

FCC Radio Test Report				
FCC ID: RWO-RZ090281				
This report concerns (check one): ⊠Original Grant ⊡Class I Change ⊡Class II Change				
Project No.: 1809C163Equipment: NotebookTest Model: RZ09-0281Series Model: RZ09-028Applicant: Razer Inc.Address: 201 3rd Street, Suite 900, San Francisco, CA 94103, USA				
Date of Receipt       :       Sep. 26, 2018         Date of Test       :       Sep. 29, 2018 ~ Oct. 26, 2018         Issued Date       :       Nov. 21, 2018         Tested by       :       BTL Inc.				
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The information, data and test plan are provided by manufacturer, so it is manufacturer's responsibility to ensure that the apparatus meets the essential requirements 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.





Table of Contents	Page
1. CERTIFICATION	6
2 . SUMMARY OF TEST RESULTS	7
2.1 TEST FACILITY	8
2.2 MEASUREMENT UNCERTAINTY	8
3 . GENERAL INFORMATION	9
3.1 GENERAL DESCRIPTION OF EUT	9
3.2 DESCRIPTION OF TEST MODES	13
3.3 TABLE OF PARAMETERS OF TEST SOFTWARE SETTING	15
3.4 BLOCK DIAGRAM SHOWING THE CONFIGURATION OF SYSTEM TES	STED 18
3.5 DESCRIPTION OF SUPPORT UNITS	18
4. EMC EMISSION TEST	19
4.1 CONDUCTED EMISSION MEASUREMENT	19
4.1.1 POWER LINE CONDUCTED EMISSION	19
4.1.2 TEST PROCEDURE 4.1.3 DEVIATION FROM TEST STANDARD	19
4.1.3 DEVIATION FROM TEST STANDARD 4.1.4 TEST SETUP	19 20
4.1.5 EUT OPERATING CONDITIONS	20
4.1.6 EUT TEST CONDITIONS	20
4.1.7 TEST RESULTS	20
4.2 RADIATED EMISSION MEASUREMENT	21
4.2.1 RADIATED EMISSION LIMITS 4.2.2 TEST PROCEDURE	21 22
4.2.2 TEST PROCEDURE 4.2.3 DEVIATION FROM TEST STANDARD	22
4.2.4 TEST SETUP	22
4.2.5 EUT OPERATING CONDITIONS	24
4.2.6 EUT TEST CONDITIONS	24
4.2.7 TEST RESULTS (9 kHz TO 30 MHz) 4.2.8 TEST RESULTS (30 MHz TO 1000 MHz)	24 24
4.2.9 TEST RESULTS (ABOVE 1000 MHz)	24 24
5. SPECTRUM BANDWIDTH	25
5.1 APPLIED PROCEDURES / LIMIT	25
5.1.1 TEST PROCEDURE	25
5.1.2 DEVIATION FROM STANDARD	25
5.1.3 TEST SETUP 5.1.4 EUT OPERATION CONDITIONS	26 26
5.1.4 EUT OPERATION CONDITIONS 5.1.5 EUT TEST CONDITIONS	26 26
5.1.6 TEST RESULTS	26
6 . MAXIMUM OUTPUT POWER	27





Table of Contents	Page
6.1 APPLIED PROCEDURES / LIMIT 6.1.1 TEST PROCEDURE 6.1.2 DEVIATION FROM STANDARD 6.1.3 TEST SETUP	27 27 28 28
6.1.4 EUT OPERATION CONDITIONS 6.1.5 EUT TEST CONDITIONS 6.1.6 TEST RESULTS	28 28 28
7 . POWER SPECTRAL DENSITY TEST 7.1 APPLIED PROCEDURES / LIMIT 7.1.1 TEST PROCEDURE 7.1.2 DEVIATION FROM STANDARD 7.1.3 TEST SETUP 7.1.4 EUT OPERATION CONDITIONS 7.1.5 EUT TEST CONDITIONS 7.1.6 TEST RESULTS	29 29 30 30 30 30 30 30 30
8 . FREQUENCY STABILITY MEASUREMENT 8.1 APPLIED PROCEDURES / LIMIT 8.1.1 TEST PROCEDURE 8.1.2 DEVIATION FROM STANDARD 8.1.3 TEST SETUP 8.1.4 EUT OPERATION CONDITIONS 8.1.5 EUT TEST CONDITIONS 8.1.6 TEST RESULTS	31 31 31 32 32 32 32 32
9 . MEASUREMENT INSTRUMENTS LIST APPENDIX A - CONDUCTED EMISSION	33 35
APPENDIX B - RADIATED EMISSION (9 KHZ TO 30 MHZ) APPENDIX C - RADIATED EMISSION (30 MHZ TO 1000 MHZ)	38 43
APPENDIX D - RADIATED EMISSION (ABOVE 1000 MHZ) APPENDIX E - BANDWIDTH	68 320
APPENDIX F - MAXIMUM OUTPUT POWER APPENDIX G - POWER SPECTRAL DENSITY APPENDIX H - FREQUENCY STABILITY	368 395 516



# **REPORT ISSUED HISTORY**

Description	Issued Date
Original Issue.	Nov. 21, 2018



# **1. CERTIFICATION**

Equipment : Brand Name : Test Model : Series Model :	RAZER RZ09-0281 RZ09-028
Applicant :	
Manufacturer :	Razer Inc.
Address :	201 3rd Street, Suite 900, San Francisco, CA 94103, USA
Factory :	BYD Precision Manufacture Co.,Ltd.
Address :	No.3001, Baohe Road, Baolong industrial, Longgang Street , Longgang Zone, Shenzhen
Date of Test :	Sep. 29, 2018 ~ Oct. 26, 2018
Test Sample :	Engineering Sample No.: D180908790 for conducted, D180908791 for radiated
Standard(s) :	FCC Part15, Subpart E(15.407) / ANSI C63.10-2013

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

The test data, data evaluation, and equipment configuration contained in our test report (Ref No. BTL-FCCP-4-1809C163) were obtained utilizing the test procedures, test instruments, test sites that has been accredited by the Authority of A2LA according to the ISO-17025 quality assessment standard and technical standard(s).

Test results included in this report is only for the RLAN 5G UNII-1, UNII-2A, UNII-2C, UNII-3 part.

# 2. SUMMARY OF TEST RESULTS

Test procedures according to the technical standard(s):

FCC Part15, Subpart E(15.407)					
Standard(s) Section	Judgment	Remark			
15.207	AC Power Line Conducted Emissions	PASS			
15.407(a)	Spectrum Bandwidth	PASS			
15.407(a) Maximum Output Power		PASS			
15.407(a)	Power Spectral Density	PASS			
15.407(a)	Radiated Emissions	PASS			
15.407(b)	Band Edge Emissions	PASS			
15.407(g)	Frequency Stability	PASS			

Note:

(1) "N/A" denotes test is not applicable in this test report.



# 2.1 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 number for FCC: 854385 BTL's designation number for FCC: CN5020

#### 2.2 MEASUREMENT UNCERTAINTY

The measurement uncertainty figures shall be calculated according the methods described in the ETSI TR 100 028 and shall correspond to an expansion factor (coverage factor) k=1.96 or k=2(which provide confidence levels of respectively 90% and 95.45% in the case where the distributions characterizing the actual measurement uncertainties are normal (Gaussian)). Measurement Uncertainty for a Level of Confidence of 95 %, U=2xUc(y).

The BTL measurement uncertainty as below table:

A. Conducted Measurement:

Test Site	Method	Measurement Frequency Range	U, (dB)
DG-C02	CISPR	150 KHz ~ 30 MHz	2.32

B. Radiated Measurement:

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	3.82
		30 MHz~200 MHz	H	3.60
DG-CB03		200 MHz~1,000 MHz	V	3.86
DG-CB03		200 MHz~1,000 MHz	H	3.94
		1 GHz~18 GHz	V	3.12
		1 GHz~18 GHz	H	3.68
		18 GHz~40 GHz	V	4.15
		18 GHz~40 GHz	Н	4.14

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



# **3. GENERAL INFORMATION**

# 3.1 GENERAL DESCRIPTION OF EUT

Equipment	Notebook		
Brand Name	RAZER		
Test Model	RZ09-0281		
Series Model	RZ09-028		
Model Difference(s)	RZ09-0281 uses an indepe an integrated graphics card	ndent graphics card and RZ09-028 uses	
Software Version	Windows 10		
Hardware Version	N13RW2_MB		
	Operation Frequency         UNII-1: 5150 MHz ~ 5250 MHz           UNII-2A: 5250 MHz ~ 5350 MHz         UNII-2A: 5250 MHz ~ 5350 MHz           UNII-2C: 5470 MHz ~ 5725 MHz         UNII-3: 5725 MHz ~ 5850 MHz		
Product Description	Modulation Type802.11a:OFDM802.11n:OFDM802.11ac:OFDM		
	Bit Rate of Transmitter         802.11a: 54/48/36/24/18/12/9/6 Mbps           802.11n: up to 300 Mbps         802.11ac: up to 366 Mbps		
Power Source	<ul> <li>#1 DC voltage supplied from AC/DC adapter. Model: RC30-0239</li> <li>#2 Supplied from rechargeable Li-ion battery. Brand/Model: RAZER/RC30-0281</li> </ul>		
Power Rating	#1 I/P: 100-240Vac, 50/60Hz,2A O/P: 20V === 3.25A #2 DC11.55V, 4602mAh/53.1Wh		



		802.11a: 18.85dBm
		802.11n (20M): 19.03dBm
	Output Bower (Mex.)	802.11n (40M): 18.18dBm
	Output Power (Max.) for UNII-1	802.11ac (20M): 19.11dBm
	IOF UNII-1	802.11ac (40M): 18.37dBm
		802.11ac (80M): 16.96dBm
		802.11ac (160M): 16.62dBm
		802.11a: 19.04dBm
		802.11n (20M): 19.01dBm
	Output Power (Max.)	802.11n (40M): 18.03dBm
	for UNII-2A	802.11ac (20M): 19.11dBm
		802.11ac (40M): 18.33dBm
Output Douron		802.11ac (80M): 16.98dBm
Output Power	Output Power (Max.) for UNII-2C	802.11a: 18.92dBm
		802.11n (20M): 18.94dBm
		802.11n (40M): 18.14dBm
		802.11ac (20M): 18.99dBm
		802.11ac (40M): 18.39dBm
		802.11ac (80M): 17.13dBm
		802.11ac (160M): 16.82dBm
		802.11a: 18.86dBm
		802.11n (20M): 18.90dBm
	Output Power (Max.)	802.11n (40M): 18.28dBm
	for UNII-3	802.11ac (20M): 19.03dBm
		802.11ac (40M): 18.45dBm
		802.11ac (80M): 17.15dBm

Note:

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

2.

802.11a 802.11n 20 MHz 802.11ac 20 MHz		802.11n 40 MHz 802.11ac 40 MHz		802.11ac 80 MHz	
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				



802.11a 802.11n 20 MHz 802.11ac 20 MHz		802.11n 40 MHz 802.11ac 40 MHz		802.11ac 80 MHz	
UNII	-2A	UNI	I-2A	UNI	I-2A
Channel	Frequency (MHz)	Channel	Frequency (MHz)	Channel	Frequency (MHz)
52	5260	54	5270	58	5290
56	5280	62	5310		
60	5300				
64	5320				

802.11a 802.11n 20 MHz 802.11ac 20 MHz		802.11n 40 MHz 802.11ac 40 MHz		802.11ac 80 MHz	
UNII	-2C	UNII-2C		UNII-2C	
Channel	Frequency (MHz)	Channel	Frequency (MHz)	Channel	Frequency (MHz)
100	5500	102	5510	106	5530
104	5520	110	5550	122	5610
108	5540	118	5590		
112	5560	126	5630		
116	5580	134	5670		
132	5660				
136	5680				
140	5700				

802.11a 802.11n 20 MHz 802.11ac 20 MHz		802.11n 40 MHz 802.11ac 40 MHz		802.11ac 80 MHz	
UNII-3		UNII-3		UNII-3	
Channel	Frequency (MHz)	Channel	Frequency (MHz)	Channel	Frequency (MHz)
149	5745	151	5755	155	5775
153	5765	159	5795		
157	5785				
161	5805				
165	5825				

802.11ac (160 MHz)				
Channel	Frequency (MHz)			
50	5250			
114	5570			



# 3. Antenna Specification:

Ant.	Brand	P/N	Antenna Type	Connector	Gain (dBi)
1	N/A	BY5780-16-002-C	PIFA	N/A	4.99
2	N/A	BY5780-16-001-C	PIFA	N/A	4.60

Note:

(1) EUT incorporates a MIMO function. Physically, the EUT provides two completed transmitters and receivers (2T2R), all transmit signals are completely correlated, so Directional gain =10log[(10<sup>G1/20</sup>+10<sup>G2/20</sup>+...10<sup>GN/20</sup>)<sup>2</sup>/N]dBi, that is

Directional gain= $10\log[(10^{4.99/20}+10^{4.60/20})^2/2]dBi = 7.81.$ 

So, the UNII-1,UNII-2A, UNII-2C out power limit is 24-7.81+6=22.19, the UNII-3 out power limit is 30-7.81+6=28.19. the UNII-1,UNII-2A,UNII-2C power density limit is 11-7.81+6=9.19, the UNII-3 power density limit is 30-7.81+6=28.19.

4.	Operating Mode TX Mode	2TX
	802.11a	V (ANT 1+ANT 2)
	802.11n (20 MHz)	V (ANT 1+ANT 2)
	802.11n (40 MHz)	V (ANT 1+ANT 2)
	802.11ac (20 MHz)	V (ANT 1+ANT 2)
	802.11ac (40 MHz)	V (ANT 1+ANT 2)
	802.11ac (80 MHz)	V (ANT 1+ANT 2)
	802.11ac(160MHz)	V (ANT 1+ANT 2)

# 3.2 DESCRIPTION OF TEST MODES

To investigate the maximum EMI emission characteristics generates from EUT, the test system was pre-scanning tested base on the consideration of following EUT operation mode or test configuration mode which possible have effect on EMI emission level. Each of these EUT operation mode(s) or test configuration mode(s) mentioned above was evaluated respectively.

Pretest Mode	Description
Mode 1	TX A Mode / CH36, CH40, CH48 (UNII-1)
Mode 2	TX N20 Mode / CH36, CH40, CH48 (UNII-1)
Mode 3	TX N40 Mode / CH38, CH46 (UNII-1)
Mode 4	TX AC20 Mode / CH36, CH40, CH48 (UNII-1)
Mode 5	TX AC40 Mode / CH38, CH46 (UNII-1)
Mode 6	TX AC80 Mode / CH42 (UNII-1)
Mode 7	TX AC160 Mode / CH50 (UNII-1)
Mode 8	TX A Mode / CH52, CH60, CH64 (UNII-2A)
Mode 9	TX N20 Mode / CH52, CH60, CH64 (UNII-2A)
Mode 10	TX N40 Mode / CH54, CH62 (UNII-2A)
Mode 11	TX AC20 Mode / CH52, CH60, CH64 (UNII-2A)
Mode 12	TX AC40 Mode / CH54, CH62 (UNII-2A)
Mode 13	TX AC80 Mode / CH58 (UNII-2A)
Mode 14	TX A Mode / CH100, CH116, CH140 (UNII-2C)
Mode 15	TX N20 Mode / CH100, CH116, CH140 (UNII-2C)
Mode 16	TX N40 Mode / CH102, CH110, CH134 (UNII-2C)
Mode 17	TX AC20 Mode / CH100, CH116, CH140 (UNII-2C)
Mode 18	TX AC40 Mode / CH102, CH110, CH134 (UNII-2C)
Mode 19	TX AC80 Mode / CH106, CH122 (UNII-2C)
Mode 20	TX AC160 Mode / CH114 (UNII-2C)
Mode 21	TX A Mode / CH149,CH157,CH165 (UNII-3)
Mode 22	TX N20 Mode / CH149,CH157,CH165 (UNII-3)
Mode 23	TX N40 Mode / CH151,CH159 (UNII-3)
Mode 24	TX AC20 Mode / CH149,CH157,CH165 (UNII-3)
Mode 25	TX AC40 Mode / CH151,CH159 (UNII-3)
Mode 26	TX AC80 Mode / CH155 (UNII-3)
Mode 27	TX Mode
The EUT system ope test as following:	erated these modes were found to be the worst case during the pre-scanning

For Conducted Test		
Final Test Mode	Description	
Mode 27	TX Mode	



For Radiated Test			
Final Test Mode	Description		
Mode 1	TX A Mode / CH36, CH40, CH48 (UNII-1)		
Mode 2	TX N20 Mode / CH36, CH40, CH48 (UNII-1)		
Mode 3	TX N40 Mode / CH38, CH46 (UNII-1)		
Mode 4	TX AC20 Mode / CH36, CH40, CH48 (UNII-1)		
Mode 5	TX AC40 Mode / CH38, CH46 (UNII-1)		
Mode 6	TX AC80 Mode / CH42 (UNII-1)		
Mode 7	TX AC160 Mode / CH50 (UNII-1)		
Mode 8	TX A Mode / CH52, CH60, CH64 (UNII-2A)		
Mode 9	TX N20 Mode / CH52, CH60, CH64 (UNII-2A)		
Mode 10	TX N40 Mode / CH54, CH62 (UNII-2A)		
Mode 11	TX AC20 Mode / CH52, CH60, CH64 (UNII-2A)		
Mode 12	TX AC40 Mode / CH54, CH62 (UNII-2A)		
Mode 13	TX AC80 Mode / CH58 (UNII-2A)		
Mode 14	TX A Mode / CH100, CH116, CH140 (UNII-2C)		
Mode 15	TX N20 Mode / CH100, CH116, CH140 (UNII-2C)		
Mode 16	TX N40 Mode / CH102, CH110, CH134 (UNII-2C)		
Mode 17	TX AC20 Mode / CH100, CH116, CH140 (UNII-2C)		
Mode 18	TX AC40 Mode / CH102, CH110, CH134 (UNII-2C)		
Mode 19	TX AC80 Mode / CH106, CH122 (UNII-2C)		
Mode 20	TX AC160 Mode / CH114 (UNII-2C)		
Mode 21	TX A Mode / CH149,CH157,CH165 (UNII-3)		
Mode 22	TX N20 Mode / CH149,CH157,CH165 (UNII-3)		
Mode 23	TX N40 Mode / CH151,CH159 (UNII-3)		
Mode 24	TX AC20 Mode / CH149,CH157,CH165 (UNII-3)		
Mode 25	TX AC40 Mode / CH151,CH159 (UNII-3)		
Mode 26	TX AC80 Mode / CH155 (UNII-3)		

Note:

(1) For radiated 30 MHz to 1000 MHz test, the 802.11a mode is found to be the worst case and recorded.

(2) For radiated, the 2TX (ANT 1+ANT 2) is found to be the worst case and recorded.



#### 3.3 TABLE OF PARAMETERS OF TEST SOFTWARE SETTING

During testing channel & power controlling software provided by the customer was used to control the operating channel as well as the output power level. The RF output power selection is for the setting of RF output power expected by the customer and is going to be fixed on the firmware of the final end product

UNII-1					
Test Software Version		DRTU			
Frequency (MHz)	5180	5200	5240		
A Mode	15/15	15/15	15/15		
Frequency (MHz)	5180	5200	5240		
N20 Mode	15.5/15.5	15.5/15.5	15.5/15.5		
Frequency (MHz)	5190	5230			
N40 Mode	14.5/14.5	14.5/14.5			

UNII-2A					
Test Software Version		DRTU			
Frequency (MHz)	5260	5300	5320		
A Mode	15.5/15.5	15.5/15.5	15.5/15.5		
Frequency (MHz)	5260	5300	5320		
N20 Mode	16/16	16/15.5	16/15.5		
Frequency (MHz)	5270	5310			
N40 Mode	15/14.5	15/14.5			

UNII-2C					
Test Software Version		DRTU			
Frequency (MHz)	5500	5580	5700		
A Mode	15.5/15.5	15.5/15.5	15.5/15.5		
Frequency (MHz)	5500	5580	5700		
N20 Mode	16/15.5	16/15.5	16/15.5		
Frequency (MHz)	5510	5550	5670		
N40 Mode	15/14.5	15/14.5	15/14.5		



UNII-3				
Test Software Version	DRTU			
Frequency (MHz)	5745	5785	5825	
A Mode	15.5/15.5	15.5/15.5	15.5/15.5	
Frequency (MHz)	5745	5785	5825	
N20 Mode	15.5/15.5	15.5/15.5	15.5/15.5	
Frequency (MHz)	5755	5795		
N40 Mode	15/15	15/15		

UNII-1				
Test Software Version	DRTU			
Frequency (MHz)	5180	5200	5240	
AC20 Mode	15.5/15.5	15.5/15.5	15.5/15.5	
Frequency (MHz)	5190	5230		
AC40 Mode	14.5/14.5	14.5/14.5		
Frequency (MHz)	5210			
AC80 Mode	12.5/12.5			

UNII-2A			
Test Software Version	DRTU		
Frequency (MHz)	5260	5300	5320
AC20 Mode	15.5/15.5	16/15.5	16/15.5
Frequency (MHz)	5270	5310	
AC40 Mode	15/14.5	15/14.5	
Frequency (MHz)	5290		
AC80 Mode	13/13		

UNII-2C				
Test Software Version	DRTU			
Frequency (MHz)	5500 5580 5700			
AC20 Mode	16/15.5	16/15.5	16/15.5	
Frequency (MHz)	5510	5550	5670	
AC40 Mode	15/14.5	15/14.5	15/14.5	
Frequency (MHz)	5530	5610		
AC80 Mode	13/13	13.5/12.5		

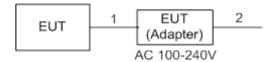


UNII-3			
Test Software Version	DRTU		
Frequency (MHz)	5745	5785	5825
AC20 Mode	15.5/15.5	15.5/15.5	15.5/15.5
Frequency (MHz)	5755	5795	
AC40 Mode	15/15	15/15	
Frequency (MHz)	5775		
AC80 Mode	13/13		

	UNII-1	UNII-2C	
Test Software Version	DRTU		
Frequency (MHz)	5250	5570	
AC160 Mode	13/12.5	13/12.5	



# 3.4 BLOCK DIAGRAM SHOWING THE CONFIGURATION OF SYSTEM TESTED



#### 3.5 DESCRIPTION OF SUPPORT UNITS

The EUT has been tested as an independent unit together with other necessary accessories or support units. The following support units or accessories were used to form a representative test configuration during the tests.

Item	Equipment	Mfr/Brand	Model/Type No.	FCC ID	Series No.
-	-	-	-	-	-

Item	Shielded Type	Ferrite Core	Length	Note
1	NO	NO	2m	DC Cable
2	NO	NO	1m	AC Cable



# 4. EMC EMISSION TEST

#### 4.1 CONDUCTED EMISSION MEASUREMENT

#### 4.1.1 POWER LINE CONDUCTED EMISSION (Frequency Range 150 kHz-30 MHz)

Frequency of Emission (MHT)	Conducted Li	mit (dBµV)
Frequency of Emission (MHz)	Quasi-peak	Average
0.15 -0.50	66to 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 test result calculated as following:
  - Measurement Value = Reading Level + Correct Factor Correct Factor = Insertion Loss + Cable Loss + Attenuator Factor(if use)
  - Margin Level = Measurement Value Limit Value

#### 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

#### 4.1.2 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.

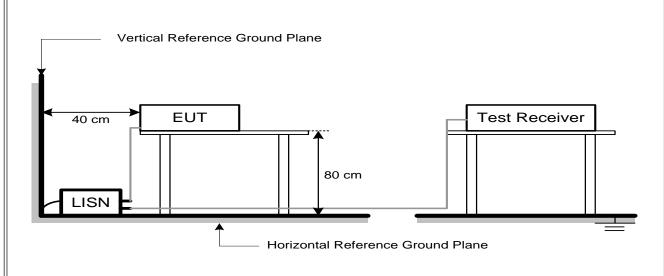
#### 4.1.3 DEVIATION FROM TEST STANDARD

No deviation





# 4.1.4 TEST SETUP



#### 4.1.5 EUT OPERATING 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 mode.

#### 4.1.6 EUT TEST CONDITIONS

Temperature: 27°C Relative Humidity: 39% Test Voltage: AC 120V/60Hz

#### 4.1.7 TEST RESULTS

Please refer to the Appendix A.

Remark:

- (1) All readings are QP Mode value unless otherwise stated AVG in column of <sup>ℂ</sup>Note<sub>□</sub>. If the QP Mode Measured value compliance with the QP Limits and lower than AVG Limits, the EUT shall be deemed to meet both QP & AVG Limits and then only QP Mode was measured, but AVG Mode didn't perform ∘ In this case, a "\*" marked in AVG Mode column of Interference Voltage Measured ∘
- (2) Measuring frequency range from 150 kHz to 30 MHz  $\circ$



# 4.2 RADIATED EMISSION MEASUREMENT

#### **4.2.1 RADIATED EMISSION LIMITS**

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.

Frequencies	Field Strength	Measurement Distance
(MHz)	(micorvolts/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

Frequencies	EIRP Limit (dBm)	Equivalent Field Strength
(MHz)	(ab)	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 5950	10(Note 2)	105.3
5725-5850	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  $\frac{1000000\sqrt{30P}}{-}\mu V/m, \text{ where P is the eirp (Watts)}$ 

field strength: E =

2. According to FCC 16-24, All emissions shall be limited to a level of -27 dBm/MHz at 75 MHz or more above or below theband edge increasing linearly to 10 dBm/MHz at 25 MHz above or below the band edge, and from 25MHz above or below the band edge increasing linearly to a level of 15.6 dBm/MHz at 5 MHz above orbelow the band edge, and from 5 MHz above or below the band edge increasing linearly to a level of 27dBm/MHz at the band edge.



# 4.2.2 TEST PROCEDURE

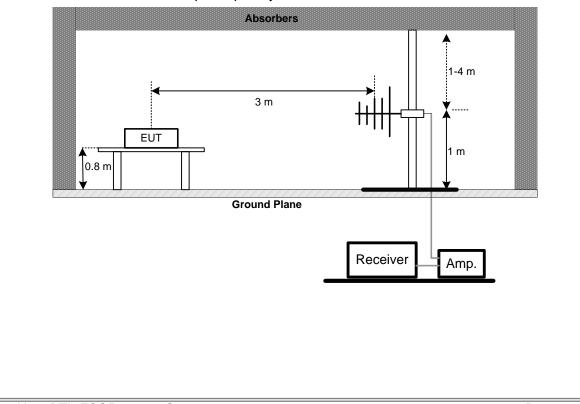
- a. The measuring distance of 3 m shall be used for measurements. The EUT was placed on the top of a rotating table 0.8 meter above the ground at a 3 meter semi-anechoic chamber. The table was rotated 360 degrees to determine the position of the highest radiation.(below 1GHz)
- b. The measuring distance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

#### 4.2.3 DEVIATION FROM TEST STANDARD

No deviation

# 4.2.4 TEST SETUP

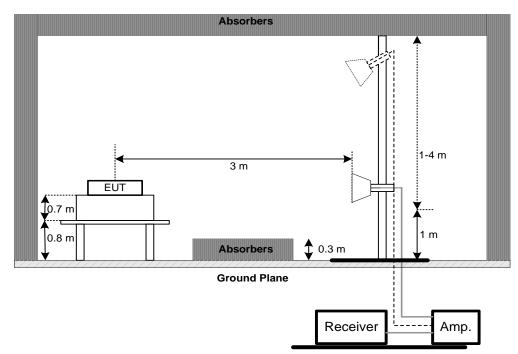
(A)Radiated Emission Test Set-Up Frequency 30 MHz-1000 MHz



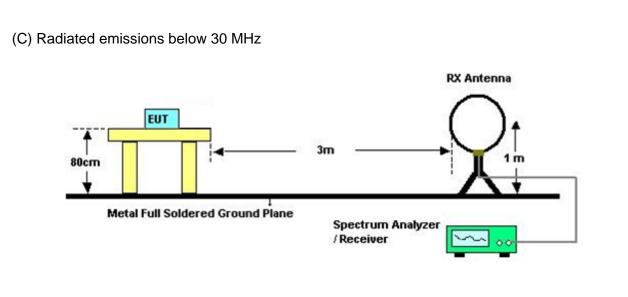




# (B) Radiated Emission Test Set-Up Frequency Above 1 GHz







# 4.2.5 EUT OPERATING CONDITIONS

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

# 4.2.6 EUT TEST CONDITIONS

Temperature: 25°C Relative Humidity: 60% Test Voltage: AC 120V/60Hz

#### 4.2.7 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.

#### 4.2.8 TEST RESULTS (30 MHz TO 1000 MHz)

Please refer to the Appendix C.

#### 4.2.9 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. SPECTRUM BANDWIDTH

# 5.1 APPLIED PROCEDURES / LIMIT

FCC Part15, Subpart E				
Test Item	Limit	Frequency Range (MHz)	Result	
	26 dB Bandwidth	5150-5250	PASS	
	26 dB Bandwidth	5250-5350	PASS	
Bandwidth	26 dB Bandwidth	5470-5725	PASS	
	Minimum 500kHz 6 dB	5725-5850	PASS	
	Bandwidth	0720-0000	FA00	

#### 5.1.1 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 Parameters	Setting
Attenuation	Auto
Span Frequency	> 26 dB Bandwidth
DDW/	300 kHz(Bandwidth 20 MHz)
RBW	1 MHz(Bandwidth 40 MHz and 80 MHz)
	1 MHz(Bandwidth 20 MHz)
VBW	3 MHz(Bandwidth 40 MHz and 80 MHz)
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

# 5.1.2 DEVIATION FROM STANDARD

No deviation.



# 5.1.3 TEST SETUP

EUT	SPECTRUM	
	ANALYZER	

#### 5.1.4 EUT OPERATION CONDITIONS

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

#### 5.1.5 EUT TEST CONDITIONS

Temperature: 25°C Relative Humidity: 58% Test Voltage: AC 120V/60Hz

#### 5.1.6 TEST RESULTS

Please refer to the Appendix E.

# 6. MAXIMUM OUTPUT POWER

# 6.1 APPLIED PROCEDURES / LIMIT

FCC Part15, Subpart E				
Test Item	Limit Frequency Range (MHz)		Result	
	Fixed:1 Watt (30 dBm)	5150-5250	PASS	
Maximum Output	Mobile and portable: 250 mW (24 dBm)	5150-5250	PASS	
Power	250mW (24 dBm)	5250-5350	PASS	
	250mW (24 dBm)	5470-5725	PASS	
	1 Watt (30 dBm)	5725-5850	PASS	

#### Note:

- 1. 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).
- 2. 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.

#### 6.1.1 TEST PROCEDURE

- a. The EUT was directly connected to the spectrum analyzer and antenna output port as show in the block diagram below.
- b. Used spectrum analyzer band power measurement function.

c.

d. <sup>–</sup>

Spectrum Parameter	Setting
Attenuation	Auto
Span Frequency	Encompass the entire emissions bandwidth (EBW) of the signal
RBW	= 1 MHz.
VBW	≥ 3 MHz.
Sweep points	≥ 2 x span / RBW
Detector	RMS
Trace	Trace average at least 100 traces in power averaging(rms) mode.
Sweep Time	auto rdance with method of KDB 789033 D02.



#### 6.1.2 DEVIATION FROM STANDARD

No deviation.

#### 6.1.3 TEST SETUP



#### 6.1.4 EUT OPERATION CONDITIONS

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

#### 6.1.5 EUT TEST CONDITIONS

Temperature: 25°C Relative Humidity: 58% Test Voltage: AC 120V/60Hz

#### 6.1.6 TEST RESULTS

Please refer to the Appendix F.

# 7. POWER SPECTRAL DENSITY TEST

# 7.1 APPLIED PROCEDURES / LIMIT

FCC Part15, Subpart E				
Test Item	Limit	Frequency Range (MHz)	Result	
	Other then Mobile and portable: 17 dBm/MHz	5150-5250	PASS	
Dower Spectral	Mobile and portable:11 dBm/MHz	5150-5250	PASS	
Power Spectral Density	11 dBm/MHz	5250-5350	PASS	
	11 dBm/MHz	5470-5725	PASS	
	30 dBm/500kHz	5725-5850	PASS	

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

Note:

- For UNII-3, according to KDB publication 789033 D02 General UNII Test Procedures New Rules v01r02, section II.F.5., it is acceptable to set RBW at 1 MHz and VBW at 3 MHz if the spectrum analyzer does not have 500 kHz RBW.
- The value measured with RBW=1 MHz is to be added with 10log(500 kHz/1 MHz) which is -3 dB. For example, if the measured value is +10dBm using RBW=1 MHz (that is +10 dBm/MHz), then the converted value will be +7dBm/500kHz.



# 7.1.2 DEVIATION FROM STANDARD

No deviation.

#### 7.1.3 TEST SETUP

EUT	SPECTRUM	
	ANALYZER	

# 7.1.4 EUT OPERATION CONDITIONS

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

#### 7.1.5 EUT TEST CONDITIONS

Temperature: 25°C Relative Humidity: 58% Test Voltage: AC 120V/60Hz

#### 7.1.6 TEST RESULTS

Please refer to the Appendix H.

# 8. FREQUENCY STABILITY MEASUREMENT

# 8.1 APPLIED PROCEDURES / LIMIT

FCC Part15, Subpart E				
Test Item	Limit	Frequency Range (MHz)	Result	
		5150-5250	PASS	
	Specified in the user's manual	5250-5350	PASS	
Frequency Stability		5470-5725	PASS	
		5725-5850	PASS	

# 8.1.1 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 Parameter	Setting
Attenuation	Auto
Span Frequency	Entire absence of modulation emissions bandwidth
RBW	10 kHz
VBW	10 kHz
Sweep Time	Auto

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

d. User manual temperature is 0°C~40°C.

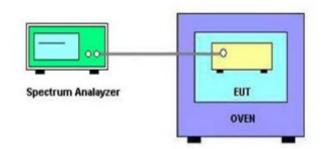
# 8.1.2 DEVIATION FROM STANDARD

No deviation.





#### 8.1.3 TEST SETUP



#### 8.1.4 EUT OPERATION CONDITIONS

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

#### 8.1.5 EUT TEST CONDITIONS

Temperature: 25°C Relative Humidity: 58% Test Voltage: AC 120V/60Hz

8.1.6 TEST RESULTS Please refer to the Appendix I.



# 9. MEASUREMENT INSTRUMENTS LIST

	Conducted Emission Measurement					
Item	Kind of Equipment	Manufacturer	Type No.	Serial No.	Calibrated until	
1	EMI Test Receiver	R&S	ESCI	100382	Mar. 11, 2019	
2	LISN	EMCO	3816/2	52765	Mar. 11, 2019	
3	50Ω Terminator	SHX	TF2-3G-A	8122901	Mar. 11, 2019	
4	TWO-LINE V-NETWORK	R&S	ENV216	101447	Mar. 11, 2019	
5	Measurement Software	Farad	EZ-EMC Ver.NB-03A1-01	N/A	N/A	
6	Cable	N/A	RG223	12m	Mar. 23, 2019	

	Radiated Emission Measurement - 9KHZ TO 30MHZ					
Item	Kind of Equipment	Manufacturer	Type No.	Serial No.	Calibrated until	
1	Loop Antenna	EM	EM-6876-1	230	Feb. 07, 2019	
2	Cable	N/A	RG 213/U	C-102	Jun. 01, 2019	
3	EMI Test Receiver	R&S	ESCI	100382	Mar. 11, 2019	
4	Measurement Software	Farad	EZ-EMC Ver.NB-03A1-01	N/A	N/A	

	Radiated Emission Measurement - 30MHZ TO 1000MHZ					
Item	Kind of Equipment	Manufacturer	Type No.	Serial No.	Calibrated until	
1	Antenna	Schwarbeck	VULB9160	9160-3232	Mar. 11, 2019	
2	Amplifier	HP	8447D	2944A09673	Aug. 11, 2019	
3	Receiver	Agilent	N9038A	MY52130039	Aug. 11, 2019	
4	Cable	emci	LMR-400(30MHz-1 GHz)(8m+5m)	N/A	May 25, 2019	
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 Emission Measurement - Above 1GHz					
Ite	m Kind of Equip	Kind of Equipment Manufacturer		Type No.	Serial No.	Calibrated until
	1 Double Rid Guide Ante	0	ETS	3115	75789	Mar. 11, 2019
2	2 Broad-Band Antenna		Schwarzbeck	BBHA 9170	9170319	Jun. 30, 2019
3	3 Amplifie	ſ	Agilent	8449B	3008A02274	Mar. 11, 2019
2	Microwav 4 Preamplifier Adaptor	With	EMC INSTRUMENT	EMC2654045	980039 & HA01	Mar. 11, 2019
5	5 Receive	r	Agilent	N9038A	MY52130039	Aug. 11, 2019
6	6 Controlle	r	СТ	SC100	N/A	N/A
7	7 Controlle	r	MF	MF-7802	MF780208416	N/A
8	3 Cable		mitron	B10-01-01-12M	18072744	Jul. 30, 2019
ç	9 Measurem Software		Farad	EZ-EMC Ver.NB-03A1-01	N/A	N/A
1	Microwav 0 Preamplifier Adaptor	With	EMC NSTRUMENT	EMC2654045	980039 & HA01	Mar. 11, 2019

	Spectrum Bandwidth Measurement				
Item	Kind of Equipment	Manufacturer	Type No.	Serial No.	Calibrated until
1	Spectrum Analyzer	R&S	FSP40	100185	Aug. 11, 2019

	Maximum Output Power Measurement				
Item	Kind of Equipment	Manufacturer	Type No.	Serial No.	Calibrated until
1	Spectrum Analyzer	R&S	FSP40	100185	Aug. 11, 2019

Power Spectral Density Measurement					
Item	Kind of Equipment	Manufacturer	Type No.	Serial No.	Calibrated until
1	Spectrum Analyzer	R&S	FSP40	100185	Aug. 11, 2019

	Frequency Stability Measurement				
Item	Kind of Equipment	Manufacturer	Type No.	Serial No.	Calibrated until
1	Spectrum Analyzer	R&S	FSP40	100185	Aug. 11, 2019
2	Precision Oven Tester	Bell	BTH-50C	20170306001	Mar. 11, 2019

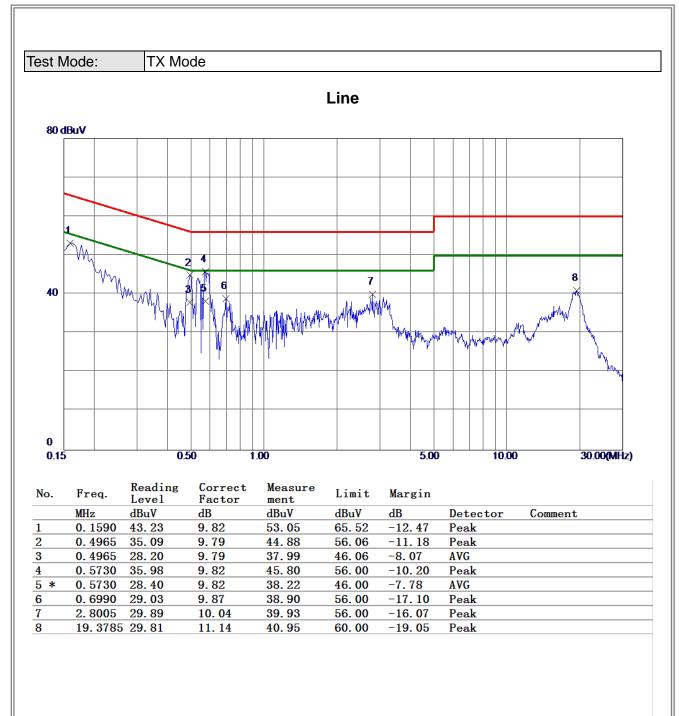
Remark: "N/A" denotes no model name, serial no. or calibration specified. All calibration period of equipment list is one year.



# **APPENDIX A - CONDUCTED EMISSION**

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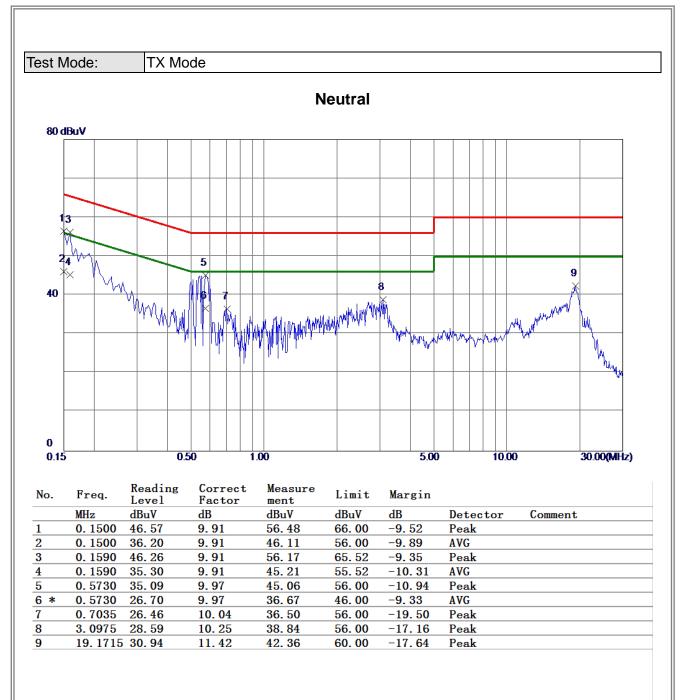




Note:The test result has included the cable loss.

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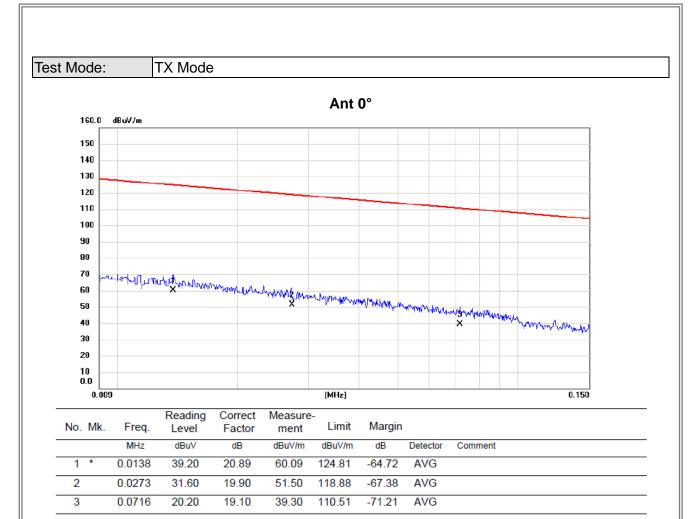
Note:The test result has included the cable loss.



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

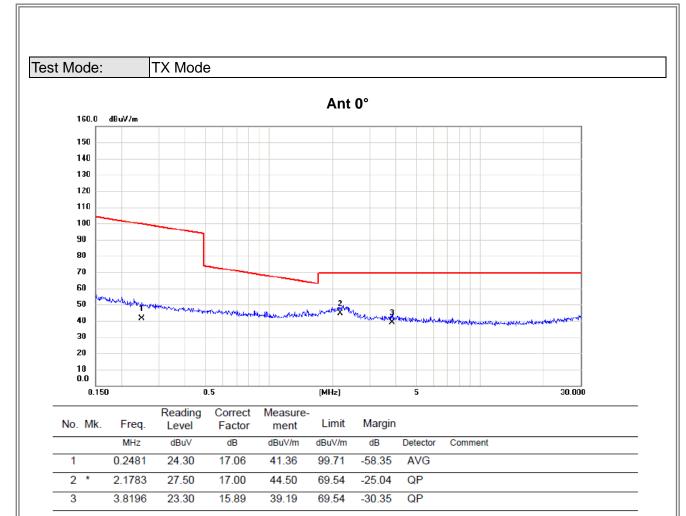






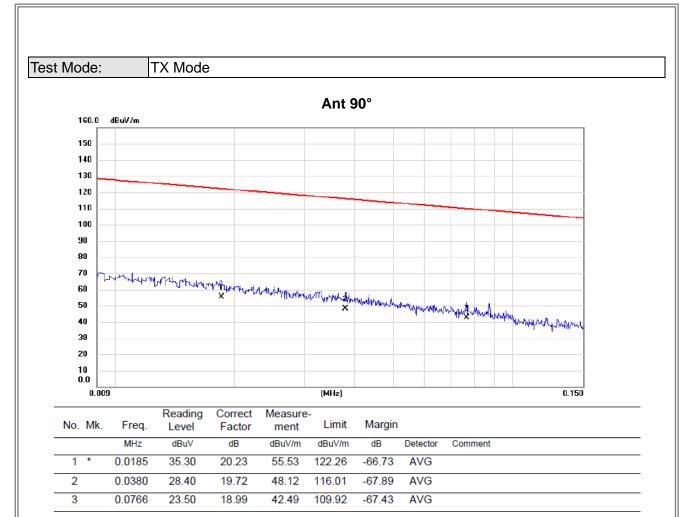






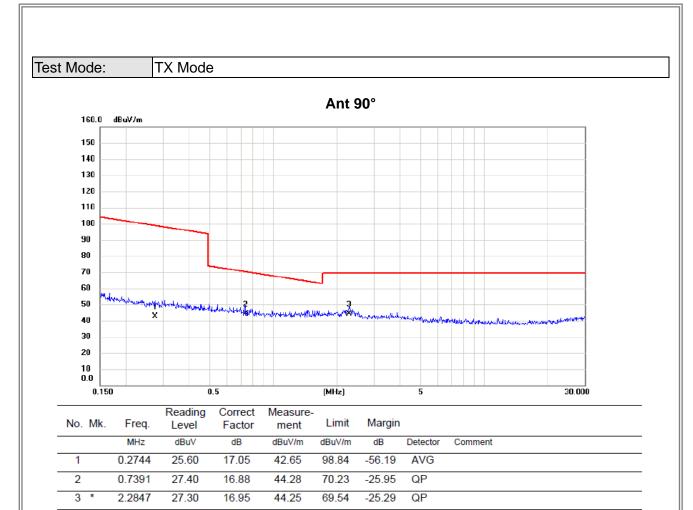










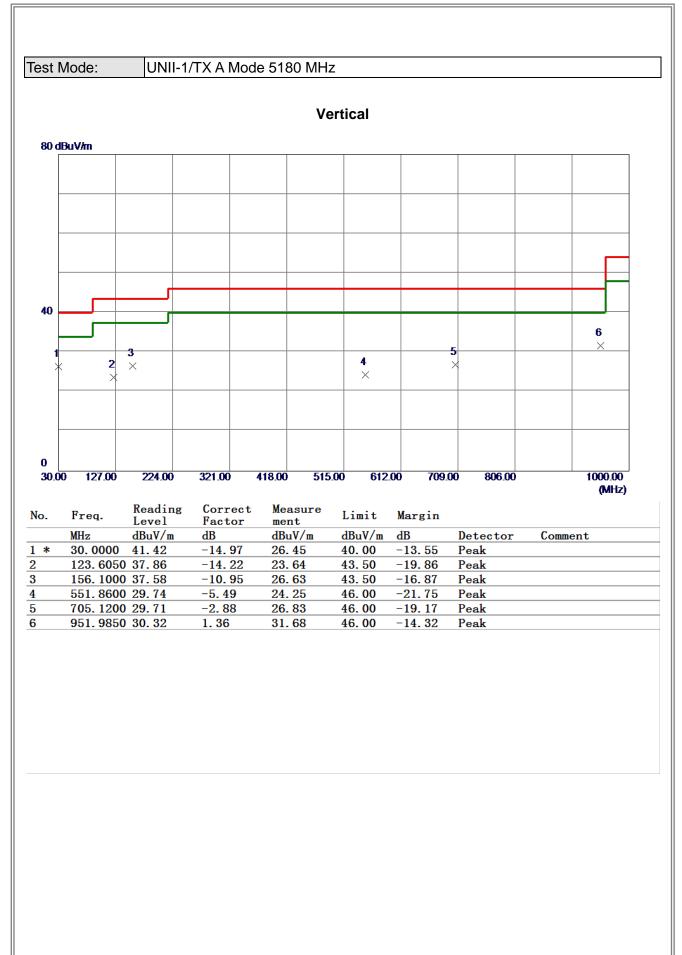




## APPENDIX C - RADIATED EMISSION (30 MHZ TO 1000 MHZ)

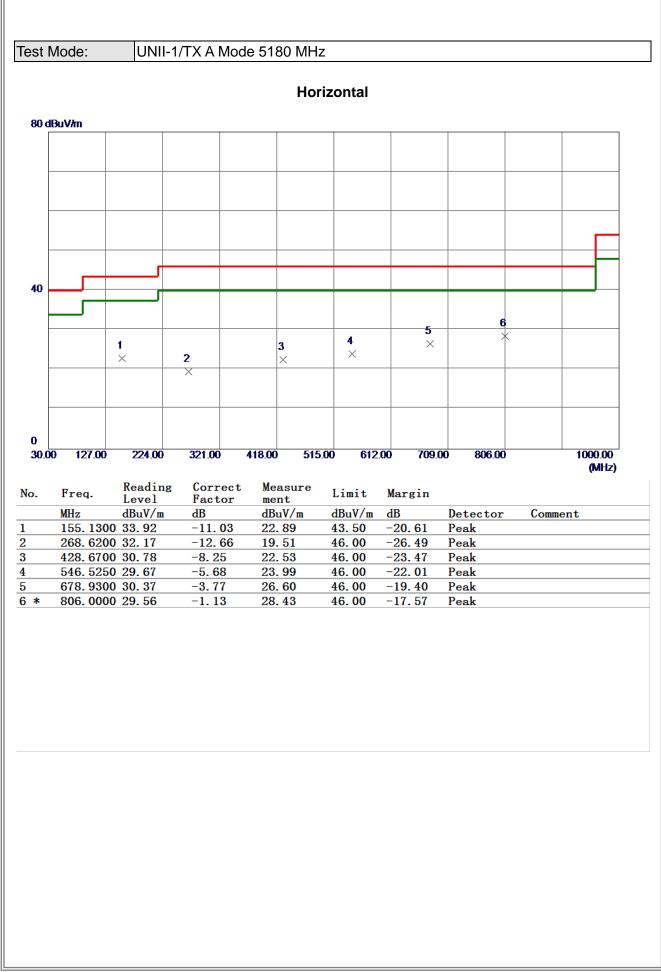






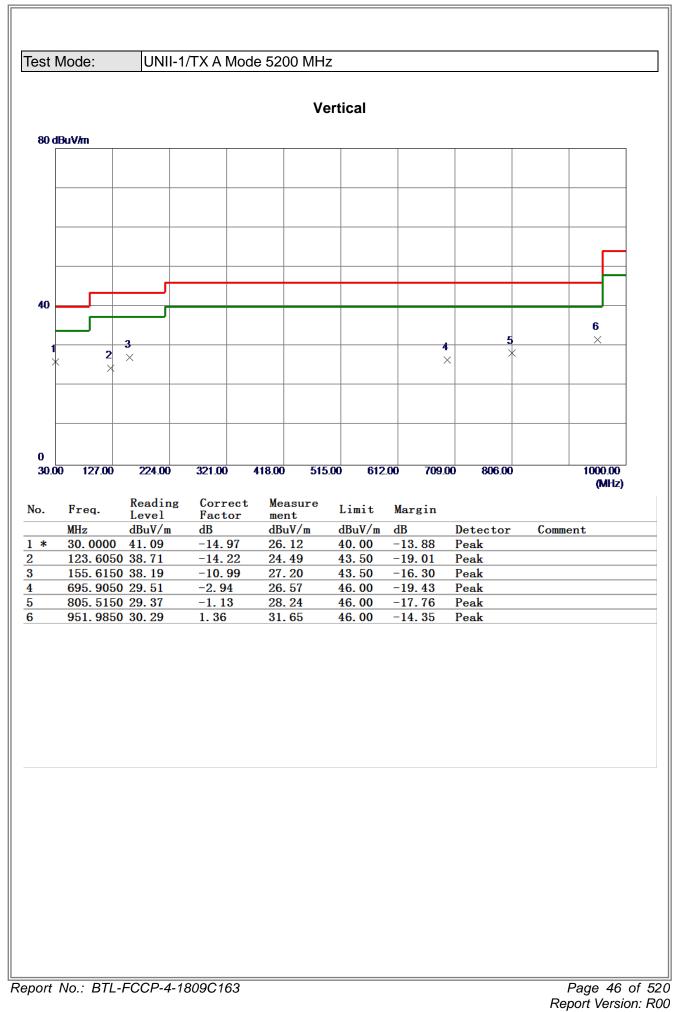






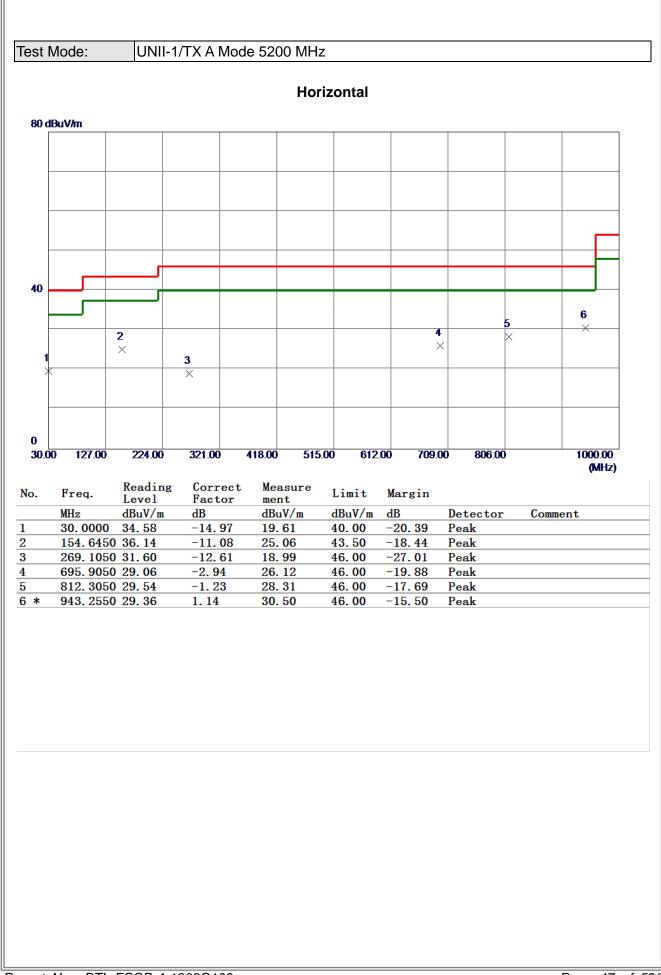






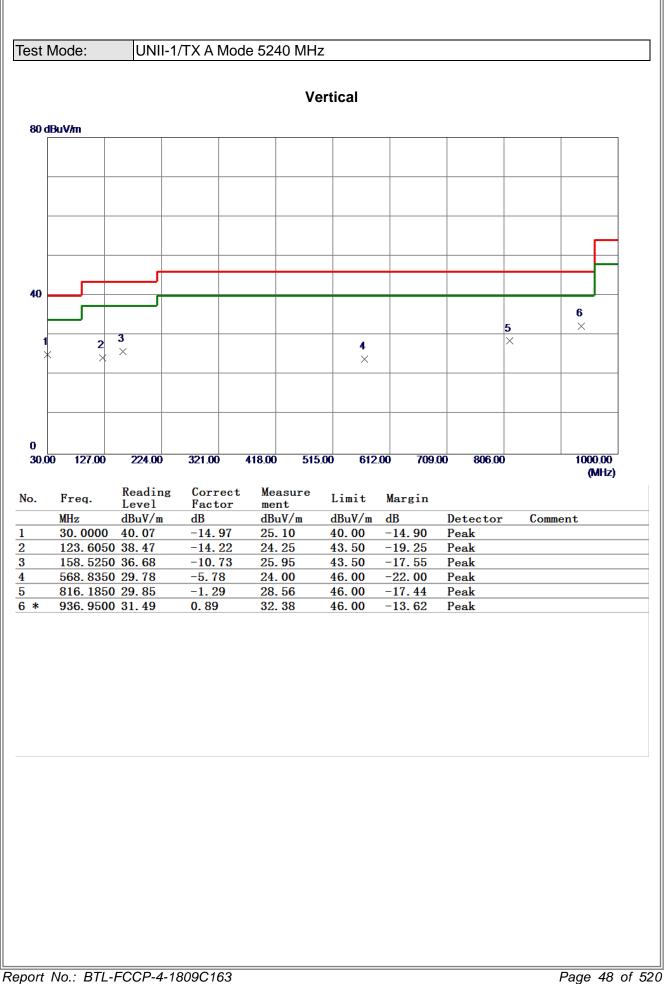






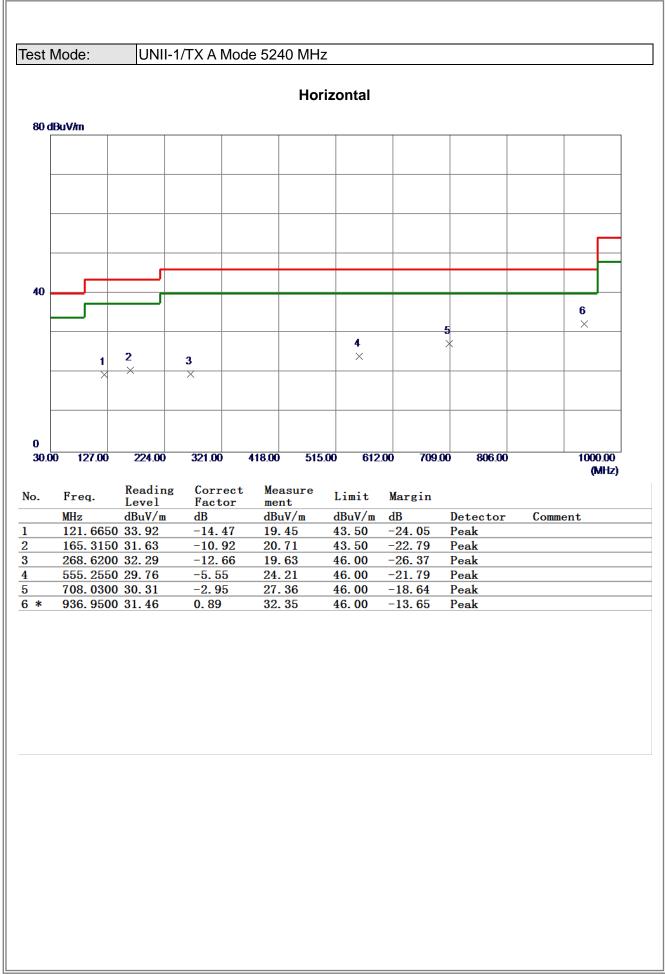






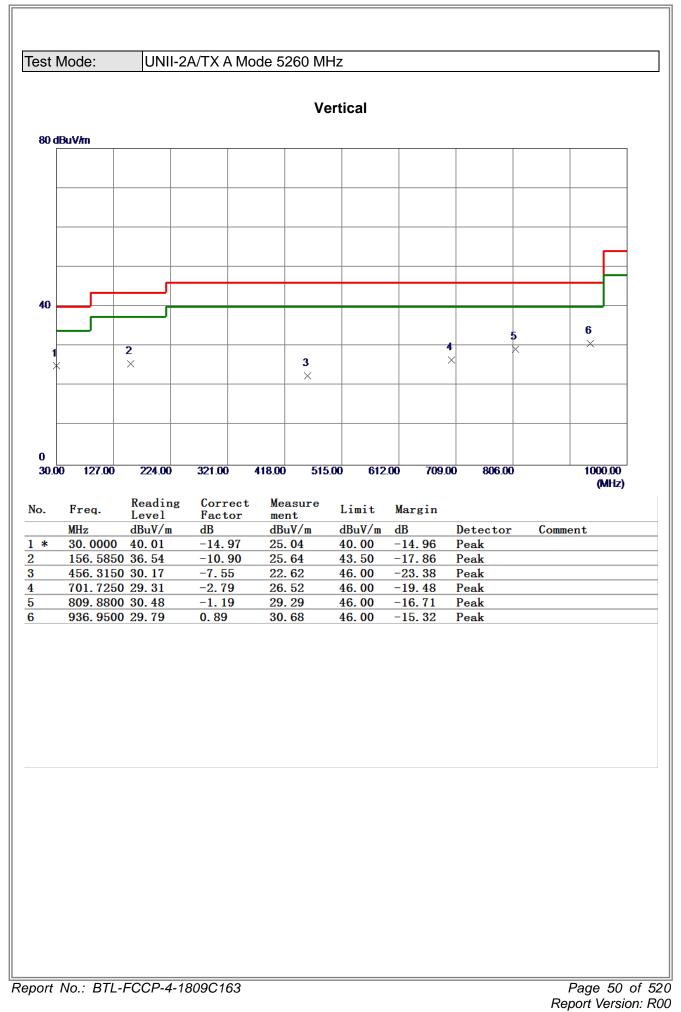






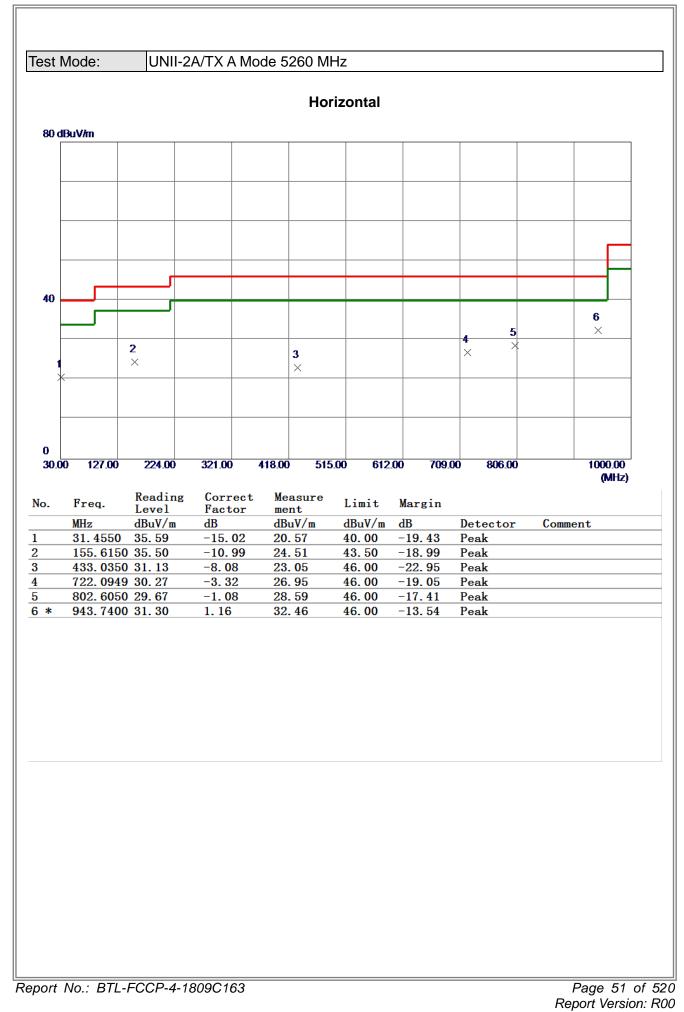






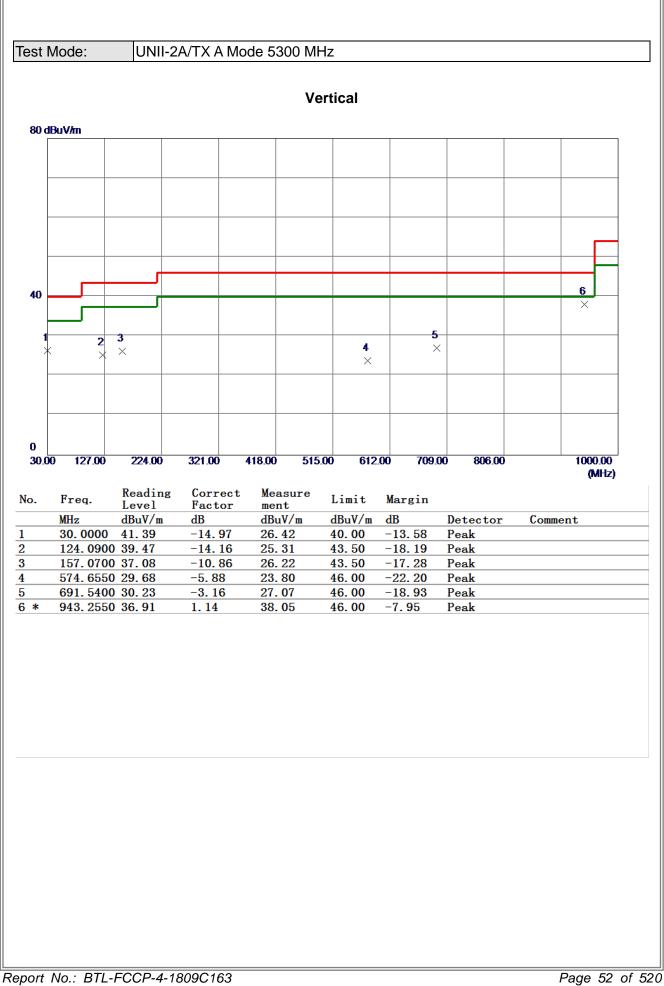






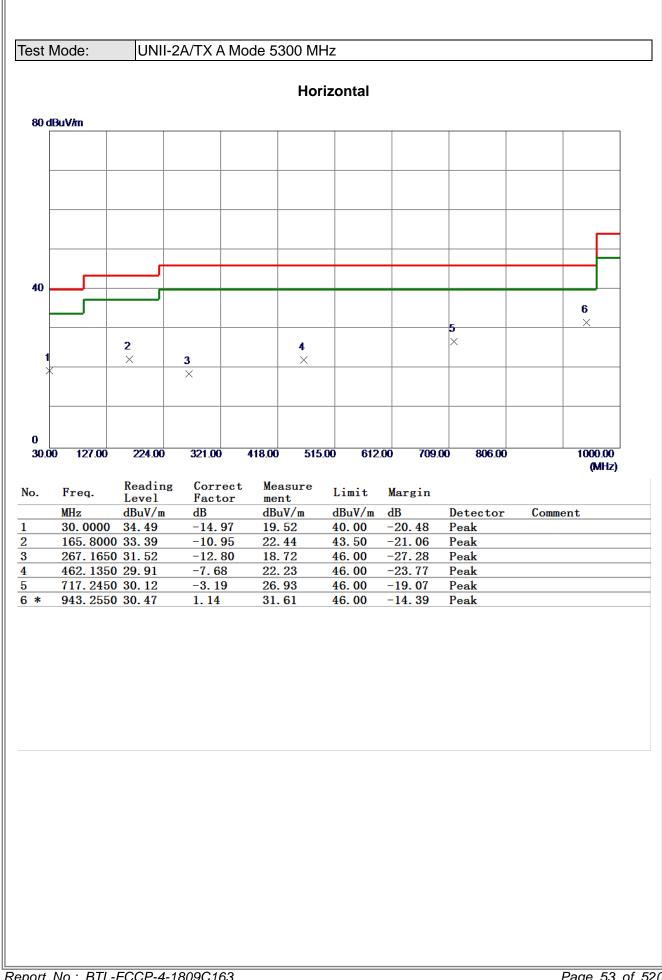






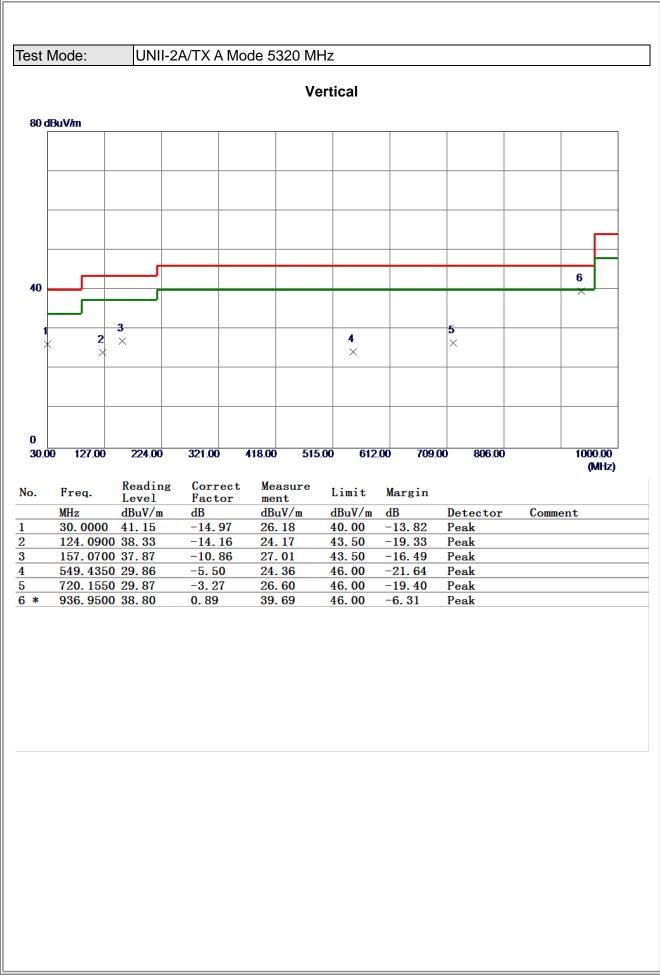






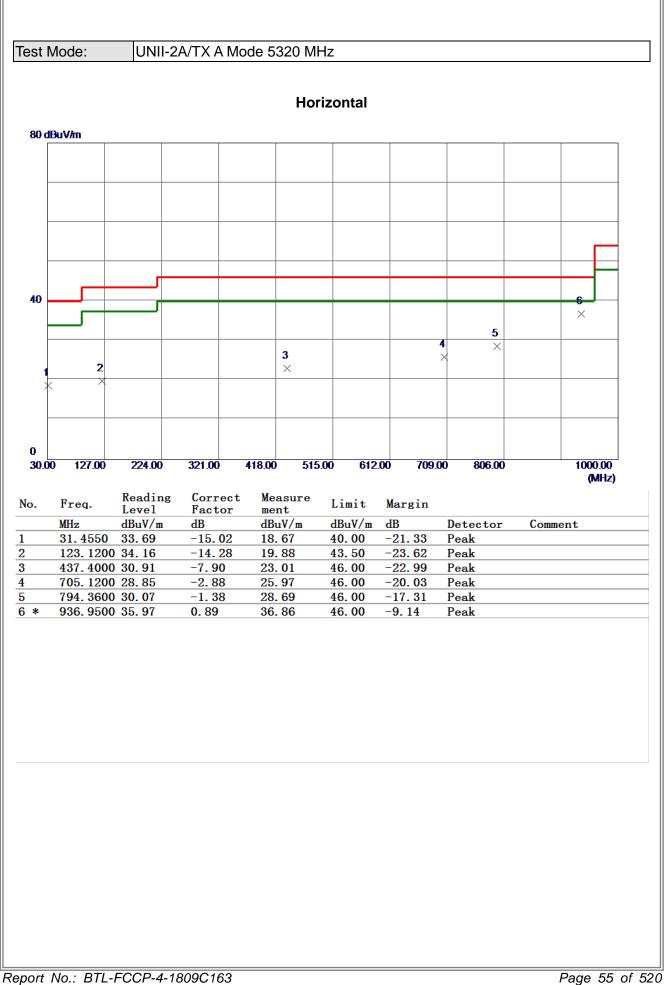






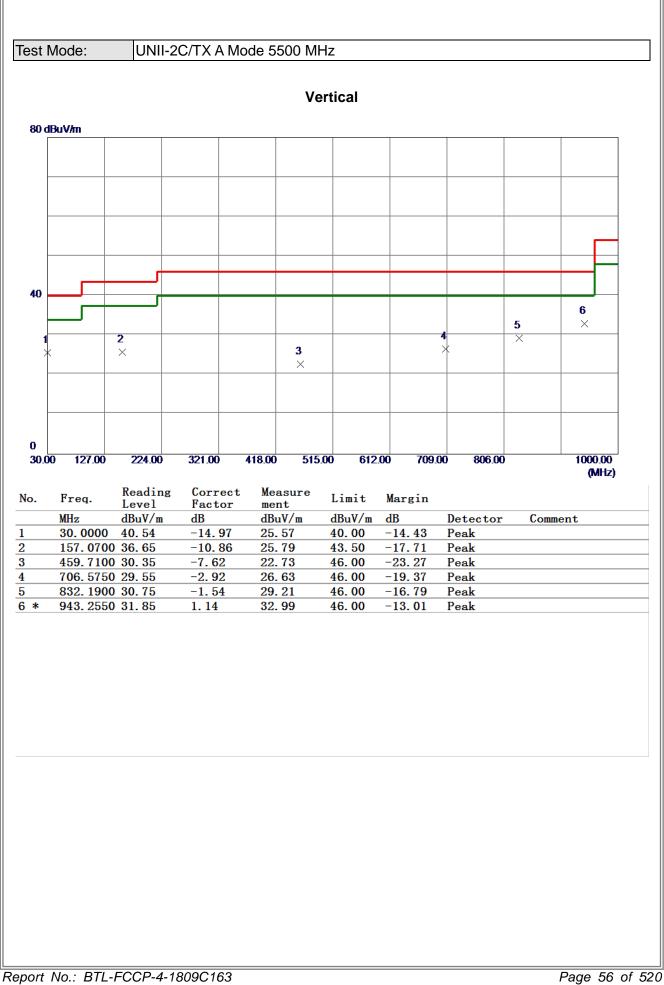






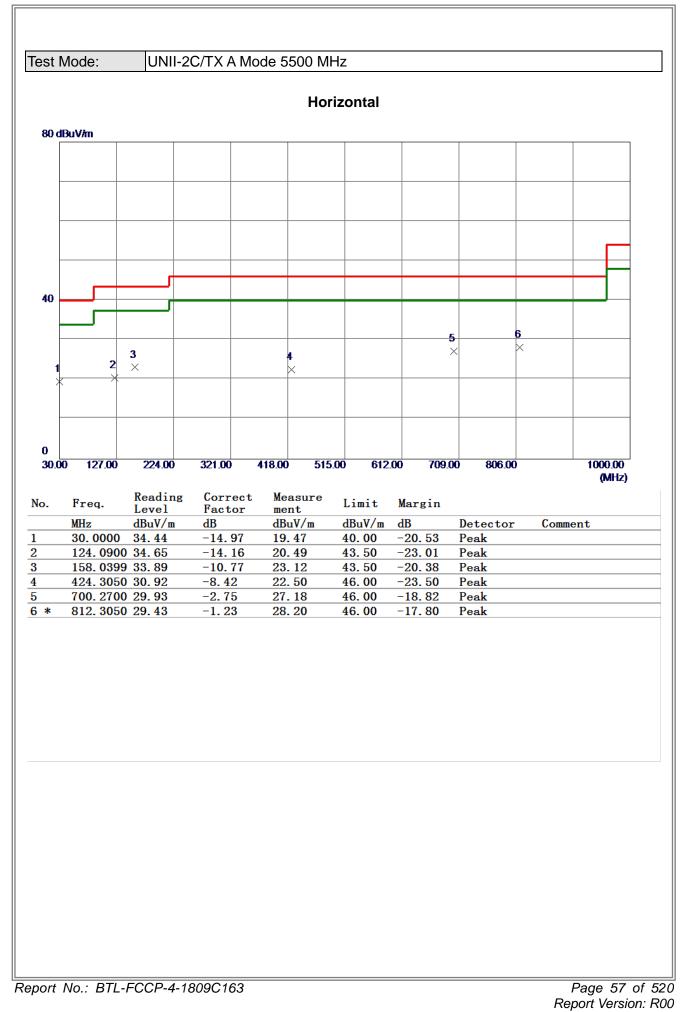






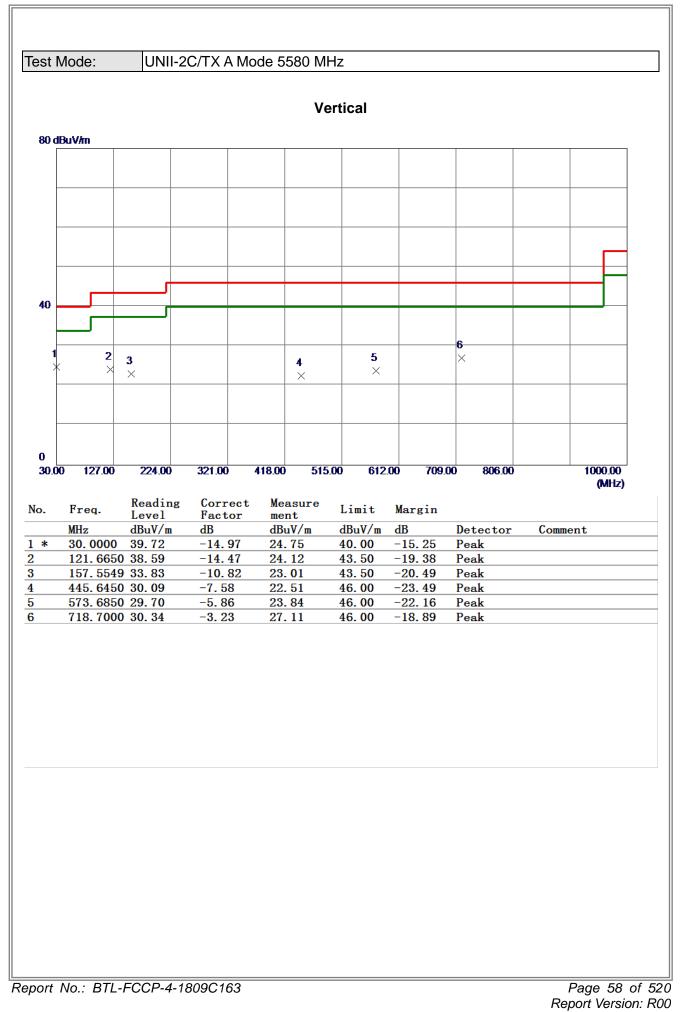






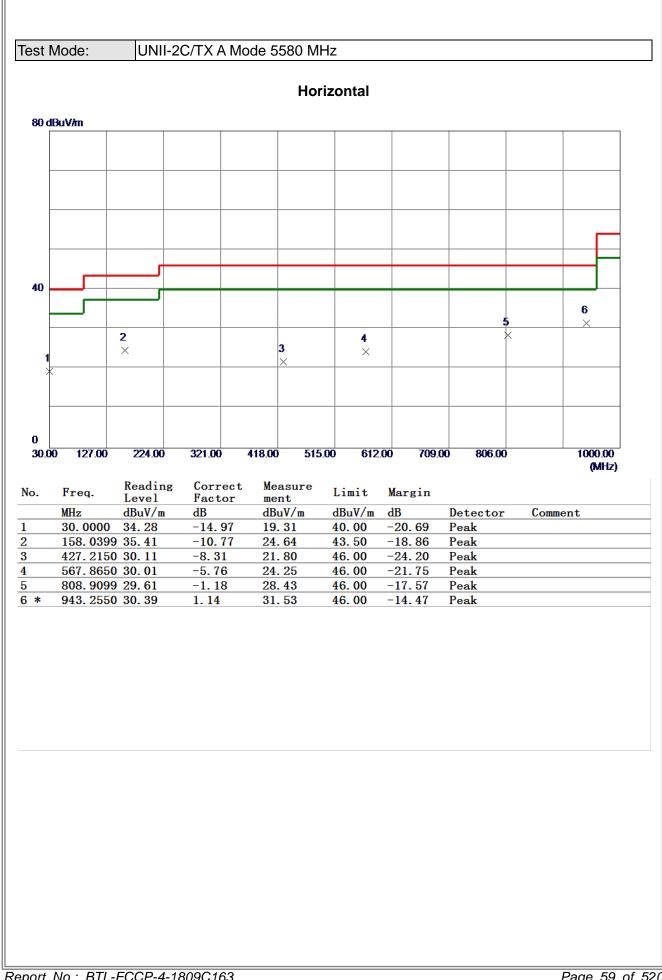






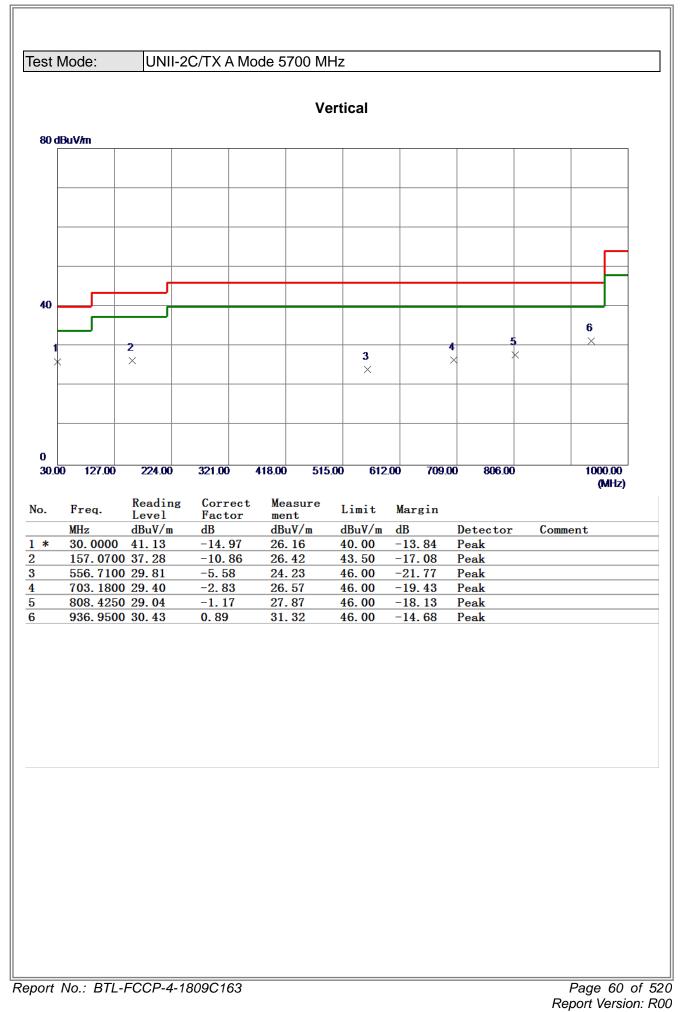






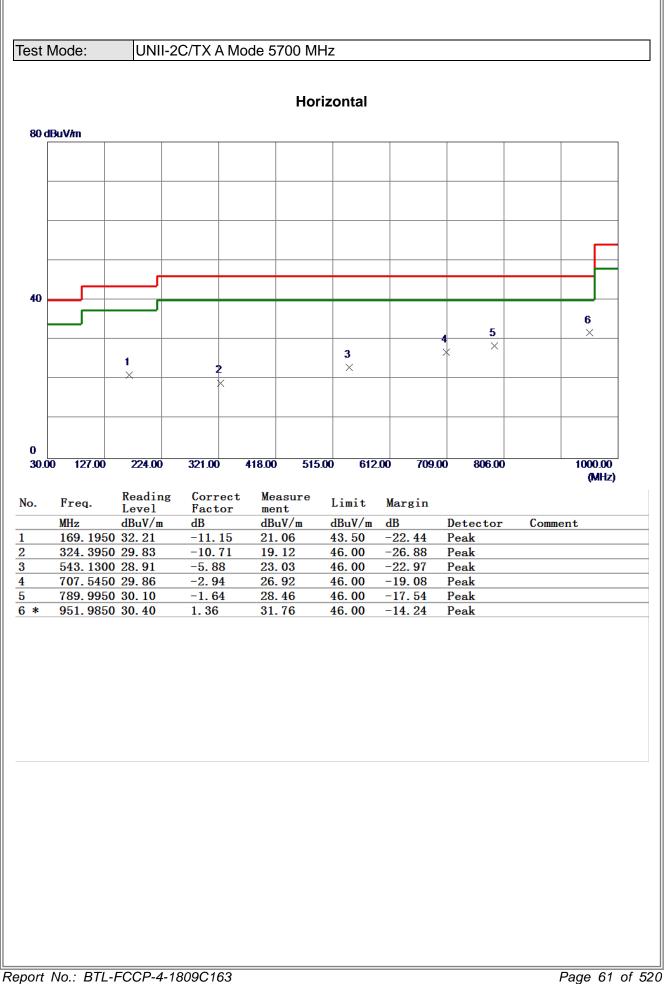






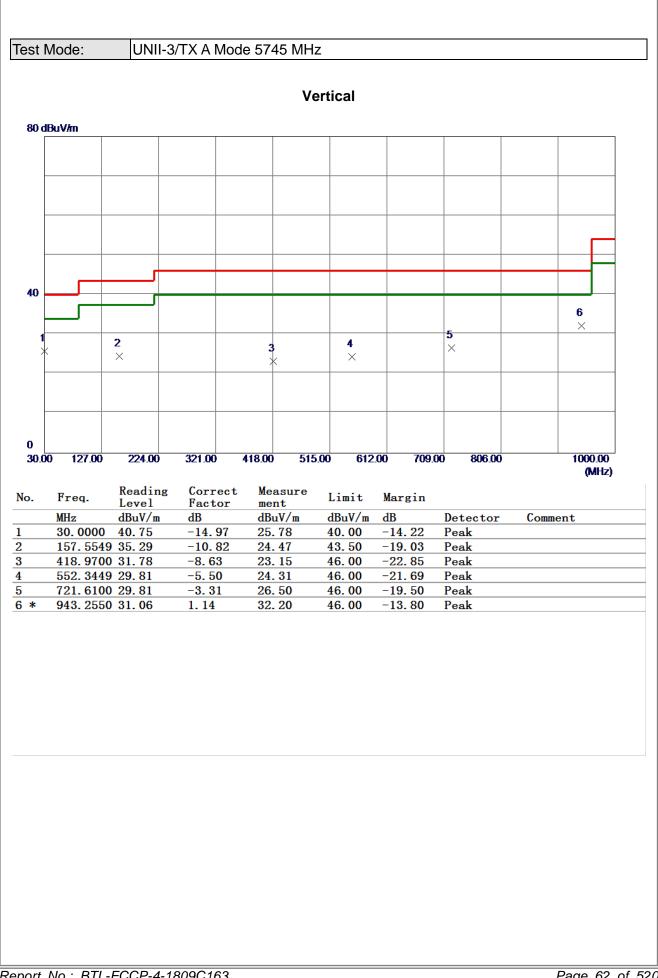






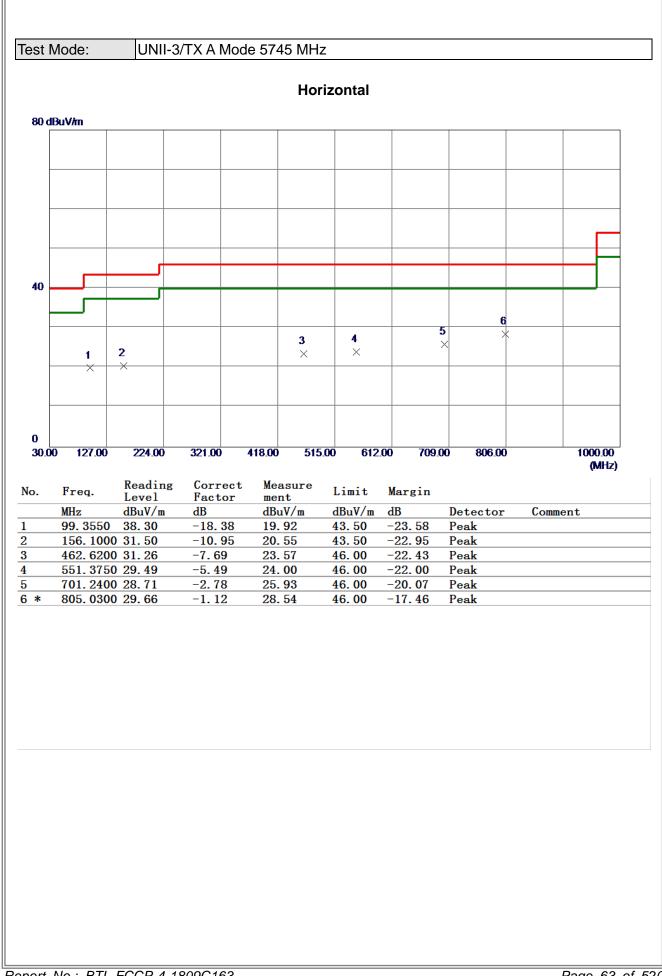






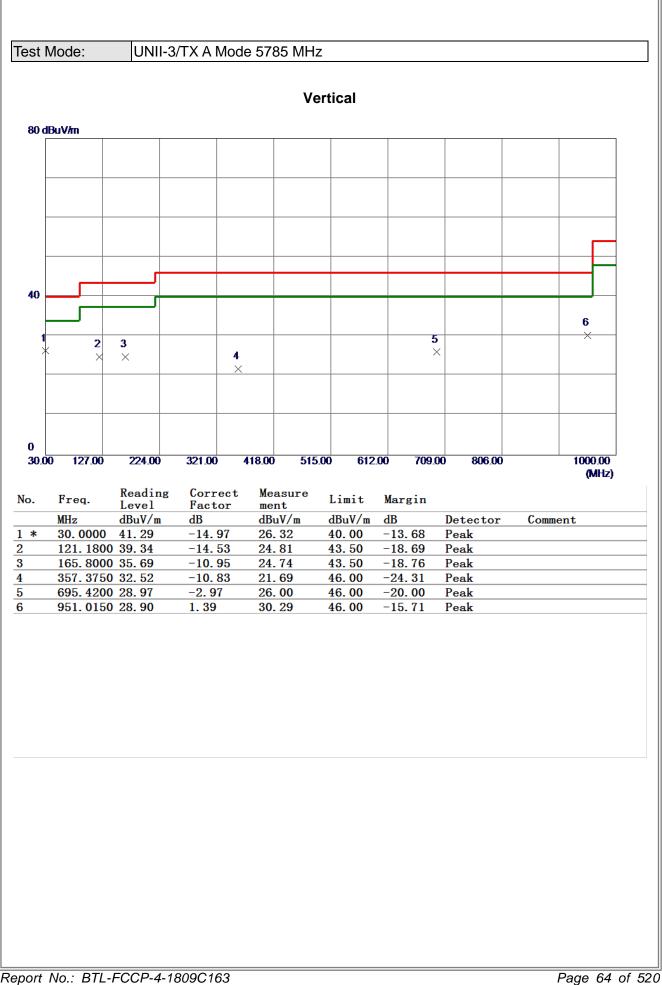






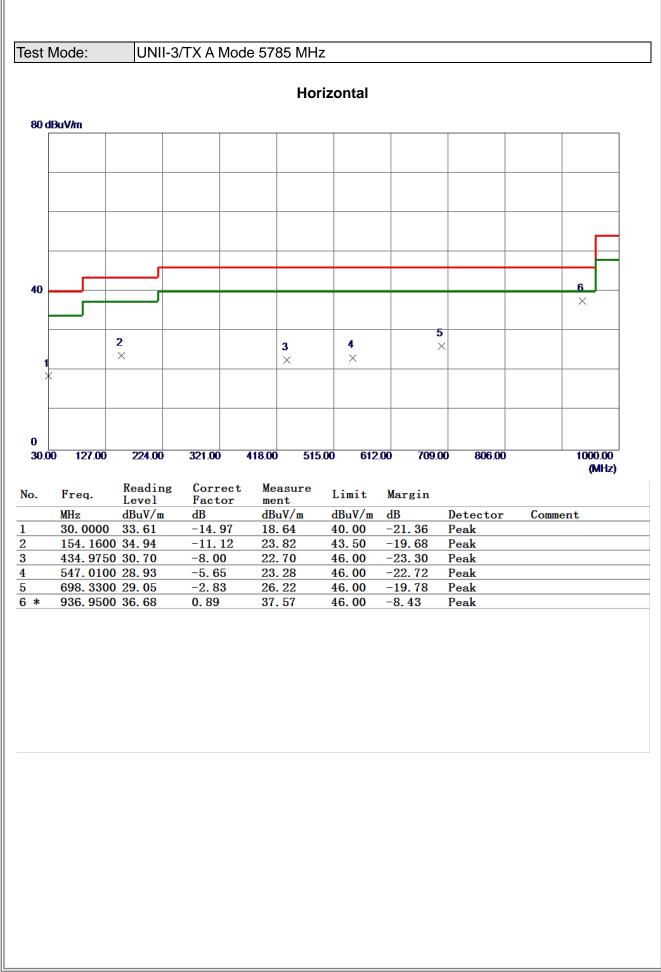






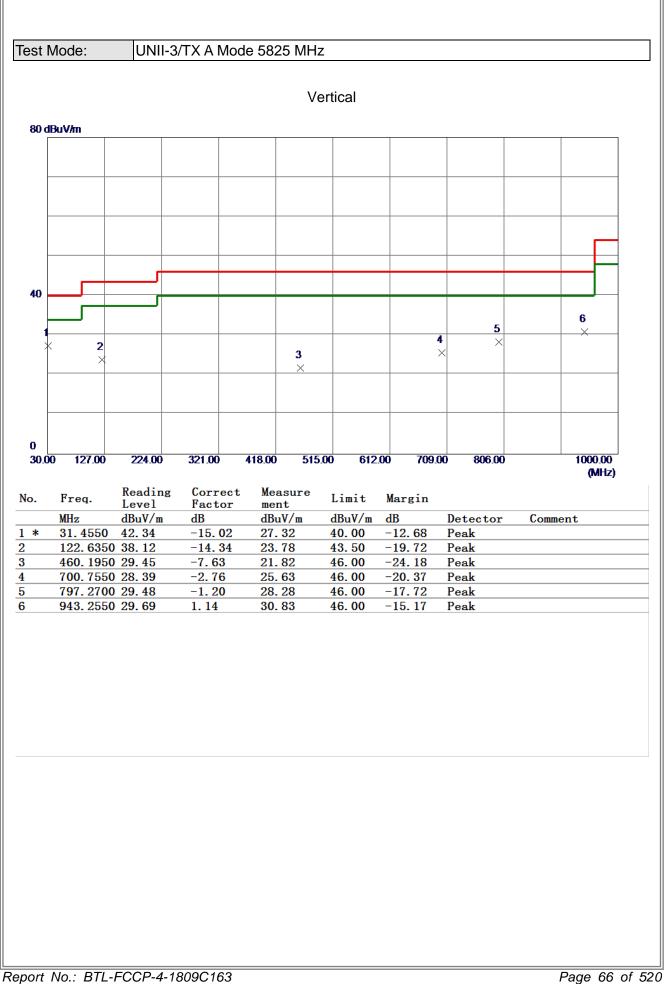






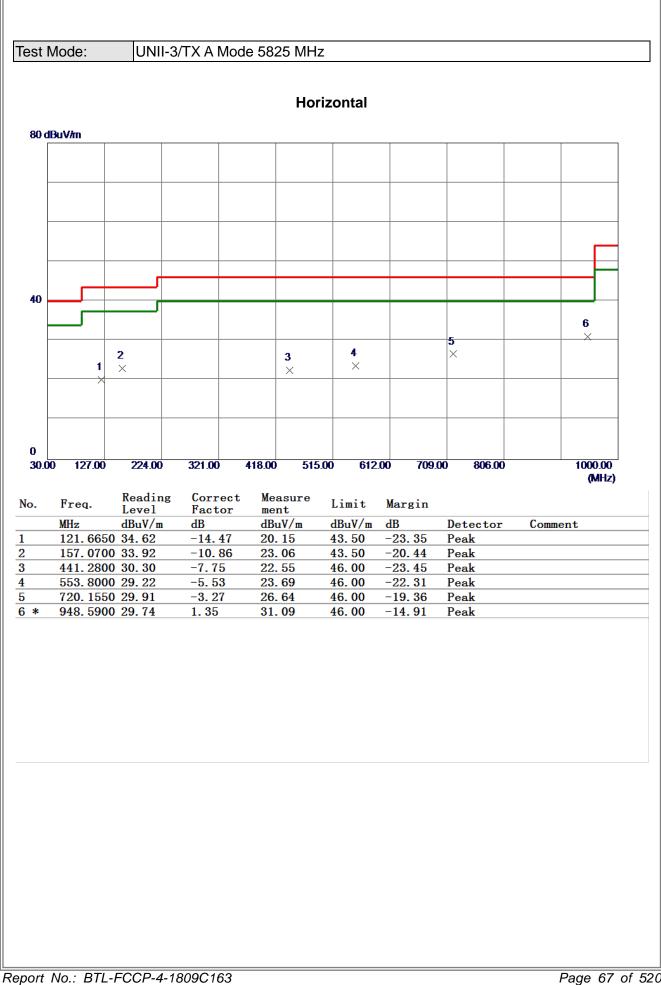














## **APPENDIX D - RADIATED EMISSION (ABOVE 1000 MHZ)**





