



Test report No.: 2350302R-RFUSV01S-A

TEST REPORT (Class II Permissive Change)

Product Name	Host-based multiradio modules with WiFi, Bluetooth and NFC
Trademark	u-blox
Model and /or type reference	EMMY-W163
FCC ID	XPYEMMYW163
Applicant's name / address	u-blox AG Zürcherstrasse 68. Thalwil, 8800. Switzerland
Manufacturer's name	u-blox AG
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 / Genie Chang)	<i>Genie Chang</i>
Tested By (Senior Engineer / Bill Lin)	<i>Bill Lin</i>
Approved By (Senior Engineer / Jack Hsu)	<i>Jack Hsu</i>
Date of Receipt	2022/11/07
Date of Issue	2023/06/26
Report Version	V1.0

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Appendix 1: EUT Test Photographs

Appendix 2: Product Photos-Please refer to the file: 2350302R-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.

DEKRA is liable to the client for the maintenance of the confidentiality of all information related to the item under test and the results of the test.

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
2350302R-RFUSV01S-A	V1.0	Initial issue of report.	2023/06/26

1. General Information

1.1. EUT Description

Product Name	Host-based multiradio modules with WiFi, Bluetooth and NFC
Trademark	u-blox
Model and /or type reference	EMMY-W163
EUT Rated Voltage	DC 3.3V
EUT Test Voltage	DC 3.3V
Frequency Range	802.11b/g/n-20 MHz: 2412-2462 MHz 802.11n-40 MHz: 2422-2452 MHz
Number of Channels	802.11b/g/n-20 MHz: 11 802.11n-40 MHz: 7
Data Speed	802.11b: 1-11 Mbps, 802.11g: 6-54 Mbps, 802.11n: up to 150Mbps
Channel separation	802.11b/g/n: 5 MHz
Type of Modulation	802.11b: DSSS, DBPSK, DQPSK, CCK 802.11g/n: OFDM, BPSK, QPSK, 16QAM, 64QAM
Channel Control	Auto
Blockchain verified QR code	

Antenna List

No.	Manufacturer	Part No.	Antenna Type	Peak Gain
1	Mercedes	A1779052902	PIFA	-0.3 dBi for 2400 MHz

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

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

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

802.11n-40 MHz Center Frequency of Each Channel:

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

Note:

1. The EUT is a Host-based multiradio modules with WiFi, Bluetooth and NFC with a built-in WLAN and Bluetooth transceiver, this report for 2.4GHz 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. Lowest and highest data rates are tested in each mode. Only worst case is shown in the report.
4. This is to request a Class II permissive change for FCC ID: XPYEMMYW163, originally granted on 09/09/2016.

The major change filed under this application is:

Change #1: Addition a PIFA Antenna, the antenna type is different with the original application.

Host information		
Brand	Product Name	Model No.
ART	Car Infotainment Unit	ICC

Test Mode	Mode 1	Transmit (802.11b)
		Transmit (802.11g)
		Transmit (802.11n-20 MHz)
		Transmit (802.11n-40 MHz)

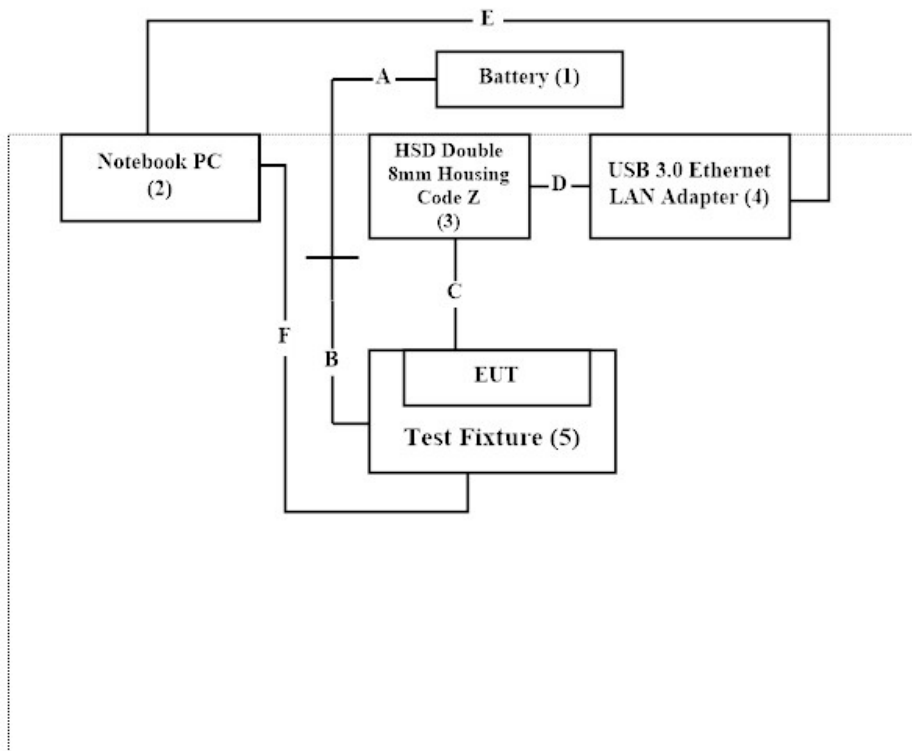
1.2. Tested System Details

The types for all equipment, plus descriptions of all cables used in the tested system (including inserted cards) are:

Product	Manufacturer	Model No.	Serial No.	Power Cord
1 Battery	YUASA	55B24L-CMF II	N/A	N/A
2 Notebook PC	DELL	Latitude E5440	FS9TK32	N/A
3 HSD Double 8mm Housing Code Z	Rosenberger	D4Z0009-000Z	N/A	N/A
4 USB 3.0 Ethernet LAN Adapter	Manhattan	506847	N/A	N/A
5 Test Fixture	ART	ICC	N/A	N/A

Cable Type	Cable Description
A Power Cable	Non-shielded, 1.8m
B Power Cable	Non-shielded, 1m
C HSD Cable Jack to HSD Dacar 566	Non-shielded, 0.8m
D USB 3.0 Ethernet LAN Adapter Cable	Non-shielded, 0.2m
E ETH Cable	Non-shielded, 1m
F CSM 2 HSD to USB 3.0 Cable	Non-shielded, 1.5m

1.3. Configuration of Tested System



1.4. EUT Exercise Software

1.	Setup the EUT as shown in Section 1.3.
2.	Execute software “PuTTY Configuration version Release 0.73” on the Notebook PC.
3.	Configure the test mode, the test channel, and the 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
Radiated Emission	Temperature (°C)	10~40 °C	23.7 °C
	Humidity (%RH)	10~90 %	63.8 %
Conductive	Temperature (°C)	10~40 °C	22.0 °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 Conducted Measurements / HY-SR02

	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	101306	2022/05/23	2023/05/22
V	Two-Line V-Network	R&S	ENV216	101307	2022/07/04	2023/07/03
V	Coaxial Cable	SUHNER	RG400 BNC	RF001	2022/05/24	2023/05/23

Note:

1. All equipments are calibrated every one year.
2. The test instruments marked with “V” are used to measure the final test results.
3. Test Software Version: RF Conducted Test Tools R3 V3.0.0.14.

For Radiated Measurements / HY-CB03

	Equipment	Manufacturer	Model No.	Serial No.	Cal. Date	Due Date
V	Loop Antenna	AMETEK	HLA6121	49611	2022/03/18	2023/03/17
V	Bi-Log Antenna	SCHWARZBECK	VULB9168	9168-675	2021/08/11	2023/08/10
V	Horn Antenna	Com-Power	AH-840	101100	2021/10/04	2023/10/03
V	Horn Antenna	RF SPIN	DRH18-E	210508A18ES	2022/06/08	2023/06/07
V	Pre-Amplifier	SGH	0301	20211007-10	2023/01/10	2024/01/09
V	Pre-Amplifier	SGH	PRAMP118	20200701	2023/01/10	2024/01/09
V	Pre-Amplifier	EMCI	EMC05820SE	980310	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	Filter	MICRO TRONICS	BRM50702	G269	2022/07/31	2023/07/30
	Filter	MICRO TRONICS	BRM50716	G196	2022/07/27	2023/07/26
V	EMI Test Receiver	R&S	ESR3	102793	2022/12/05	2023/12/04
V	Spectrum Analyzer	R&S	FSV3044	101113	2023/02/04	2024/02/03
V	Coaxial Cable	SGH	SGH18	2021005-1	2023/01/10	2024/01/09
	Coaxial Cable	SGH	SGH18	202108-4		
	Coaxial Cable	SGH	HA800	GD20110223-1		
	Coaxial Cable	SGH	HA800	GD20110222-3		

Note:

1. Bi-Log Antenna and Horn Antenna(AH-840) is calibrated every two years, the other equipments are calibrated every one year.
2. The test instruments marked with “V” are used to measure the final test results.
3. Test Software Version: E3 210616 dekra V9.

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	
Peak Power Output	± 0.89 dB	
Radiated Emission	Under 1 GHz ± 4.05 dB	Above 1 GHz ± 3.73 dB
Band Edge	Under 1 GHz ± 4.05 dB	Above 1 GHz ± 3.73 dB
Duty Cycle	± 2.31 ms	

2. Maximum Power Output

2.1. Test Setup



2.2. Limits

The maximum peak power shall be less 1 Watt.

2.3. 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).

2.4. Test Result of Peak Power Output

Product : Host-based multiradio modules with WiFi, Bluetooth and NFC
Test Item : Maximum Power Output Data
Test Mode : Transmit (802.11b)
Test Date : 2023/01/18

Channel No.	Frequency (MHz)	Data Rate (Mbps)	Average Power (dBm)	Limit (dBm)	Result
01	2412	1	17.83	<30	Pass
06	2437	1	17.79	<30	Pass
11	2462	1	17.74	<30	Pass

Channel No.	Frequency (MHz)	Data Rate (Mbps)	Peak Power (dBm)	Limit (dBm)	Result
01	2412	1	20.64	<30	Pass
06	2437	1	20.55	<30	Pass
11	2462	1	20.53	<30	Pass

Product : Host-based multiradio modules with WiFi, Bluetooth and NFC
Test Item : Maximum Power Output Data
Test Mode : Transmit (802.11g)
Test Date : 2023/01/18

Channel No.	Frequency (MHz)	Data Rate (Mbps)	Average Power (dBm)	Limit (dBm)	Result
01	2412	6	12.89	<30	Pass
06	2437	6	15.90	<30	Pass
11	2462	6	12.82	<30	Pass

Channel No.	Frequency (MHz)	Data Rate (Mbps)	Peak Power (dBm)	Limit (dBm)	Result
01	2412	6	20.56	<30	Pass
06	2437	6	24.01	<30	Pass
11	2462	6	20.53	<30	Pass

Product : Host-based multiradio modules with WiFi, Bluetooth and NFC
Test Item : Maximum Power Output Data
Test Mode : Transmit (802.11n-20 MHz)
Test Date : 2023/01/18

Channel No.	Frequency (MHz)	Data Rate	Average Power (dBm)	Limit (dBm)	Result
01	2412	HT0	12.95	<30	Pass
06	2437	HT0	15.97	<30	Pass
11	2462	HT0	11.86	<30	Pass

Channel No.	Frequency (MHz)	Data Rate	Peak Power (dBm)	Limit (dBm)	Result
01	2412	HT0	21.05	<30	Pass
06	2437	HT0	24.13	<30	Pass
11	2462	HT0	20.11	<30	Pass

Product : Host-based multiradio modules with WiFi, Bluetooth and NFC
Test Item : Maximum Power Output Data
Test Mode : Transmit (802.11n-40 MHz)
Test Date : 2023/01/18

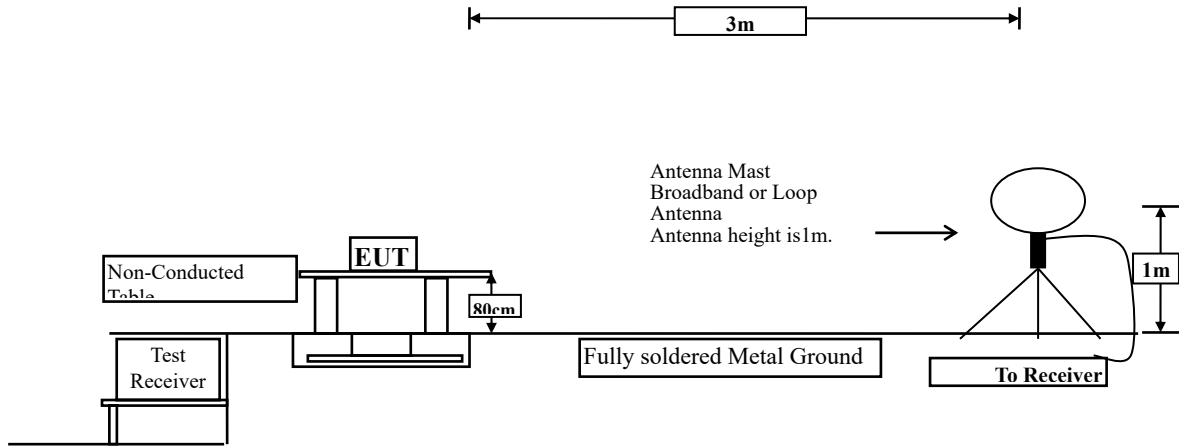
Channel No.	Frequency (MHz)	Data Rate	Average Power (dBm)	Limit (dBm)	Result
03	2422	HT0	10.83	<30	Pass
06	2437	HT0	13.77	<30	Pass
09	2452	HT0	10.85	<30	Pass

Channel No.	Frequency (MHz)	Data Rate	Peak Power (dBm)	Limit (dBm)	Result
03	2422	HT0	18.14	<30	Pass
06	2437	HT0	22.80	<30	Pass
09	2452	HT0	18.16	<30	Pass

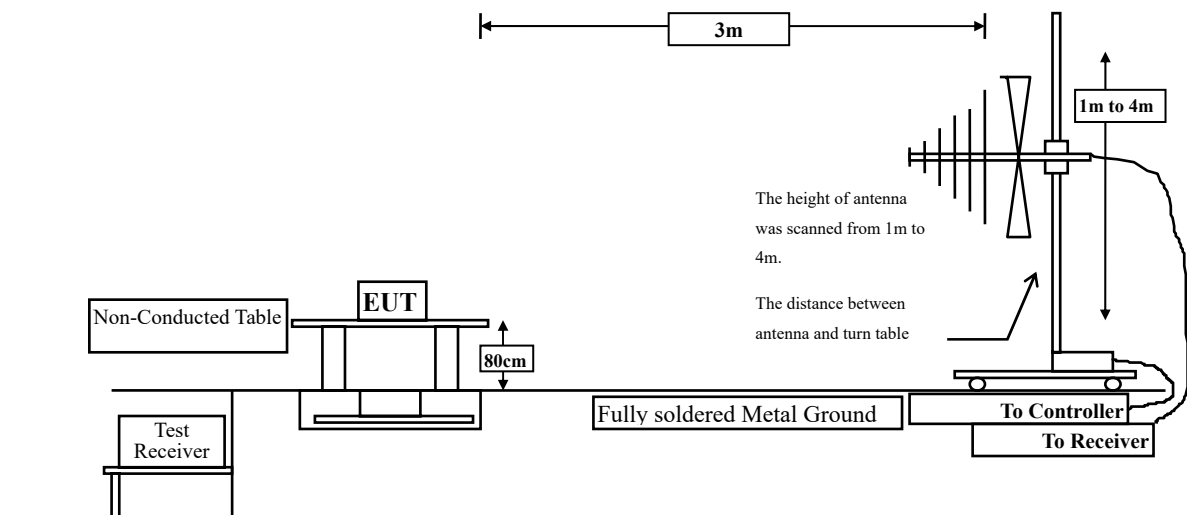
3. Radiated Emission

3.1. Test Setup

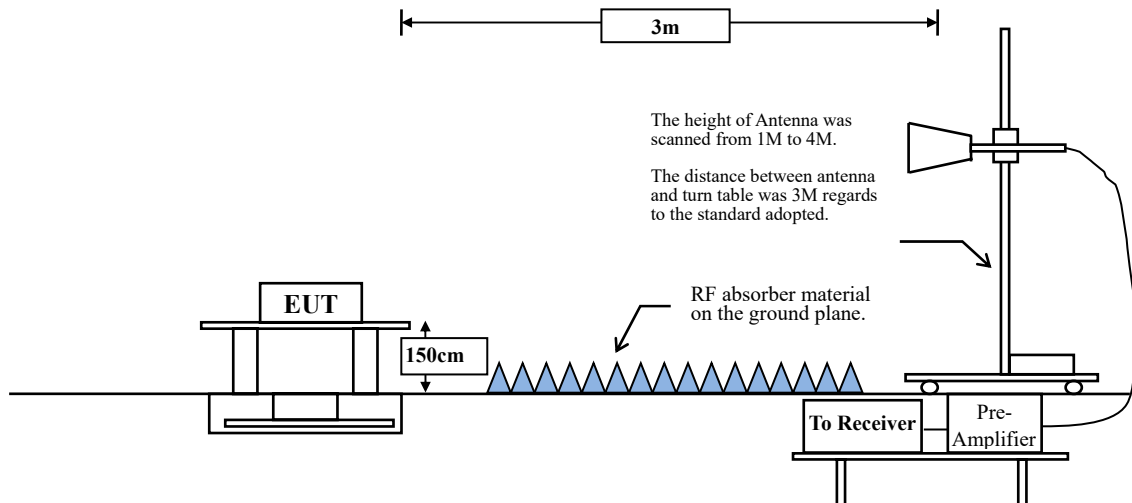
Radiated Emission Under 30 MHz



Radiated Emission Below 1 GHz



Radiated Emission Above 1 GHz



3.2. 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.

3.3. 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 from 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 = 1MHz.

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

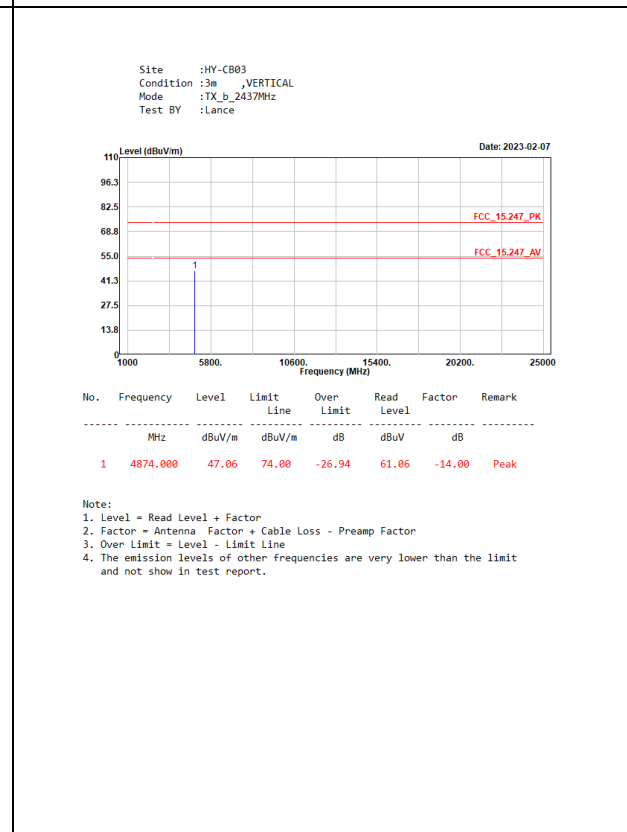
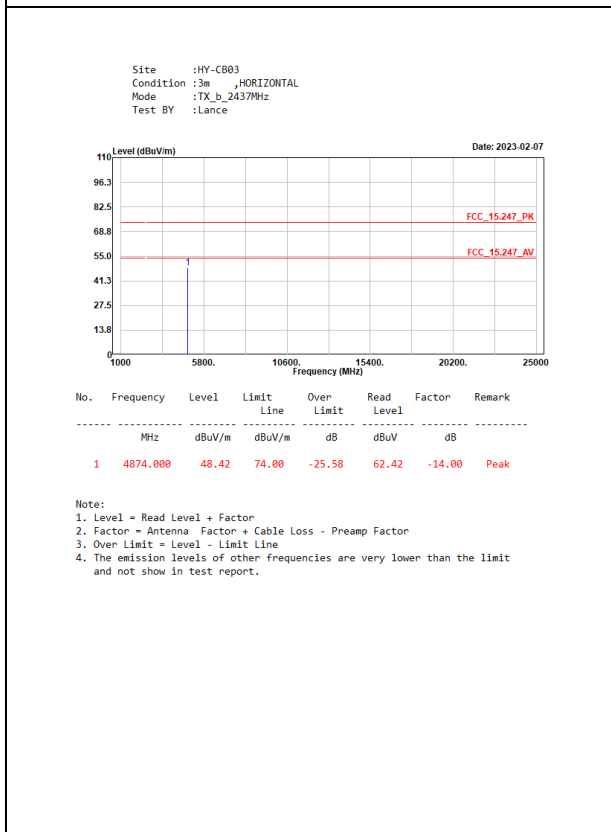
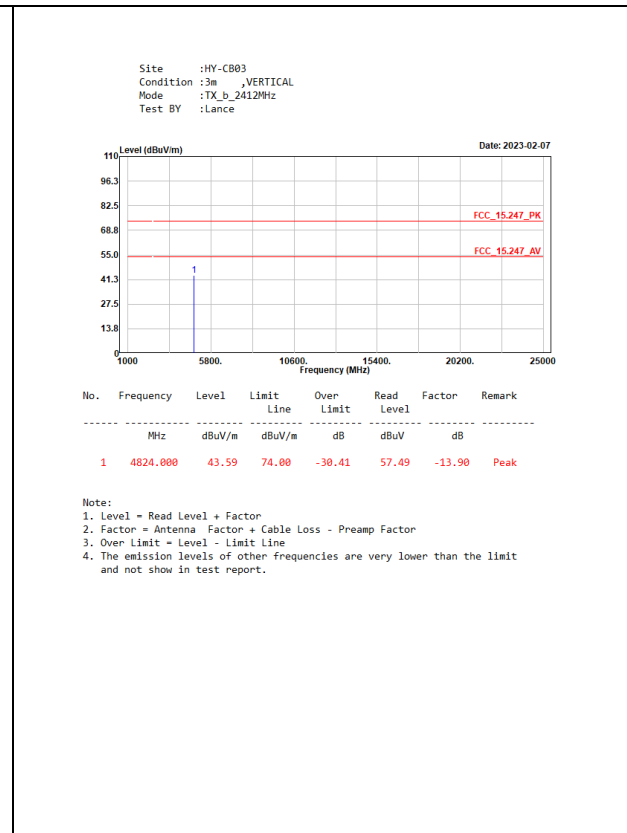
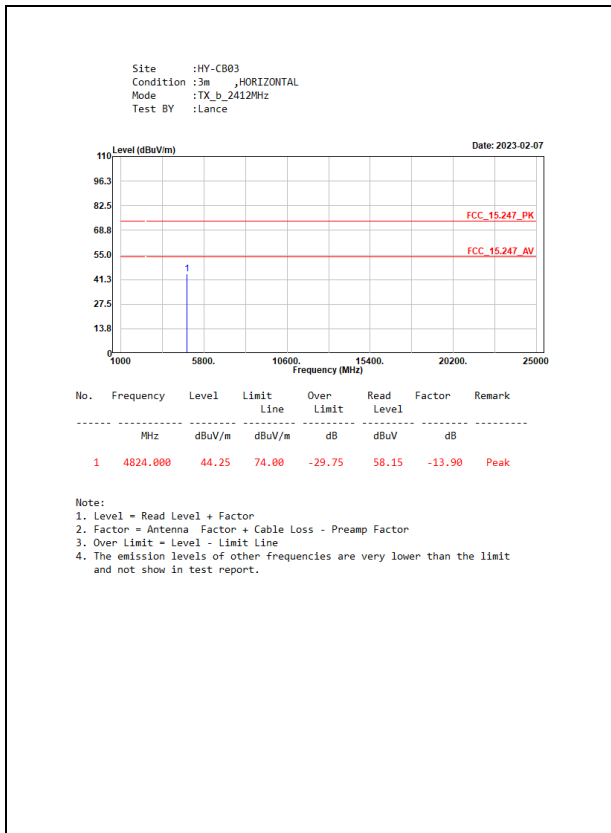
VBW \geq 1/T, when duty cycle < 98 %

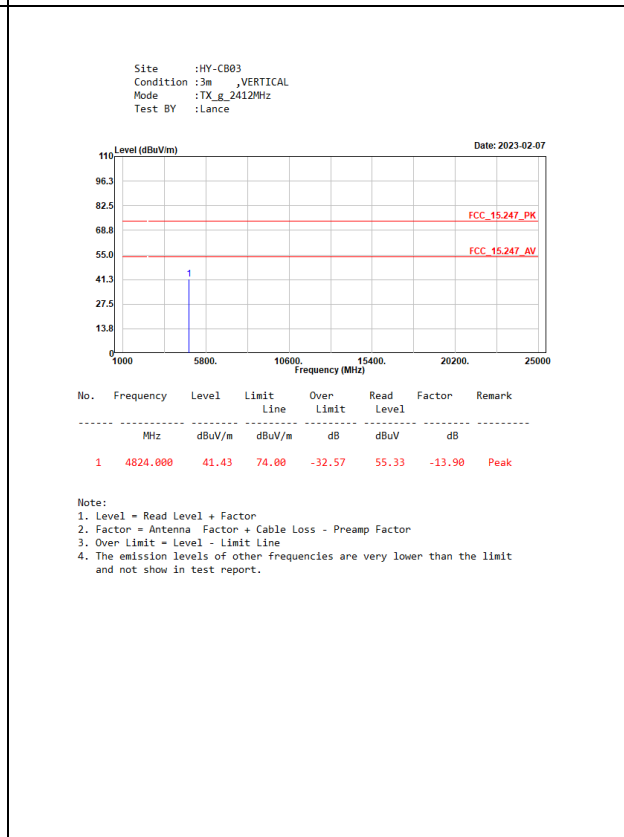
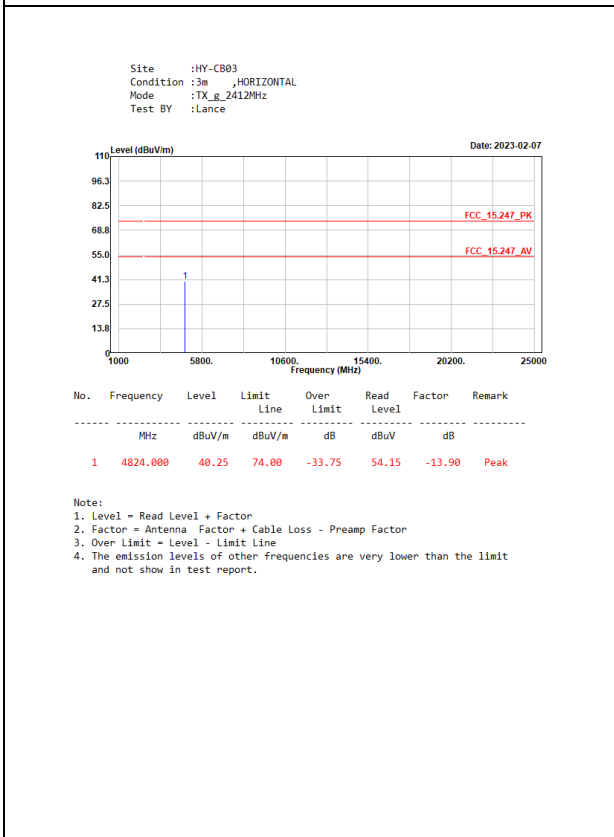
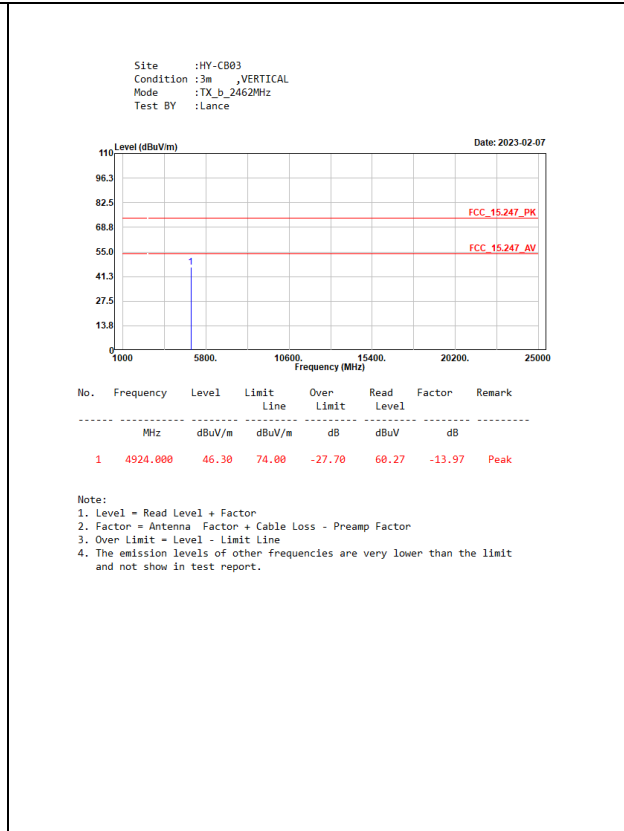
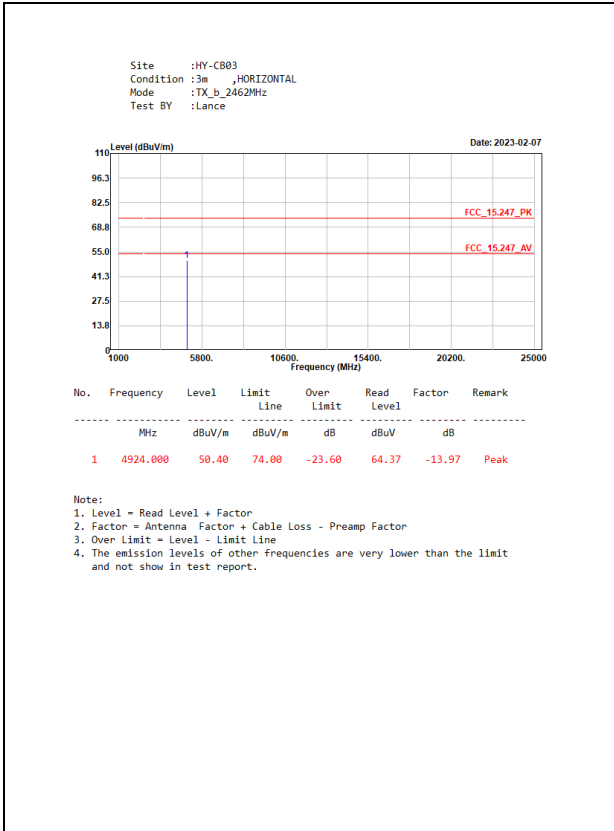
(T refers to the minimum transmission duration over which the transmitter is on and is transmitting at its maximum power control level for the tested mode of operation.)

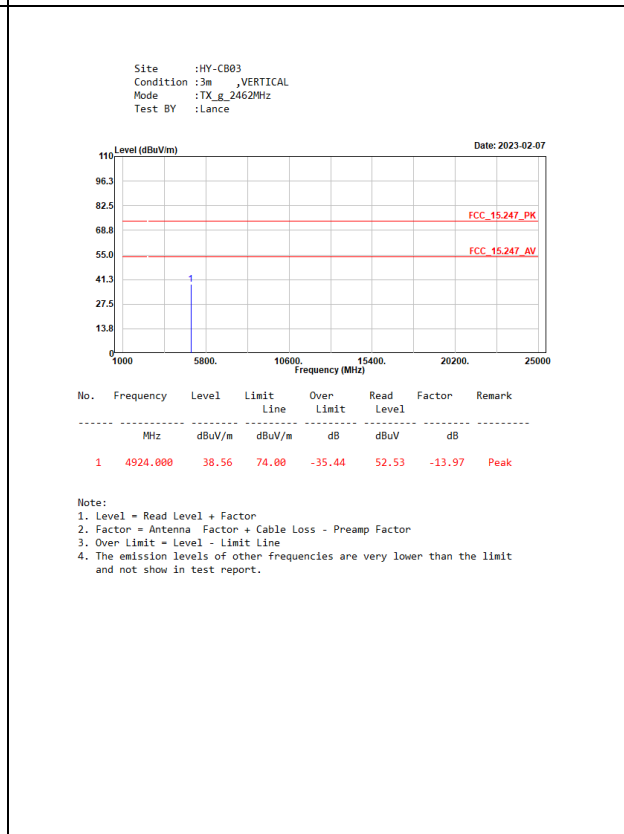
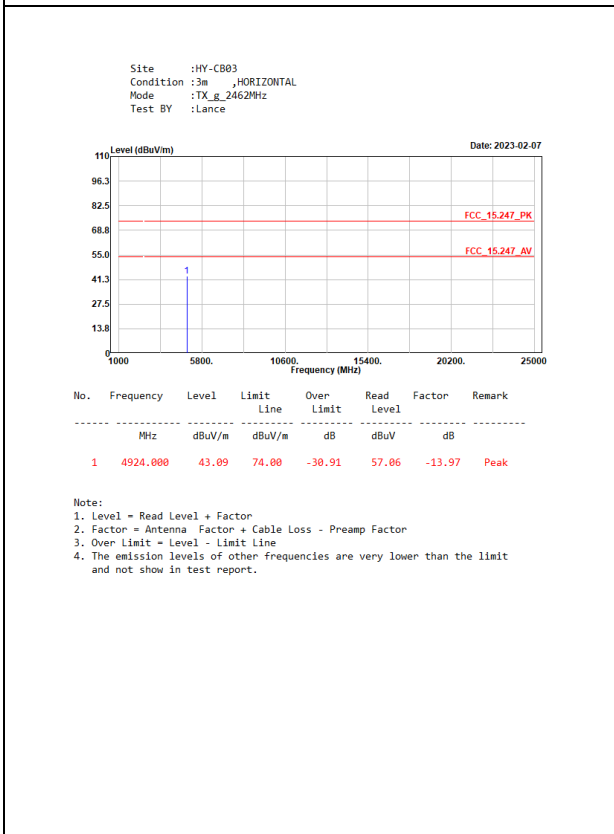
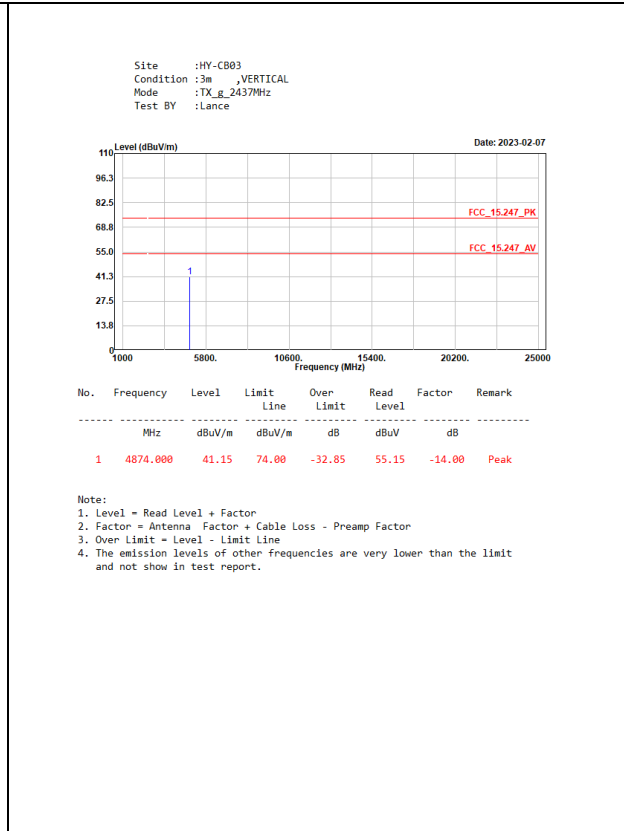
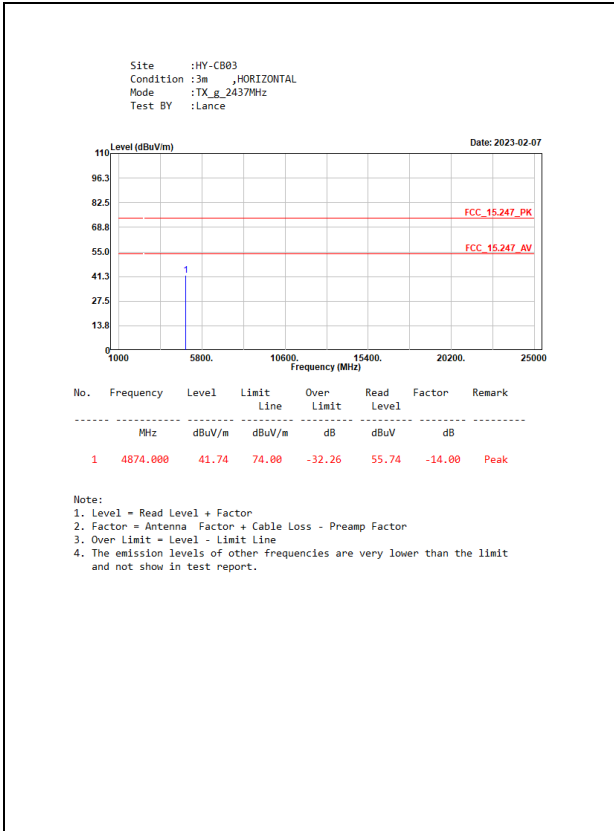
2.4GHz band	Duty Cycle (%)	T (ms)	1/T (Hz)	VBW (Hz)
802.11 b	48.68	4.5150	221	300
802.11 g	44.12	2.1000	476	500
802.11 n20	41.18	1.9600	510	1000
802.11 n40	21.67	0.9100	1099	2000

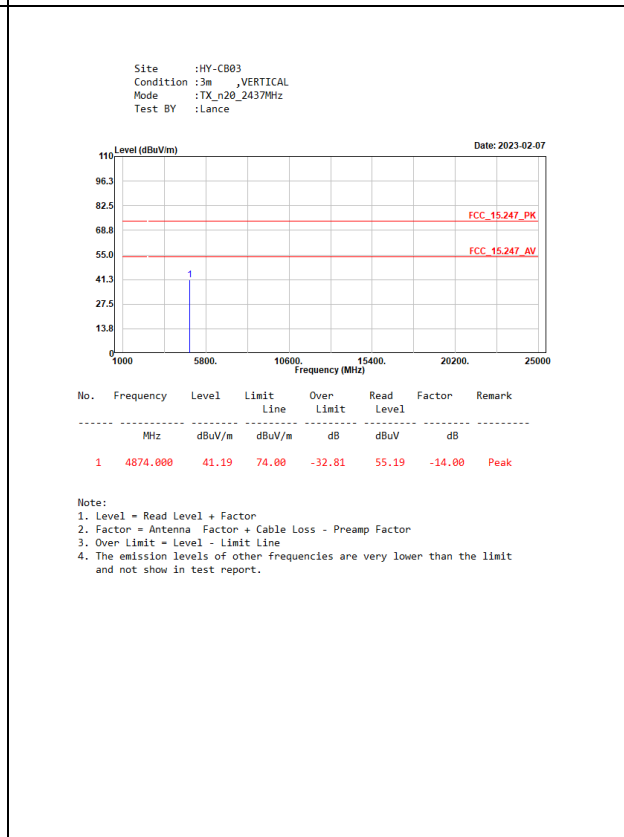
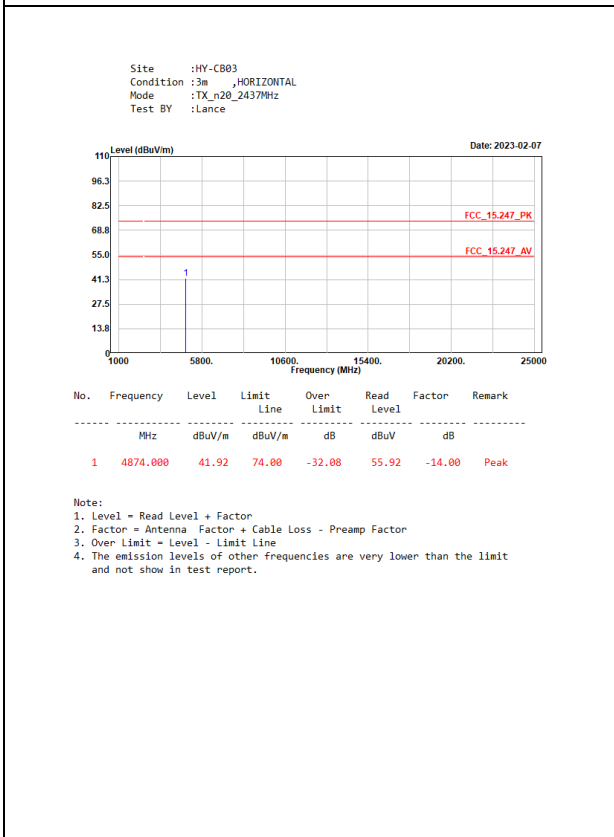
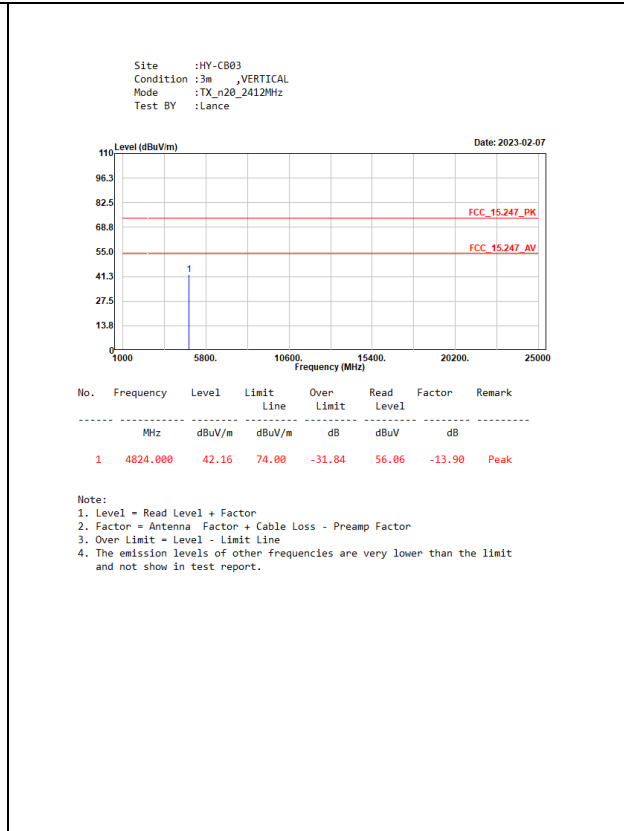
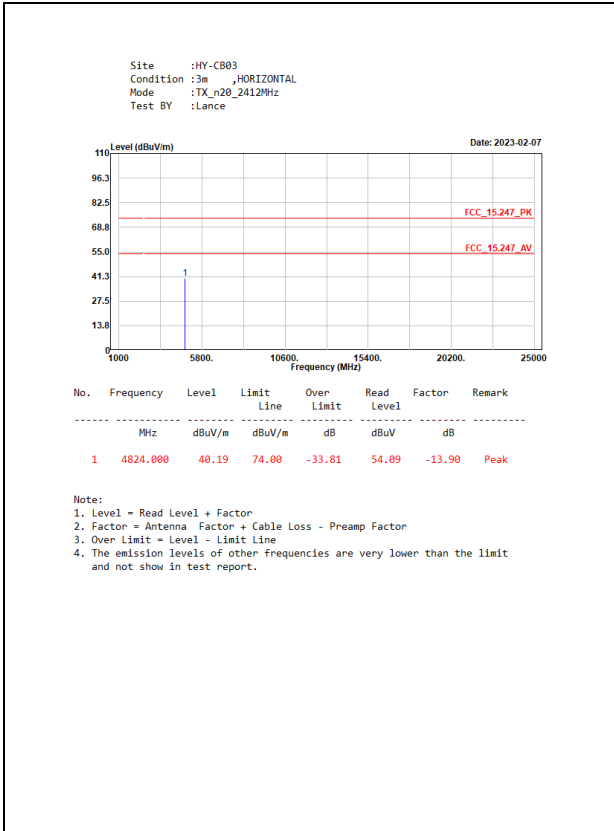
Note: Duty Cycle Refer to Section 9

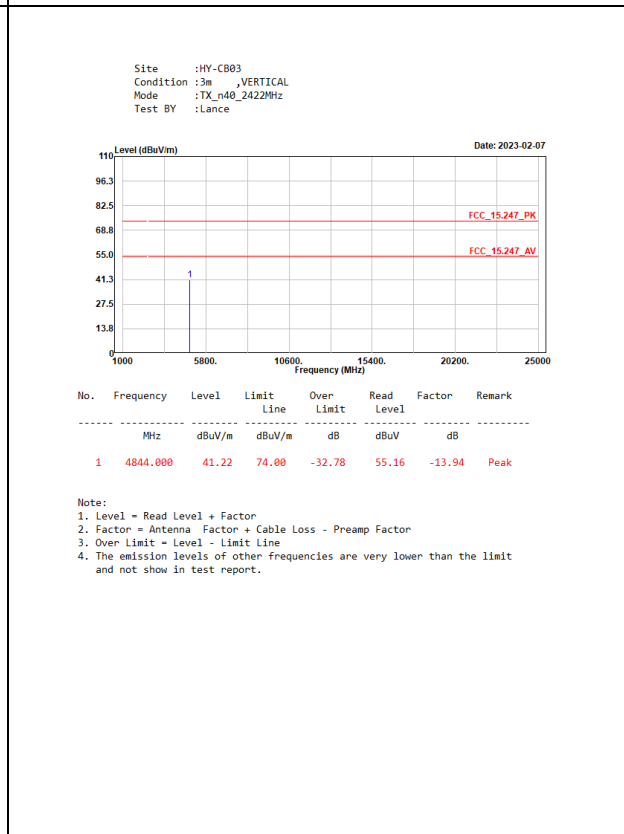
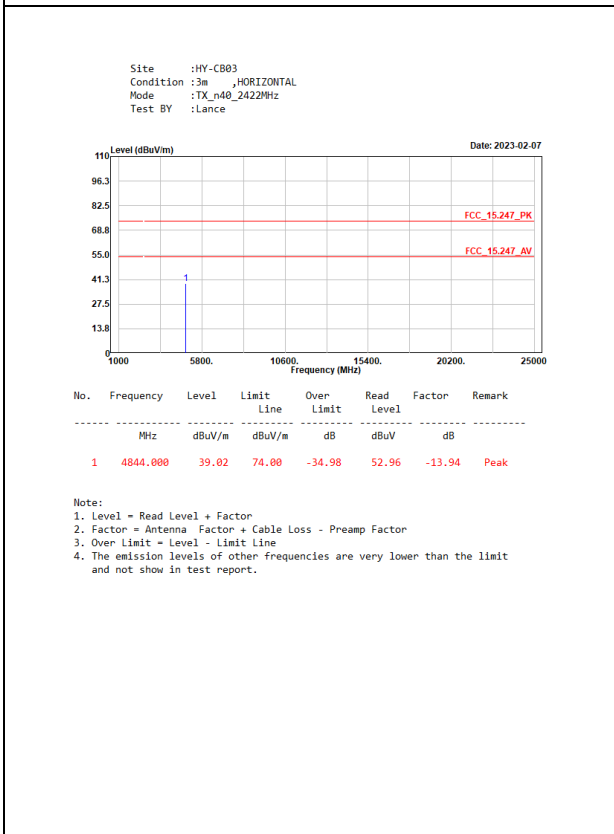
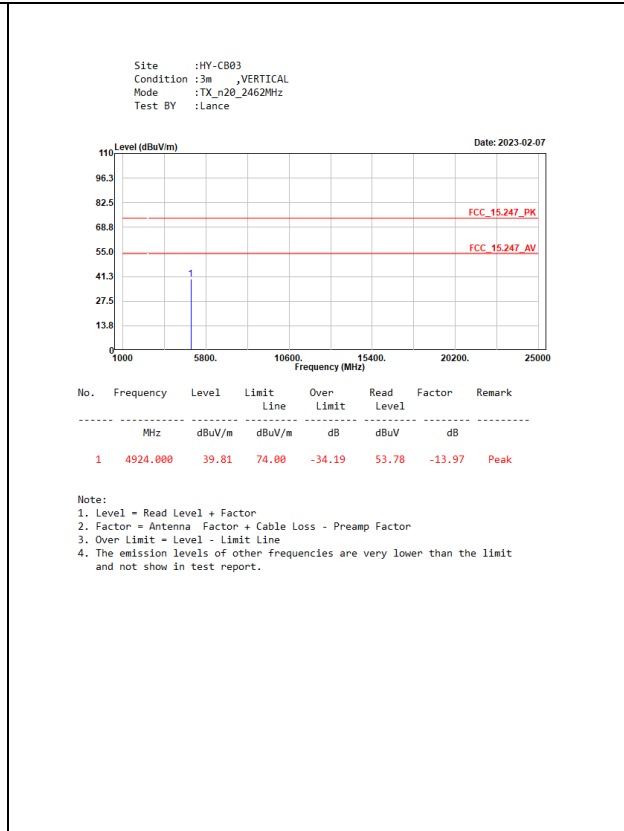
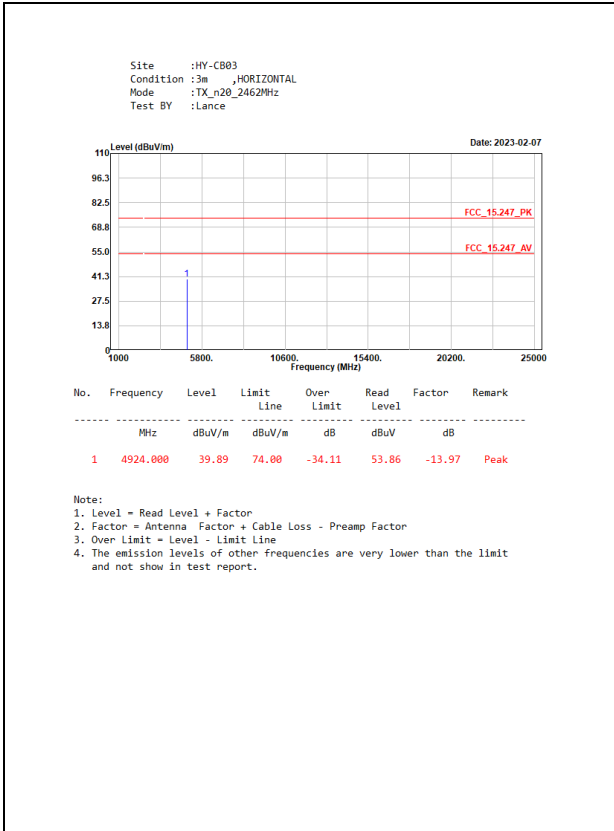
3.4. Test Result of Radiated Emission

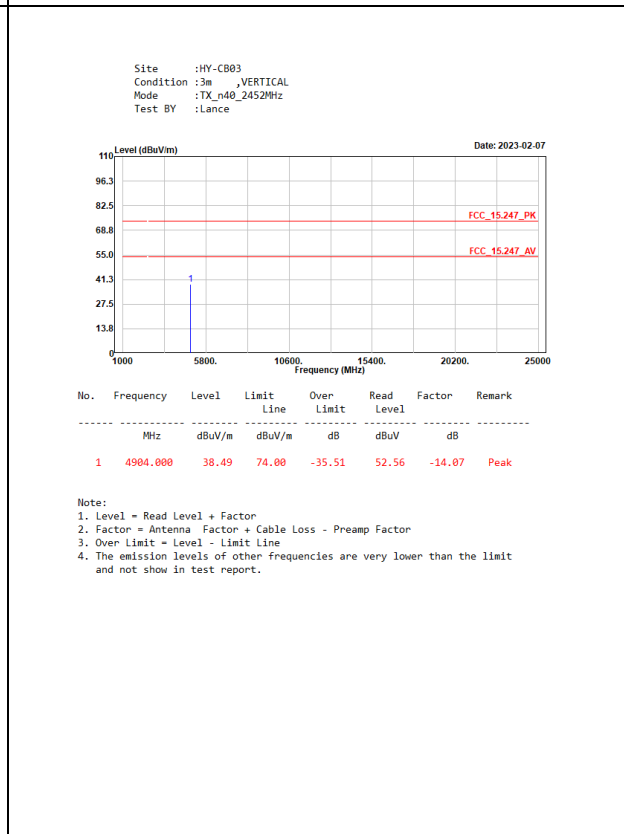
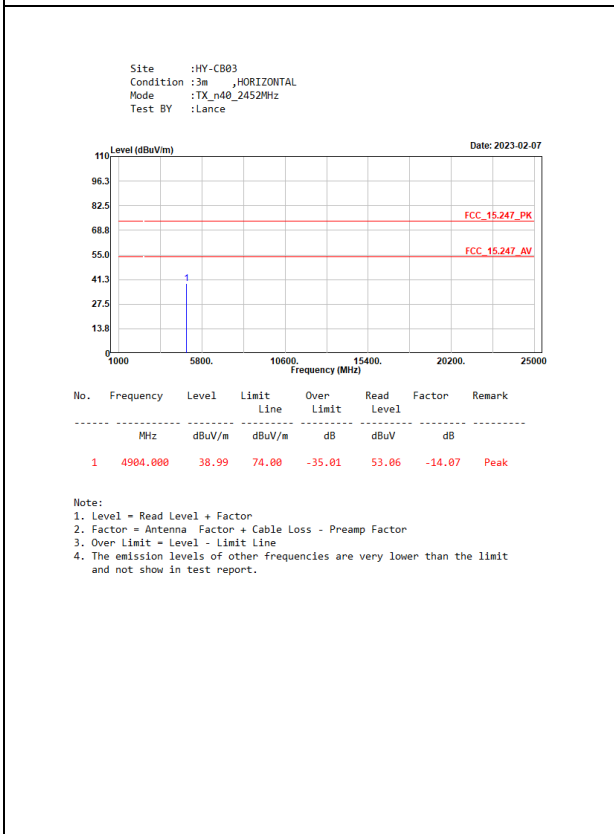
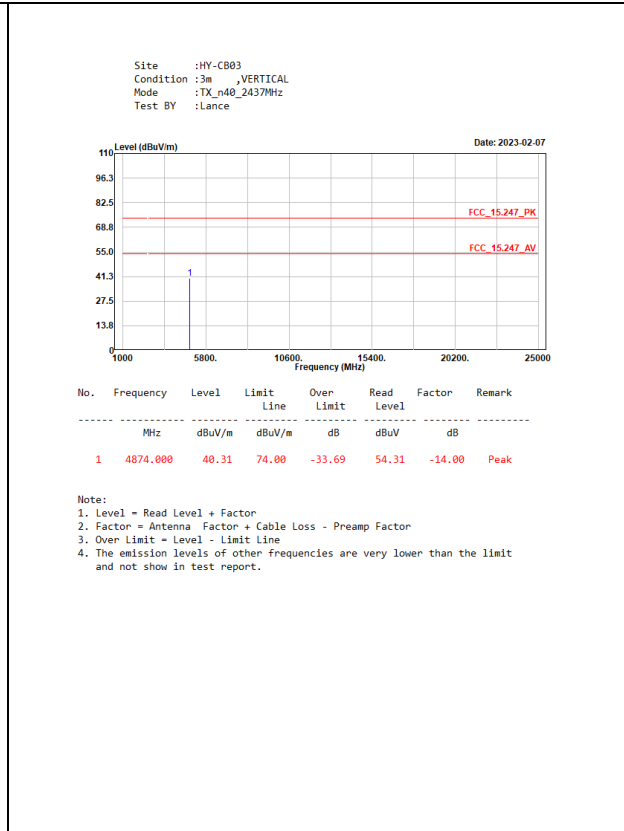
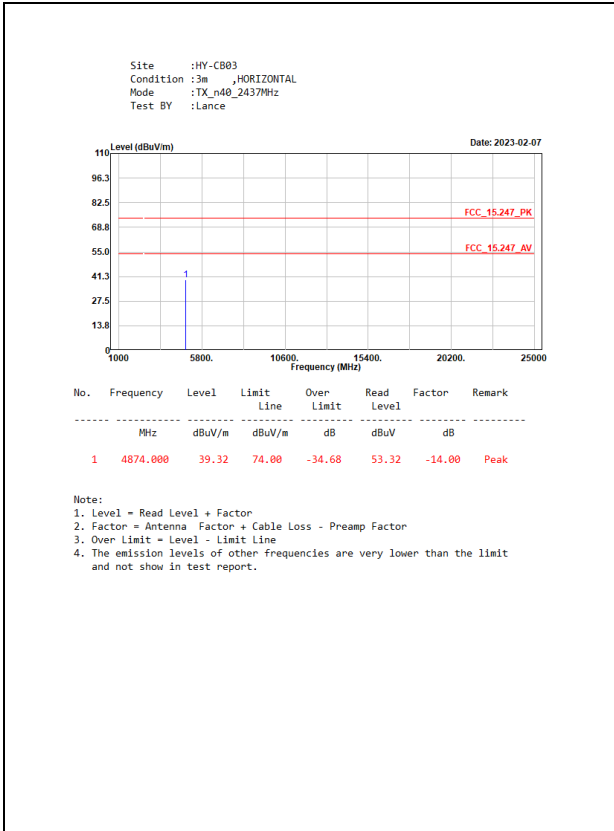


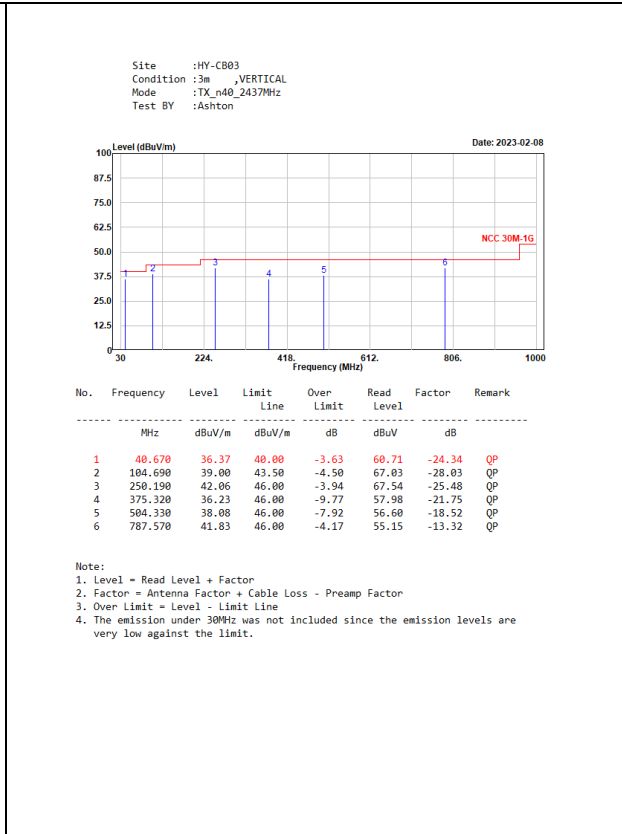
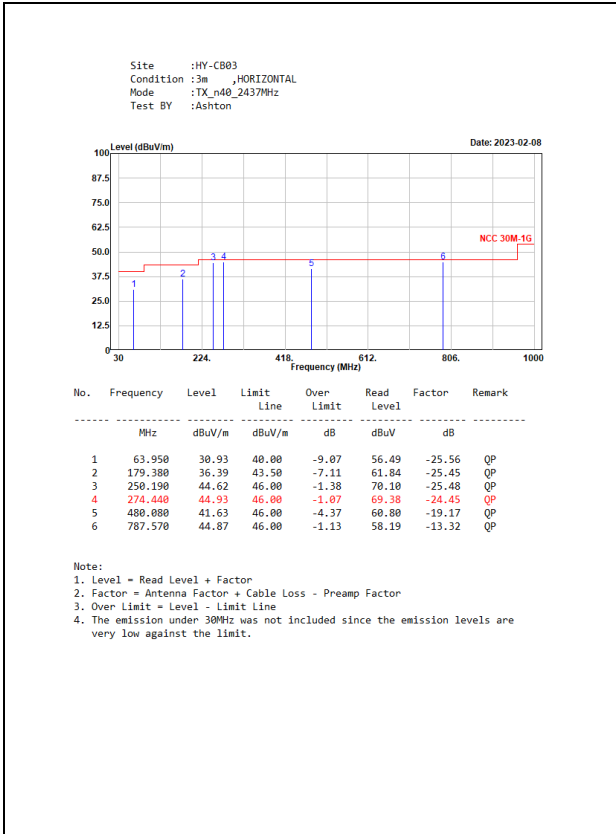








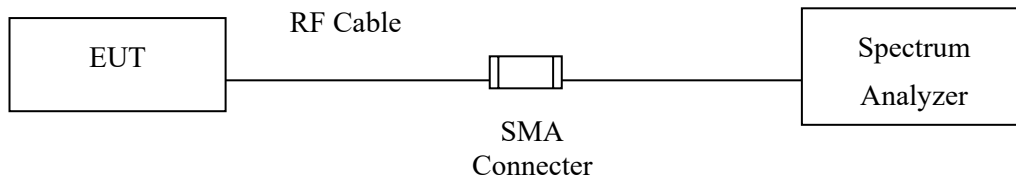




4. Band Edge

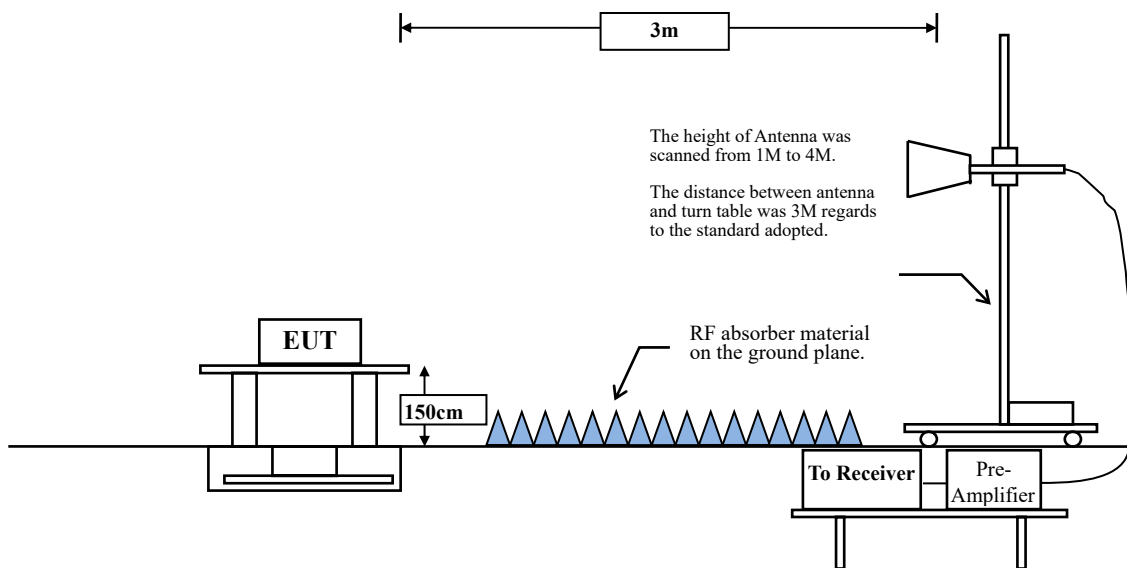
4.1. Test Setup

RF Conducted Measurement



RF Radiated Measurement:

Above 1 GHz



4.2. 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)).

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.

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 %

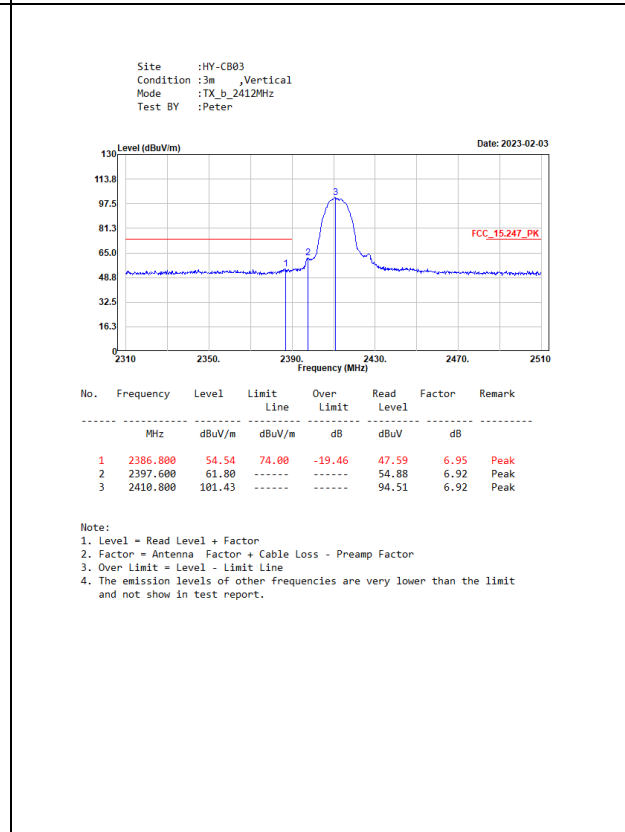
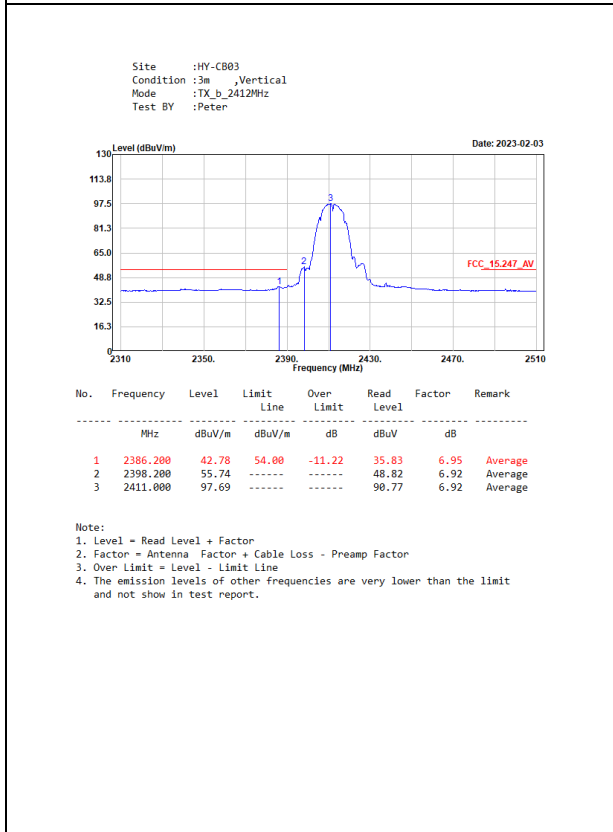
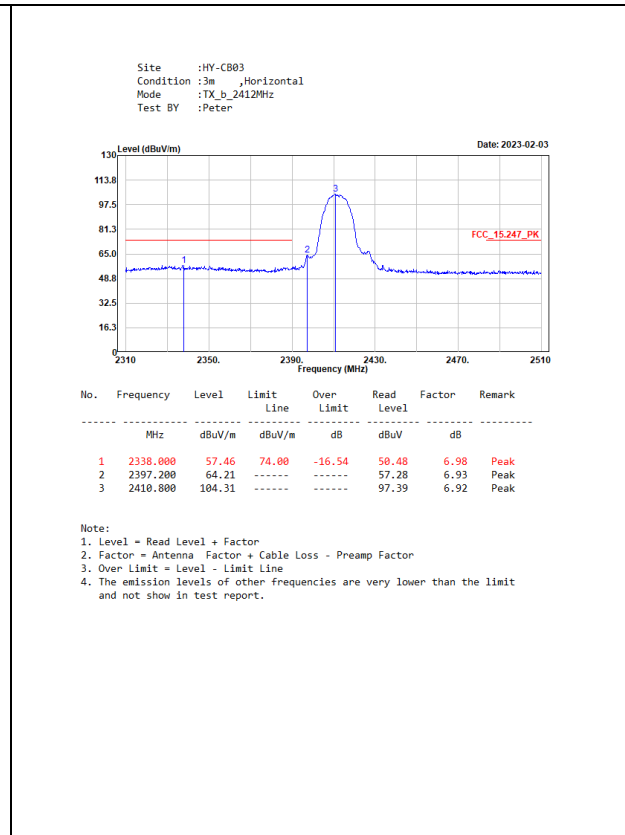
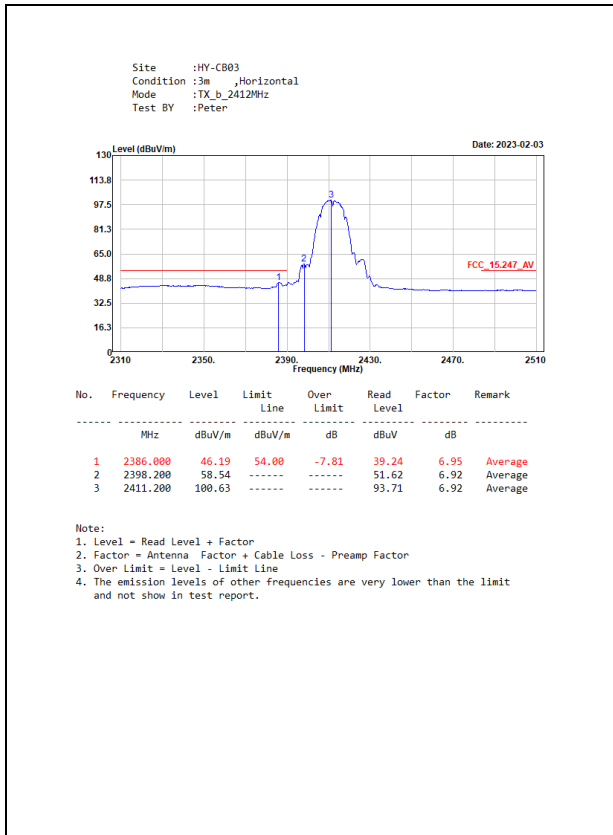
VBW \geq 1/T, when duty cycle < 98 %

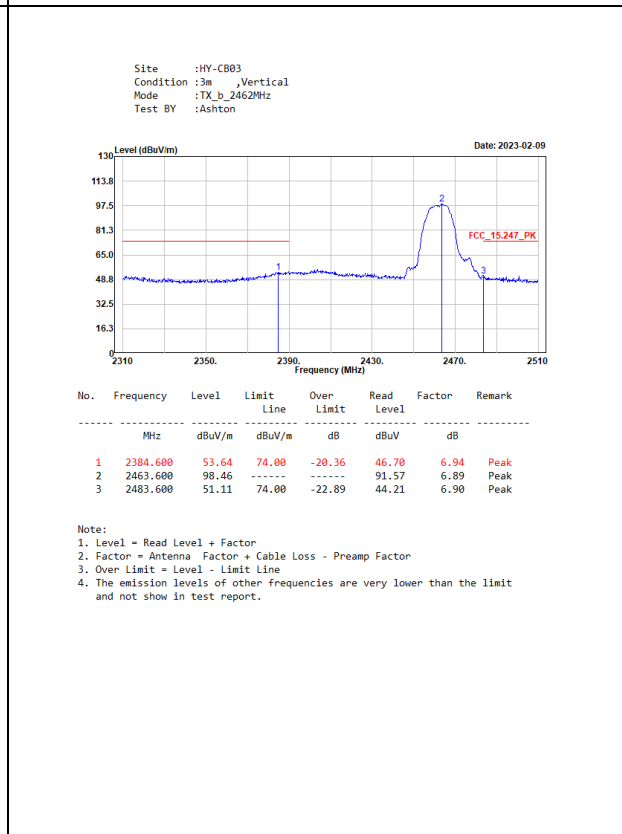
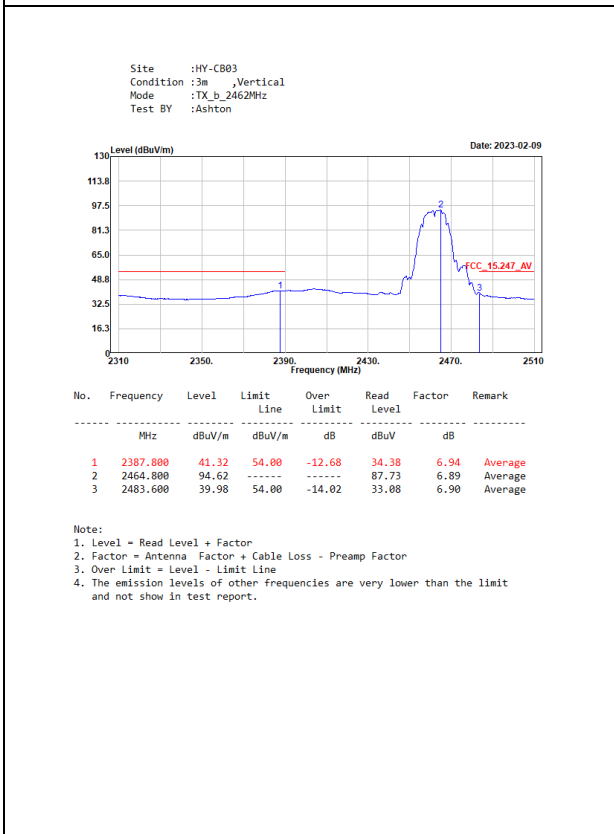
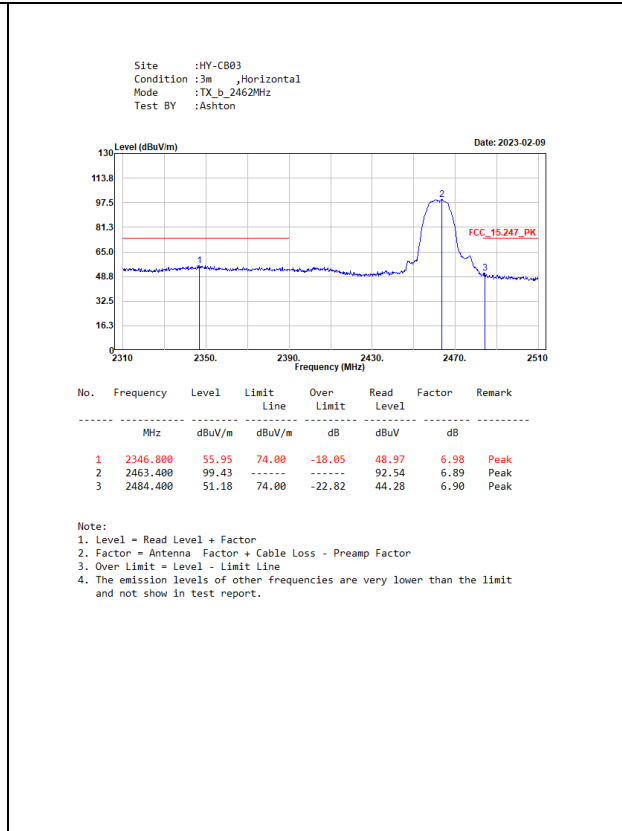
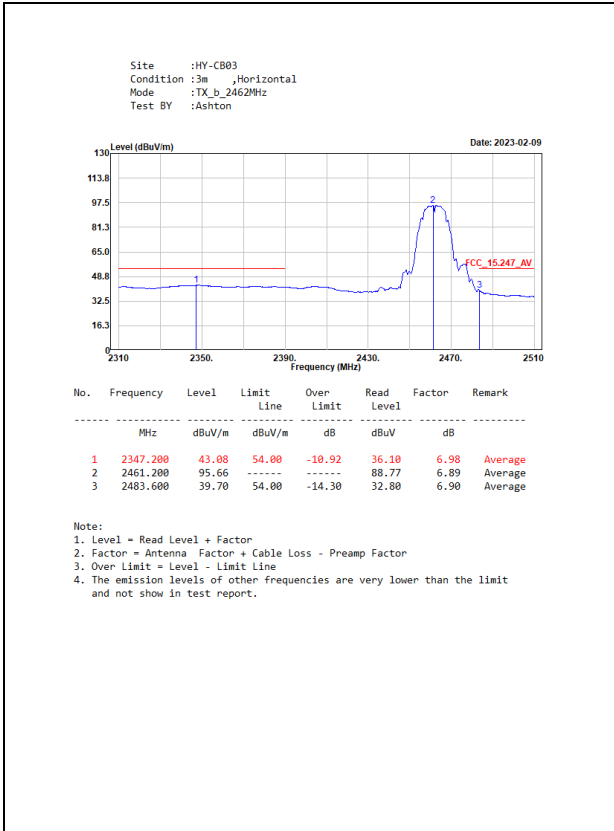
(T refers to the minimum transmission duration over which the transmitter is on and is transmitting at its maximum power control level for the tested mode of operation.)

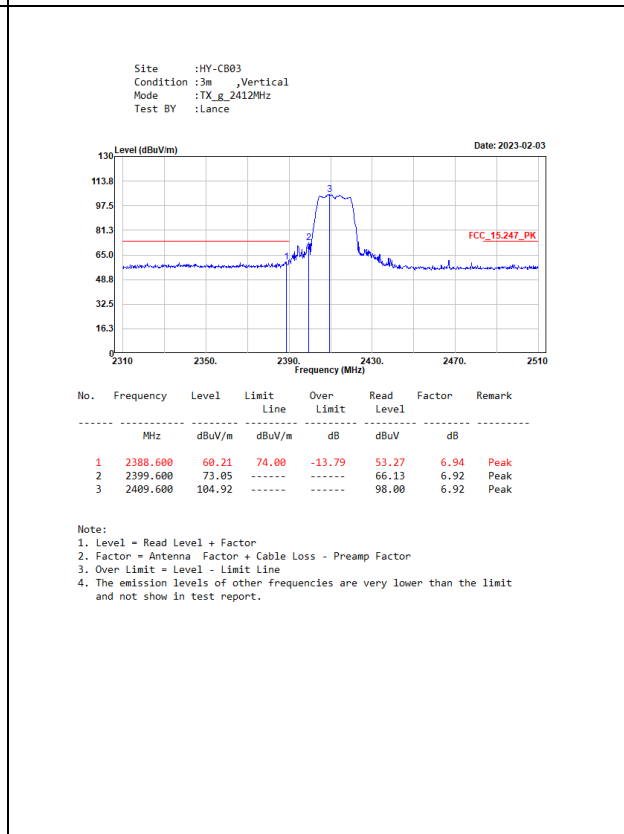
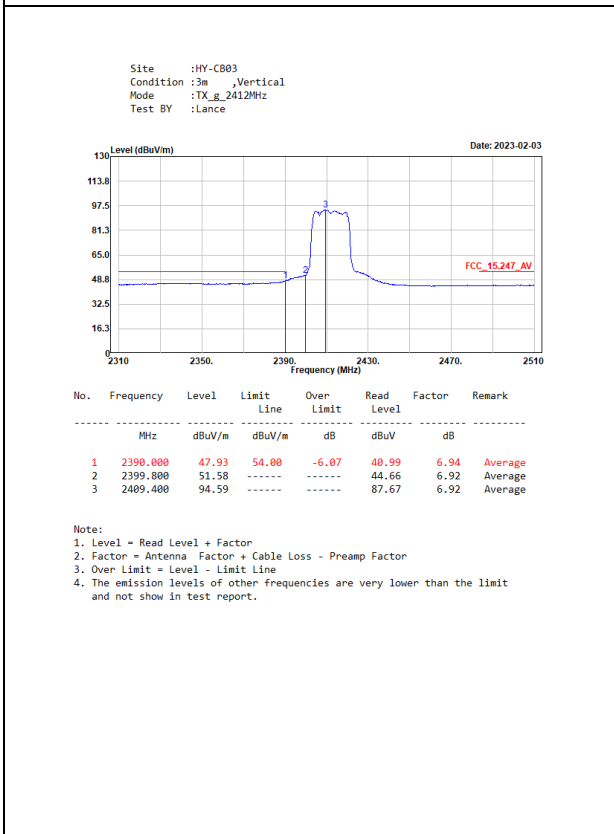
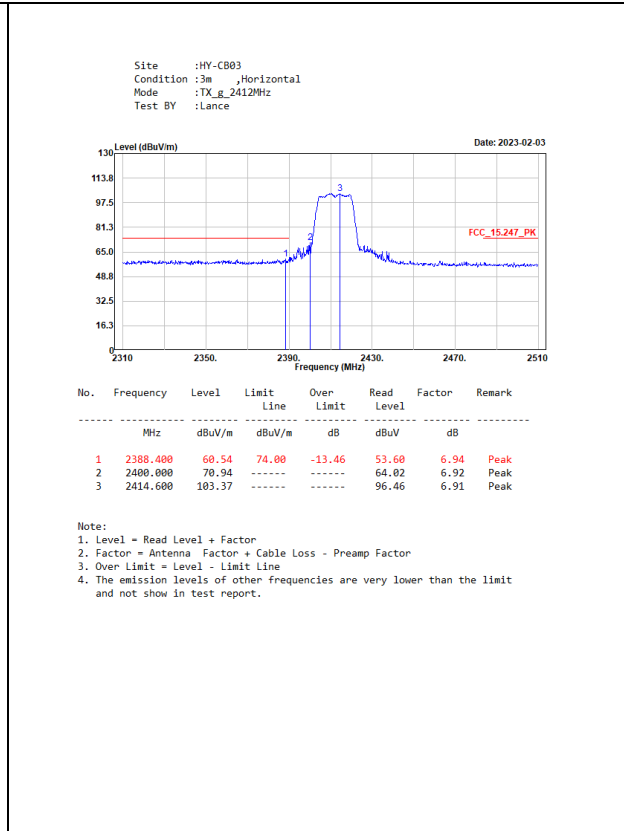
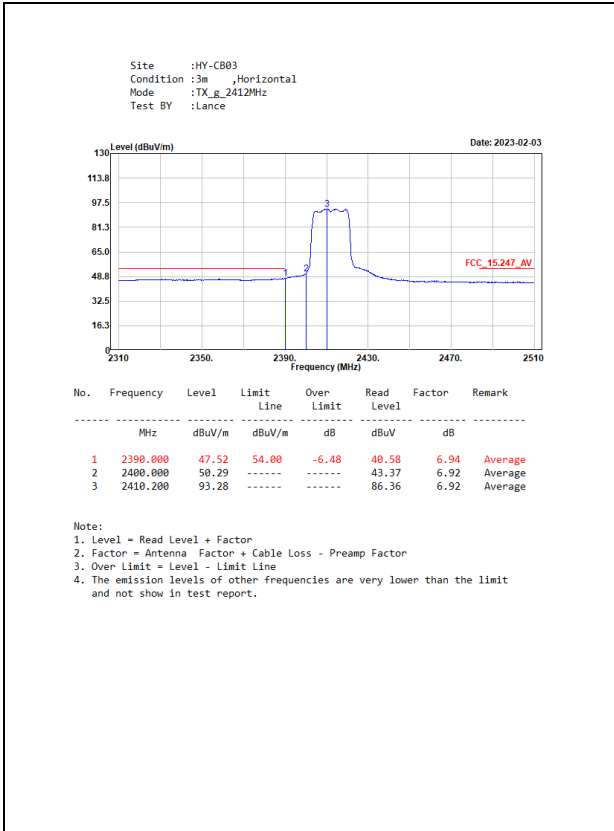
2.4GHz band	Duty Cycle (%)	T (ms)	1/T (Hz)	VBW (Hz)
802.11 b	48.68	4.5150	221	300
802.11 g	44.12	2.1000	476	500
802.11 n20	41.18	1.9600	510	1000
802.11 n40	21.67	0.9100	1099	2000

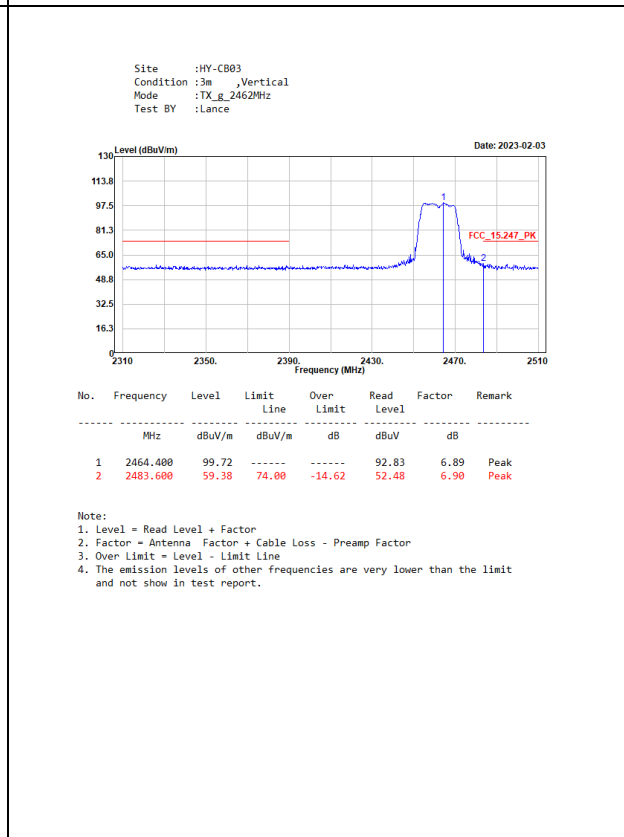
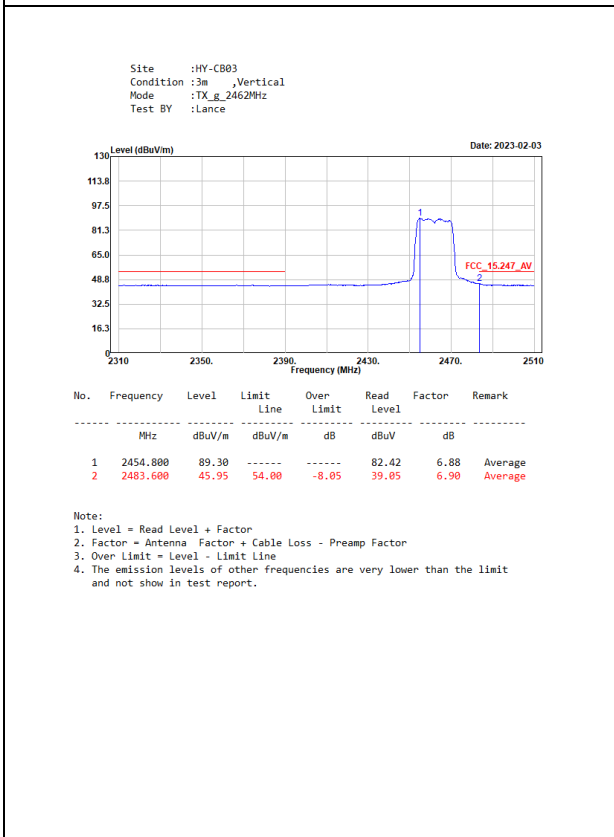
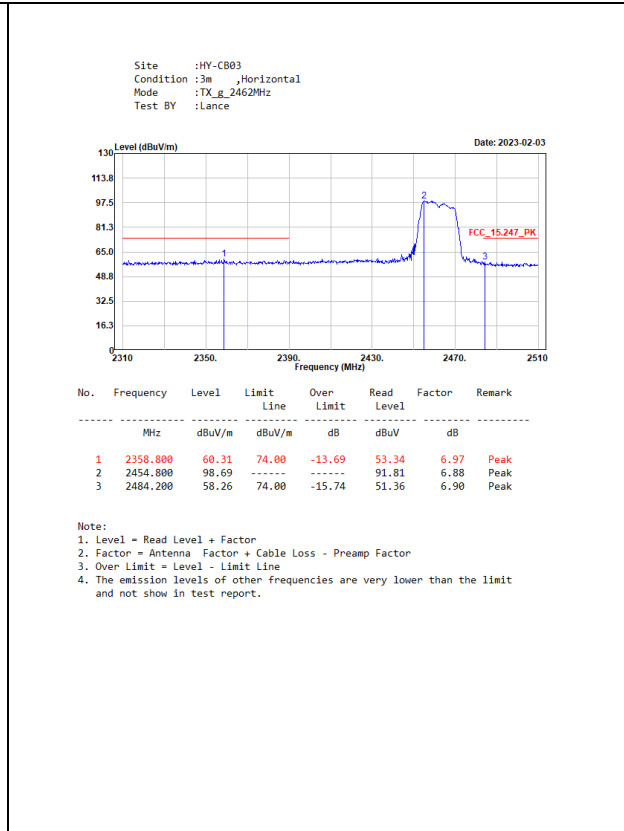
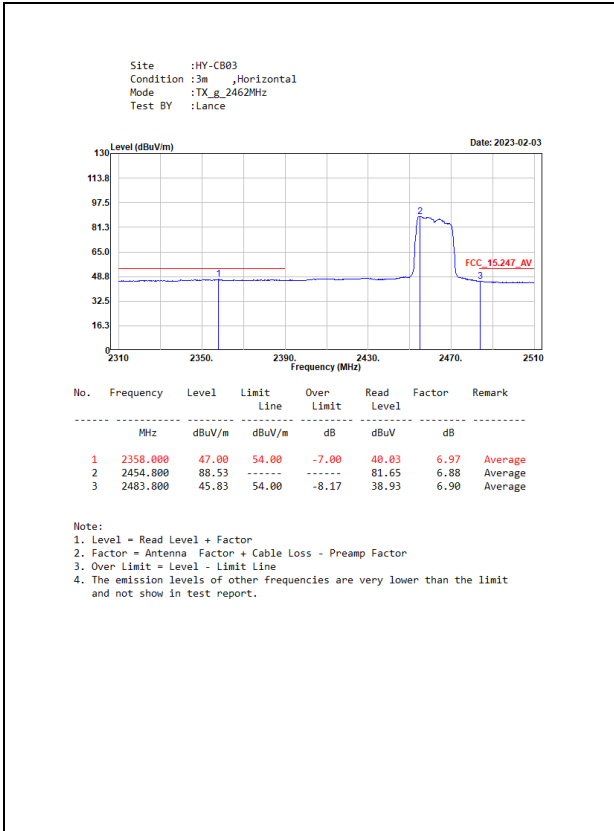
Note: Duty Cycle Refer to Section 9

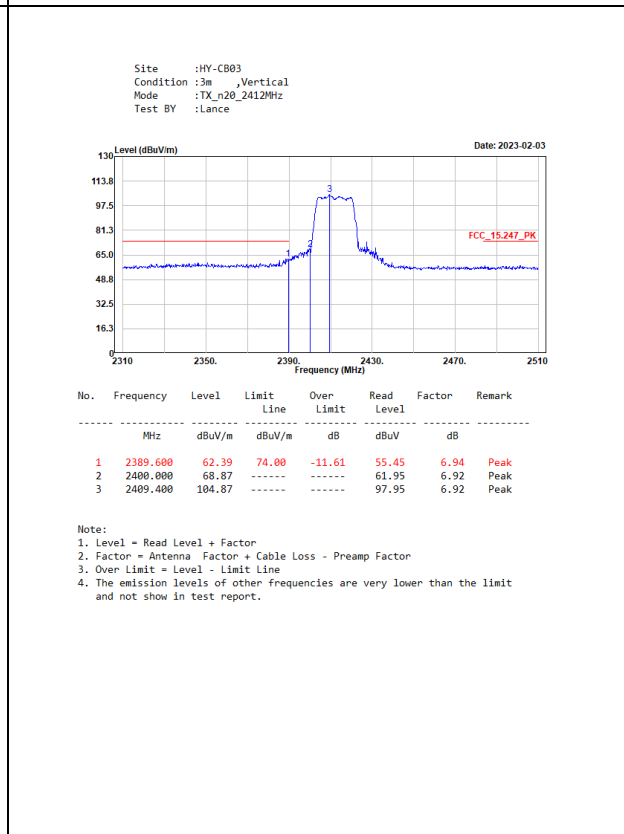
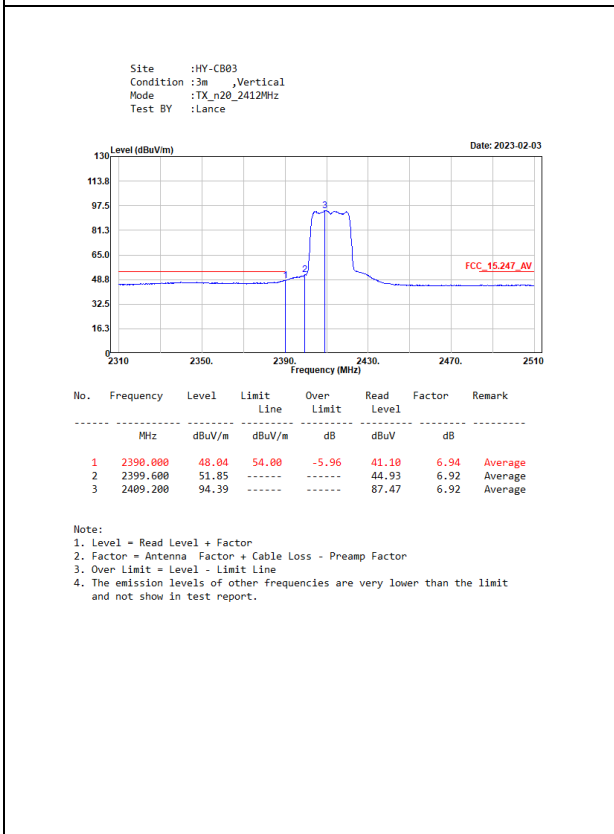
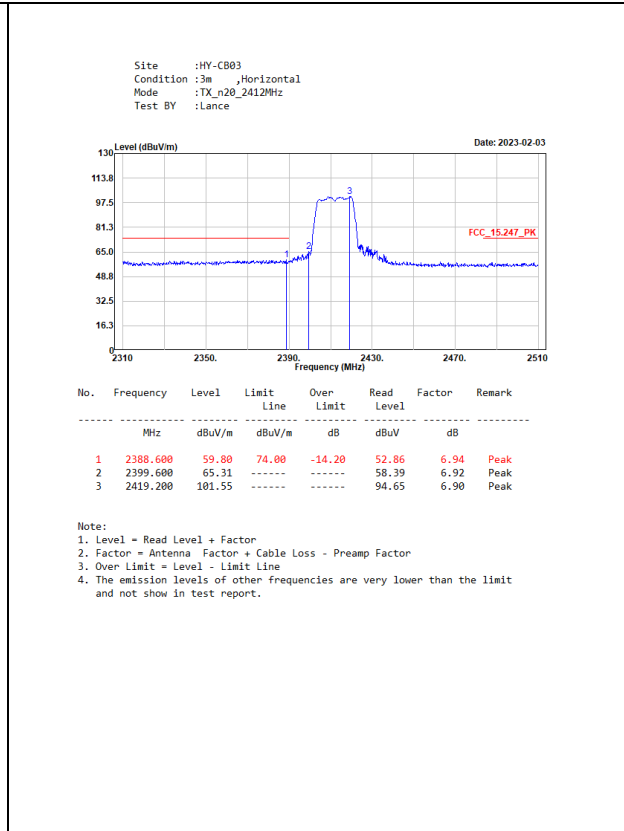
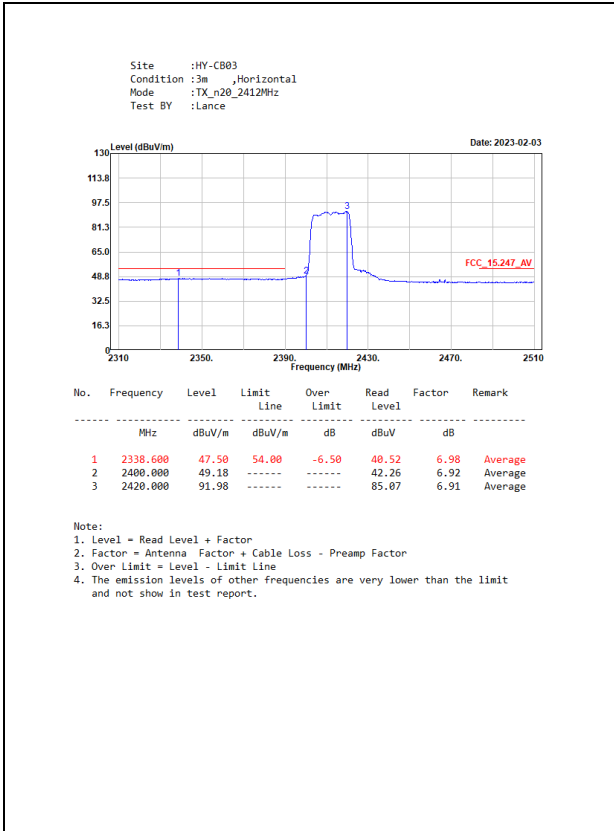
4.4. Test Result of Band Edge

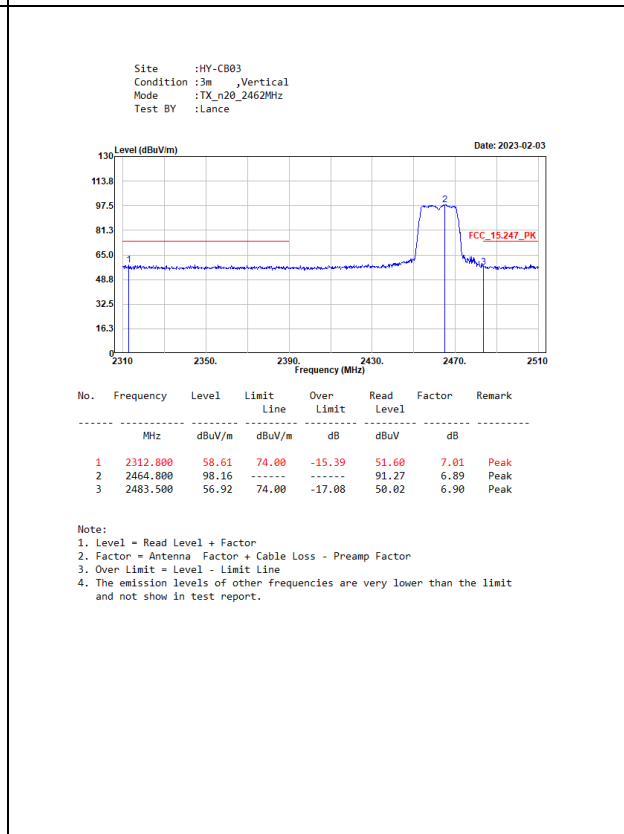
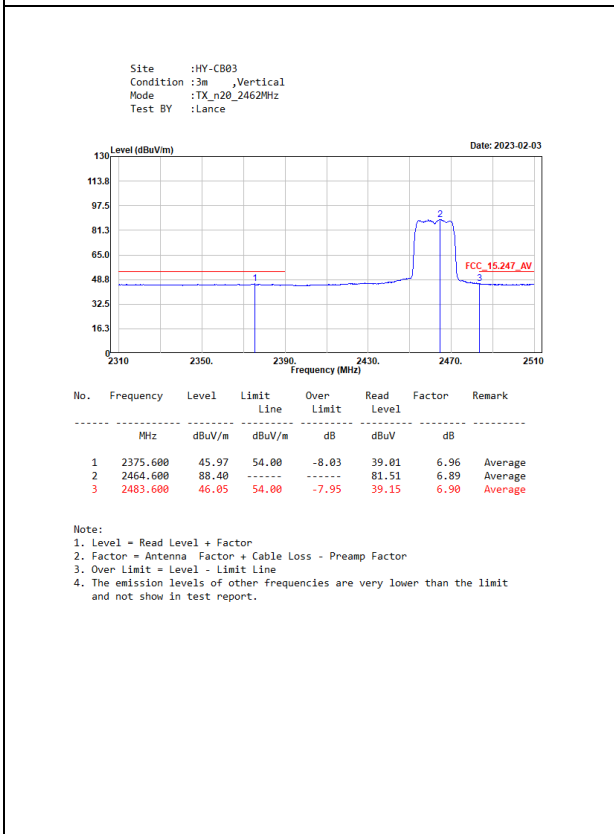
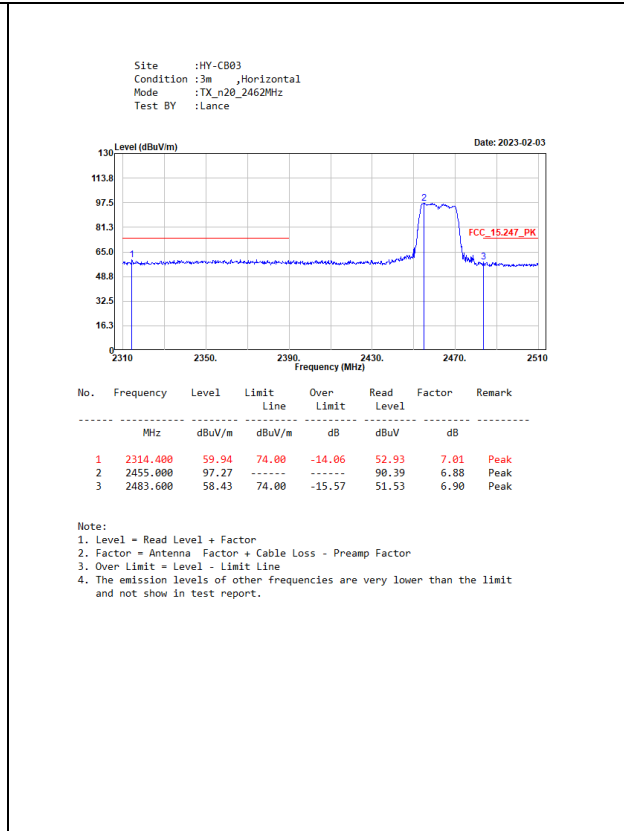
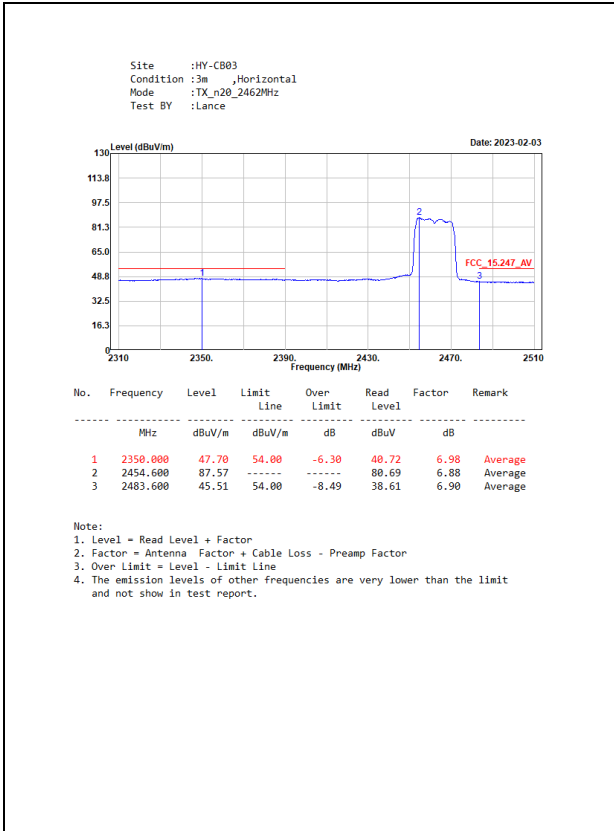


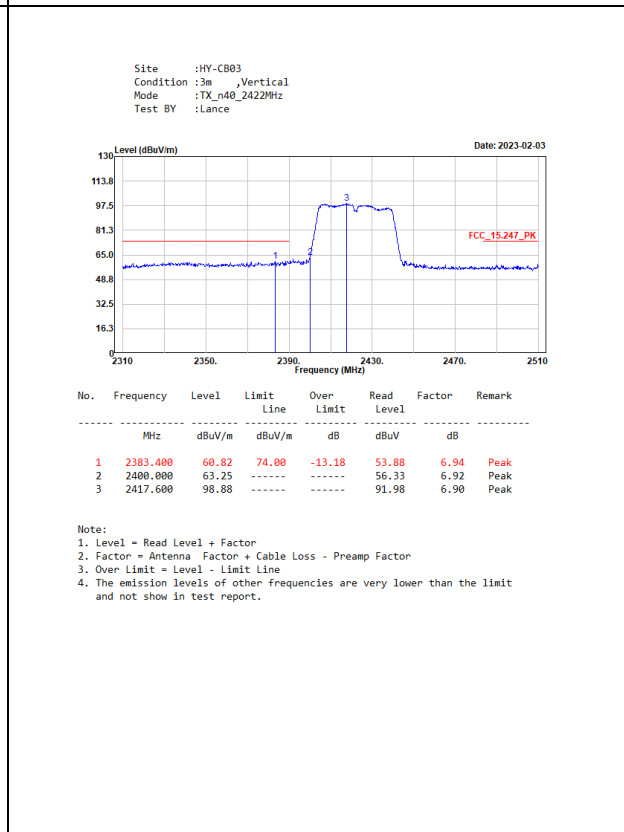
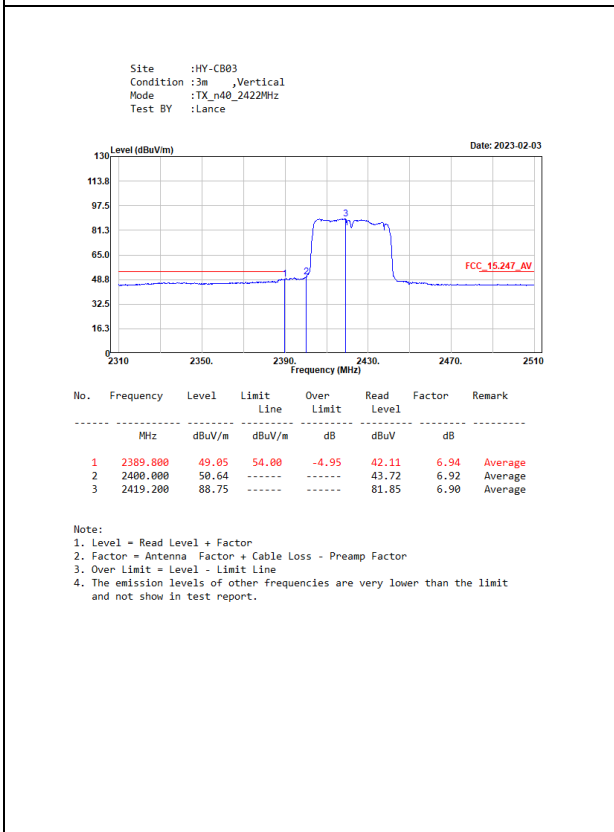
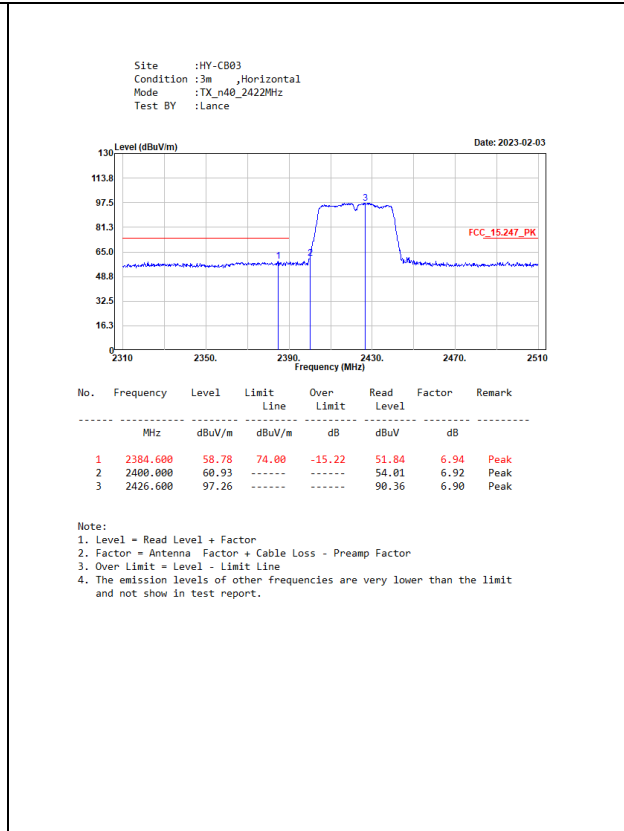
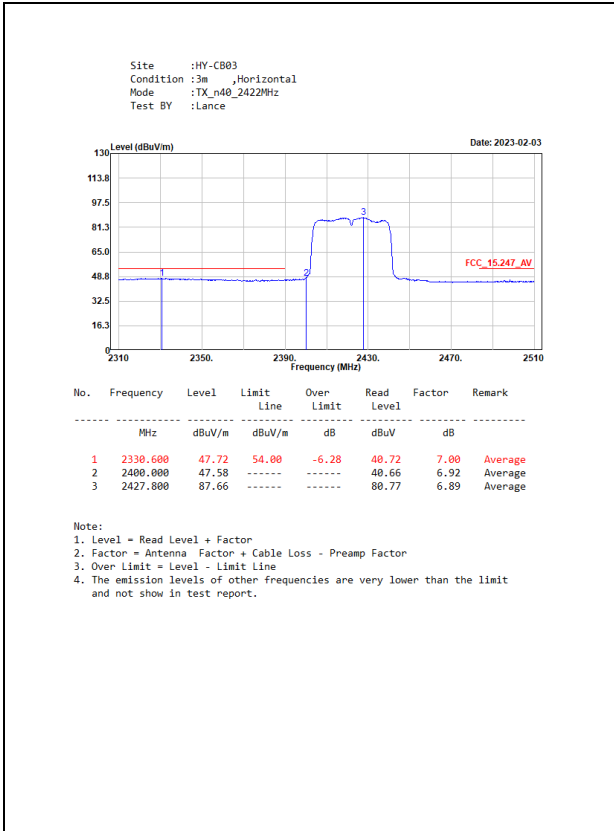


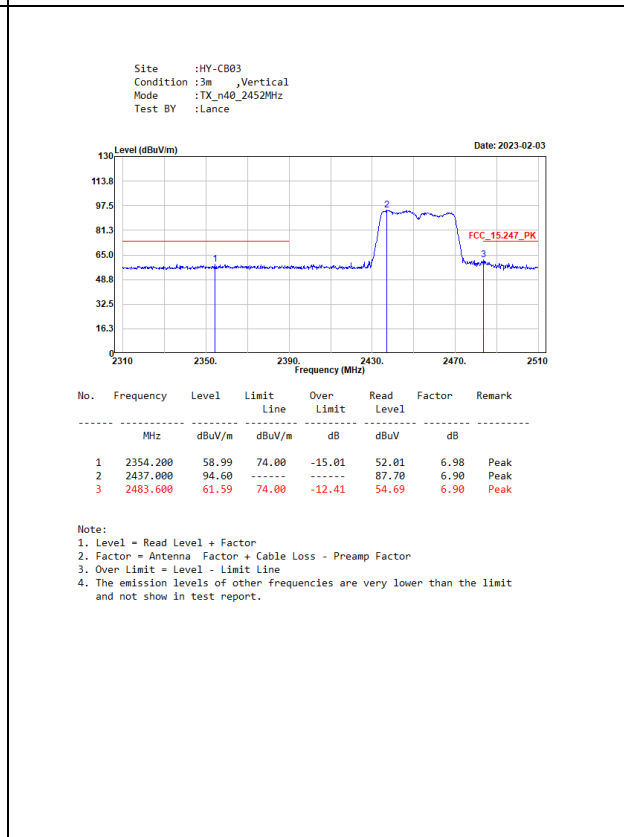
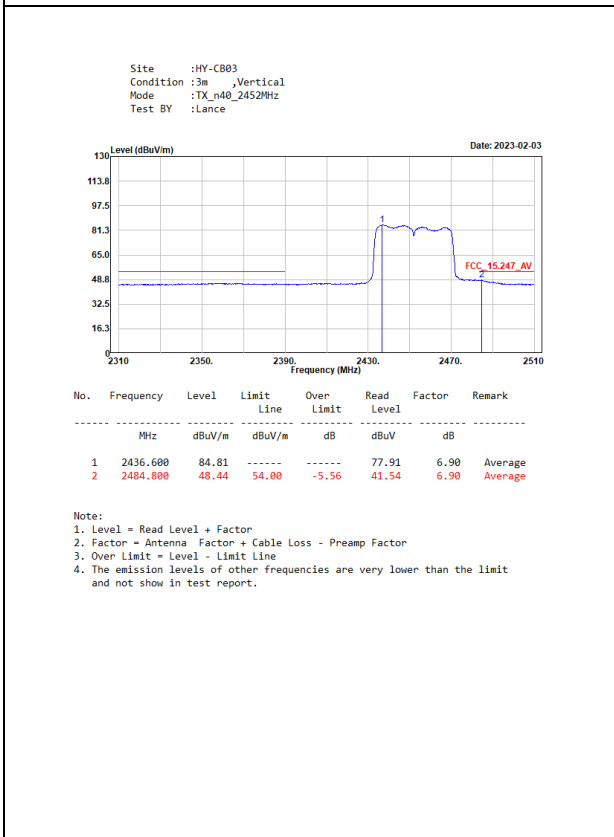
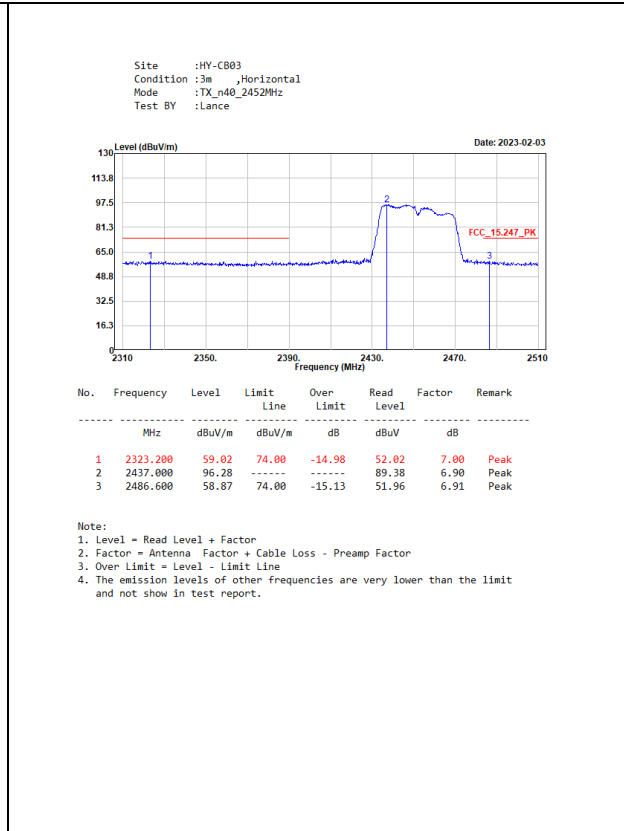
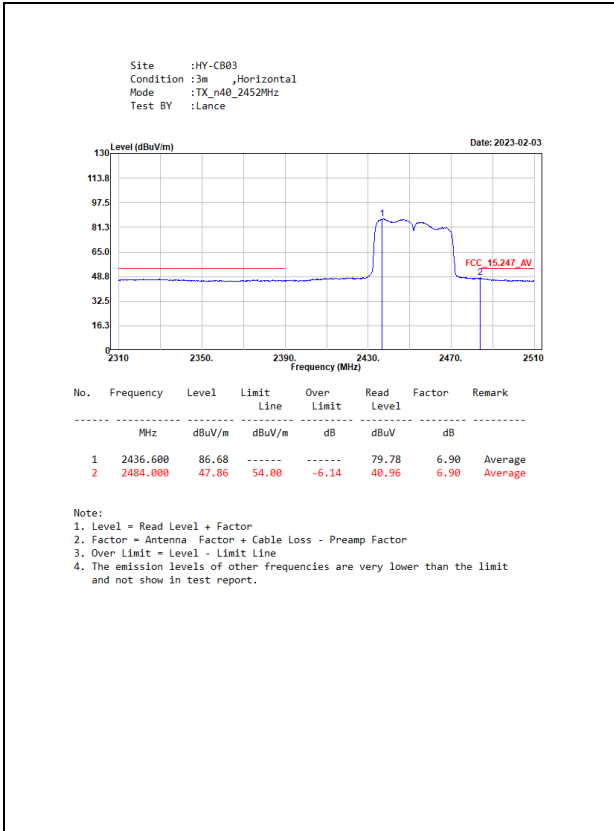






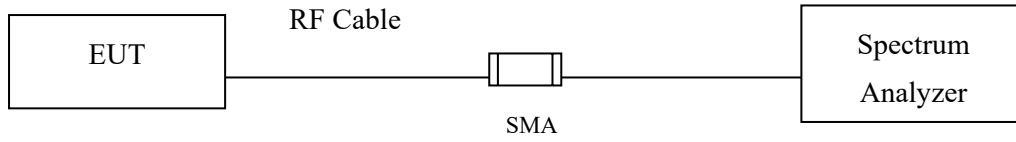






5. Duty Cycle

5.1. Test Setup



5.2. 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.

5.3. Test Result of Duty Cycle

Product : Host-based multiradio modules with WiFi, Bluetooth and NFC
Test Item : Duty Cycle
Test Mode : Transmit

Duty Cycle Formula:

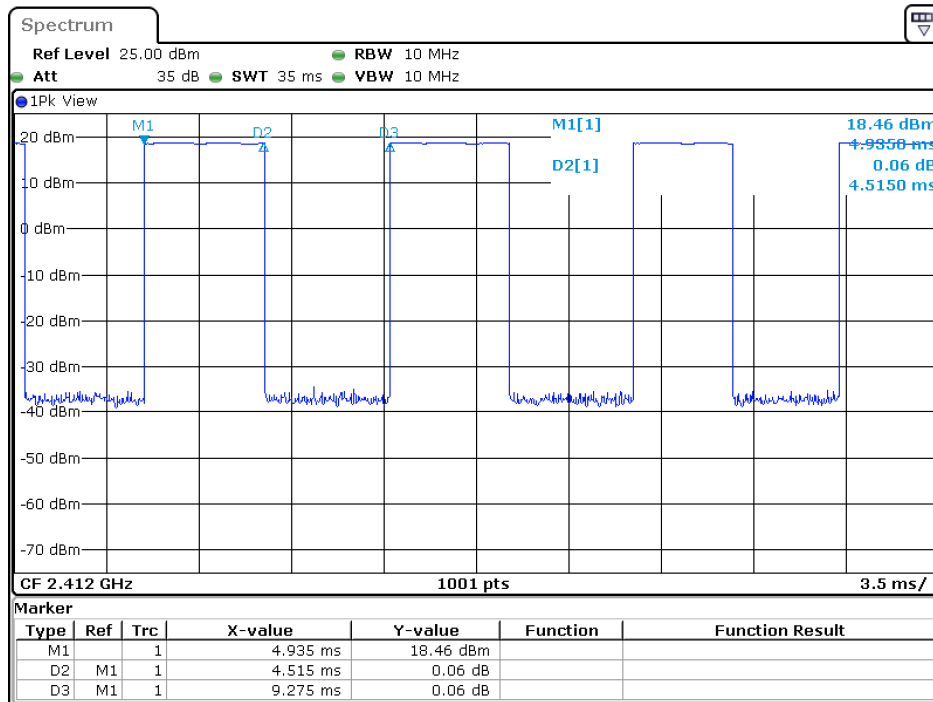
Duty Cycle = $Ton / (Ton + Toff)$

Duty Factor = $10 \text{ Log } (1/\text{Duty Cycle})$

Results:

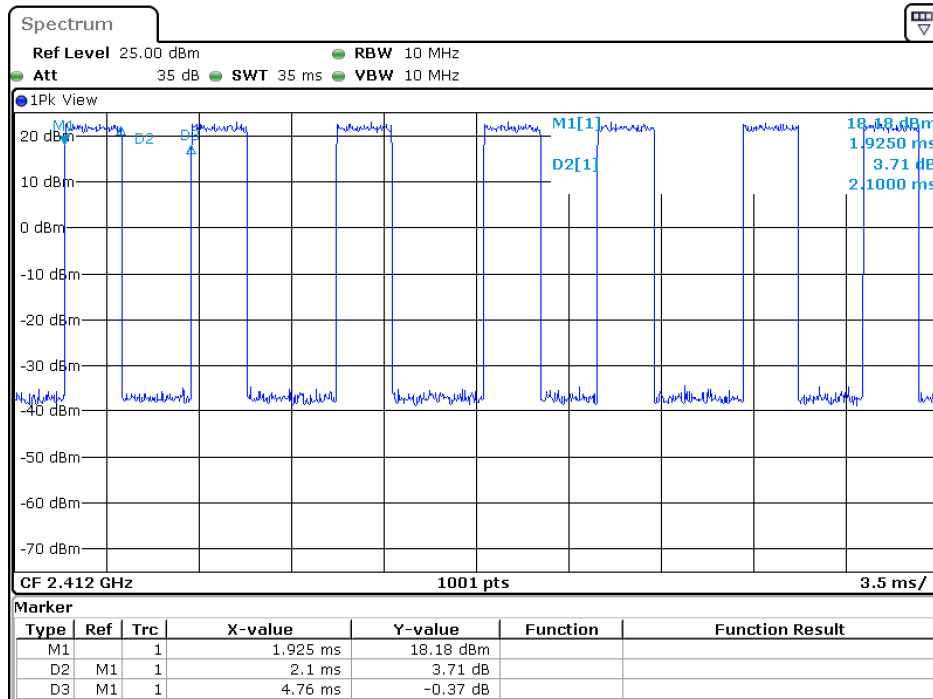
2.4 GHz band	Ton (ms)	Ton + Toff (ms)	Duty Cycle (%)	Duty Factor (dB)
802.11 b	4.5150	9.2750	48.68	3.13
802.11 g	2.1000	4.7600	44.12	3.55
802.11 n20	1.9600	4.7600	41.18	3.85
802.11 n40	0.9100	4.2000	21.67	6.64

802.11b



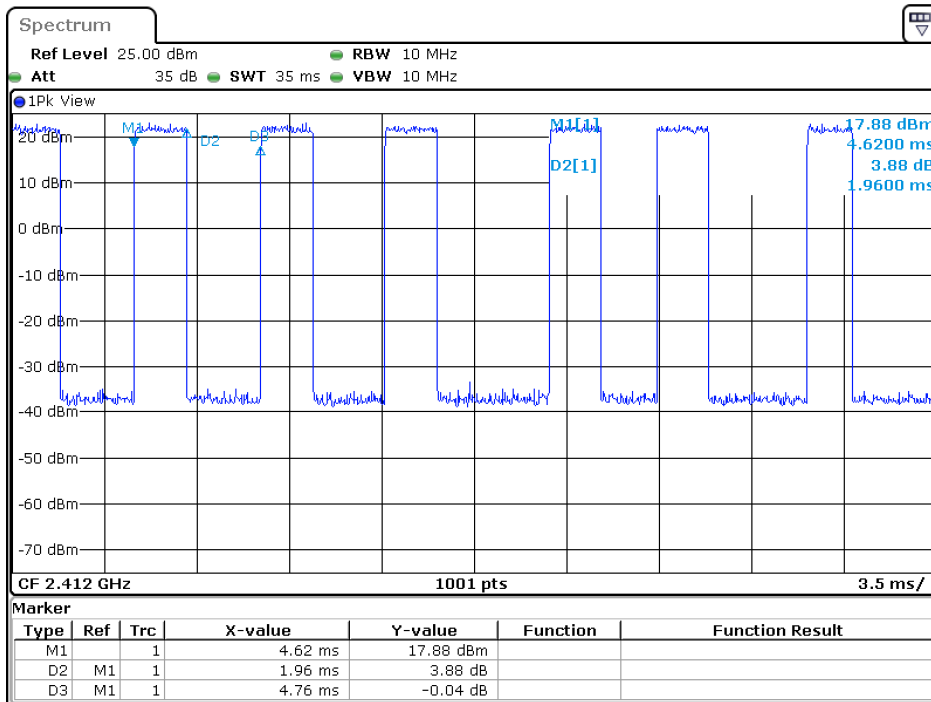
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802.11g



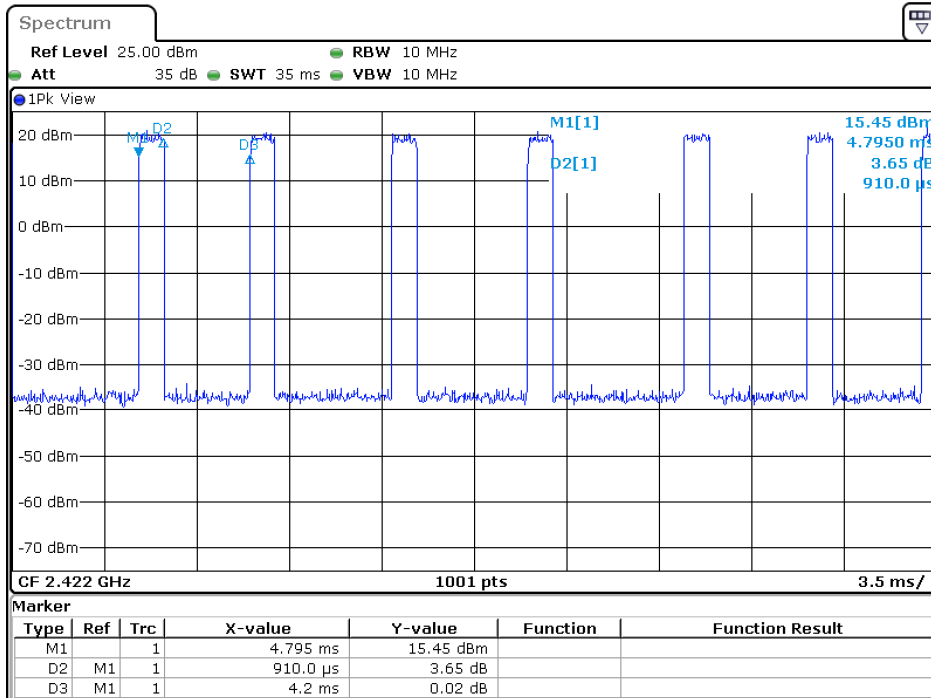
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802.11n20



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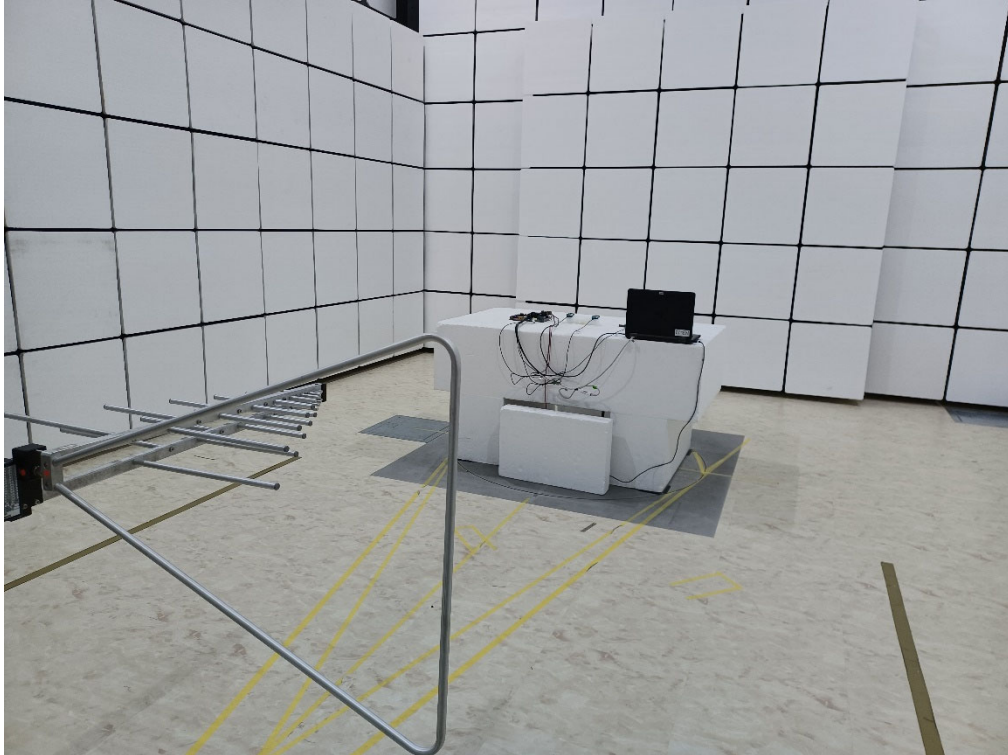
802.11n40



Date: 21.NOV.2022 21:31:27

Appendix 1: EUT Test Setup Photographs

Radiated Test



Radiated Test (Horn)

