

FCC RF Inspection Report

Product Name	Wireless module
Model No	WAPC003
FCC ID.	SLE-WAPC003

Applicant	Moxa Inc.
Address	No. 1111, Heping Rd., Bade Dist., Taoyuan City 334004, Taiwan

Date of Receipt	Apr. 25, 2022
Issued Date	Jul. 25, 2022
Report No.	2240703R-RFNAOTHV03-2
Report Version	V1.0



The test results relate only to the samples tested.

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.

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The test report shall not be reproduced without the written approval of DEKRA Testing and Certification Co., Ltd.

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 Report

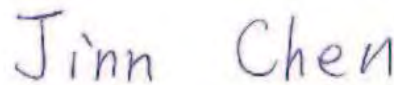
Issued Date: Jul. 25, 2022

Report No.: 2240703R-RFNAOTHV03-2



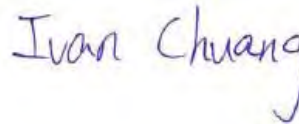
Product Name	Wireless module
Applicant	Moxa Inc.
Address	No. 1111, Heping Rd., Bade Dist., Taoyuan City 334004, Taiwan
Manufacturer	Moxa Inc.
Model No.	WAPC003
FCC ID.	SLE-WAPC003
EUT Rated Voltage	12-48 VDC, PoE
EUT Test Voltage	12 VDC
Trade Name	MOXA
Applicable Standard	FCC CFR Title 47 Part 15 Subpart E ANSI C63.4: 2014, ANSI C63.10: 2013 KDB Publication 789033, KDB Publication 987594
Test Result	Complied

Documented By :



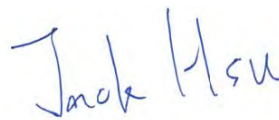
(Supervisor / Jinn Chen)

Tested By :



(Senior Engineer / Ivan Chuang)

Approved By :



(Senior Engineer / Jack Hsu)

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Revision History

Report No.	Version	Description	Issued Date
2240703R-RFNAOTHV03-2	V1.0	Initial issue of report.	Jul. 25, 2022

1. GENERAL INFORMATION

1.1. EUT Description

Product Name	Wireless module
Trade Name	MOXA
FCC ID.	SLE-WAPC003
Model No.	WAPC003
Frequency Range	802.11a/n/ac-20MHz: 5180-5320MHz, 5500-5700MHz, 5745-5825MHz 802.11n/ac-40MHz: 5190-5310 MHz, 5510-5670MHz, 5755-5795MHz 802.11ac-20MHz: 5720 MHz, 802.11ac-40MHz: 5710 MHz 802.11ac-80MHz: 5210-5290MHz, 5530-5690MHz, 5775MHz
Number of Channels	802.11a/n/ac-20MHz: 24; 802.11n/ac-40MHz: 11, 802.11ac-80MHz: 6
Data Rate	802.11a: 6 - 54Mbps 802.11n: up to 300Mbps 802.11ac-80MHz: up to 866.7Mbps
Type of Modulation	802.11a/n/ac: OFDM, BPSK, QPSK, 16QAM, 64QAM, 256QAM
Antenna Type	Dipole Antenna, Panel Antenna
Channel Control	Auto
Antenna Gain	Refer to the table "Antenna List"

Antenna List

No.	Manufacturer	Part No.	Antenna Type	Peak Gain
1	MOXA	ANT-WDB-ANM-0306	Dipole	5.7dBi For 5.15~5.25GHz 5.7dBi For 5.25~5.35GHz 6.3dBi For 5.47~5.725GHz 6.3dBi For 5.725~5.825GHz
2	MOXA	ANT-WDB-ANM-0502	Dipole	1.41dBi For 5GHz
3	MOXA	ANT-WDB-ARM-02	Dipole	0.81dBi For 5.15~5.25GHz 0.36dBi For 5.25~5.35GHz 0.36dBi For 5.47~5.725GHz -0.39dBi For 5.725~5.825GHz
4	MOXA	ANT-WDB-ARM-0202	Dipole	1.8dBi For 5GHz
5	MOXA	MAT-WDB-CA-RM-2-0205	Dipole	5.7dBi For 5.15~5.25GHz 5.76dBi For 5.25~5.35GHz 5.7dBi For 5.47~5.725GHz 5.2dBi For 5.725~5.825GHz
6	MOXA	MAT-WDB-DA-RM-2-0203-1m	Dipole	2.72dBi For 5.15~5.25GHz 2.72dBi For 5.25~5.35GHz 2.72dBi For 5.47~5.725GHz 2.34dBi For 5.725~5.825GHz
7	MOXA	MAT-WDB-PA-NF-2-0708	Panel	8.77dBi For 5.15~5.25GHz 8.77dBi For 5.25~5.35GHz 8.61dBi For 5.47~5.725GHz 8.18dBi For 5.725~5.825GHz
8	MOXA	ANT-WDB-PNF-1011	Panel	12.04dBi For 5.15~5.25GHz 12.04dBi For 5.25~5.35GHz 11.06dBi For 5.47~5.725GHz 11.06dBi For 5.725~5.825GHz
9	MOXA	ANT-WDB-ONM-0707	Dipole	7.3dBi For 5.15~5.25GHz 7.3dBi For 5.25~5.35GHz 7.5dBi For 5.47~5.725GHz 7.6dBi For 5.725~5.825GHz
10	MOXA	ANT-WDB-ONF-0709	Dipole	8.61dBi For 5.15~5.25GHz 8.15dBi For 5.25~5.35GHz 8.87dBi For 5.47~5.725GHz 8.87dBi For 5.725~5.825GHz
11	MOXA	ANT-WSB5-PNF-16	Panel	16.38dBi For 5.15~5.25GHz 16.38dBi For 5.25~5.35GHz 16.94dBi For 5.47~5.725GHz 16.94dBi For 5.725~5.825GHz

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

802.11a/n/ac-20MHz Center Working Frequency of Each Channel:

Channel	Frequency	Channel	Frequency	Channel	Frequency	Channel	Frequency
Channel 36:	5180 MHz	Channel 40:	5200 MHz	Channel 44:	5220 MHz	Channel 48:	5240 MHz
Channel 52:	5260 MHz	Channel 56:	5280 MHz	Channel 60:	5300 MHz	Channel 64:	5320 MHz
Channel 100:	5500 MHz	Channel 104:	5520 MHz	Channel 108:	5540 MHz	Channel 112:	5560 MHz
Channel 116:	5580 MHz	Channel 120:	5600 MHz	Channel 124:	5620 MHz	Channel 128:	5640 MHz
Channel 132:	5660 MHz	Channel 136:	5680 MHz	Channel 140:	5700 MHz	Channel 149:	5745 MHz
Channel 153:	5765 MHz	Channel 157:	5785 MHz	Channel 161:	5805 MHz	Channel 165:	5825 MHz

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

Channel	Frequency	Channel	Frequency	Channel	Frequency	Channel	Frequency
Channel 38:	5190 MHz	Channel 46:	5230 MHz	Channel 54:	5270 MHz	Channel 62:	5310 MHz
Channel 102:	5510 MHz	Channel 110:	5550 MHz	Channel 118:	5590 MHz	Channel 126:	5630 MHz
Channel 134:	5670 MHz	Channel 151:	5755 MHz	Channel 159:	5795 MHz		

802.11ac-20MHz Center Working Frequency of Each Channel:

Channel	Frequency
Channel 144:	5720 MHz

802.11ac-40MHz Center Working Frequency of Each Channel:

Channel	Frequency
Channel 142:	5710 MHz

802.11ac-80MHz Center Working Frequency of Each Channel:

Channel	Frequency	Channel	Frequency	Channel	Frequency	Channel	Frequency
Channel 42:	5210 MHz	Channel 58:	5290 MHz	Channel 106:	5530 MHz	Channel 122:	5610 MHz
Channel 138:	5690 MHz	Channel 155:	5775 MHz				

Note:

1. This device is a Wireless module with a built-in 5GHz WLAN transceiver.
2. Regarding the operation frequency, the customer-provided frequency and worst-case is selected to perform the test.
3. Lowest data rate is tested in each mode. The only worst case is shown in the report.
4. These tests were conducted on a sample of the equipment for the purpose of demonstrating compliance of transmitter with Part 15 Subpart E for Unlicensed National Information Infrastructure devices.
5. This is a permissive change for FCC ID: SLE-WAPC003. According to the major change, DEKRA tests Conducted Emission, Radiated Emission, Radiated Band Edge worst-case and other testing data refer to original module report (report no.: 2110552R-E3032110128). Additional the host: Wireless AP/bridge/client, Brand: MOXA, Model number: AWK-4252A is contain this module's FCC ID.

Test Mode	Transmit (802.11ac-80BW)_POE SISO A: Transmit (802.11a) MIMO: Transmit (802.11ac-20BW) MIMO: Transmit (802.11ac-40BW) MIMO: Transmit (802.11ac-80BW)
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1.2. Summary of Test Item

Test Condition			Test Item					
			Conducted			Radiated		
Antenna No.	Antenna Type	Antenna Gain	Conducted Power	Power Density	Occupied Bandwidth	Radiated Emission	Band Edge	DFS
1	Dipole	5.7dBi For 5.150~5.250GHz 5.7dBi For 5.250~5.350GHz 6.3dBi For 5.470~5.725GHz 6.3dBi For 5.725~5.825GHz						
2	Dipole	1.41dBi For 5GHz						
3	Dipole	0.81dBi For 5.150~5.250GHz 0.36dBi For 5.250~5.350GHz 0.36dBi For 5.470~5.725GHz -0.39dBi For 5.725~5.825GHz						
4	Dipole	1.8dBi For 5GHz						
5	Dipole	5.7dBi For 5.150~5.250GHz 5.76Bi For 5.250~5.350GHz 5.7dBi For 5.470~5.725GHz 5.2dBi For 5.725~5.825GHz						
6	Dipole	2.72dBi For 5.150~5.250GHz 2.72dBi For 5.250~5.350GHz 2.72dBi For 5.470~5.725GHz 2.34dBi For 5.725~5.825GHz						
7	Panel	8.77dBi For 5.15~5.25GHz 8.77dBi For 5.25~5.35GHz 8.61dBi For 5.47~5.725GHz 8.18dBi For 5.725~5.825GHz						
8	Panel	12.04dBi For 5.150~5.250GHz 12.04dBi For 5.250~5.350GHz 11.06dBi For 5.470~5.725GHz 11.06dBi For 5.725~5.825GHz						
9	Dipole	7.3dBi For 5.150~5.250GHz 7.3dBi For 5.250~5.350GHz 7.5dBi For 5.470~5.725GHz 7.6dBi For 5.725~5.825GHz						
10	Dipole	8.61dBi For 5.150~5.250GHz 8.15dBi For 5.250~5.350GHz 8.87dBi For 5.470~5.725GHz 8.87dBi For 5.725~5.825GHz	✓	✓	✓	✓	✓	✓
11	Panel	16.38dBi For 5.15~5.25GHz 16.38dBi For 5.25~5.35GHz 16.94dBi For 5.47~5.725GHz 16.94dBi For 5.725~5.825GHz	✓	✓	✓	✓	✓	

Note:

- Transmitting antennas of directional gain greater than 6 dBi, the conducted output power from the intentional radiator shall be reduced below the limit.

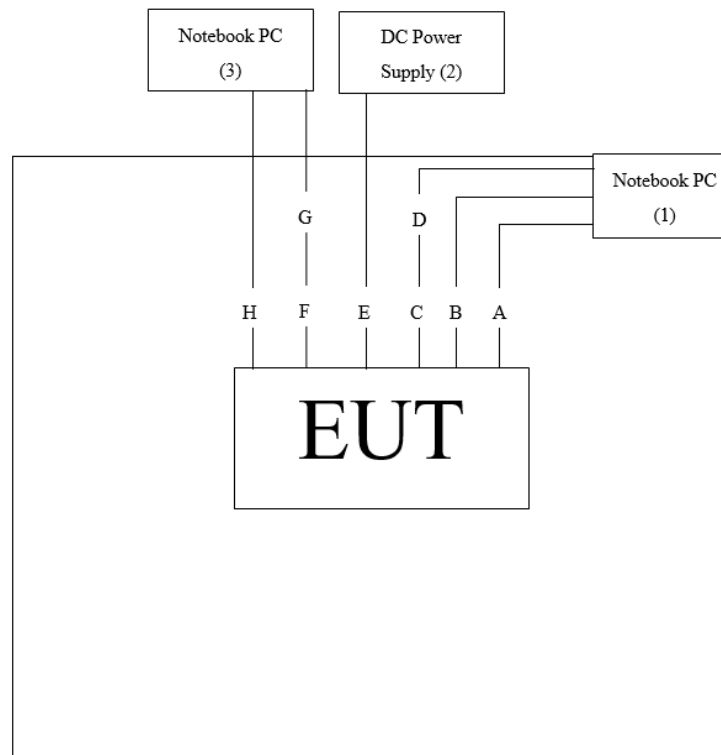
1.3. Tested System Details

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	Notebook PC	ASUS	P2438U	H1NXCV11U083025	N/A
2	DC Power Supply	KEYSIGHT	E36234A	MY59001234	Non-shielded, 1.8m
3	Notebook PC	DELL	Inspiron 15 3000	GT5JPJ2	N/A

Signal Cable Type	Signal cable Description
A	USB Cable Shielded, 1.2m
B	LAN Cable Non-shielded, 2m
C	LAN to RS-232 Cable Non-shielded, 1.5m
D	RS-232 to USB Cable Shielded, 0.8m
E	Power Cable Non-shielded, 1m
F	DI/DO Cable Non-shielded, 1.1m
G	LAN Cable Non-shielded, 2m
H	LAN Cable Non-shielded, 3m

1.4. Configuration of tested System



1.5. EUT Exercise Software

1. Setup the EUT as shown in Section 1.4.
2. Execute software “QCARCT V3.0.295.0” on the Notebook Computer.
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.

1.6. Test Facility

Ambient conditions in the laboratory:

Performed Item	Items	Required	Actual
Conducted Emission	Temperature (°C)	10~40 °C	26.4 °C
	Humidity (%RH)	10~90 %	47.2 %
Radiated Emission	Temperature (°C)	10~40 °C	22.9 °C
	Humidity (%RH)	10~90 %	69.1 %

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
Address : No. 5-22, Ruishukeng Linkou District, New Taipei City,
24451, Taiwan

Performed Location : No. 26, Huaya 1st Rd., Guishan Dist., Taoyuan City
333411, Taiwan, R.O.C.

Phone number : +886-3-275-7255
Fax number : +866-3-327-8031
Email address : info.tw@dekra.com
Website : <http://www.dekra.com.tw>

1.7. List of Test Equipment

For Radiated measurements /HY-CB03

	Equipment	Manufacturer	Model No.	Serial No.	Cal. Date	Due. Date
	Loop Antenna	AMETEK	HLA6121	56736	2022.05.14	2023.05.13
X	Bi-Log Antenna	SCHWARZBECK	VULB9168	9168-675	2021.08.10	2022.08.09
X	Horn Antenna	ETS-Lindgren	3117	00227700	2021.11.09	2022.11.08
X	Horn Antenna	Com-Power	AH-840	101100	2021.10.04	2022.10.03
X	Pre-Amplifier	SGH	SGH0301-9	20211007-10	2022.02.22	2023.02.21
X	Pre-Amplifier	EMCI	EMC051835SE	980313	2021.11.24	2022.11.23
X	Pre-Amplifier	EMCI	EMC05820SE	980310	2021.07.07	2022.07.06
	Pre-Amplifier	EMCI	EMC184045SE	980369		
X	Coaxial Cable	EMCI	EMC102-KM-KM-600	1160314	2022.05.12	2023.05.11
	Coaxial Cable	EMCI	EMC102-KM-KM-7000	170242		
	Filter	MICRO TRONICS	BRM50702	G251	2021.09.16	2022.09.15
X	Filter	MICRO TRONICS	BRM50716	G188	2021.09.16	2022.09.15
X	EMI Test Receiver	R&S	ESR	102793	2021.12.15	2022.12.14
X	Spectrum Analyzer	R&S	FSV3044	101113	2022.01.25	2023.02.24
	Coaxial Cable	SGH	SGH18	2021005-3		
X	Coaxial Cable	SGH	SGH18	202108-4	2022.03.18	2023.03.17
	Coaxial Cable	SGH	SGH18	20110223-1		
	Coaxial Cable	SGH	HA800	GD20110222-3		

Note:

1. All equipments are calibrated every one year.
2. The test instruments marked with "X" are used to measure the final test results.
3. Test Software version : E3 210616 dekra V9

1.8. Uncertainty

Uncertainties have been calculated according to the DEKRA internal document.

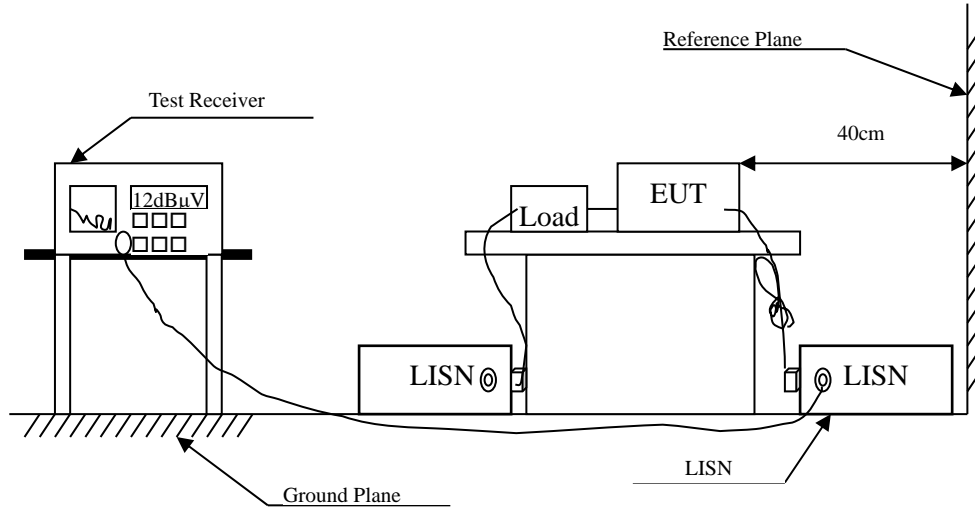
The reported expanded uncertainties are based on a standard uncertainty multiplied by a coverage factor of $k=2$, providing a level of confidence of approximately 95%.

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	±3.42 dB	
Radiated Emission	Under 1GHz ±4.06 dB	Above 1GHz ±3.73 dB
Band Edge	Under 1GHz ±4.06 dB	Above 1GHz ±3.73 dB
Duty Cycle	±2.31msec	

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	AV
0.15 - 0.50	66-56	56-46
0.50-5.0	56	46
5.0 - 30	60	50

Remarks : In the above table, the tighter limit applies at the band edges.

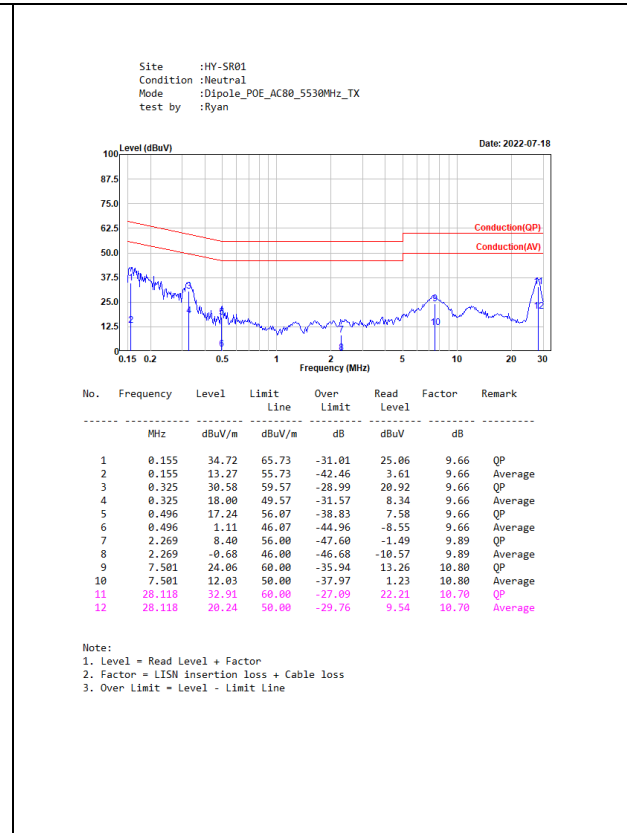
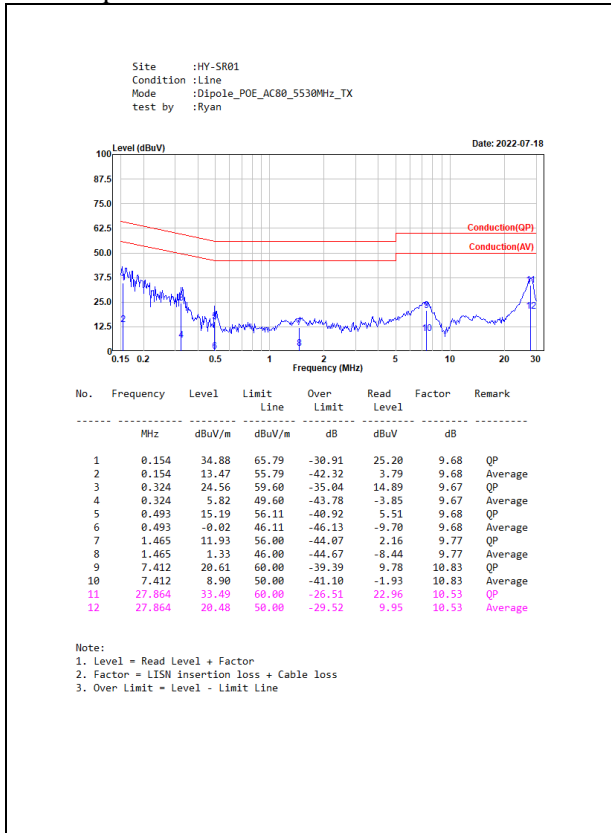
2.3. Test Procedure

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 /50uH coupling impedance for the measuring equipment. The peripheral devices are also connected to the main power through a LISN that provides a 50ohm /50uH coupling impedance with 50ohm termination. (Please refers to the block diagram of the test setup and photographs.)

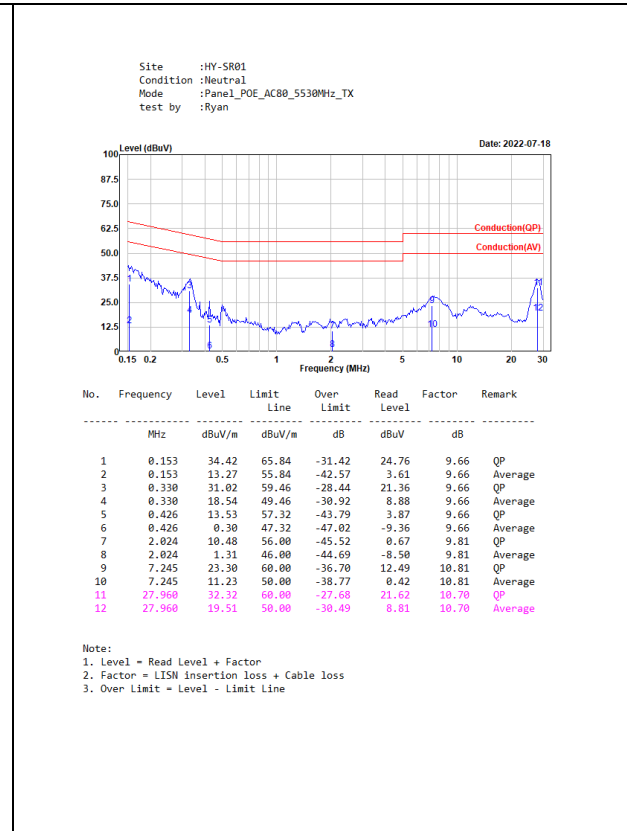
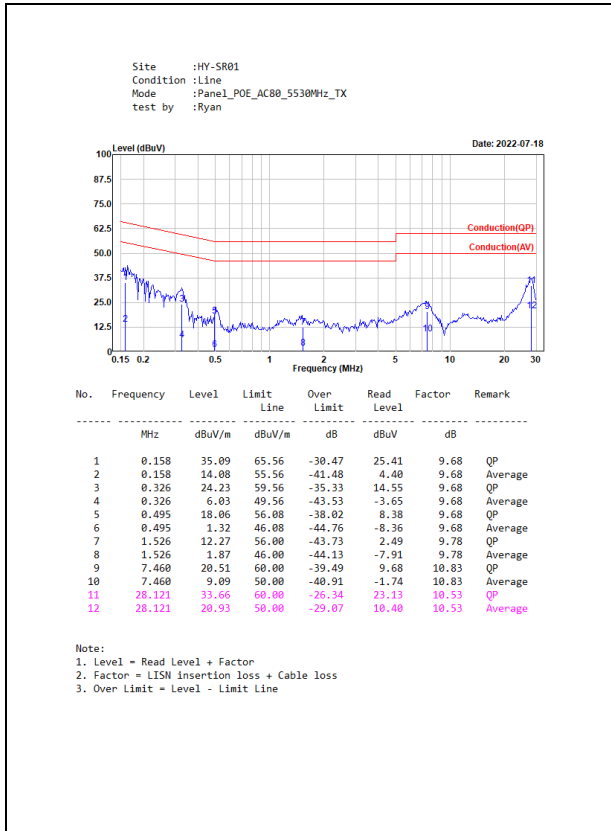
Both sides of A.C. line are checked for maximum conducted interference. In order to find the maximum emission, the relative positions of equipment and all of the interface cables must be changed according to ANSI C63.4:2014 on conducted measurement.

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

2.4. Test Result of Conducted Emission Dipole-PoE



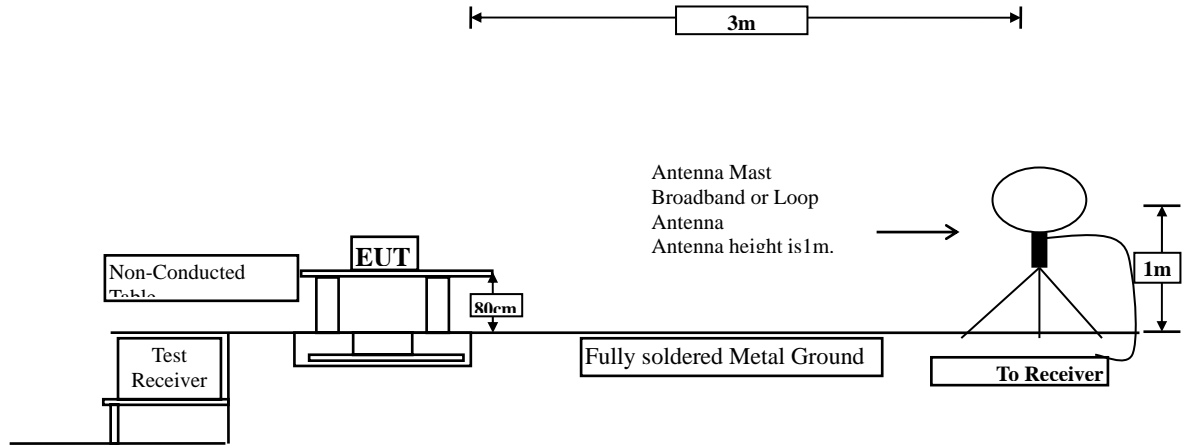
Panel-PoE



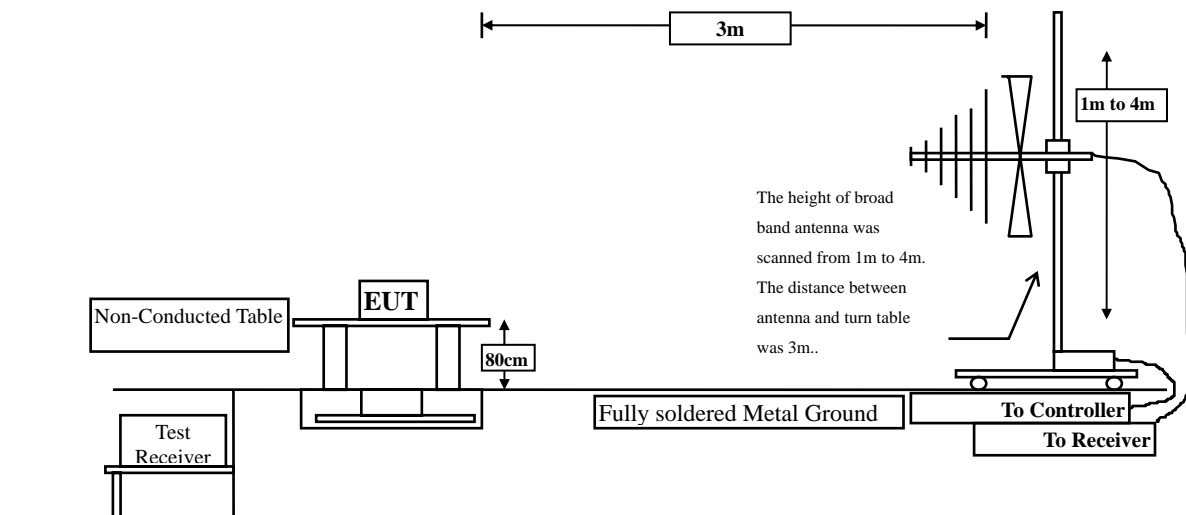
3. Radiated Emission

3.1. Test Setup

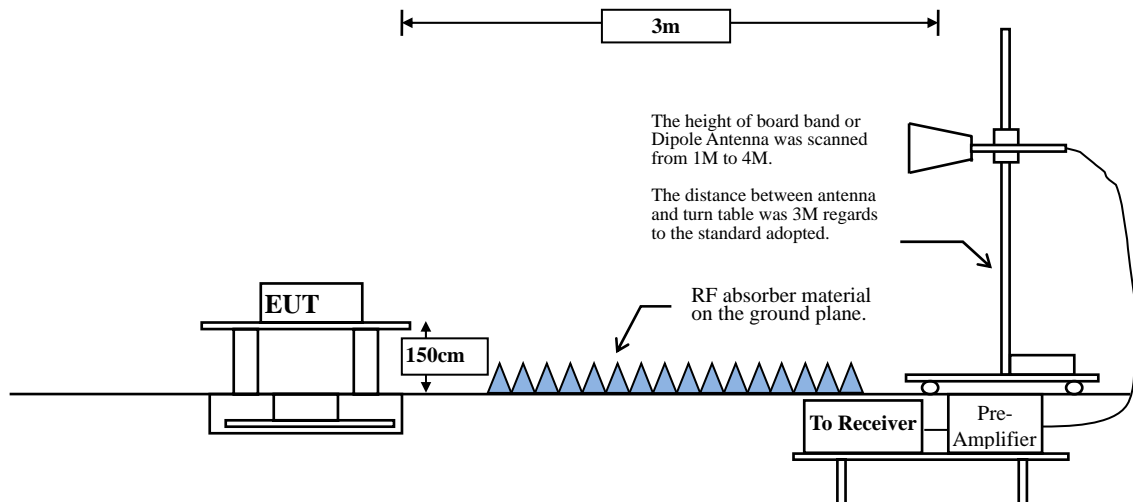
Radiated Emission Under 30MHz



Radiated Emission Below 1GHz



Radiated Emission Above 1GHz



3.2. Limits

Emissions radiated outside of the specified frequency bands, except for harmonics, shall be attenuated by at least 20dB 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(a) 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: E field strength (dB μ V/m) = 20 log E field strength (uV/m)

3.3. Test Procedure

The EUT was setup according to ANSI C63.10, 2013 and tested according to FCC KDB-789033 test procedure for compliance to FCC 47CFR 15. 407 requirements.

Measuring the frequency range below 1GHz, 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 30MHz setting on the field strength meter is 9kHz and 30MHz~1GHz is 120kHz and above 1GHz is 1MHz.

Radiated emission measurements below 30MHz are made using Loop Antenna and 30MHz~1GHz are made using broadband Bilog antenna and above 1GHz 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 9kHz - 10th Harmonic of fundamental was investigated.

RBW and VBW Parameter setting:

According to KDB 789033 section II.G.5 Procedure for Unwanted Maximum Emissions Measurements above 1000 MHz.

RBW = 1MHz.

VBW \geq 3MHz.

According to KDB 789033 section II.G.6 Procedures for Average Unwanted Emissions Measurements above 1000 MHz.

RBW = 1MHz.

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

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

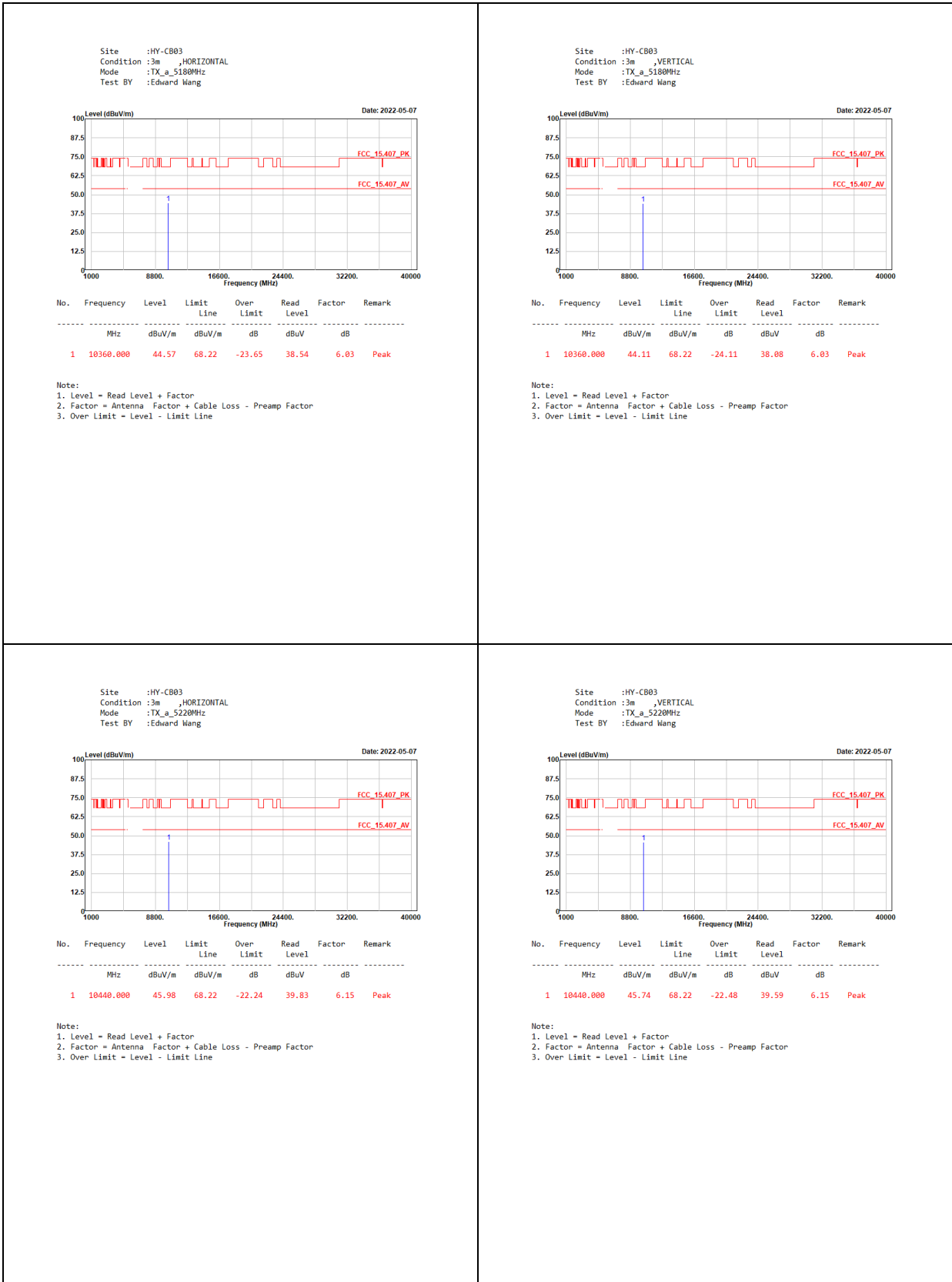
(T refers to the minimum transmission duration over which the transmitter is on and is transmitting at its maximum power control level for the tested mode of operation.)

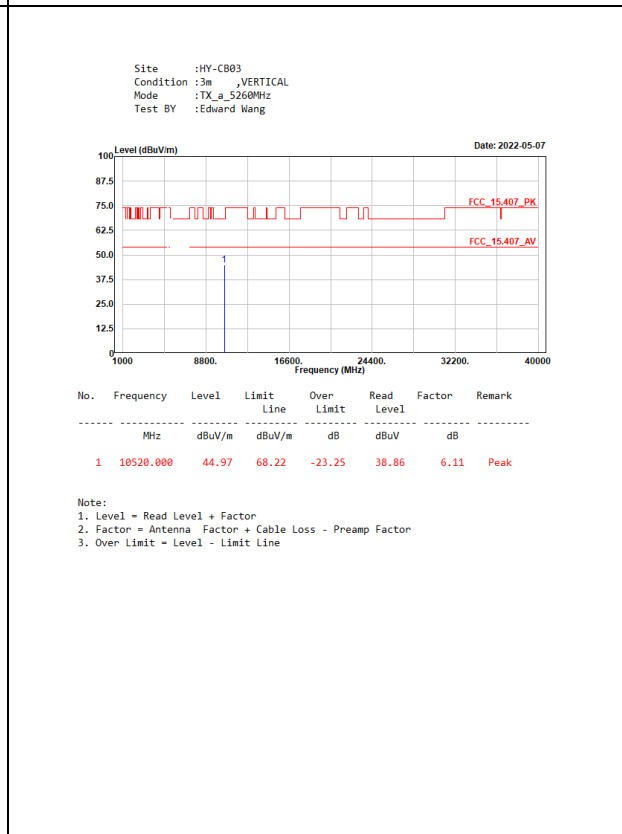
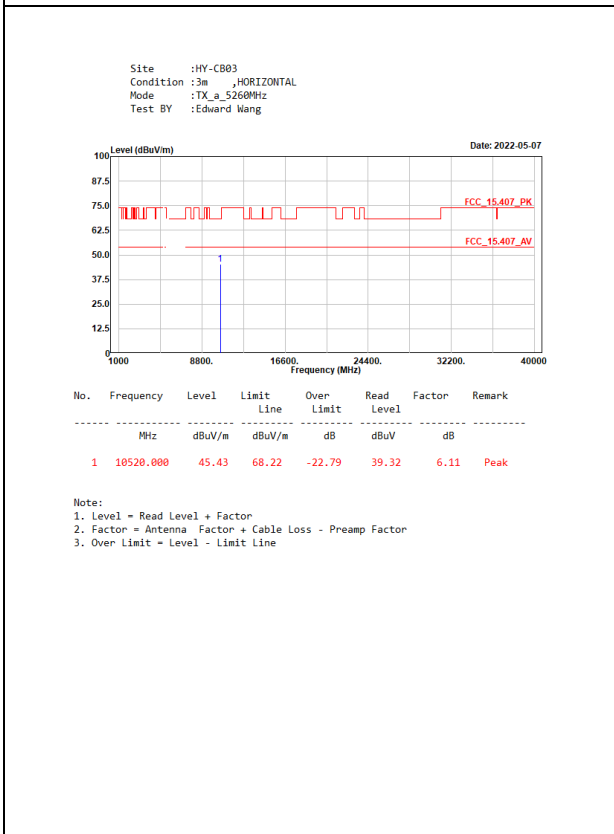
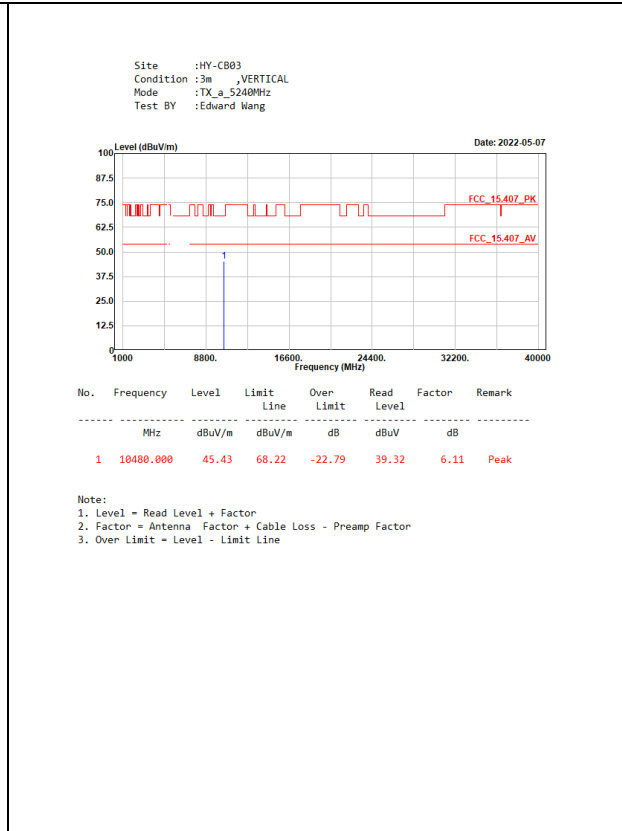
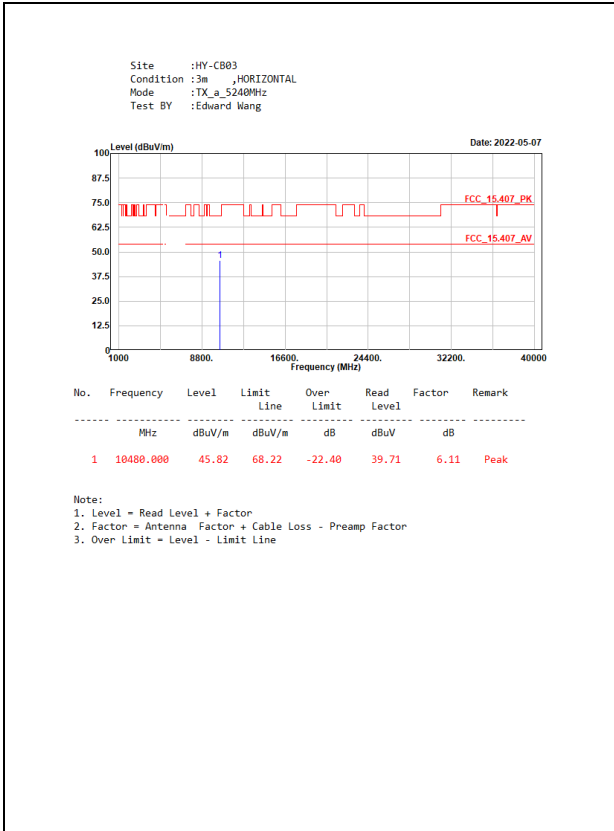
5GHz band	Duty Cycle (%)	T (ms)	1/T (Hz)	VBW (Hz)
802.11 a	95.57	2.0500	488	500
802.11 ac20	98.04	5.0000	200	200
802.11 ac40	94.47	2.3900	418	500
802.11 ac80	91.87	1.1300	885	1000

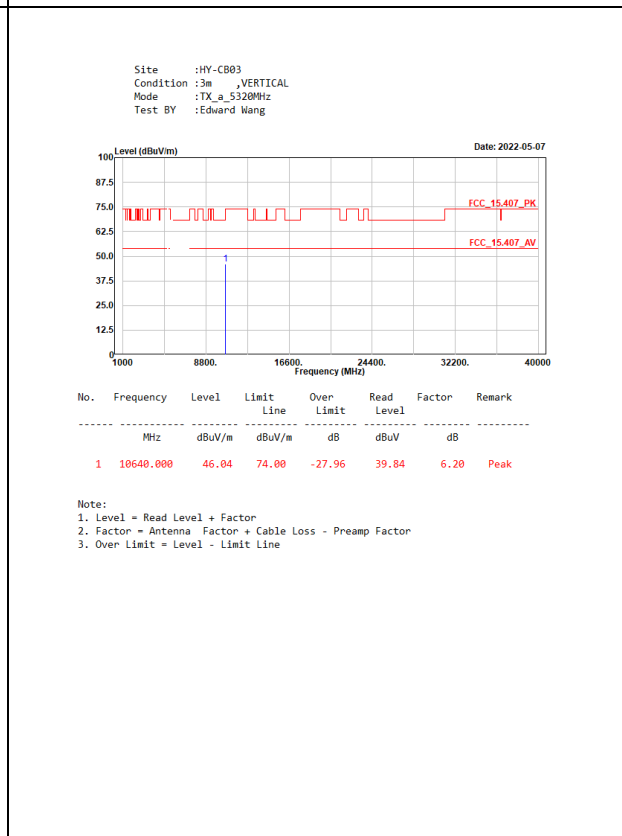
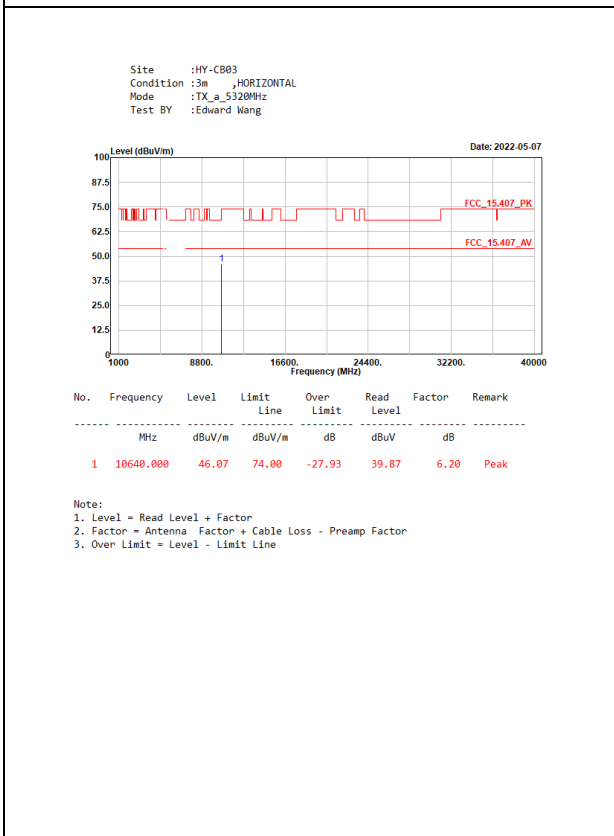
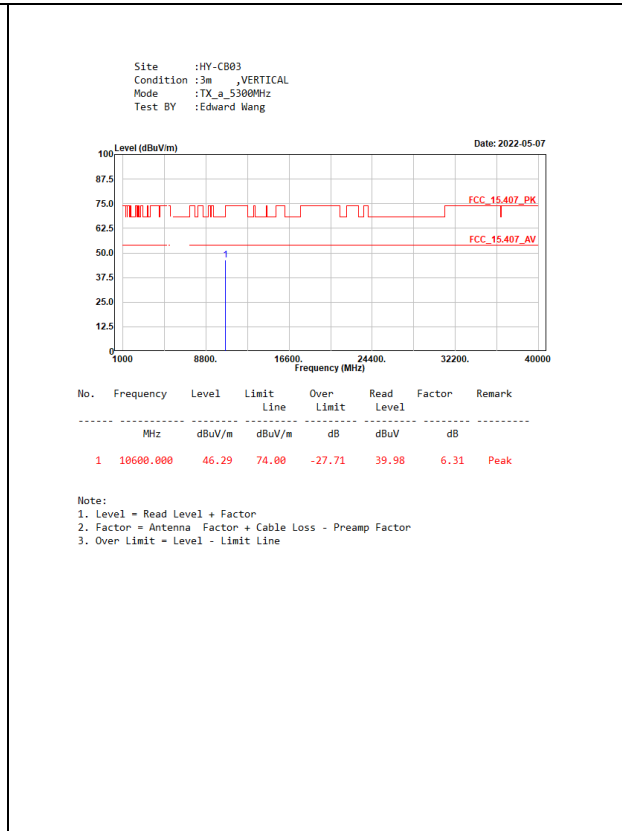
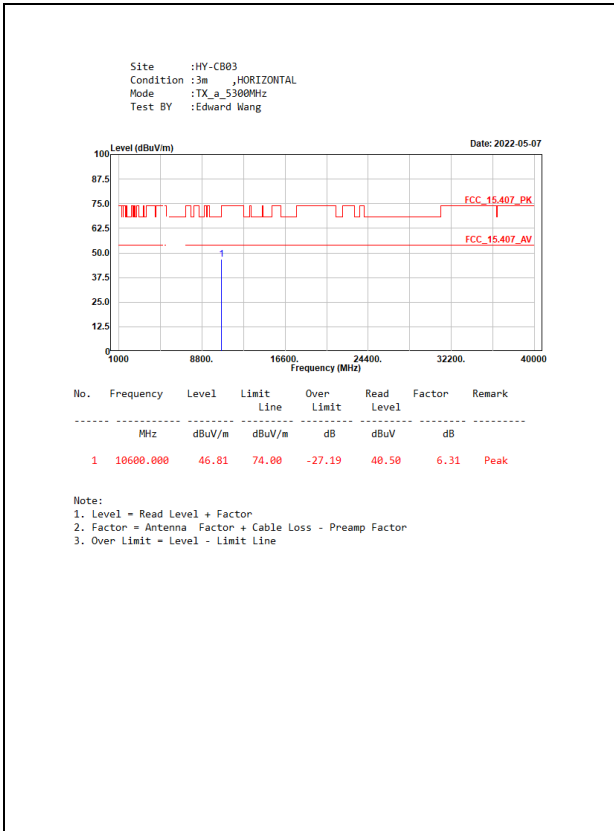
Note: Duty Cycle Refer to Section 5.

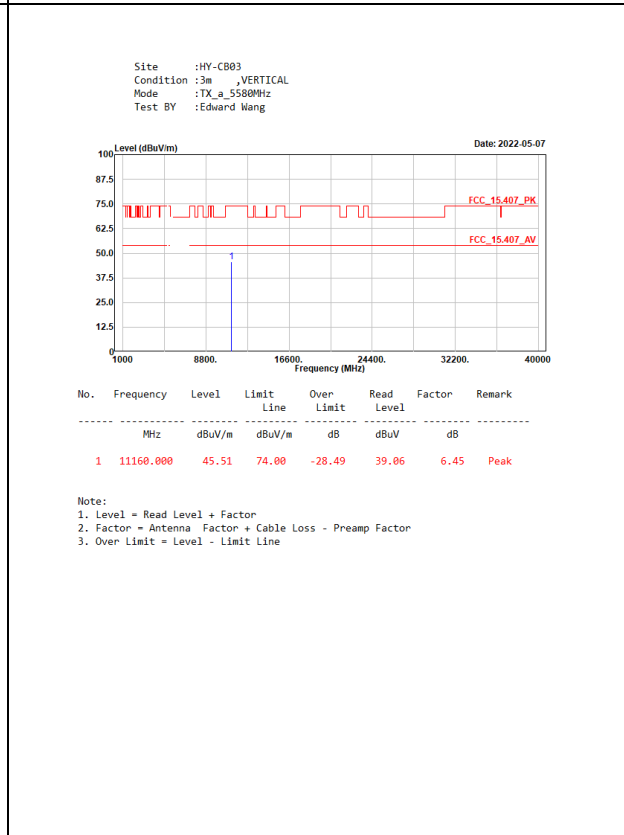
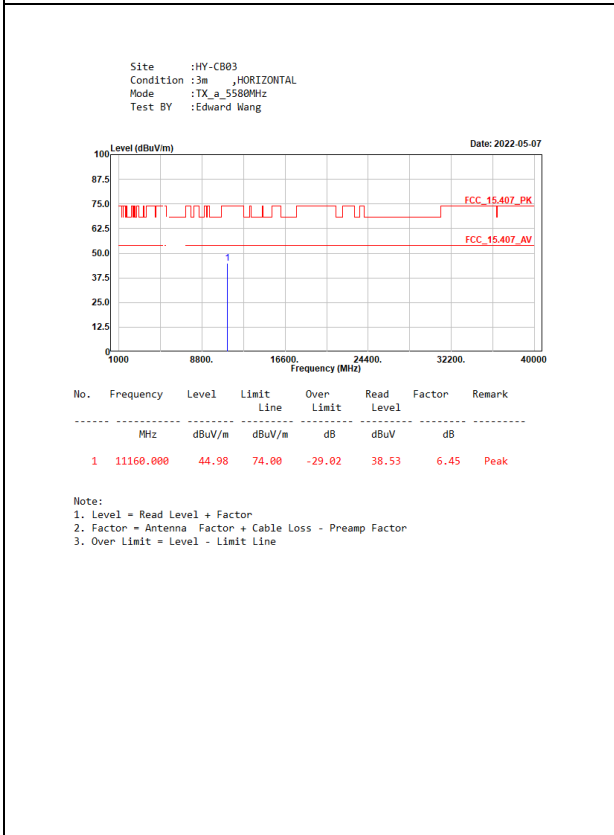
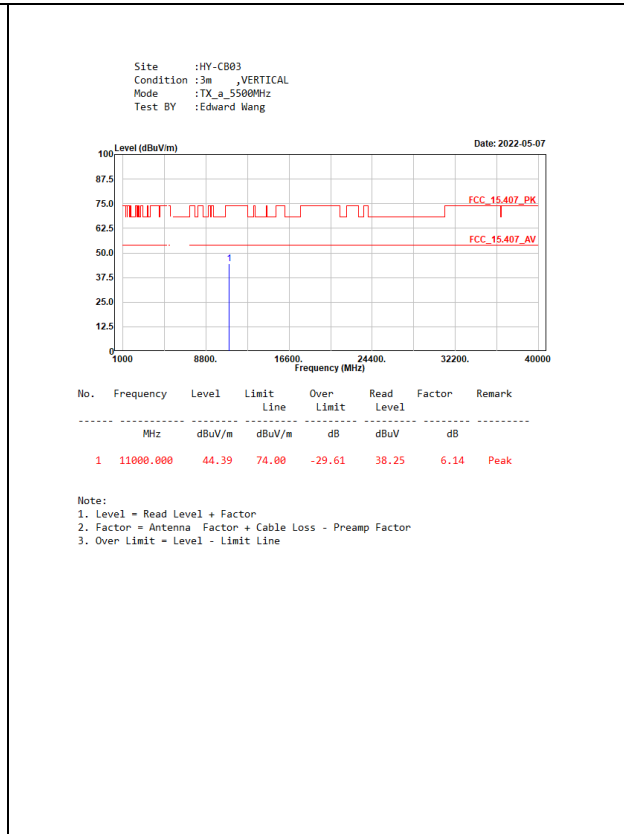
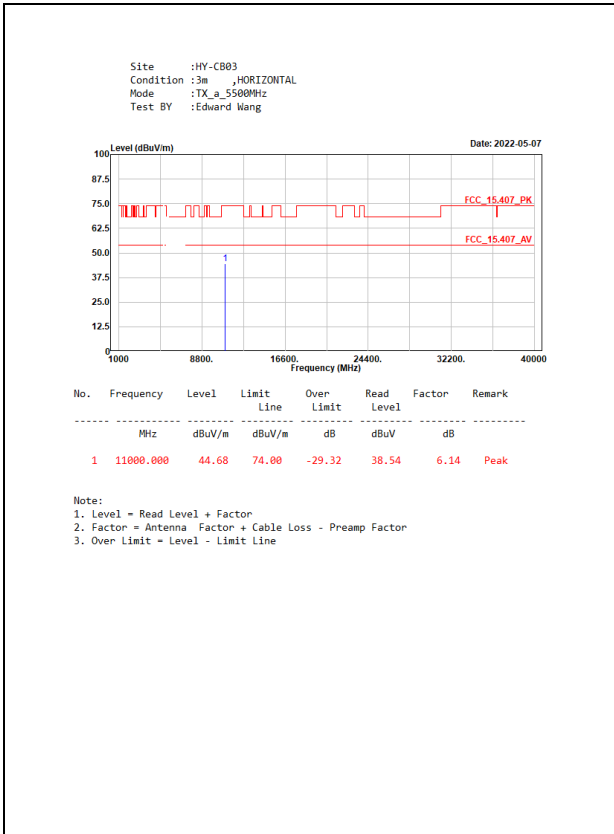
3.4. Test Result of Radiated Emission

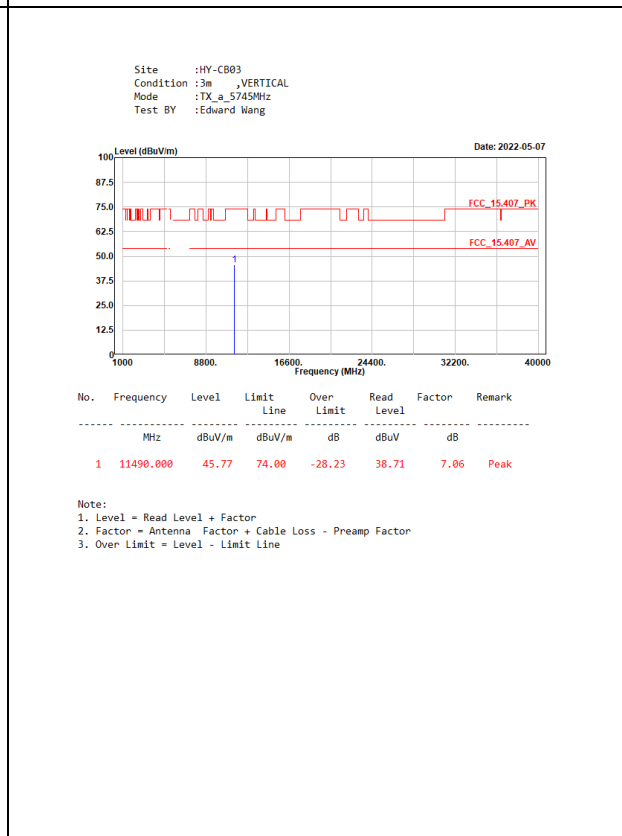
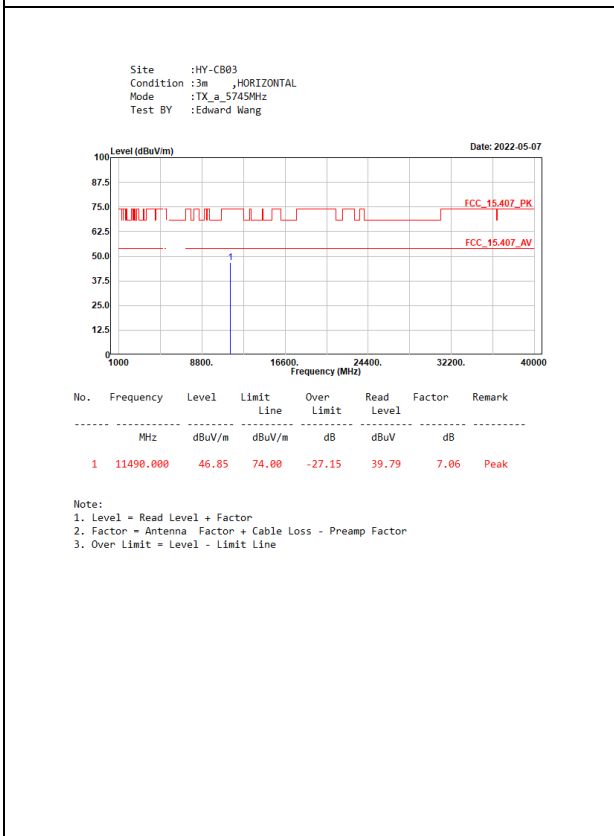
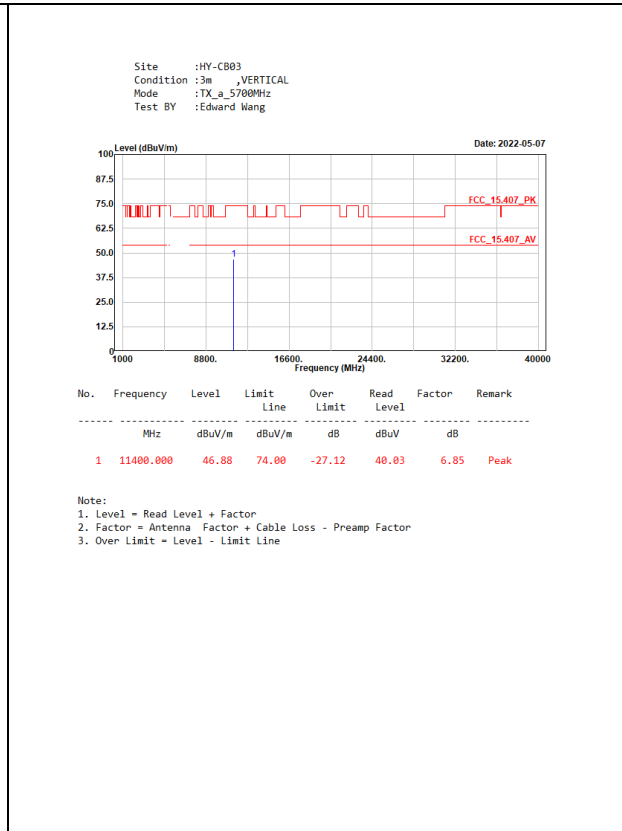
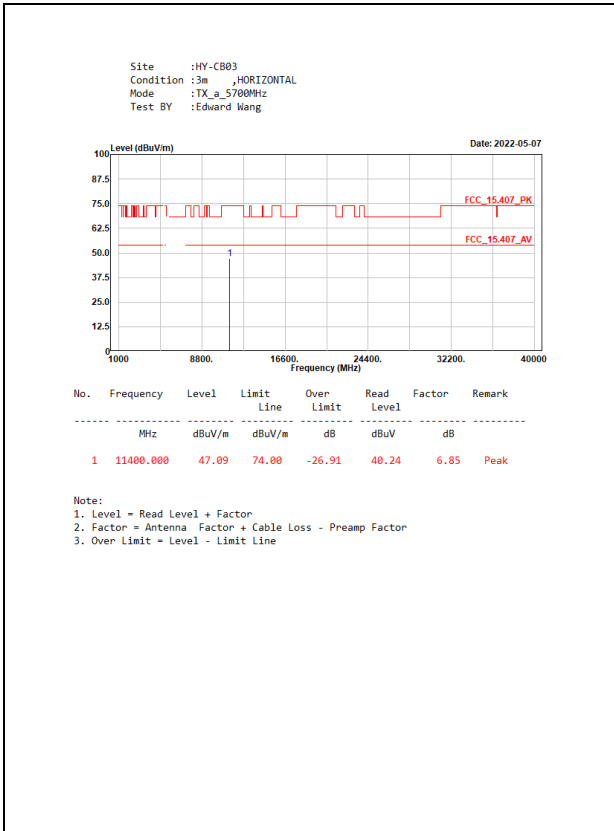
Dipole_SISO A

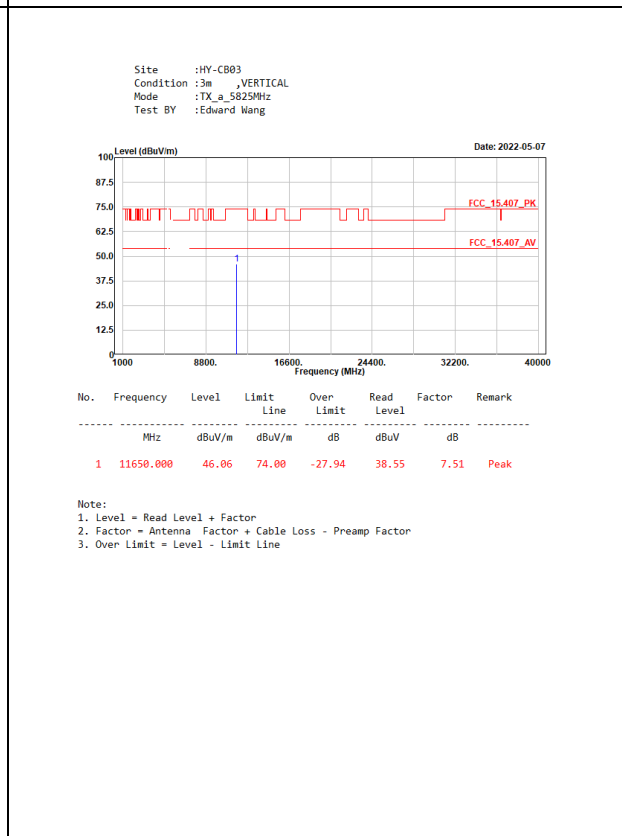
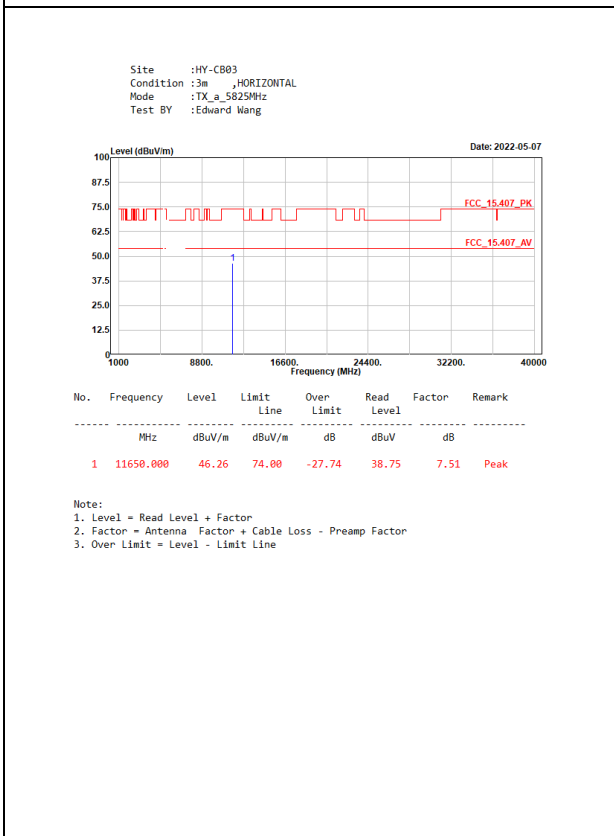
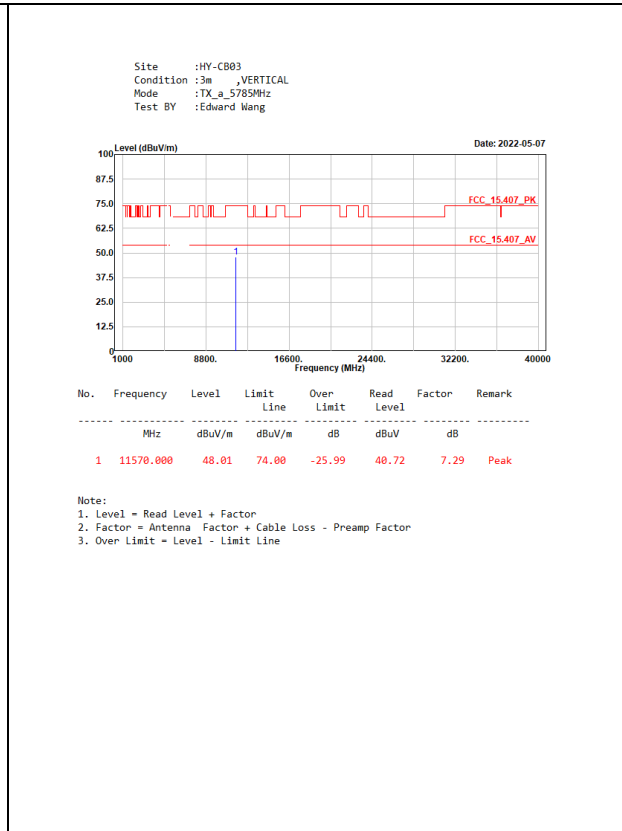
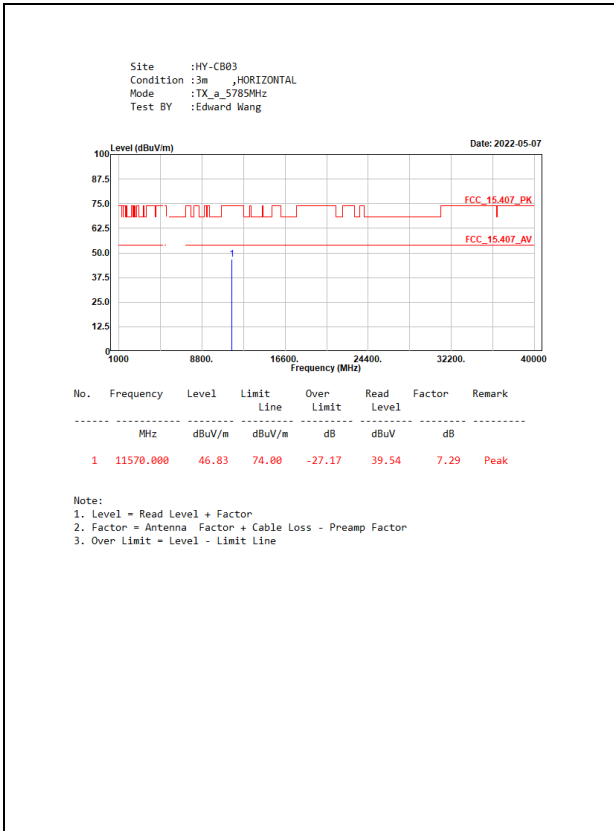




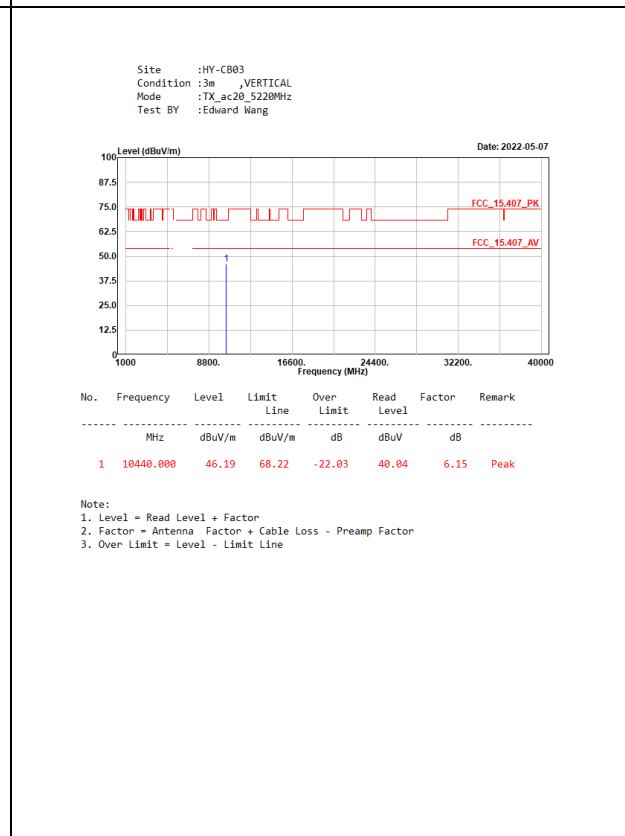
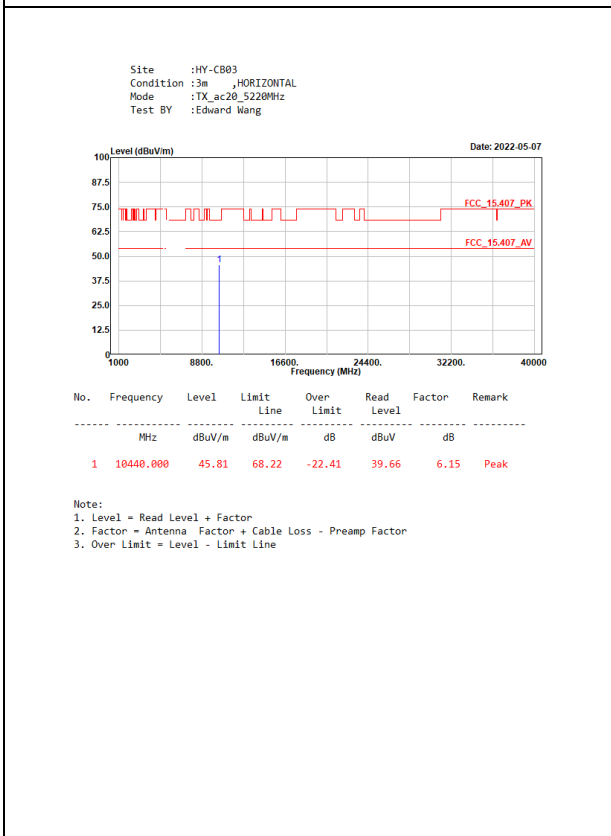
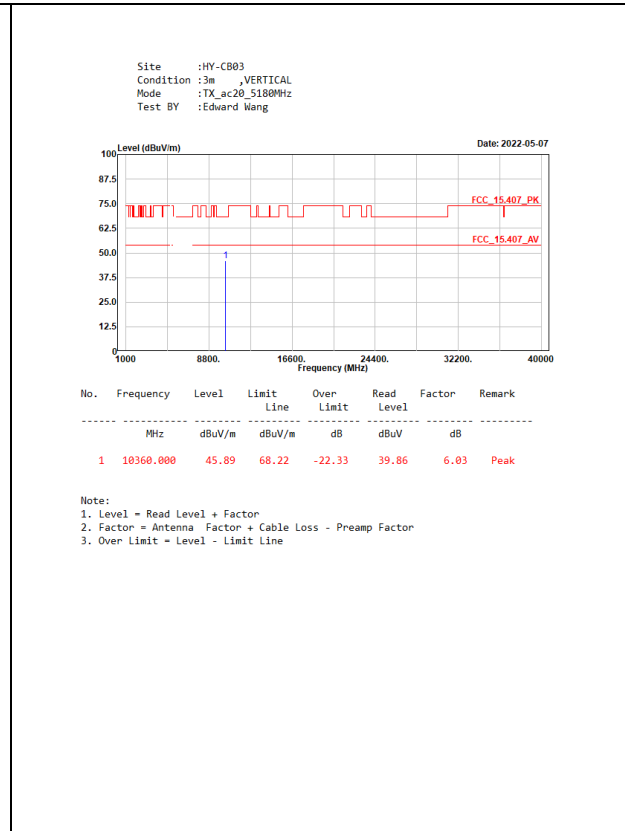
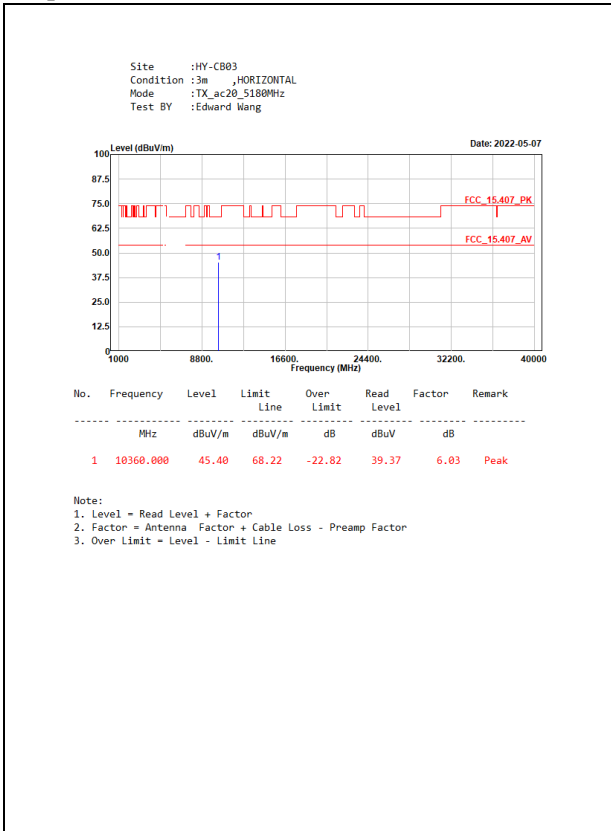


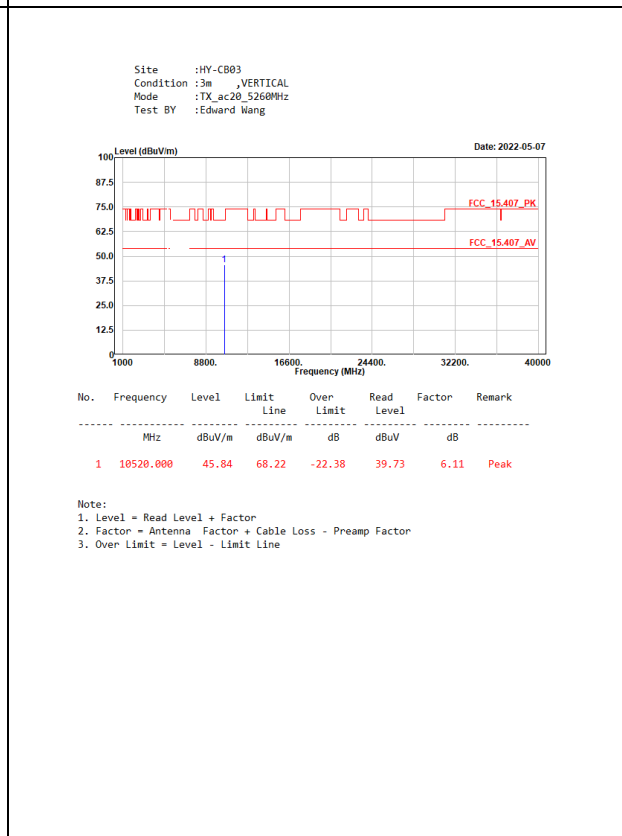
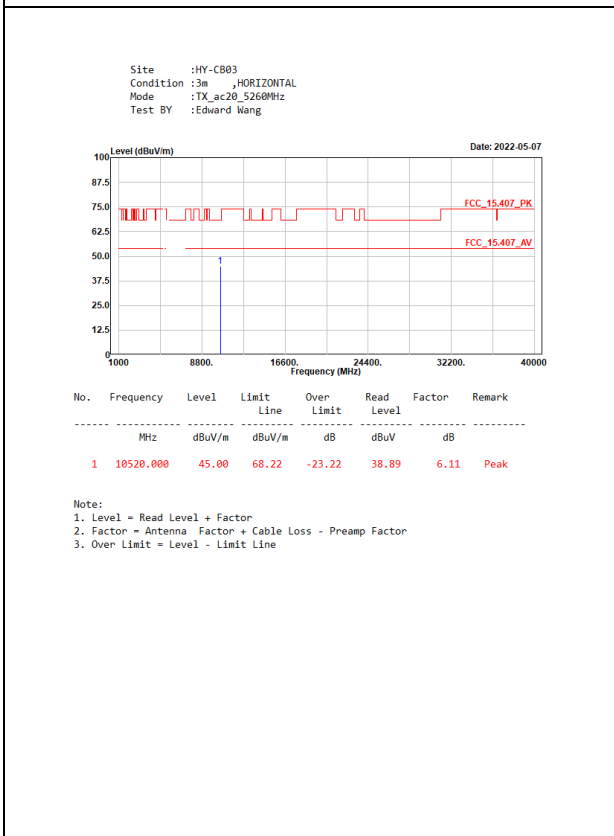
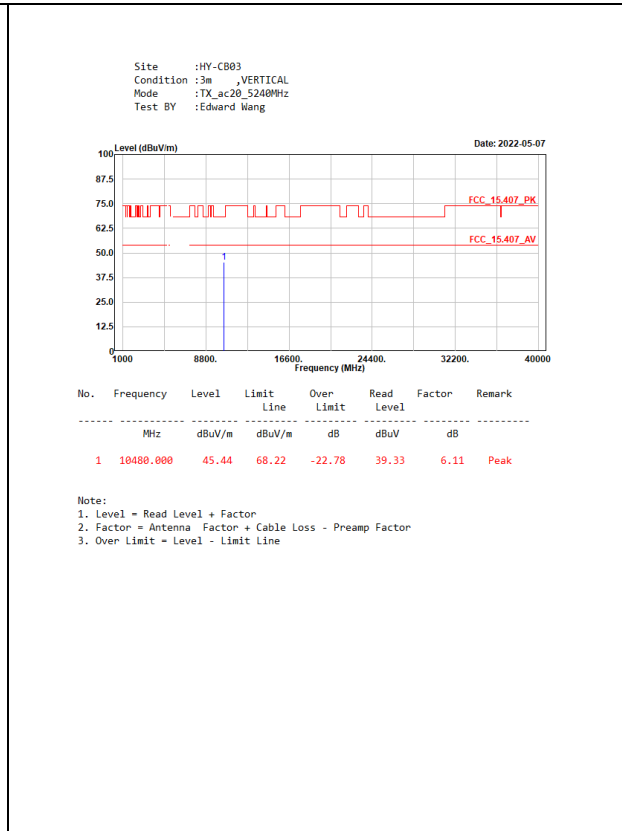
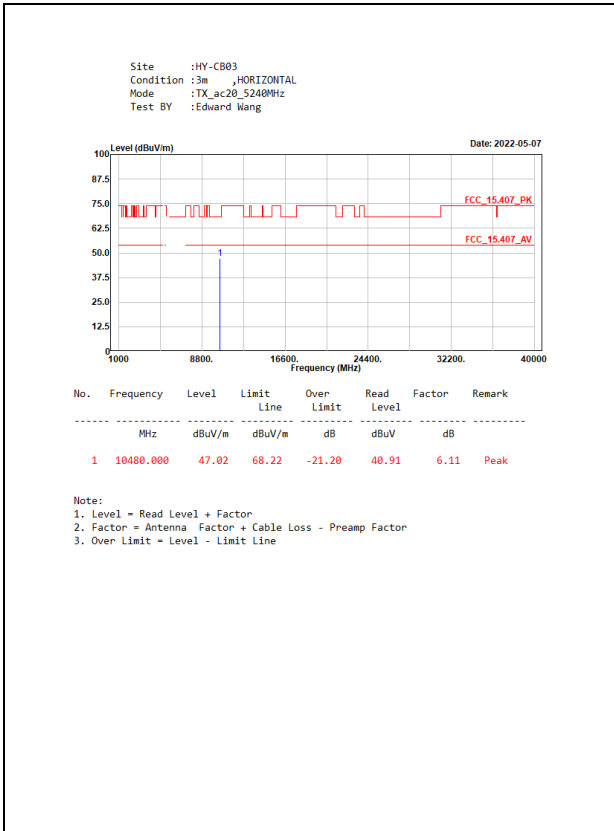


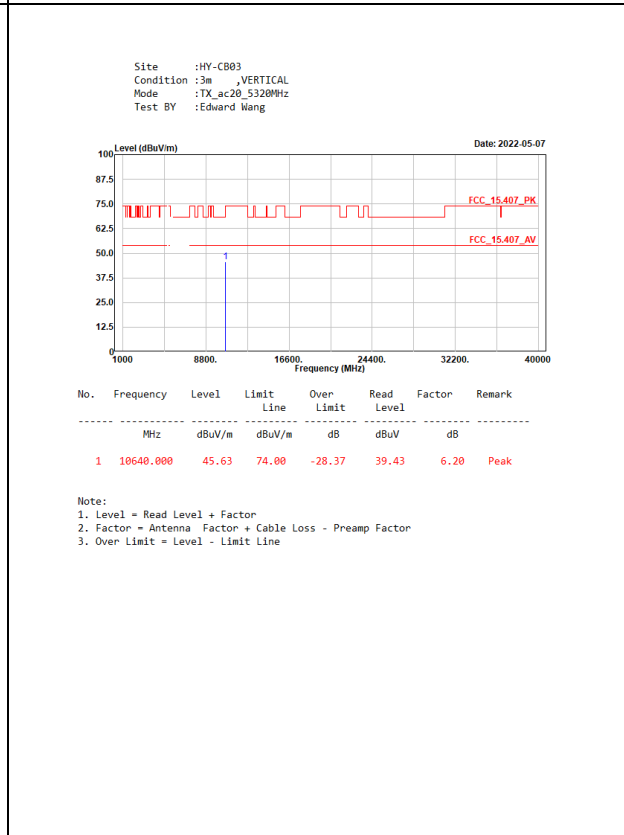
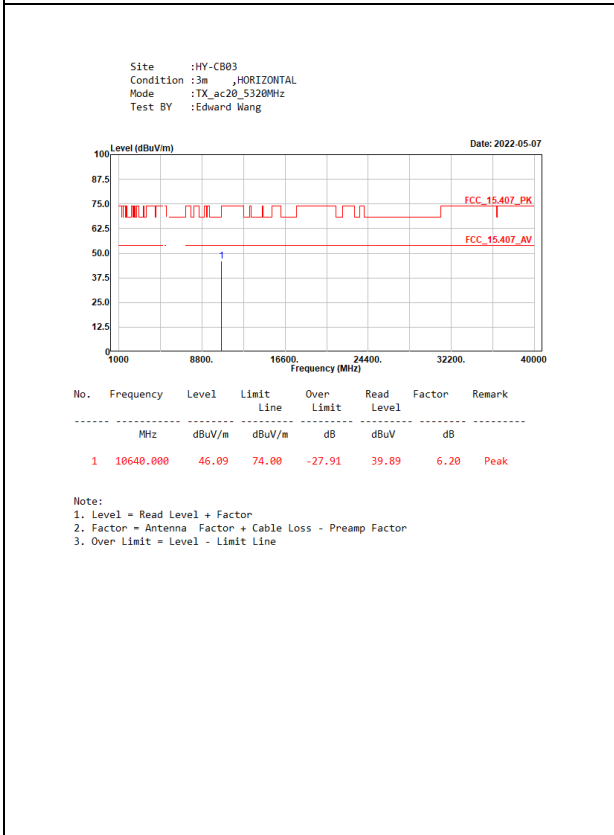
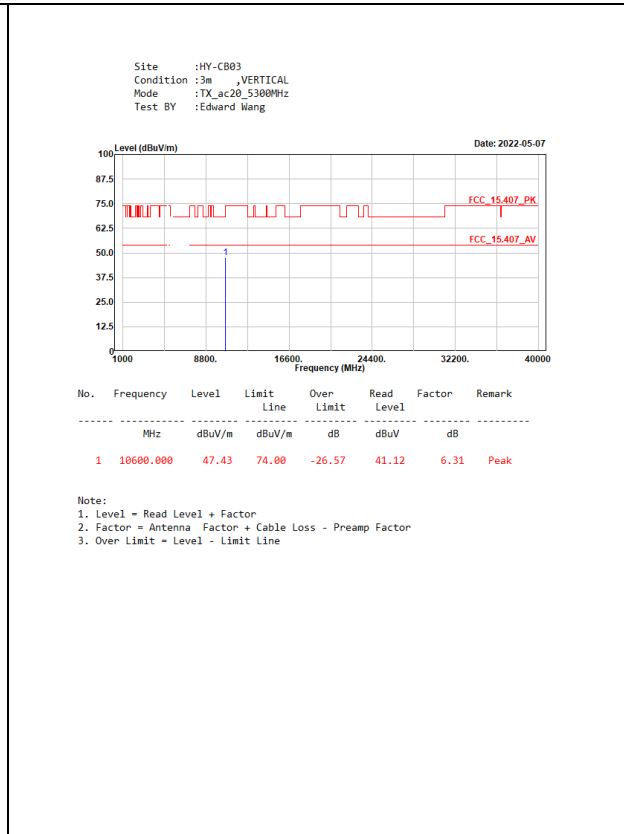
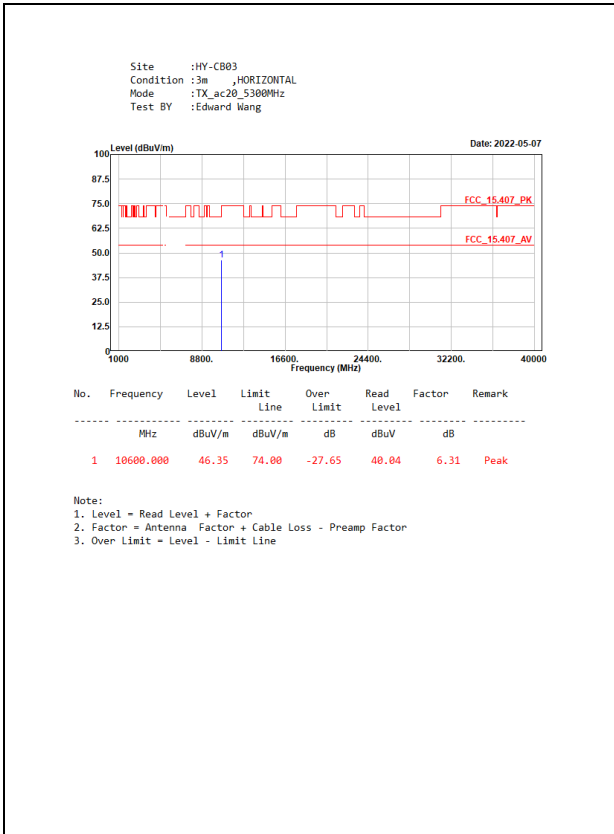


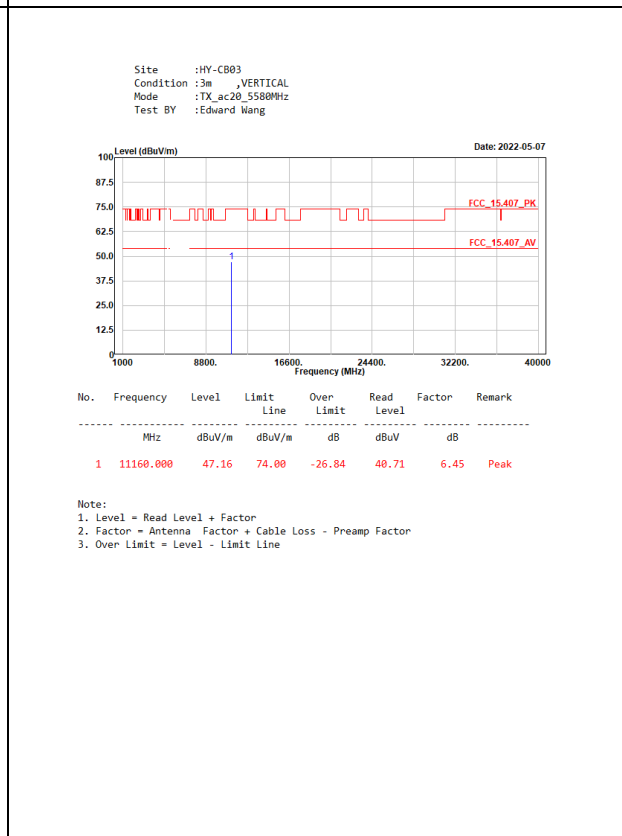
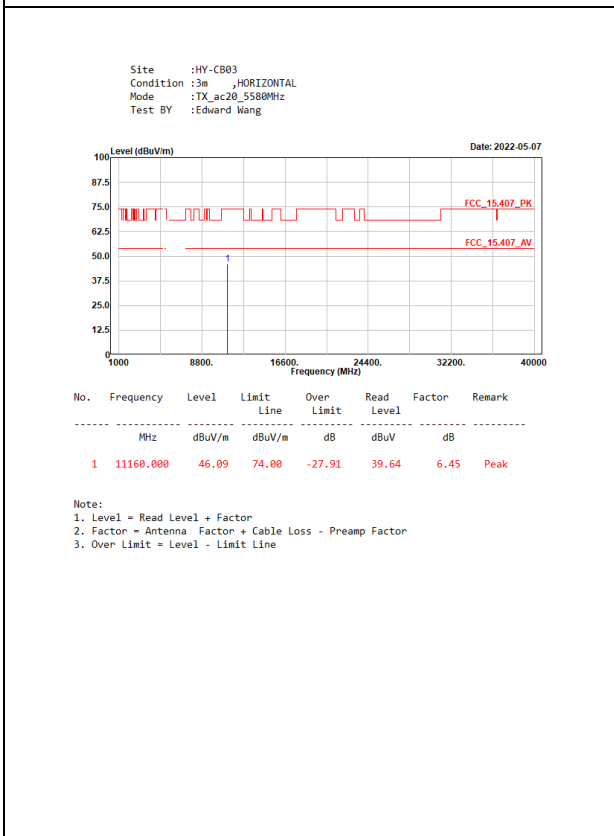
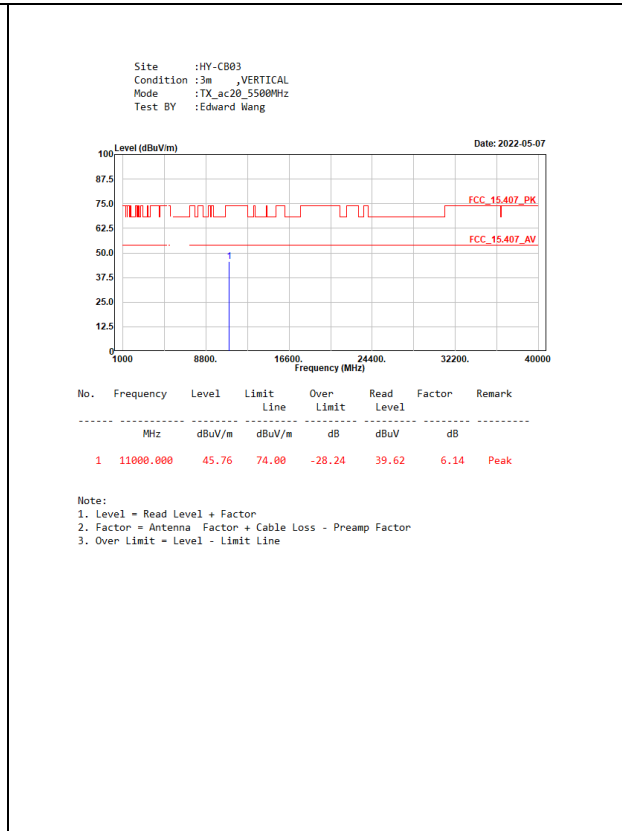
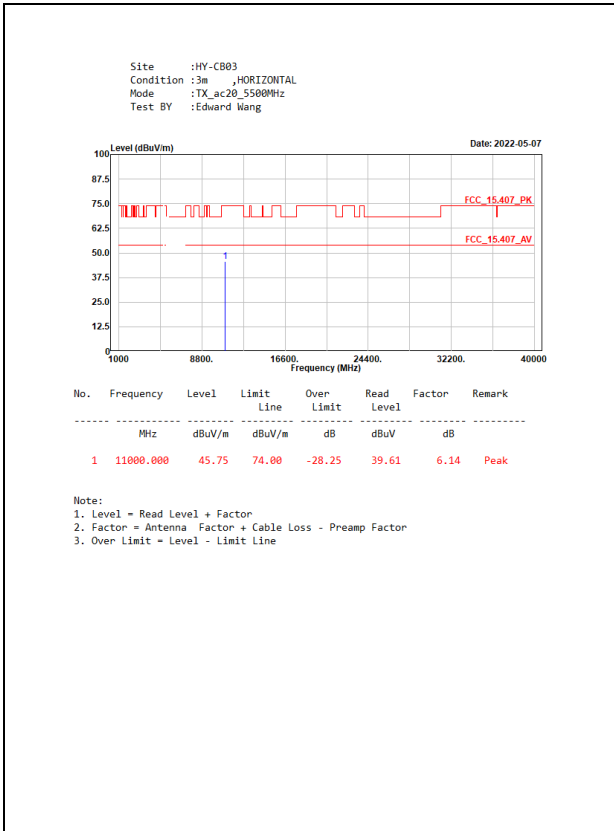


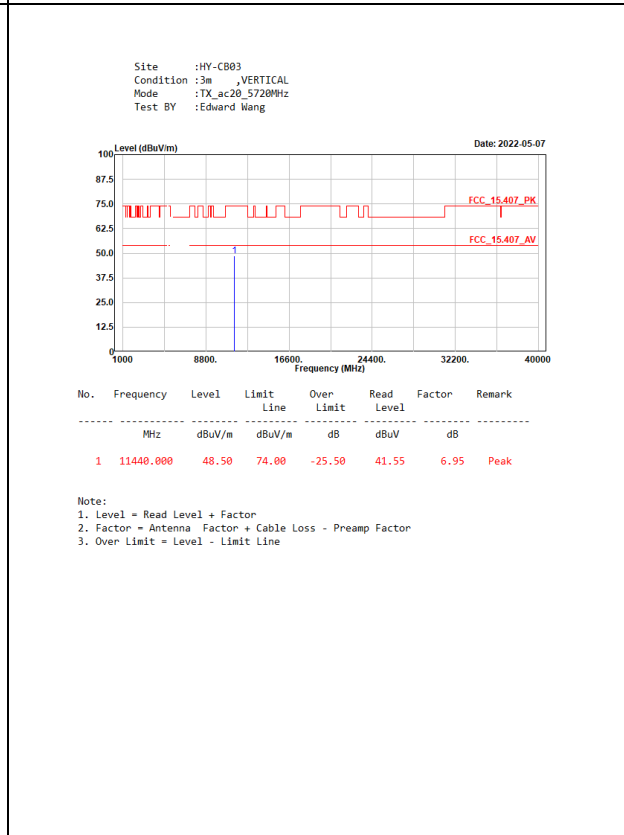
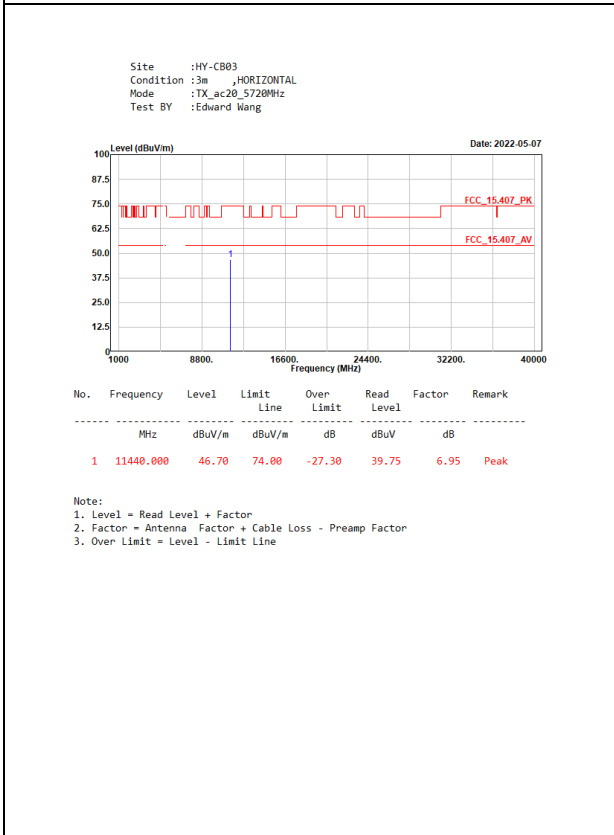
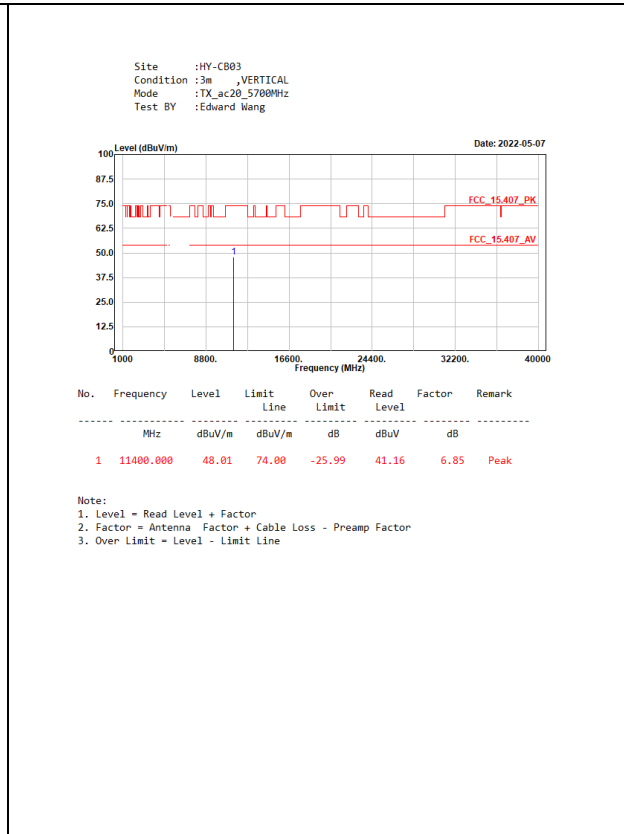
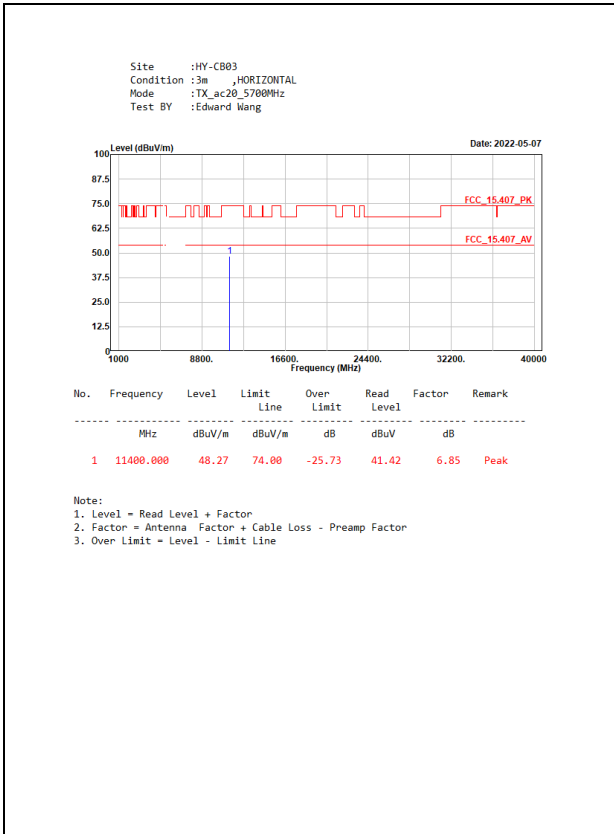
Dipole_MIMO

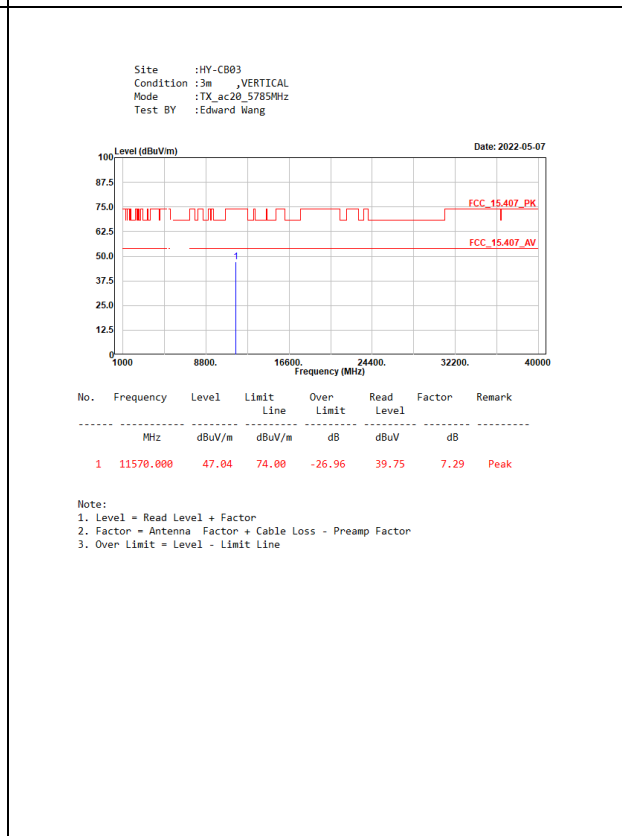
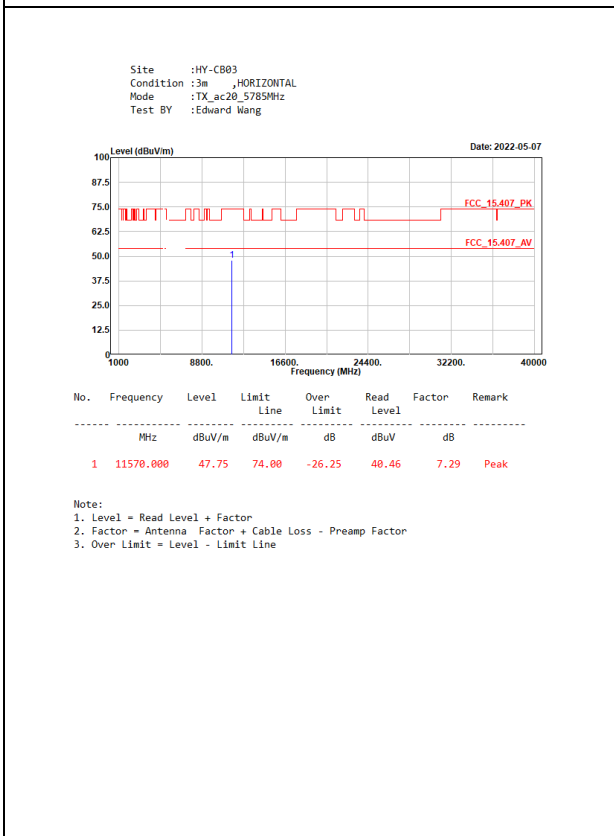
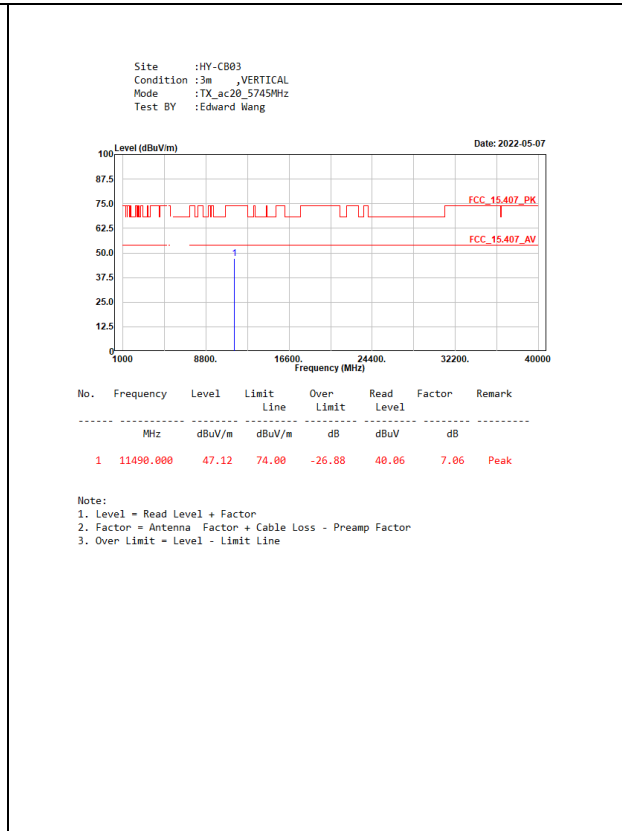
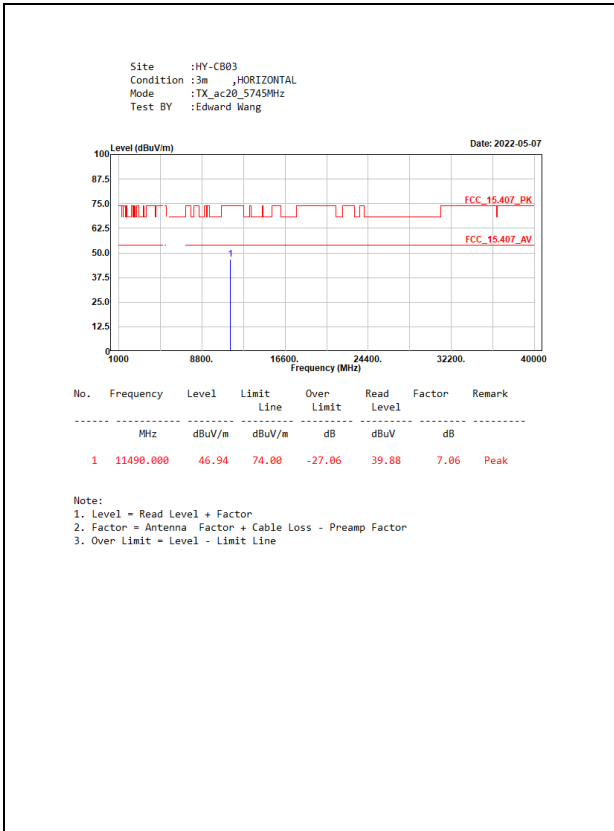


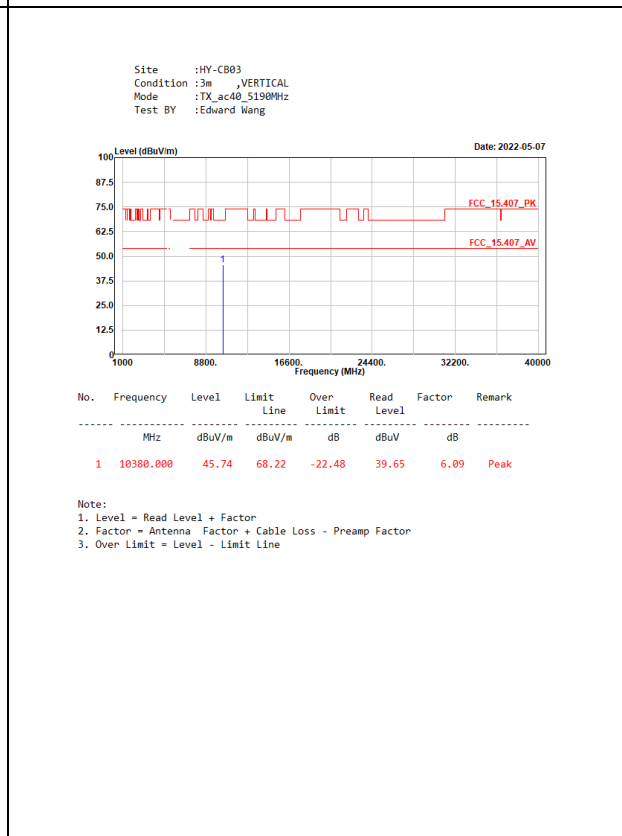
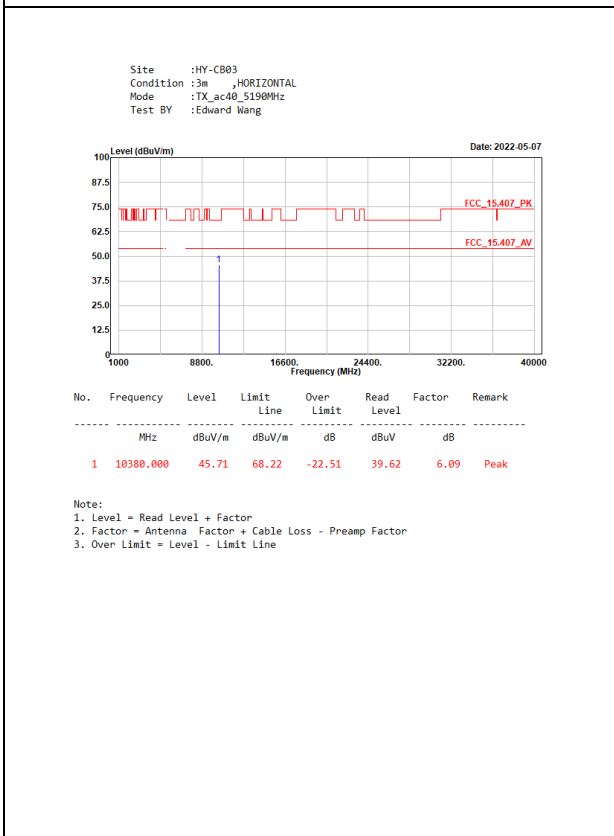
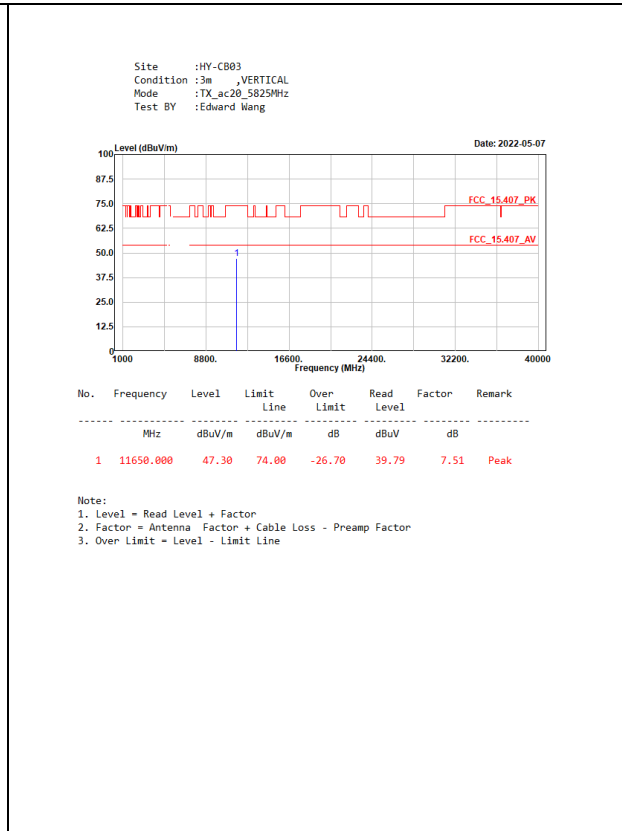
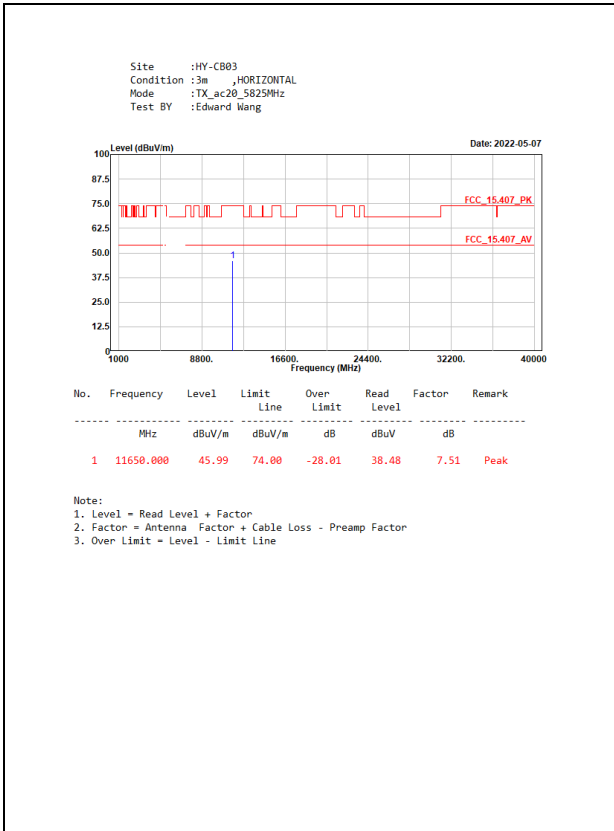


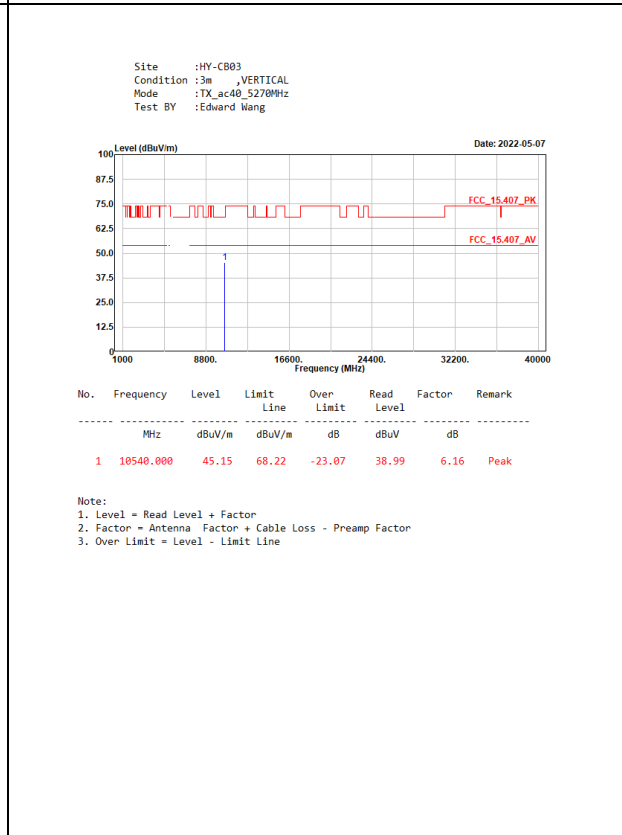
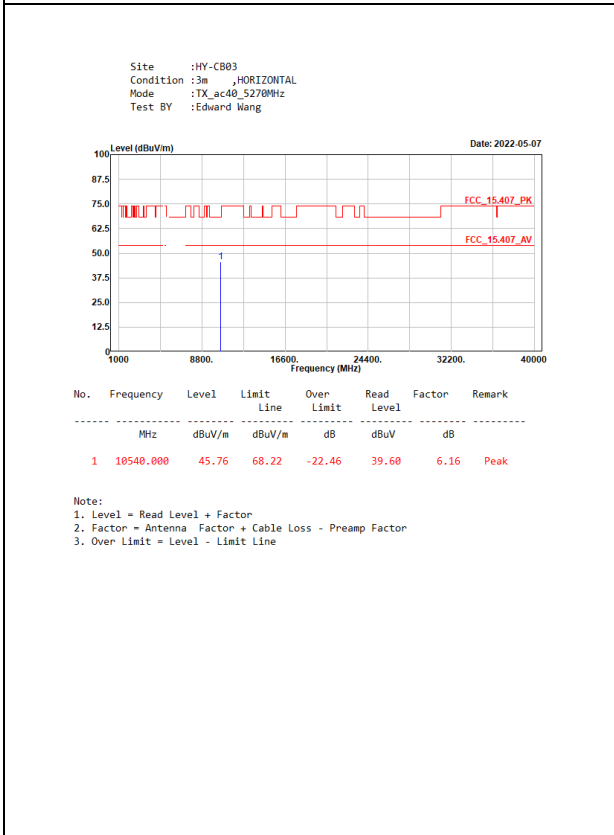
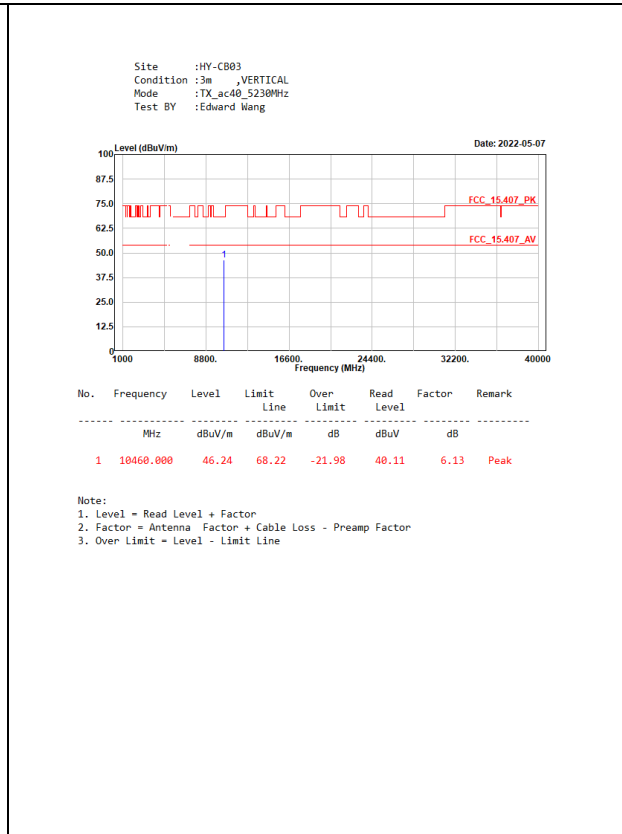
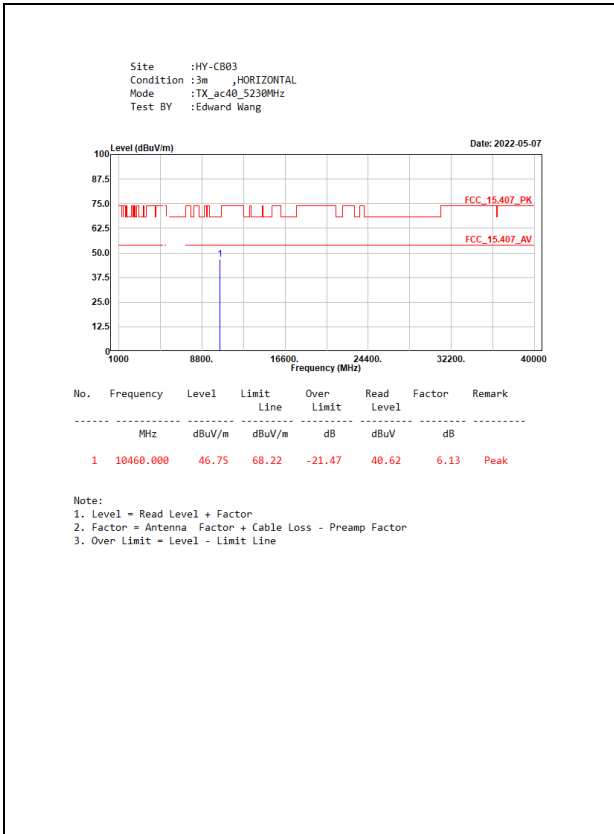


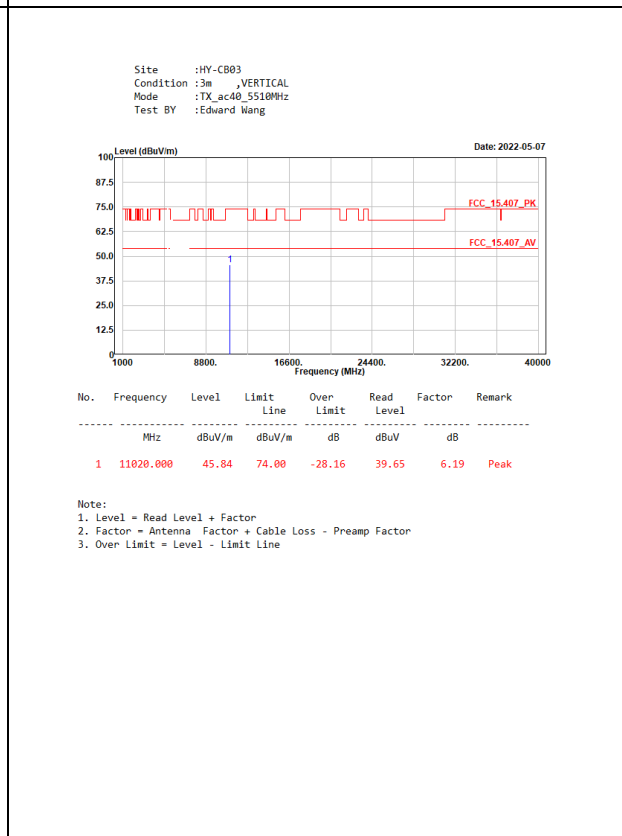
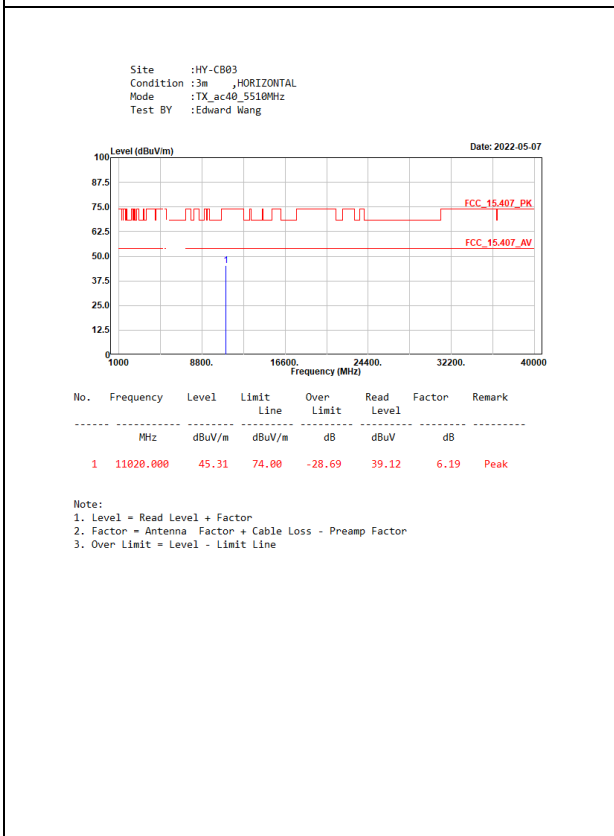
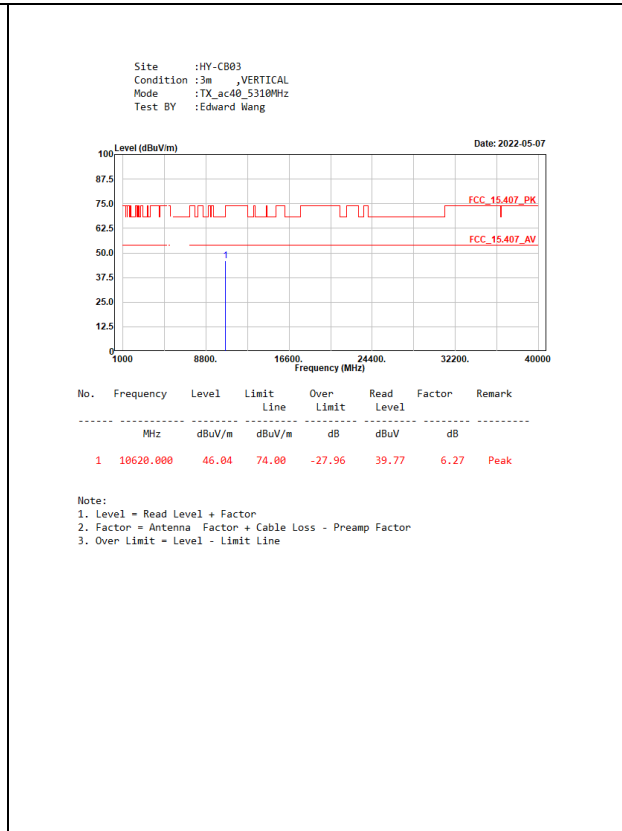
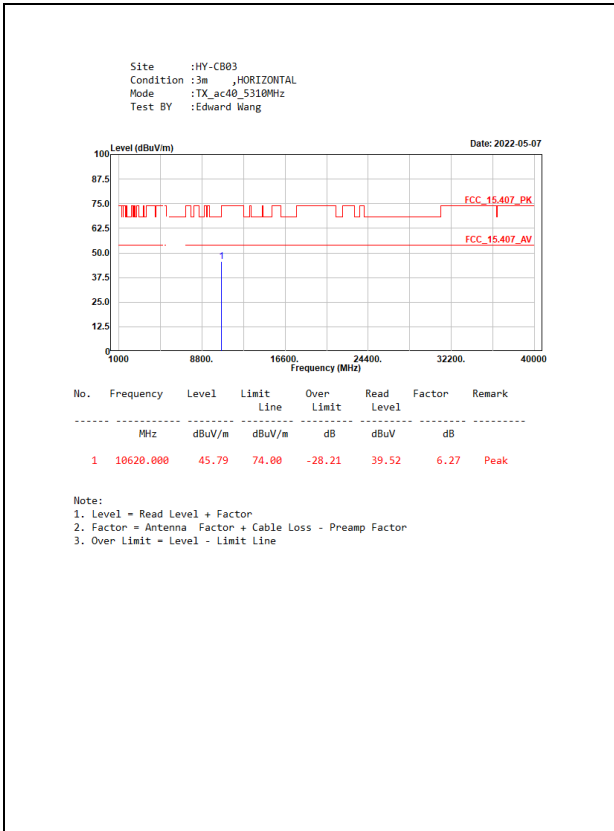


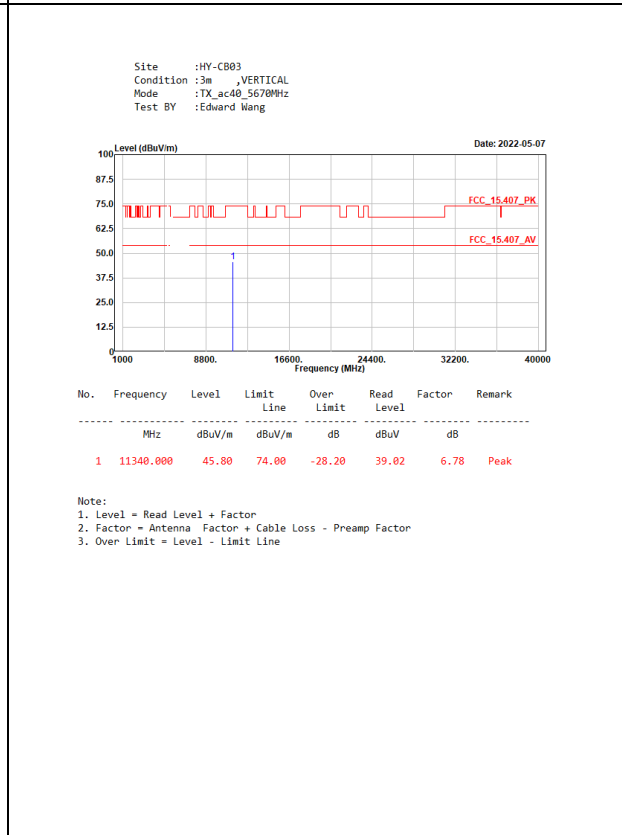
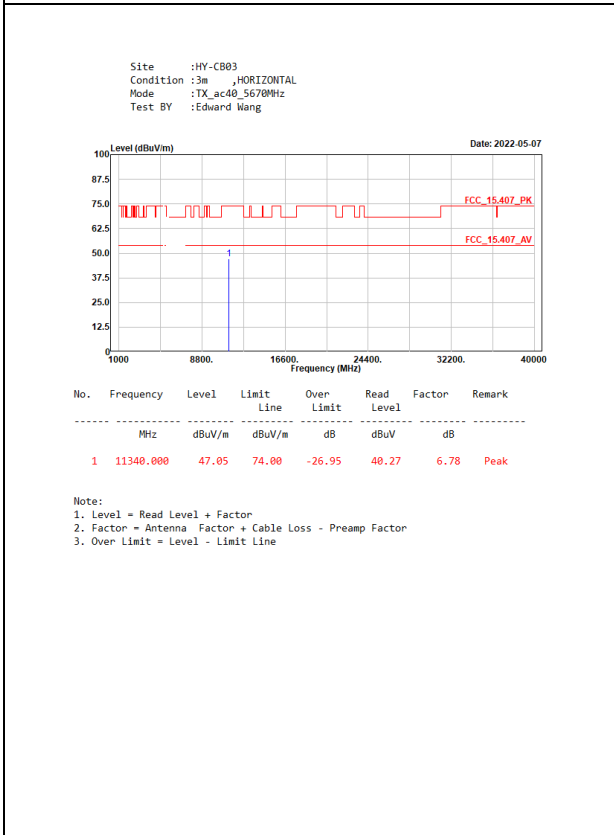
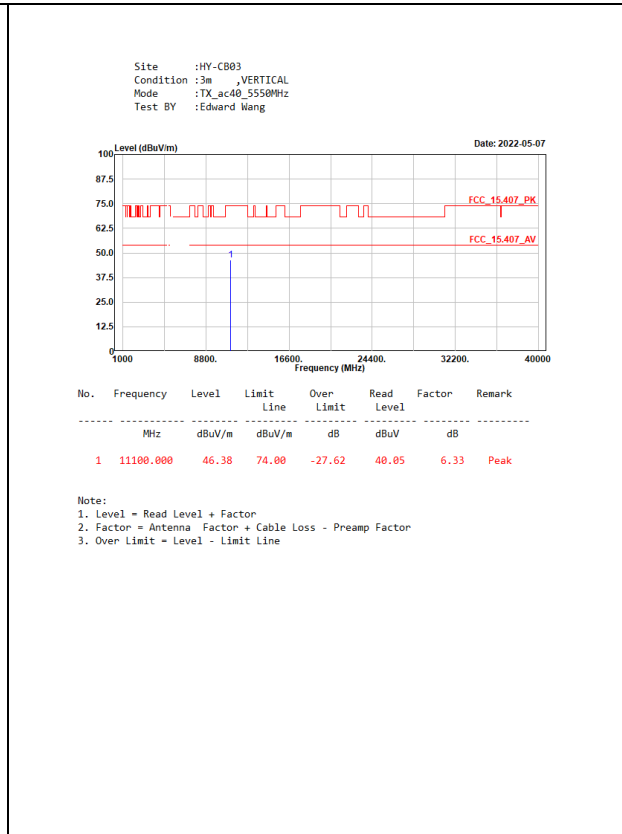
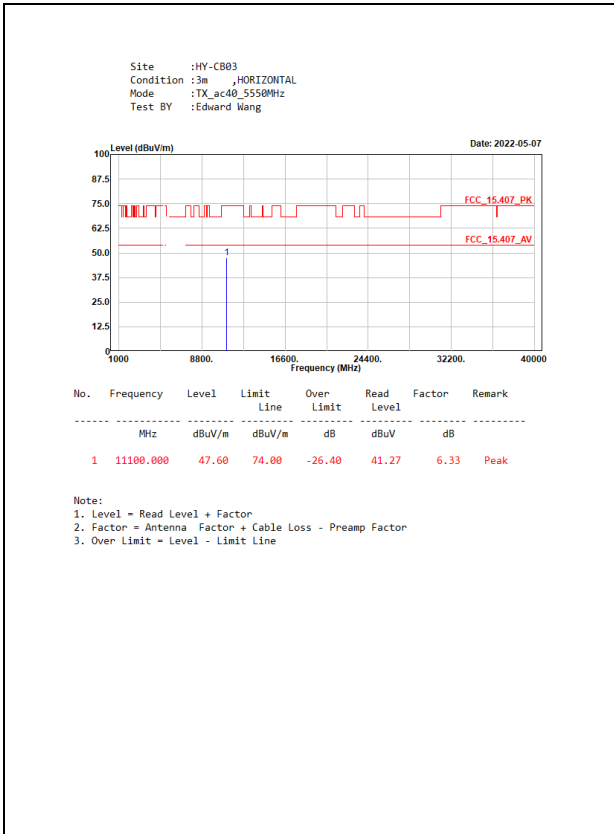


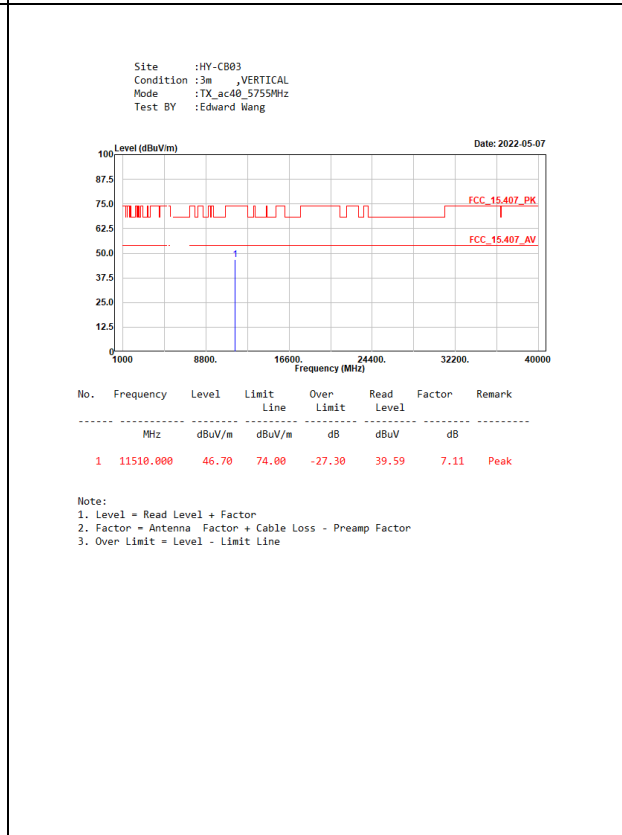
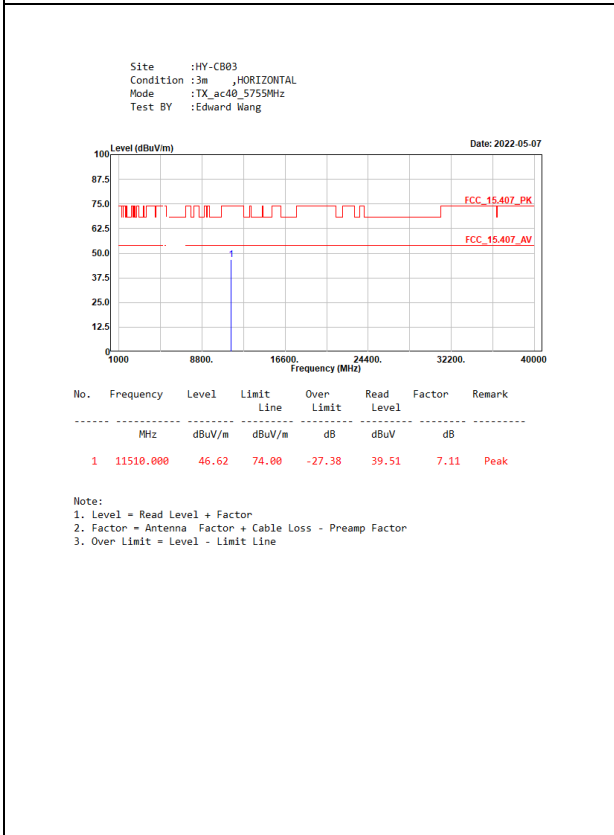
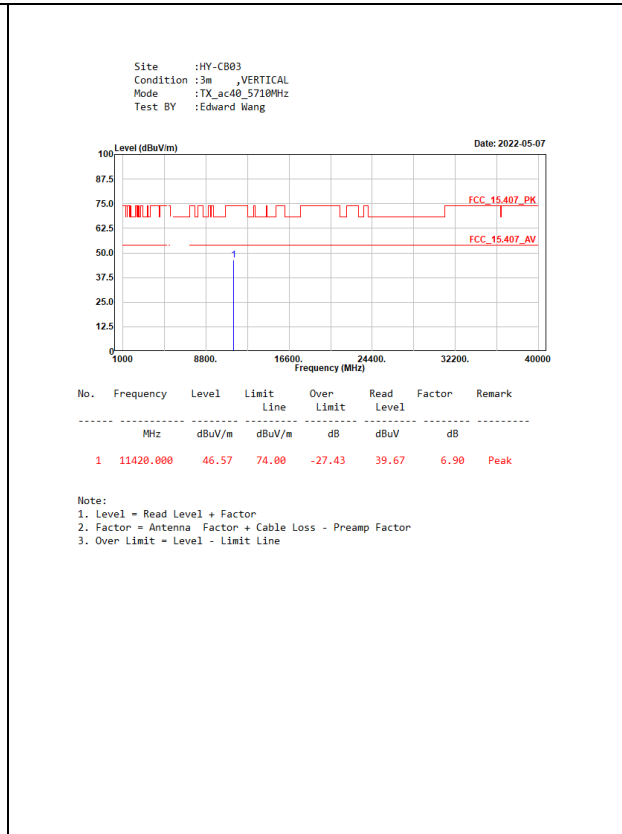
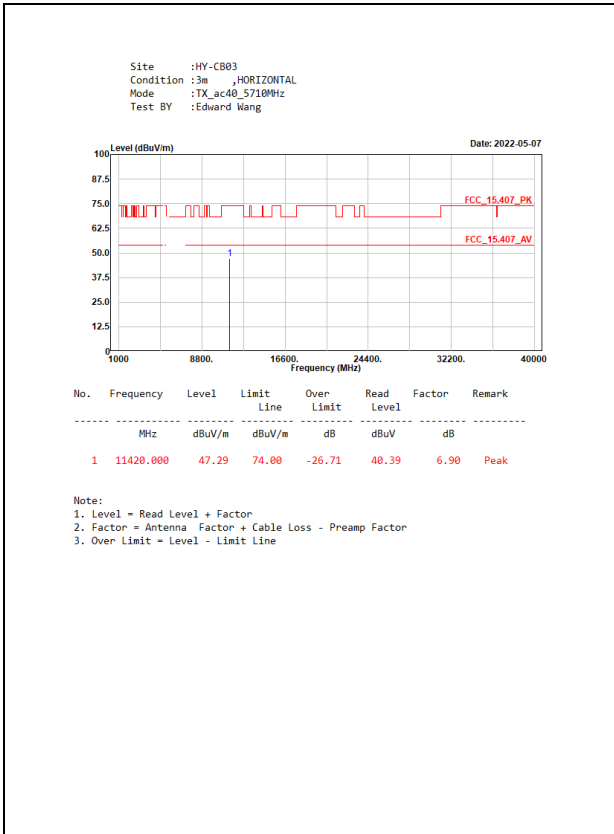


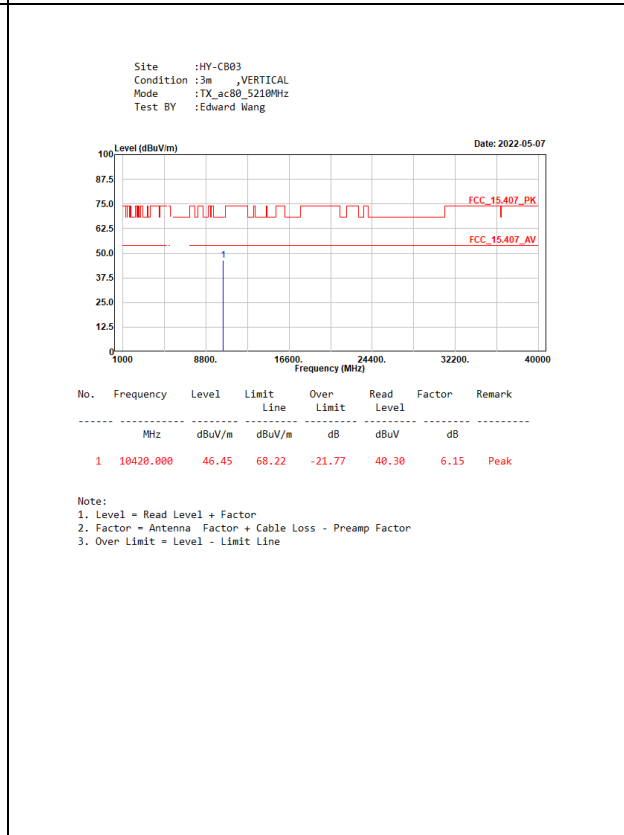
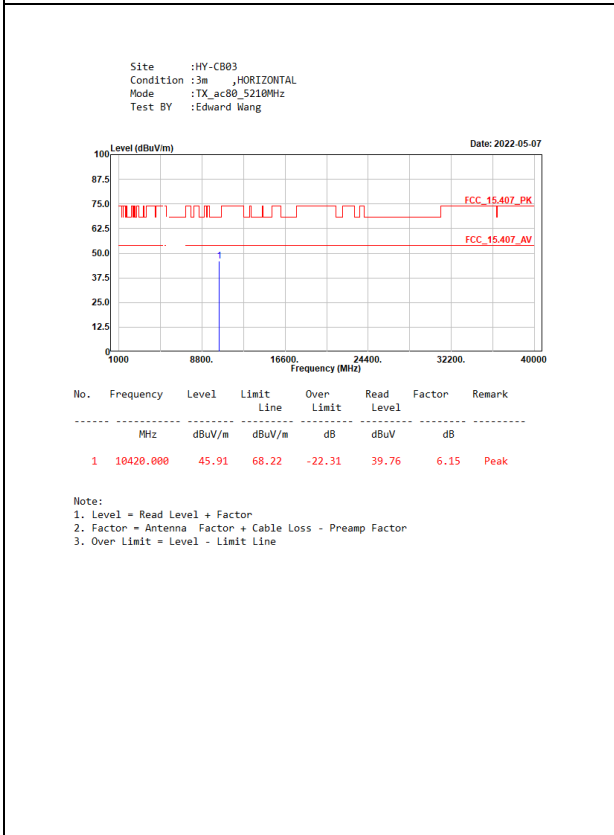
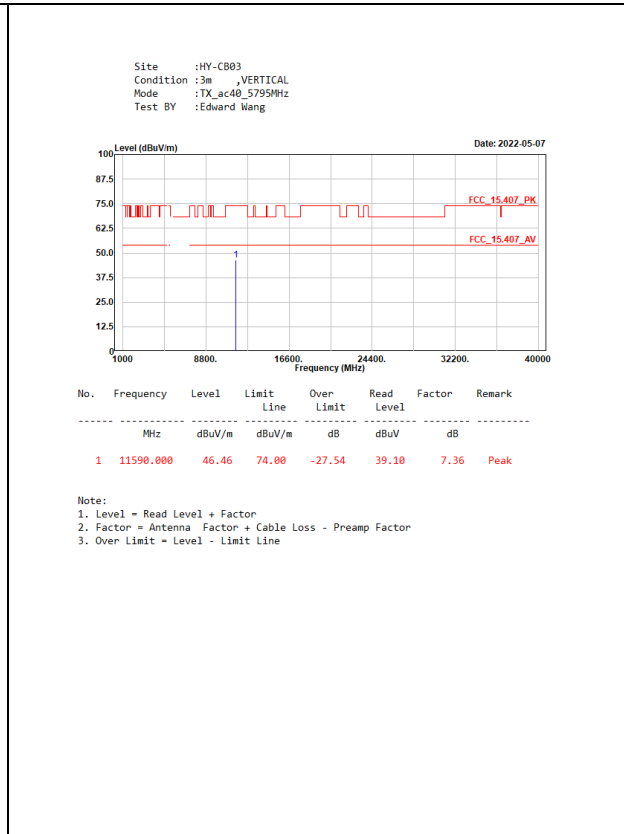
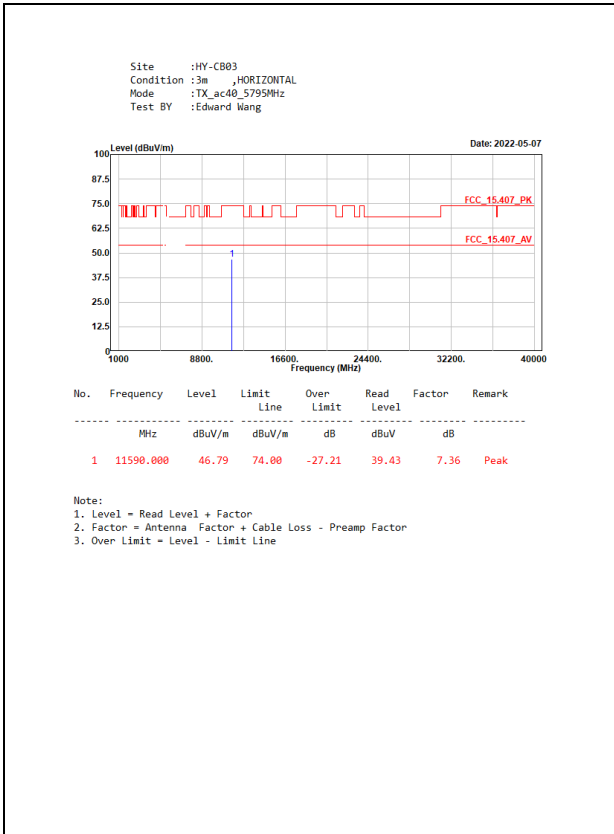


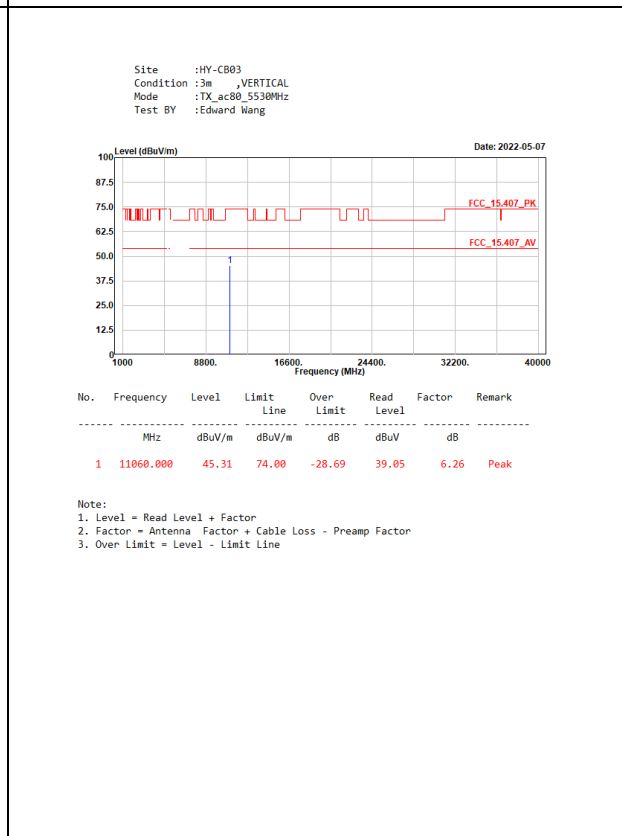
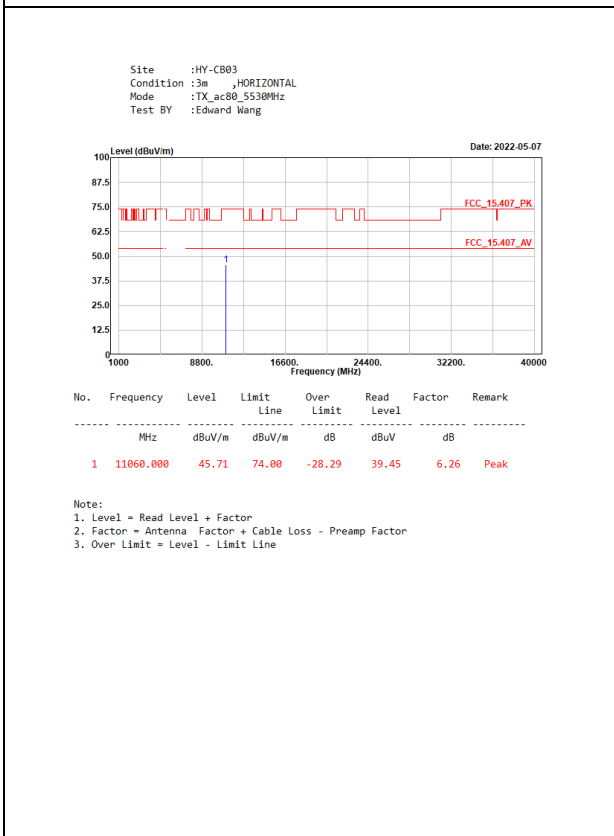
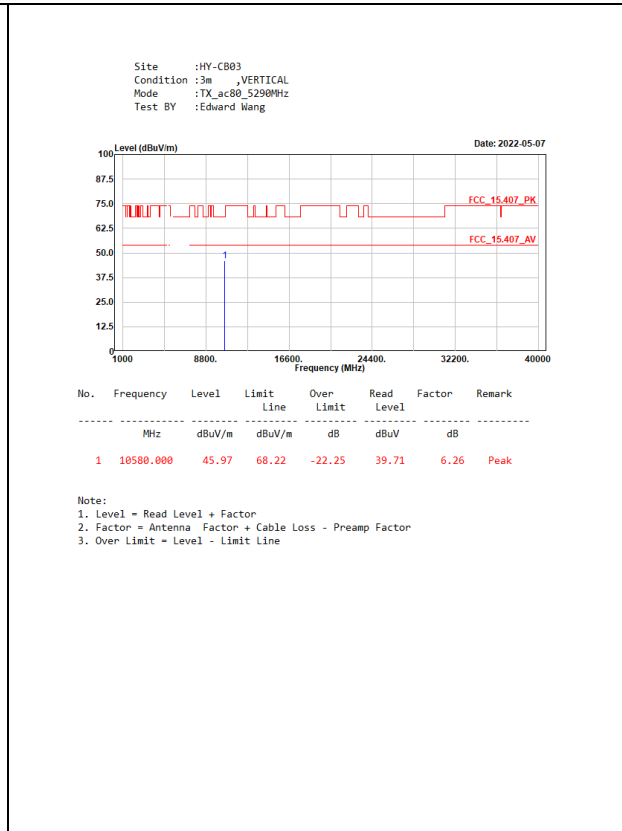
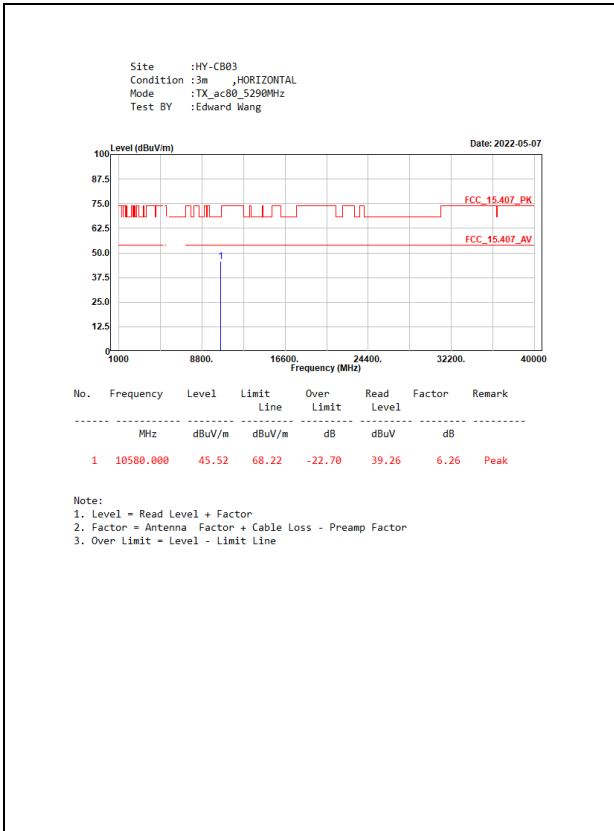


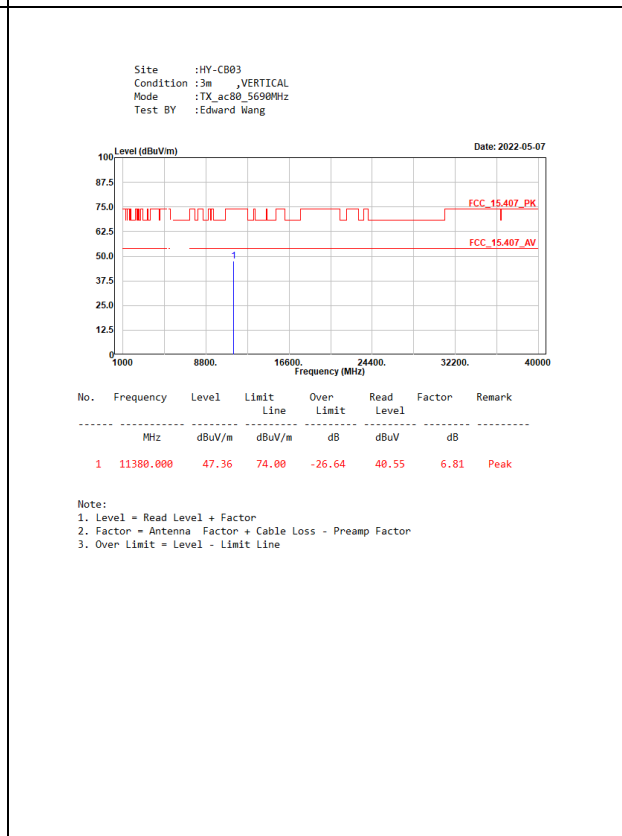
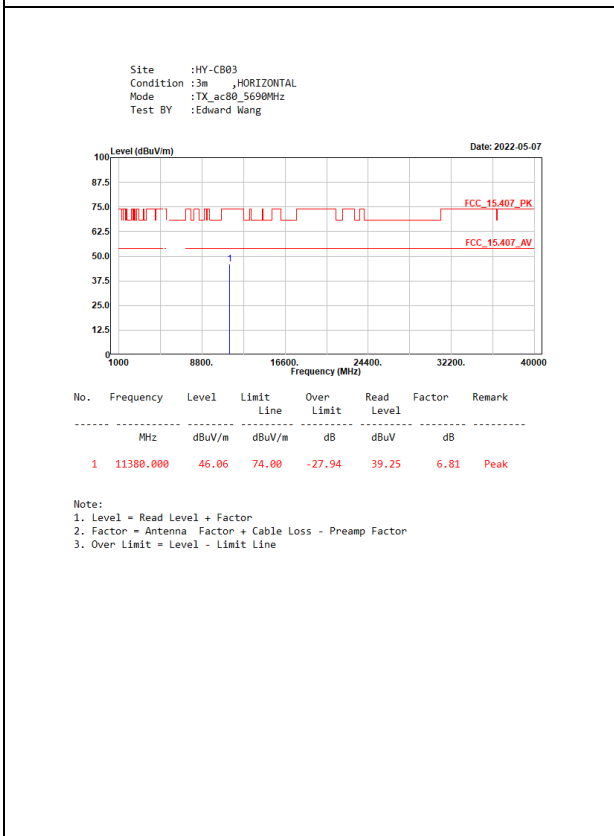
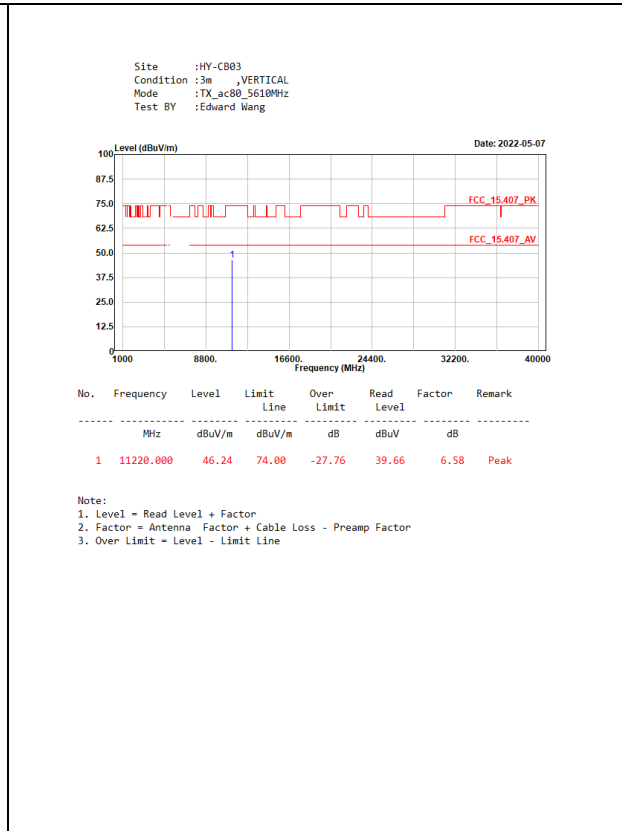
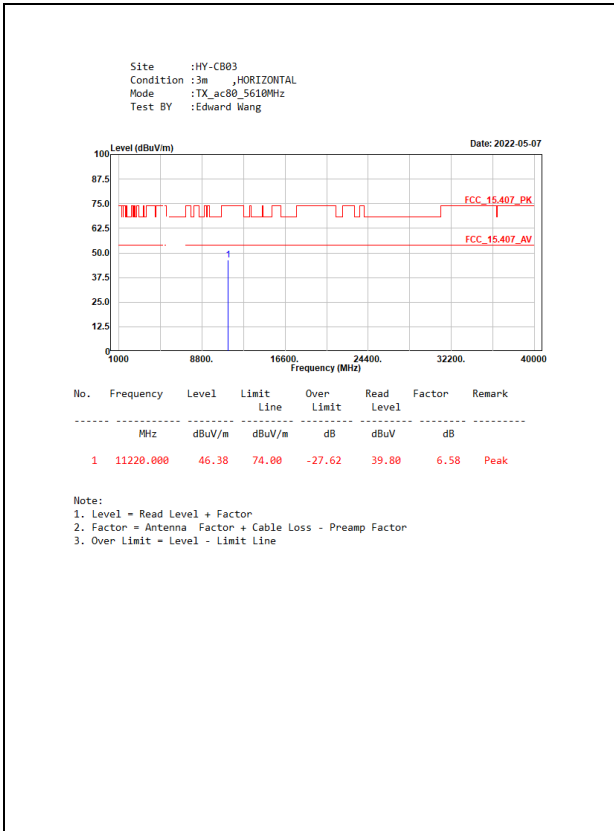


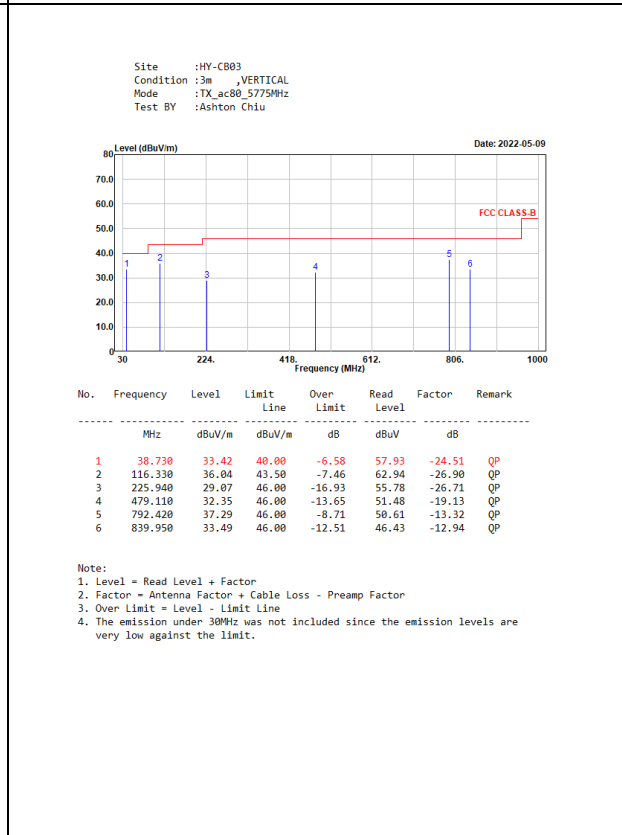
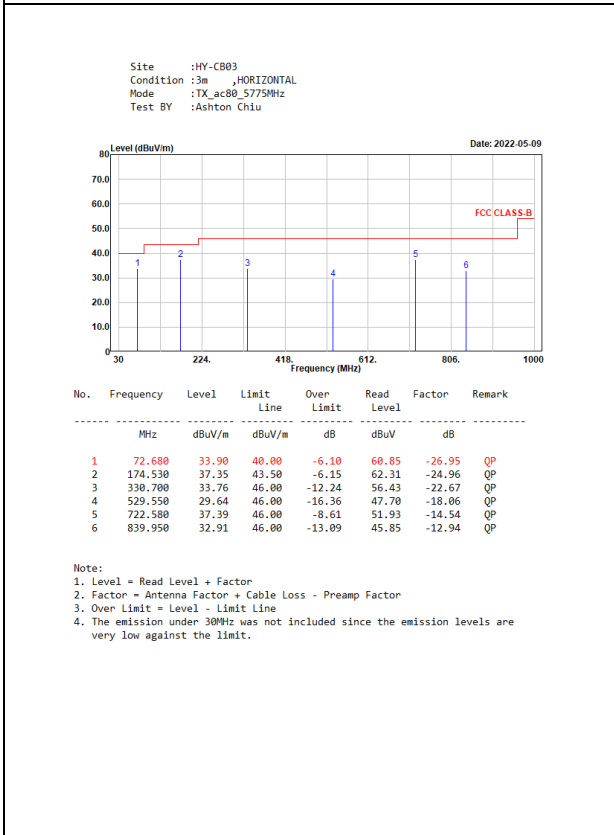
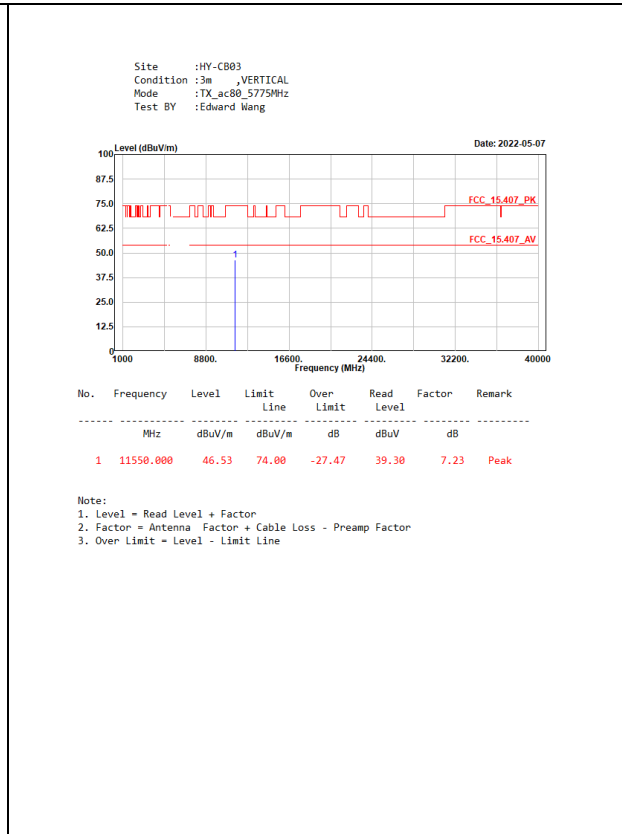
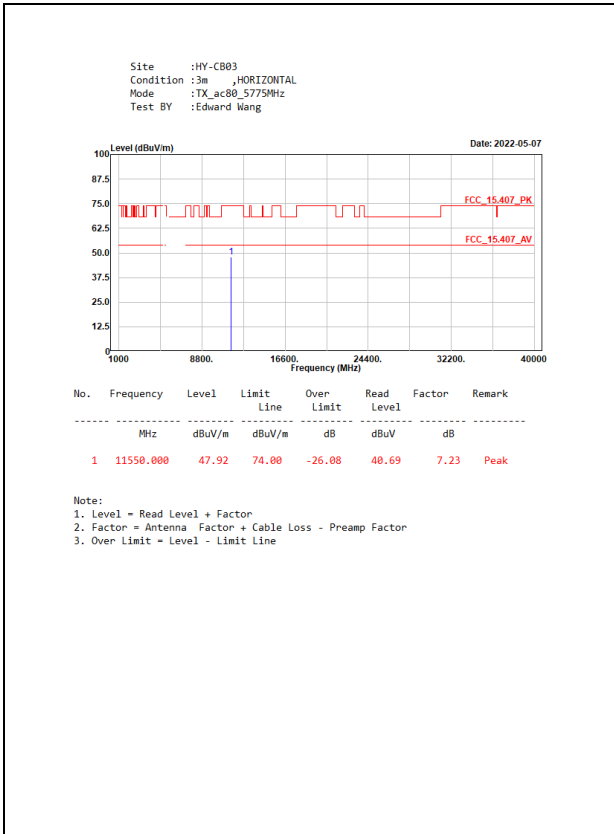




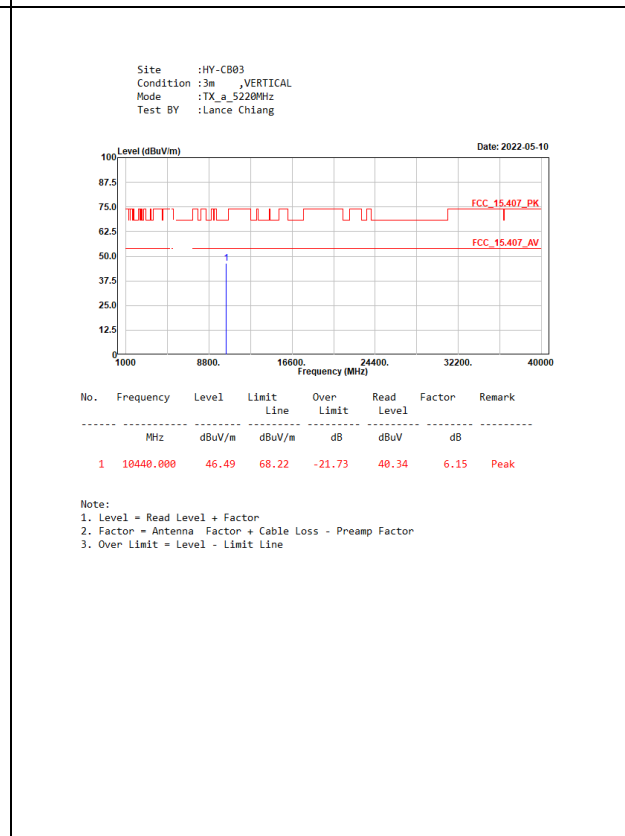
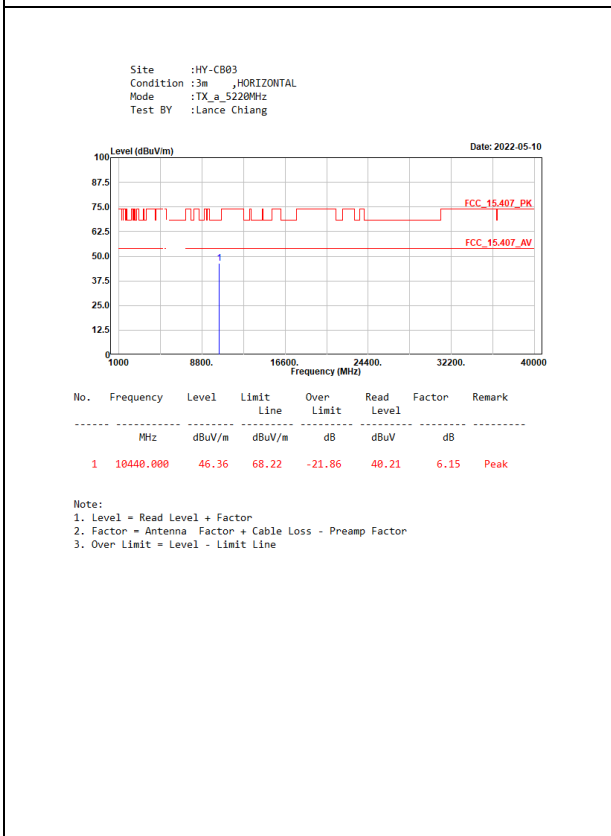
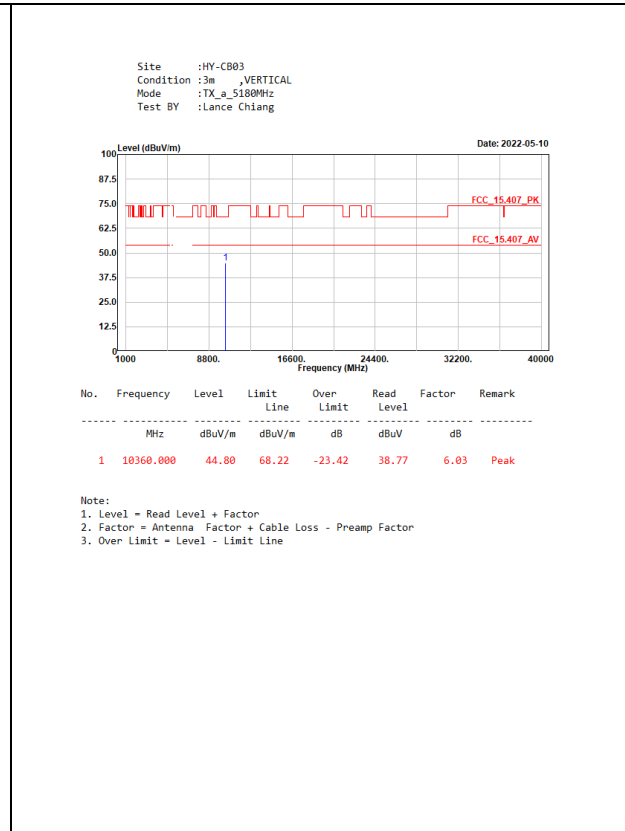
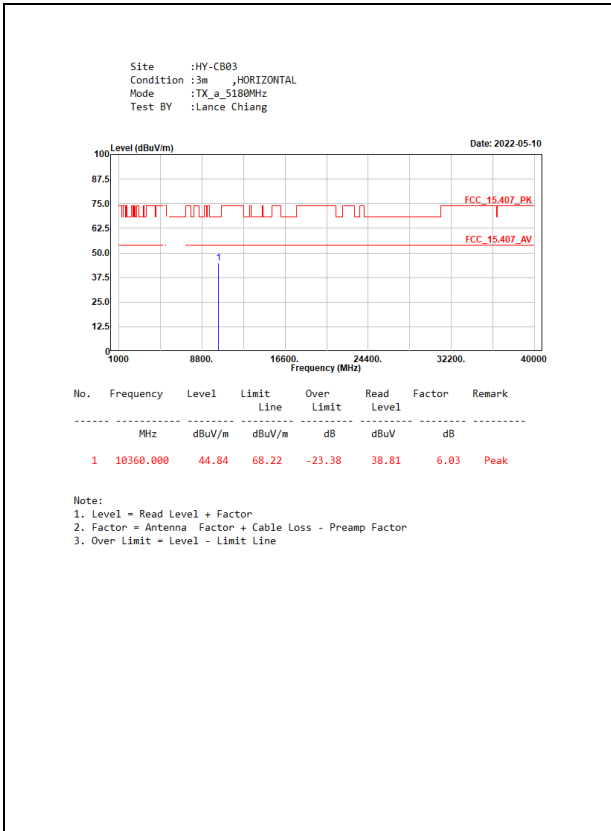


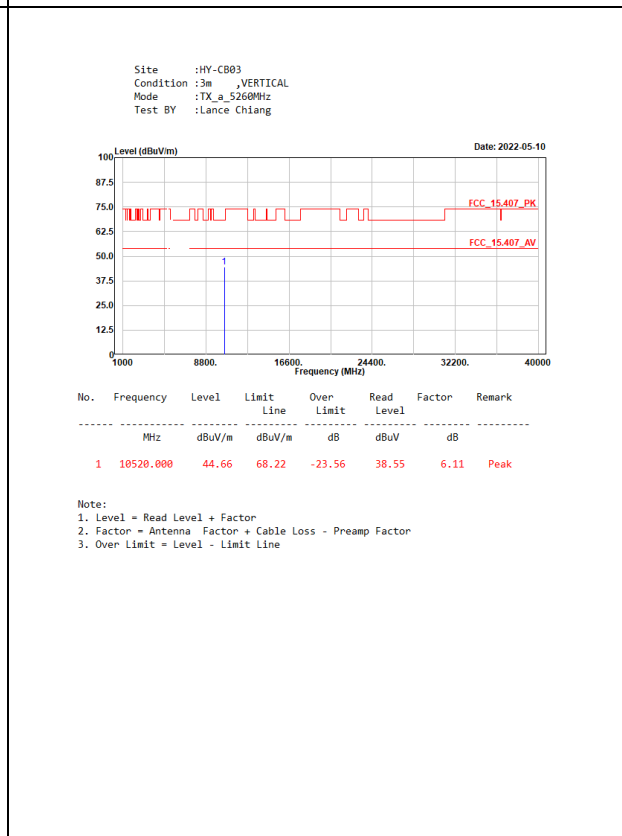
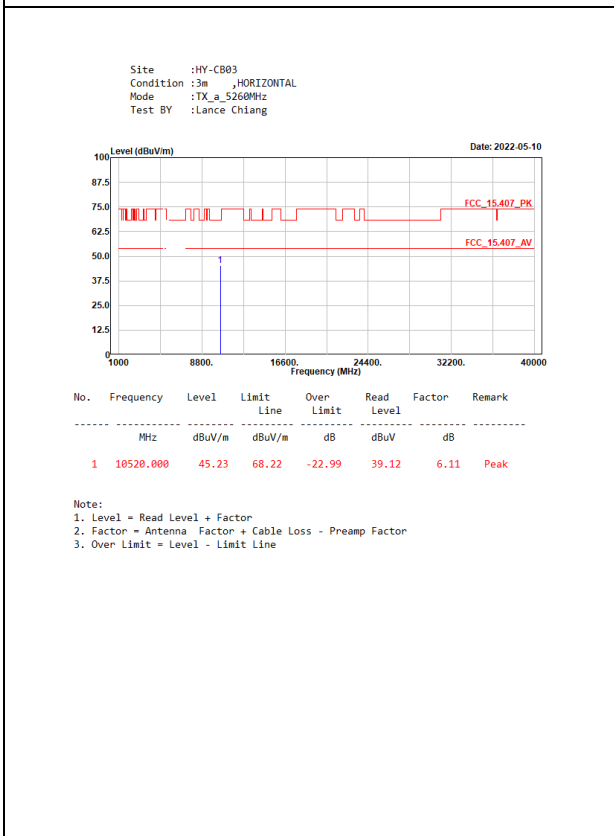
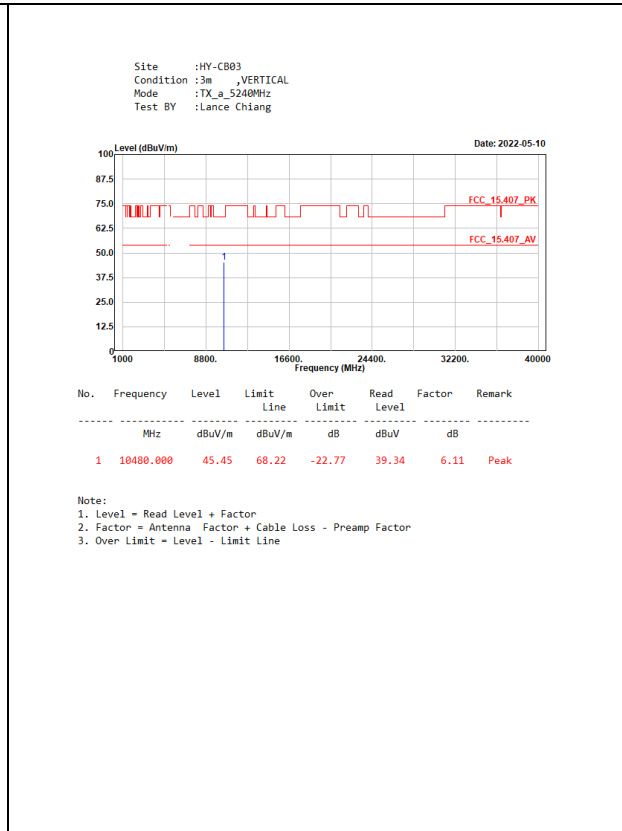
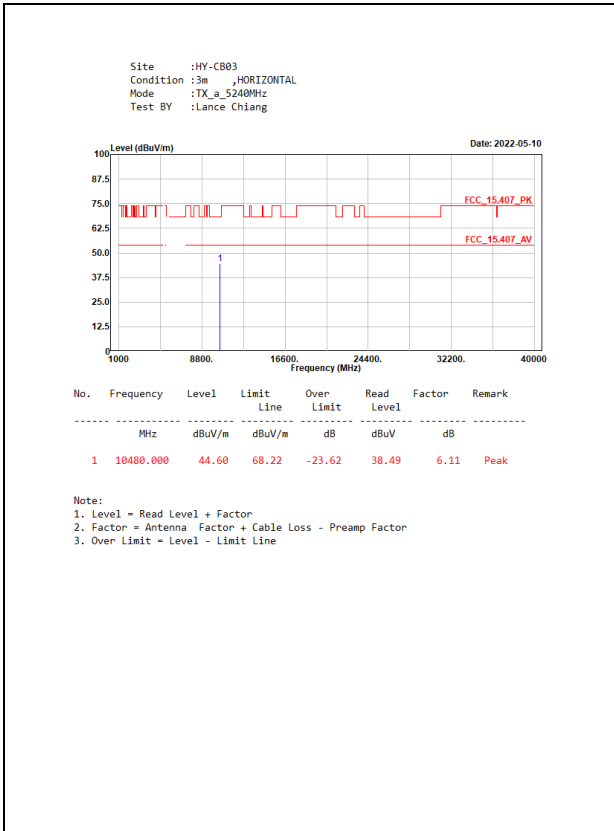


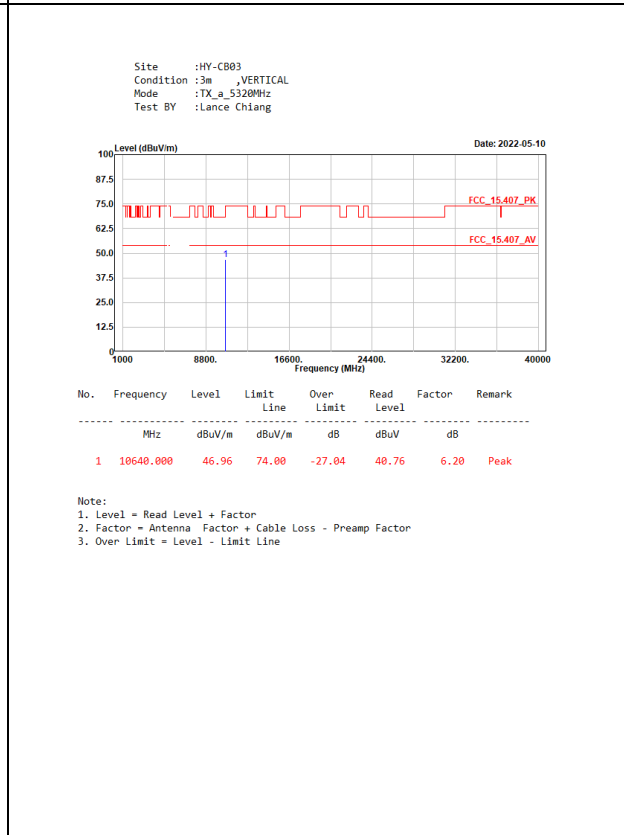
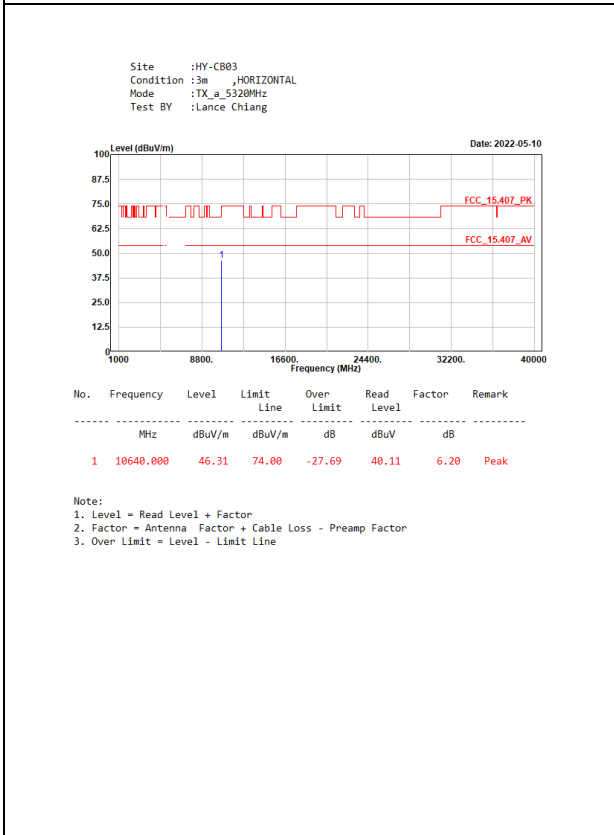
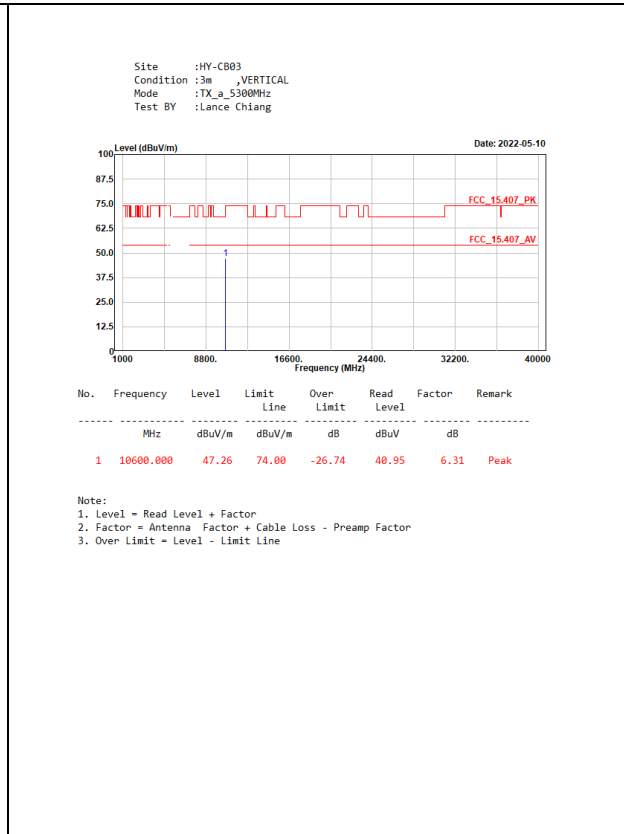
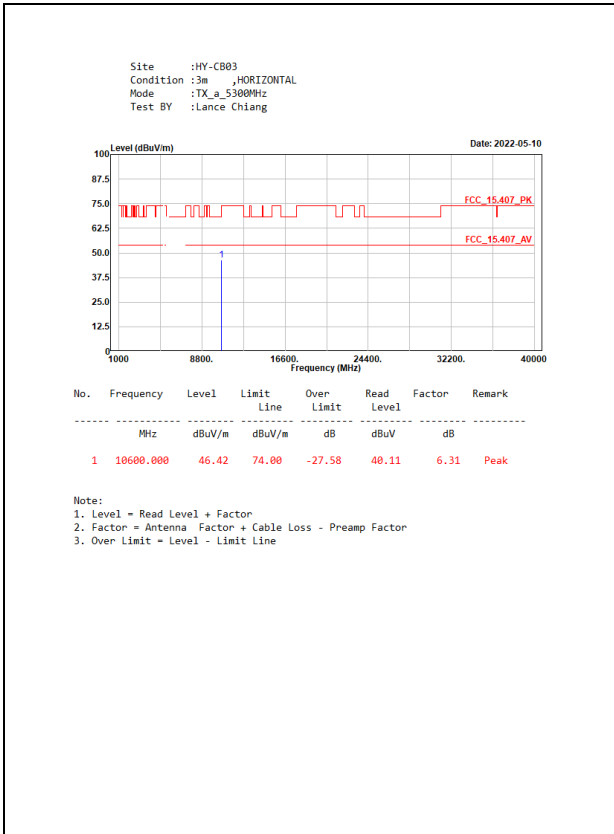


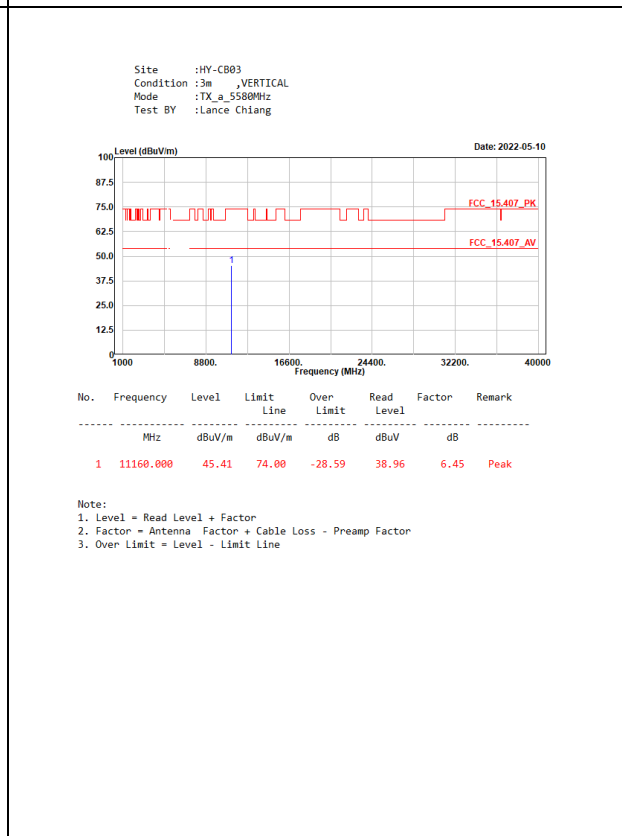
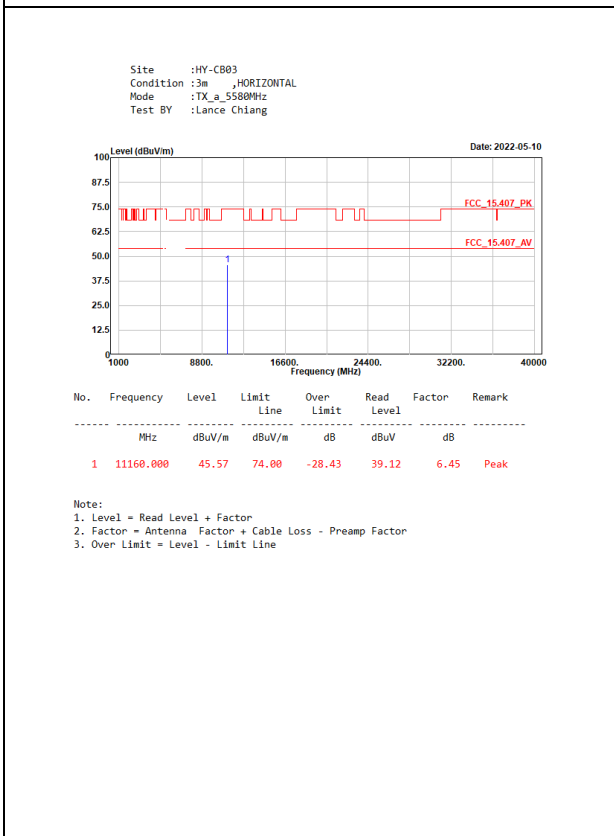
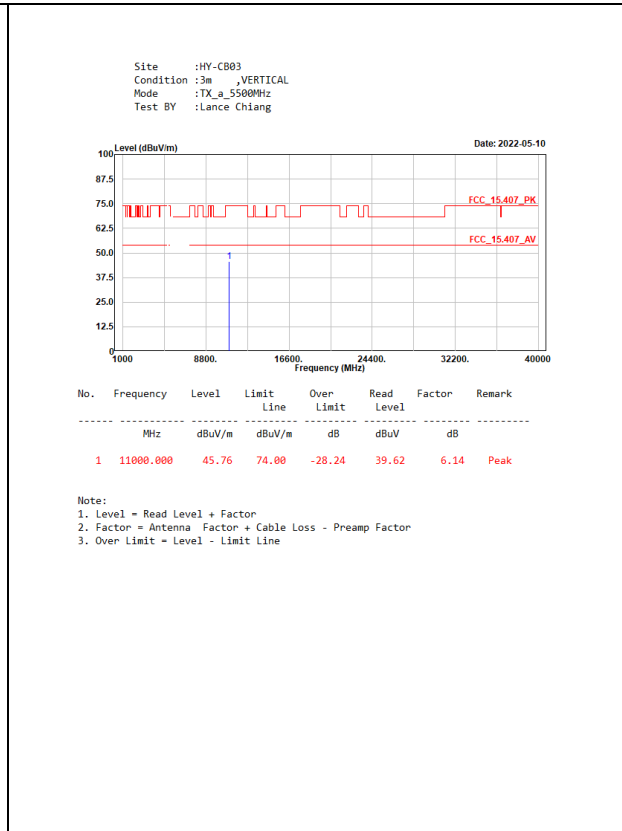
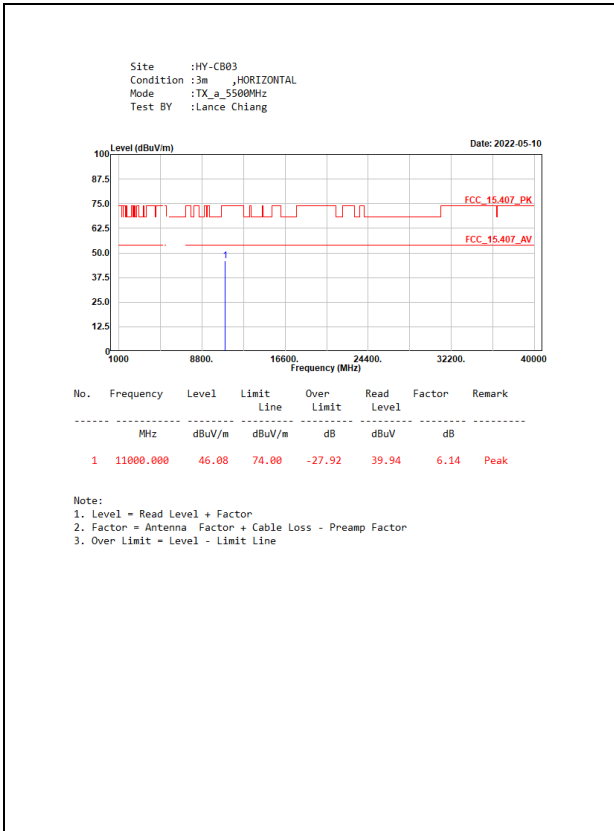


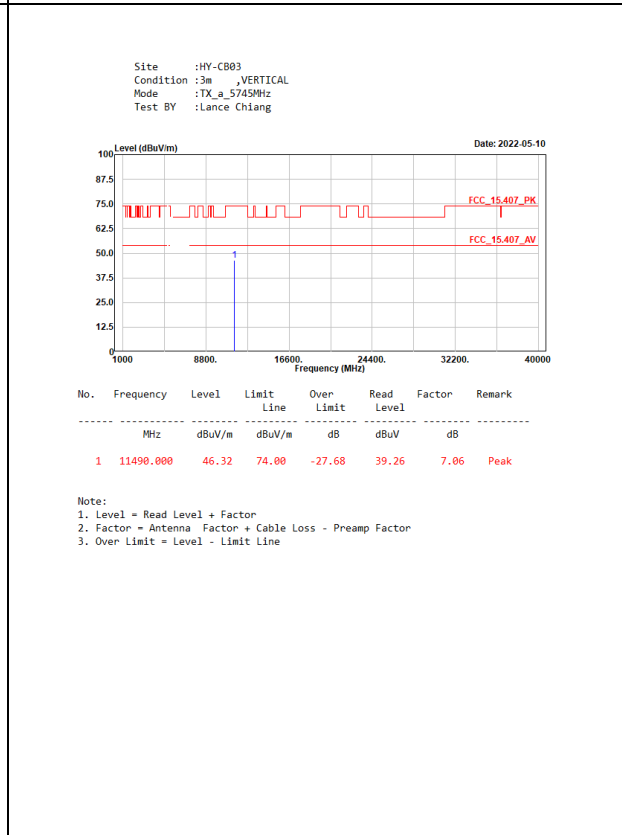
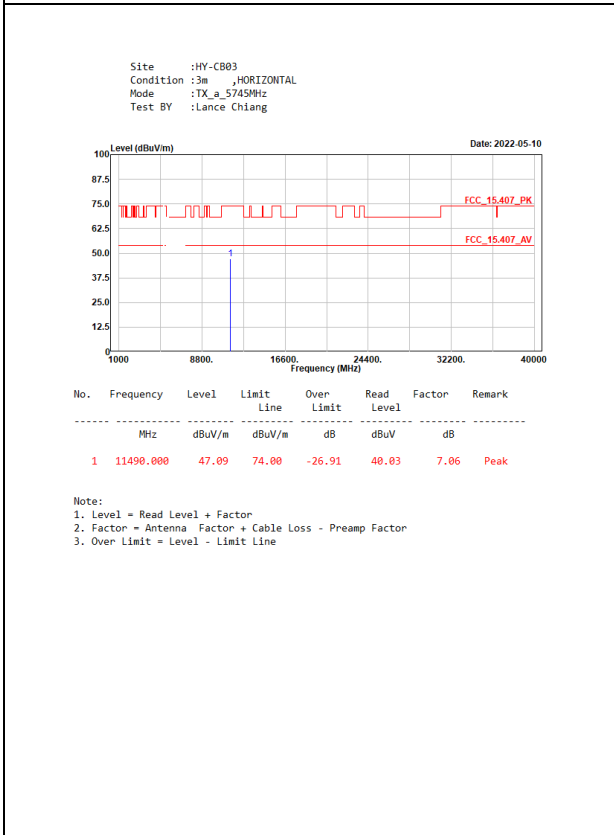
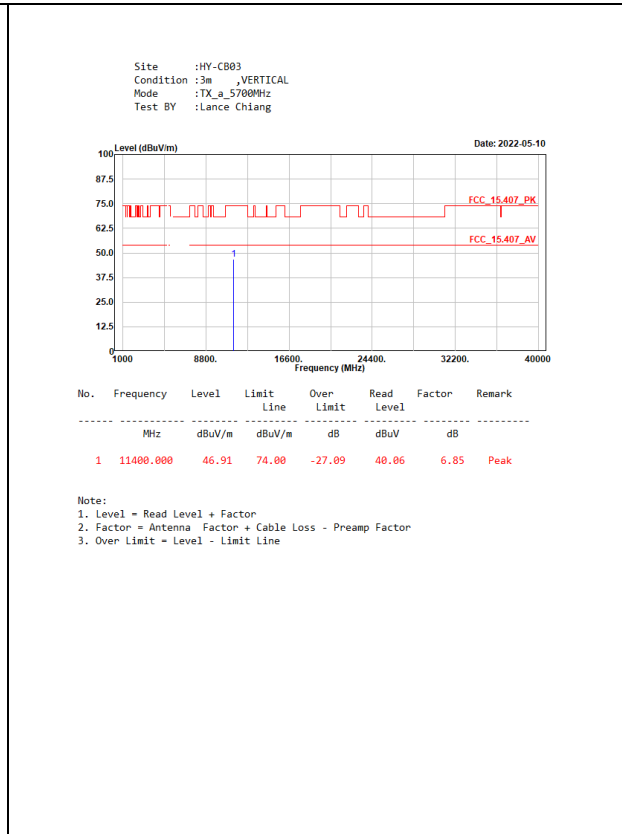
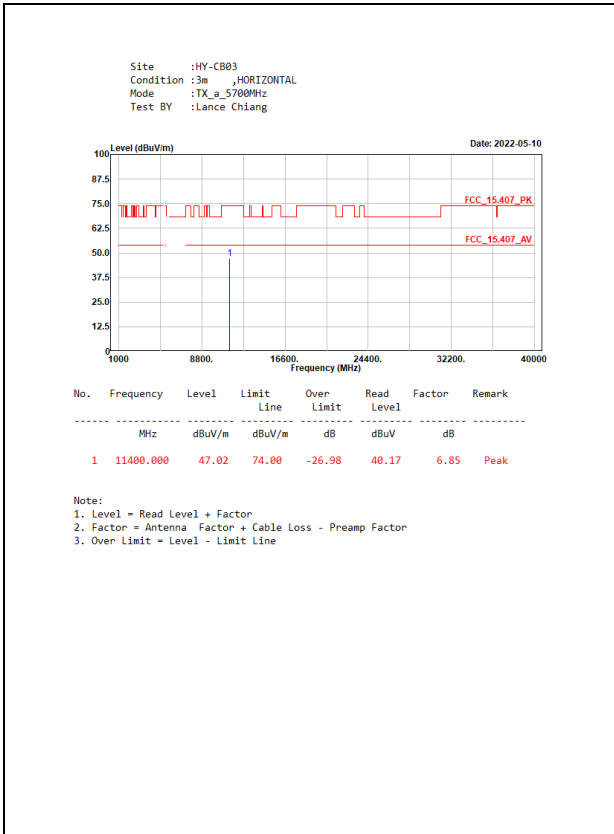
Panel_SISO A

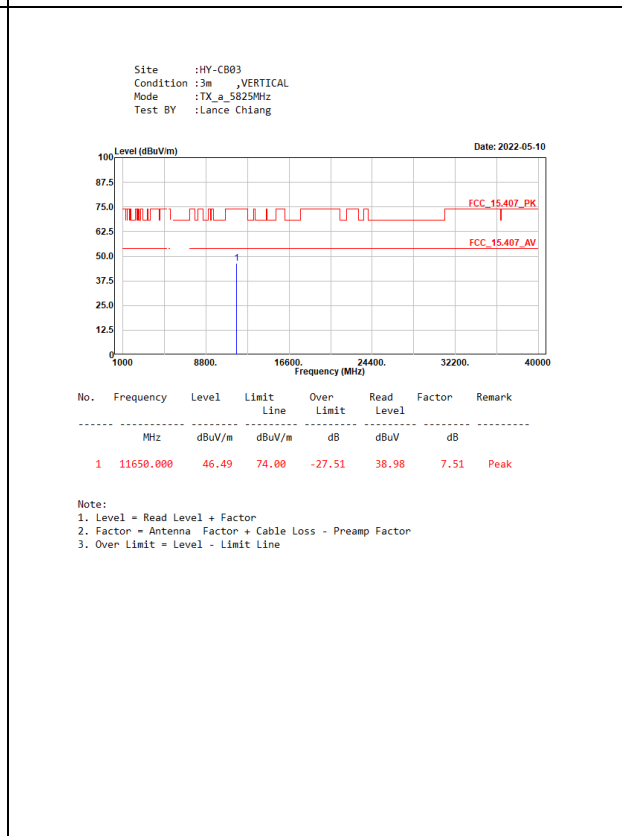
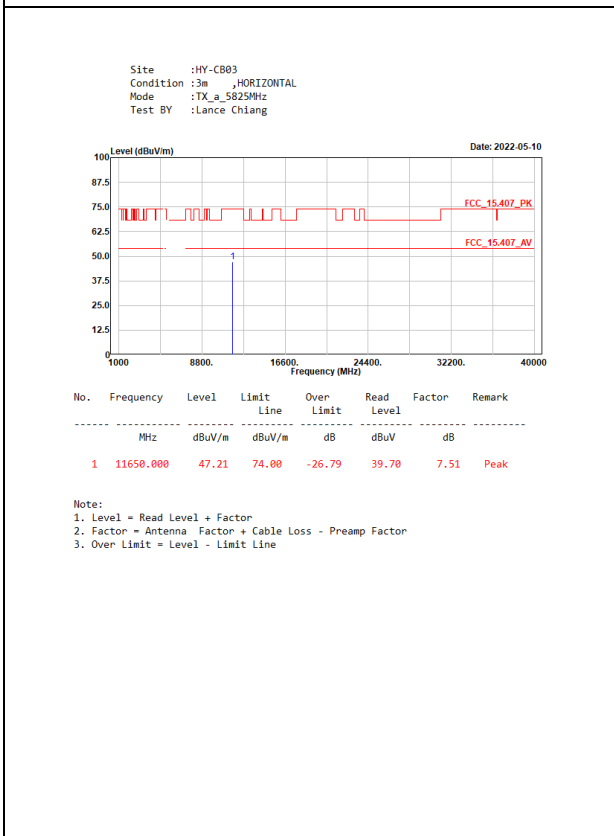
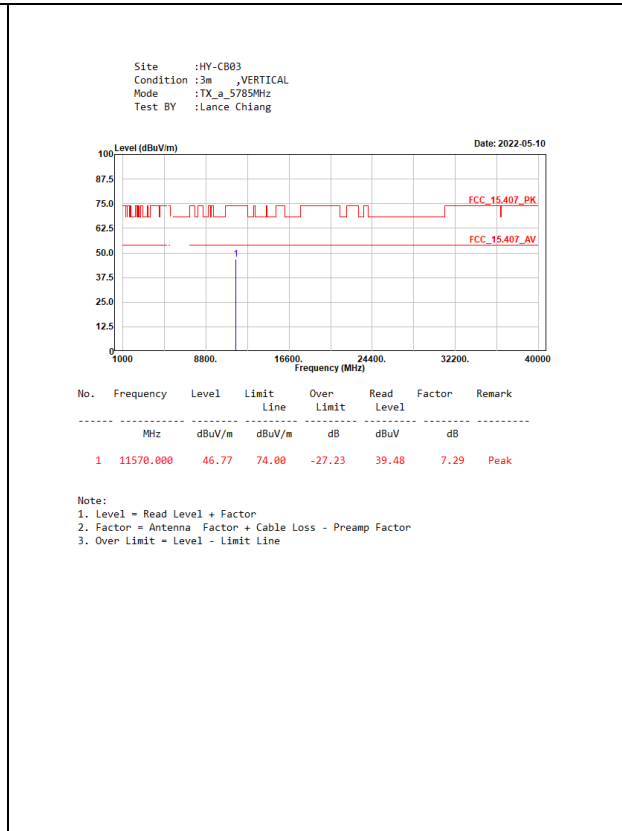
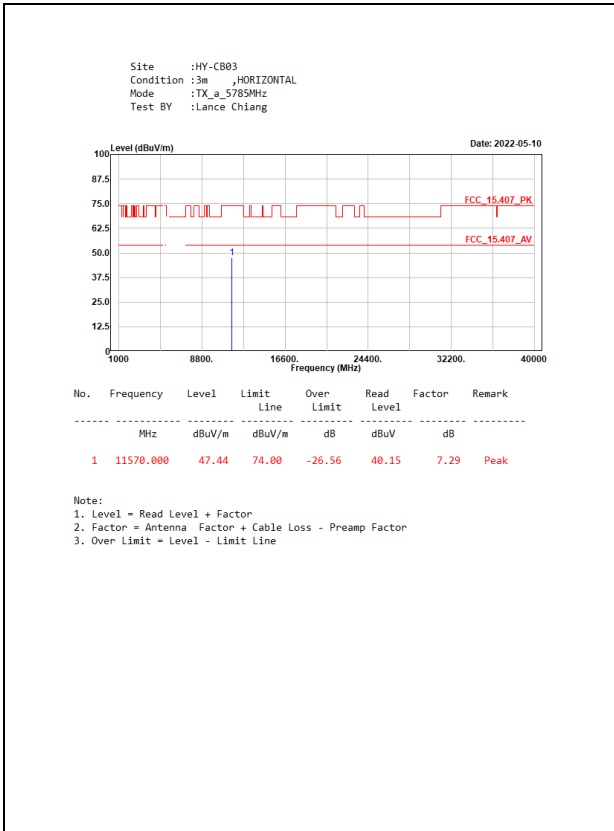




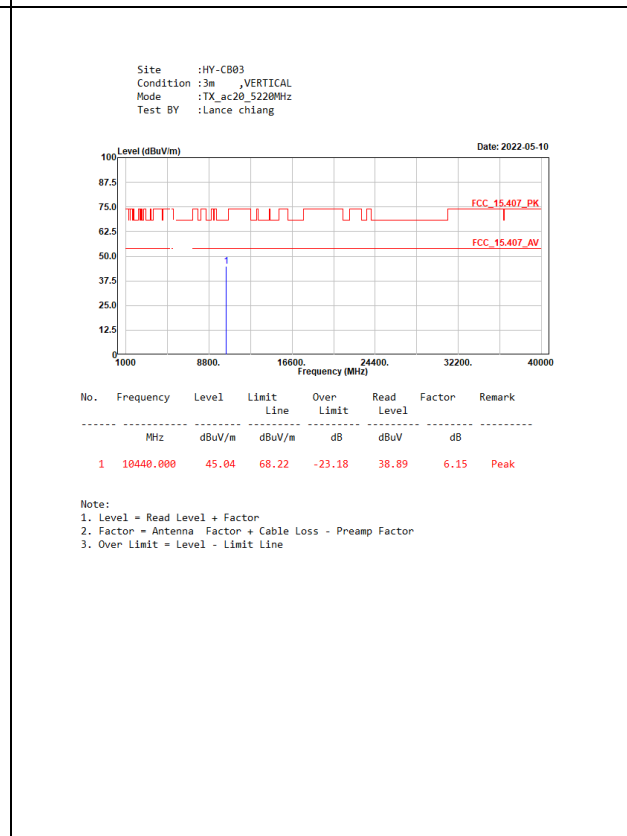
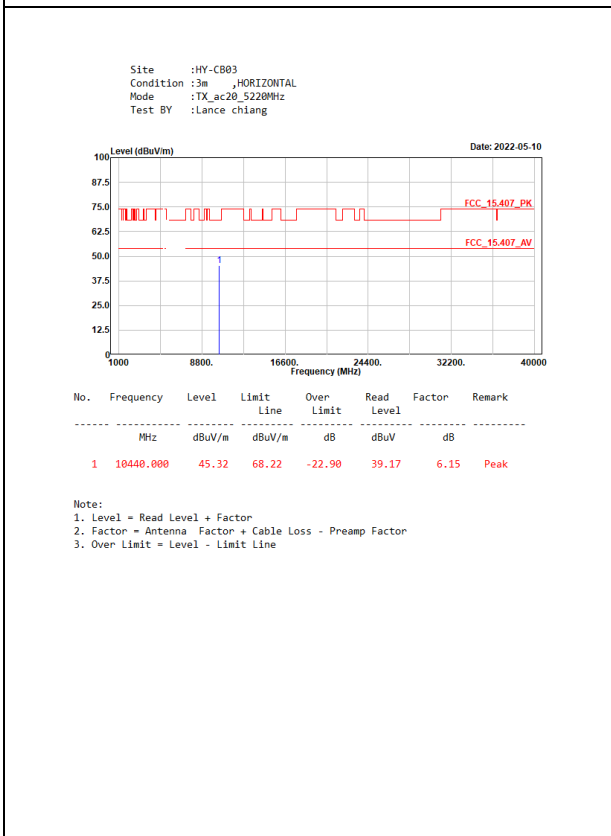
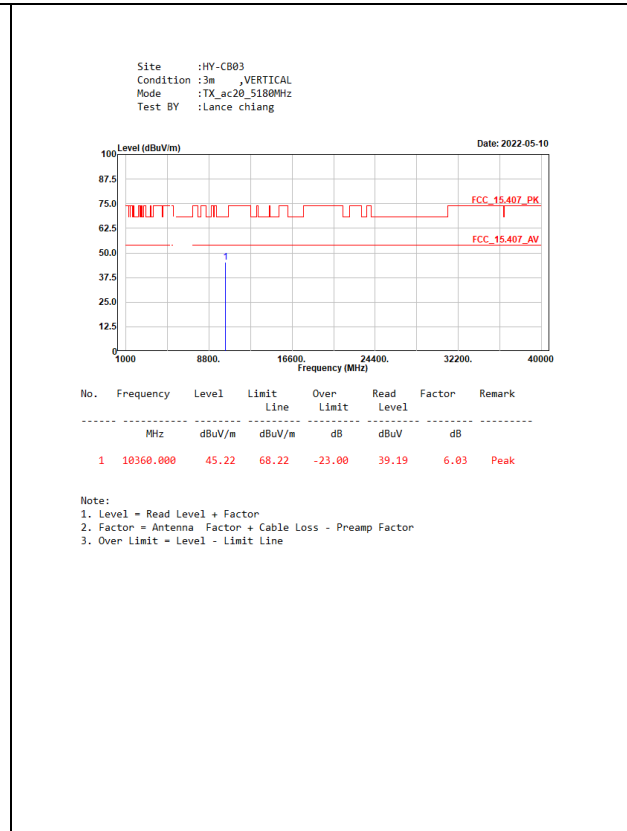
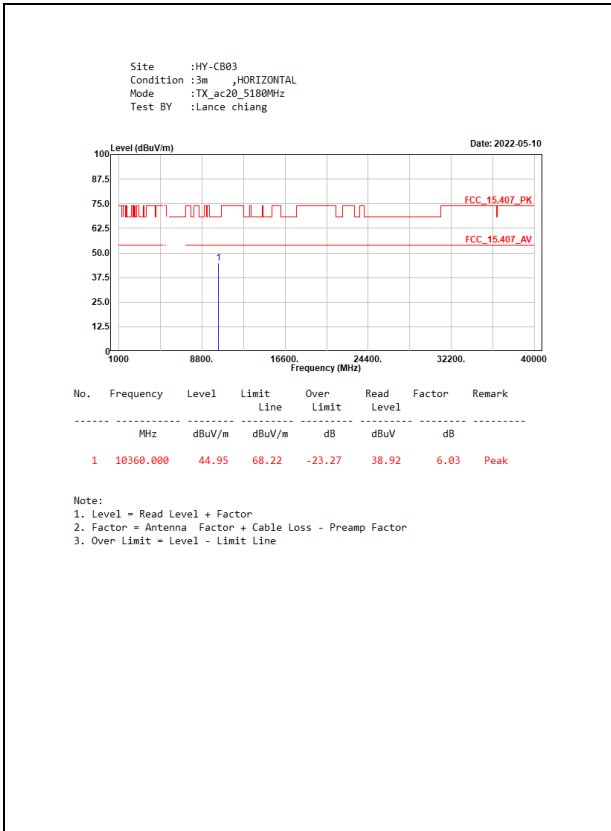


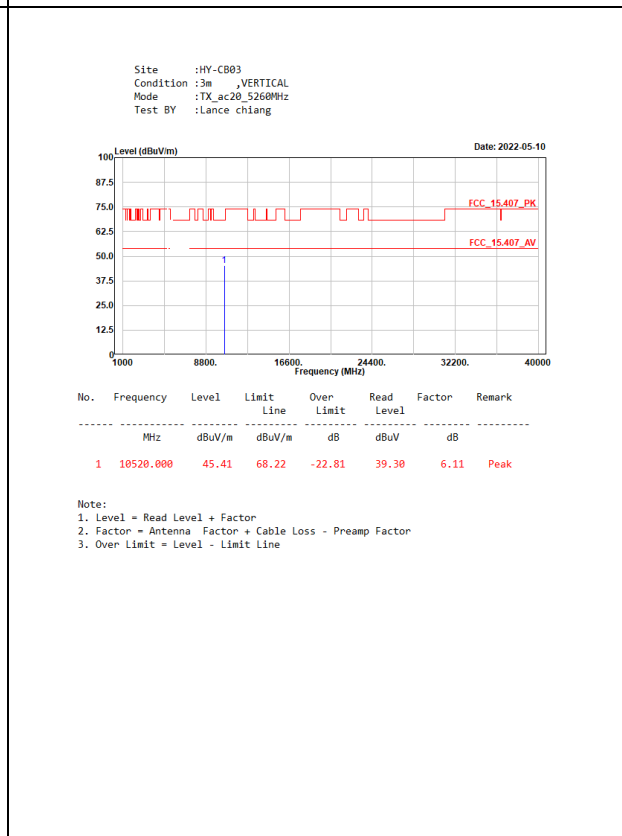
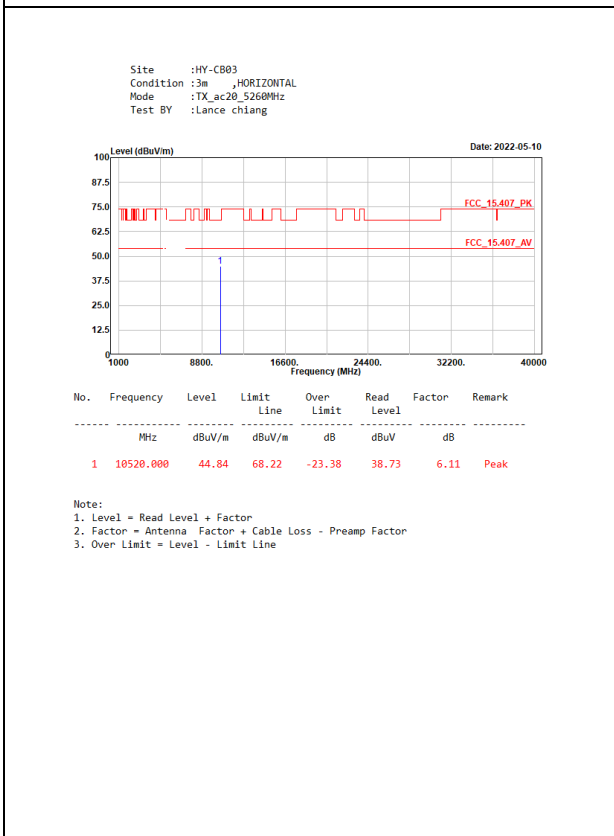
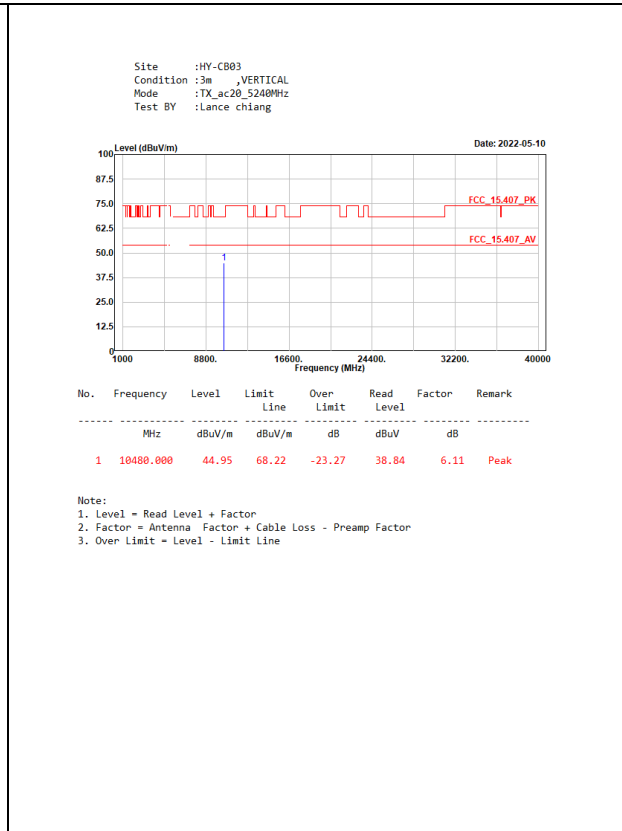
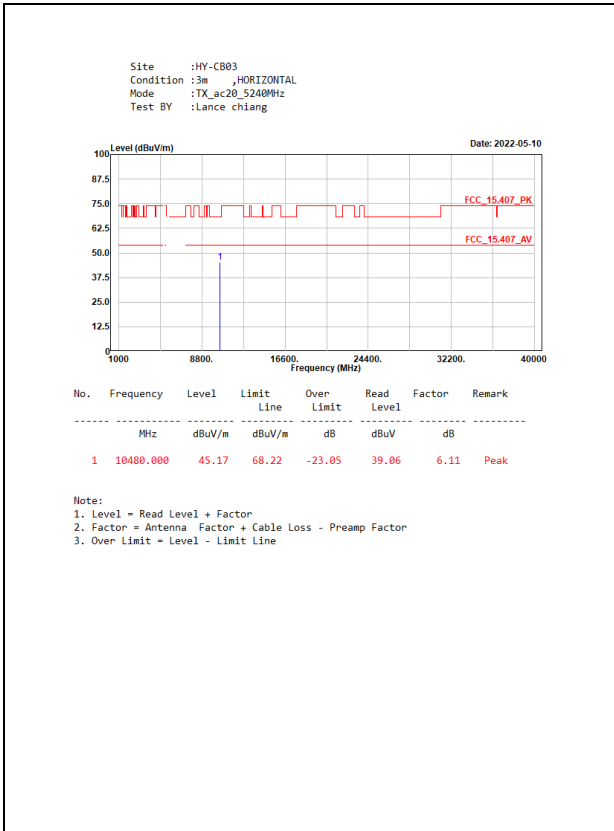


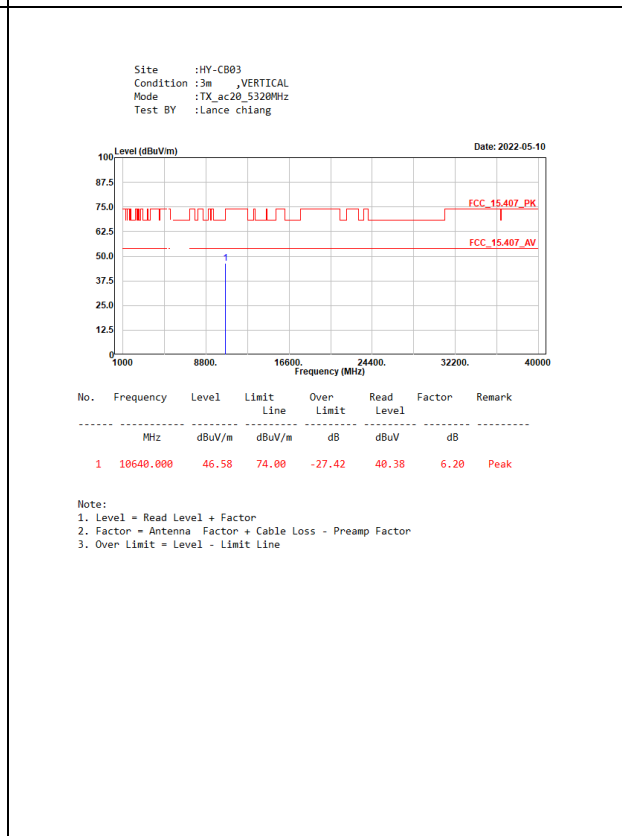
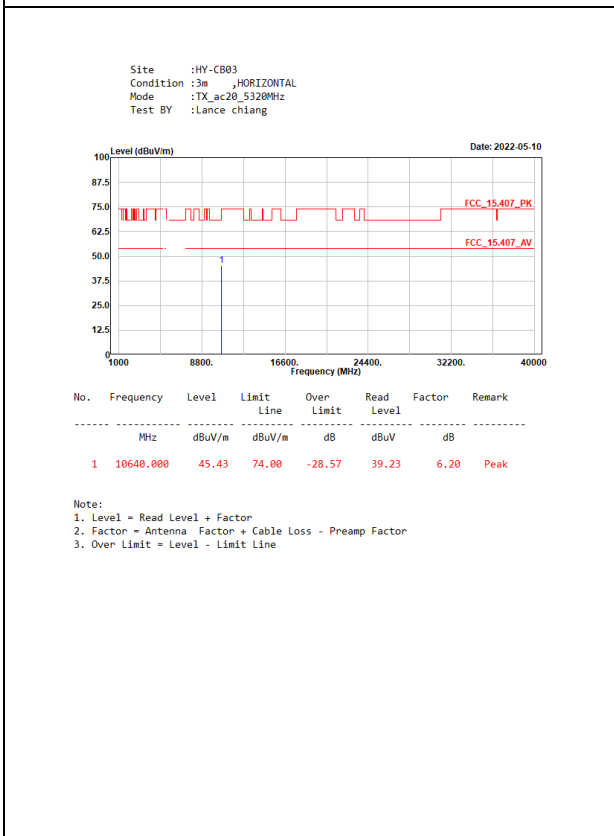
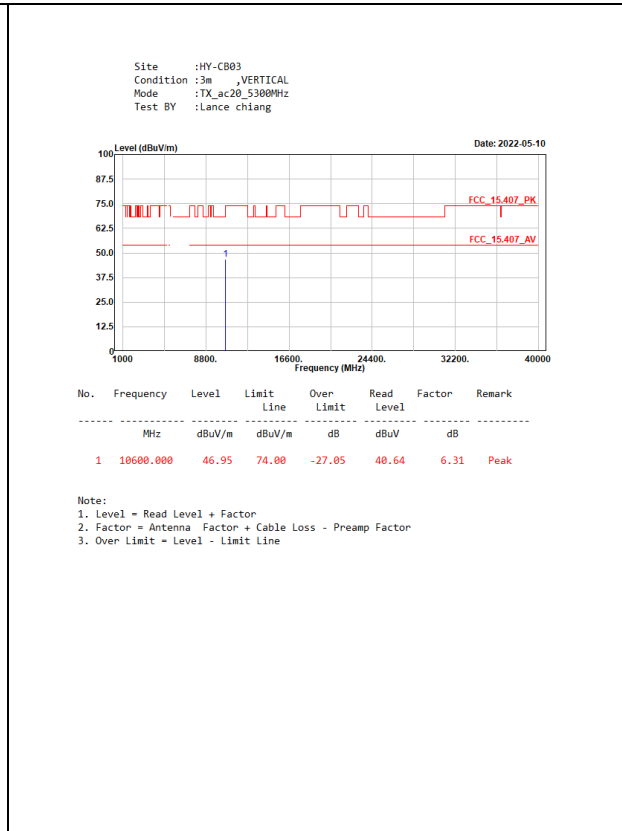
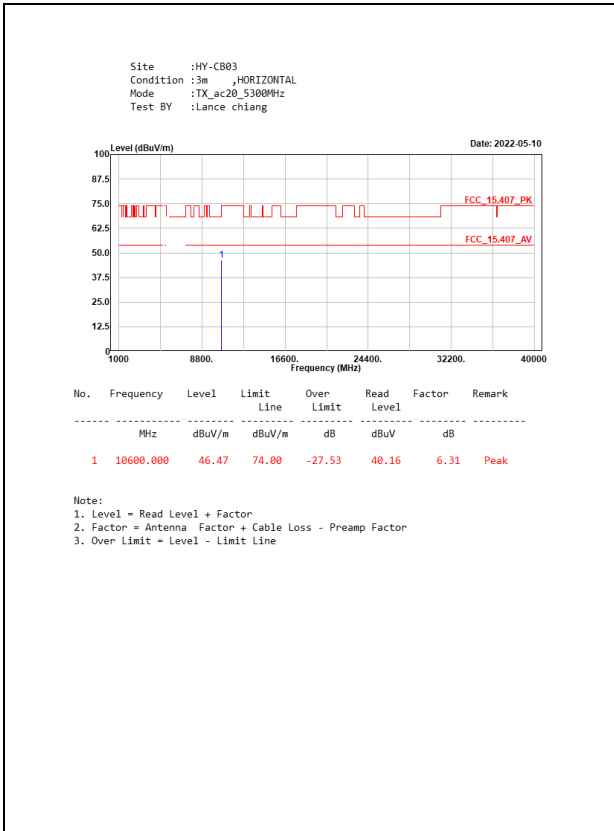


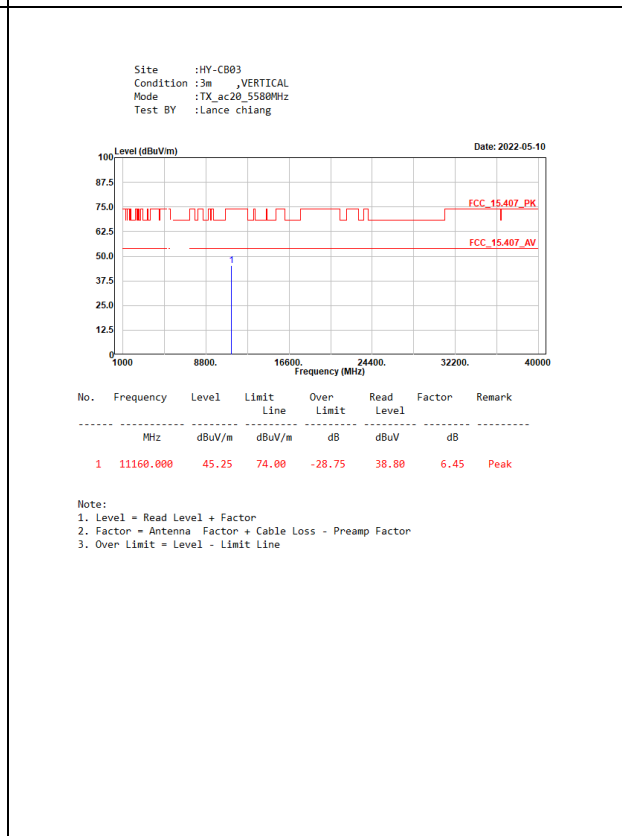
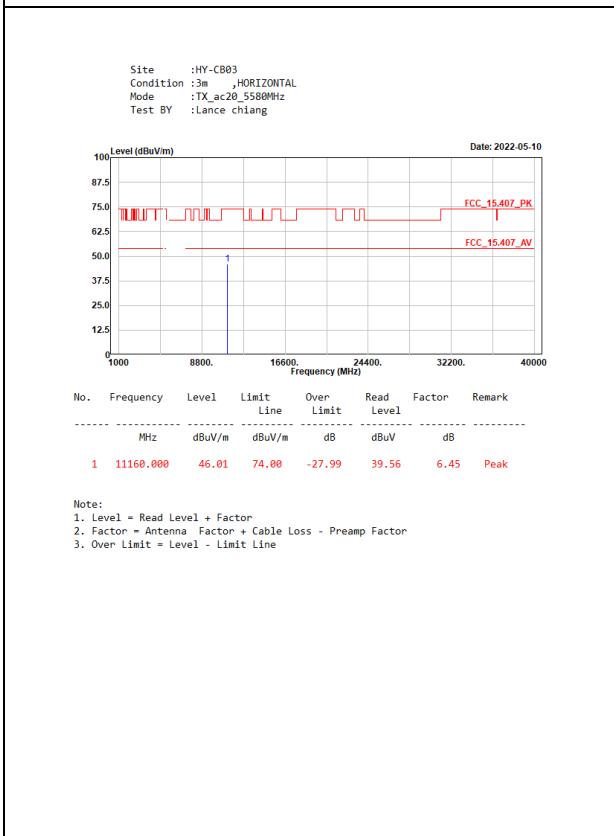
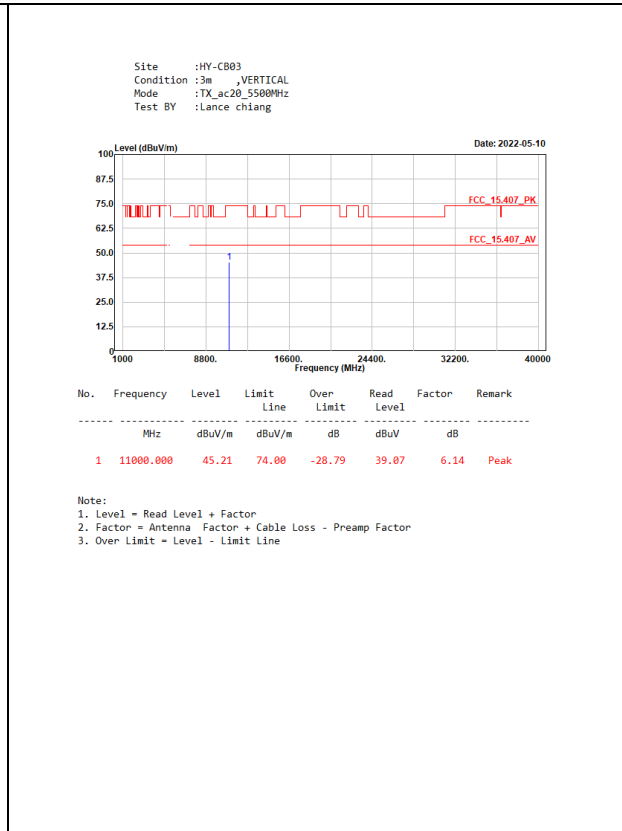
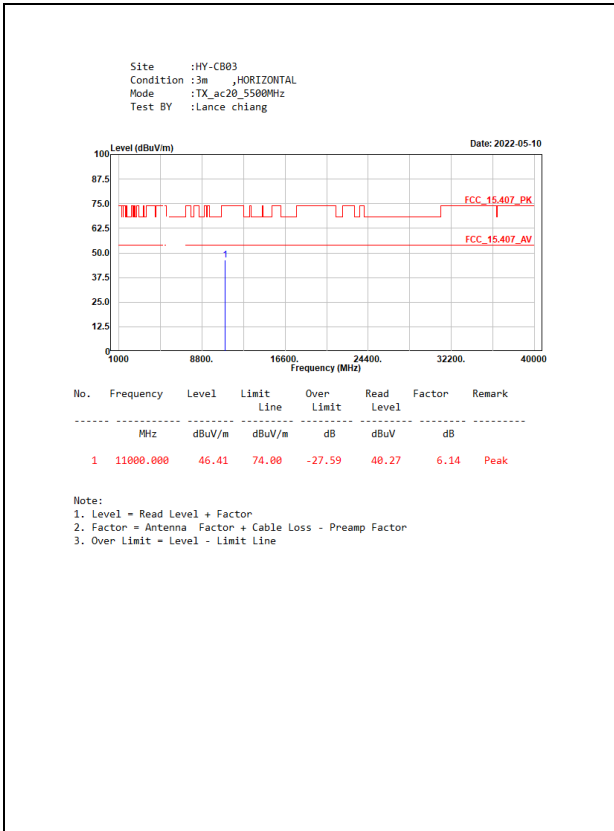


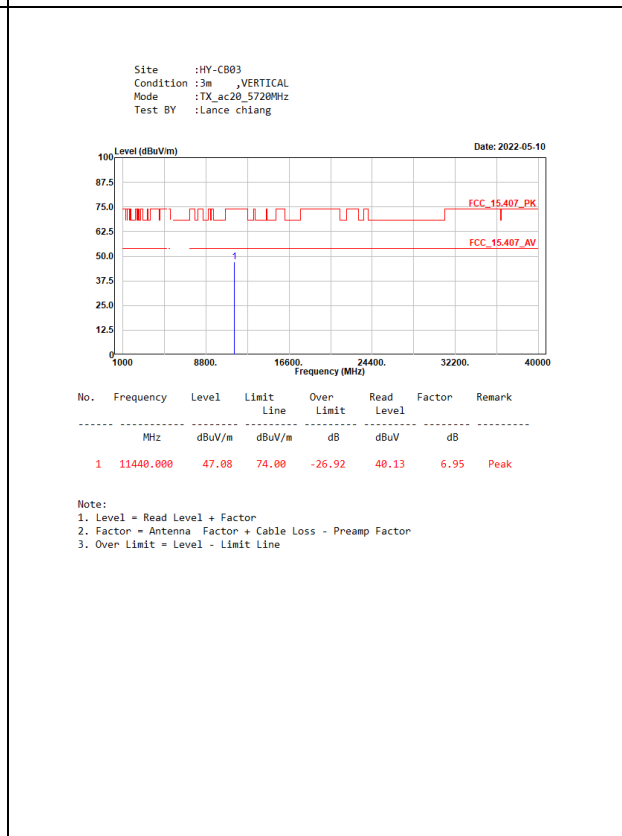
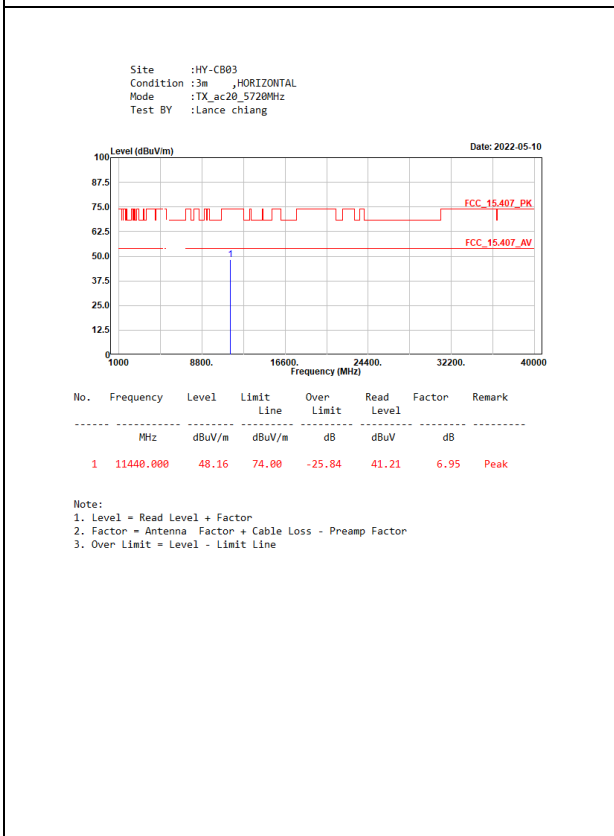
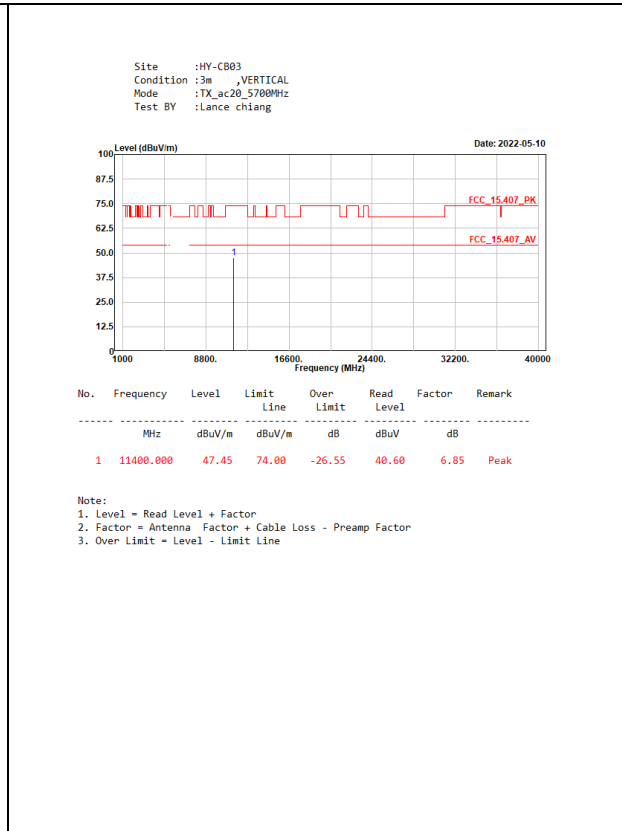
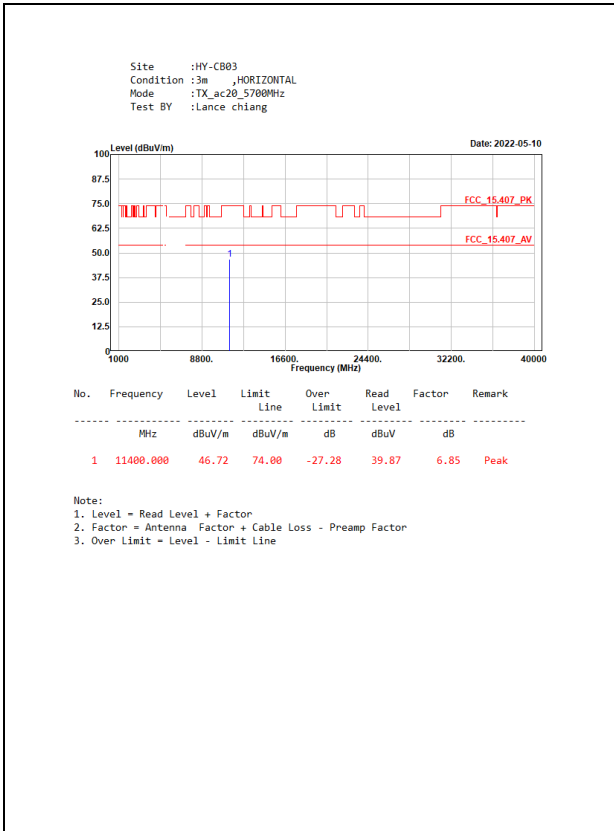
Panel_MIMO

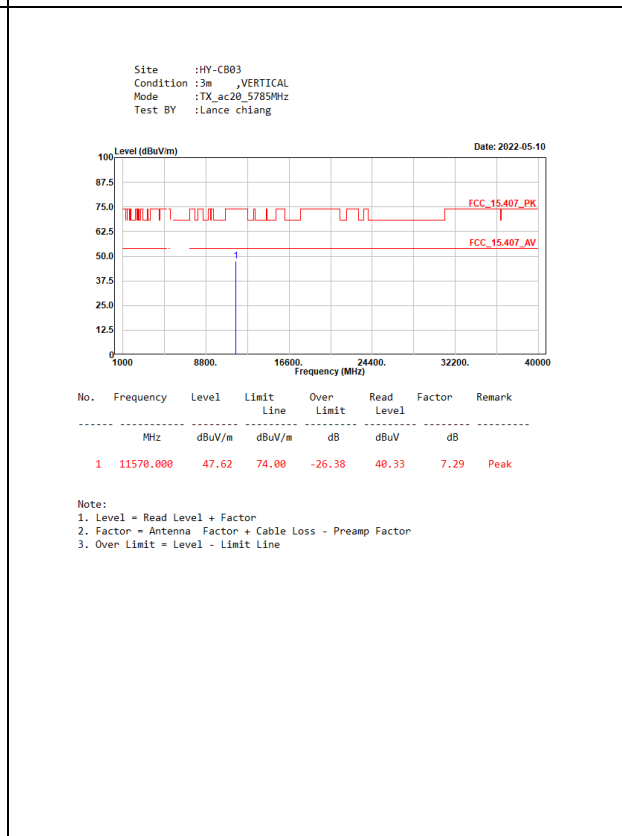
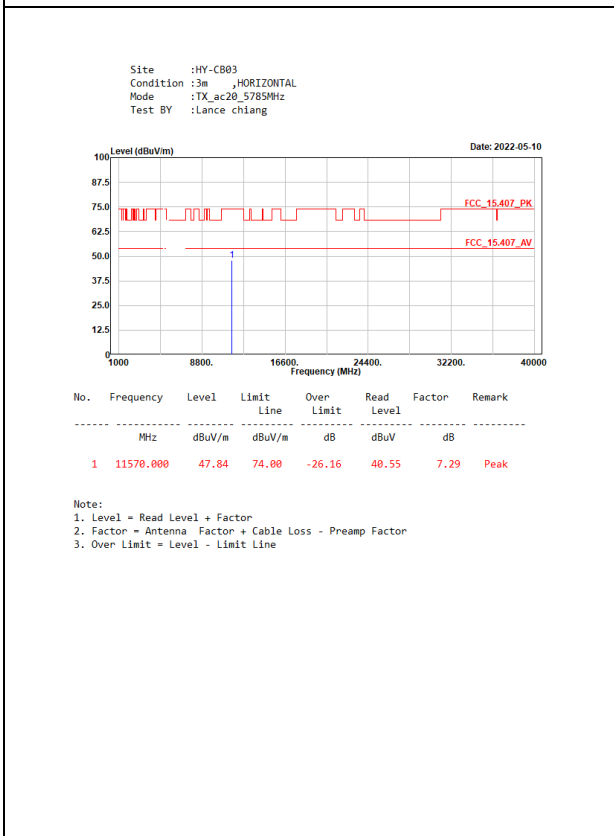
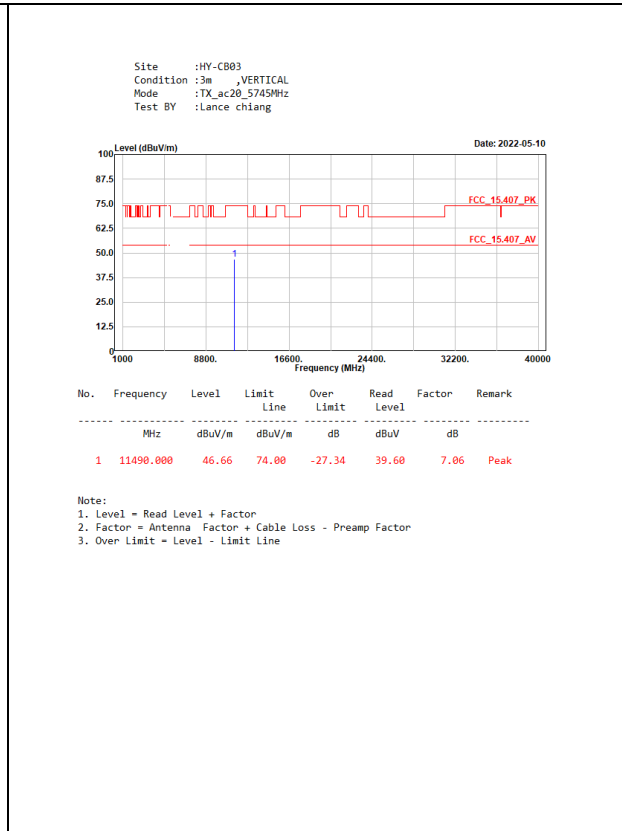
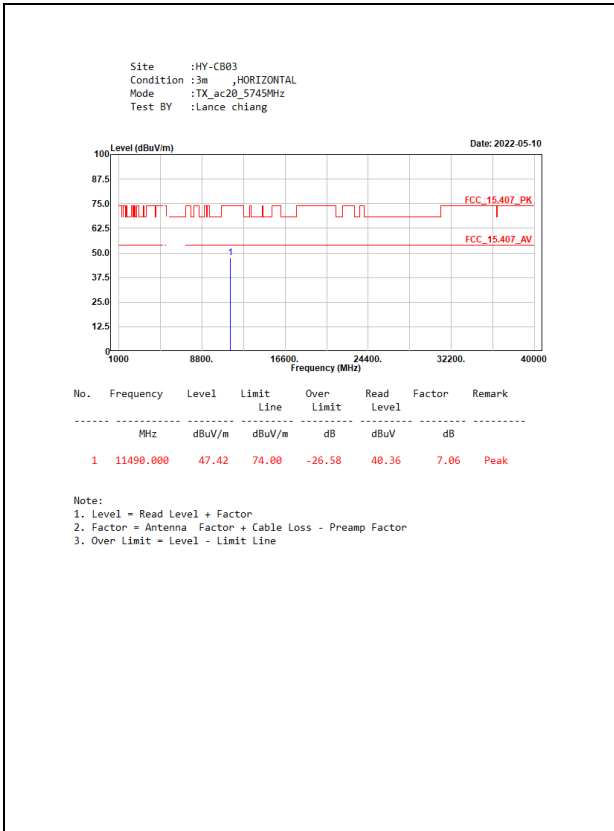


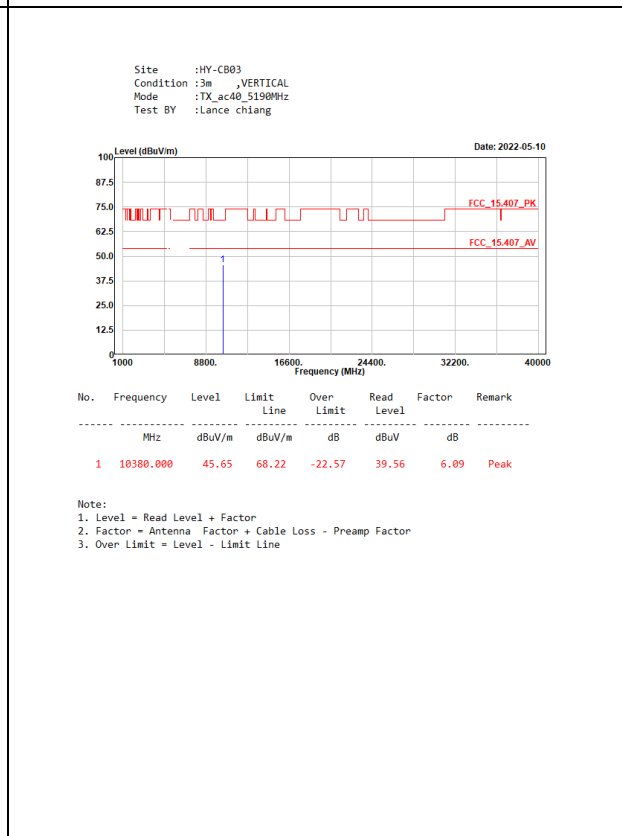
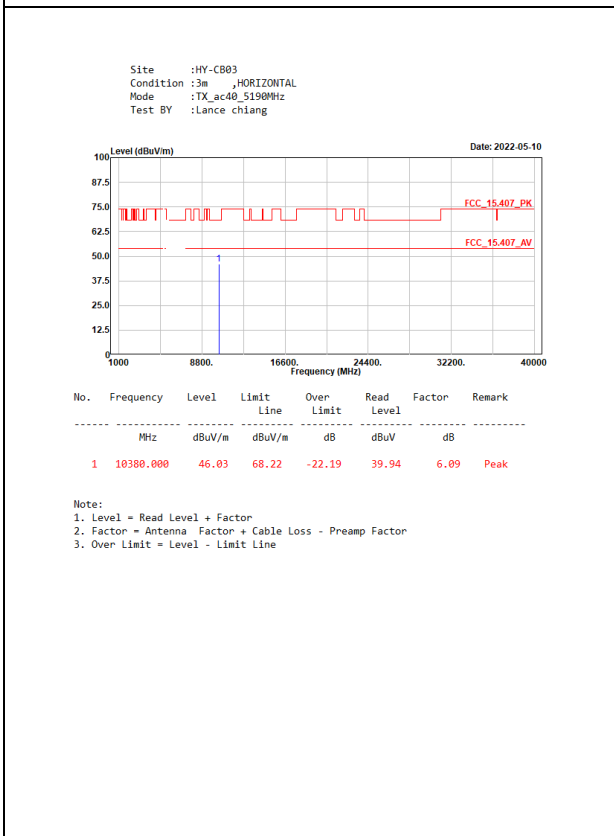
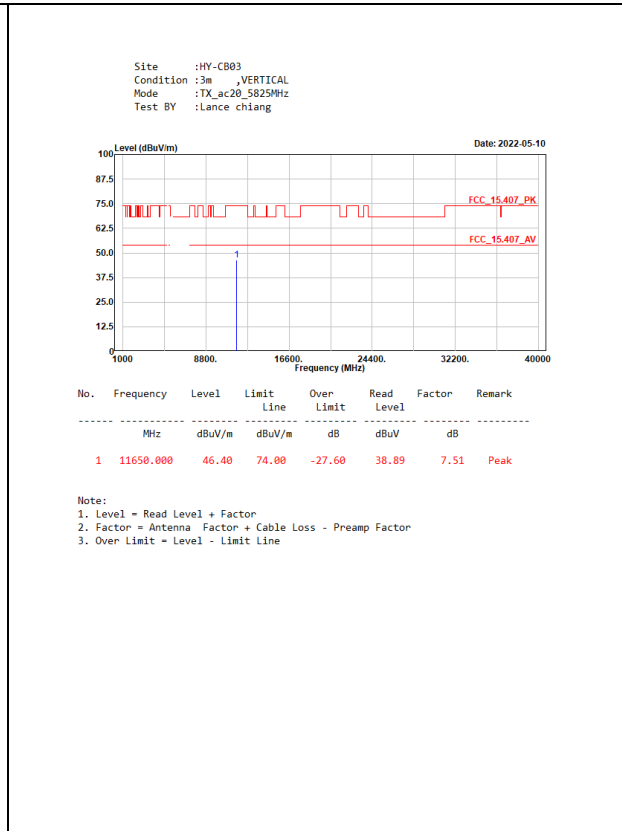
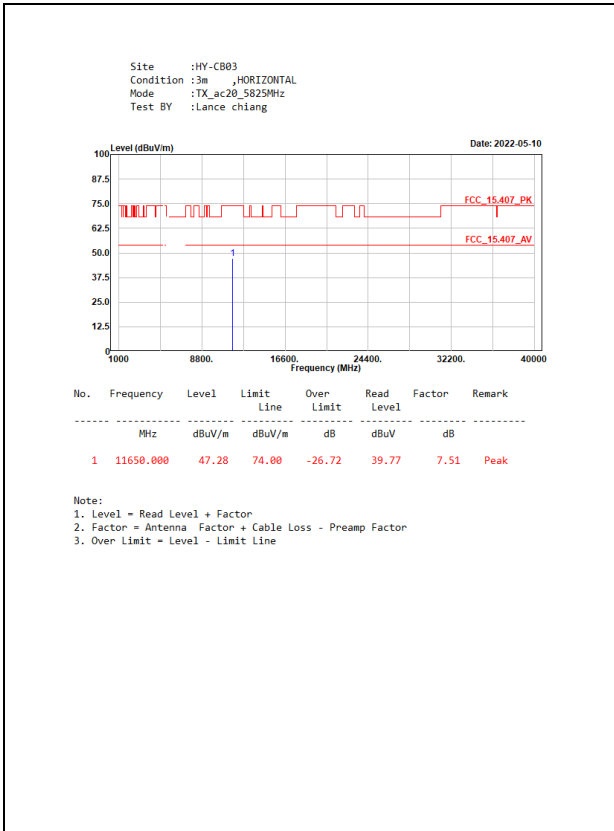


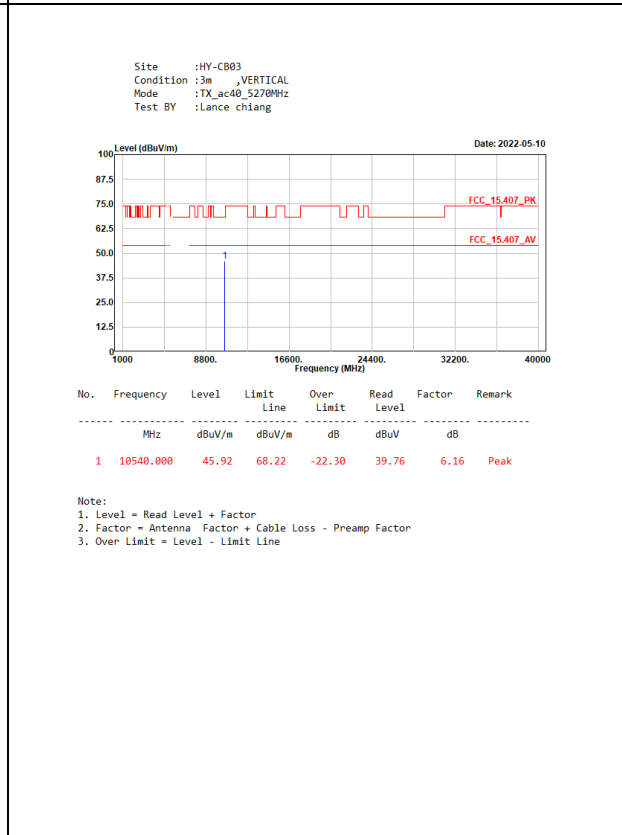
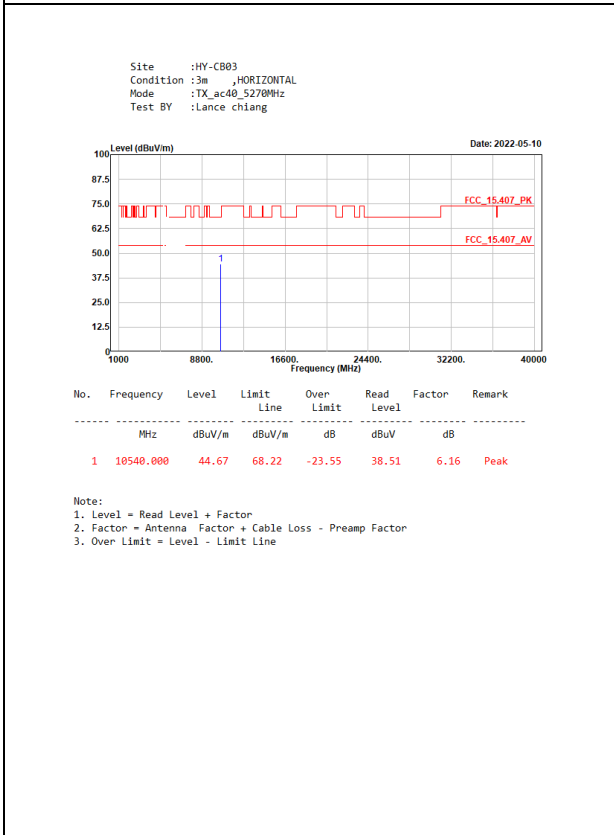
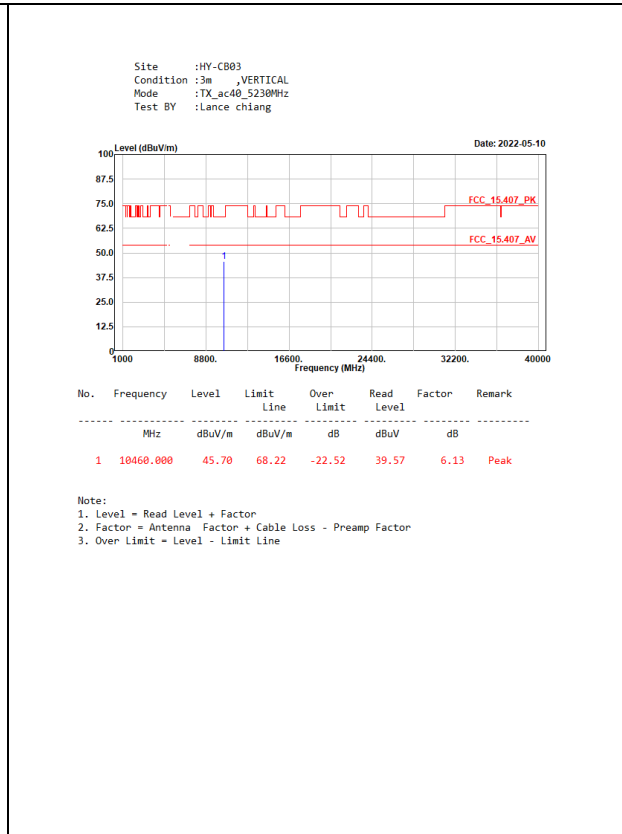
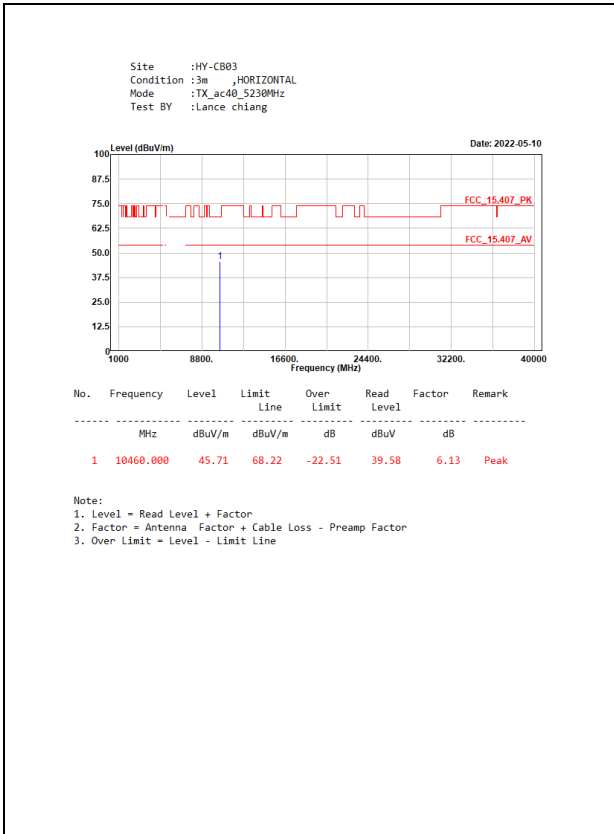


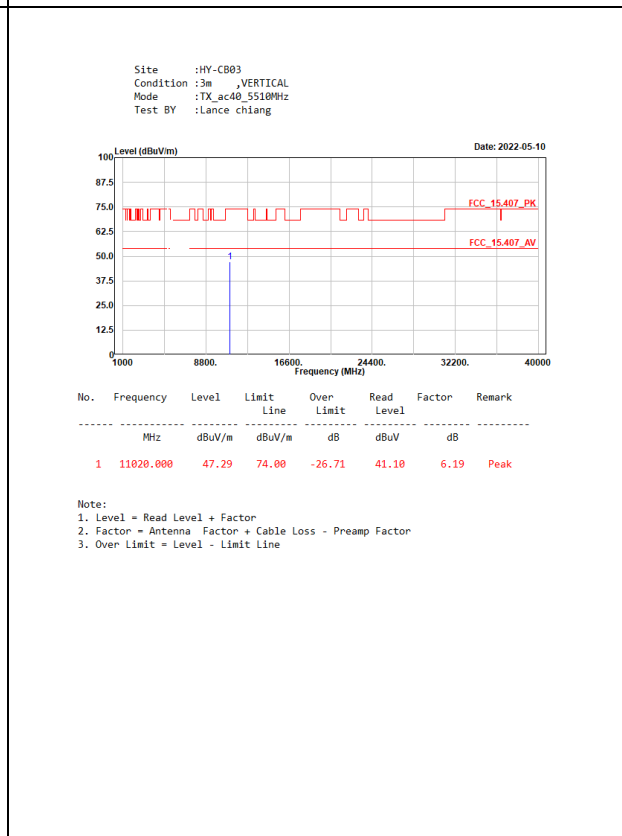
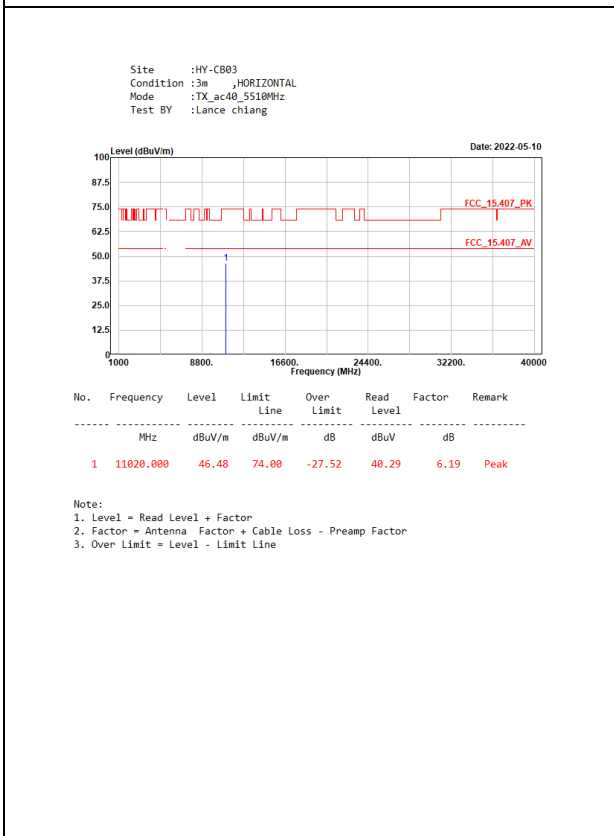
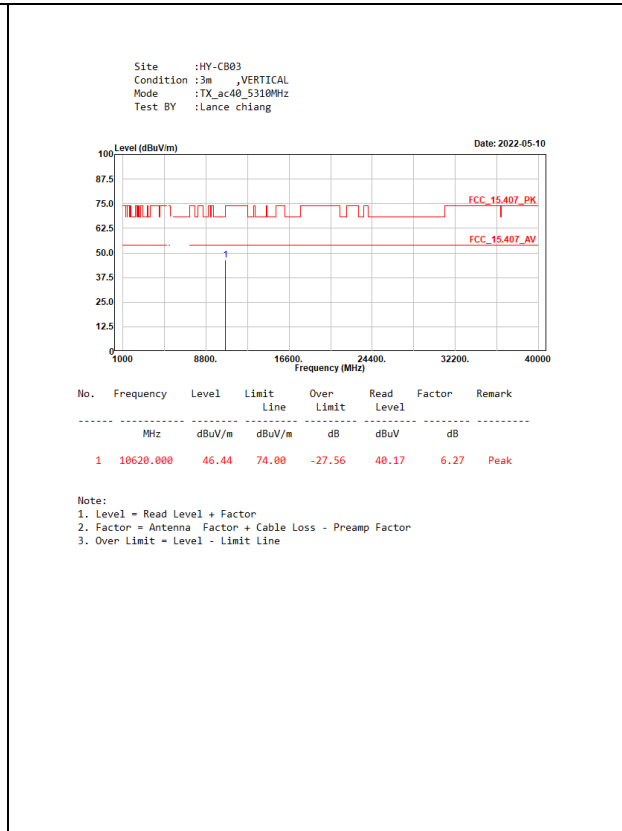
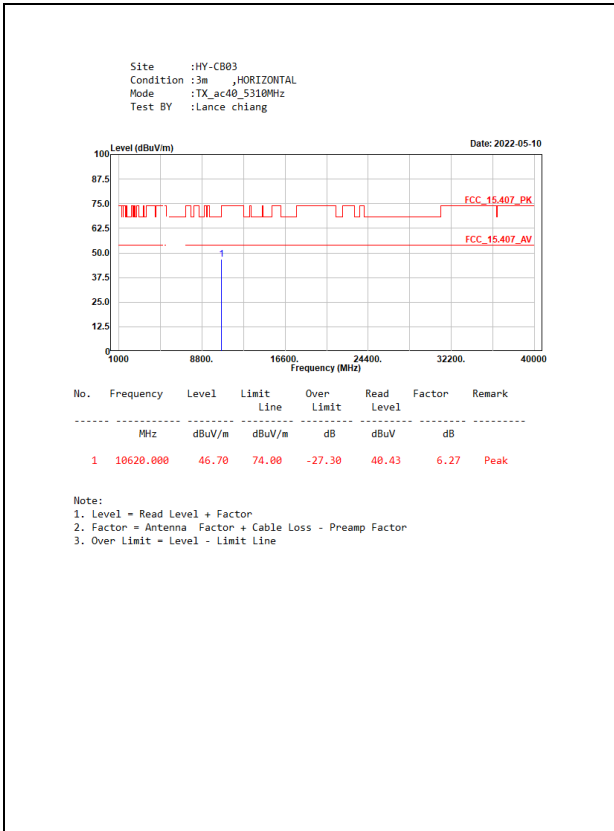


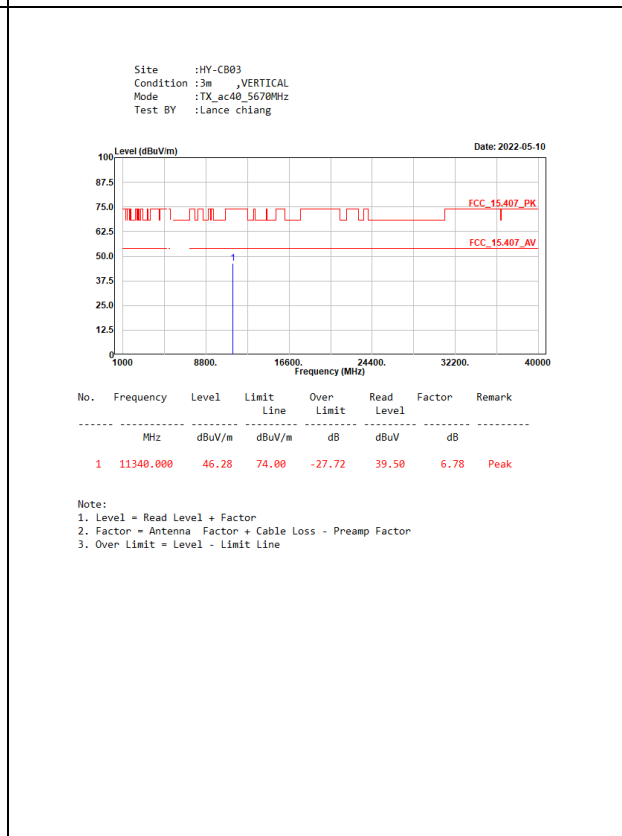
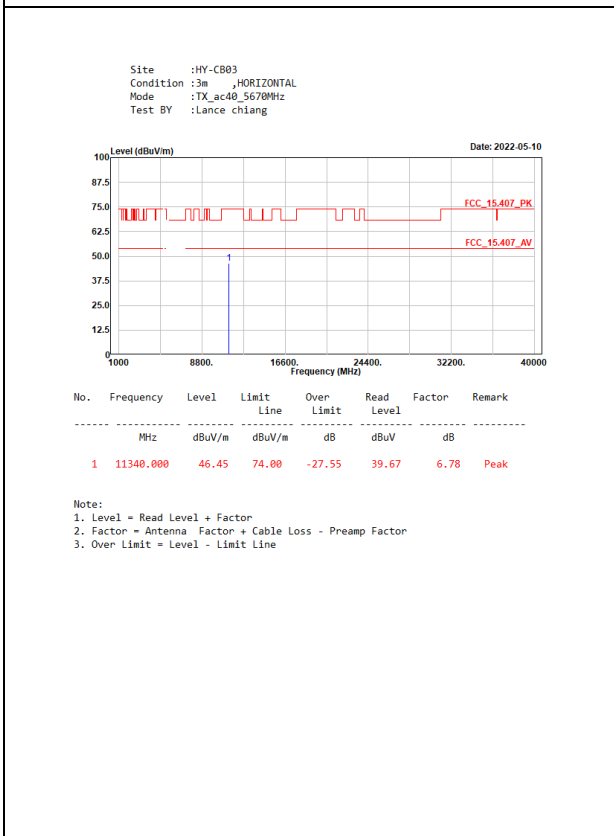
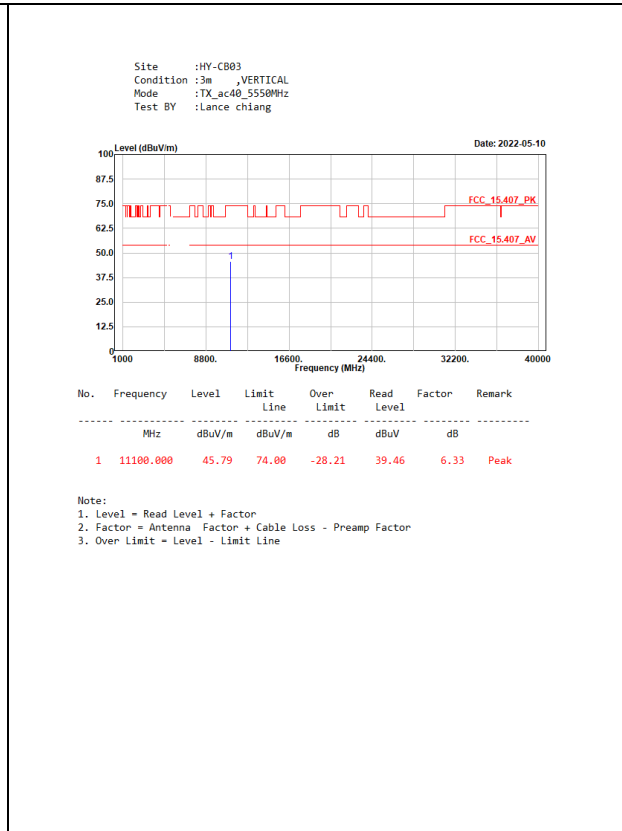
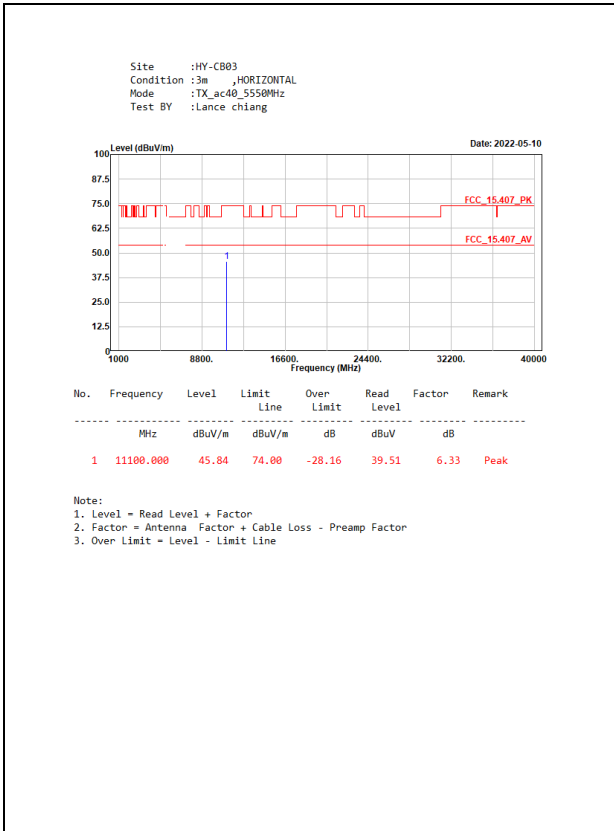


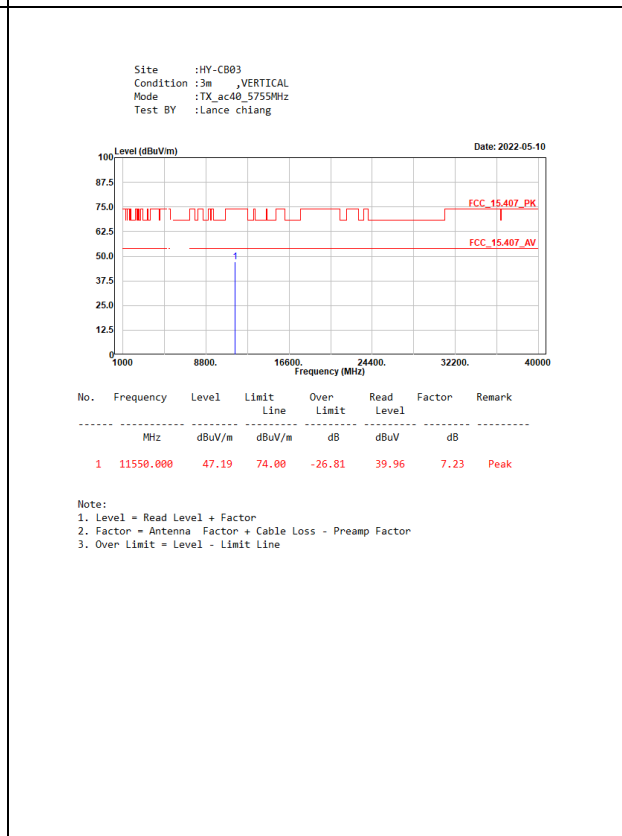
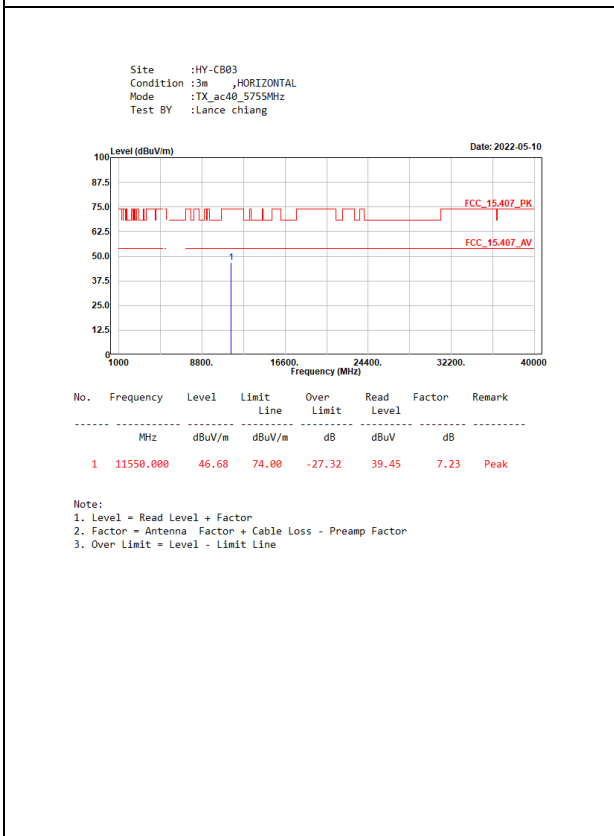
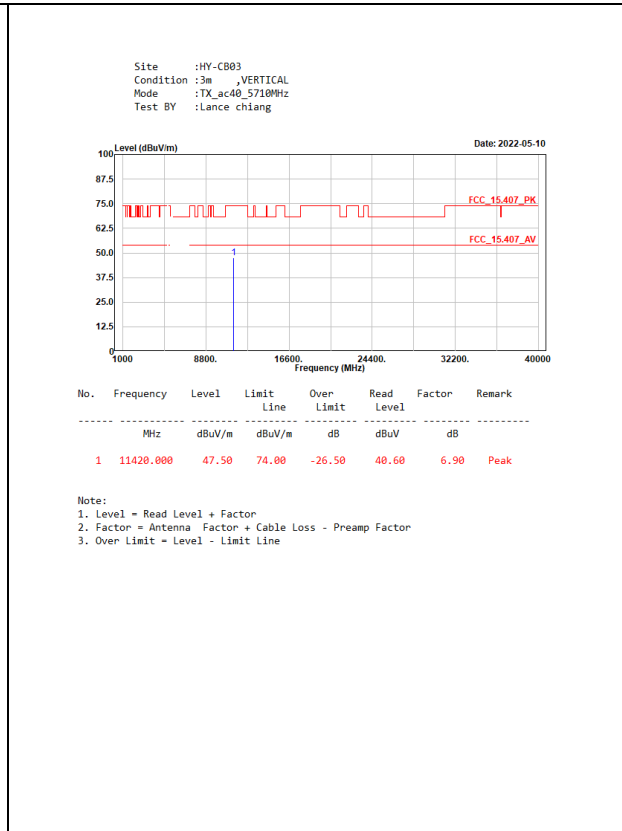
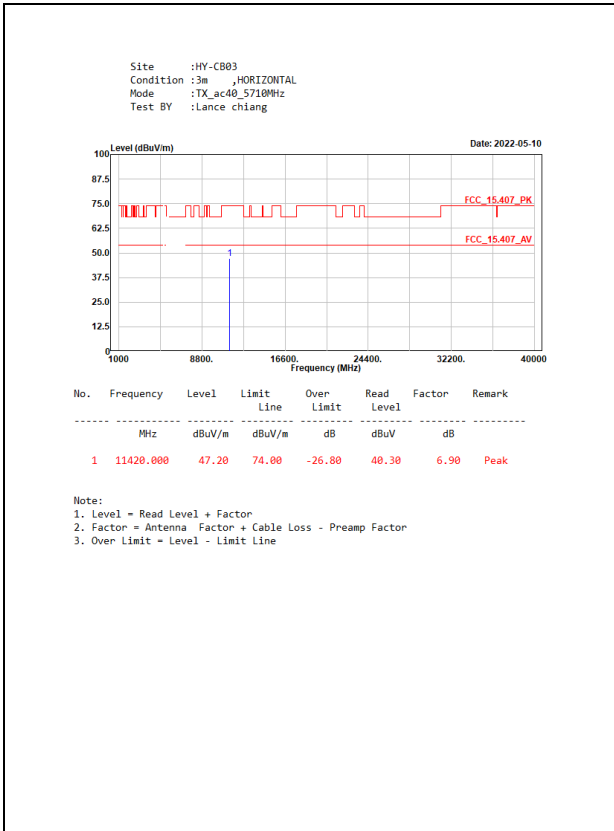


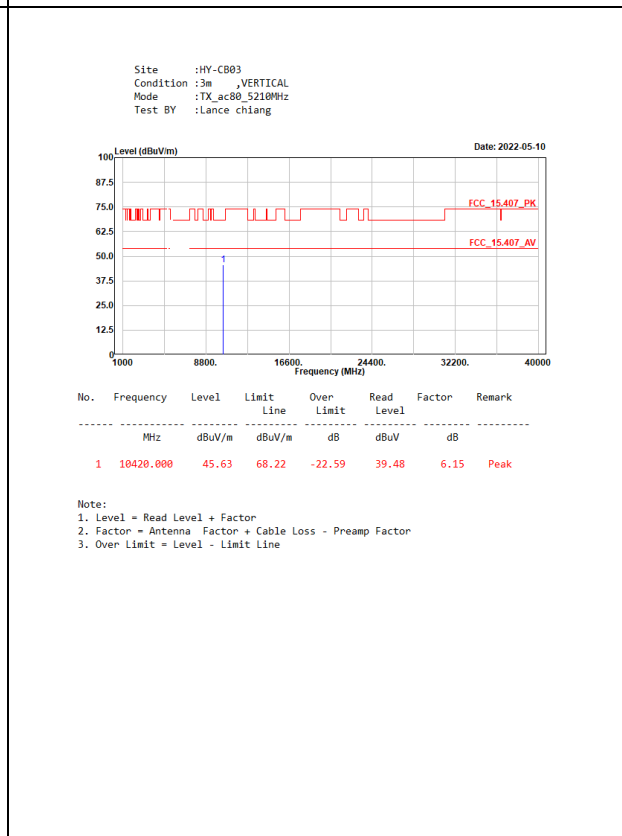
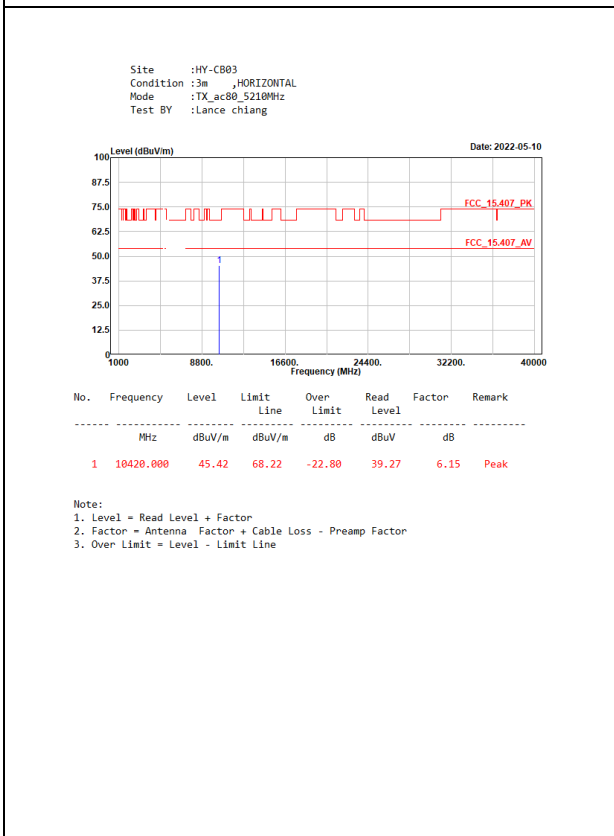
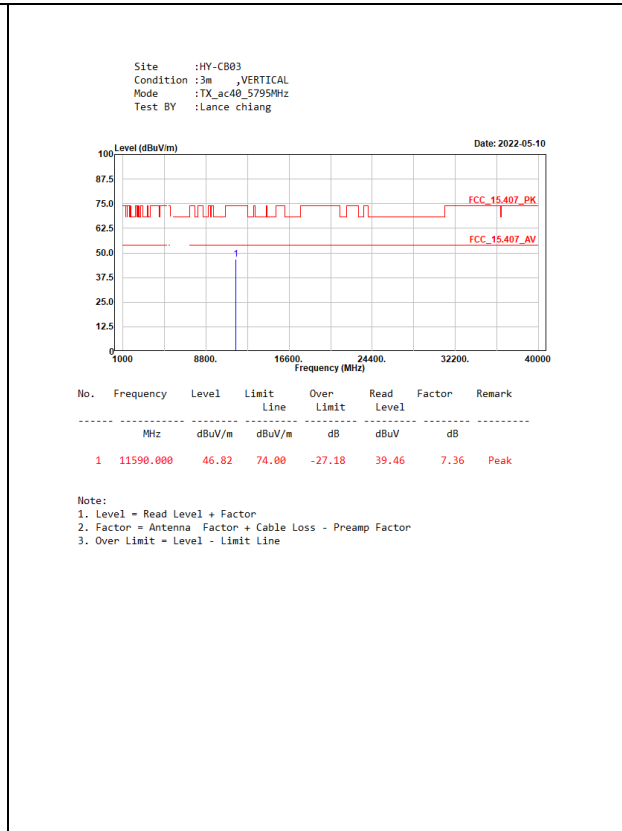
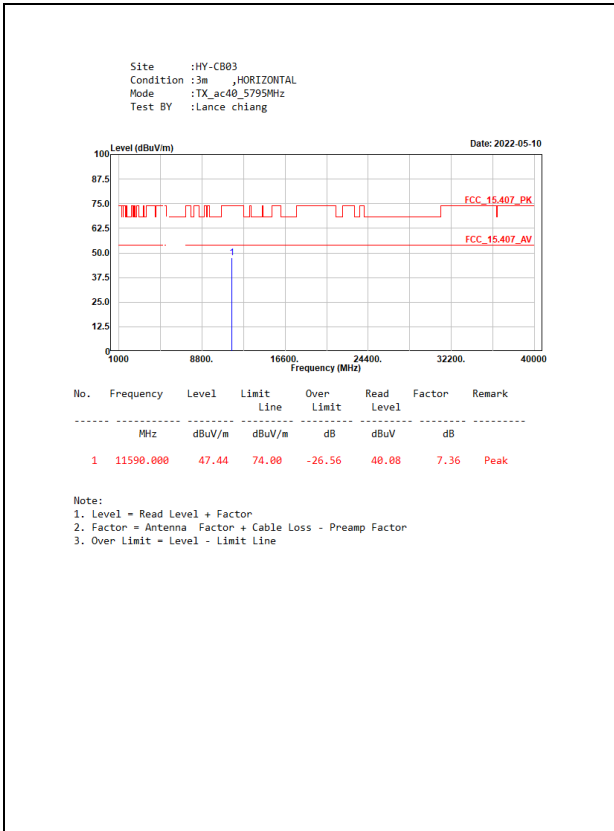


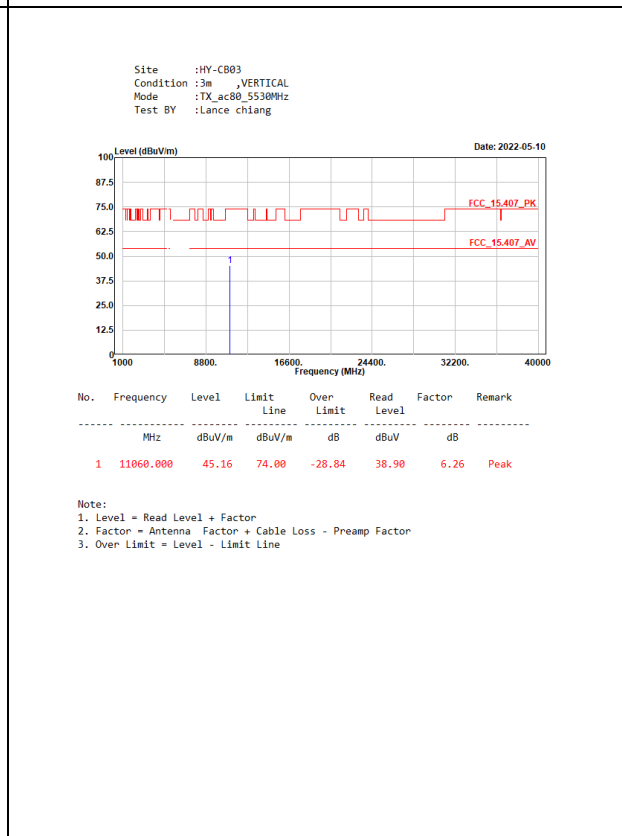
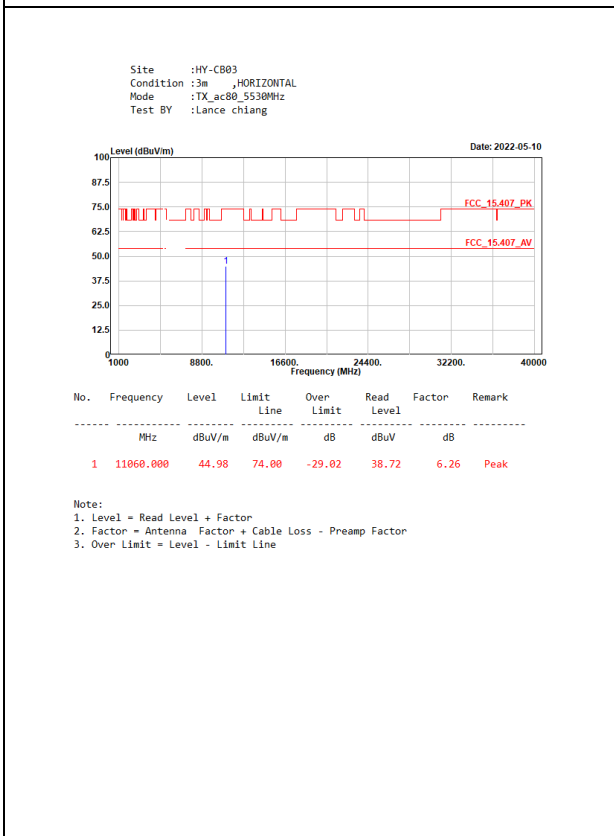
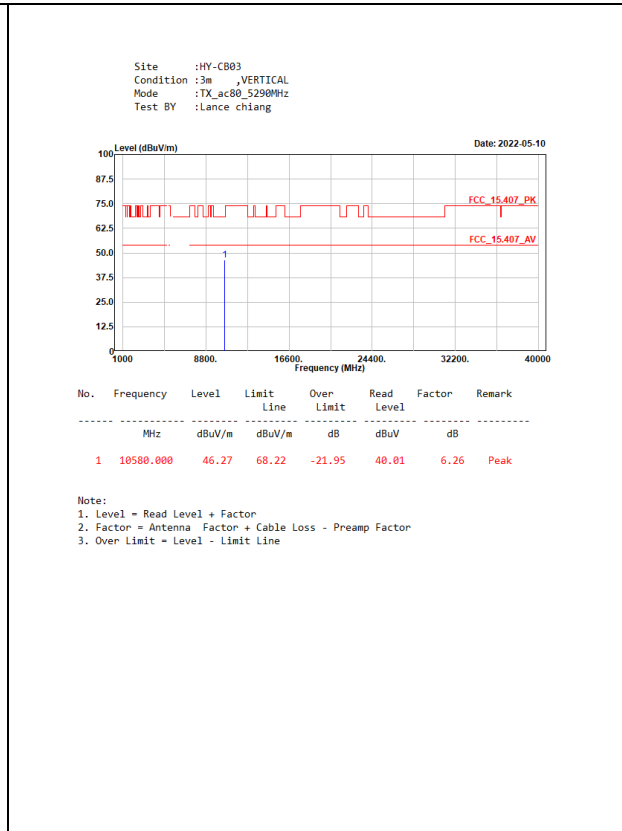
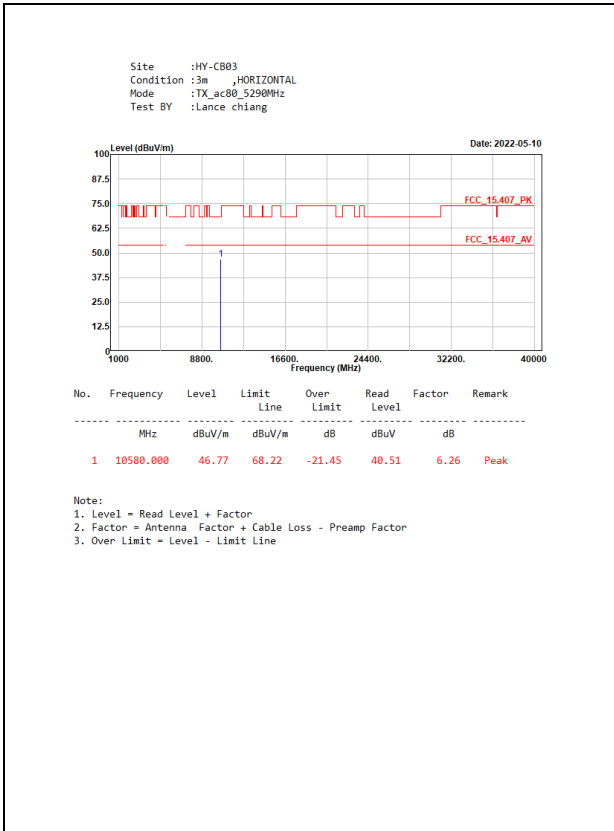


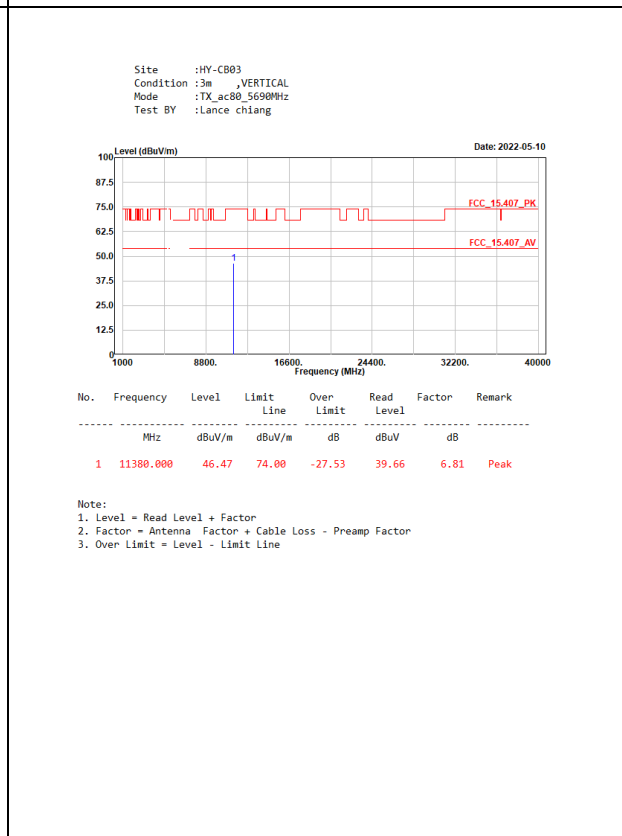
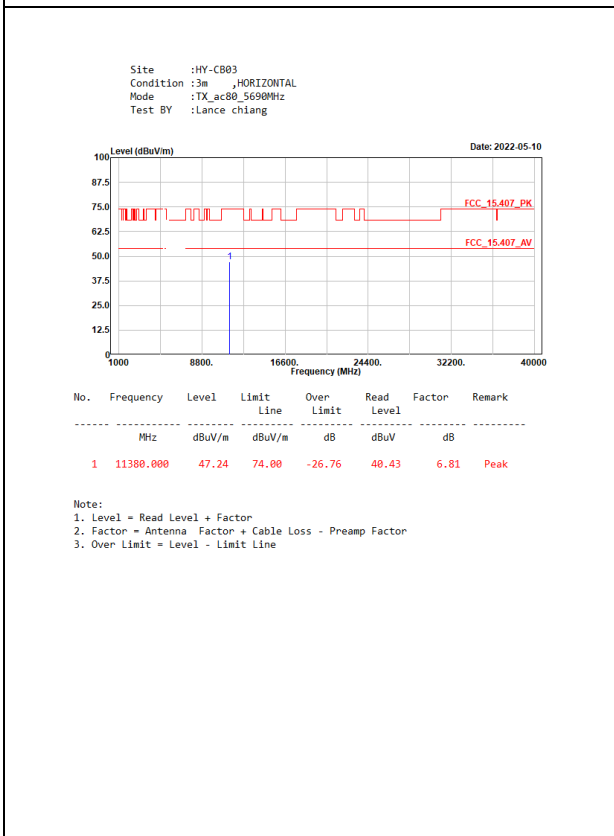
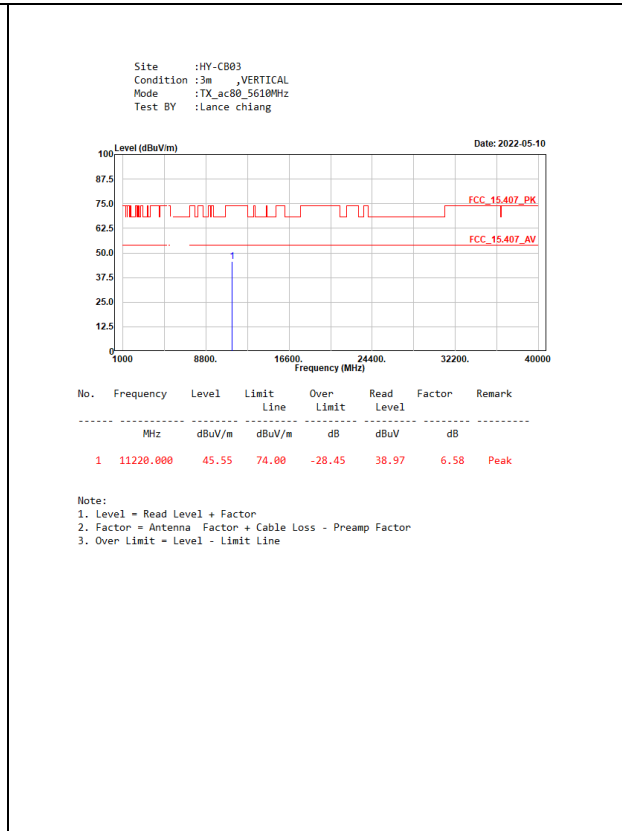
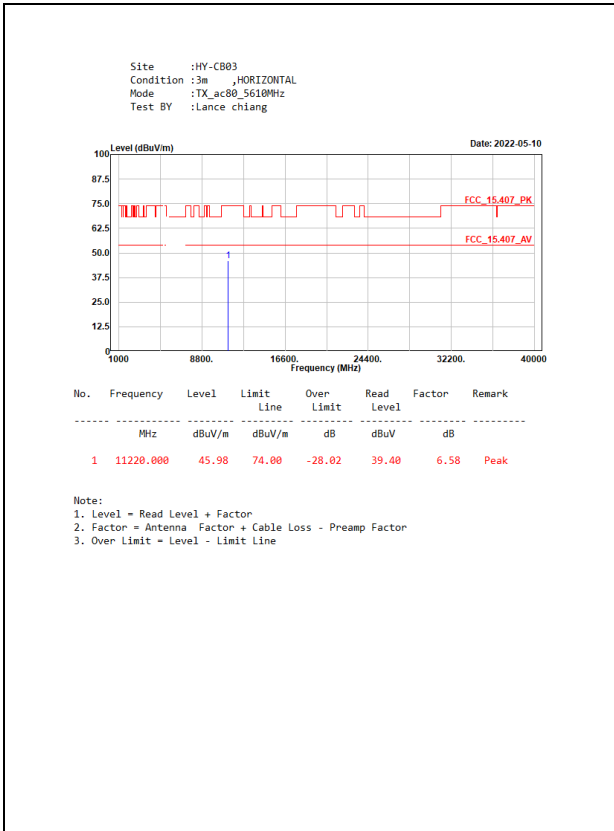


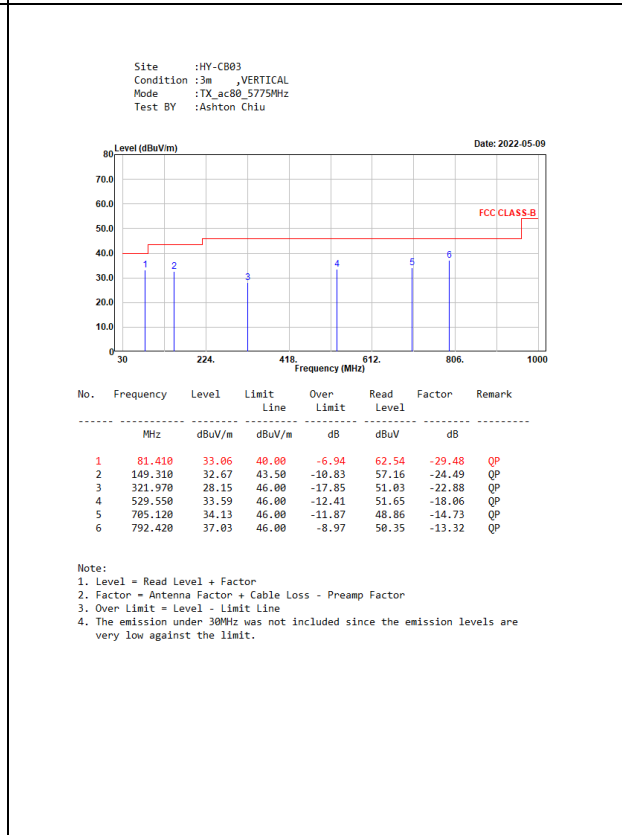
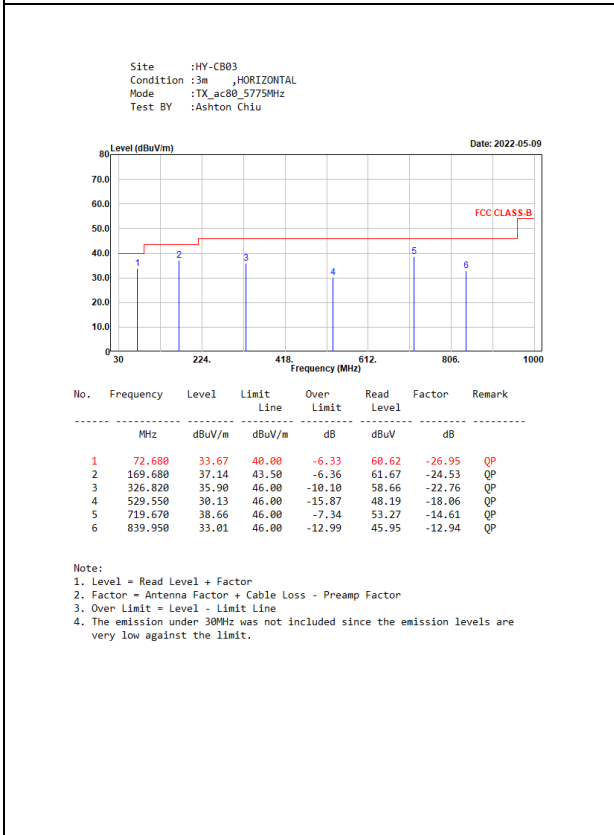
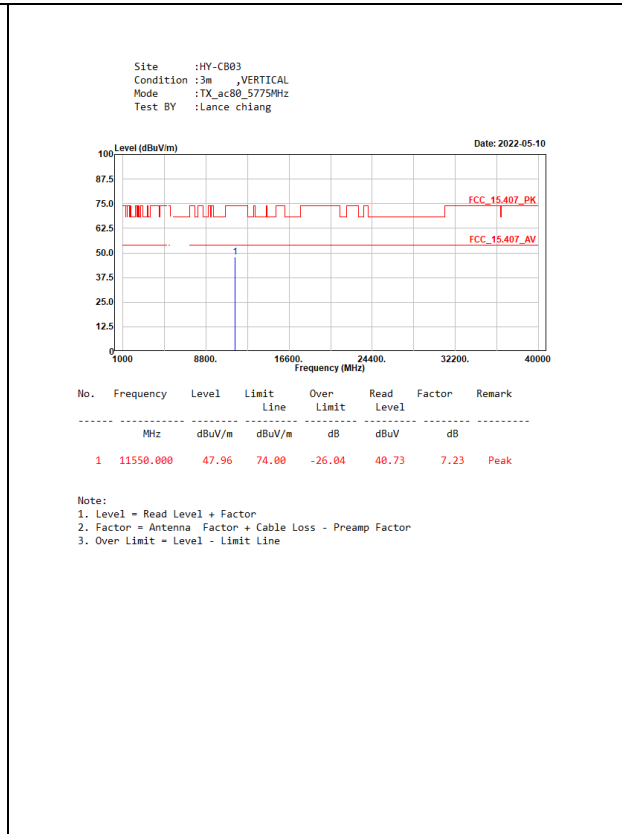
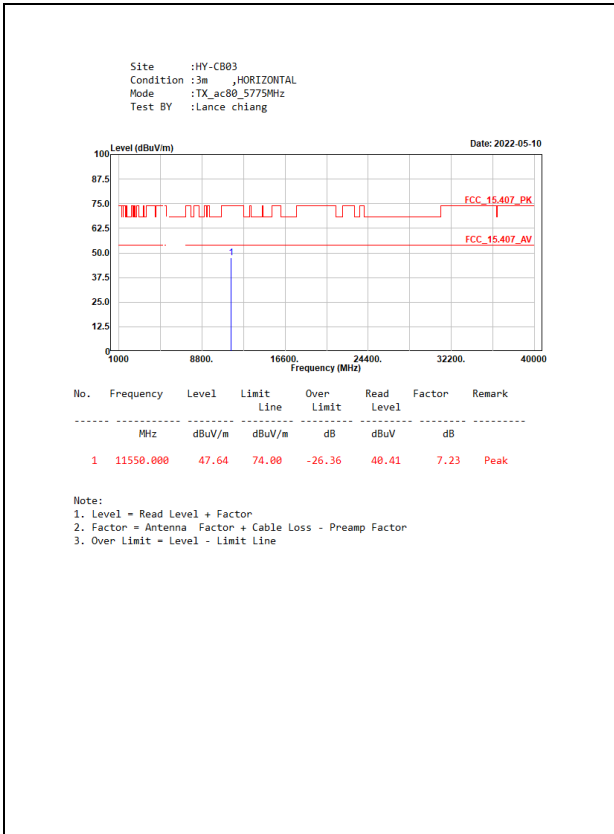








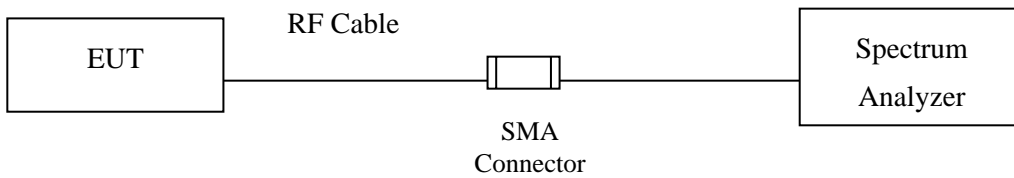




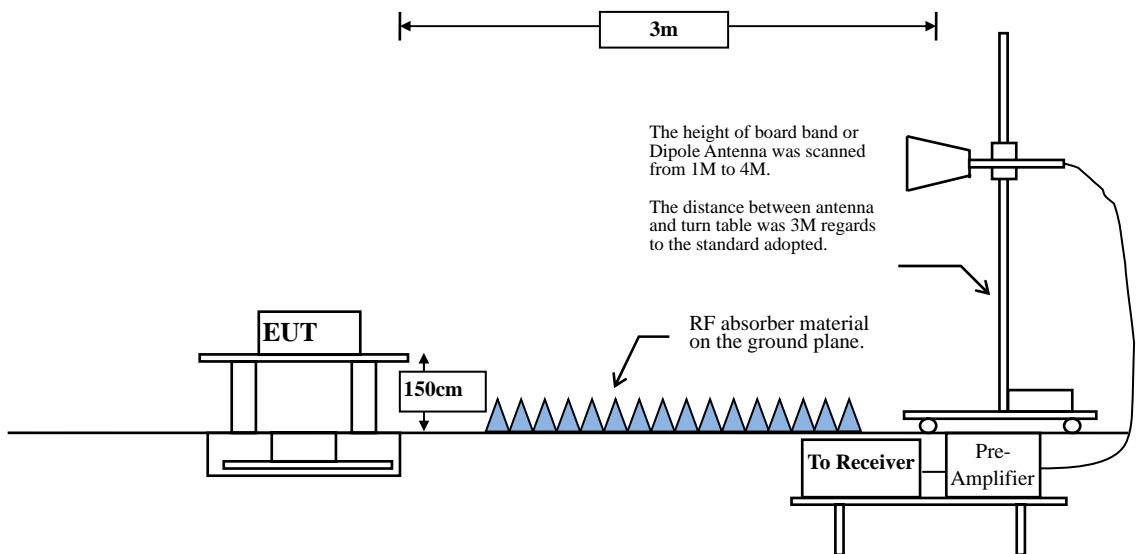
4. Band Edge

4.1. Test Setup

RF Conducted Measurement:



RF Radiated Measurement:



4.2. Limits

The provisions of Section 15.205 of this part apply to intentional radiators operating under this section.

Radiated emissions which fall in the restricted bands, as defined in Section 15.205, must also comply with the radiated emission limits specified in Section 15.209:

FCC Part 15 Subpart C Paragraph 15.209 Limits		
Frequency MHz	uV/m @3m	dB μ V/m@3m
30-88	100	40
88-216	150	43.5
216-960	200	46
Above 960	500	54

- Remarks :
1. RF Voltage (dB μ V) = 20 log RF Voltage (uV)
 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 is placed on a turn table which is 1.5 meter above ground. The turn table can rotate 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 can move up and down between 1 meter and 4 meters to find out the maximum emission level.

Both horizontal and vertical polarization of the antenna are set on measurement. In order to find the maximum emission, all of the interface cables must be manipulated according to ANSI C63.10:2013 on radiated measurement.

The bandwidth below 1GHz setting on the field strength meter is 120 kHz, above 1GHz are 1 MHz.

The EUT was setup to ANSI C63.10, 2013; tested to UNII test procedure of FCC KDB-789033 for compliance to FCC 47CFR Subpart E requirements.

RBW and VBW Parameter setting:

According to KDB 789033 section II.G.5 Procedure for Unwanted Maximum Emissions
Measurements above 1000 MHz.

RBW = 1MHz.

VBW \geq 3MHz.

According to KDB 789033 section II.G.6 Procedures for Average Unwanted Emissions
Measurements above 1000 MHz.

RBW = 1MHz.

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

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

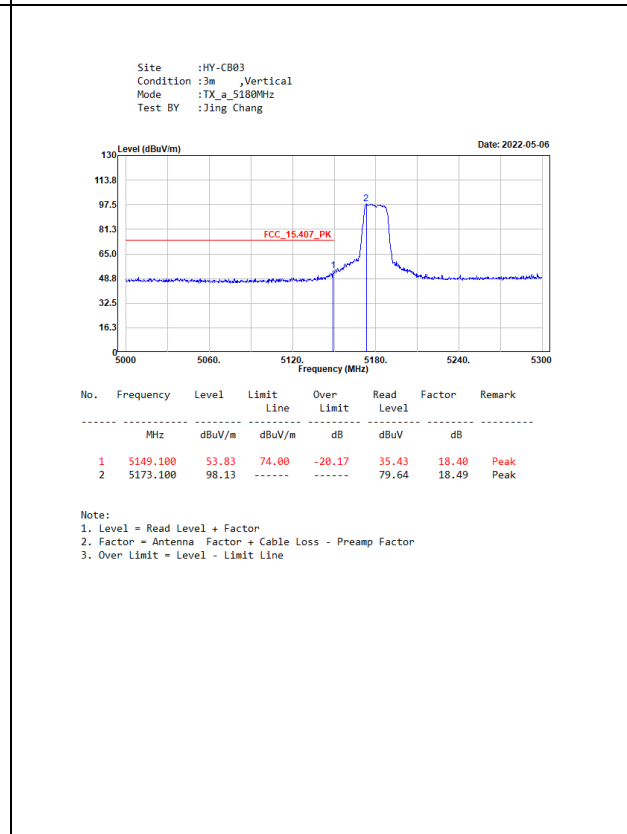
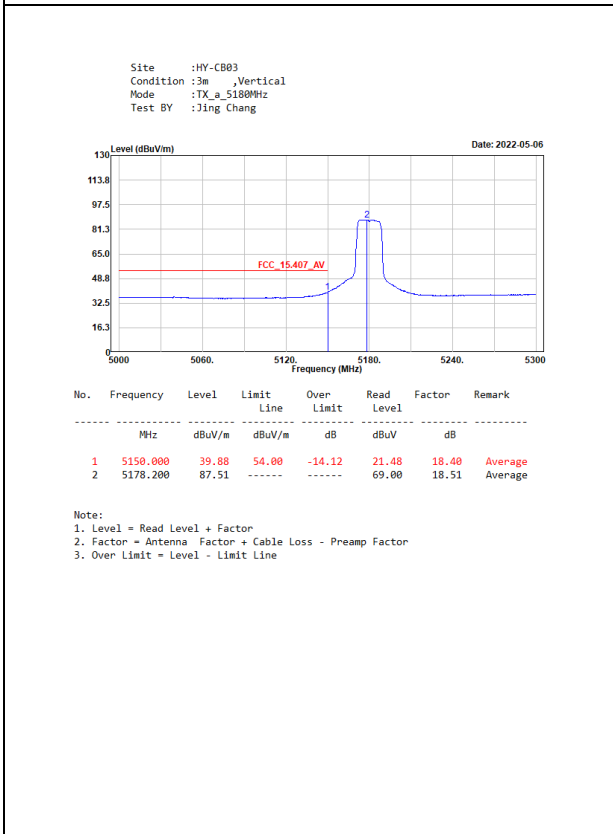
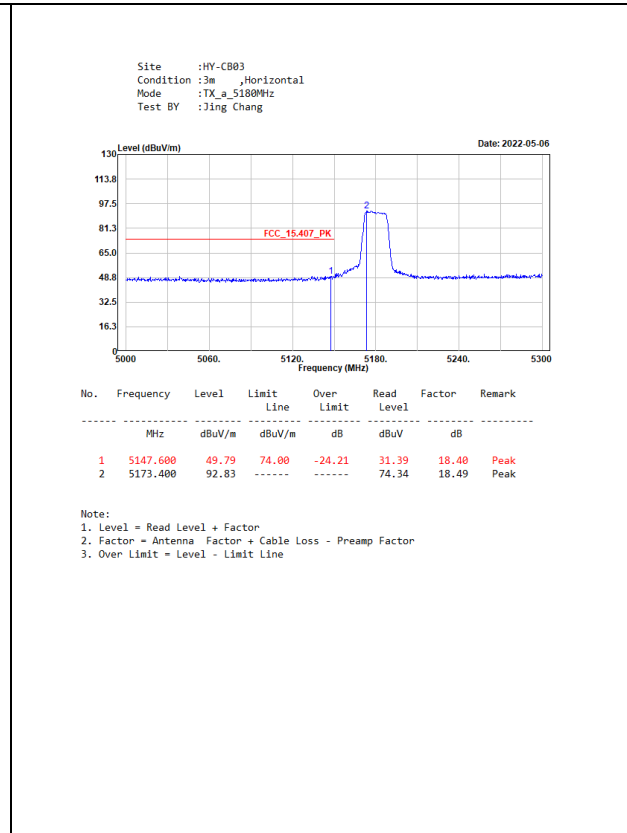
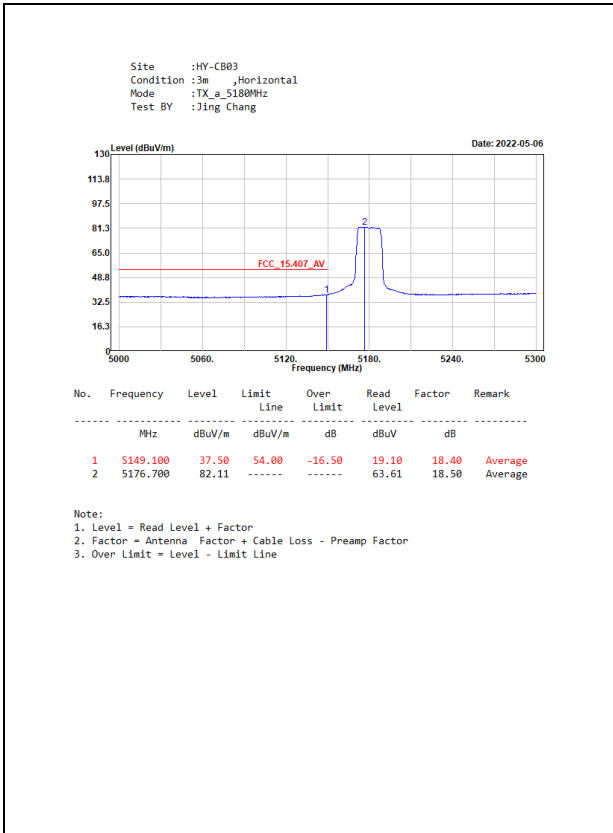
(T refers to the minimum transmission duration over which the transmitter is on and is
transmitting at its maximum power control level for the tested mode of operation.)

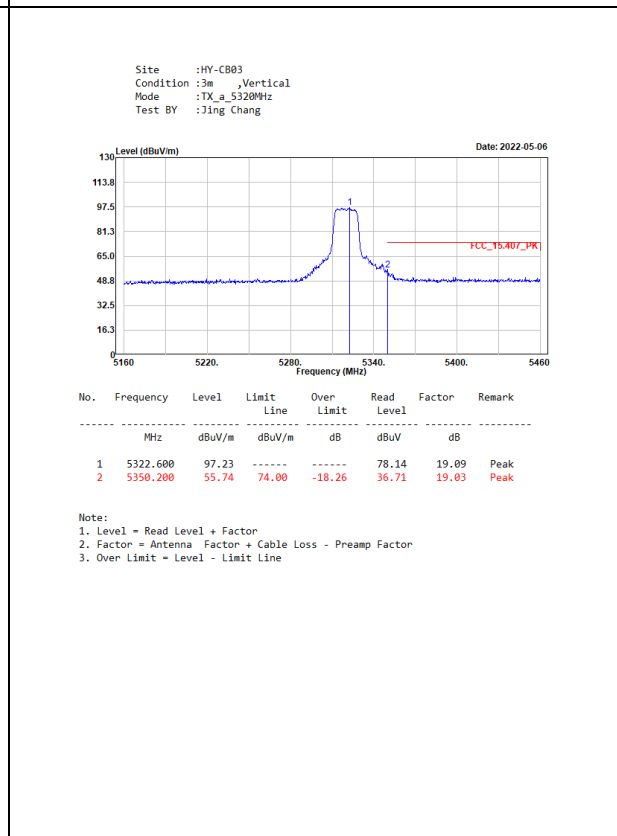
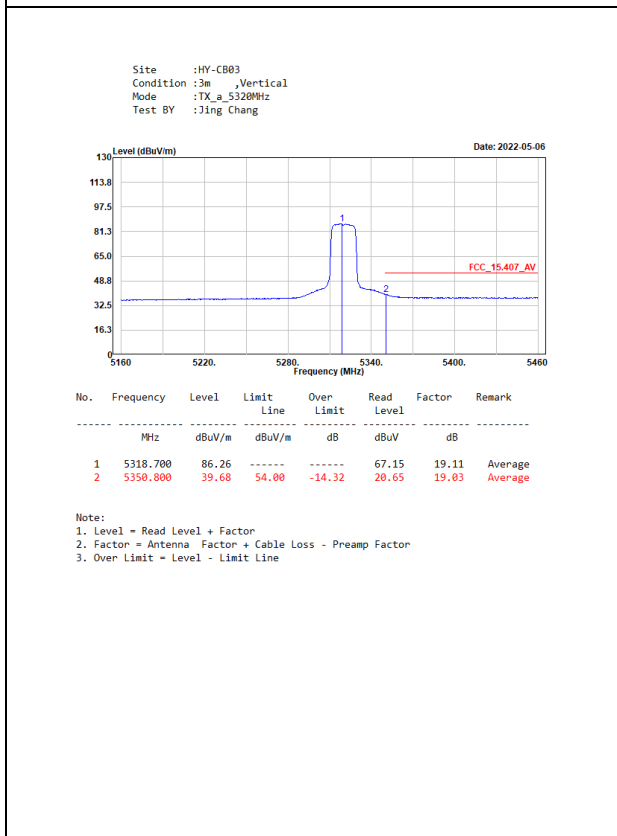
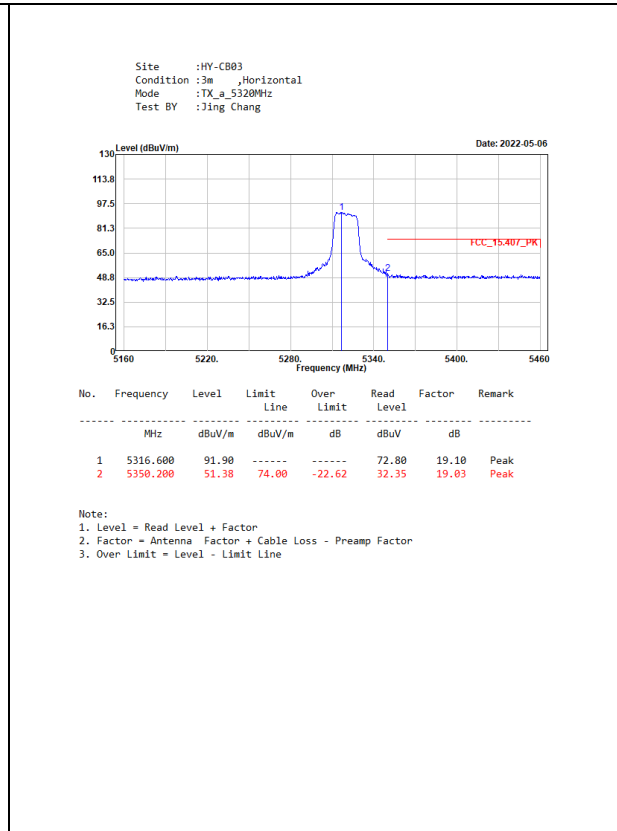
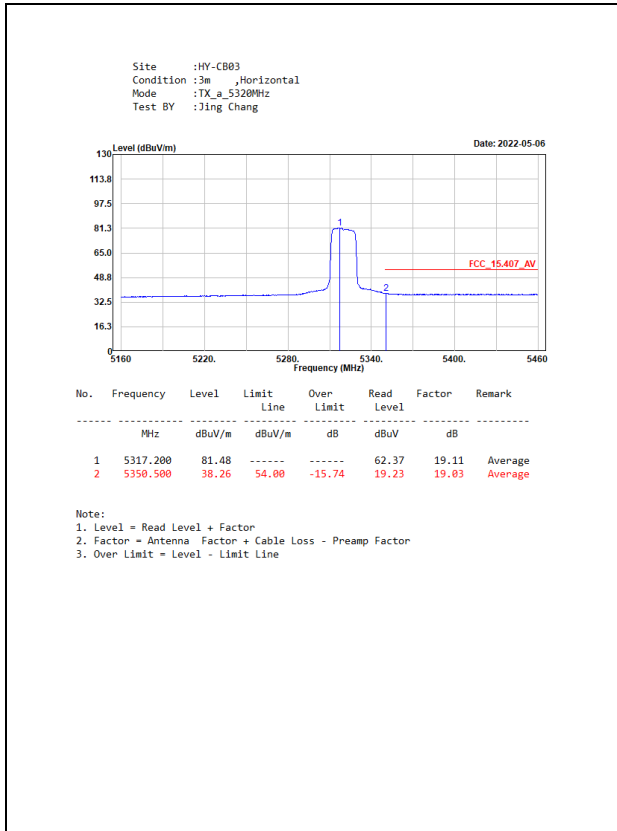
5GHz band	Duty Cycle (%)	T (ms)	1/T (Hz)	VBW (Hz)
802.11 a	95.57	2.0500	488	500
802.11 ac20	98.04	5.0000	200	200
802.11 ac40	94.47	2.3900	418	500
802.11 ac80	91.87	1.1300	885	1000

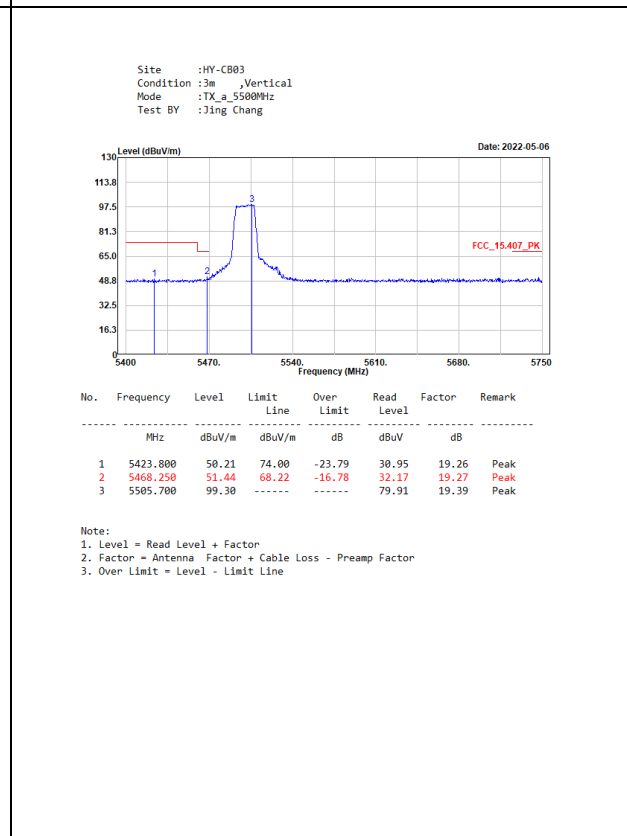
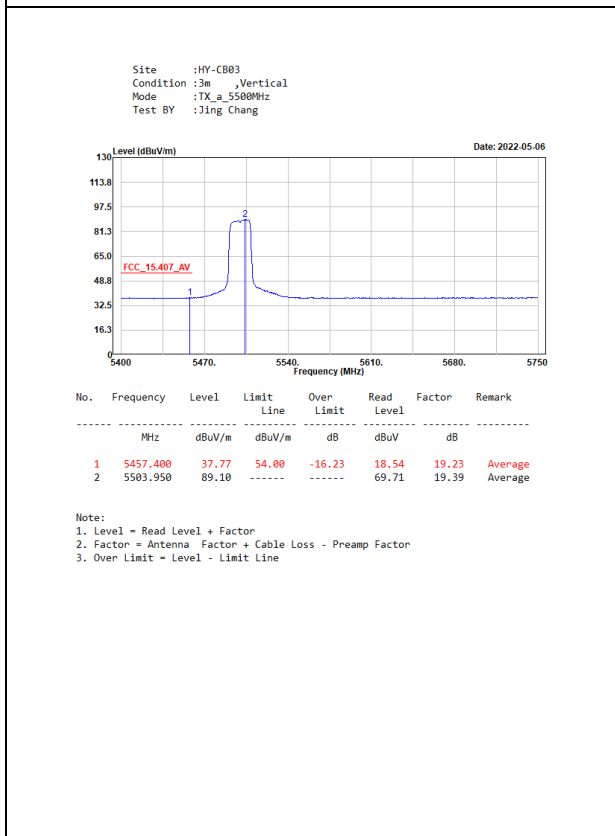
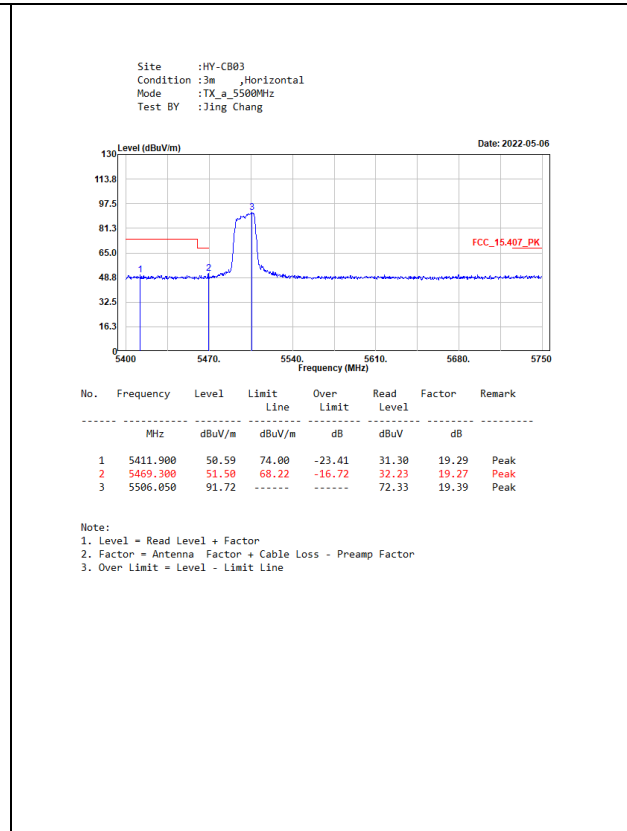
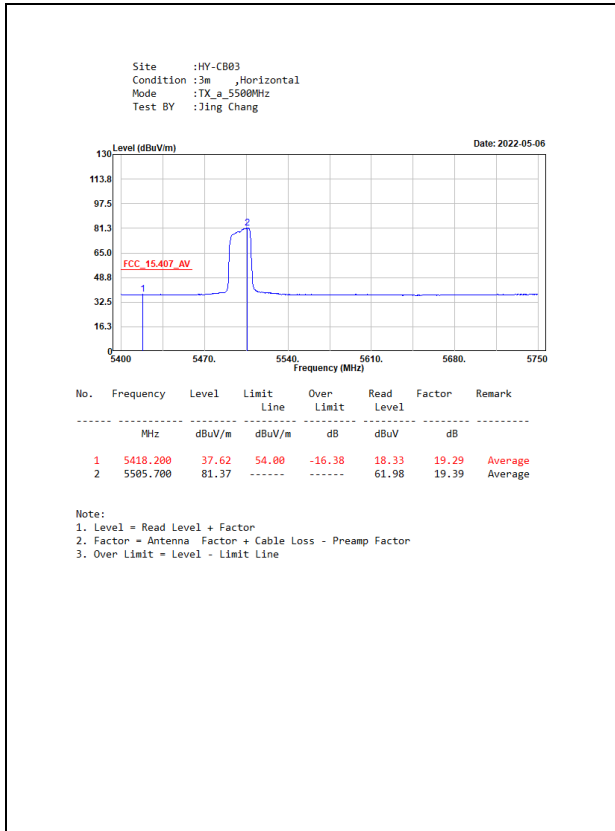
Note: Duty Cycle Refer to Section 5.

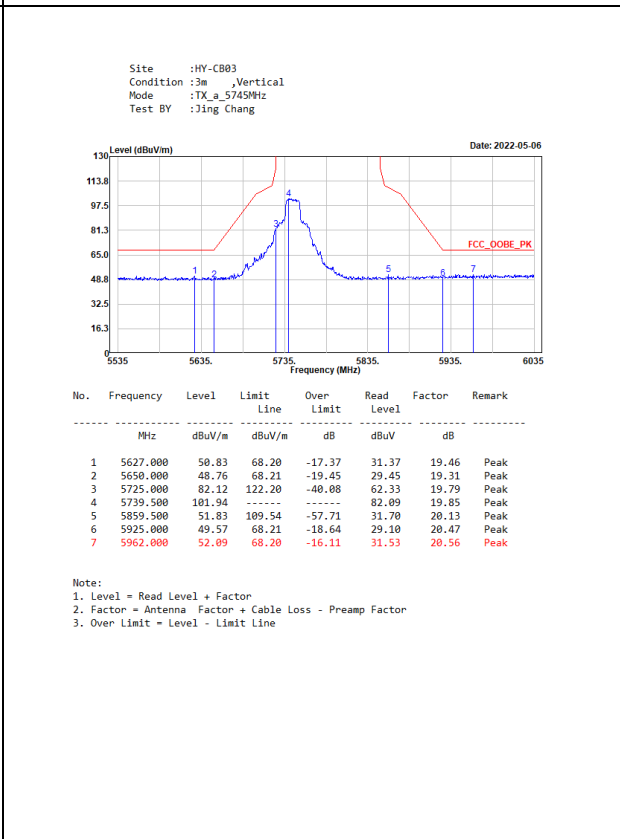
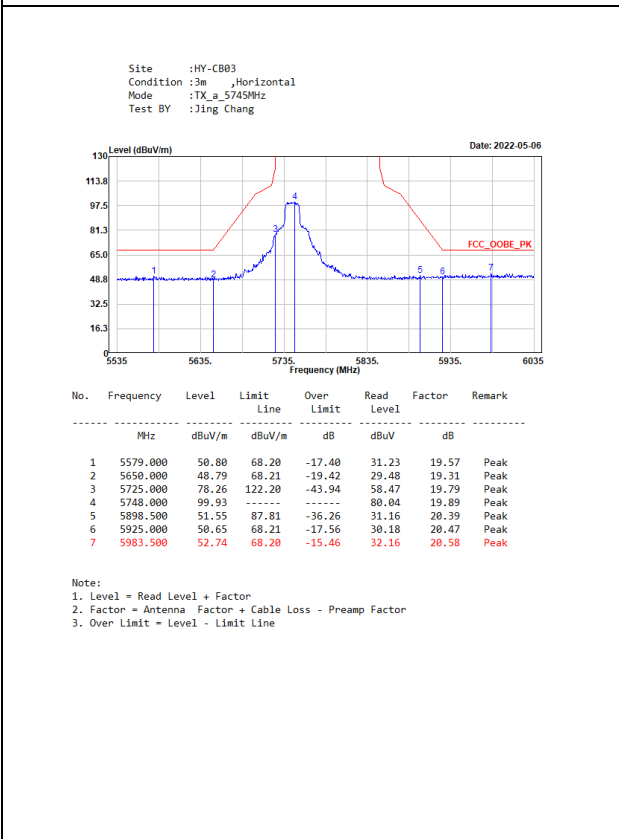
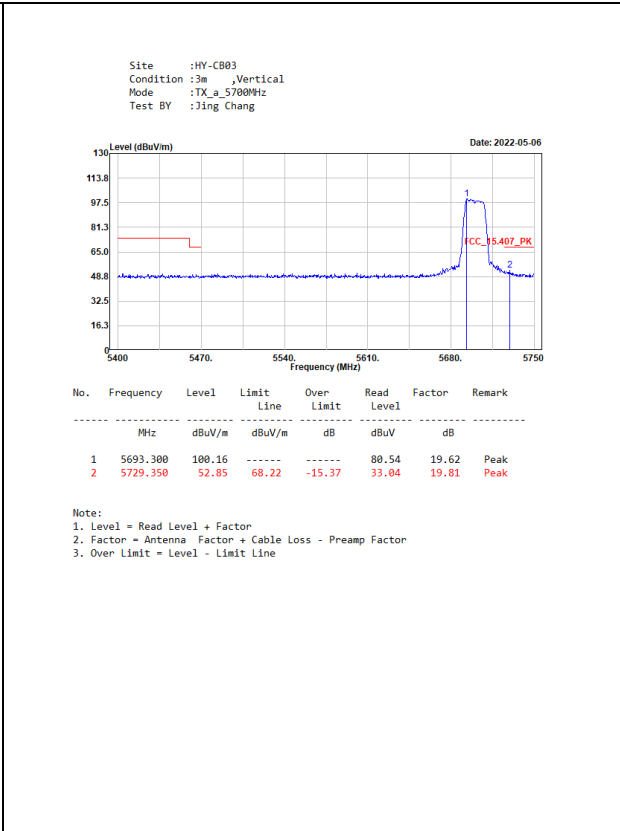
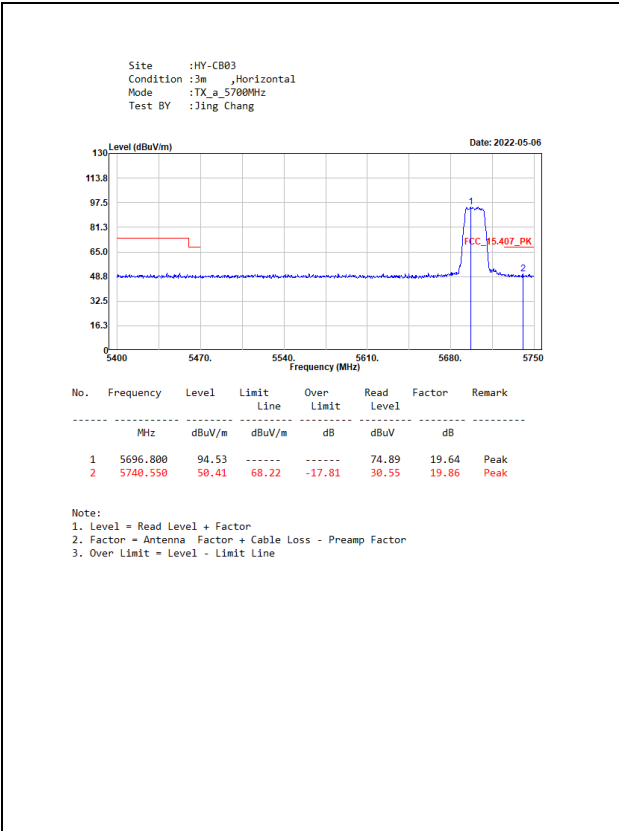
4.4. Test Result of Band Edge

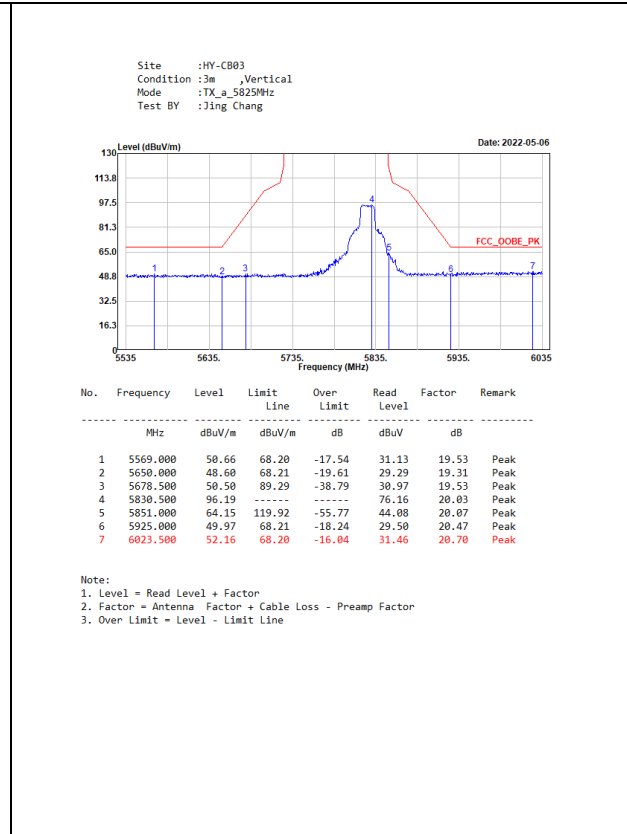
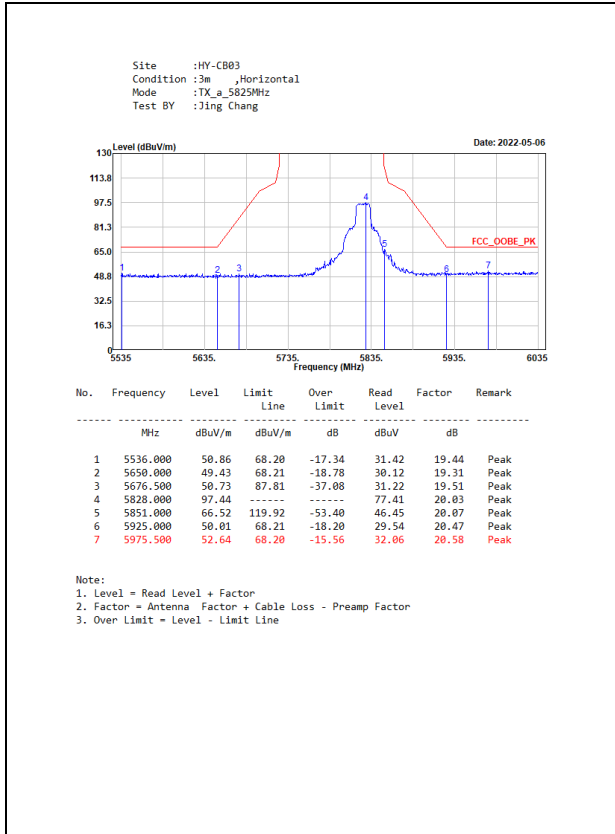
Dipole_SISO A



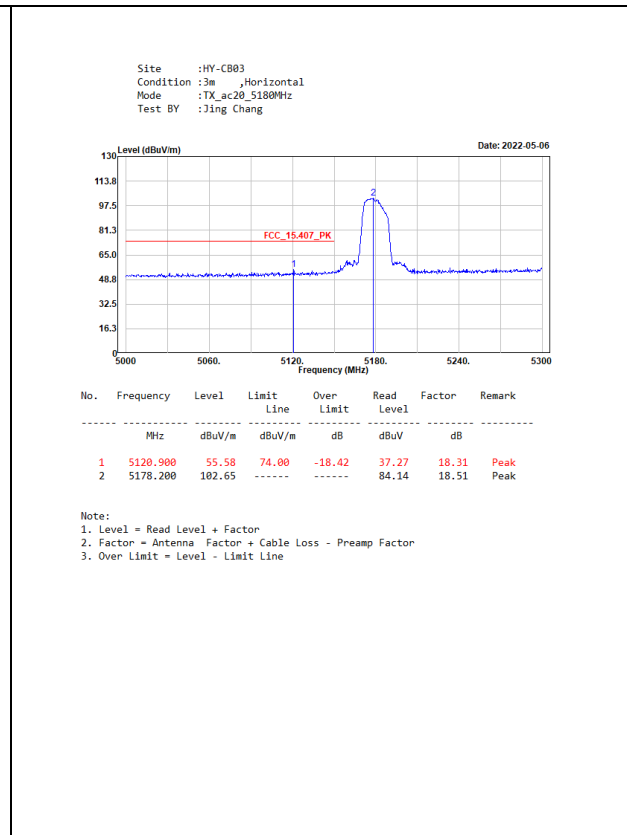
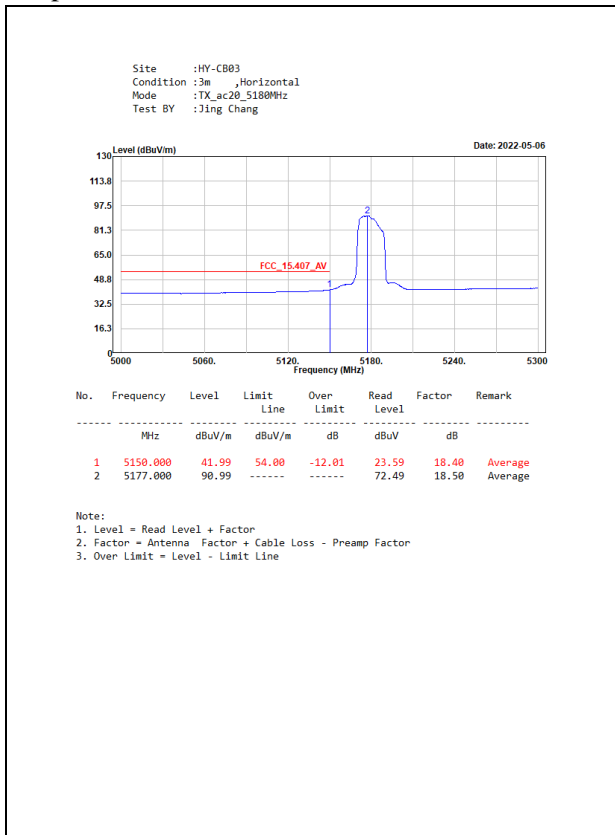


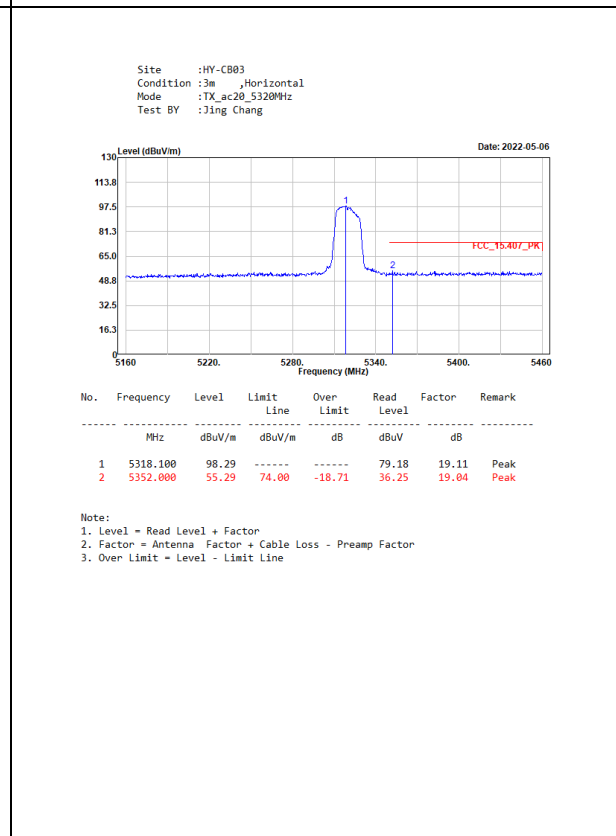
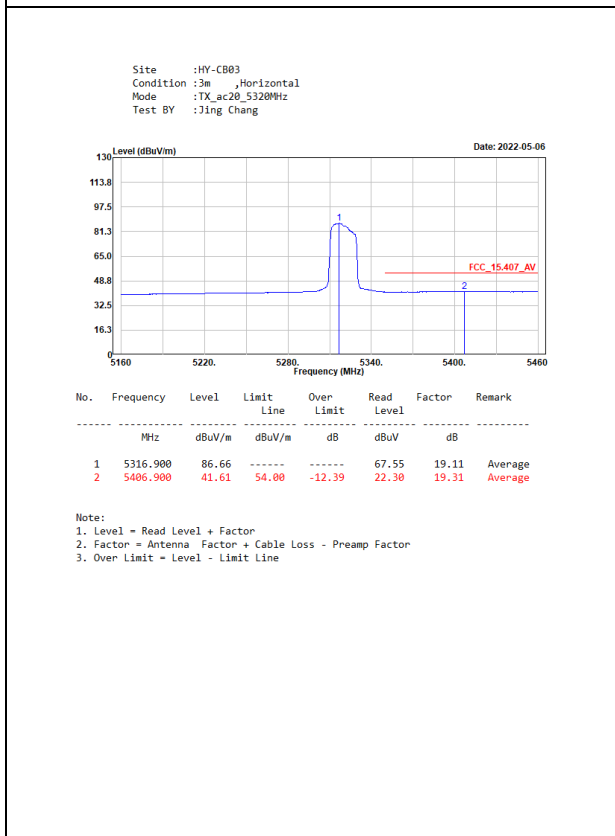
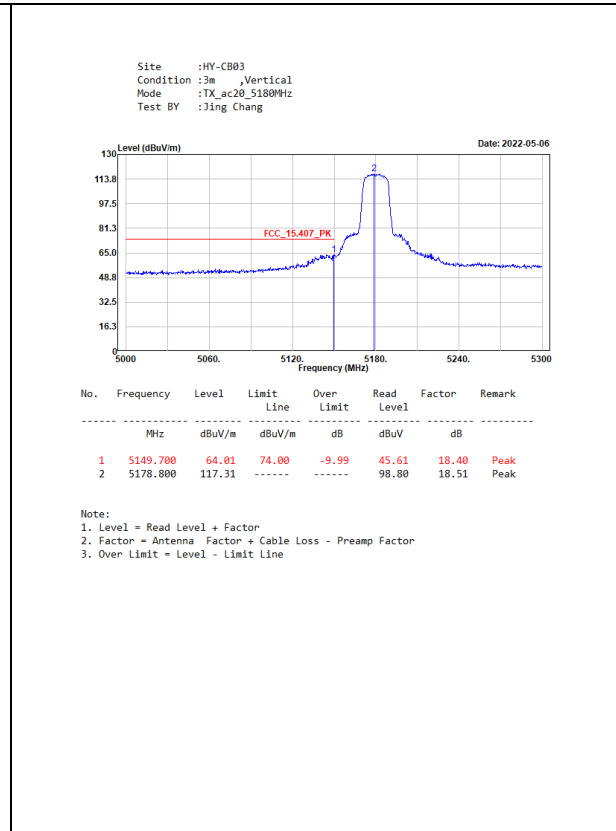
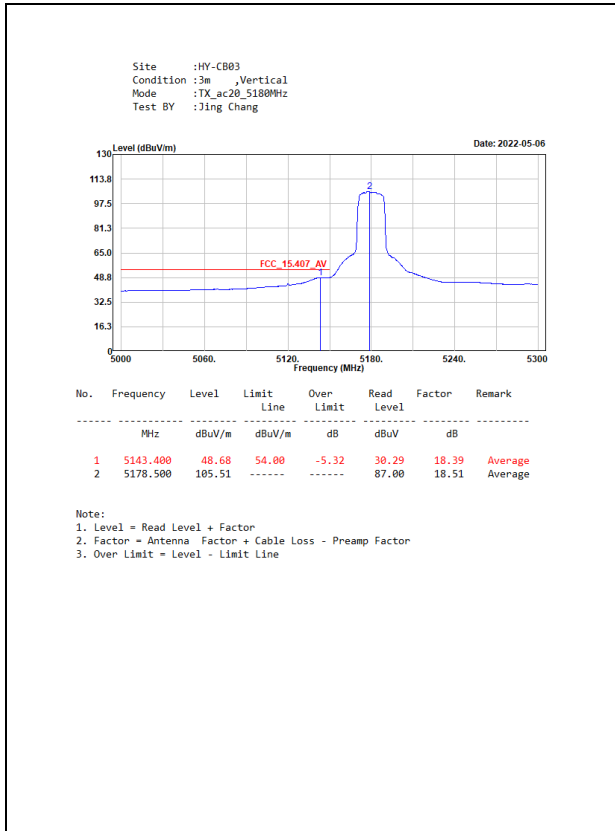


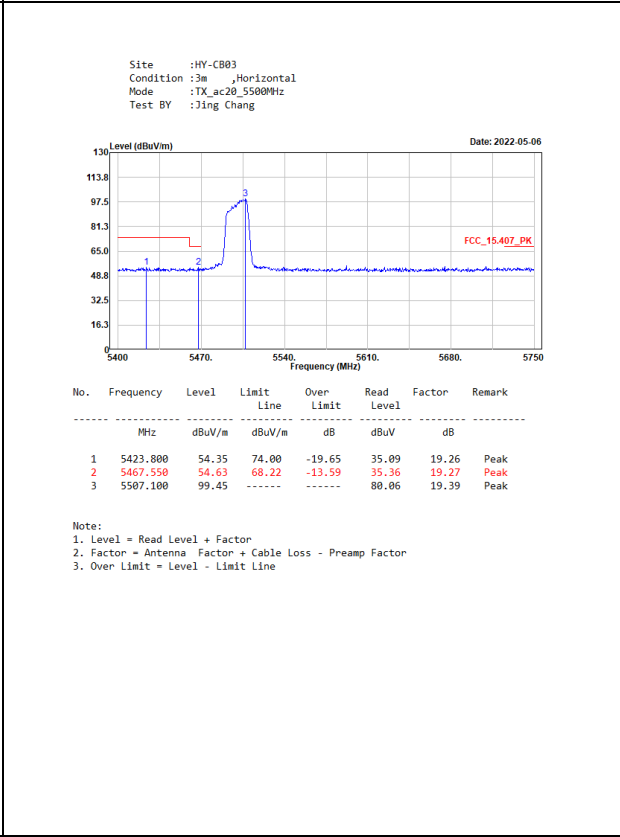
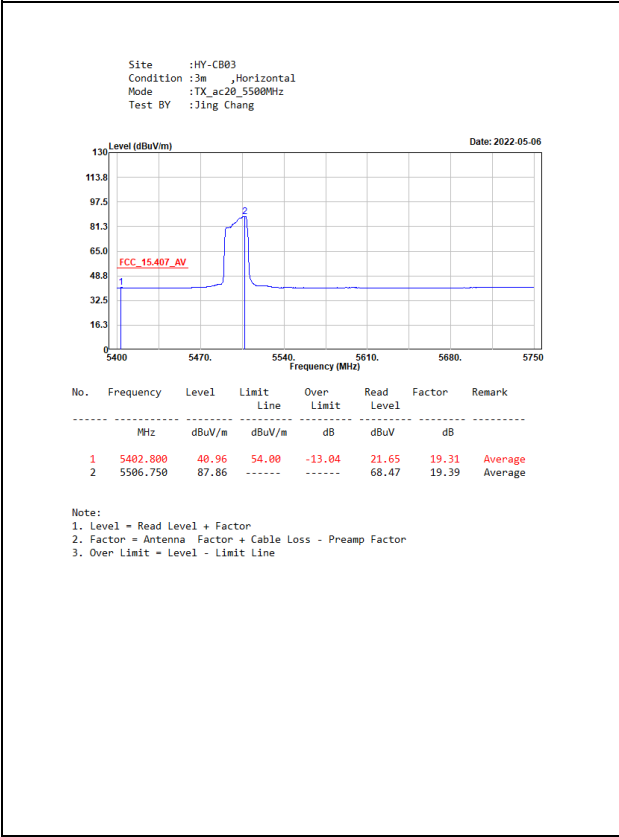
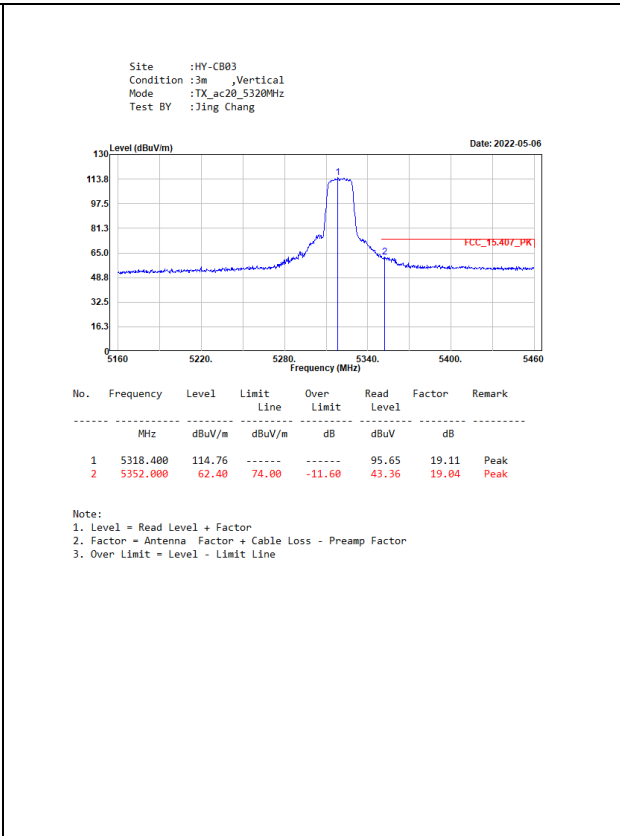
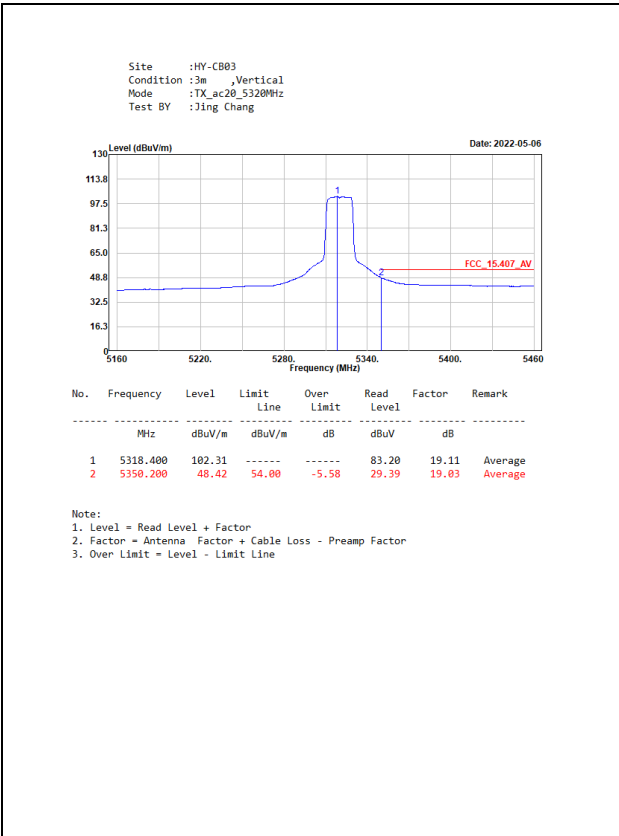


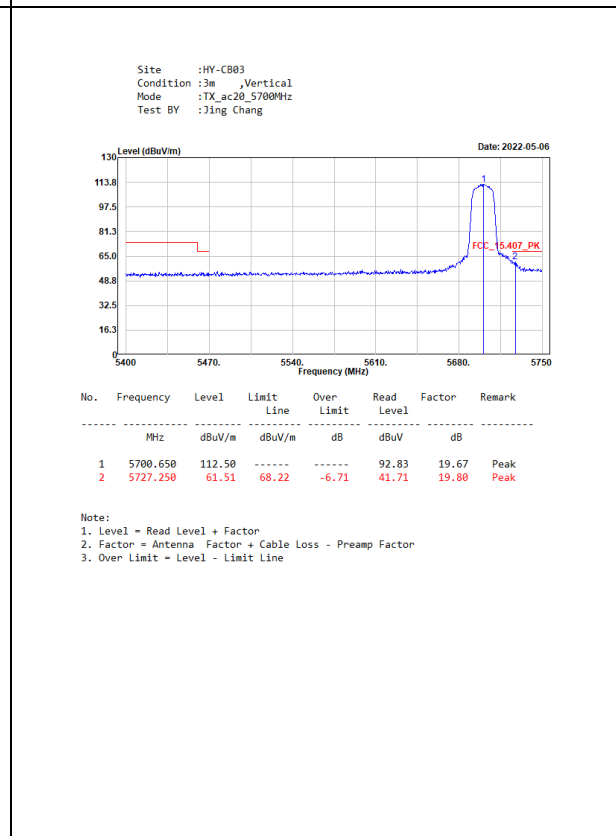
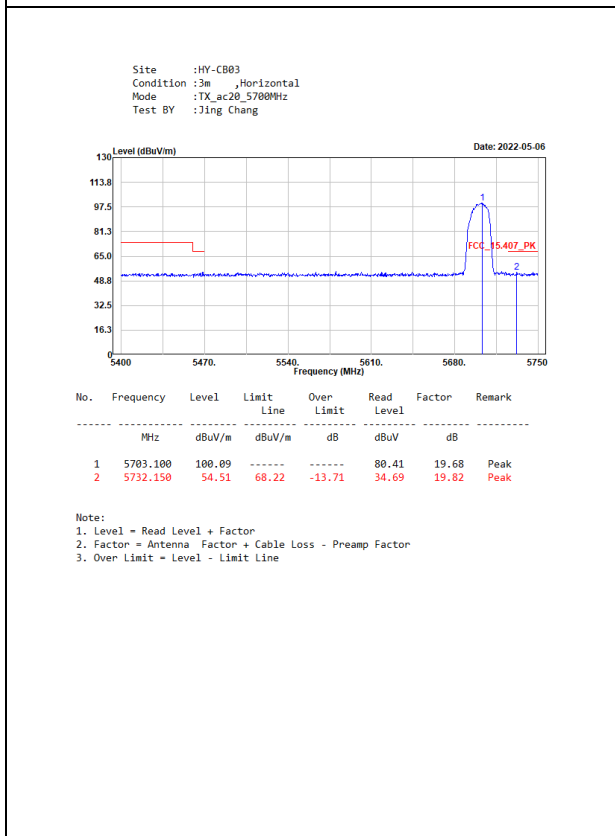
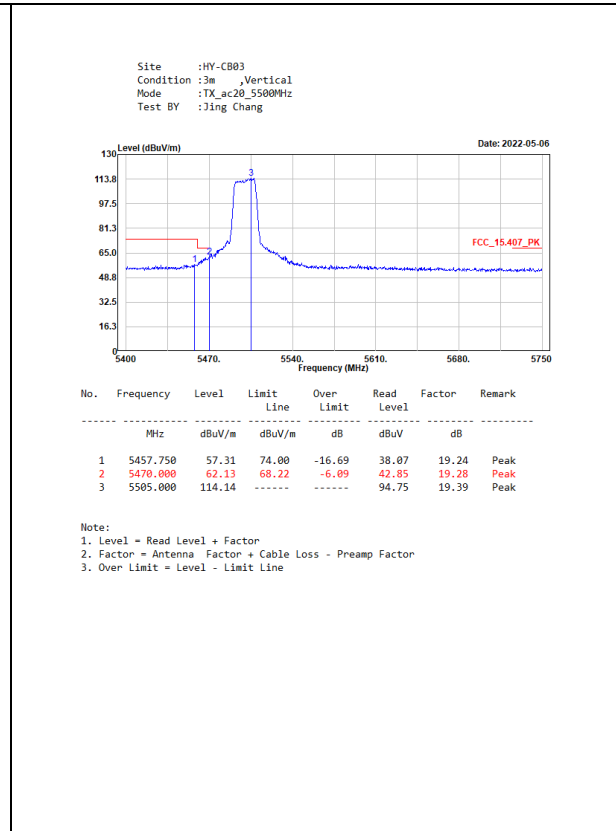
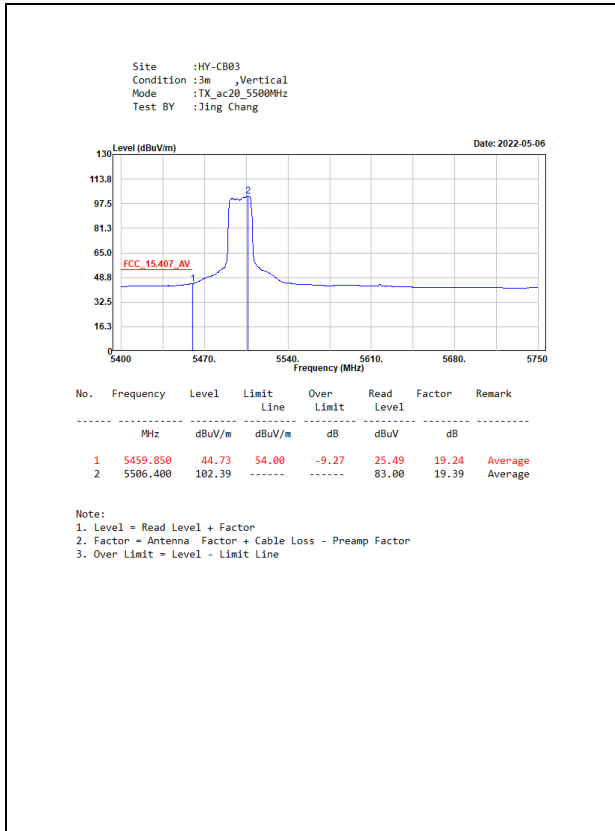


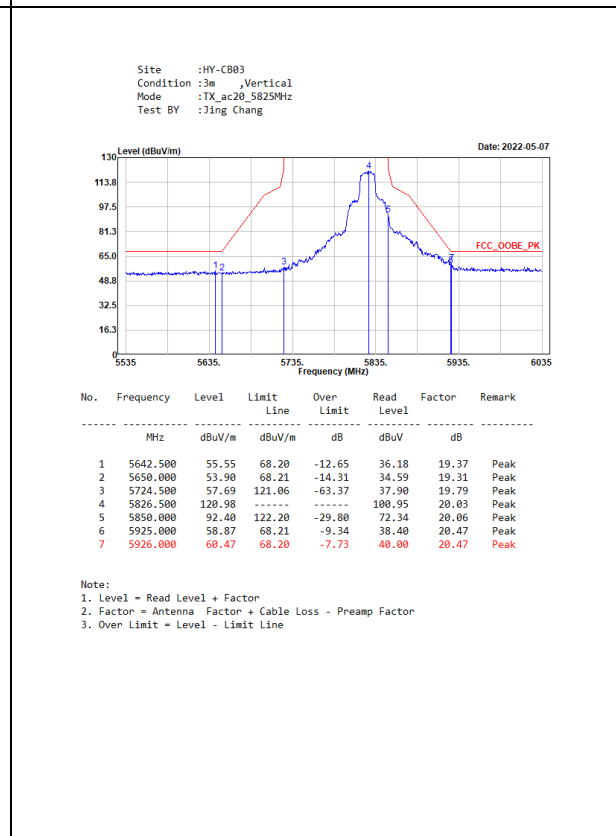
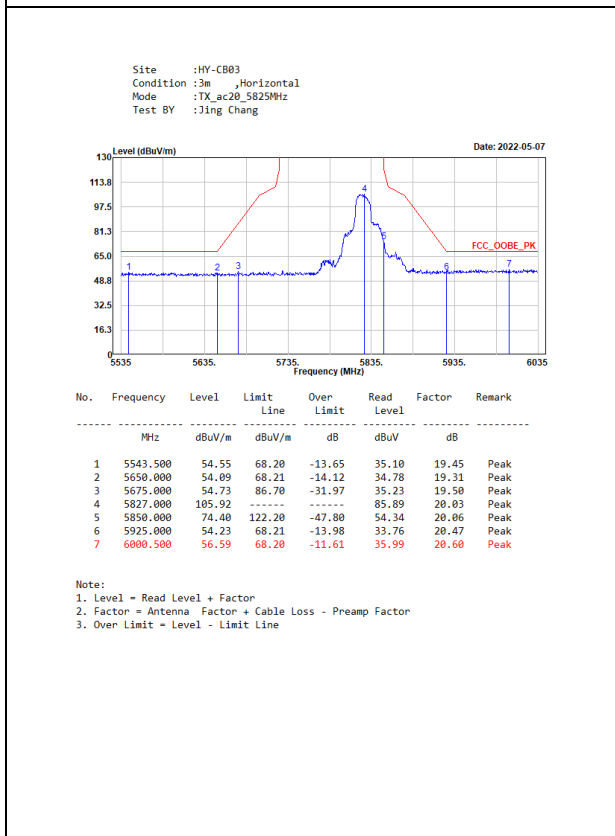
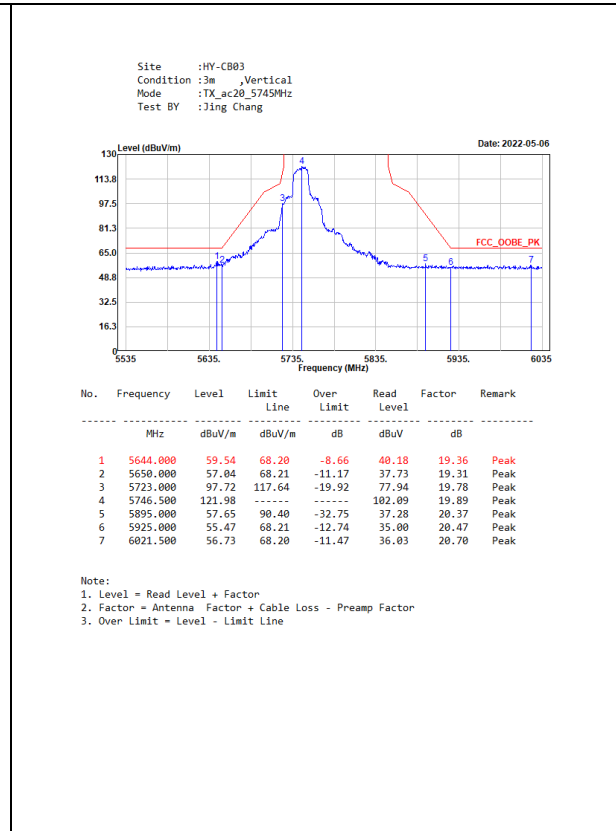
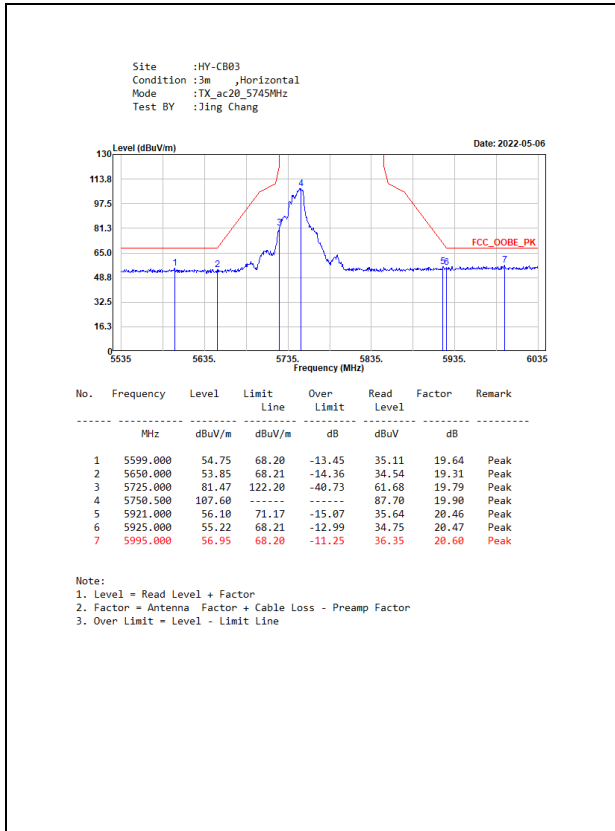
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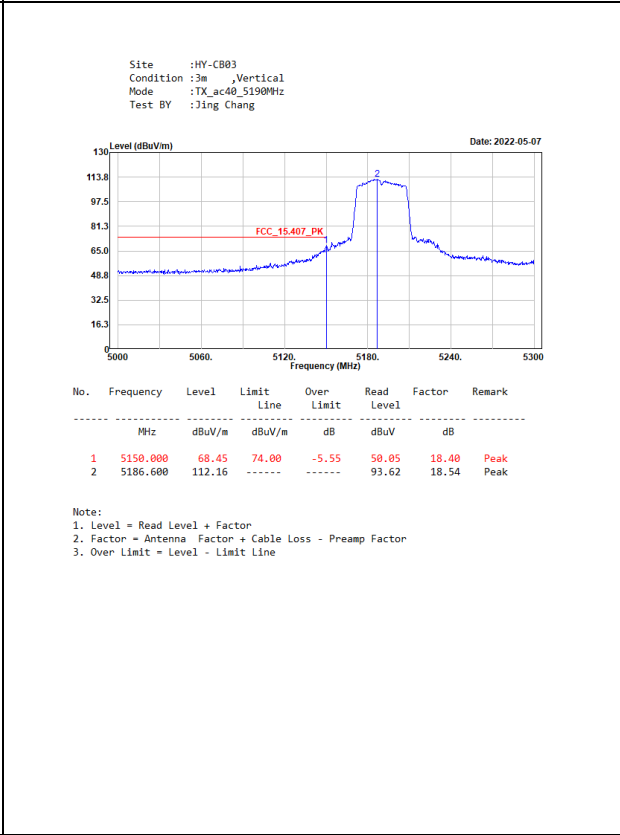
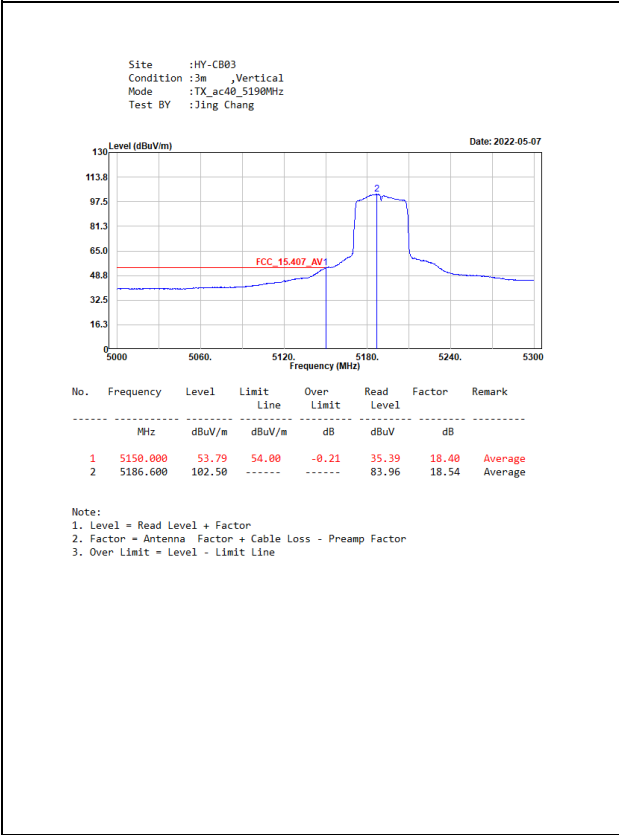
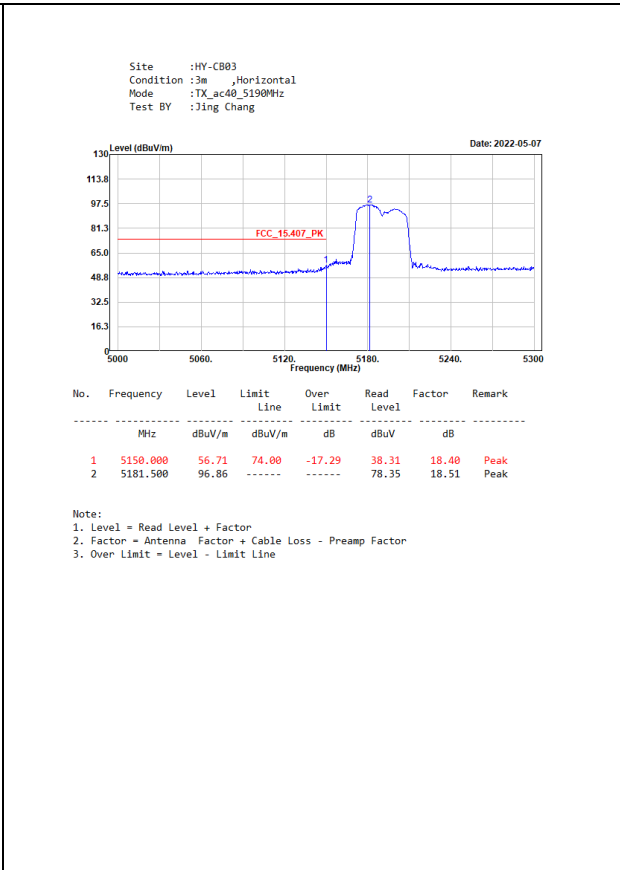
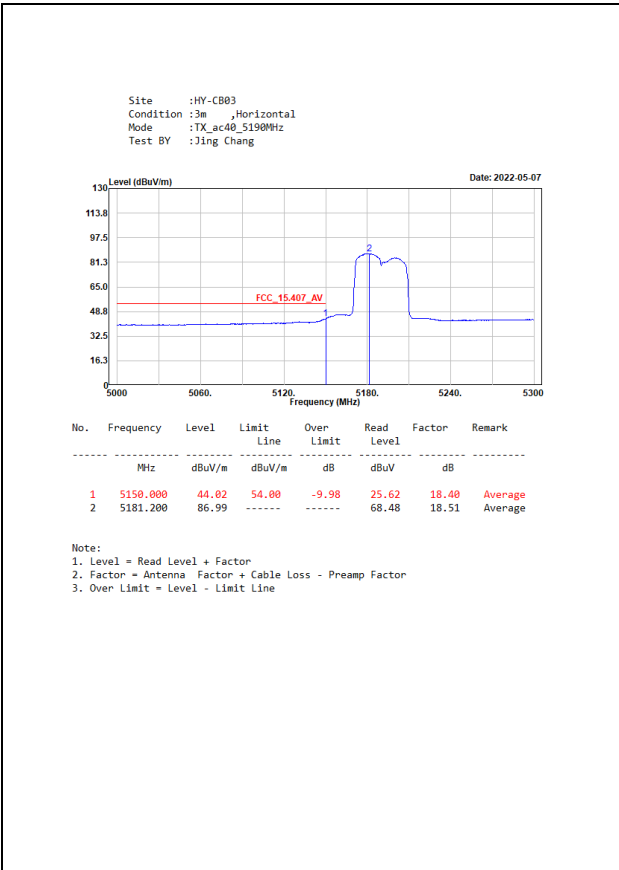


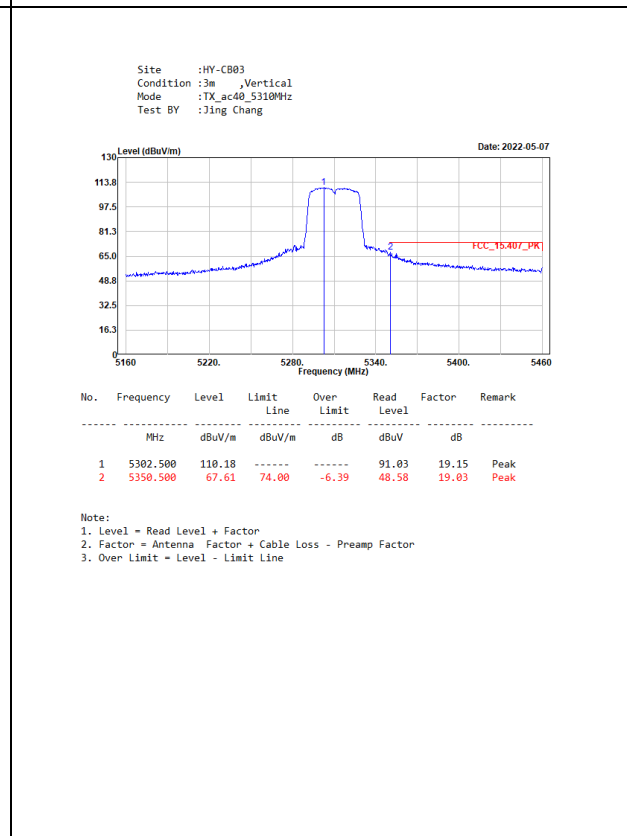
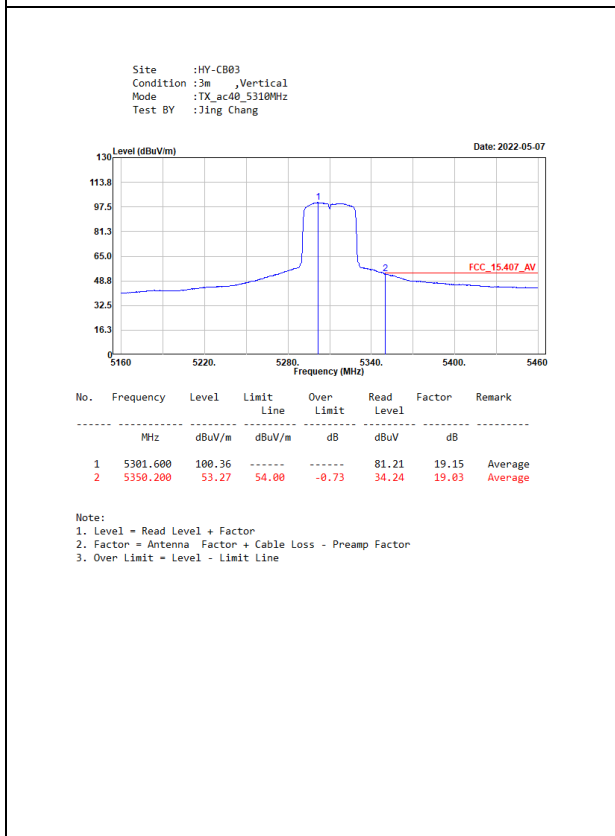
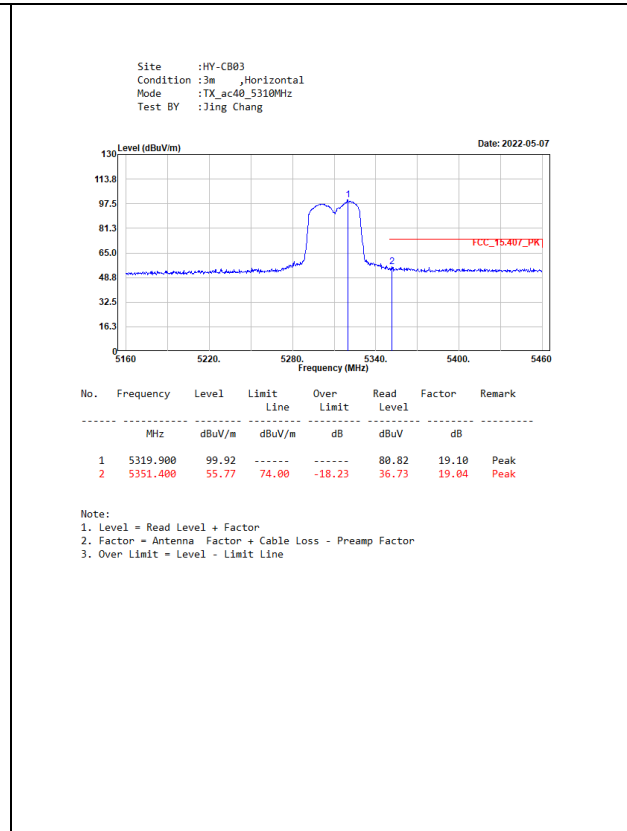
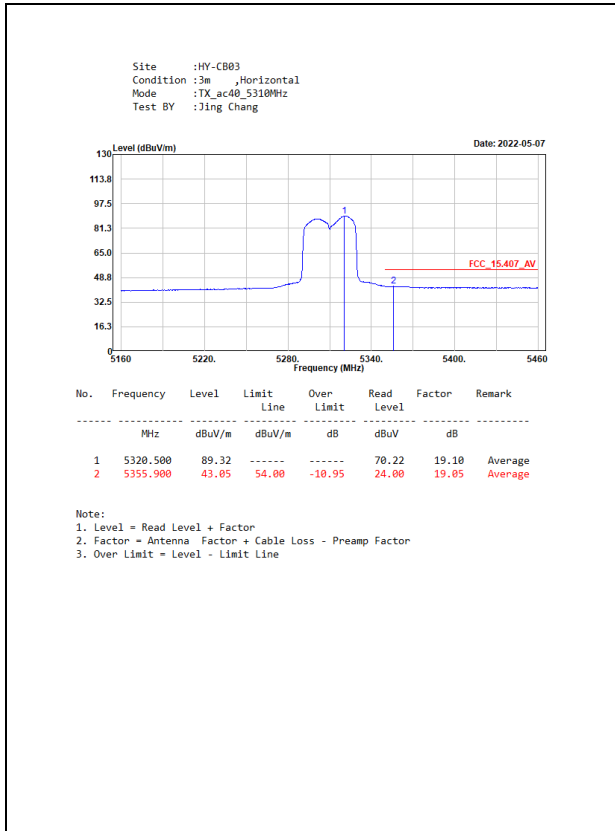


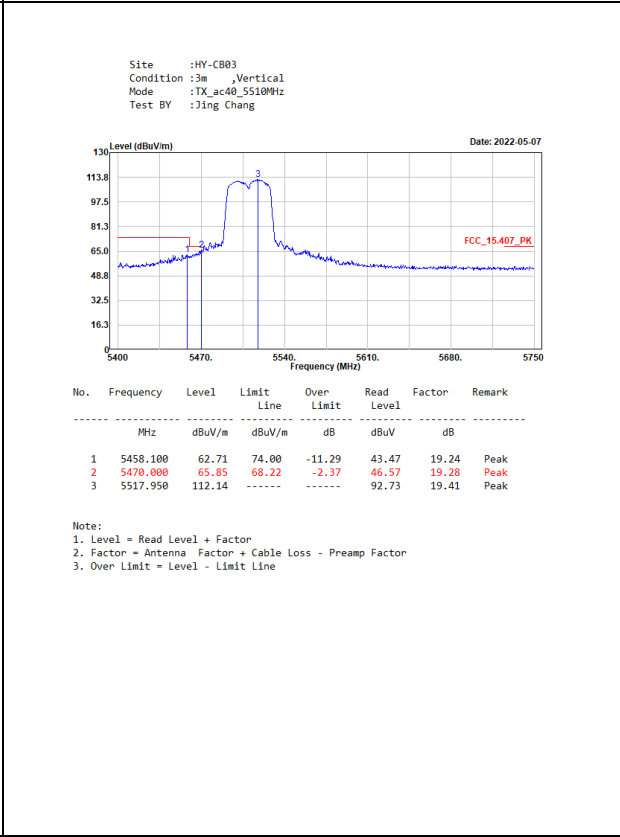
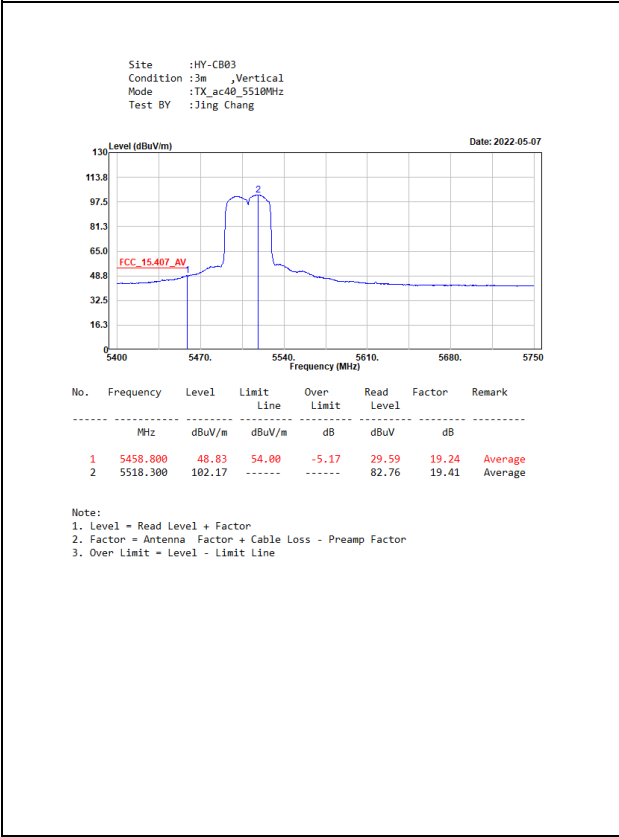
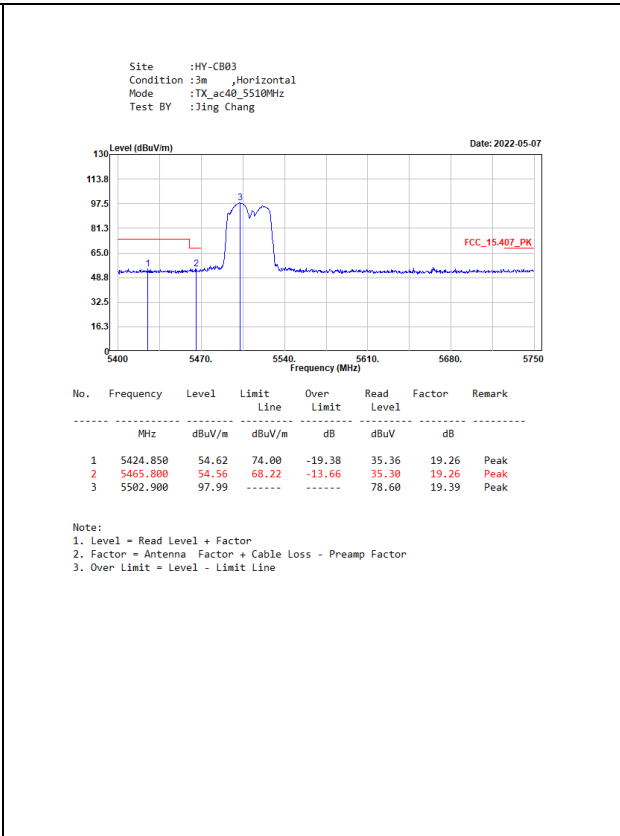
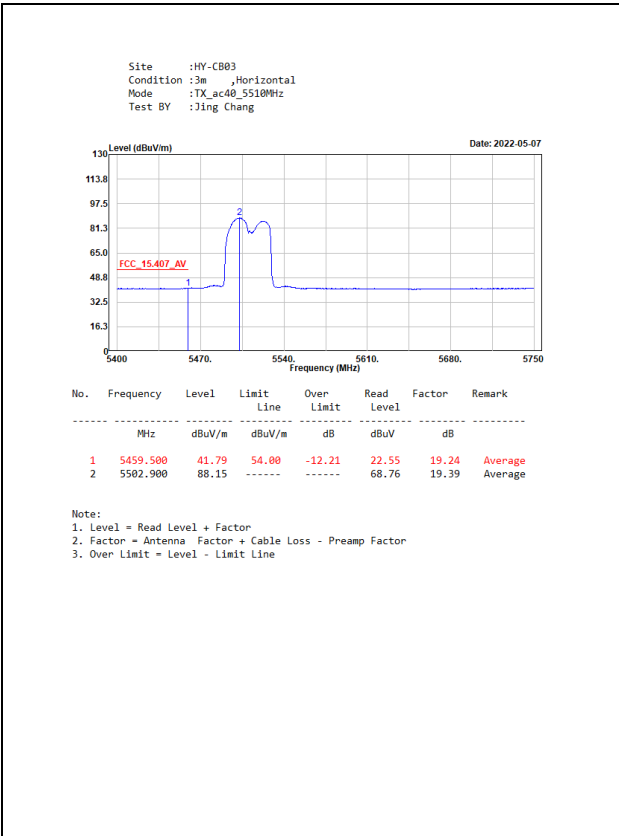


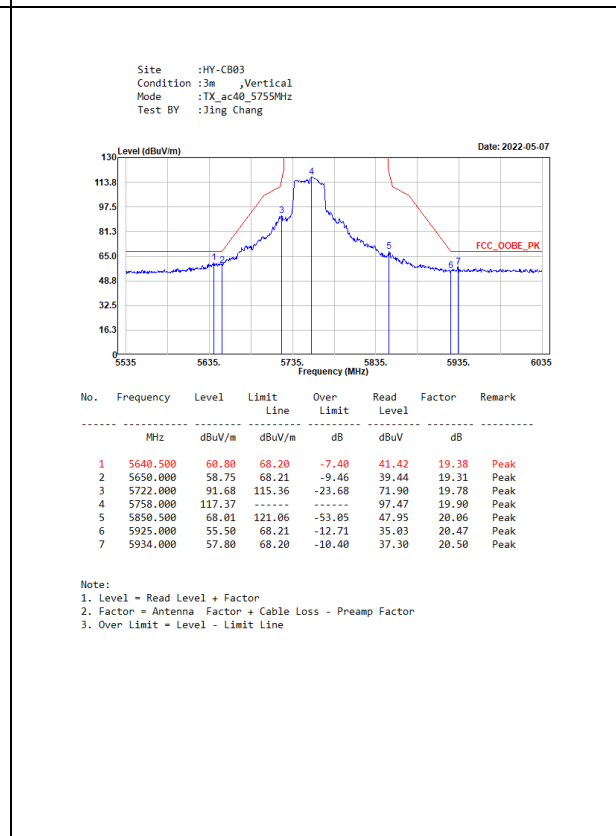
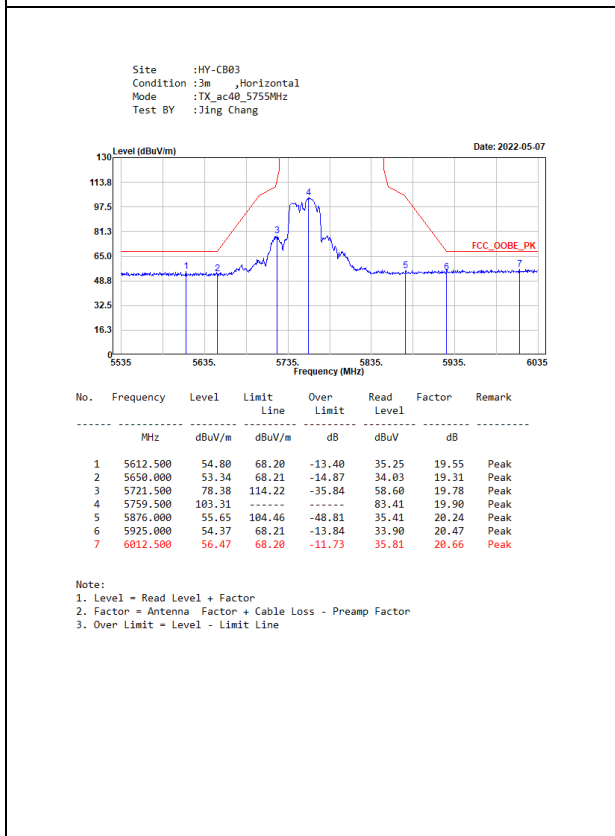
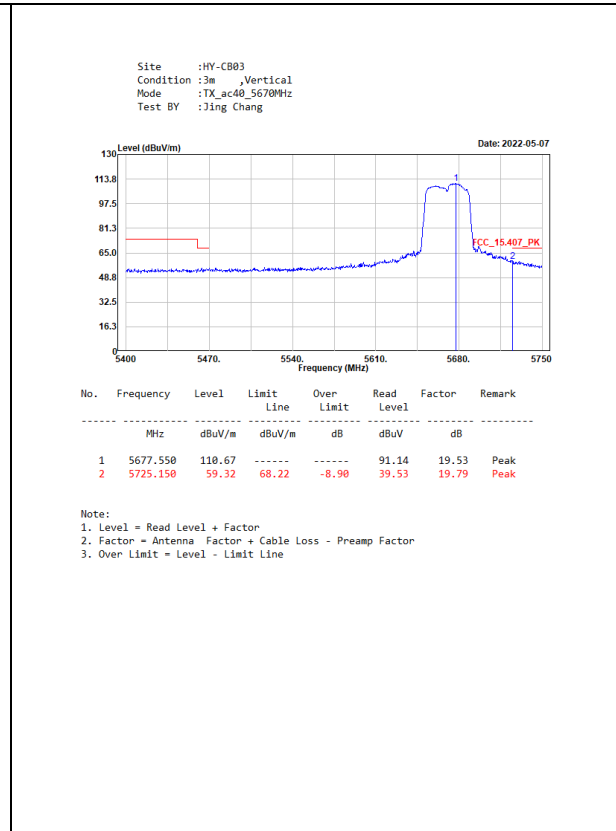
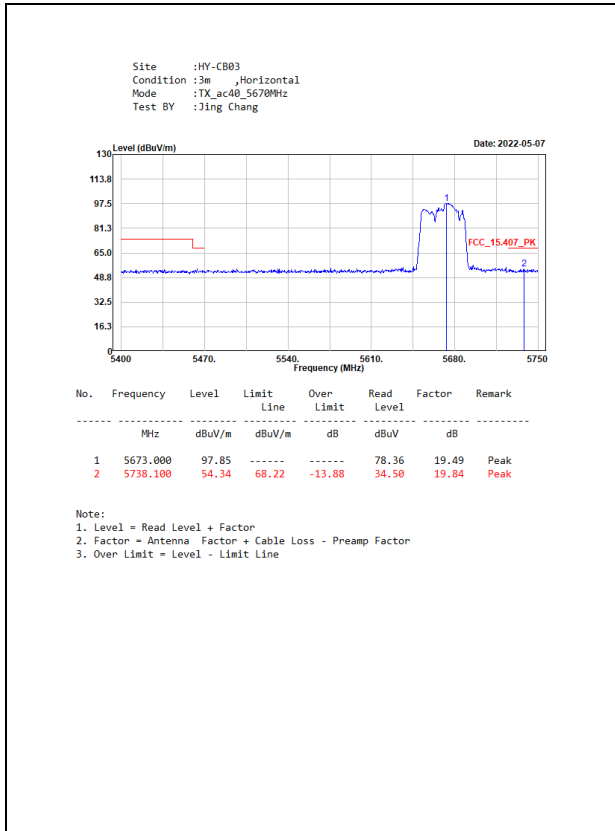


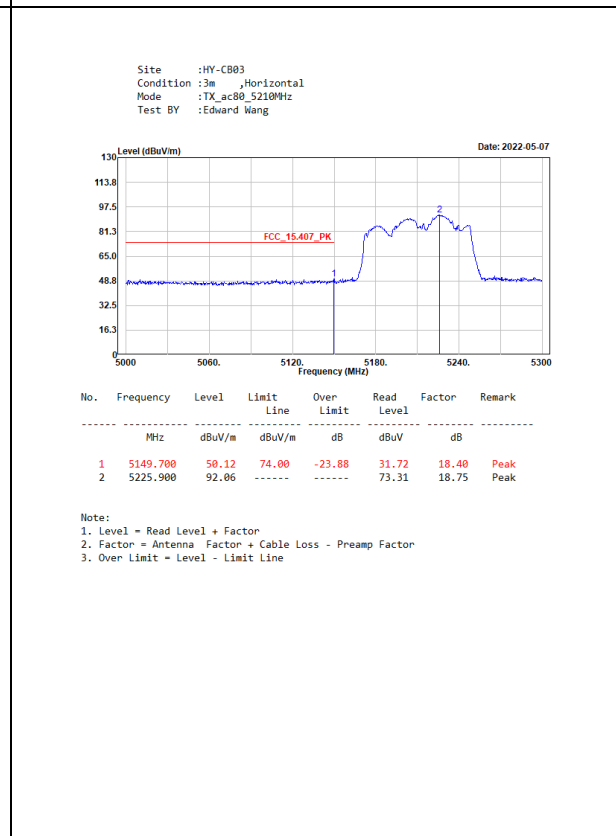
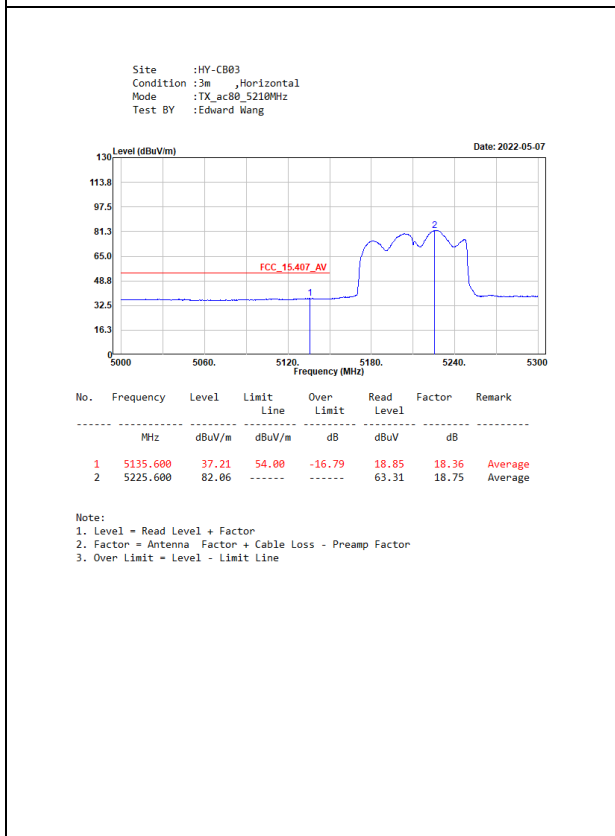
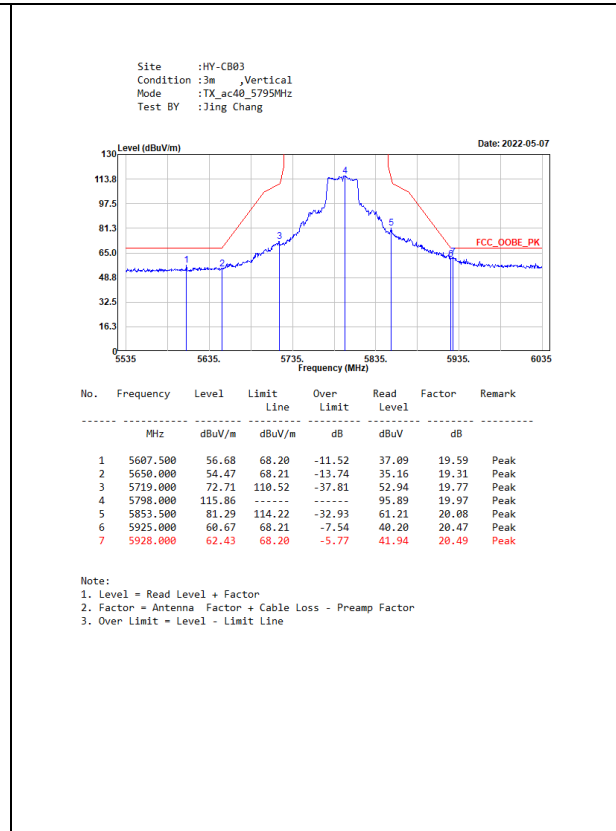
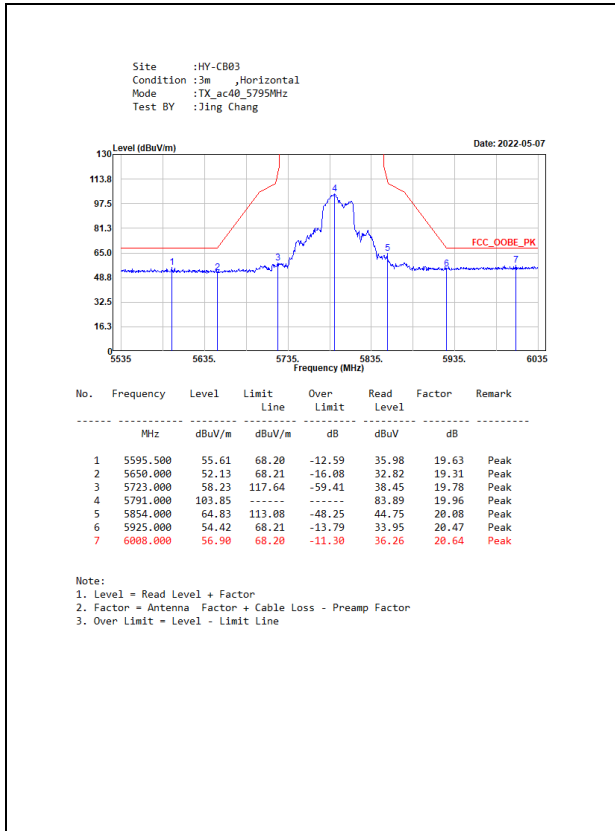


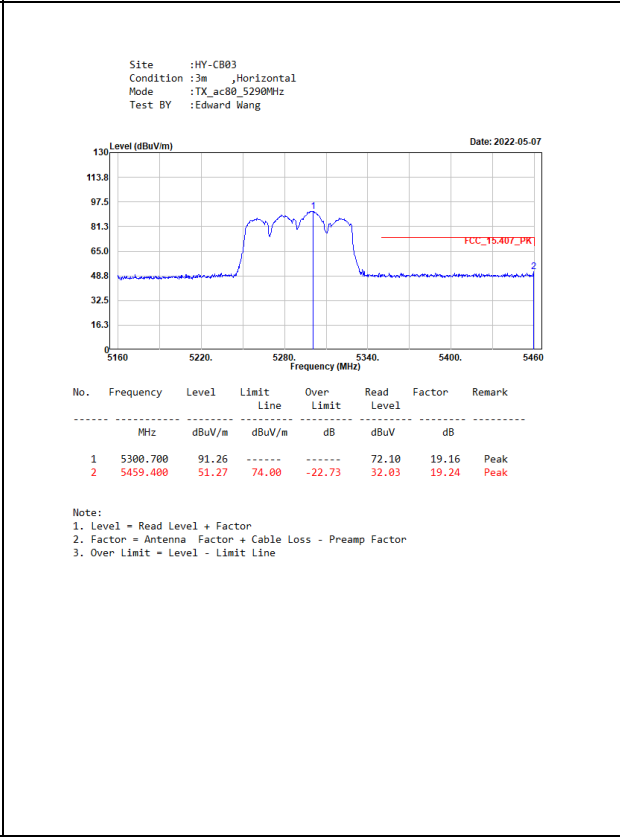
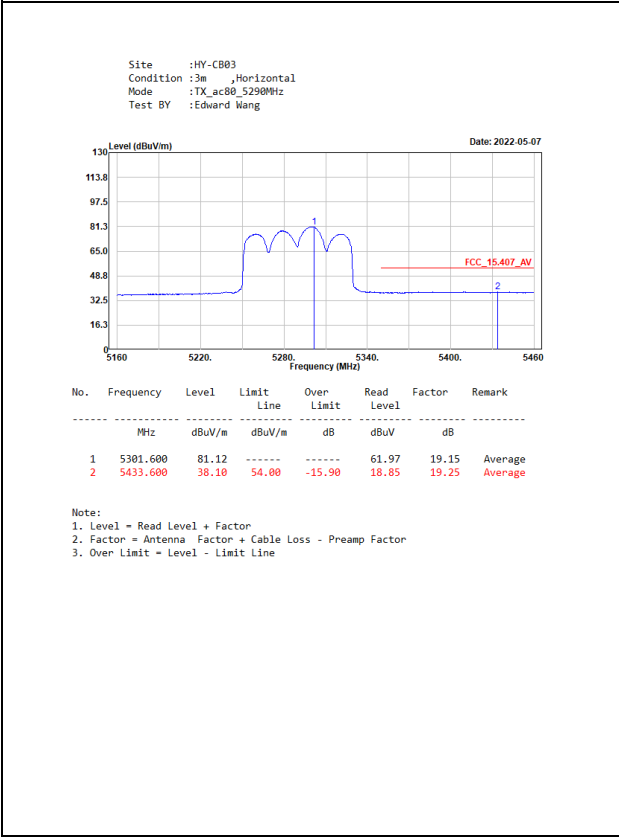
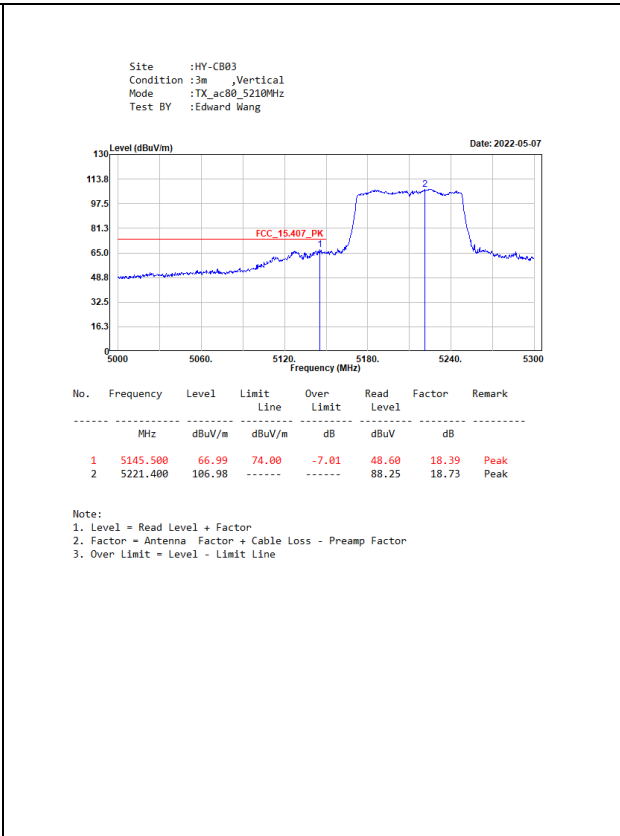
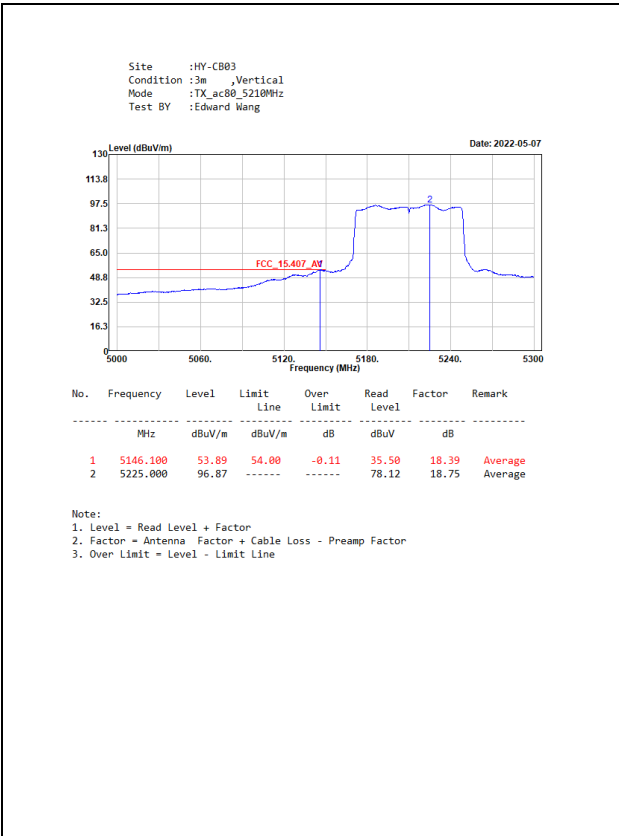


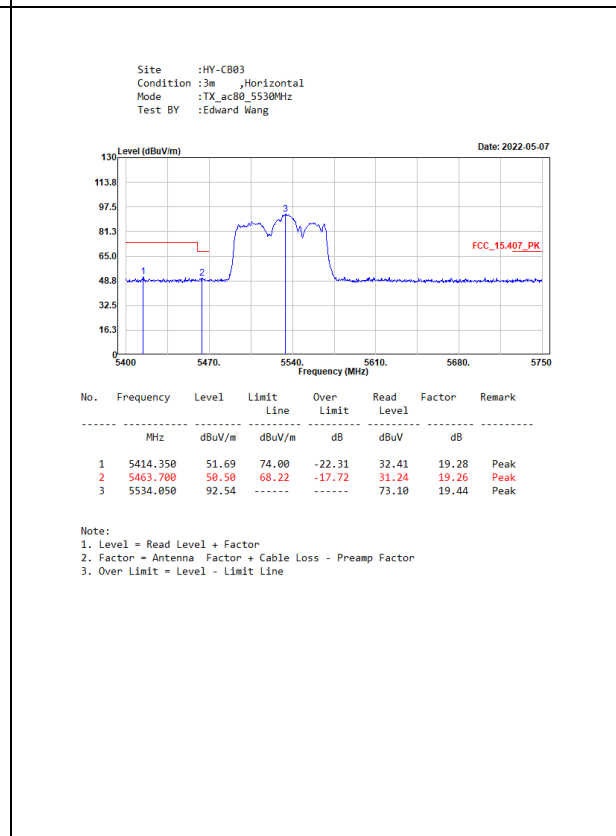
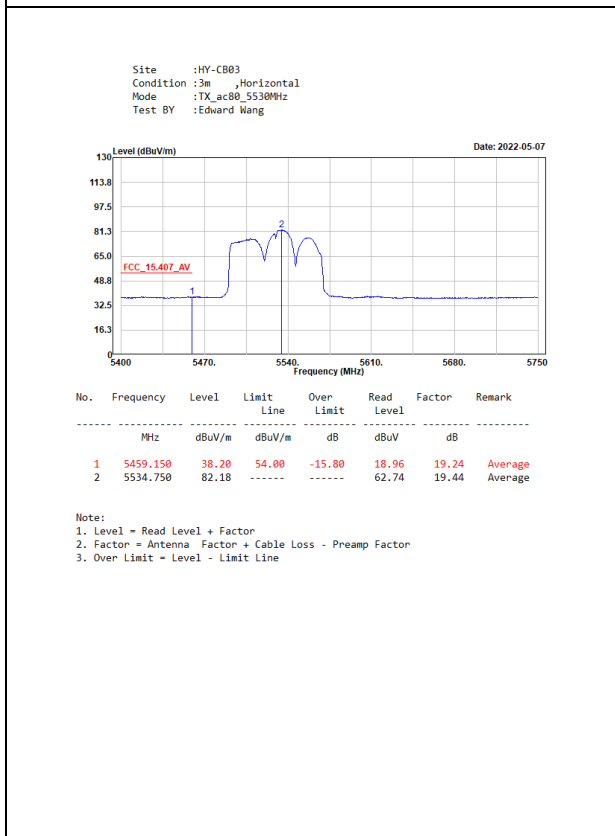
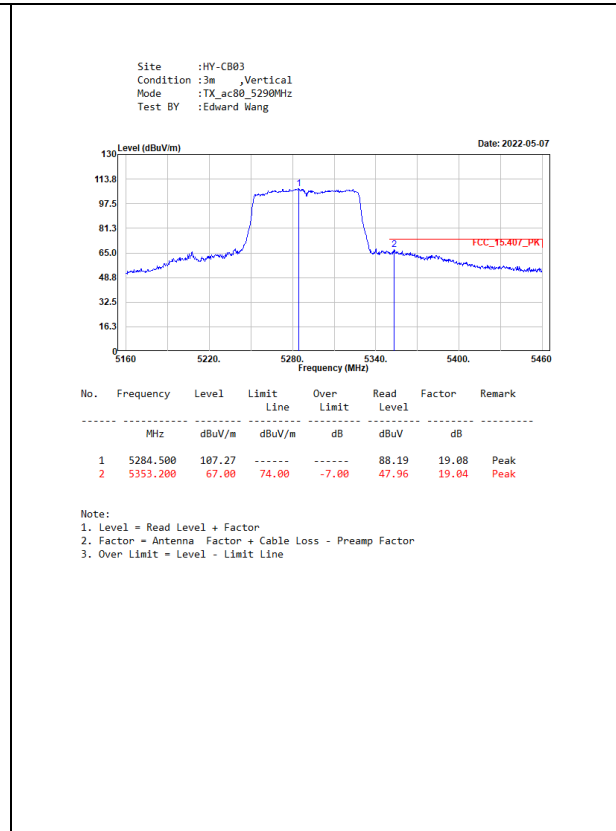
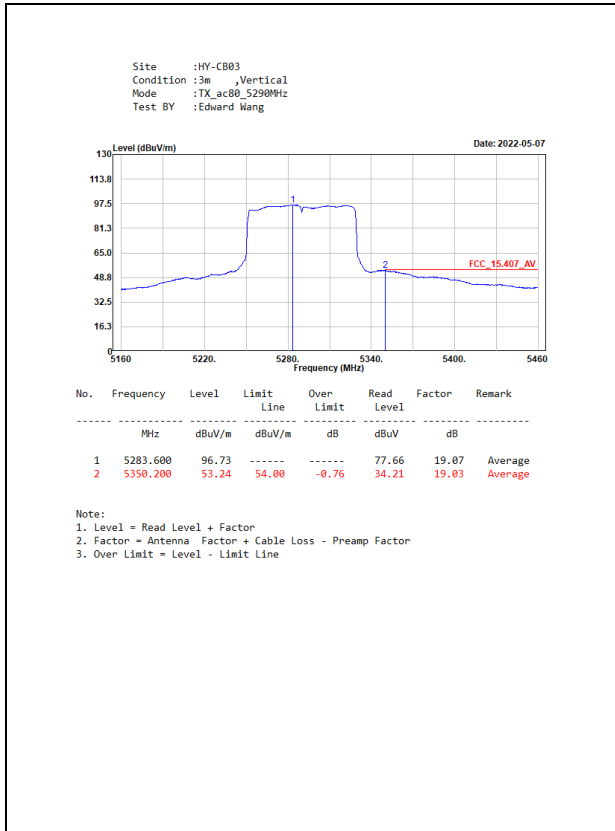


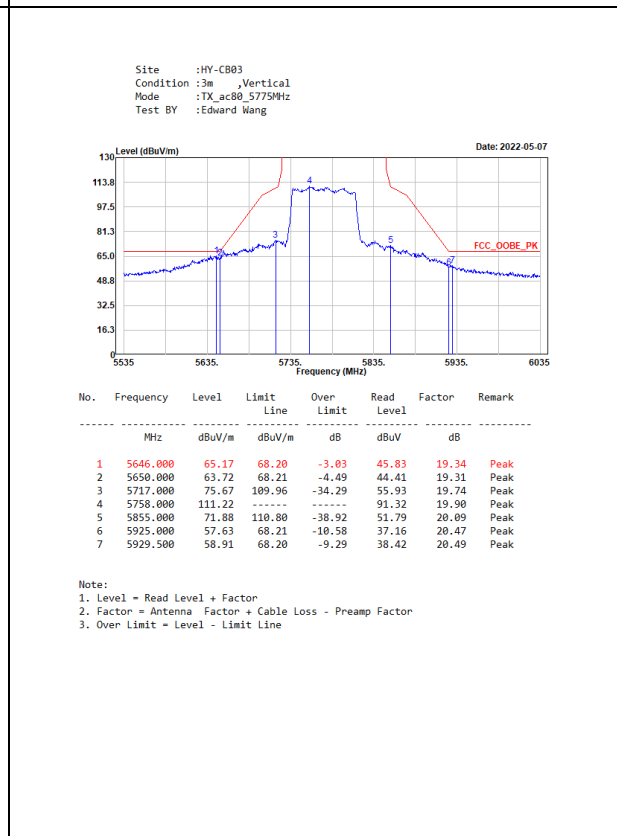
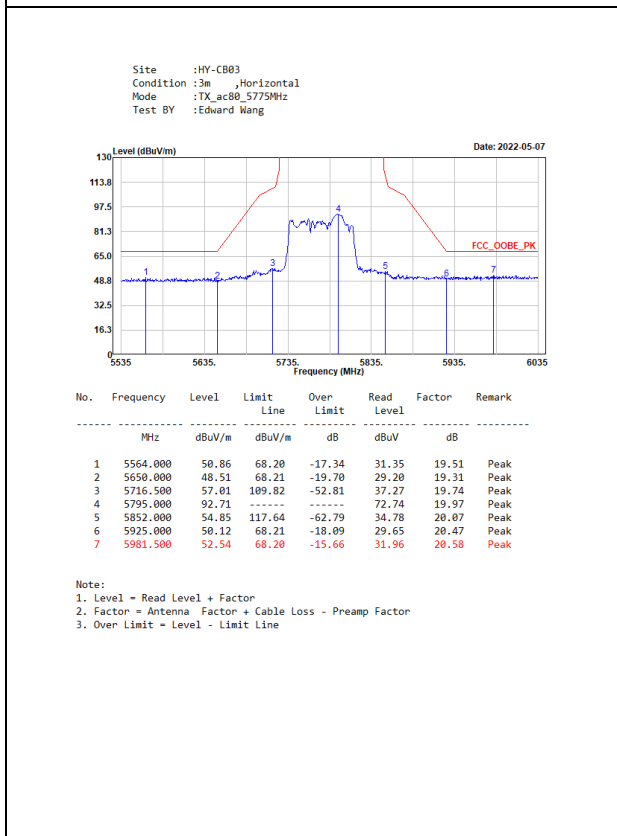
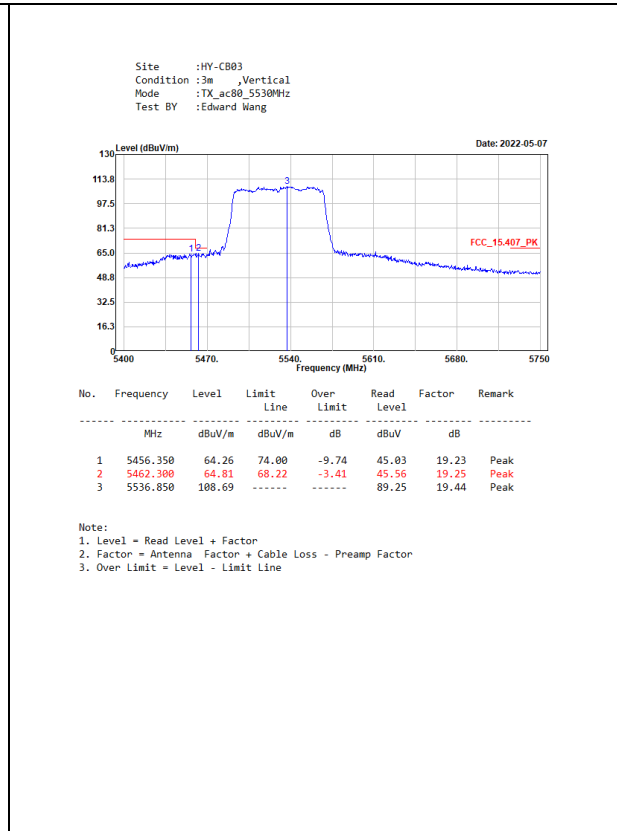
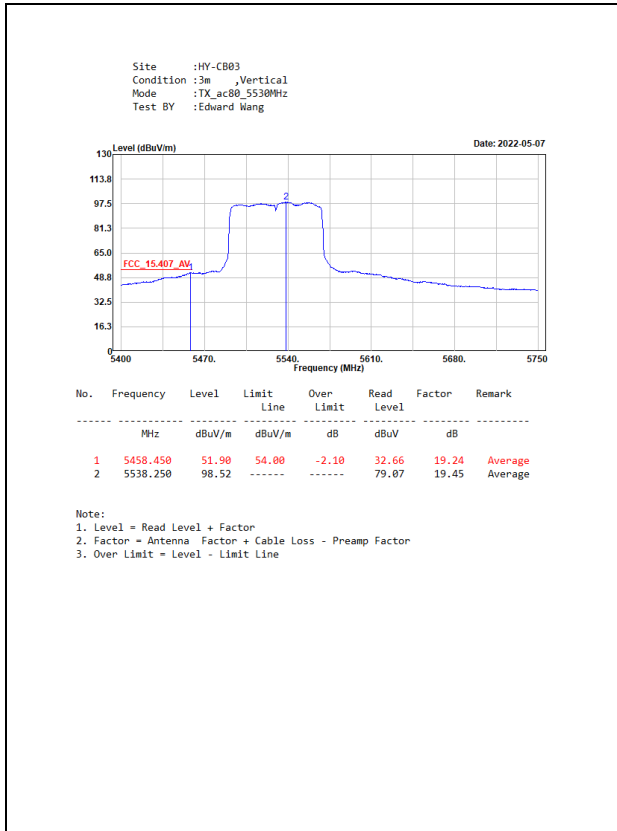




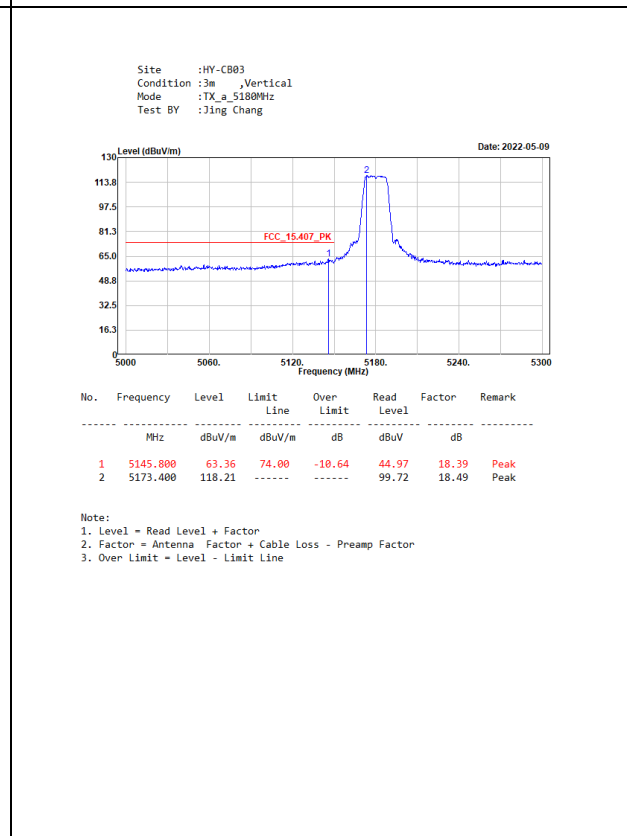
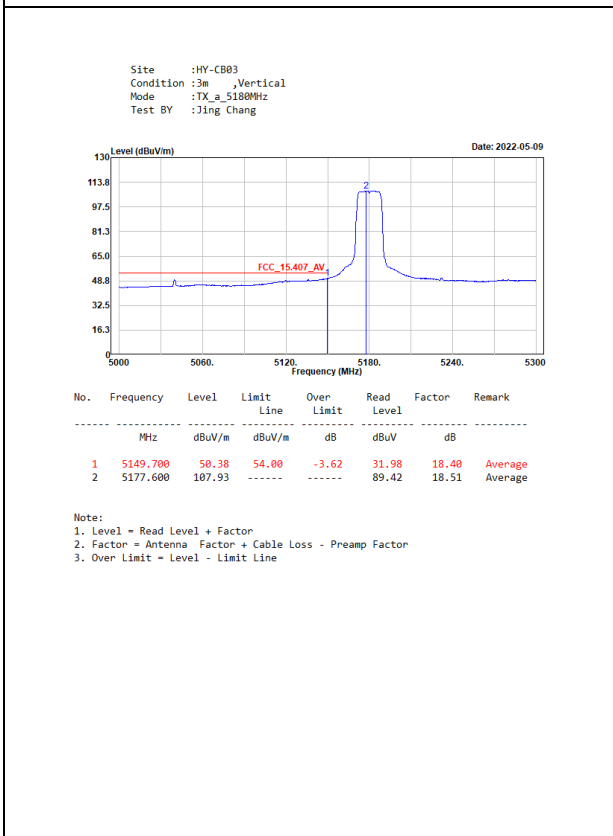
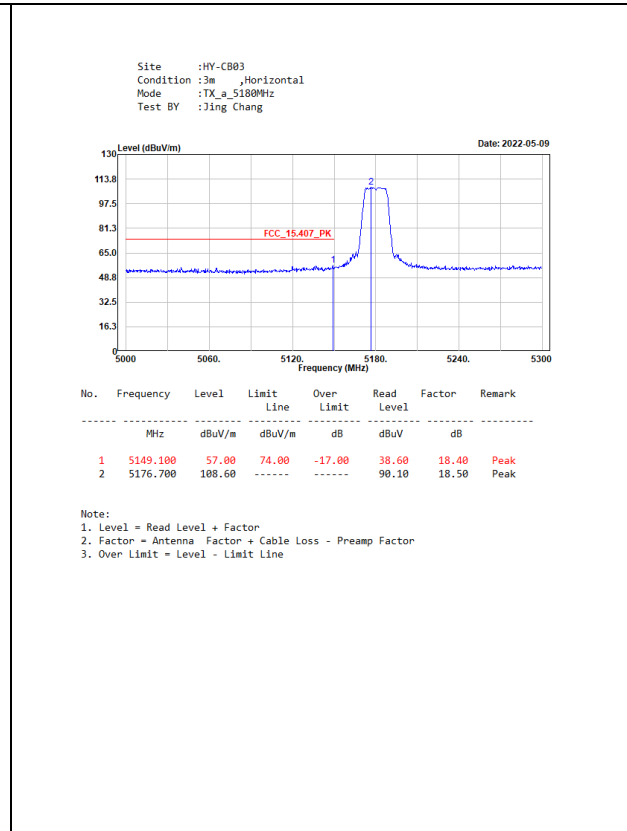
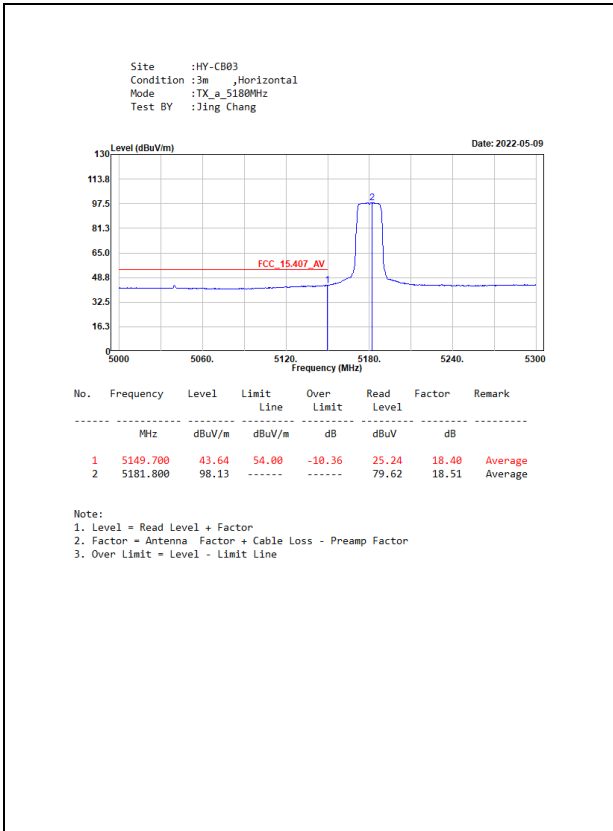


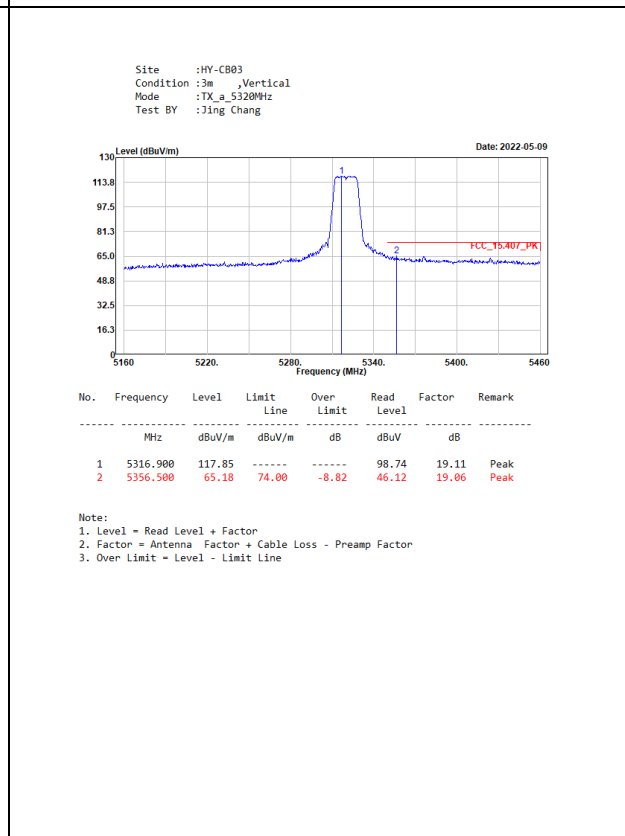
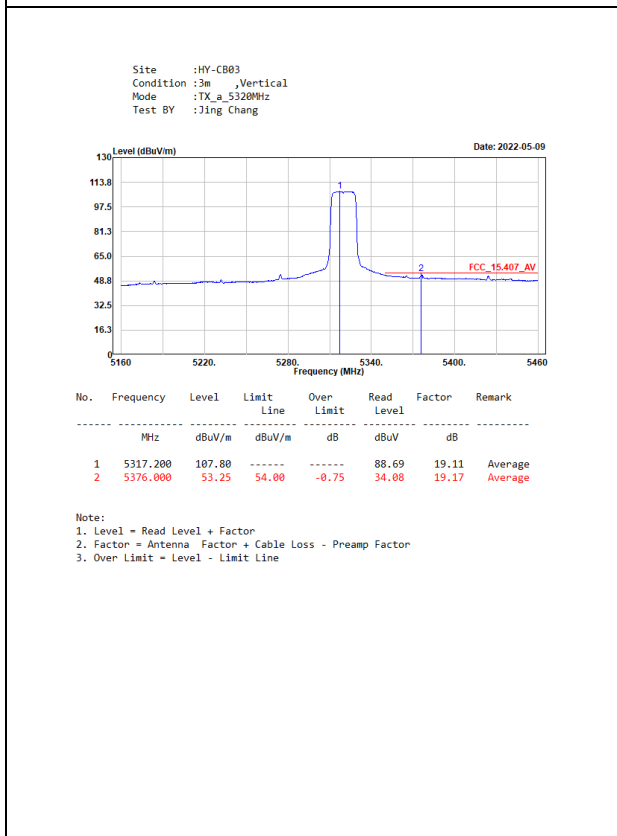
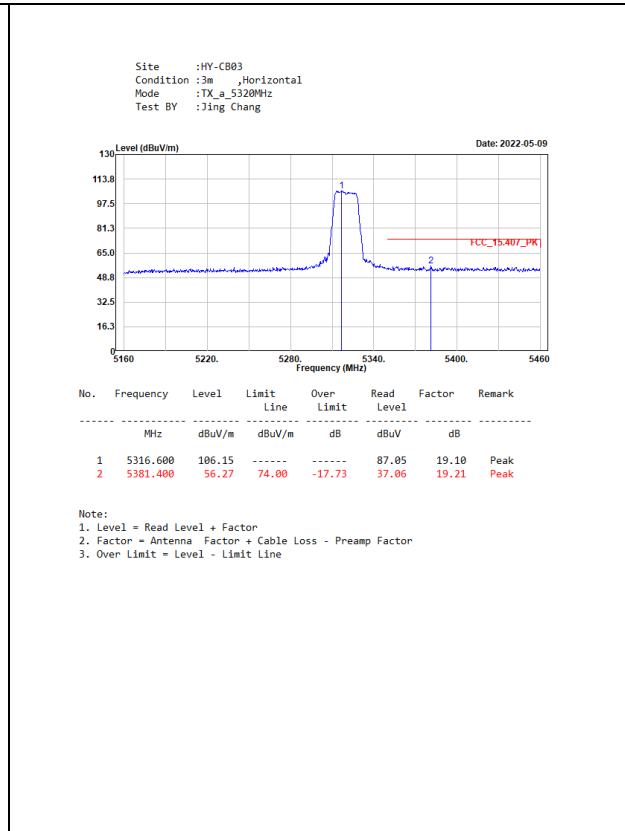
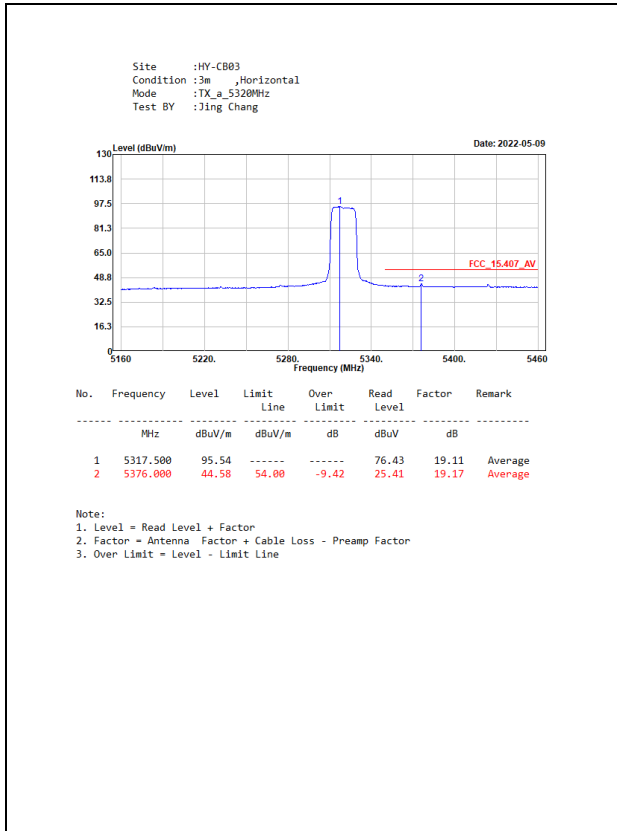


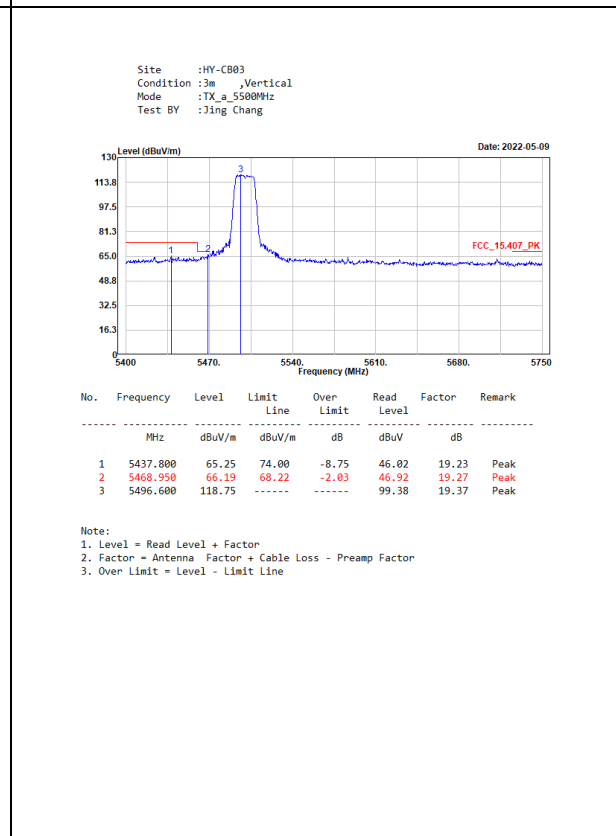
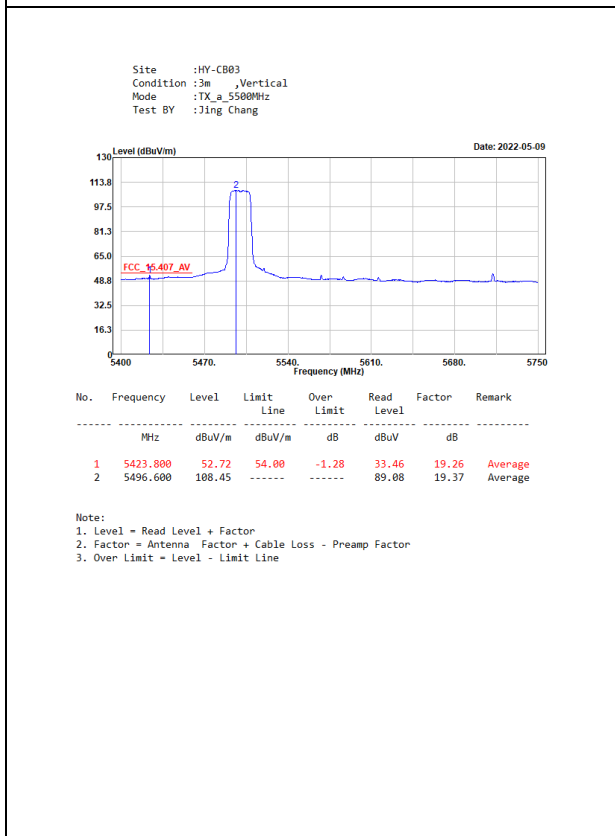
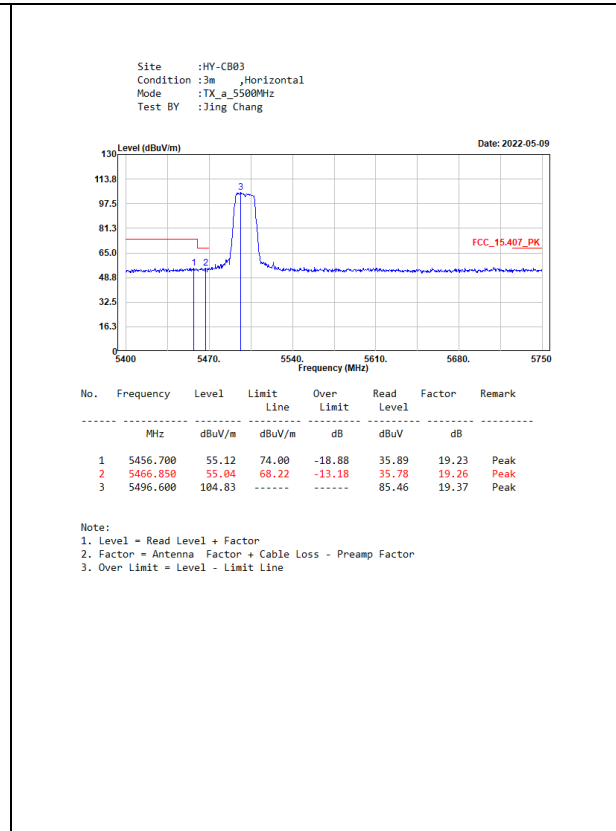
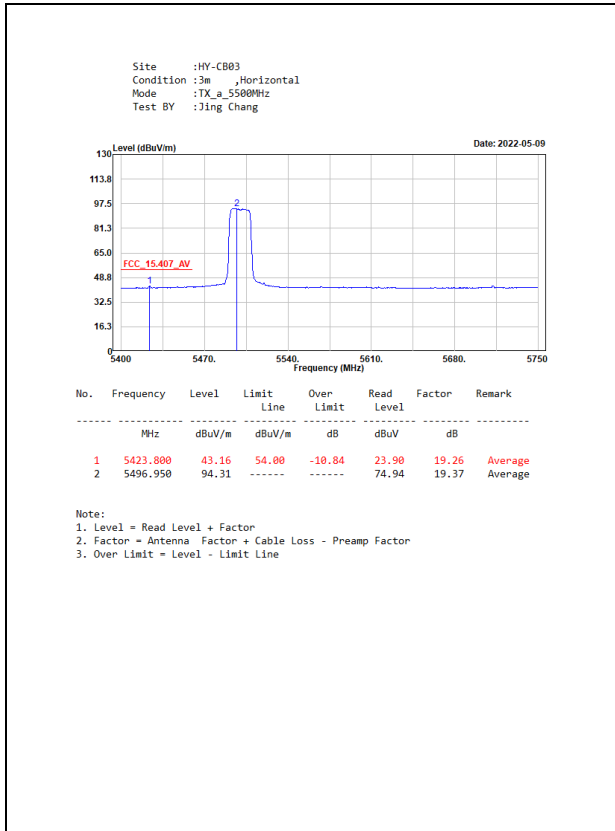


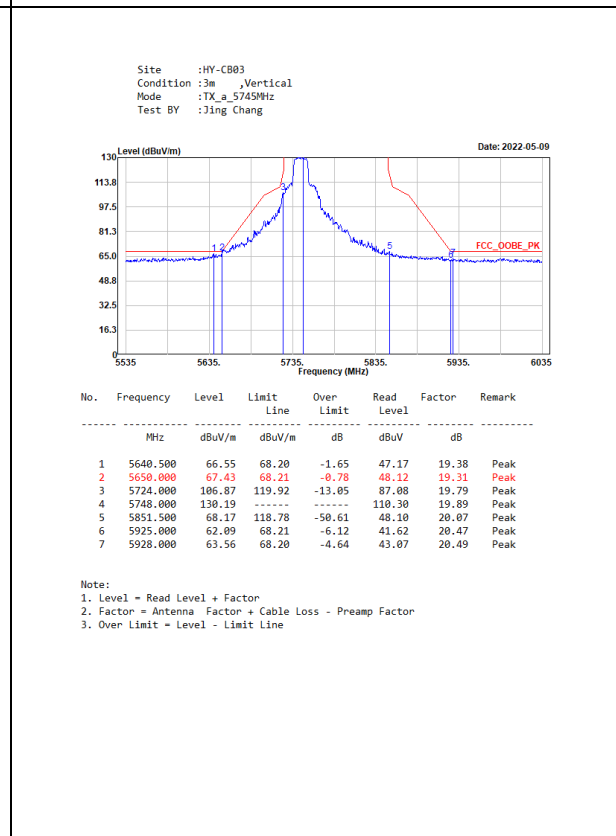
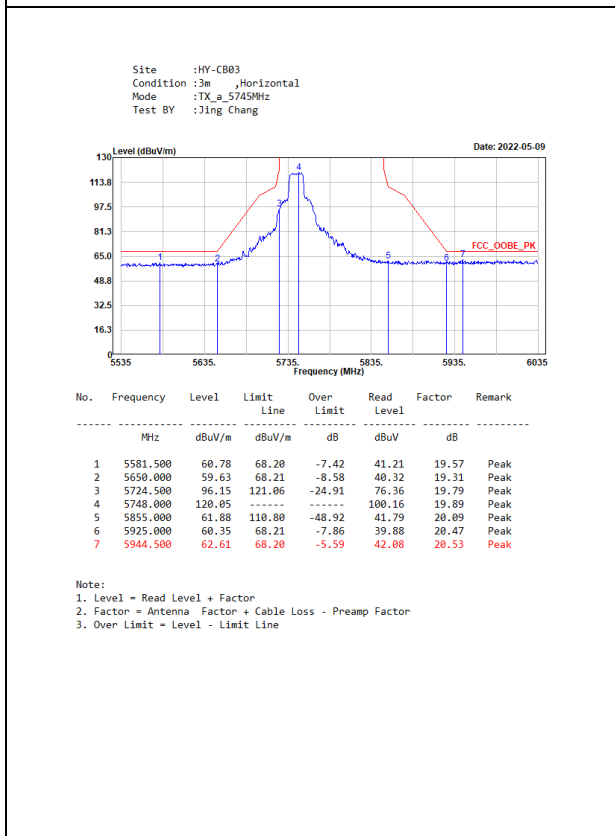
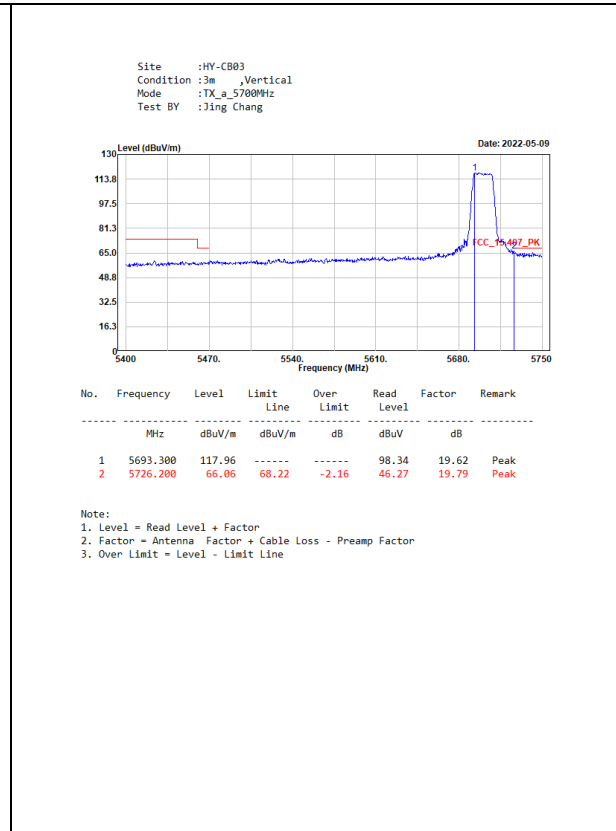
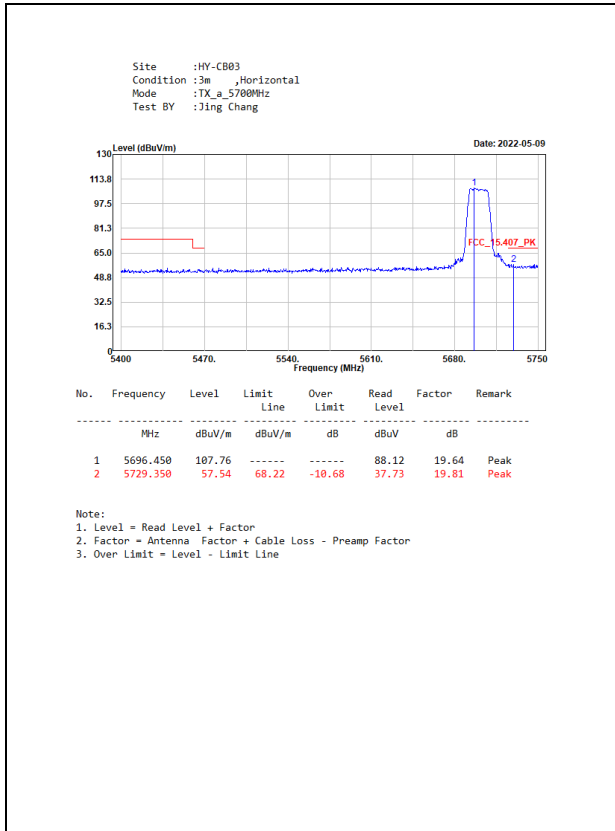


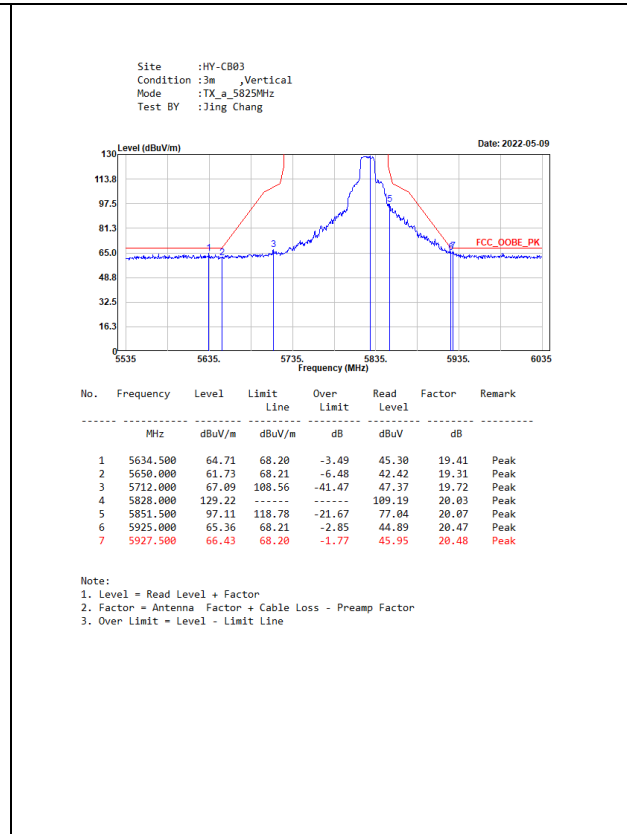
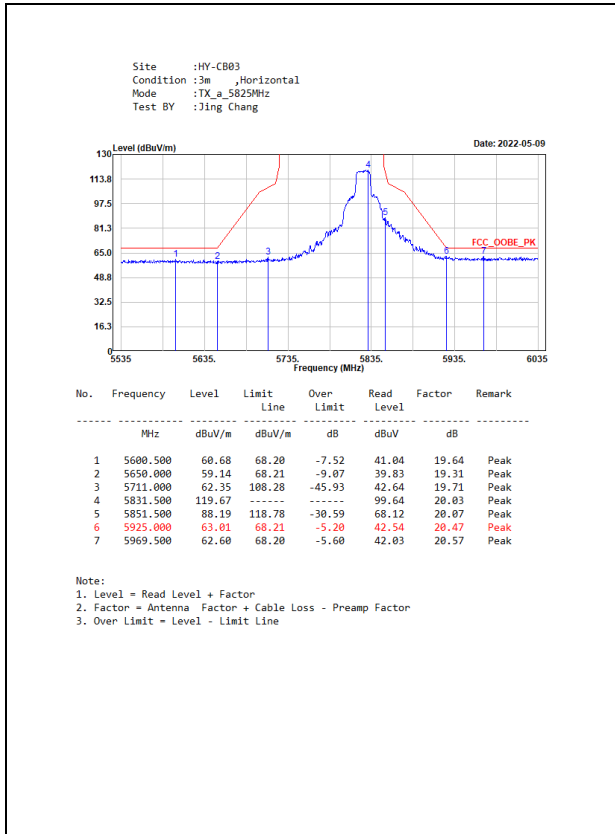
Panel_SISO A



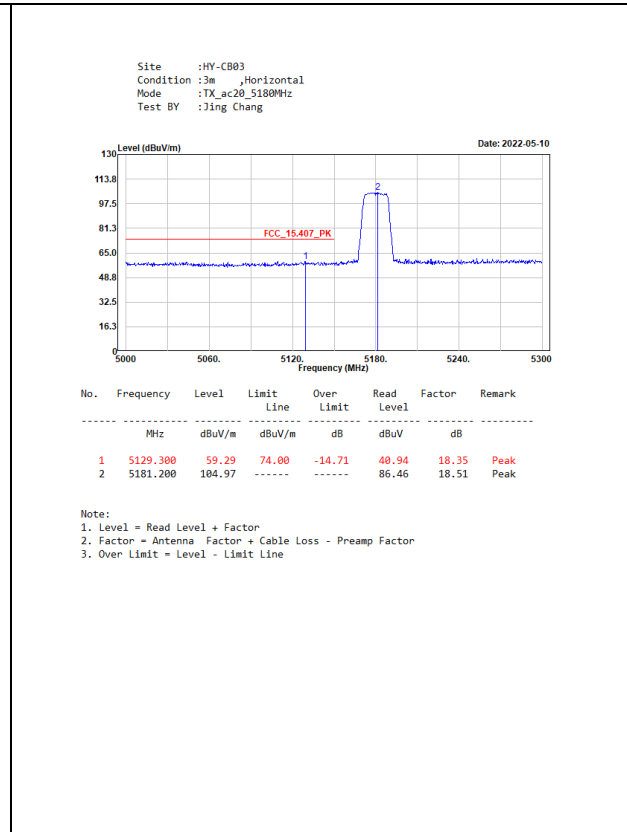
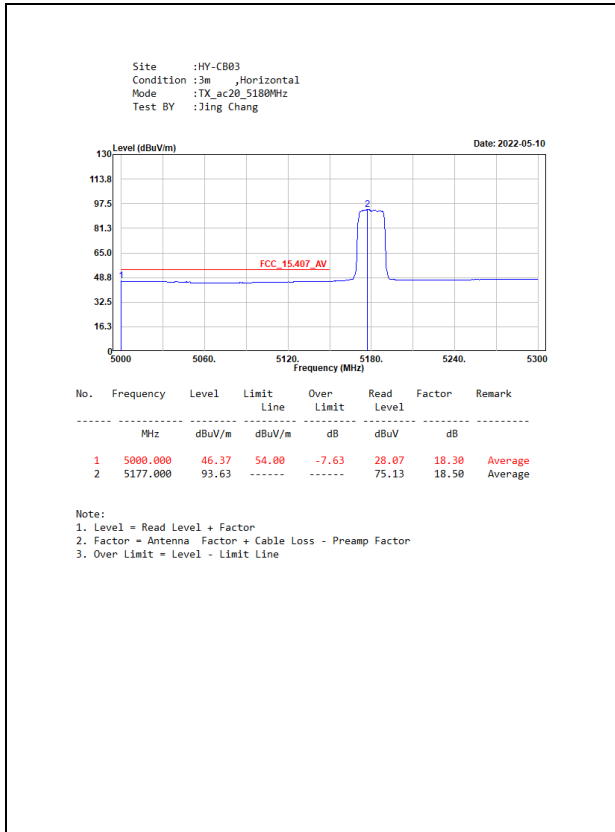


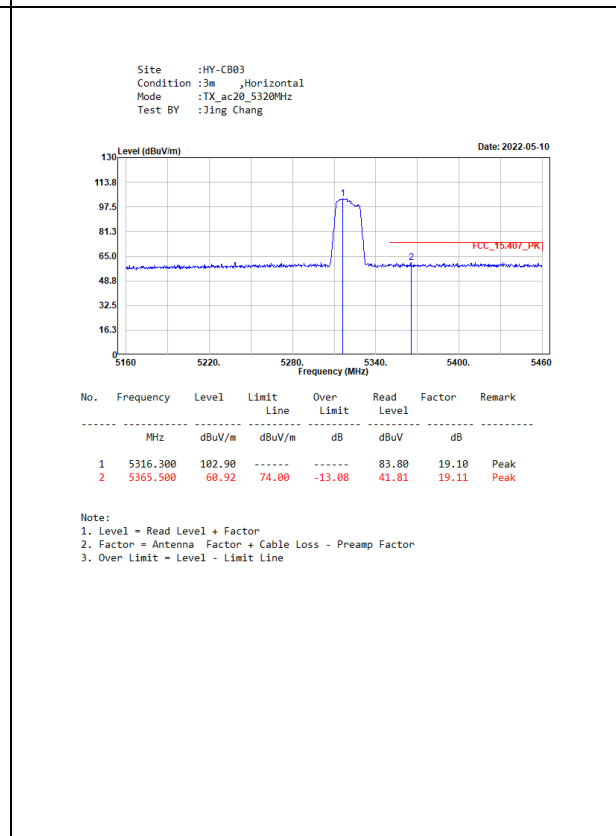
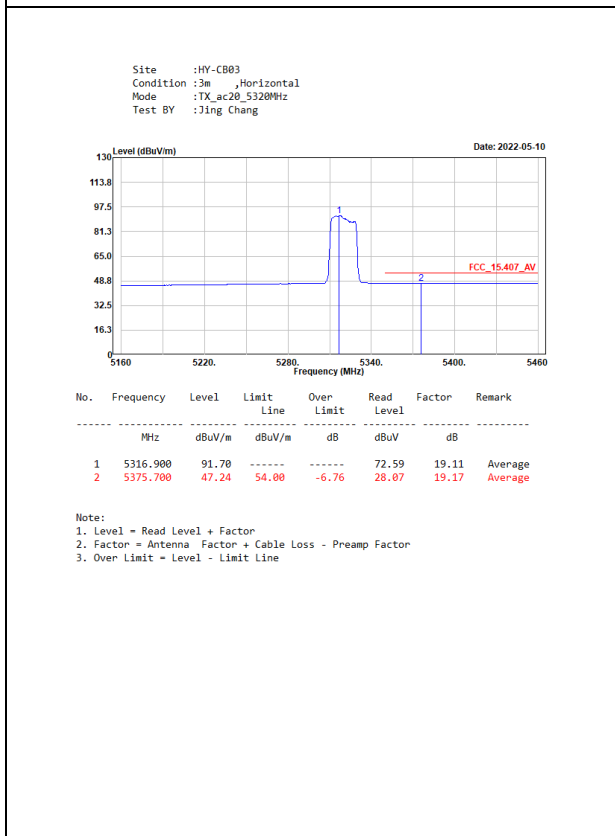
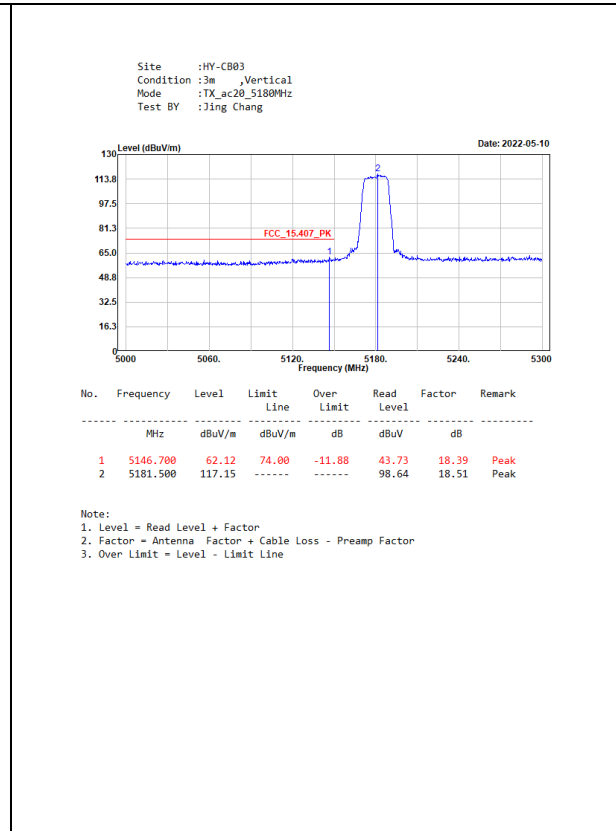
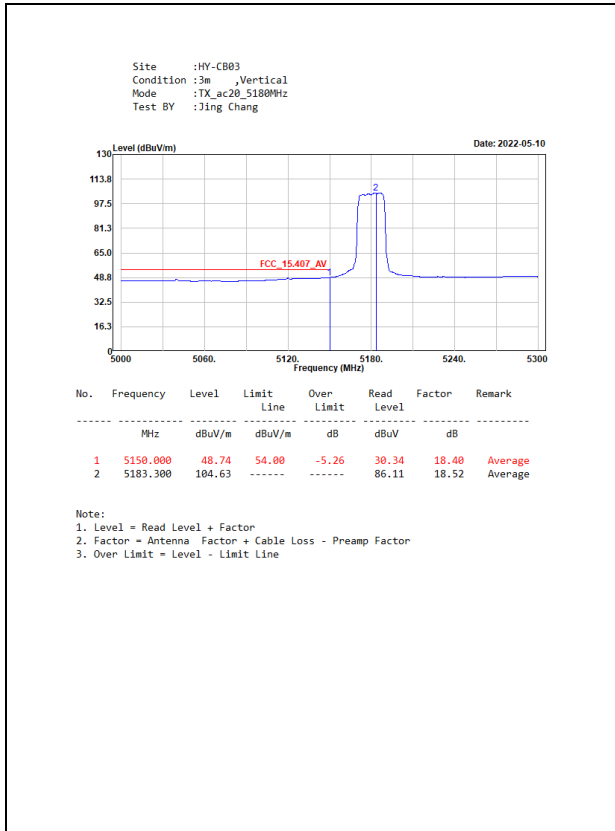


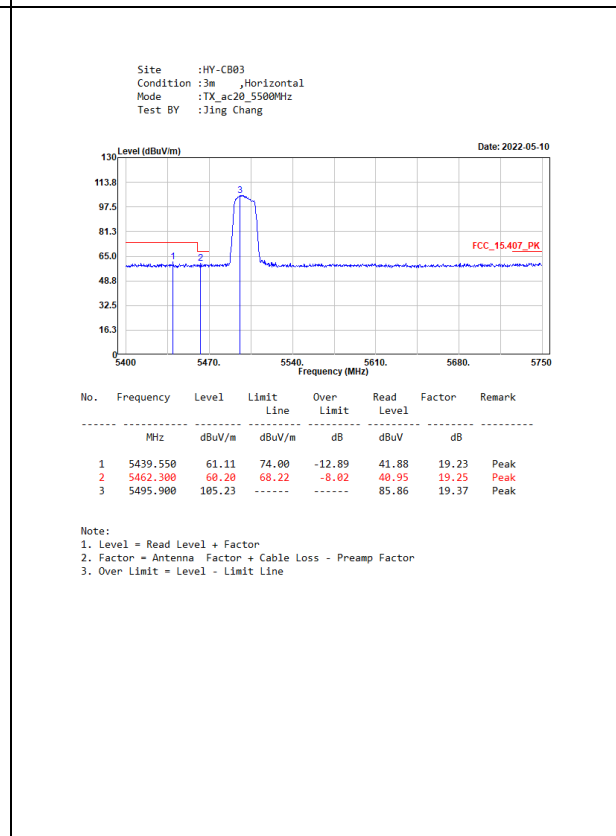
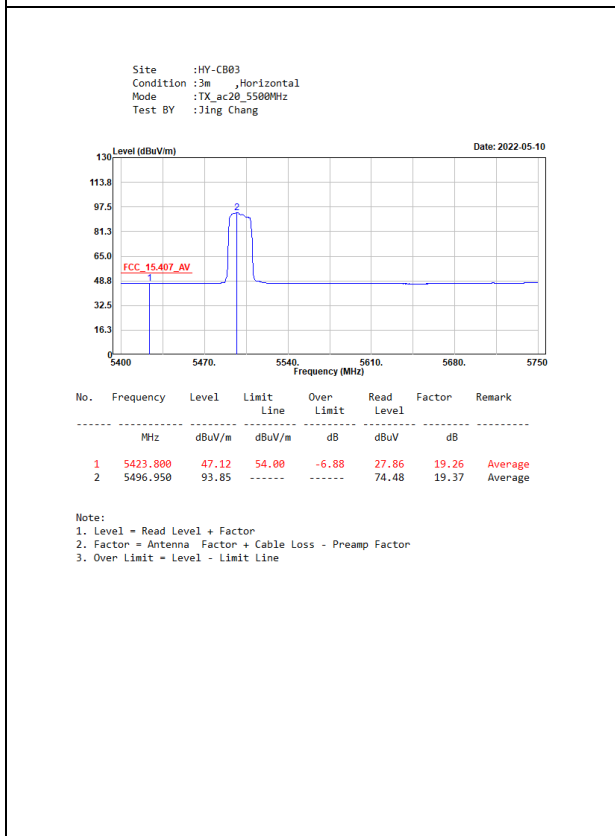
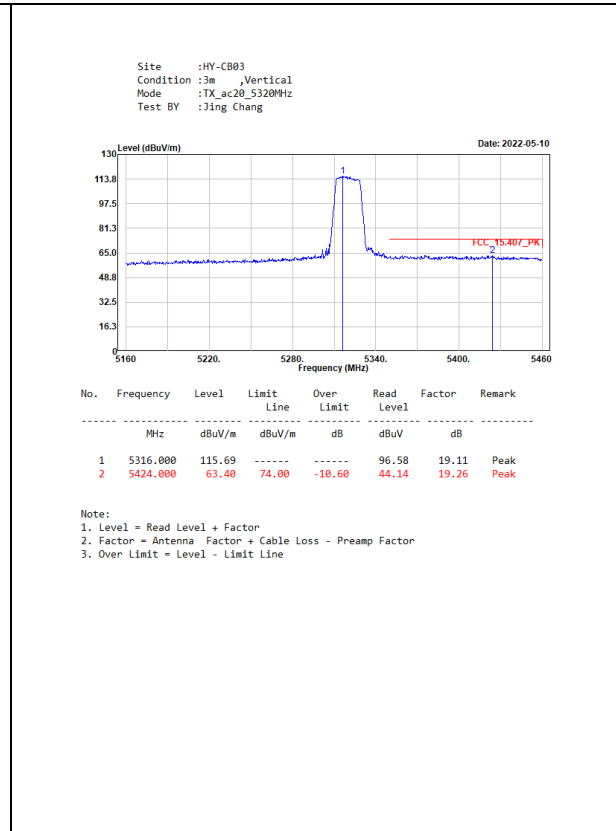
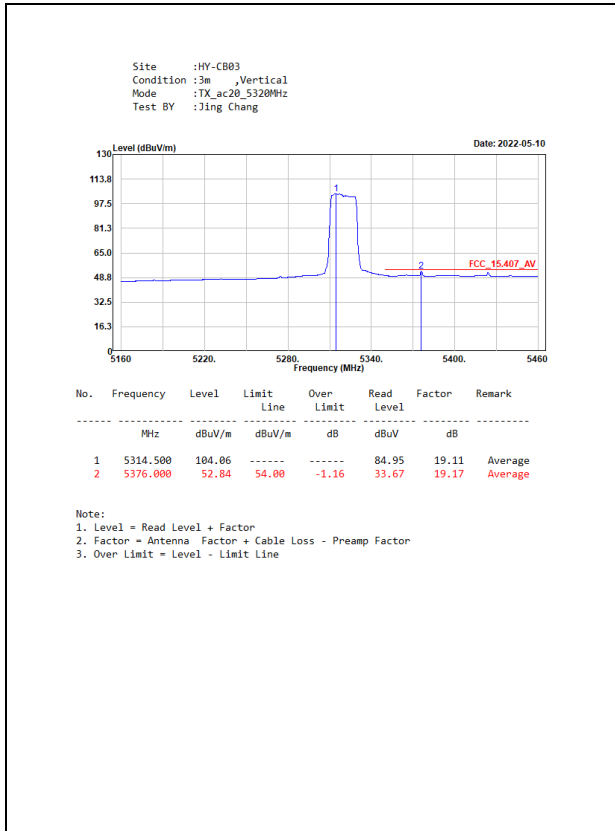


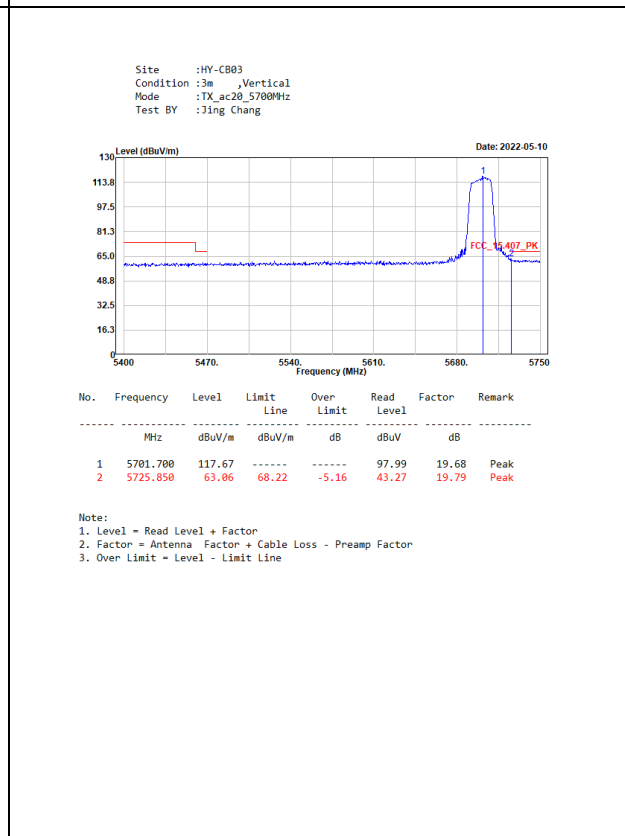
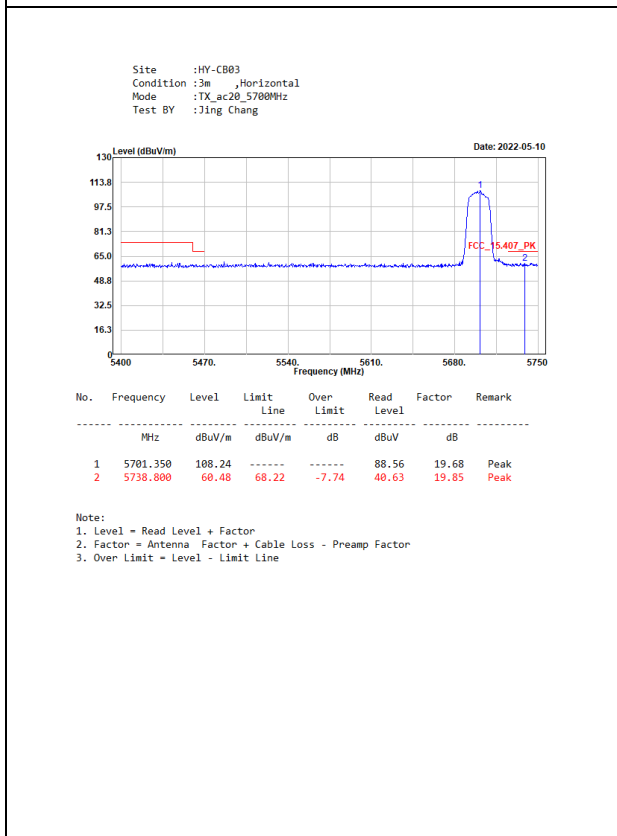
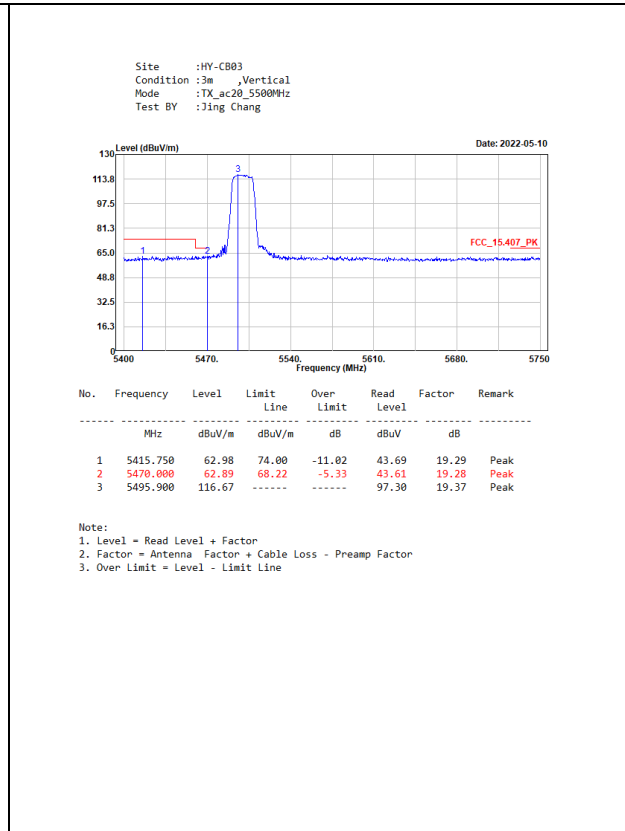
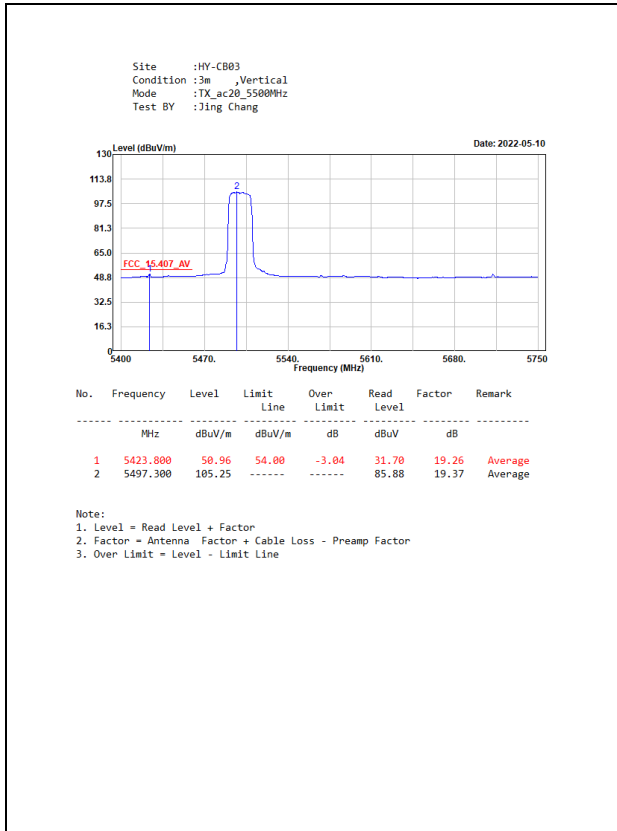


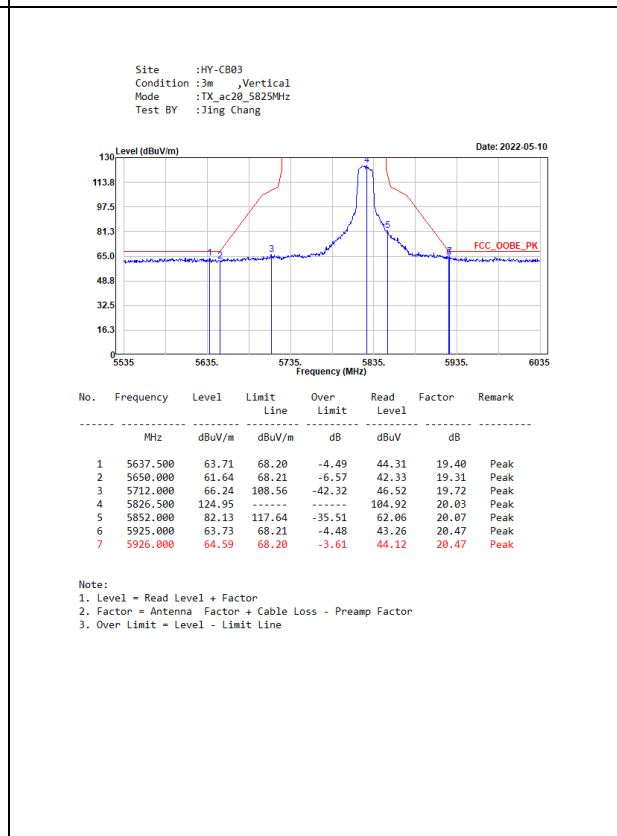
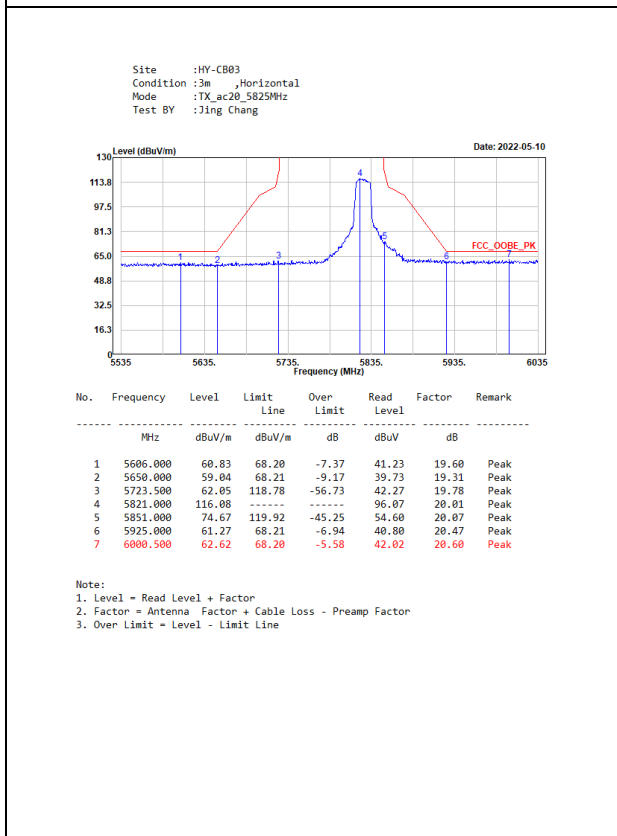
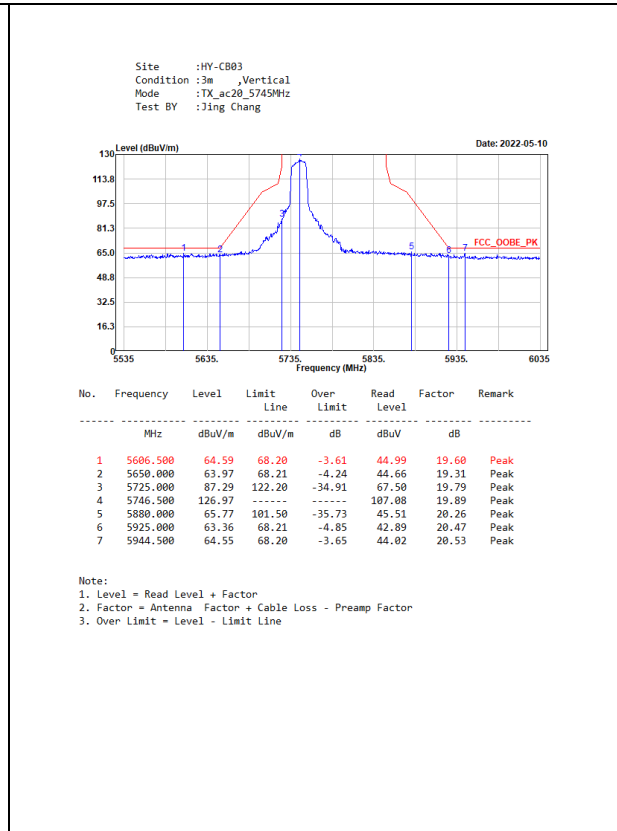
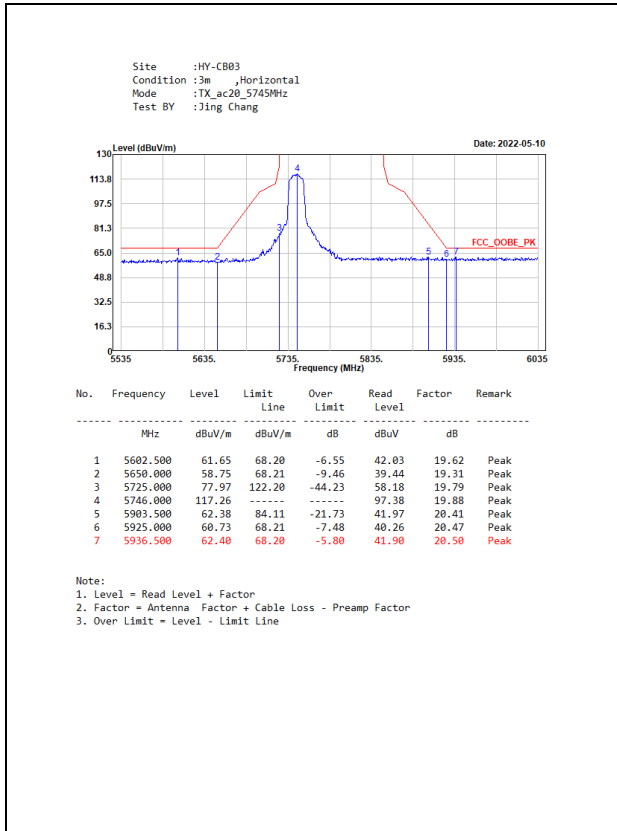
Panel_MIMO

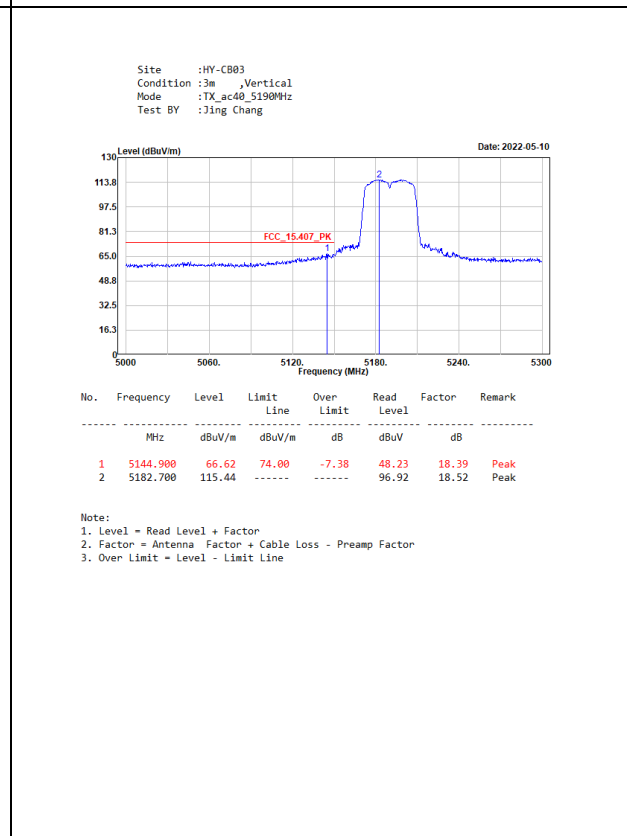
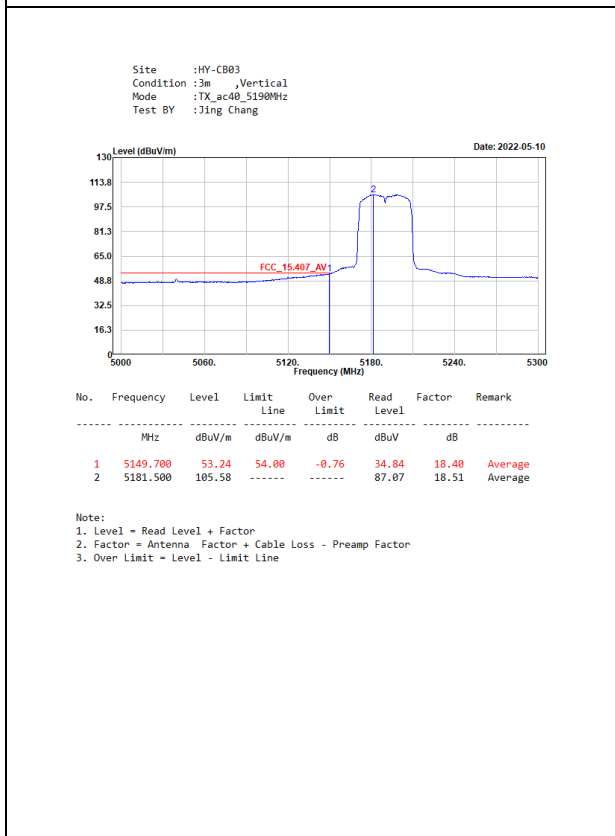
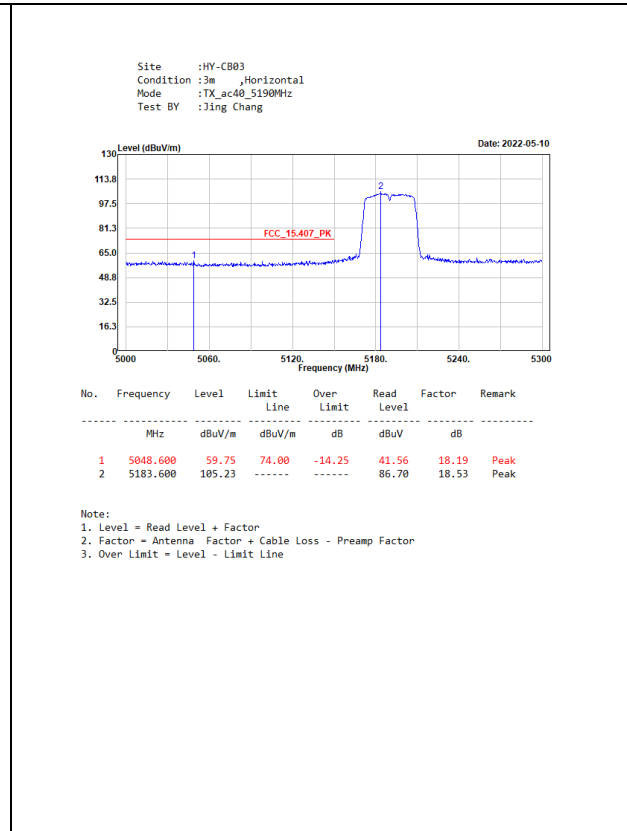
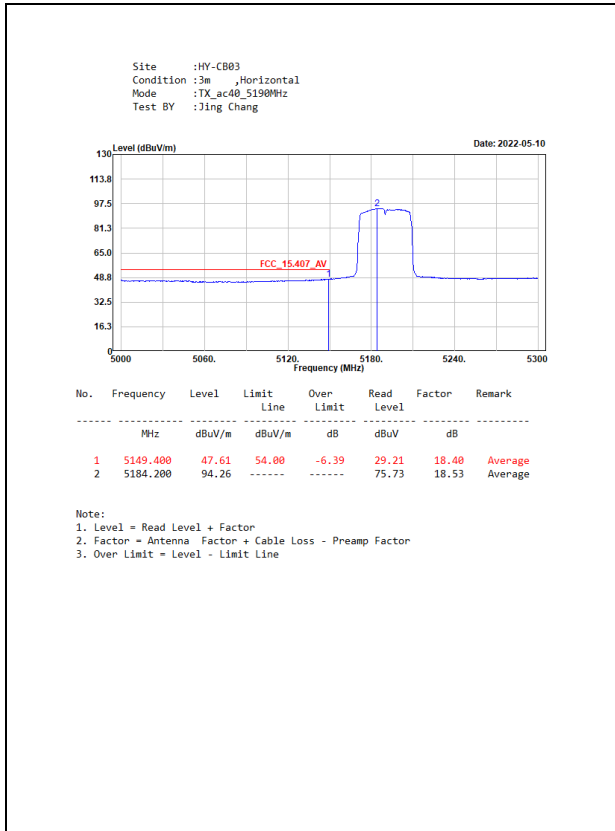


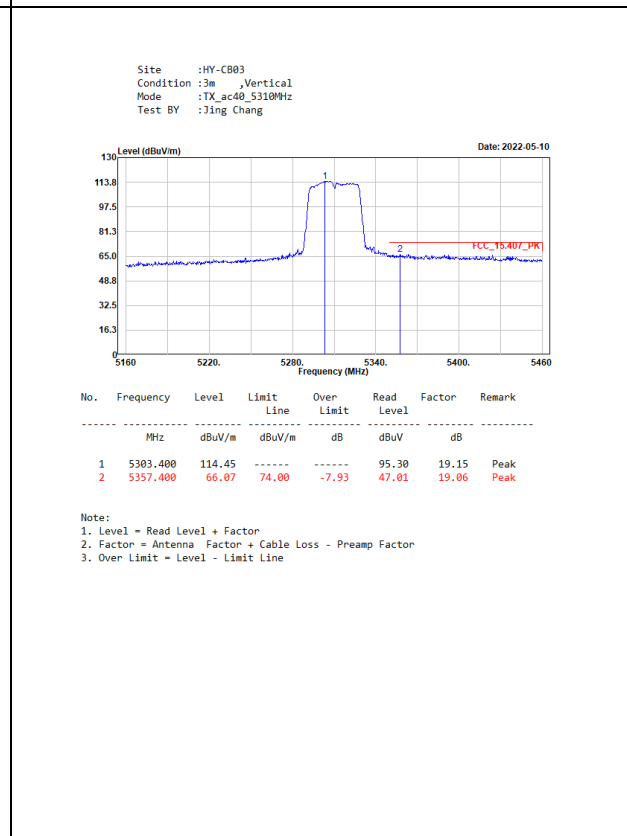
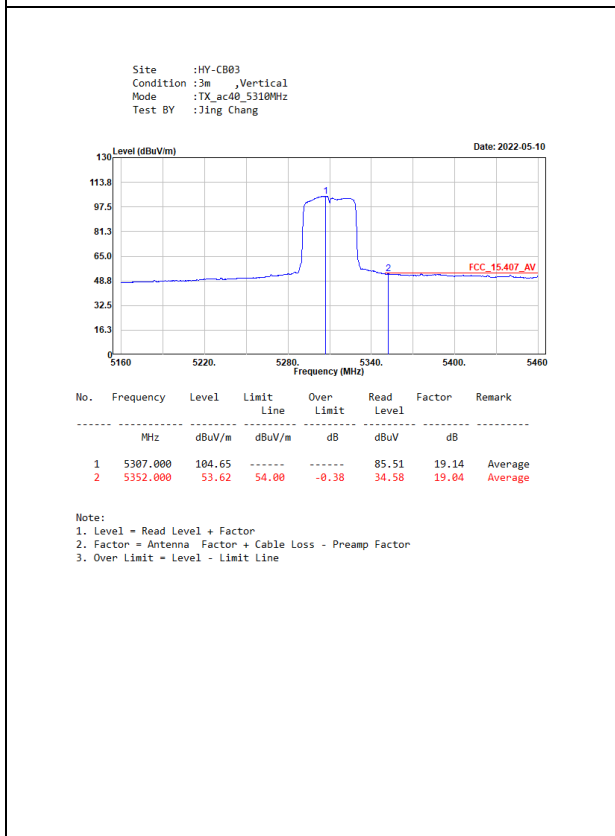
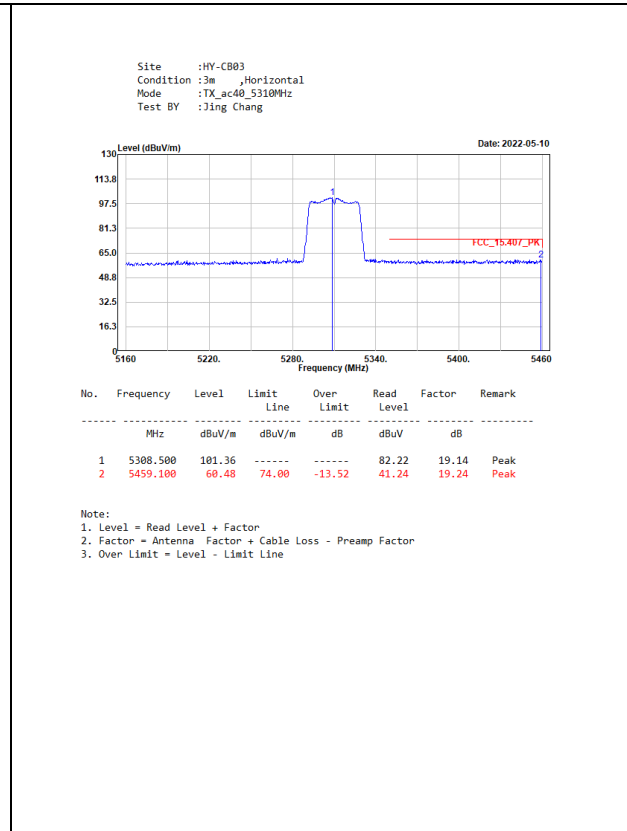
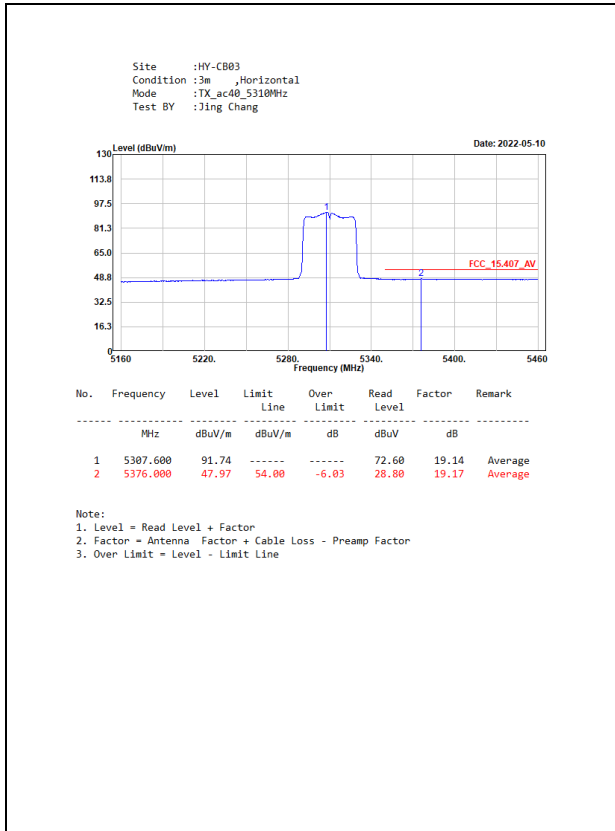


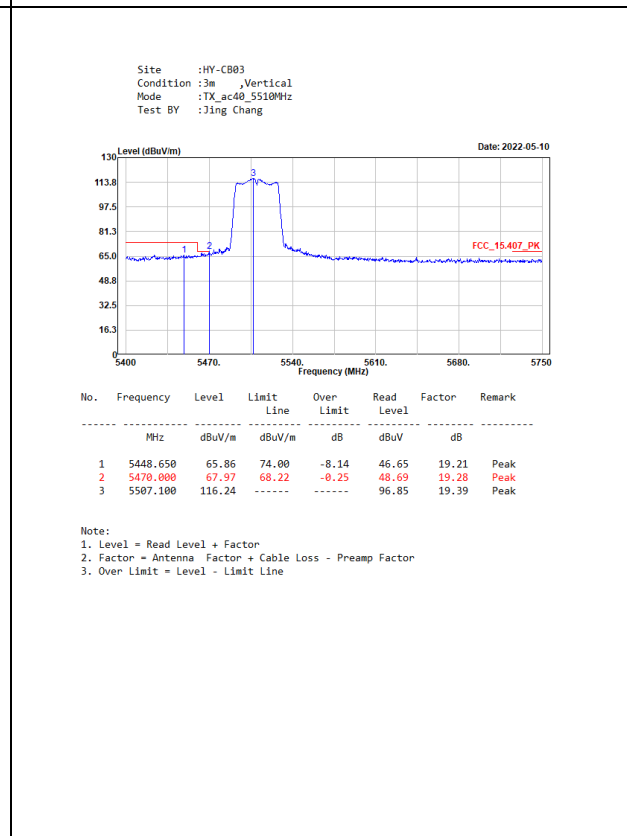
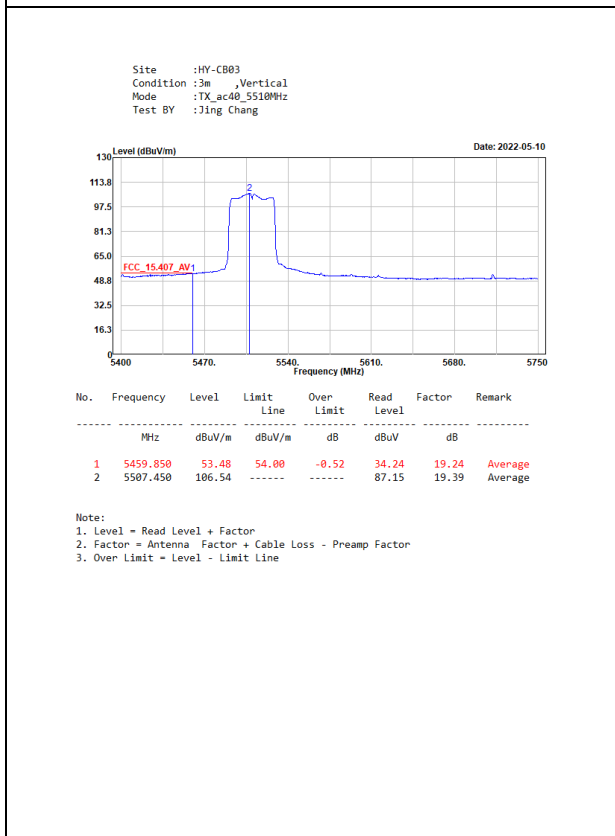
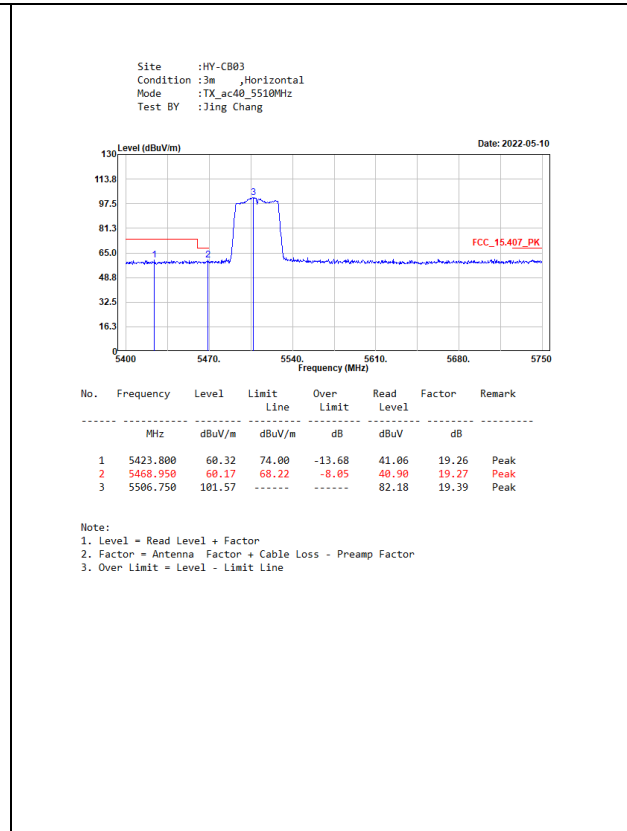
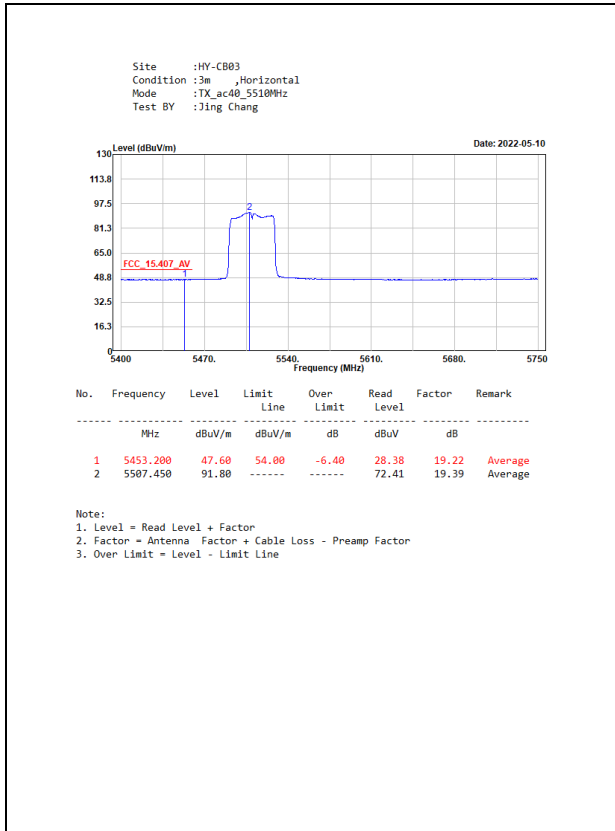


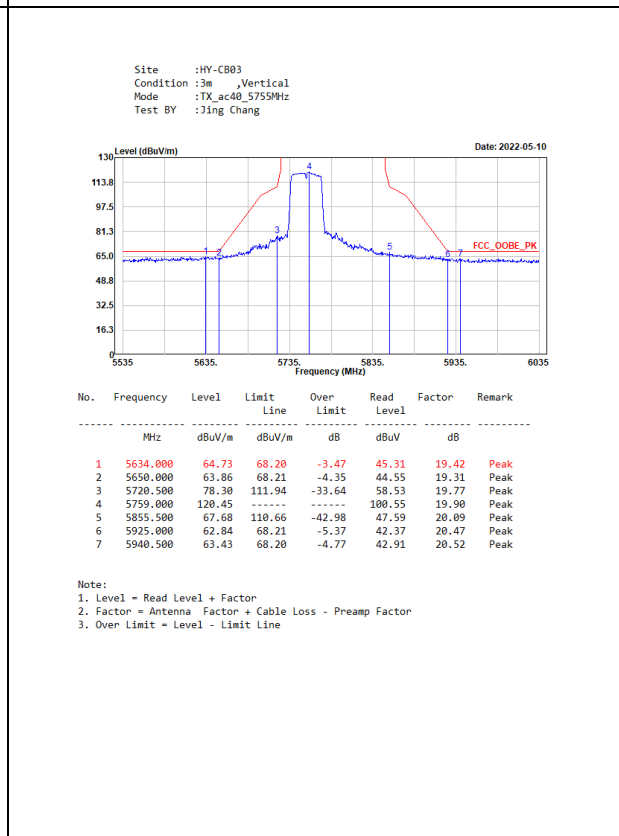
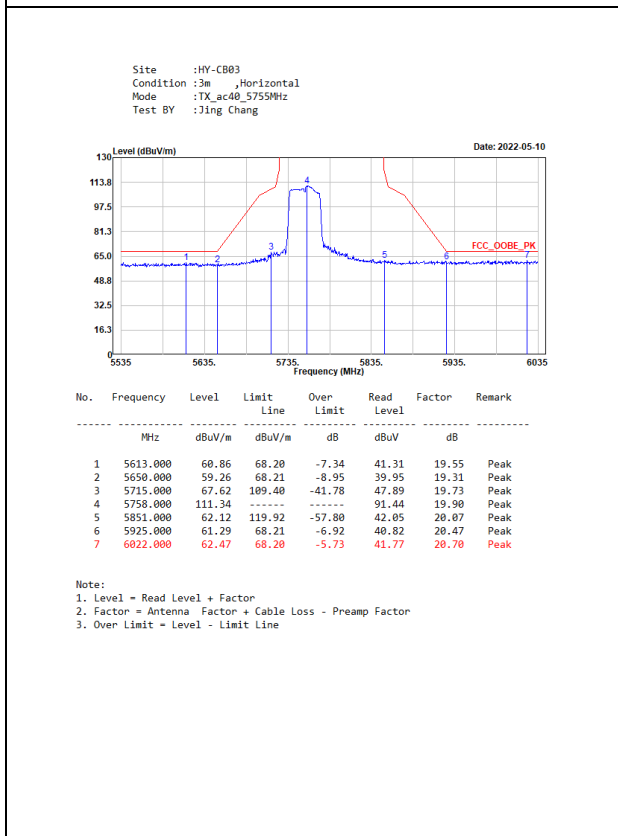
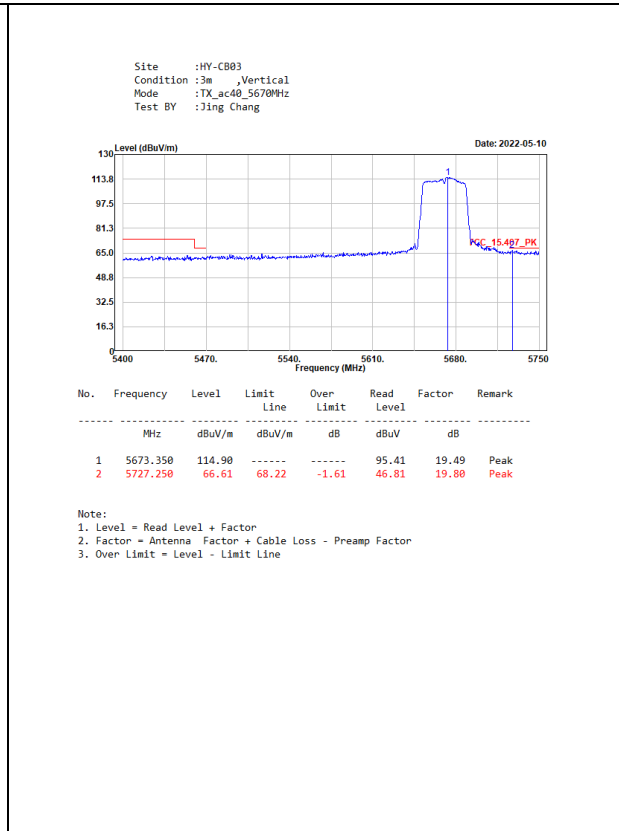
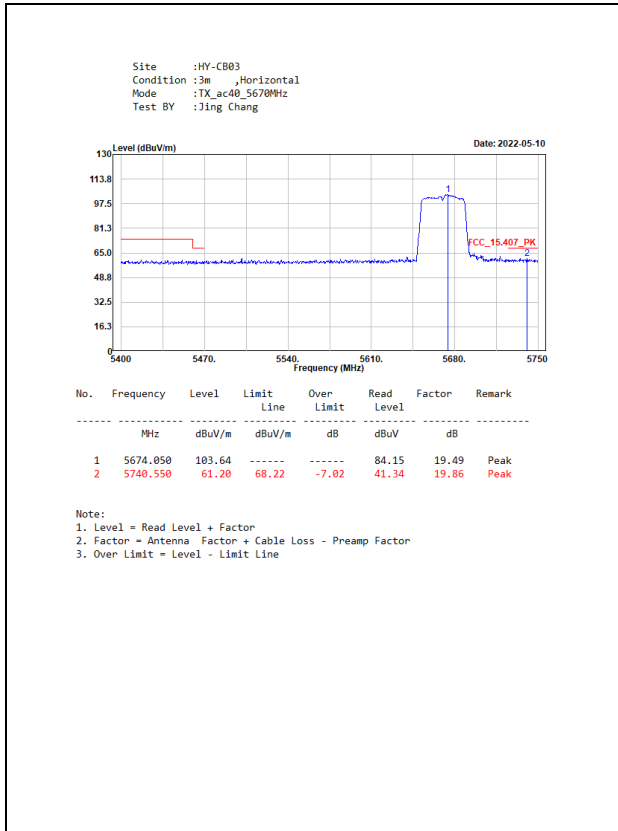


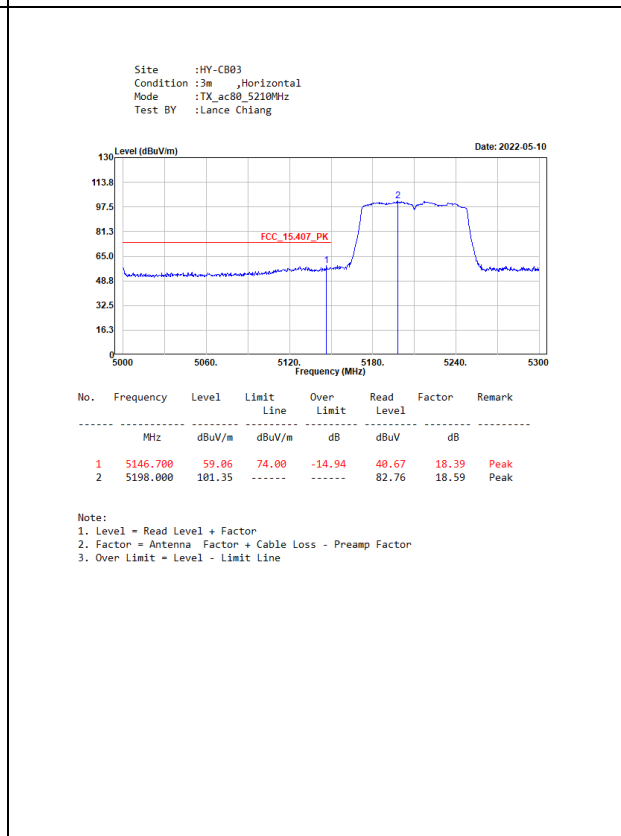
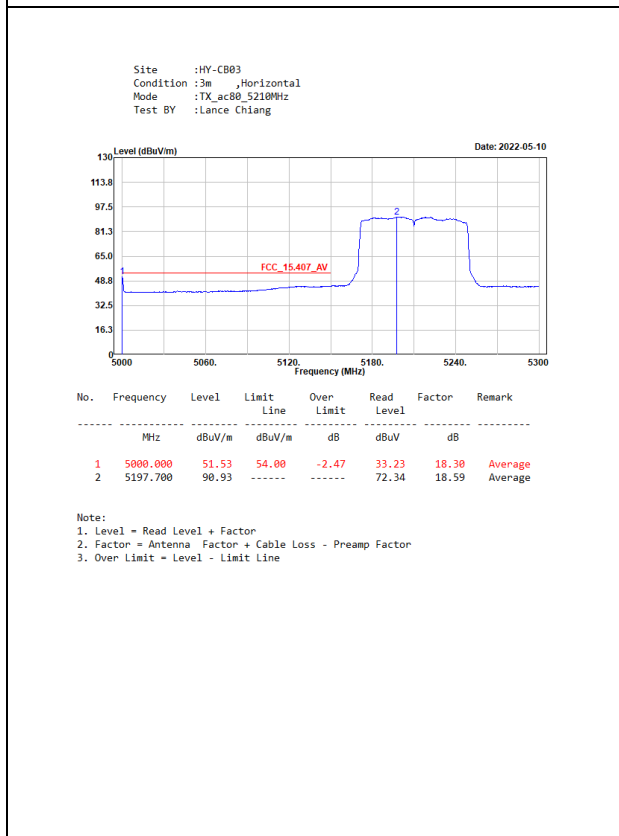
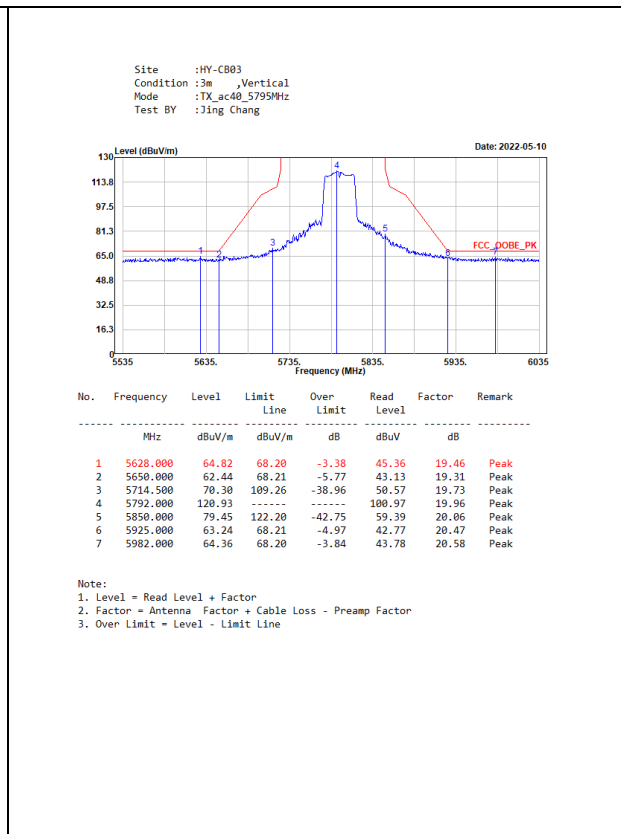
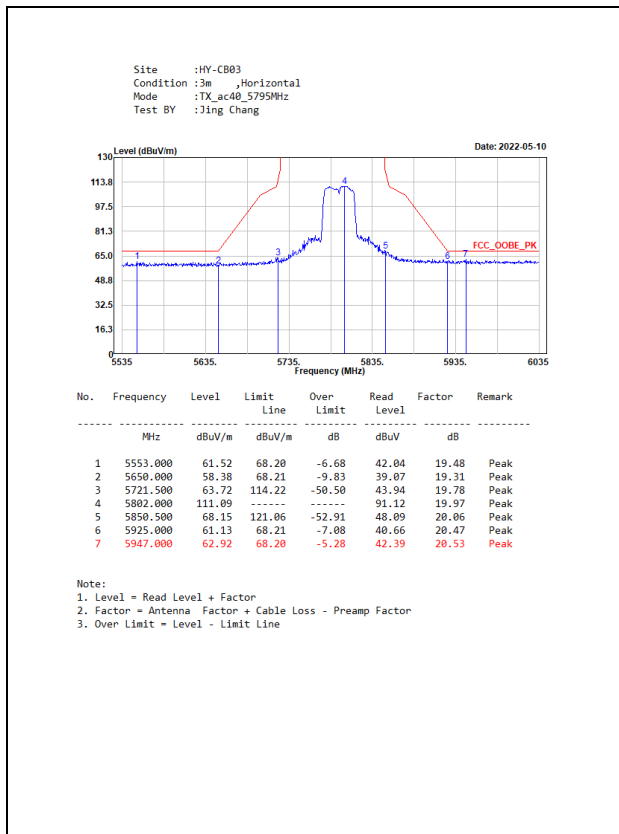


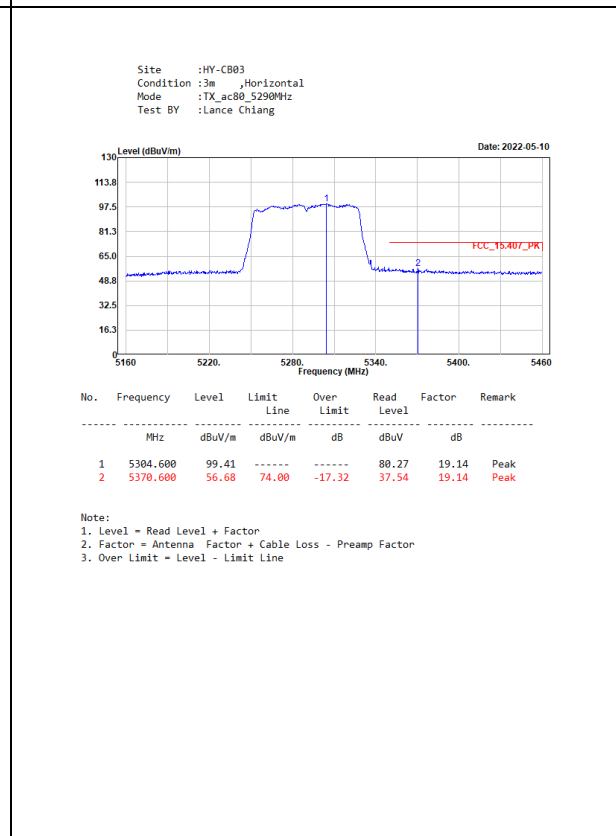
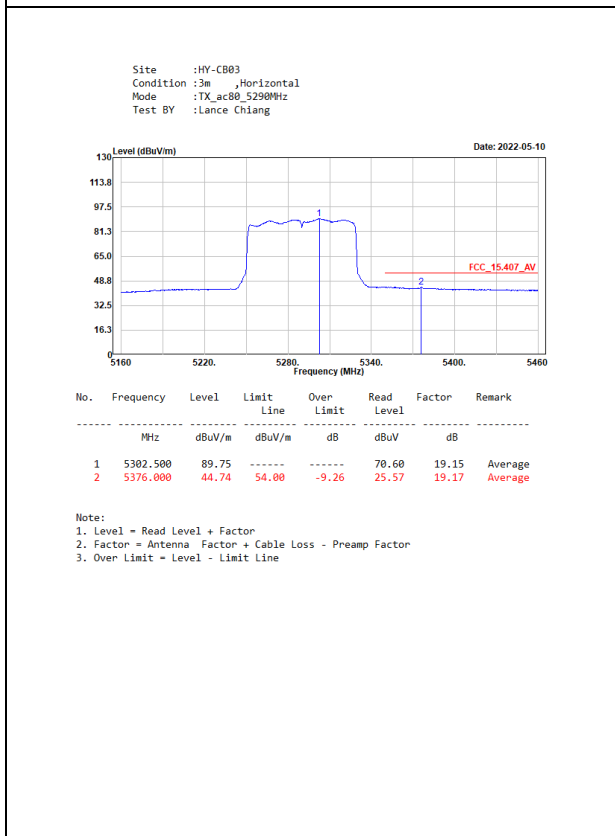
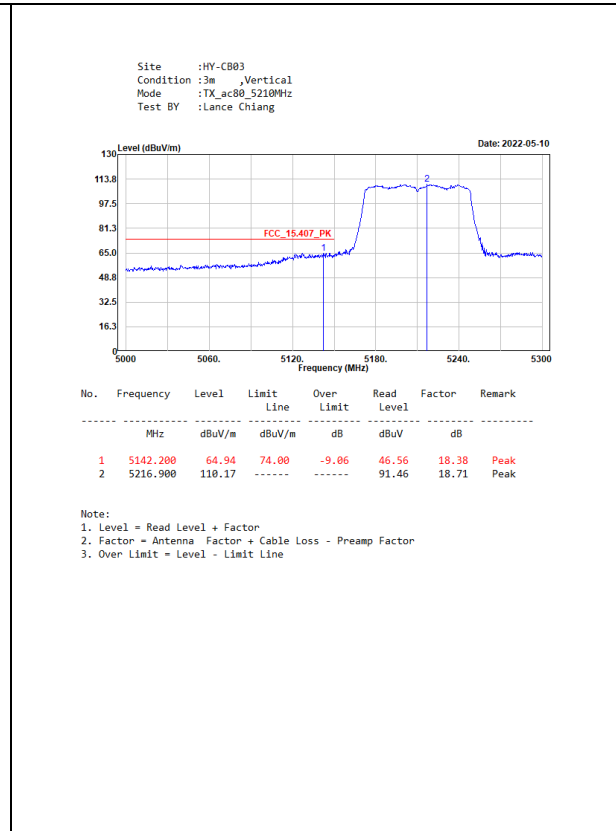
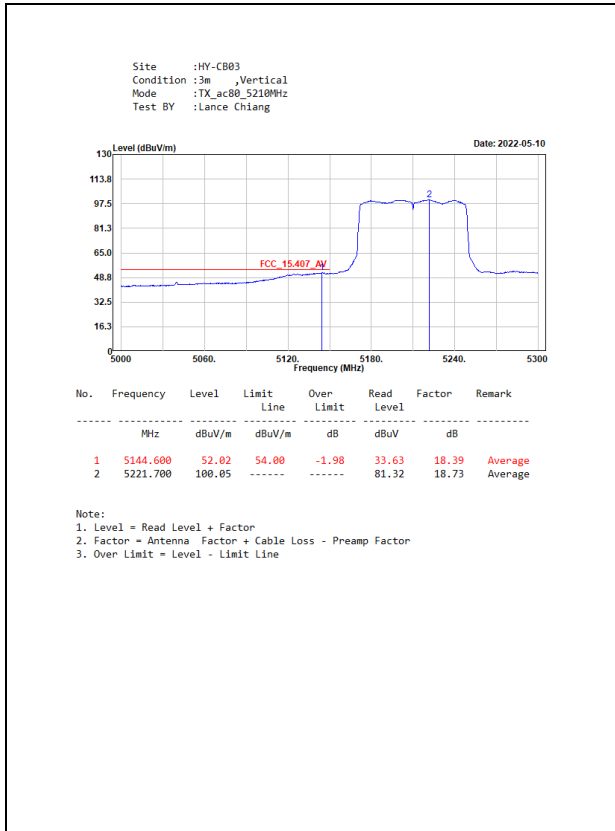


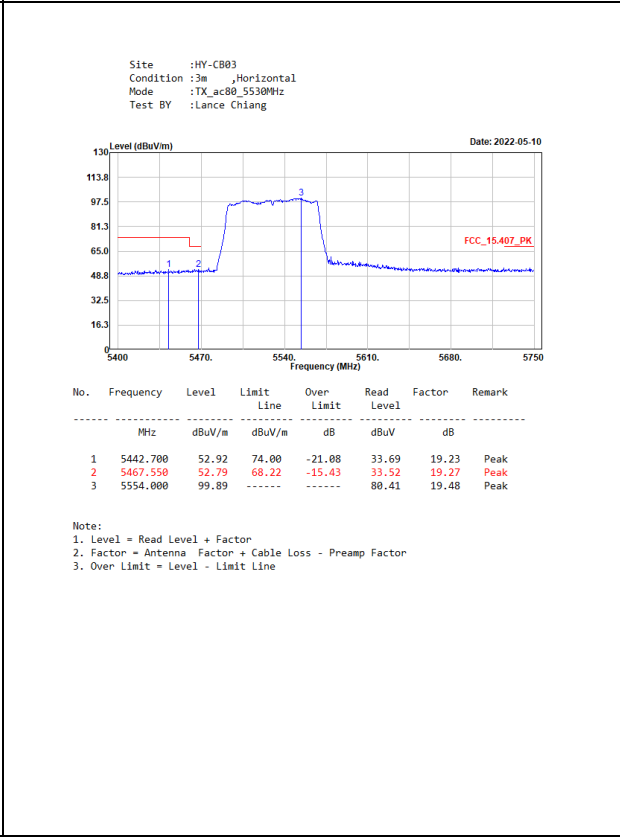
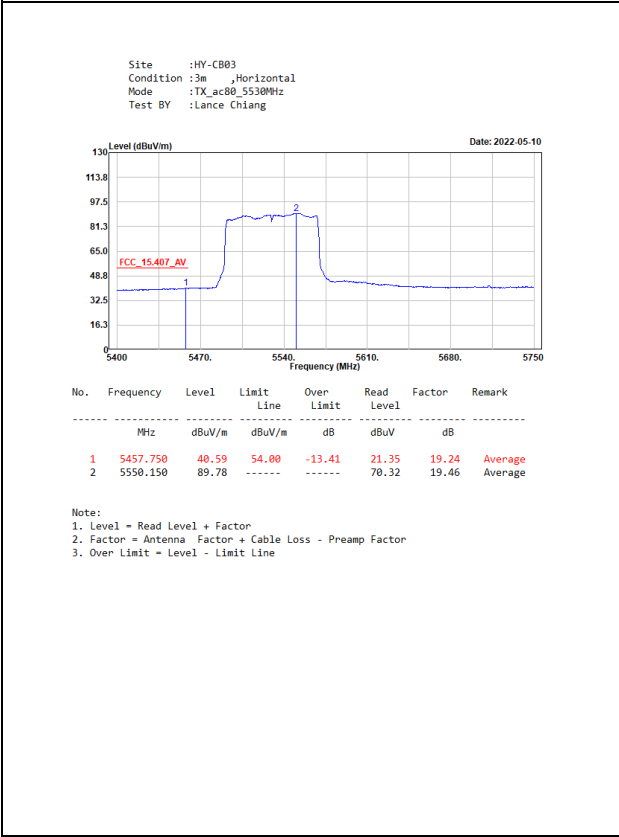
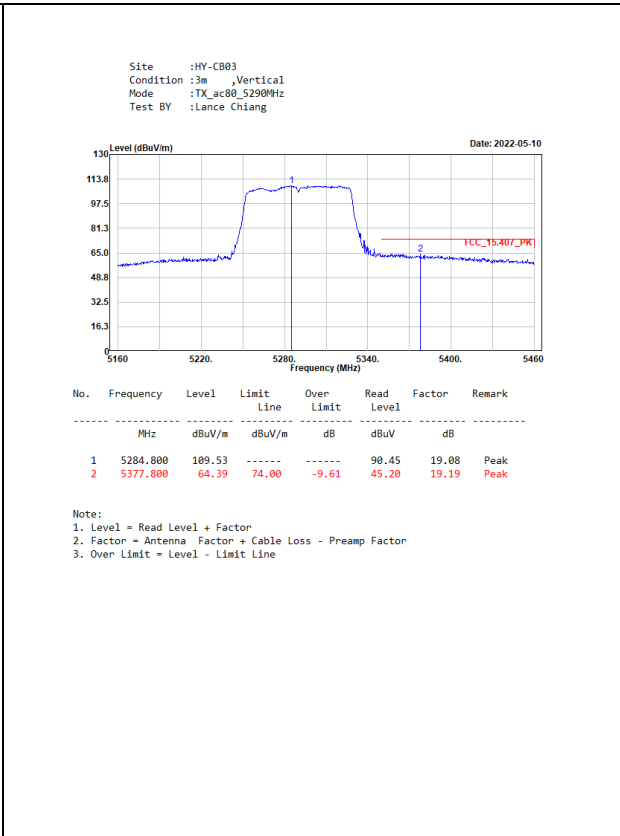
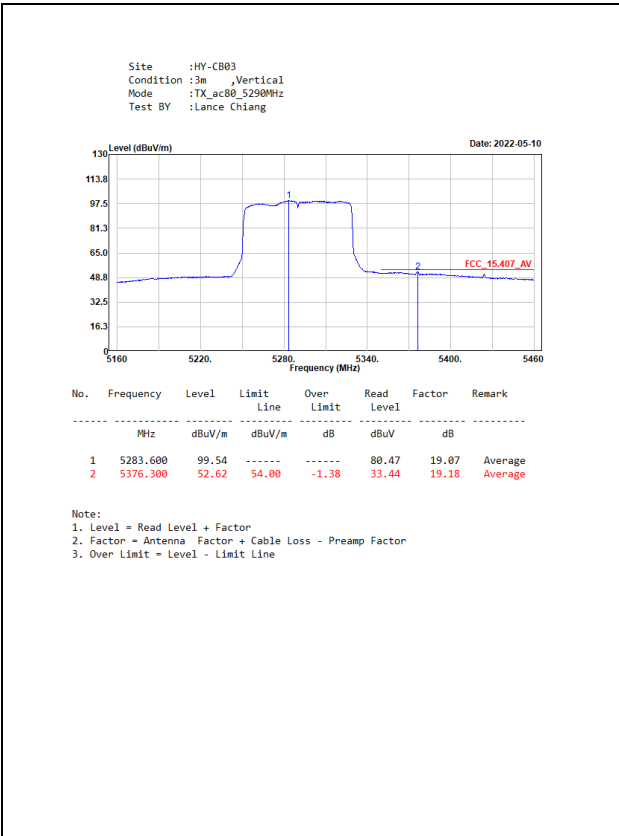


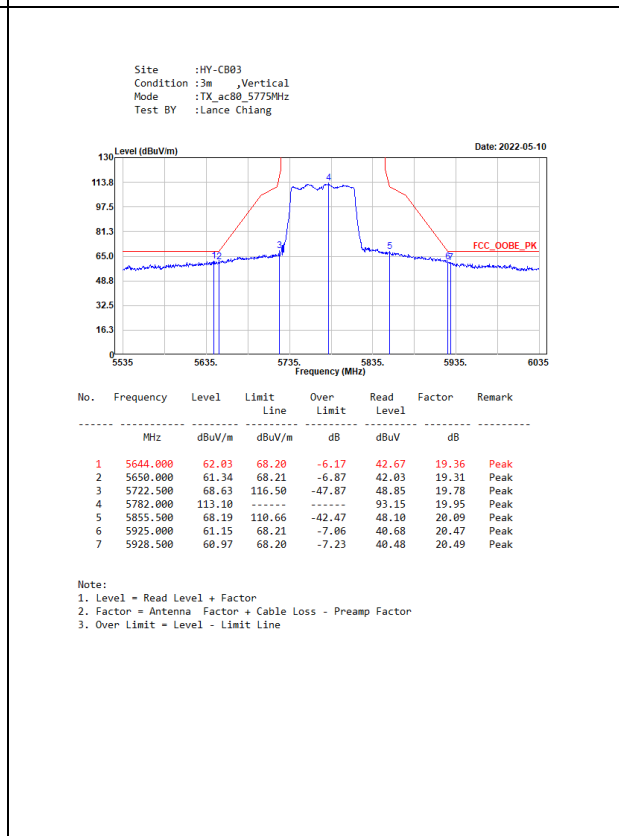
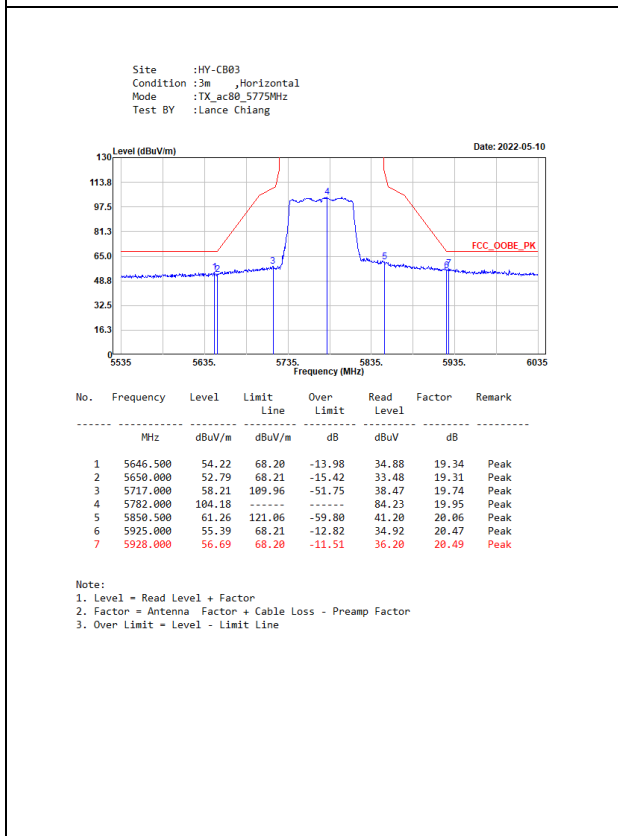
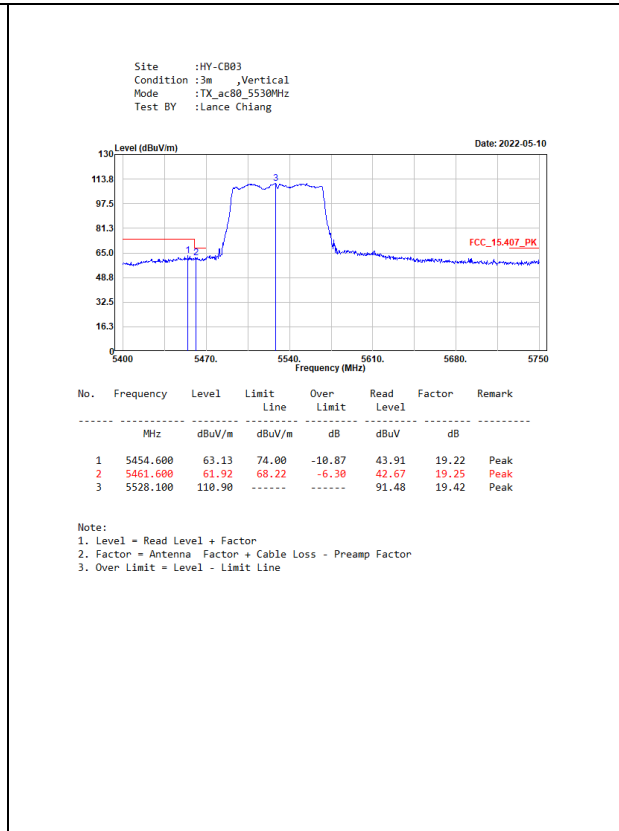
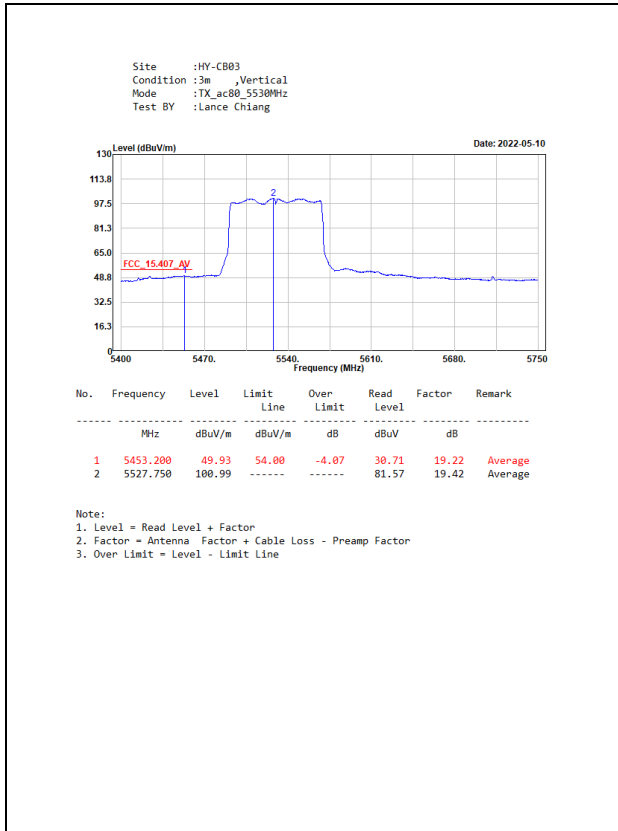






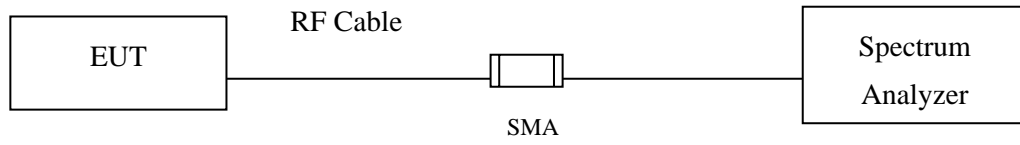






5. Duty Cycle

5.1. Test Setup



5.2. Test Procedure

The EUT was setup according to ANSI C63.10 2013; tested according to U-NII test procedure of KDB789033 for compliance to FCC 47CFR 15.407 requirements.

5.3. Test Result of Duty Cycle

Product : Wireless module
Test Item : Duty Cycle

Duty Cycle Formula:

Duty Cycle = $T_{on} / (T_{on} + T_{off})$

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

Results:

5GHz band	Ton (ms)	Ton + Toff (ms)	Duty Cycle (%)	Duty Factor (dB)
802.11 a	2.0500	2.1450	95.57	0.20
802.11 ac20	5.0000	5.1000	98.04	0.09
802.11 ac40	2.3900	2.5300	94.47	0.25
802.11 ac80	1.1300	1.2300	91.87	0.37

6. EMI Reduction Method During Compliance Testing

No modification was made during testing.