

FCC Radio Test Report

FCC ID: KA2AP3711A1

This report concerns: Original Grant

Project No.	:	2004H005
Equipment	:	5km Long Range 802.11ac Wireless Bridge
Brand Name	:	D-Link Corporation
Test Model	:	DAP-3711
Series Model	:	N/A
Applicant	:	D-Link Corporation
Address	:	17595 Mt. Herrmann, Fountain Valley, California United State 92708
Manufacturer	:	D-Link Corporation
Address	:	No.289, SinHu 3rd Rd., Neihi District Taiper City 114, Taiwan, R.O.C
Date of Receipt	:	Apr. 17, 2020
Date of Test	:	May 04, 2020 ~ May 14, 2020
Issued Date	:	Aug. 07, 2020
Report Version	:	R03
Test Sample	:	Engineering Sample No.: SH202004176/SH202004177/SH2020041715
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.

Prepared by : Krain Wu

Ryan, Wang

Approved by : Ryan Wang



Certificate # 5123.03

Add: No. 29, Jintang Road, Tangzhen Industry Park, Pudong New Area, Shanghai 201210, China TEL: +86-021-61765666

Web: www.newbtl.com



Declaration

BTL represents to the client that testing is done in accordance with standard procedures as applicable and that test instruments used has been calibrated with standards traceable to international standard(s) and/or national standard(s).

BTL's reports apply only to the specific samples tested under conditions. It is manufacture's responsibility to ensure that additional production units of this model are manufactured with the identical electrical and mechanical components. **BTL** shall have no liability for any declarations, inferences or generalizations drawn by the client or others from **BTL** issued reports.

The report must not be used by the client to claim product certification, approval, or endorsement by NIST, A2LA, or any agency of the U.S. Government.

This report is the confidential property of the client. As a mutual protection to the clients, the public and ourselves, the test report shall not be reproduced, except in full, without our written approval.

BTL's laboratory quality assurance procedures are in compliance with the **ISO/IEC 17025** requirements, and accredited by the conformity assessment authorities listed in this test report.

BTL is not responsible for the sampling stage, so the results only apply to the sample as received.

The information, data and test plan are provided by manufacturer which may affect the validity of results, so it is manufacturer's responsibility to ensure that the apparatus meets the essential requirements of applied standards and in all the possible configurations as representative of its intended use.

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.



Table of Contents	Page
REPORT ISSUED HISTORY	5
1. SUMMARY OF TEST RESULTS	6
1.1 TEST FACILITY	7
1.2 MEASUREMENT UNCERTAINTY	7
1.3 TEST ENVIRONMENT CONDITIONS	7
2. GENERAL INFORMATION	8
2.1 GENERAL DESCRIPTION OF EUT	8
2.2 TEST MODES	0 11
2.3 PARAMETERS OF TEST SOFTWARE	13
2.4 DUTY CYCLE	14
2.5 BLOCK DIAGRAM SHOWING THE CONFIGURATION OF SYSTEM TESTED	16
2.6 SUPPORT UNITS	16
3 . AC POWER LINE CONDUCTED EMISSIONS TEST	17
3.1 LIMIT	17
3.2 TEST PROCEDURE	17
3.3 DEVIATION FROM TEST STANDARD	17
3.4 TEST SETUP	18
3.5 EUT OPERATION CONDITIONS	18
3.6 TEST RESULTS	18
4 . RADIATED EMISSIONS TEST	19
4.1 LIMIT	19
4.2 TEST PROCEDURE	20
4.3 DEVIATION FROM TEST STANDARD	20
4.4 TEST SETUP	21
4.5 EUT OPERATION CONDITIONS	23
4.6 TEST RESULTS - 9 KHZ to 30 MHZ	23
4.7 TEST RESULTS - 30 MHz TO 1000 MHz	23
4.8 TEST RESULTS - ABOVE 1000 MHz	23
5 . BANDWIDTH TEST	24
5.1 LIMIT	24
5.2 TEST PROCEDURE	24
5.3 TEST PROCEDURE	24
5.4 TEST SETUP	25



Table of Contents	Page
5.5 EUT OPERATION CONDITIONS	25
5.6 TEST RESULTS	25
6 . MAXIMUM OUTPUT POWER TEST	26
6.1 LIMIT	26
6.2 TEST PROCEDURE	26
6.3 DEVIATION FROM STANDARD	26
6.4 TEST SETUP	26
6.5 EUT OPERATION CONDITIONS	26
6.6 TEST RESULTS	26
7 . POWER SPECTRAL DENSITY TEST	27
7.1 LIMIT	27
7.2 TEST PROCEDURE	27
7.3 DEVIATION FROM STANDARD	27
	28
7.5 EUT OPERATION CONDITIONS	28
7.6 TEST RESULTS	28
8 . MEASUREMENT INSTRUMENTS LIST	29
9.EUT TEST PHOTOS	31
APPENDIX A - AC POWER LINE CONDUCTED EMISSIONS	34
APPENDIX B - RADIATED EMISSION - 9 KHZ TO 30 MHZ	37
APPENDIX C - RADIATED EMISSION - 30 MHZ TO 1 GHZ	38
APPENDIX D - RADIATED EMISSION - ABOVE 1000 MHZ	41
APPENDIX E - BANDWIDTH	154
APPENDIX F - CONDUCTED OUTPUT POWER	165
APPENDIX G - POWER SPECTRAL DENSITY	181



REPORT ISSUED HISTORY

Report Version	Description	Issued Date
R00	Original Issue.	Jun. 15, 2020
R01	Correct the limit of output power & power spectral density.	Jun. 29, 2020
R02	Update the data of Band 1.	Jul. 21, 2020
R03	Revised report to address TCB's comments.	Aug. 07, 2020



1. SUMMARY OF TEST RESULTS

FCC Part15, Subpart E(15.407)							
Standard(s) Section	Test Item	Test Result	Judgement	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)	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	NOTE (3)			
15.407(c)	Automatically Discontinue Transmission		PASS	NOTE (3)			

Test procedures according to the technical standard(s):

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.



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. AC Power Line Conducted Emissions test:

Test Site	Method	Measurement Frequency Range	U, (dB)
SH-C01	CISPR	9 kHz ~ 150 MHz	2.92

B. 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	Η	3.76
SH-CB01		200 MHz~1,000 MHz	V	4.24
50-0601		200 MHz~1,000 MHz	Н	3.84
		1 GHz~18 GHz	V	4.46
		1 GHz~18 GHz	Η	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	25.7°C	49%	AC 120V	Forest Li
Radiated Emissions-9K-30MHz	23°C	46%	AC 120V	Vince Zong
Radiated Emissions-30 MHz to 1GHz	23°C	46%	AC 120V	Vince Zong
Radiated Emissions-Above 1000 MHz	23°C	46%	AC 120V	Vince Zong
Spectrum Bandwidth	25.7°C	49%	AC 120V	Forest Li
Maximum Output Power	25.7°C	49%	AC 120V	Forest Li
Power Spectral Density	25.7°C	49%	AC 120V	Forest Li
Frequency Stability	Normal & Extreme	49%	Normal & Extreme	Forest Li



2. GENERAL INFORMATION

2.1 GENERAL DESCRIPTION OF EUT

Equipment	5km Long Range 802.11ac Wireless Bridge
Brand Name	D-Link Corporation
Test Model	DAP-3711
Series Model	N/A
Model Difference(s)	N/A
Software Version	v1.0.2
Hardware Version	A1
Power Source	PoE supplied.
Power Rating	I/P: 100~240V 0.35A O/P: 24V 0.5A
Operation Frequency	UNII-1: 5150 MHz~5250 MHz UNII-3: 5725 MHz~5850 MHz
Modulation Type	OFDM
Bit Rate of Transmitter	Up to 866Mbps
Maximum Conducted Output Power for UNII-1 (2TX) Non-Beamforming	IEEE 802.11a: 16.08 dBm (0.0406 W) IEEE 802.11n (HT20): 16.44 dBm (0.0441 W) IEEE 802.11n (HT40): 17.56 dBm (0.0570 W) IEEE 802.11ac (VHT20): 16.10 dBm (0.0407 W) IEEE 802.11ac (VHT40): 17.83 dBm (0.0607 W) IEEE 802.11ac (VHT80): 15.65 dBm (0.0367 W)
Maximum Conducted Output Power for UNII-3 (2TX) Non-Beamforming	IEEE 802.11a: 17.63 dBm (0.0579 W) IEEE 802.11n (HT20): 17.96 dBm (0.0625 W) IEEE 802.11n (HT40): 17.88 dBm (0.0614 W) IEEE 802.11ac (VHT20): 17.62 dBm (0.0578 W) IEEE 802.11ac (VHT40): 17.75 dBm (0.0596 W) IEEE 802.11ac (VHT80): 17.61 dBm (0.0577 W)

Note:

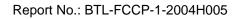
1. For a more detailed features description, please refer to the manufacturer's specifications or the user's manual.

2. Channel List:

BIL

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-1	UN	II-1	UN	II-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	III-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	N/A	N/A	PCB	N/A	15	N/A
2	N/A	N/A	PCB	N/A	15	N/A

Note:

(1) Antenna Gain=15 dBi. This EUT supports MIMO 2X2, any transmit signals are correlated with each other, so Directional gain = GAnt.+10log(N)dBi, that is Directional gain=15+10log(2)dBi=18.01; So, the UNII-1,UNII-3 output power limit is 30-18.01+6=17.99.

The UNII-1 power spectral density limit is 17-18.01+6=4.99, the UNII-3 power spectral density limit is 30-18.01+6=17.99.

4. Table for Antenna Configuration:

Operating Mode	TX Mode	2TX
IEEE 802.1	1a	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)



LL

3

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)
Mode 13	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 13 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 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)	



Conducted test			
Test 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 / CH52, CH60, CH64 (UNII-2A)		
Mode 8	TX N (HT20) Mode / CH52, CH60, CH64 (UNII-2A)		
Mode 9	TX N (HT40) Mode / CH54, CH62 (UNII-2A)		
Mode 10	TX AC (VHT20) Mode / CH52, CH60, CH64 (UNII-2A)		
Mode 11	TX AC (VHT40) Mode / CH54, CH62 (UNII-2A)		
Mode 12	TX AC (VHT80) Mode / CH58 (UNII-2A)		
Mode 13	TX A Mode / CH100, CH116, CH140 (UNII-2C)		
Mode 14	TX N (HT20) Mode / CH100, CH116, CH140 (UNII-2C)		
Mode 15	TX N (HT40) Mode / CH102, CH110, CH134 (UNII-2C)		
Mode 16	TX AC (VHT20) Mode / CH100, CH116, CH140 (UNII-2C)		
Mode 17	TX AC (VHT40) Mode / CH102, CH110, CH134 (UNII-2C)		
Mode 18	TX AC (VHT80) Mode / CH106, CH122 (UNII-2C)		
Mode 19	TX A Mode / CH149,CH157,CH165 (UNII-3)		
Mode 20	TX N (HT20) Mode / CH149,CH157,CH165 (UNII-3)		
Mode 21	TX N (HT40) Mode / CH151,CH159 (UNII-3)		
Mode 22	TX AC (VHT20) Mode / CH149,CH157,CH165 (UNII-3)		
Mode 23	TX AC (VHT40) Mode / CH151,CH159 (UNII-3)		
Mode 24	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.



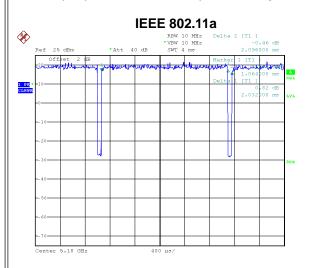
2.3 PARAMETERS OF TEST SOFTWARE

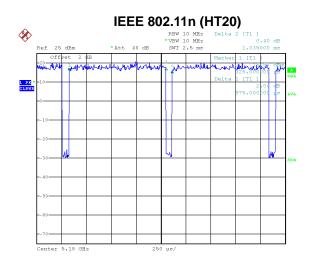
Test Software		artgui	
Test Frequency (MHz)	5180	5200	5240
IEEE 802.11a	13	13	13
IEEE 802.11n (HT20)	13	13	13
IEEE 802.11ac (VHT20)	13	13	13
Test Frequency (MHz)	5190	5230	
IEEE 802.11n (HT40)	14.5	14.5	
IEEE 802.11ac (VHT40)	14	14.5	
Test Frequency (MHz)	5745	5785	5825
IEEE 802.11a	14	13.5	13
IEEE 802.11n (HT20)	13.5	13.5	13
IEEE 802.11ac (VHT20)	13.5	13.5	13
Test Frequency (MHz)	5755	5795	
IEEE 802.11n (HT40)	14	14	
IEEE 802.11ac (VHT40)	14	13.5	
Test Frequency (MHz)	5210		
IEEE 802.11ac (VHT80)	12.5		
Test Frequency (MHz)	5775		
IEEE 802.11ac (VHT80)	14		



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.





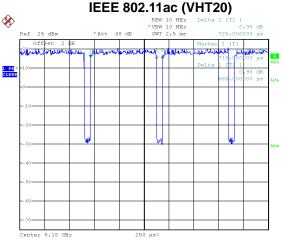
Date: 27.APR.2020 15:39:34

Duty cycle = 2.032 ms / 2.096 ms = 96.95% Duty cycle = 2.032 ms / 2.096 ms = 96.95% Duty cycle = 0.13 db Du

Date: 27.APR.2020 15:45:47

Duty cycle = 0.490 ms / 0.550 ms = 89.09% Duty Factor = 10 * log(1 / Duty cycle) = 0.50 dB Date: 27.APR.2020 15:44:46

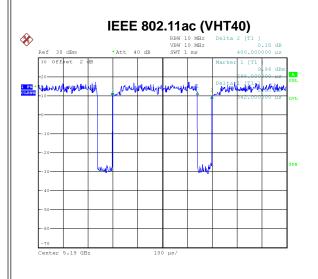


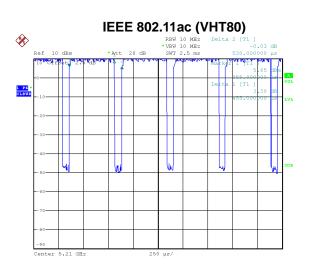


Date: 27.APR.2020 15:46:34

Duty cycle = 0.665 ms / 0.725 ms = 91.72% Duty Factor = 10 * log(1 / Duty cycle) = 0.11 dB

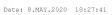
BL





Date: 27.APR.2020 15:56:38

Duty cycle = 0.342 ms / 0.400 ms = 85.50% Duty Factor = 10 * log(1 / Duty cycle) = 0.68 dB



Duty cycle = 0.455 ms / 0.530 ms = 85.85% Duty Factor = 10 * log(1 / Duty cycle) = 0.66 dB

NOTE:

For IEEE 802.11a:

For radiated emissions frequency above 1 GHz, the resolution bandwidth of test receiver/spectrum analyzer is 1 MHz and the video bandwidth is 0.49 kHz (Duty cycle < 98%).

For 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 1.50 kHz (Duty cycle < 98%).

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

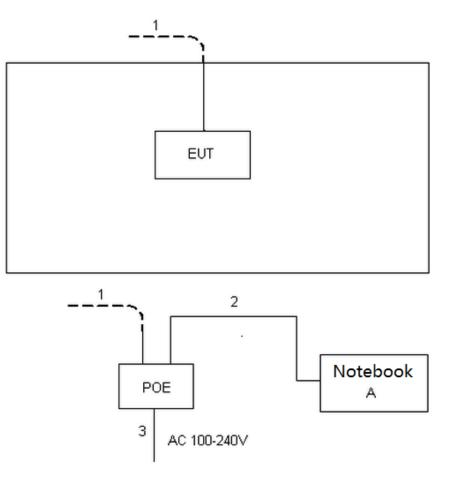
For radiated emissions frequency above 1 GHz, the resolution bandwidth of test receiver/spectrum analyzer is 1 MHz and the video bandwidth is 2.92 kHz (Duty cycle < 98%).

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 2.19 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	Lenovo	#P152014	N/A

Item	Cable Type	Shielded Type	Ferrite Core	Length
1	RJ45 Cable	NO	NO	10m
2	RJ45 Cable	NO	NO	1m
3	AC Cable	NO	NO	1m



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 to 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

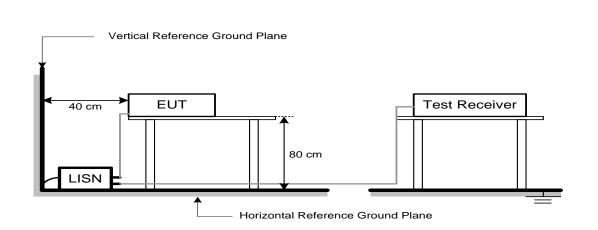
- a. The EUT was placed 0.8 meters from the horizontal ground plane with EUT being connected to the power mains through a line impedance stabilization network (LISN). All other support equipment powered from additional LISN(s). The LISN provide 50 Ohm/ 50uH of coupling impedance for the measuring instrument.
- 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
88-216 216-960	150 200	3 3 3 3

LIMITS OF UNWANTED EMISSION OUT OF THE RESTRICTED BANDS

Frequency (MHz)	EIRP Limit (dBm/MHz)	Equivalent Field Strength at 3m (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: $E = \frac{1000000\sqrt{30P}}{100000}$

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)
- 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.

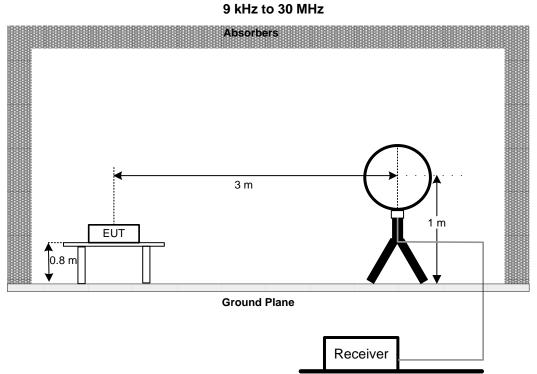
4.3 DEVIATION FROM TEST STANDARD

No deviation

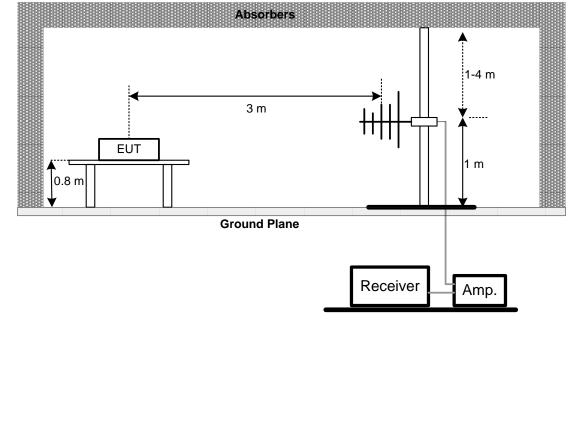


<u>3ĩL</u>

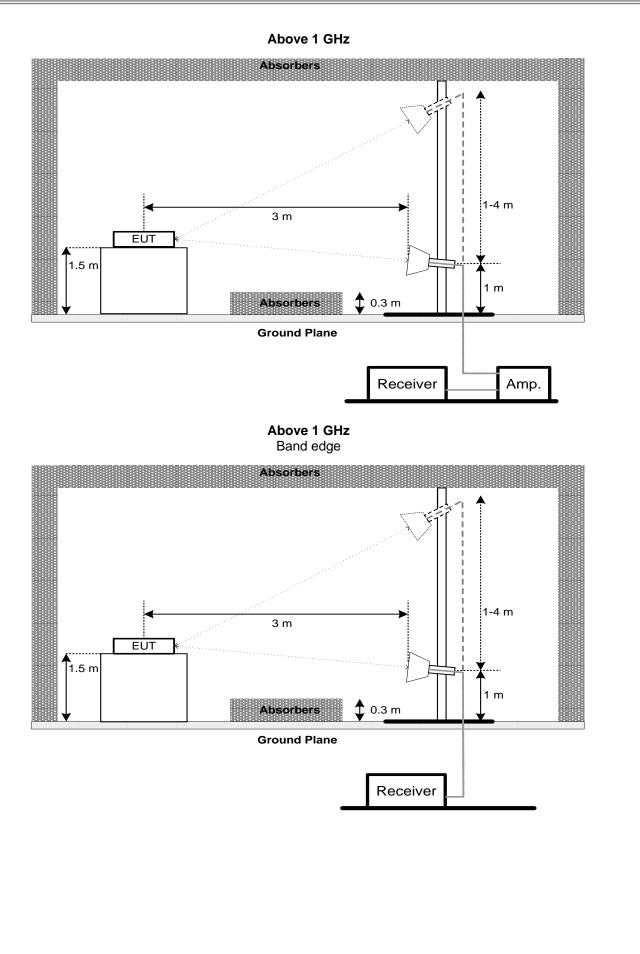
4.4 TEST SETUP



30 MHz to 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) 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)		
15.407(a) 15.407(e)	26 dB Bandwidth	-	5150-5250		
	26 dB Bandwidth	-	5250-5350		
	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, UNII-2A, UNII-2C:

Spectrum Parameter	Setting
Attenuation	Auto
Span Frequency	> 26 dB Bandwidth
RBW	300 kHz (Bandwidth 20 MHz)
K B V V	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	Frequency Range (MHz)				
15.407(a)	Conducted Output Power	AP device: 1 Watt (30 dBm) Client device: 250 mW (24 dBm)	5150-5250		
		250 mW (24 dBm)	5250-5350		
		250 mW (24 dBm)	5470-5725		
		1 Watt (30dBm)	5725-5850		

Note:

- a. For an outdoor 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. The maximum e.i.r.p. at any elevation angle above 30 degrees as measured from the horizon must not exceed 125 mW (21 dBm).
- 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



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		Limit	Frequency Range (MHz)		
	Power Spectral Density	AP device: 17 dBm/MHz Client device: 11 dBm/MHz	5150-5250		
15.407(a)		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.
- 2. 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

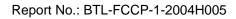
Please refer to the APPENDIX G.



8. 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. 21, 2021	
2	TWO-LINE V-NETWORK	R&S	ENV216	101340	Sep. 01, 2020	
3	EMI Test Receiver	R&S	ESCI	100082	Jul. 15, 2020	
4	50Ω coaxial switch	Anritsu	MP59B	6201750902	Mar. 28, 2021	
5	Cable	10m	EMCRG400-BM-NM- 10000	170628	Mar. 21, 2021	
6	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. 28, 2021	
2	Pre-Amplifier	emci	EMC9135	980400	Mar. 21, 2021	
3	MXE EMI Receiver	Keysight	N9038A	MY57150106	Mar. 21, 2021	
4	Test Cable	emci	EMC104-SM-SM-700 0	170330	Apr. 16, 2021	
5	Test Cable	emci	EMC104-SM-SM-100 0	170331	Apr. 16, 2021	
6	Test Cable	emci	EMC104-SM-NM-350 0	170621	Apr. 16, 2021	
7	Measurement Software	Farad	EZ-EMC Ver.BTL-2ANT-1	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. 28, 2021	
2	Pre-Amplifier	emci	EMC012645SE	980421	Mar. 28, 2021	
3	EXA Spectrum Analyzer	Keysight	N9010A	MY56480545	Mar. 21, 2021	
4	Test Cable	emci	EMC104-SM-SM-700 0	170330	Apr. 16, 2021	
5	Test Cable	emci	EMC104-SM-SM-100 0	170331	Apr. 16, 2021	
6	Test Cable	emci	EMC104-SM-NM-350 0	170621	Apr. 16, 2021	
7	Measurement Software	Farad	EZ-EMC Ver.NB-03A1-01	N/A	N/A	
8	MXE EMI Receiver	Keysight	N9038A	MY57150106	Mar. 28, 2021	

	Bandwidth						
Item	Kind of Equipment	Manufacturer	Type No.	Serial No.	Calibrated until		
1	1 Spectrum Analyzer R&S FSP40 100626 Mar. 21, 2021						

Conducted Output Power							
Item	Kind of Equipment	Manufacturer	Type No.	Serial No.	Calibrated until		
1	Spectrum Analyzer	R&S	FSP40	100626	Mar. 21, 2021		

	Power Spectral Density							
Ite	m Kind of Equipment	Manufacturer	Type No.	Serial No.	Calibrated until			
1	Spectrum Analyzer	R&S	FSP40	100626	Mar. 21, 2021			

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

All calibration period of equipment list is one year.

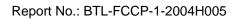


9. EUT TEST PHOTOS

Conducted Emissions Test Photos



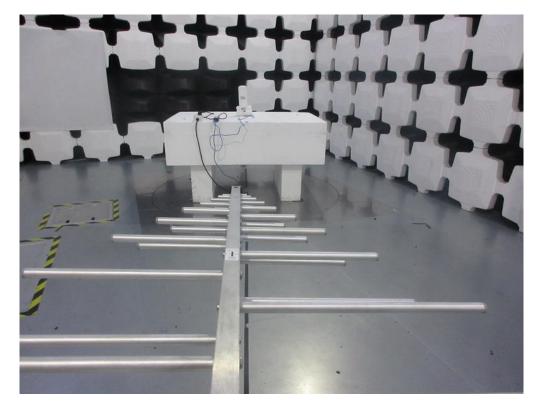


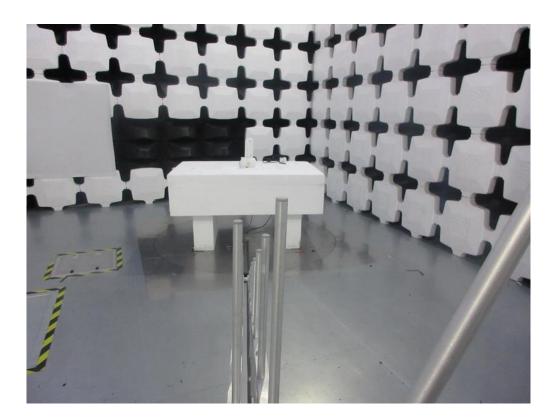




Radiated Emissions Test Photos

30 MHz to 1 GHz



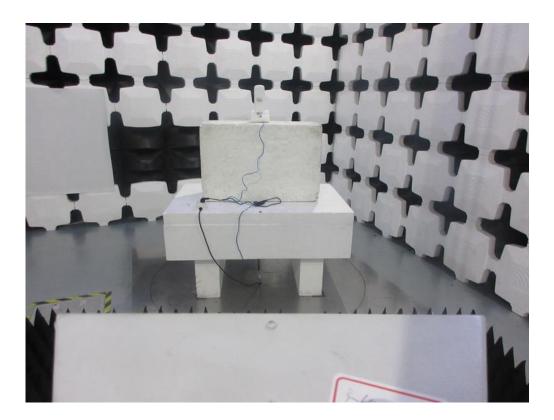




Radiated Emissions Test Photos

Above 1 GHz

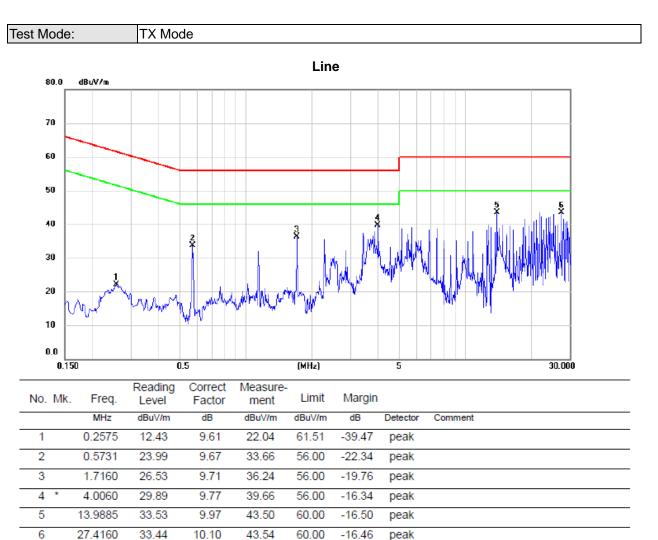






APPENDIX A - AC POWER LINE CONDUCTED EMISSIONS



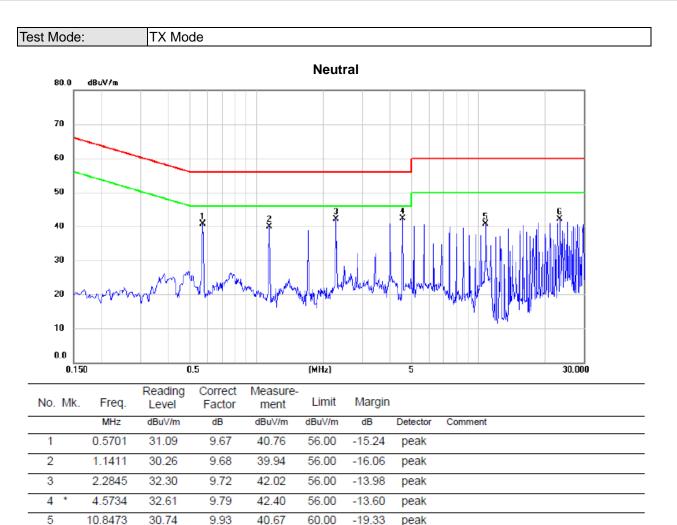


REMARKS:

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

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





REMARKS:

6

23.3870

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

10.07

42.14

60.00

-17.86

peak

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

32.07



APPENDIX B - RADIATED EMISSION - 9 KHZ TO 30 MHZ

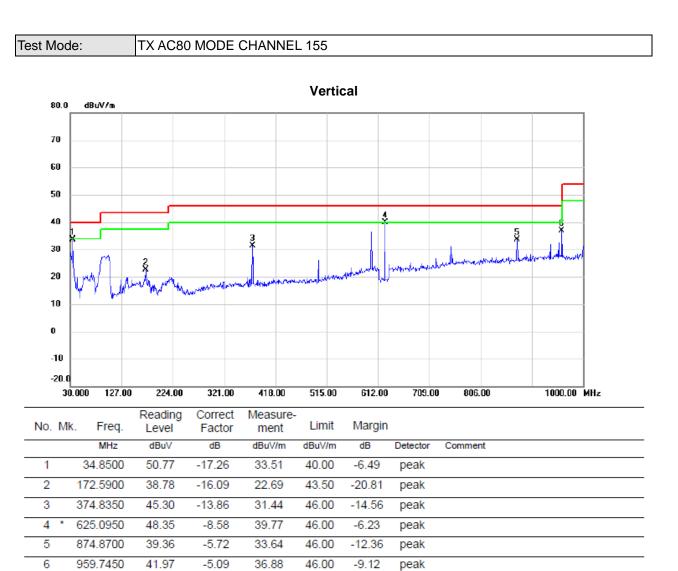
Note: Below 30MHz, The measured value have enough margin over 20dB than the limit, therefore they are not reported





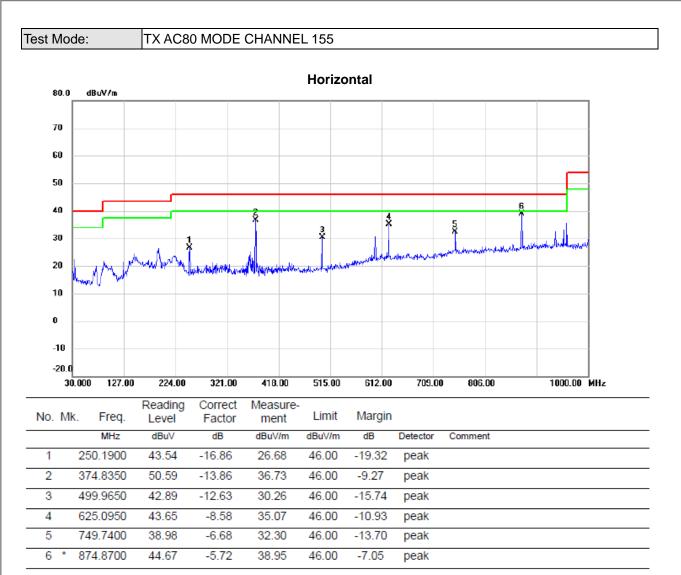
APPENDIX C - RADIATED EMISSION - 30 MHZ TO 1 GHZ





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



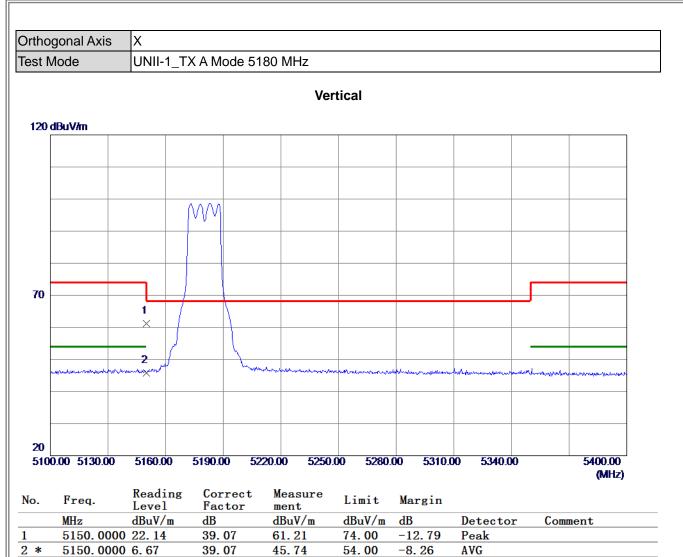


- (1) Measurement Value = Reading Level + Correct Factor.
- (2) Margin Level = Measurement Value Limit Value.



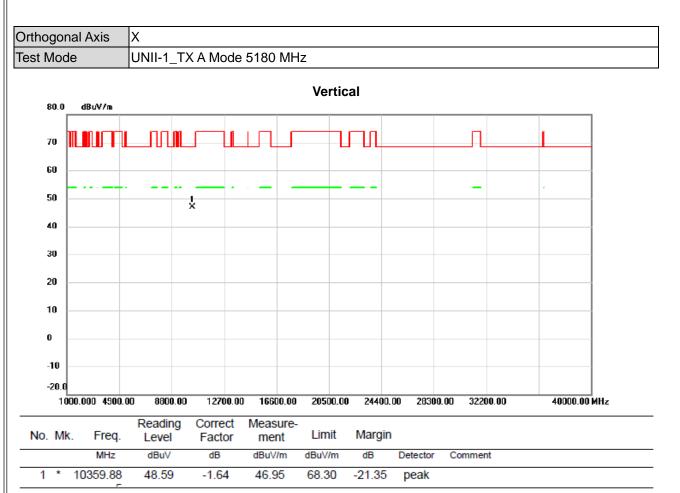
APPENDIX D - RADIATED EMISSION - ABOVE 1000 MHZ





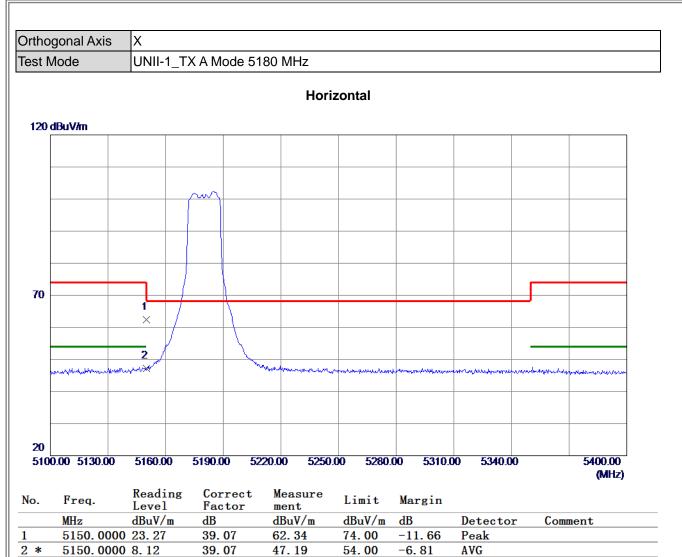
(1) Measurement Value = Reading Level + Correct Factor.





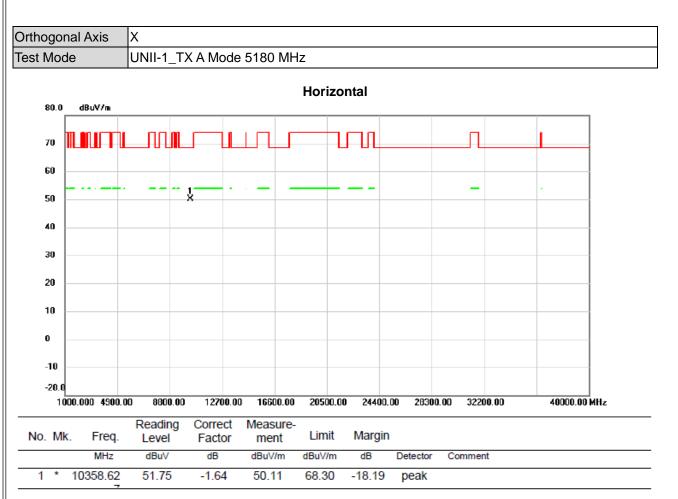
- (1) Measurement Value = Reading Level + Correct Factor.
- (2) Margin Level = Measurement Value Limit Value.





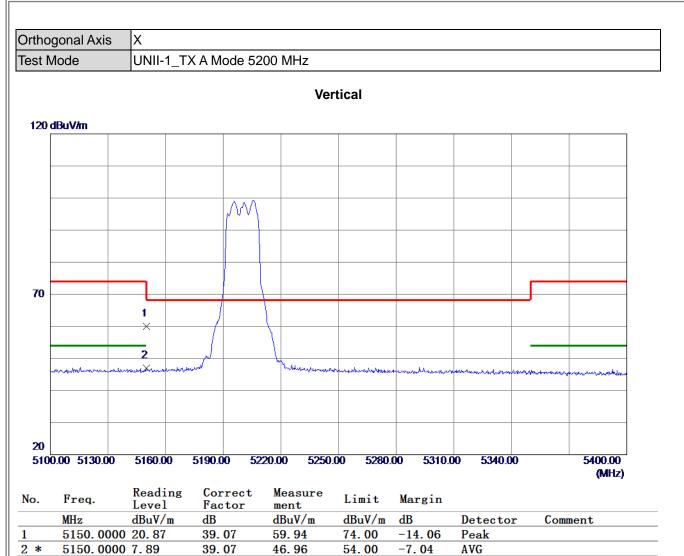
(1) Measurement Value = Reading Level + Correct Factor.





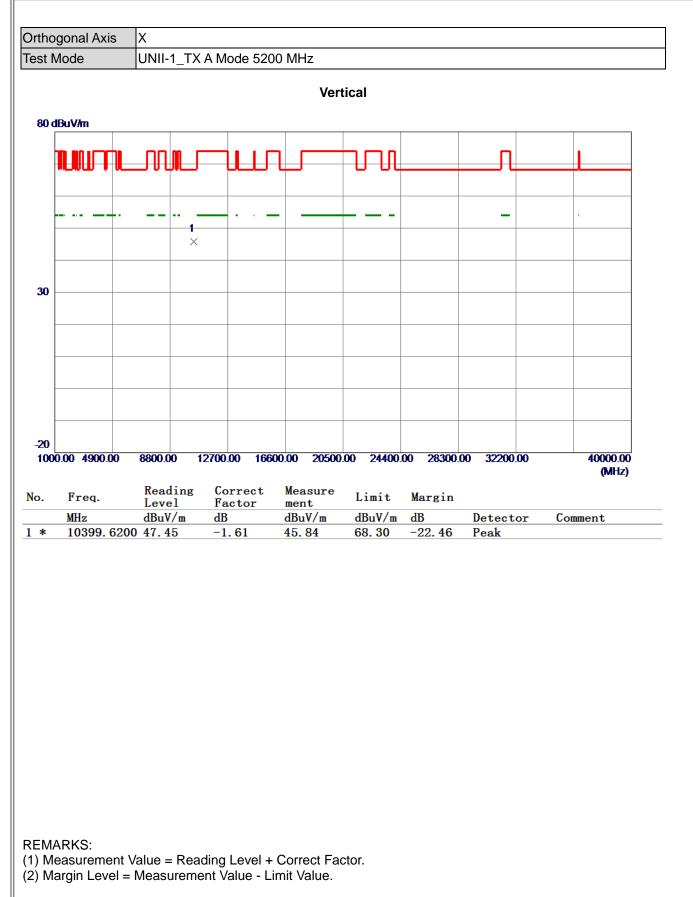
- (1) Measurement Value = Reading Level + Correct Factor.
- (2) Margin Level = Measurement Value Limit Value.



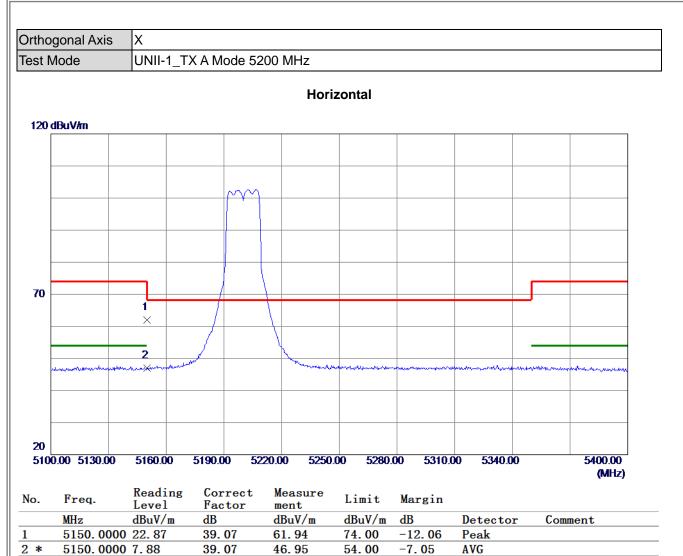


(1) Measurement Value = Reading Level + Correct Factor.



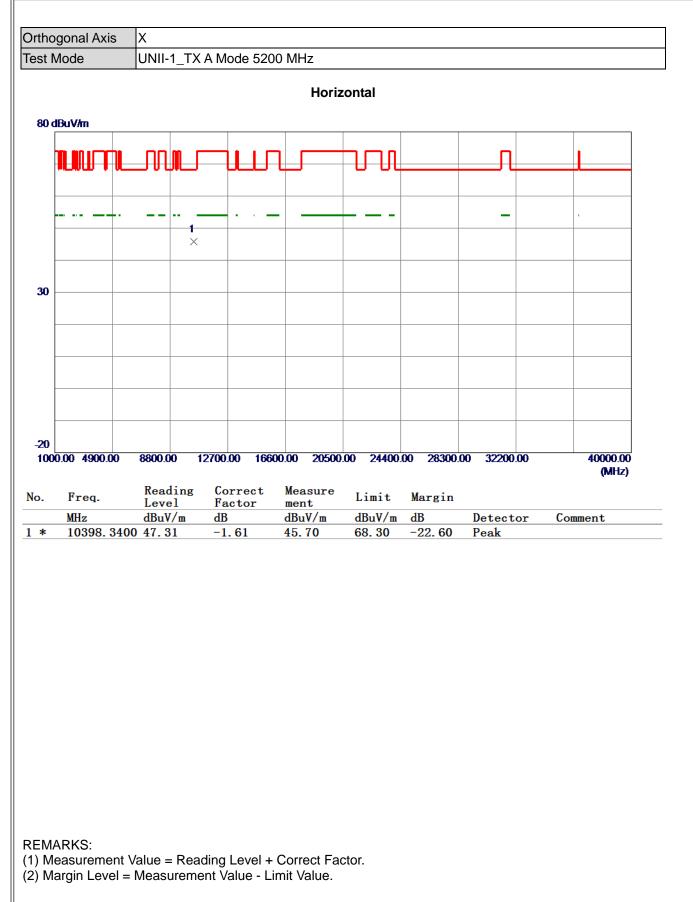




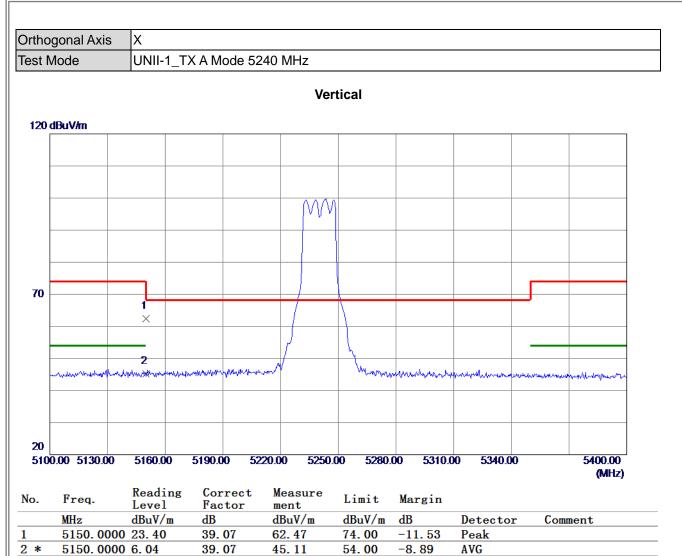


(1) Measurement Value = Reading Level + Correct Factor.



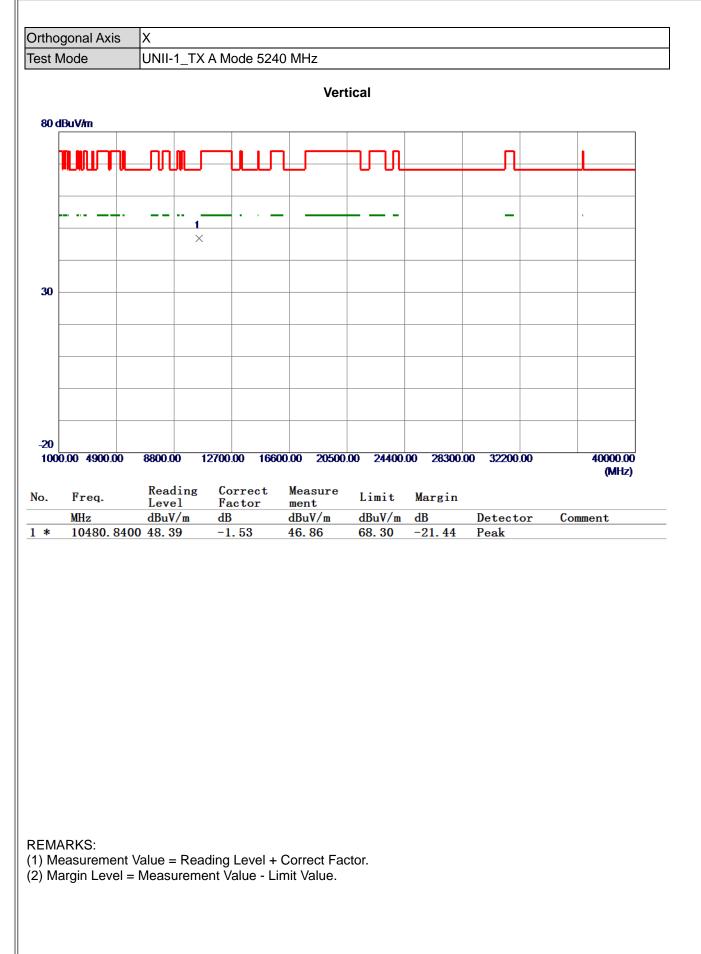




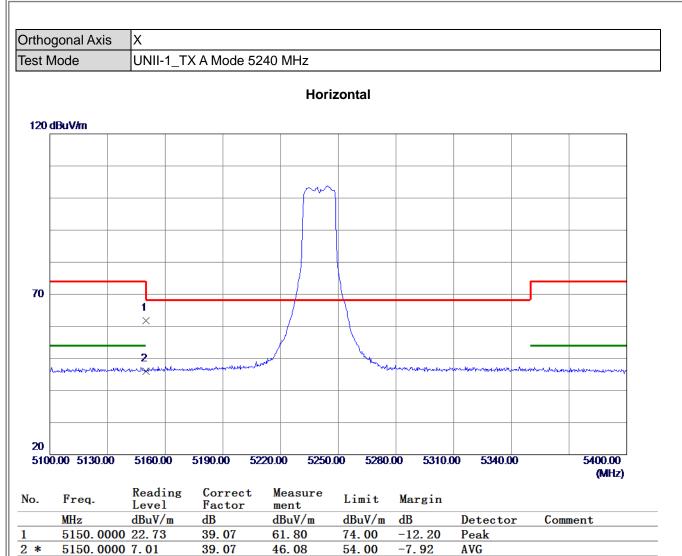


(1) Measurement Value = Reading Level + Correct Factor.



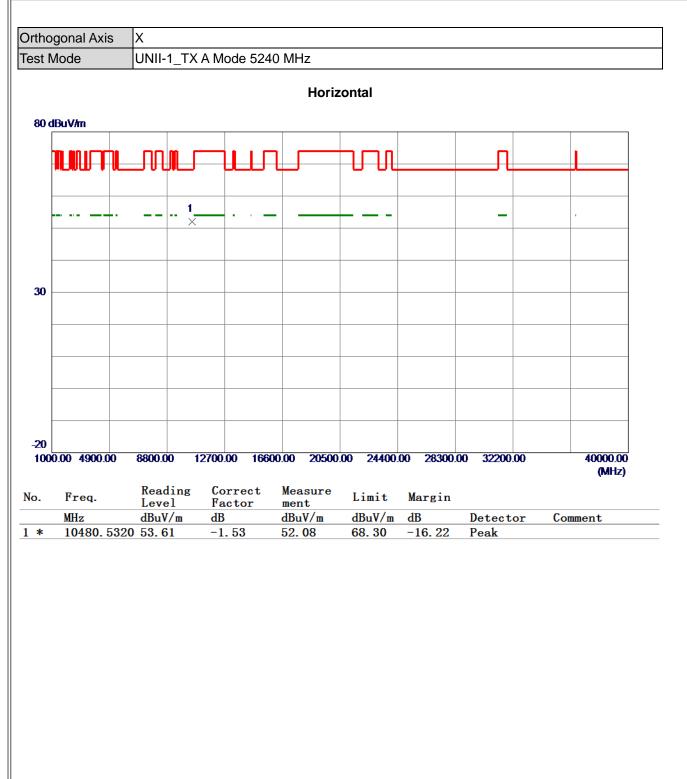






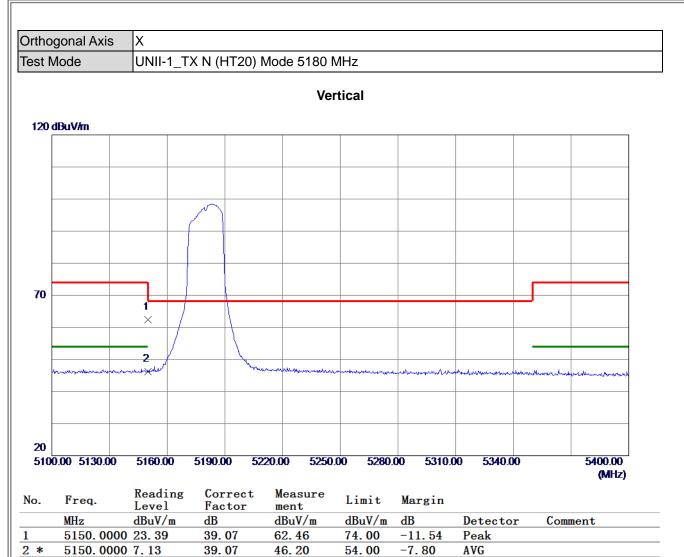
(1) Measurement Value = Reading Level + Correct Factor.





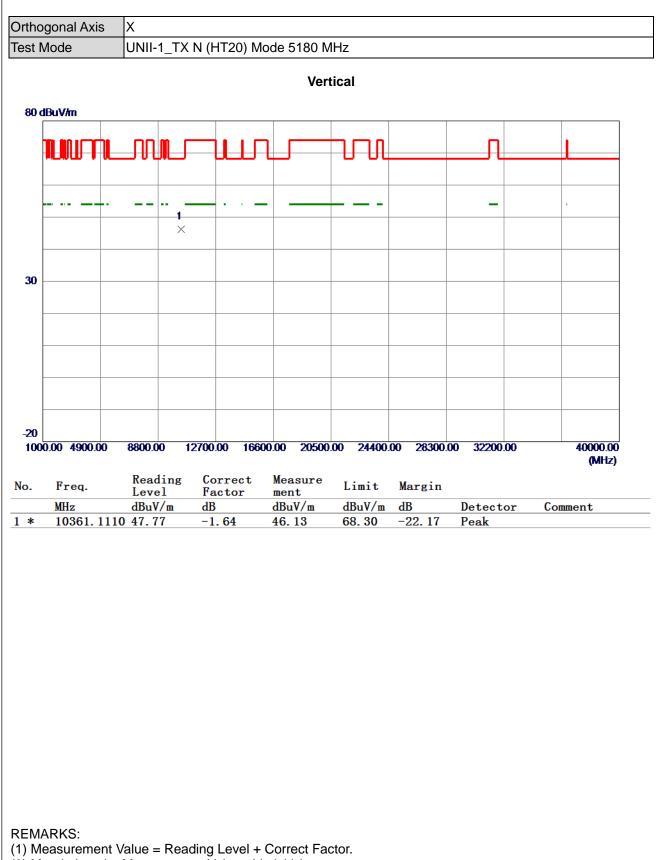
(1) Measurement Value = Reading Level + Correct Factor.



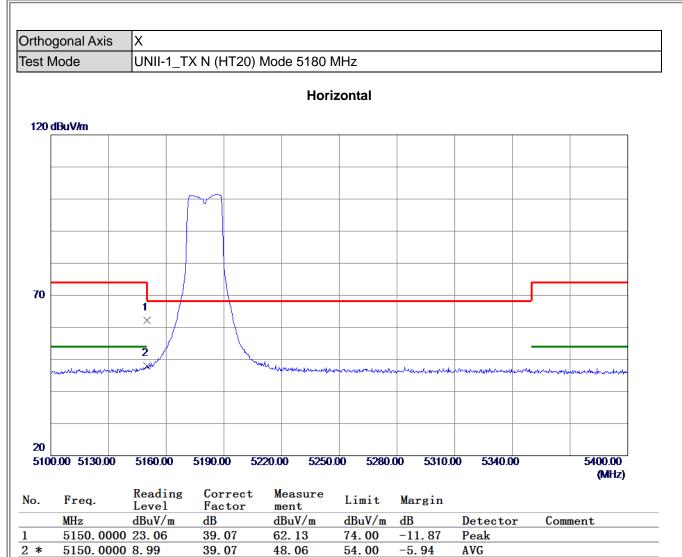


(1) Measurement Value = Reading Level + Correct Factor.



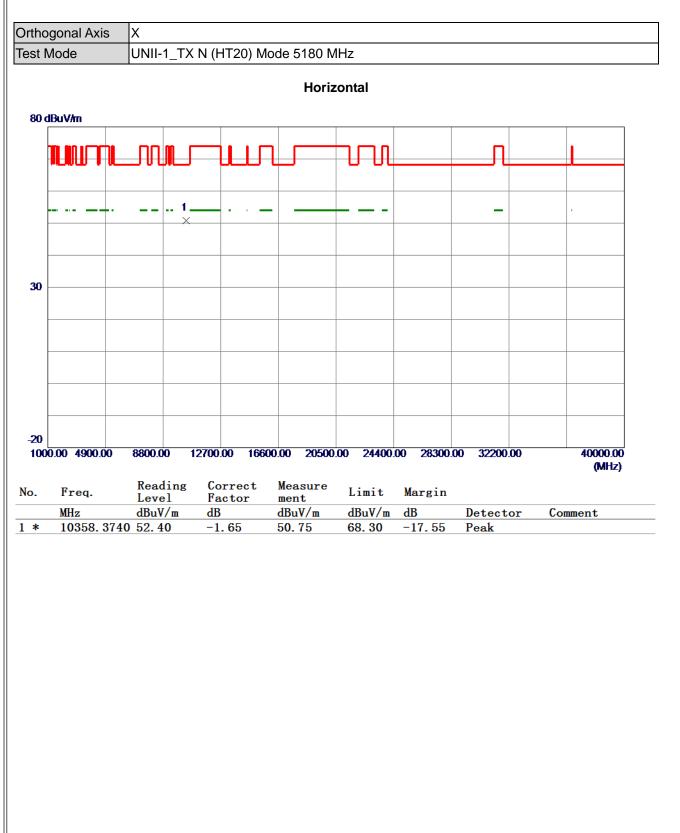






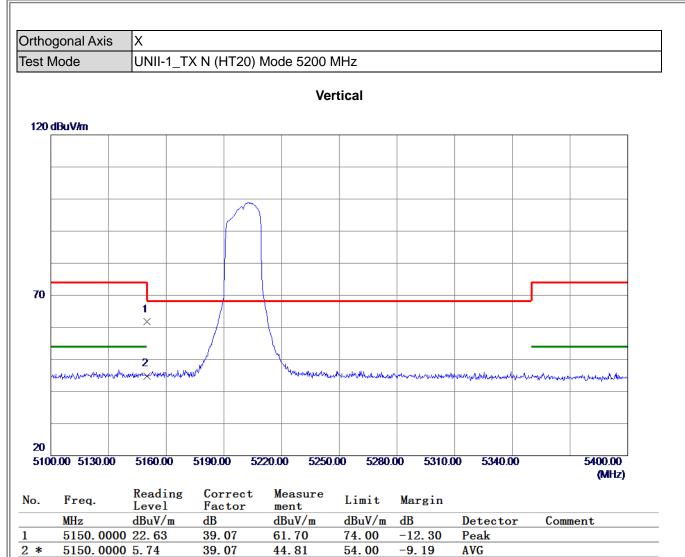
(1) Measurement Value = Reading Level + Correct Factor.





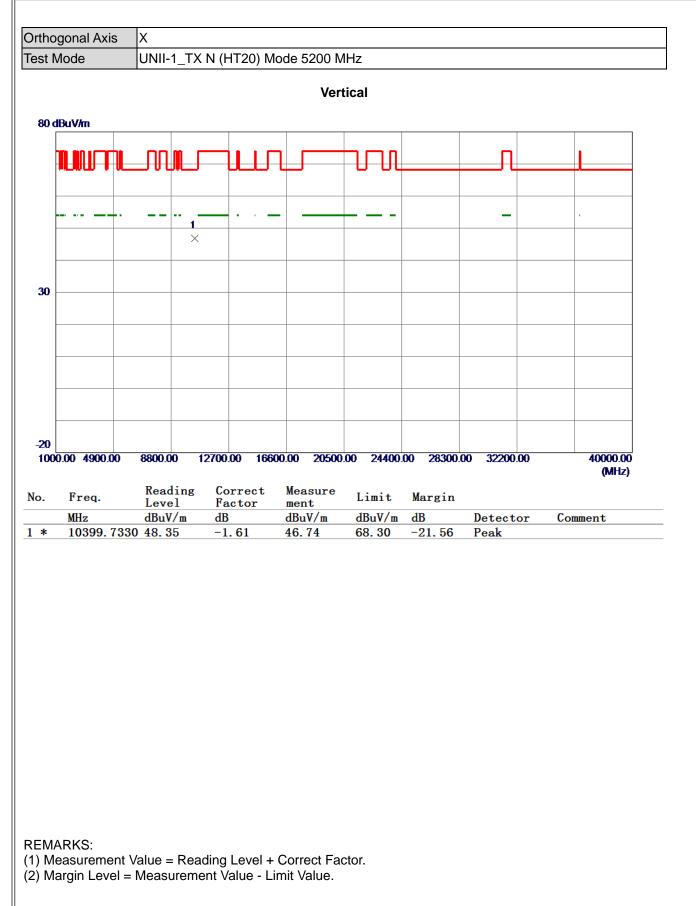
(1) Measurement Value = Reading Level + Correct Factor.



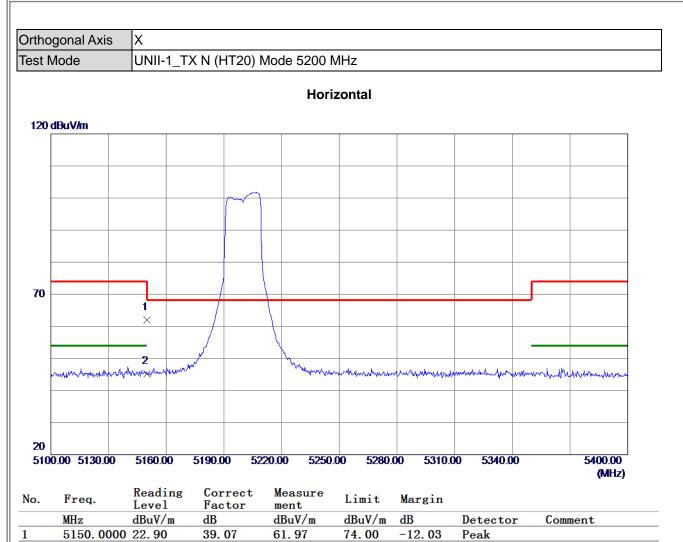


(1) Measurement Value = Reading Level + Correct Factor.









2 *

5150.0000 6.22

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

39.07

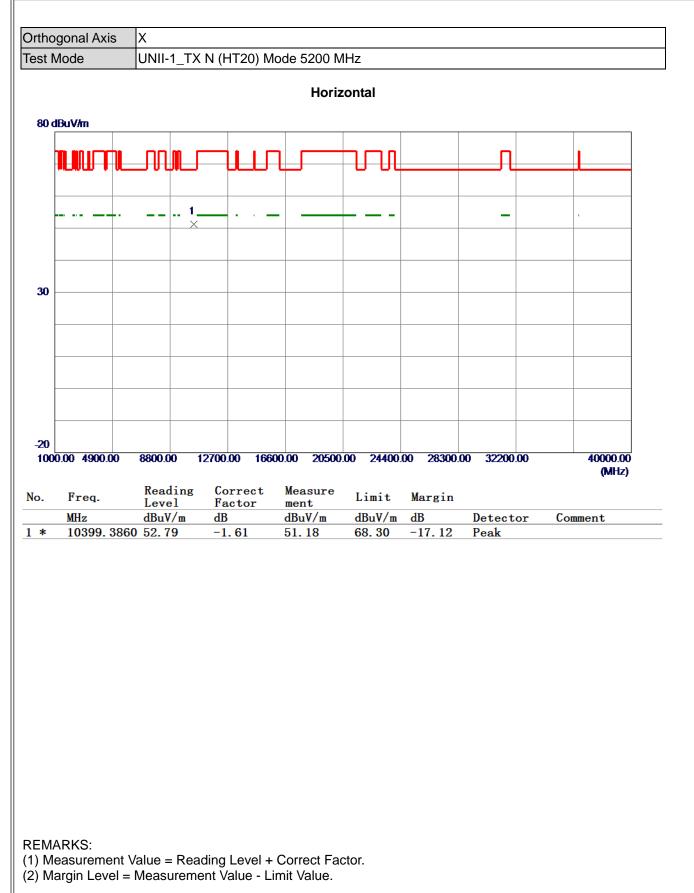
45.29

54.00

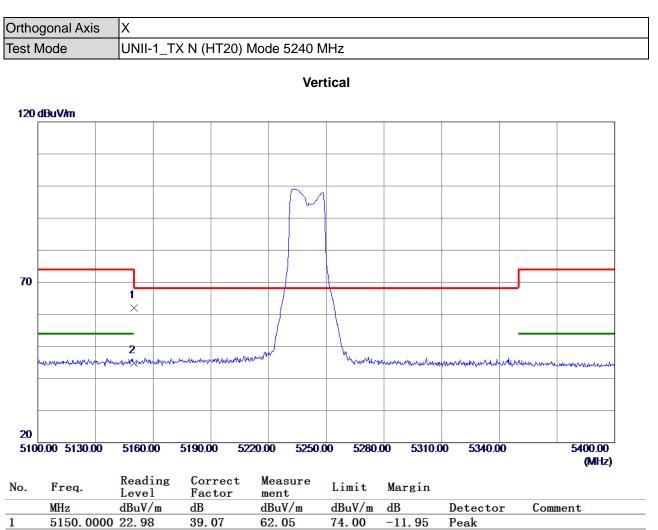
-8.71

AVG





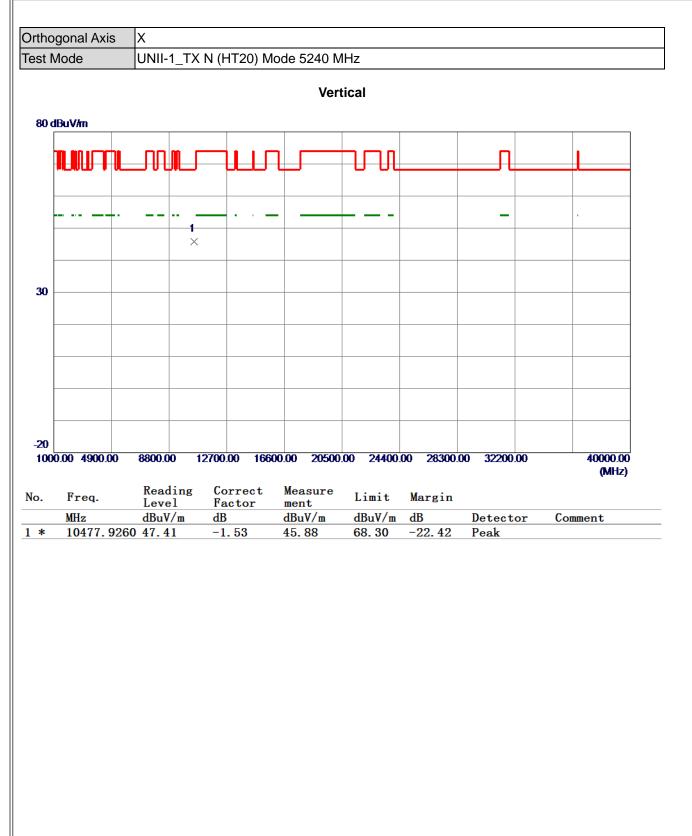




	1112	ubu (/ m	uD	ubu (/ m	ubu (/ m	ub	Detector	Commerre
1	5150.0000	22.98	39.07	62.05	74.00	-11. 95	Peak	
2 *	5150.0000	5.81	39.07	44.88	54. 00	-9.12	AVG	

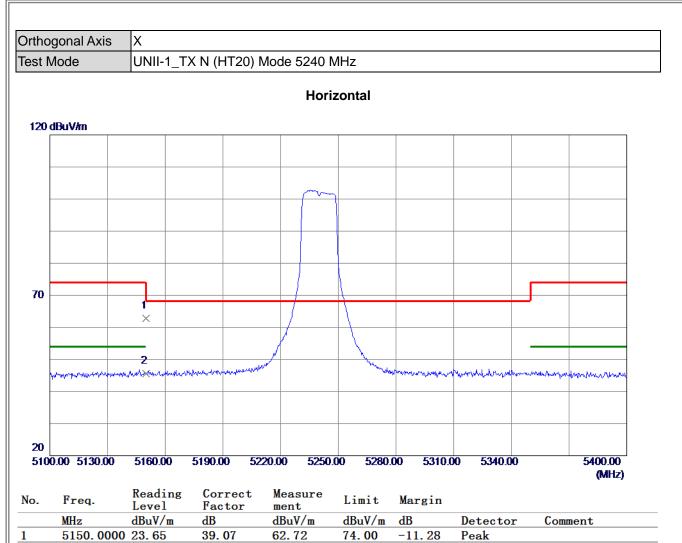
(1) Measurement Value = Reading Level + Correct Factor.





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





2 *

5150.0000 6.56

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

39.07

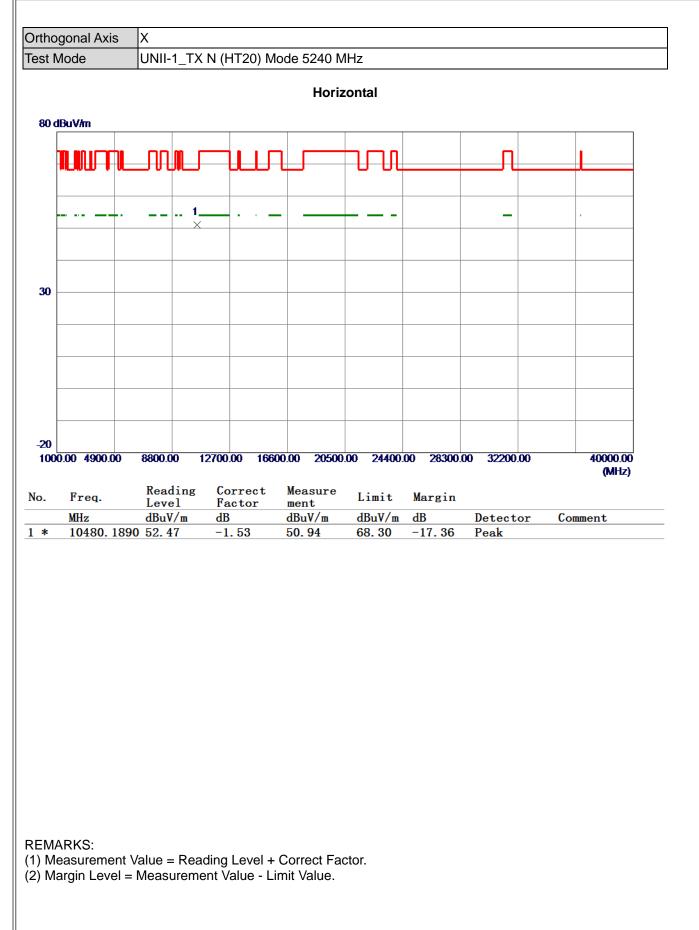
45. 63

54.00

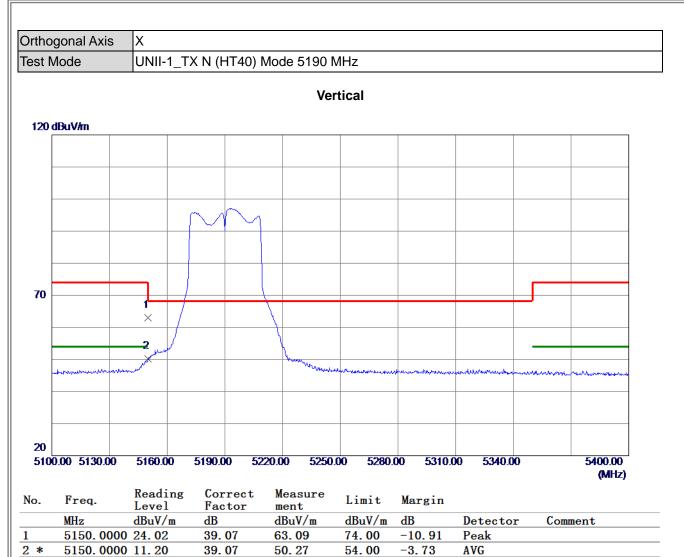
-<mark>8. 37</mark>

AVG



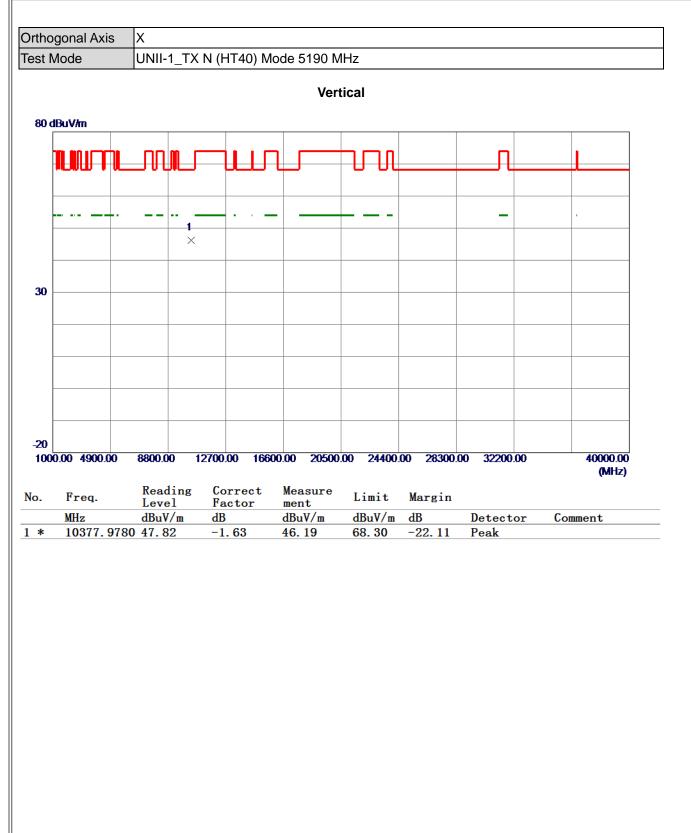






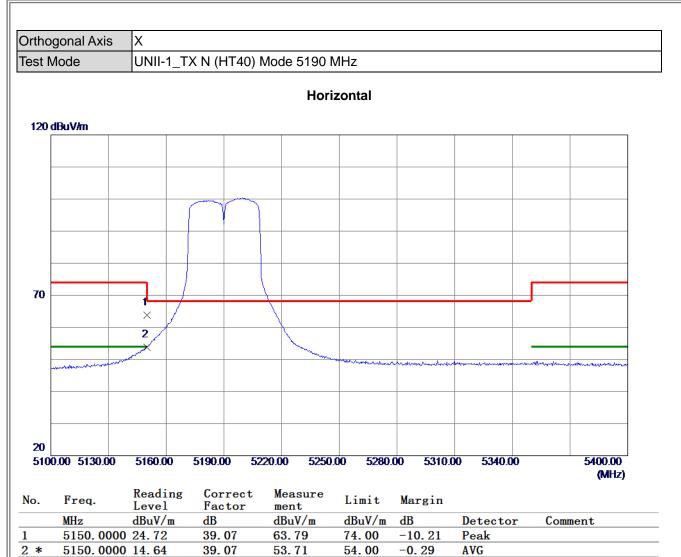
(1) Measurement Value = Reading Level + Correct Factor.





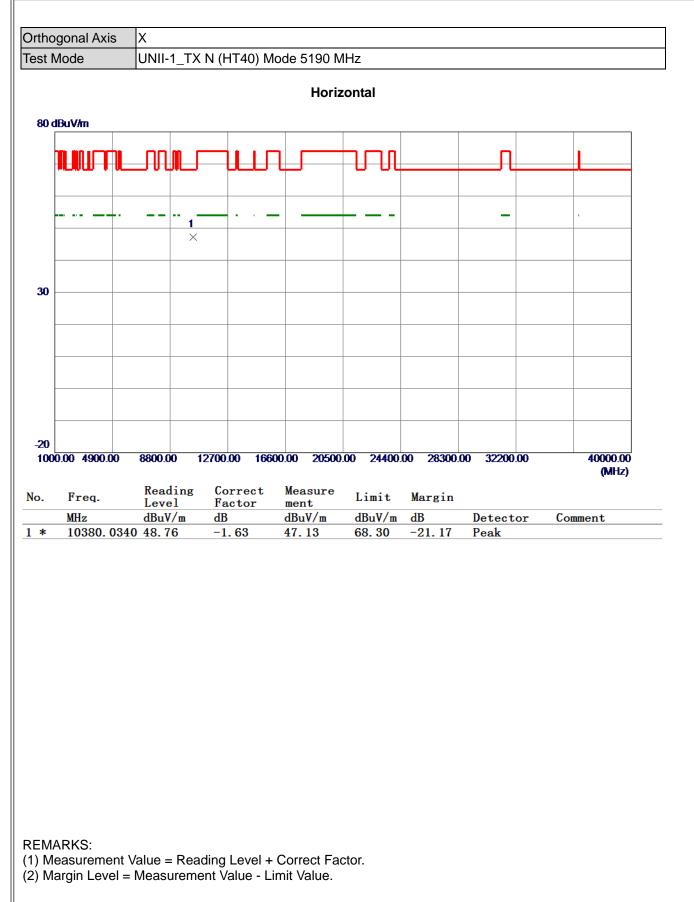
(1) Measurement Value = Reading Level + Correct Factor.



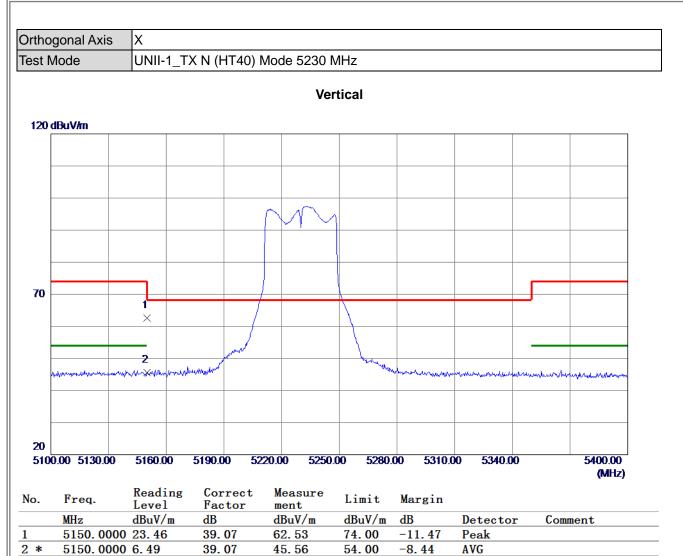


(1) Measurement Value = Reading Level + Correct Factor.



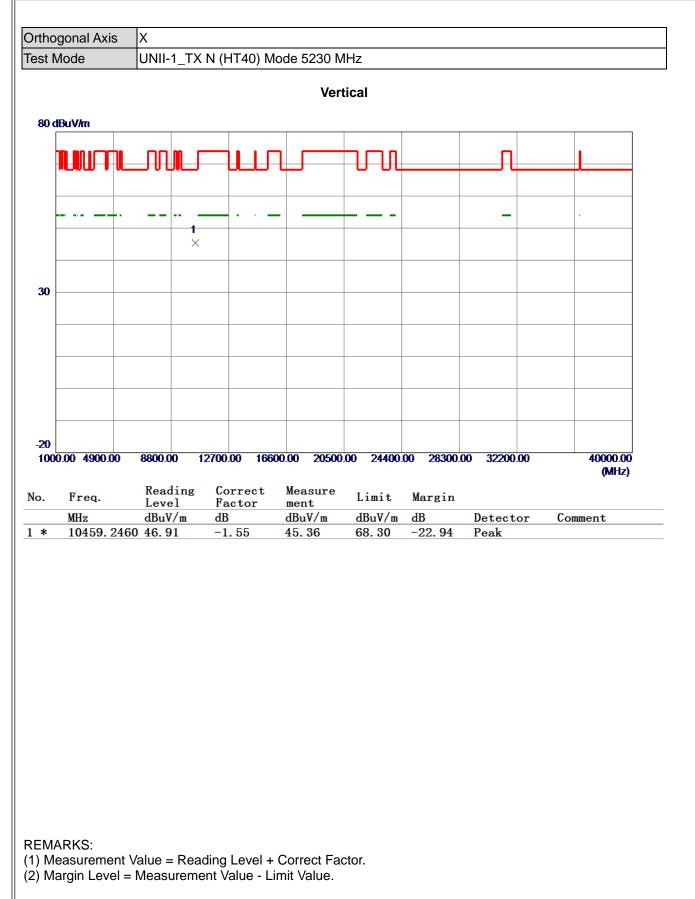




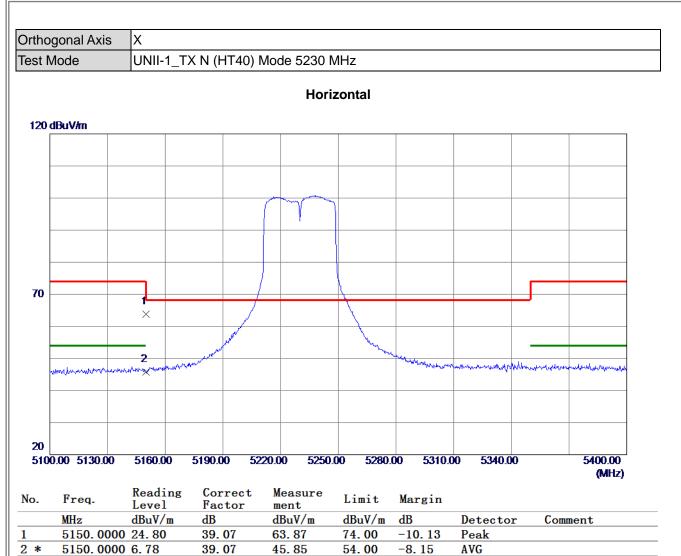


(1) Measurement Value = Reading Level + Correct Factor.



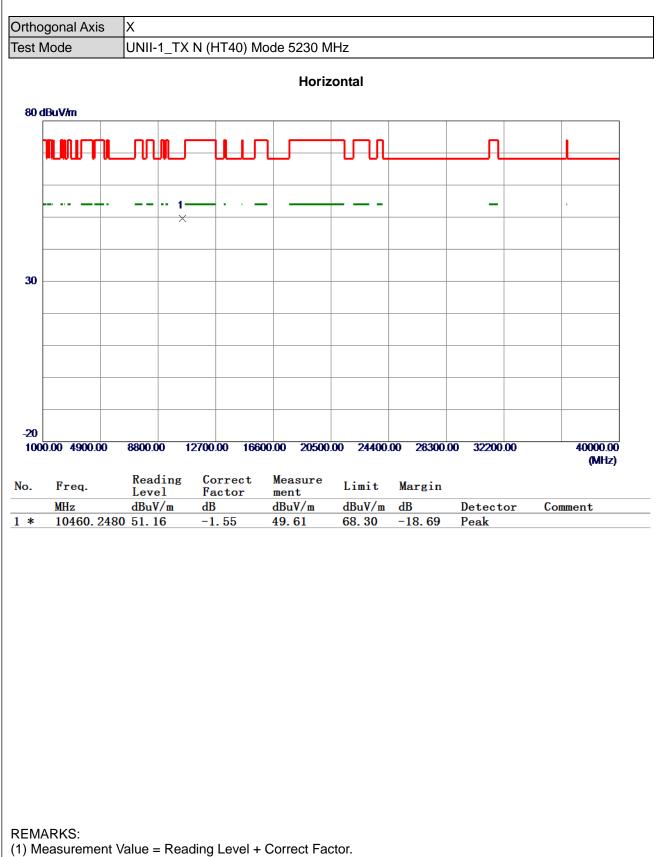




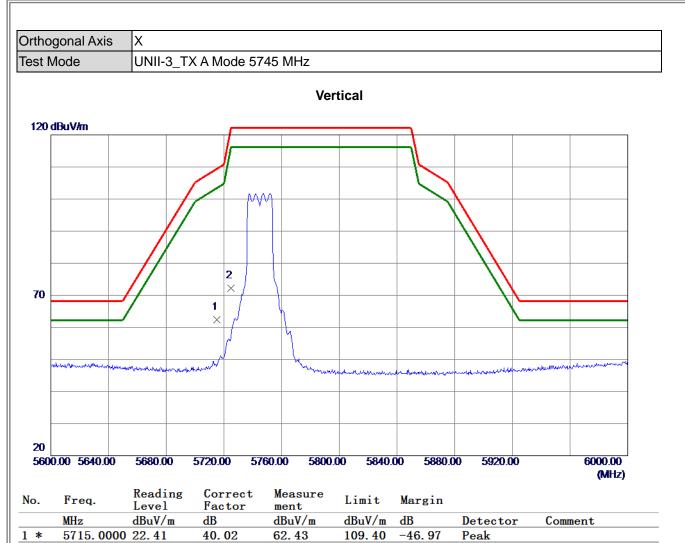


(1) Measurement Value = Reading Level + Correct Factor.









2

5725. 0000 32. 11

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

40.05

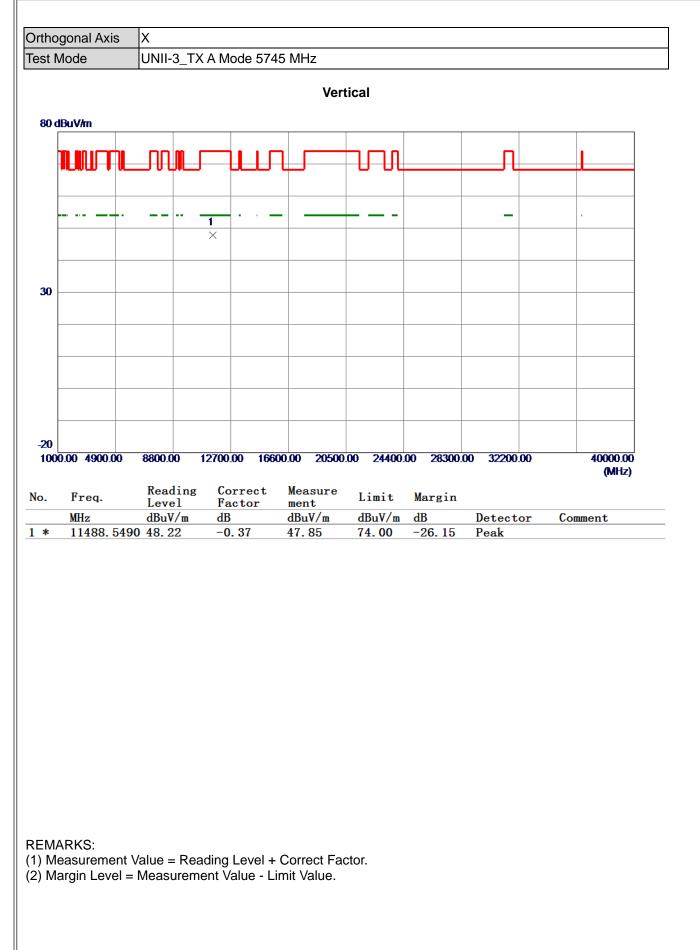
72.16

122. 20

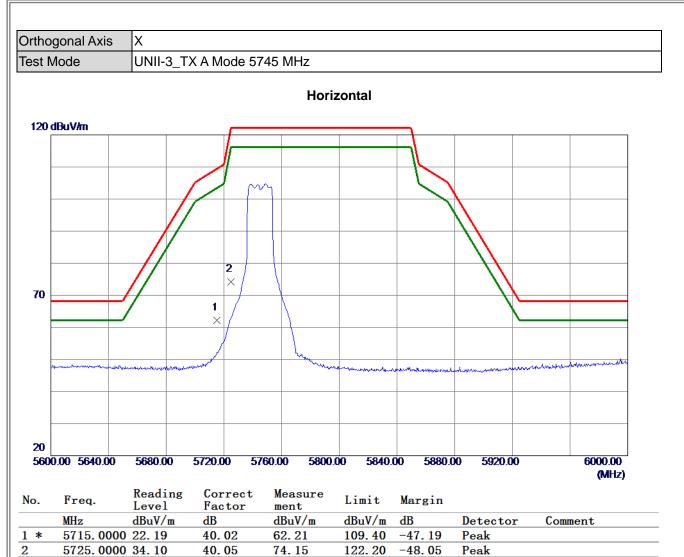
-50.04

Peak







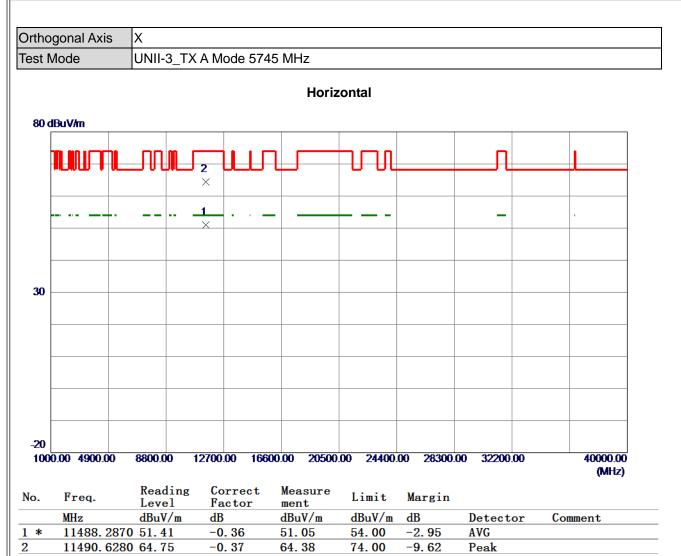


Peak

REMARKS:

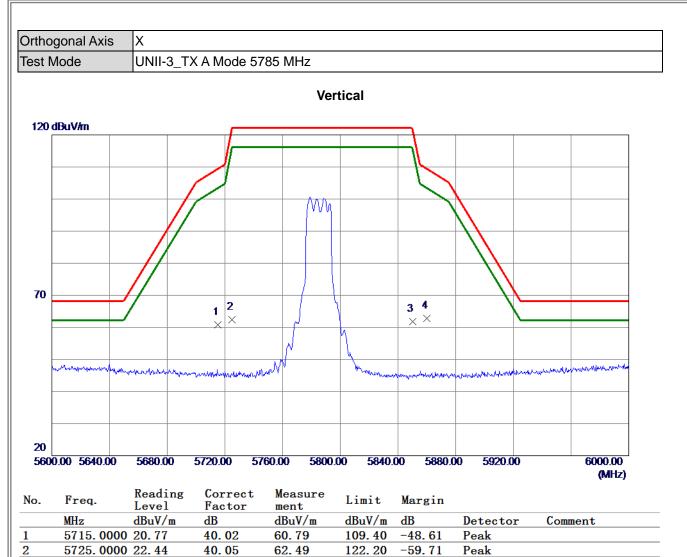
(1) Measurement Value = Reading Level + Correct Factor.





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





122.20

109.40

-60.37

-46.65

Peak

Peak

REMARKS: (1) Measurement Value – Rea

5850.0000 21.49

5860.0000 22.38

3

4 *

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

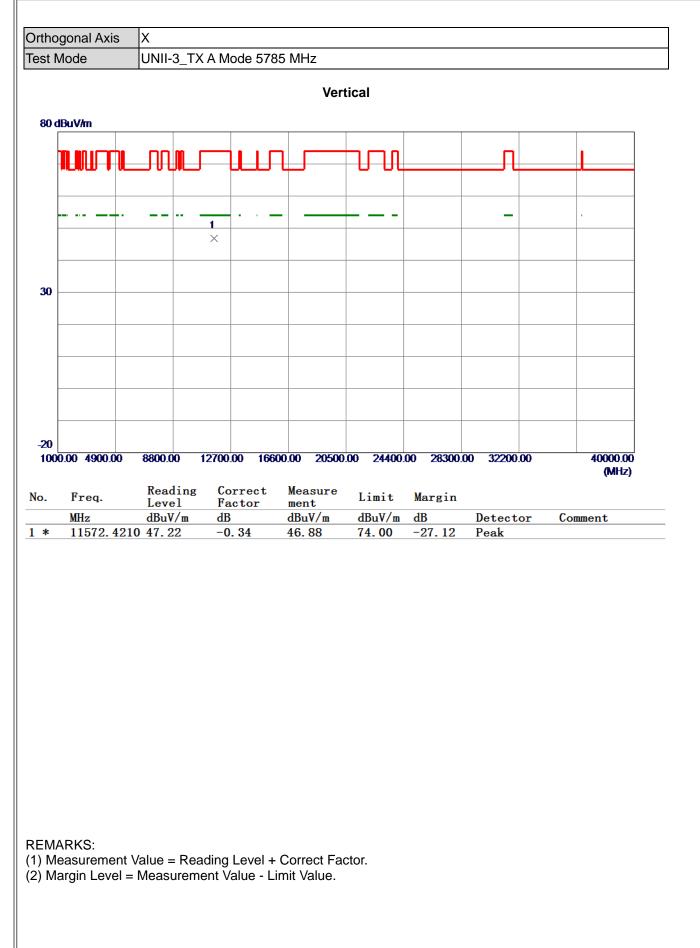
40.34

40.37

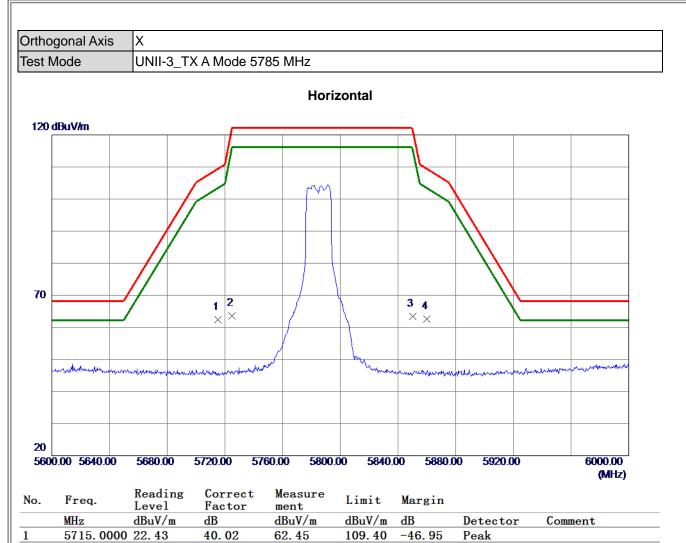
61.83

62.75









REMARKS: (1) Measurement Value – Re

5725. 0000 23. 47

5850.0000 23.05

5860.0000 22.25

2

3

4 *

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

40.05

40.34

40.37

63.52

63.39

62.62

122. 20

122.20

109.40

-58.68

-58.81

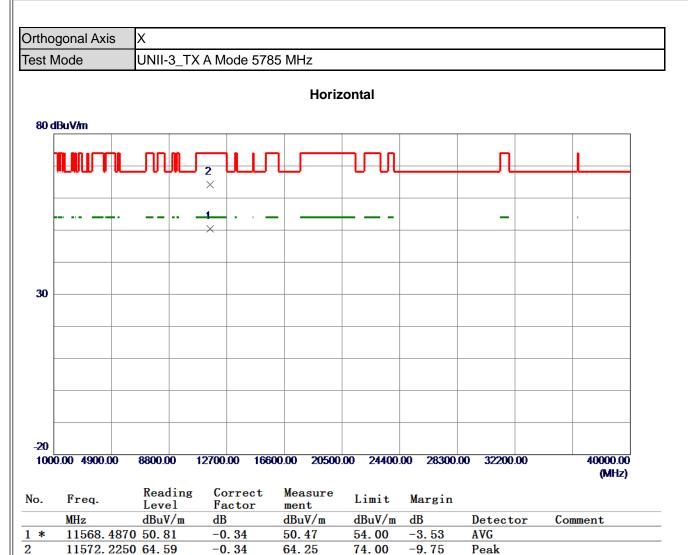
-46.78

Peak

Peak

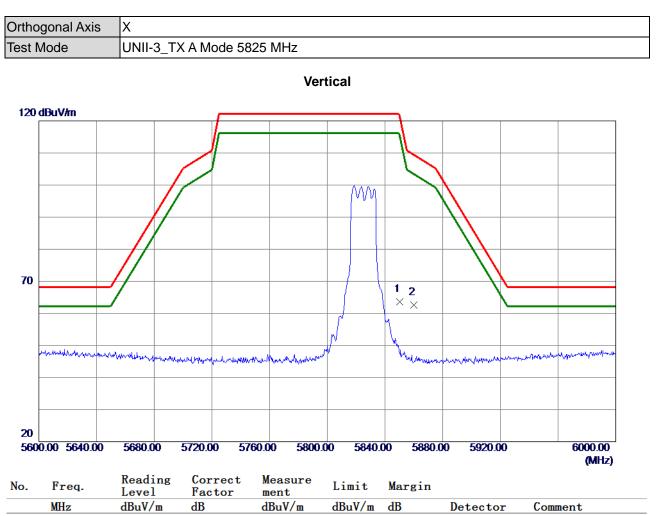
Peak





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

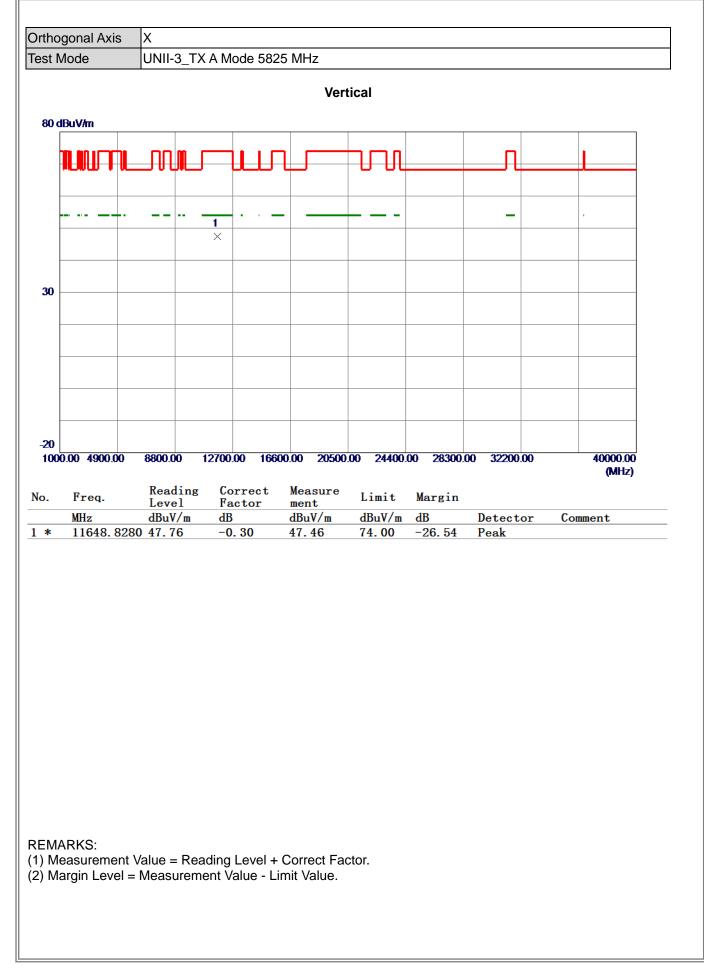




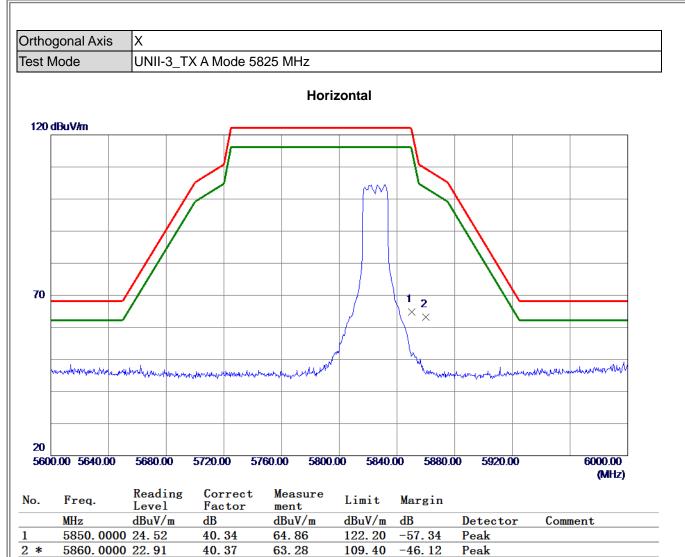
NO.	IICų.	Level	Factor	ment	LIMIC	margin		
	MHz	dBuV/m	dB	dBuV/m	dBuV/m	dB	Detector	Comment
1	5850. 0000	23.22	40.34	63. 56	122.20	-58.64	Peak	
2 *	5860.0000	22.24	40.37	62.61	109.40	-46.79	Peak	

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



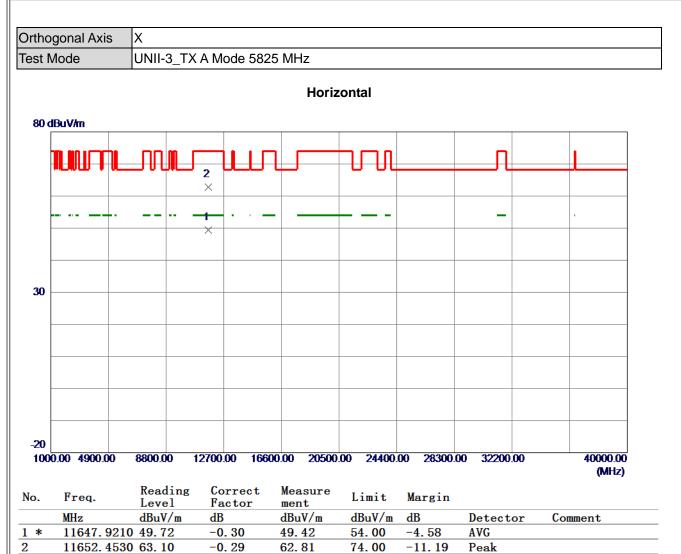






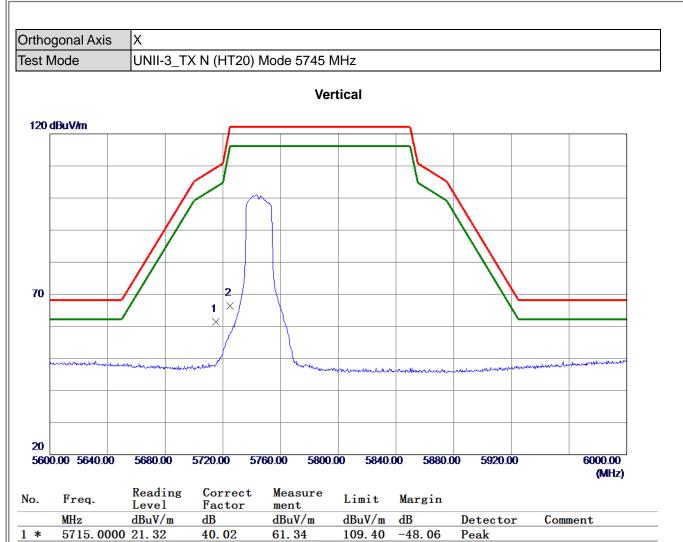
(1) Measurement Value = Reading Level + Correct Factor.





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





2

5725.0000 26.34

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

40.05

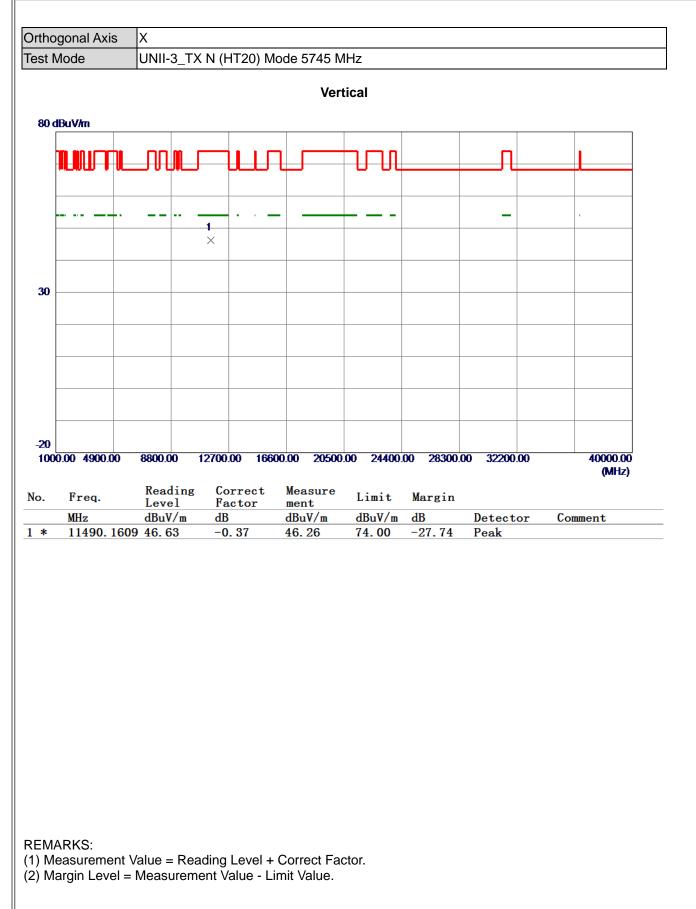
66.39

122. 20

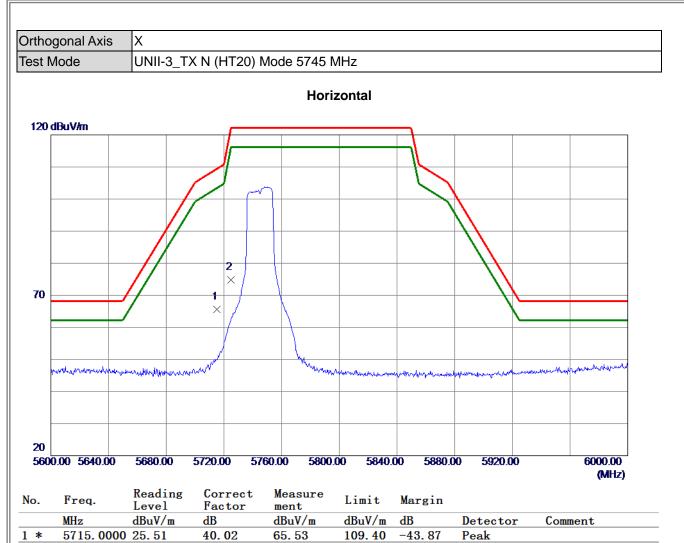
-55.81

Peak









2

5725.0000 34.83

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

40.05

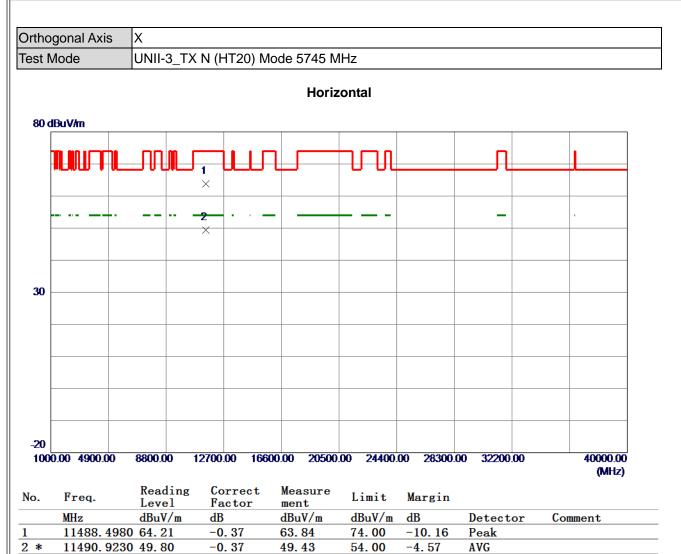
74.88

122. 20

-47.32

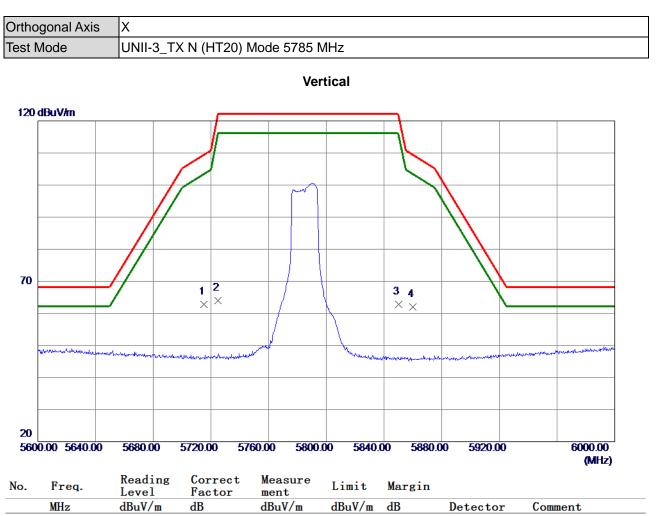
Peak





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

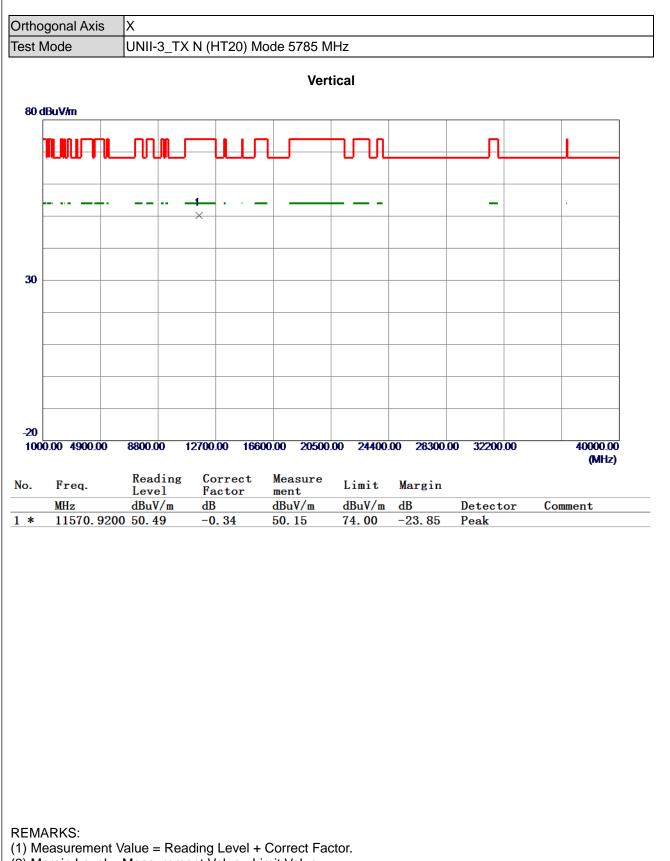




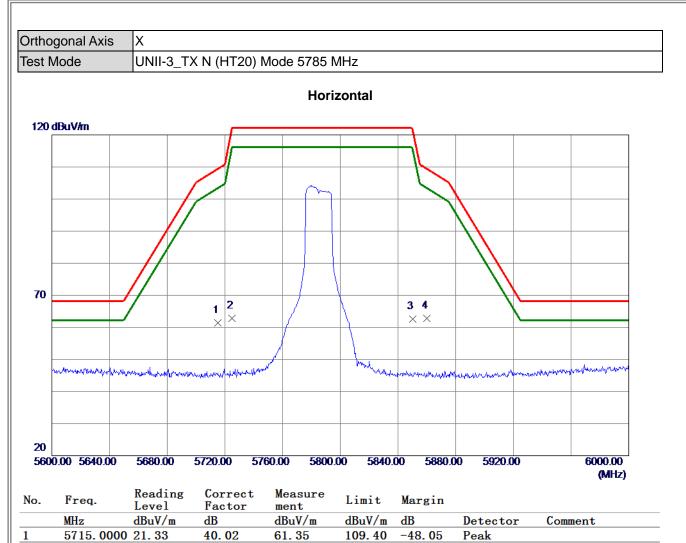
		10101	1 40 001	mone			
	MHz	dBuV/m	dB	dBuV/m	dBuV/m dB	Detector	Comment
1 :	∗ 5715. 00 0	0 22.79	40.02	62.81	109.40 -46.59	Peak	
2	5725.000	0 23.89	40.05	63.94	122. 20 -58. 26	Peak	
3	585 0. 000	0 22.40	40.34	62.74	122. 20 -59. 46	Peak	
4	5860.000	0 21.58	40.37	61.95	109.40 -47.45	Peak	

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









REMARKS: (1) Measurement Value – I

5725. 0000 22. 77

5850.0000 22.25

5860.0000 22.49

2

3

4 *

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

40.05

40.34

40.37

62.82

62.59

62.86

122. 20

122.20

109.40

-5<mark>9.</mark> 38

-5<mark>9.</mark> 61

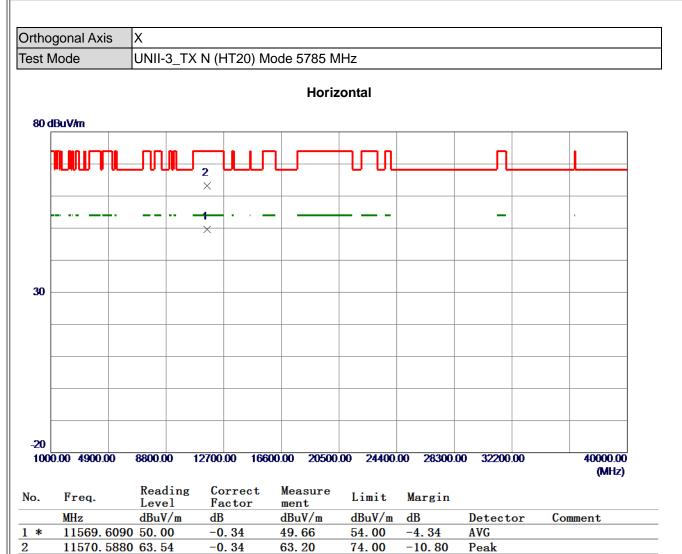
-46.54

Peak

Peak

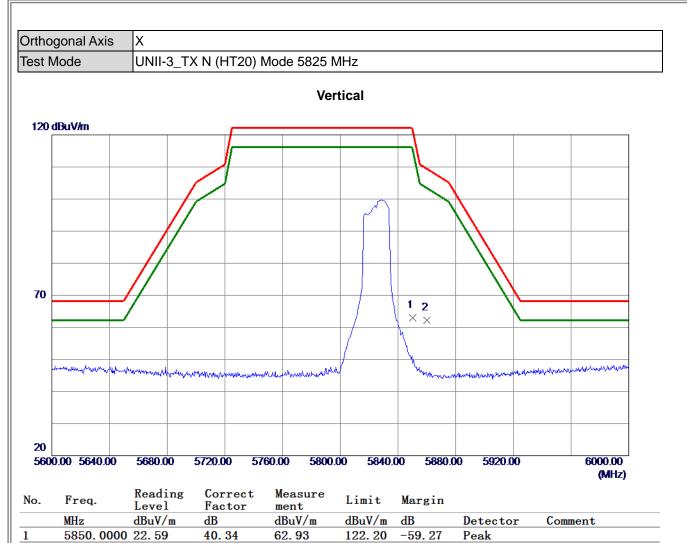
Peak





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





2 *

5860.0000 21.91

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

40.37

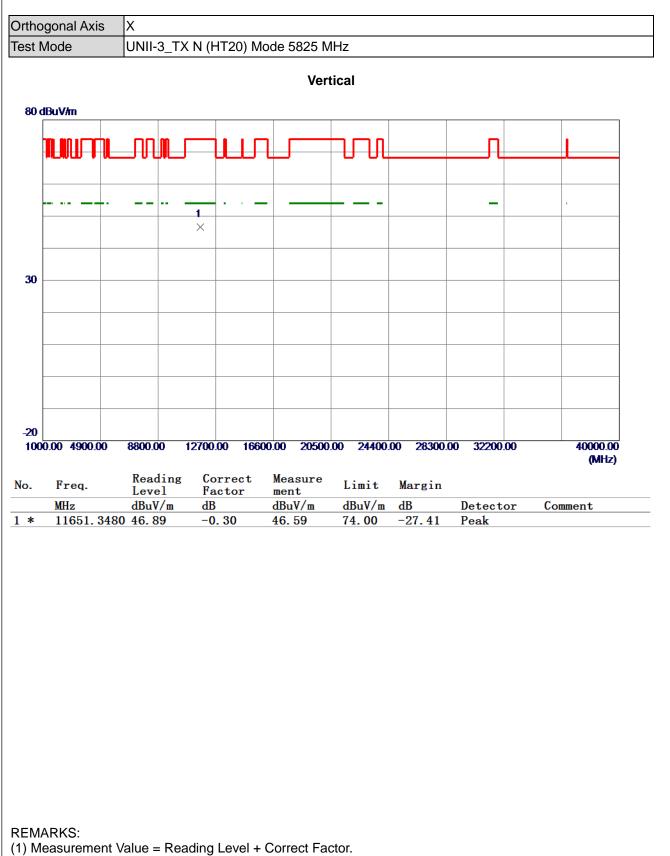
62.28

109.40

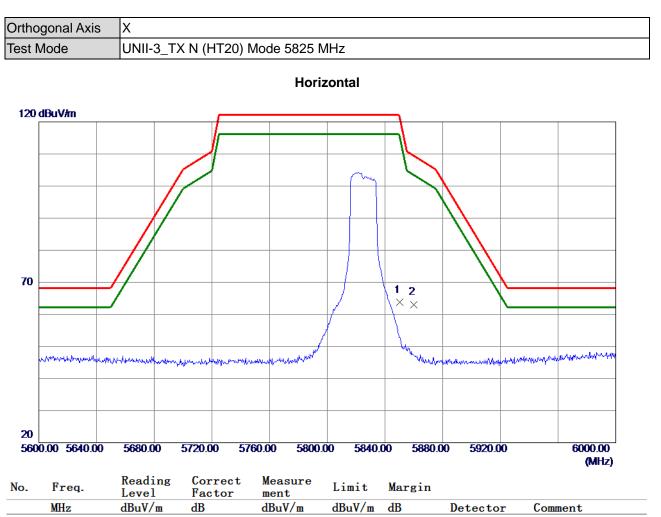
-47.12

Peak





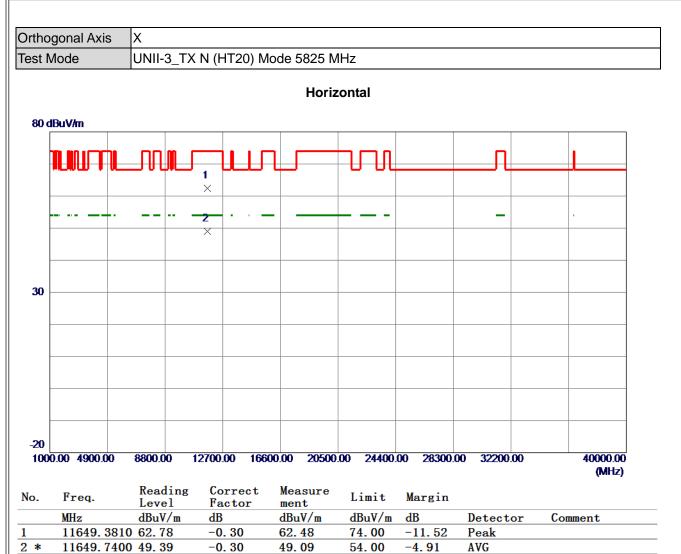




		Level	Factor	ment				
	MHz	dBuV/m	dB	dBuV/m	dBuV/m	dB	Detector	Comment
1	5850.0000	23.36	40.34	63.70	122.20	-58. 50	Peak	
2 *	5860.0000	22.55	40.37	62.92	109.40	-46.48	Peak	

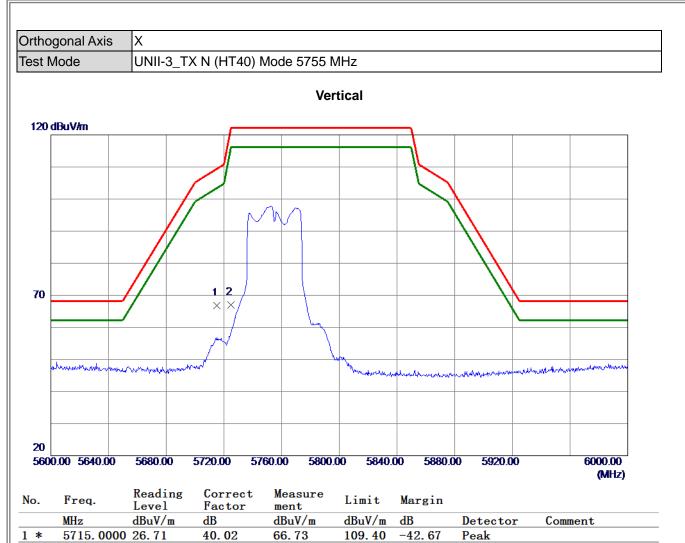
(1) Measurement Value = Reading Level + Correct Factor.





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





2

5725.0000 26.93

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

40.05

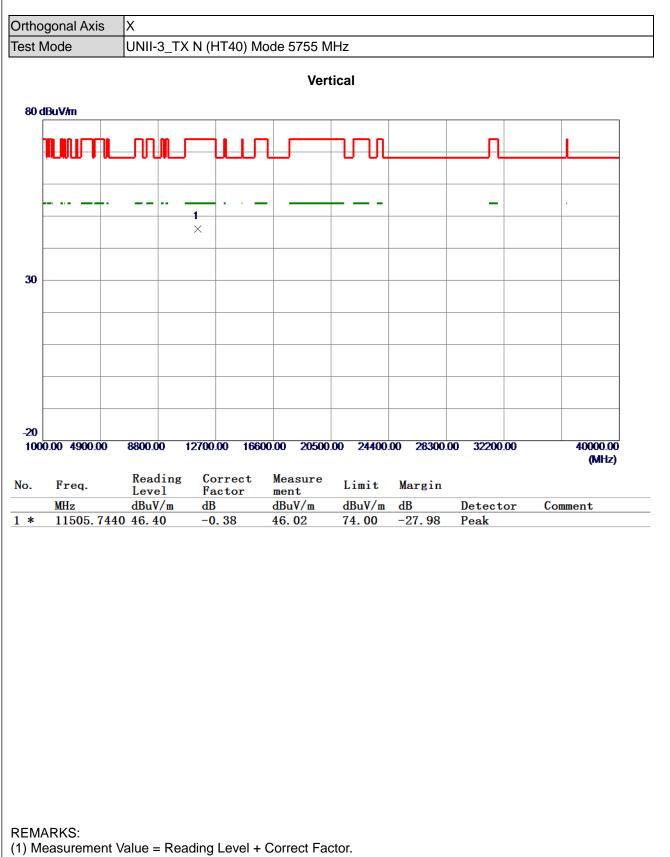
66.98

122. 20

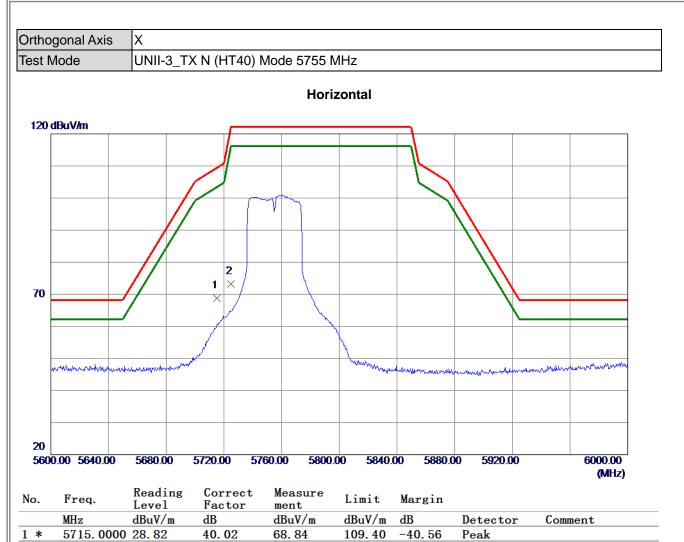
-55.22

Peak









2

5725.0000 33.20

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

40.05

73.25

122. 20

-48.95

Peak