

# **FCC Radio Test Report**

## FCC ID: TE7LM500

This report concerns: Original Grant

Project No.	: 1909C149
Equipment	: Tapo Smart Light Bulb Wi-Fi Module
Brand Name	: tp-link
Test Model	: LM500
Series Model	: N/A
Applicant	: TP-Link Technologies Co., Ltd.
Address	: Building 24(floors1,3,4,5) and 28(floors1-4) Central Science and
	Technology Park, Shennan Rd, Nanshan, Shenzhen, China
Manufacturer	: TP-Link Technologies Co., Ltd.
Address	: Building 24(floors1,3,4,5) and 28(floors1-4) Central Science and
	Technology Park, Shennan Rd, Nanshan, Shenzhen, China
Date of Receipt	: Sep. 27, 2019
Date of Test	: Sep. 27, 2019 ~ Nov. 08, 2019
Issued Date	: Feb. 27, 2020
<b>Report Version</b>	: R01
Test Sample	: Engineering Sample No.: DG2019102113
Standard(s)	: FCC Part15, Subpart C (15.247)
	ANSI C63.10-2013
	KDB 558074 D01 15.247 Meas Guidance v05r02

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

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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

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	6
1. SUMMARY OF TEST RESULTS	7
1.1 TEST FACILITY	8
1.2 MEASUREMENT UNCERTAINTY	8
1.3 TEST ENVIRONMENT CONDITIONS	8
2 . GENERAL INFORMATION	9
2.1 GENERAL DESCRIPTION OF EUT	9
2.2 DESCRIPTION OF TEST MODES	10
2.3 PARAMETERS OF TEST SOFTWARE	11
2.4 DUTY CYCLE	12
2.5 BLOCK DIAGRAM SHOWING THE CONFIGURATION OF SYSTEM TEST	ED 13
2.6 SUPPORT UNITS	13
3 . AC POWER LINE CONDUCTED EMISSIONS TEST	14
3.1 LIMIT	14
3.2 TEST PROCEDURE	14
3.3 DEVIATION FROM TEST STANDARD	14
3.4 TEST SETUP	15
3.5 EUT OPERATION CONDITIONS	15
3.6 TEST RESULTS	15
4. RADIATED EMISSIONS TEST	16
4.1 LIMIT	16
4.2 TEST PROCEDURE	17
4.3 DEVIATION FROM TEST STANDARD	17
4.4 TEST SETUP 4.5 EUT OPERATION CONDITIONS	18 19
4.5 EUT OPERATION CONDITIONS 4.6 TEST RESULTS - 9 KHZ TO 30 MHZ	19 19
4.7 TEST RESULTS - 30 MHZTO 1000 MHZ	19
4.8 TEST RESULTS - ABOVE 1000 MHZ	19
5. BANDWIDTH TEST	20
5.1 LIMIT	20
5.2 TEST PROCEDURE	20
5.3 DEVIATION FROM STANDARD	20
5.4 TEST SETUP	20



Table of Contents	Page
5.5 EUT OPERATION CONDITIONS	20
5.6 TEST RESULTS	20
6. MAXIMUM AVERAGE OUTPUT POWER TEST	21
6.1 LIMIT	21
6.2 TEST PROCEDURE	21
6.3 DEVIATION FROM STANDARD	21
6.4 TEST SETUP	21
6.5 EUT OPERATION CONDITIONS	21
6.6 TEST RESULTS	21
7. CONDUCTED SPURIOUS EMISSIONS	22
	22
7.2 TEST PROCEDURE 7.3 DEVIATION FROM STANDARD	22 22
7.4 TEST SETUP	22
7.5 EUT OPERATION CONDITIONS	22
7.6 TEST RESULTS	22
8 . POWER SPECTRAL DENSITY TEST	23
8.1 LIMIT	23
8.2 TEST PROCEDURE	23
8.3 DEVIATION FROM STAND ARD	23
8.4 TEST SETUP	23
8.5 EUT OPERATION CONDITIONS	23
8.6 TEST RESULTS	23
9. MEASUREMENT INSTRUMENTS LIST	24
10 . EUT TEST PHOTO	26
APPENDIX A - AC POWER LINE CONDUCTED EMISSIONS	31
APPENDIX B - RADIATED EMISSION - 9 KHZ TO 30 MHZ	34
APPENDIX C - RADIATED EMISSION - 30 MHZ TO 1000 MHZ	39
APPENDIX D - RADIATED EMISSION- ABOVE 1000 MHZ	42
APPENDIX E - BANDWIDTH	103
APPENDIX F - MAXIMUM AVERAGE OUTPUT POWER	107
<b>APPENDIX G - CONDUCTED SPURIOUS EMISSIONS</b>	109



## Table of Contents

Page

## **APPENDIX H - POWER SPECTRAL DENSITY**

113

## **REPORT ISSUED HISTORY**

Report Version	Description	Issued Date
R00	Original Issue.	Jan. 16, 2020
R01	Changed the model name.	Feb. 27, 2020

## 1. SUMMARY OF TEST RESULTS

Test procedures according to the technical standard(s):

FCC Part15, Subpart C (15.247)						
Standard(s) Section	Test Item	Test Result	Judgment	Remark		
15.207	AC Power Line Conducted Emissions	APPENDIX A	PASS			
15.247(d) 15.205(a) 15.209(a)	Radiated Emissions	APPENDIX B APPENDIX C APPENDIX D	PASS			
15.247(a)(2)	Bandwidth	APPENDIX E	PASS			
15.247(b)(3)	Maximum Average Output Power	APPENDIX F	PASS			
15.247(d)	Conducted Spurious Emissions	APPENDIX G	PASS			
15.247(e)	Power Spectral Density	APPENDIX H	PASS			
15.203	Antenna Requirement		PASS	Note(2)		

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.



## 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)
SH-C01	CISPR	150 kHz ~ 30 MHz	2.70

#### B. Radiated emissions test:

Test Site	Method	Measurement Frequency Range	Ant. H / V	U, (dB)
		9kHz ~ 30MHz	V	3.79
		9kHz ~ 30MHz	Н	3.57
	CISPR	30MHz ~ 200MHz	V	4.88
		30MHz ~ 200MHz	Н	4.14
DG-CB03		200MHz ~ 1,000MHz	V	4.62
DG-CD03		200MHz ~ 1,000MHz	Н	4.80
		1GHz ~ 6GHz	-	4.58
		6GHz ~ 18GHz	-	5.18
		18GHz ~ 26.5GHz	-	3.62
		26.5GHz ~ 40GHz	-	4.00

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	Laughing Zhang
Radiated Emissions-9K-30MHz	<b>25</b> °C	60%	DC 5V	Laughing Zhang
Radiated Emissions-30 MHz to 1GHz	<b>24</b> °C	68%	DC 5V	Sheldon Ou
Radiated Emissions-Above 1000 MHz	<b>26</b> °C	65%	DC 5V	Sheldon Ou
Bandwidth	25°C	60%	DC 5V	Jonas Chen
Maximum Average Output Power	25°C	60%	DC 5V	Jonas Chen
Conducted Spurious Emissions	25°C	60%	DC 5V	Jonas Chen
Power Spectral Density	25°C	60%	DC 5V	Jonas Chen

## 2. GENERAL INFORMATION

## 2.1 GENERAL DESCRIPTION OF EUT

Equipment	Tapo Smart Light Bulb Wi-Fi Module
Brand Name	tp-link
Test Model	LM500
Series Model	N/A
Model Difference(s)	N/A
Power Source	Supplied from PC USB port.
Power Rating	DC 5V
Operation Frequency	2412 MHz ~ 2462 MHz
Modulation Type	IEEE 802.11b: DSSS IEEE 802.11g: OFDM IEEE 802.11n: OFDM
Bit Rate of Transmitter	IEEE 802.11b: 11/5.5/2/1 Mbps IEEE 802.11g: 54/48/36/24/18/12/9/6 Mbps IEEE 802.11n: up to 72.2 Mbps
Maximum Average Output Power	IEEE 802.11b: 16.96 dBm (0.0497 W) IEEE 802.11g: 17.12 dBm (0.0516 W) IEEE 802.11n (HT20): 17.26 dBm (0.0532 W)

#### Note:

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

#### 2. Channel List:

	CH01 - CH11 for IEEE 802.11b, IEEE 802.11g, IEEE 802.11n (HT20)						
Channel	Frequency (MHz)	Channel	Frequency (MHz)	Channel	Frequency (MHz)	Channel	Frequency (MHz)
01	2412	04	2427	07	2442	10	2457
02	2417	05	2432	08	2447	11	2462
03	2422	06	2437	09	2452		

#### 3. Antenna Specification:

Ant.	Brand	Model Name	Antenna Type	Connector	Gain (dBi)
1	<b>TP-LINK</b>	N/A	РСВ	N/A	0.27



## 2.2 DESCRIPTION OF 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 B Mode Channel 01/06/11
Mode 2	TX G Mode Channel 01/06/11
Mode 3	TX N-20 MHz Mode Channel 01/06/11
Mode 4	TX N-20 MHz Mode Channel 11
Mode 5	TX B Mode Channel 01/02/06/10/11
Mode 6	TX G Mode Channel 01/02/06/10/11
Mode 7	TX N-20 MHz Mode Channel 01/02/06/10/11

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 4 TX N-20 MHz Mode Channel 11			

Radiated emissions test - Below 1GHz		
Final Test Mode Description		
Mode 4	TX N-20 MHz Mode Channel 11	

Radiated emissions test- Above 1GHz		
Final Test Mode: Description		
Mode 5	TX B Mode Channel 01/02/06/10/11	
Mode 6	TX G Mode Channel 01/02/06/10/11	
Mode 7	TX N-20 MHz Mode Channel 01/02/06/10/11	

Conducted test			
Final Test Mode Description			
Mode 1	TX B Mode Channel 01/06/11		
Mode 2	TX G Mode Channel 01/06/11		
Mode 3	e 3 TX N-20 MHz Mode Channel 01/06/11		



NOTE:

- (1) The measurements are performed at the high, middle, low available channels.
- (2) All the bit rate of transmitter have been tested and found the lowest rate is found to be the worst case and recorded.
- (3) For radiated emission below 1 GHz test, the IEEE 802.11n20 Channel 11 is found to be the worst case and recorded.
- (4) For radiated emission above 1 GHz test, 1GHz~26.5GHz 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.

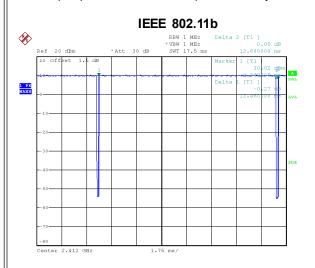
## 2.3 PARAMETERS OF TEST SOFTWARE

Test Software	UI_mptool.exe		
Frequency (MHz)	2412 2437 2462		
IEEE 802.11b	36	36	35
IEEE 802.11g	45	44	44
IEEE 802.11n (HT20)	46	46	46



## 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.



 FOR TO ADDRESS

 Set
 2.0 MB

 Set
 2.0 MB

Date: 9.0CT.2019 18:53:07

Ref 20 dBm         *Att 30 dB         SWI 4 ms         0.12 dB           20 Offlet 1.6 dB         *Att 30 dB         SWI 4 ms         2.056000 ms           20 offlet 1.6 dB         1         Marker 1 (T1 6/75 dB         6/75 dB		IEEE 80	<b>)2.11n (I</b>	HT20)
20         Offket         1.5         dB         1         6,75         dB           -1 <t< th=""><th>Ref 20 dBm</th><th>* a++ 30 dB</th><th>*VBW 1 MHz</th><th>0.12 dB</th></t<>	Ref 20 dBm	* a++ 30 dB	*VBW 1 MHz	0.12 dB
				Marker 1 [T1
-10 -20 -10 -10 -20 -20 -20 -20 -20 -20 -20 -2	18 1 1 1 1 1 1 1 1 1 1 1	it is the terms to the second		6.75 dB
-10 -10 -10 -30 -30 -30 -30 -30 -59 -59 -59 -59 -59 -59 -59 -59	na manun	were the world and were	ntrus pursua	Delta P (Ti )
- 20 20	-0			
	-10			
- 30 - 40 - 50 - 50				
	- 20			
- 40	- 30			
	40			
	50			
60*	- 50		4	
	- 60 4			

Duty cycle = 12.460 ms / 12.600 ms = 98.89%

Date: 9.0CT.2019 18:53:48

Duty cycle = 1.920 ms / 2.056 ms = 93.39% Duty Factor = 10 log(1/Duty cycle) = 0.30

NOTE:

For IEEE 802.11g and IEEE 802.11n (HT20):

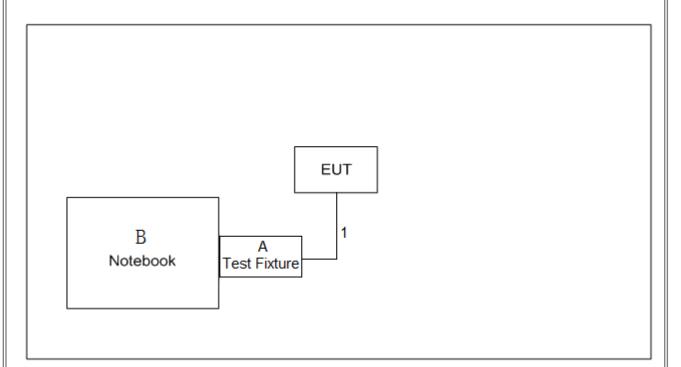
For radiated emissions frequency above 1 GHz, the resolution bandwidth of test receiver/spectrum analyzer is 1 MHz and the video bandwidth is 1 kHz (Duty cycle < 98%).

Date: 9.0CT.2019 18:53:29

Duty cycle = 2.070 ms / 2.210 ms = 93.67% Duty Factor = 10 log(1/Duty cycle) = 0.28



## 2.5 BLOCK DIAGRAM SHOWING THE CONFIGURATION OF SYSTEM TESTED



## 2.6 SUPPORT UNITS

ltem	Equipment	Brand	Model No.	Series No.
А	Test Fixture	N/A	N/A	N/A
В	Notebook	Dell	Inspiron 15-7559	N/A

ltem	Cable Type	Shielded Type	Ferrite Core	Length
1	Data Cable	NO	NO	0.2m



## 3. AC POWER LINE CONDUCTED EMISSIONS TEST

## 3.1 LIMIT

Frequency of Emission (MHz)	Limit (dBµV)		
Frequency of Emission (MHz)	Quasi-peak	Average	
0.15 - 0.50	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 Parameters	Setting	
Attenuation	10 dB	
Start Frequency	0.15 MHz	
Stop Frequency	30 MHz	
IF Bandwidth	9 kHz	

#### 3.2 TEST PROCEDURE

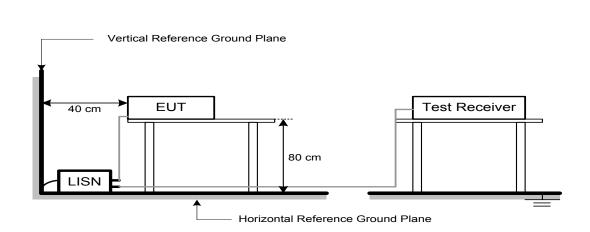
- a. The EUT was placed 0.8 meters from the horizontal ground plane with EUT being connected to the power mains through a line impedance stabilization network (LISN). All other support equipment powered from additional LISN(s). The LISN provide 50 Ohm/ 50uH of coupling impedance for the measuring instrument.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

EUT was programmed to be in continuously transmitting 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 EMISSION MEASUREMENT (9 kHz-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 RADIATED EMISSION MEASUREMENT (Above 1000 MHz)

	(dBuV/m at 3 m)	
Frequency (MHz)	Peak	Average
Above 1000	74	54

NOTE:

- (1) The limit for radiated test was performed according to FCC PART 15C.
- (2) The tighter limit applies at the band edges.
- (3) Emission level (dBuV/m)=20log Emission level (uV/m).

Spectrum Parameter	Setting	
Attenuation	Auto	
Start Frequency	1000 MHz	
Stop Frequency	10th carrier harmonic	
RBW / VBW	1 MHz / 3 MHz for Peak,	
(Emission in restricted band)	1 MHz / 1/T for Average	
Receiver Parameter	Setting	
	5	
Attenuation	Auto	

Start ~ Stop Frequency110 kHz~490 kHz for PK/AVG detectorStart ~ Stop Frequency490 kHz~30 MHz for QP detectorStart ~ Stop Frequency30 MHz~1000 MHz for QP detector

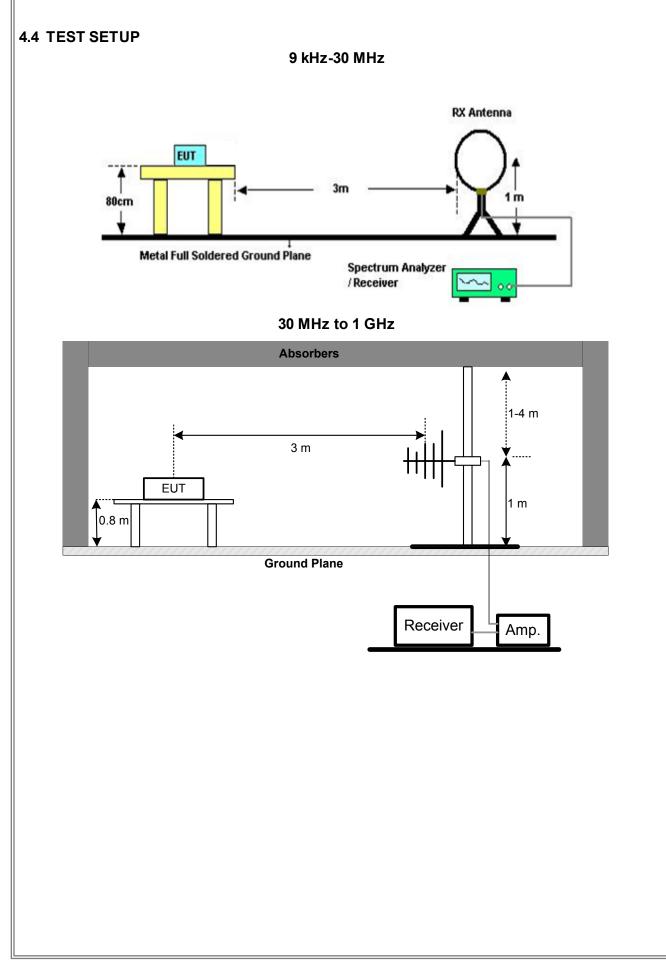
#### 4.2 TEST PROCEDURE

- 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 1 GHz)
- 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 1 GHz)
- 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.

## 4.3 DEVIATION FROM TEST STANDARD

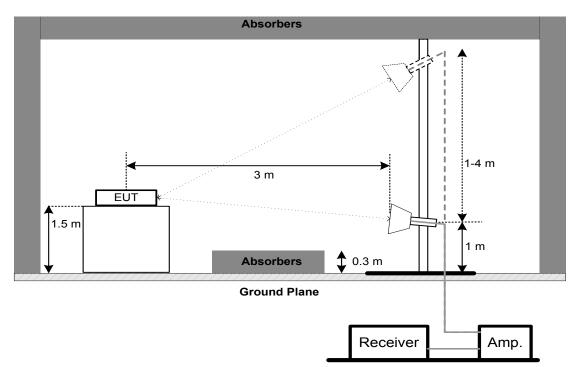
No deviation





# **3**[L

## Above 1 GHz



## 4.5 EUT OPERATION CONDITIONS

The EUT was programmed to be in continuously transmitting mode.

## 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 TEST

## 5.1 LIMIT

FCC Part15, Subpart C (15.247)				
Section	Limit			
45.047(-)(0)	6 dB Bandwidth	Minimum 500 kHz		
15.247(a)(2)	99% Emission Bandwidth	-		

## 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. For 6dB Bandwidth Spectrum setting: RBW= 100KHz, VBW=300KHz, Sweep time = 2.5 ms. For 99% OBW Spectrum Setting: RBW= 300KHz, VBW=1MHz, Sweep time = 2.5 ms.
- c. The bandwidth was performed in accordance with method 11.8.1 of ANSI C63.10-2013.

## 5.3 DEVIATION FROM STANDARD

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 AVERAGE OUTPUT POWER TEST

#### 6.1 LIMIT

FCC Part15, Subpart C (15.247)			
Section Test Item Limit			
15.247(b)(3) Maximum Average Output Power		1 Watt or 30dBm	

## 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. The maximum conducted output power was performed in accordance with method 11.9.2.3.1of ANSI C63.10-2013.

#### 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. CONDUCTED SPURIOUS EMISSIONS

## 7.1 LIMIT

In any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power, based on either an RF conducted or a radiated measurement, provided the transmitter demonstrates compliance with the peak Output Power limits. If the transmitter complies with the Output Power limits based on the use of RMS averaging over a time interval, as permitted under paragraph (b)(3) of this section, the attenuation required under this paragraph shall be 30 dB instead of 20 dB. Attenuation below the general limits specified in Section 15.209(a) is not required.

#### 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: RBW= 100 kHz, VBW=300 kHz, Sweep time = Auto.

#### 7.3 DEVIATION FROM STANDARD

No deviation.

## 7.4 TEST SETUP



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. POWER SPECTRAL DENSITY TEST

## 8.1 LIMIT

FCC Part15, Subpart C (15.247)					
Section Test Item Limit					
15.247(e)	Power Spectral Density	8 dBm (in any 3 kHz)			

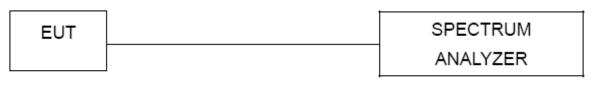
#### 8.2 TEST PROCEDURE

- a. The EUT was directly connected to the spectrum analyzer and antenna output port as show in the block diagram below.
- b. Spectrum Setting: RBW=3 kHz, VBW=10 kHz, Sweep time = Auto.
- c. The Power Spectral Density was performed in accordance with method 11.10.2 of ANSI C63.10-2013.

## 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	Mar. 10, 2020	
2	LISN	EMCO	3816/2	52765	Mar. 10, 2020	
3	TWO-LINE V-NETWORK	R&S	ENV216	101447	May 19, 2020	
4	50Ω Terminator	SHX	TF5-3	15041305	Mar. 10, 2020	
5	Measurement Software	Farad	EZ-EMC Ver.NB-03A1-01	N/A	N/A	
6	Cable	N/A	RG223	12m	Mar. 12, 2020	

	Radiated Emissions - 9 kHz to 30 MHz					
Item	Kind of Equipment	Manufacturer	Type No.	Serial No.	Calibrated until	
1	Loop Antenna	EM	EM-6876-1	230	Jan. 15, 2020	
2	Cable	N/A	RG 213/U	C-102	May 31, 2020	
3	EMI Test Receiver	R&S	ESCI	100895	Mar. 10, 2020	
4	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	Antenna	Schwarzbeck	VULB9160	9160-3232	Mar. 09, 2020	
2*	Amplifier	HP	8447D	2944A09673	Aug. 11, 2021	
3	Receiver	Agilent	N9038A	MY52130039	Aug. 03, 2020	
4	Cable	emci	LMR-400(30MHz-1 GHz)(8m+5m)	N/A	May 24, 2020	
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	

	Radiated Emissions - Above 1 GHz					
Item	Kind of Equipment	Manufacturer	Type No.	Serial No.	Calibrated until	
1	Double Ridged Guide Antenna	ETS	3115	75789	Mar. 09, 2020	
2	Broad-Band Horn Antenna	Schwarzbeck	BBHA 9170	9170319	Jun. 23, 2020	
3	Amplifier	Agilent	8449B	3008A02333	Mar. 10, 2020	
4	Microwave Preamplifier With Adaptor	EMC INSTRUMENT	EMC2654045	980039 & HA01	Mar. 10, 2020	
5	Receiver	Agilent	N9038A	MY52130039	Aug. 03, 2020	
6	Controller	CT	SC100	N/A	N/A	
7	Controller	MF	MF-7802	MF780208416	N/A	
8	Cable	mitron	B10-01-01-12M	18072744	Jun. 29, 2020	
9	Measurement Software	Farad	EZ-EMC Ver.NB-03A1-01	N/A	N/A	

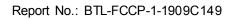


Bandwidth & Antenna Conducted Spurious Emissions & Power Spectral Density						
Item	Item Kind of Equipment Manufacturer Type No. Serial No. Calibrated until					
1	Spectrum Analyzer	R&S	FSP40	100185	Aug. 03, 2020	
		Maximum	Average Output Po	wer		
Item	Kind of Equipment	Manufacturer	Type No.	Serial No.	Calibrated until	
1	Peak Power Analyzer	Keysight	8990B	MY51000506	Aug. 03, 2020	
2	Wideband power sensor	Keysight	N1923A	MY58310004	Aug. 03, 2020	

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

"\*" calibration period of equipment list is three year.

Except \* item, all calibration period of equipment list is one year.





## 10. EUT TEST PHOTO

## AC Power Line Conducted Emissions Test Photos



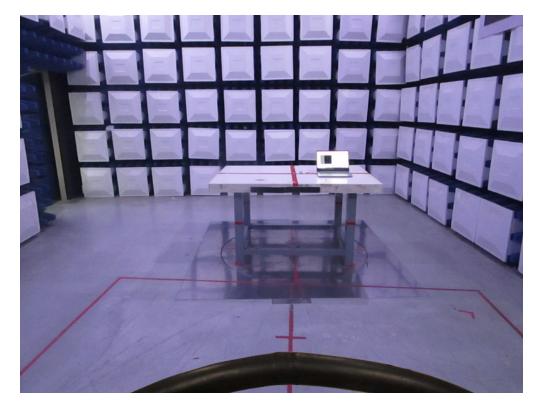


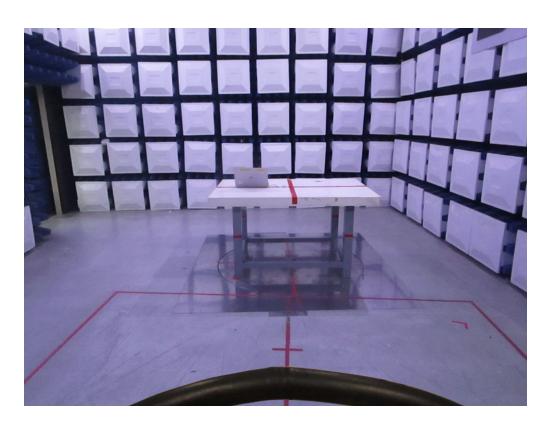




**Radiated Emissions Test Photos** 

9 kHz to 30 MHz



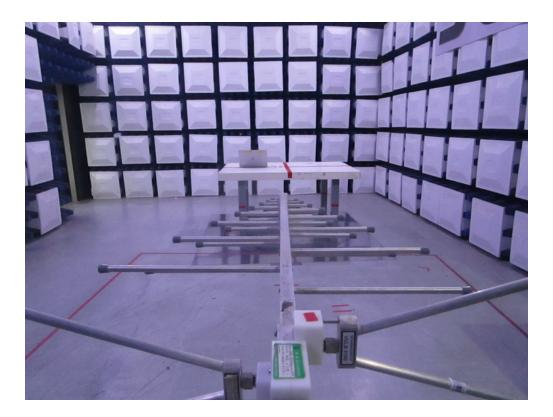




**Radiated Emissions Test Photos** 

30 MHz to 1 GHz



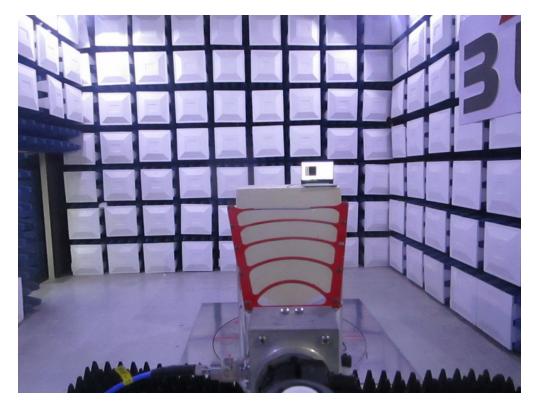






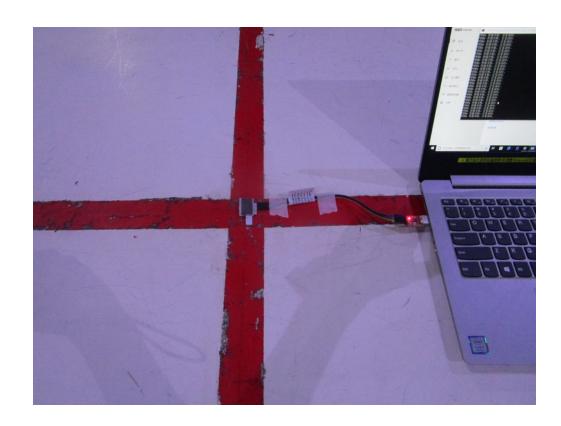
Radiated Emissions Test Photos

Above 1 GHz





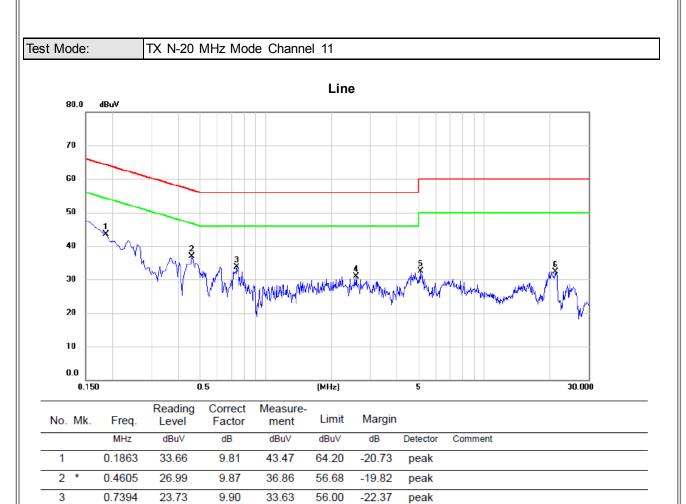






## APPENDIX A - AC POWER LINE CONDUCTED EMISSIONS





**REMARKS**:

4

5

6

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

20.93

22.23

21.12

2.6025

5.0954

21.0885

10.03

10.19

11.18

30.96

32.42

32.30

56.00

60.00

60.00

-25.04

-27.58

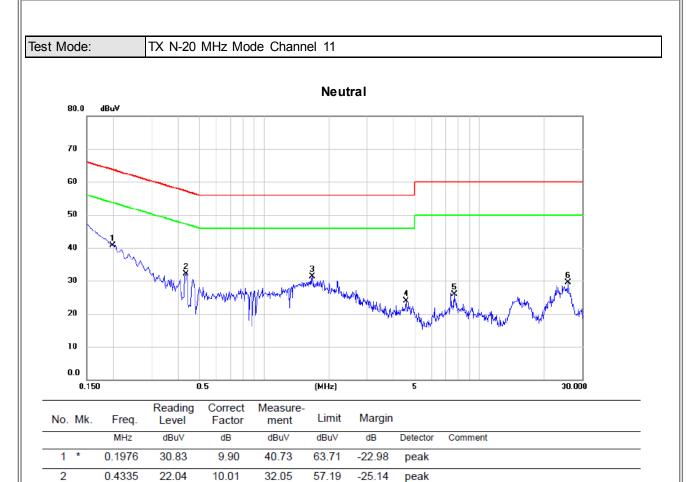
-27.70

peak

peak

peak





**REMARKS**:

3

4

5

6

1.6800

4.5690

7.6245

25.7325

21.04

13.62

15.31

18.02

10.17

10.36

10.62

11.48

31.21

23.98

25.93

29.50

56.00

56.00

60.00

60.00

-24.79

-32.02

-34.07

-30.50

peak

peak

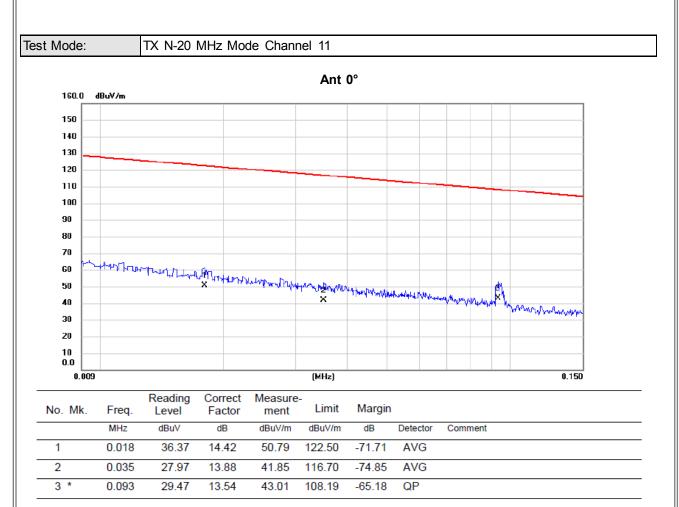
peak

peak

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

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

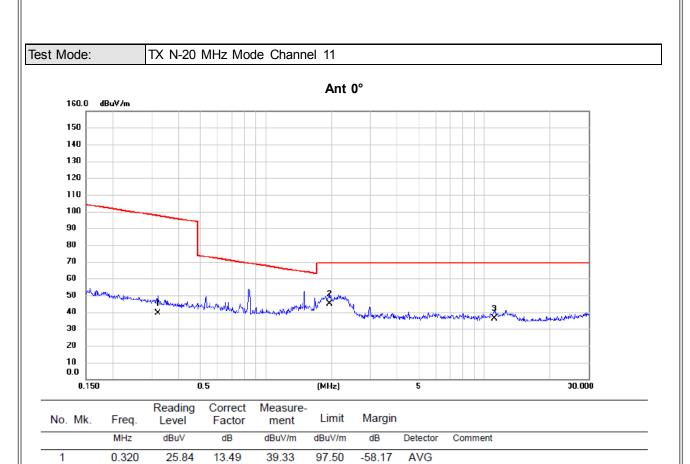




**REMARKS**:

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





2 \*

3

1.949

11.139

33.18

24.51

11.85

11.62

45.03

36.13

69.54

69.54

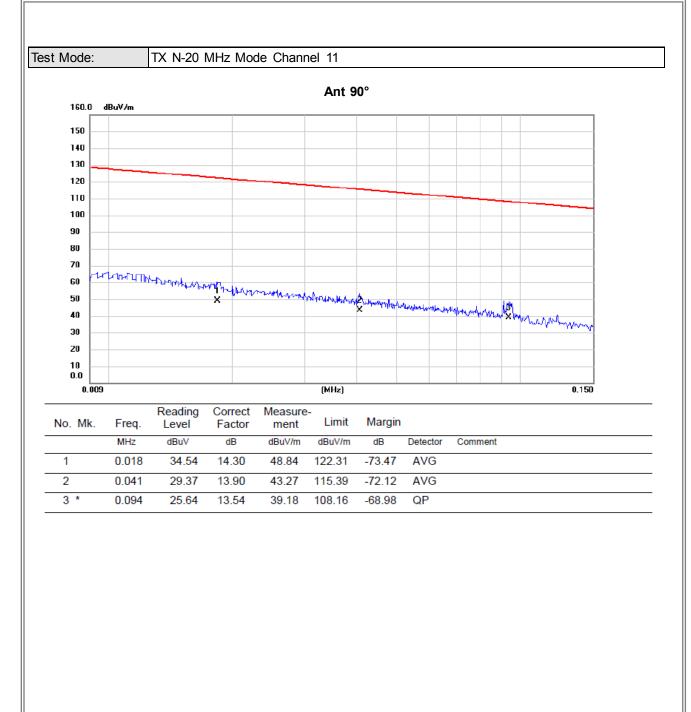
-24.51

-33.41

QP QP

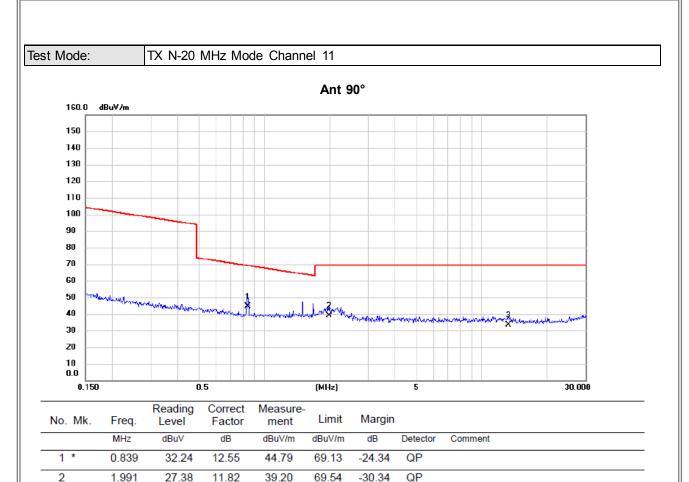
- (1) Measurement Value = Reading Level + Correct Factor.
- (2) Margin Level = Measurement Value Limit Value.

## **BIL**



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





3

13.267

21.86

11.59

33.45

69.54

-36.09

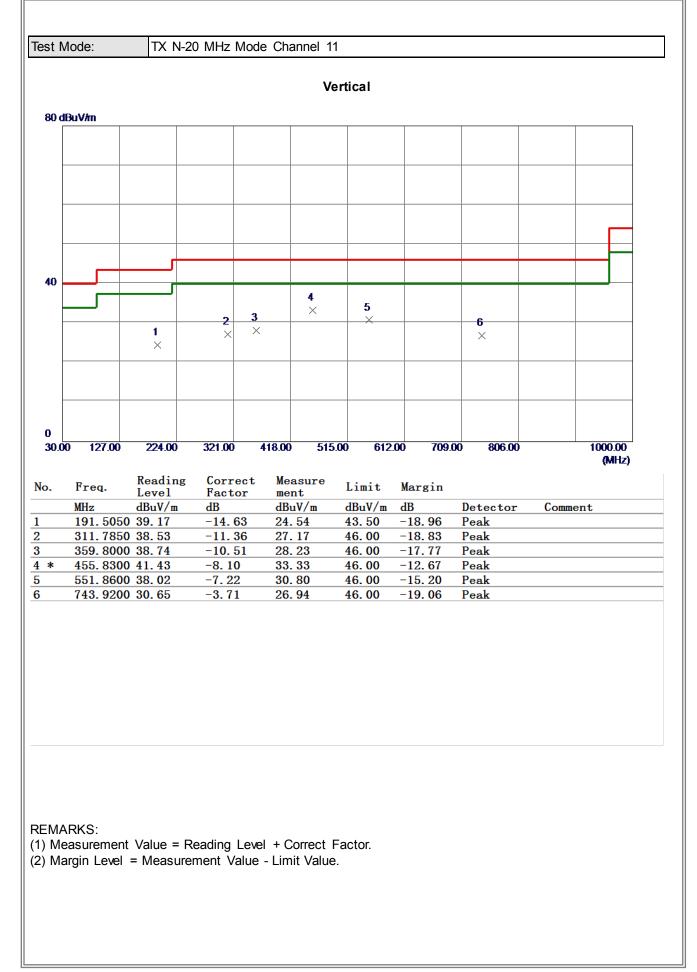
QP

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

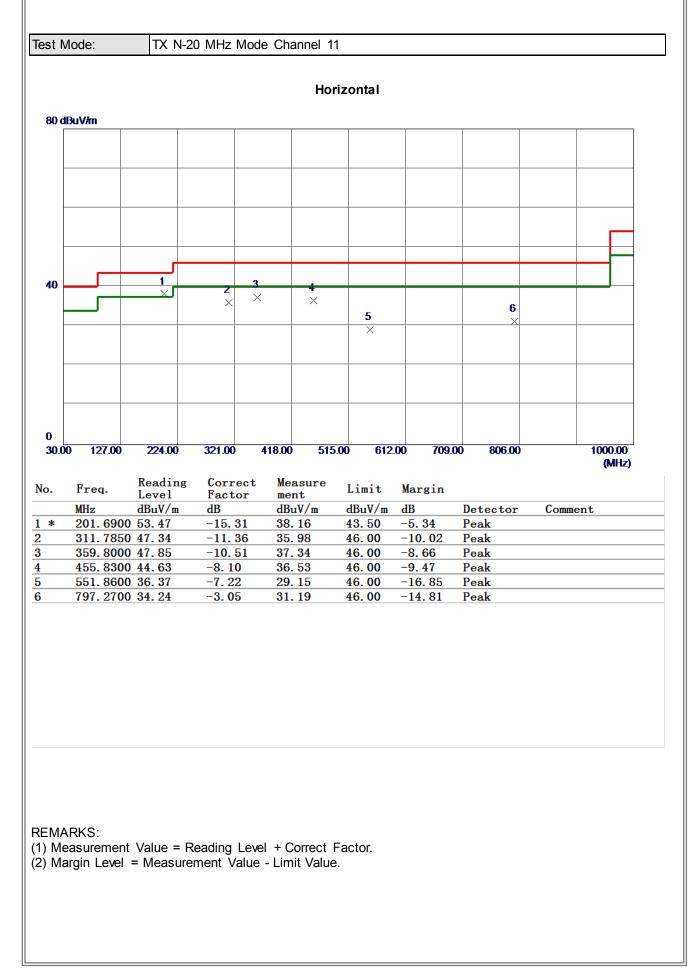


## APPENDIX C - RADIATED EMISSION - 30 MHZ TO 1000 MHZ



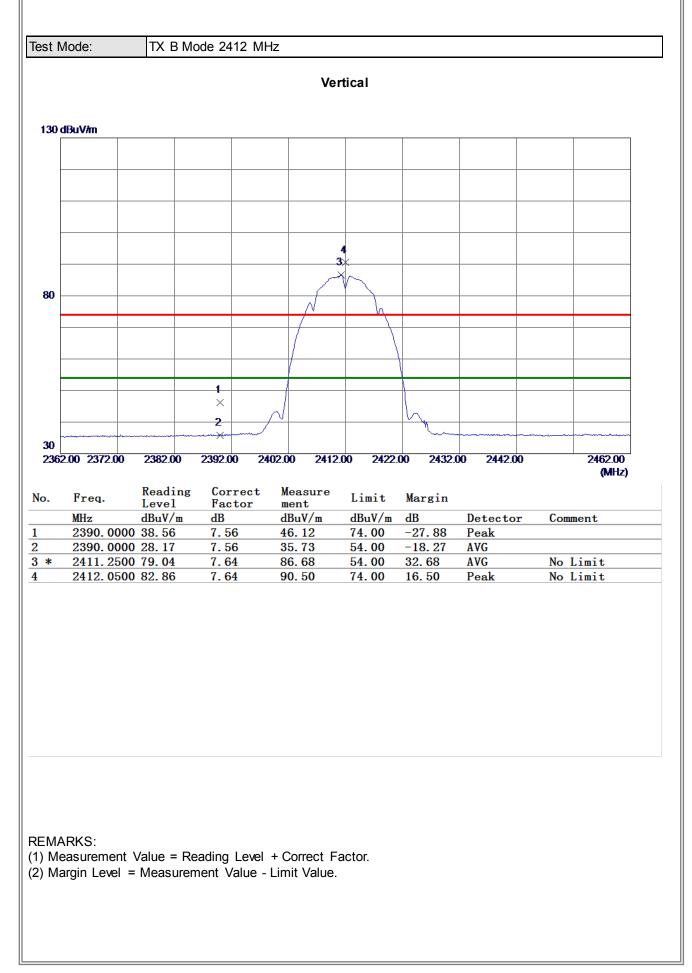




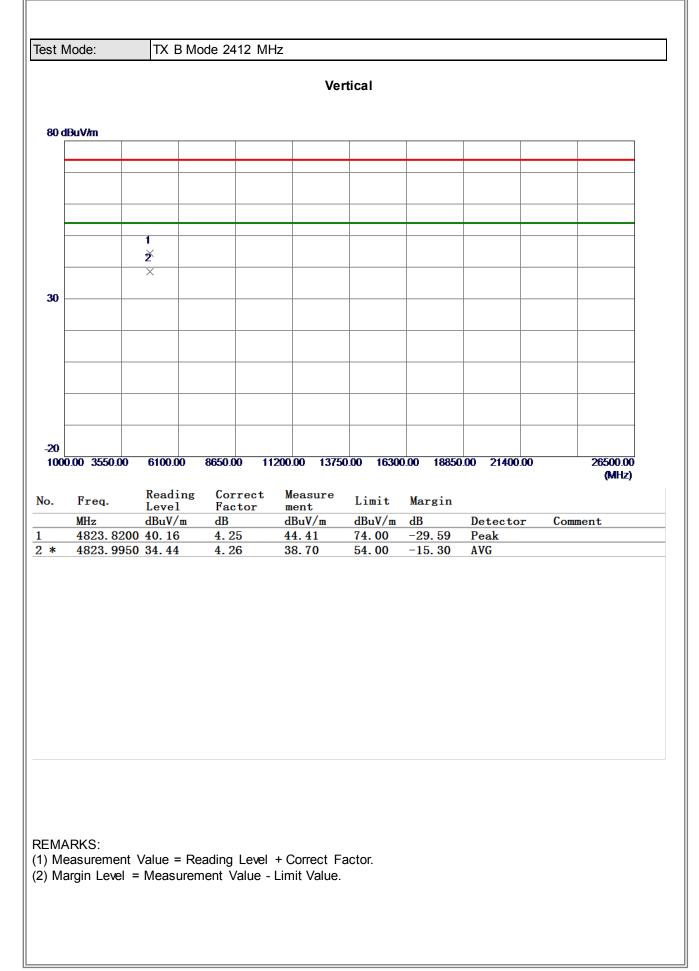


## APPENDIX D - RADIATED EMISSION- ABOVE 1000 MHZ

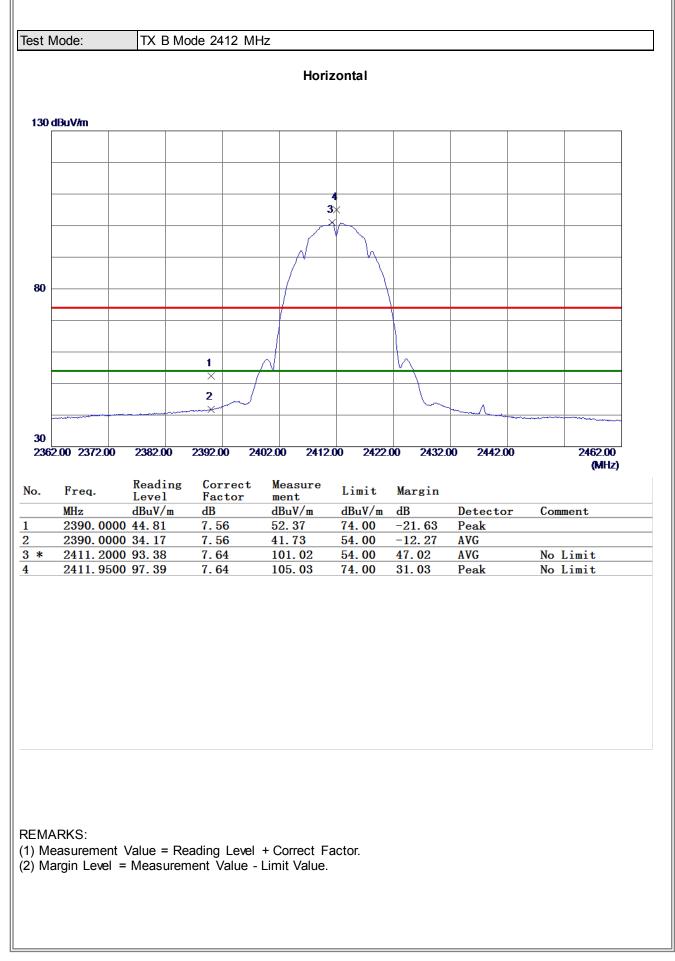




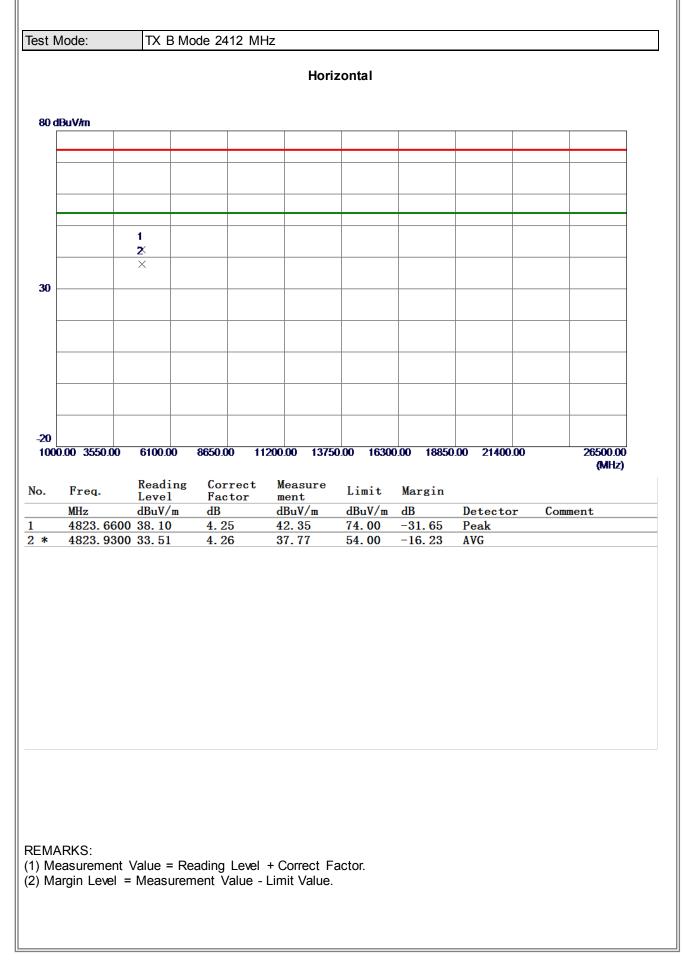




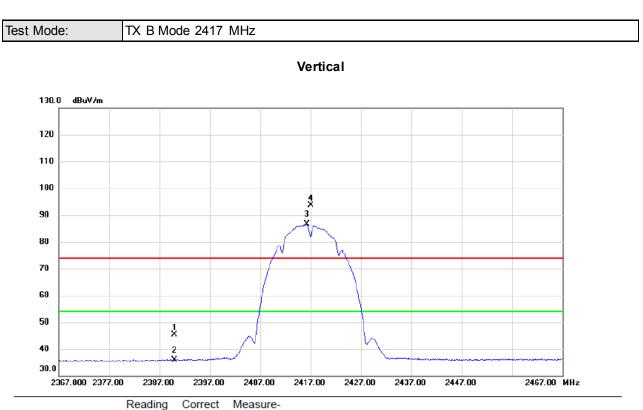








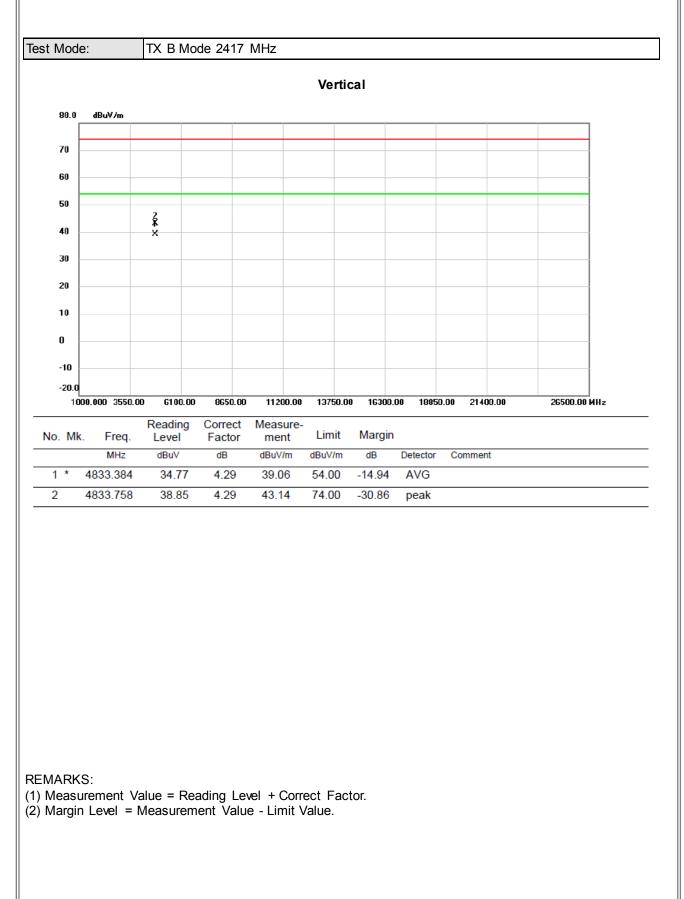




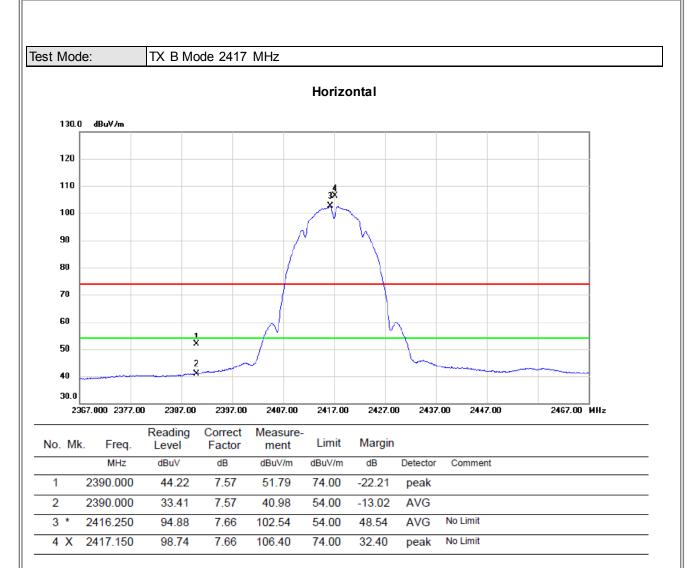
No.	Mk.	Freq.	Level	Factor	ment	Limit	Margin		
		MHz	dBuV	dB	dBuV/m	dBuV/m	dB	Detector	Comment
1		2390.000	37.79	7.57	45.36	74.00	-28.64	peak	
2		2390.000	28.39	7.57	35.96	54.00	-18.04	AVG	
3	*	2416.250	78.86	7.66	86.52	54.00	32.52	AVG	No Limit
4	Х	2417.000	86.09	7.66	93.75	74.00	19.75	peak	No Limit

- 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.





2 \*

4833.915

33.77

4.29

38.06

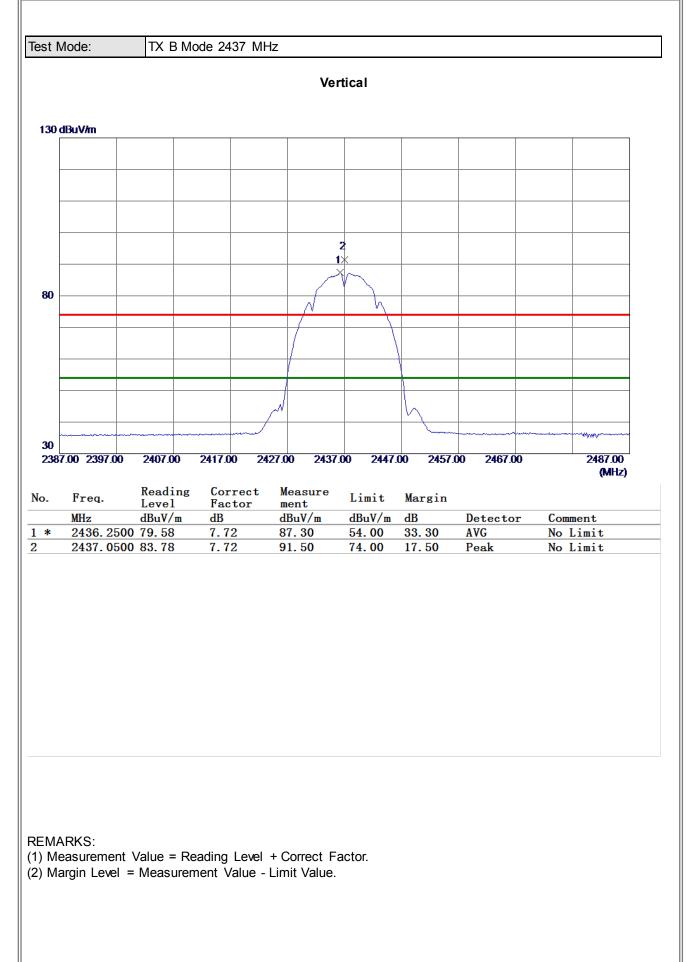
54.00

-15.94

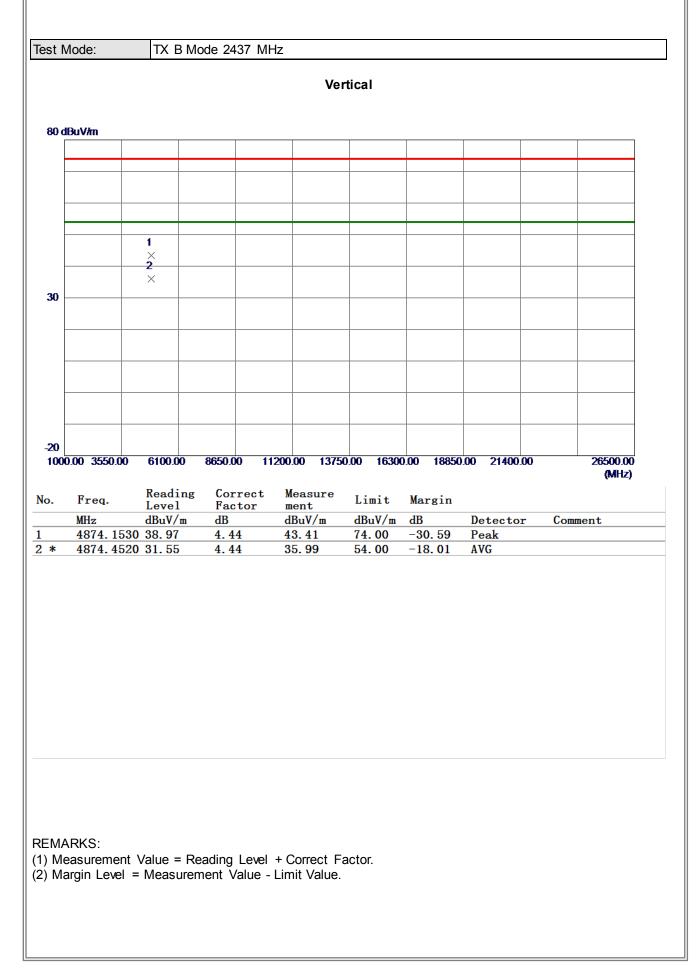
AVG

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

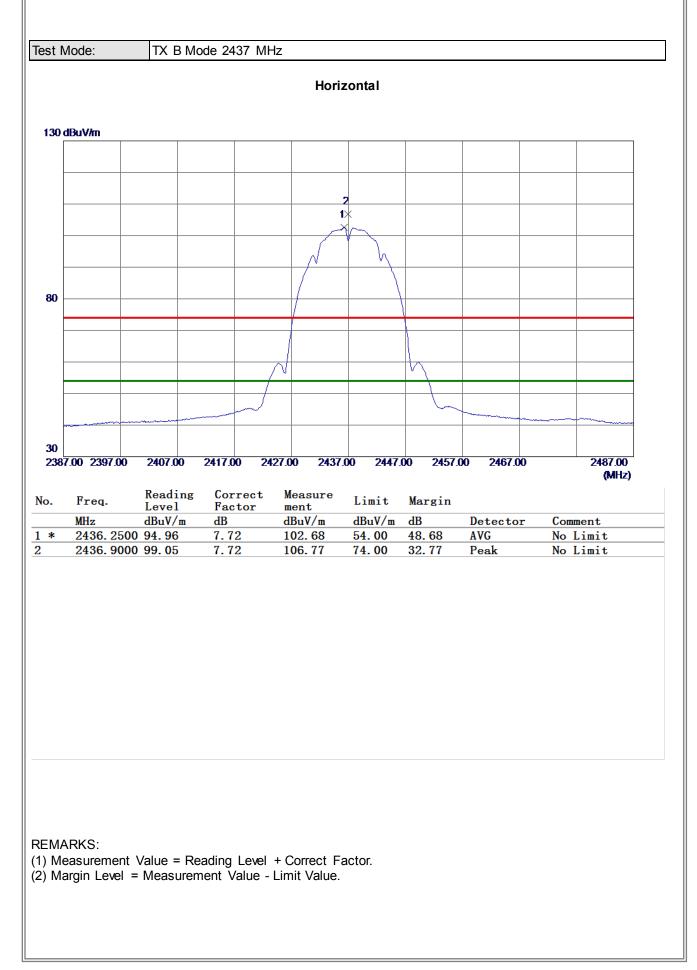




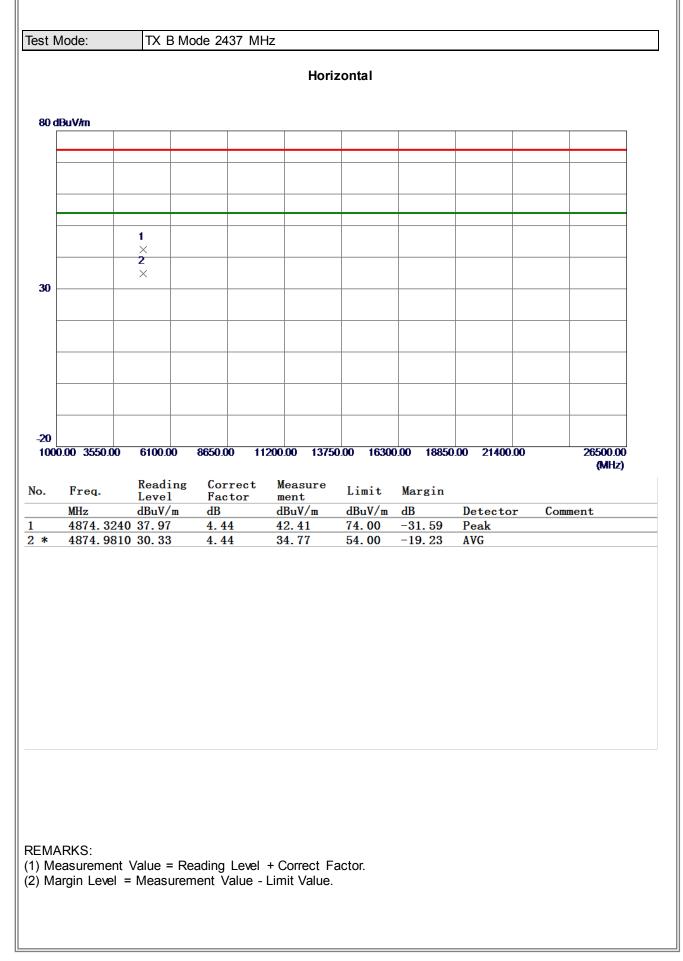




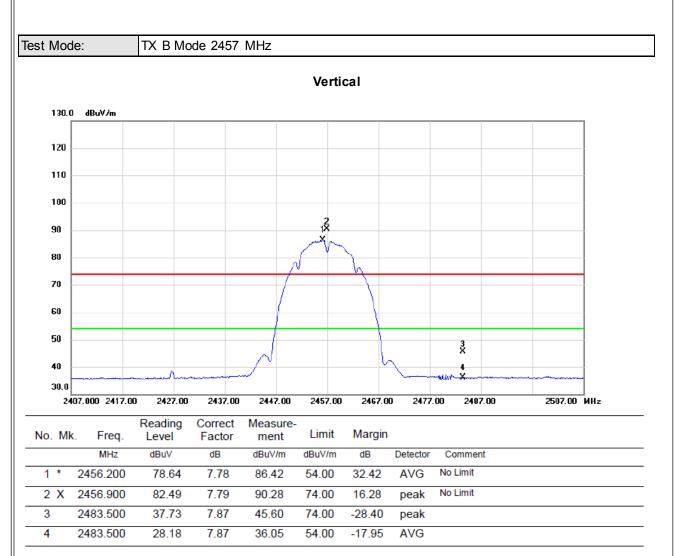






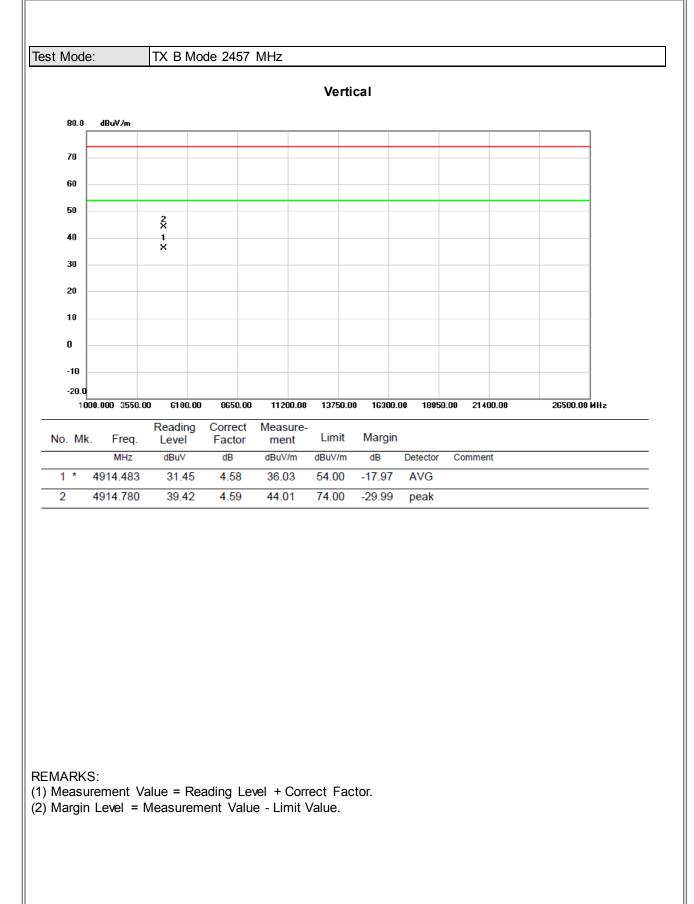




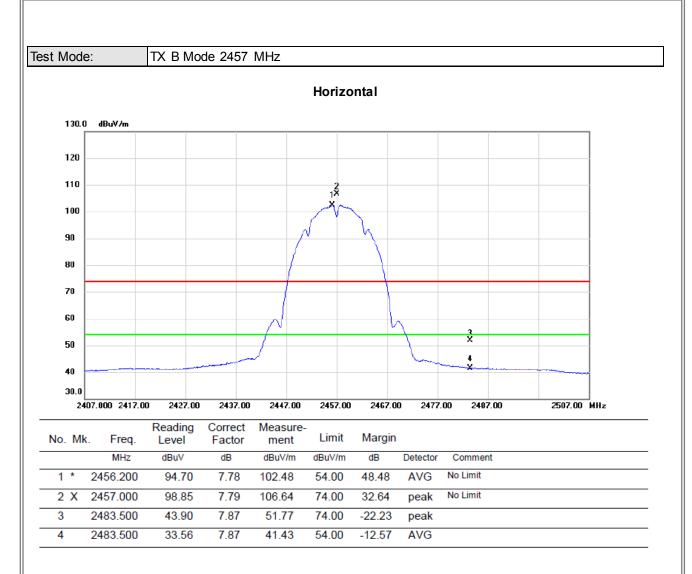


- (1) Measurement Value = Reading Level + Correct Factor.
- (2) Margin Level = Measurement Value Limit Value.









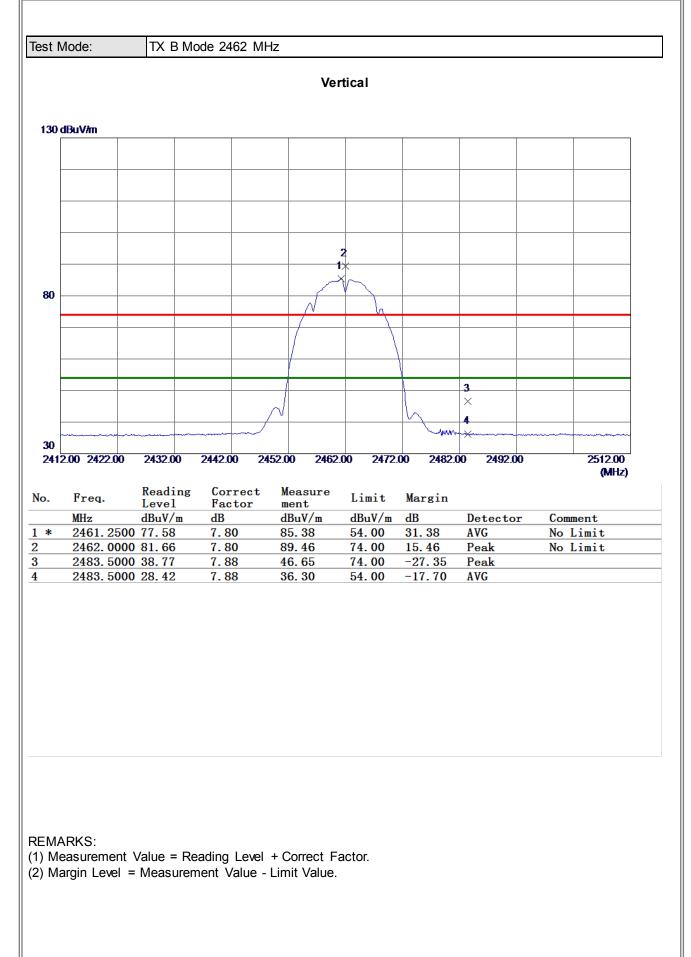
- (1) Measurement Value = Reading Level + Correct Factor.
- (2) Margin Level = Measurement Value Limit Value.



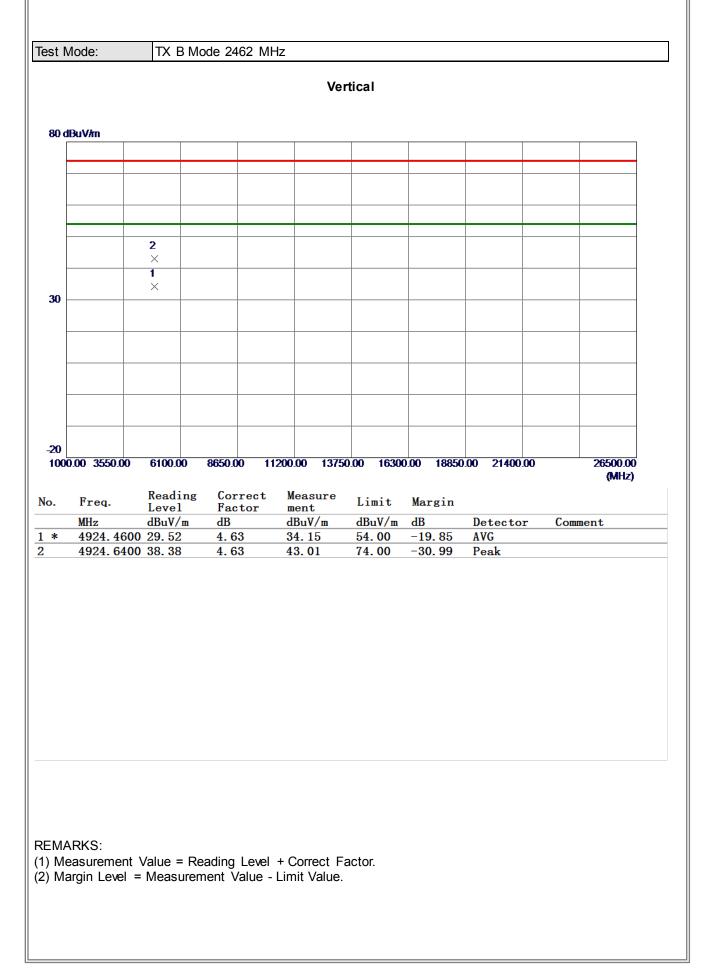


- (1) Measurement Value = Reading Level + Correct Factor.
- (2) Margin Level = Measurement Value Limit Value.

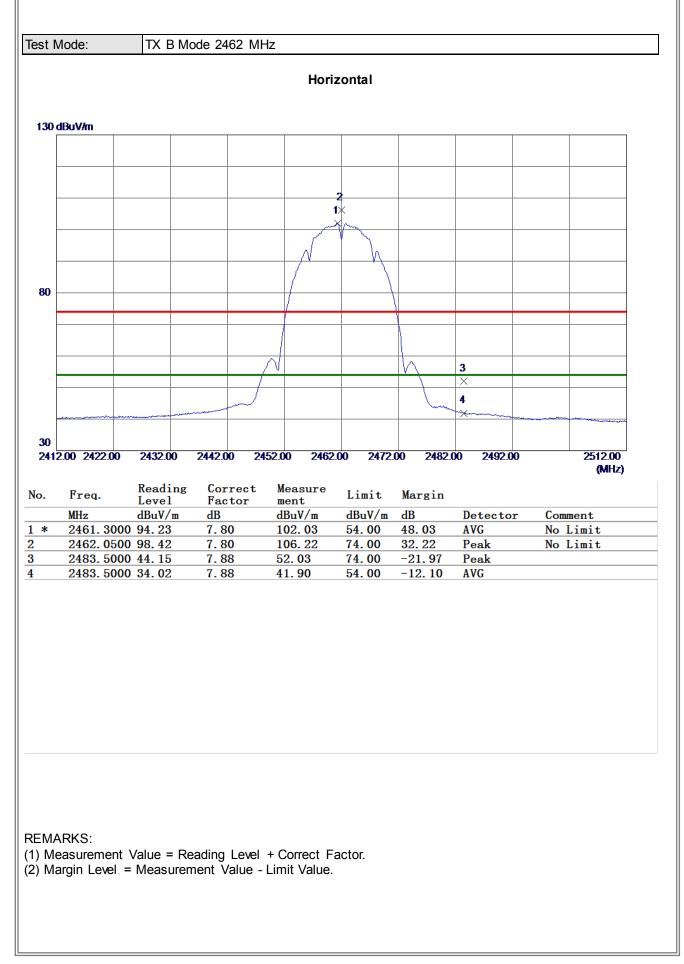




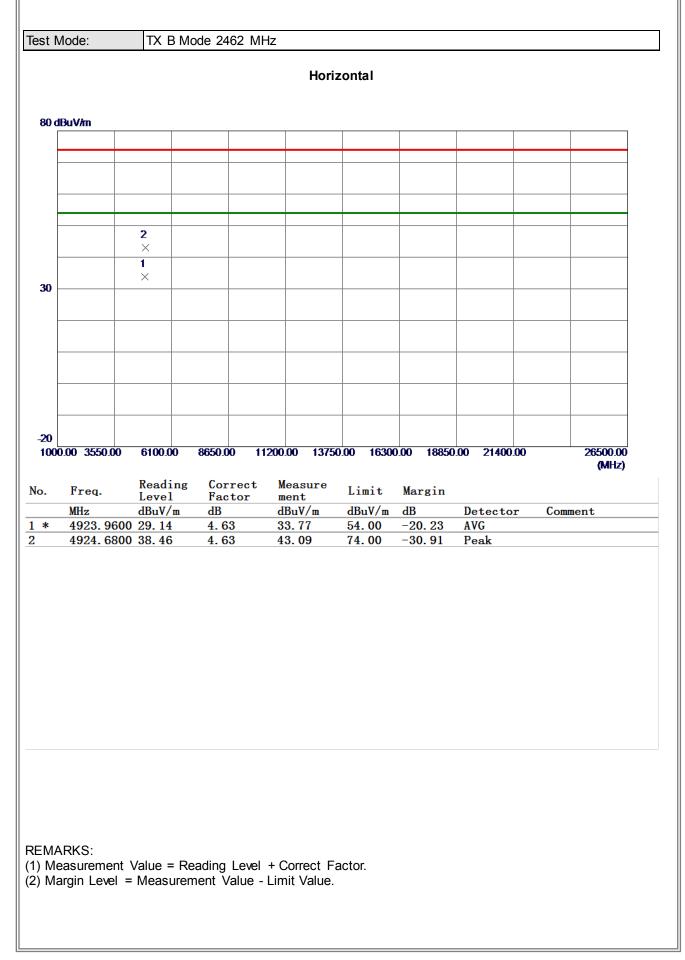




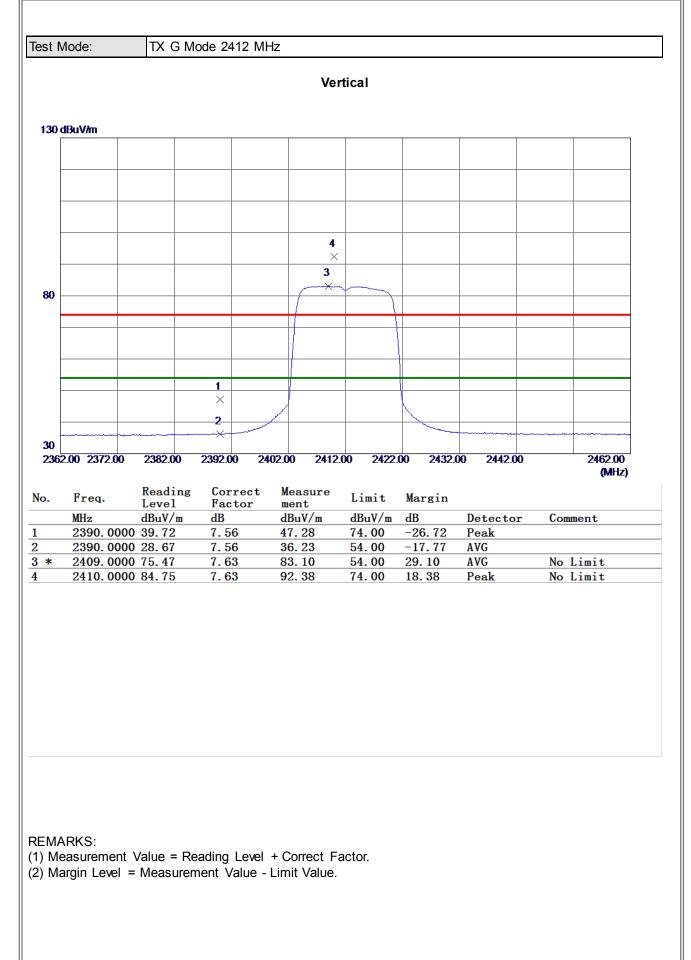




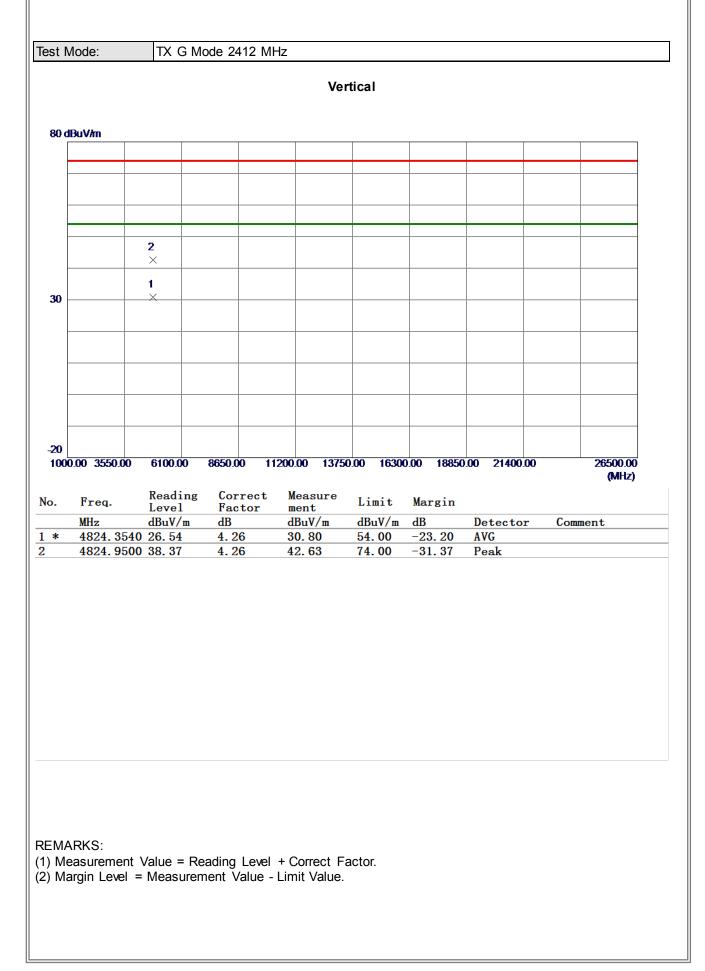




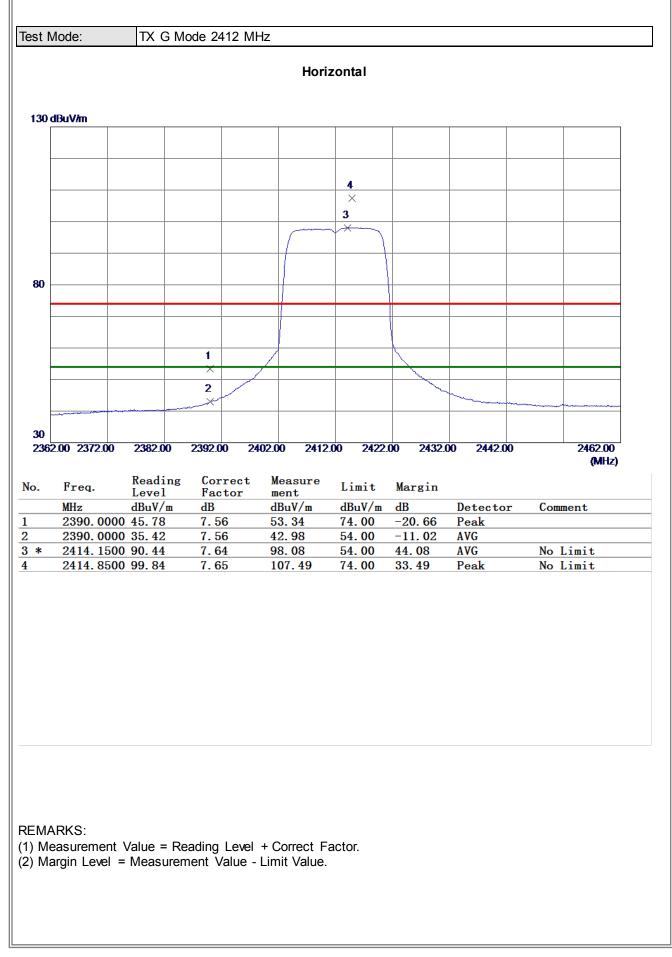




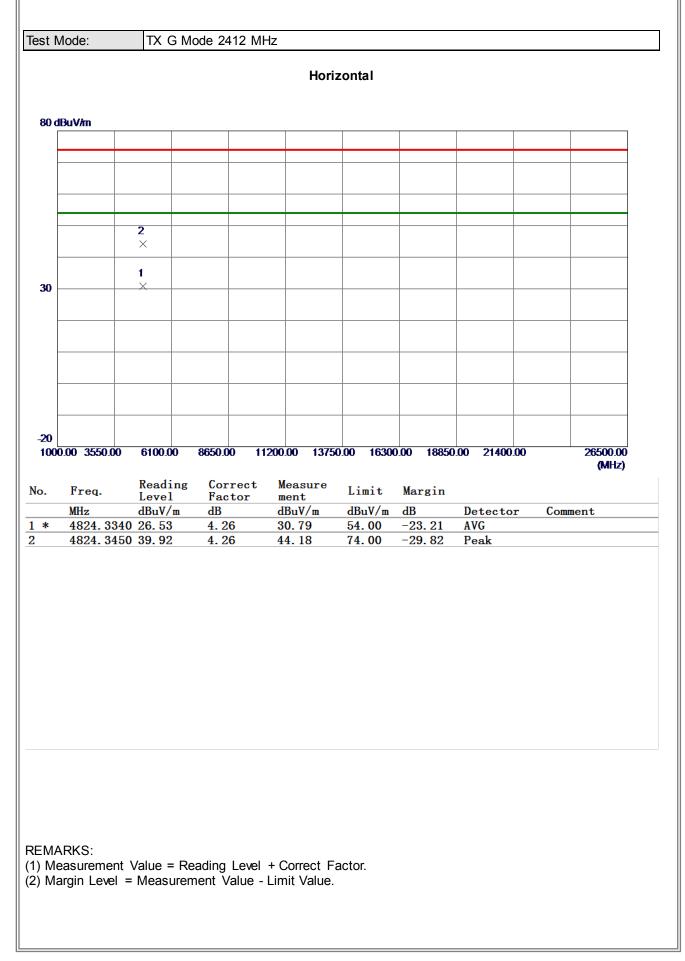




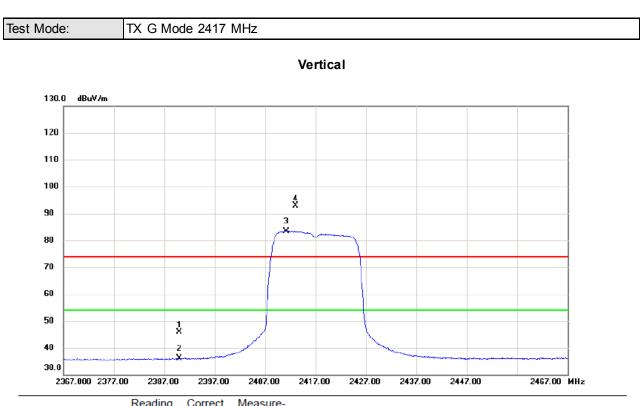












No.	Mk	. Freq.	Reading Level	Factor	Measure- ment	Limit	Margin		
		MHz	dBuV	dB	dBuV/m	dBuV/m	dB	Detector	Comment
1		2390.000	38.19	7.57	45.76	74.00	-28.24	peak	
2		2390.000	28.51	7.57	36.08	54.00	-17.92	AVG	
3	*	2411.250	75.77	7.63	83.40	54.00	29.40	AVG	No Limit
4	Х	2413.000	85.23	7.65	92.88	74.00	18.88	peak	No Limit

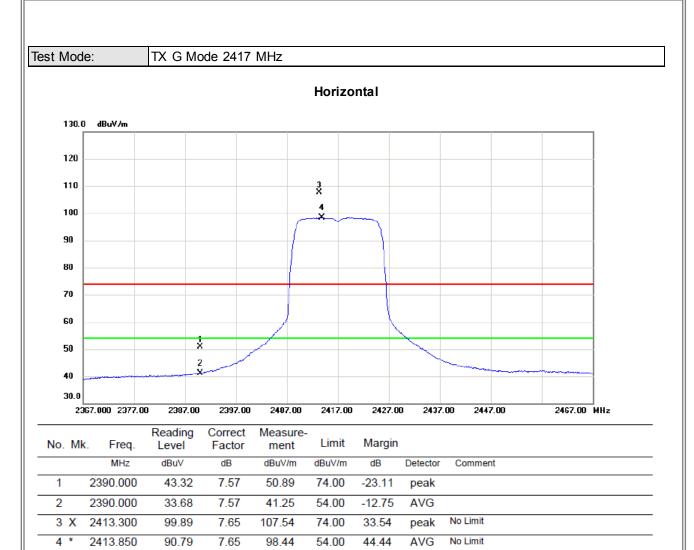
- (1) Measurement Value = Reading Level + Correct Factor.
  (2) Margin Level = Measurement Value Limit Value.





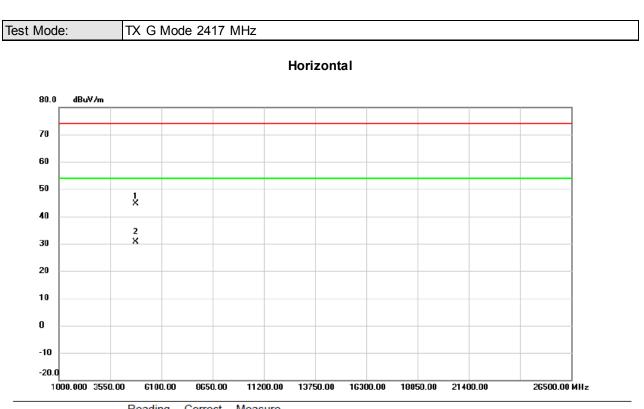
- (1) Measurement Value = Reading Level + Correct Factor.
- (2) Margin Level = Measurement Value Limit Value.





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

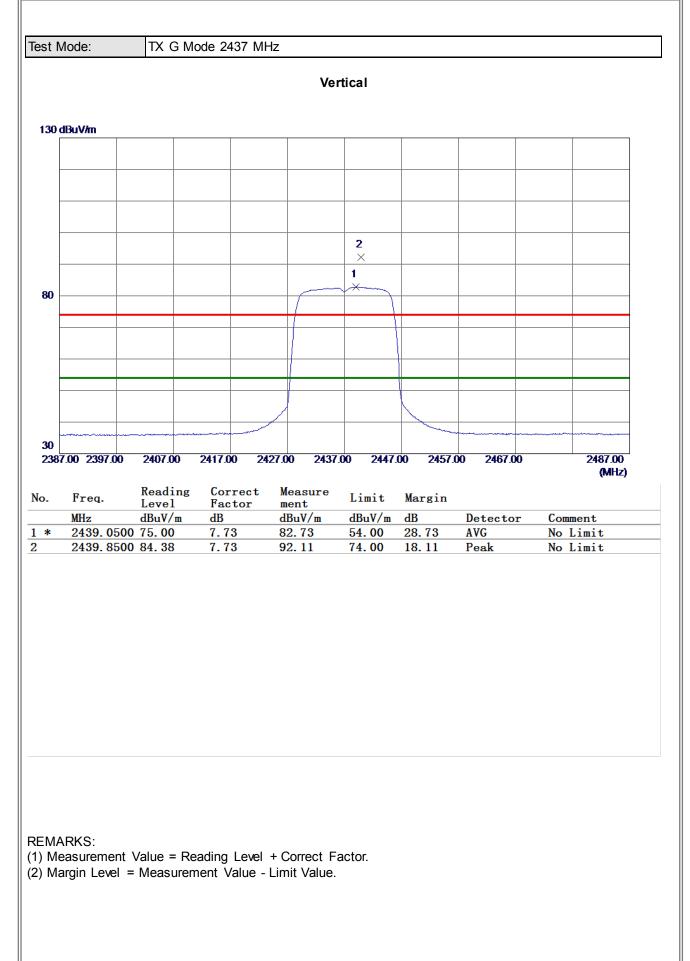




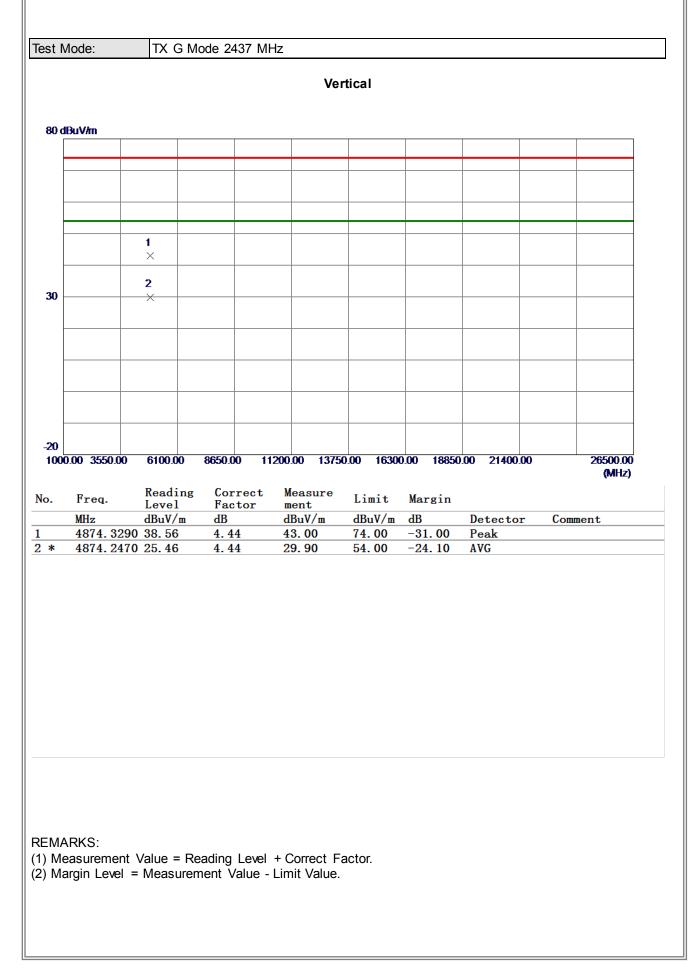
	No.	Mk.	Freq.	Reading Level	Correct Factor	Measure- ment	Limit	Margin		
_			MHz	dBuV	dB	dBuV/m	dBuV/m	dB	Detector	Comment
_	1	4	834.320	40.39	4.29	44.68	74.00	-29.32	peak	
_	2	* 4	834.852	26.23	4.30	30.53	54.00	-23.47	AVG	

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

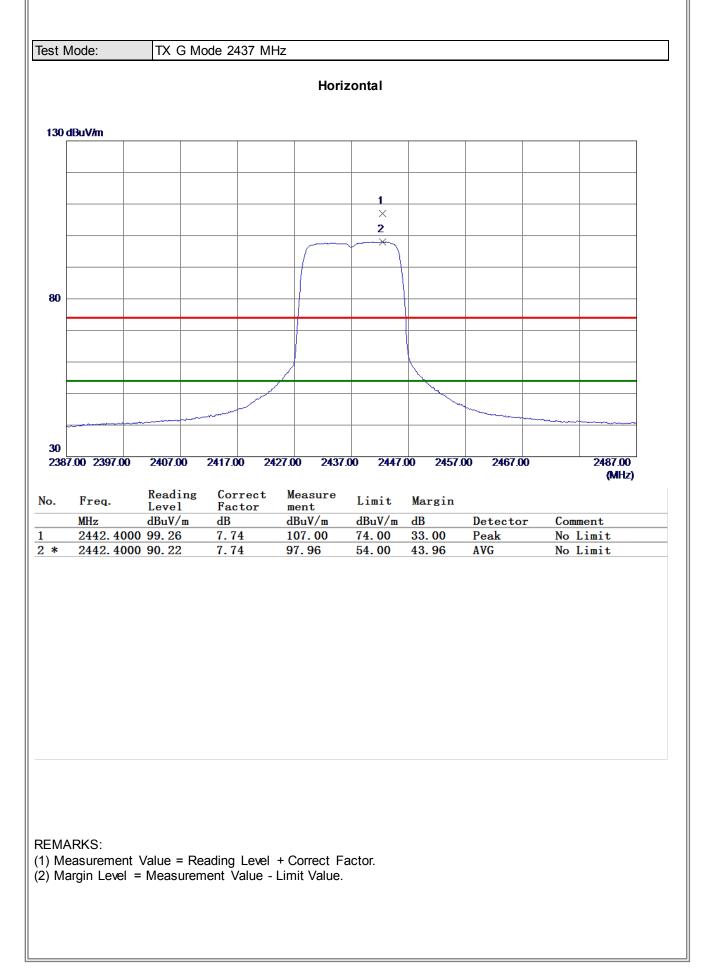




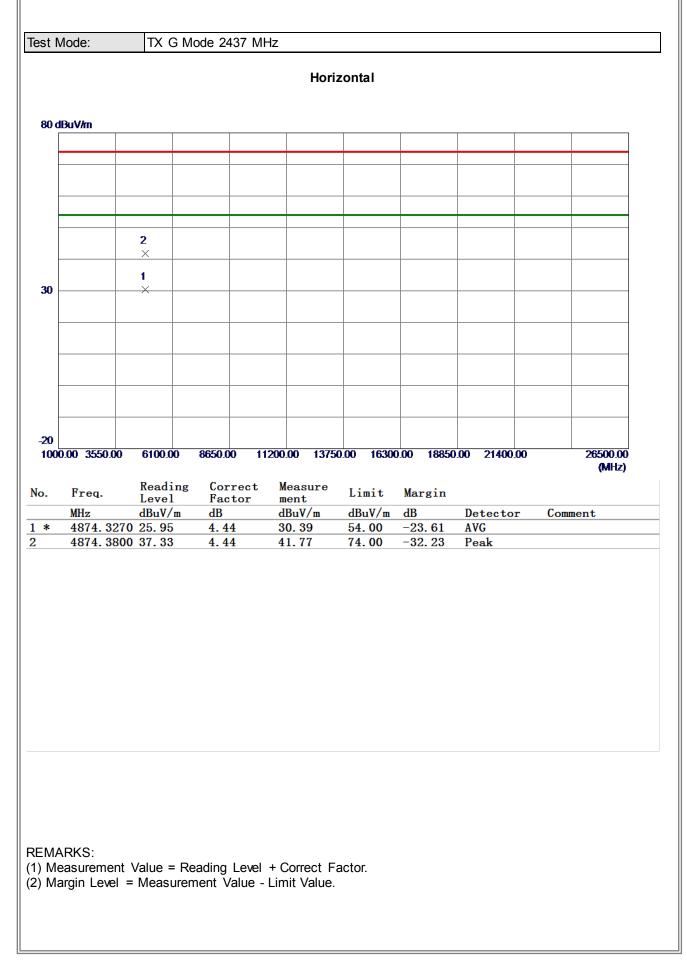




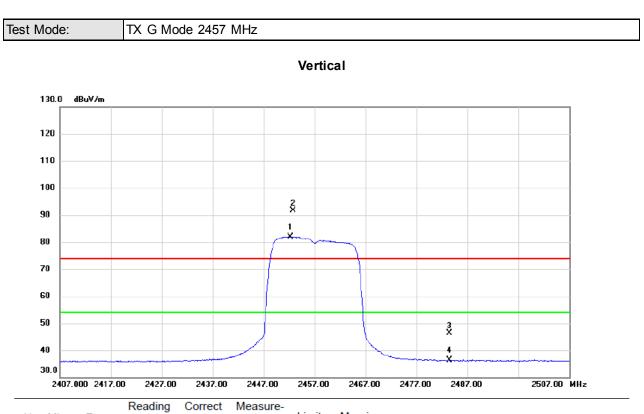








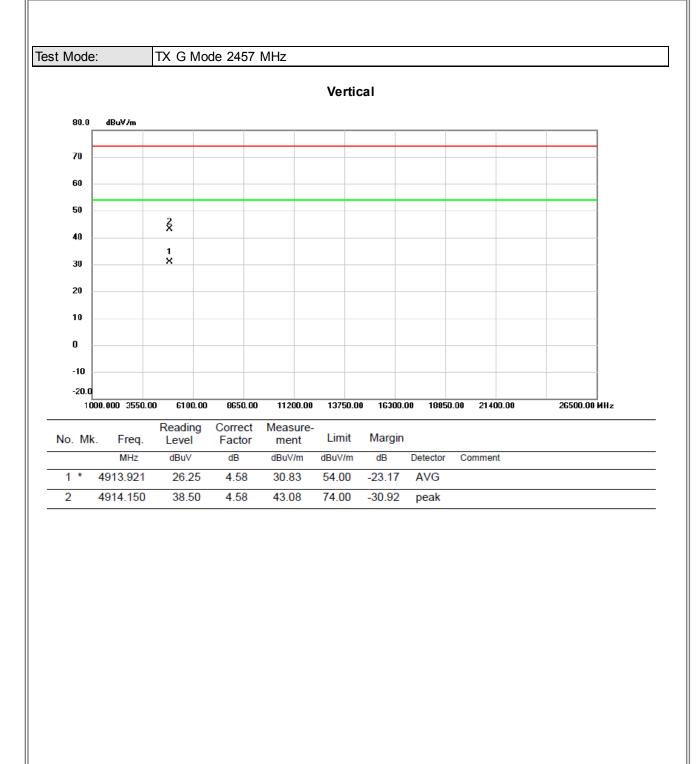




No. N	٨k.	Freq.	Level	Factor	ment	Limit	Margin		
		MHz	dBuV	dB	dBuV/m	dBuV/m	dB	Detector	Comment
1 *	2	452.300	74.11	7.78	81.89	54.00	27.89	AVG	No Limit
2 X	2	452.800	83.74	7.78	91.52	74.00	17.52	peak	No Limit
3	2	483.500	38.43	7.87	46.30	74.00	-27.70	peak	
4	2	483.500	28.40	7.87	36.27	54.00	-17.73	AVG	

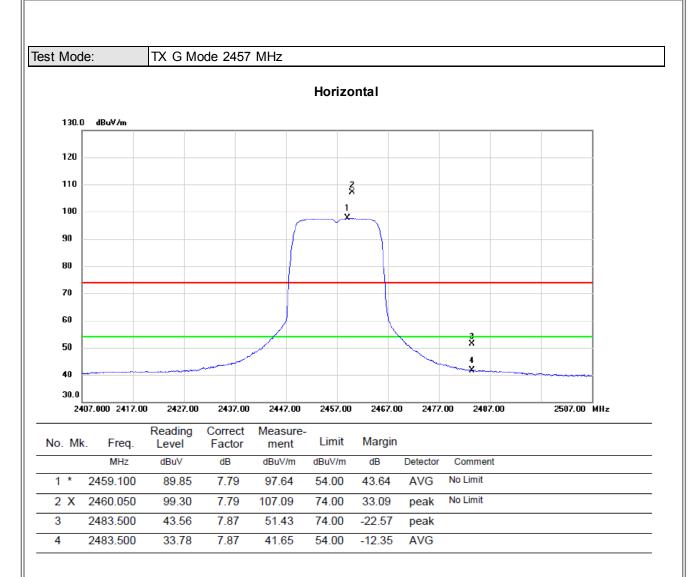
- (1) Measurement Value = Reading Level + Correct Factor.
- (2) Margin Level = Measurement Value Limit Value.





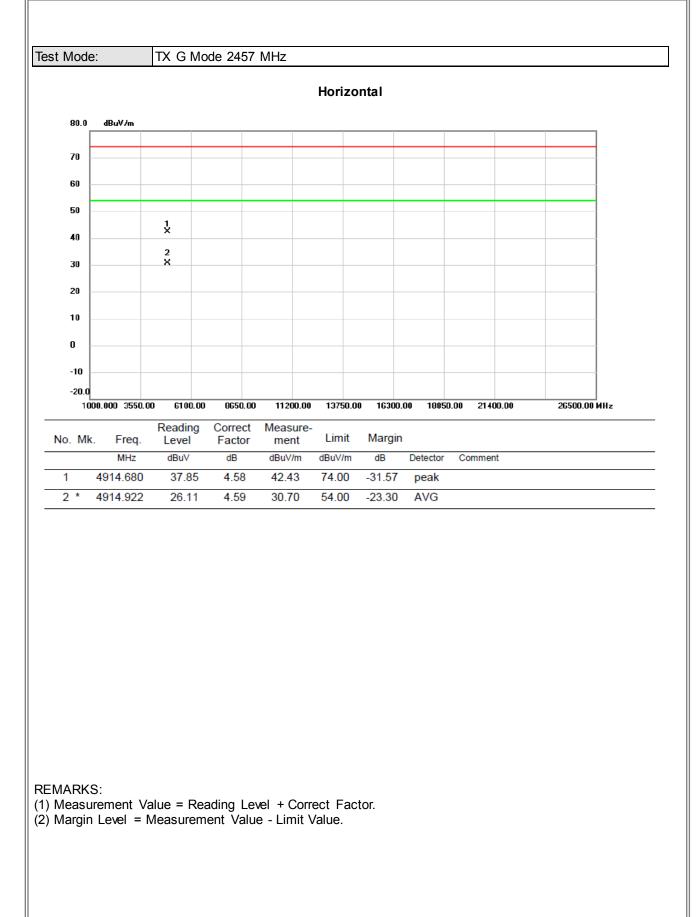
- (1) Measurement Value = Reading Level + Correct Factor.
- (2) Margin Level = Measurement Value Limit Value.



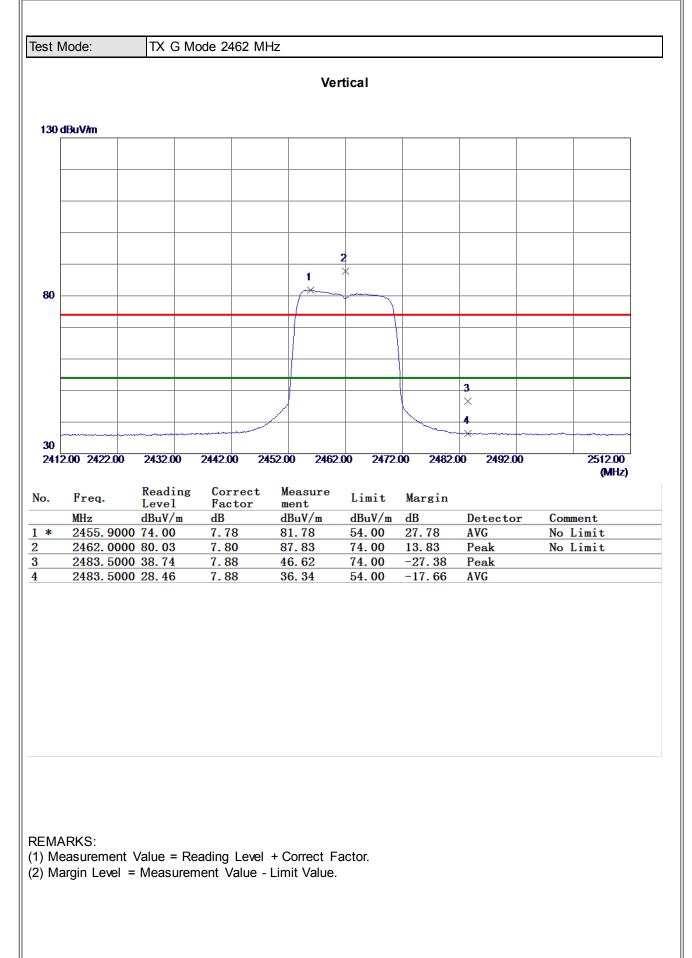


- (1) Measurement Value = Reading Level + Correct Factor.
- (2) Margin Level = Measurement Value Limit Value.

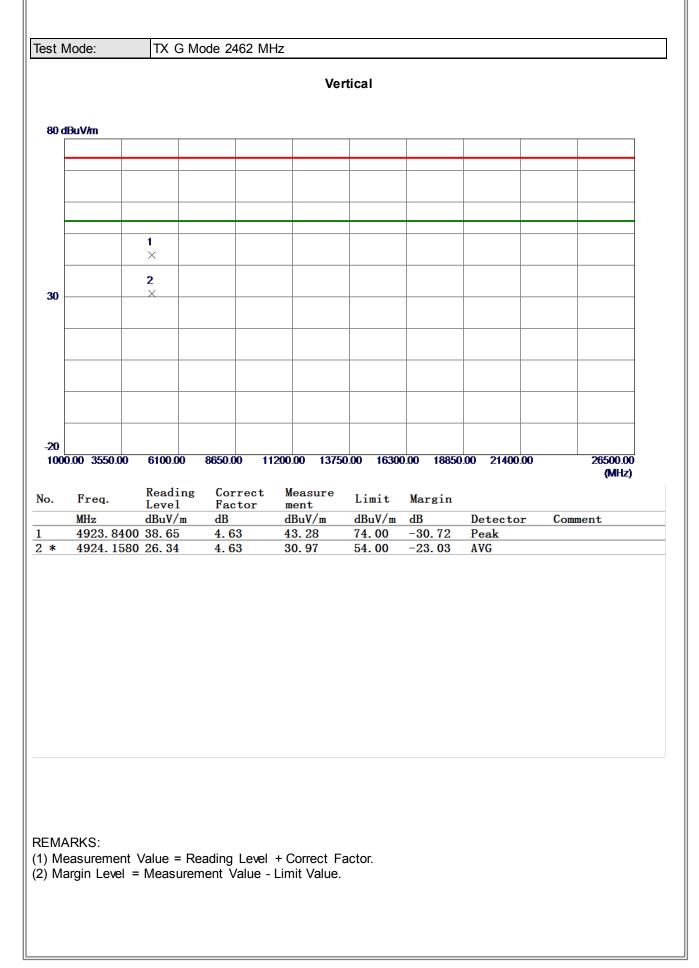




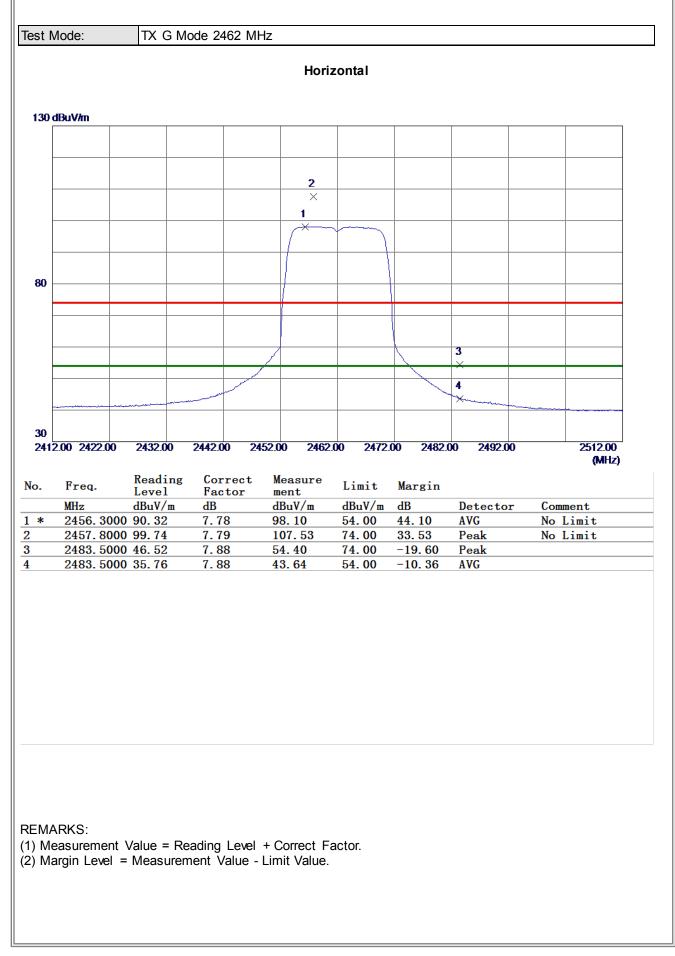




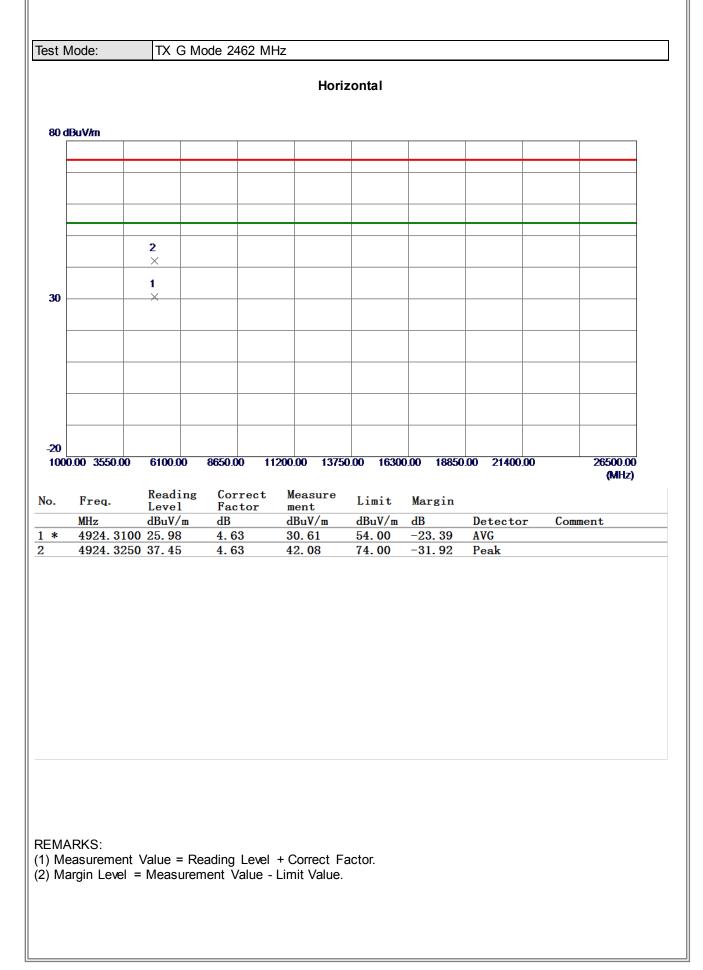




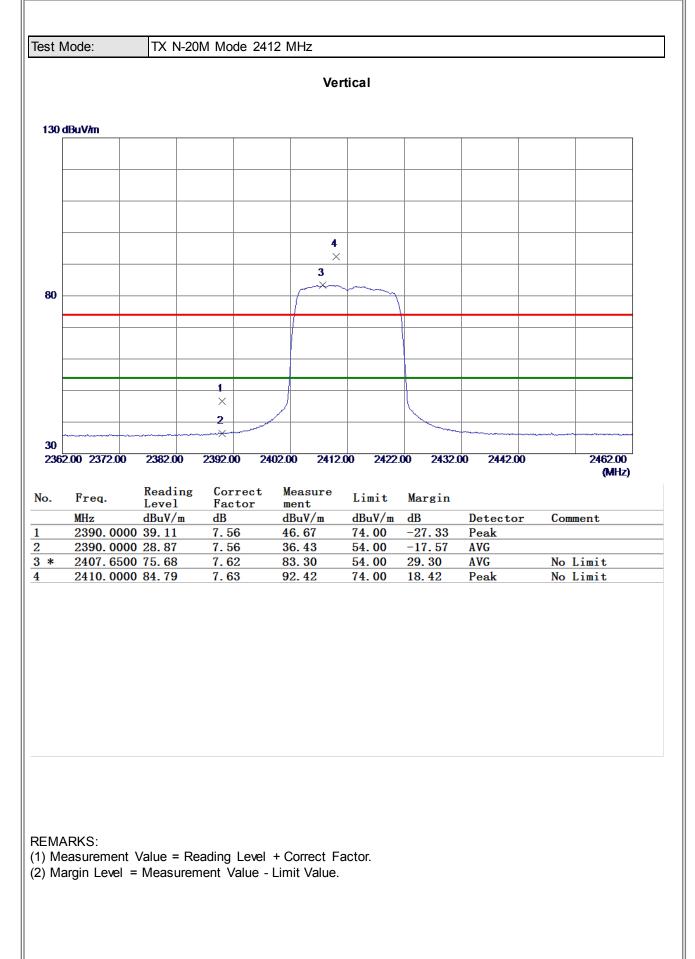




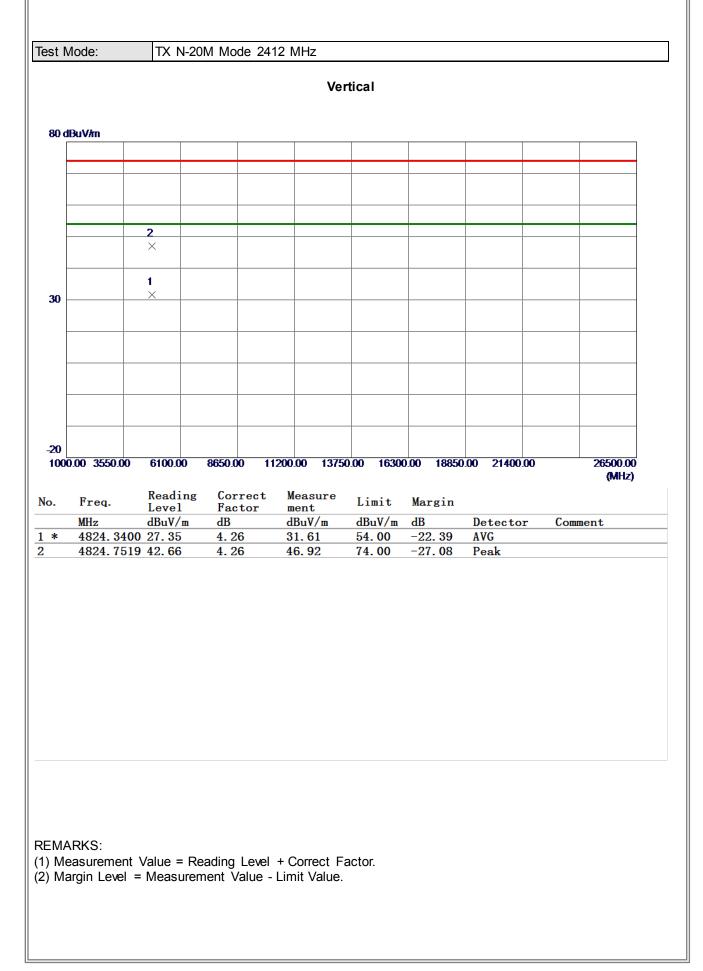




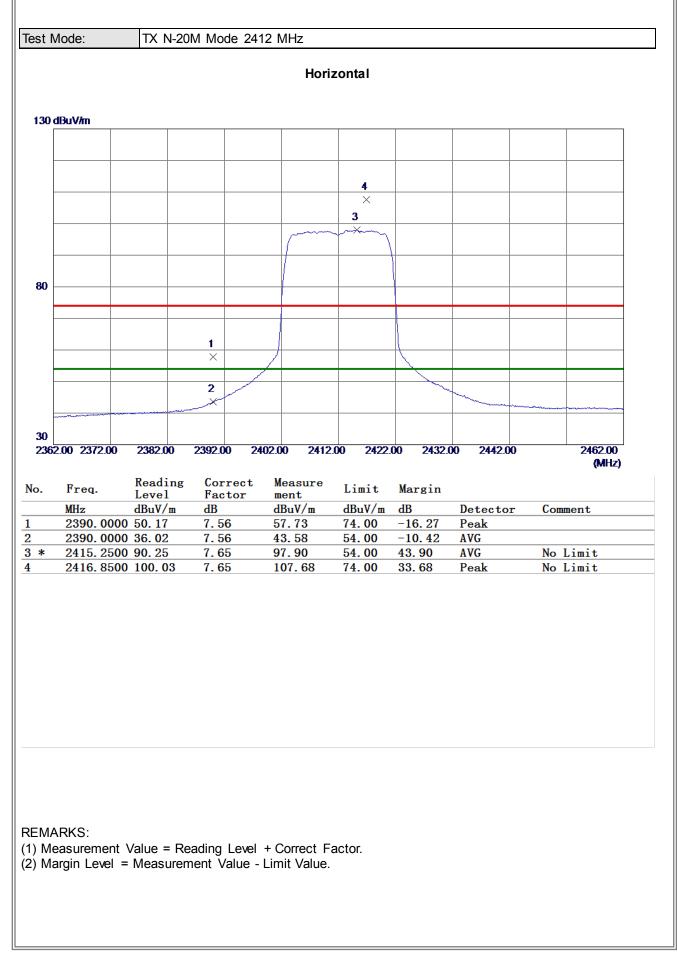




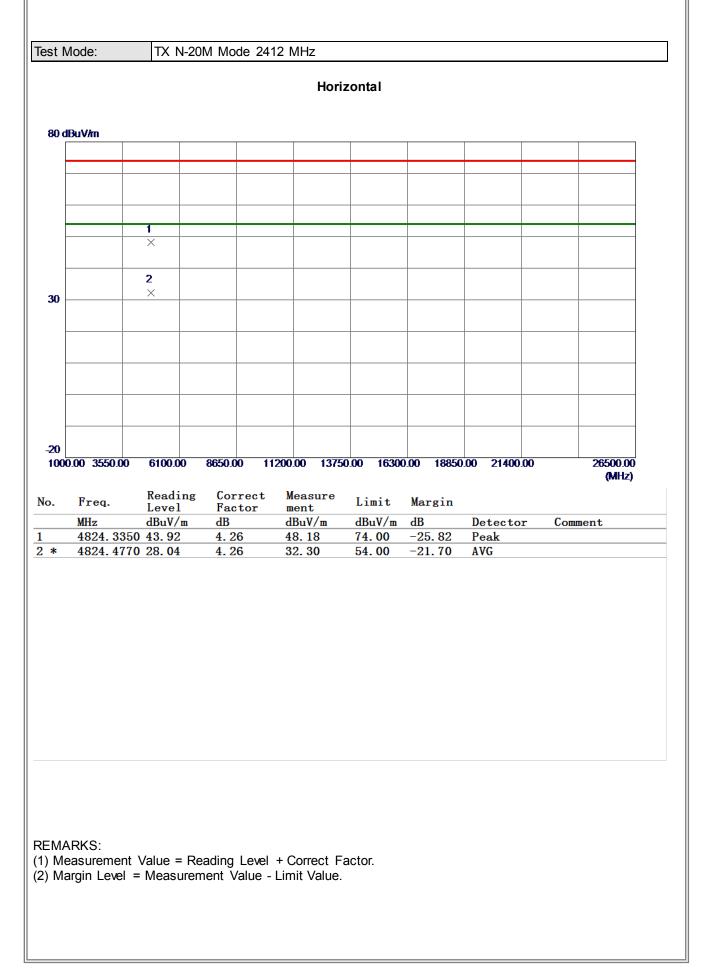




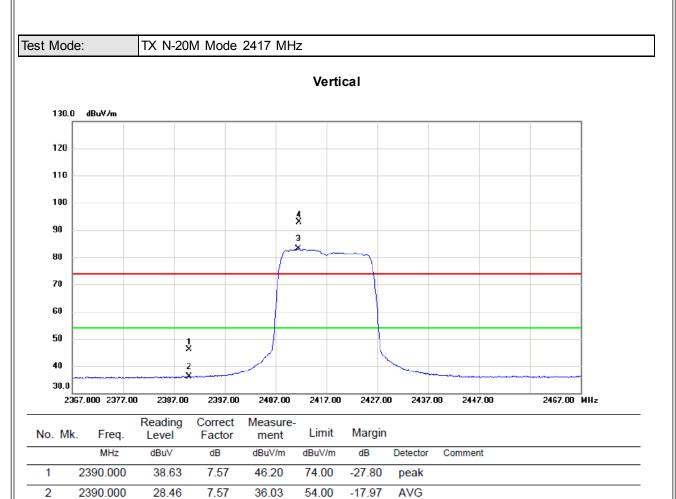












3 \*

4 X

2411.400

2411.650

75.40

85.15

7.64

7.64

83.04

92.79

54.00

74.00

29.04

18.79

AVG

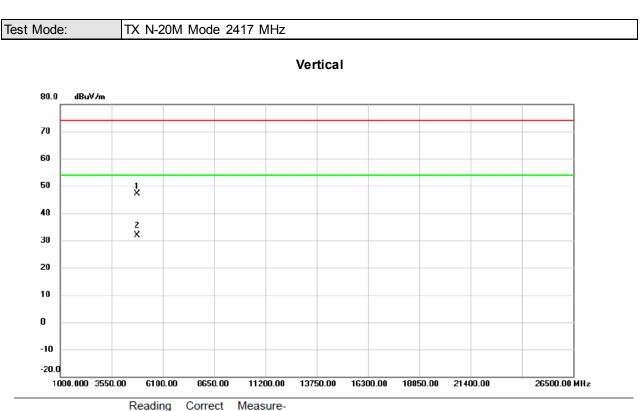
peak

No Limit

No Limit

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

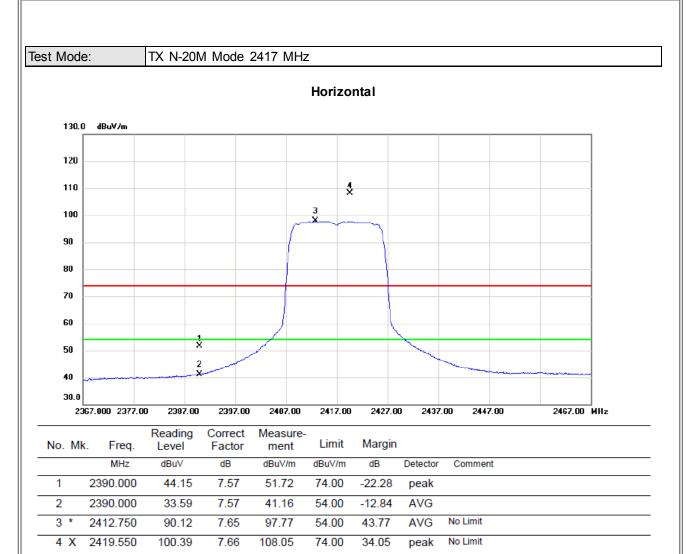




	No. M	ſk.	Freq.		Factor	ment	Limit	Margin		
			MHz	dBuV	dB	dBuV/m	dBuV/m	dB	Detector	Comment
	1	48	34.154	42.89	4.29	47.18	74.00	-26.82	peak	
-	2 *	48	34.474	27.54	4.30	31.84	54.00	-22.16	AVG	

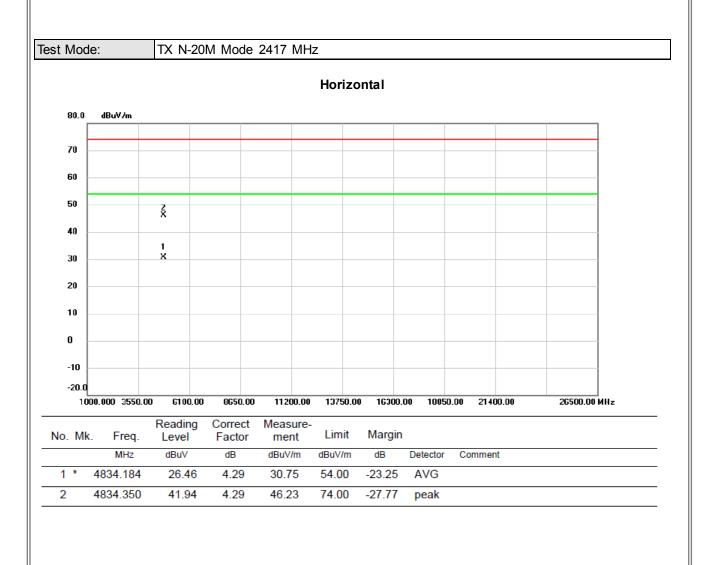
- (1) Measurement Value = Reading Level + Correct Factor.(2) Margin Level = Measurement Value Limit Value.





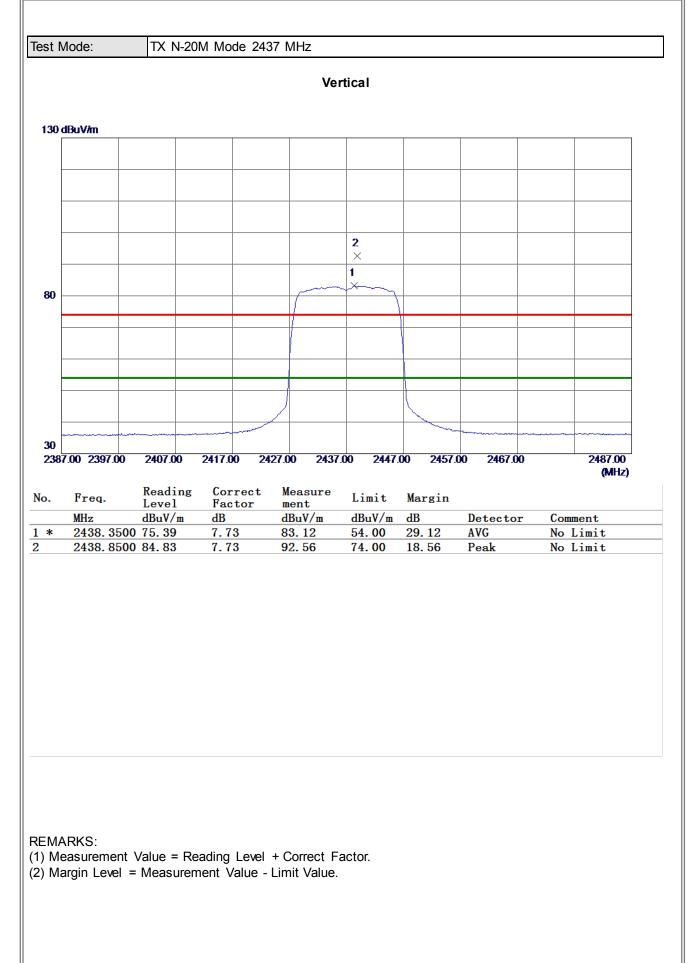
- (1) Measurement Value = Reading Level + Correct Factor.
- (2) Margin Level = Measurement Value Limit Value.



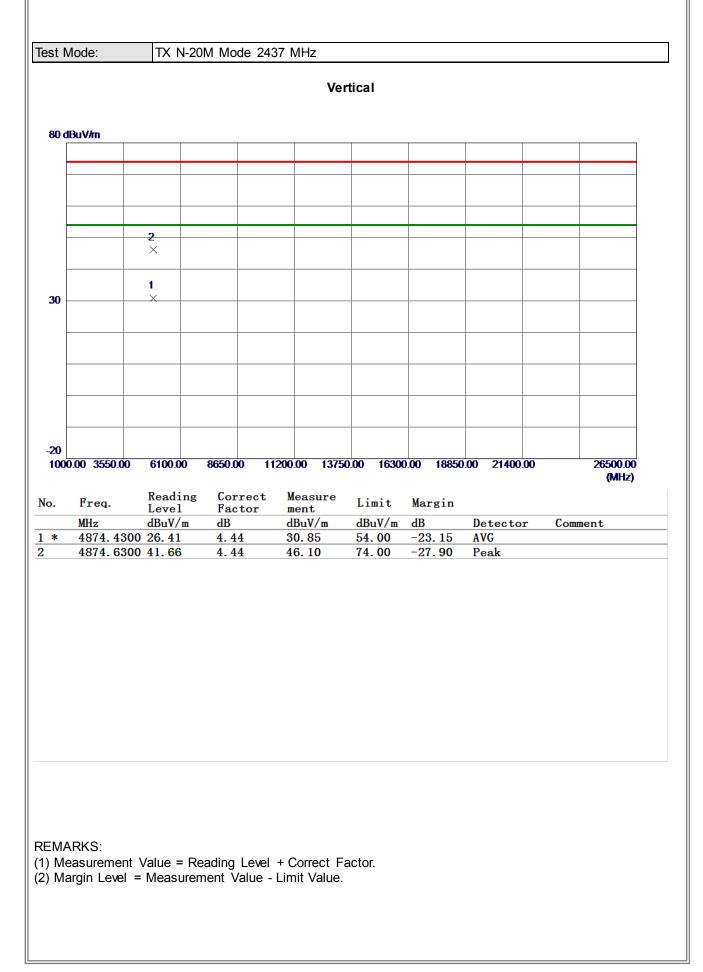


- (1) Measurement Value = Reading Level + Correct Factor.
- (2) Margin Level = Measurement Value Limit Value.

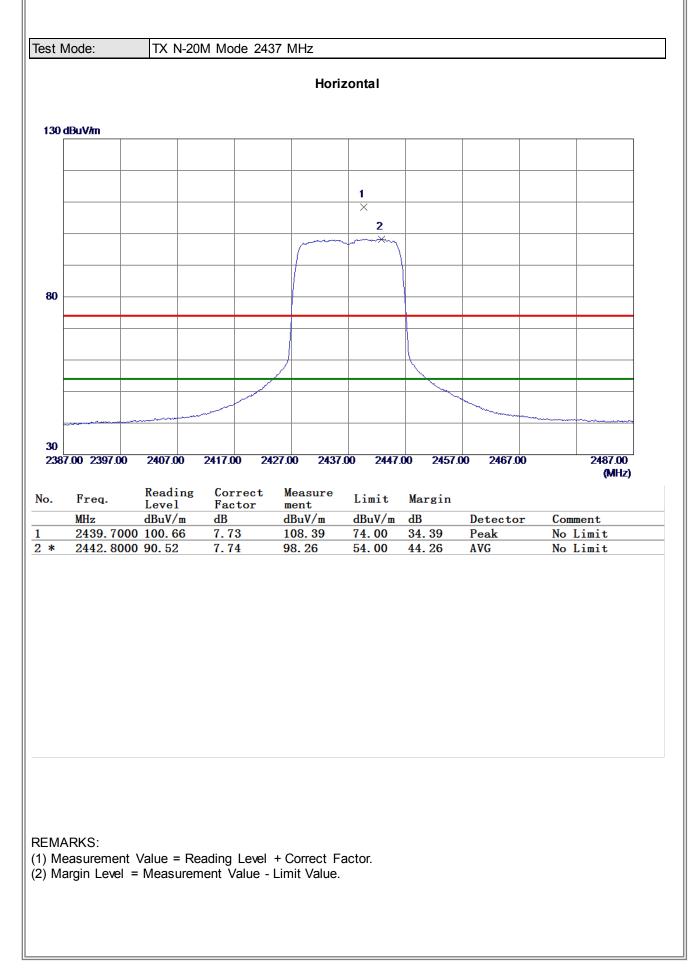




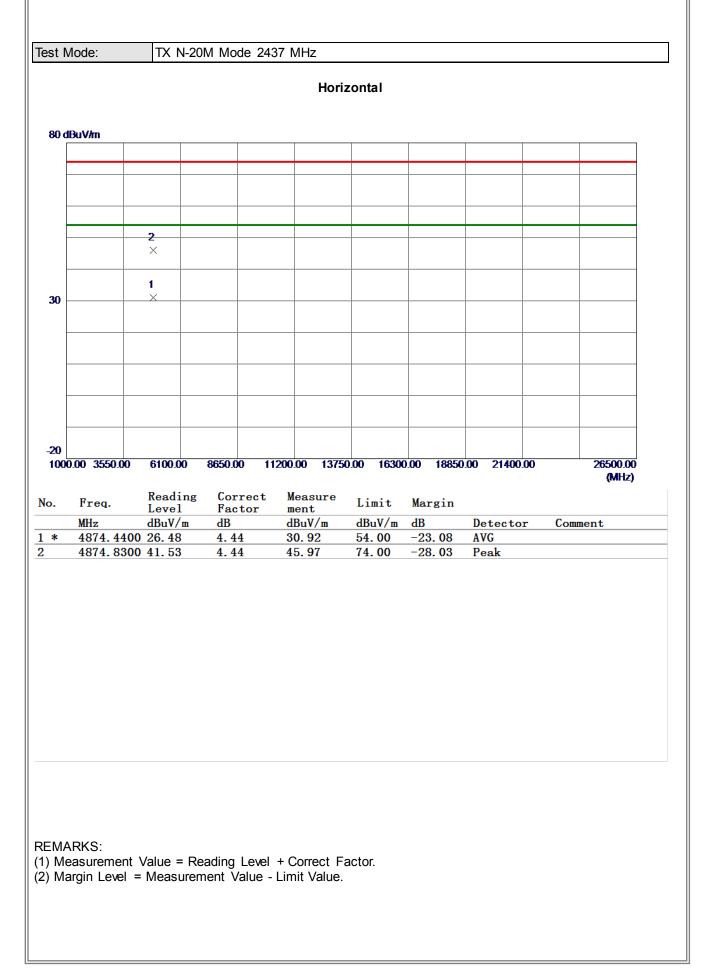




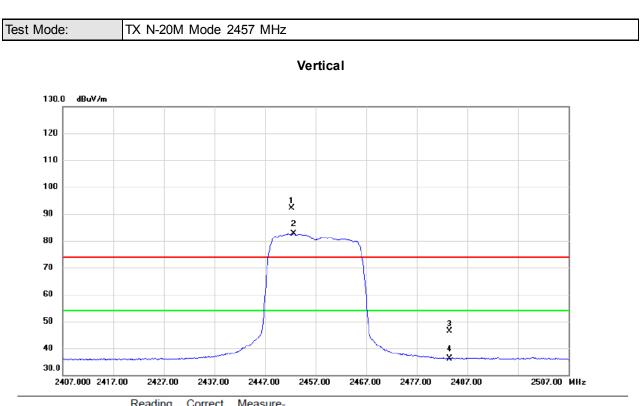












No. Mk	. Freq	Reading Level	Factor	Measure- ment	Limit	Margin			
	MHz	dBuV	dB	dBuV/m	dBuV/m	dB	Detector	Comment	
1 X	2452.300	) 84.35	7.78	92.13	74.00	18.13	peak	No Limit	
2 *	2452.650	) 74.79	7.78	82.57	54.00	28.57	AVG	No Limit	
3	2483.500	38.54	7.87	46.41	74.00	-27.59	peak		
4	2483.500	) 28.21	7.87	36.08	54.00	-17.92	AVG		

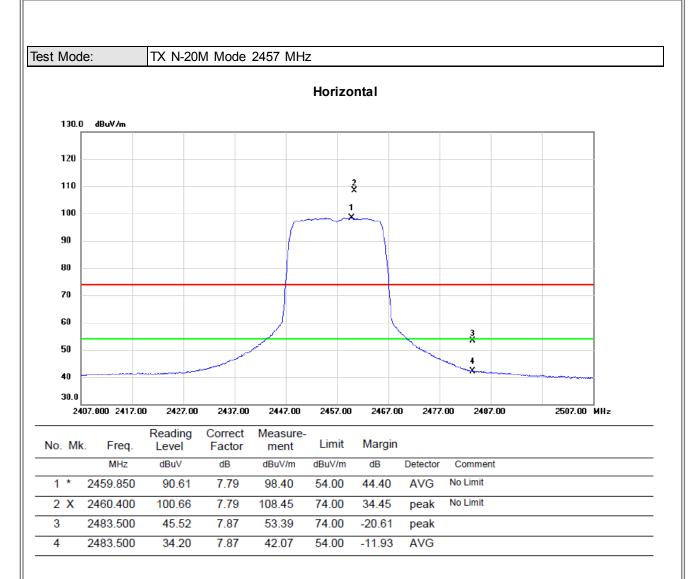
- (1) Measurement Value = Reading Level + Correct Factor.
- (2) Margin Level = Measurement Value Limit Value.





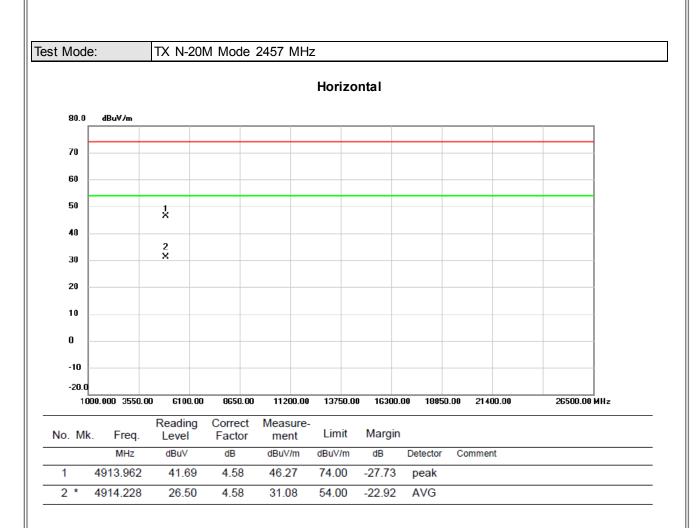
- (1) Measurement Value = Reading Level + Correct Factor.
- (2) Margin Level = Measurement Value Limit Value.





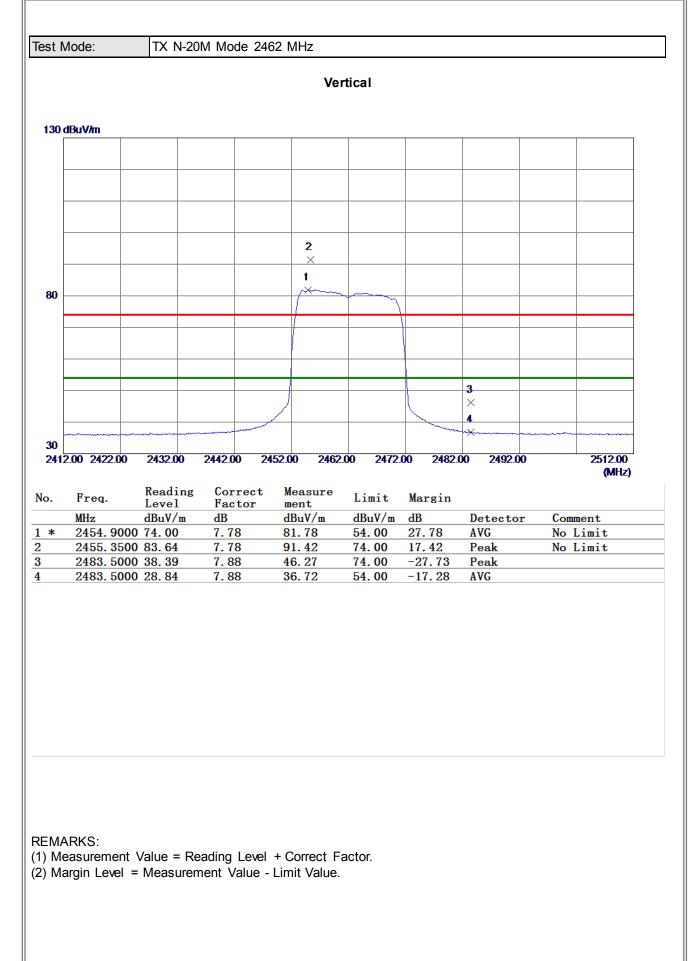
- (1) Measurement Value = Reading Level + Correct Factor.
- (2) Margin Level = Measurement Value Limit Value.



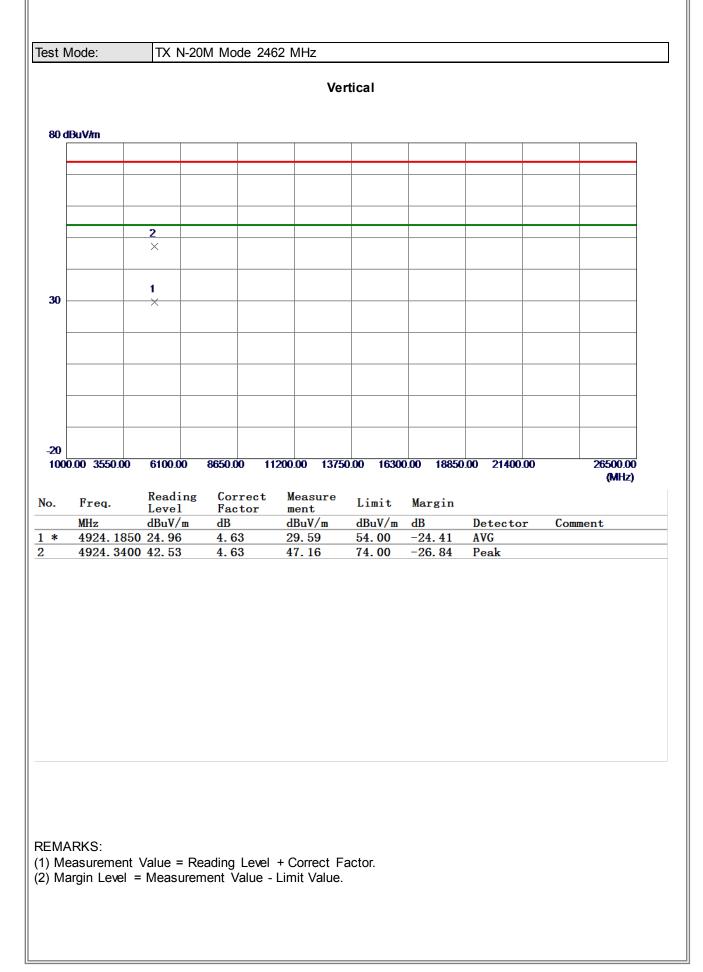


- (1) Measurement Value = Reading Level + Correct Factor.
- (2) Margin Level = Measurement Value Limit Value.

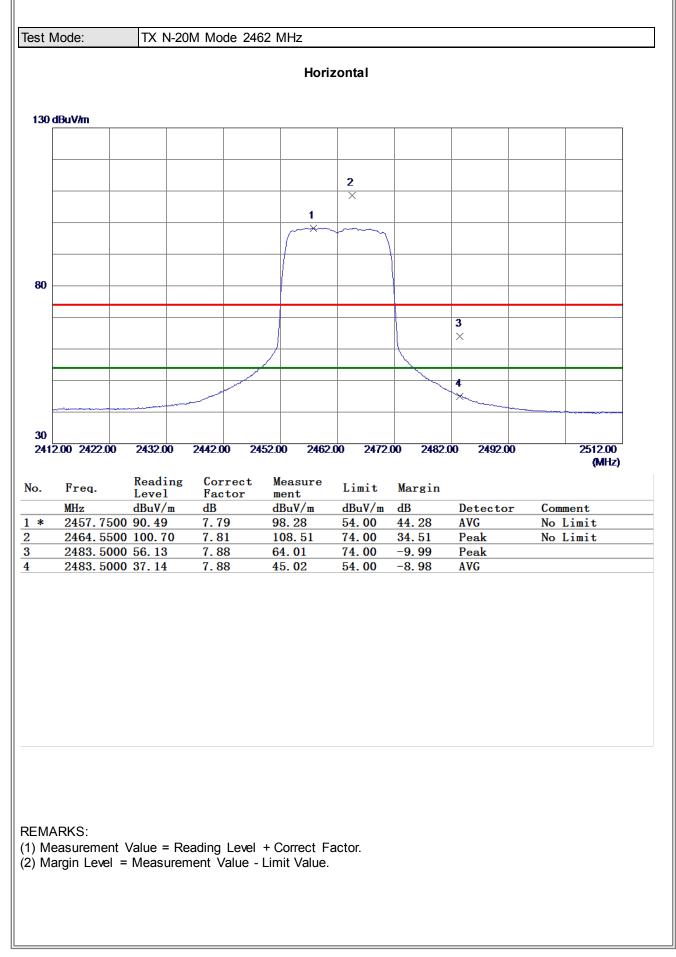




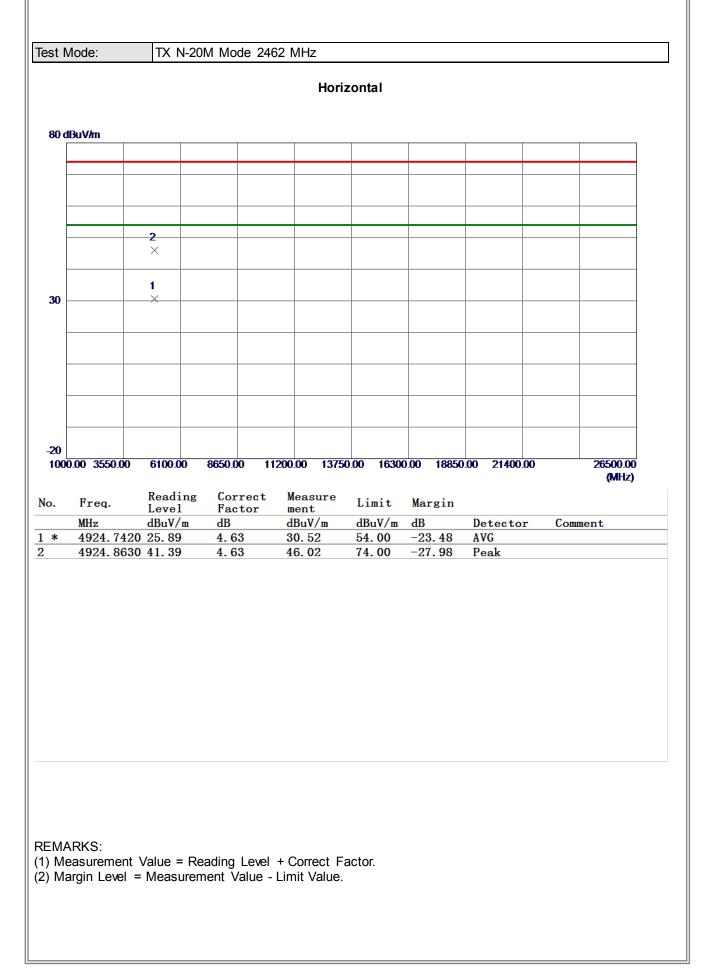












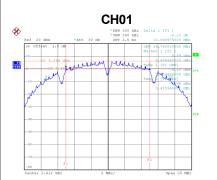


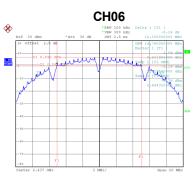
## **APPENDIX E - BANDWIDTH**



### Test Mode TX B Mode

Channel Frequency (MHz)		6 dB Bandwidth (MHz)	6 dB Bandwidth Min. Limit (kHz)	Result
01	2412	10.07	500	Complies
06	2437	10.10	500	Complies
11	2462	10.14	500	Complies





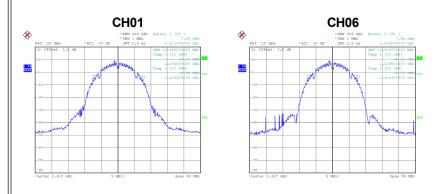


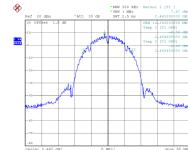
Date: 14.0CT.2019 16:56:35

Date: 14.0CT.2019 17:03:57

Date: 14.0CT.2019 17:10:31

Channel	Frequency (MHz)	99 % Emission Bandwidth (MHz)	Result	
01	2412	14.80	Complies	
06	2437	14.90	Complies	
11	2462	14.80	Complies	





CH11

Date: 14.0CT.2019 17:01:01

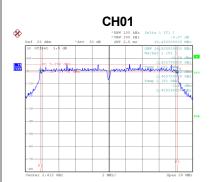
Date: 14.0CT.2019 17:06:51

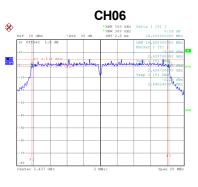
Date: 14.0CT.2019 17:12:22

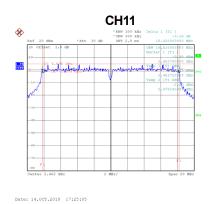


### Test Mode TX G Mode

Channel Frequency (MHz)		6 dB Bandwidth (MHz)	6 dB Bandwidth Min. Limit (kHz)	Result		
01	2412	16.43	500	Complies		
06	2437	16.43	500	Complies		
11	2462	16.42	500	Complies		

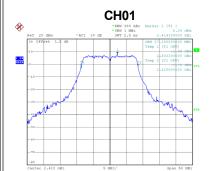


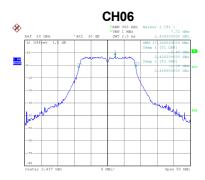


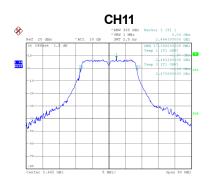


Date: 14.0CT.2019 17:14:44

Channel Frequency (MHz)		99 % Emission Bandwidth (MHz)	Result	
01	2412	17.30	Complies	
06 2437		17.30	Complies	
11	2462	17.30	Complies	







Date: 14.0CT.2019 17:16:23

Date: 14.0CT.2019 17:23:25

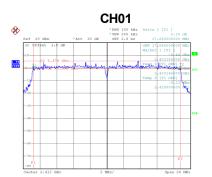
Date: 14.0CT.2019 17:22:02

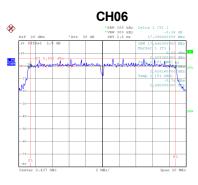
#### Date: 14.0CT.2019 17:26:14

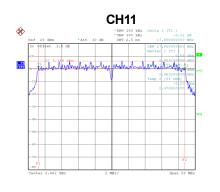


### Test Mode TX N-20M Mode

Channel Frequency (MHz)		6 dB Bandwidth (MHz)	6 dB Bandwidth Min. Limit (kHz)	Result
01	2412	17.62	500	Complies
06	2437	17.40	500	Complies
11	2462	17.59	500	Complies







Date: 14.0CT.2019 17:27:43

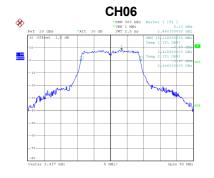
Date: 14.0CT.2019 17:33:03

:33:03

Date: 14.0CT.2019 17:36:00

Channel Frequency (MHz)			99 % Emission Bandwidth (MHz)	Result	
	01 2412		18.10	Complies	
	06 2437		18.10	Complies	
	11	2462	18.10	Complies	







Date: 14.0CT.2019 17:31:07

Date: 14.0CT.2019 17:34:28

Date: 14.0CT.2019 17:37:12



## APPENDIX F - MAXIMUM AVERAGE OUTPUT POWER



06

11

2437

2462

Test Mode	Test Mode TX B Mode								
Channel	Frequency (MHz)	Average Output Power (dBm)	Average Output Power (W)	Max. Limit (dBm)	Max. Limit (W)	Result			
01	2412	16.95	0.0495	30.00	1.0000	Complies			
06	2437	16.96	0.0497	30.00	1.0000	Complies			
11	2462	16.73	0.0471	30.00	1.0000	Complies			
Test Mode	TX G Mo	de							
Channel	Frequency (MHz)	Average Output Power (dBm)	Average Output Power (W)	Max. Limit (dBm)	Max. Limit (W)	Result			
01	2412	17.06	0.0509	30.00	1.0000	Complies			
06	2437	17.11	0.0515	30.00	1.0000	Complies			
11	2462	17.12	0.0516	30.00	1.0000	Complies			
Test Mode	TX N-20N	1 Mode							
Channel	Frequency (MHz)	Average Output Power (dBm)	Average Output Power (W)	Max. Limit (dBm)	Max. Limit (W)	Result			
01	2412	17.01	0.0502	30.00	1.0000	Complies			

0.0509

0.0532

30.00

30.00

1.0000

1.0000

Complies

Complies

17.07

17.26



# APPENDIX G - CONDUCTED SPURIOUS EMISSIONS



