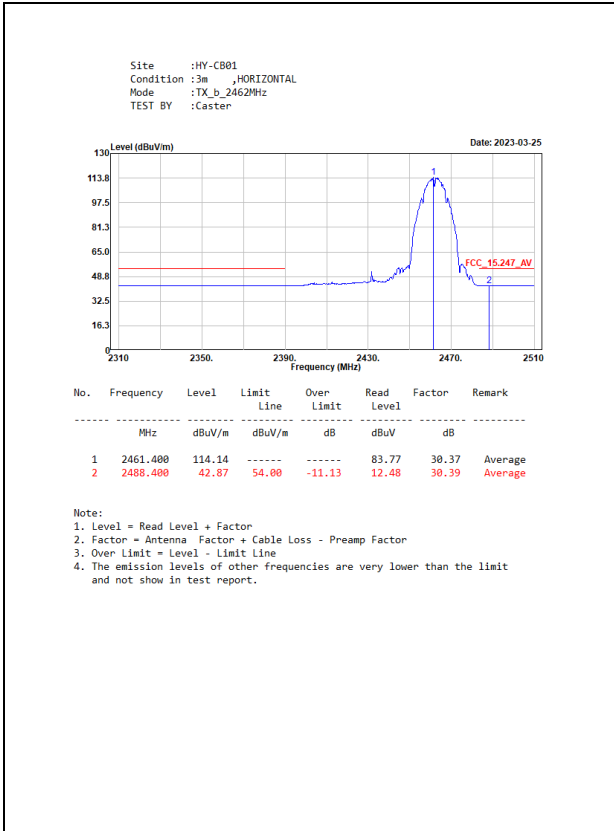
Note: Duty Cycle Refer to Section 9.

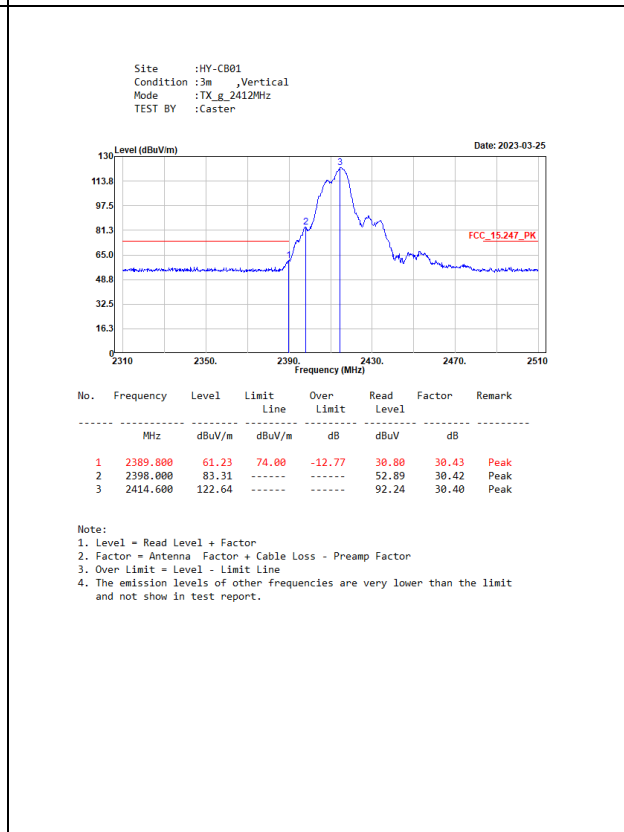
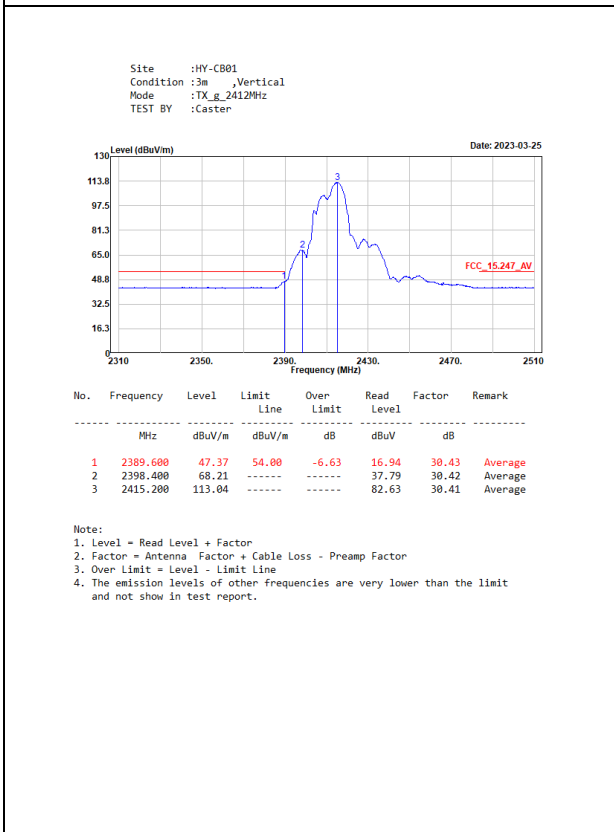
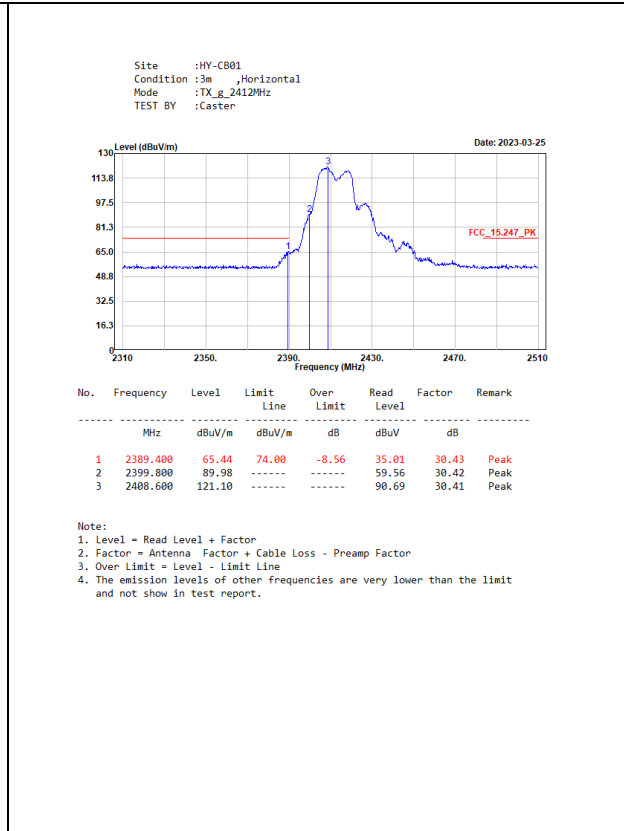
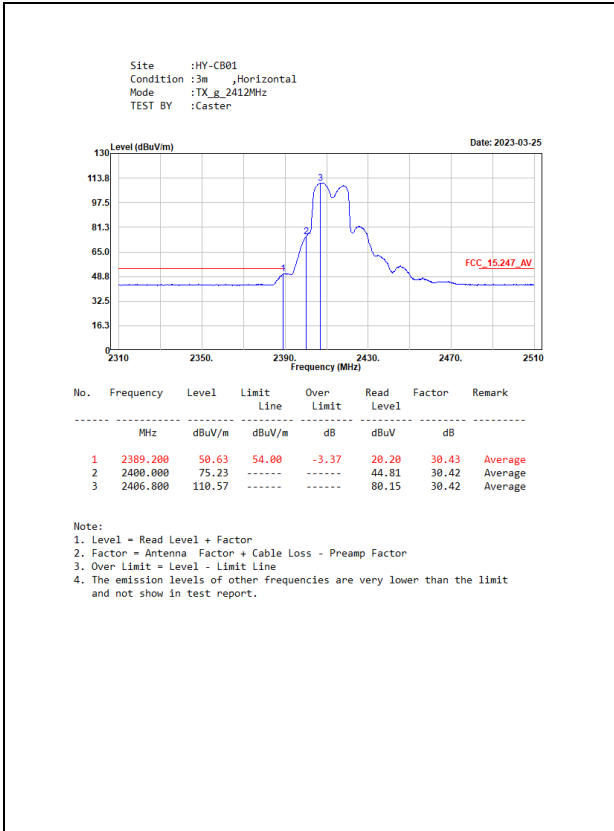
6.4. Test Result of Band Edge

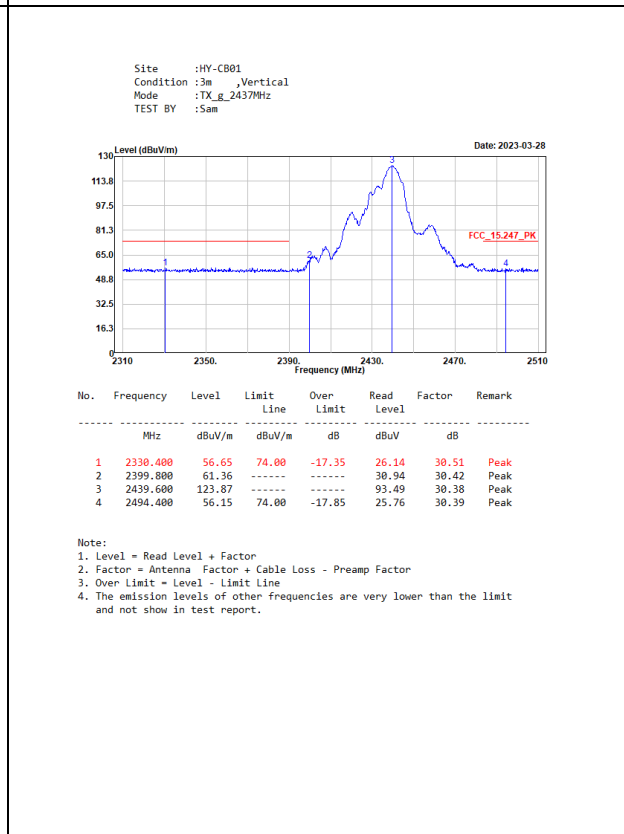
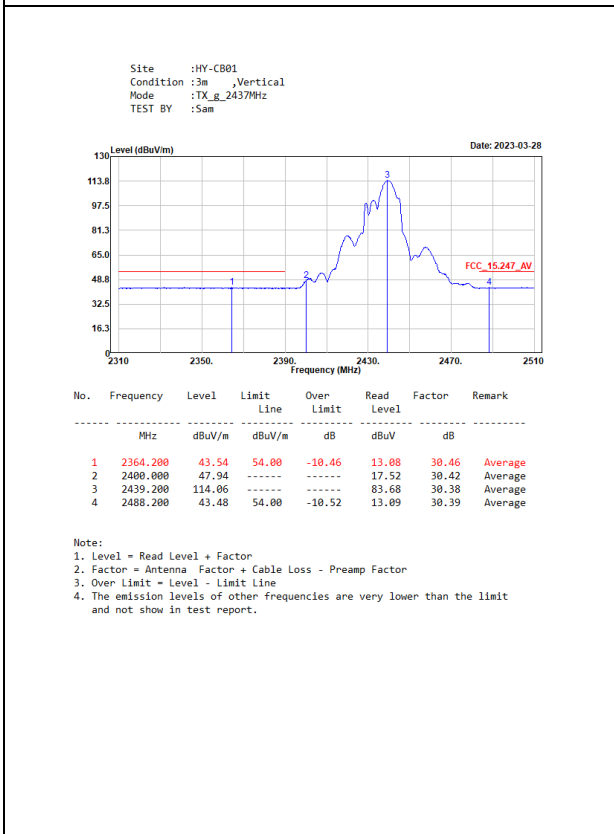
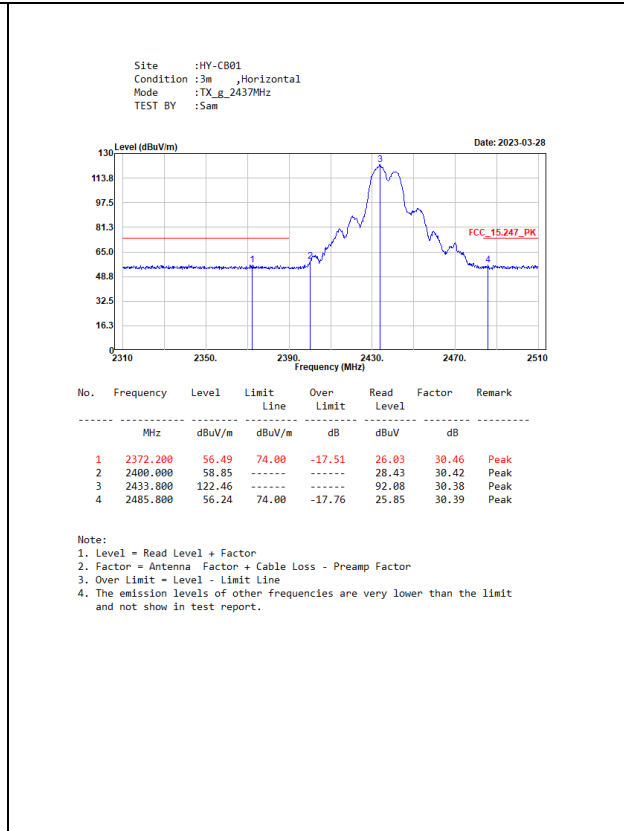
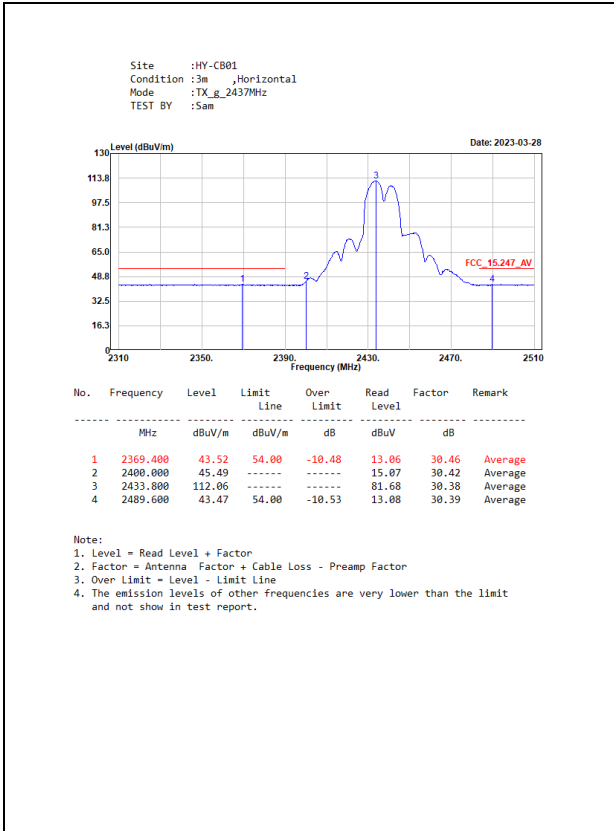
CDD

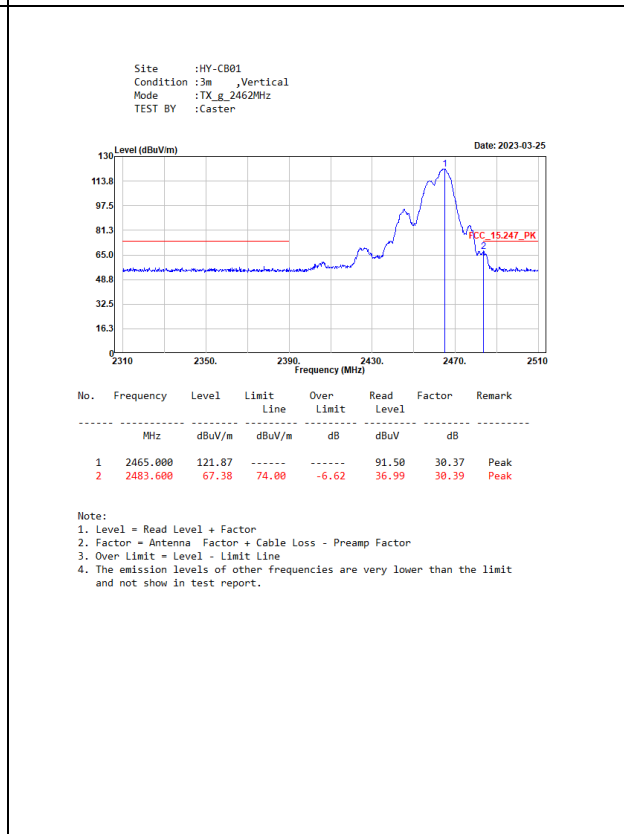
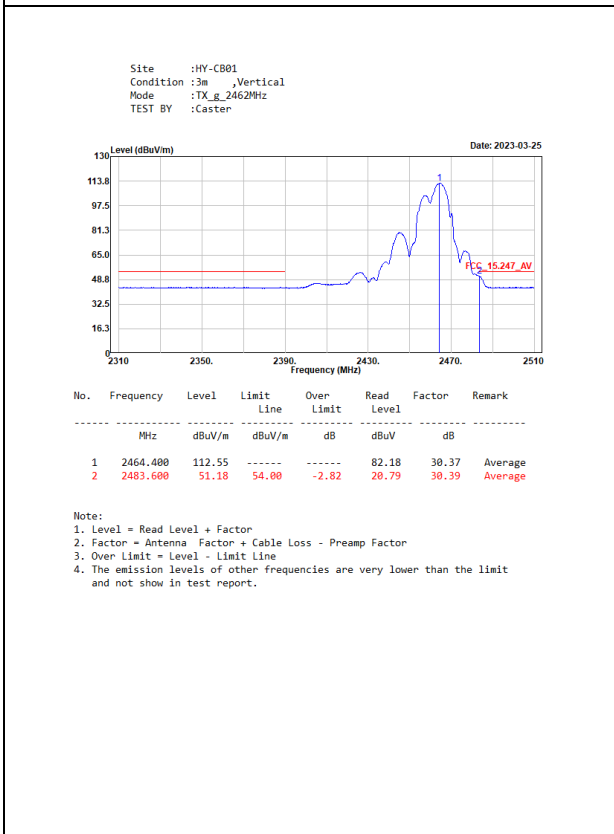
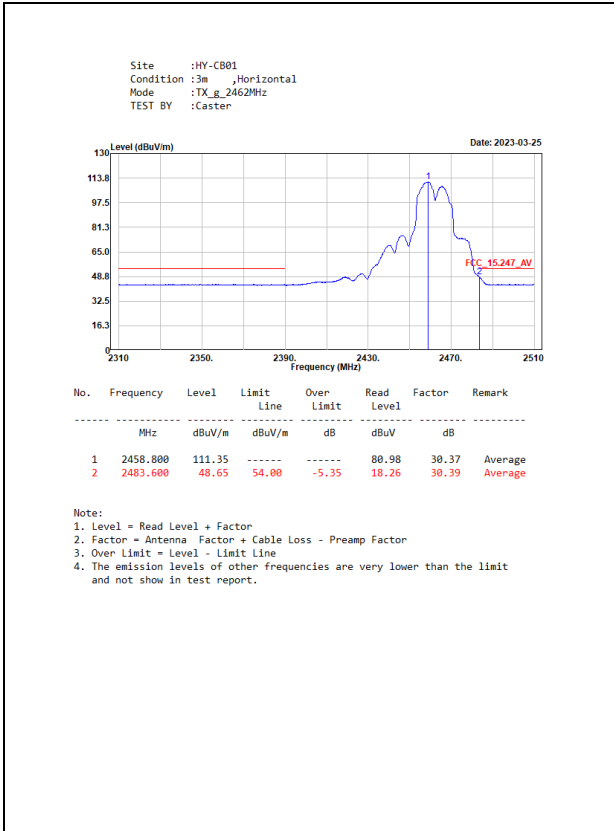


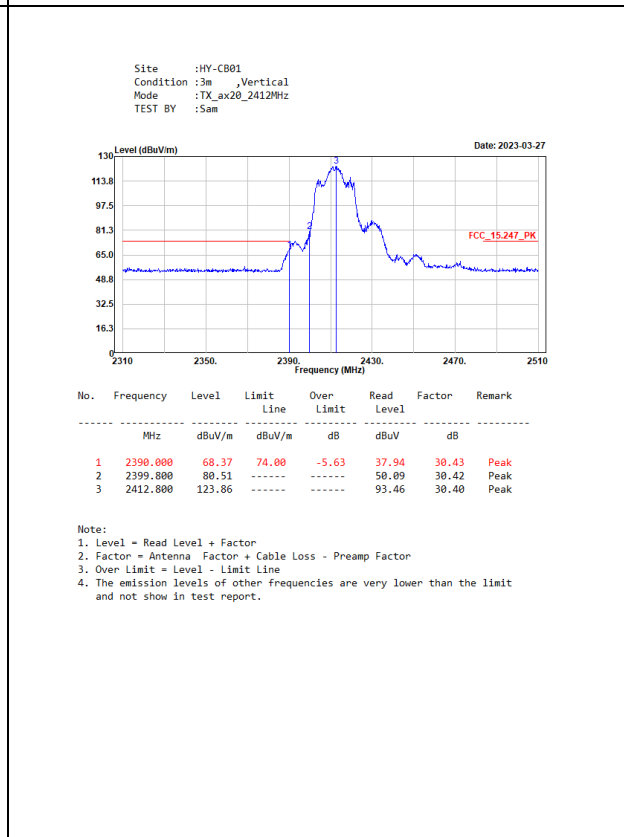
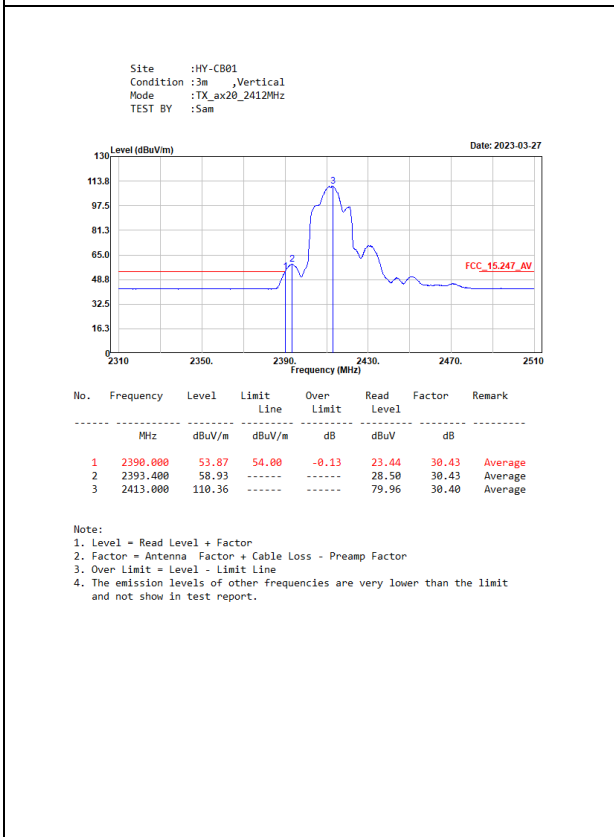
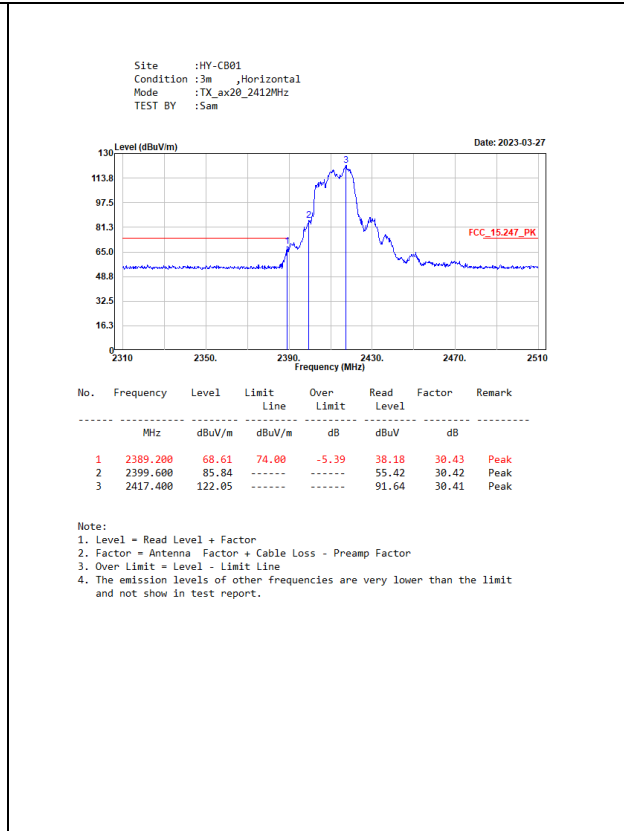
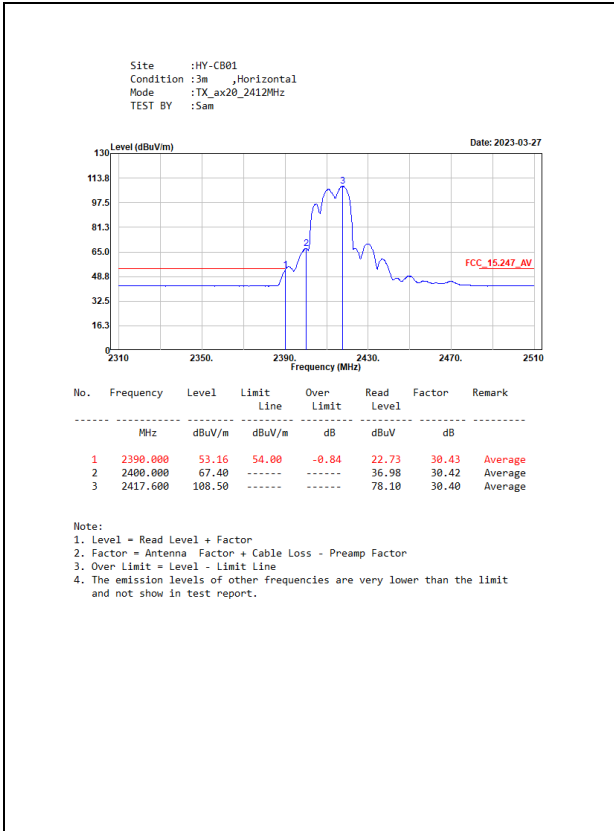


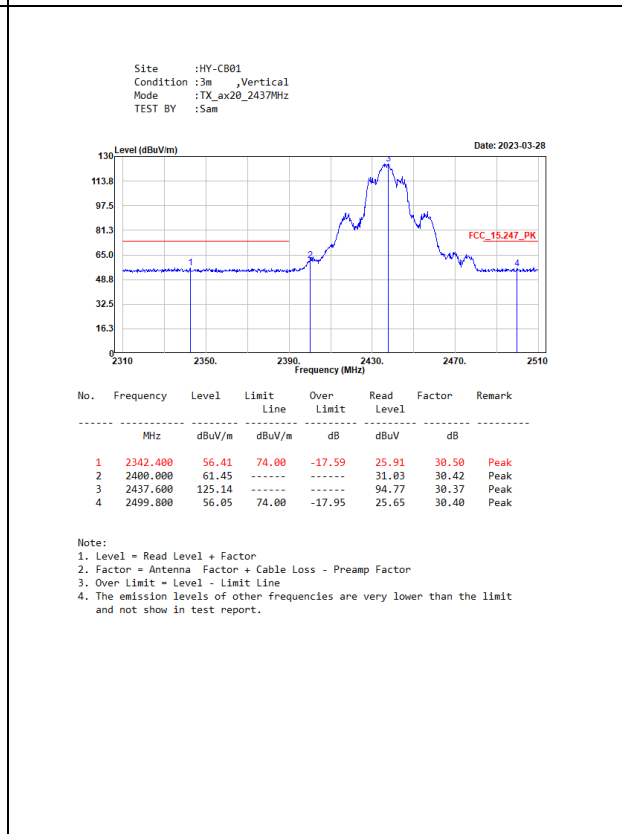
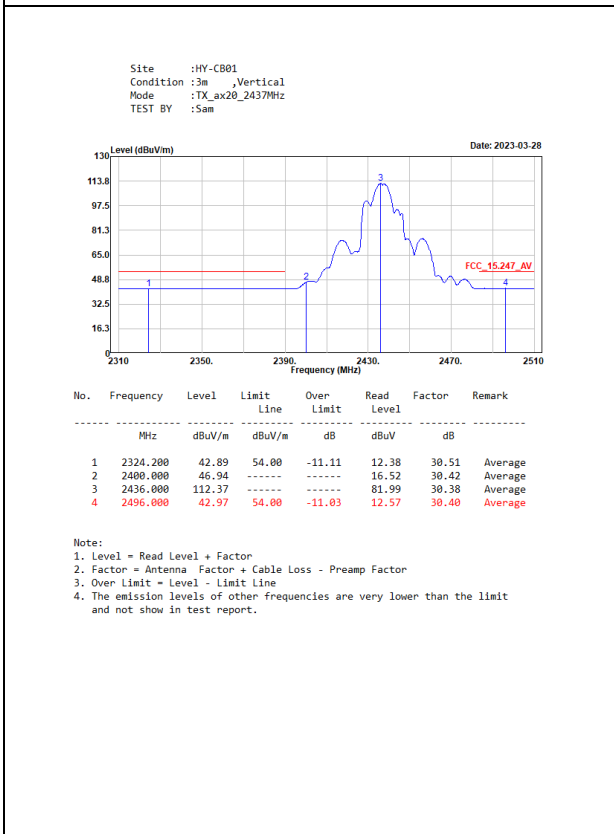
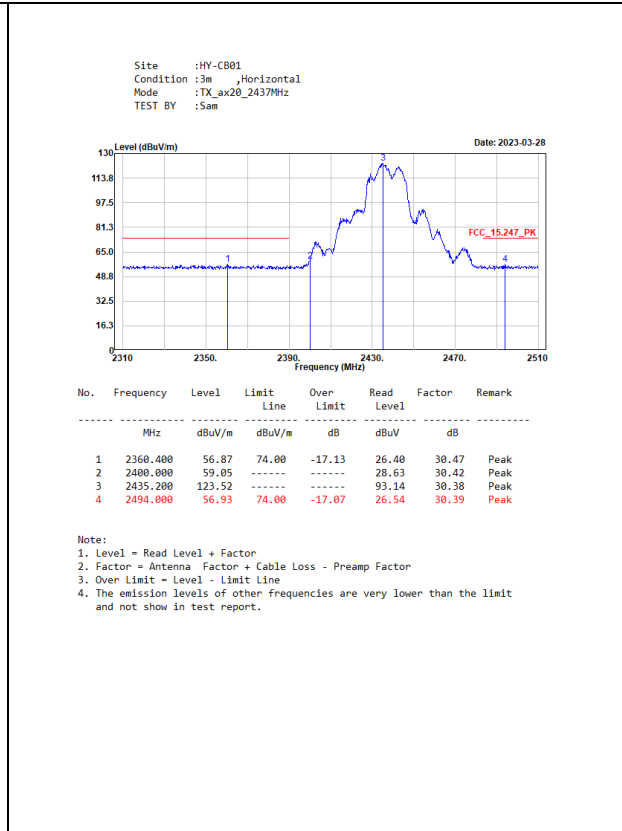
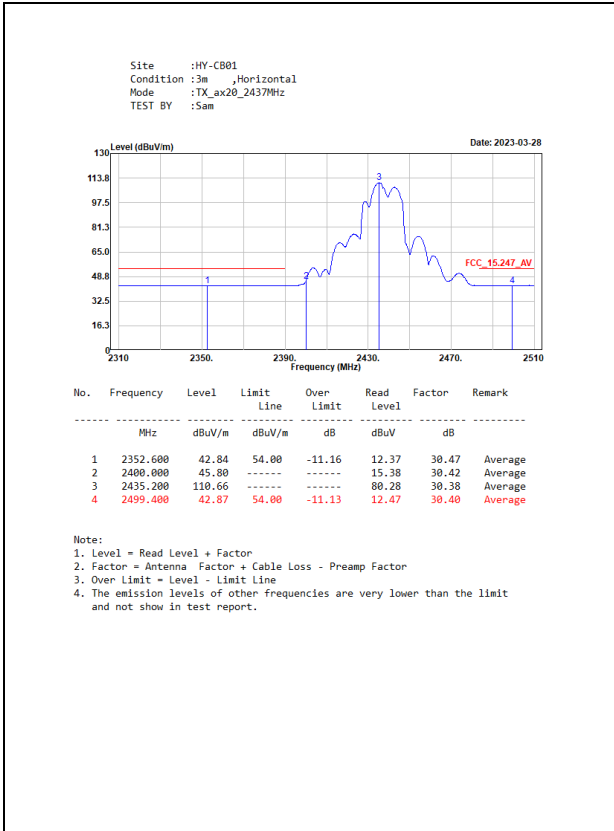


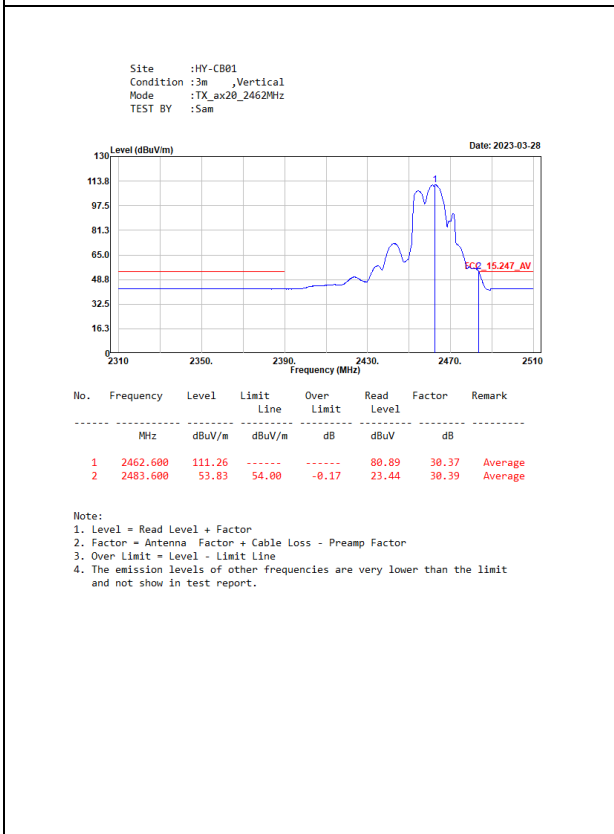
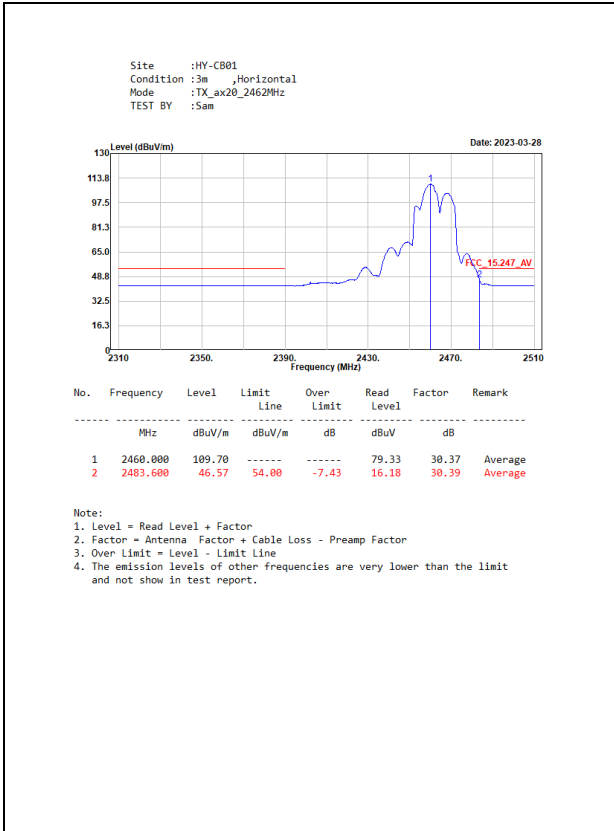


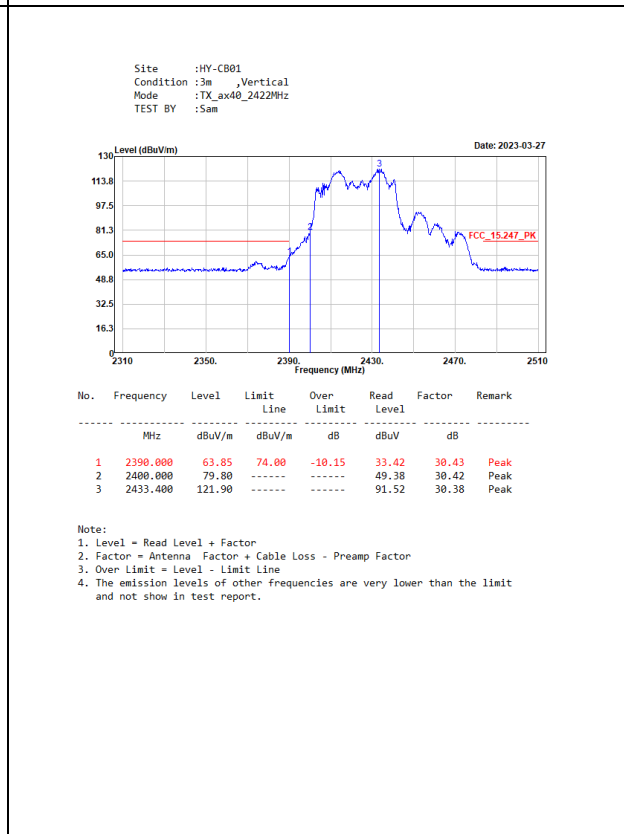
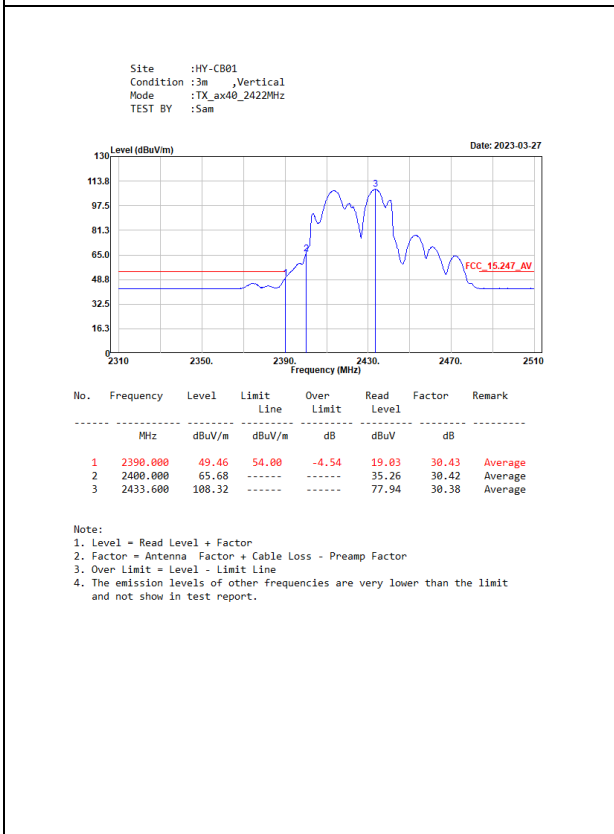
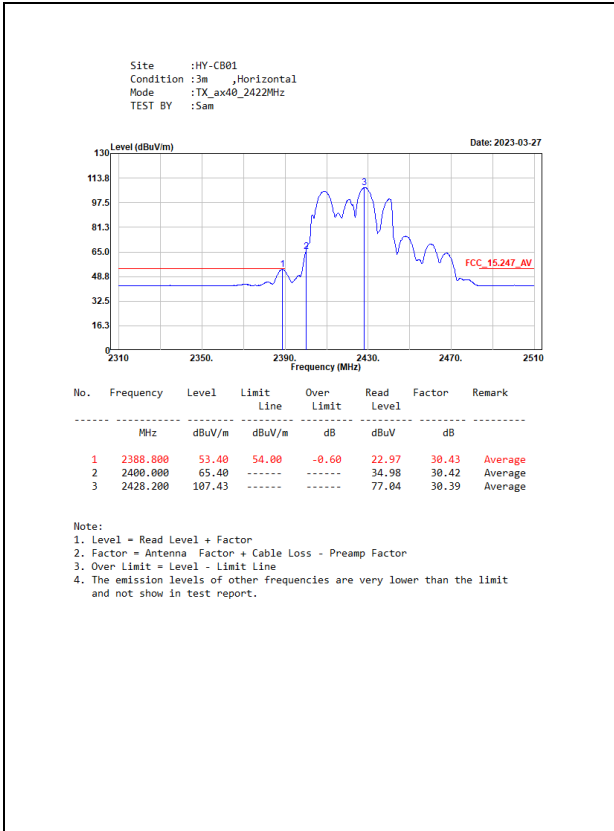


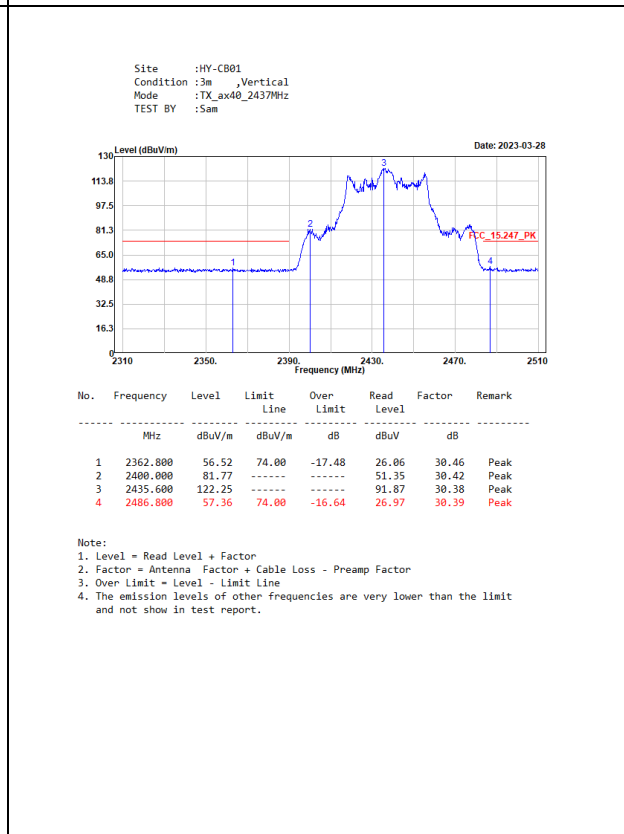
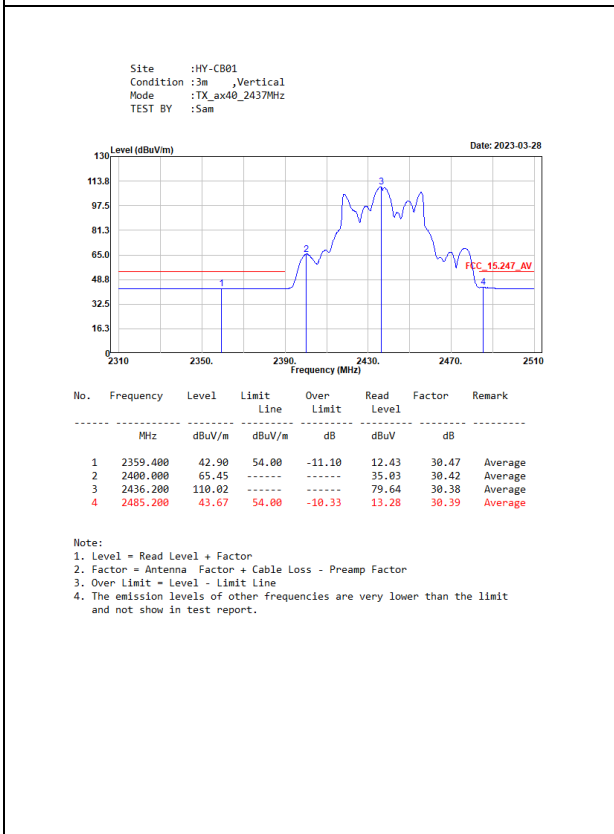
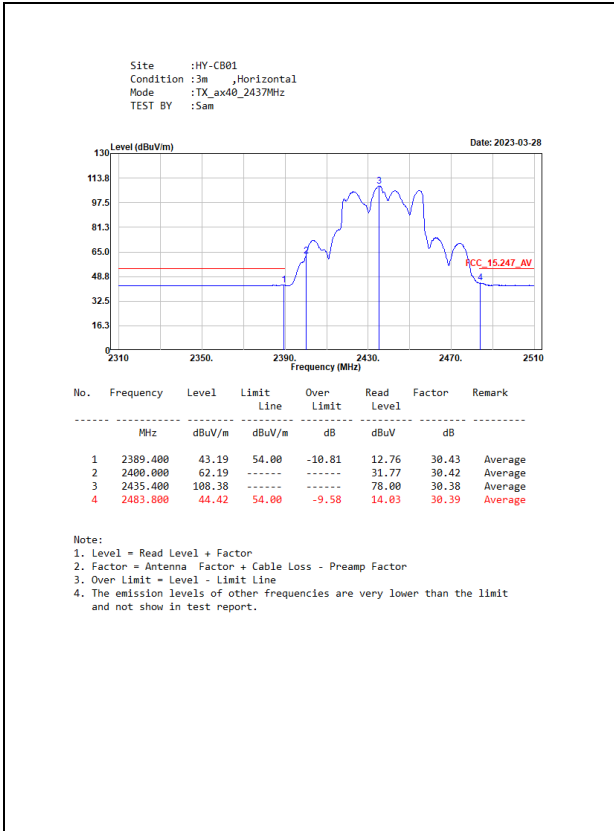


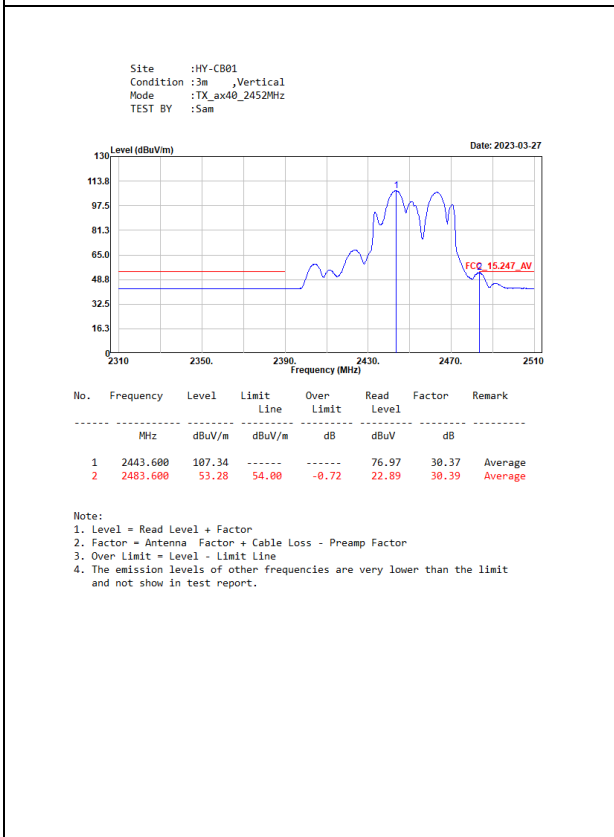
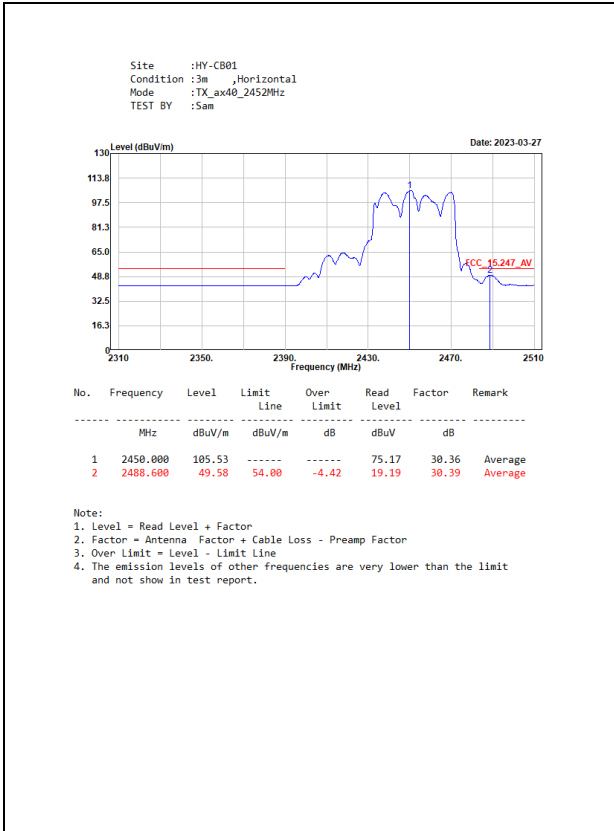




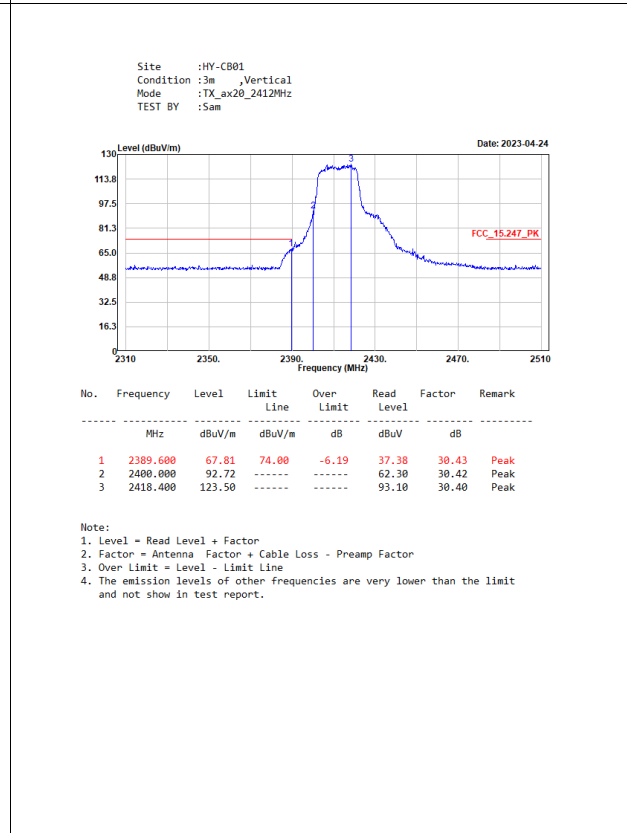
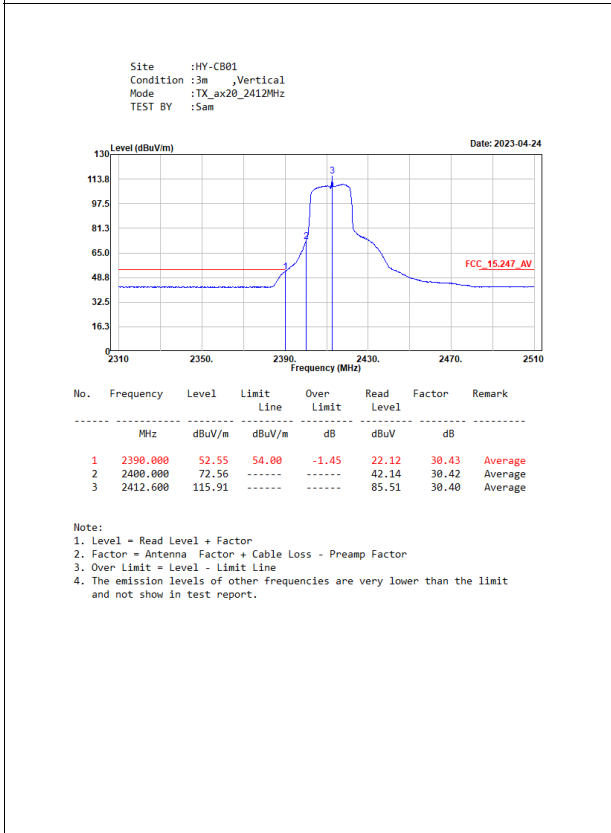
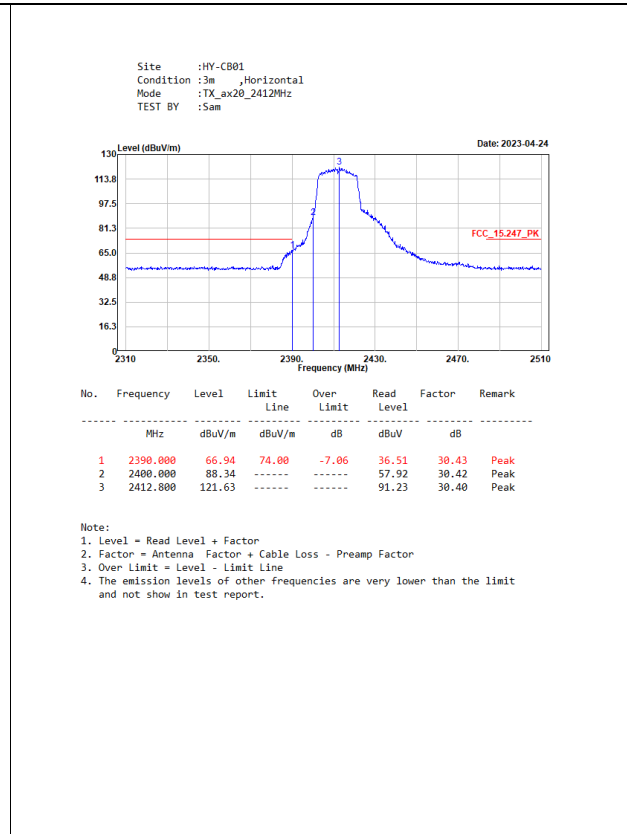
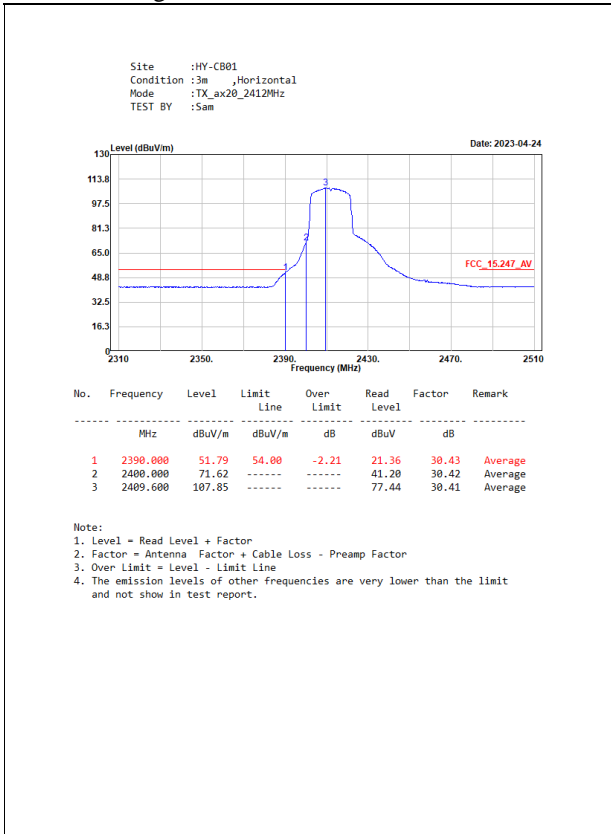


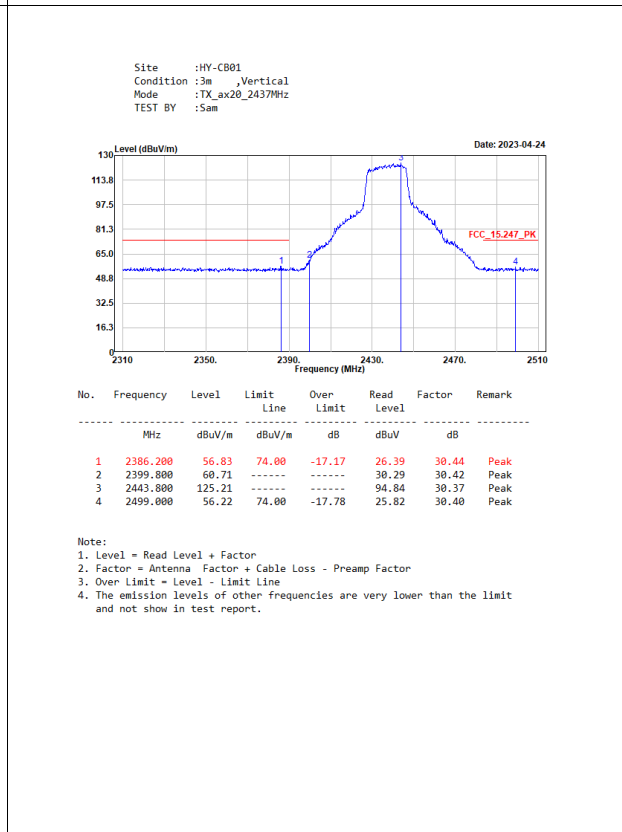
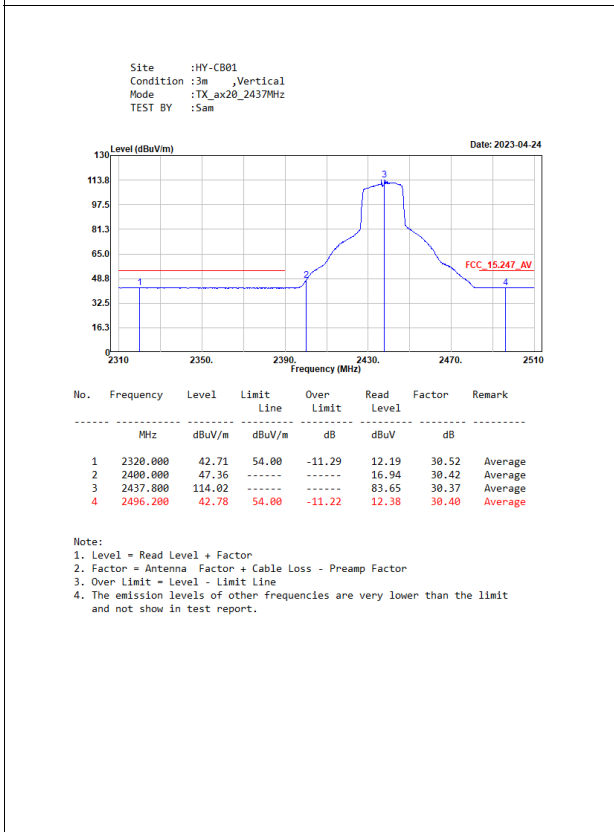
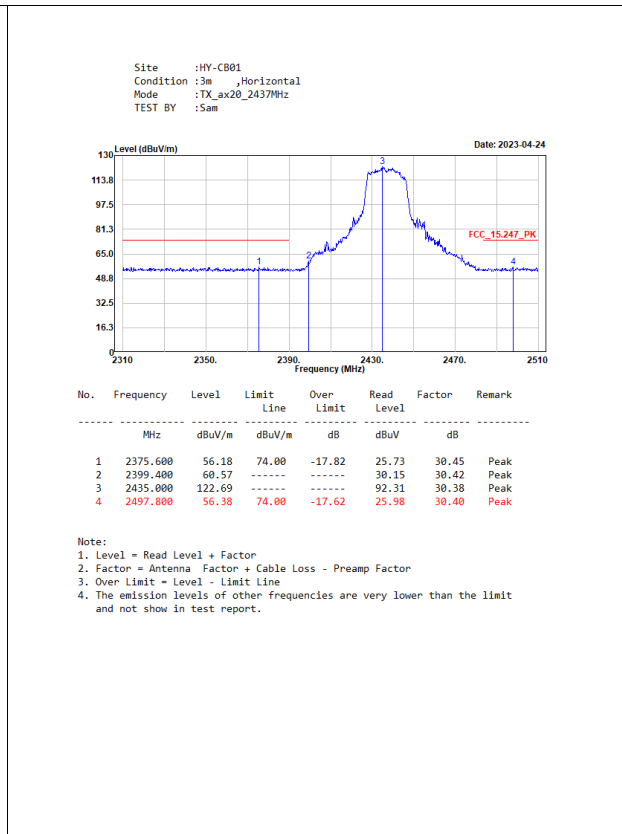
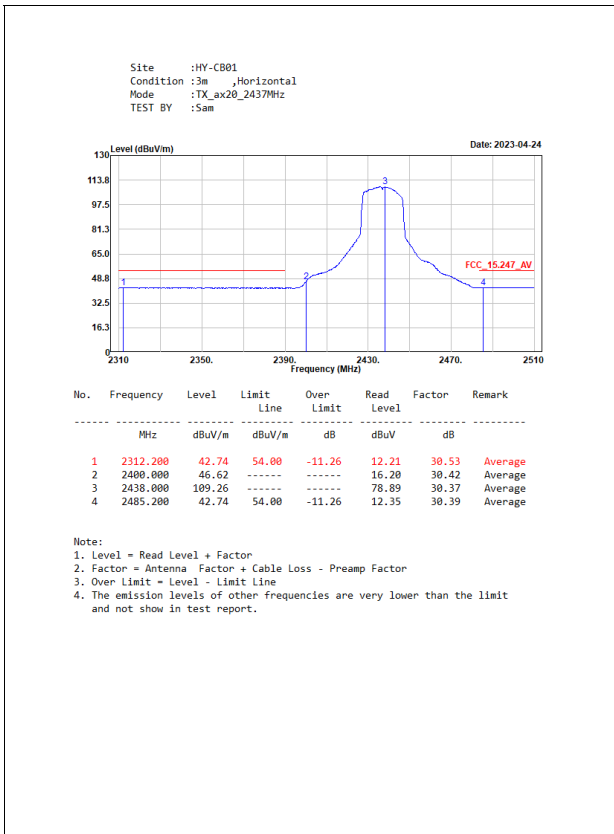


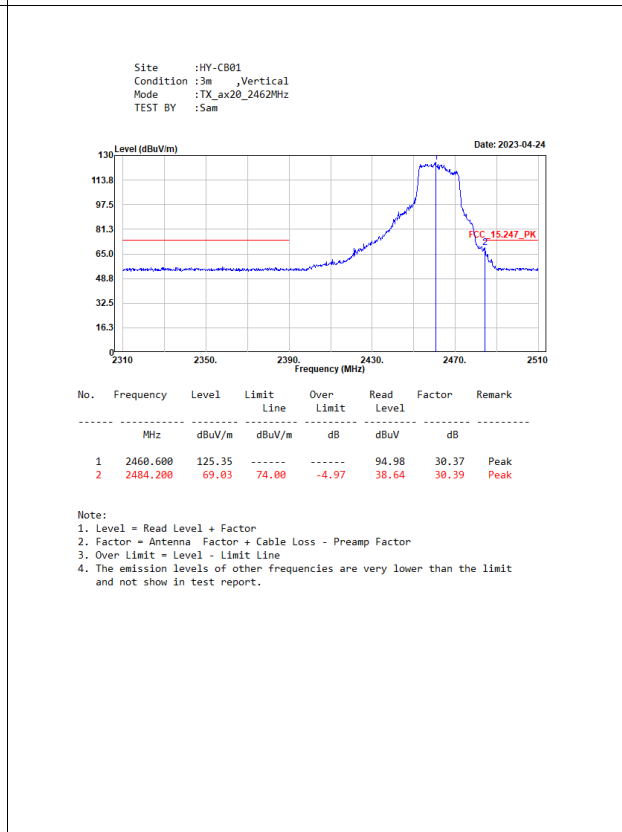
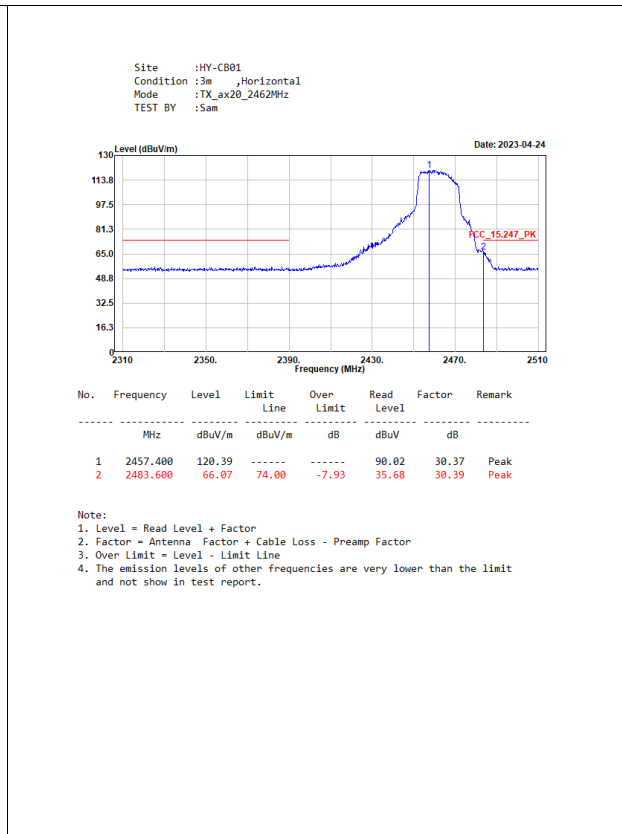


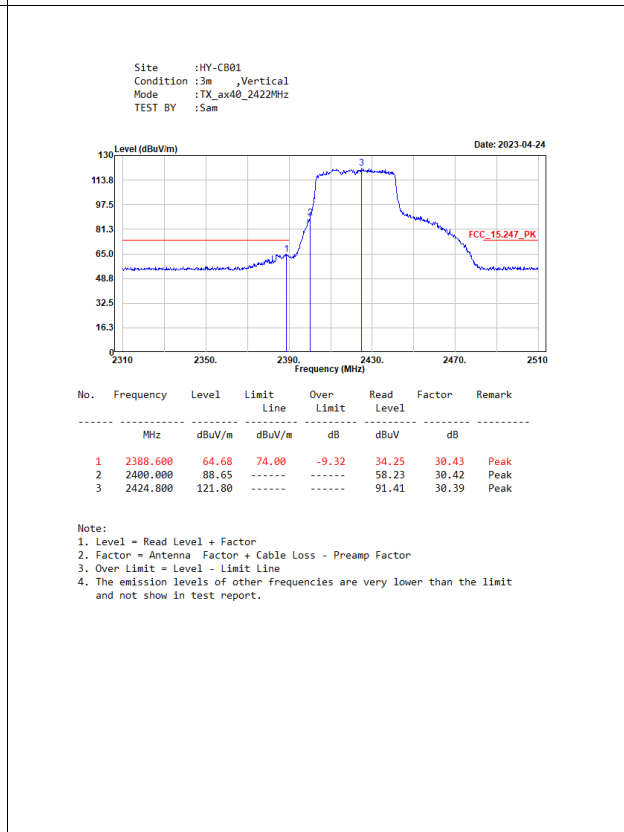
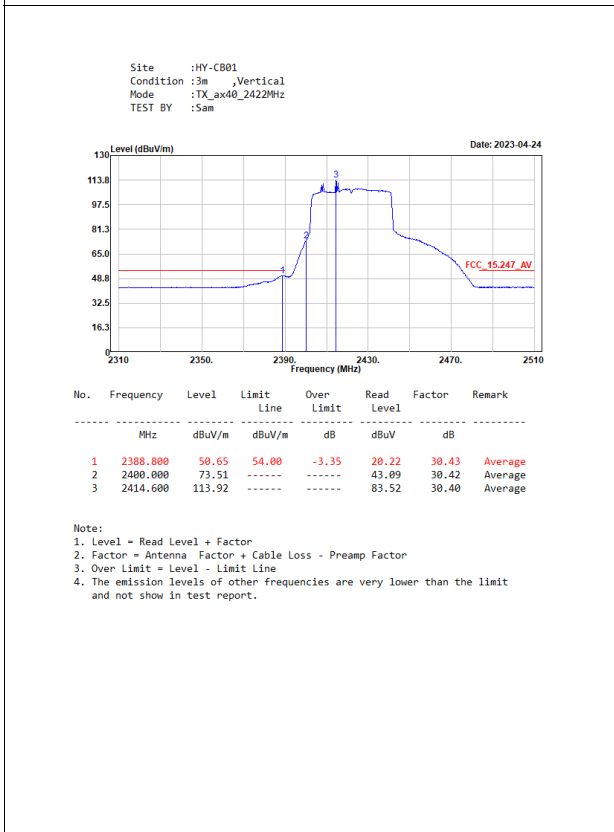
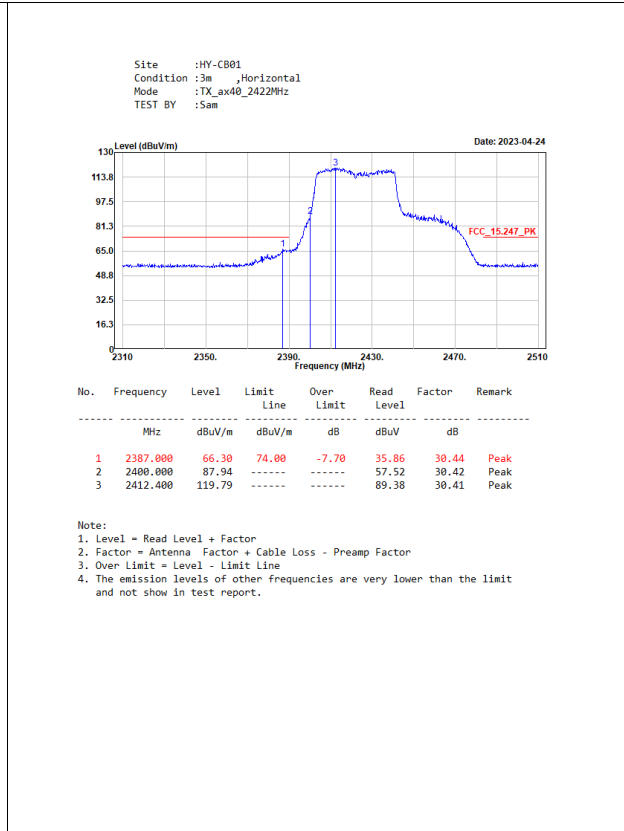
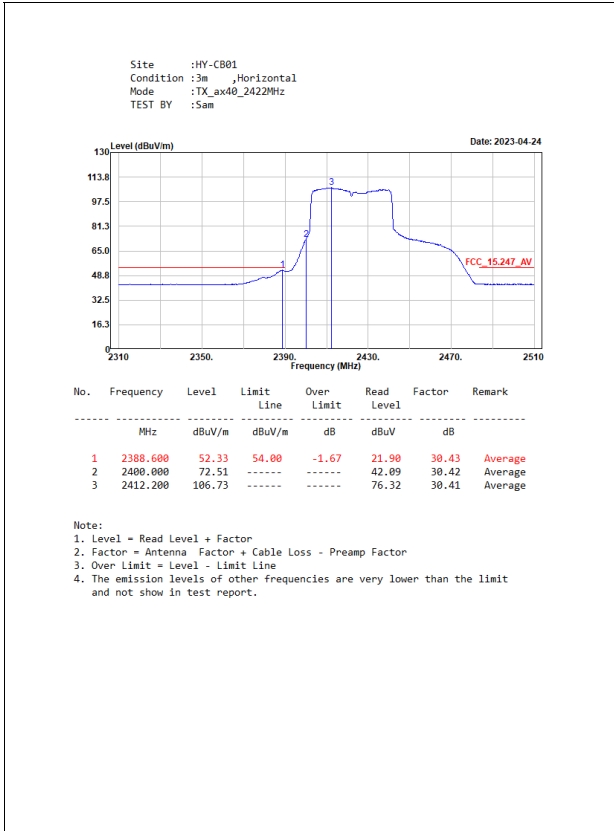


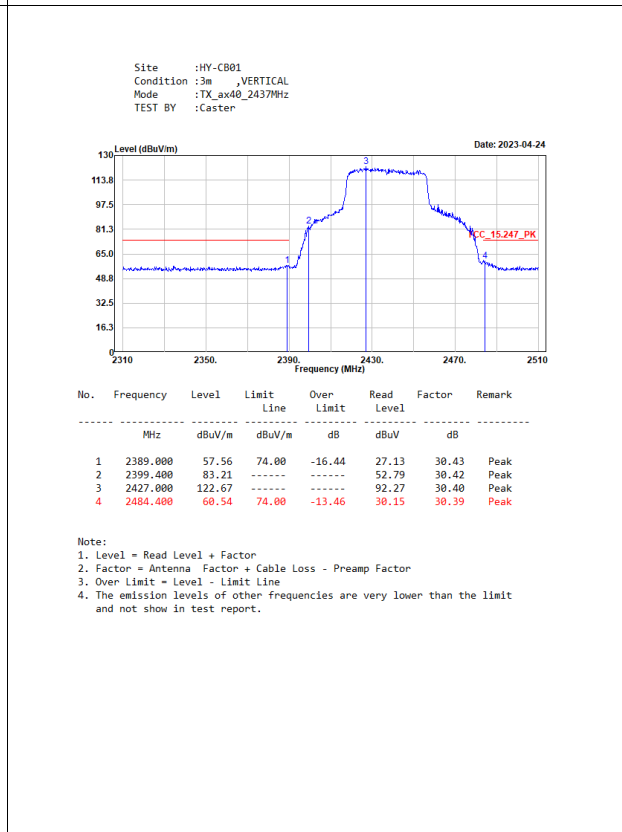
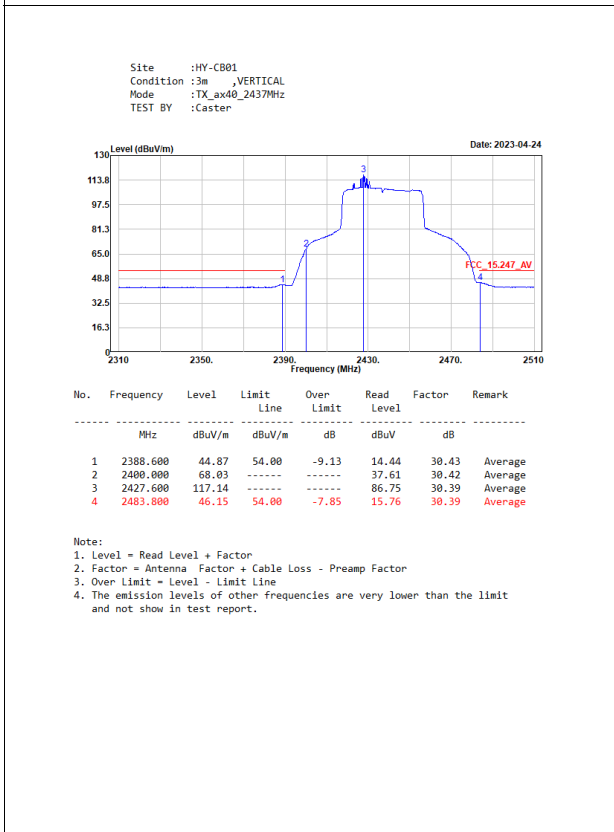
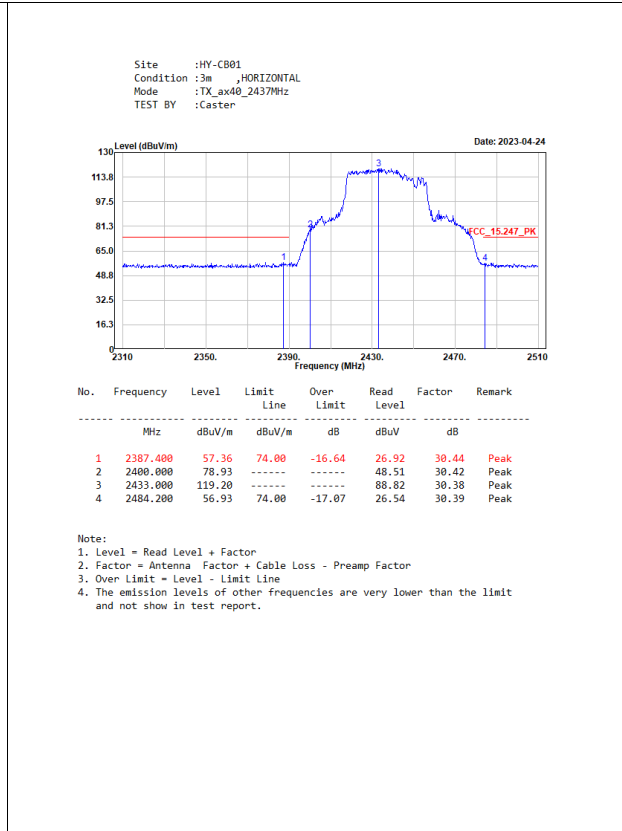
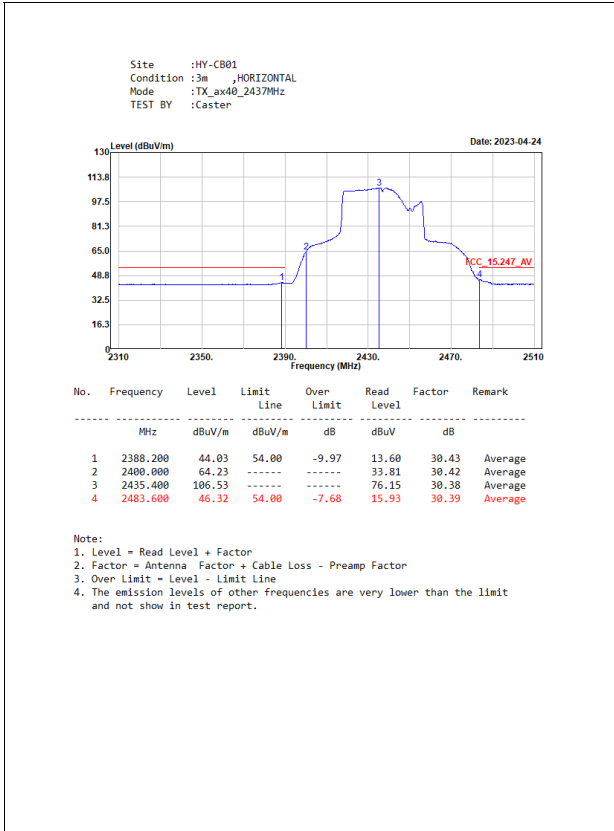
Beamforming

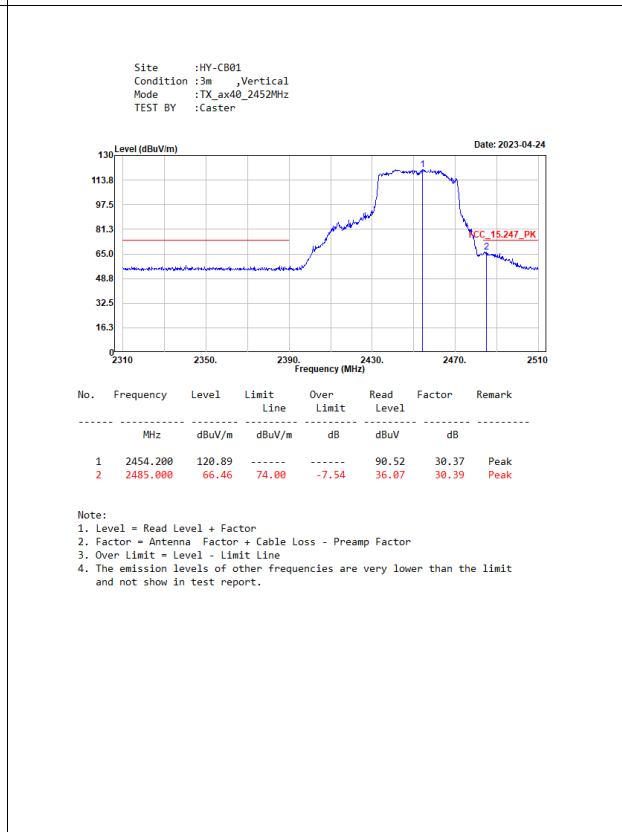
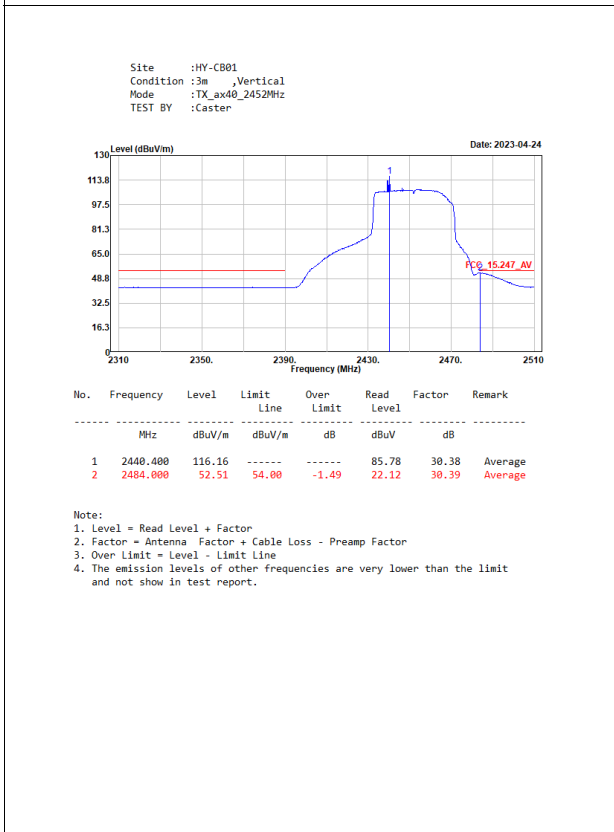
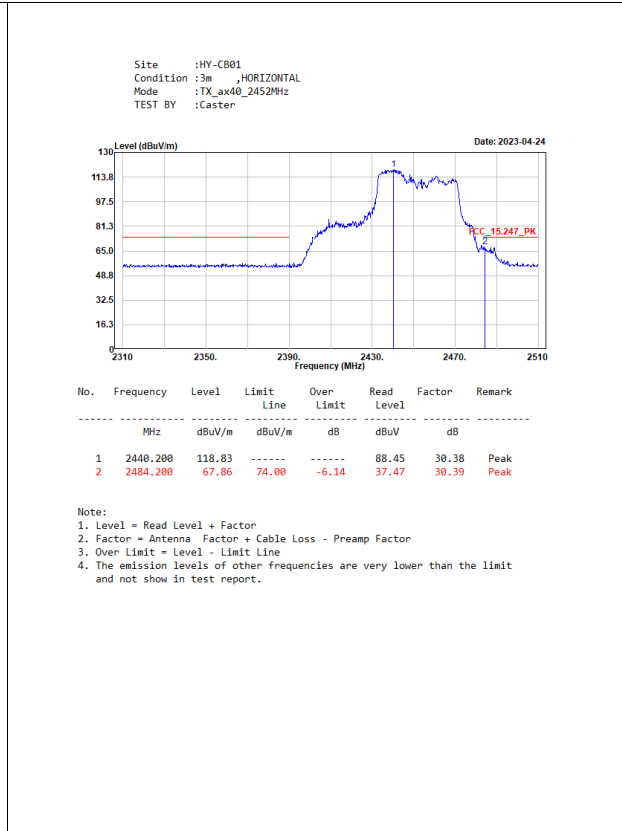
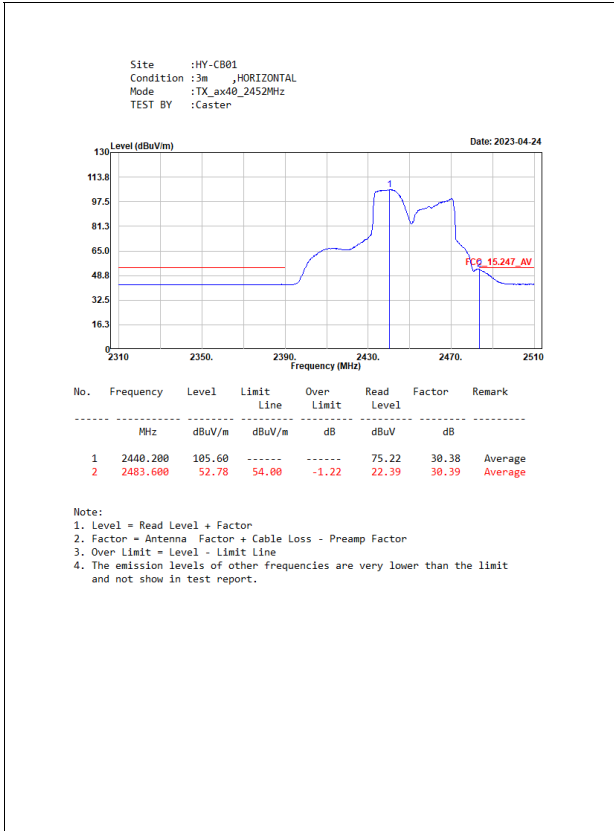






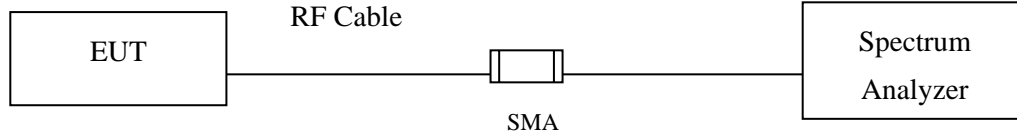






7. 6 dB Bandwidth

7.1. Test Setup



7.2. Limits

The minimum bandwidth shall be at least 500 kHz.

7.3. Test Procedure

The EUT was setup according to ANSI C63.4, 2014; tested according to ANSI C63.10 Section 11.8 for compliance to FCC 47CFR 15.247 requirements.

7.4. Test Result of 6 dB Bandwidth

Product : Internet Gateway
 Test Item : 6 dB Bandwidth Data
 Test Mode : Transmit (802.11b)-CDD

Chain A

Channel No.	Frequency (MHz)	Measurement Level (kHz)	Required Limit (kHz)	Result
01	2412	7073	>500	Pass
06	2437	7552	>500	Pass
11	2462	8032	>500	Pass

Chain B

Channel No.	Frequency (MHz)	Measurement Level (kHz)	Required Limit (kHz)	Result
01	2412	7592	>500	Pass
06	2437	7073	>500	Pass
11	2462	7073	>500	Pass

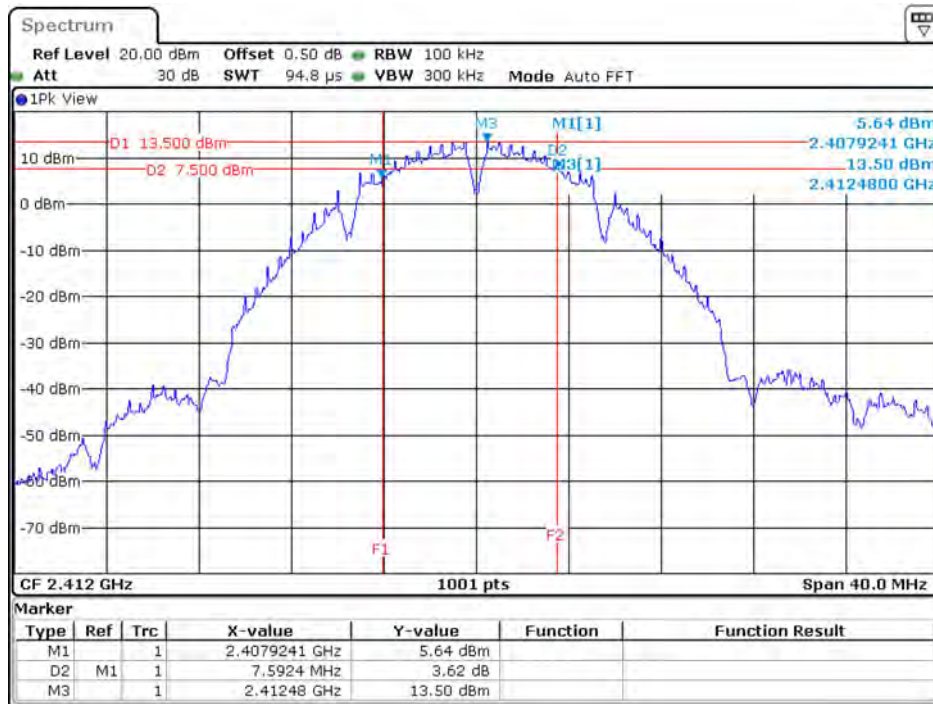
Chain C

Channel No.	Frequency (MHz)	Measurement Level (kHz)	Required Limit (kHz)	Result
01	2412	7073	>500	Pass
06	2437	7033	>500	Pass
11	2462	7073	>500	Pass

Chain D

Channel No.	Frequency (MHz)	Measurement Level (kHz)	Required Limit (kHz)	Result
01	2412	7273	>500	Pass
06	2437	7552	>500	Pass
11	2462	7073	>500	Pass

Figure Channel 01 (Chain B):



Date: 28. MAR 2023 17:38:05

Product : Internet Gateway
 Test Item : 6 dB Bandwidth Data
 Test Mode : Transmit (802.11g)-CDD

Chain A

Channel No.	Frequency (MHz)	Measurement Level (kHz)	Required Limit (kHz)	Result
01	2412	16264	>500	Pass
06	2437	16304	>500	Pass
11	2462	16344	>500	Pass

Chain B

Channel No.	Frequency (MHz)	Measurement Level (kHz)	Required Limit (kHz)	Result
01	2412	15904	>500	Pass
06	2437	16304	>500	Pass
11	2462	16264	>500	Pass

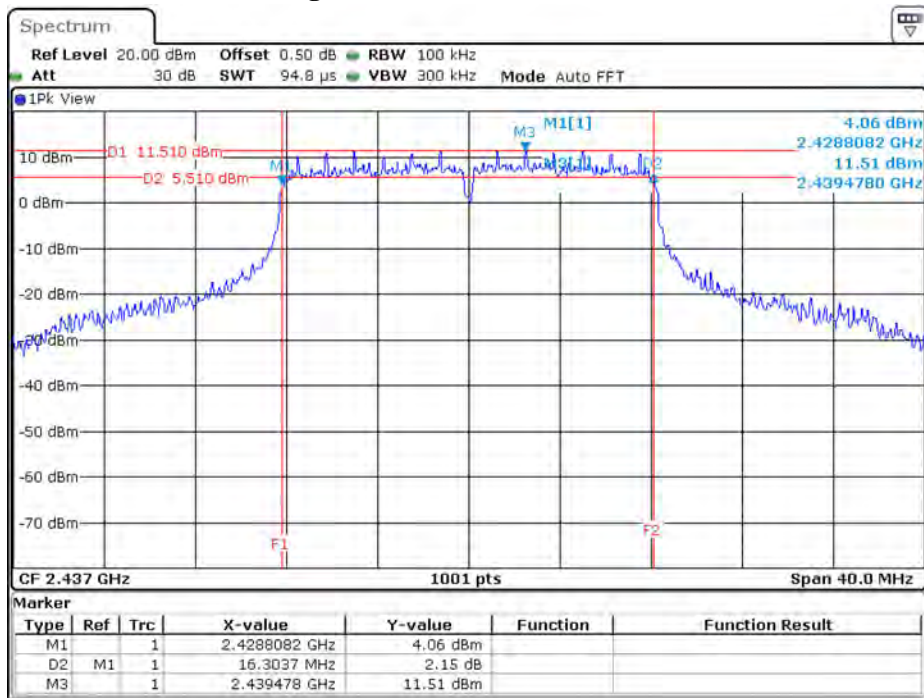
Chain C

Channel No.	Frequency (MHz)	Measurement Level (kHz)	Required Limit (kHz)	Result
01	2412	15904	>500	Pass
06	2437	15944	>500	Pass
11	2462	16304	>500	Pass

Chain D

Channel No.	Frequency (MHz)	Measurement Level (kHz)	Required Limit (kHz)	Result
01	2412	15944	>500	Pass
06	2437	16304	>500	Pass
11	2462	16024	>500	Pass

Figure Channel 06 (Chain B):



Date: 28.MAR.2023 19:18:42

Product : Internet Gateway
 Test Item : 6 dB Bandwidth Data
 Test Mode : Transmit (802.11ax-20 MHz)-CDD

Chain A

Channel No.	Frequency (MHz)	Measurement Level (kHz)	Required Limit (kHz)	Result
01	2412	18581	>500	Pass
06	2437	18741	>500	Pass
11	2462	18741	>500	Pass

Chain B

Channel No.	Frequency (MHz)	Measurement Level (kHz)	Required Limit (kHz)	Result
01	2412	18502	>500	Pass
06	2437	18581	>500	Pass
11	2462	18941	>500	Pass

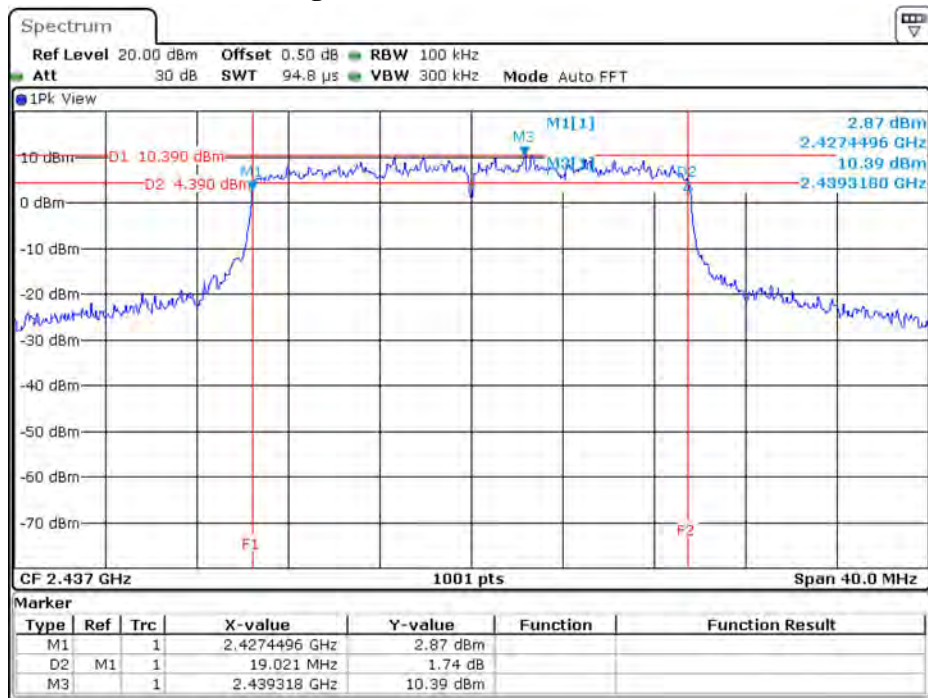
Chain C

Channel No.	Frequency (MHz)	Measurement Level (kHz)	Required Limit (kHz)	Result
01	2412	17942	>500	Pass
06	2437	19021	>500	Pass
11	2462	18661	>500	Pass

Chain D

Channel No.	Frequency (MHz)	Measurement Level (kHz)	Required Limit (kHz)	Result
01	2412	18502	>500	Pass
06	2437	18302	>500	Pass
11	2462	18342	>500	Pass

Figure Channel 06 (Chain C):



Date: 28.MAR.2023 19:49:39

Product : Internet Gateway
 Test Item : 6 dB Bandwidth Data
 Test Mode : Transmit (802.11ax-40 MHz)-CDD

Chain A

Channel No.	Frequency (MHz)	Measurement Level (kHz)	Required Limit (kHz)	Result
03	2422	37802	>500	Pass
06	2437	37483	>500	Pass
09	2452	37642	>500	Pass

Chain B

Channel No.	Frequency (MHz)	Measurement Level (kHz)	Required Limit (kHz)	Result
03	2422	37483	>500	Pass
06	2437	37483	>500	Pass
09	2452	37403	>500	Pass

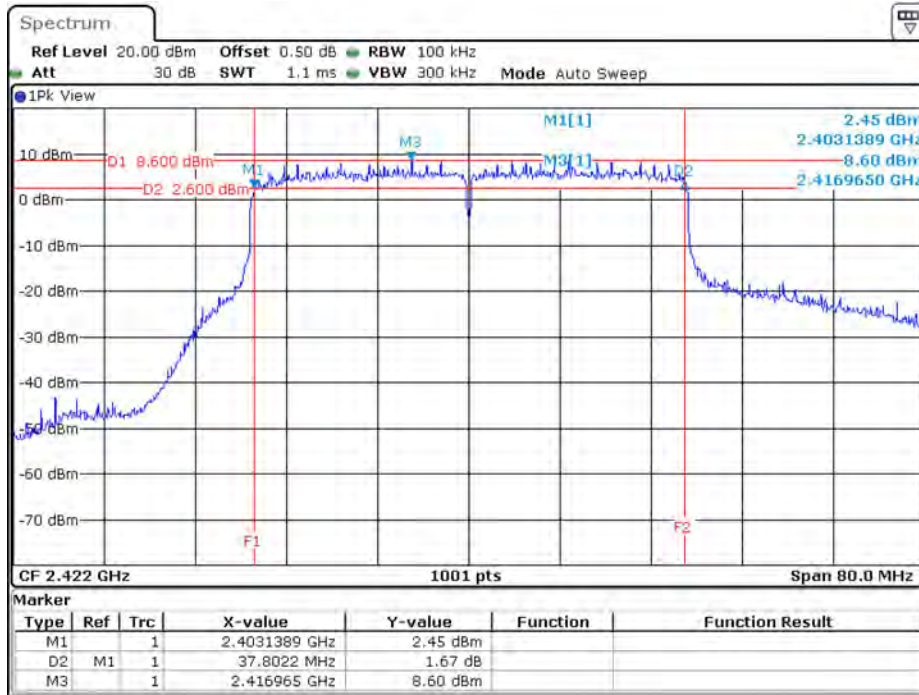
Chain C

Channel No.	Frequency (MHz)	Measurement Level (kHz)	Required Limit (kHz)	Result
03	2422	37882	>500	Pass
06	2437	37722	>500	Pass
09	2452	37483	>500	Pass

Chain D

Channel No.	Frequency (MHz)	Measurement Level (kHz)	Required Limit (kHz)	Result
03	2422	37882	>500	Pass
06	2437	37642	>500	Pass
09	2452	37642	>500	Pass

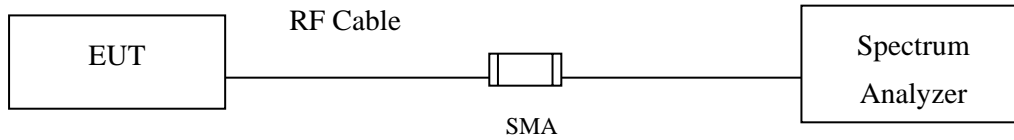
Figure Channel 03 (Chain A):



Date: 28.MAR.2023 20:08:25

8. Power Density

8.1. Test Setup



8.2. Limits

The transmitted power density averaged over any 1 second interval shall not be greater +8 dBm in any 3 kHz bandwidth.

8.3. Test Procedure

The EUT was setup according to ANSI C63.10, 2013; tested according to DTS test procedure of KDB 558074 for compliance to FCC 47CFR 15.247 requirements.

The maximum power spectral density using C63.10 Section 11.10.2 Method PKPSD (peak PSD)

The maximum power density shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6 dBi.

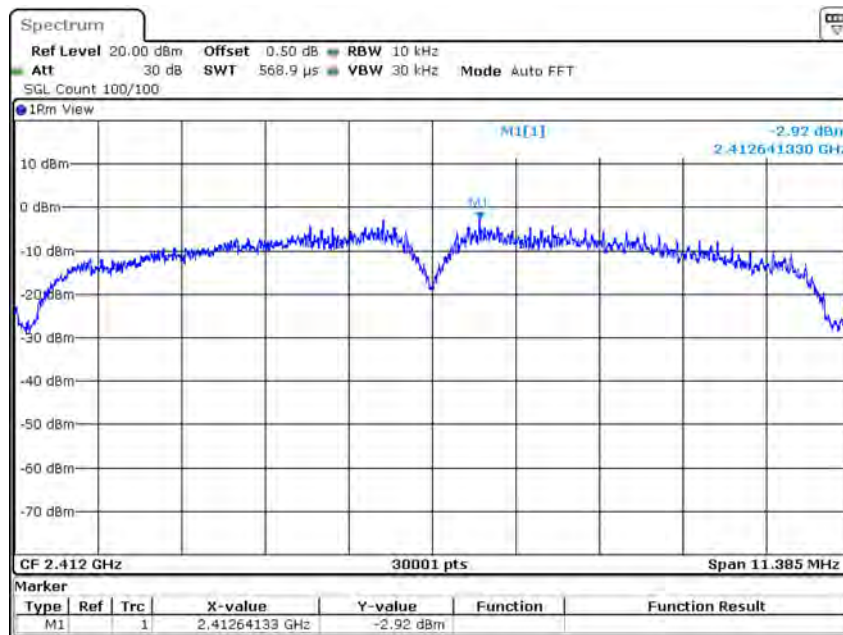
8.4. Test Result of Power Density

Product : Internet Gateway
 Test Item : Power Density Data
 Test Mode : Transmit (802.11b)-CDD

Channel No.	Frequency (MHz)	Data Rate (Mbps)	Chain	PPSD/MHz (dBm)	Duty factor (dBm)	Total PPSD/MHz (dBm)	Limit (dBm)	Result
01	2412	1	A	-4.850	1.338	3.57	8	Pass
			B	-2.920				
			C	-3.750				
			D	-3.850				
06	2437	1	A	-4.210	1.338	3.47	8	Pass
			B	-3.270				
			C	-3.970				
			D	-4.190				
11	2462	1	A	-3.580	1.338	3.73	8	Pass
			B	-3.130				
			C	-3.400				
			D	-4.510				

Note: Total PPSD/MHz = 10*log(Chain A (mW) + Chain B (mW) + Chain C (mW) + Chain D (mW)) + Duty factor.

Figure Channel 01 (Chain B):



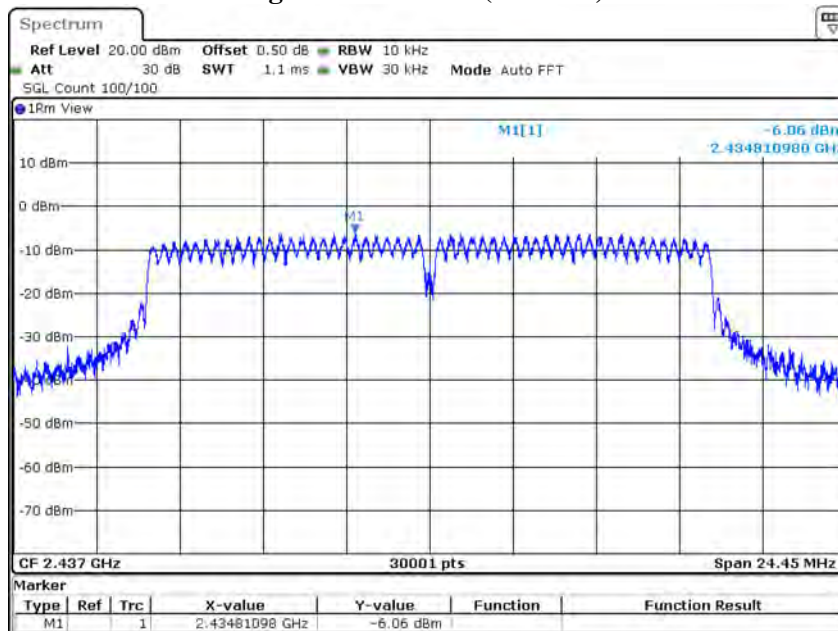
Date: 28 MAR 2023 17:38:22

Product : Internet Gateway
 Test Item : Power Density Data
 Test Mode : Transmit (802.11g)-CDD

Channel No.	Frequency (MHz)	Data Rate (Mbps)	Chain	PPSD/MHz (dBm)	Duty factor (dBm)	Total PPSD/MHz (dBm)	Limit (dBm)	Result
01	2412	6	A	-6.330	0.324	-0.01	8	Pass
			B	-6.420				
			C	-6.340				
			D	-6.340				
06	2437	6	A	-6.390	0.324	0.06	8	Pass
			B	-6.060				
			C	-6.390				
			D	-6.310				
11	2462	6	A	-6.650	0.324	-0.23	8	Pass
			B	-6.580				
			C	-6.640				
			D	-6.420				

Note: Total PPSD/MHz = 10*log(Chain A (mW) + Chain B (mW) + Chain C (mW) + Chain D (mW)) + Duty factor.

Figure Channel 06 (Chain B):



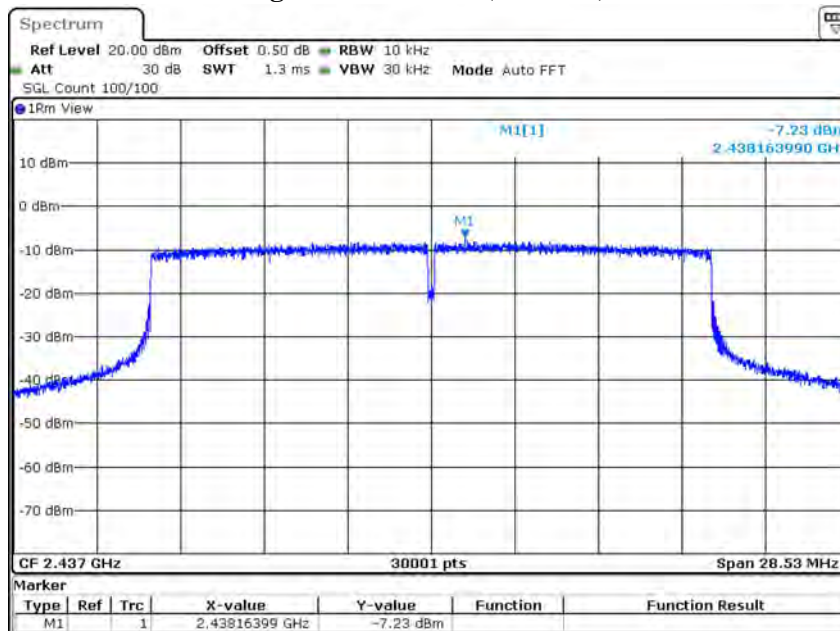
Date: 28.MAR.2023 19:19:00

Product : Internet Gateway
 Test Item : Power Density Data
 Test Mode : Transmit (802.11ax-20 MHz)-CDD

Channel No.	Frequency (MHz)	Data Rate	Chain	PPSD/MHz (dBm)	Duty factor (dBm)	Total PPSD/MHz (dBm)	Limit (dBm)	Result
01	2412	MCS0	A	-9.370	0.324	-2.92	8	Pass
			B	-9.460				
			C	-8.900				
			D	-9.340				
06	2437	MCS0	A	-8.180	0.324	-1.51	8	Pass
			B	-7.980				
			C	-7.230				
			D	-8.100				
11	2462	MCS0	A	-9.100	0.324	-2.54	8	Pass
			B	-8.800				
			C	-8.410				
			D	-9.280				

Note: Total PPSD/MHz = 10*log(Chain A (mW) + Chain B (mW) + Chain C (mW) + Chain D (mW)) + Duty factor.

Figure Channel 06 (Chain C):



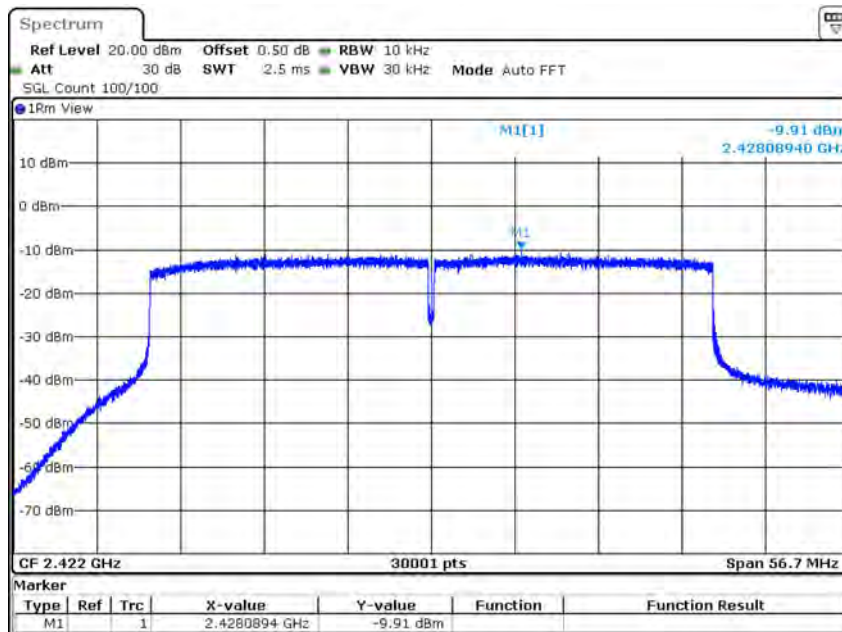
Date: 28.MAR.2023 19:49:57

Product : Internet Gateway
 Test Item : Power Density Data
 Test Mode : Transmit (802.11ax-40 MHz)-CDD

Channel No.	Frequency (MHz)	Data Rate	Chain	PPSD/MHz (dBm)	Duty factor (dBm)	Total PPSD/MHz (dBm)	Limit (dBm)	Result
03	2422	MCS0	A	-9.910	0.256	-4.15	8	Pass
			B	-10.680				
			C	-10.440				
			D	-10.720				
06	2437	MCS0	A	-10.180	0.256	-3.95	8	Pass
			B	-10.220				
			C	-10.330				
			D	-10.190				
09	2452	MCS0	A	-12.120	0.256	-5.66	8	Pass
			B	-11.810				
			C	-11.960				
			D	-11.850				

Note: Total PPSD/MHz = 10*log(Chain A (mW) + Chain B (mW) + Chain C (mW) + Chain D (mW)) + Duty factor.

Figure Channel 03 (Chain A):



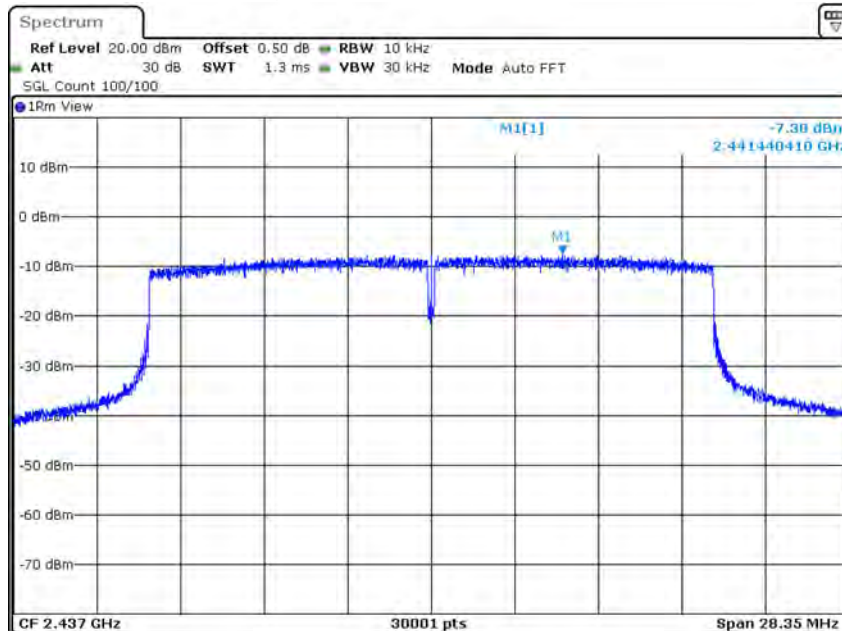
Date: 28 MAR 2023 20:08:44

Product : Internet Gateway
 Test Item : Power Density Data
 Test Mode : Transmit (802.11ax-20 MHz)-Beamforming

Channel No.	Frequency (MHz)	Data Rate	Chain	PPSD/MHz (dBm)	Duty factor (dBm)	Total PPSD/MHz (dBm)	Limit (dBm)	Result
01	2412	MCS0	A	-7.510	0.234	-1.21	8	Pass
			B	-7.430				
			C	-7.320				
			D	-7.600				
06	2437	MCS0	A	-7.300	0.234	-1.19	8	Pass
			B	-7.330				
			C	-7.570				
			D	-7.570				
11	2462	MCS0	A	-7.790	0.234	-1.61	8	Pass
			B	-7.580				
			C	-8.170				
			D	-7.950				

Note: Total PPSD/MHz = 10*log(Chain A (mW) + Chain B (mW) + Chain C (mW) + Chain D (mW)) + Duty factor.

Figure Channel 06 (Chain A):



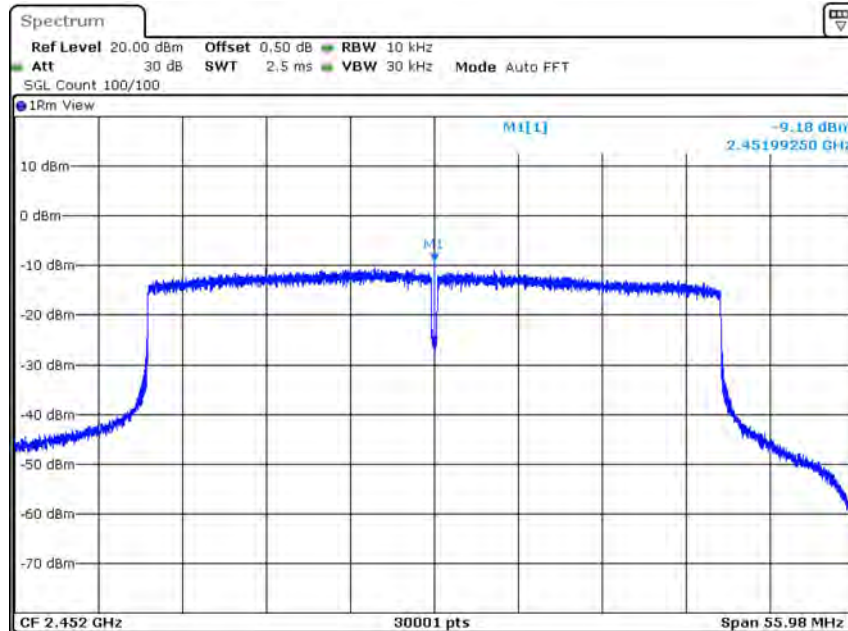
Date: 3.MAY.2023 18:26:15

Product : Internet Gateway
 Test Item : Power Density Data
 Test Mode : Transmit (802.11ax-40 MHz)-Beamforming

Channel No.	Frequency (MHz)	Data Rate	Chain	PPSD/MHz (dBm)	Duty factor (dBm)	Total PPSD/MHz (dBm)	Limit (dBm)	Result
03	2422	MCS0	A	-9.860	0.324	-3.86	8	Pass
			B	-10.340				
			C	-10.090				
			D	-10.550				
06	2437	MCS0	A	-9.410	0.324	-3.46	8	Pass
			B	-10.090				
			C	-9.870				
			D	-9.890				
09	2452	MCS0	A	-9.180	0.324	-3.83	8	Pass
			B	-10.750				
			C	-10.290				
			D	-10.670				

Note: Total PPSD/MHz = 10*log(Chain A (mW) + Chain B (mW) + Chain C (mW) + Chain D (mW)) + Duty factor.

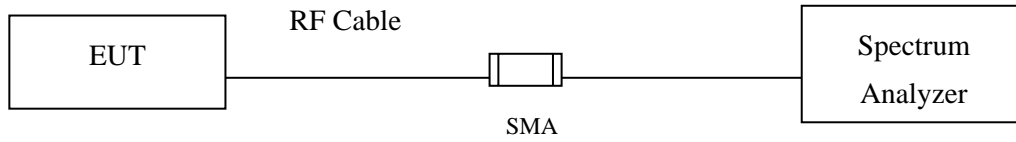
Figure Channel 09 (Chain A):



Date: 3 MAY 2023 19:27:53

9. Duty Cycle

9.1. Test Setup



9.2. Test Procedure

The EUT was setup according to ANSI C63.10 2013; tested according to ANSI C63.10 2013 for compliance to FCC 47CFR 15.247 requirements.

9.3. Test Result of Duty Cycle

Product : Internet Gateway
Test Item : Duty Cycle
Test Mode : Transmit-CDD mode

Duty Cycle Formula:

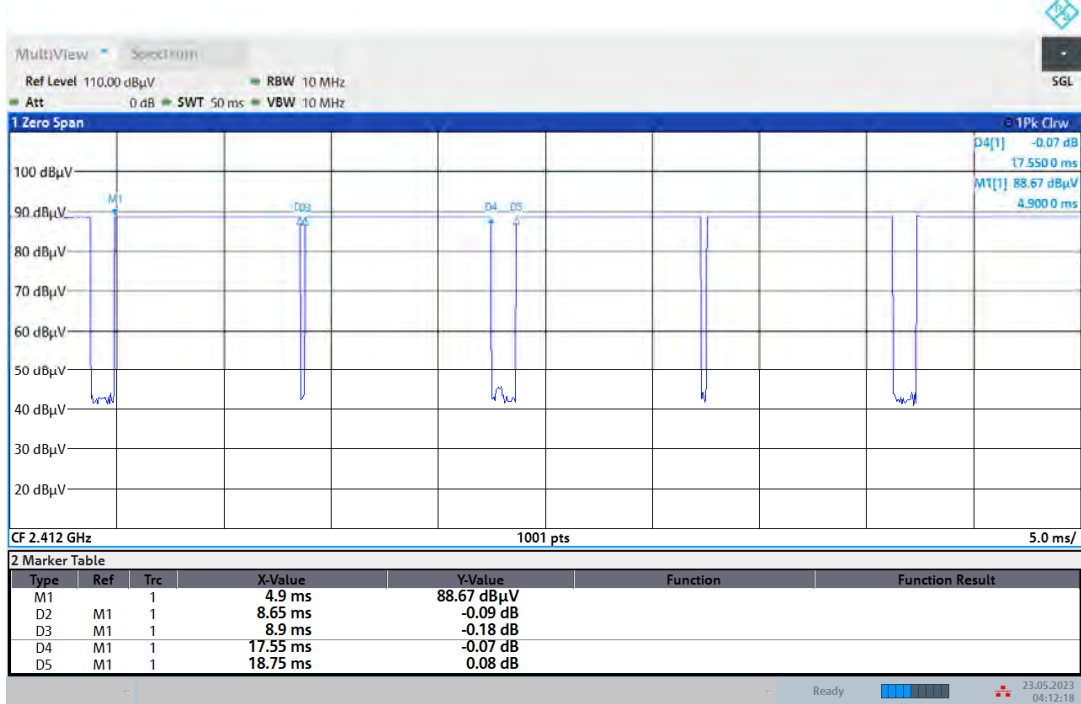
Duty Cycle = Ton / (Ton + Toff)

Duty Factor = 10 Log (1/Duty Cycle)

Results:

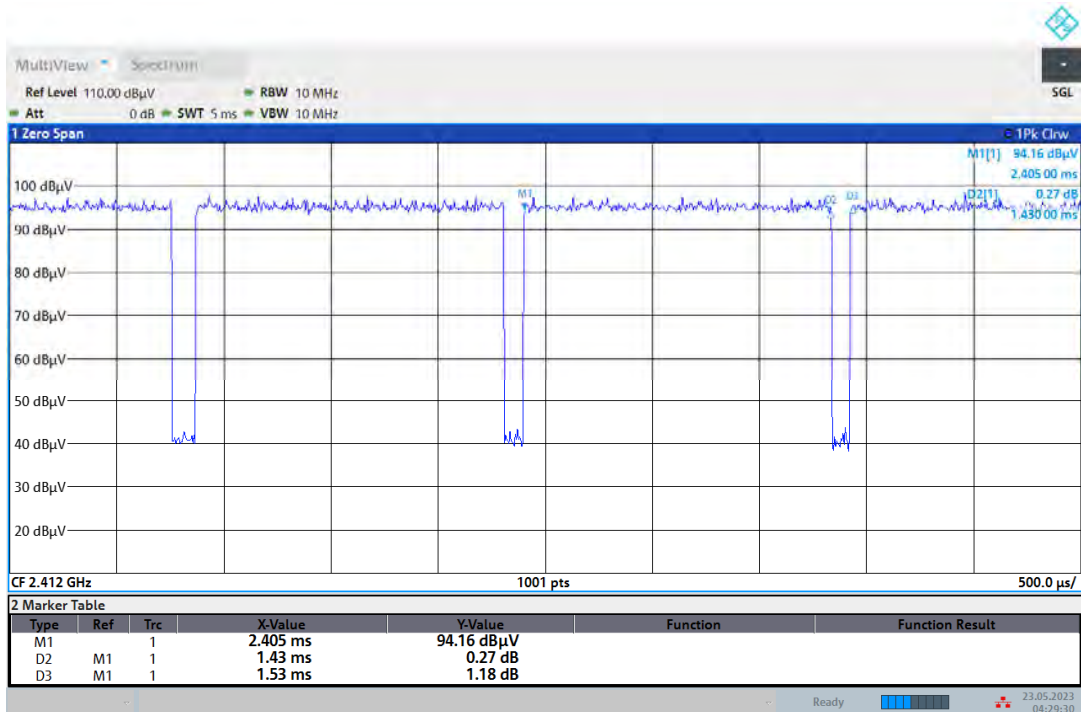
2.4GHz band	Ton (ms)	Ton + Toff (ms)	Duty Cycle (%)	Duty Factor (dB)
802.11b	17.3000	18.7500	92.27	0.35
802.11g	1.4300	1.5300	93.46	0.29
802.11ax-20 MHz	5.4300	5.8300	93.14	0.31
802.11ax-40 MHz	5.4100	5.8100	93.12	0.31

802.11b



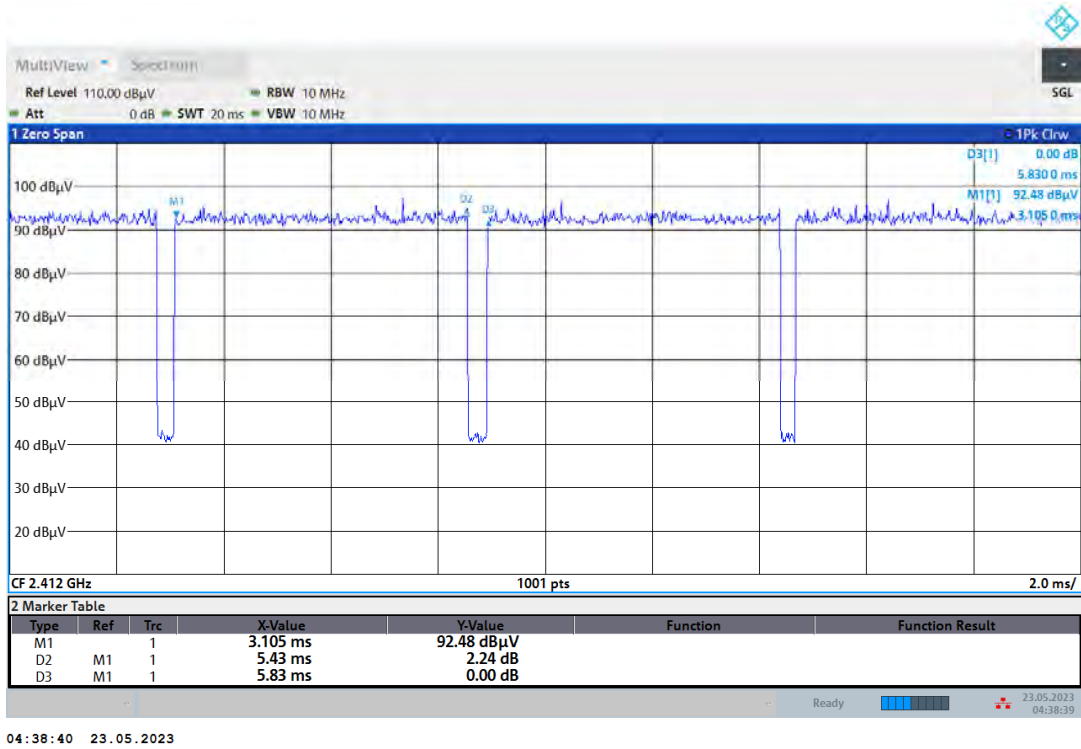
04:12:20 23.05.2023

802.11g

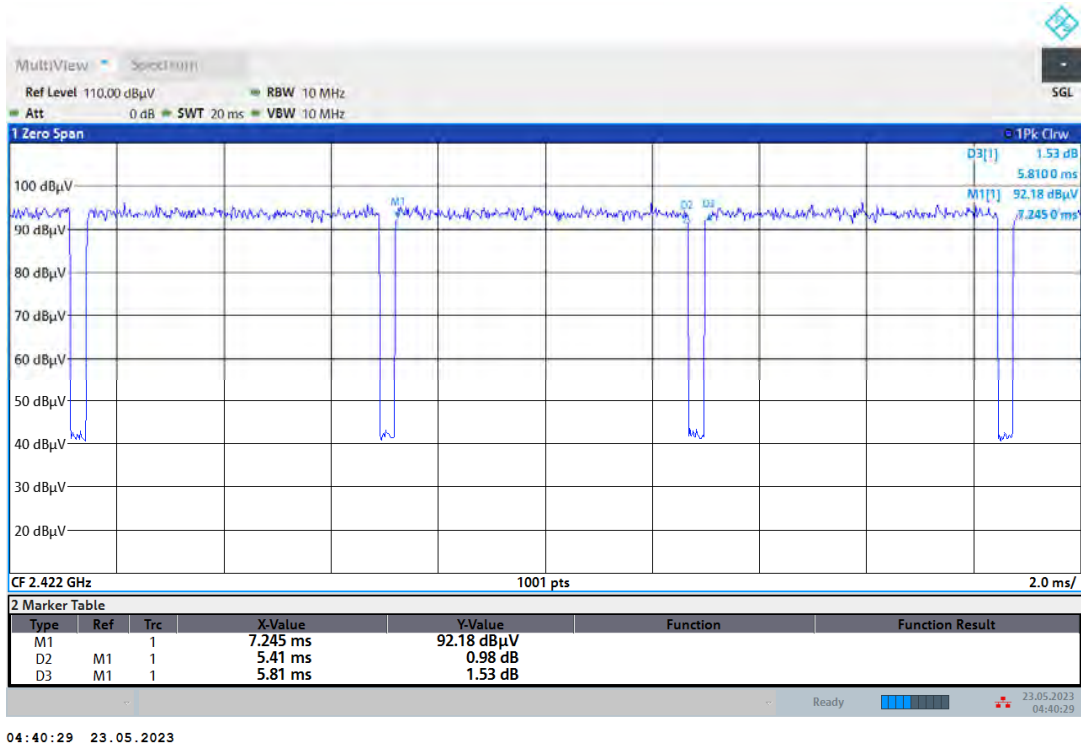


04:29:30 23.05.2023

802.11ax-20 MHz



802.11ax-40 MHz



Product : Internet Gateway
Test Item : Duty Cycle
Test Mode : Transmit-Beamforming mode

Duty Cycle Formula:

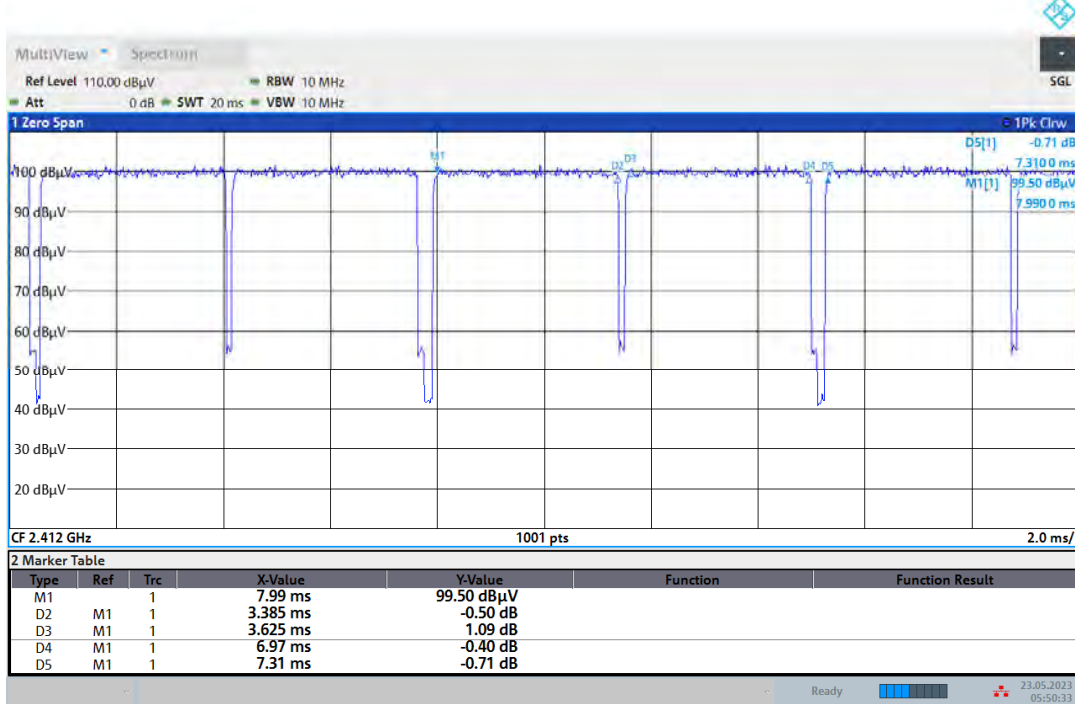
Duty Cycle = Ton / (Ton + Toff)

Duty Factor = 10 Log (1/Duty Cycle)

Results:

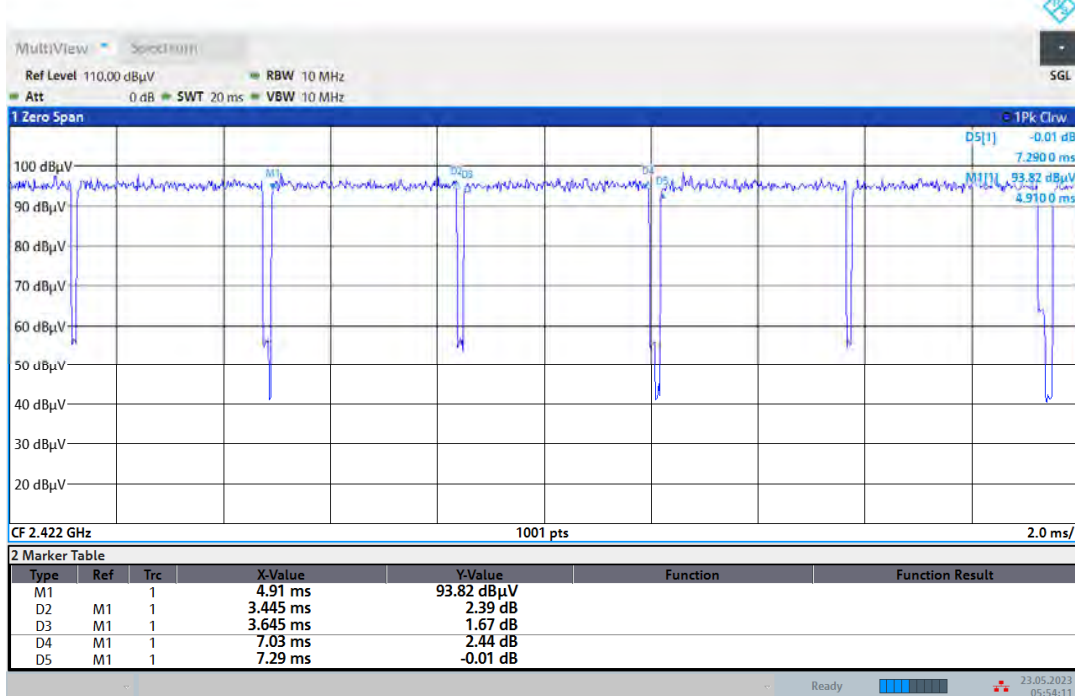
2.4GHz band	Ton (ms)	Ton + Toff (ms)	Duty Cycle (%)	Duty Factor (dB)
802.11ax-20 MHz	6.7300	7.3100	92.07	0.36
802.11ax-40 MHz	6.8300	7.2900	93.69	0.28

802.11ax-20 MHz



05:50:34 23.05.2023

802.11ax-40 MHz



05:54:12 23.05.2023