

# **FCC Radio Test Report**

# FCC ID: KA2IRX1560A1

## This report concerns: Original Grant

Project No.	:	1910H003
Equipment	:	AX1500 Wi-Fi 6 Router
Brand Name	:	D-Link
Test Model	:	DIR-X1560
Series Model	:	N/A
Applicant	:	D-Link Corporation
Address	:	17595 Mt. Herrmann Fountain Valley, CA92708 USA
Manufacturer	:	D-Link Corporation
Address	:	17595 Mt. Herrmann Fountain Valley, CA92708 USA
Date of Receipt	:	Oct. 10, 2019
Date of Test	:	Oct. 10, 2019~Nov. 07, 2019
Issued Date	:	Nov. 19, 2019
<b>Report Version</b>	:	R00
Test Sample	:	Engineering Sample No.: SH201910112
Standard(s)	:	FCC Part15, Subpart E(15.407)
		ANSI C63.10-2013
		FCC KDB 789033 D02 General UNII Test Procedures New Rules v02r01
		FCC KDB 662911 D01 Multiple Transmitter Output v02r01

The above equipment has been tested and found compliance with the requirement of the relative standards by BTL Inc.

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For the use of the authority's logo is limited unless the Test Standard(s)/Scope(s)/Item(s) mentioned in this test report is (are) included in the conformity assessment authorities acceptance respective. Please note that the measurement uncertainty is provided for informational purpose only and are not use in determining the Pass/Fail results.



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# **REPORT ISSUED HISTORY**

Report Version	Description	Issued Date
R00	Original Issue.	Nov. 19, 2019

# 1. SUMMARY OF TEST RESULTS

Test procedures	according to	the technical	standard(s):

FCC Part15, Subpart E(15.407)						
Standard(s) Section	Test Item	Test Item Test Result Jud				
15.207 15.407(b)	AC Power Line Conducted Emissions	APPENDIX A	PASS			
15.407(b) 15.205(a) 15.209(a)	Radiated Emissions	APPENDIX B APPENDIX C APPENDIX D	PASS			
15.407(a) 15.407(e)	Spectrum Bandwidth	APPENDIX E	PASS			
15.407(a)	Maximum Output Power	APPENDIX F	PASS			
15.407(a)	Power Spectral Density	APPENDIX G	PASS			
15.407(g)	Frequency Stability	APPENDIX H	PASS			
15.203	Antenna Requirements		PASS			
15.407(c)	Automatically Discontinue Transmission		PASS	NOTE (2)		

#### Note:

- (1) "N/A" denotes test is not applicable in this test report.
- (2) During no any information transmission, the EUT can automatically discontinue transmission and become standby mode for power saving. the EUT can detect the controlling signal of ACK message transmitting from remote device and verify whether it shall resend or discontinue transmission.
- (3) For UNII-1 this device was functioned as a  $\square$  Access point device  $\square$  Client device



#### **1.1 TEST FACILITY**

The test facilities used to collect the test data in this report is at the location of No. 29, Jintang Road, Tangzhen Industry Park, Pudong New Area, Shanghai 201210, China BTL's Test Firm Registration Number for FCC: 476765

BTL's Designation Number for FCC: CN1241

## **1.2 MEASUREMENT UNCERTAINTY**

ISO/IEC 17025 requires that an estimate of the measurement uncertainties associated with the emissions test results be included in the report. The measurement uncertainties given below are based on a 95% confidence level (based on a coverage factor (k=2)) The BTL measurement uncertainty as below table:

A. Radiated emissions test:

Test Site	Method	Measurement Frequency Range	Ant. H / V	U, (dB)
		9 KHz~30 MHz	V	3.79
		9 KHz~30 MHz	Н	3.57
	CISPR	30 MHz~200 MHz	V	4.04
		30 MHz~200 MHz		3.76
SH-CB01		200 MHz~1,000 MHz	V	4.24
30-0001		200 MHz~1,000 MHz	Н	3.84
		1 GHz~18 GHz	V	4.46
		1 GHz~18 GHz		4.40
		18 GHz~40 GHz	V	3.95
		18 GHz~40 GHz	Н	3.95

Note: Unless specifically mentioned, the uncertainty of measurement has not been taken into account to declare the compliance or non-compliance to the specification.

## **1.3 TEST ENVIRONMENT CONDITIONS**

Test Item	Temperature	Humidity	Test Voltage	Tested By
AC Power Line Conducted Emissions	22°C	53%	AC 120V	Forest Li
Radiated Emissions-9K-30MHz	22°C	45%	AC 120V	Forest Li
Radiated Emissions-30 MHz to 1GHz	22°C	55%	AC 120V	Forest Li
Radiated Emissions-Above 1000 MHz	22°C	56%	AC 120V	Forest Li
Spectrum Bandwidth	25°C	48%	AC 120V	Forest Li
Maximum Output Power	25°C	48%	AC 120V	Forest Li
Power Spectral Density	25°C	48%	AC 120V	Forest Li
	Normal		Normal	
Frequency Stability	&	48%	&	Forest Li
	Extreme		Extreme	



# 2. GENERAL INFORMATION

# 2.1 GENERAL DESCRIPTION OF EUT

Equipment	AX1500 Wi-Fi 6 Router
Brand Name	D-Link
Test Model	DIR-X1560
Series Model	N/A
Model Difference(s)	N/A
Software Version	1
Hardware Version	A1
Power Source	DC Voltage supplied from AC/DC adapter: Brand/Model: Gongjin /S18B22-120A150-CJ
Power Rating	I/P: 100-240V ~ 50/60Hz 0.7A O/P: 12V1.5A
Operation Frequency	UNII-1: 5150 MHz~5250 MHz UNII-3: 5725 MHz~5850 MHz
Modulation Type	OFDM
Bit Rate of Transmitter	Up to 867Mbps
Maximum Conducted Output Power for UNII-1 (1TX) Non-Beamforming	IEEE 802.11a: 23.70 dBm (0.2344W)
Maximum Conducted Output Power for UNII-3 (1TX) Non-Beamforming	IEEE 802.11a: 24.19 dBm (0.2624 W)
Maximum Conducted Output Power for UNII-1 (2TX) Non-Beamforming	IEEE 802.11n (HT20): 26.80 dBm (0.4786 W) IEEE 802.11n (HT40): 25.36 dBm (0.3436 W) IEEE 802.11ac (VHT20): 26.92 dBm (0.4920 W) IEEE 802.11ac (VHT40): 25.51 dBm (0.3556 W) IEEE 802.11ac (VHT80): 22.07 dBm (0.1611 W)
Maximum Conducted Output Power for UNII-3 (2TX) Non-Beamforming	IEEE 802.11n (HT20): 26.05 dBm (0.4027 W) IEEE 802.11n (HT40): 26.25 dBm (0.4217 W) IEEE 802.11ac (VHT20): 26.77 dBm (0.4753 W) IEEE 802.11ac (VHT40): 26.26 dBm (0.4227 W) IEEE 802.11ac (VHT80): 27.10 dBm (0.5129 W)
Maximum Conducted Output Power for UNII-1 (2TX) Beamforming	IEEE 802.11n (HT20): 26.10 dBm ( 0.4074W) IEEE 802.11n (HT40): 24.30 dBm (0.2692W) IEEE 802.11ac (VHT20): 26.90 dBm (0.4898W) IEEE 802.11ac (VHT40): 25.30 dBm ( 0.3388W) IEEE 802.11ac (VHT80): 21.51 dBm (0.1416W)
Maximum Conducted Output Power for UNII-3 (2TX) Beamforming	IEEE 802.11n (HT20): 25.22 dBm ( 0.3327W) IEEE 802.11n (HT40): 25.70 dBm (0.3715 W) IEEE 802.11ac (VHT20): 26.40 dBm ( 0.4365W) IEEE 802.11ac (VHT40): 25.71 dBm ( 0.3724W) IEEE 802.11ac (VHT80): 27.02 dBm ( 0.5035W)

Note:

1. For a more detailed features description, please refer to the manufacturer's specifications or the user's manual.



## 2. Channel List:

IEEE 802.11a IEEE 802.11n (HT20) IEEE 802.11ac (VHT20)		IEEE 802.11n (HT40) IEEE 802.11ac (VHT40)		IEEE 802.11ac (VHT80)	
UNI	UNII-1		II-1	UNII-1	
Channel	Frequency (MHz)	Channel	Frequency (MHz)	Channel	Frequency (MHz)
36	5180	38	5190	42	5210
40	5200	46	5230		
44	5220				
48	5240				

IEEE 802.11a IEEE 802.11n (HT20) IEEE 802.11ac (VHT20)		IEEE 802.11n (HT40) IEEE 802.11ac (VHT40)		IEEE 802.11ac (VHT80)		
UNI	I-3	UN	II-3	UN	UNII-3	
Channel	Frequency (MHz)	Channel	Frequency (MHz)	Channel	Frequency (MHz)	
149	5745	151	5755	155	5775	
153	5765	159	5795			
157	5785					
161	5805					
165	5825					

## 3. Antenna Specification:

Ant.	Brand	Model Name	Antenna Type	Connector	Gain (dBi)
1	N/A	N/A	Dipole	N/A	2
2	N/A	N/A	Dipole	N/A	2

Note:

(1) The EUT incorporates a MIMO function. Physically, the EUT provides two completed transmitters and receivers (2T2R), all transmit signals are completely uncorrelated, then, Direction gain = GANT, that is Directional gain for UNII-1=2; for UNII-3=2.

(2) The EUT incorporates beamforming Function, so Directional gain = GANT + 10 log(NANT) dBi, that is Directional gain for UNII-1=2+10 log(2)dBi =5 dBi; for UNII-3=2+10 log(2)dBi =5 dBi.

## 4. Table for Antenna Configuration:

Operating Mode		1TX	2TX
TX	Mode		217
IEEE 802.11a		V (Ant. 1)	
IEEE 802.11n (HT20)			V (Ant. 1 + Ant. 2)
IEEE 802.11n (HT40)			V (Ant. 1 + Ant. 2)
IEEE 802.11ac (VHT20)			V (Ant. 1 + Ant. 2)
IEEE 802.11ac (VHT40)			V (Ant. 1 + Ant. 2)
IEEE 802.11ac (VHT80)			V (Ant. 1 + Ant. 2)



# 2.2 TEST MODES

The test system was pre-tested based on the consideration of all possible combinations of EUT operation mode.

Pretest Mode	Description	
Mode 1	TX A Mode / CH36, CH40, CH48 (UNII-1)	
Mode 2	TX N (HT20) Mode / CH36, CH40, CH48 (UNII-1)	
Mode 3	TX N (HT40) Mode / CH38, CH46 (UNII-1)	
Mode 4	TX AC (VHT20) Mode / CH36, CH40, CH48 (UNII-1)	
Mode 5	TX AC (VHT40) Mode / CH38, CH46 (UNII-1)	
Mode 6	TX AC (VHT80) Mode / CH42 (UNII-1)	
Mode 7	TX A Mode / CH149,CH157,CH165 (UNII-3)	
Mode 8	TX N (HT20) Mode / CH149,CH157,CH165 (UNII-3)	
Mode 9	TX N (HT40) Mode / CH151,CH159 (UNII-3)	
Mode 10	TX AC (VHT20) Mode / CH149,CH157,CH165 (UNII-3)	
Mode 11	TX AC (VHT40) Mode / CH151,CH159 (UNII-3)	
Mode 12	TX AC (VHT80) Mode / CH155 (UNII-3)	

Following mode(s) as (were) found to be the worst case(s) and selected for the final test.

	AC power line conducted emissions test
Final Test Mode	Description
Mode 12	TX AC(VHT80) Mode / CH155 (UNII-3)

Radiated emissions test				
Final Test Mode Description				
Mode 1	TX A Mode / CH36, CH40, CH48 (UNII-1)			
Mode 4	TX AC (VHT20) Mode / CH36, CH40, CH48 (UNII-1)			
Mode 5 TX AC (VHT40) Mode / CH38, CH46 (UNII-1)				
Mode 6 TX AC (VHT80) Mode / CH42 (UNII-1)				
Mode 7 TX A Mode / CH149,CH157,CH165 (UNII-3)				
Mode 10	TX AC (VHT20) Mode / CH149,CH157,CH165 (UNII-3)			
Mode 11 TX AC (VHT40) Mode / CH151,CH159 (UNII-3)				
Mode 12 TX AC (VHT80) Mode / CH155 (UNII-3)				



Conducted test				
Description				
TX A Mode / CH36, CH40, CH48 (UNII-1)				
TX AC (VHT20) Mode / CH36, CH40, CH48 (UNII-1)				
TX AC (VHT40) Mode / CH38, CH46 (UNII-1)				
TX AC (VHT80) Mode / CH42 (UNII-1)				
TX A Mode / CH149,CH157,CH165 (UNII-3)				
TX AC (VHT20) Mode / CH149,CH157,CH165 (UNII-3)				
TX AC (VHT40) Mode / CH151,CH159 (UNII-3)				
TX AC (VHT80) Mode / CH155 (UNII-3)				

Note:

(1) For radiated emission below 1 GHz test, the IEEE 802.11ac80 is found to be the worst case and recorded.

(2) For radiated emission above 1 GHz test, 1GHz~26.5GHz and 26.5GHz~40GHz have been pre-tested and in this report only recorded the worst case. The remaining spurious points are all below the limit value of 20dB.

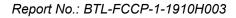
(3) The measurements for RF Output Power were tested during Non-Beamforming and Beamforming, the worst case was Non-Beamforming, only worst case was documented for other test ietms.



## 2.3 PARAMETERS OF TEST SOFTWARE

## Non-Beamforming

Test Software		accessMTool	
Test Frequency (MHz)	5180	5200	5240
IEEE 802.11a	84	88	100
IEEE 802.11n (HT20)	82	100	100
IEEE 802.11ac (VHT20)	84	100	100
Test Frequency (MHz)	5190	5230	
IEEE 802.11n (HT40)	80	92	
IEEE 802.11ac (VHT40)	80	92	
Test Frequency (MHz)	5745	5785	5825
IEEE 802.11a	100	100	100
IEEE 802.11n (HT20)	100	100	100
IEEE 802.11ac (VHT20)	100	100	100
Test Frequency (MHz)	5755	5795	
IEEE 802.11n (HT40)	100	100	
IEEE 802.11ac (VHT40)	100	100	
Test Frequency (MHz)	5210		
IEEE 802.11ac (VHT80)	80		
Test Frequency (MHz)	5775		
IEEE 802.11ac (VHT80)	100		





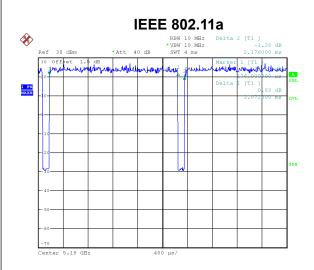
## Beamforming

Test Software		accessMTool	
Test Frequency (MHz)	5180	5200	5240
IEEE 802.11n (HT20)	84	100	100
IEEE 802.11ac (VHT20)	84	100	100
Test Frequency (MHz)	5190	5230	
IEEE 802.11n (HT40)	80	92	
IEEE 802.11ac (VHT40)	80	92	
Test Frequency (MHz)	5745	5785	5825
IEEE 802.11n (HT20)	100	100	100
IEEE 802.11ac (VHT20)	100	100	100
Test Frequency (MHz)	5755	5795	
IEEE 802.11n (HT40)	100	100	
IEEE 802.11ac (VHT40)	100	100	
Test Frequency (MHz)	5210		
IEEE 802.11ac (VHT80)	90		
Test Frequency (MHz)	5775		
IEEE 802.11ac (VHT80)	90		



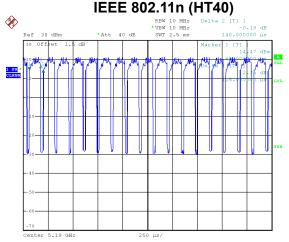
# 2.4 DUTY CYCLE

If duty cycle is  $\geq$  98 %, duty factor is not required. If duty cycle is < 98 %, duty factor shall be considered.



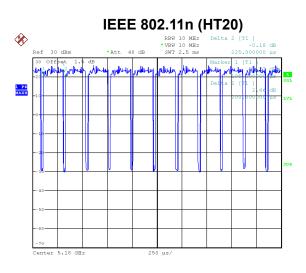
Date: 25.0CT.2019 11:30:59

Duty cycle = 2.072 ms / 2.176 ms = 95.22%Duty Factor =  $10 * \log(1 / 95.22\%) = 0.21 \text{ dB}$ 



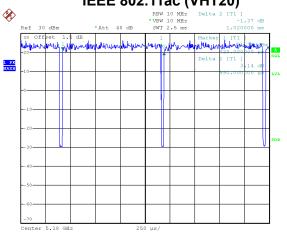
Date: 25.0CT.2019 11:48:35

Duty cycle = 0.115 ms / 0.140 ms = 82.14% Duty Factor = 10 \* log(1 / 82.14%) = 0.85 dB



Date: 25.0CT.2019 11:47:25

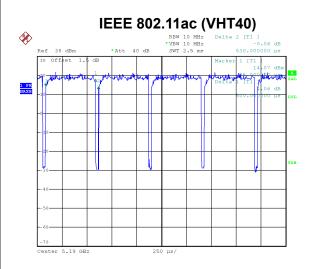
Duty cycle = 0.200 ms / 0.225 ms = 88.89% Duty Factor = 10 \* log(1 / 88.89%) = 0.51 dB IEEE 802.11ac (VHT20)

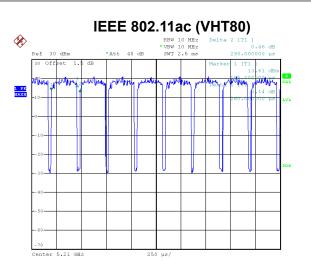


Date: 25.0CT.2019 11:41:05

Duty cycle = 0.990 ms / 1.020 ms = 97.06% Duty Factor = 10 \* log(1 / 97.06%) = 0.13 dB







Date: 25.0CT.2019 11:42:42

Duty cycle = 0.500 ms / 0.530 ms = 94.34% Duty Factor = 10 \* log(1 / 94.34%) = 0.25 dB Date: 25.0CT.2019 11:45:36

Duty cycle = 0.260 ms / 0.290 ms = 89.66% Duty Factor = 10 \* log(1 / 89.66%) = 0.47 dB

## NOTE:

For IEEE 802.11a, IEEE 802.11n (HT20) and IEEE 802.11ac (VHT20):

For radiated emissions frequency above 1 GHz, the resolution bandwidth of test receiver/spectrum analyzer is 1 MHz and the video bandwidth is 1 kHz (Duty cycle < 98%).

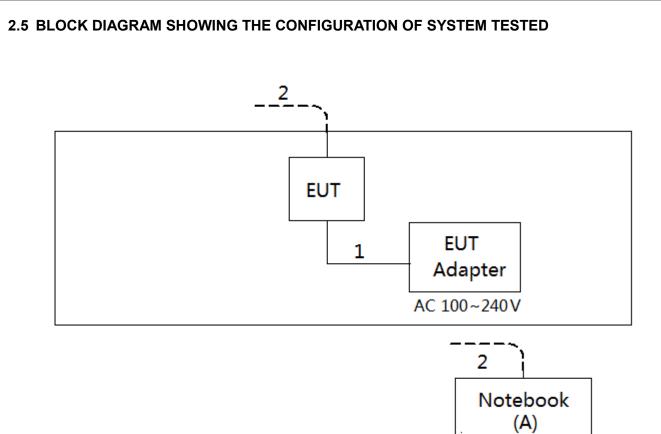
For IEEE 802.11n (HT40) and IEEE 802.11ac (VHT40):

For radiated emissions frequency above 1 GHz, the resolution bandwidth of test receiver/spectrum analyzer is 1 MHz and the video bandwidth is 2 kHz (Duty cycle < 98%).

For IEEE 802.11ac (VHT80):

For radiated emissions frequency above 1 GHz, the resolution bandwidth of test receiver/spectrum analyzer is 1 MHz and the video bandwidth is 3 kHz (Duty cycle < 98%).





## 2.6 SUPPORT UNITS

Item	Equipment	Mfr/Brand	Model/Type No.	Series No.
А	Notebook	Lenovo	#P152014	N/A

Item	Cable Type	Shielded Type	Ferrite Core	Length
1	DC Cable	N/A	N/A	1.5m
2	RJ45 Cable	N/A	N/A	10m



## 3. AC POWER LINE CONDUCTED EMISSIONS TEST

## 3.1 LIMIT

Frequency	Limit (dBµV)		
(MHz)	Quasi-peak	Average	
0.15 - 0.5	66 to 56*	56 - 46*	
0.50 - 5.0	56	46	
5.0 - 30.0	60	50	

NOTE:

(1) The tighter limit applies at the band edges.

(2) The limit of " \* " marked band means the limitation decreases linearly with the logarithm of the frequency in the range.

#### The following table is the setting of the receiver

Receiver Parameter	Setting
Attenuation	10 dB
Start Frequency	0.15 MHz
Stop Frequency	30 MHz
IF Bandwidth	9 KHz

#### 3.2 TEST PROCEDURE

- a. The EUT was placed 0.8 meters from the horizontal ground plane with EUT being connected to the power mains through a line impedance stabilization network (LISN). All other support equipment powered from additional LISN(s). The LISN provide 50 Ohm/ 50uH of coupling impedance for the measuring instrument.
- b. Interconnecting cables that hang closer than 40 cm to the ground plane shall be folded back and forth in the center forming a bundle 30 to 40 cm long.
- c. I/O cables that are not connected to a peripheral shall be bundled in the center. The end of the

cable may be terminated, if required, using the correct terminating impedance. The overall length shall not exceed 1 m.

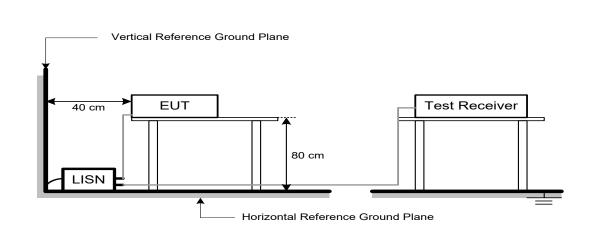
- d. LISN at least 80 cm from nearest part of EUT chassis.
- e. For the actual test configuration, please refer to the related Item -EUT Test Photos.

## 3.3 DEVIATION FROM TEST STANDARD

No deviation



# 3.4 TEST SETUP



## 3.5 EUT OPERATION CONDITIONS

The EUT was configured for testing in a typical fashion (as a customer would normally use it). The EUT has been programmed to continuously transmit during test. This operating condition was tested and used to collect the included data.

The EUT was programmed to be in continuously transmitting/TX mode.

## 3.6 TEST RESULTS

Please refer to the APPENDIX A.



# 4. RADIATED EMISSIONS TEST

## **4.1 LIMIT**

In case the emission fall within the restricted band specified on 15.205(a), then the 15.209(a) limit in the table below has to be followed.

#### LIMITS OF RADIATED EMISSIONS MEASUREMENT (9 kHz to 1000 MHz)

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

#### LIMITS OF UNWANTED EMISSION OUT OF THE RESTRICTED BANDS

Frequency	EIRP Limit	Equivalent Field Strength at 3m
(MHz)	(dBm/MHz)	(dBµV/m)
5150-5250	-27	68.3
5250-5350	-27	68.3
5470-5725	-27	68.3
	-27 NOTE (2)	68.3
5725-5850	10 NOTE (2)	105.3
	15.6 NOTE (2)	110.9
	27 NOTE (2)	122.3

NOTE:

(1) The following formula is used to convert the equipment isotropic radiated power (eirp) to field strength:  $E = \frac{1000000\sqrt{30P}}{1000000\sqrt{30P}}$ 

 $\mu$ V/m, where P is the eirp (Watts)

(2) According to 15.407(b)(4)(i), all emissions shall be limited to a level of -27 dBm/MHz at 75 MHz or more above or below the band edge increasing linearly to 10 dBm/MHz at 25 MHz above or below the band edge, and from 25 MHz above or below the band edge increasing linearly to a level of 15.6 dBm/MHz at 5 MHz above or below the band edge, and from 5 MHz above or below the band edge increasing linearly to a level of 27 dBm/MHz at the band edge.



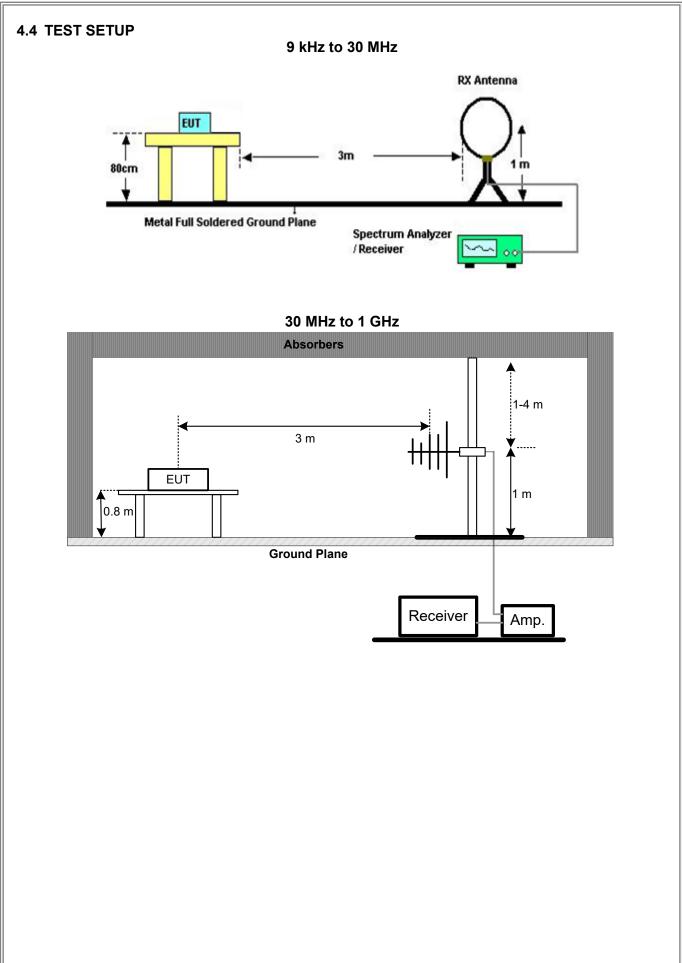
## 4.2 TEST PROCEDURE

- a. The measuring distance of 3 m shall be used for measurements. The EUT was placed on the top of a rotating table 0.8 meter above the ground at a 3 meter semi-anechoic chamber. The table was rotated 360 degrees to determine the position of the highest radiation.(below 1GHz)
- b. The measuring distance of 3 m shall be used for measurements. The EUT was placed on the top of a rotating table 1.5 meter above the ground at a 3 meter semi-anechoic chamber. The table was rotated 360 degrees to determine the position of the highest radiation.(above 1GHz)
- c. The height of the equipment or of the substitution antenna shall be 0.8m or 1.5m; the height of the test antenna shall vary between 1 m to 4 m. Both horizontal and vertical polarizations of the antenna are set to make the measurement.
- d. For each suspected emission, the EUT was arranged to its worst case and then the antenna was tuned to heights find the maximum reading (used Bore sight function).
- e. The receiver system was set to peak and average detect function and specified bandwidth with maximum hold mode when the test frequency is above 1 GHz.
- f. The initial step in collecting radiated emission data is a receiver peak detector mode prescanning the measurement frequency range. Significant peaks are then marked and then Quasi Peak detector mode re-measured.
- g. All readings are Peak unless otherwise stated QP in column of Note. Peak denotes that the Peak reading compliance with the QP Limits and then QP Mode measurement didn't perform. (below 1 GHz)
- h. All readings are Peak Mode value unless otherwise stated AVG in column of Note. If the Peak Mode Measured value compliance with the Peak Limits and lower than AVG Limits, the EUT shall be deemed to meet both Peak & AVG Limits and then only Peak Mode was measured, but AVG Mode didn't perform. (above 1 GHz)
- i. For the actual test configuration, please refer to the related Item -EUT Test Photos.

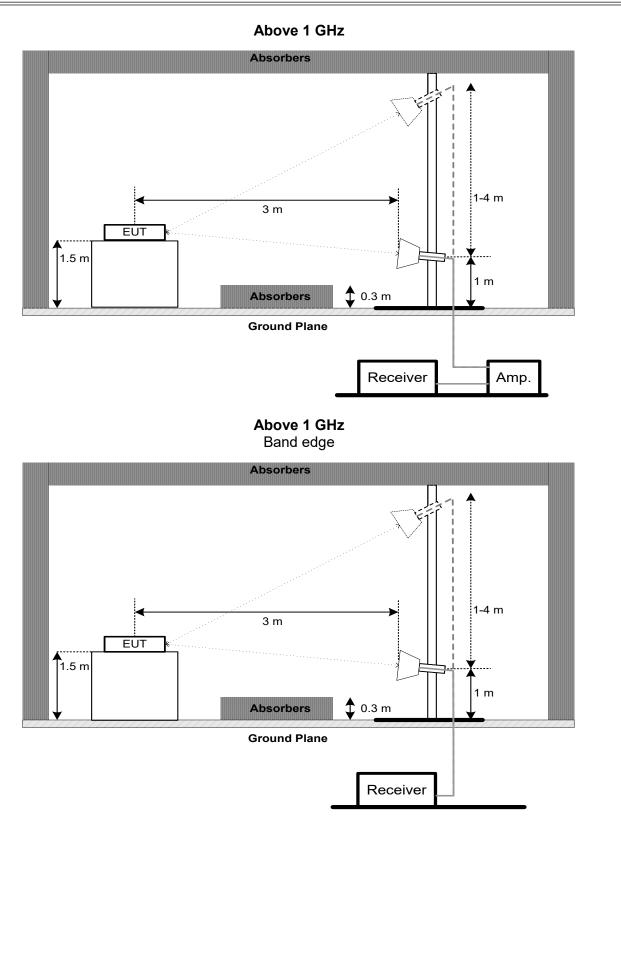
## 4.3 DEVIATION FROM TEST STANDARD

No deviation











## 4.5 EUT OPERATION CONDITIONS

The EUT tested system was configured as the statements of 4.1.5 unless otherwise a special operating condition is specified in the follows during the testing.

#### 4.6 TEST RESULTS - 9 KHZ to 30 MHZ

Please refer to the APPENDIX B

Remark:

- (1) The amplitude of spurious emissions which are attenuated by more than 20 dB below the permissible value has no need to be reported.
- (2) Distance extrapolation factor = 40 log (specific distance / test distance) (dB).
- (3) Limit line = specific limits (dBuV) + distance extrapolation factor.

#### 4.7 TEST RESULTS - 30 MHz TO 1000 MHz

Please refer to the APPENDIX C.

#### 4.8 TEST RESULTS - ABOVE 1000 MHz

Please refer to the APPENDIX D.

Remark:

(1) No limit: This is fundamental signal, the judgment is not applicable. For fundamental signal judgment was referred to Peak output test.



# 5. BANDWIDTH TEST

## 5.1 LIMIT

FCC Part15, Subpart E (15.407)			
Section	Test Item	Limit	Frequency Range (MHz)
	26 dB Bandwidth	-	5150-5250
15.407(a)	26 dB Bandwidth	-	5250-5350
15.407(e)	26 dB Bandwidth	-	5470-5725
	6 dB Bandwidth	Minimum 500 kHz	5725-5850

#### 5.2 TEST PROCEDURE

- a. The EUT was directly connected to the spectrum analyzer and antenna output port as show in the block diagram below
- b. a. Spectrum Setting:

## For UNII-1:

Spectrum Parameter	Setting
Attenuation	Auto
Span Frequency	> 26 dB Bandwidth
RBW	300 kHz (Bandwidth 20 MHz) 1 MHz (Bandwidth 40 MHz and 80 MHz)
VBW	1 MHz (Bandwidth 20 MHz) 3 MHz (Bandwidth 40 MHz and 80 MHz)
Detector	Peak
Trace	Max Hold
Sweep Time	Auto

#### For UNII-3:

Spectrum Parameter	Setting
Attenuation	Auto
Span Frequency	6 dB Bandwidth
RBW	100 kHz
VBW	300 kHz
Detector	Peak
Trace	Max Hold
Sweep Time	Auto

c. Measured the spectrum width with power higher than 26 dB below carrier

## 5.3 TEST PROCEDURE

No deviation.



# 5.4 TEST SETUP

EUT	SPECTRUM
	ANALYZER

## 5.5 EUT OPERATION CONDITIONS

The EUT was programmed to be in continuously transmitting mode.

## 5.6 TEST RESULTS

Please refer to the APPENDIX E.



# 6. MAXIMUM OUTPUT POWER TEST

## 6.1 LIMIT

FCC Part15, Subpart E (15.407)			
Section	Section Test Item Limit		Frequency Range (MHz)
15 407(0)	15.407(a) Conducted Output Power	AP device: 1 Watt (30 dBm) Client device: 250 mW (24 dBm)	5150-5250
15.407(a)		250 mW (24 dBm)	5250-5350
		250 mW (24 dBm)	5470-5725
		1 Watt (30dBm)	5725-5850

#### Note:

- a. For an indoor access point operating in the band 5.15-5.25 GHz, the maximum conducted output power over the frequency band of operation shall not exceed 1 W provided the maximum antenna gain does not exceed 6 dBi. In addition, the maximum power spectral density shall not exceed 17 dBm in any 1 megahertz band. If transmitting antennas of directional gain greater than 6 dBi are used, both the maximum conducted output power and the maximum power spectral density shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6 dBi.
- b. For the 5.25-5.35 GHz and 5.47-5.725 GHz bands, the maximum conducted output power over the frequency bands of operation shall not exceed the lesser of 250 mW or 11 dBm + 10log B, where B is the 26dB Bandwidth in megahertz.



## 6.2 TEST PROCEDURE

- a. The EUT was directly connected to the power meter and antenna output port as show in the block diagram below.
- b. Test test was performed in accordance with method of FCC KDB 789033 D02 General UNII Test Procedures New Rules v02r01.

#### 6.3 DEVIATION FROM STANDARD

No deviation.

## 6.4 TEST SETUP

EUT	Power Meter

#### 6.5 EUT OPERATION CONDITIONS

The EUT was programmed to be in continuously transmitting mode.

#### 6.6 TEST RESULTS

Please refer to the APPENDIX F.



# 7. POWER SPECTRAL DENSITY TEST

## 7.1 LIMIT

FCC Part15, Subpart E (15.407)			
Section	Test Item	Limit	Frequency Range (MHz)
		AP device: 17 dBm/MHz Client device: 11 dBm/MHz	5150-5250
15.407(a)	Power Spectral Density	11 dBm/MHz	5250-5350
		11 dBm/MHz	5470-5725
		30 dBm/500 kHz	5725-5850

## 7.2 TEST PROCEDURE

- a. The EUT was directly connected to the spectrum analyzer and antenna output port as show in the block diagram below.
- b. Spectrum Setting

Spectrum Parameter	Setting
Attenuation	Auto
Span Frequency	Encompass the entire emissions bandwidth (EBW) of the signal
RBW	= 1 MHz.
VBW	≥ 3 MHz.
Detector	RMS
Trace average	100 trace
Sweep Time	Auto

Note:

- 1. For UNII-3, according to KDB publication 789033 D02 General UNII Test Procedures New Rules v02r01, section II.F.5., it is acceptable to set RBW at 1 MHz and VBW at 3 MHz if the spectrum analyzer does not have 500 kHz RBW.
- The value measured with RBW=1 MHz is to be added with 10log(500 kHz/1 MHz) which is -3 dB. For example, if the measured value is +10dBm using RBW=1 MHz (that is +10 dBm/MHz), then the converted value will be +7dBm/500kHz.

## 7.3 DEVIATION FROM STANDARD

No deviation.



## 7.4 TEST SETUP

EUT	SPECTRUM
	ANALYZER

## 7.5 EUT OPERATION CONDITIONS

The EUT was programmed to be in continuously transmitting mode.

## 7.6 TEST RESULTS

Please refer to the APPENDIX H.



# 8. FREQUENCY STABILITY MEASUREMENT

## 8.1 LIMIT

FCC Part15, Subpart E (15.407)			
Section	Test Item	Limit	Frequency Range (MHz)
15.407(g)	Frequency Stability	An emission is maintained within the band of operation under all	5150-5250 5250-5350 5470-5600
10.407 (g)		conditions of normal operation as specified in the users manual	5650-5725 5725-5850

## 8.2 TEST PROCEDURE

- a. The EUT was directly connected to the spectrum analyzer and antenna output port as show in the block diagram below.
- b. Spectrum Setting:

Spectrum Parameter	Setting
Attenuation	Auto
ISnan Frequency	Entire absence of modulation emissions bandwidth
RBW	10 kHz
VBW	10 kHz
Sweep Time	Auto

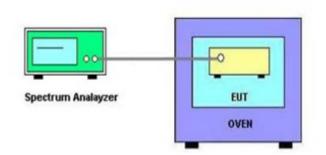
- c. The test extreme voltage is to change the primary supply voltage from 85 to 115 percent of the nominal value.
- d. User manual temperature is 0°C~40°C.

## 8.3 DEVIATION FROM STANDARD

No deviation.



## 8.4 TEST SETUP



## 8.5 EUT OPERATION CONDITIONS

The EUT was programmed to be in continuously transmitting mode.

## 8.6 TEST RESULTS

Please refer to the APPENDIX I.



# 9. MEASUREMENT INSTRUMENTS LIST

	AC Power Line Conducted Emissions						
Item	Kind of Equipment	Manufacturer	Type No.	Serial No.	Calibrated until		
1	Line Impedance Stabilisation Network	Schwarzbeck	NNLK 8121	8121-822	Mar. 29, 2020		
2	TWO-LINE V- NETWORK	R&S	ENV216	101340	Nov. 20, 2019		
3	Test Cable	emci	EMCRG400-BM- NM-10000	170628	Apr. 17, 2020		
4	EMI Test Receiver	R&S	ESCI	100082	Mar. 29, 2020		
5	50Ω Terminator	SHX	TF2-1G-A	17051602	Mar. 29, 2020		
6	50Ω coaxial switch	Anritsu	MP59B	6201750902	Mar. 29, 2020		
7	Measurement Software	Farad	EZ-EMC Ver.NB- 03A1-01	N/A	N/A		

	Radiated Emissions - 9 kHz to 30 MHz						
Item Kind of Equipment Manufacturer Type No. Serial No. Calibra				Calibrated until			
1	Loop Antenna	EMCI	EMCI LPA600	275	Mar. 29, 2020		
2	EMI Test Receiver	R&S	ESCI	100082	Mar. 29, 2020		
3	Measurement Software	Farad	EZ-EMC Ver.NB- 03A1-01	N/A	N/A		

	Radiated Emissions - 30 MHz to 1 GHz						
Item	Kind of Equipment	Manufacturer	Type No.	Serial No.	Calibrated until		
1	TRILOG Broadband Antenna	Schwarzbeck	VULB 9168	719	Mar. 29, 2020		
2	Pre-Amplifier	emci	EMC9135	980400	Mar. 29, 2020		
3	MXE EMI Receiver	Keysight	N9038A	MY57150106	Mar. 29, 2020		
4	Test Cable	emci	EMC104-SM-SM- 7000	170330	Apr. 17, 2020		
5	Test Cable	emci	EMC104-SM-SM- 1000	170331	Apr. 17, 2020		
6	Test Cable	emci	EMC104-SM-NM- 3500	170621	Apr. 17, 2020		
7	Measurement Software	Farad	EZ-EMC Ver.NB- 03A1-01	N/A	N/A		



	Radiated Emissions - Above 1 GHz						
Item	Kind of Equipment	Manufacturer	Type No.	Serial No.	Calibrated until		
1	Double-Ridged Waveguide Horn Antenna	ETS-Lindgren	9120D	00206960	Mar. 29, 2020		
2	Pre-Amplifier	emci	EMC012645SE	980421	Mar. 29, 2020		
3	EXA Spectrum Analyzer	Keysight	N9010A	MY56480545	Mar. 29, 2020		
4	Test Cable	emci	EMC104-SM-SM- 7000	170330	Apr. 17, 2020		
5	Test Cable	emci	EMC104-SM-SM- 1000	170331	Apr. 17, 2020		
6	Test Cable	emci	EMC104-SM-NM- 3500	170621	Apr. 17, 2020		
7	Measurement Software	Farad	EZ-EMC Ver.NB- 03A1-01	N/A	N/A		
8	Double-Ridged Waveguide Horn Antenna	ETS-Lindgren	3116C	00203919	Mar. 29, 2020		
9	Pre-Amplifier	emci	EMC184045SE	980409	Mar. 29, 2020		

	Bandwidth					
Item	Kind of Equipment	Manufacturer	Type No.	Serial No.	Calibrated until	
1	Spectrum Analyzer	R&S	FSP40	100626	Mar. 29, 2020	

	Conducted Output Power					
Item	Kind of Equipment	Manufacturer	Type No.	Serial No.	Calibrated until	
1	Spectrum Analyzer	R&S	FSP40	100626	Mar. 29, 2020	

	Power Spectral Density					
Item	Kind of Equipment	Manufacturer	Type No.	Serial No.	Calibrated until	
1	Spectrum Analyzer	R&S	FSP40	100626	Mar. 29, 2020	

	Frequency Stability						
Item	Kind of Equipment	Manufacturer	Type No.	Serial No.	Calibrated until		
1	Spectrum Analyzer	R&S	FSP40	100626	Mar. 29, 2020		
2	Temperature And Humidity Box	Blue pand	BPHS-120B	170616454	Nov. 10, 2019		

Remark: "N/A" denotes no model name, serial no. or calibration specified.

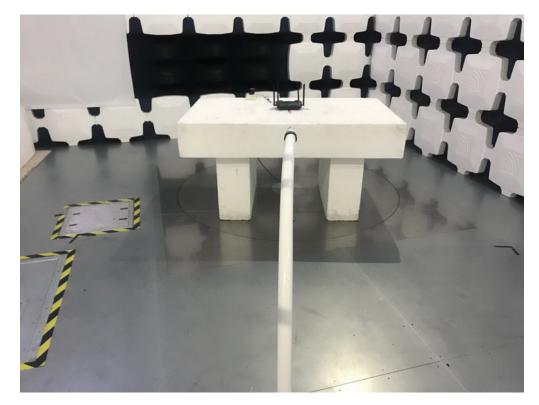
All calibration period of equipment list is one year.

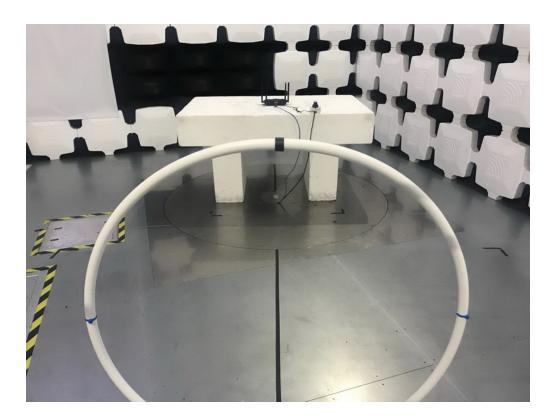


# 10. EUT TEST PHOTOS

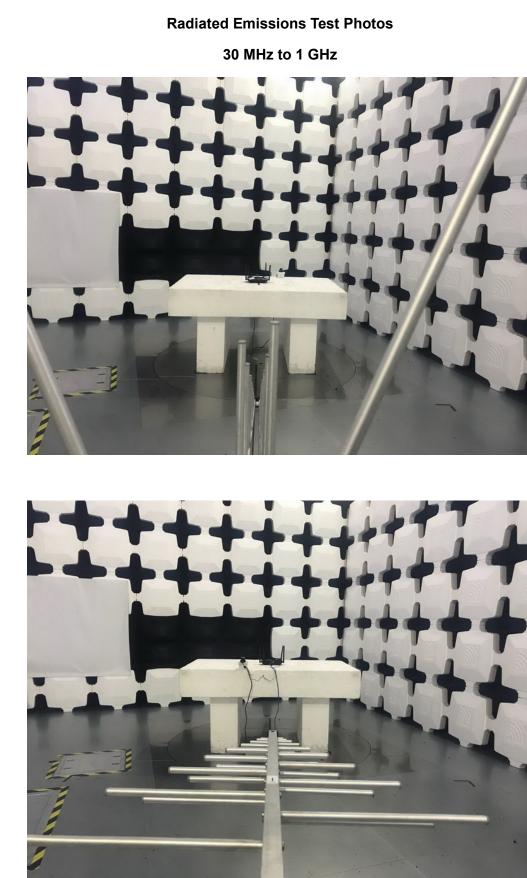
## **Radiated Emissions Test Photos**

9 kHz to 30 MHz



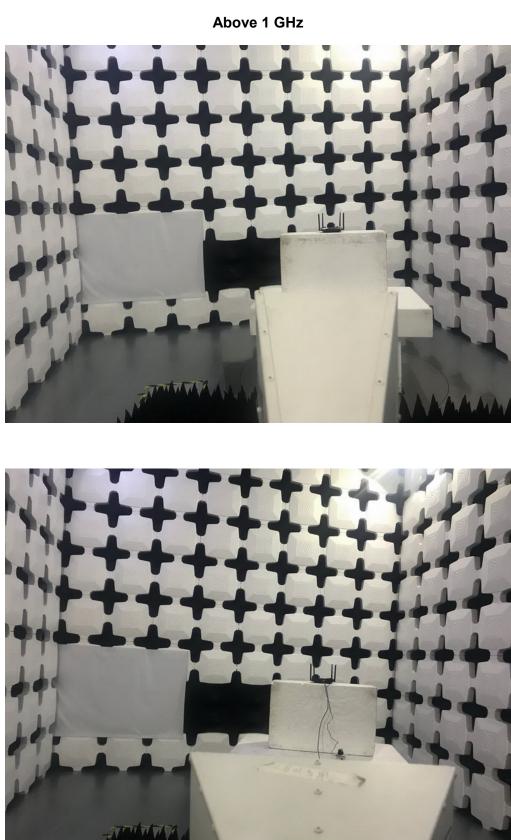








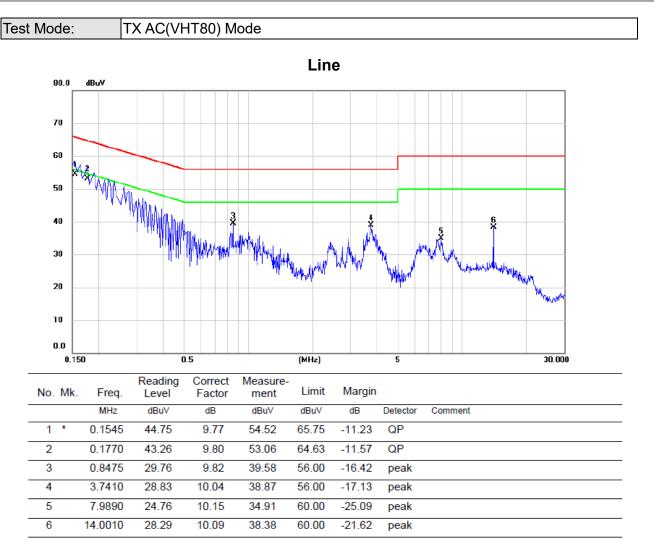






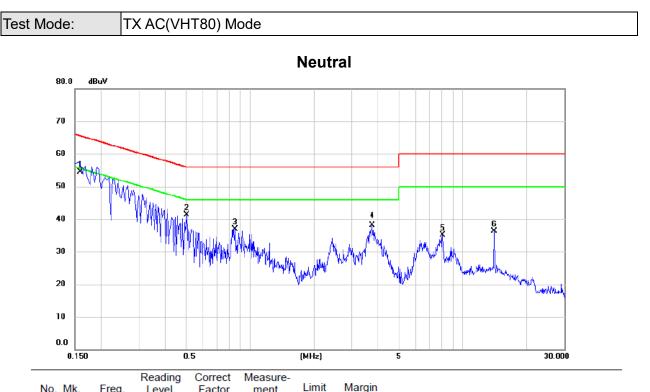
# **APPENDIX A - AC POWER LINE CONDUCTED EMISSIONS**





- (1) Measurement Value = Reading Level + Correct Factor.
- (2) Margin Level = Measurement Value Limit Value.





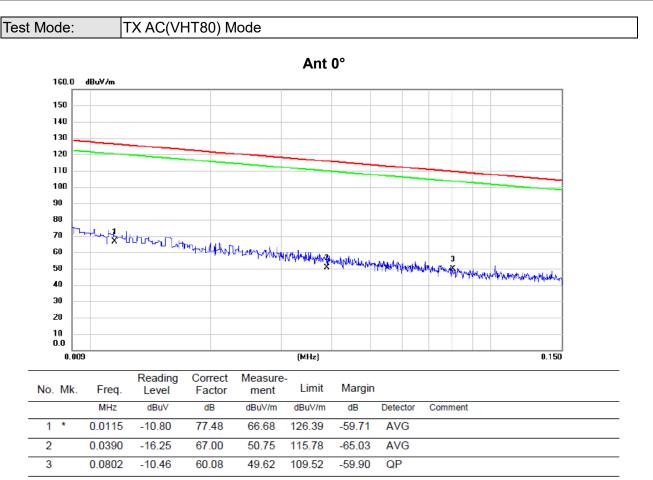
No.	Mk.	Freq.	Level	Factor	ment	Limit	Margin		
		MHz	dBuV	dB	dBuV	dBuV	dB	Detector	Comment
1	*	0.1590	44.91	9.60	54.51	65.52	-11.01	peak	
2		0.5054	31.42	9.83	41.25	56.00	-14.75	peak	
3		0.8520	27.06	9.77	36.83	56.00	-19.17	peak	
4		3.7410	28.05	10.02	38.07	56.00	-17.93	QP	
5		8.0520	24.88	10.15	35.03	60.00	-24.97	peak	
6		14.0010	26.14	10.11	36.25	60.00	-23.75	peak	

- (1) Measurement Value = Reading Level + Correct Factor.
- (2) Margin Level = Measurement Value Limit Value.



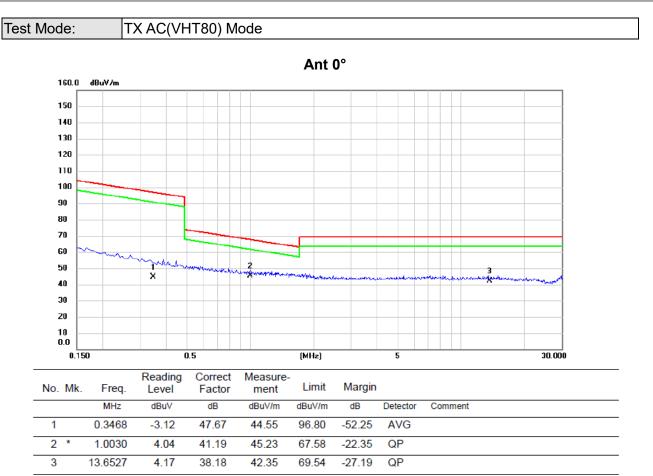
## APPENDIX B - RADIATED EMISSION - 9 KHZ TO 30 MHZ





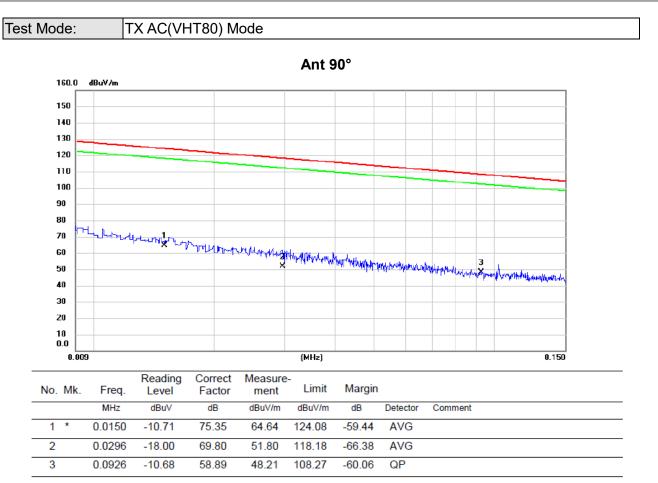
- (1) Measurement Value = Reading Level + Correct Factor.
- (2) Margin Level = Measurement Value Limit Value.





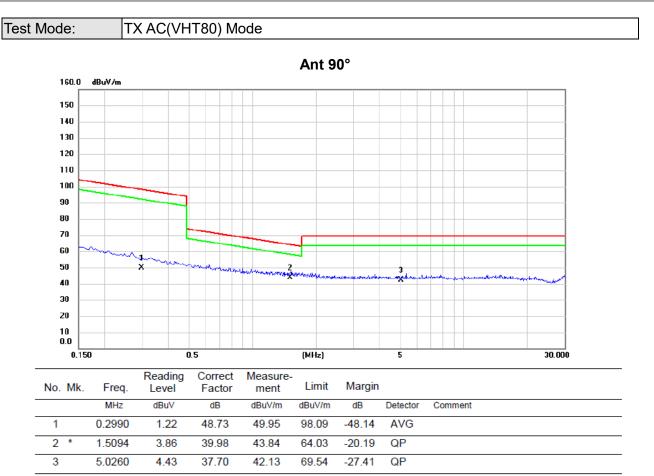
- (1) Measurement Value = Reading Level + Correct Factor.
- (2) Margin Level = Measurement Value Limit Value.





- (1) Measurement Value = Reading Level + Correct Factor.
- (2) Margin Level = Measurement Value Limit Value.



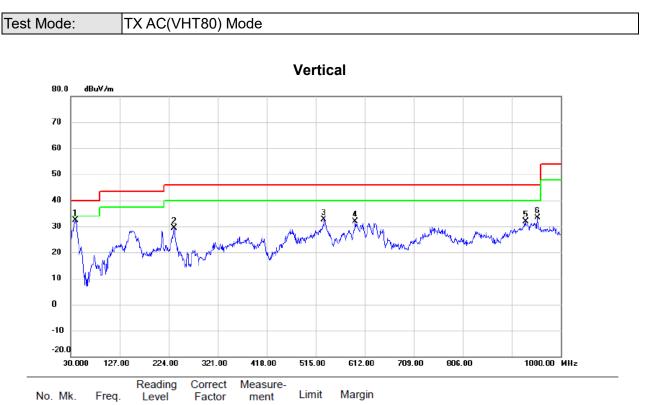


- (1) Measurement Value = Reading Level + Correct Factor.
- (2) Margin Level = Measurement Value Limit Value.



## **APPENDIX C - RADIATED EMISSION - 30 MHZ TO 1 GHZ**

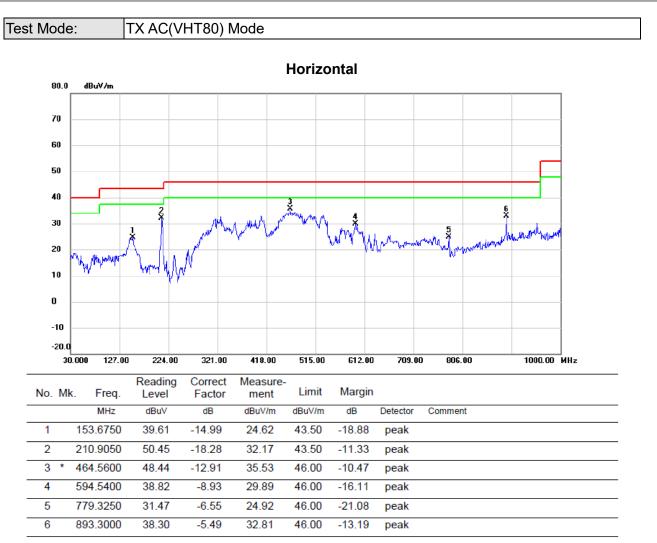




No.	Mk.	Freq.	Level	Factor	ment	Limit	Margin		
		MHz	dBuV	dB	dBuV/m	dBuV/m	dB	Detector	Comment
1	*	40.1850	48.59	-16.20	32.39	40.00	-7.61	peak	
2		235.1550	46.50	-17.12	29.38	46.00	-16.62	peak	
3		531.4900	44.50	-11.75	32.75	46.00	-13.25	peak	
4		593.5700	40.90	-8.98	31.92	46.00	-14.08	peak	
5		930.1600	37.09	-5.25	31.84	46.00	-14.16	peak	
6		953.4400	38.56	-5.13	33.43	46.00	-12.57	peak	

- (1) Measurement Value = Reading Level + Correct Factor.(2) Margin Level = Measurement Value Limit Value.



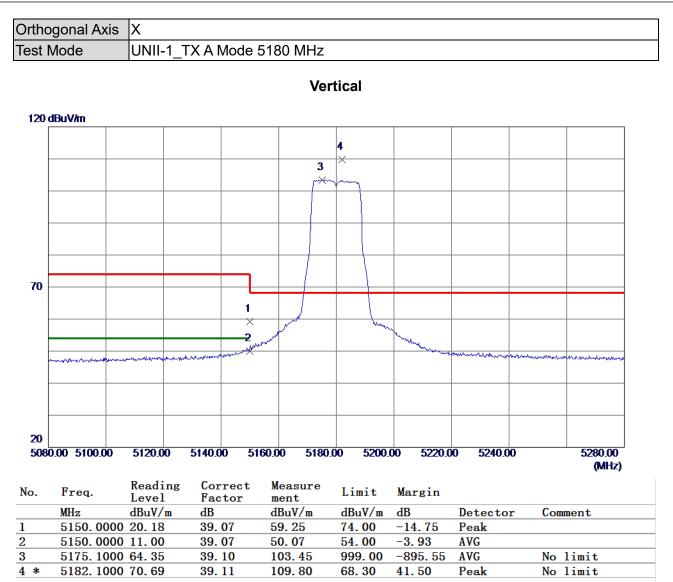


- (1) Measurement Value = Reading Level + Correct Factor.
- (2) Margin Level = Measurement Value Limit Value.



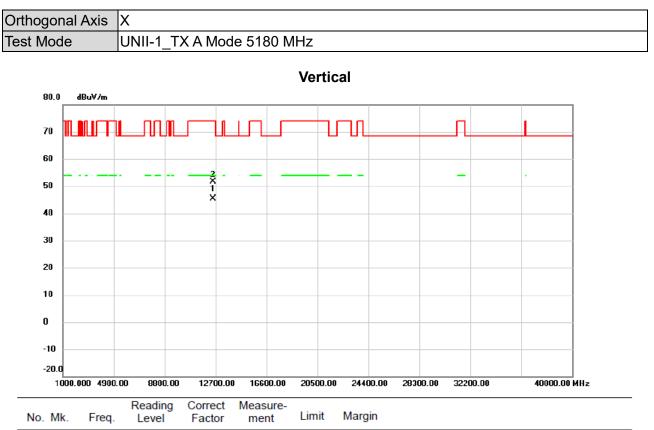
## **APPENDIX D - RADIATED EMISSION - ABOVE 1000 MHZ**





- (1) Measurement Value = Reading Level + Correct Factor.
- (2) Margin Level = Measurement Value Limit Value.

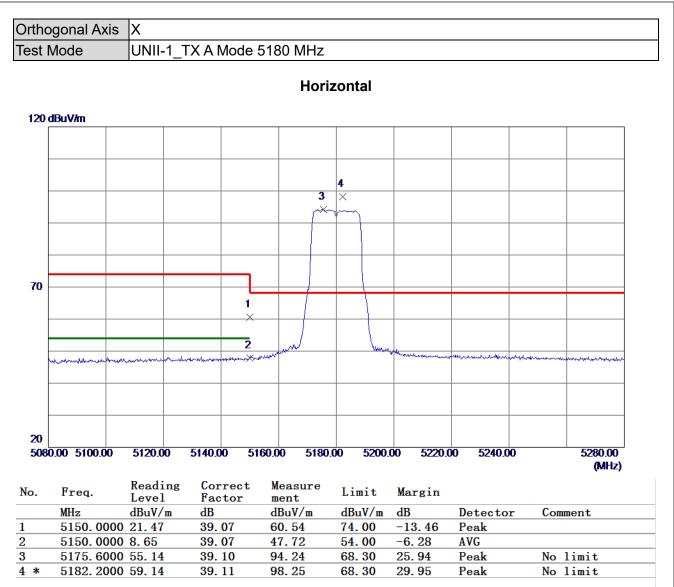




No.	Mk	. Freq.	Level	Factor	ment	Limit	Margin		
		MHz	dBuV	dB	dBuV/m	dBuV/m	dB	Detector	Comment
1	*	12492.00		2.94	45.26	54.00	-8.74	AVG	
2		12500.15	48.60	2.93	51.53	74.00	-22.47	peak	

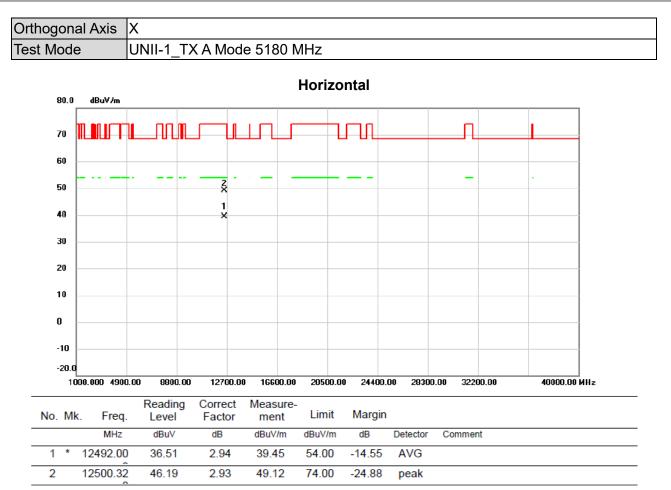
- (1) Measurement Value = Reading Level + Correct Factor.
- (2) Margin Level = Measurement Value Limit Value.





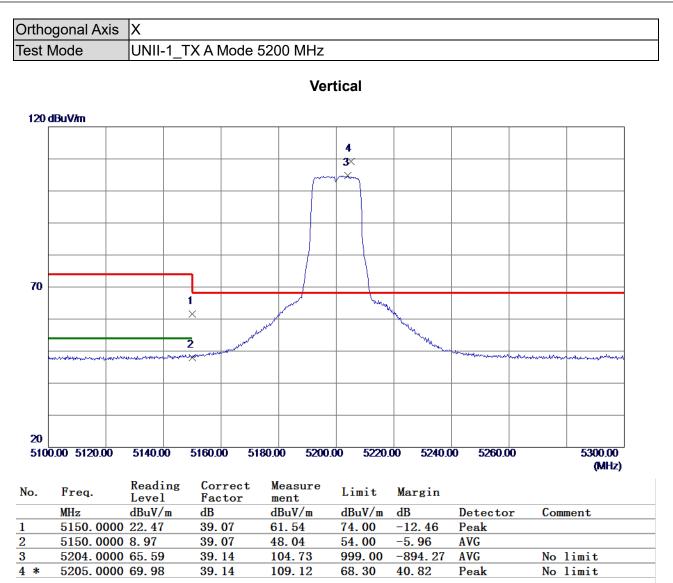
- (1) Measurement Value = Reading Level + Correct Factor.
- (2) Margin Level = Measurement Value Limit Value.





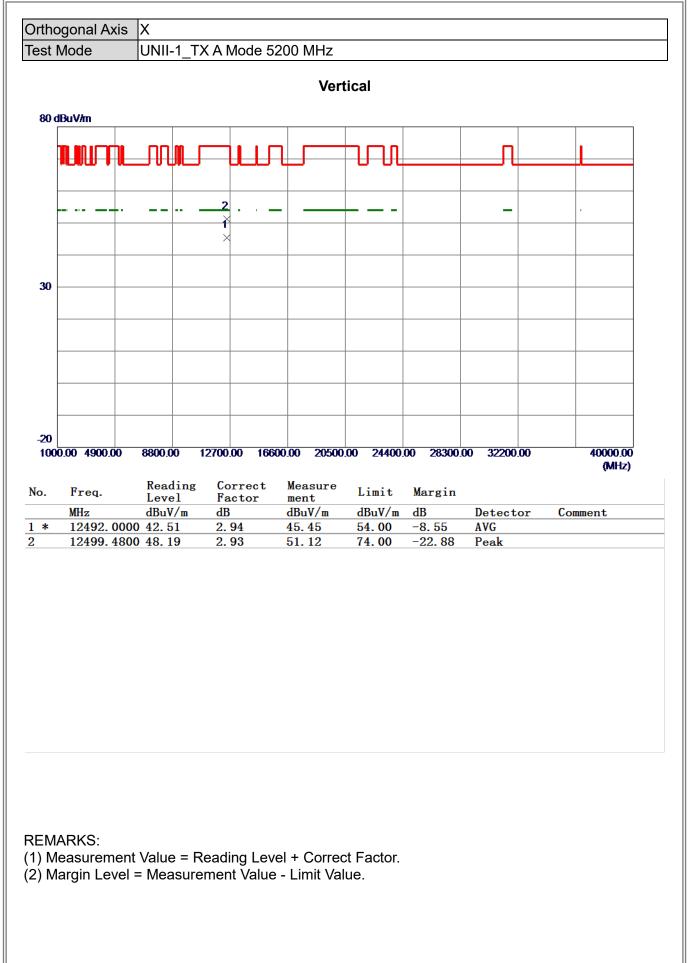
- (1) Measurement Value = Reading Level + Correct Factor.
- (2) Margin Level = Measurement Value Limit Value.



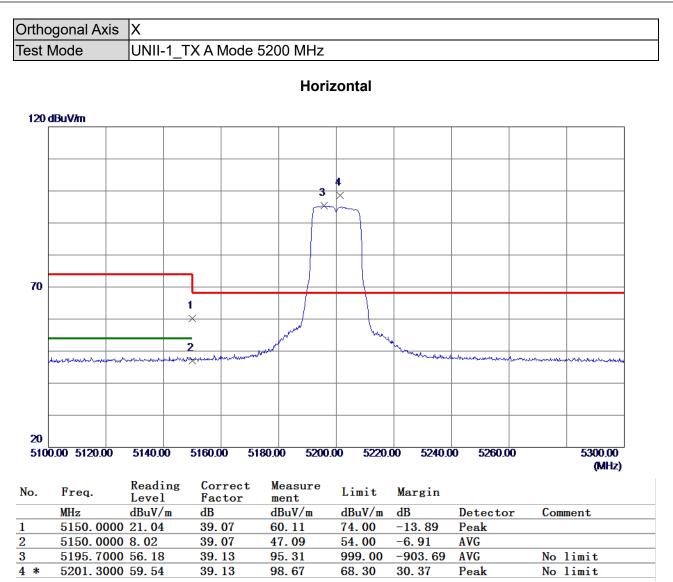


- (1) Measurement Value = Reading Level + Correct Factor.
- (2) Margin Level = Measurement Value Limit Value.



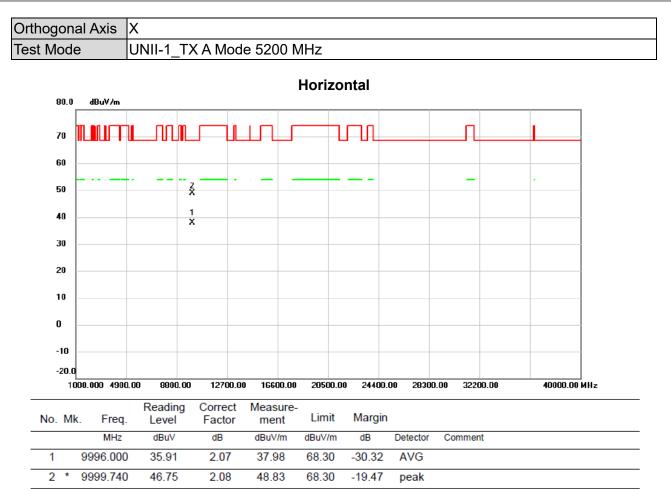






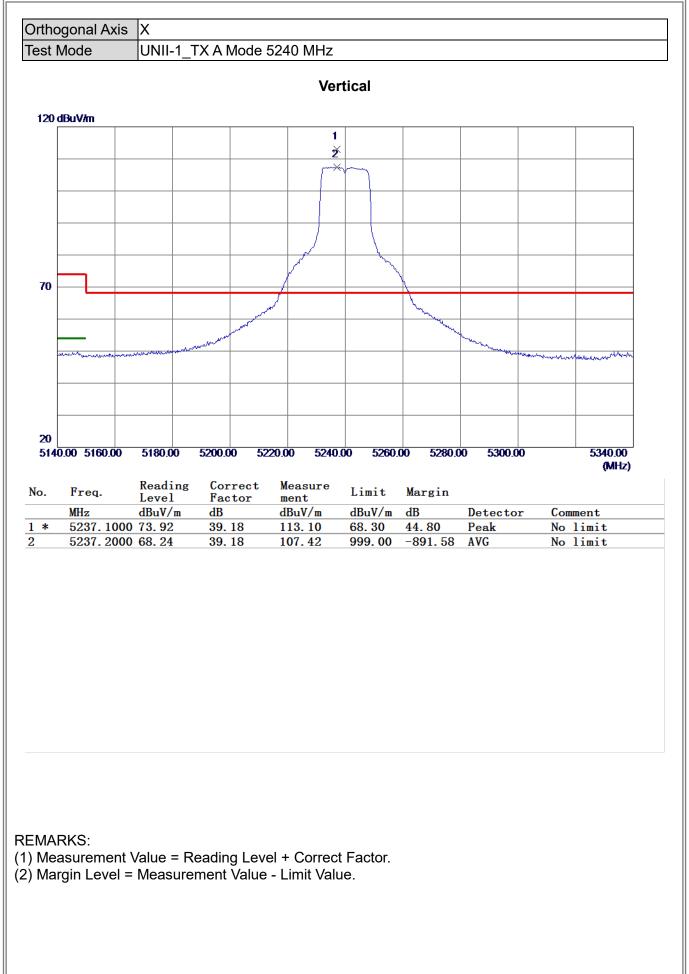
- (1) Measurement Value = Reading Level + Correct Factor.
- (2) Margin Level = Measurement Value Limit Value.



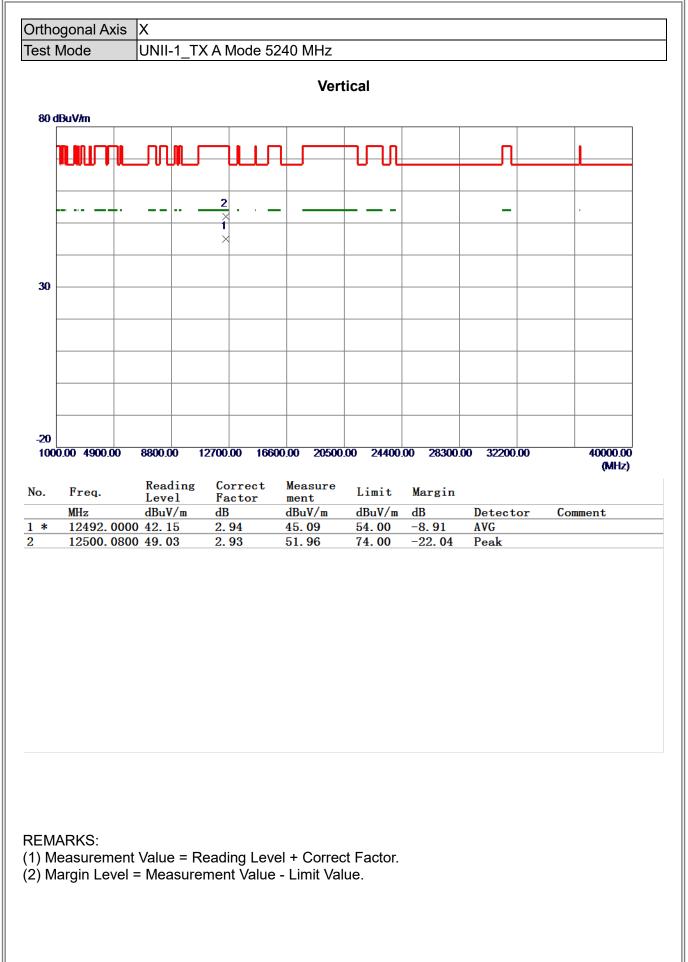


- (1) Measurement Value = Reading Level + Correct Factor.
- (2) Margin Level = Measurement Value Limit Value.

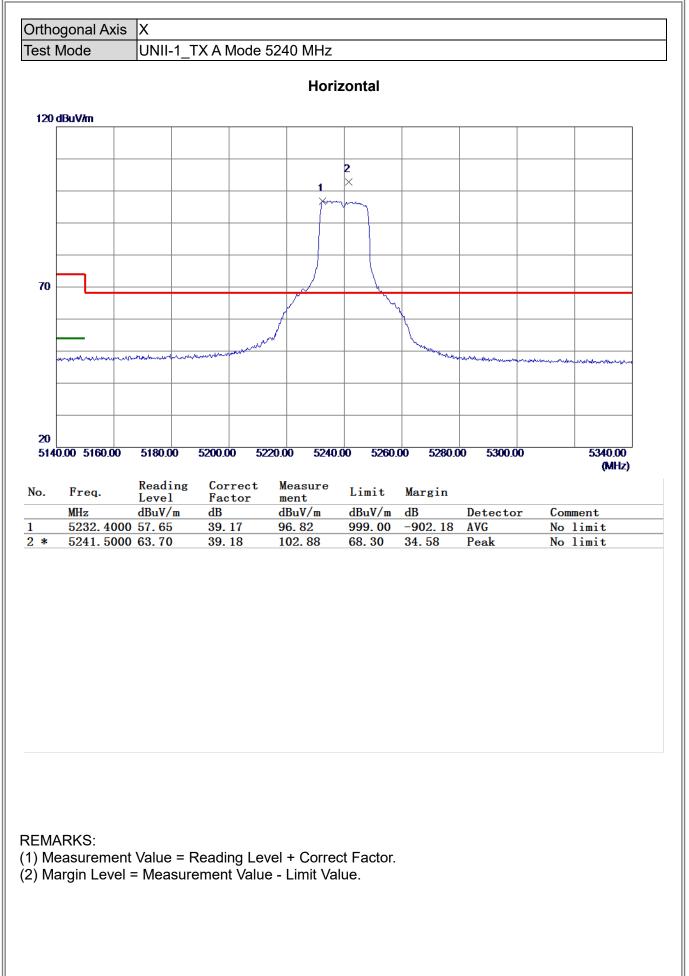




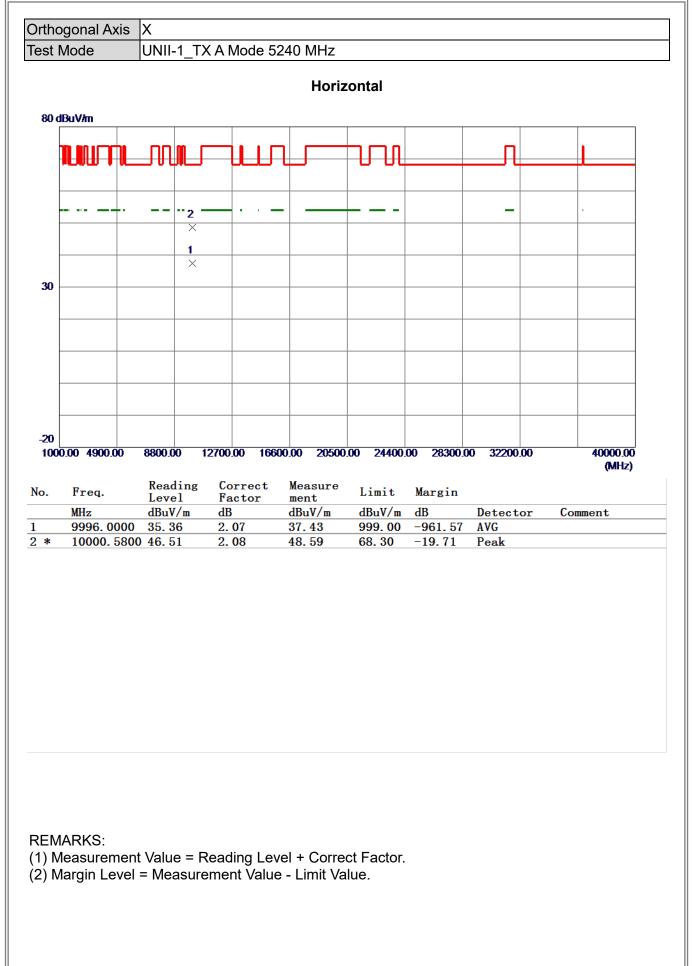




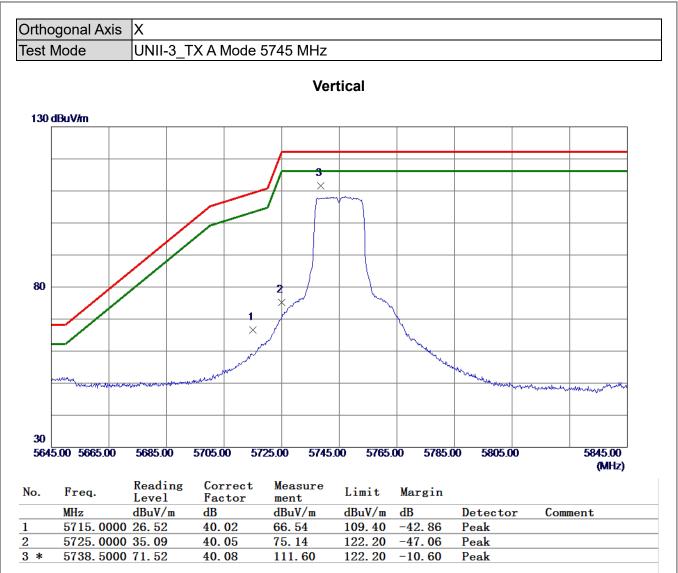






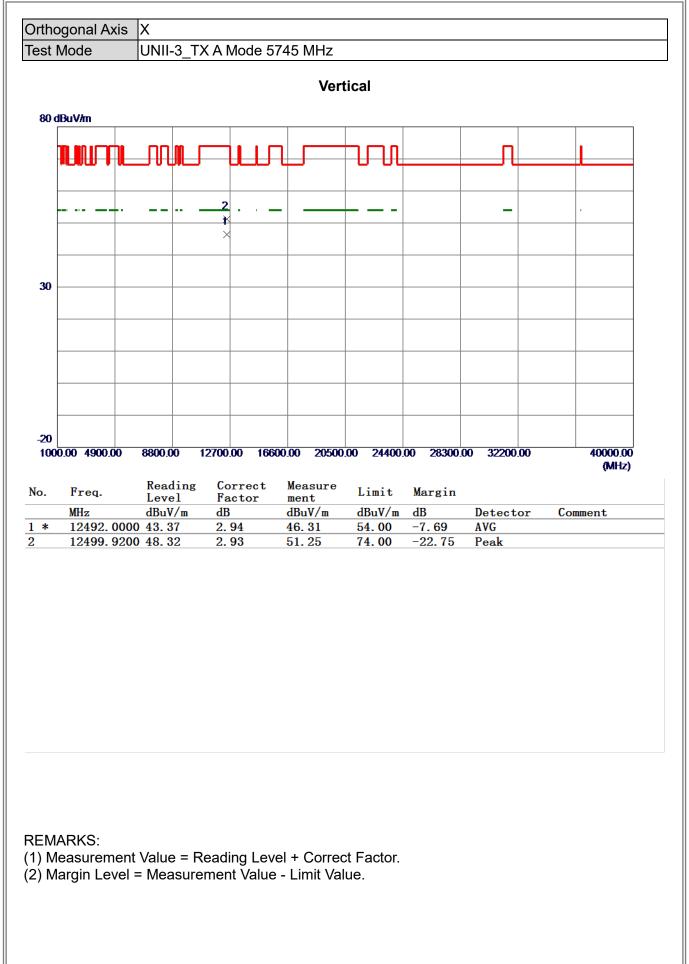




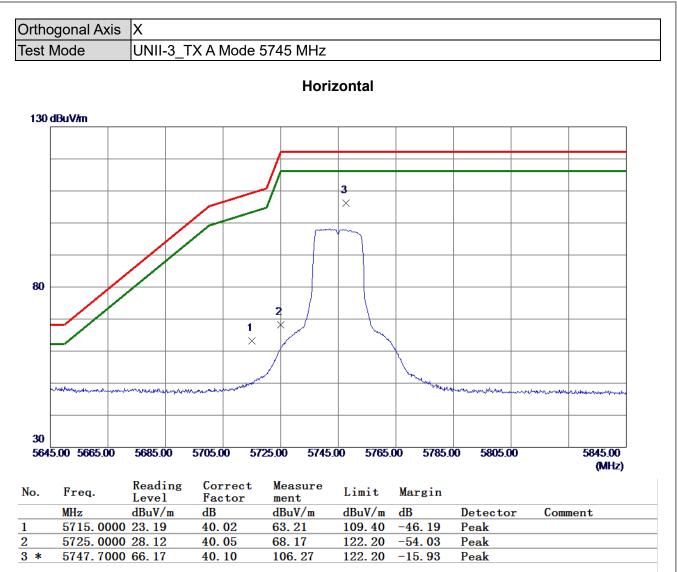


- (1) Measurement Value = Reading Level + Correct Factor.
- (2) Margin Level = Measurement Value Limit Value.



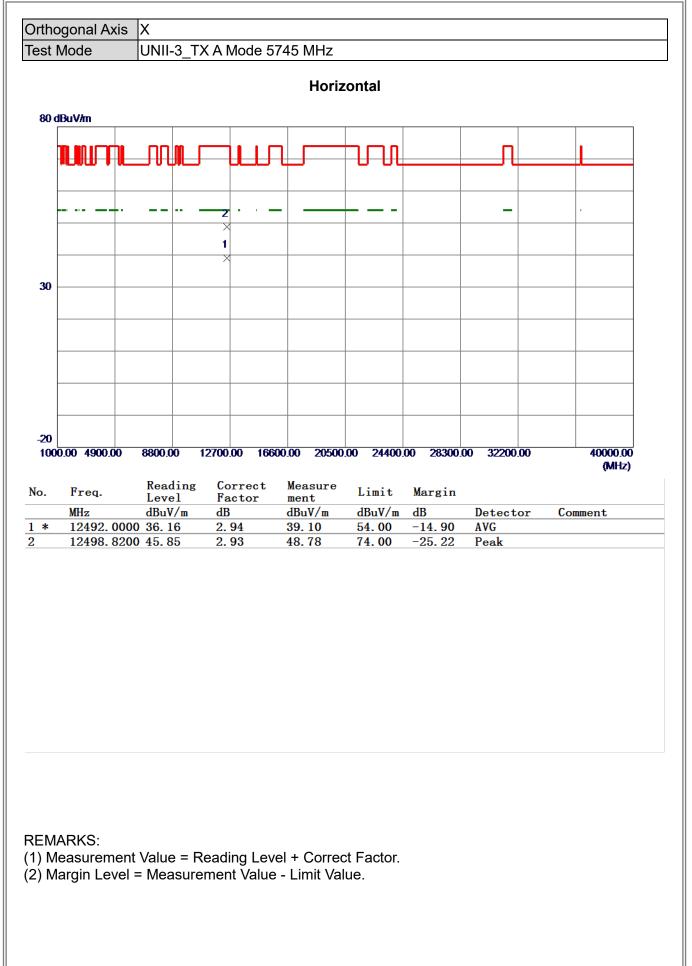




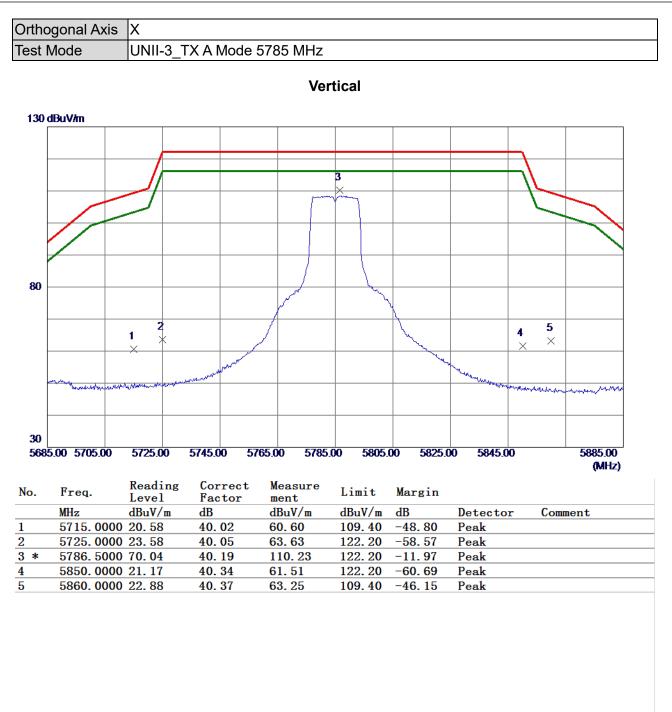


- (1) Measurement Value = Reading Level + Correct Factor.
- (2) Margin Level = Measurement Value Limit Value.



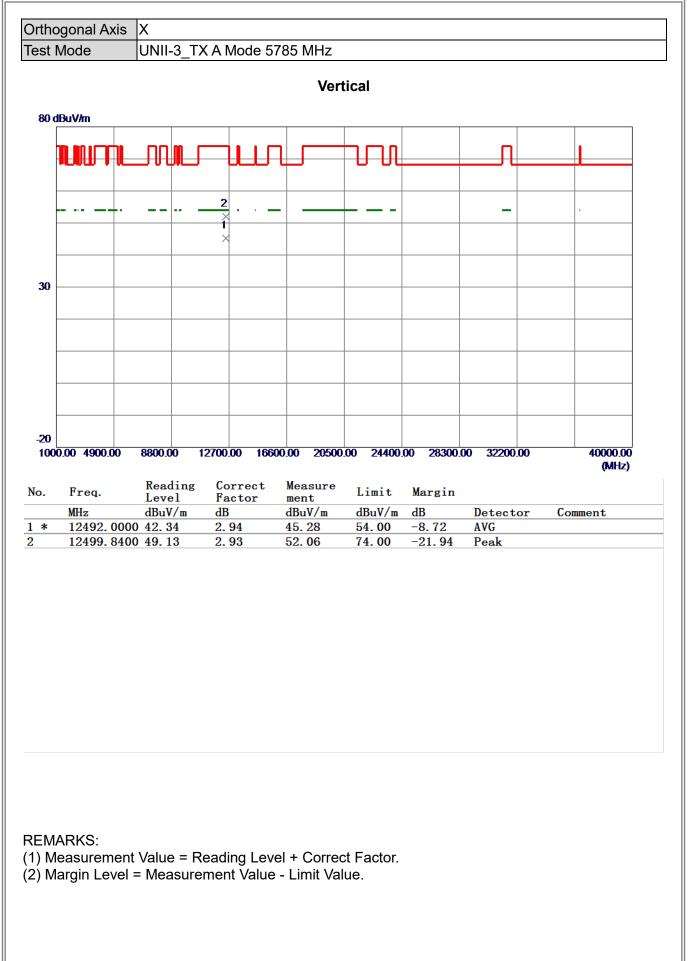




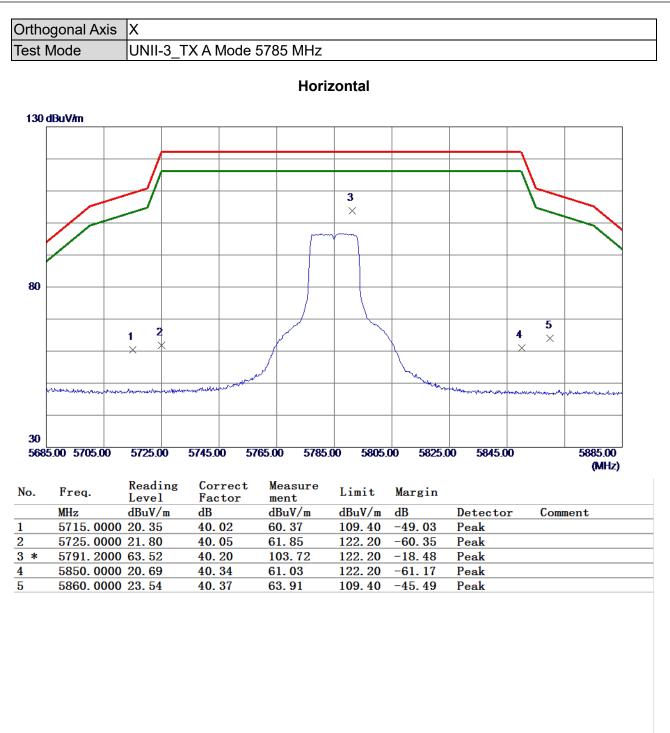


- (1) Measurement Value = Reading Level + Correct Factor.
- (2) Margin Level = Measurement Value Limit Value.



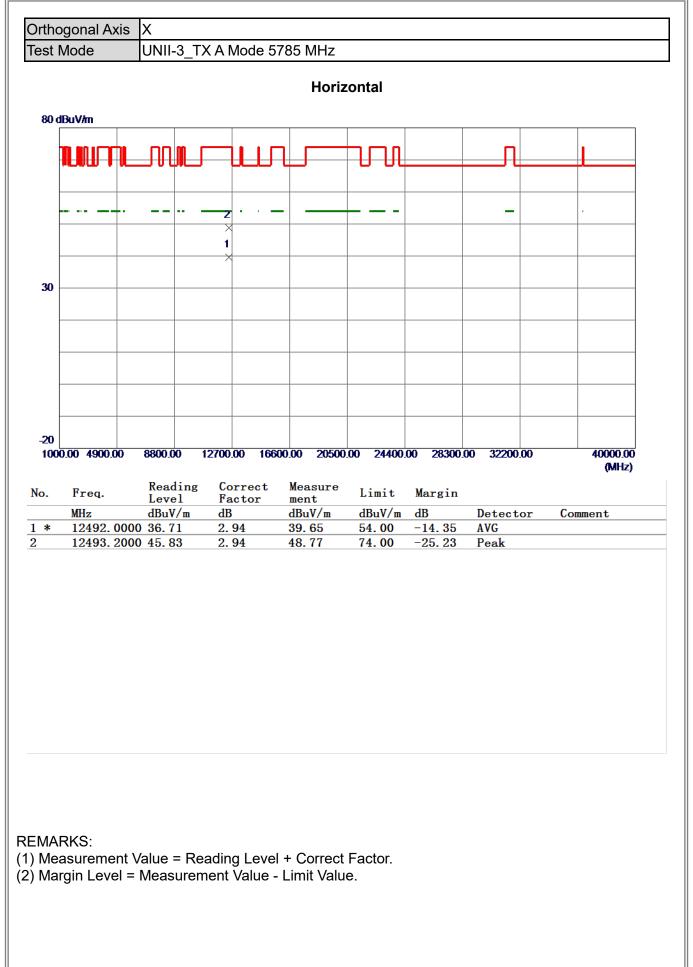




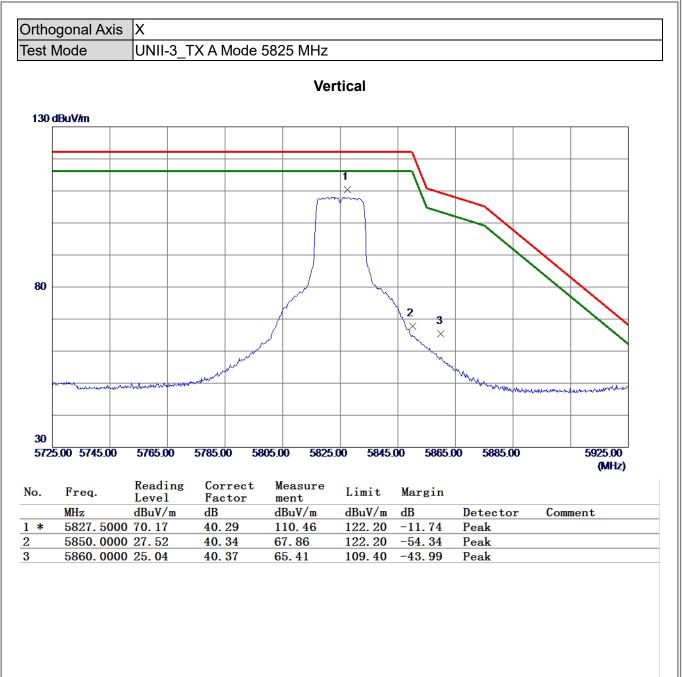


- (1) Measurement Value = Reading Level + Correct Factor.
- (2) Margin Level = Measurement Value Limit Value.



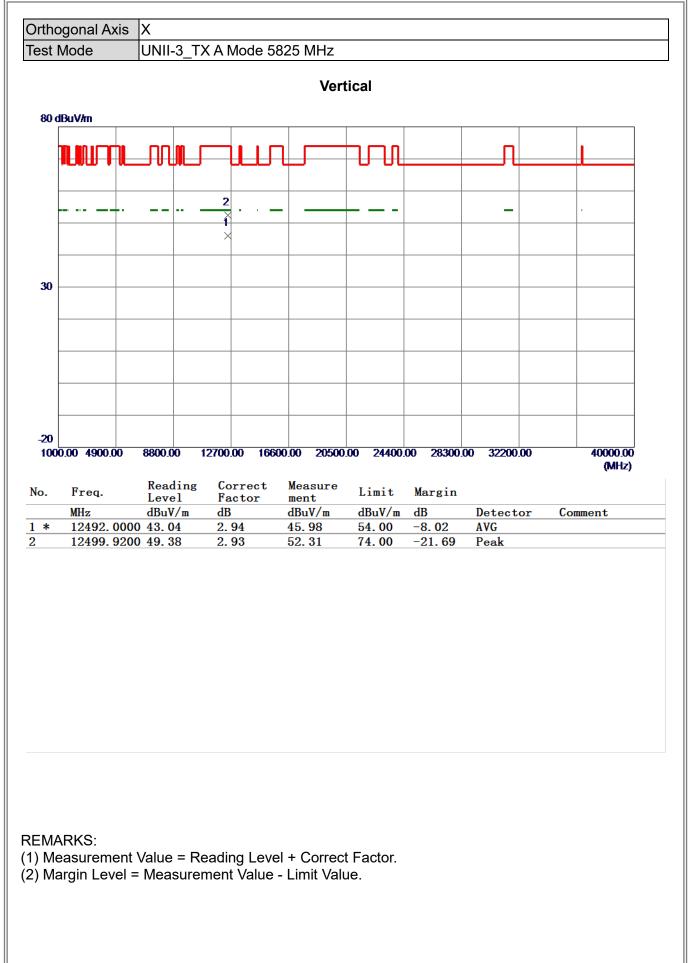




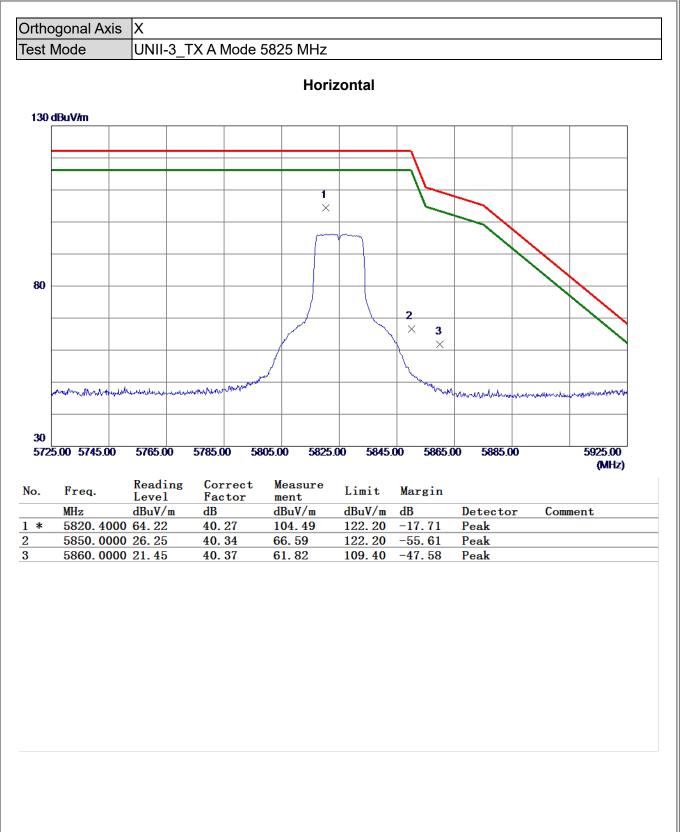


- (1) Measurement Value = Reading Level + Correct Factor.
- (2) Margin Level = Measurement Value Limit Value.



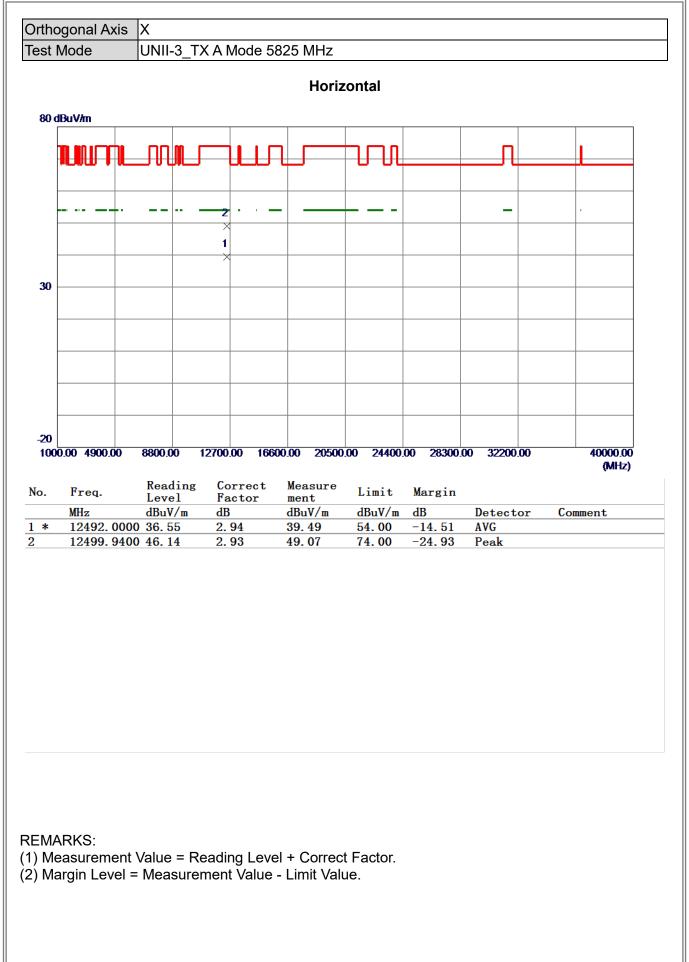




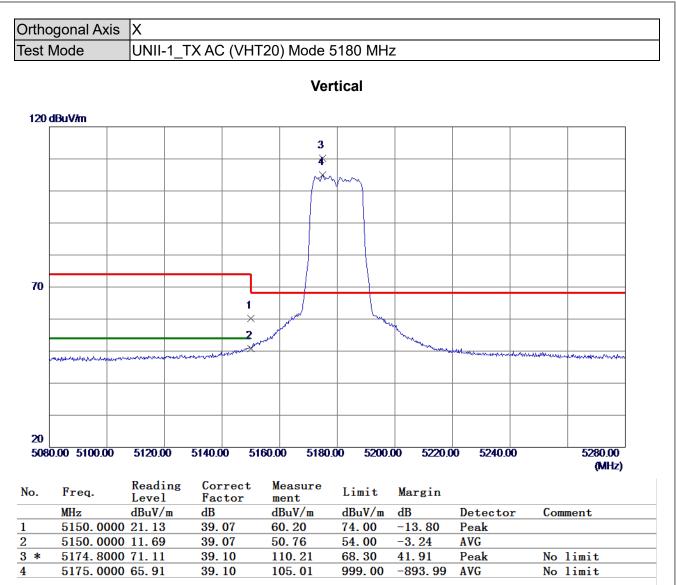


- (1) Measurement Value = Reading Level + Correct Factor.
- (2) Margin Level = Measurement Value Limit Value.



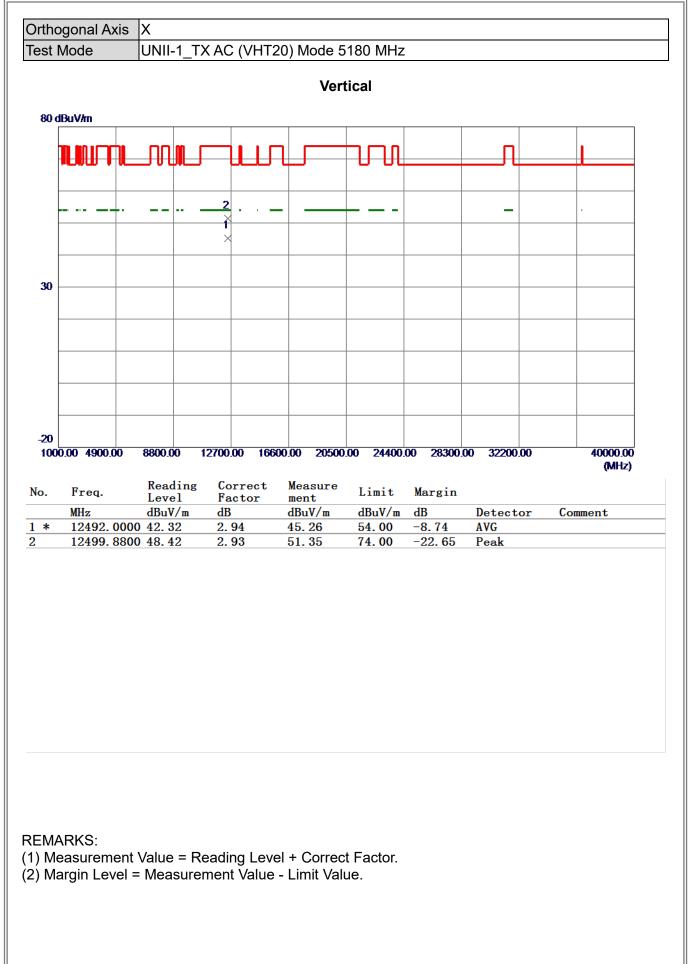




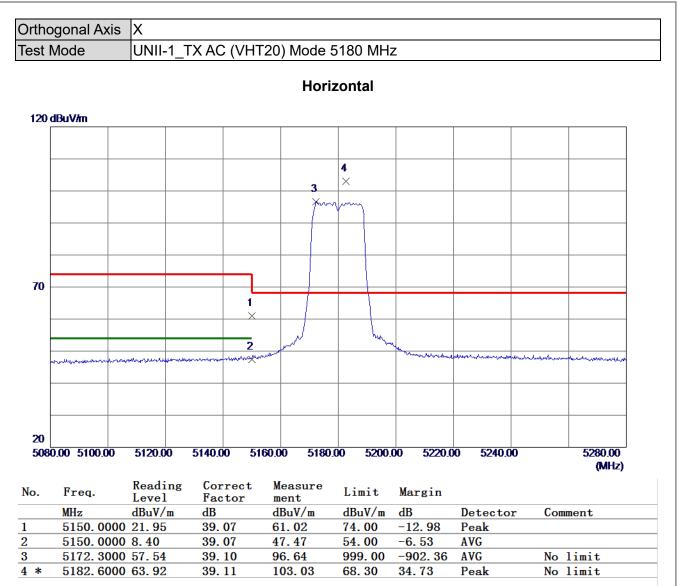


- (1) Measurement Value = Reading Level + Correct Factor.
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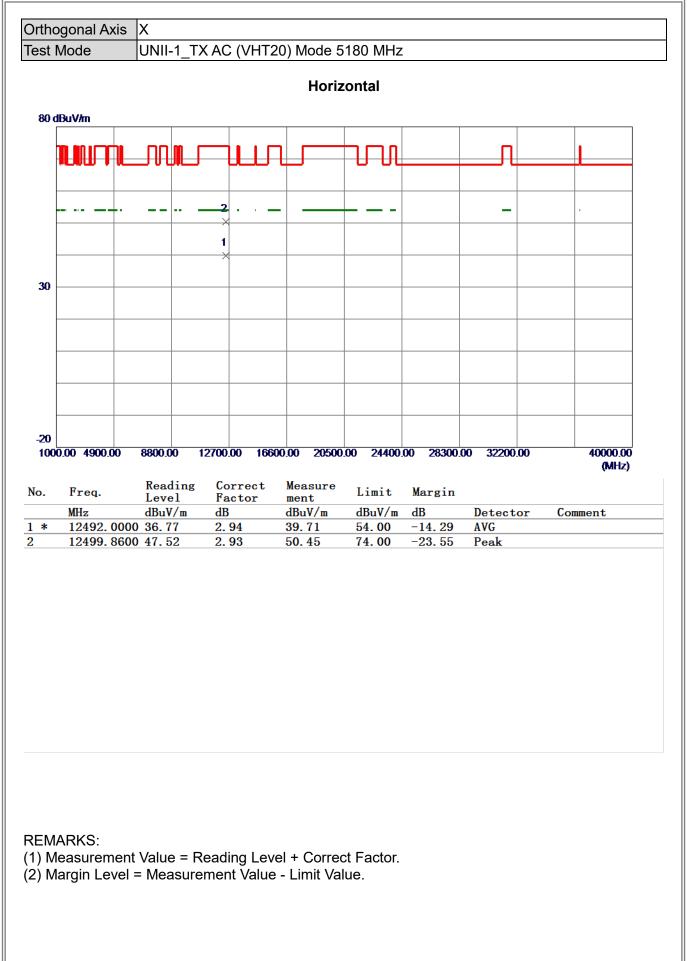




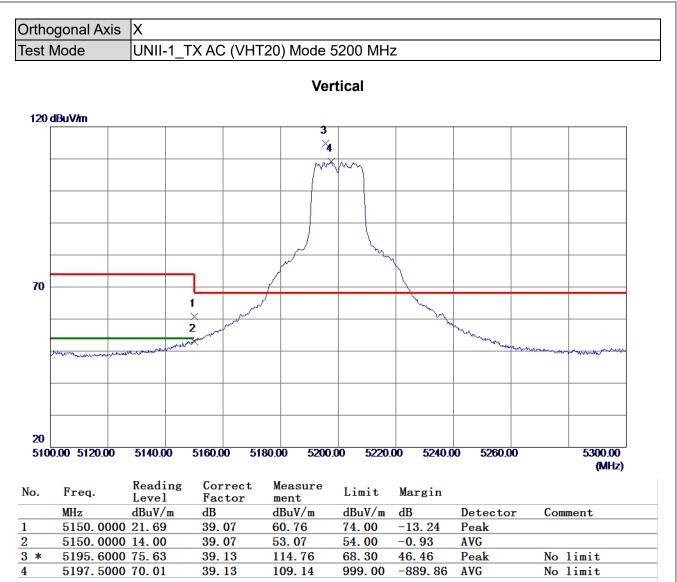


- (1) Measurement Value = Reading Level + Correct Factor.
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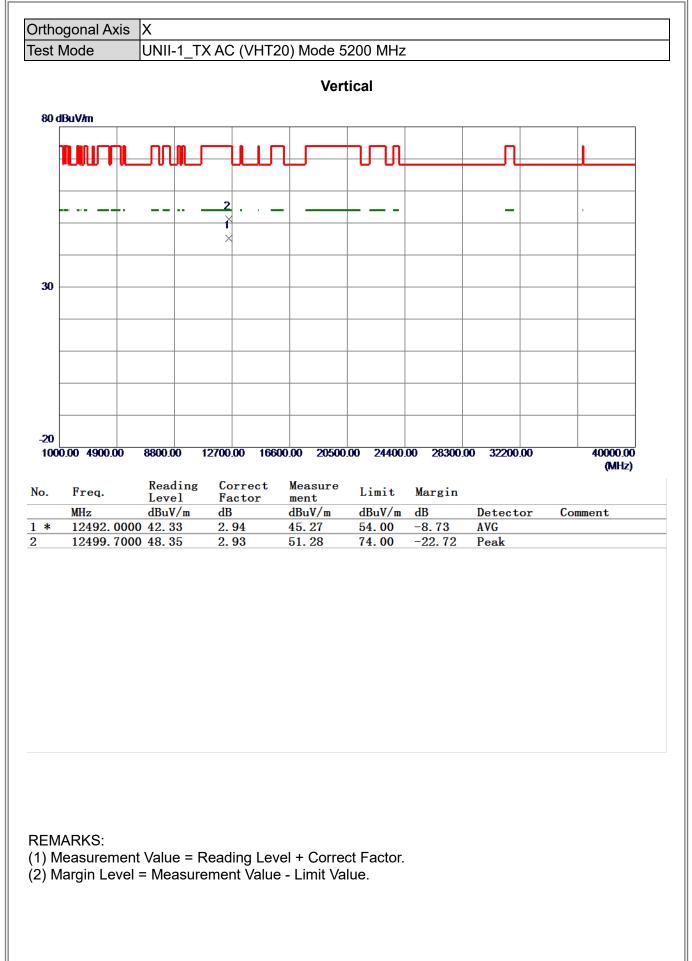




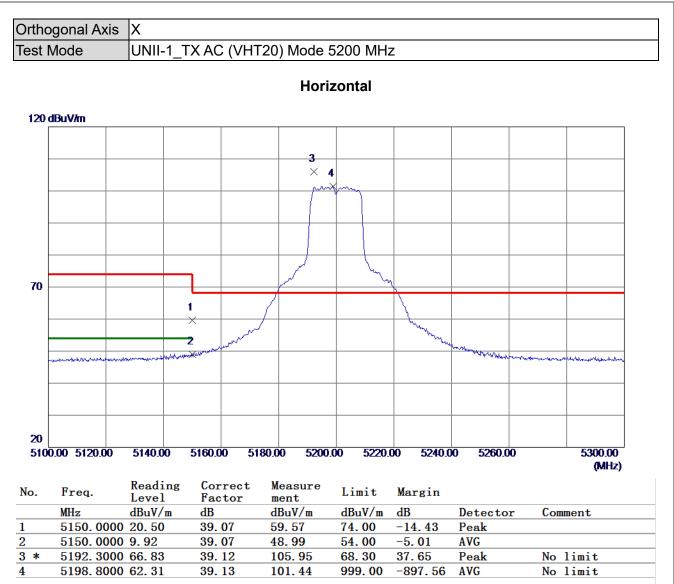


- (1) Measurement Value = Reading Level + Correct Factor.
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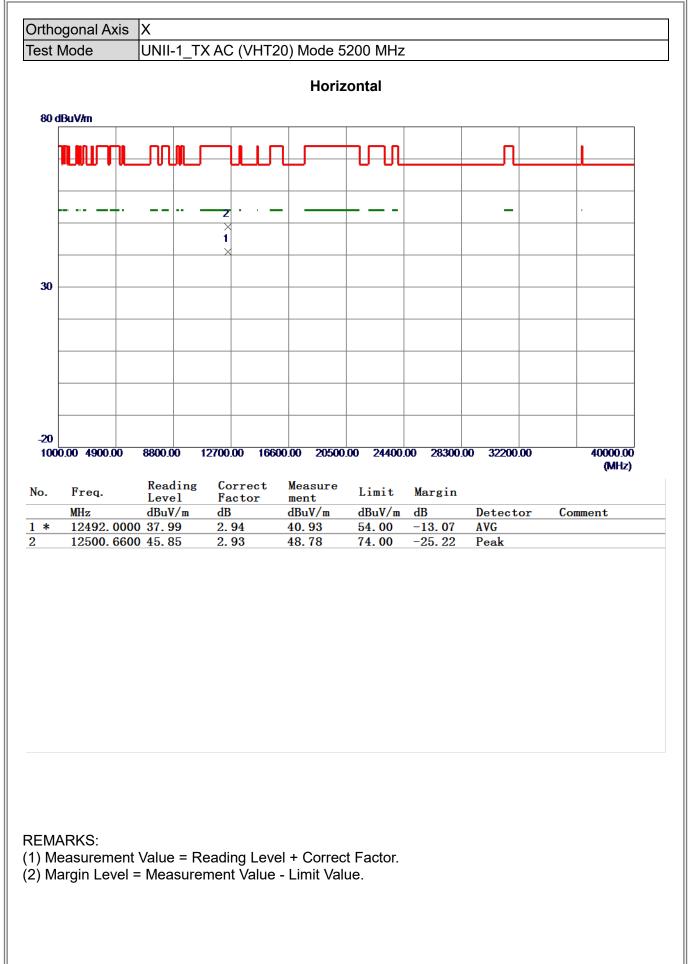




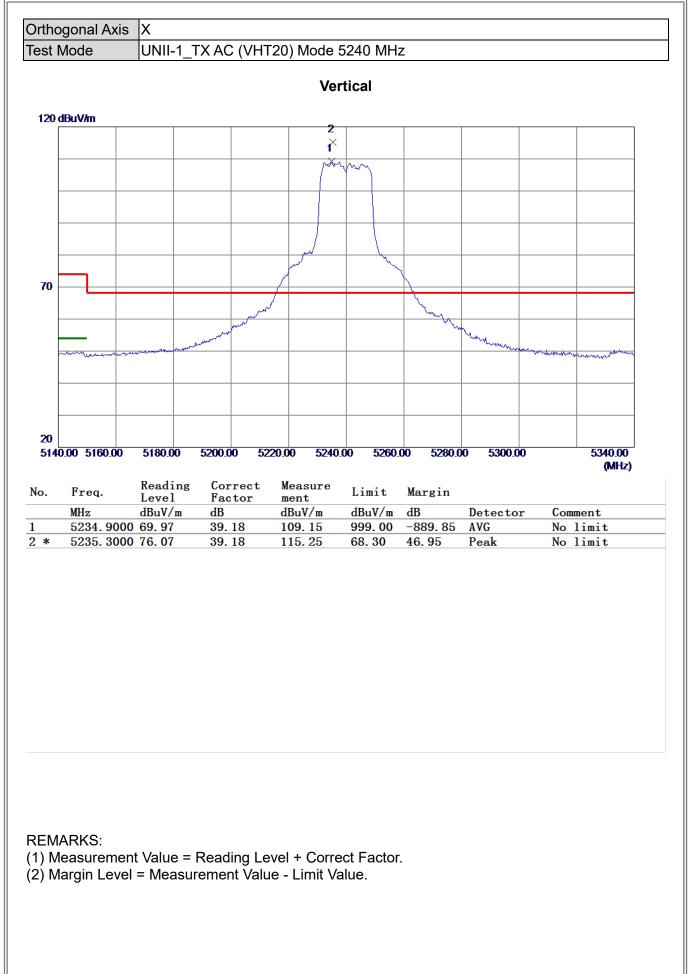


- (1) Measurement Value = Reading Level + Correct Factor.
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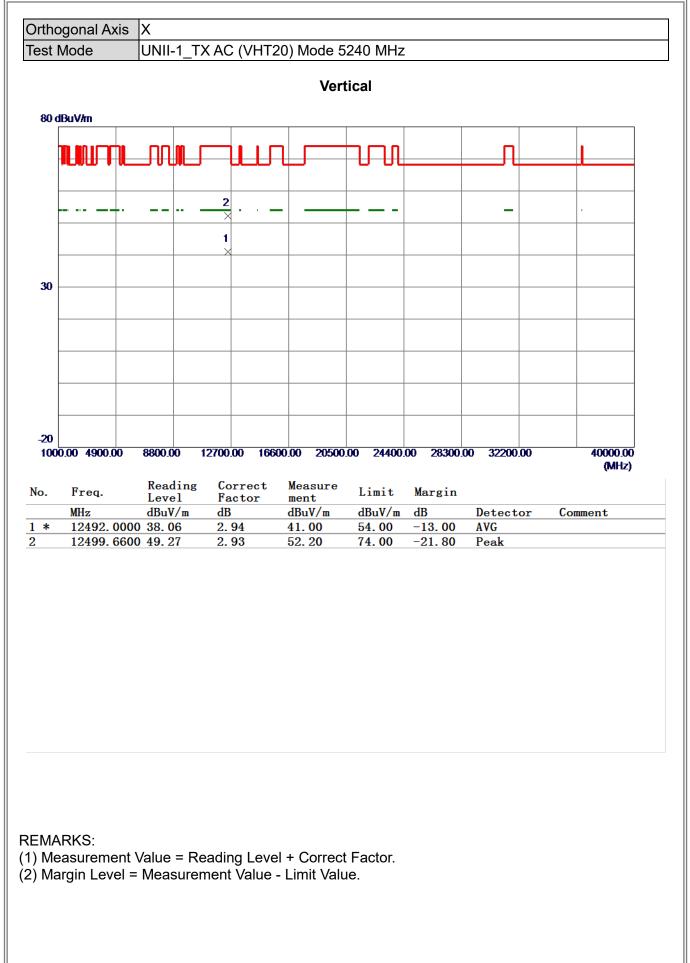




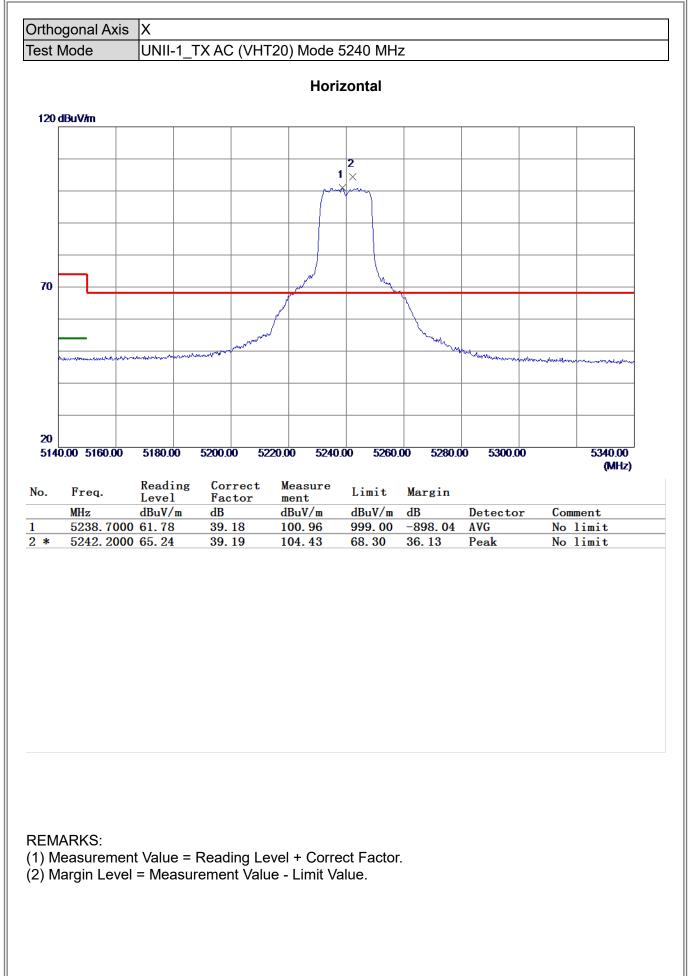




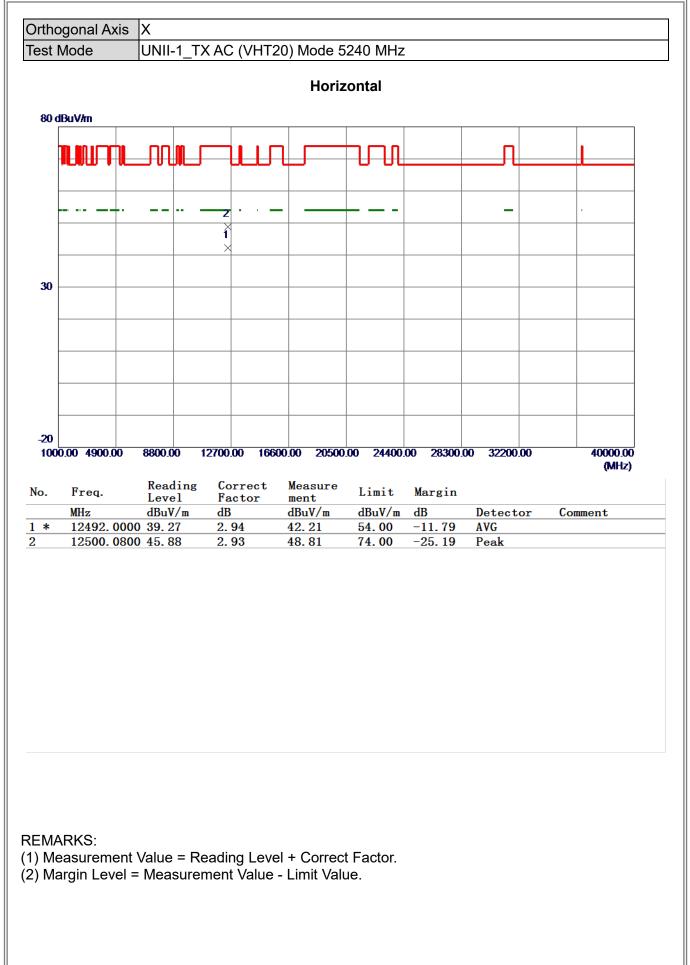




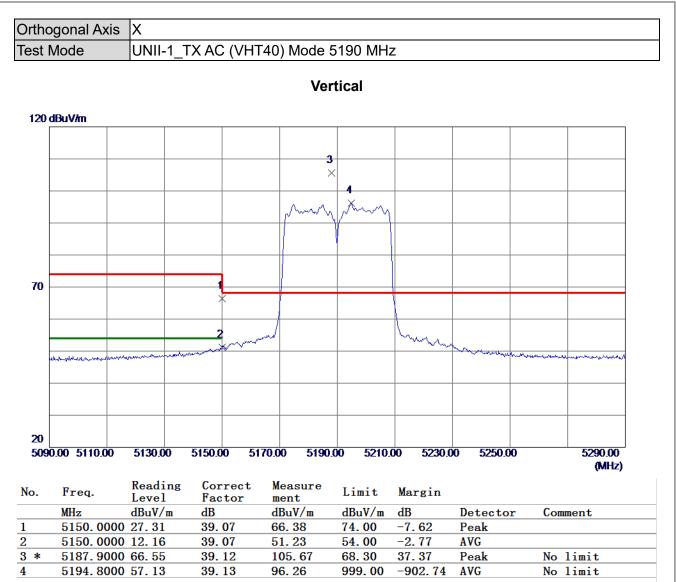






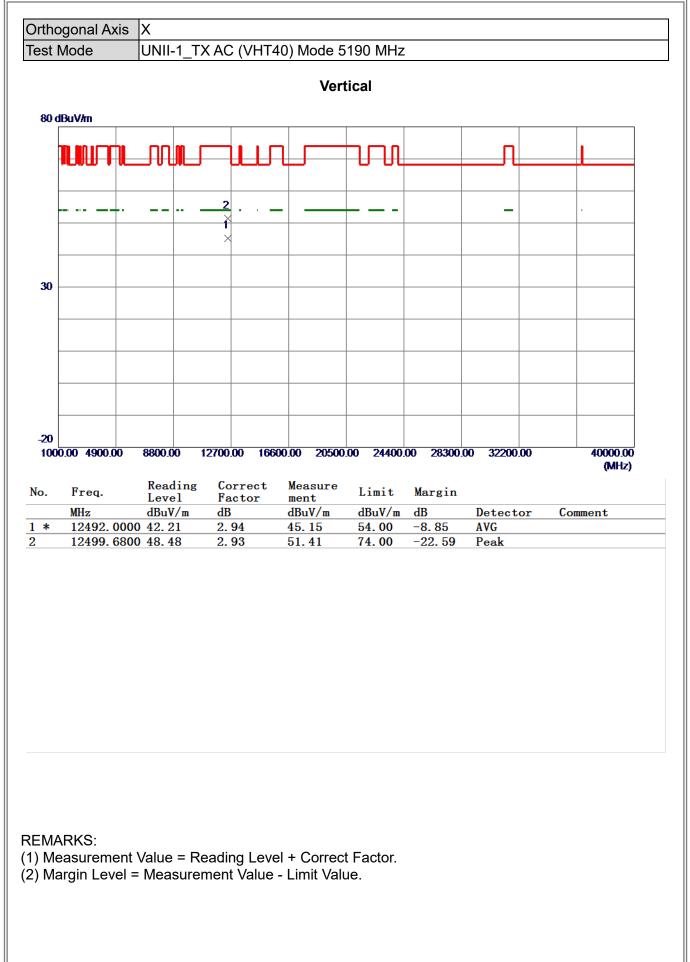




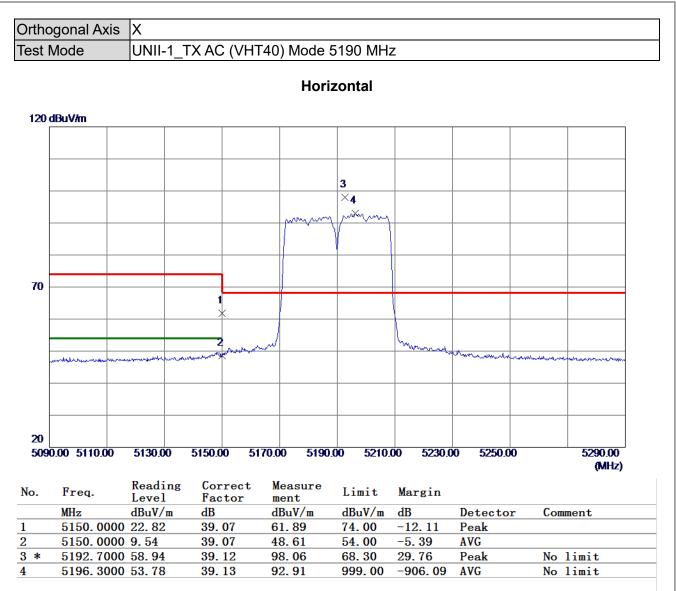


- (1) Measurement Value = Reading Level + Correct Factor.
- (2) Margin Level = Measurement Value Limit Value.



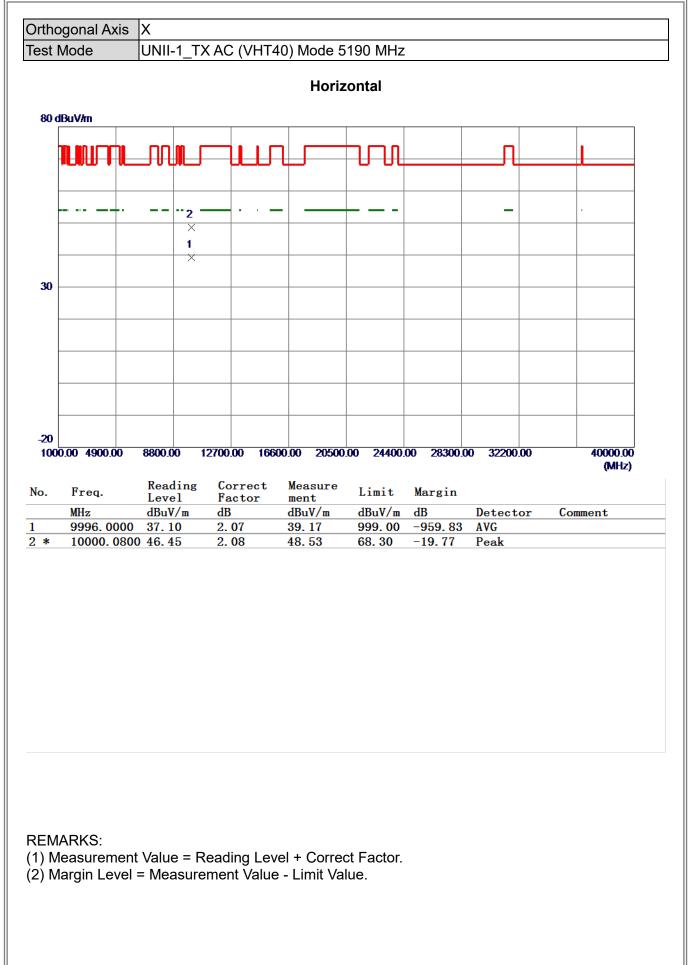




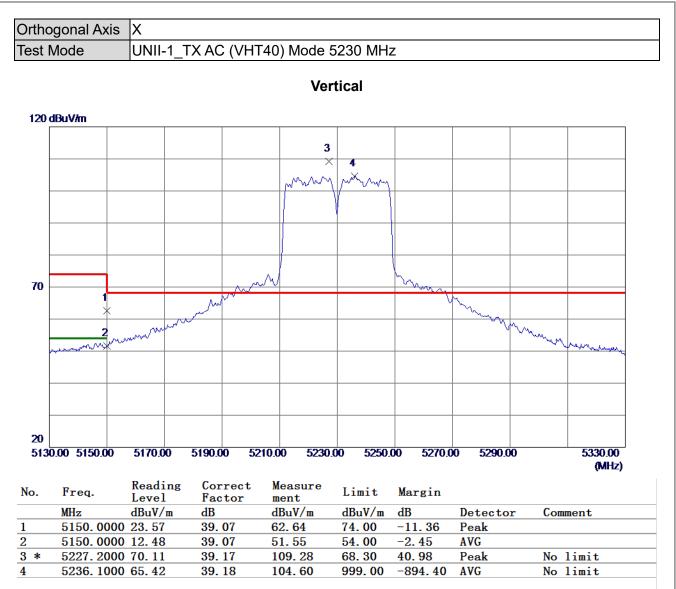


- (1) Measurement Value = Reading Level + Correct Factor.
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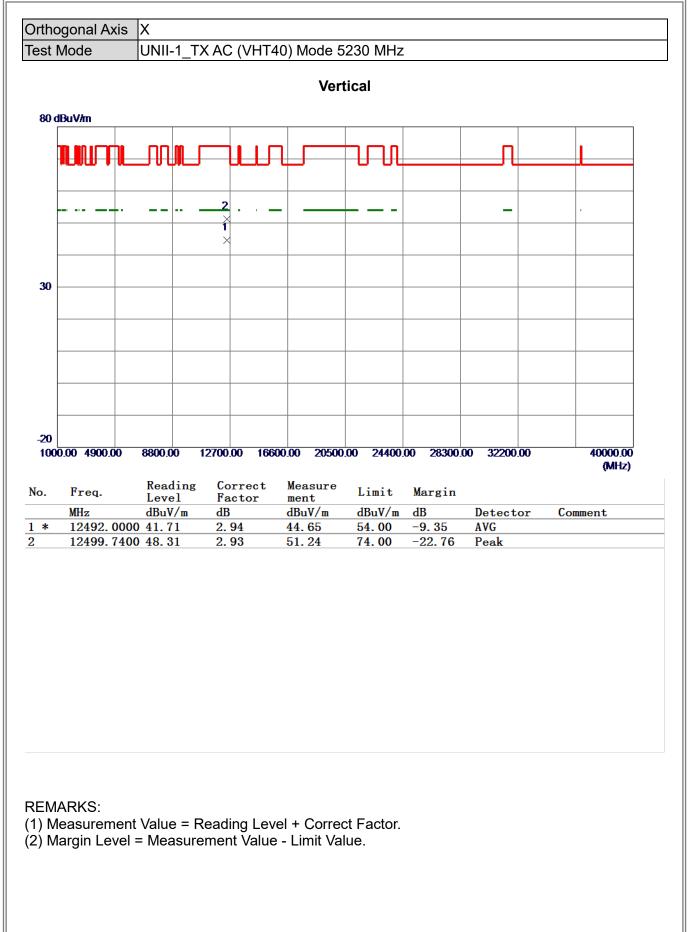




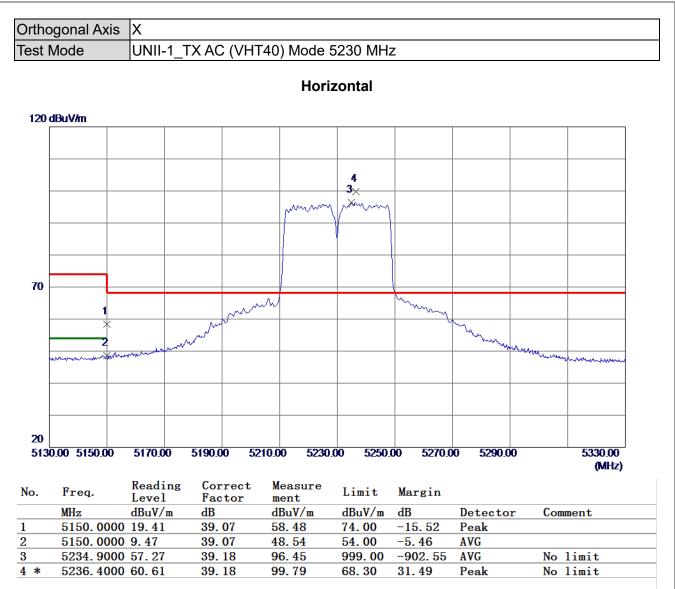


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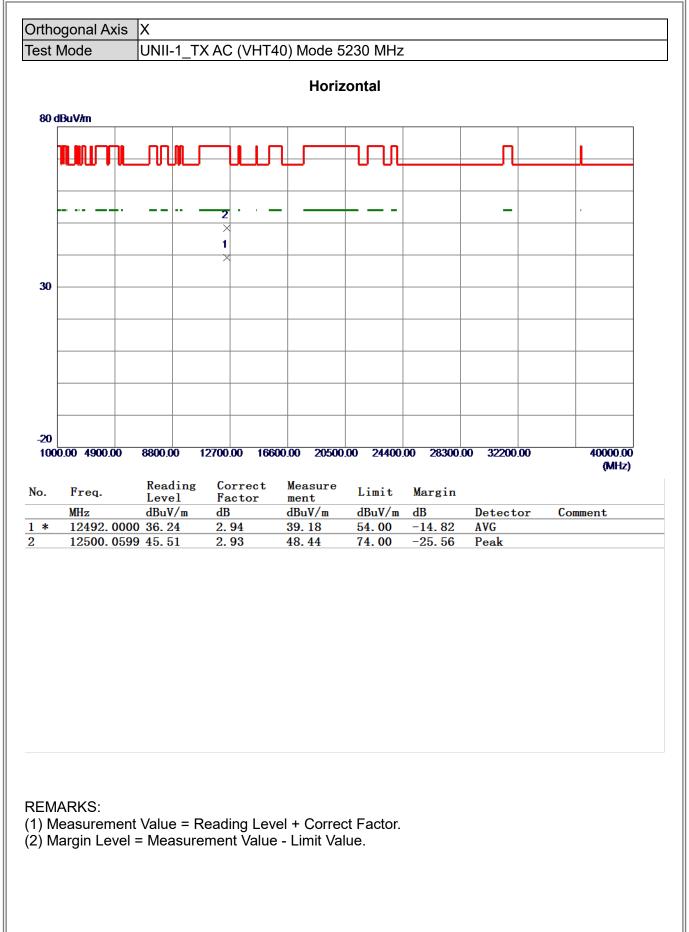




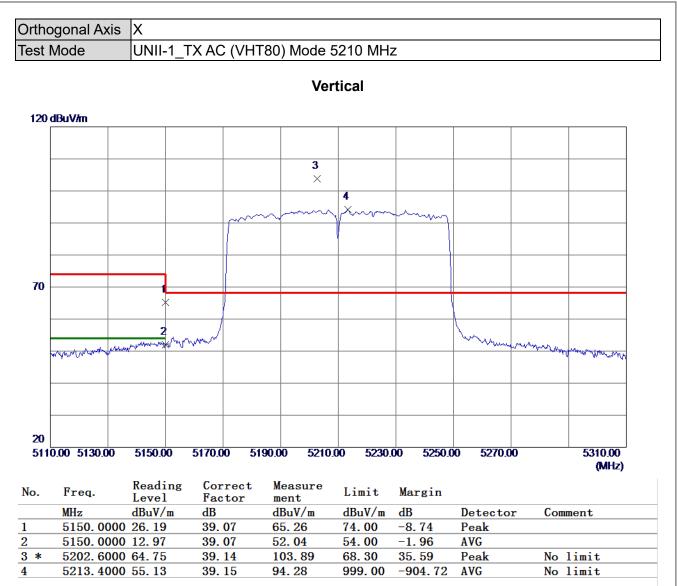


- (1) Measurement Value = Reading Level + Correct Factor.
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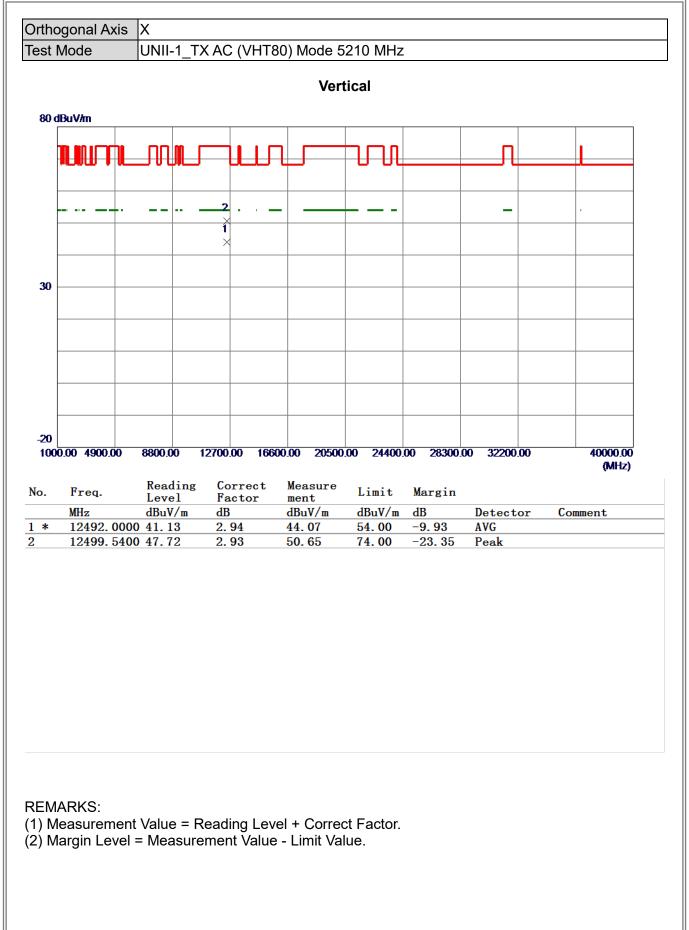




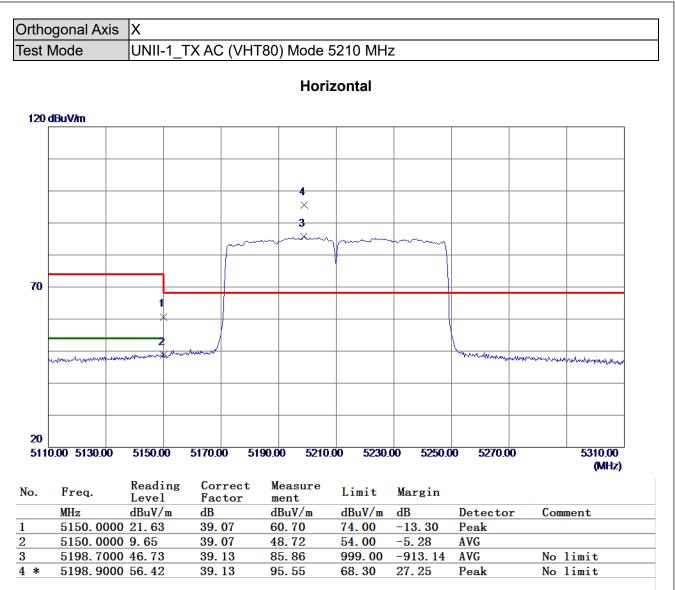


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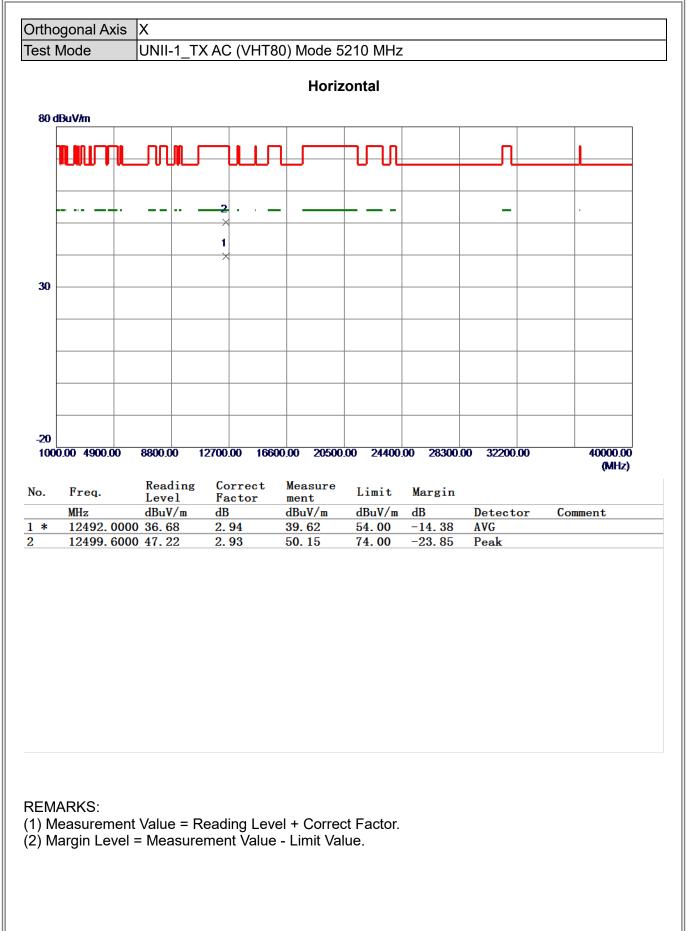




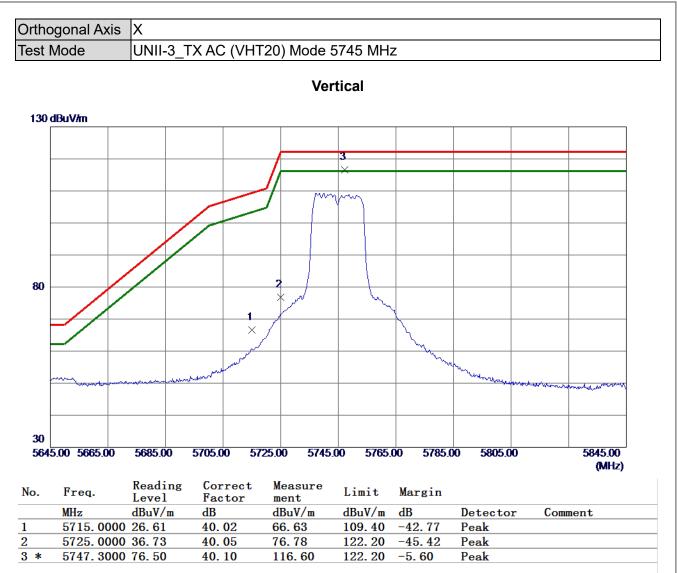


- (1) Measurement Value = Reading Level + Correct Factor.
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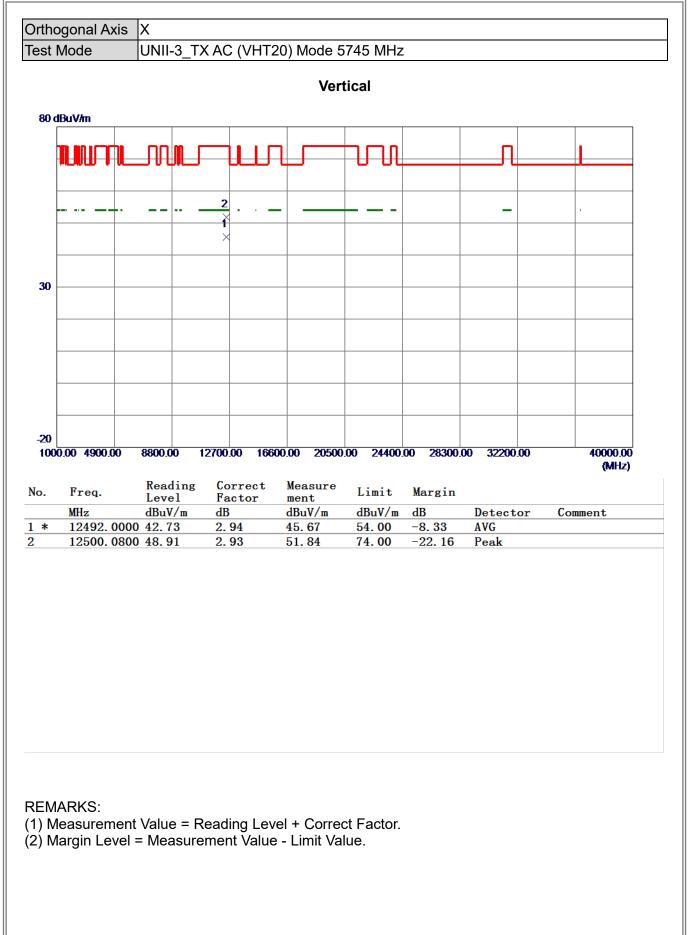




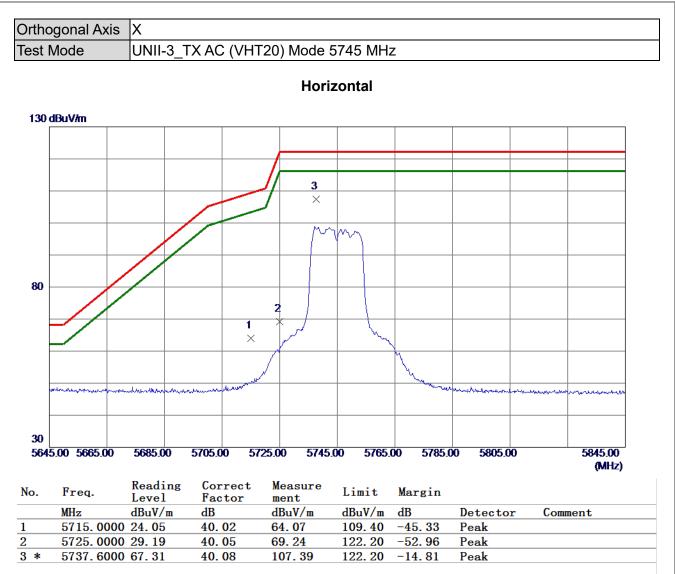


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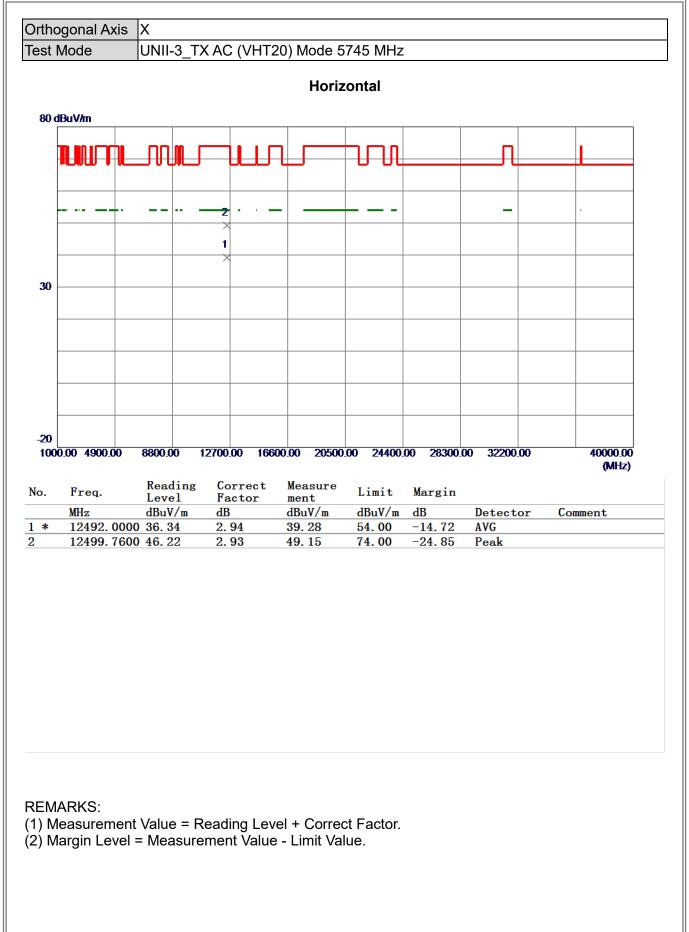




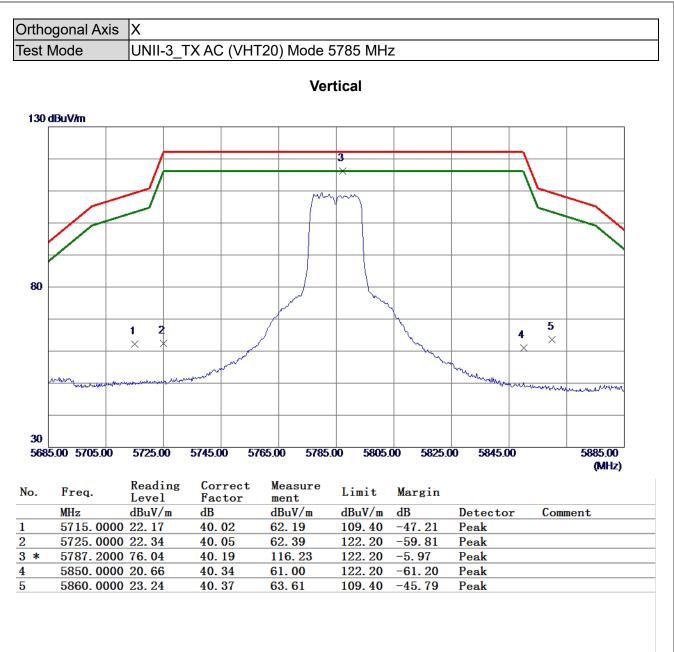


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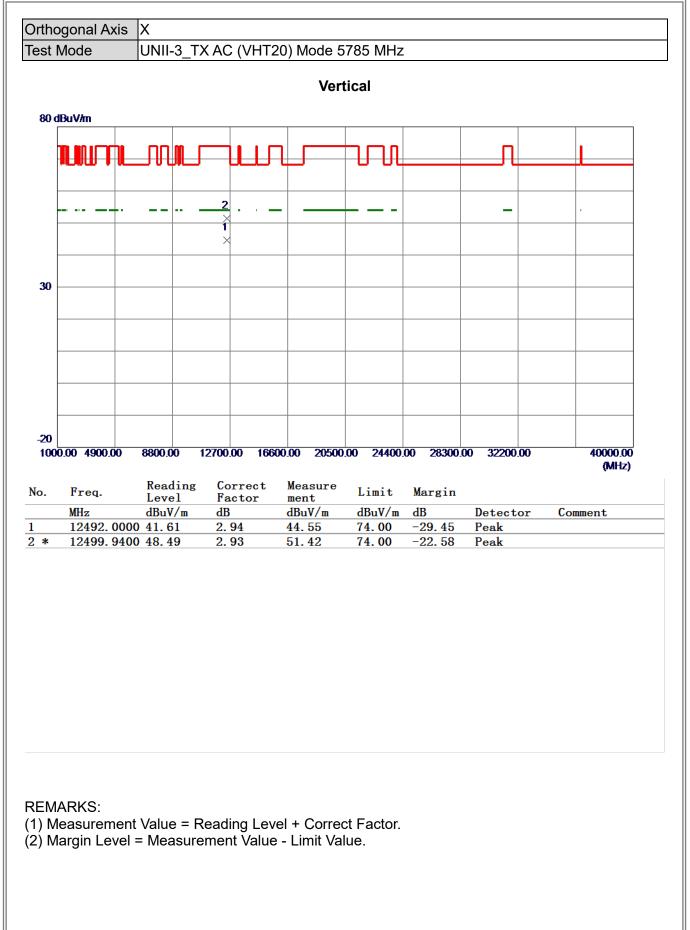




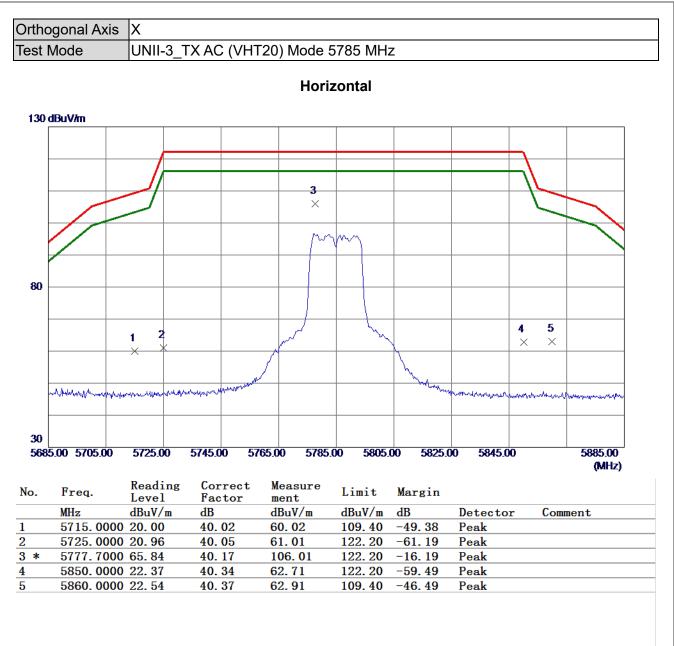


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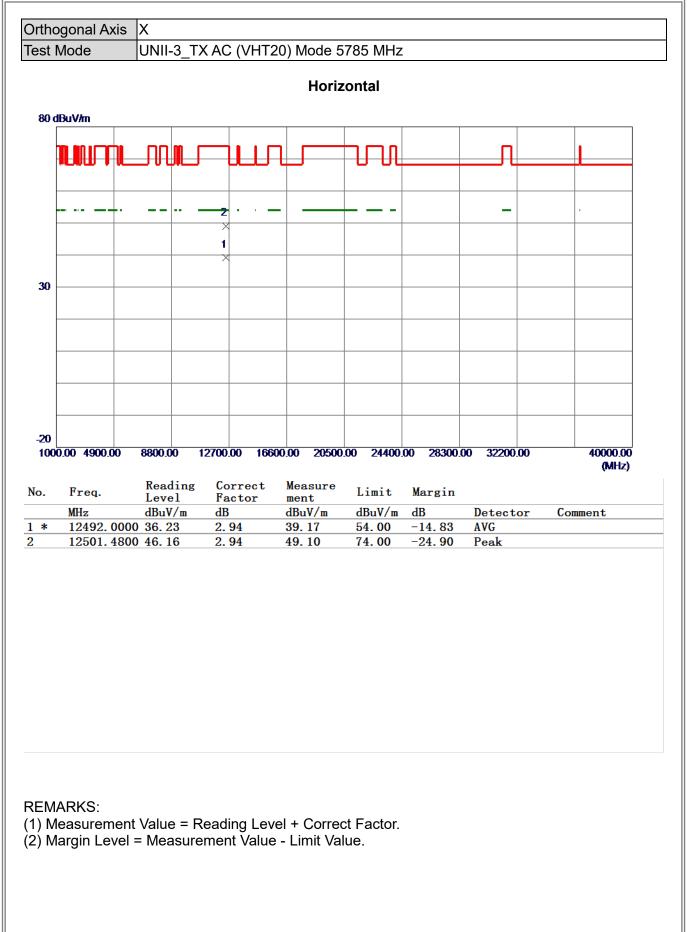




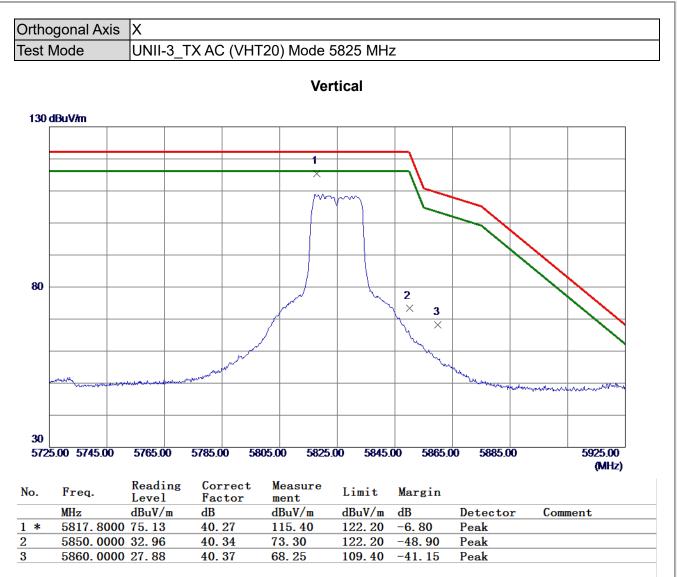


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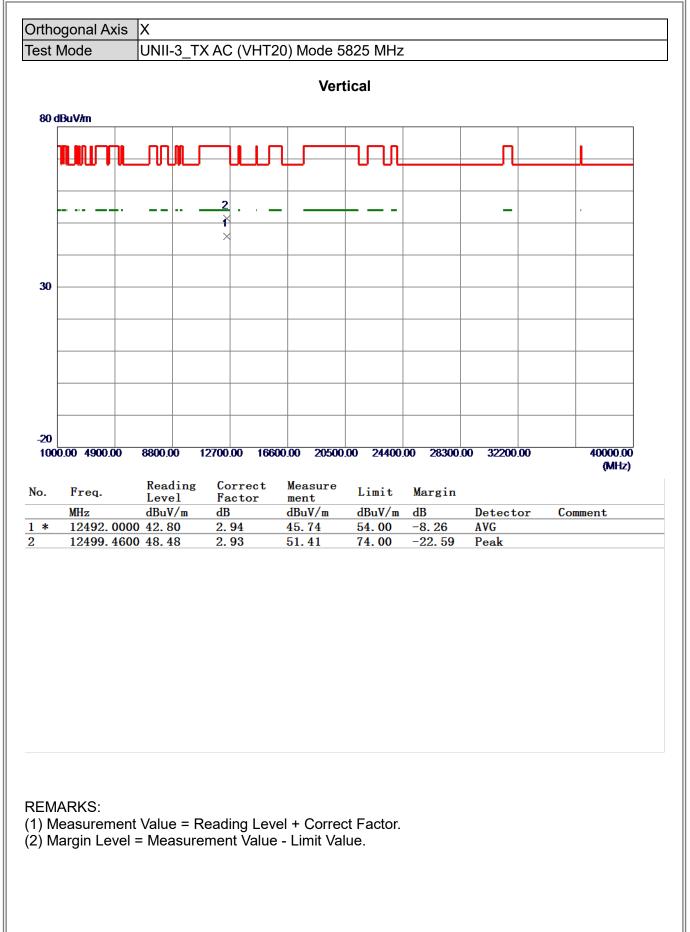




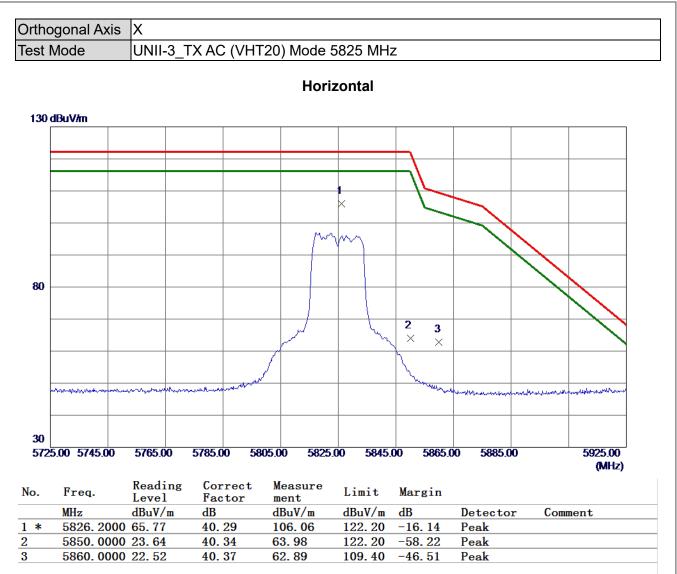


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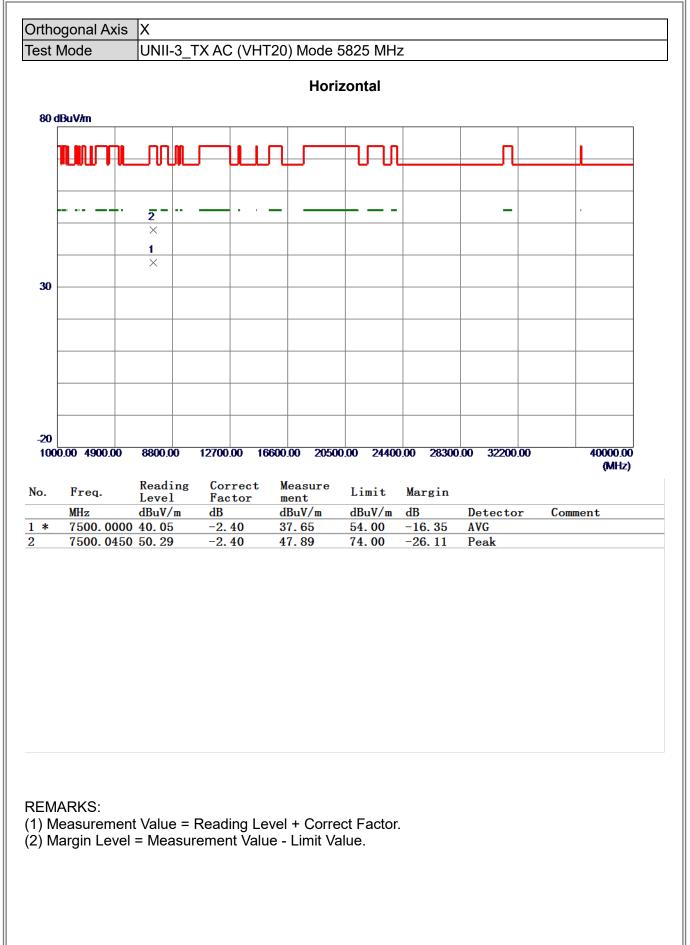




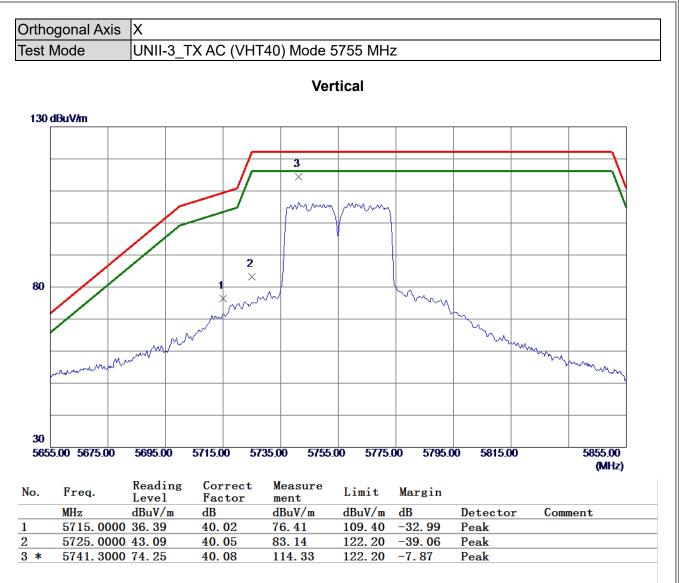


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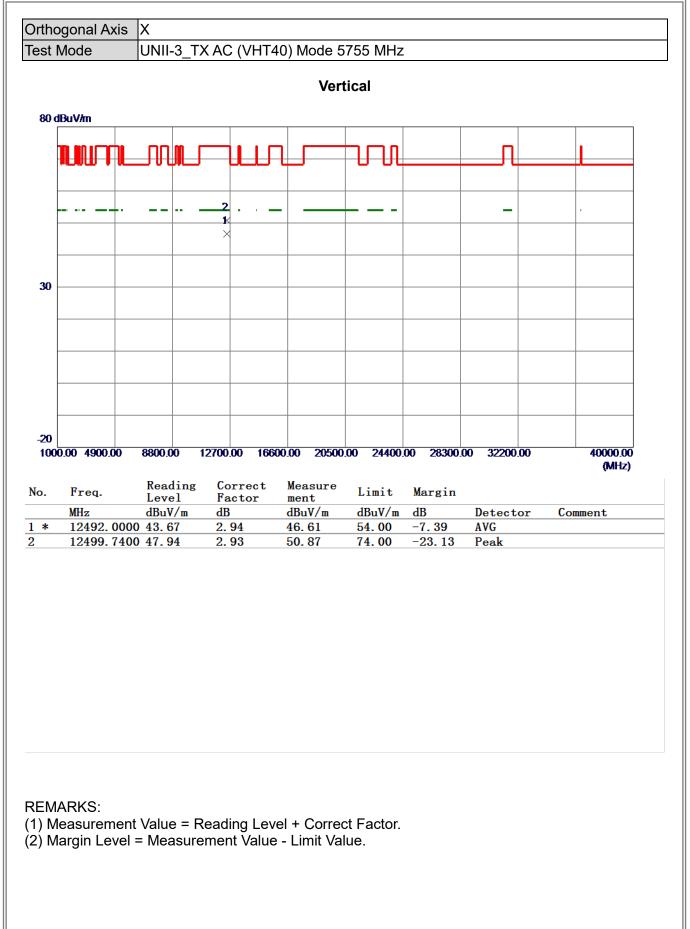




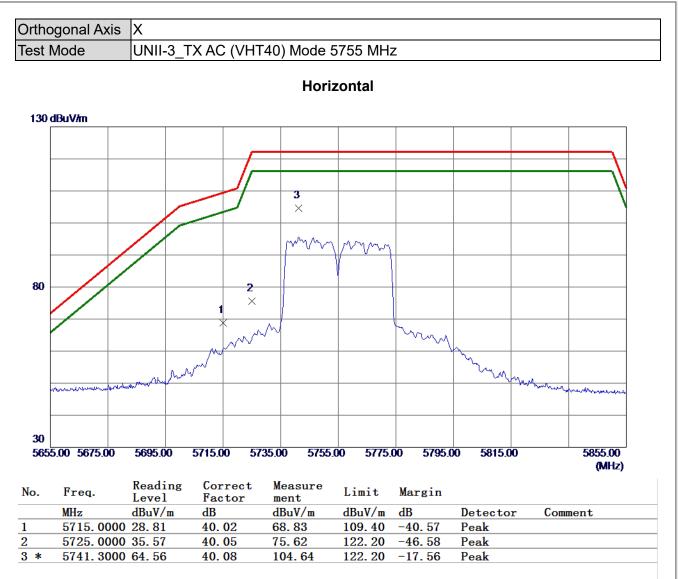


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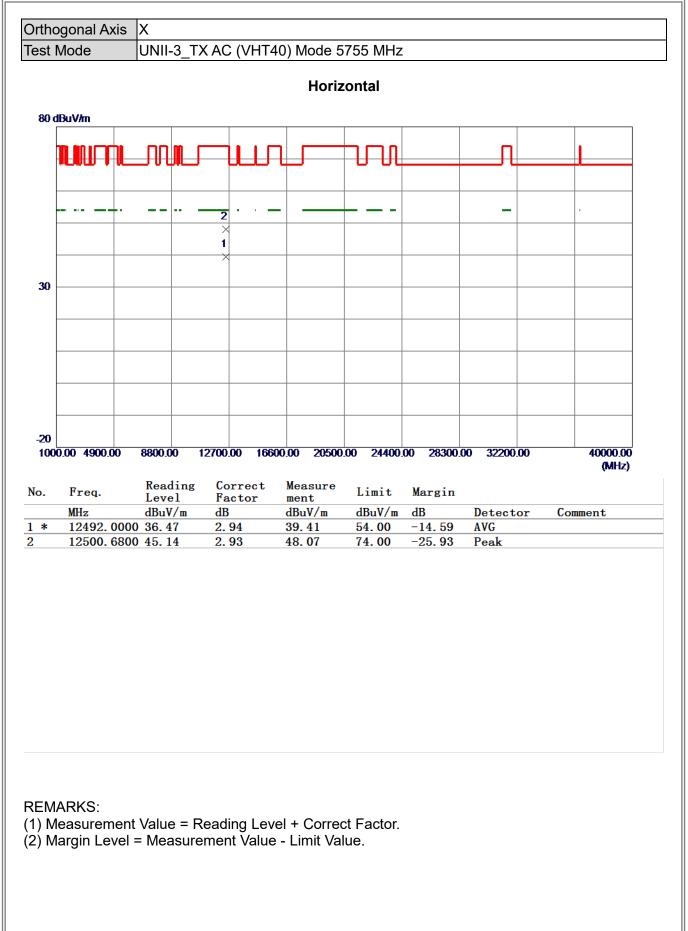




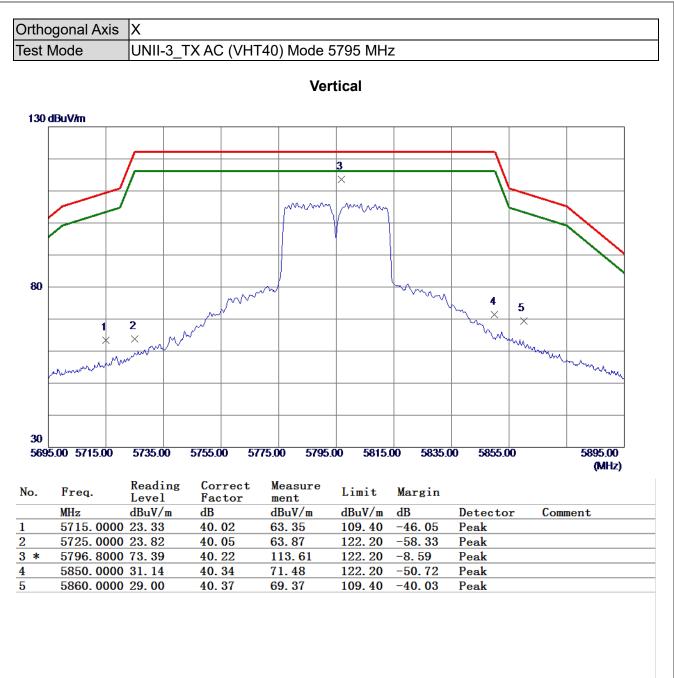


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