

FCC Radio Test Report

FCC ID: 2AXJ4VX20

This report concerns: Original Grant

:	2101C102
:	AX1800 Mesh Wi-Fi 6 System with Built-in Smart Speaker
:	tp-link
:	Deco Voice X20
:	N/A
:	TP-Link Corporation Limited
	Room 901, 9/F. , New East Ocean Centre, 9 Science Museum Road,
	Tsim Sha Tsui, Kowloon, Hong Kong
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	Tsim Sha Tsui, Kowloon, Hong Kong
:	Jan. 11, 2021
:	Feb. 03, 2021 ~ Apr. 09, 2021
:	May 19, 2021
:	R02
:	Engineering Sample No.: DG2021020289 for conducted,
	DG2021020290 for radiated.
:	FCC CFR Title 47, Part 15, Subpart E FCC KDB 789033 D02 General UNII Test Procedures New Rules v02r01 FCC KDB 662911 D01 Multiple Transmitter Output v02r01 ANSI C63.10-2013

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

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Certificate #5123.02

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Limitation

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.	Apr. 22, 2021
R01	Modified the comments of ACB.	May 17, 2021
R02	Modified the comments of ACB.1. Delete Note 3 in Section 2.1, and add relevant description of Note 5 in Section 2.2.	May 19, 2021

1. SUMMARY OF TEST RESULTS

Test procedures according to the technical standard(s):

FCC CFR Title 47, Part 15, Subpart E						
Standard(s) Section	Test Item Test Result		Judgment	Remark		
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)	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	NOTE (2)		
15.407(c)	Automatically Discontinue Transmission		PASS	NOTE (3)		

Note:

- (1) "N/A" denotes test is not applicable in this test report.
- (2) The device what use a permanently attached antenna were considered sufficient to comply with the provisions of 15.203.

(3) 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.

- (4) For UNII-1 this device was functioned as a
 - Outdoor access point device
 - Indoor access point device
 - Fixed point-to-point access points device
 - Client device



1.1 TEST FACILITY

The test facilities used to collect the test data in this report is at the location of No.3, Jinshagang 1st Road, Shixia, Dalang Town, Dongguan, Guangdong, China. BTL's Test Firm Registration Number for FCC: 357015 BTL's Designation Number for FCC: CN1240

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. AC power line conducted emissions test:

Test Site	Method	Measurement Frequency Range	U, (dB)
DG-C02	CISPR	150kHz ~ 30MHz	2.68

B. Radiated emissions test:

Test Site	Method	Measurement Frequency Range	Ant. H / V	U, (dB)
		9kHz ~ 30MHz	-	3.02
		30MHz ~ 200MHz	V	4.26
	CISPR	30MHz ~ 200MHz	Н	3.38
		200MHz ~ 1,000MHz	V	3.98
DG-CB03		200MHz ~ 1,000MHz	Н	3.94
		1GHz ~ 6GHz	-	3.96
		6GHz ~ 18GHz	-	5.24
		18GHz ~ 26.5GHz	-	3.62
		26.5GHz ~ 40GHz	-	4.00

C. Other Measurement test:

Test Item	Uncertainty
Bandwidth	±3.8 %
Maximum Output Power	±0.95 dB
Power Spectral Density	±0.86 dB
Frequency Stability	±0.16 dB
Temperature	±0.08 °C
Humidity	±1.5%

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	25°C	53%	AC 120V/60Hz	Hand Huang
Radiated Emissions-9kHz to 30MHz	25°C	60%	AC 120V/60Hz	Hand Huang
Radiated Emissions-30MHz to 1000MHz	22°C	52%	AC 120V/60Hz	Berton Luo
Radiated Emissions-Above 1000 MHz	26°C	52%	AC 120V/60Hz	Grani Zhou
Bandwidth	23°C	52%	AC 120V/60Hz	Jesse Wang
Maximum Output Power	23°C	52%	AC 120V/60Hz	Hand Huang
Power Spectral Density	23°C	52%	AC 120V/60Hz	Jesse Wang
Frequency Stability	Normal & Extreme	52%	Normal & Extreme	Jesse Wang



2. GENERAL INFORMATION

2.1 GENERAL DESCRIPTION OF EUT

Equipment	AX1800 Mesh Wi-Fi 6 System with Built-in Smart Speaker				
Brand Name	tp-link				
Test Model	Deco Voice X20				
Series Model	N/A				
Model Difference(s)	N/A				
Power Source	DC voltage supplied from AC adapter. Model: T120150-2B4				
Power Rating	I/P: 100-240V ~50/60Hz, 0.6A O/P: 12V === 1.5A				
Operation Frequency Band(s)	UNII-1: 5150 MHz ~ 5250 MHz UNII-3: 5725 MHz ~ 5850 MHz				
Modulation Type	IEEE 802.11a/n/ac: OFDM IEEE 802.11ax: OFDMA				
Bit Rate of Transmitter	IEEE 802.11a: 54/48/36/24/18/12/9/6 Mbps IEEE 802.11n: up to 300 Mbps IEEE 802.11ac: up to 866.7 Mbps IEEE 802.11ax: up to 1201 Mbps				
Maximum Output Power_UNII-1	IEEE 802.11a: 27.88 dBm (0.6138 W)				
Maximum Output Power_UNII-3	IEEE 802.11a: 27.46 dBm (0.5572 W)				

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 802.11ax(HE20)		IEEE 802.11n(HT40) IEEE 802.11ac(VHT40) IEEE 802.11ax(HE40)		IEEE 802.11ac(VHT80) IEEE 802.11ax(HE80)	
UNI	I-1	UN	-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 802.11ax(HE20)		IEEE 802.11n(HT40) IEEE 802.11ac(VHT40) IEEE 802.11ax(HE40)		IEEE 802.11ac(VHT80) IEEE 802.11ax(HE80)	
UNI	I-3	UN	II-3	UN	II-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)	Note
1	tp-link	N/A	Dipole	IPEX	0.82	UNII-1
2	tp-link	N/A	Dipole	IPEX	0.85	UNII-1
1	tp-link	N/A	Dipole	IPEX	0.86	UNII-3
2	tp-link	N/A	Dipole	IPEX	0.94	UNII-3

Note:

1) This EUT supports CDD, and all antenna gains are not equal, so Directional gain=10log[$(10^{G1/20}+10^{G2/20}+...10^{GN/20})^2/N$]dBi, For UNII-1: that is Directional gain=10log[$(10^{0.82/20}+10^{0.85/20})^2/2$]dBi =3.85. For UNII-3: that is Directional gain=10log[$(10^{0.86/20}+10^{0.94/20})^2/2$]dBi =3.91.

2) The antenna gain is provided by the manufacturer.

4. Table for Antenna Configuration:

Operating Mode TX Mode	2TX
IEEE 802.11a	V(Ant. 1 + Ant. 2)
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)
IEEE 802.11ax(HE20)	V(Ant. 1 + Ant. 2)
IEEE 802.11ax(HE40)	V(Ant. 1 + Ant. 2)
IEEE 802.11ax(HE80)	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 Channel 36/40/48 (UNII-1)
Mode 2	TX AC(VHT20) Mode Channel 36/40/48 (UNII-1)
Mode 3	TX AC(VHT40) Mode Channel 38/46 (UNII-1)
Mode 4	TX AC(VHT80) Mode Channel 42 (UNII-1)
Mode 5	TX AX(HE20) Mode Channel 36/40/48 (UNII-1)
Mode 6	TX AX(HE40) Mode Channel 38/46 (UNII-1)
Mode 7	TX AX(HE80) Mode Channel 42 (UNII-1)
Mode 8	TX A Mode Channel 149/157/165 (UNII-3)
Mode 9	TX AC(VHT20) Mode Channel 149/157/165 (UNII-3)
Mode 10	TX AC(VHT40) Mode Channel 151/159 (UNII-3)
Mode 11	TX AC(VHT80) Mode Channel 155 (UNII-3)
Mode 12	TX AX(HE20) Mode Channel 149/157/165 (UNII-3)
Mode 13	TX AX(HE40) Mode Channel 151/159 (UNII-3)
Mode 14	TX AX(HE80) Mode Channel 155 (UNII-3)
Mode 15	TX A Mode Channel 48 (UNII-1)

Following mode(s) was (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 15	TX A Mode Channel 48 (UNII-1)	

Radiated Emissions Test - Below 1GHz			
Final Test Mode Description			
Mode 15 TX A Mode Channel 48 (UNII-1)			



	Radiated Emissions Test - Above 1GHz				
Final Test Mode	Description				
Mode 1	TX A Mode Channel 36/40/48 (UNII-1)				
Mode 2	TX AC(VHT20) Mode Channel 36/40/48 (UNII-1)				
Mode 3	TX AC(VHT40) Mode Channel 38/46 (UNII-1)				
Mode 4	TX AC(VHT80) Mode Channel 42 (UNII-1)				
Mode 5	TX AX(HE20) Mode Channel 36/40/48 (UNII-1)				
Mode 6	TX AX(HE40) Mode Channel 38/46 (UNII-1)				
Mode 7	TX AX(HE80) Mode Channel 42 (UNII-1)				
Mode 8	TX A Mode Channel 149/157/165 (UNII-3)				
Mode 9	TX AC(VHT20) Mode Channel 149/157/165 (UNII-3)				
Mode 10	TX AC(VHT40) Mode Channel 151/159 (UNII-3)				
Mode 11	TX AC(VHT80) Mode Channel 155 (UNII-3)				
Mode 12	TX AX(HE20) Mode Channel 149/157/165 (UNII-3)				
Mode 13	TX AX(HE40) Mode Channel 151/159 (UNII-3)				
Mode 14	TX AX(HE80) Mode Channel 155 (UNII-3)				

Conducted Test				
Final Test Mode	Description			
Mode 1	TX A Mode Channel 36/40/48 (UNII-1)			
Mode 2	TX AC(VHT20) Mode Channel 36/40/48 (UNII-1)			
Mode 3	TX AC(VHT40) Mode Channel 38/46 (UNII-1)			
Mode 4	TX AC(VHT80) Mode Channel 42 (UNII-1)			
Mode 5	TX AX(HE20) Mode Channel 36/40/48 (UNII-1)			
Mode 6	TX AX(HE40) Mode Channel 38/46 (UNII-1)			
Mode 7	TX AX(HE80) Mode Channel 42 (UNII-1)			
Mode 8	TX A Mode Channel 149/157/165 (UNII-3)			
Mode 9	TX AC(VHT20) Mode Channel 149/157/165 (UNII-3)			
Mode 10	TX AC(VHT40) Mode Channel 151/159 (UNII-3)			
Mode 11	TX AC(VHT80) Mode Channel 155 (UNII-3)			
Mode 12	TX AX(HE20) Mode Channel 149/157/165 (UNII-3)			
Mode 13	TX AX(HE40) Mode Channel 151/159 (UNII-3)			
Mode 14	TX AX(HE80) Mode Channel 155 (UNII-3)			

Note:

(1) For AC power line conducted emissions and radiated emission below 1 GHz test, the IEEE 802.11a channel 48 is found to be the worst case and recorded.

(2) For radiated emission above 1 GHz test, the spurious points of 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) All the bit rate of transmitter have been tested and found the lowest rate is found to be the worst case and recorded.

(4) VHT20/VHT40 covers HT20/HT40, due to same modulation. The power setting for 802.11n HT20 and HT40 are the same or lower than 802.11ac VHT20 and VHT40.

(5) IEEE 802.11ax mode only supports full RU, so only the full RU is evaluated and measured inside report.



2.3 PARAMETERS OF TEST SOFTWARE

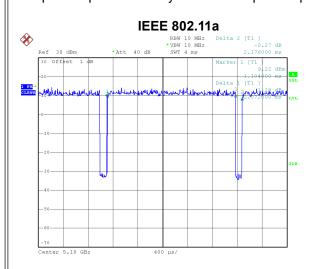
Test Software Version

accessMTool_3.0.0.6



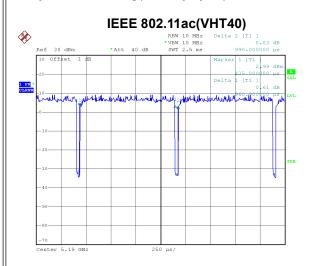
2.4 DUTY CYCLE

If duty cycle is \geq 98 %, duty factor is not required. If duty cycle is < 98 %, duty factor shall be considered. The output power = measured power + duty factor. The power spectral density = measured power spectral density + duty factor.



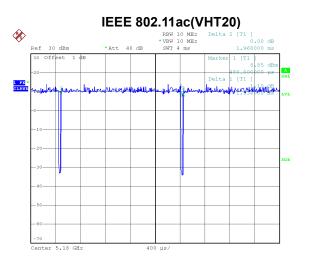
Date: 4.FEB.2021 17:18:13

Duty cycle = 2.072 ms / 2.176 ms = 95.22% Duty Factor = 10 log(1 / Duty cycle) = 0.21



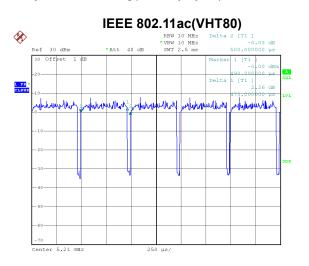
Date: 4.FEB.2021 17:19:48

Duty cycle = 0.960 ms / 0.990 ms = 96.97% Duty Factor = 10 log(1 / Duty cycle) = 0.13



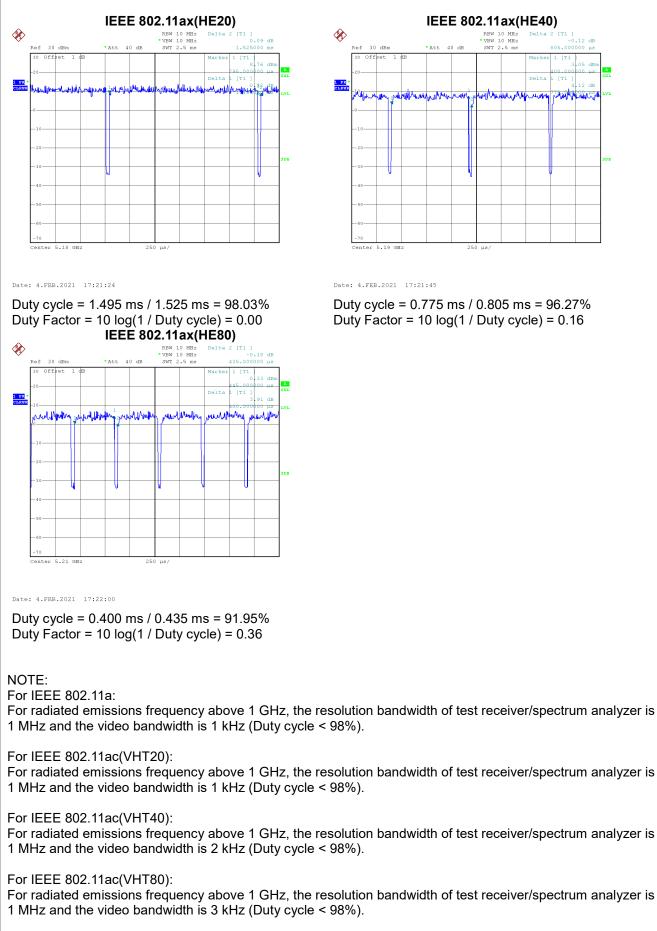
Date: 4.FEB.2021 17:19:15

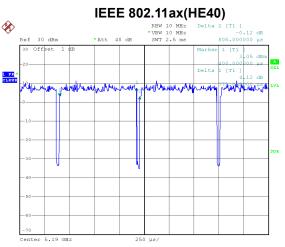
Duty cycle = 1.936 ms / 1.968 ms = 98.37% Duty Factor = 10 log(1 / Duty cycle) = 0.00



Date: 4.FEB.2021 17:20:51

Duty cycle = 0.470 ms / 0.500 ms = 94.00% Duty Factor = 10 log(1 / Duty cycle) = 0.27





Date: 4.FEB.2021 17:21:45

Duty cycle = 0.775 ms / 0.805 ms = 96.27% Duty Factor = $10 \log(1 / \text{Duty cycle}) = 0.16$

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For IEEE 802.11ax(HE20):

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 802.11ax(HE40):

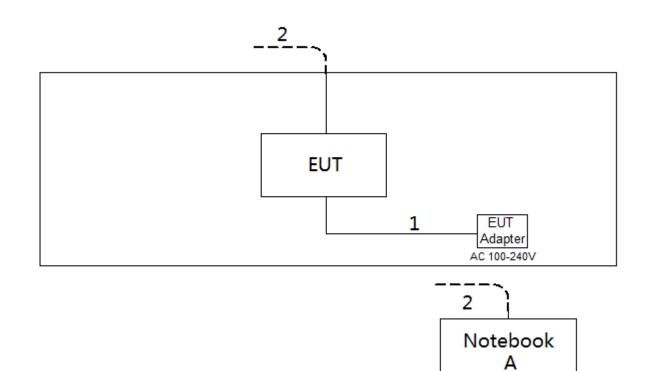
For radiated emissions frequency above 1 GHz, the resolution bandwidth of test receiver/spectrum analyzer is 1 MHz and the video bandwidth is 2 kHz (Duty cycle < 98%).

For IEEE 802.11ax(HE80):

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%).



2.5 BLOCK DIAGRAM SHOWING THE CONFIGURATION OF SYSTEM TESTED



2.6 SUPPORT UNITS

Item	Equipment	Brand	Model No.	Series No.
А	Notebook	Dell	Inspiron 15-7559	N/A

Item	Cable Type	Shielded Type	Ferrite Core	Length
1	DC Cable	NO	NO	1.5m
2	RJ45 Cable	NO	NO	10m



3. AC POWER LINE CONDUCTED EMISSIONS

3.1 LIMIT

Frequency	Limit (dBµV)		
(MHz)	Quasi-peak	Average	
0.15 - 0.5	66 to 56*	56 to 46*	
0.5 - 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.

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.

The following table is the setting of the receiver:

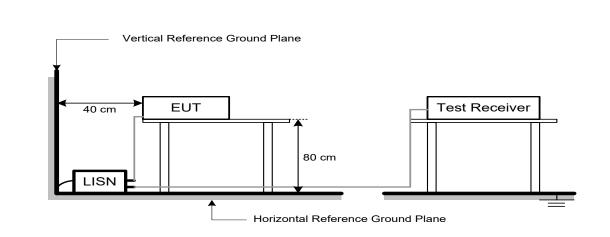
Receiver Parameter	Setting
Start Frequency	0.15 MHz
Stop Frequency	30 MHz
IF Bandwidth	9 kHz

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

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 (Above 1000 MHz)

Frequency	EIRP Limit	Equivalent Field Strength at 3m
(MHz)	(dBm/MHz)	(dBµV/m)
5150-5250	-27	68.2
	-27	68.2
5725-5850	10	105.2
NOTE (2)	15.6	110.8
	27	122.2

NOTE:

(1) The following formula is used to convert the equipment isotropic radiated power (eirp) to field strength: $E = \frac{1000000\sqrt{30P}}{100000}$

μV/m, where P is the eirp (Watts) 3

(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 pre-scanning 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.

The following table is the setting of the receiver:

Spectrum Parameters	Setting
Start ~ Stop Frequency	9 kHz~150 kHz for RBW 200 Hz
Start ~ Stop Frequency	0.15 MHz~30 MHz for RBW 9 kHz
Start ~ Stop Frequency	30 MHz~1000 MHz for RBW 100 kHz

Spectrum Parameters	Setting
Start Frequency	1000 MHz
Stop Frequency	10th carrier harmonic or 40 GHz, whichever is lower
RBW / VBW	1 MHz / 3 MHz for PK value
(Emission in restricted band)	1 MHz / 1/T Hz for AVG value

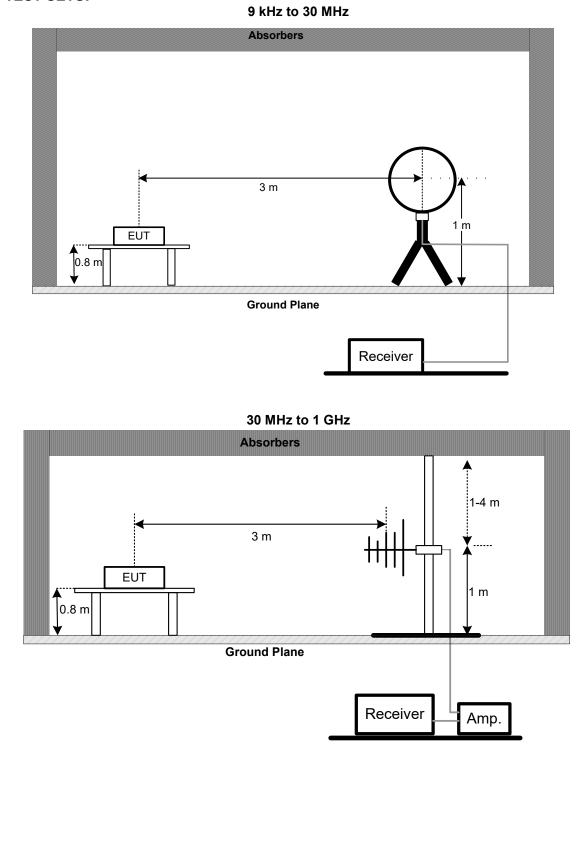
Receiver Parameters	Setting
Start ~ Stop Frequency	9 kHz~90 kHz for PK/AVG detector
Start ~ Stop Frequency	90 kHz~110 kHz for QP detector
Start ~ Stop Frequency	110 kHz~490 kHz for PK/AVG detector
Start ~ Stop Frequency	490 kHz~30 MHz for QP detector
Start ~ Stop Frequency	30 MHz~1000 MHz for QP detector
Start ~ Stop Frequency	1 GHz~40 GHz for PK/AVG detector



4.3 DEVIATION FROM TEST STANDARD

No deviation.

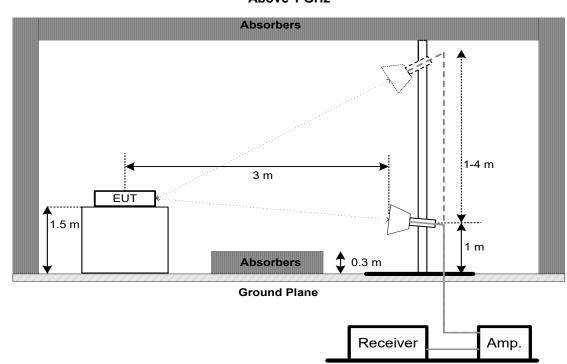
4.4 TEST SETUP





BL

Above 1 GHz



4.5 EUT OPERATION CONDITIONS

The EUT tested system was configured as the statements of 3.5 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) Distance extrapolation factor = 40 log (specific distance / test distance) (dB).
- (2) 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

5.1 LIMIT

Section	Test Item	Limit	Frequency Range (MHz)
FCC 15.407(a)	26 dB Bandwidth	-	5150-5250
FCC 15.407(e)	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. Spectrum Setting:
- For UNII-1:

Spectrum Parameter	Setting
Span Frequency	> 26 dB Bandwidth
RBW	Appromiximately 1% of the emission bandwidth
VBW	> RBW
Detector	Peak
Trace	Max Hold
Sweep Time	Auto

For UNII-3:

Spectrum Parameter	Setting
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 / 6 dB below carrier.

5.3 DEVIATION FROM STANDARD

No deviation.

5.4 TEST SETUP



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

6.1 LIMIT

Section	Test Item	Limit	Frequency Range (MHz)
FCC 15.407(a)	Maximum Output Power	AP device: 1 Watt (30 dBm) Client device: 250 mW (23.98 dBm)	5150-5250
		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.

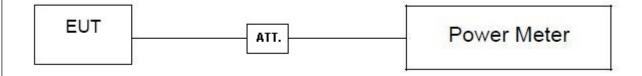
6.2 TEST PROCEDURE

- 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



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

7.1 LIMIT

Section	Test Item	Limit	Frequency Range (MHz)
FCC 15.407(a)	Power Spectral Density	AP device: 17 dBm/MHz Client device: 11 dBm/MHz	5150-5250
. ,		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:

For UNII-1:

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

For UNII-3:

Spectrum Parameter	Setting
Span Fraguenov	Encompass the entire emissions bandwidth (EBW)
Span Frequency	of the signal
RBW	100 kHz.
VBW	300 kHz.
Detector	RMS
Trace average	100 trace
Sweep Time	Auto

Note:

- 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 100kHz and VBW at 300kHz if the spectrum analyzer does not have 500 kHz RBW. Then, add 10 log (500 kHz/100 kHz) to the measured result, i.e. 7 dB.
- During the test of U-NII 3 PSD, the measurement result with RBW=100kHz has been added 7 dB by compensating offset. For example, the cable loss is 15.5 dB, and the final offset is 15.5 + 7 = 22.5 dB when RBW=100kHz is used.

7.3 DEVIATION FROM STANDARD

No deviation.



7.4 TEST SETUP



7.5 EUT OPERATION CONDITIONS

The EUT was programmed to be in continuously transmitting mode.

7.6 TEST RESULTS

Please refer to the APPENDIX G.



8. FREQUENCY STABILITY

8.1 LIMIT

Section	Test Item	Limit	Frequency Range (MHz)
		An emission is maintained within the band of	5150-5250
FCC 15.407(g) Frequency Stability	operation under all conditions of normal operation as specified in the users manual.	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
Span Frequency	Entire absence of modulation emissions bandwidth
RBW	10 kHz
VBW	10 kHz
Detector	Peak
Trace	Max Hold
Sweep Time	Auto

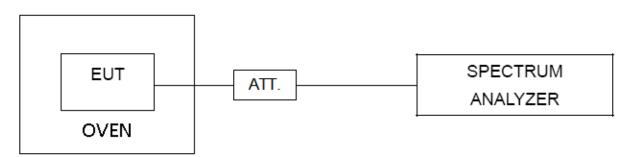
c. The test extreme voltage is to change the primary supply voltage from 85 to 115 percent of the nominal value.

d. User manual temperature is -20°C~45°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 H.



9. MEASUREMENT INSTRUMENTS LIST

	AC Power Line Conducted Emissions					
Item	Kind of Equipment	Manufacturer	Type No.	Serial No.	Calibrated until	
1	EMI Test Receiver	R&S	ESCI	100382	Feb. 28, 2022	
2	LISN	EMCO	3816/2	52765	Feb. 27, 2022	
3	TWO-LINE V-NETWORK	R&S	ENV216	101447	Feb. 27, 2022	
4	50Ω Terminator	SHX	TF5-3	15041305	Feb. 27, 2022	
5	Measurement Software	Farad	EZ-EMC Ver.NB-03A1-01	N/A	N/A	
6	Cable	N/A	RG223	12m	Mar. 09, 2022	
7	643 Shield Room	ETS	6*4*3m	N/A	N/A	

	Radiated Emissions - 9 kHz to 30 MHz					
Item	Kind of Equipment	Manufacturer	Type No.	Serial No.	Calibrated until	
1	Antenna	EM	EM-6876-1	230	Apr. 16, 2021	
2	Cable	N/A	RG 213/U	N/A	May 29, 2021	
3	EMI Test Receiver	R&S	ESCI	100895	Feb. 27, 2022	
4	Measurement	Fanad	EZ-EMC	N/A	N/A	
4	Software	Farad	Ver.NB-03A1-01	IN/A	IN/A	
5	966 Chambe Room	RM	9*6*6m	N/A	Jul. 25, 2021	

	Radiated Emissions - 30 MHz to 1 GHz					
Item	Kind of Equipment	Manufacturer	Type No.	Serial No.	Calibrated until	
1	Trilog-Broadband Antenna	Schwarzbeck	VULB9168	586	Nov. 27, 2021	
2	Amplifier	HP	8447D	2944A08742	Feb. 28, 2022	
3	Receiver	Agilent	N9038A	MY52130039	Jul. 25, 2021	
4	Cable	emci	LMR-400(30MHz-1 GHz)(8m+5m)	N/A	May 22, 2021	
5	Controller	СТ	SC100	N/A	N/A	
6	Controller	MF	MF-7802	MF780208416	N/A	
7	Measurement Software	Farad	EZ-EMC Ver.NB-03A1-01	N/A	N/A	
8	966 Chambe Room	RM	9*6*6m	N/A	Jul. 25, 2021	

	Radiated Emissions - Above 1 GHz					
Item	Kind of Equipment	Manufacturer	Type No.	Serial No.	Calibrated until	
1	Double Ridged Guide Antenna	ETS	3115	75789	May 12, 2021	
2	Broad-Band Horn Antenna	Schwarzbeck	BBHA 9170	9170319	Jul. 07, 2021	
3	Amplifier	Agilent	8449B	3008A02584	Jul. 25, 2021	
4	Microwave Preamplifier With Adaptor	EMC INSTRUMENT	EMC2654045	980039 & HA01	Feb. 28, 2022	
5	Receiver	Agilent	N9038A	MY52130039	Jul. 25, 2021	
6	Controller	СТ	SC100	N/A	N/A	
7	Controller	MF	MF-7802	MF780208416	N/A	
8	Cable	N/A	EMC104-SM-SM-6 000	N/A	Oct. 16, 2021	
9	Measurement Software	Farad	EZ-EMC Ver.NB-03A1-01	N/A	N/A	
10	Band Reject Filter	Micro-Tronics	BRC50705-01	10	Feb. 27, 2022	
11	Band Reject Filter	Micro-Tronics	BRC50703-01	7	Feb. 27, 2022	
12	966 Chambe Room	RM	9*6*6m	N/A	Jul. 25, 2021	

	Bandwidth & Power Spectral Density						
Item	Kind of Equipment	Manufacturer	Type No.	Serial No.	Calibrated until		
1	Spectrum Analyzer	R&S	FSP40	100185	Jul. 25, 2021		
2	Attenuator	WOKEN	6SM3502	VAS1214NL	Feb. 07, 2022		
3	RF Cable	Tongkaichuan	N/A	N/A	N/A		
4	DC Block	Mini	N/A	N/A	N/A		

	Maximum Output Power					
Item	Kind of Equipment	Manufacturer	Type No.	Serial No.	Calibrated until	
1	Peak Power Analyzer	Keysight	8990B	MY51000506	Aug. 07, 2021	
2	Wideband power sensor	Keysight	N1923A	MY58310004	Jul. 25, 2021	
3	Attenuator	WOKEN	6SM3502	VAS1214NL	Feb. 07, 2022	
4	RF Cable	Tongkaichuan	N/A	N/A	N/A	

	Frequency Stability					
Item	Kind of Equipment	Manufacturer	Type No.	Serial No.	Calibrated until	
1	Spectrum Analyzer	R&S	FSP40	100185	Jul. 25, 2021	
2	Precision Oven Tester	CEPREI	CEEC-M64T-40	15-008	Feb. 27, 2022	
3	Attenuator	WOKEN	6SM3502	VAS1214NL	Feb. 07, 2022	
4	RF Cable	Tongkaichuan	N/A	N/A	N/A	
5	DC Block	Mini	N/A	N/A	N/A	

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

All calibration period of equipment list is one year.

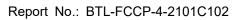


10. EUT TEST PHOTOS



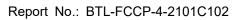
AC Power Line Conducted Emissions Test Photos



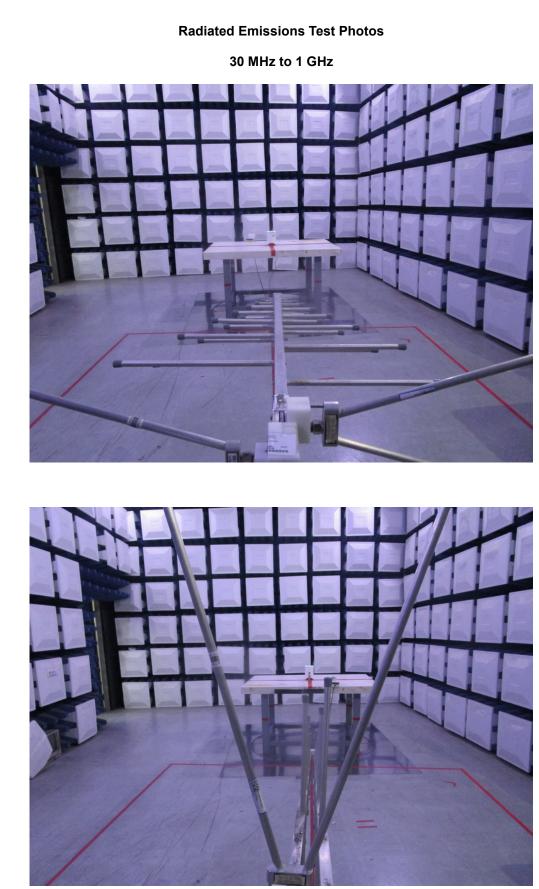


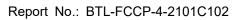


Radiated Emissions Test Photos 9 kHz to 30 MHz

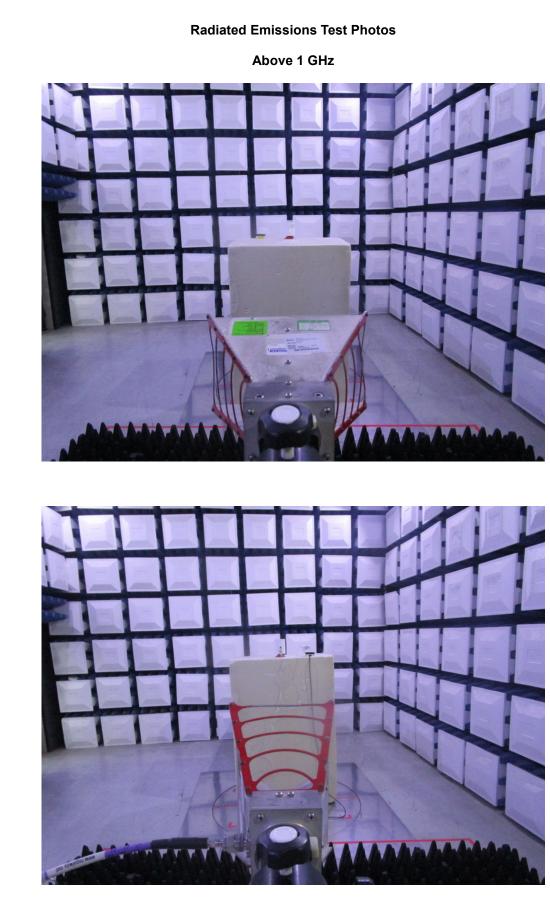






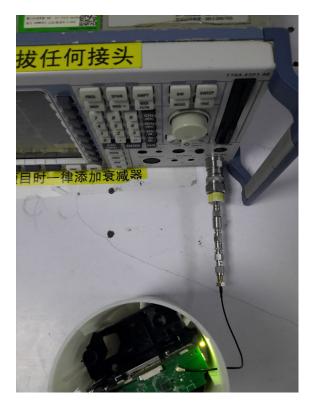








Conducted Test Photos

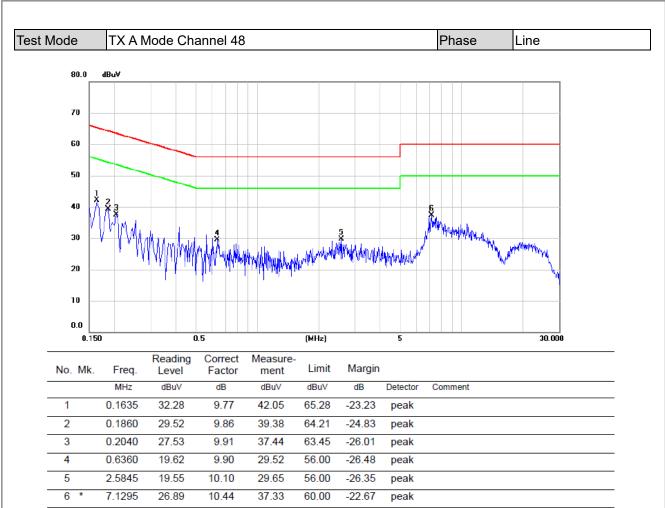




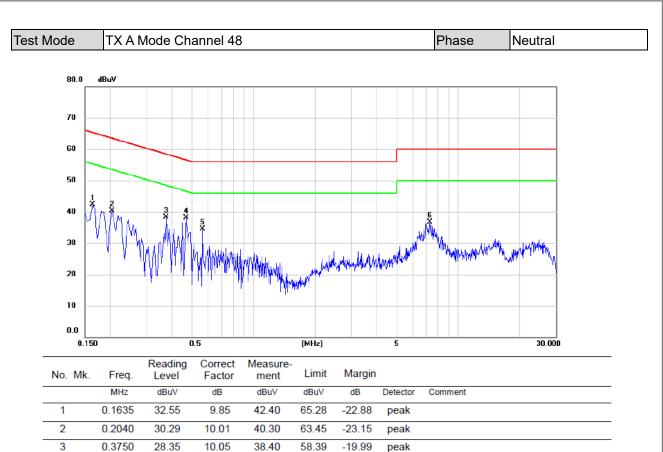


APPENDIX A - AC POWER LINE CONDUCTED EMISSIONS

BL



- (1) Measurement Value = Reading Level + Correct Factor.
- (2) Margin Level = Measurement Value Limit Value.
- (3) The test result has included the cable loss.



38.05

34.55

36.70

56.52

56.00

60.00

-18.47

-21.45

-23.30

peak

peak

peak

10.11

10.16

10.79

REMARKS:

4

6

* 5

0.4695

0.5640

7.2645

27.94

24.39

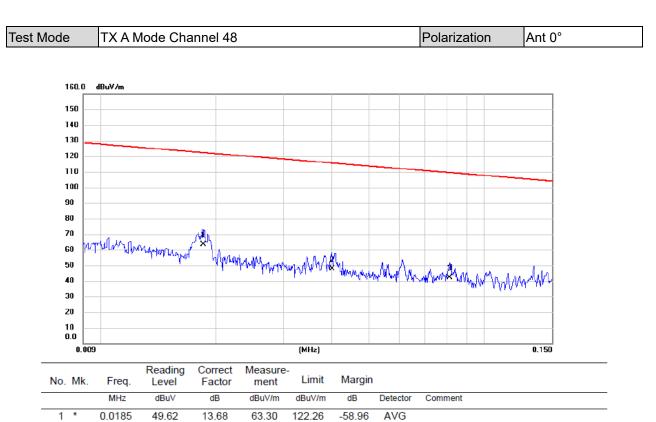
25.91

- (1) Measurement Value = Reading Level + Correct Factor.
- (2) Margin Level = Measurement Value Limit Value.
- (3) The test result has included the cable loss.



APPENDIX B - RADIATED EMISSION - 9 KHZ TO 30 MHZ





115.54

109.41

-67.75

-67.02

AVG

AVG

47.79

42.39

REMARKS:

2

3

0.0401

0.0812

35.11

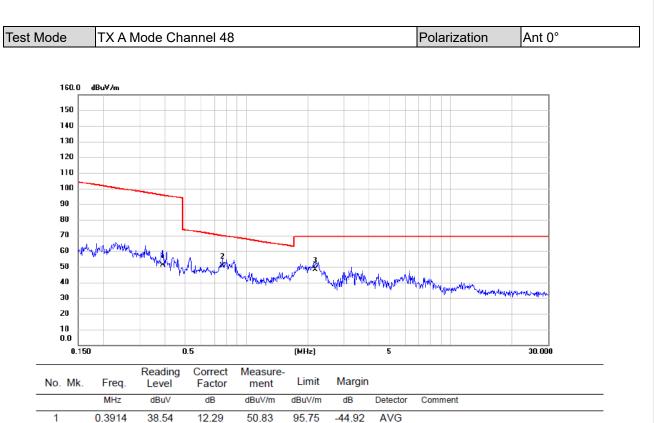
29.78

12.68

12.61

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





2

3

*

0.7670

2.1783

38.64

36.97

11.89

11.21

50.53

48.18

69.91

69.54

-19.38

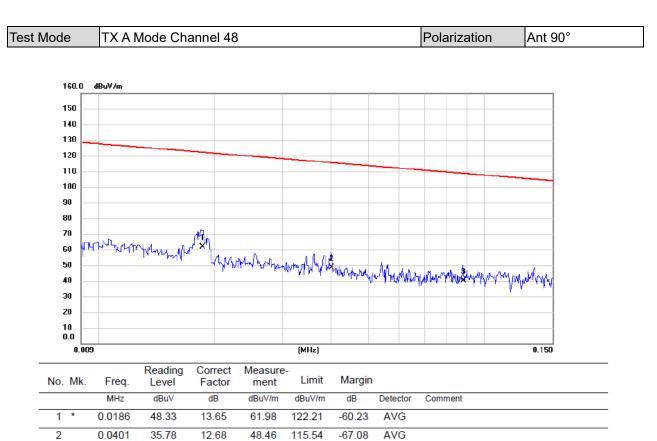
-21.36

QP

QP

- (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.

0.0881

3

27.52

12.65

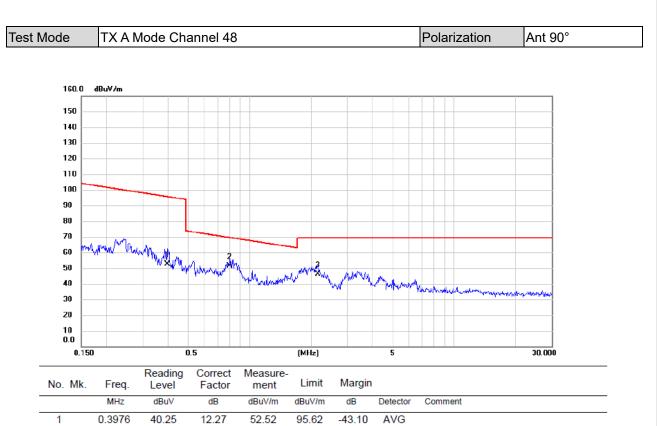
40.17

108.71

-68.54

AVG





-17.99

-23.16

QP

QP

69.54

69.54

REMARKS:

2

3

0.8002

2.1552

39.67

35.15

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

11.88

11.23

51.55

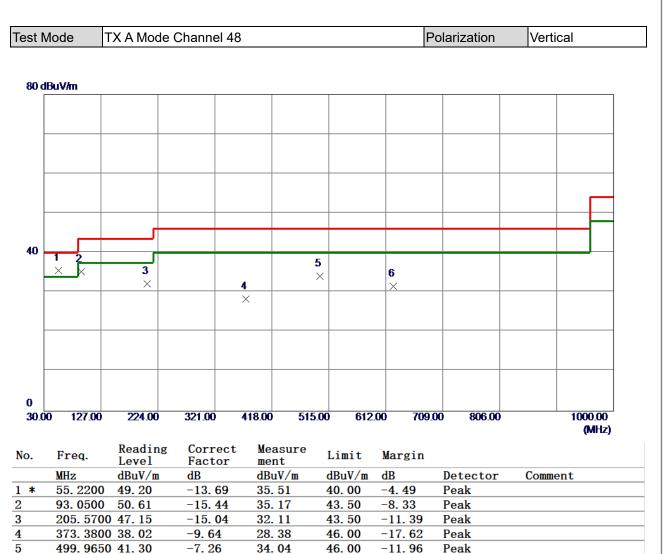
46.38

(2) Margin Level = Measurement Value - Limit Value.



APPENDIX C - RADIATED EMISSION - 30 MHZ TO 1000 MHZ





46.00

-14.55

Peak

REMARKS:

6

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

-4.81

31.45

(2) Margin Level = Measurement Value - Limit Value.

625.0949 36.26



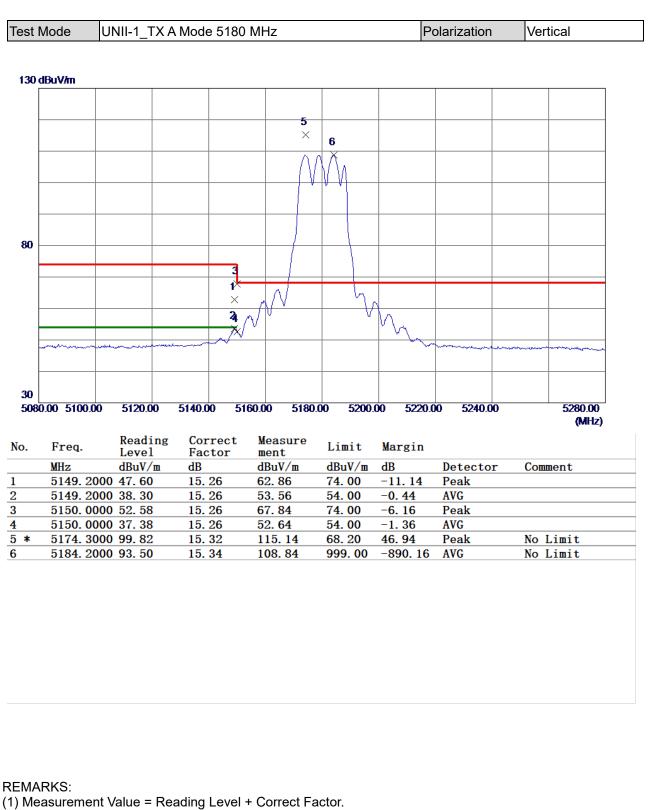
est Mode		TX A Mode Channel 48						Polarization	Horizontal	
80 dE	3uV/m	1 1								
40 -			<u>3</u> ×	4		5 ×				
		2 ×		×			6 ×			
	×									
0										
30.00) 127.0	0 224.00	321.00	418.00	515.	00 612	.00 70	09.00 806.00	1000.00	
		Reading	Correc	at Mo	asure				(MHz)	
0.	Freq.	Level	Factor			Limit	Margin	n		
	MHz	dBuV/m	dB	dB	uV/m	dBuV/m	dB	Detector	Comment	
	83.835				. 76	40.00	-13. 24			
		137. 1850 43. 61		-12.61 31		43. 50	-12. 50			
*	279. 2900 49. 27			-12. 20 37		46.00	-8.93	Peak		
	369. 5000 44. 87				. 13	46.00	-10. 87			
	499.9650 44.05		-7.26 36.79			46.00	-9.21	Peak		
	625.09	49 36.81	-4.81	32	. 00	46.00	-14. 00) Peak		

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



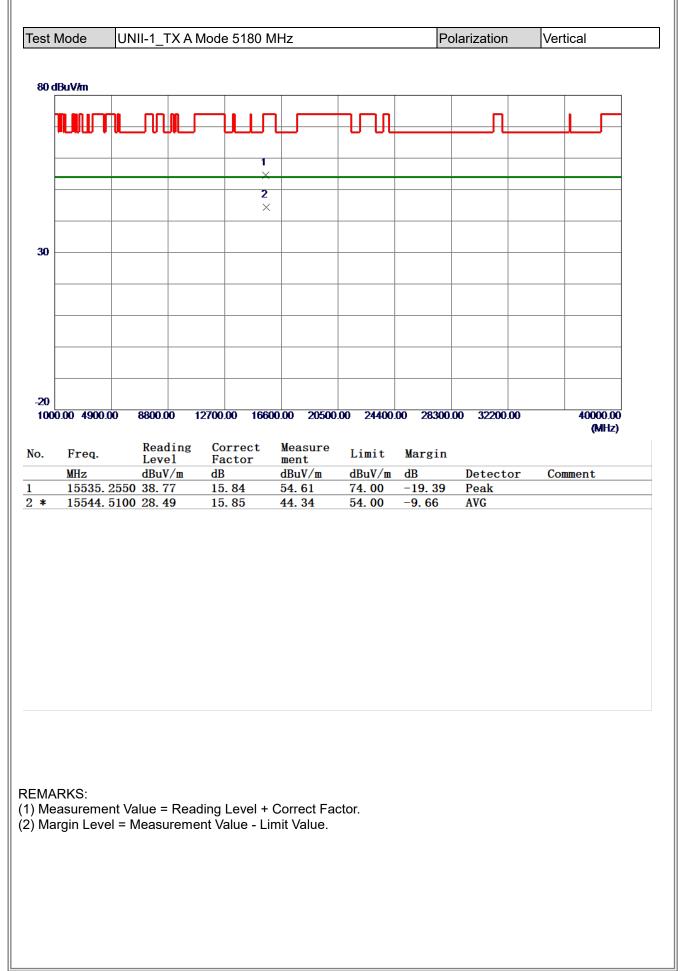
APPENDIX D - RADIATED EMISSION - ABOVE 1000 MHZ

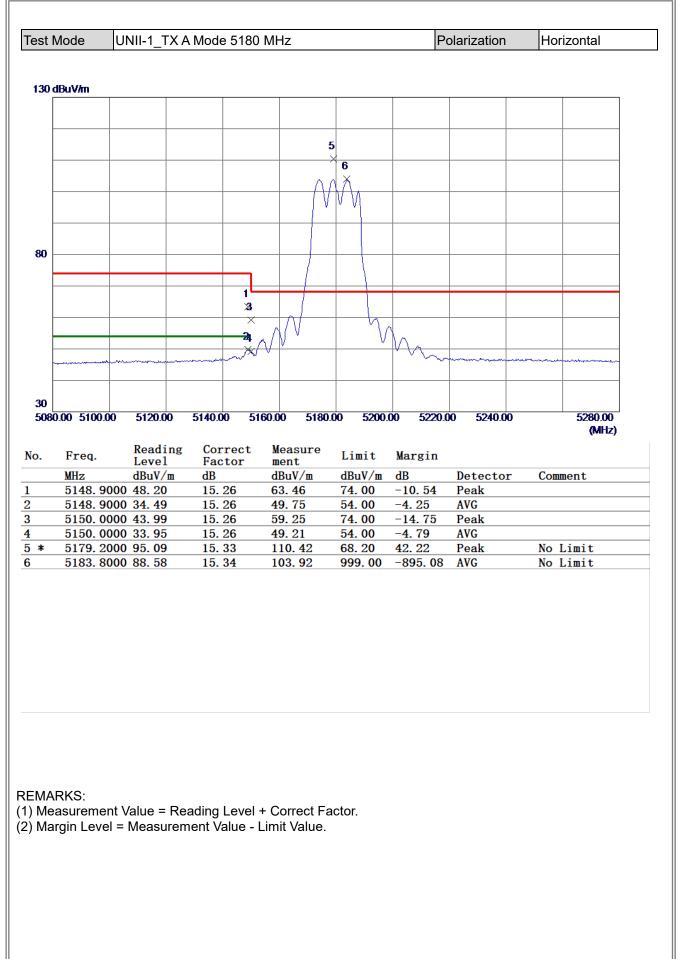




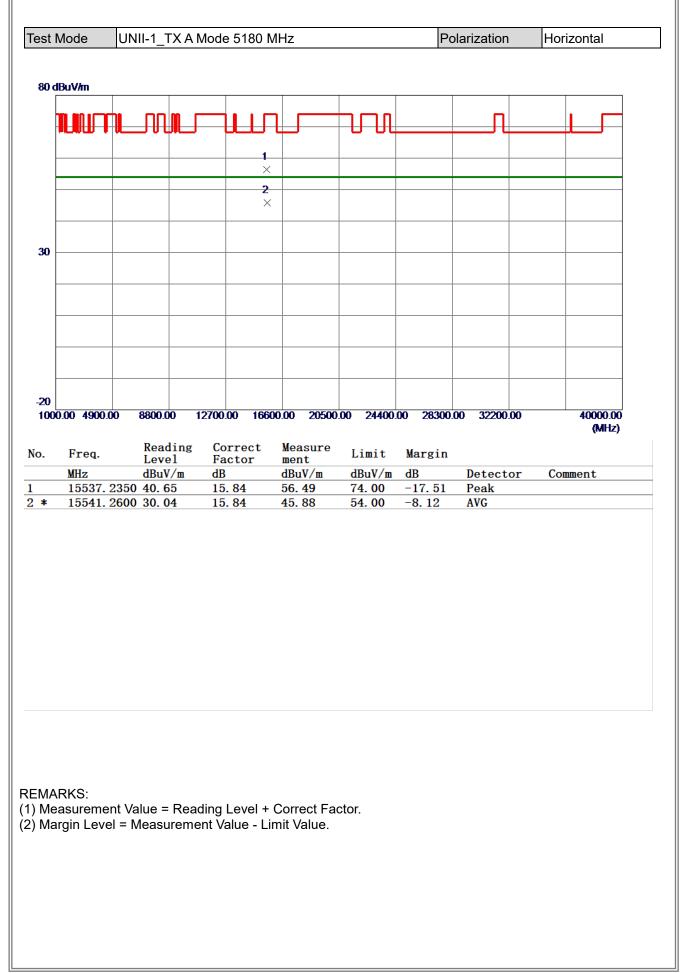
(2) Margin Level = Measurement Value - Limit Value.



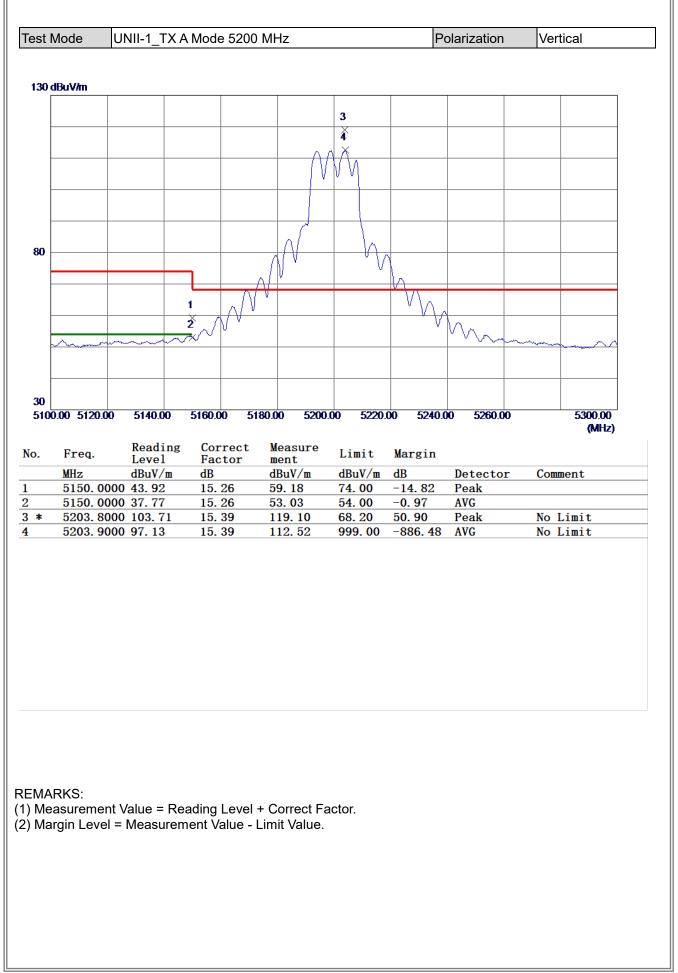




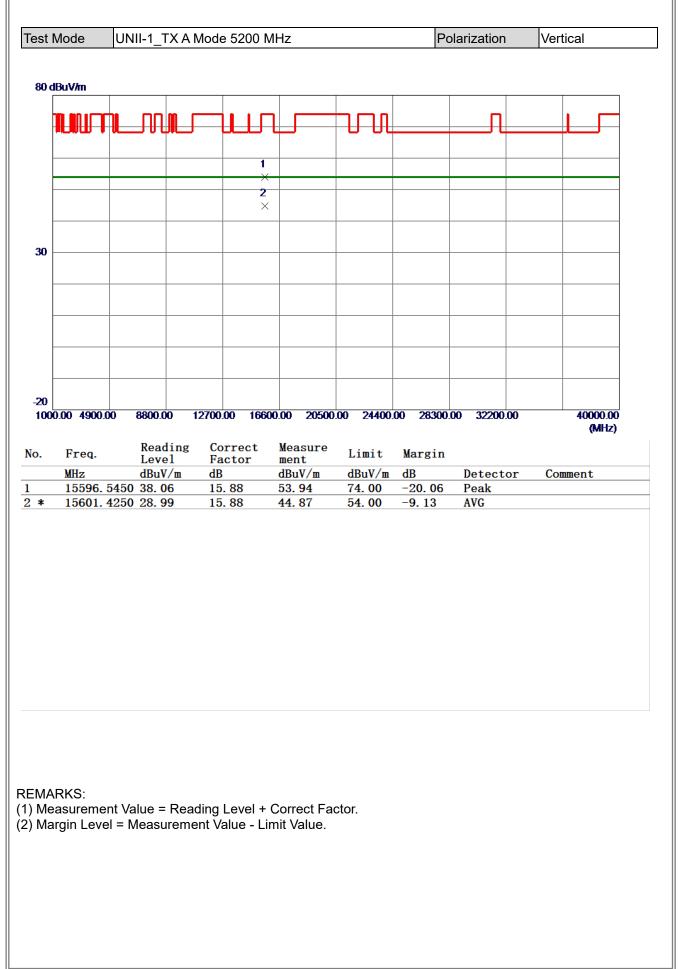


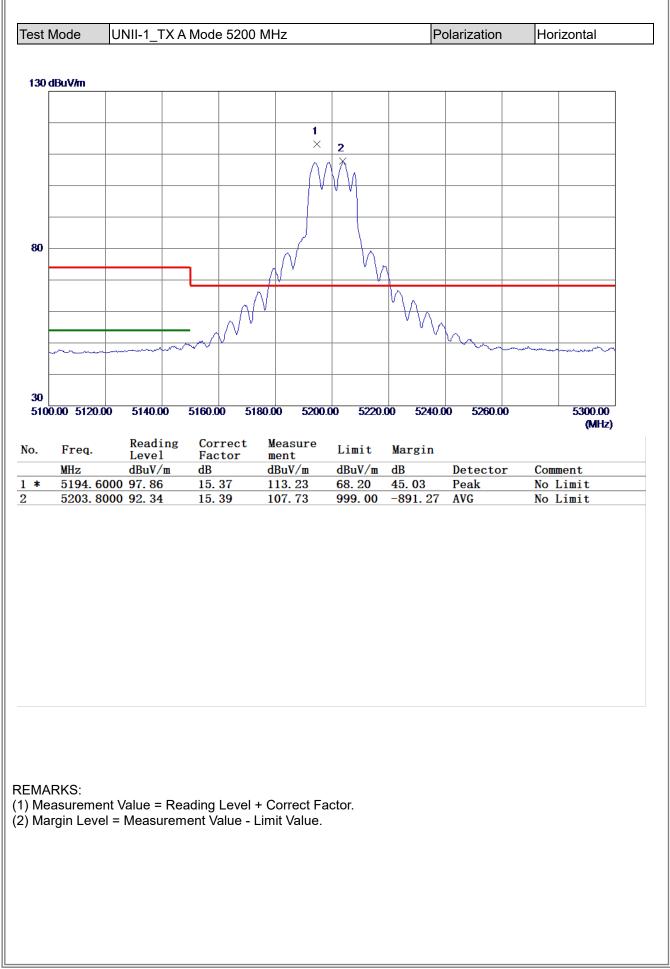


BL

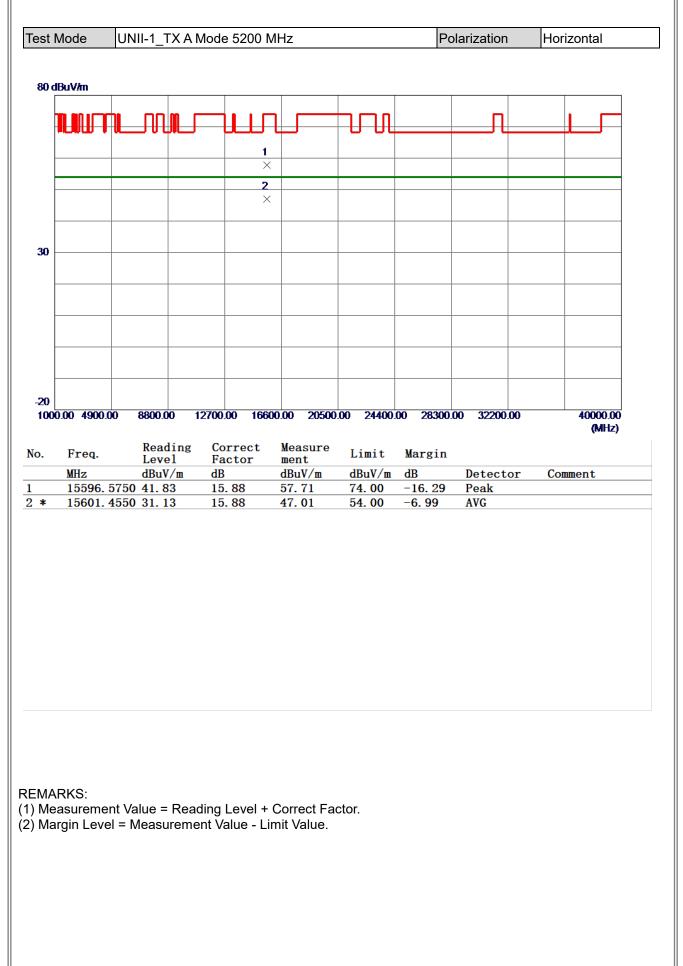


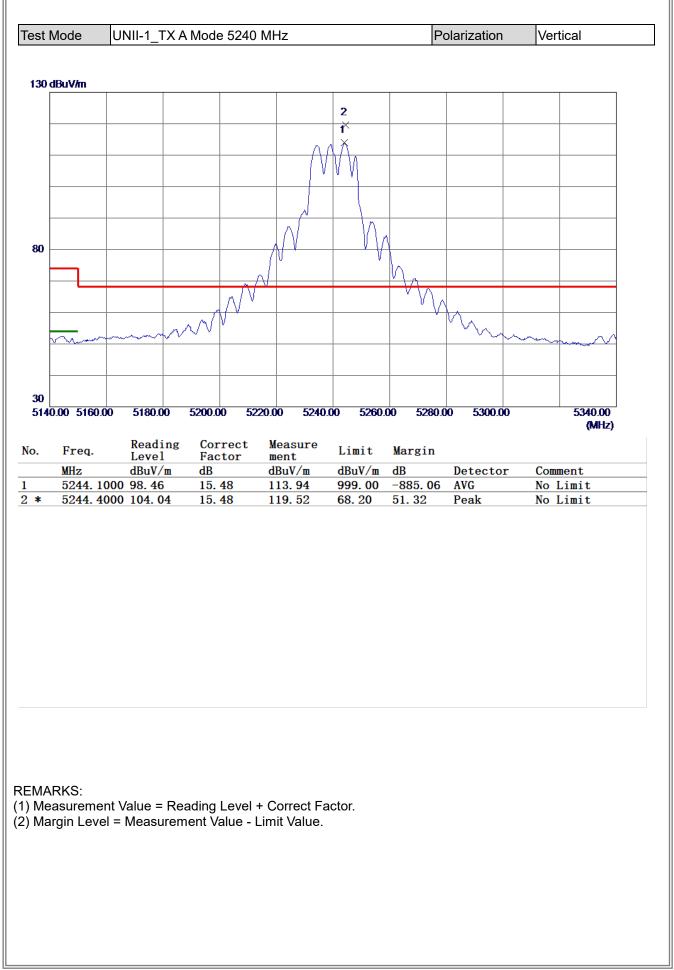




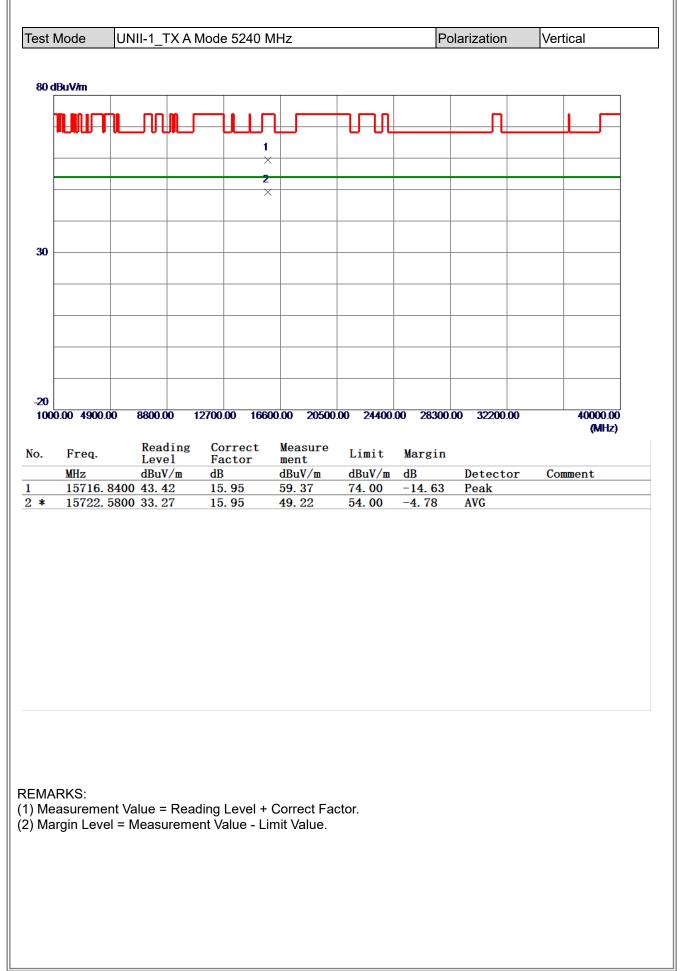


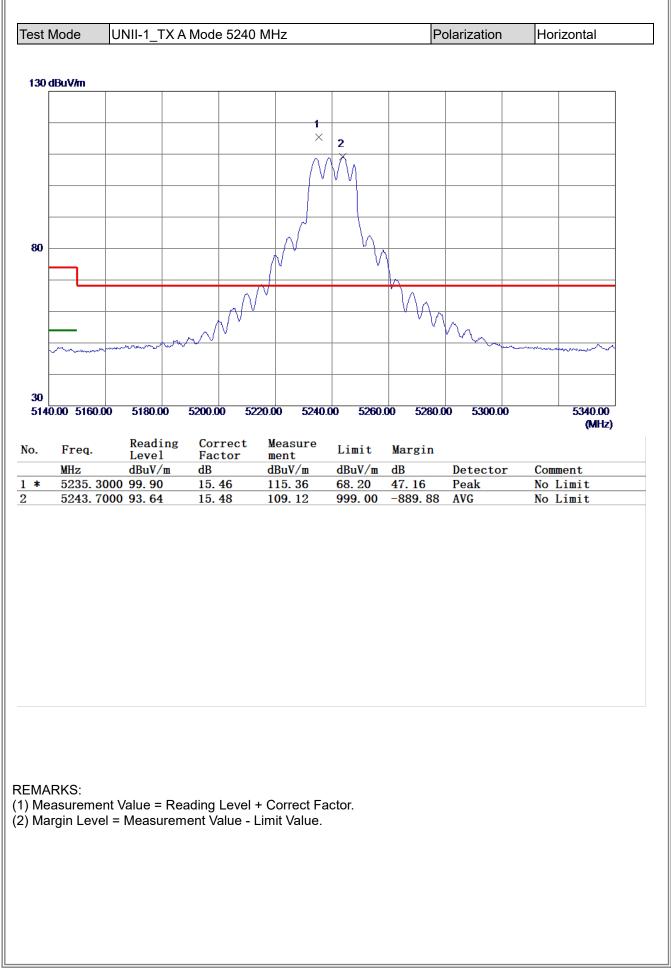




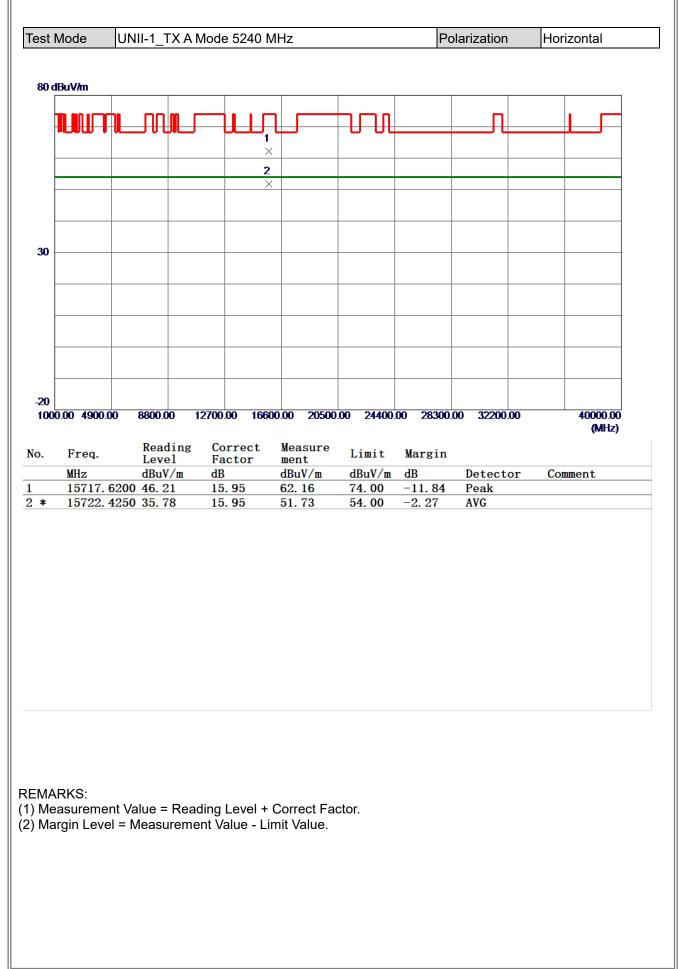




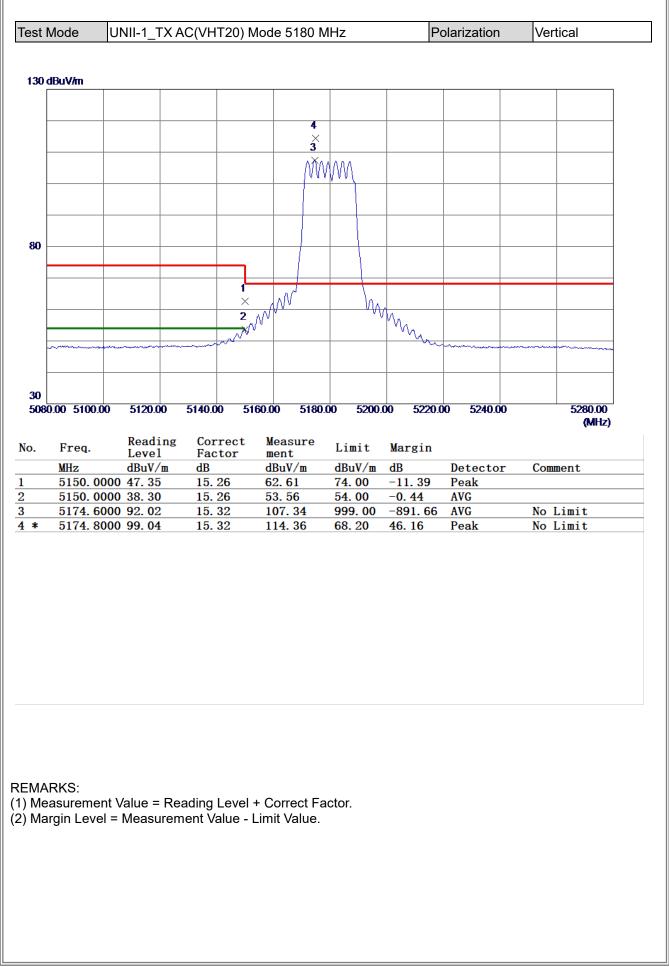




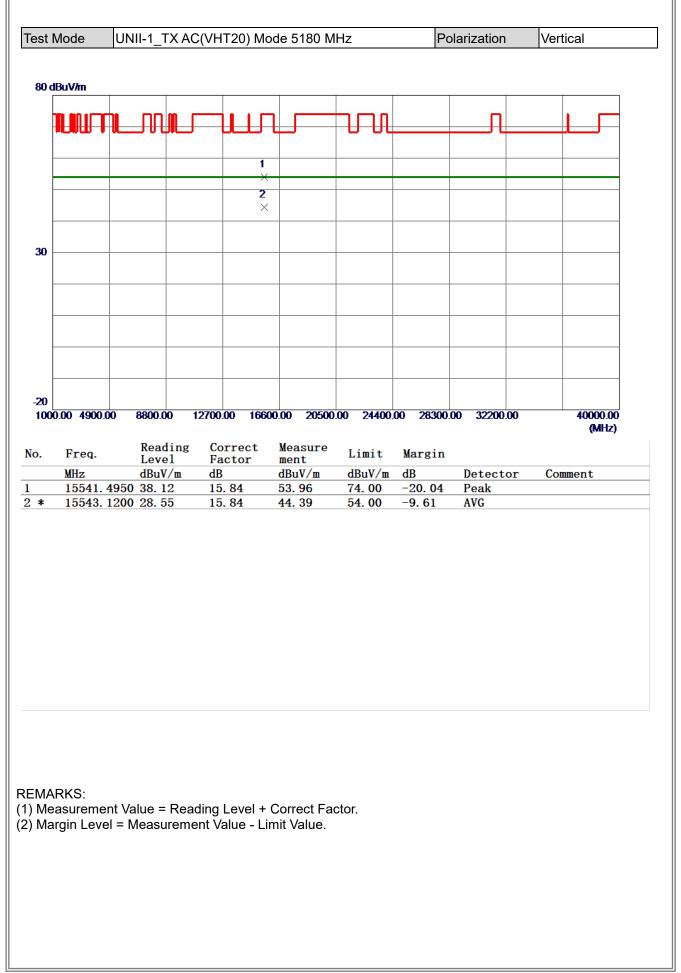




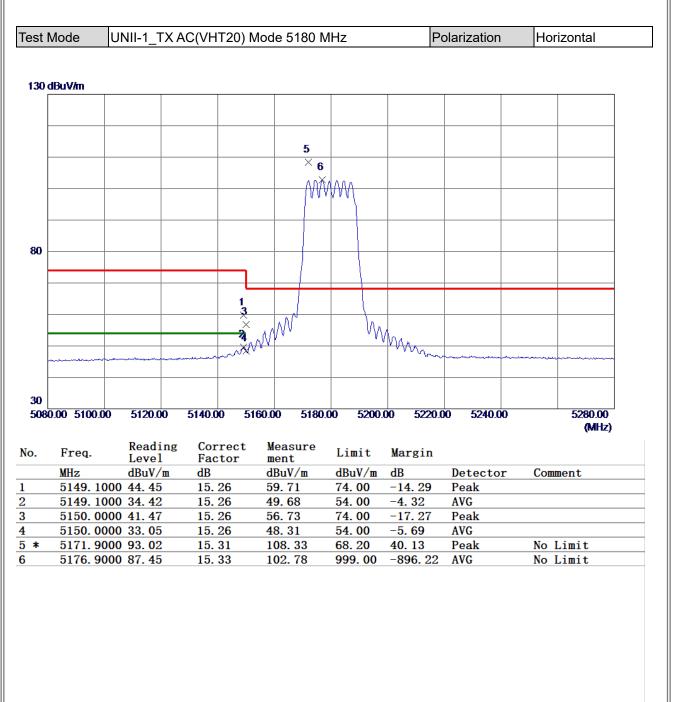






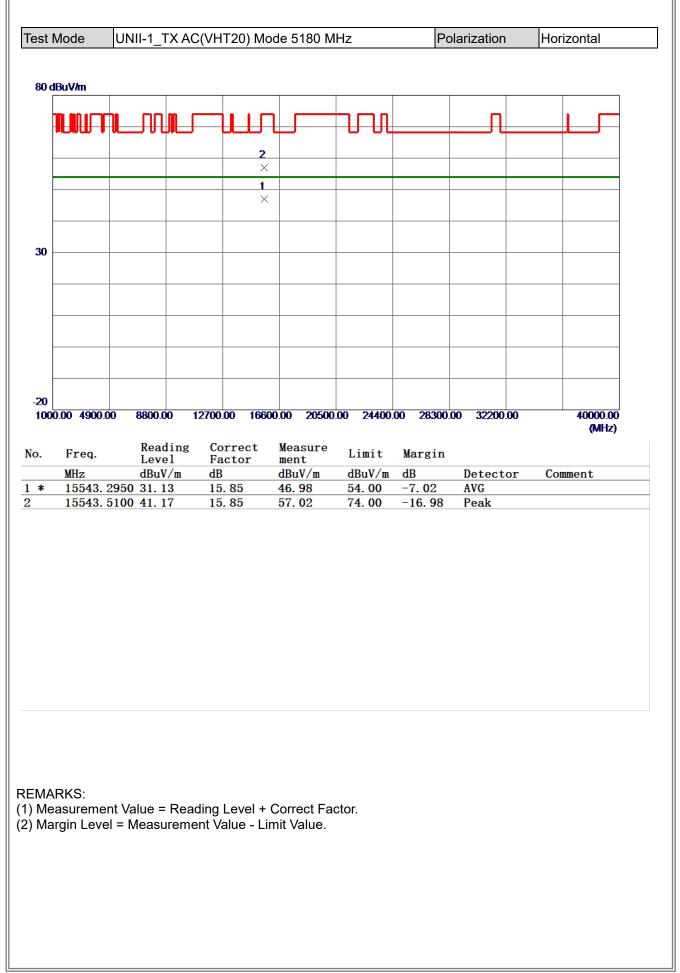




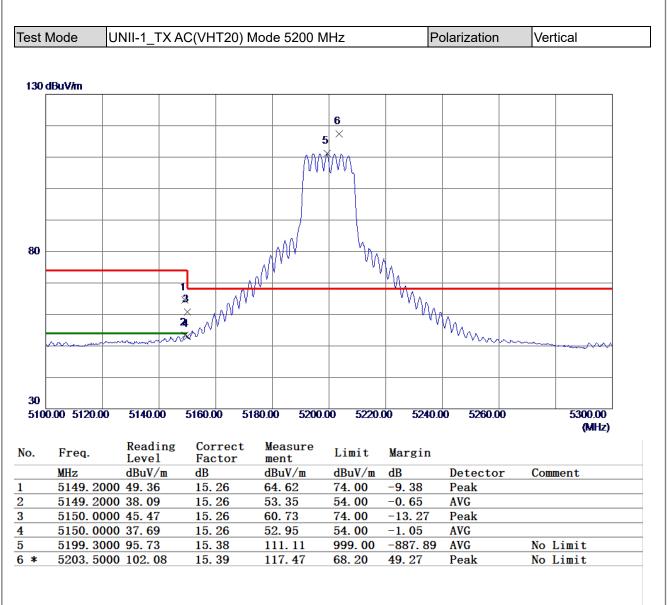


- (1) Measurement Value = Reading Level + Correct Factor.
- (2) Margin Level = Measurement Value Limit Value.



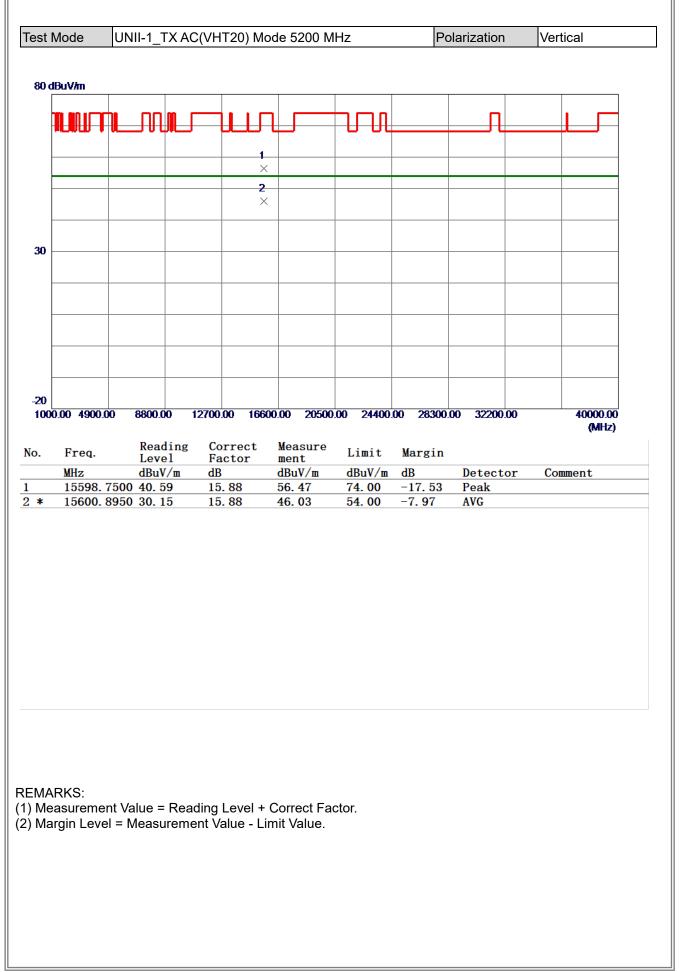




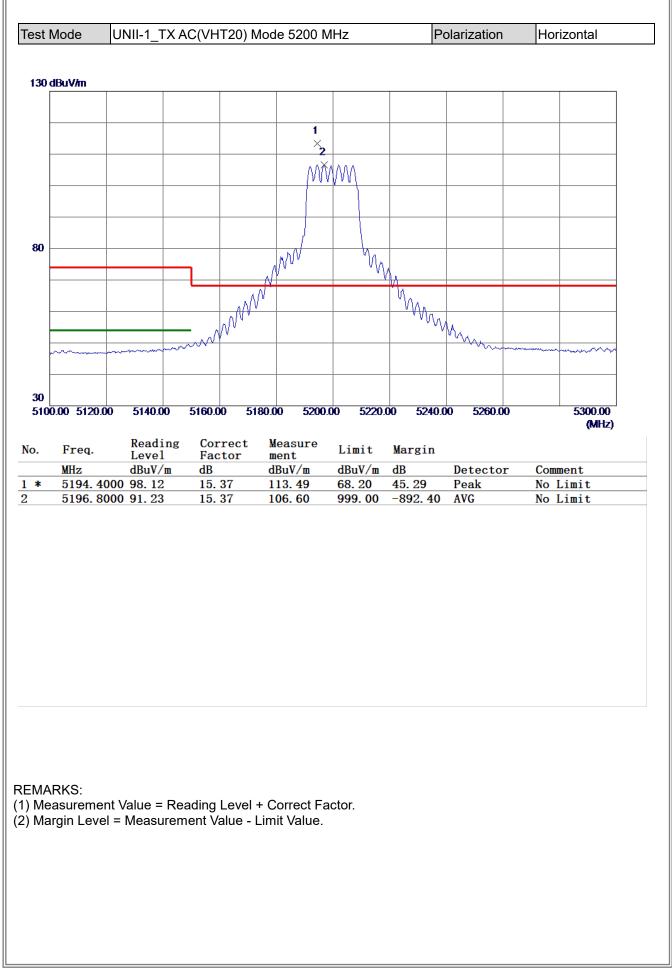


- (1) Measurement Value = Reading Level + Correct Factor.
- (2) Margin Level = Measurement Value Limit Value.

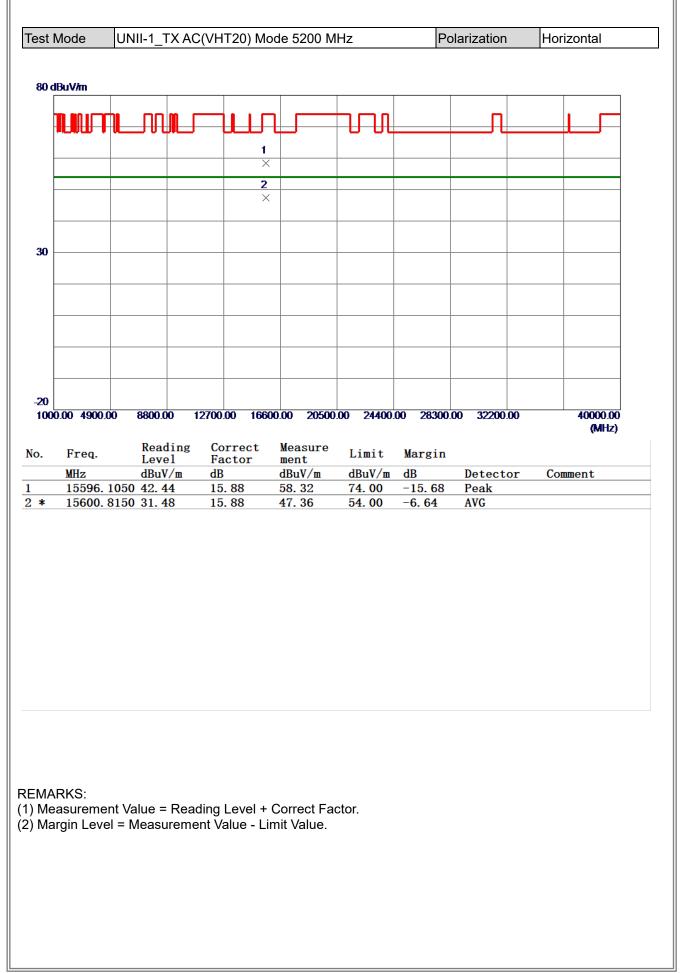




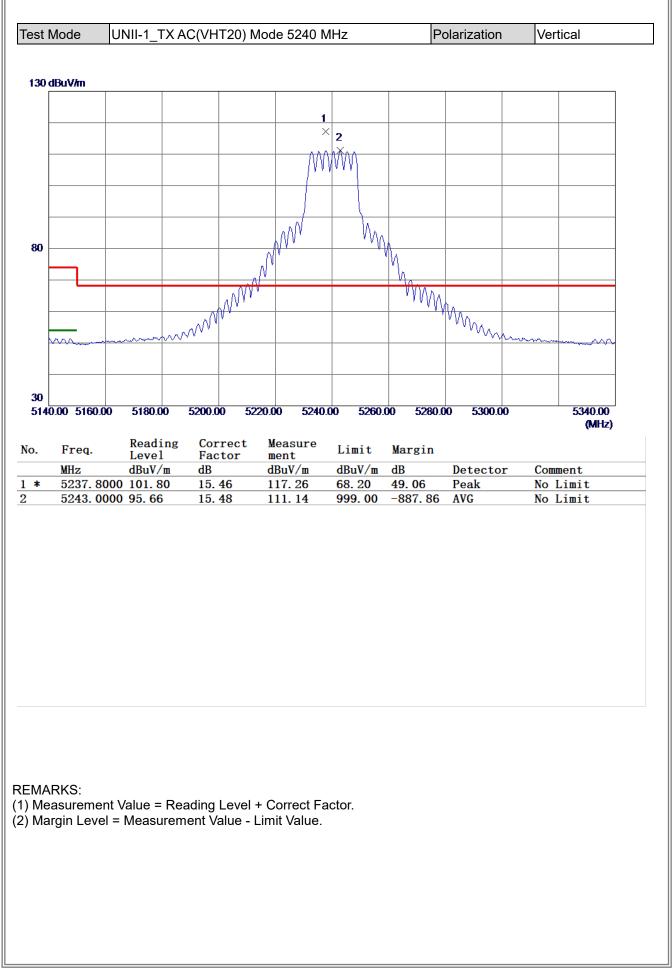




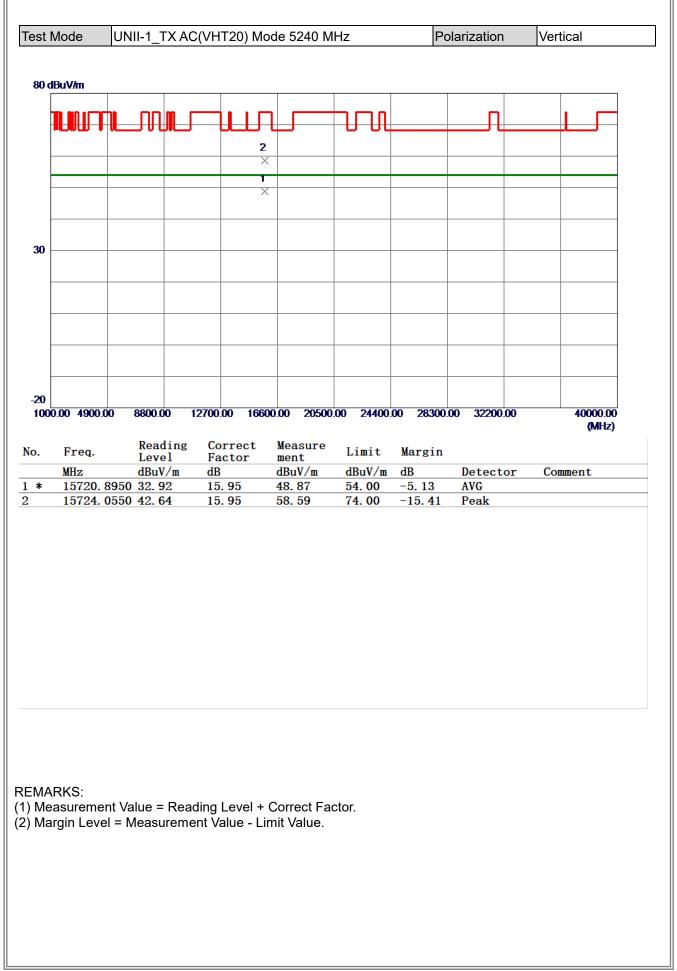




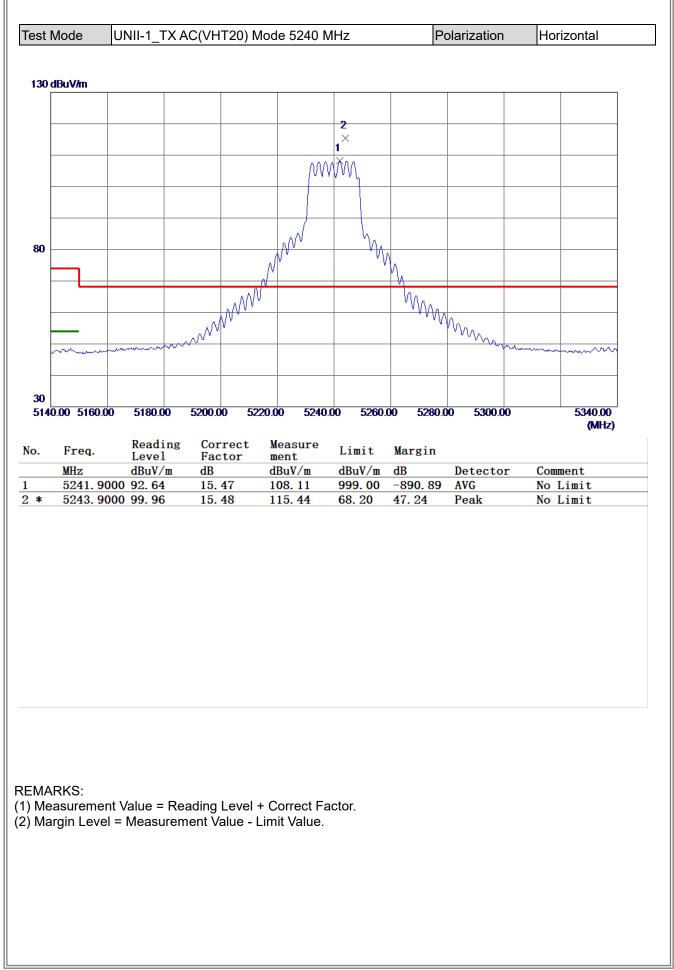




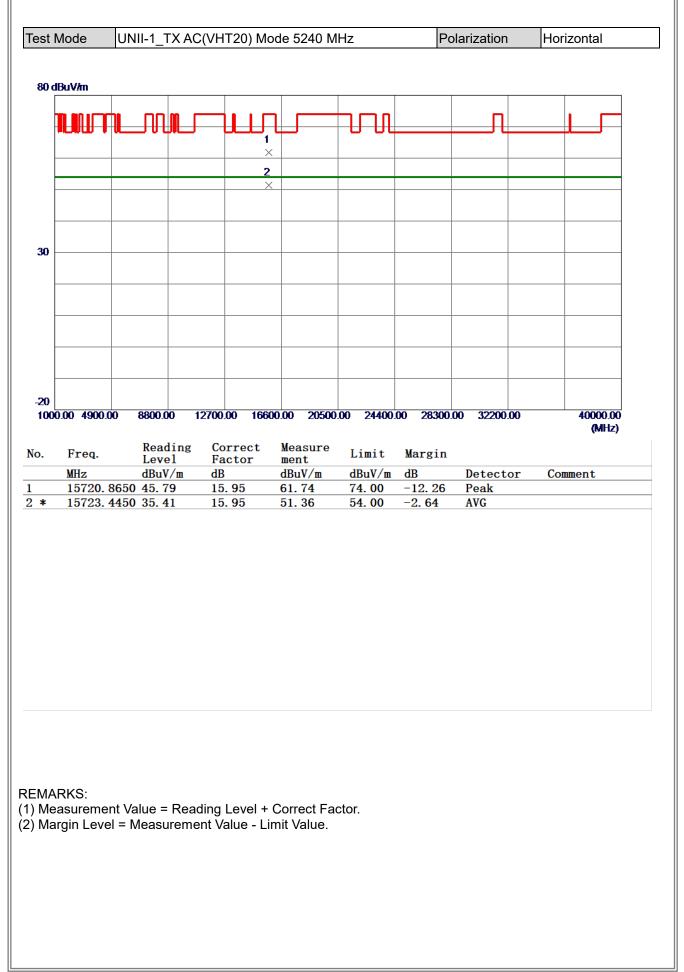










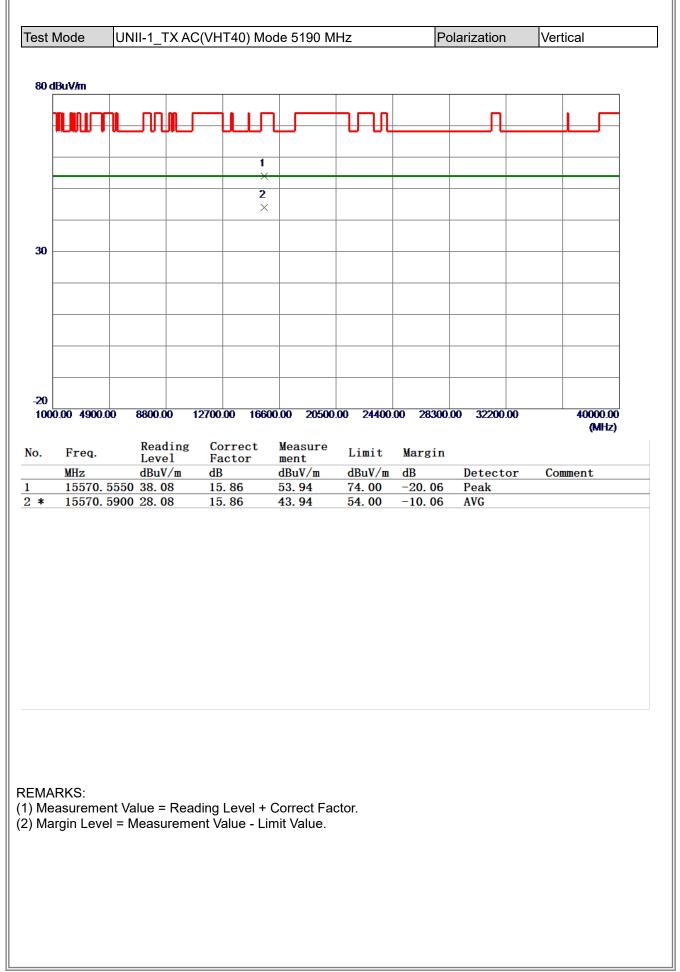




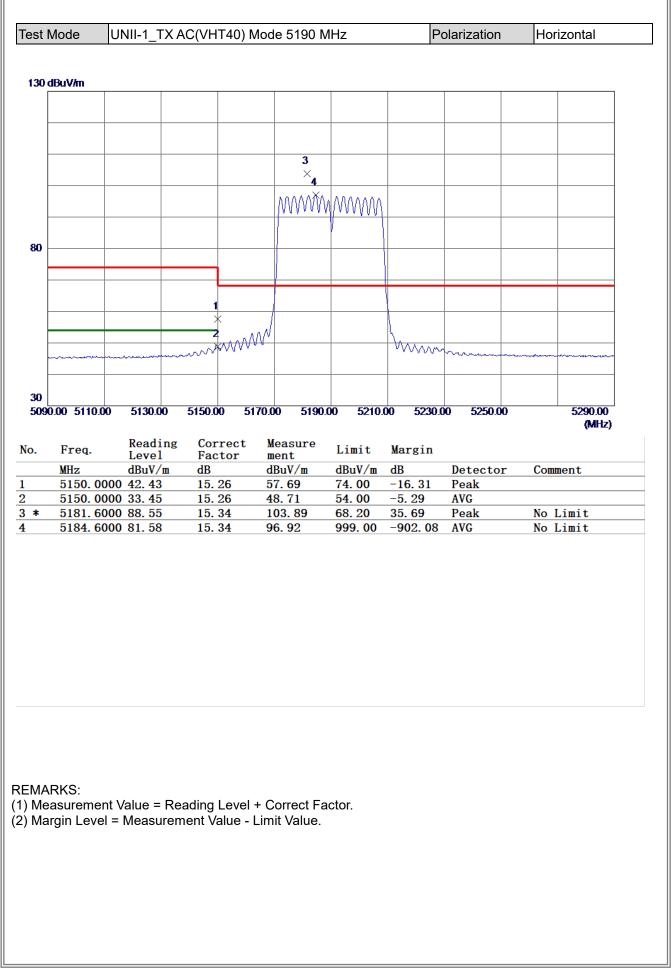
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509	0.00 5110.00	5130.00	5150.00 51	70.00 5190.	00 5210.0	0 5230.0	0 5250.00	5290.00 (MHz)
о.	Freq.	Reading Level	Correct Factor	Measure ment	Limit	Margin		
	MHz	dBuV/m	dB	dBuV/m	dBuV/m	dB	Detector	Comment
	5149.300		15.26	62.97 52.01	74.00	-11.03	Peak AVG	
		0 38.00	15.26	53.91 60.33	54.00 74.00	<u>-0.09</u> -13.67	Peak	
	5149.300	0 45 07	15 26		14.00	10.07		
	5150.000		15.26			-0.93	AVC	
} 		0 37.81	15.26 15.26 15.35	53. 07 102. 39	54.00	-0. 93 -896. 61	AVG AVG	No Limit

- Measurement Value = Reading Level + Correct Factor.
   Margin Level = Measurement Value Limit Value.

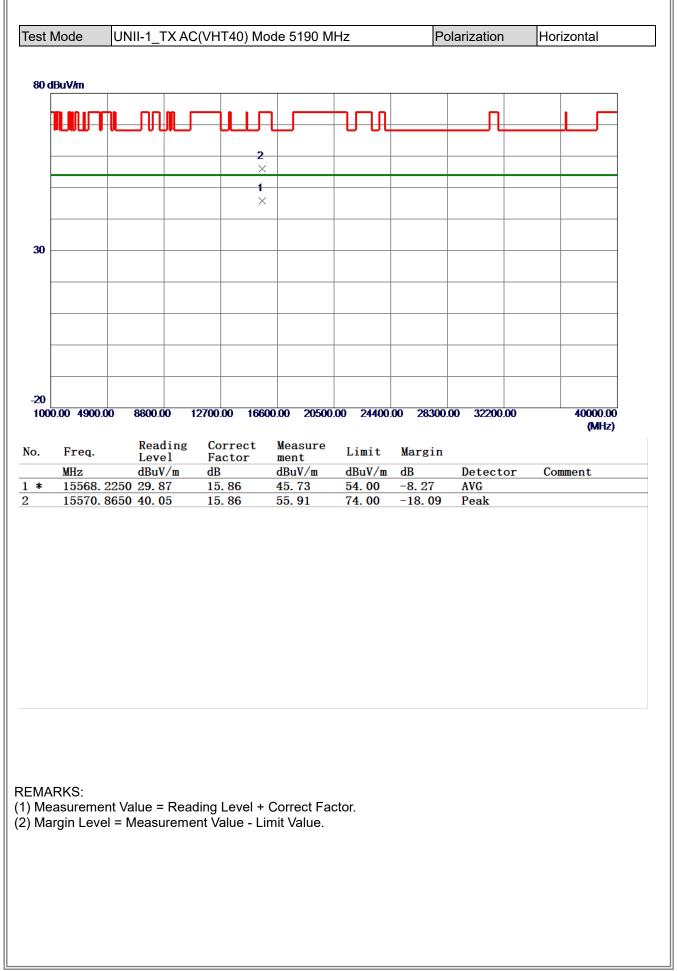




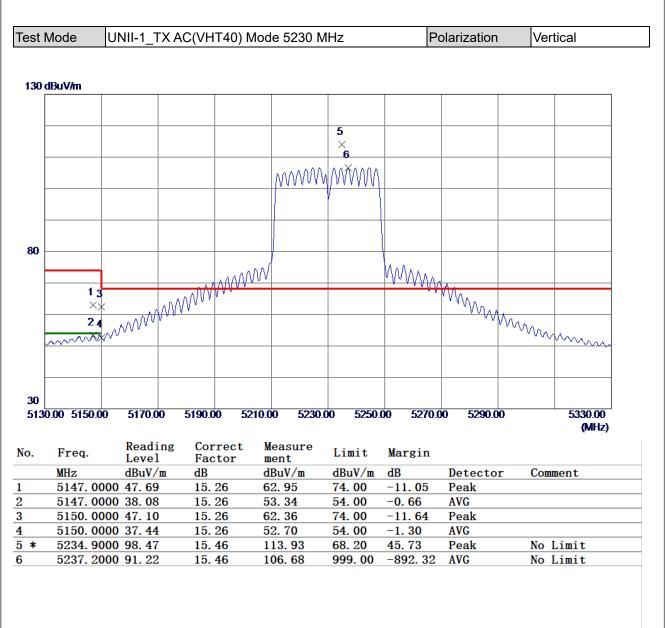






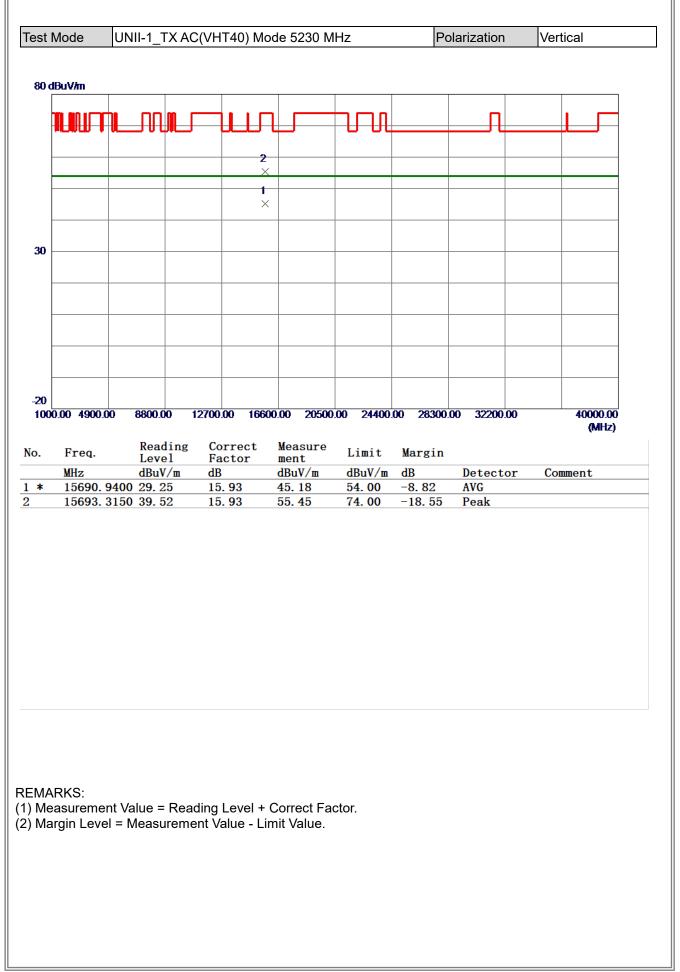




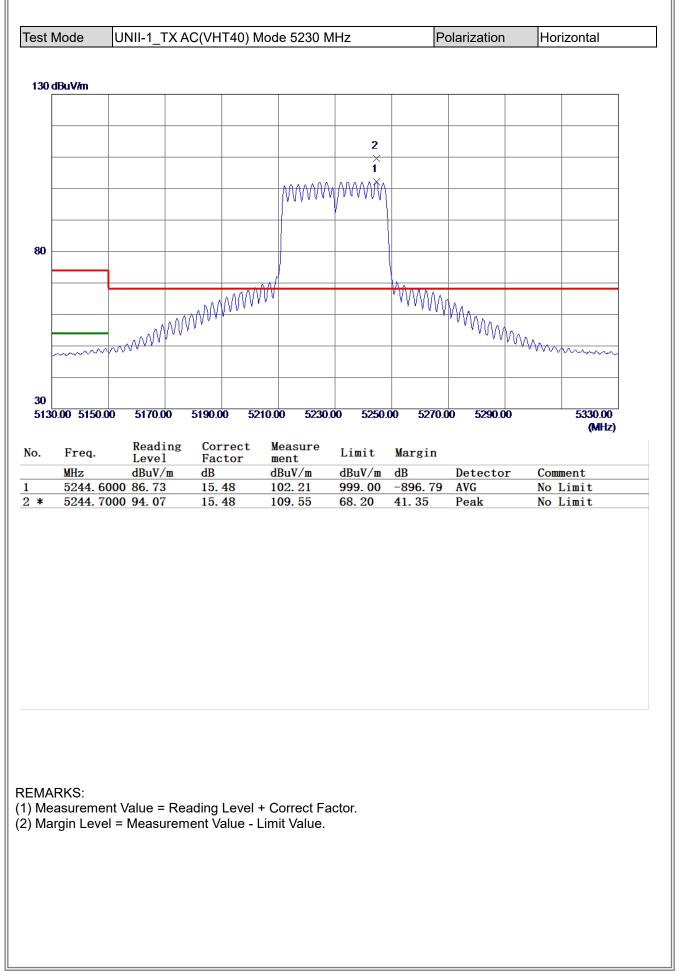


- (1) Measurement Value = Reading Level + Correct Factor.
- (2) Margin Level = Measurement Value Limit Value.

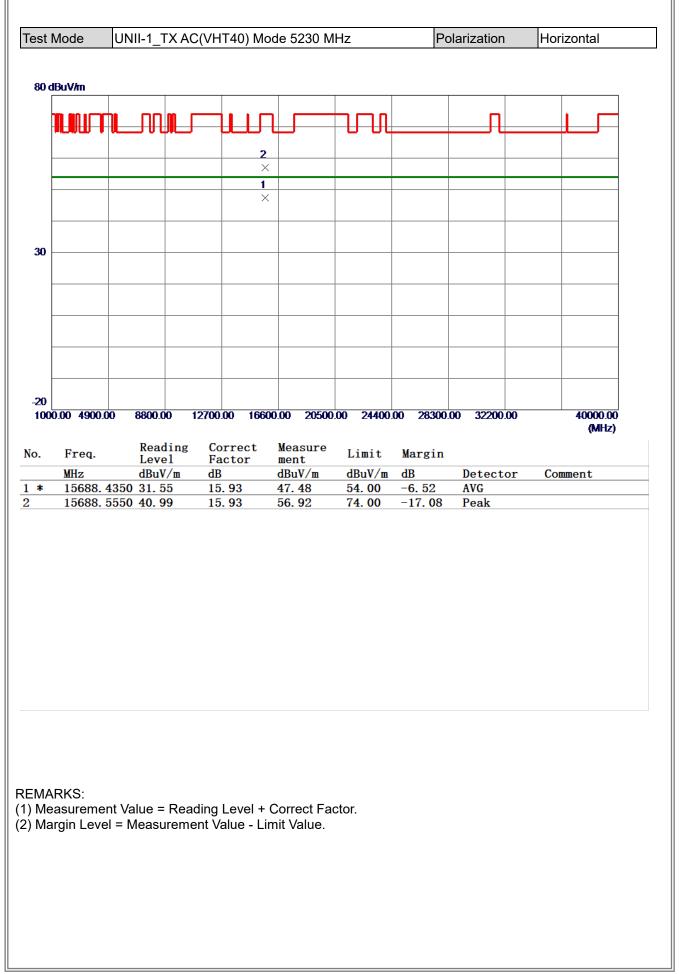




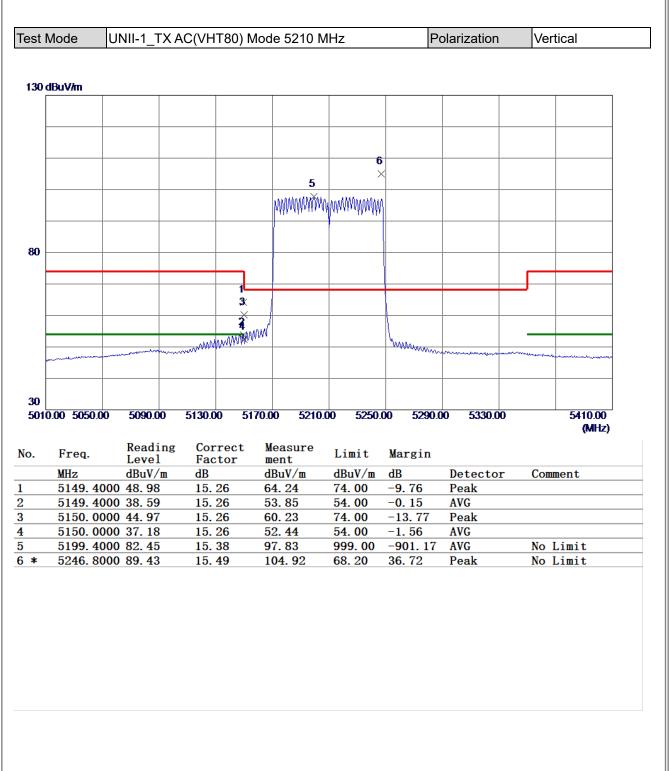






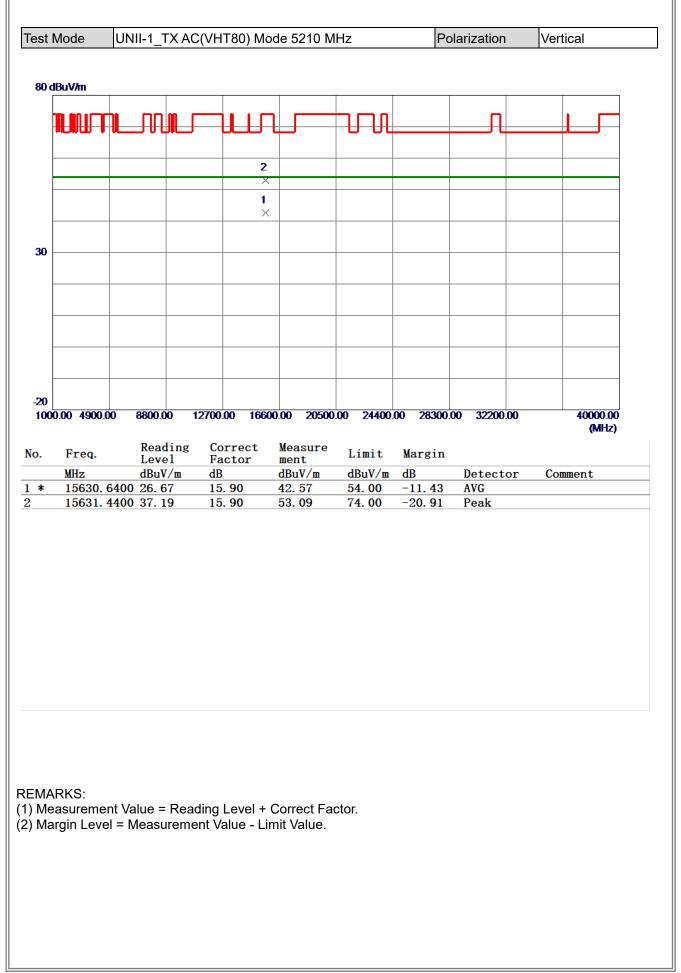




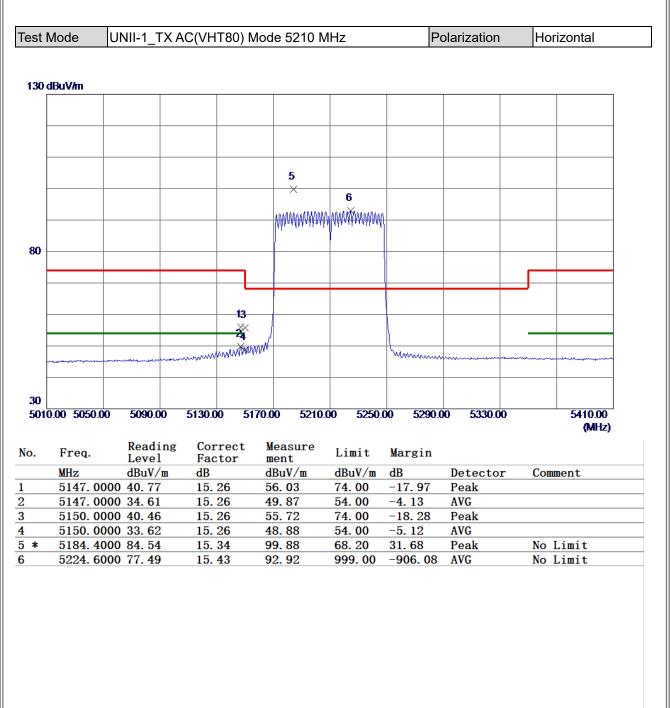


- (1) Measurement Value = Reading Level + Correct Factor.
- (2) Margin Level = Measurement Value Limit Value.



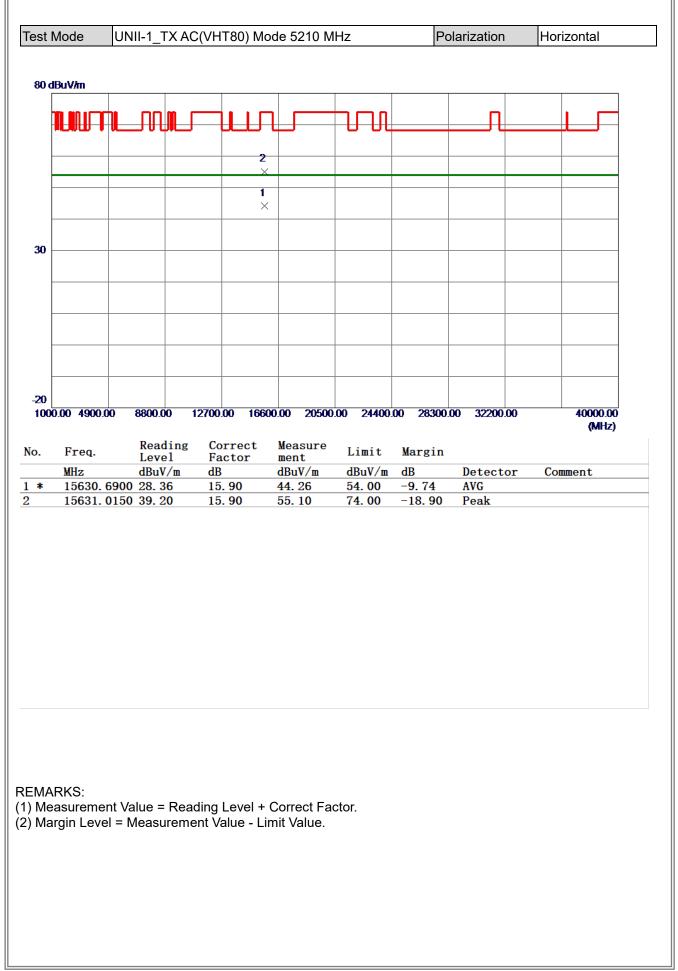




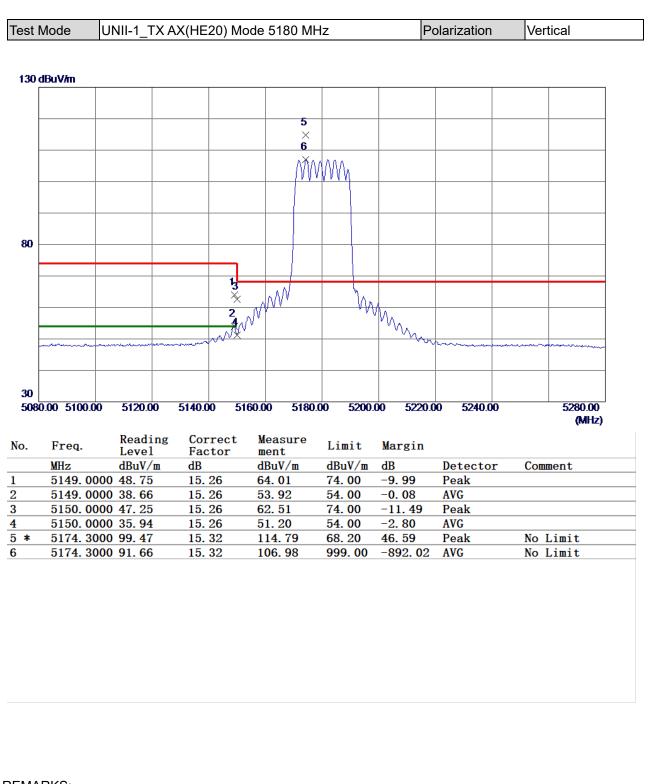


- (1) Measurement Value = Reading Level + Correct Factor.
- (2) Margin Level = Measurement Value Limit Value.



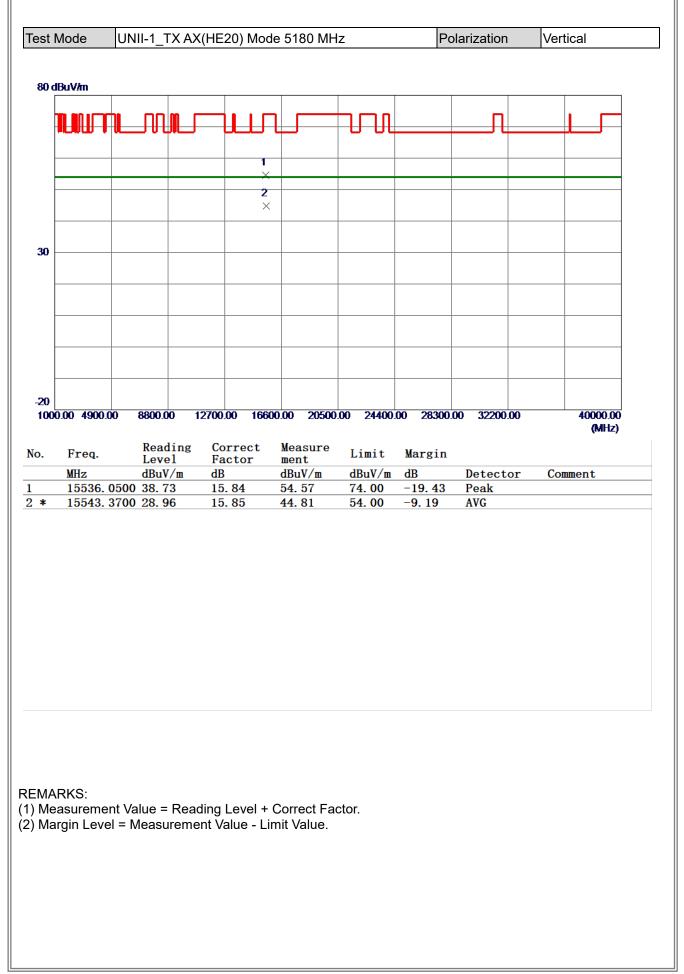




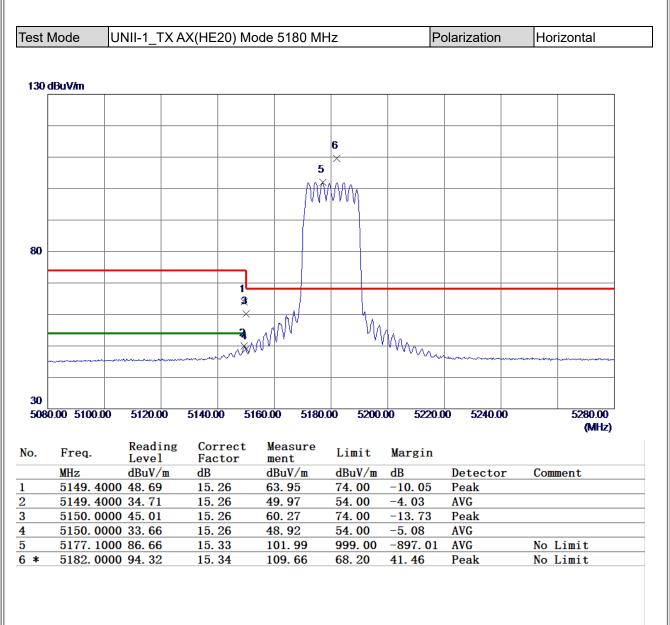


- (1) Measurement Value = Reading Level + Correct Factor.
- (2) Margin Level = Measurement Value Limit Value.



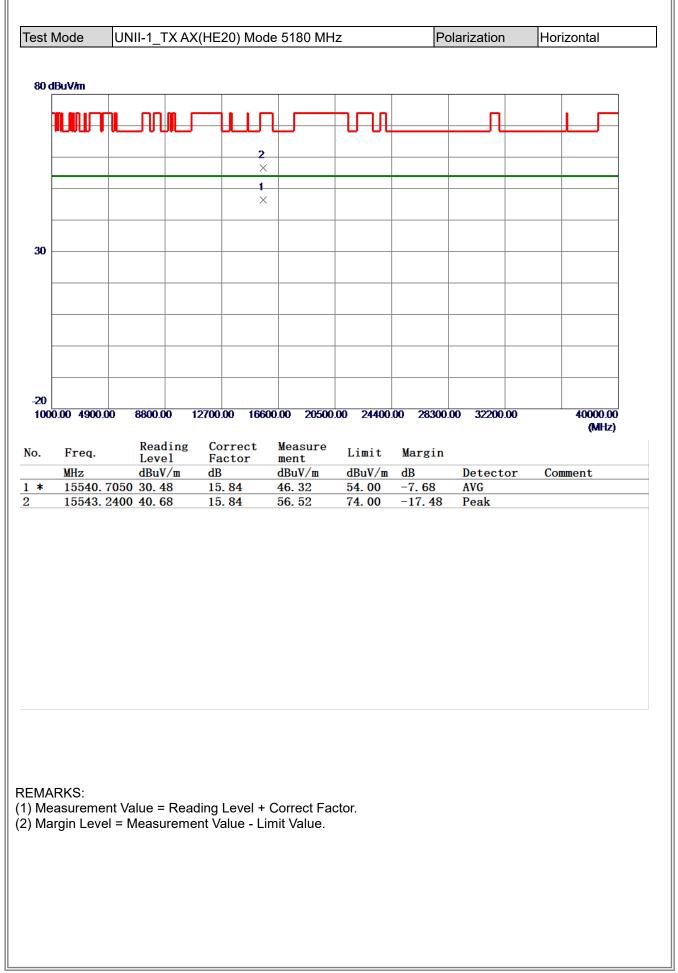




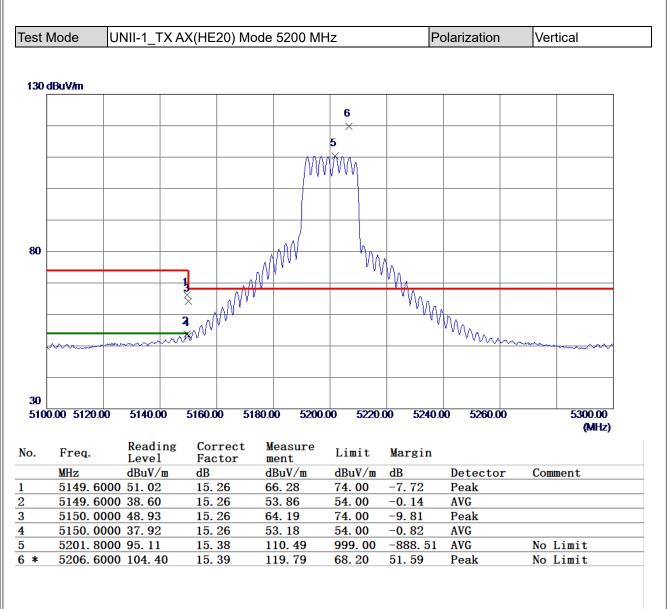


- (1) Measurement Value = Reading Level + Correct Factor.
- (2) Margin Level = Measurement Value Limit Value.



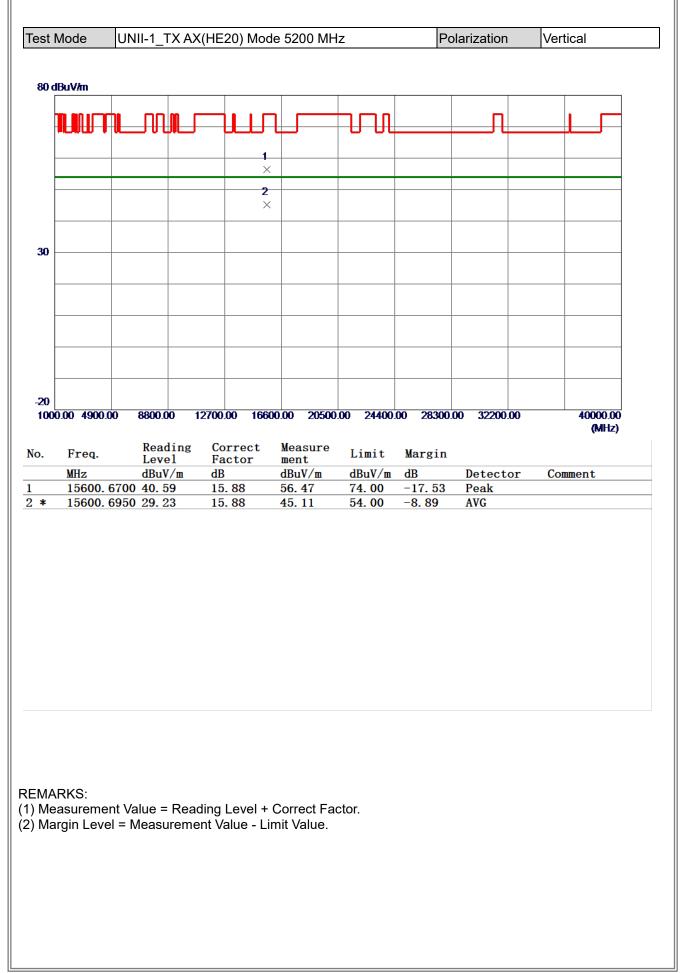




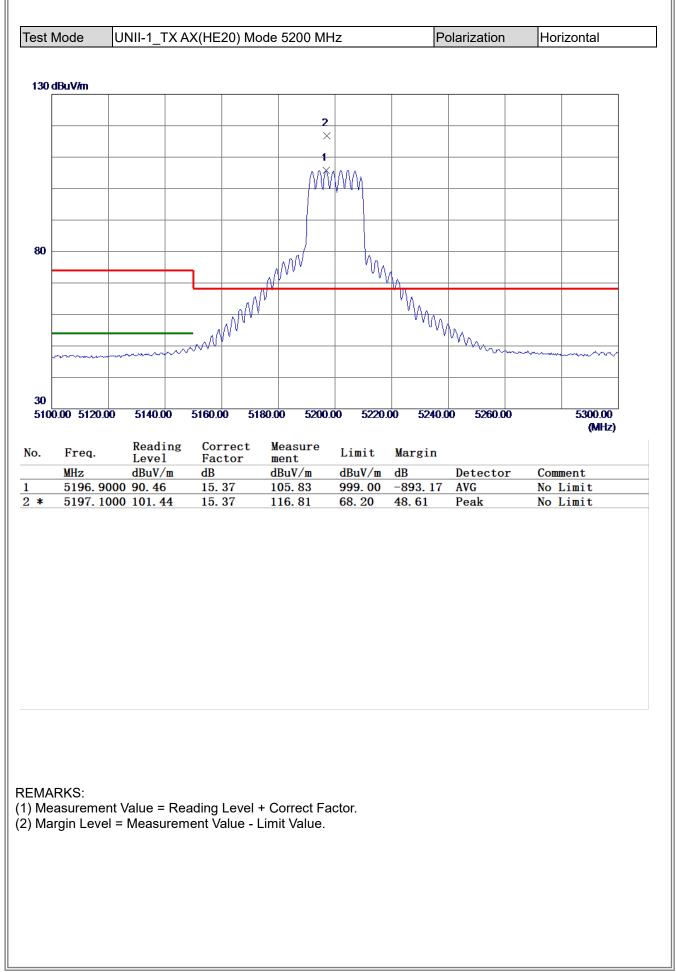


- (1) Measurement Value = Reading Level + Correct Factor.
- (2) Margin Level = Measurement Value Limit Value.

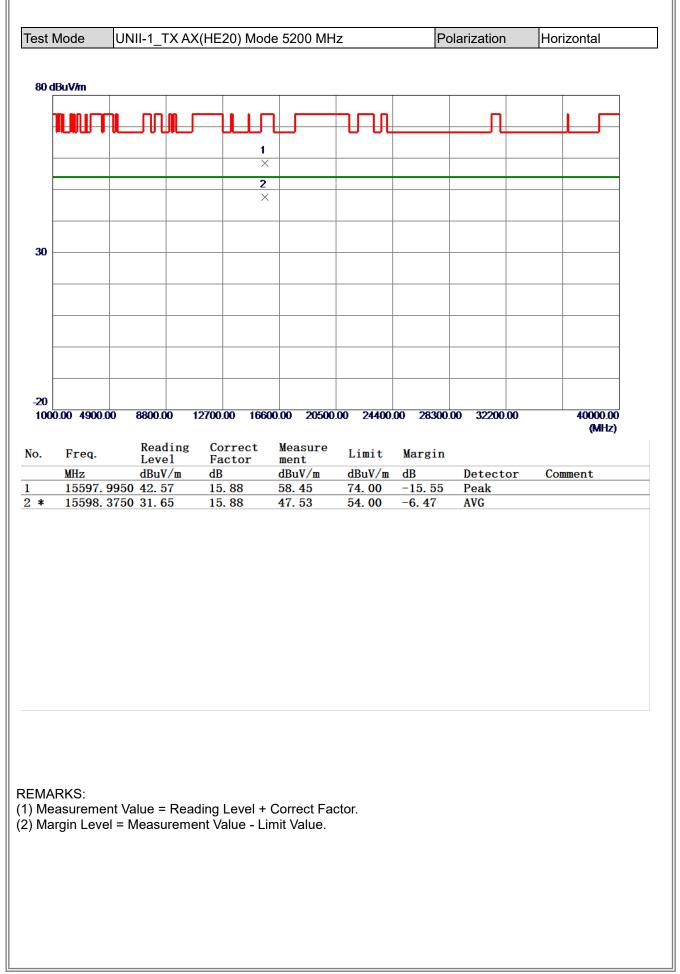




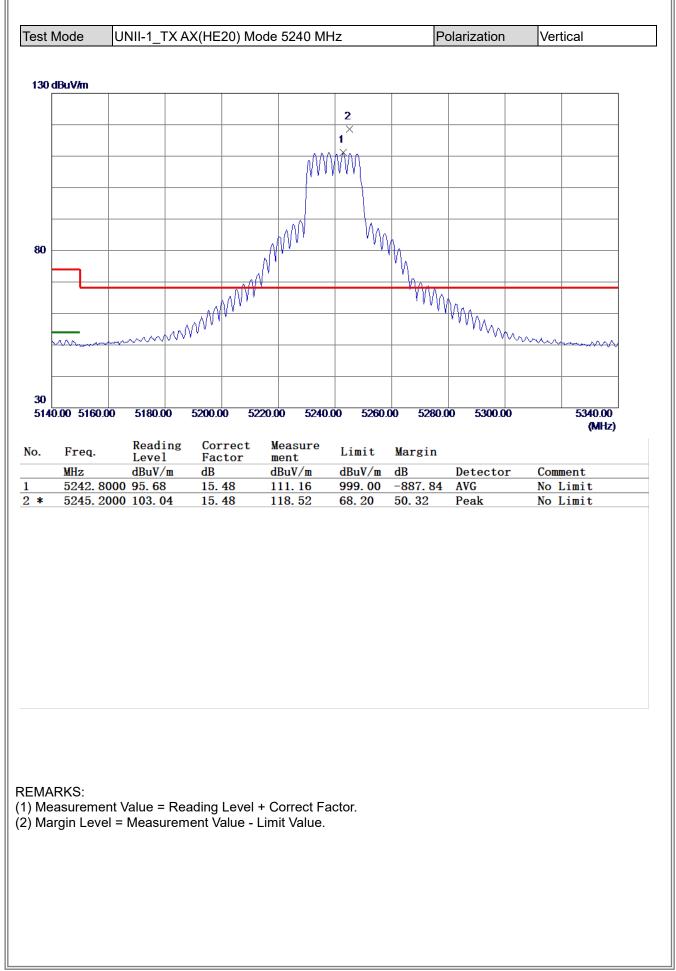




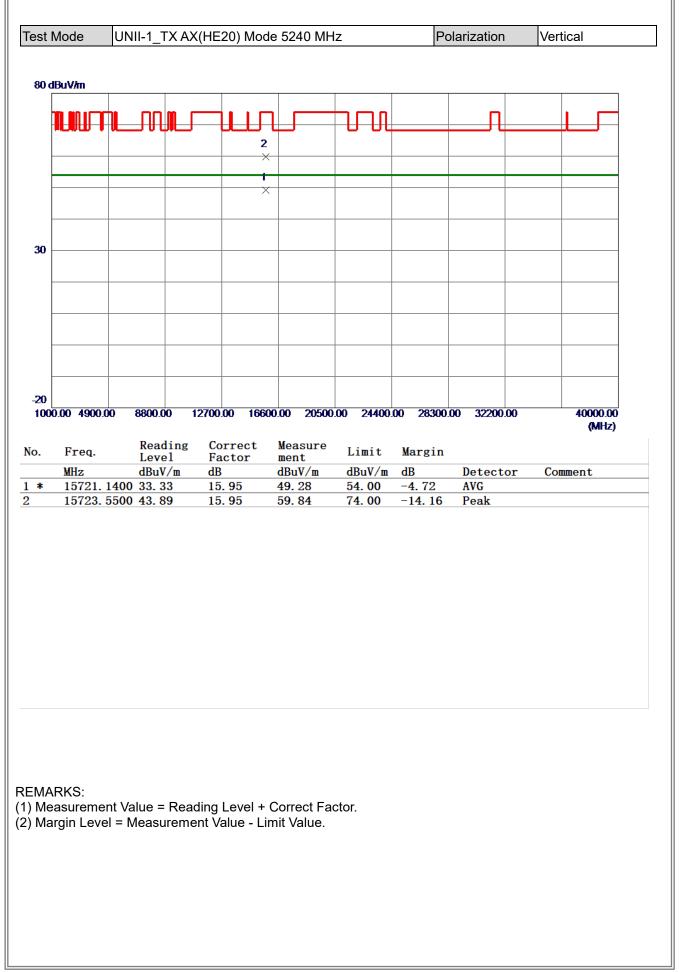




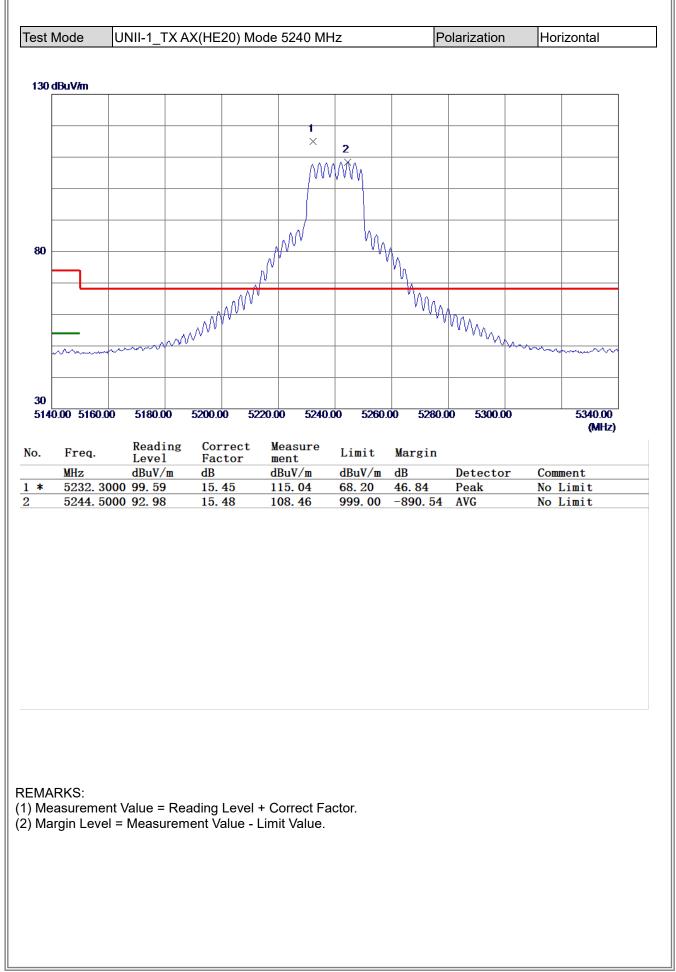




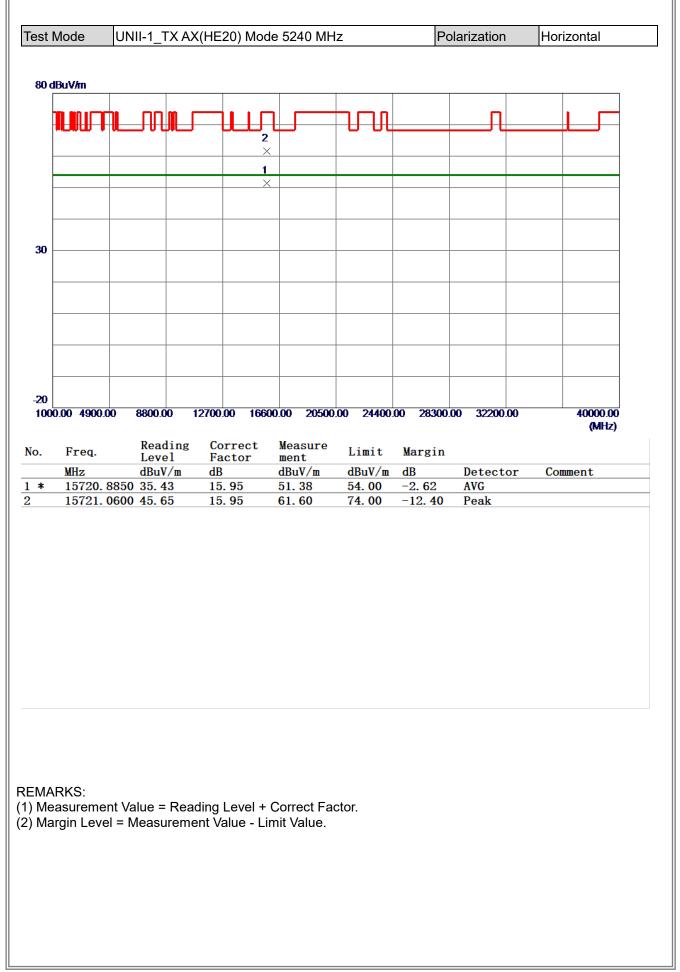










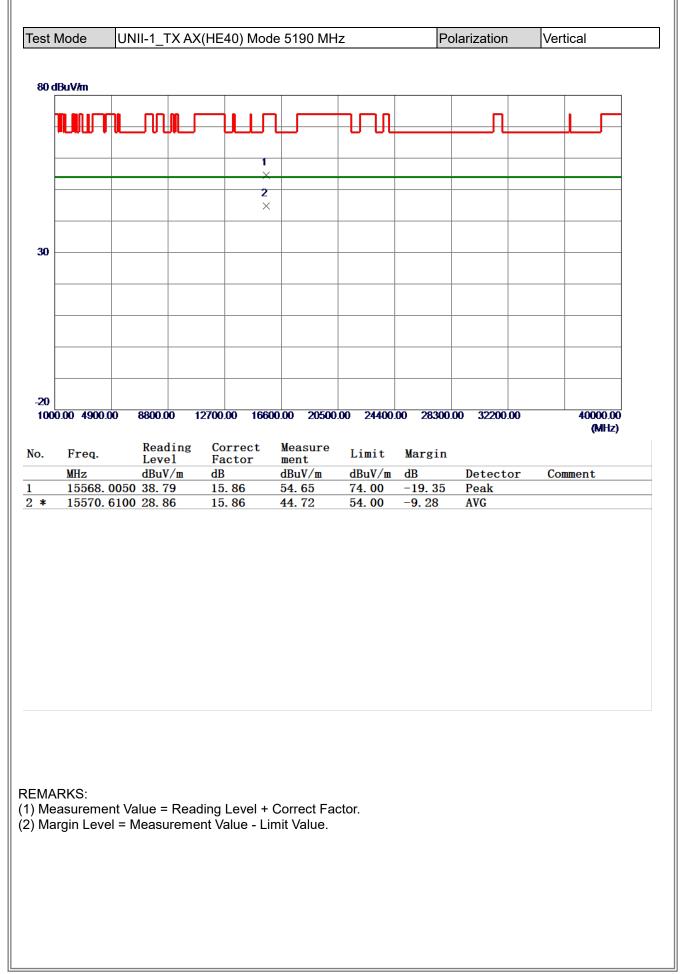




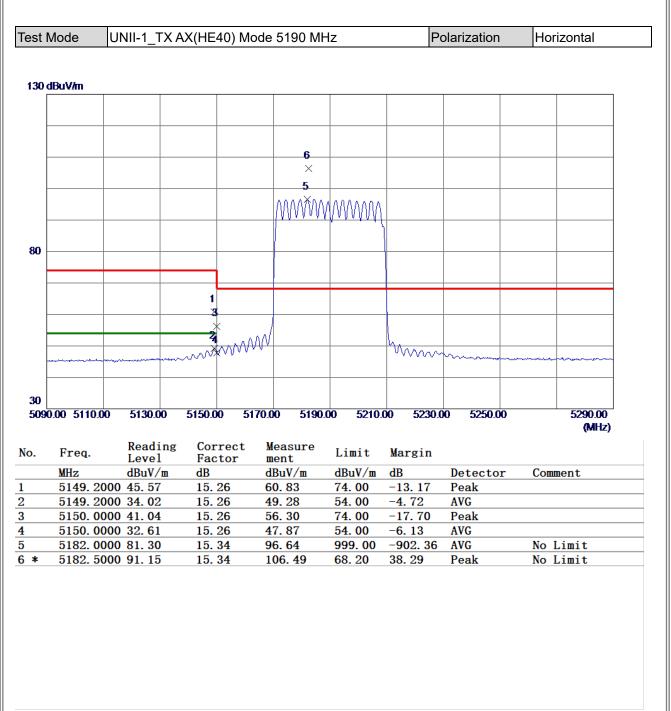
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5090.0	0 5110.00 Freq.	Reading	Correct	Measure	00 5210.0 Limit		0 5250.00	
o. 🗎						00 5230.0 Margin dB	Detector	
5090.0	Freq. MHz 5149.4000	Reading Level dBuV/m ) 45.78	Correct Factor dB 15.26	Measure ment dBuV/m 61.04	Limit dBuV/m 74.00	Margin dB -12.96	Detector Peak	(MHz)
5090.0	Freq. MHz 5149.4000 5149.4000	Reading Level dBuV/m 45.78 38.39	Correct Factor dB 15.26 15.26	Measure ment dBuV/m 61.04 53.65	Limit dBuV/m 74.00 54.00	Margin dB -12.96 -0.35	Detector Peak AVG	(MHz)
5090.0	Freq. MHz 5149.4000 5149.4000 5150.0000	Reading Level dBuV/m ) 45.78 ) 38.39 ) 47.21	Correct Factor dB 15.26 15.26 15.26	Measure ment dBuV/m 61.04 53.65 62.47	Limit dBuV/m 74.00 54.00 74.00	Margin dB -12.96 -0.35 -11.53	Detector Peak AVG Peak	(MHz)
5090.0 p. 1 1 1 1 1 1 1 1 1 1 1 1 1 1	Freq. MHz 5149.4000 5149.4000	Reading Level dBuV/m ) 45.78 ) 38.39 ) 47.21 ) 38.01	Correct Factor dB 15.26 15.26	Measure ment dBuV/m 61.04 53.65	Limit dBuV/m 74.00 54.00	Margin dB -12.96 -0.35	Detector Peak AVG	(MHz)

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



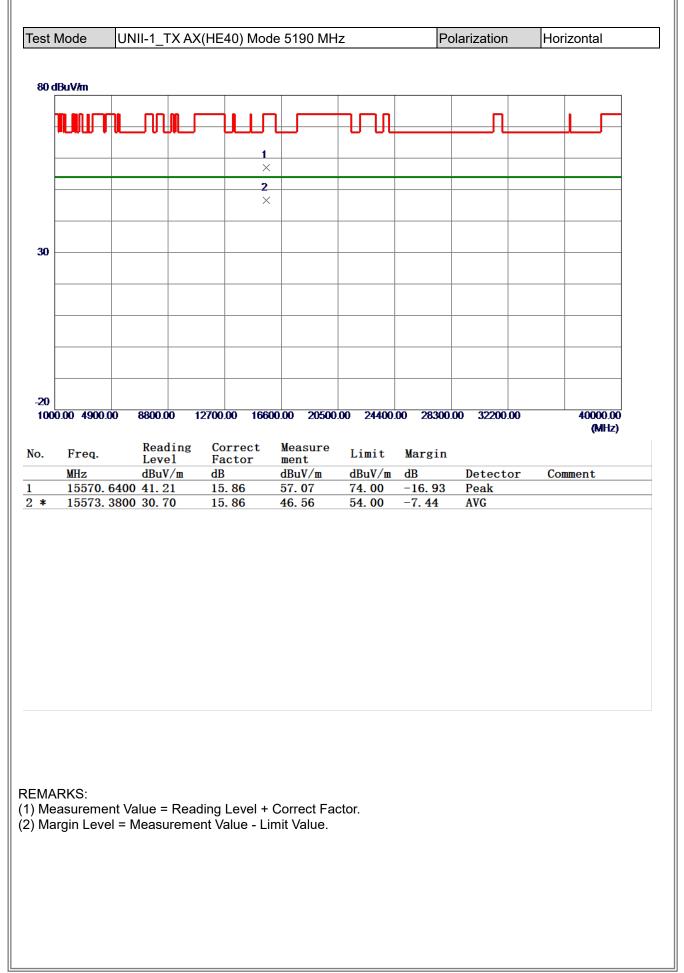




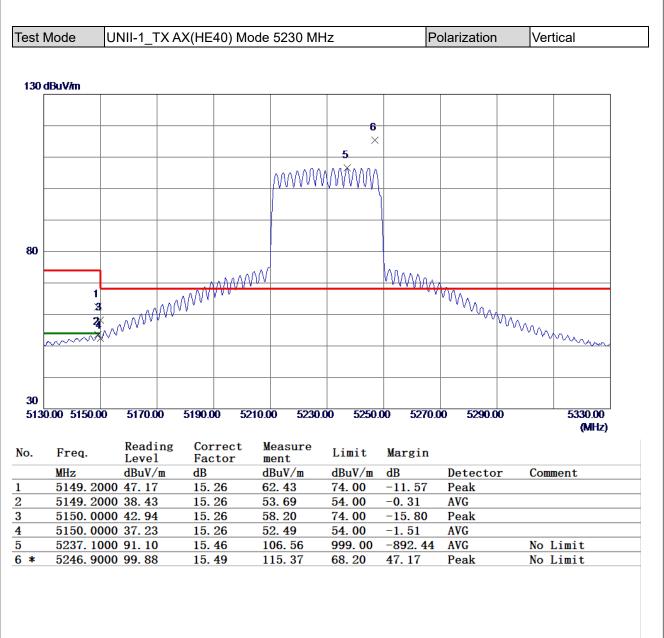


- (1) Measurement Value = Reading Level + Correct Factor.
- (2) Margin Level = Measurement Value Limit Value.



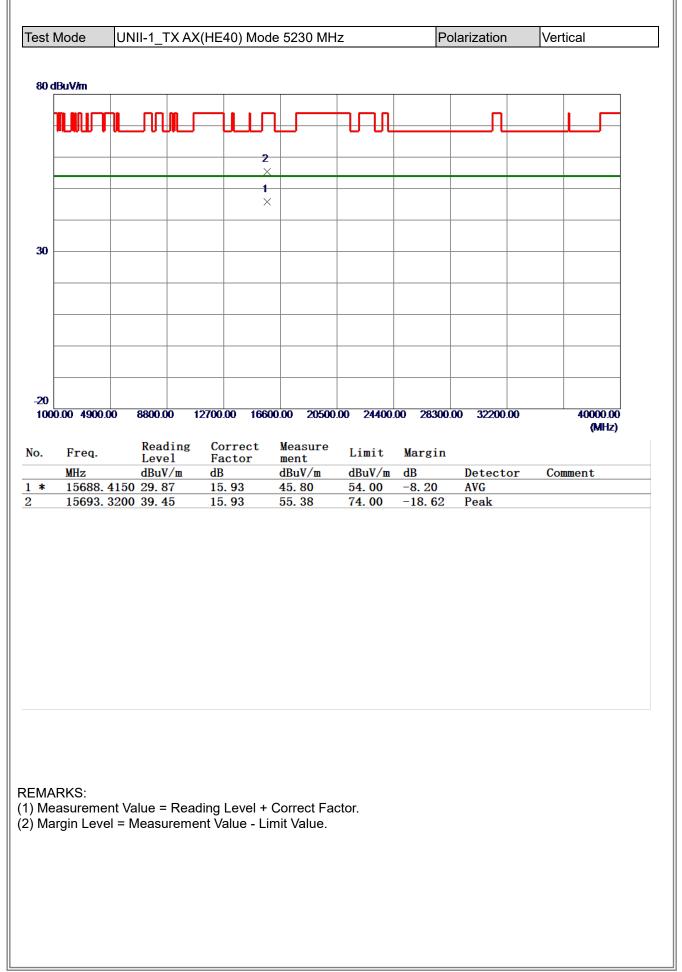




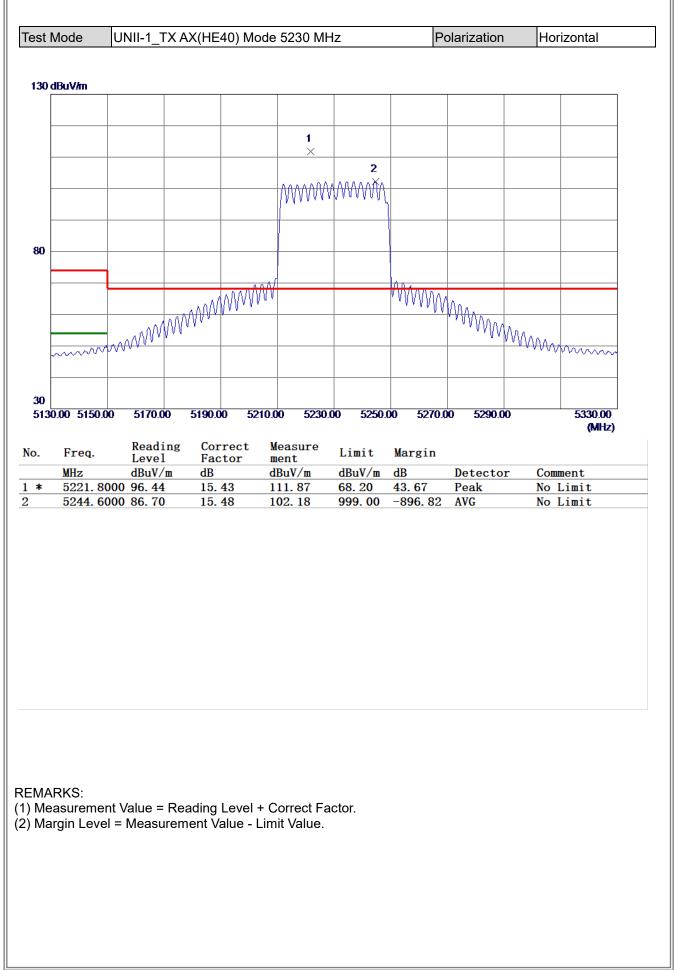


- (1) Measurement Value = Reading Level + Correct Factor.
- (2) Margin Level = Measurement Value Limit Value.

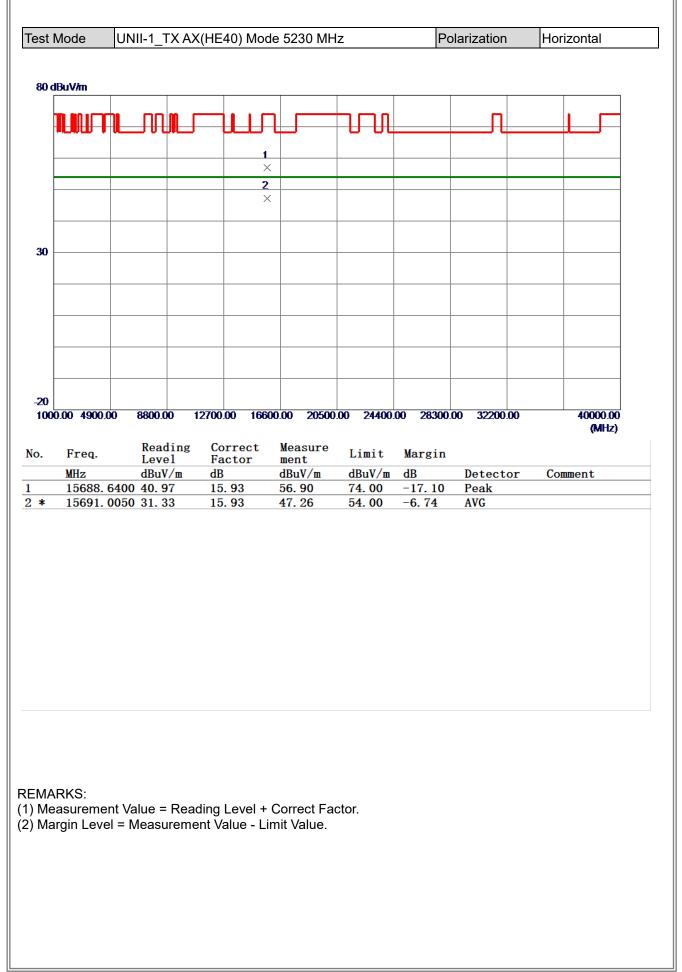




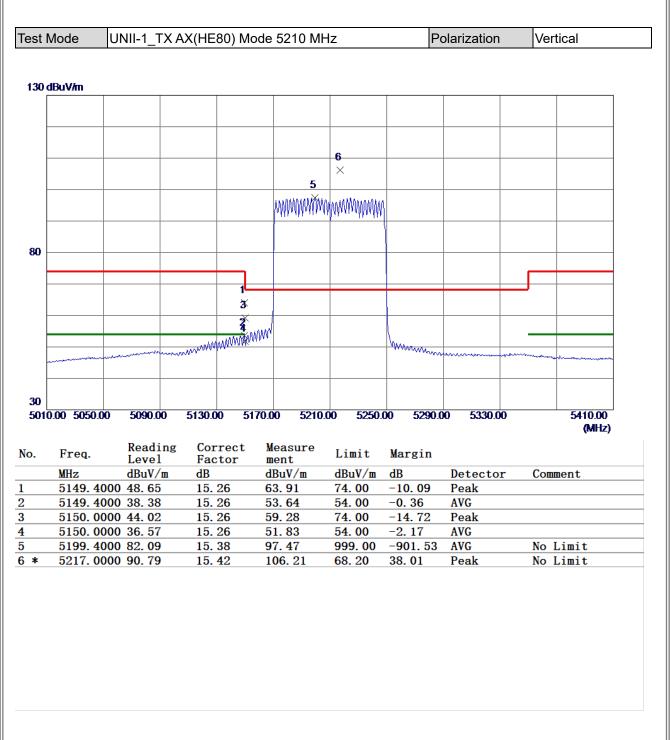






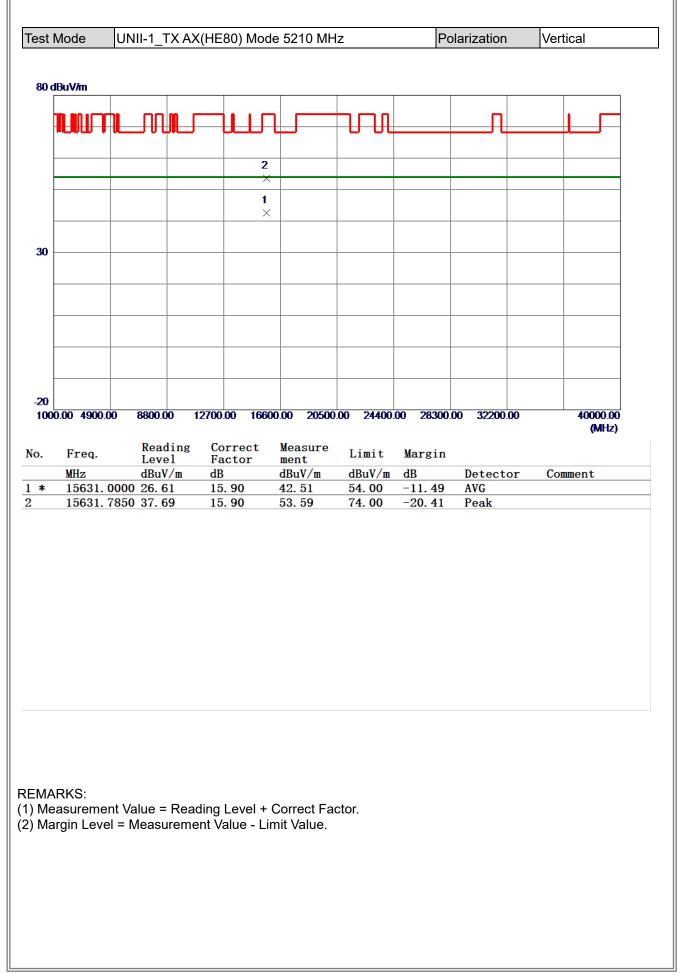




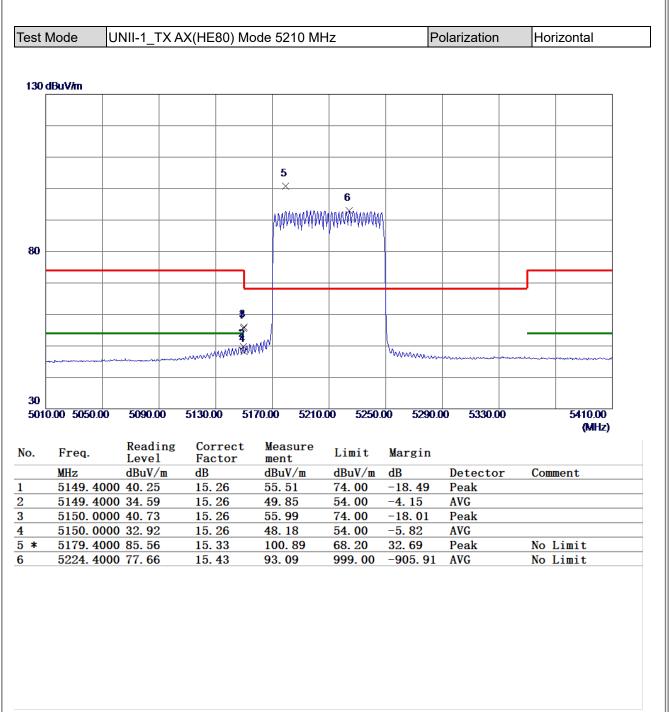


- (1) Measurement Value = Reading Level + Correct Factor.
- (2) Margin Level = Measurement Value Limit Value.



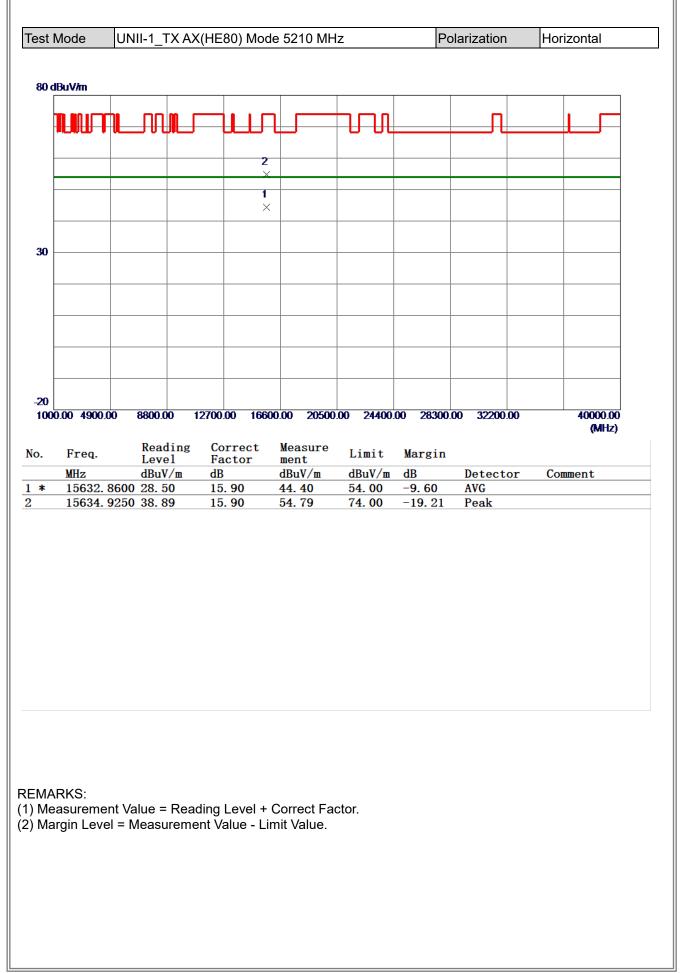




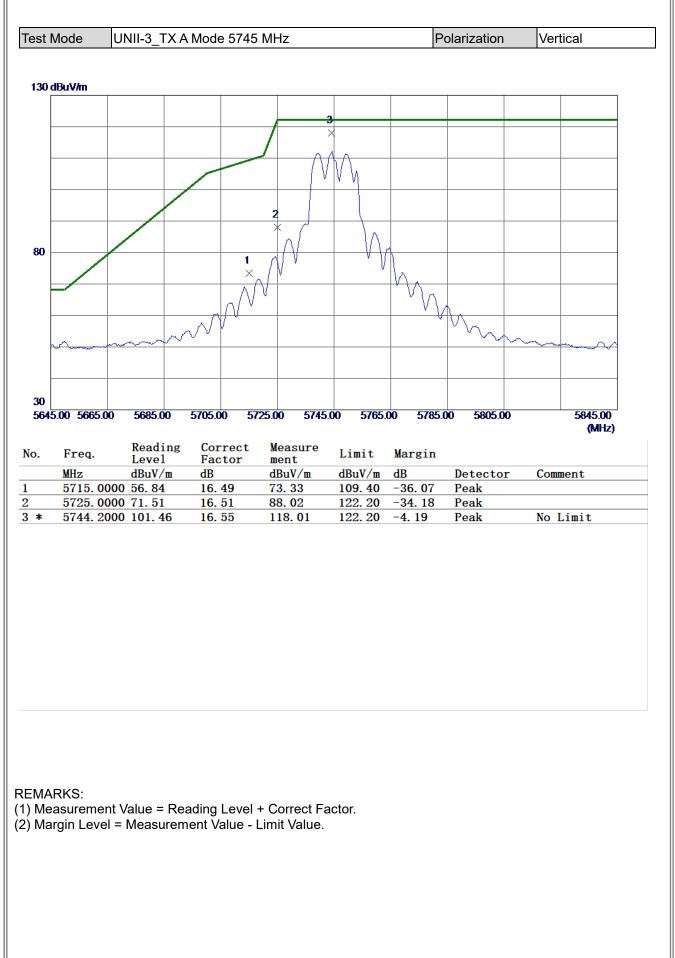


- (1) Measurement Value = Reading Level + Correct Factor.
- (2) Margin Level = Measurement Value Limit Value.

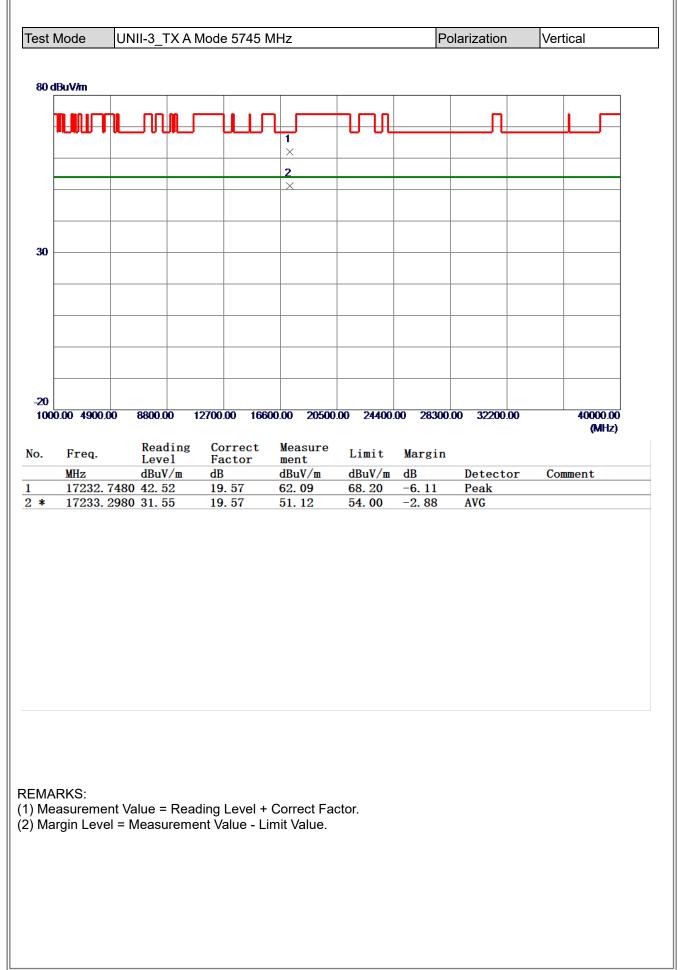




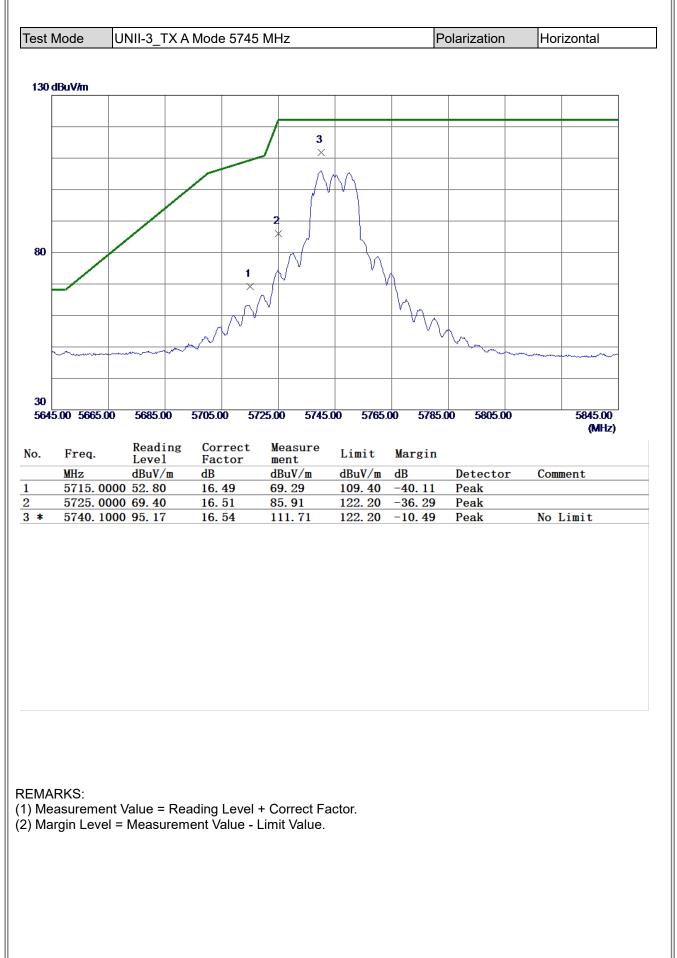




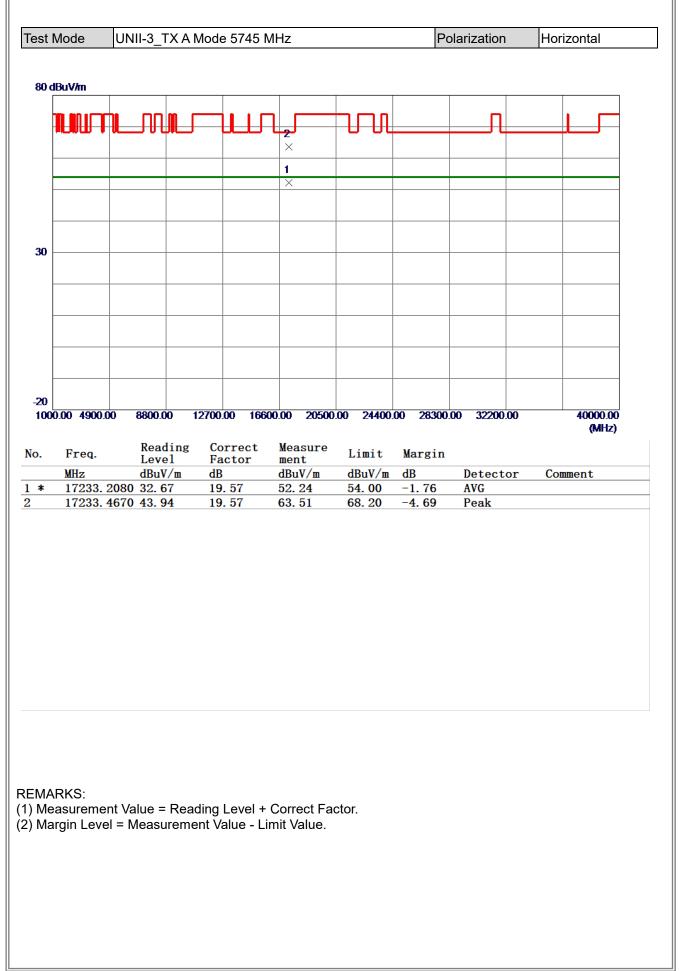




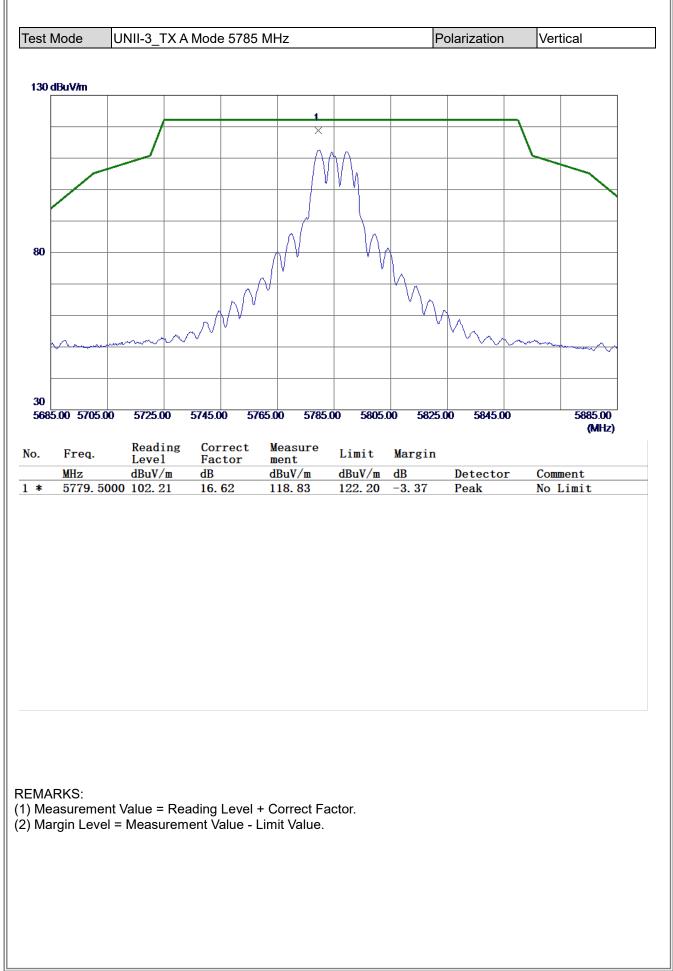




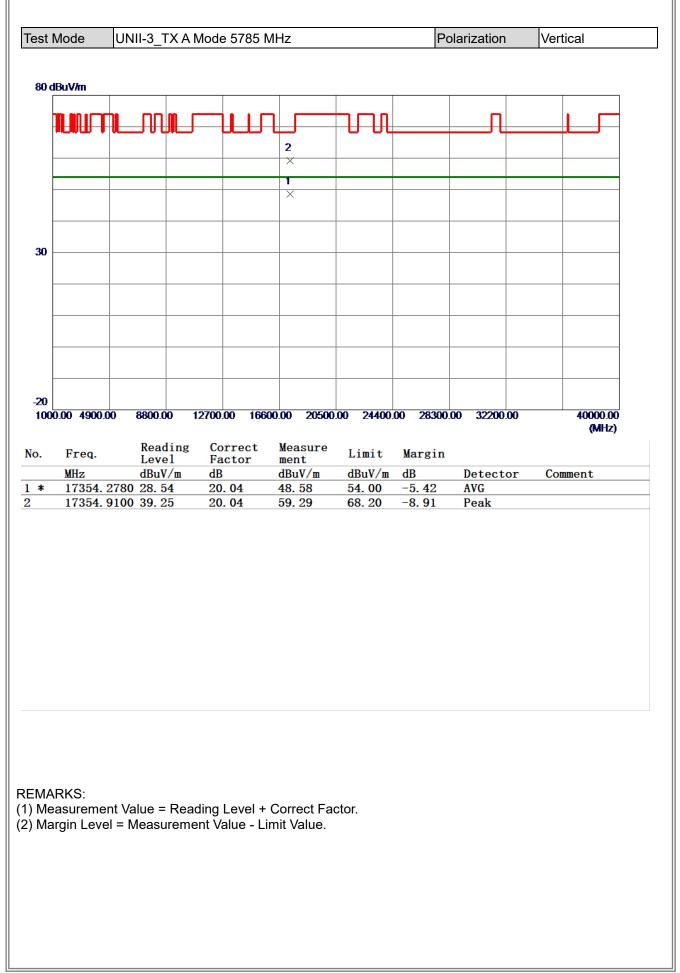




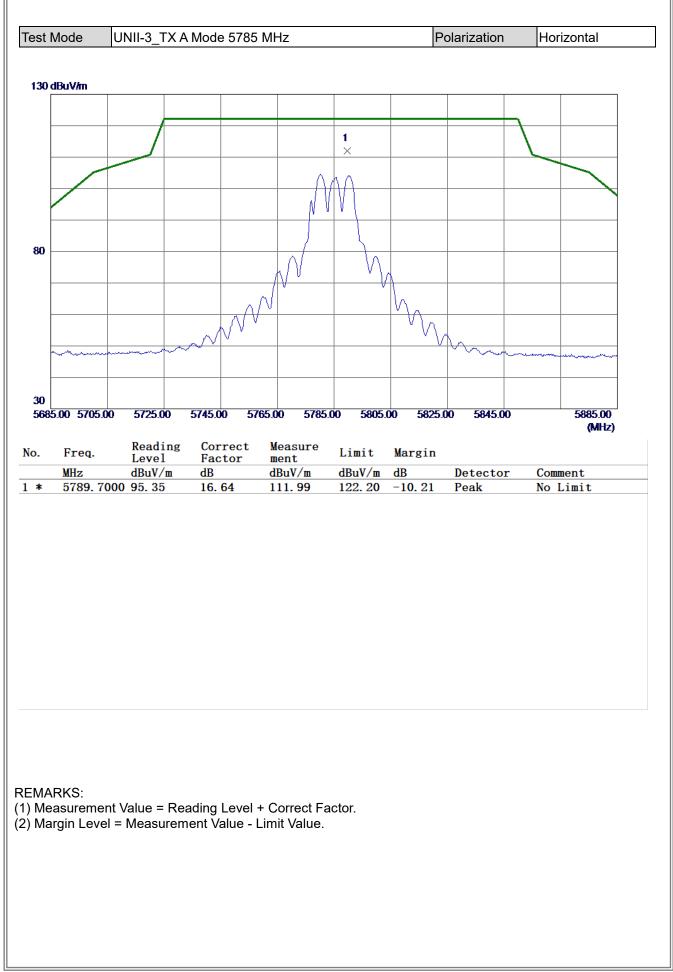




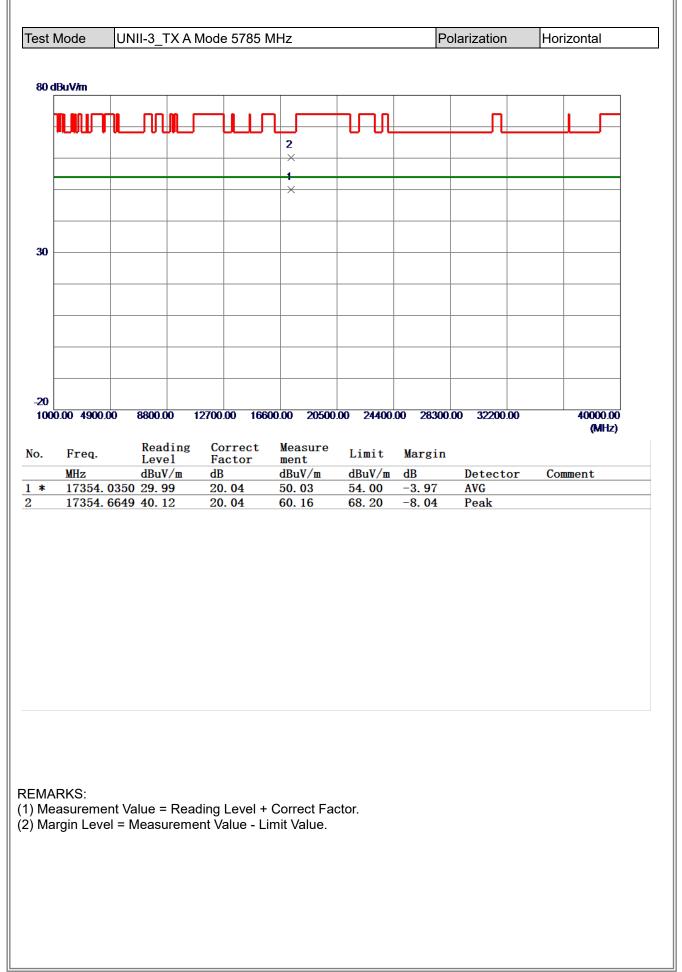




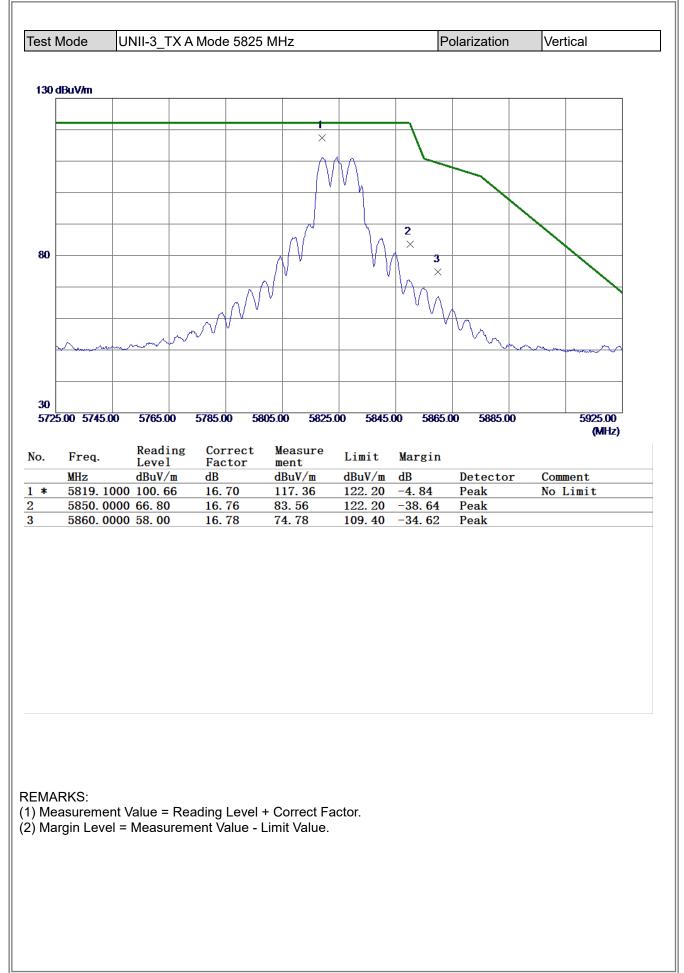
## **BIL**



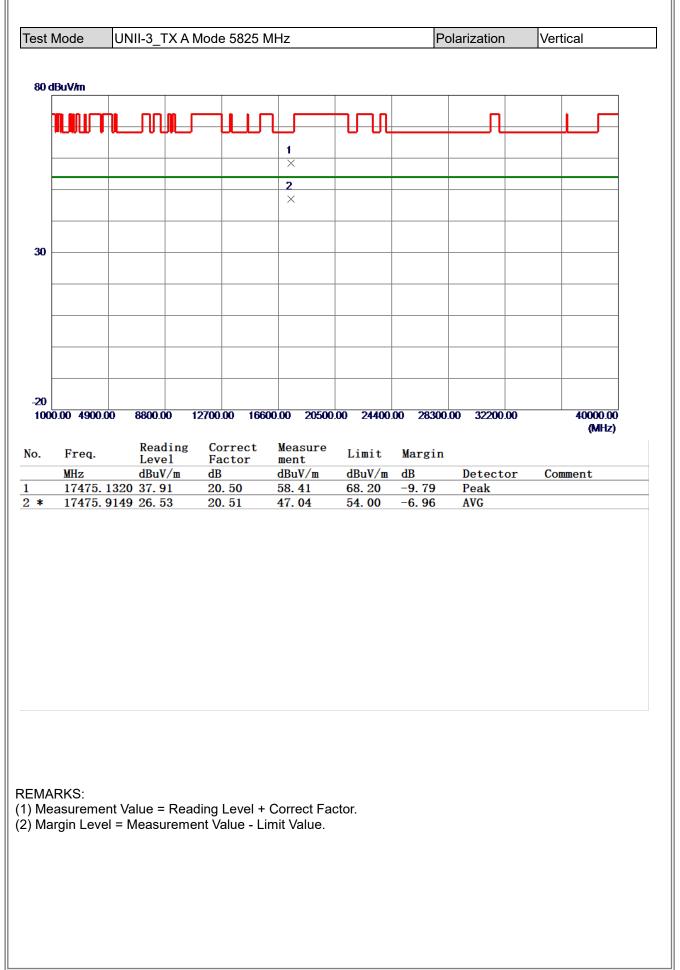




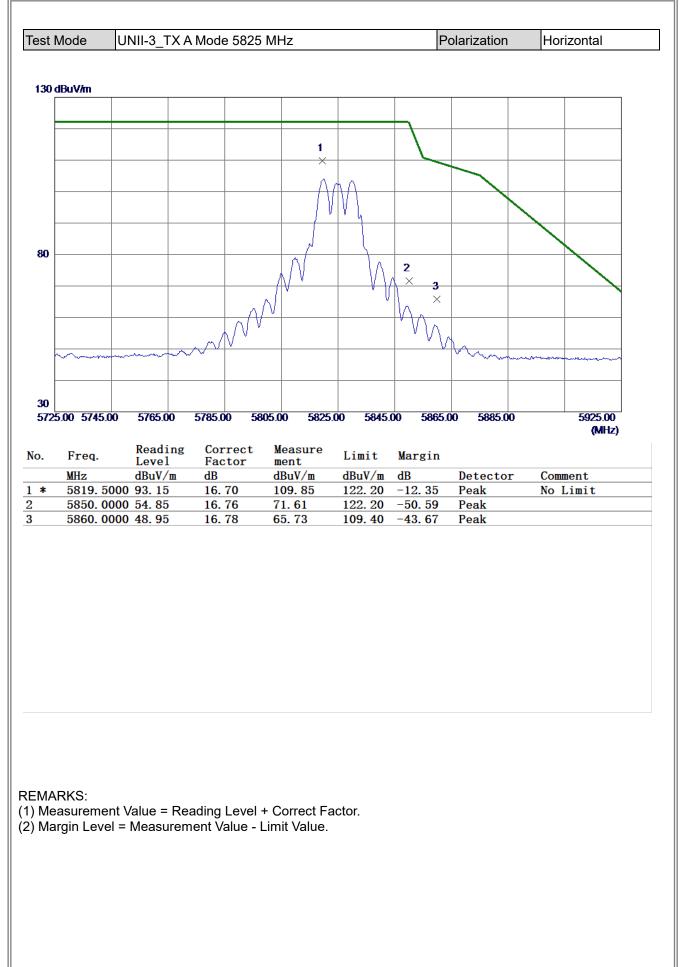
## **BIL**



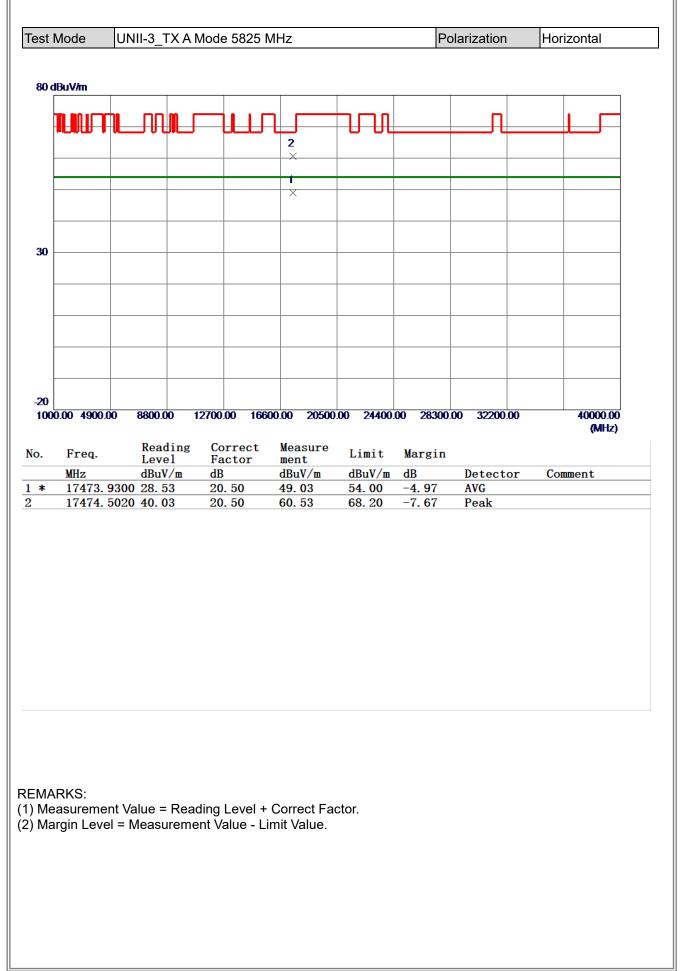




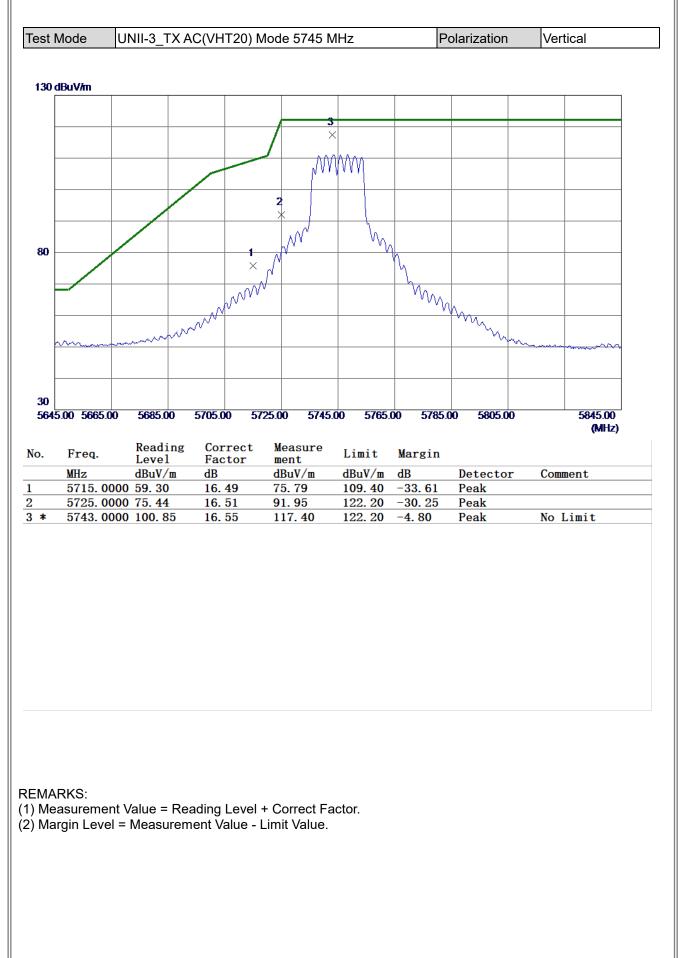
## **BIL**



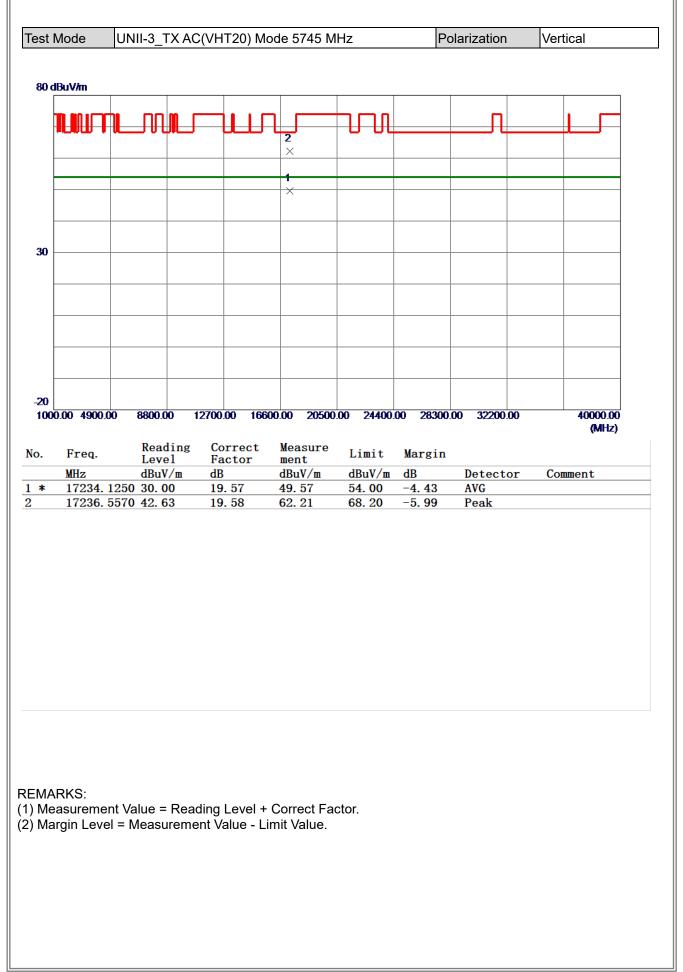




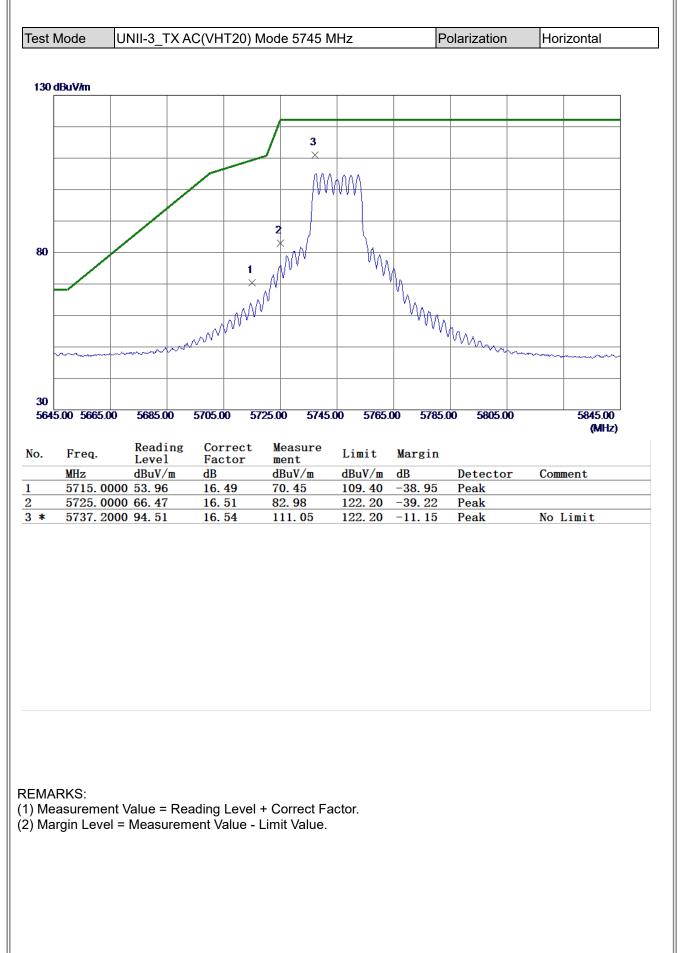




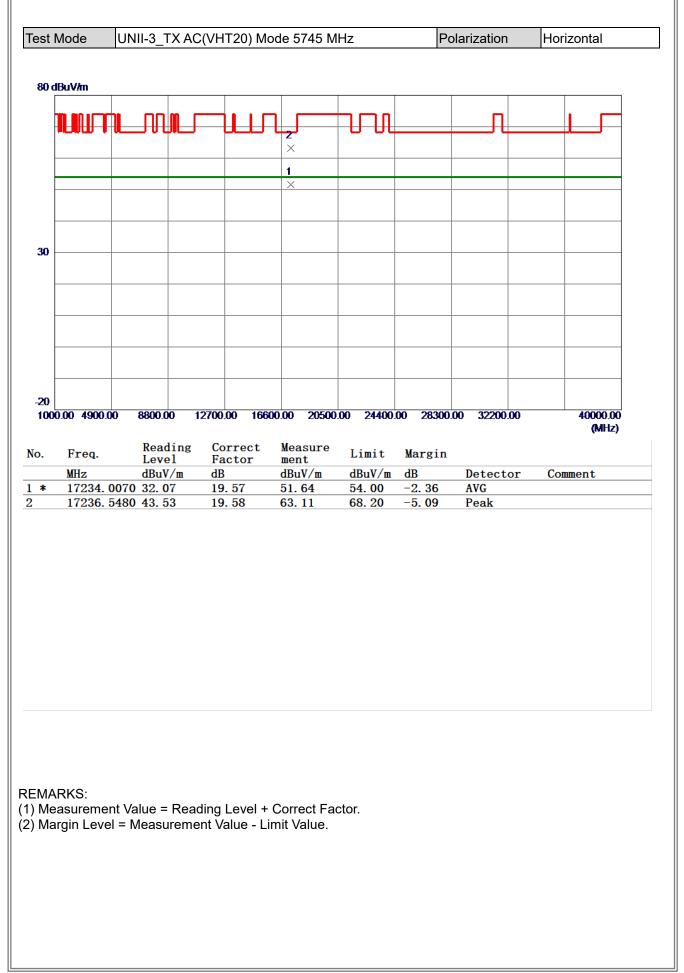




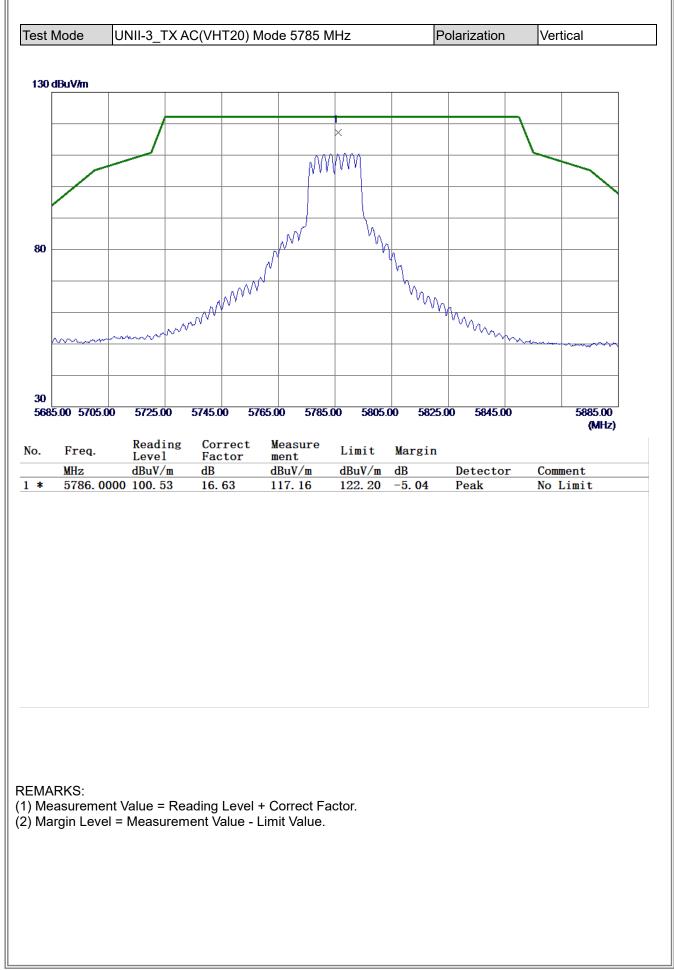




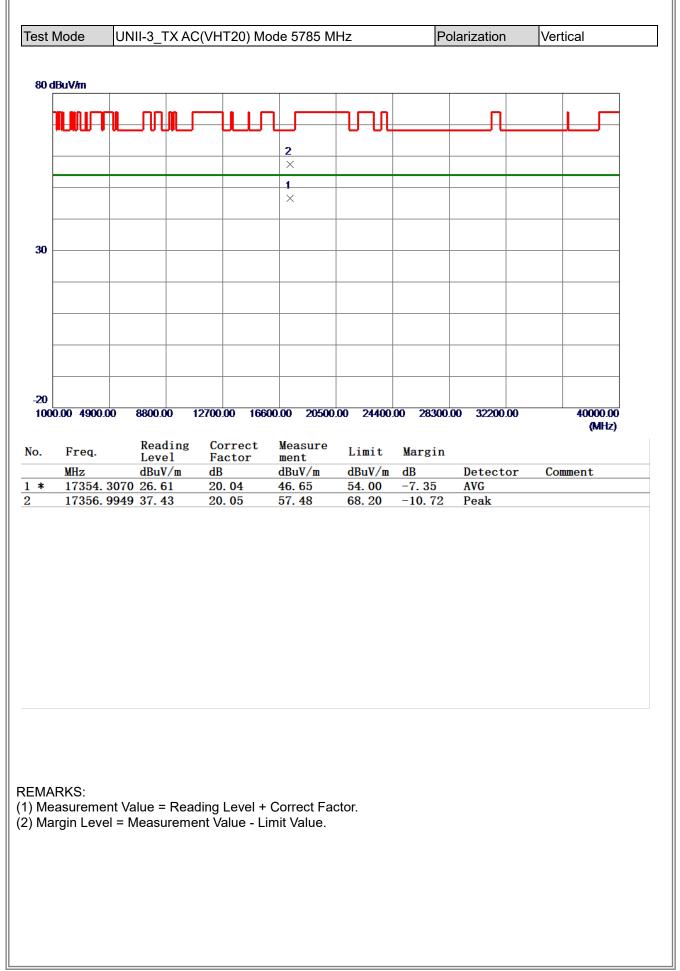




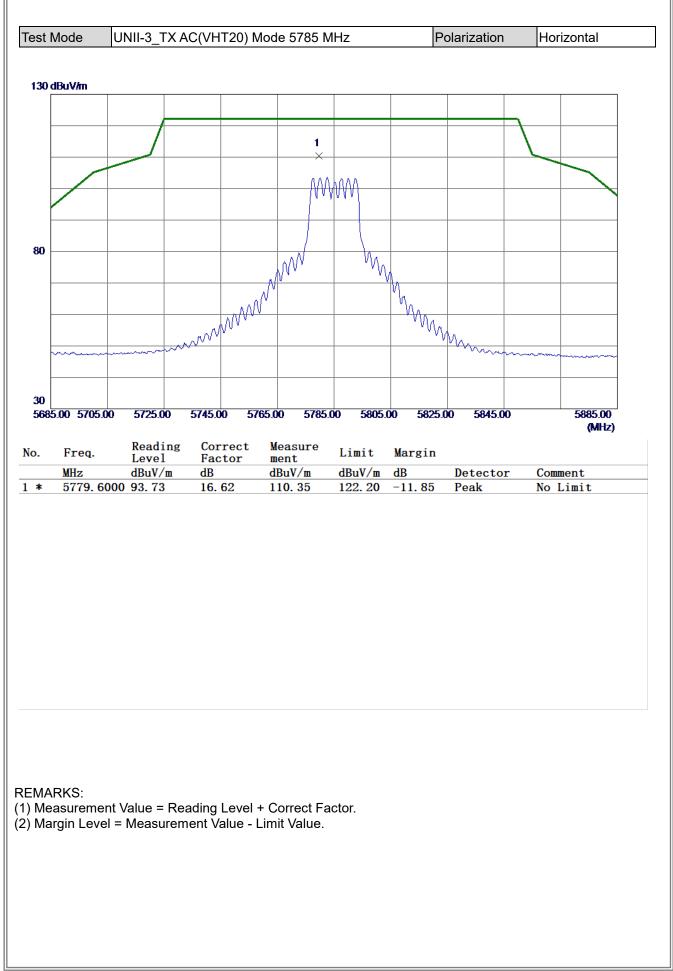




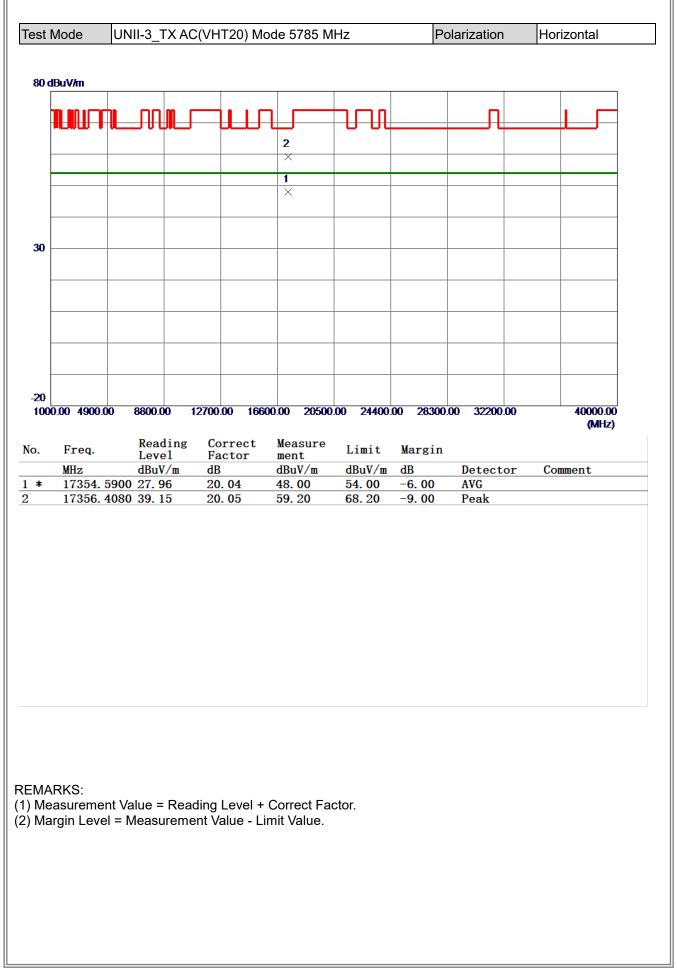




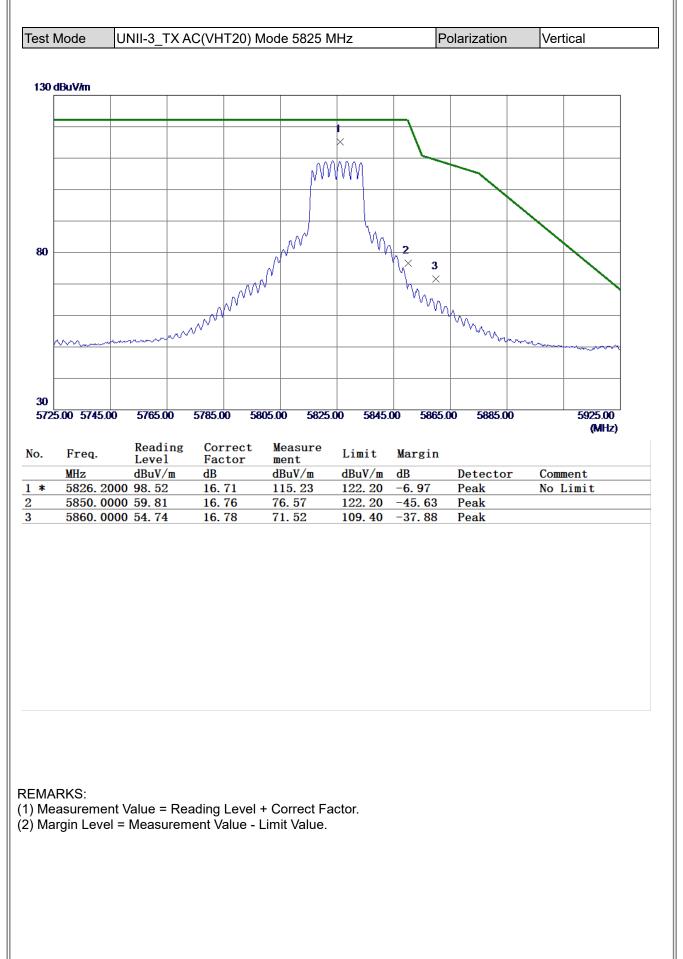




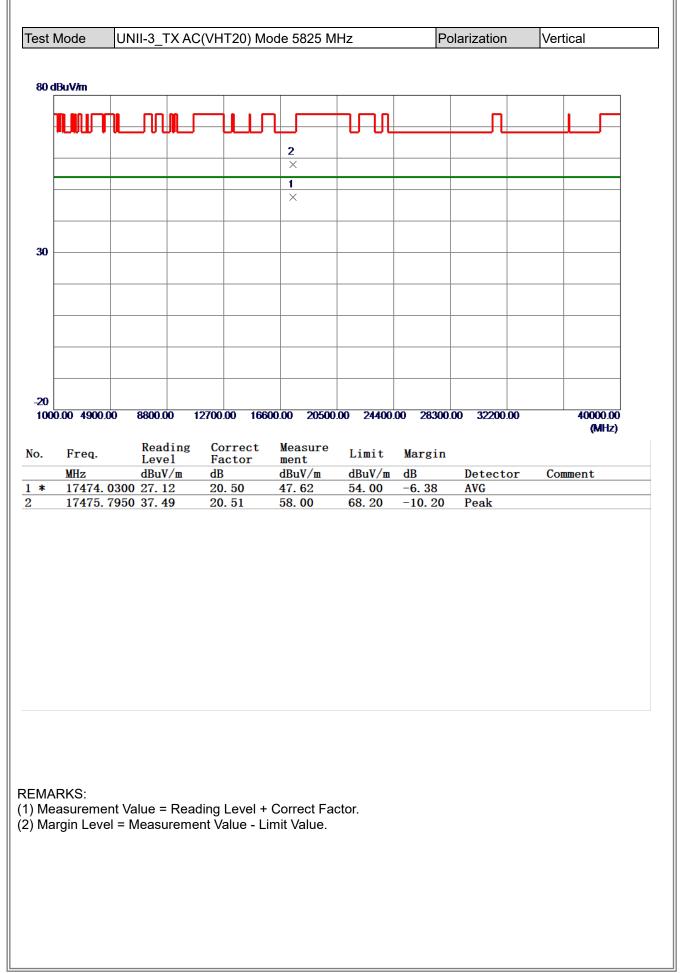




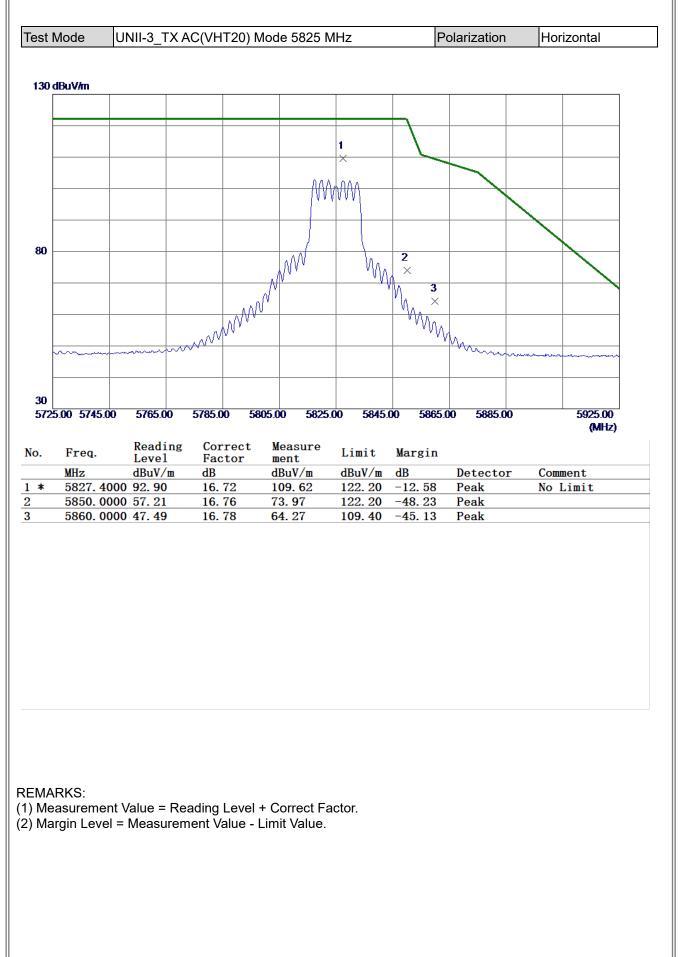




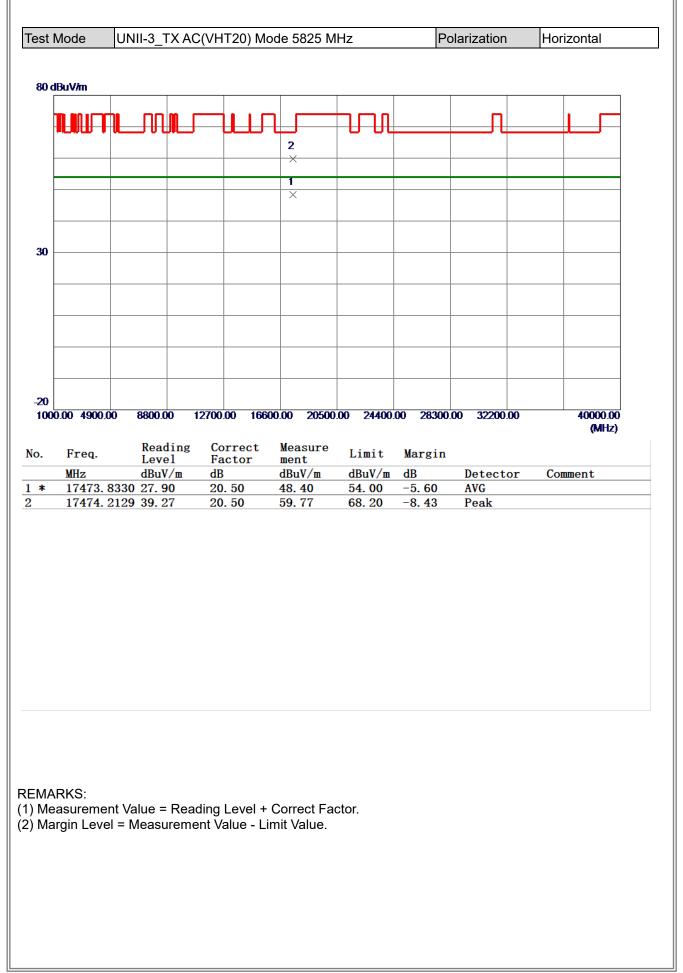




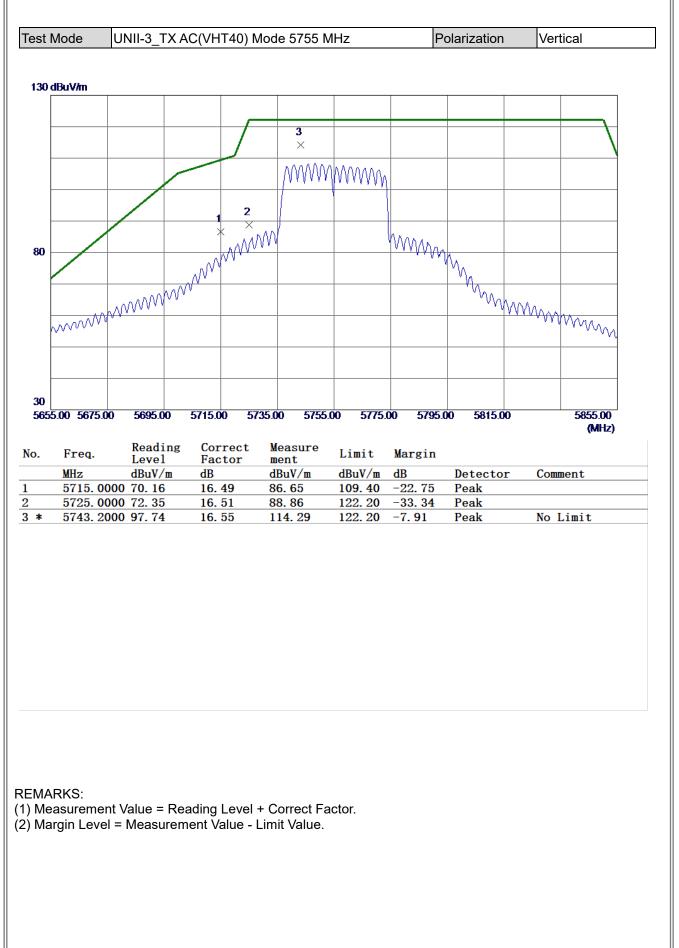




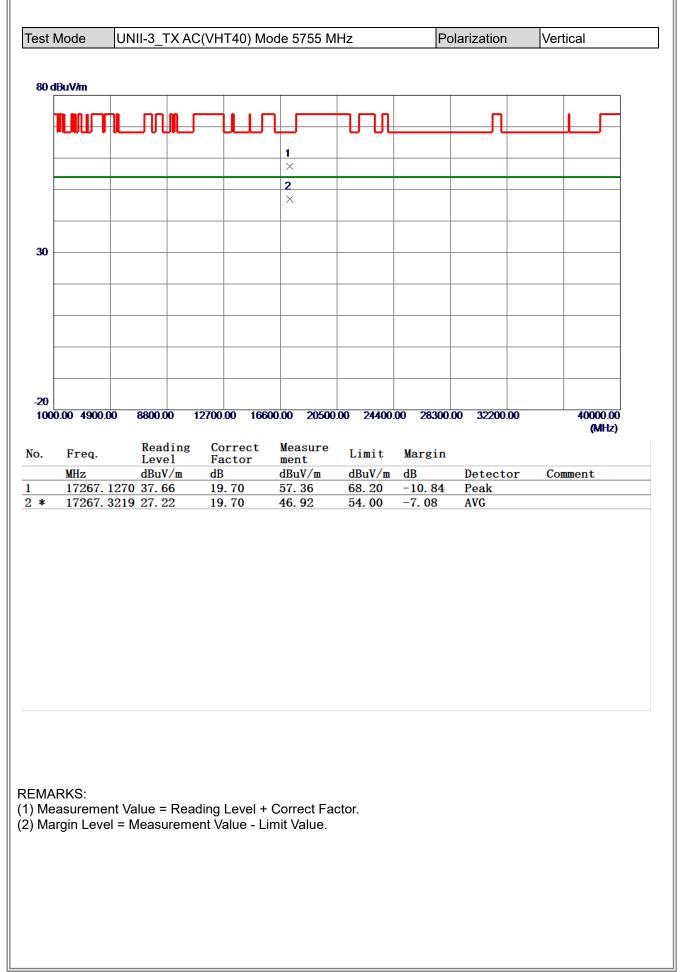




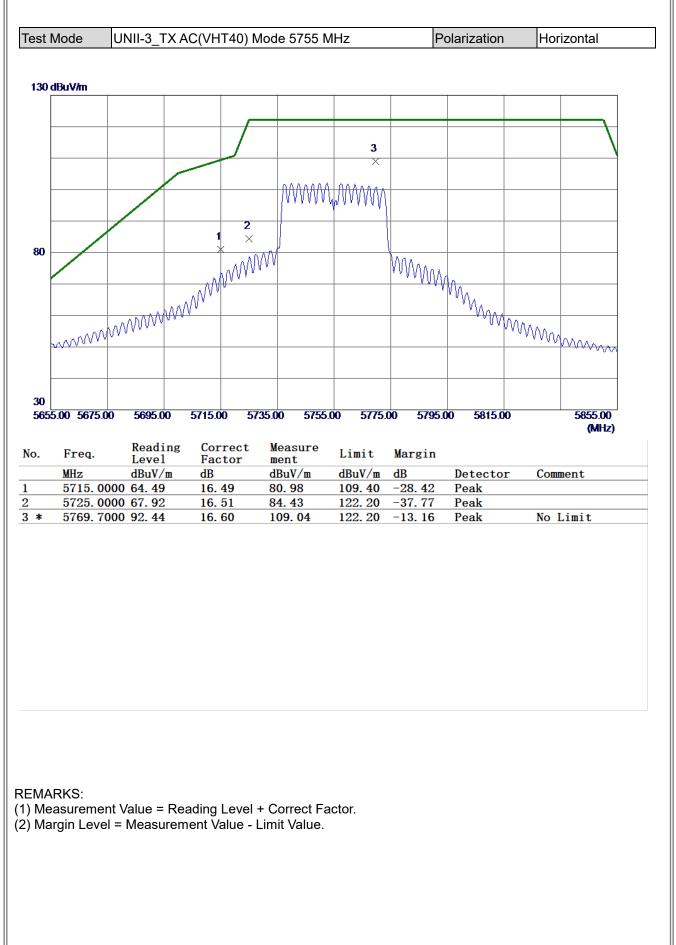




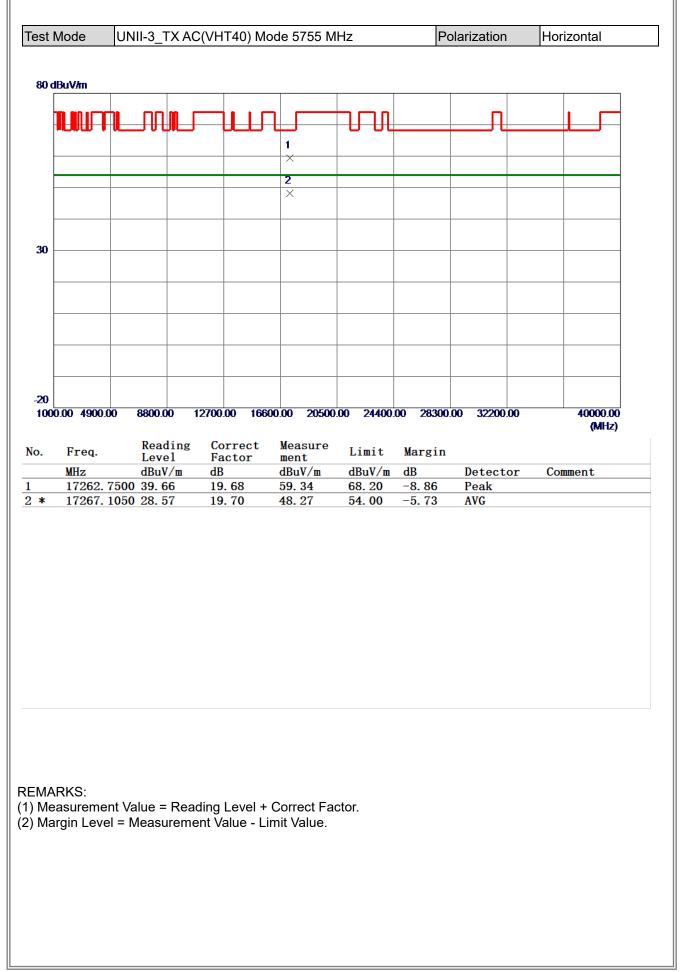




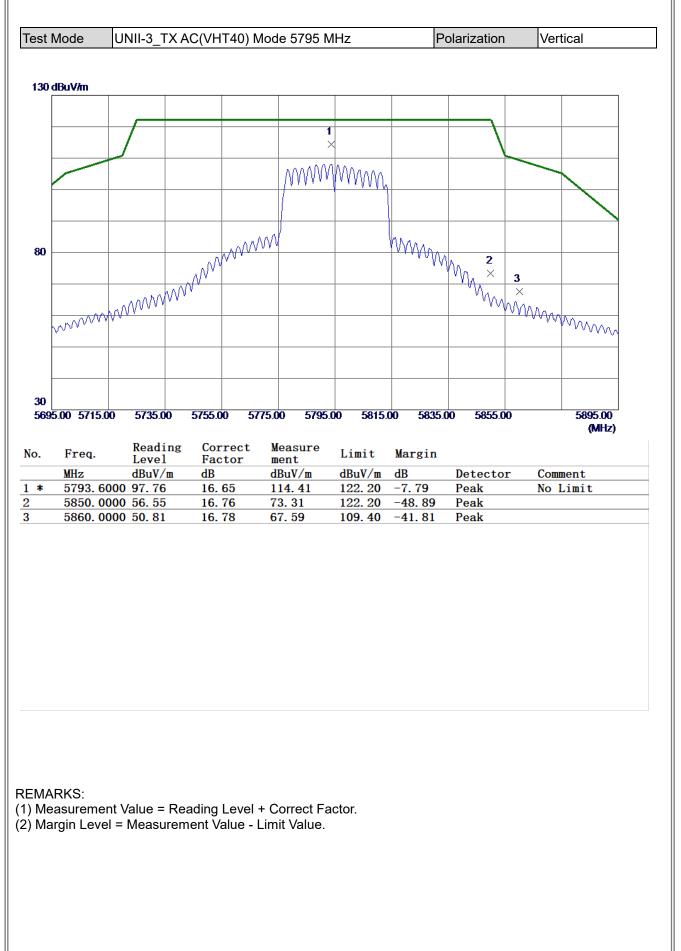




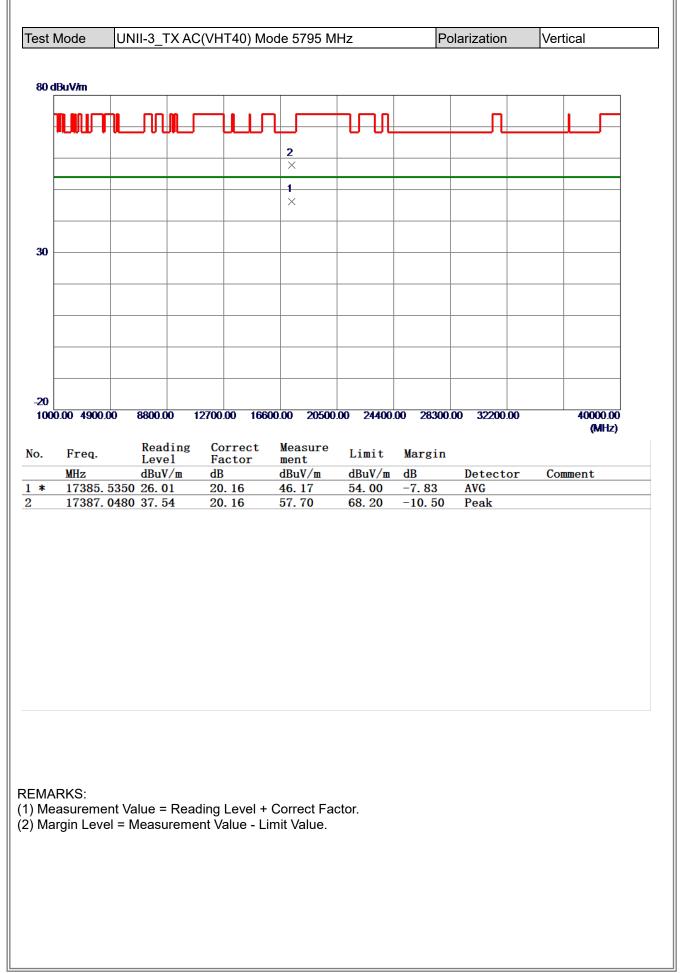




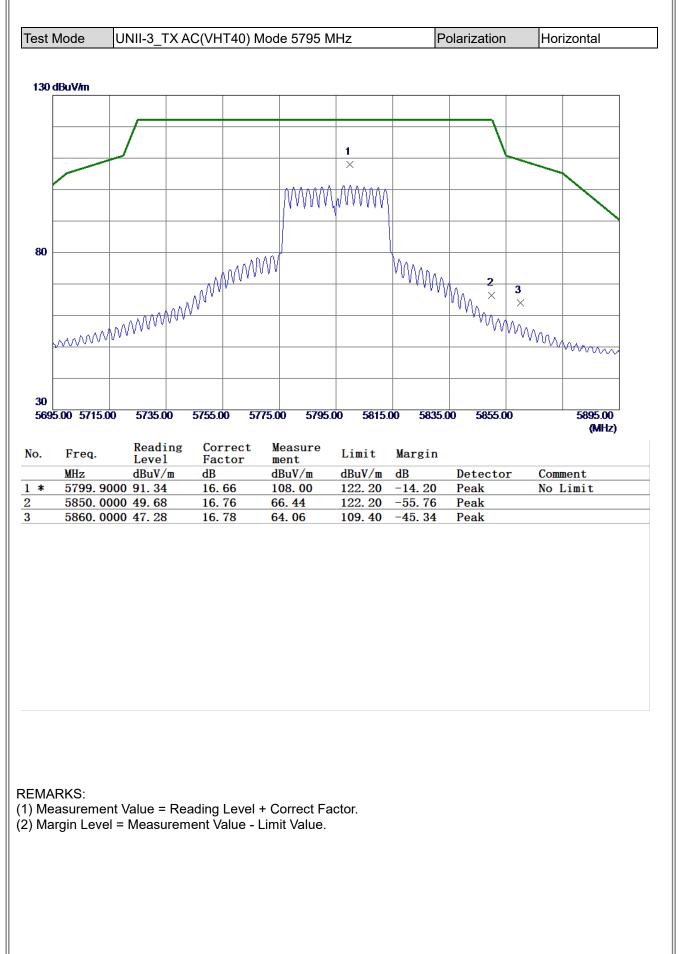




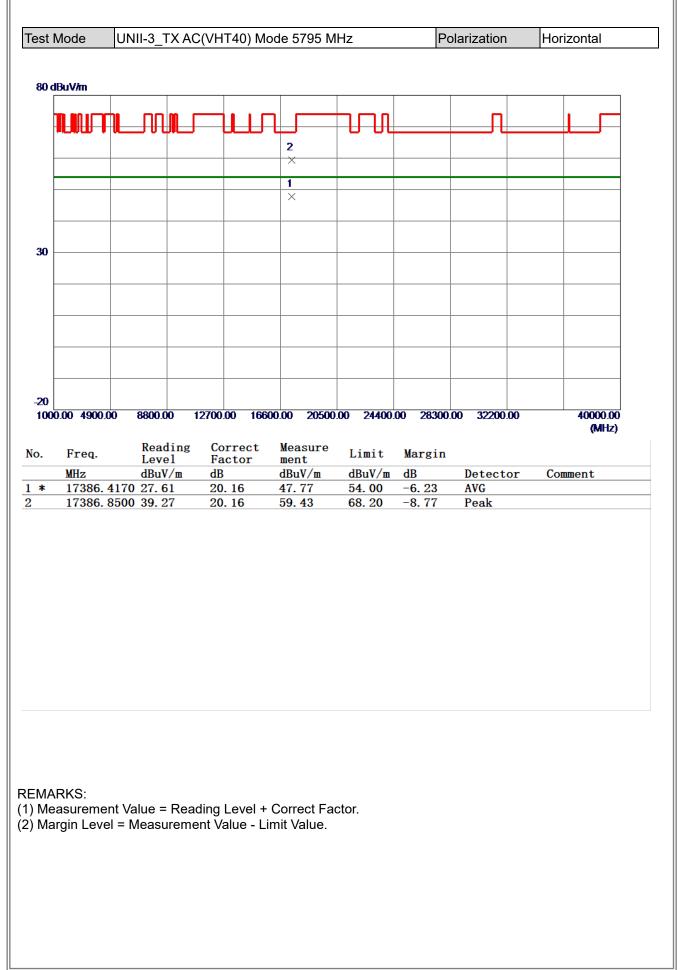




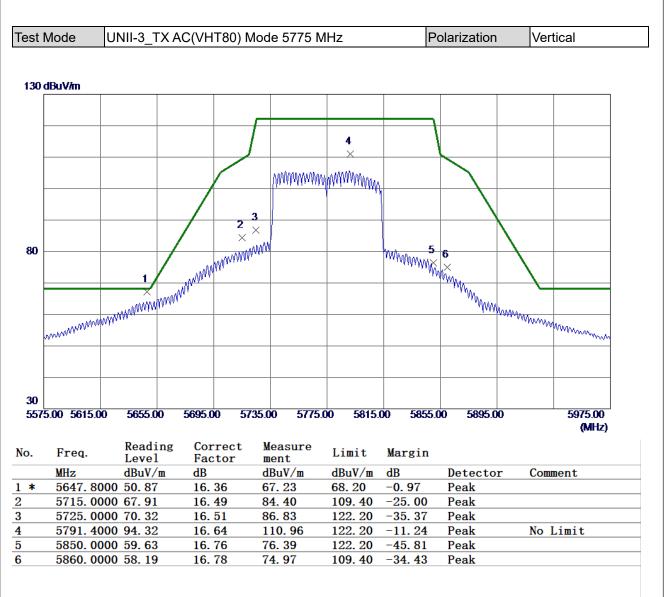








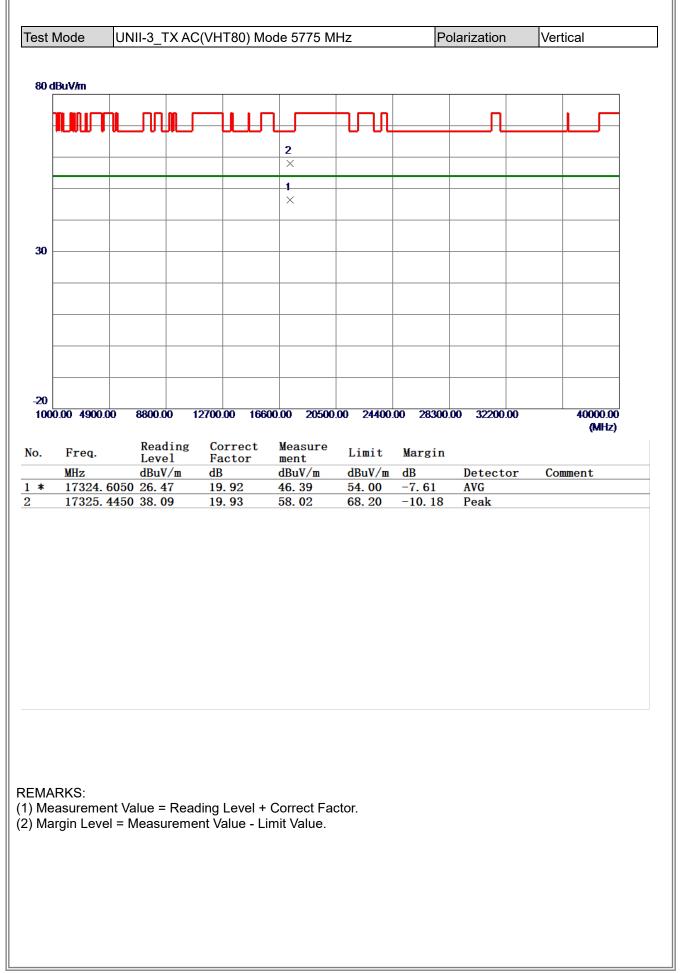




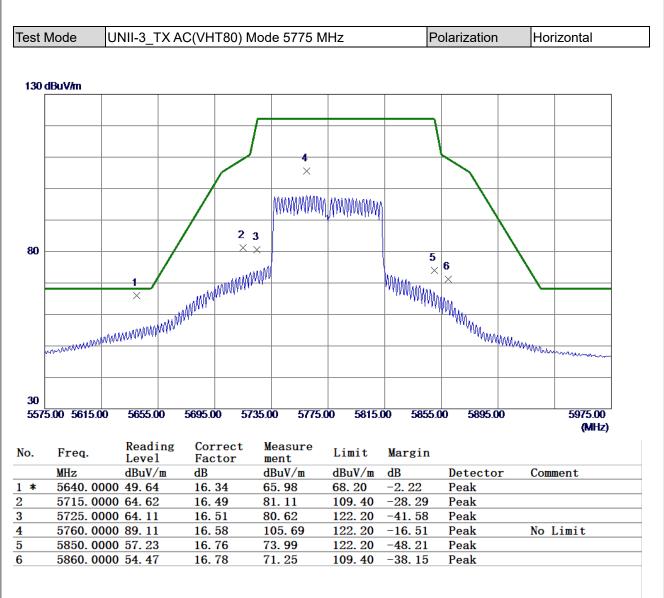
**REMARKS**:

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





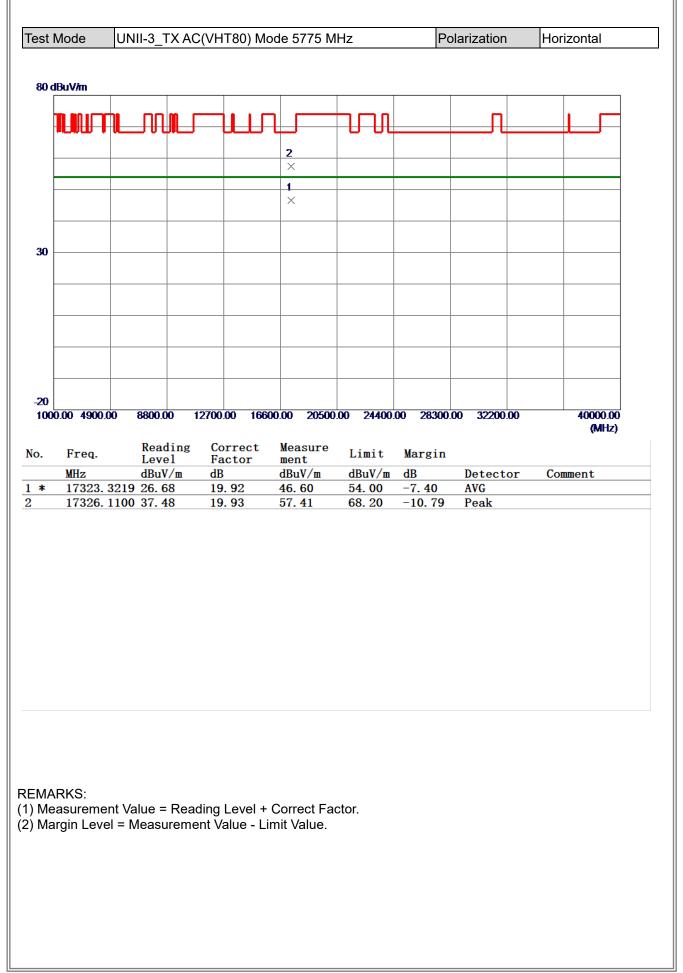




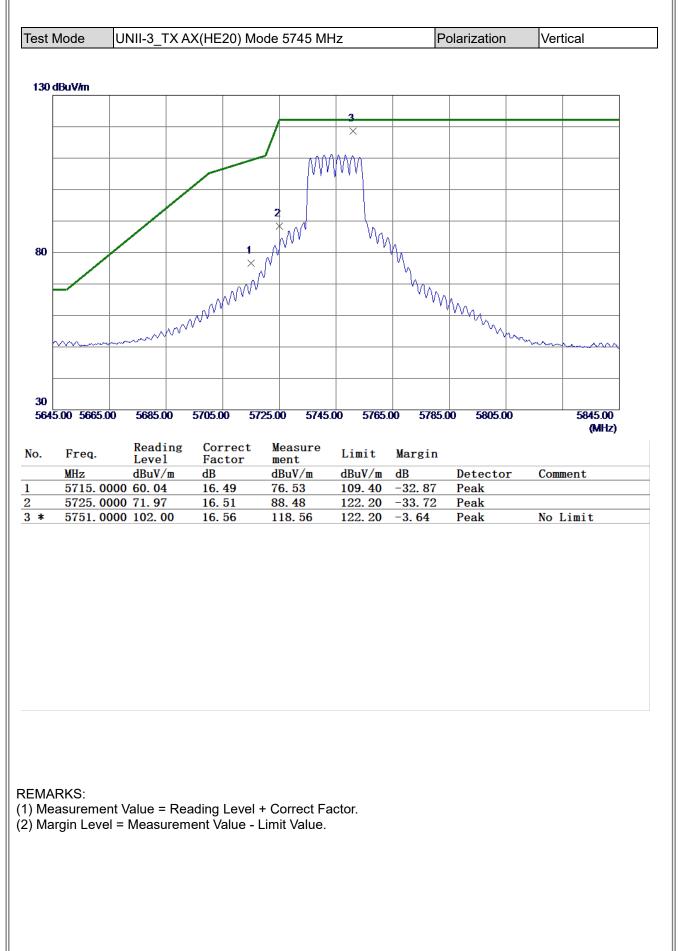
REMARKS:

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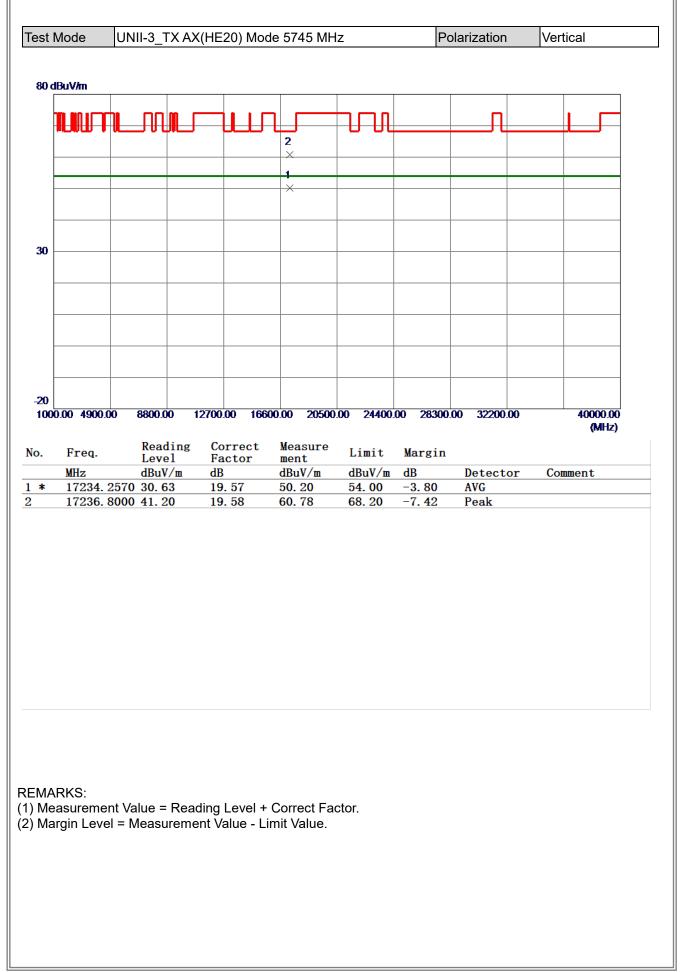




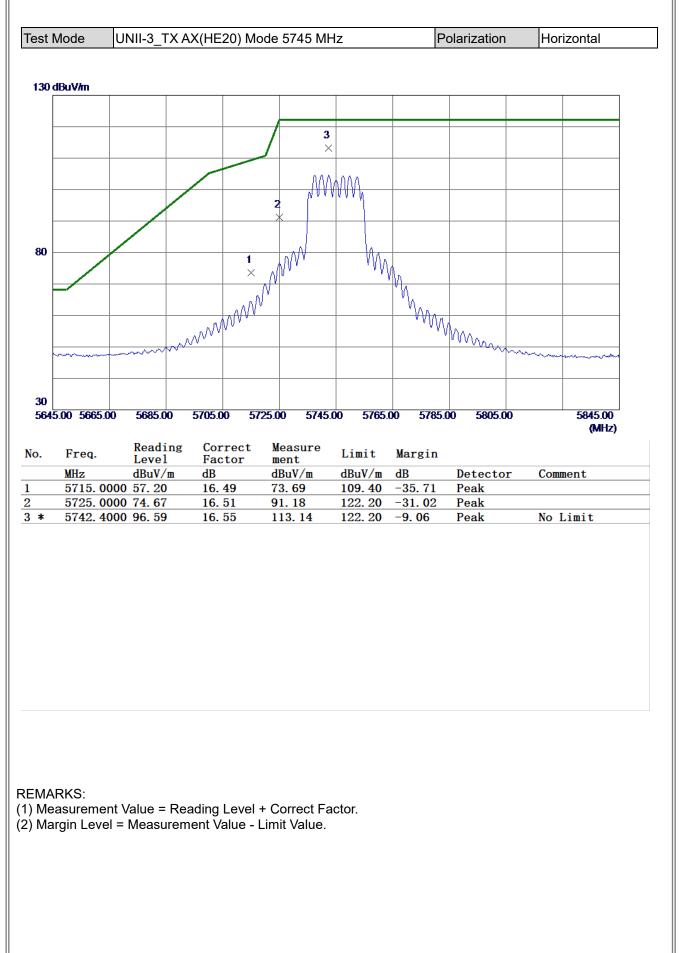




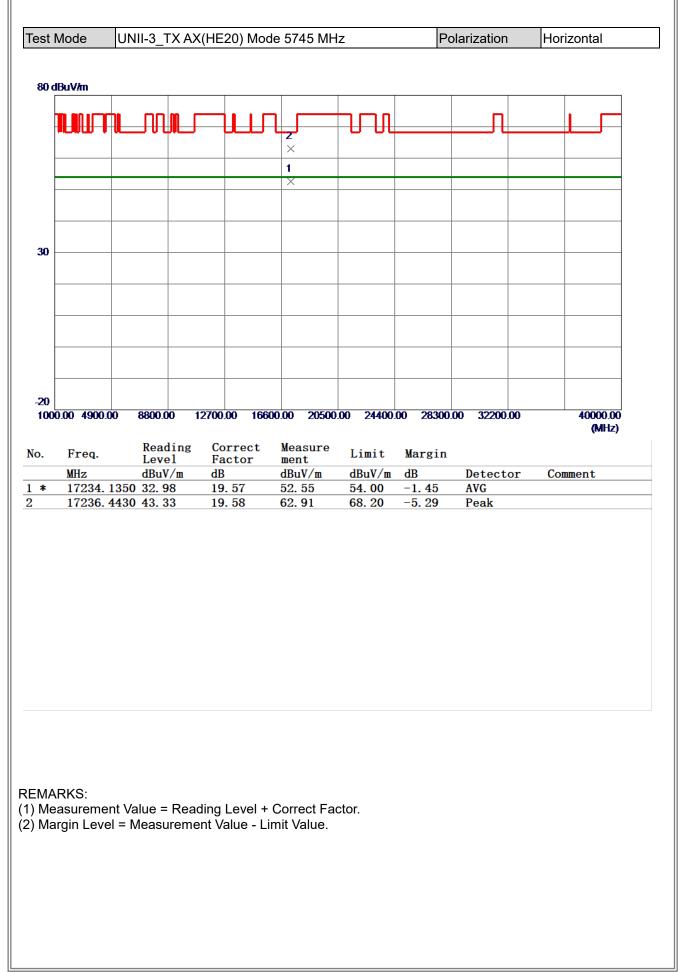




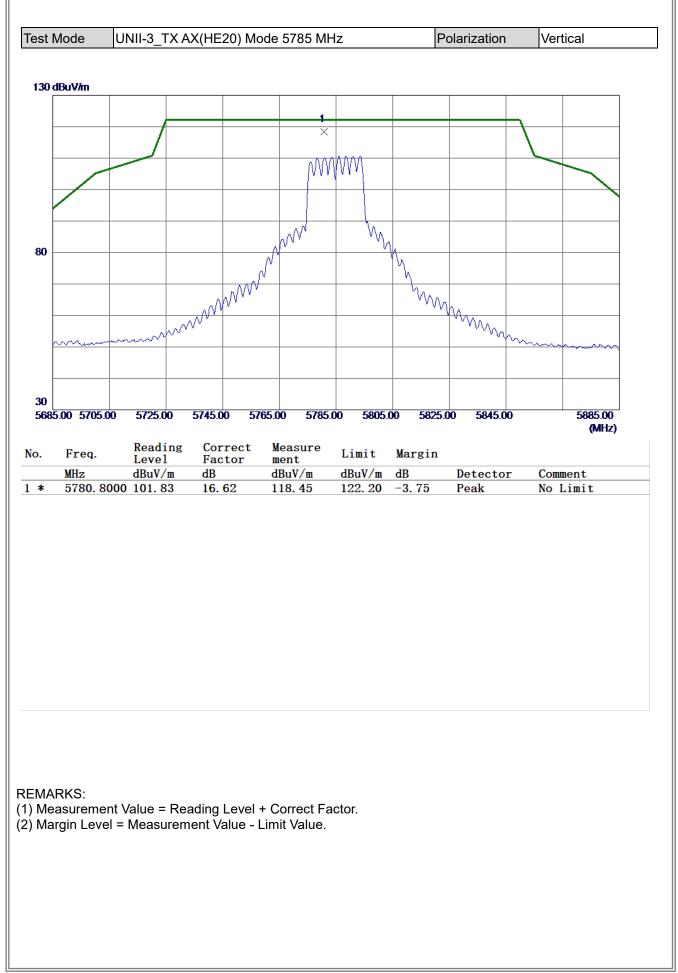




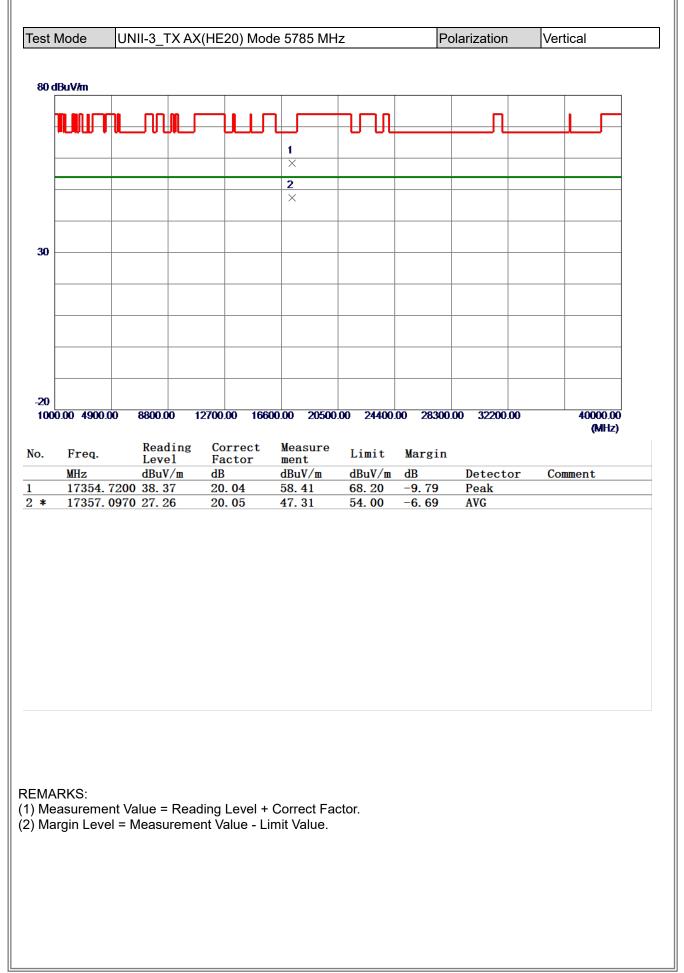




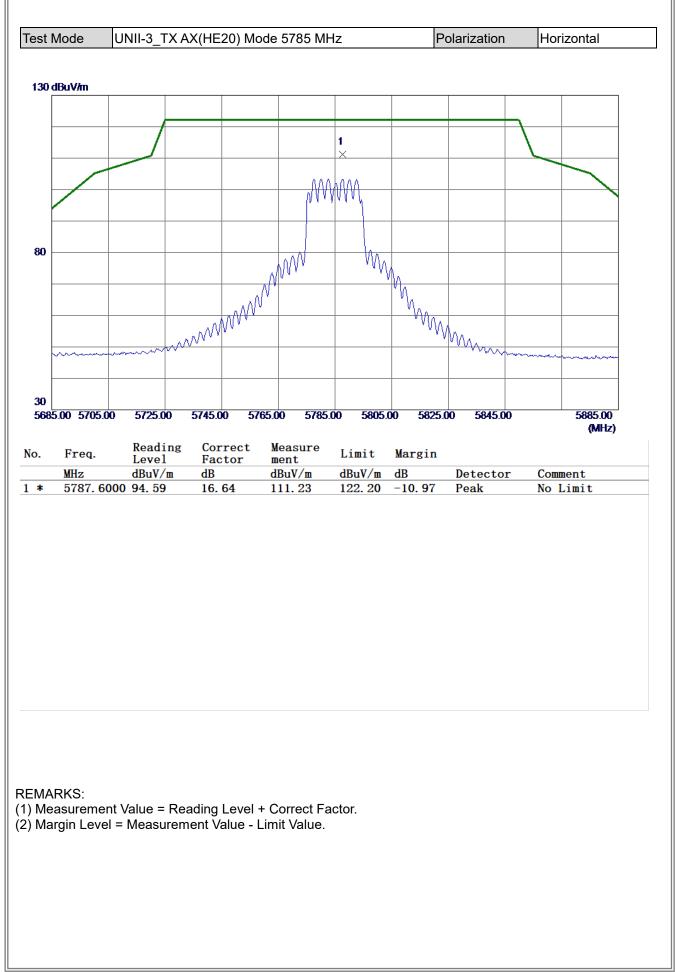




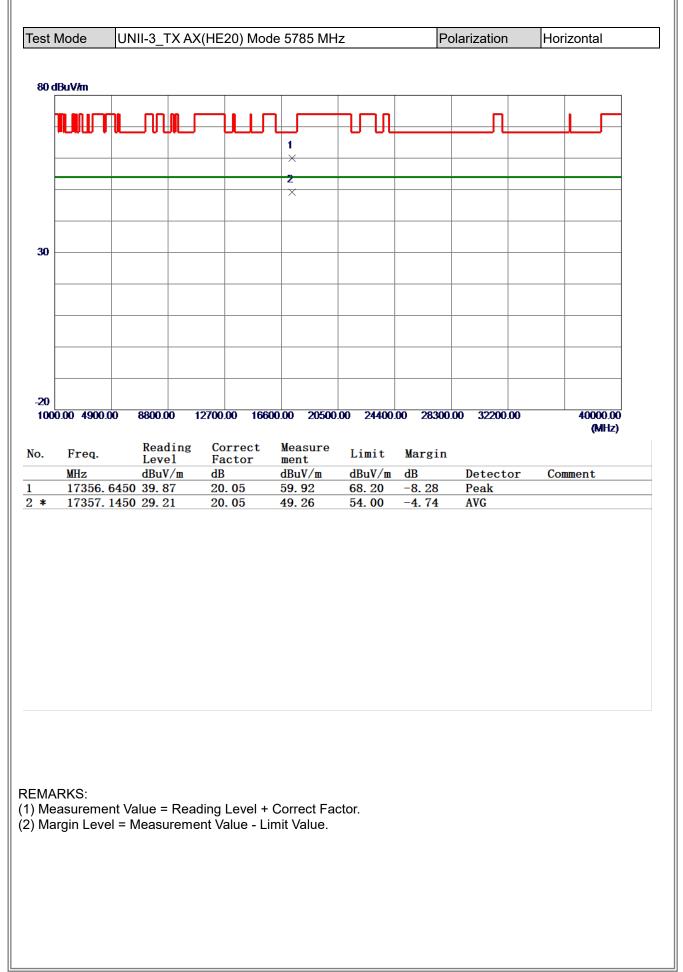




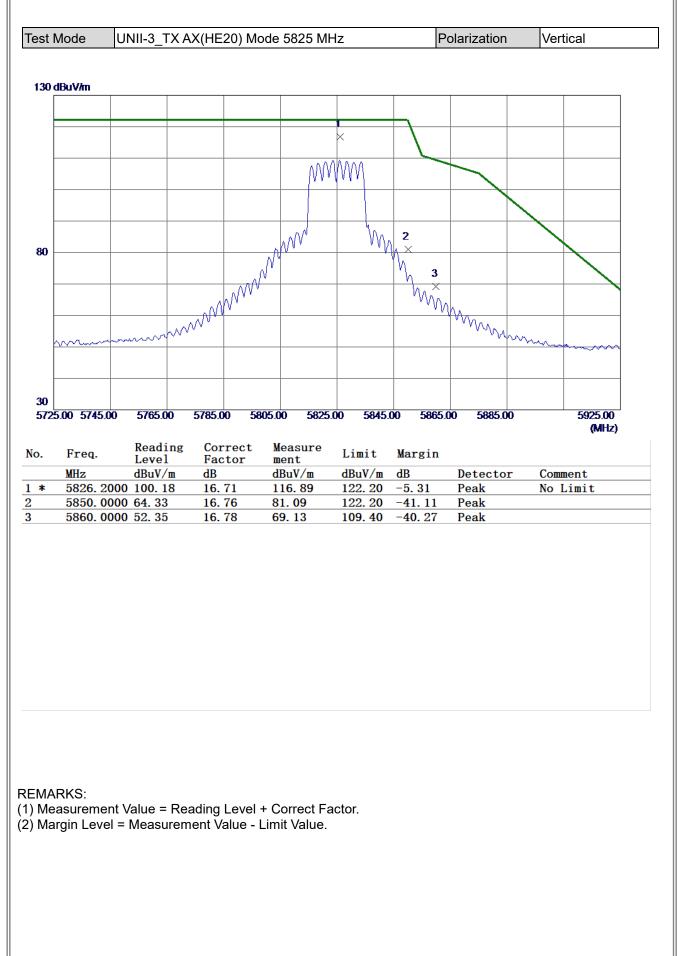




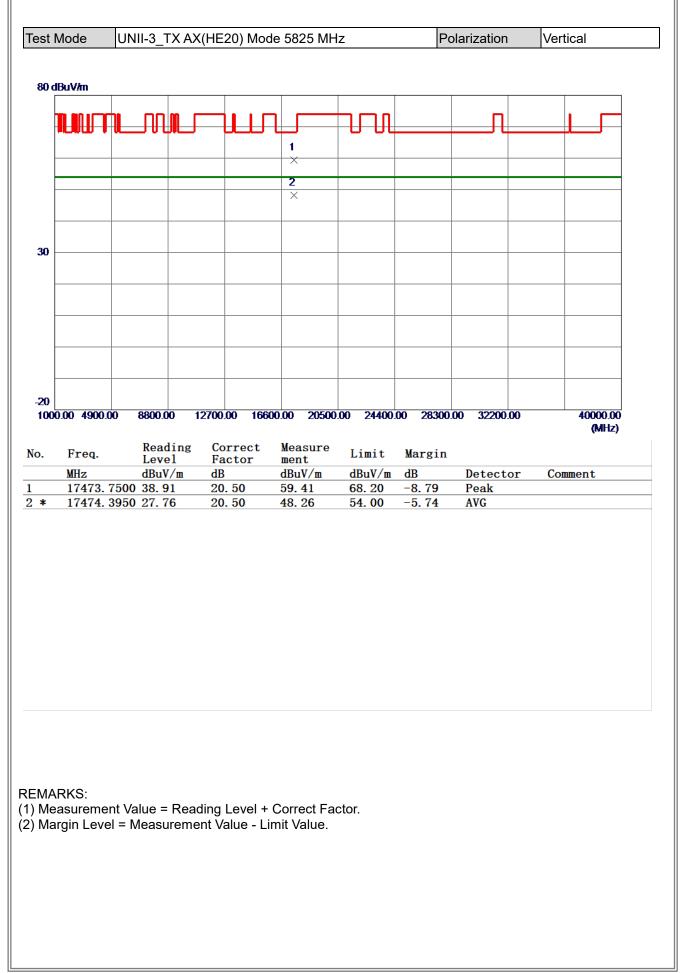




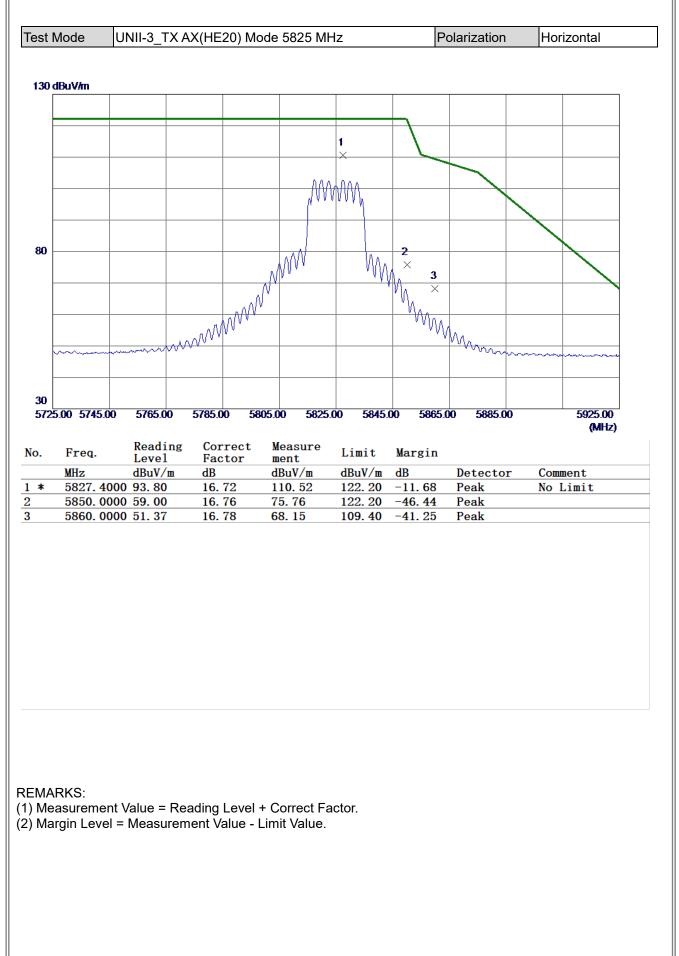




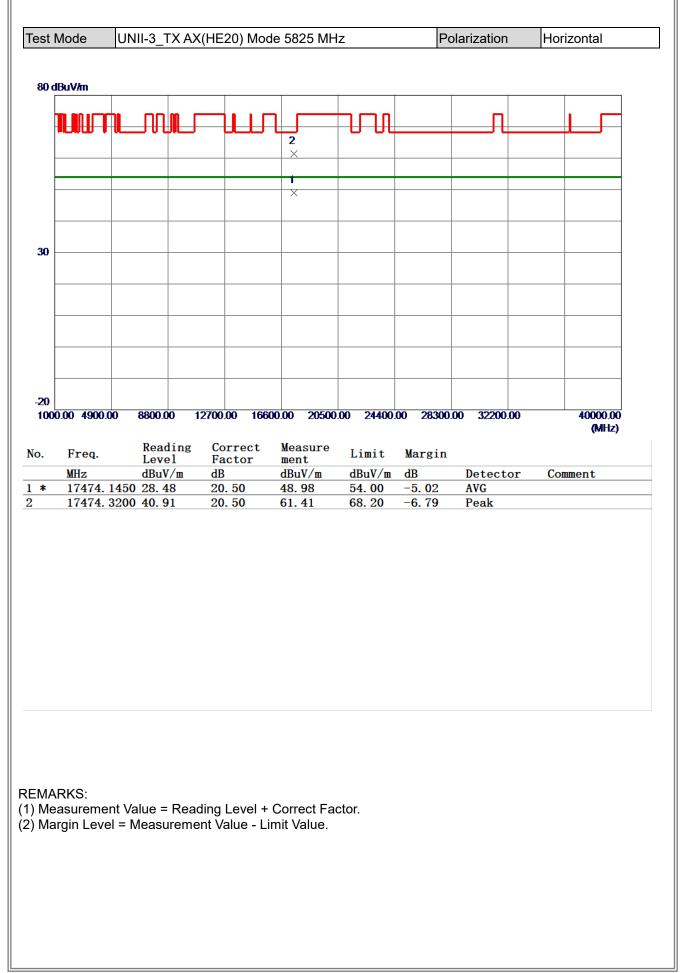




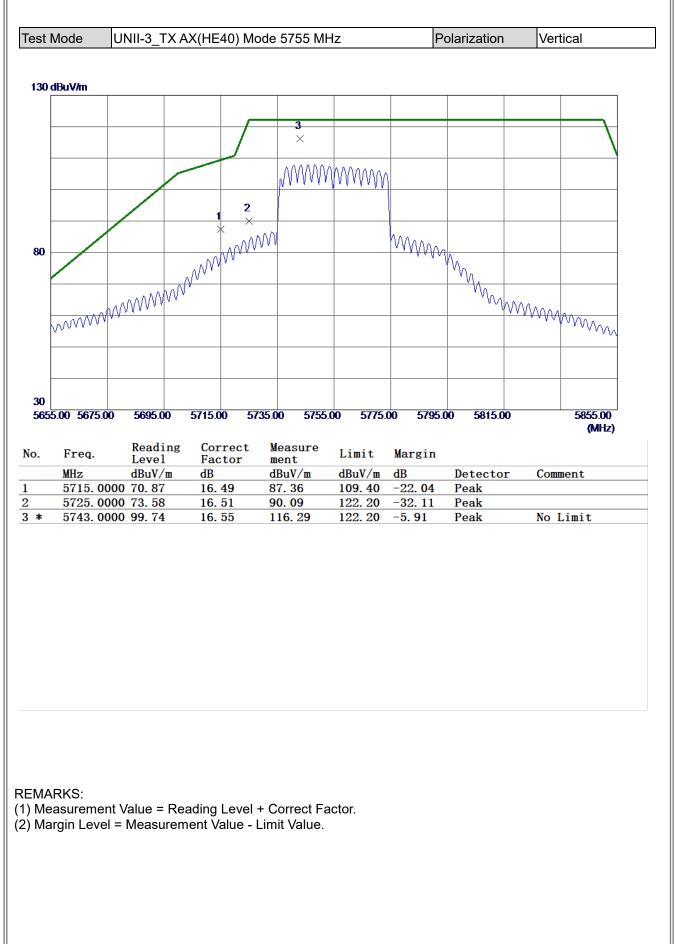




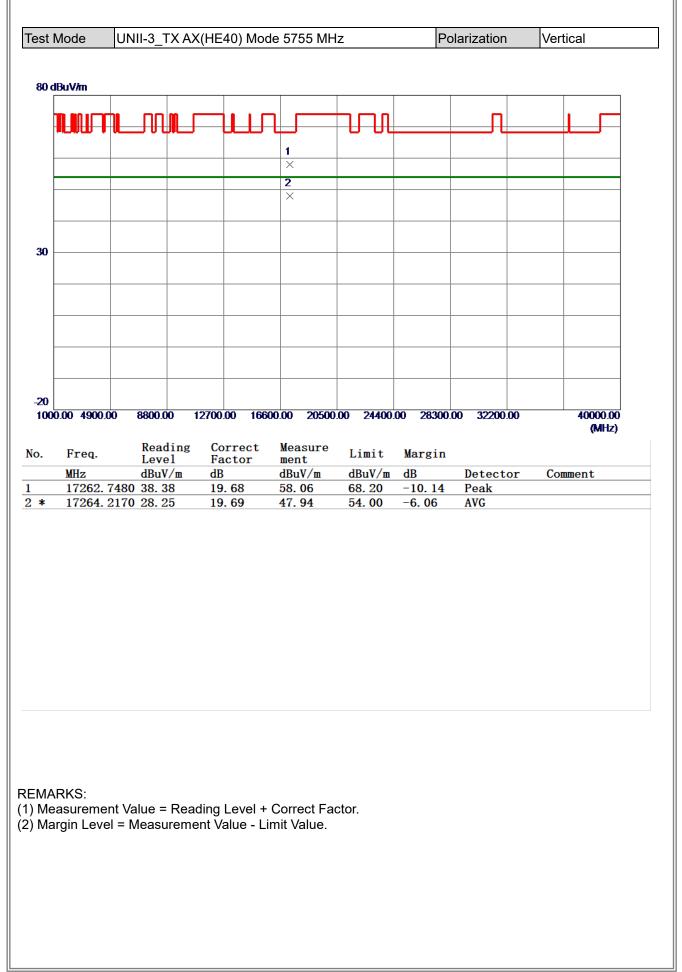




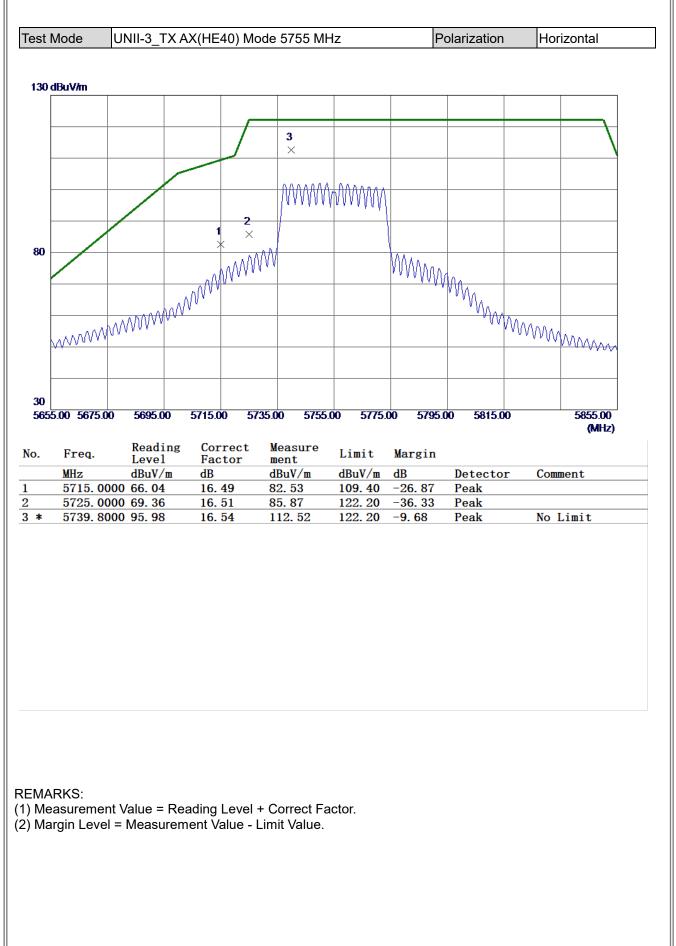




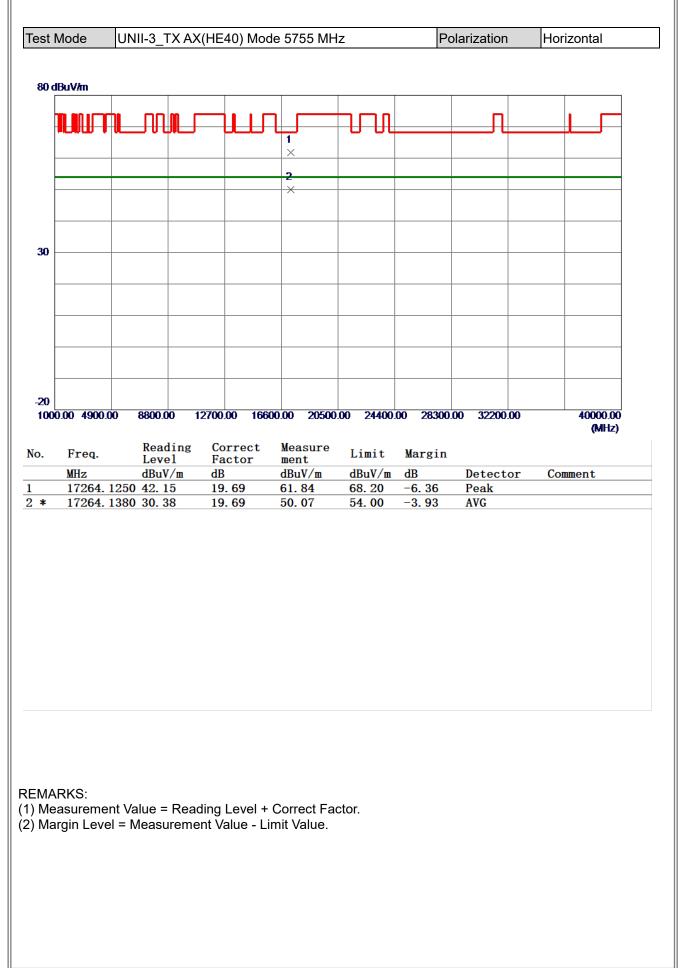




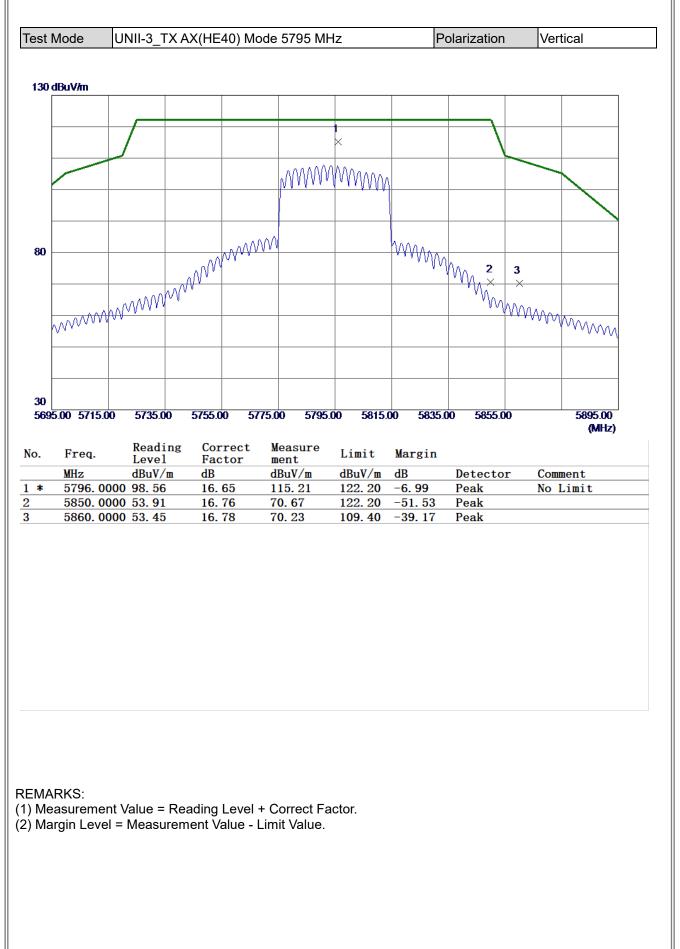




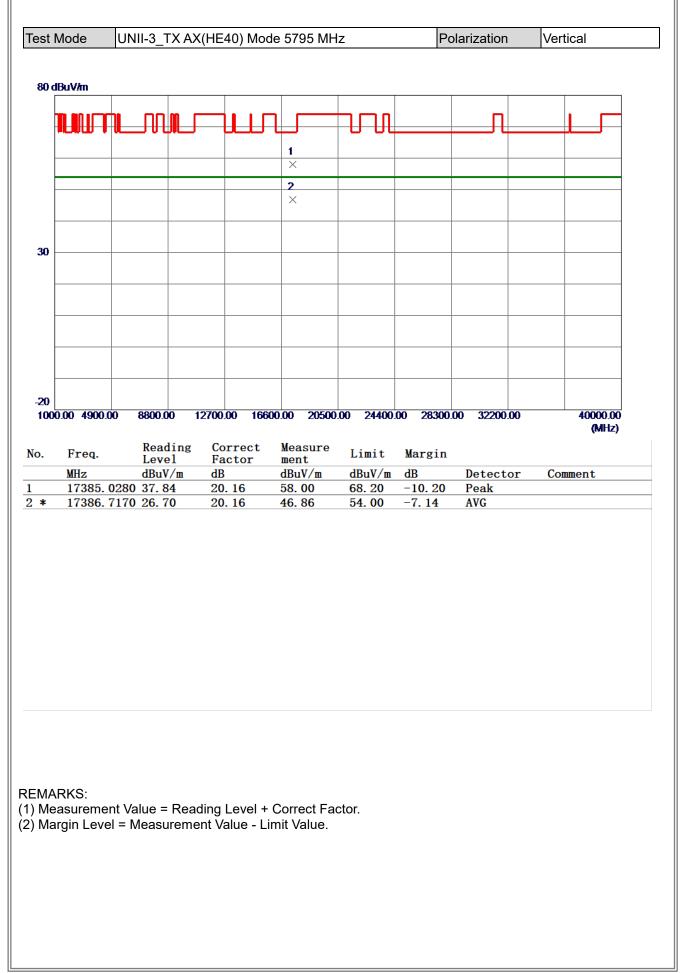




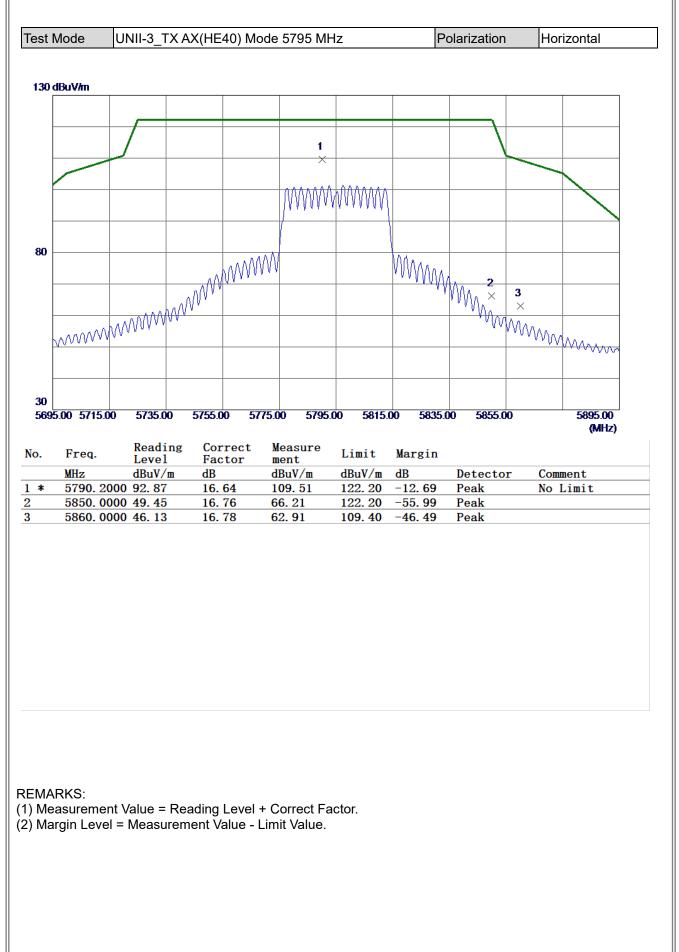




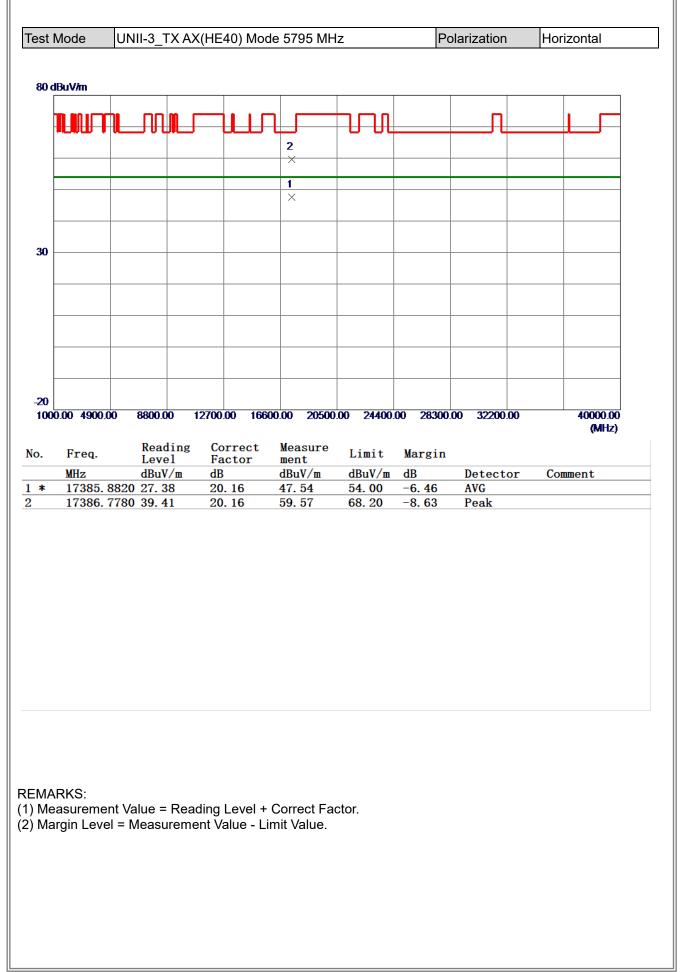




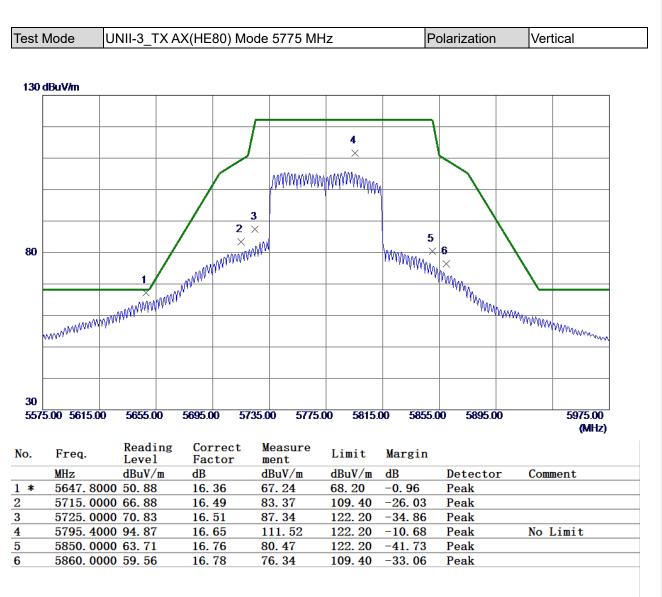








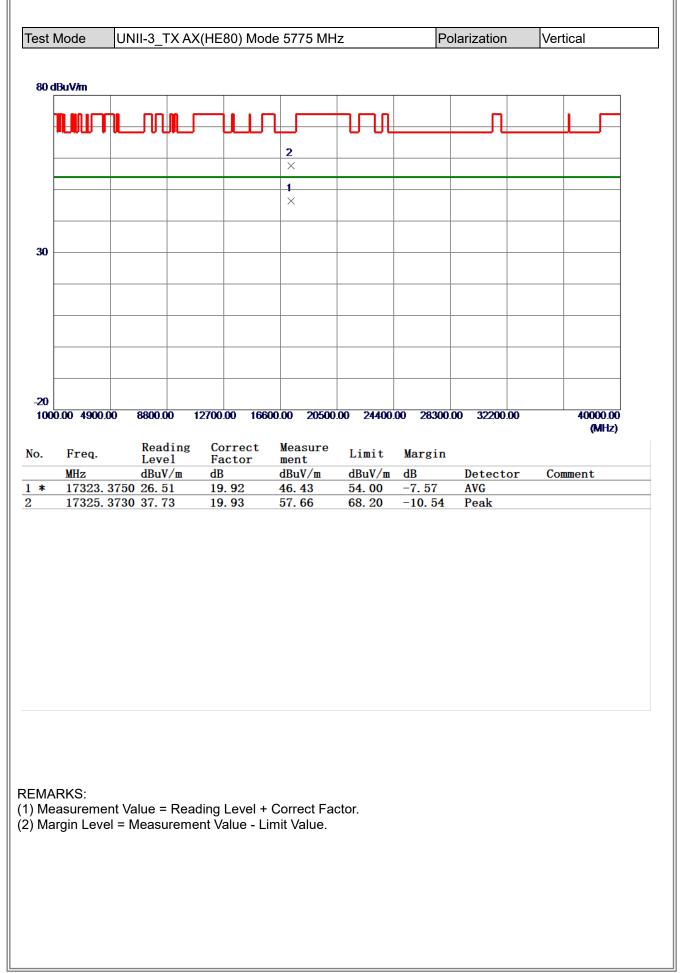




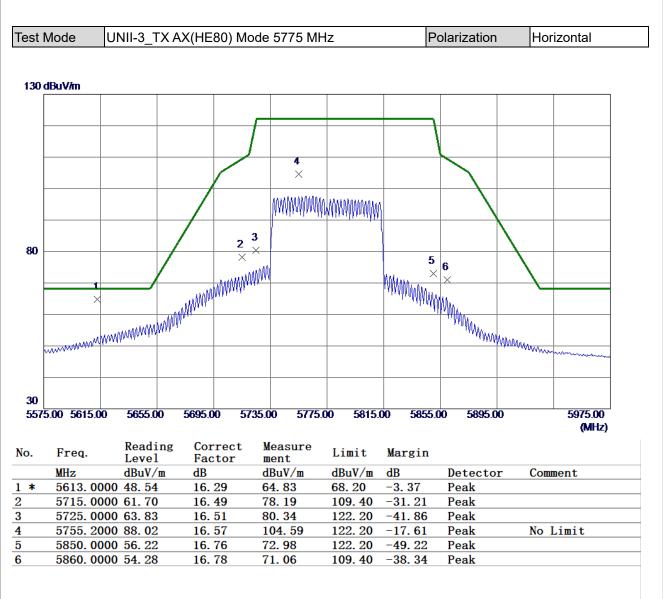
**REMARKS**:

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





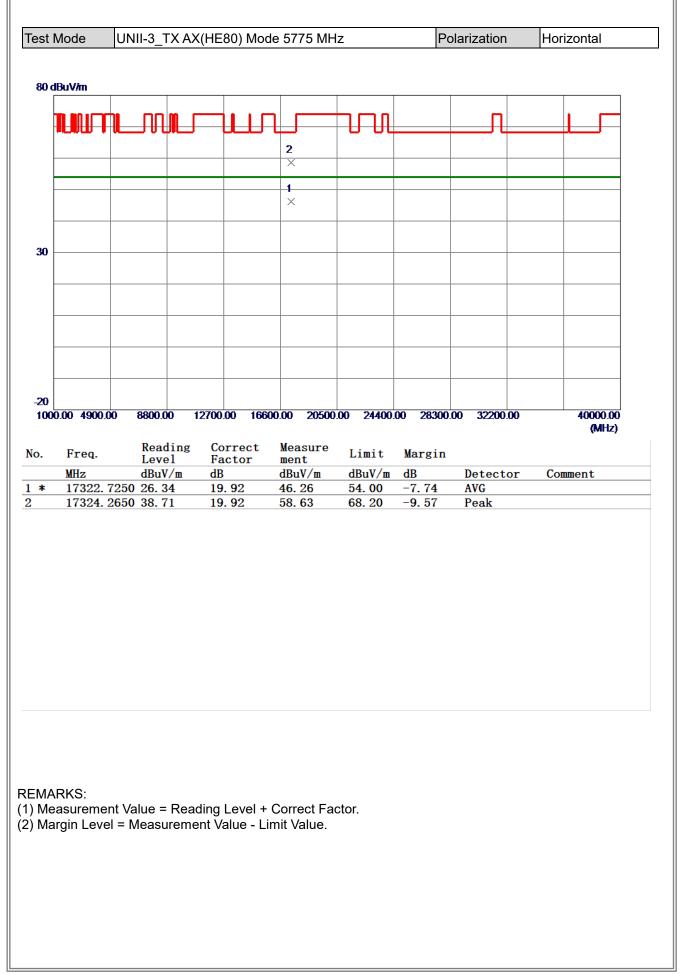




**REMARKS**:

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







## **APPENDIX E - BANDWIDTH**