FCC RADIO TEST REPORT
FCC ID: 2ALH2-PFAF100

Product：	PIQS Virtual Touch Projector
Trade Mark：	PIQS
Model Name：	F1
Serial Model：	F+, F1+, F PLUS, F1 PLUS, F PRO, F1 PRO
Report No.：	SER180410001004E

Prepared for

PIQS Technology(Shenzhen) Limited

West, 6F Buiding 1, No.35 CuiJing Road, Pingshan New District, Shenzhen City, Guangdong Province, P.R.China

Prepared by

Shenzhen NTEK Testing Technology Co., Ltd.

1/F, Building E, Fenda Science Park, Sanwei Community, Xixiang Street Bao'an District, Shenzhen 518126 P.R. China

Tel.: +86-755-6115 6588

Fax.: +86-755-6115 6599

Website:http://www.ntek.org.cn

TEST RESULT CERTIFICATION

Applicant's name	:	PIQS Technology(Shenzhen) Limited
Address	:	West, 6F Buiding 1, No.35 CuiJing Road, Pingshan New District, Shenzhen City, Guangdong Province, P.R.China
Manufacturer's Name	:	Butterfly technology(Shenzhen) Limited
Address	:	East, 6F Buiding 1, No.35 CuiJing Road, Pingshan New District, Shenzhen City, Guangdong Province, P.R.China

Product description

Product name	:	PIQS Virtual Touch Projector
Model and/or type reference	:	F1
Serial Model	:	F+, F1+, F PLUS, F1 PLUS, F PRO, F1 PRO
Standards	:	FCC Part15.407
Test procedure		ANSI C63.10-2013 and KDB 789033 D02 General UNII Test Procedures New Rules v01r01 FCC KDB 662911 D01 Multiple Transmitter Output v02r01 FCC KDB 662911 D02 MIMO With Cross Polarized Antenna V01

This device described above has been tested by NTEK, and the test results show that the equipment under test (EUT) is in compliance with the FCC requirements/ the Industry Canada requirements.. And it is applicable only to the tested sample identified in the report.

This report shall not be reproduced except in full, without the written approval of NTEK, this document may be altered or revised by NTEK, personnel only, and shall be noted in the revision of the document.

Date of Test

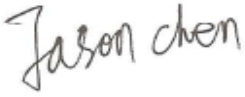
Date (s) of performance of tests ..... 10 Apr. 2018 ~ 12 Jun. 2018

Date of Issue ..... 12 Jun. 2018

Test Result ..... **Pass**

Testing Engineer : 

(Allen Liu)

Technical Manager : 

(Jason Chen)

Authorized Signatory : 

(Sam Chen)

Table of Contents

Table of Contents

Revision History

Report No.	Version	Description	Issued Date
SER180410001004E	Rev.01	Initial issue of report	Jun 12, 2018

1. SUMMARY OF TEST RESULTS

Test procedures according to the technical standards:

FCC Part15 (15.407) , Subpart E			
Standard Section	Test Item	Judgment	Remark
15.207	AC Power Line Conducted Emissions	PASS	
15.209(a), 15.407 (b)(1) 15.407 (b)(4) 15.407 (b)(6)	Spurious Radiated Emissions	PASS	(Outsourcing)
15.407 (a)(1) 15.407 (a)(3) 15.1049	26 dB and 99% Emission Bandwidth	PASS	
15.407(e)	Minimum 6 dB bandwidth	PASS	
15.407 (a)(1) 15.407 (a)(3)	Maximum Conducted Output Power	PASS	
2.1051, 15.407(b)(1) 15.407(b)(4)	Band Edge	PASS	
15.407 (a)(1) 15.407 (a)(3)	Power Spectral Density	PASS	
2.1051, 15.407(b)	Spurious Emissions at Antenna Terminals	PASS	
15.203	Antenna Requirement	PASS	

NOTE:

(1)" N/A" denotes test is not applicable in this Test Report

Outsourcing: The 26G-40G Spurious Radiated Emissions in this test were outsourced to the Shenzhen Academy of Metrology & Quality Inspection(The A2LA Certificate Registration Number is 3292.01)

1.1 FACILITIES AND ACCREDITATIONS

FACILITIES

All measurement facilities used to collect the measurement data are located at 1/F, Building E, Fenda Science Park, Sanwei Community, Xixiang Street, Bao'an District, Shenzhen 518126 P.R. China.

The sites are constructed in conformance with the requirements of ANSI C63.7, ANSI C63.10 and CISPR Publication 22.

LABORATORY ACCREDITATIONS AND LISTINGS

Site Description

CNAS-Lab.	:	The Laboratory has been assessed and proved to be in compliance with CNAS-CL01:2006 (identical to ISO/IEC 17025:2005) The Certificate Registration Number is L5516.
IC-Registration		The Certificate Registration Number is 9270A-1.
FCC- Accredited		Test Firm Registration Number: 463705. Designation Number: CN1184
A2LA-Lab.		The Certificate Registration Number is 4298.01 This laboratory is accredited in accordance with the recognized International Standard ISO/IEC 17025:2005 General requirements for the competence of testing and calibration laboratories. This accreditation demonstrates technical competence for a defined scope and the operation of a laboratory quality management system (refer to joint ISO-ILAC-IAF Communiqué dated 8 January 2009).
Name of Firm	:	Shenzhen NTEK Testing Technology Co., Ltd.
Site Location	:	1/F, Building E, Fenda Science Park, Sanwei Community, Xixiang Street, Bao'an District, Shenzhen 518126 P.R. China.

1.2 MEASUREMENT UNCERTAINTY

The reported uncertainty of measurement y±U, where expended uncertainty U is based on a standard uncertainty multiplied by a coverage factor of k=2, providing a level of confidence of approximately 95 %.

No.	Item	Uncertainty
1	Conducted Emission Test	±2.80dB
2	RF power, conducted	±0.16dB
3	Spurious emissions, conducted	±0.21dB
4	All emissions, radiated(30MHz~1GHz)	±2.64dB
5	All emissions, radiated(1GHz~6GHz)	±2.40dB
6	All emissions, radiated(＞6GHz)	±2.52dB
7	Temperature	±0.5°C
8	Humidity	±2%

2. GENERAL INFORMATION

2.1 GENERAL DESCRIPTION OF EUT

Equipment	PIQS Virtual Touch Projector	
Trade Mark	PIQS	
Model Name	F1	
FCC ID	2ALH2-PFAF100	
Product Description	IEEE 802.11 WLAN Mode Supported	☒802.11a/ac(20MHz channel bandwidth) ☒802.11n/ac(20MHz channel bandwidth) ☒802.11n/ac(40MHz channel bandwidth) ☒802.11ac(80MHz channel bandwidth)
	Data Rate	802.11 a: 6,9,12,18,24,36,48,54Mbps; 802.11n(HT20):MCS0-MCS15; 802.11n(HT40):MCS0-MCS15; 802.11ac: NSS1,MCS0-MCS9,NSS2,MCS0-MCS9;
	Modulation	OFDM with BPSK/QPSK/16QAM/64QAM/256QAM for 802.11a/n/ac;
	Operating Frequency Range	☒5180-5240MHz for 802.11a/n(HT20)/ac20; 5190-5230MHz for 802.11n(HT40)/ac40; 5210MHz for 802.11 ac80; ☒5745-5825 MHz for 802.11a/n(HT20)/ac20; 5755-5795 MHz for 802.11a/n(HT40)/ac40; 5775MHz for 802.11 ac80;
	Number of Channels	☒4 channels for 802.11a/n20/ac20 in the 5180-5240MHz band ; 2 channels for 802.11 n40/ac40 in the 5190-5230MHz band ; 1 channels for 802.11 ac80 in the 5210MHz band ; ☒5 channels for 802.11a/n20/ac20 in the 5745-5825MHz band ; 2 channels for 802.11 n40/ac40 in the 5755-5795MHz band ; 1 channels for 802.11 ac80 in the 5775MHz band ;
	Antenna Type	Antenna A/B: FPCB Antenna
	Smart system	☒SISO for 802.11a ☒MIMO for 802.11n/ac
	Antenna Gain	See Table for Filed Antenna
	Based on the application, features, or specification exhibited in User's Manual, More details of EUT technical specification, please refer to the User's Manual.	
Ratings	DC 19V from Adapter	
Adapter	Model: ADP-120ZB BB Input: AC 100~240V, 50-60Hz, 2.0A Output: DC 19V, 6.32A	
Battery	N/A	
Connecting I/O Port(s)	Please refer to the User's Manual	

Note:

1. For a more detailed features description, please refer to the manufacturer's specifications or the User's Manual.
2. Frequency and Channel list for 802.11a/n(20MHz) band I (5180-5240MHz):

802.11a/n/ac(20MHz) Carrier Frequency Channel							
Channel	Frequency (MHz)	Channel	Frequency (MHz)	Channel	Frequency (MHz)	Channel	Frequency (MHz)
36	5180	44	5220	-	-	-	-
40	5200	48	5240	-	-	-	-

Frequency and Channel list for 802.11n(40MHz) band I (5190-5230MHz):

802.11n /ac(40MHz) Carrier Frequency Channel							
Channel	Frequency (MHz)	Channel	Frequency (MHz)	Channel	Frequency (MHz)	Channel	Frequency (MHz)
38	5190	-	-	-	-	-	-
46	5230	-	-	-	-	-	-

802.11ac (80MHz) Carrier Frequency Channel	
Channel	Frequency (MHz)
42	5210

Frequency and Channel list for 802.11a/n(20 MHz) band IV (5745-5825MHz):

802.11a/n/ac(20 MHz) Carrier Frequency Channel							
Channel	Frequency (MHz)	Channel	Frequency (MHz)	Channel	Frequency (MHz)	Channel	Frequency (MHz)
149	5745	153	5765	157	5785	161	5805
165	5825	-	-	-	-	-	-

Frequency and Channel list for 802.11n(40MHz) band IV (5755-5795MHz):

802.11n/ac 40MHz Carrier Frequency Channel					
Channel	Frequency (MHz)	Channel	Frequency (MHz)	Channel	Frequency (MHz)
151	5755	159	5795	-	-

802.11ac 80MHz Carrier Frequency Channel	
Channel	Frequency (MHz)
155	5775

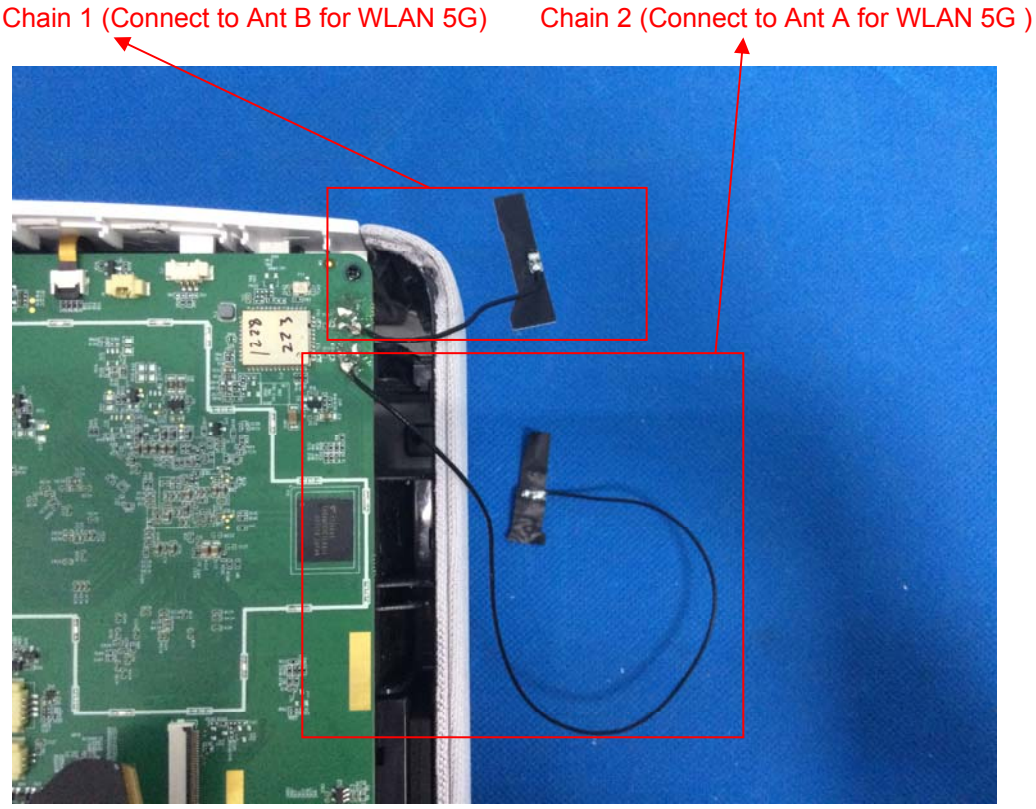
The EUT has two types of antenna.

Antenna	Brand	Model Name (P/N)	Antenna Type	Connector	Antenna Gain(dBi)	
					5.2G	5.8G
A(main)	N/A	N/A	FPCB	I-PEX	2	2
B(aux)	N/A	N/A	FPCB	I-PEX	2	2

Note: The EUT has two types of antenna.
Only the highest antenna gain for each type has been recorded in this test report, please refer to antenna list for more antenna information.

5G Band:
For IEEE 802.11a mode (1TX, 2RX):
The EUT can support both 1TX and 2RX functions.
For 1TX
Only Chain 1 can be used as transmitting antenna.
Chain 1 and Chain 2 could receive simultaneously.

For IEEE 802.11n mode (1TX/2TX, 2RX):
The EUT can support both 1TX and 2TX functions.
For 1TX
Only Chain 1 can be used as transmitting antenna.
Chain 1 and Chain 2 could receive simultaneously.
For 2TX
Chain 1 and Chain 2 could both transmit/receive simultaneously.
Only 2TX function was selected to test and record in the report, the 1TX test results were covered by 2TX Test results.
For IEEE 802.11ac mode (1TX/2TX, 2RX):
The EUT can support both 1TX and 2TX functions.
For 1TX
Only Chain 1 can be used as transmitting antenna.
Chain 1 and Chain 2 could receive simultaneously.
For 2TX
Both Chain 1 and Chain 2 can be used as transmitting/receiving antenna.
Chain 1 and Chain 2 could both transmit/receive simultaneously.
Only 2TX function was selected to test and record in the report, the 1TX test results were covered by 2TX Test results.



The Control software(rf test tool.exe) can control Model antenna A B,

For 5GHz mode,antenna A B are transmitting, May antennas simultaneously transmit.

And the data is recorded for radiated emission, and band edge.

For MIMO mode , Directional gain=[10log(G_A+ G_B)] dbi =5.01dbi in 5.2GHz

Directional gain=[10log(G_A+ G_B)] dbi =5.01dbi in 5.8GHz

802.11n/ac 5GHz has MIMO mode.

Note: GA means antenna gain for ANT A in Num.
GB means antenna gain for ANT B in Num.

2.2 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	Normal Link Mode
Mode 2	802.11a/n/ac 20 CH36/ CH40/ CH 48 802.11a /n/ac 20 CH149/ CH157/ CH 165
Mode 3	802.11n/ac40 CH38/ CH 46 802.11n/ac40 CH 151 / CH 159
Mode 4	802.11ac80 CH 42/CH 155

For Radiated Emission	
Final Test Mode	Description
Mode 1	Normal Link Mode
Mode 2	802.11a/n/ac 20 CH36/ CH40/ CH 48 802.11a /n/ac 20 CH149/ CH157/ CH 165
Mode 3	802.11n/ac40 CH38/ CH 46 802.11n/ac40 CH 151 / CH 159
Mode 4	802.11 ac80 CH 42/CH 155

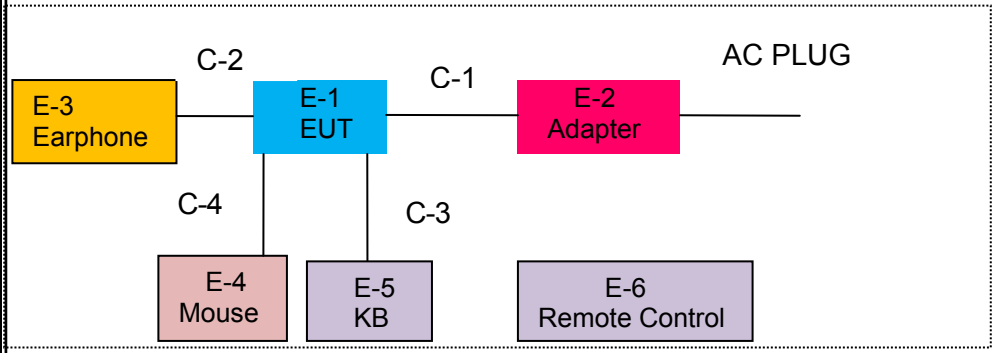
Note:

(1) The measurements are performed at the highest, middle, lowest available channels.

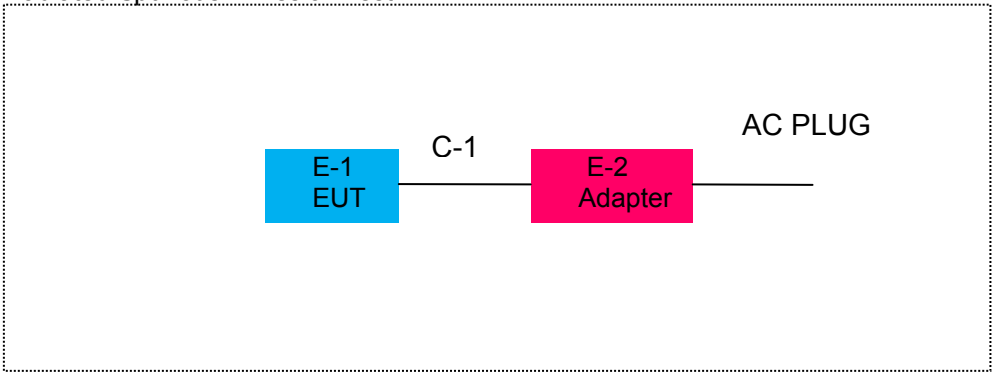
(2) The measurements are performed at all Bit Rate of Transmitter, the worst data was reported

2.3 BLOCK DIGRAM SHOWING THE CONFIGURATION OF SYSTEM TESTED

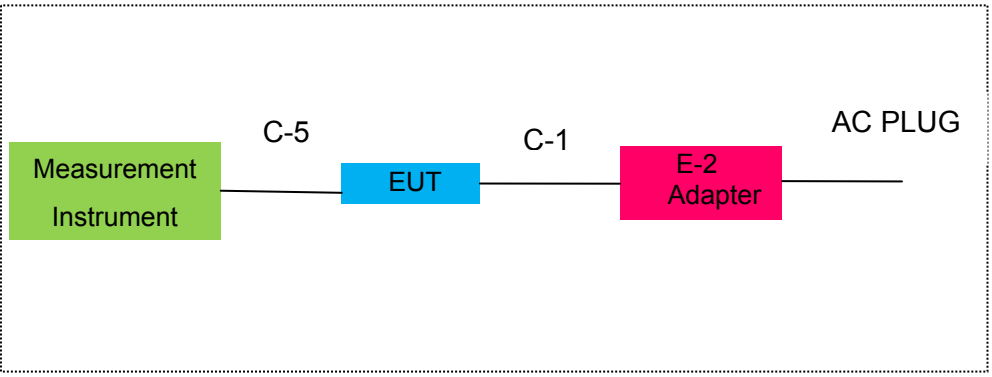
For AC Conducted Emission Mode



Radiated Spurious Emission Test



For Conducted Test Cases



2.4 DESCRIPTION OF SUPPORT UNITS(CONDUCTED MODE)

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	Brand	Model/Type No.	Series No.	Note
E-1	PIQS Virtual Touch Projector	PIQS	F1	N/A	EUT
E-2	Adapter	N/A	ADP-120ZB BB	N/A	Peripherals
E-3	Earphone	N/A	N/A	N/A	Peripherals
E-4	Mouse	N/A	N/A	N/A	Peripherals
E-5	KB	N/A	N/A	N/A	Peripherals

Item	Cable Type	Shielded Type	Ferrite Core	Length	Note
C-1	Power Cable	NO	YES	1.2m	
C-2	Earphone Cable	NO	NO	0.8m	
C-3	KB Cable	NO	NO	1.0m	
C-4	Mouse Cable	NO	NO	1.0m	
C-5	RF Cable	NO	NO	0.5m	

Note:

(1) The support equipment was authorized by Declaration of Confirmation.
(2) For detachable type I/O cable should be specified the length in cm in『Length』column.

2.5 EQUIPMENTS LIST FOR ALL TEST ITEMS

Radiation& Conducted Test equipment

Item	Kind of Equipment	Manufacturer	Type No.	Serial No.	Last calibration	Calibrated until	Calibration period
1	Spectrum Analyzer	Aglient	E4407B	MY45108040	2017.06.06	2018.06.05	1 year
2	Spectrum Analyzer	Agilent	N9020A	MY49100060	2017.10.26	2018.10.25	1 year
3	EMI Test Receiver	Agilent	N9038A	MY53227146	2017.06.06	2018.06.05	1 year
4	Test Receiver	R&S	ESPI	101318	2017.06.06	2018.06.05	1 year
5	Bilog Antenna	TESEQ	CBL6111D	31216	2018.04.08	2019.04.07	1 year
6	50Ω Coaxial Switch	Anritsu	MP59B	6200983705	2017.06.06	2018.06.05	1 year
7	Horn Antenna	EM	EM-AH-10180	2011071402	2018.04.08	2019.04.07	1 year
8	Horn Ant	Schwarzbeck	BBHA 9170	9170-181	2017.07.06	2018.07.05	1 year
9	Amplifier	EMC	EMC051835SE	980246	2017.08.09	2018.08.08	1 year
10	Amplifier	MITEQ	TTA1840-35-HG	177156	2017.06.06	2018.06.05	1 year
11	Loop Antenna	ARA	PLA-1030/B	1029	2017.06.06	2018.06.05	1 year
12	Power Meter	DARE	RPR3006W	15I00041SNO84	2017.08.07	2018.08.06	1 year
13	Test Cable (9KHz-30MHz)	N/A	R-01	N/A	2017.04.21	2020.04.20	3 year
14	Test Cable (30MHz-1GHz)	N/A	R-02	N/A	2017.04.21	2020.04.20	3 year
15	High Test Cable(1G-40GHz)	N/A	R-03	N/A	2017.04.21	2020.04.20	3 year
16	High Test Cable(1G-40GHz)	N/A	R-04	N/A	2017.04.21	2020.04.20	3 year
17	Filter	TRILTHIC	2400MHz	29	2018.03.29	2019.03.28	1 year
18	temporary antenna connector (Note)	NTS	R001	N/A	N/A	N/A	N/A

Note:
We will use the temporary antenna connector (soldered on the PCB board) When conducted test
And this temporary antenna connector is listed within the instrument list

AC Conduction Test equipment

Item	Kind of Equipment	Manufacturer	Type No.	Serial No.	Last calibration	Calibrated until	Calibration period
1	Test Receiver	R&S	ESCI	101160	2017.06.06	2018.06.05	1 year
2	LISN	R&S	ENV216	101313	2018.04.18	2019.04.19	1 year
3	LISN	SCHWARZBECK	NNLK 8129	8129245	2017.06.06	2018.06.05	1 year
4	50Ω Coaxial Switch	ANRITSU CORP	MP59B	6200983704	2017.06.06	2018.06.05	1 year
5	Test Cable (9KHz-30MHz)	N/A	C01	N/A	2017.04.21	2020.04.20	3 year
6	Test Cable (9KHz-30MHz)	N/A	C02	N/A	2017.04.21	2020.04.20	3 year
7	Test Cable (9KHz-30MHz)	N/A	C03	N/A	2017.04.21	2020.04.20	3 year

Note: Each piece of equipment is scheduled for calibration once a year except the Test Cable which is scheduled for calibration every 3 years.

3. EMC EMISSION TEST

3.1 CONDUCTED EMISSION MEASUREMENT

3.1.1 POWER LINE CONDUCTED EMISSION Limits (Frequency Range 150KHz-30MHz)

FREQUENCY (MHz)	Conducted Emission Limit		Standard
	Quasi-peak	Average	
0.15 -0.5	66 - 56 *	56 - 46 *	CISPR
0.50 -5.0	56.00	46.00	CISPR
5.0 -30.0	60.00	50.00	CISPR

0.15 -0.5	66 - 56 *	56 - 46 *	FCC/ RSS-247
0.50 -5.0	56.00	46.00	FCC/ RSS-247
5.0 -30.0	60.00	50.00	FCC/ RSS-247

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

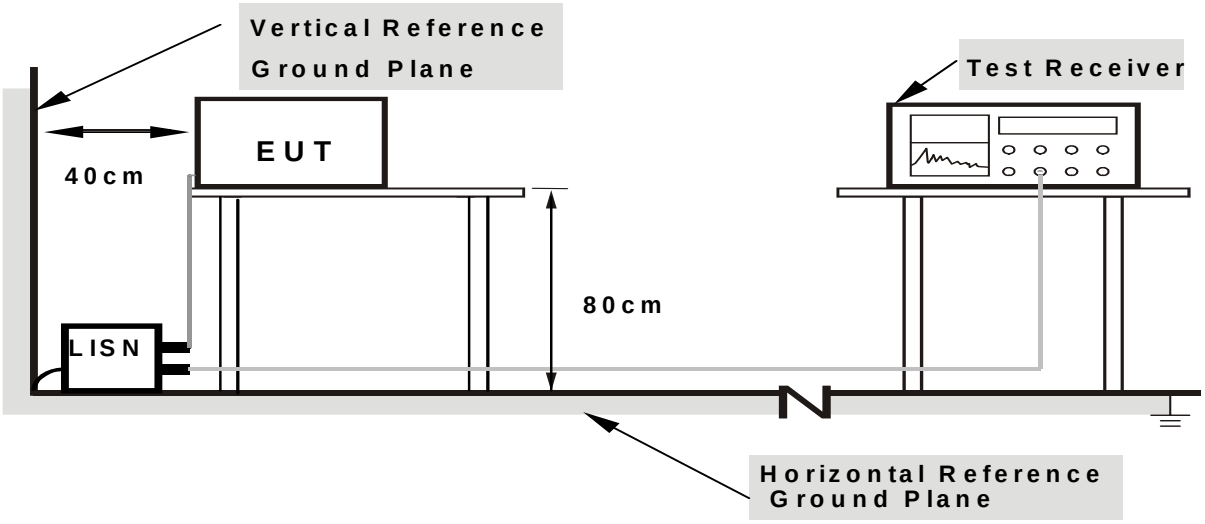
3.1.2 TEST PROCEDURE

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 equipments 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.

3.1.3 DEVIATION FROM TEST STANDARD

No deviation

3.1.4 TEST SETUP



Note: 1.Support units were connected to second LISN.
2.Both of LISNs (AMN) are 80 cm from EUT and at least 80 from other units and other metal planes

3.1.5 EUT OPERATING CONDITIONS

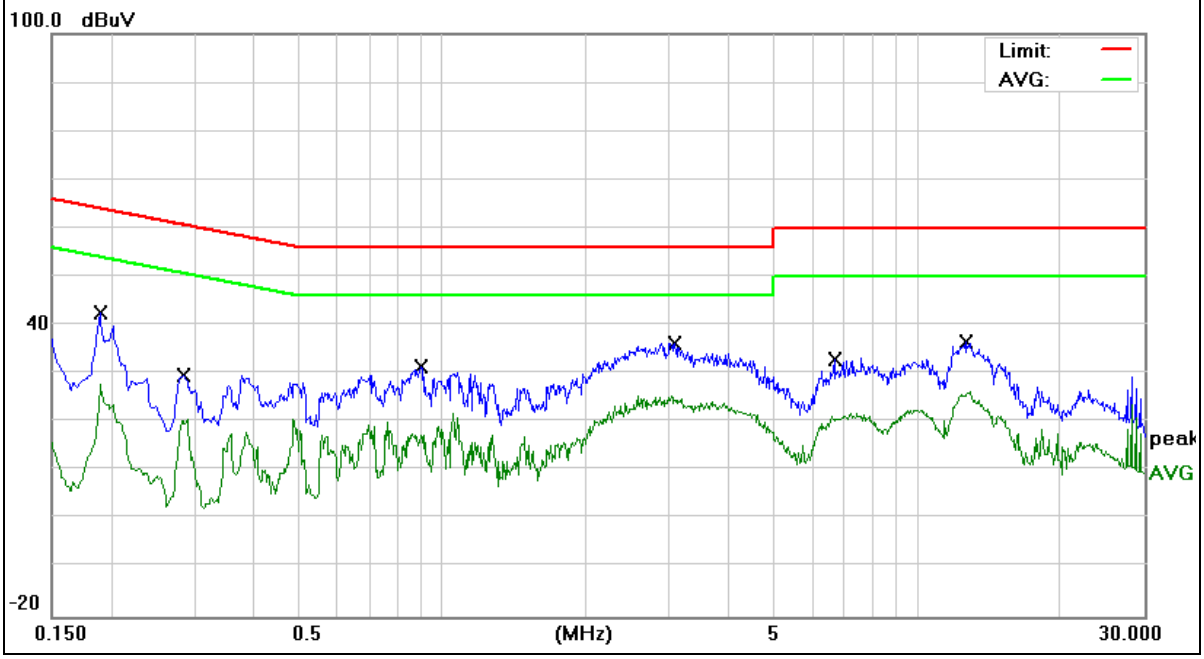
The EUT was configured for testing in a typical fashion (as a customer would normally use it). The EUT has been programmed to continuously transmit during test. This operating condition was tested and used to collect the included data.

EUT：	PIQS Virtual Touch Projector	Model Name. ：	F1
Temperature：	26 ℃	Relative Humidity：	56%
Pressure：	1010hPa	Phase：	L
Test Voltage ：	DC 19V from Adapter AC 120V/60Hz	Test Mode：	Mode 1

Frequency	Reading Level	Correct Factor	Measure-ment	Limits	Margin	Remark
(MHz)	(dBμV)	(dB)	(dBμV)	(dBμV)	(dB)	
0.1900	32.63	9.82	42.45	64.03	-21.58	QP
0.1900	16.30	9.82	26.12	54.03	-27.91	AVG
0.2832	19.96	9.82	29.78	60.72	-30.94	QP
0.2832	8.20	9.82	18.02	50.72	-32.70	AVG
0.9020	21.52	9.90	31.42	56.00	-24.58	QP
0.9020	9.43	9.90	19.33	46.00	-26.67	AVG
3.0859	26.28	10.05	36.33	56.00	-19.67	QP
3.0859	10.47	10.05	20.52	46.00	-25.48	AVG
6.6859	23.00	9.99	32.99	60.00	-27.01	QP
6.6859	11.46	9.99	21.45	50.00	-28.55	AVG
12.6257	26.47	10.11	36.58	60.00	-23.42	QP
12.6257	13.30	10.11	23.41	50.00	-26.59	AVG

Remark:

1. All readings are Quasi-Peak and Average values.
2. Factor = Insertion Loss + Cable Loss.

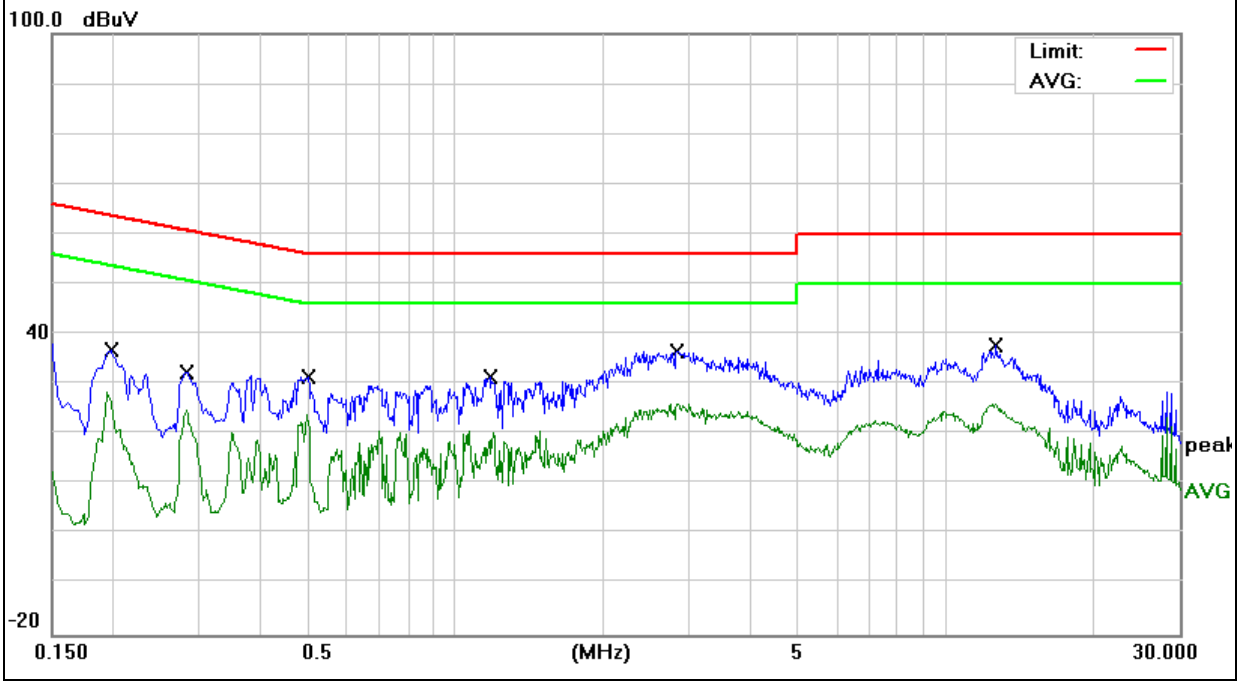


EUT：	PIQS Virtual Touch Projector	Model Name. ：	F1
Temperature：	26 ℃	Relative Humidity：	56%
Pressure：	1010hPa	Phase：	N
Test Voltage ：	DC 19V from Adapter AC 120V/60Hz	Test Mode：	Mode 1

Frequency	Reading Level	Correct Factor	Measure-ment	Limits	Margin	Remark
(MHz)	(dBμV)	(dB)	(dBμV)	(dBμV)	(dB)	
0.1980	26.93	9.92	36.85	63.69	-26.84	QP
0.1980	15.20	9.92	25.12	53.69	-28.57	AVG
0.2816	22.43	9.92	32.35	60.77	-28.42	QP
0.2816	13.28	9.92	23.20	50.77	-27.57	AVG
0.5020	21.49	9.93	31.42	56.00	-24.58	QP
0.5020	11.52	9.93	21.45	46.00	-24.55	AVG
1.1777	21.40	9.93	31.33	56.00	-24.67	QP
1.1777	9.59	9.93	19.52	46.00	-26.48	AVG
2.8380	26.69	9.95	36.64	56.00	-19.36	QP
2.8380	8.30	9.95	18.25	46.00	-27.75	AVG
12.7139	27.52	10.17	37.69	60.00	-22.31	QP
12.7139	12.28	10.17	22.45	50.00	-27.55	AVG

Remark:

1. All readings are Quasi-Peak and Average values.
2. Factor = Insertion Loss + Cable Loss.

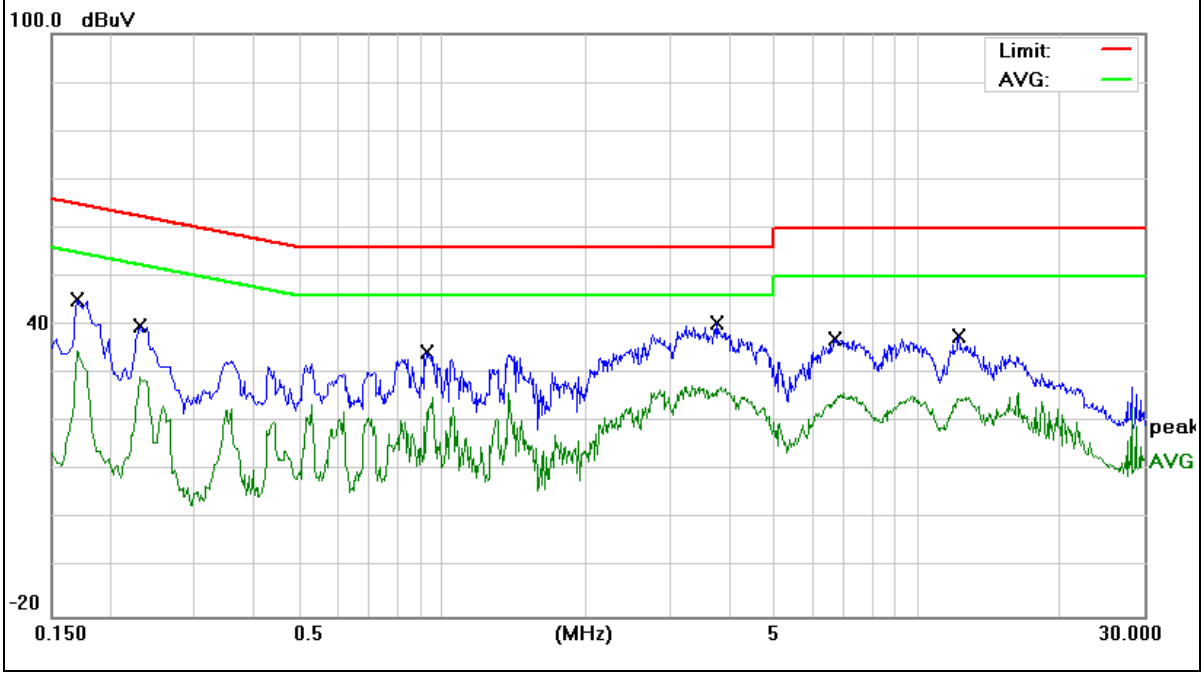


EUT：	PIQS Virtual Touch Projector	Model Name. ：	F1
Temperature：	26 ℃	Relative Humidity：	56%
Pressure：	1010hPa	Phase：	L
Test Voltage ：	DC 19V from Adapter AC 240V/60Hz	Test Mode：	Mode 1

Frequency	Reading Level	Correct Factor	Measure-ment	Limits	Margin	Remark
(MHz)	(dBμV)	(dB)	(dBμV)	(dBμV)	(dB)	
0.1700	35.35	9.82	45.17	64.96	-19.79	QP
0.1700	15.29	9.82	25.11	54.96	-29.85	AVG
0.2300	29.96	9.82	39.78	62.45	-22.67	QP
0.2300	16.87	9.82	26.69	52.45	-25.76	AVG
0.9260	24.45	9.91	34.36	56.00	-21.64	QP
0.9260	16.05	9.91	25.96	46.00	-20.04	AVG
3.7820	30.51	10.05	40.56	56.00	-15.44	QP
3.7820	18.06	10.05	28.11	46.00	-17.89	AVG
6.6779	27.16	9.99	37.15	60.00	-22.85	QP
6.6779	13.34	9.99	23.33	50.00	-26.67	AVG
12.2096	27.81	10.09	37.90	60.00	-22.10	QP
12.2096	14.65	10.09	24.74	50.00	-25.26	AVG

Remark:

1. All readings are Quasi-Peak and Average values.
2. Factor = Insertion Loss + Cable Loss.

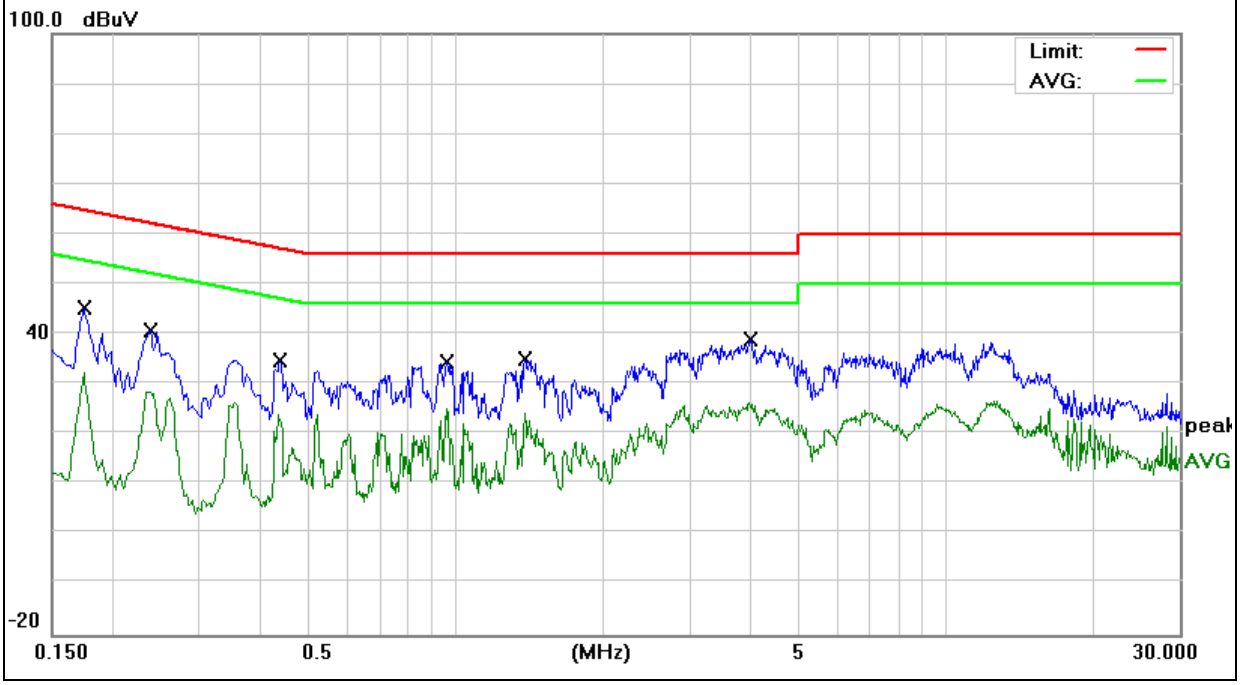


EUT：	PIQS Virtual Touch Projector	Model Name. ：	F1
Temperature：	26 ℃	Relative Humidity：	56%
Pressure：	1010hPa	Phase：	N
Test Voltage ：	DC 19V from Adapter AC 240V/60Hz	Test Mode：	Mode 1

Frequency	Reading Level	Correct Factor	Measure-ment	Limits	Margin	Remark
(MHz)	(dBμV)	(dB)	(dBμV)	(dBμV)	(dB)	
0.1737	35.19	9.92	45.11	64.78	-19.67	QP
0.1737	17.23	9.92	27.15	54.78	-27.63	AVG
0.2379	30.75	9.92	40.67	62.17	-21.50	QP
0.2379	16.73	9.92	26.65	52.17	-25.52	AVG
0.4380	24.96	9.93	34.89	57.10	-22.21	QP
0.4380	15.39	9.93	25.32	47.10	-21.78	AVG
0.9617	24.65	9.93	34.58	56.00	-21.42	QP
0.9617	14.59	9.93	24.52	46.00	-21.48	AVG
1.3817	25.16	9.93	35.09	56.00	-20.91	QP
1.3817	16.73	9.93	26.66	46.00	-19.34	AVG
3.9900	28.95	9.95	38.90	56.00	-17.10	QP
3.9900	17.16	9.95	27.11	46.00	-18.89	AVG

Remark:

1. All readings are Quasi-Peak and Average values.
2. Factor = Insertion Loss + Cable Loss.



3.2 RADIATED EMISSION MEASUREMENT

3.2.1 APPLICABLE STANDARD

According to FCC Part 15.407(d) and 15.209

3.2.2 CONFORMANCE LIMIT

According to FCC Part 15.407(b)(7): radiated emissions which fall in the restricted bands, as defined in §15.205(a), must also comply with the radiated emission limits specified in §15.209(a) (see §15.205(c)).
According to FCC Part15.205, Restricted bands

MHz	MHz	MHz	GHz
0.090-0.110	16.42-16.423	399.9-410	4.5-5.15
10.495-0.505	16.69475-16.69525	608-614	5.35-5.46
2.1735-2.1905	16.80425-16.80475	960-1240	7.25-7.75
4.125-4.128	25.5-25.67	1300-1427	8.025-8.5
4.17725-4.17775	37.5-38.25	1435-1626.5	9.0-9.2
4.20725-4.20775	73-74.6	1645.5-1646.5	9.3-9.5
6.215-6.218	74.8-75.2	1660-1710	10.6-12.7
6.26775-6.26825	123-138	2200-2300	14.47-14.5
8.291-8.294	149.9-150.05	2310-2390	15.35-16.2
8.362-8.366	156.52475-156.52525	2483.5-2500	17.7-21.4
8.37625-8.38675	156.7-156.9	2690-2900	22.01-23.12
8.41425-8.41475	162.0125-167.17	3260-3267	23.6-24.0
12.29-12.293	167.72-173.2	3332-3339	31.2-31.8
12.51975-12.52025	240-285	3345.8-3358	36.43-36.5
12.57675-12.57725	322-335.4	3600-4400	(2)
13.36-13.41			

20dBc in any 100 kHz bandwidth outside the operating frequency band. 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.

Restricted Frequency(MHz)	Field Strength (μV/m)	Field Strength (dBμV/m)	Measurement Distance
0.009~0.490	2400/F(KHz)	20 log (uV/m)	300
0.490~1.705	2400/F(KHz)	20 log (uV/m)	30
1.705~30.0	30	29.5	30
30-88	100	40	3
88-216	150	43.5	3
216-960	200	46	3
Above 960	500	54	3

Limits of Radiated Emission Measurement(Above 1000MHz)

Frequency(MHz)	Class B (dBuV/m) (at 3M)	
	PEAK	AVERAGE
Above 1000	74	54

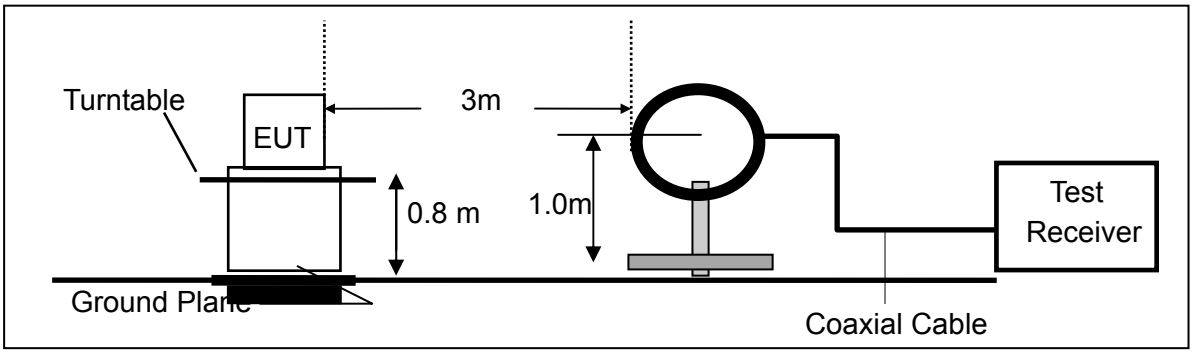
Remark :1. Emission level in dBuV/m=20 log (uV/m)
2. Measurement was performed at an antenna to the closed point of EUT distance of meters.
3. Distance extrapolation factor =40log(Specific distance/ test distance)(dB);
Limit line=Specific limits(dBuV) + distance extrapolation factor.

3.2.3 MEASURING INSTRUMENTS

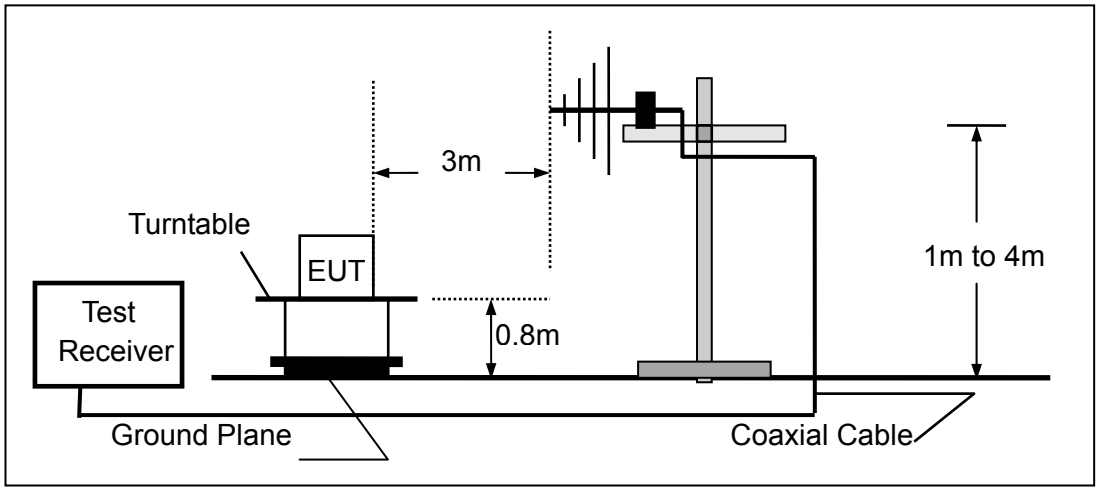
The Measuring equipment is listed in the section 6.3 of this test report.

3.2.4 TEST CONFIGURATION

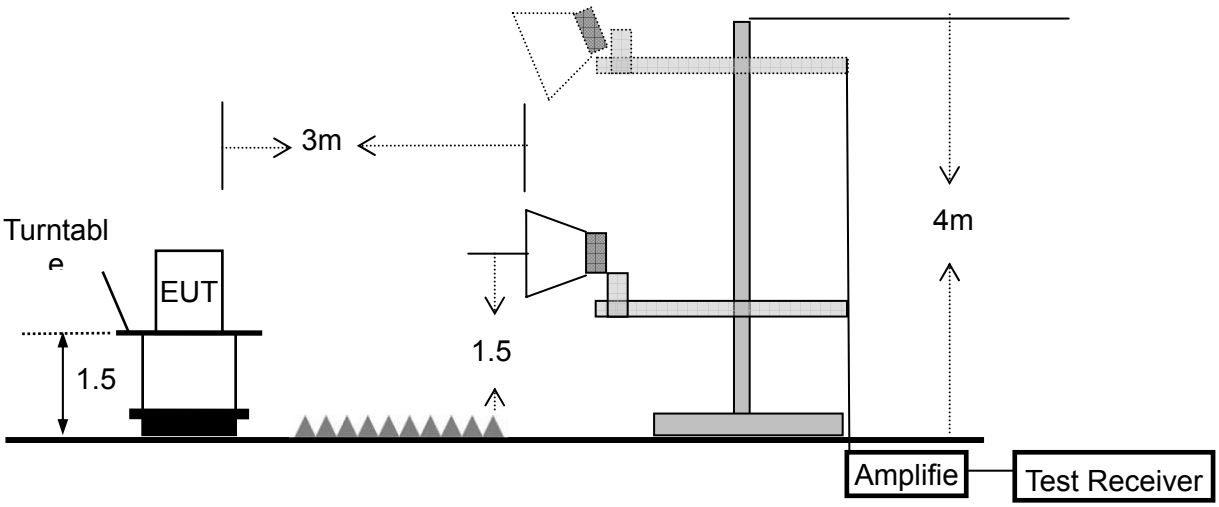
(a)For radiated emissions below 30MHz



(b)For radiated emissions from 30MHz to 1000MHz



(c) For radiated emissions above 1000MHz



3.2.5 TEST PROCEDURE

The test site semi-anechoic chamber has met the requirement of NSA tolerance 4 dB according to the standards: ANSI C63.10-2013. The test distance is 3m.The setup is according to the requirements in Section 13.1.4.1 of ANSI C63.10-2013 and CAN/CSA-CEI/IEC CISPR 22.
This test is required for any spurious emission that falls in a Restricted Band, as defined in Section 15.205. It must be performed with the highest gain of each type of antenna proposed for use with the EUT.
Use the following spectrum analyzer settings:

Spectrum Parameter	Setting
Attenuation	Auto
Start Frequency	1000 MHz
Stop Frequency	10th carrier harmonic
RB / VB (emission in restricted band)	1 MHz / 1 MHz for Peak, 1 MHz / 10Hz for Average

Receiver Parameter	Setting
Attenuation	Auto
Start ~ Stop Frequency	9kHz~150kHz / RB 200Hz for QP
Start ~ Stop Frequency	150kHz~30MHz / RB 9kHz for QP
Start ~ Stop Frequency	30MHz~1000MHz / RB 120kHz for QP

a. The measuring distance of at 3 m shall be used for measurements at frequency up to 1GHz. For frequencies above 1GHz, any suitable measuring distance may be used.
b. The EUT was placed on the top of a rotating table 0.8 m for below 1GHz and 1.5m for above 1GHz the ground at a 3 meter. The table was rotated 360 degrees to determine the position of the highest radiation.
c. The height of the equipment or of the substitution antenna shall be 0.8 m for below 1GHz and 1.5m for above 1GHz; 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. The initial step in collecting conducted emission data is a spectrum analyzer peak detector mode pre-scanning the measurement frequency range. Significant peaks are then marked and then Quasi Peak detector mode re-measured.
e. If the Peak Mode measured value compliance with and lower than Quasi Peak Mode Limit, the EUT shall be deemed to meet QP Limits and then no additional QP Mode measurement performed.
f. For the actual test configuration, please refer to the related Item –EUT Test Photos.

Note:

Both horizontal and vertical antenna polarities were tested
and performed pretest to three orthogonal axis. The worst case emissions were reported

During the radiated emission test, the Spectrum Analyzer was set with the following configurations:

Frequency Band (MHz)	Function	Resolution bandwidth	Video Bandwidth
30 to 1000	QP	120 kHz	300 kHz
Above 1000	Peak	1 MHz	1 MHz
	Average	1 MHz	10 Hz

Note: for the frequency ranges below 30 MHz, a narrower RBW is used for these ranges but the measured value should add a RBW correction factor (RBWCF) where RBWCF [dB] =10*lg(100 [kHz]/narrower RBW [kHz]). , the narrower RBW is 1 kHz and RBWCF is 20 dB for the frequency 9 kHz to 150 kHz, and the narrower RBW is 10 kHz and RBWCF is 10 dB for the frequency 150 kHz to 30 MHz.

3.2.6 TEST RESULTS (9KHZ – 30 MHZ)

EUT：	PIQS Virtual Touch Projector	Model Name. ：	F1
Temperature：	20 ℃	Relative Humidtity：	48%
Pressure：	1010 hPa	Test Voltage ：	DC 19V
Test Mode ：	TX	Polarization :	--

Freq.	Reading	Limit	Margin	State
(MHz)	(dBuV/m)	(dBuV/m)	(dB)	P/F
--	--	--	--	N/A
--	--	--	--	N/A

NOTE:

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

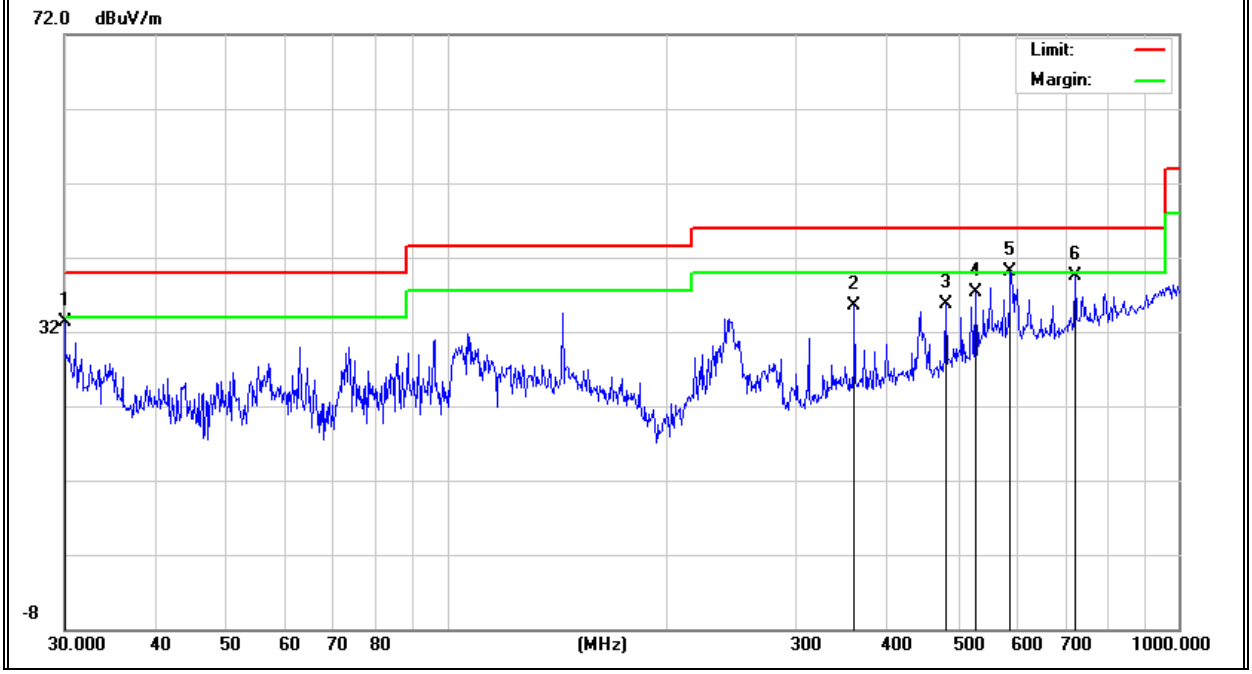
3.2.7 TEST RESULTS (30MHZ – 1GHZ)

EUT：	PIQS Virtual Touch Projector	Model Name. ：	F1
Temperature：	20 ℃	Relative Humidity：	48%
Pressure：	1010 hPa	Test Voltage ：	DC 19V
Test Mode ：	TX(5.2G)		

Polar (H/V)	Frequency (MHz)	Meter Reading (dBuV)	Factor (dB)	Emission Level (dBuV/m)	Limits (dBuV/m)	Margin (dB)	Remark
V	30.0000	14.47	18.88	33.35	40.00	-6.65	QP
V	360.4476	17.65	17.87	35.52	46.00	-10.48	QP
V	480.5276	14.25	21.41	35.66	46.00	-10.34	QP
V	528.2458	15.06	22.34	37.40	46.00	-8.60	QP
V	588.9049	16.57	23.50	40.07	46.00	-5.93	QP
V	721.7259	12.91	26.66	39.57	46.00	-6.43	QP

Remark:

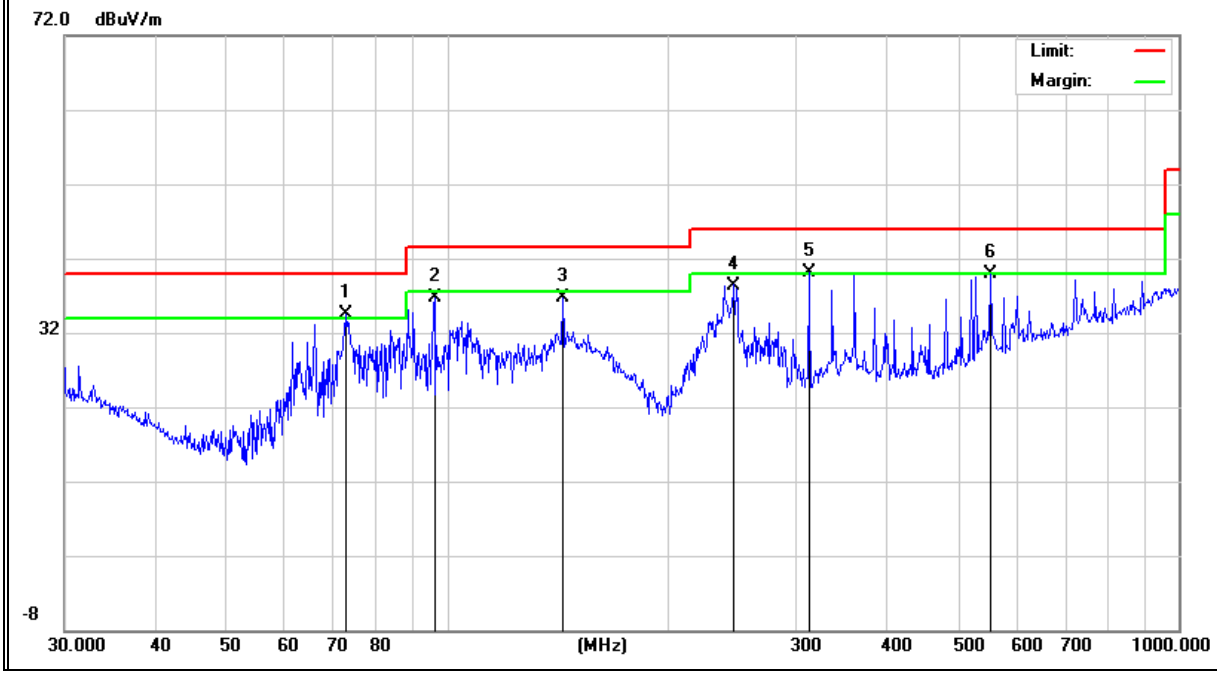
Absolute Level= ReadingLevel+ Factor, Margin= Absolute Level - Limit



Polar (H/V)	Frequency (MHz)	Meter Reading (dBuV)	Factor (dB)	Emission Level (dBuV/m)	Limits (dBuV/m)	Margin (dB)	Remark
H	72.8466	27.21	7.20	34.41	40.00	-5.59	QP
H	96.0986	25.69	11.08	36.77	43.50	-6.73	QP
H	143.8295	23.52	13.18	36.70	43.50	-6.80	QP
H	246.8149	24.06	14.34	38.40	46.00	-7.60	QP
H	312.1794	23.69	16.38	40.07	46.00	-5.93	QP
H	552.8832	15.40	24.51	39.91	46.00	-6.09	QP

Remark:

Absolute Level= ReadingLevel+ Factor, Margin= Absolute Level - Limit

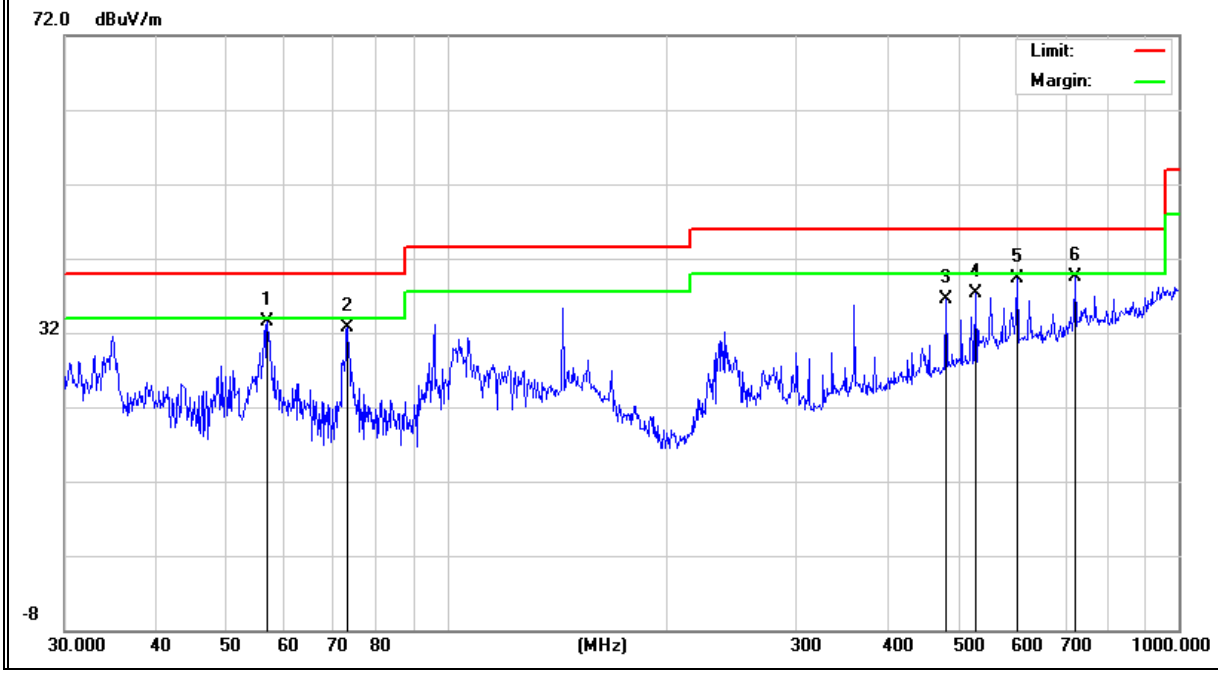


EUT：	PIQS Virtual Touch Projector	Model Name. ：	F1
Temperature：	20 ℃	Relative Humidity：	48%
Pressure：	1010 hPa	Test Voltage ：	DC 19V
Test Mode ：	TX(5.8G)		

Polar (H/V)	Frequency (MHz)	Meter Reading (dBuV)	Factor (dB)	Emission Level (dBuV/m)	Limits (dBuV/m)	Margin (dB)	Remark
V	56.7916	26.73	6.84	33.57	40.00	-6.43	QP
V	73.1025	25.41	7.34	32.75	40.00	-7.25	QP
V	480.5276	15.01	21.41	36.42	46.00	-9.58	QP
V	528.2458	14.97	22.34	37.31	46.00	-8.69	QP
V	601.4265	15.45	23.95	39.40	46.00	-6.60	QP
V	721.7259	12.91	26.66	39.57	46.00	-6.43	QP

Remark:

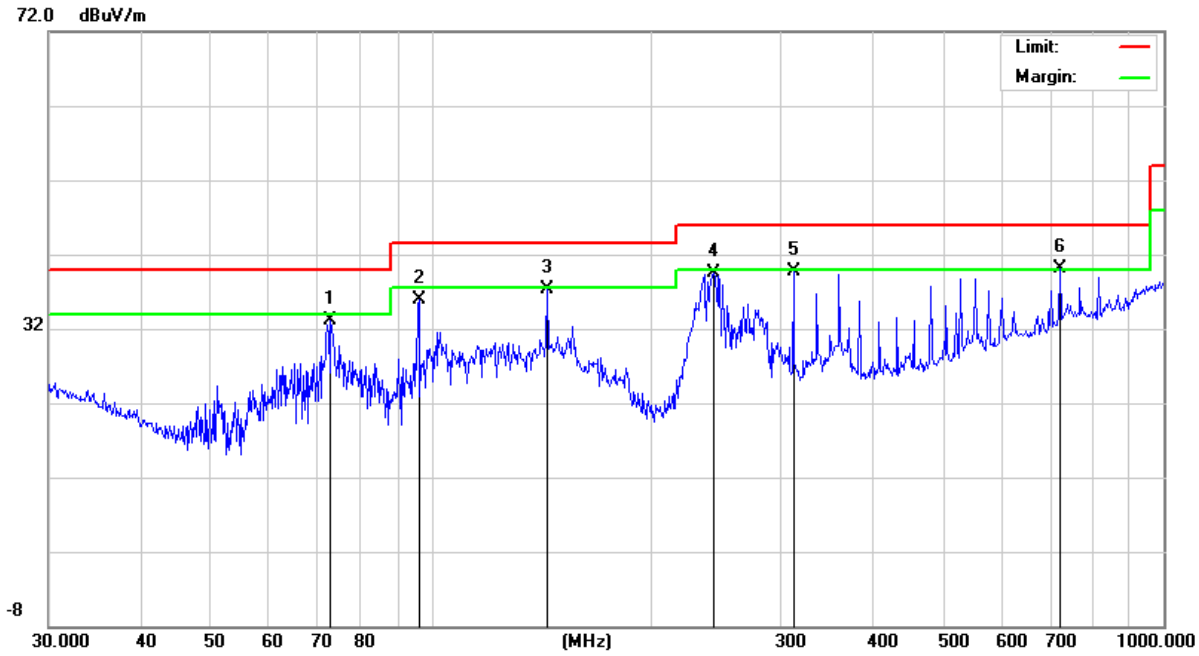
Absolute Level= ReadingLevel+ Factor, Margin= Absolute Level - Limit



Polar (H/V)	Frequency (MHz)	Meter Reading (dBuV)	Factor (dB)	Emission Level (dBuV/m)	Limits (dBuV/m)	Margin (dB)	Remark
H	72.8465	25.99	7.20	33.19	40.00	-6.81	QP
H	96.0986	24.75	11.08	35.83	43.50	-7.67	QP
H	143.8293	24.13	13.18	37.31	43.50	-6.19	QP
H	242.5252	26.06	13.45	39.51	46.00	-6.49	QP
H	312.1792	23.36	16.38	39.74	46.00	-6.26	QP
H	721.7259	13.38	26.66	40.04	46.00	-5.96	QP

Remark:

Absolute Level= ReadingLevel+ Factor, Margin= Absolute Level - Limit



3.2.8 TEST RESULTS (1GHz-26GHz)

EUT：	PIQS Virtual Touch Projector	Model Name. ：	F1
Temperature：	20 ℃	Relative Humidity：	48%
Pressure：	1010 hPa	Test Voltage ：	DC 19V
Test Mode ：	TX(5.2G)		

Polar	Frequency	Meter Reading	Cable loss	Antenna Factor	Preamp Factor	Emission Level	Limits	Margin
(H/V)	(MHz)	(dBuV)	(dB)	dB/m	(dB)	(dBuV/m)	(dBuV/m)	(dB)
Low Channel (5180 MHz)-Above 1G								
Vertical	4434.232	62.32	5.94	35.40	44.00	59.66	74.00	-14.34
Vertical	4434.232	43.48	5.94	35.40	44.00	40.82	54.00	-13.18
Vertical	10370.191	60.01	8.46	39.75	44.50	63.72	74.00	-10.28
Vertical	10370.191	42.29	8.46	39.75	44.50	46.00	54.00	-8.00
Vertical	15540.247	60.14	10.12	38.80	44.10	64.96	74.00	-9.04
Vertical	15540.247	38.98	10.12	38.80	42.70	45.20	54.00	-8.80
Horizontal	4434.193	65.68	5.94	35.18	44.00	62.80	74.00	-11.20
Horizontal	4434.193	45.47	5.94	35.18	44.00	42.59	54.00	-11.41
Horizontal	10370.254	58.98	8.46	38.71	44.50	61.65	74.00	-12.35
Horizontal	10370.254	41.25	8.46	38.71	44.50	43.92	54.00	-10.08
Horizontal	10540.339	57.81	10.12	38.38	44.10	62.21	74.00	-11.79
Horizontal	10540.339	38.62	10.12	38.38	44.10	43.02	54.00	-10.98
Middle Channel (5200 MHz)-Above 1G								
Vertical	4592.26	59.52	6.48	36.35	44.05	58.30	74.00	-15.70
Vertical	4592.26	41.91	6.48	36.35	44.05	40.69	54.00	-13.31
Vertical	10401.16	59.53	8.47	37.88	44.51	61.37	74.00	-12.63
Vertical	10401.16	43.41	8.47	37.88	44.51	45.25	54.00	-8.75
Vertical	15600.14	56.87	10.12	38.80	44.10	61.69	74.00	-12.31
Vertical	15600.14	39.23	10.12	38.80	42.70	45.45	54.00	-8.55
Horizontal	4592.47	59.59	6.48	36.37	44.05	58.39	74.00	-15.61
Horizontal	4592.47	42.61	6.48	36.37	44.05	41.41	54.00	-12.59
Horizontal	10400.16	58.98	8.47	38.64	44.50	61.59	74.00	-12.41
Horizontal	10400.16	41.25	8.47	38.64	44.50	43.86	54.00	-10.14
Horizontal	15600.33	59.55	10.12	38.38	44.10	63.95	74.00	-10.05
Horizontal	15600.33	38.61	10.12	38.38	44.10	43.01	54.00	-10.99
High Channel (5240 MHz)-Above 1G								
Vertical	4739.214	63.41	7.1	37.24	43.5	64.25	74.00	-9.75
Vertical	4739.214	45.65	7.1	37.24	43.5	46.49	54.00	-7.51
Vertical	10480.425	62.38	8.46	37.68	44.5	64.02	74.00	-9.98
Vertical	10480.425	39.16	8.46	37.68	44.5	40.8	54.00	-13.2
Vertical	15720.196	59.59	10.12	38.8	44.1	64.41	74.00	-9.59
Vertical	15720.196	38.65	10.12	38.8	42.7	44.87	54.00	-9.13
Horizontal	4739.133	62.32	7.1	37.24	43.5	63.16	74.00	-10.84
Horizontal	4739.133	41.22	7.1	37.24	43.5	42.06	54.00	-11.94
Horizontal	10481.125	58.98	8.46	38.57	44.5	61.51	74.00	-12.49
Horizontal	10481.125	42.64	8.46	38.57	44.5	45.17	54.00	-8.83
Horizontal	15720.198	59.57	10.12	38.38	44.1	63.97	74.00	-10.03
Horizontal	15720.198	41.31	10.12	38.38	44.1	45.71	54.00	-8.29

Note:"802.11a (5G)" mode is the worst mode. PK value is lower than the Average value limit, So average didn't record.

The amplitude of spurious emissions that are attenuated by more than 20dB below the permissible value has no need to be reported.

Emission level (dBuV/m) = 20 log Emission level (uV/m).

Corrected Reading: Antenna Factor + Cable Loss + Read Level - Preamp Factor = Level.

EUT：	PIQS Virtual Touch Projector	Model Name. ：	F1
Temperature：	20 ℃	Relative Humidity：	48%
Pressure：	1010 hPa	Test Voltage ：	DC 19V
Test Mode ：	TX (5.8G)		

Polar	Frequency	Meter Reading	Cable loss	Antenna Factor	Preamp Factor	Emission Level	Limits	Margin	Detector Type
(H/V)	(MHz)	(dBuV)	(dB)	dB/m	(dB)	(dBuV/m)	(dBuV/m)	(dB)	
Low Channel (5745 MHz)-Above 1G									
Vertical	4833.251	62.91	5.94	35.40	44.00	60.25	74.00	-13.75	Pk
Vertical	4833.251	45.09	5.94	35.40	44.00	42.43	54.00	-11.57	AV
Vertical	11490.265	59.73	8.46	39.75	44.50	63.44	74.00	-10.56	Pk
Vertical	11490.265	41.21	8.46	39.75	44.50	44.92	54.00	-9.08	AV
Vertical	17235.335	60.73	10.12	38.80	44.10	65.55	74.00	-8.45	Pk
Vertical	17235.335	38.48	10.12	38.80	42.70	44.70	54.00	-9.30	AV
Horizontal	4515.221	58.92	5.94	35.18	44.00	56.04	74.00	-17.96	Pk
Horizontal	4515.221	41.41	5.94	35.18	44.00	38.53	54.00	-15.47	AV
Horizontal	11490.128	55.17	8.46	38.71	44.50	57.84	74.00	-16.16	Pk
Horizontal	11490.128	39.73	8.46	38.71	44.50	42.40	54.00	-11.60	AV
Horizontal	17235.069	60.87	10.12	38.38	44.10	65.27	74.00	-8.73	Pk
Horizontal	17235.069	38.61	10.12	38.38	44.10	43.01	54.00	-10.99	AV
middle Channel (5785 MHz)-Above 1G									
Vertical	4935.116	61.86	6.48	36.35	44.05	60.64	74.00	-13.36	Pk
Vertical	4539.116	42.66	6.48	36.35	44.05	41.44	54.00	-12.56	AV
Vertical	11570.581	59.09	8.47	37.88	44.51	60.93	74.00	-13.07	Pk
Vertical	11570.581	42.02	8.47	37.88	44.51	43.86	54.00	-10.14	AV
Vertical	17355.285	59.08	10.12	38.80	44.10	63.90	74.00	-10.10	Pk
Vertical	17355.285	38.48	10.12	38.80	42.70	44.70	54.00	-9.30	AV
Horizontal	4766.508	60.74	6.48	36.37	44.05	59.54	74.00	-14.46	Pk
Horizontal	4766.508	42.97	6.48	36.37	44.05	41.77	54.00	-12.23	AV
Horizontal	11570.233	59.63	8.47	38.64	44.50	62.24	74.00	-11.76	Pk
Horizontal	11570.233	41.75	8.47	38.64	44.50	44.36	54.00	-9.64	AV
Horizontal	17355.417	60.27	10.12	38.38	44.10	64.67	74.00	-9.33	Pk
Horizontal	17355.417	39.66	10.12	38.38	44.10	44.06	54.00	-9.94	AV
High Channel (5825 MHz)-Above 1G									
Vertical	5811.369	60.73	7.10	37.24	43.50	61.57	74.00	-12.43	Pk
Vertical	5811.369	42.15	7.10	37.24	43.50	42.99	54.00	-11.01	AV
Vertical	11652.421	60.00	8.46	37.68	44.50	61.64	74.00	-12.36	Pk
Vertical	11652.421	41.76	8.46	37.68	44.50	43.40	54.00	-10.60	AV
Vertical	17473.512	58.48	10.12	38.80	44.10	63.30	74.00	-10.70	Pk
Vertical	17473.512	38.61	10.12	38.80	42.70	44.83	54.00	-9.17	AV
Horizontal	5744.623	61.87	7.10	37.24	43.50	62.71	74.00	-11.29	Pk
Horizontal	5744.623	41.76	7.10	37.24	43.50	42.60	54.00	-11.40	AV
Horizontal	11652.711	60.08	8.46	38.57	44.50	62.61	74.00	-11.39	Pk
Horizontal	11652.711	41.79	8.46	38.57	44.50	44.32	54.00	-9.68	AV
Horizontal	17474.522	59.06	10.12	38.38	44.10	63.46	74.00	-10.54	Pk
Horizontal	17474.522	39.63	10.12	38.38	44.10	44.03	54.00	-9.97	AV

Note:"802.11a(5G)" mode is the worst mode. PK value is lower than the Average value limit, So average didn't record.

The amplitude of spurious emissions that are attenuated by more than 20dB below the permissible value

has no need to be reported.

Emission level (dBuV/m) = 20 log Emission level (uV/m).

Corrected Reading: Antenna Factor + Cable Loss + Read Level - Preamp Factor = Level.

3.2.9 TEST RESULTS (26.5GHZ-40GHZ)

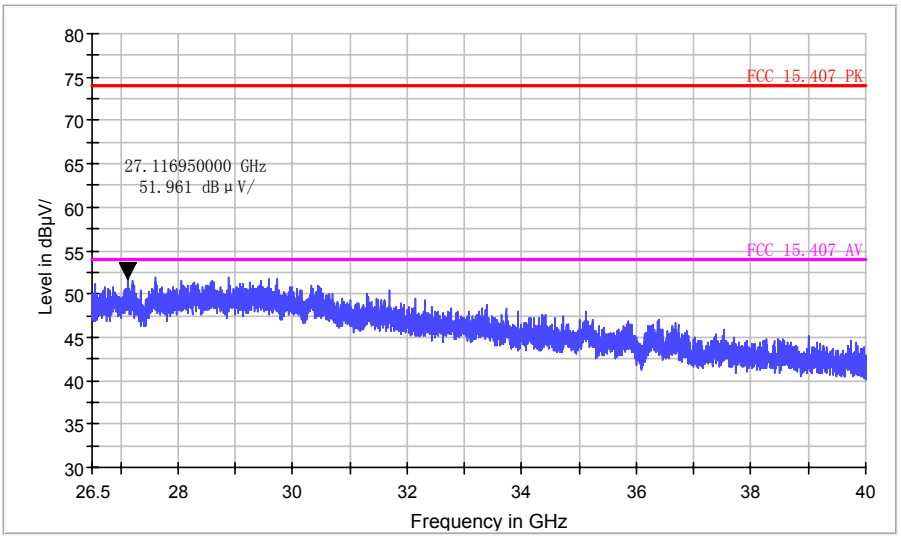
EUT：	PIQS Virtual Touch Projector	Model Name. ：	F1
Temperature：	20 ℃	Relative Humidity：	48%
Pressure：	1010 hPa	Test Voltage ：	DC 19V
Test Mode ：	TX (5.2G)-802.11a 5180MHz~5240MHz , TX (5.8G)-802.11a 5745MHz~5825MHz		

All the modulation modes have been tested, and the worst result was report as below:

Low Channel (5180 MHz)-Above 1G

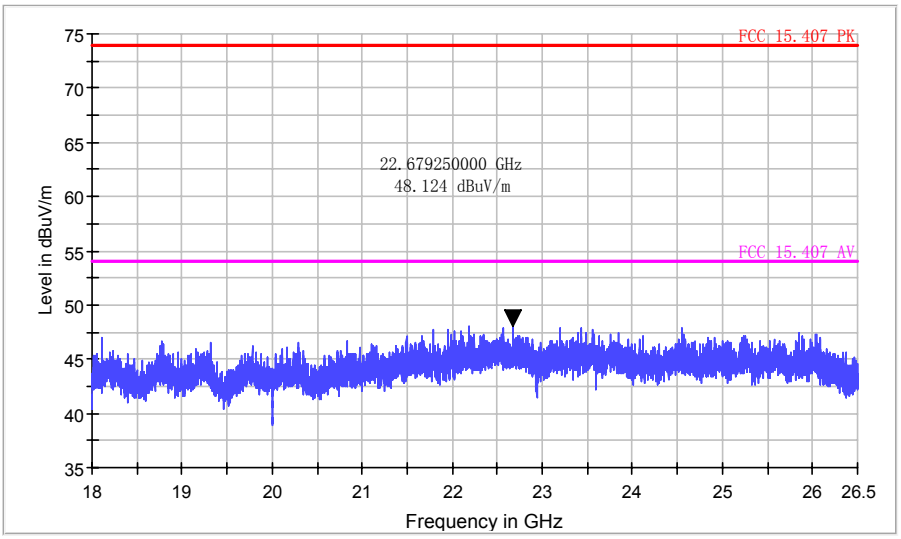
Horizontal

FCC Electric Field Strength 26.5-40GHz



Vertical

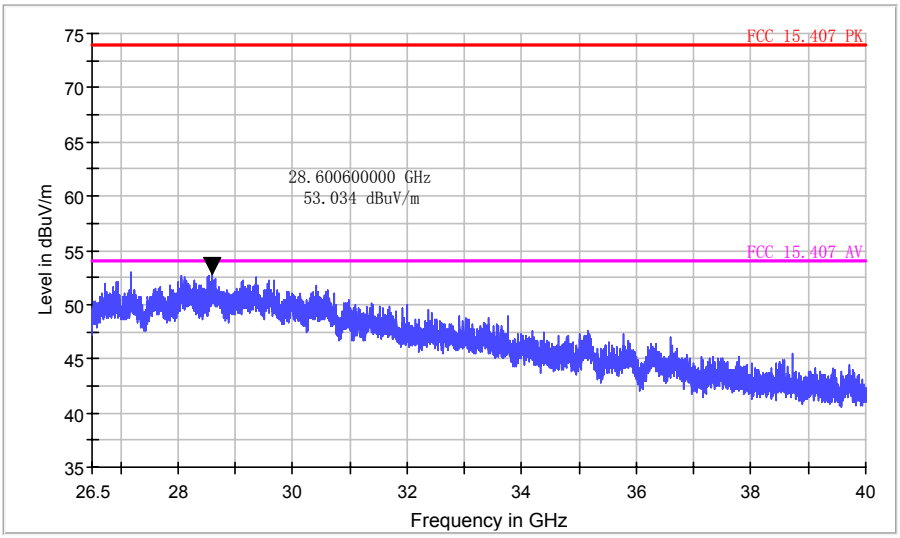
FCC Electric Field Strength 18-26.5GHz



High Channel (5240 MHz)-Above 1G

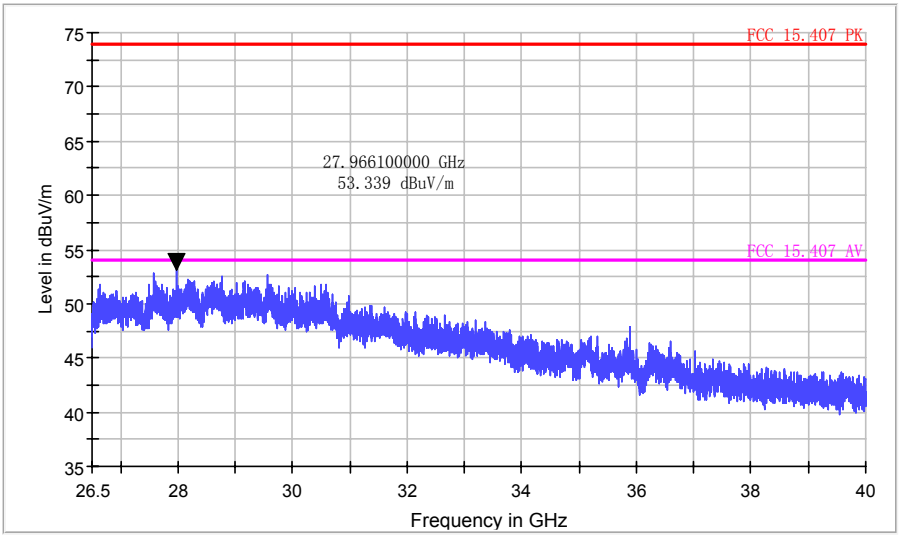
Horizontal

FCC Electric Field Strength 26.5-40GHz



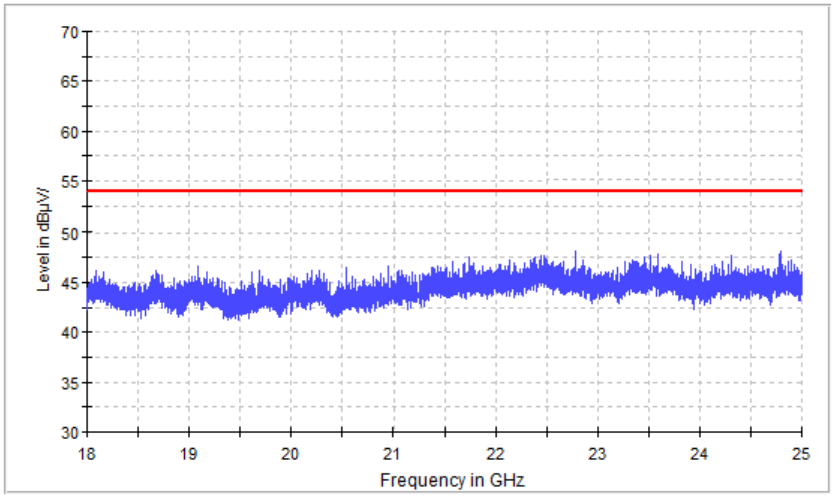
Vertical

FCC Electric Field Strength 26.5-40GHz

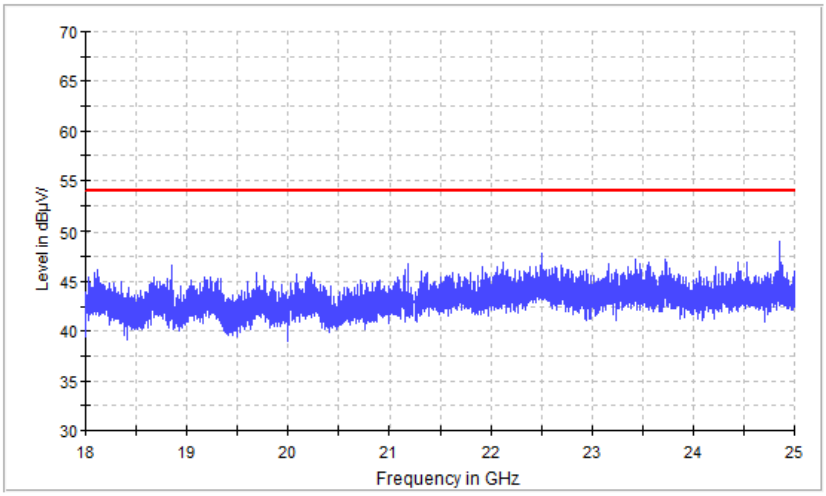


Low Channel (5745 MHz)-Above 1G

Horizontal



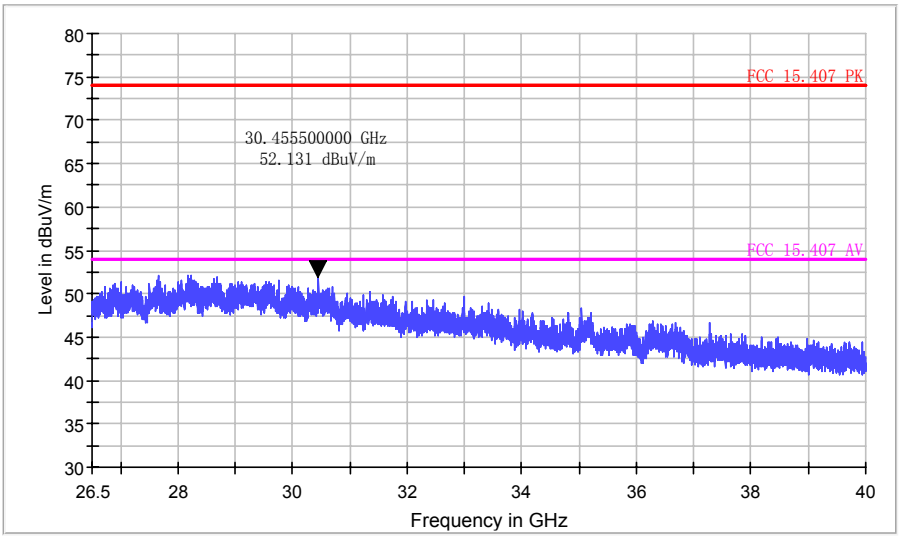
Vertical



Middle Channel (5785 MHz)-Above 1G

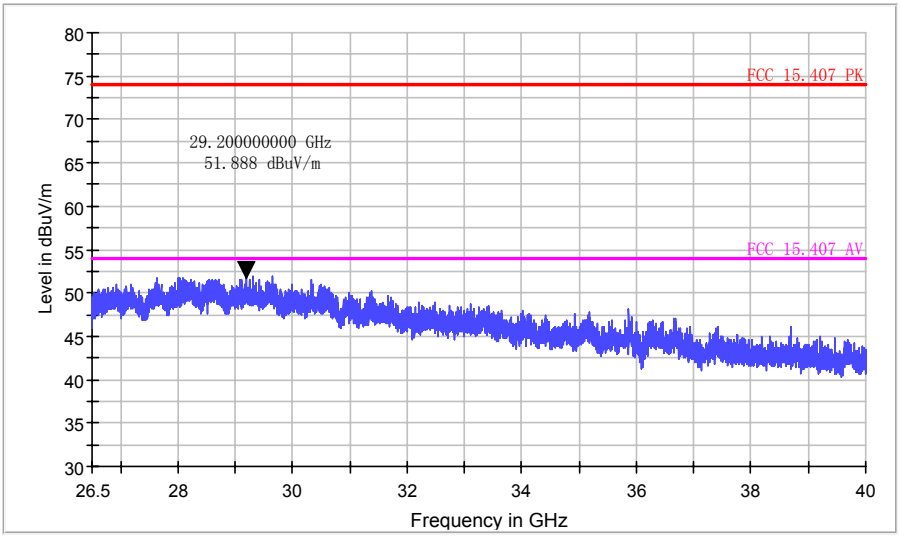
Horizontal

FCC Electric Field Strength 26.5-40GHz



Vertical

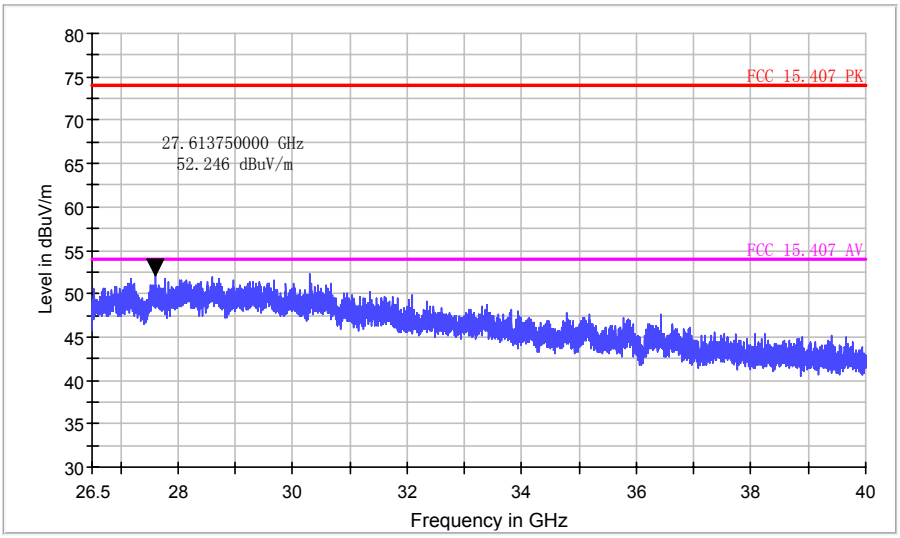
FCC Electric Field Strength 26.5-40GHz



High Channel (5825 MHz)-Above 1G

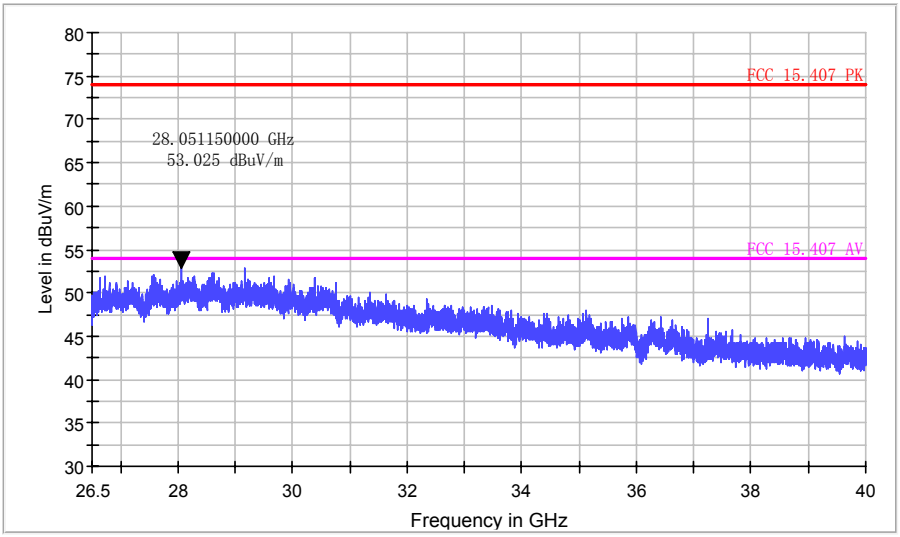
Horizontal

FCC Electric Field Strength 26.5-40GHz



Vertical

FCC Electric Field Strength 26.5-40GHz



4. POWER SPECTRAL DENSITY TEST

4.1 APPLIED PROCEDURES / LIMIT

According to FCC §15.407(a)(3)

For the band 5.15-5.25 GHz,

(i) For an outdoor access point operating in the band 5.15-5.25 GHz, 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).
(ii) For an indoor access point operating in the band 5.15-5.25 GHz, 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.

(iii) For fixed point-to-point access points operating in the band 5.15-5.25 GHz, the maximum power spectral density shall not exceed 17 dBm in any 1 megahertz band. Fixed point-to-point U-NII devices may employ antennas with directional gain up to 23 dBi without any corresponding reduction in the maximum conducted output power or maximum power spectral density. For fixed point-to-point transmitters that employ a directional antenna gain greater than 23 dBi, a 1 dB reduction in maximum conducted output power and maximum power spectral density is required for each 1 dB of antenna gain in excess of 23 dBi. Fixed, point-to-point operations exclude the use of point-to-multipoint systems, omnidirectional applications, and multiple collocated transmitters transmitting the same information. The operator of the U-NII device, or if the equipment is professionally installed, the installer, is responsible for ensuring that systems employing high gain directional antennas are used exclusively for fixed, point-to-point operations.

(iv) For client devices in the 5.15-5.25 GHz band, the maximum power spectral density shall not exceed 11 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.

For the band 5.725-5.85 GHz

(3)For the band 5.725-5.85 GHz, the maximum power spectral density shall not exceed 30 dBm in any 500-kHz 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.

,

4.2 TEST PROCEDURE

For devices operating in the bands 5.15-5.25 GHz, 5.25-5.35 GHz, and 5.47-5.725 GHz, the above procedures make use of 1 MHz RBW to satisfy directly the 1 MHz reference bandwidth specified in § 15.407(a)(5). For devices operating in the band 5.725-5.85 GHz, the rules specify a measurement bandwidth of 500 kHz. Many spectrum analyzers do not have 500 kHz RBW, thus a narrower RBW may need to be used. The rules permit the use of a RBWs less than 1 MHz, or 500 kHz, “provided that the measured power is integrated over the full reference bandwidth” to show the total power over the specified measurement bandwidth (i.e., 1 MHz, or 500 kHz). If measurements are performed using a reduced resolution bandwidth (< 1 MHz, or < 500 kHz) and integrated over 1 MHz, or 500 KHz bandwidth, the following adjustments to the procedures apply:

a) Set RBW ≥ 1/T, where T is defined in section II.B.I.a).

b) Set VBW ≥ 3 RBW.

c) If measurement bandwidth of Maximum PSD is specified in 500 kHz, add 10log(500kHz/RBW) to the measured result, whereas RBW (< 500 KHz) is the reduced resolution bandwidth of the spectrum analyzer set during measurement.

d) If measurement bandwidth of Maximum PSD is specified in 1 MHz, add 10log(1MHz/RBW) to the measured result, whereas RBW (< 1 MHz) is the reduced resolution bandwidth of spectrum analyzer set during measurement.

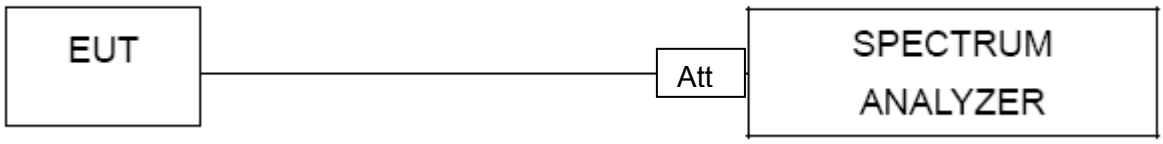
e) Care must be taken to ensure that the measurements are performed during a period of continuous transmission or are corrected upward for duty cycle.

Note: As a practical matter, it is recommended to use reduced RBW of 100 KHz for the sections 5.c) and 5.d) above, since RBW=100 KHZ is available on nearly all spectrum analyzers.

4.3 DEVIATION FROM STANDARD

No deviation.

4.4 TEST SETUP



4.5 EUT OPERATION CONDITIONS

The EUT tested system was configured as the statements of 2.1 Unless otherwise a special operating condition is specified in the follows during the testing.

4.6 TEST RESULTS

EUT：	PIQS Virtual Touch Projector	Model Name. ：	F1
Temperature：	25 ℃	Relative Humidity：	56%
Pressure：	1015 hPa	Test Voltage ：	DC 19V
Test Mode ：	TX Frequency Band I (5150-5250MHz)		

Note: A(B) Represent the value of antenna A and B, The worst data is Antenna B ,only shown Antenna B Plot.

EUT has two antennas, and different modes support different transmit mode what describe as Following form:

Mode	Tx/Rx
802.11a	1Tx, 2Rx
802.11n/ac	1Tx /2Tx, 2Rx

Mode	Frequency	Measured Power Density (dBm)		Total power density (dBm)	Calculate power density (dBm)(Note 1)		Limit (dBm)	Result
		ANT A	ANT B		ANT A	ANT B		
802.11 a	5185 MHz	3.56	3.20	-	3.56	3.20	11	PASS
	5200 MHz	1.20	3.95	-	1.20	3.95	11	PASS
	5240 MHz	1.22	4.07	-	1.22	4.07	11	PASS
802.11 n20	5185 MHz	1.45	3.97	5.90	5.90		11	PASS
	5200 MHz	1.72	4.67	6.45	6.45		11	PASS
	5240 MHz	1.12	4.35	6.04	6.04		11	PASS
802.11 n40	5190 MHz	-1.44	0.77	2.81	2.81		11	PASS
	5230 MHz	-1.68	1.15	2.97	2.97		11	PASS
802.11 ac20	5185 MHz	1.60	4.56	6.34	6.34		11	PASS
	5200 MHz	1.41	4.48	6.22	6.22		11	PASS
	5240 MHz	1.46	4.53	6.27	6.27		11	PASS
802.11 ac40	5190 MHz	1.03	1.47	4.27	4.27		11	PASS
	5230 MHz	-1.39	1.65	3.40	3.40		11	PASS
802.11 ac80	5210 MHz	-3.99	-0.16	1.34	1.34		11	PASS

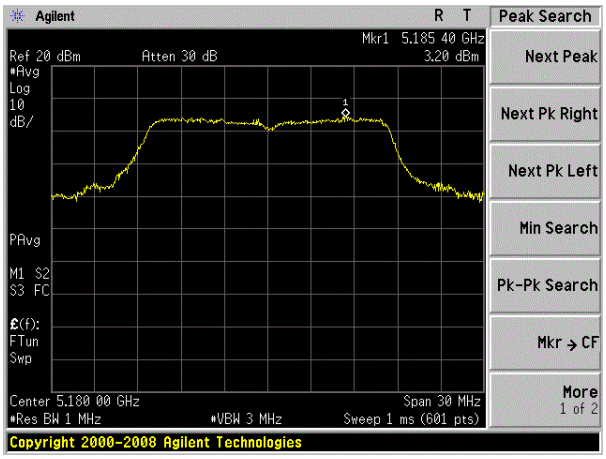
Note: 1.Calculate power density= Measured Power Density+10log(1MHz/RBW)

RBW=1MHz

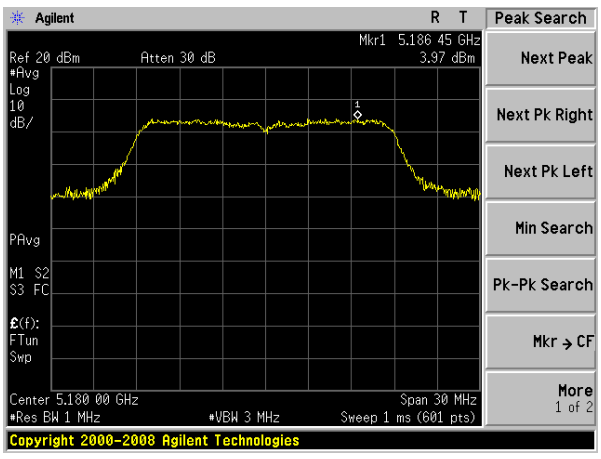
2. For 802.11n/ac 5GHz has MIMO mode.Directional gain=5.01dbi

5.01dbi＜6.0 dbi so power density limit= 11dBm/MHz

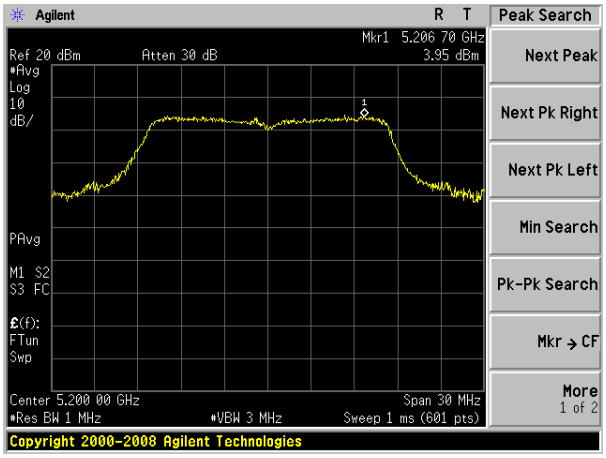
(802.11a) PSD plot on channel 36



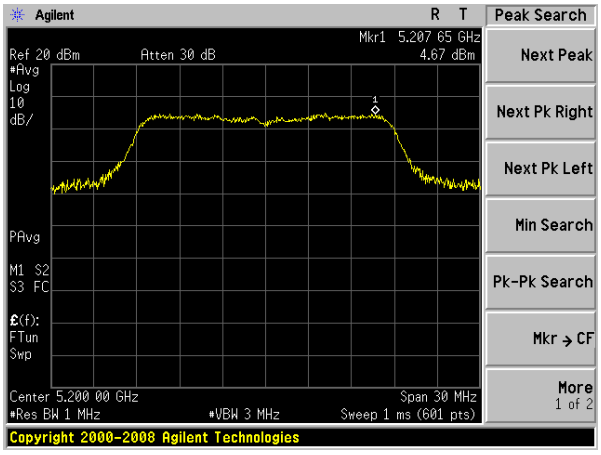
(802.11n20) PSD plot on channel 36



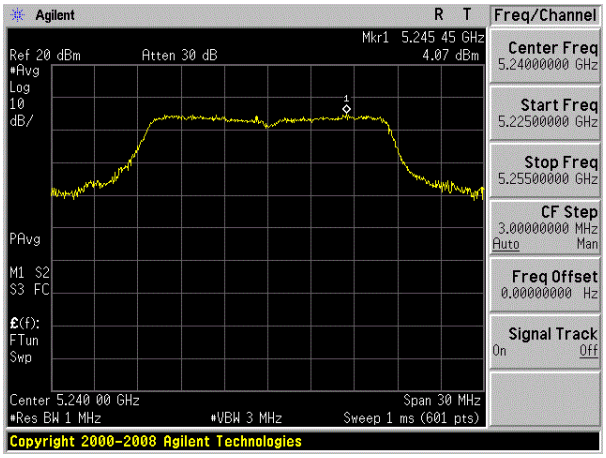
(802.11a) PSD plot on channel 40



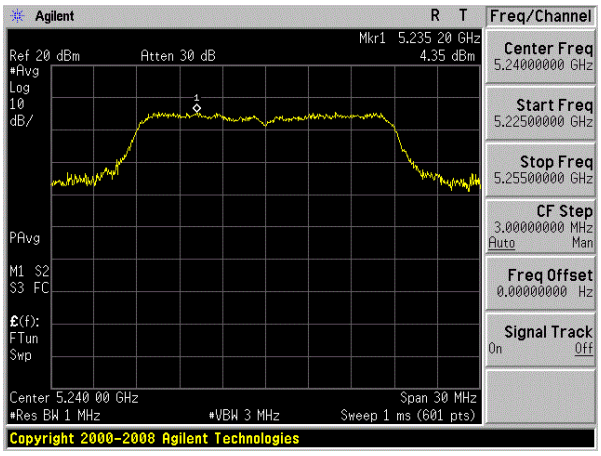
(802.11n20) PSD plot on channel 40



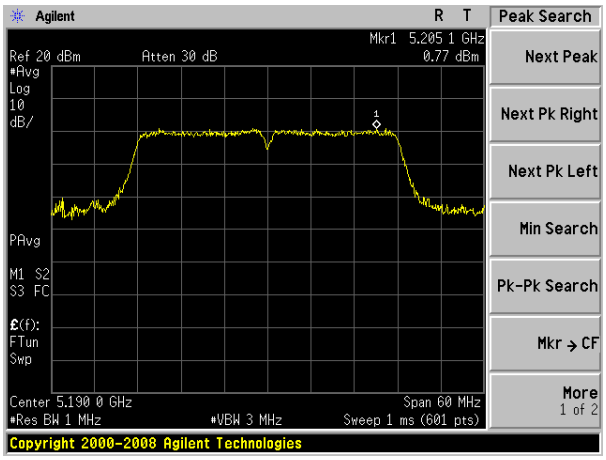
(802.11a) PSD plot on channel 48



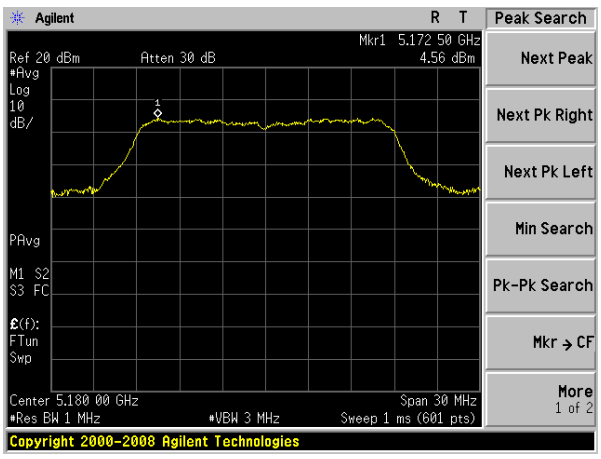
(802.11n20) PSD plot on channel 48



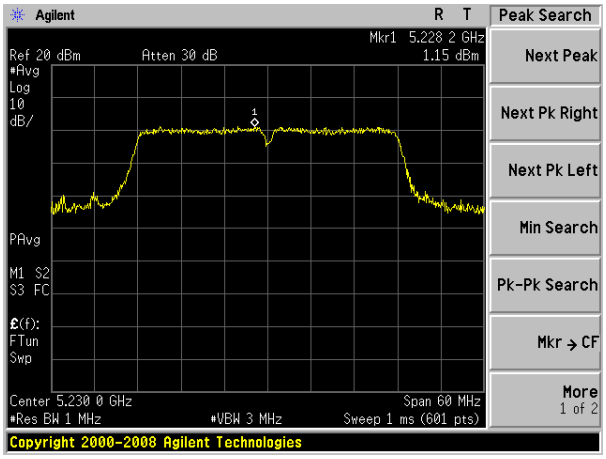
(802.11n40) PSD plot on channel 38



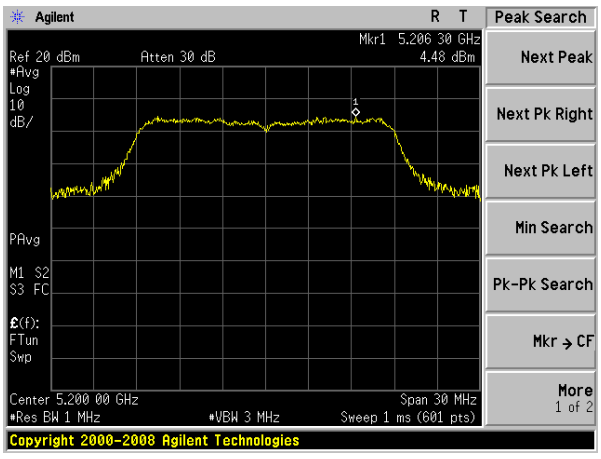
(802.11ac20) PSD plot on channel 36



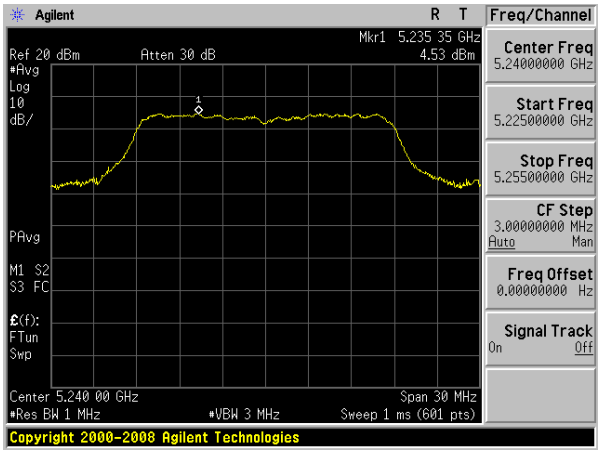
(802.11n40) PSD plot on channel 46



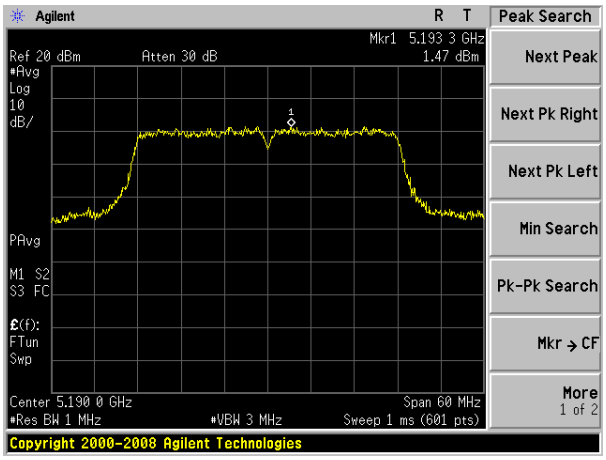
(802.11ac20) PSD plot on channel 40



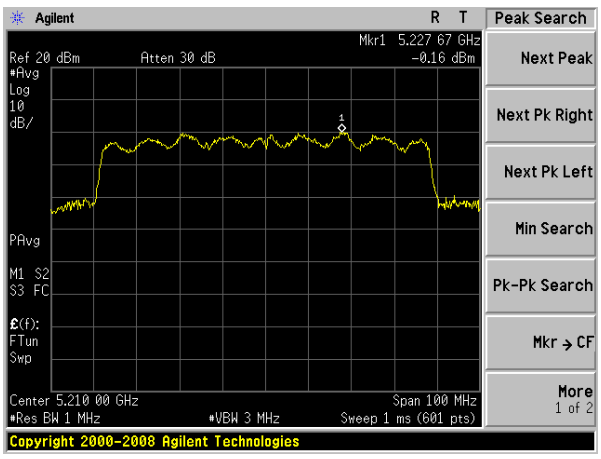
(802.11ac20) PSD plot on channel 48



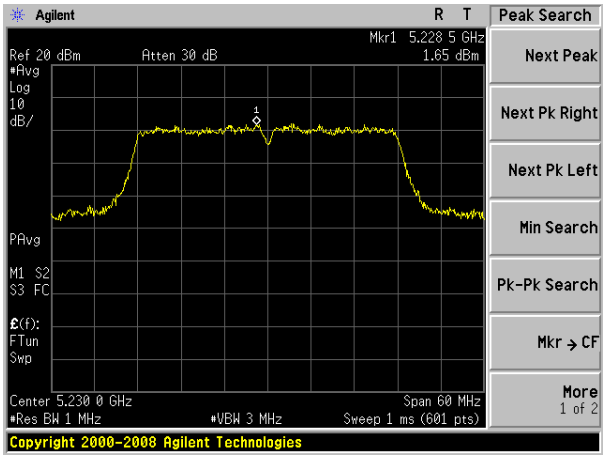
(802.11ac40) PSD plot on channel 38



(802.11ac80) PSD plot on channel 42



(802.11ac40) PSD plot on channel 46



EUT：	PIQS Virtual Touch Projector	Model Name. ：	F1
Temperature：	25 ℃	Relative Humidity：	56%
Pressure：	1015 hPa	Test Voltage ：	DC 19V
Test Mode ：	TX Frequency Band IV (5745-5825MHz)		

Note: A(B) Represent the value of antenna A and B, The worst data is Antenna A ,only shown Antenna A Plot.

EUT has two antennas, and different modes support different transmit mode what describe as Following form:

Mode	Tx/Rx
802.11a	1Tx, 2Rx
802.11n/ac	1Tx /2Tx, 2Rx

Mode	Frequency	Measured Power Density (dBm)		Total power density (dBm)	Calculate power density (dBm)(Note 1)		Limit (dBm)	Result
		ANT A	ANT B		ANT A	ANT B		
802.11 a	5745 MHz	1.779	1.745	-	1.779	1.745	30	PASS
	5785 MHz	1.545	1.680	-	1.545	1.680	30	PASS
	5825 MHz	1.325	1.352	-	1.325	1.352	30	PASS
802.11 n20	5745 MHz	-1.357	-1.233	1.716	1.716		30	PASS
	5785 MHz	-1.316	-1.378	1.663	1.663		30	PASS
	5825 MHz	-1.235	-1.230	1.778	1.778		30	PASS
802.11 n40	5755 MHz	-4.051	-3.537	-0.776	-0.776		30	PASS
	5795 MHz	-3.931	-3.833	-0.871	-0.871		30	PASS
802.11 ac20	5745 MHz	-1.482	-0.699	1.937	1.937		30	PASS
	5785 MHz	-1.264	-0.929	1.917	1.917		30	PASS
	5825 MHz	-1.455	-0.879	1.853	1.853		30	PASS
802.11 ac40	5755 MHz	-3.720	-3.586	-0.642	-0.642		30	PASS
	5795 MHz	-3.972	-3.778	-0.864	-0.864		30	PASS
802.11 ac80	5775 MHz	-7.058	-6.815	-3.925	-3.925		30	PASS

Note:

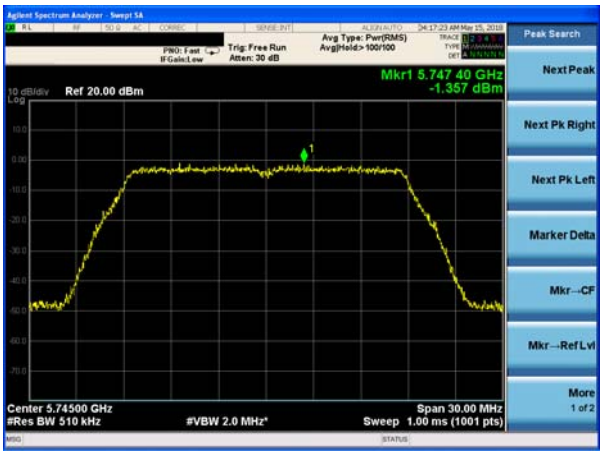
(1) Calculate power density= Measured Power Density+10log(500kHz/RBW)
RBW=0.51MHz

(2) For 802.11n/ac 5GHz has MIMO mode. Directional gain=5.01dbi

5.01 dbi＜6.0 dbi so power density limit= 30

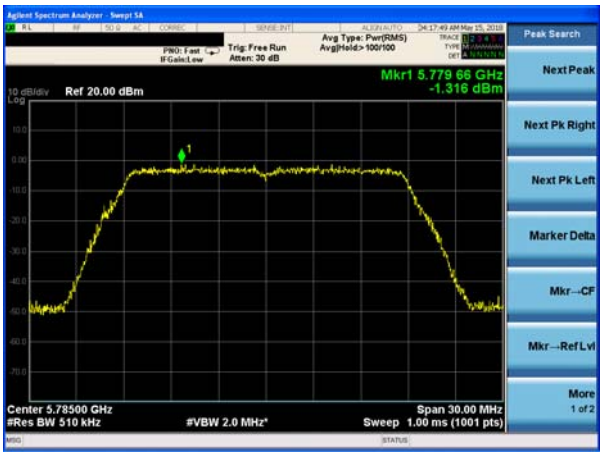
(802.11a) PSD plot on channel 149

(802.11n20) PSD plot on channel 149

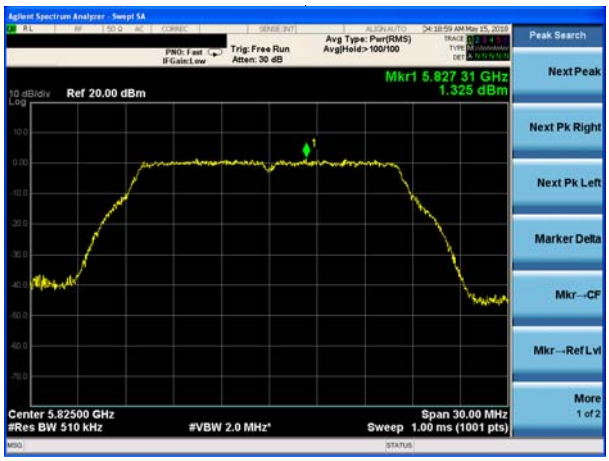


(802.11a) PSD plot on channel 157

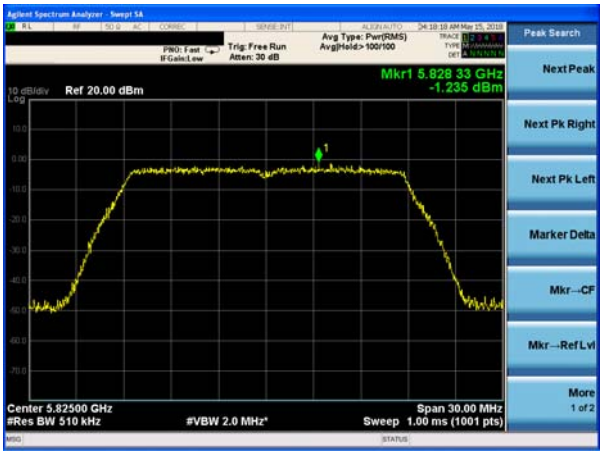
(802.11n20) PSD plot on channel 157



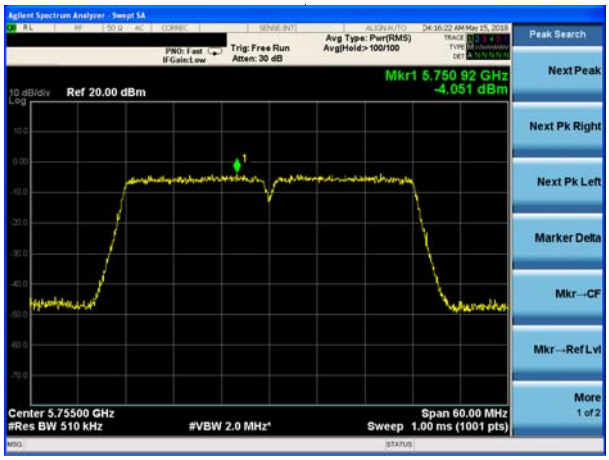
(802.11a) PSD plot on channel 165



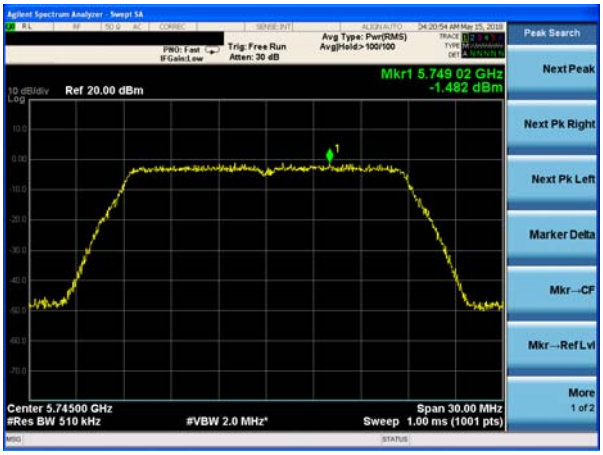
(802.11n20) PSD plot on channel 165



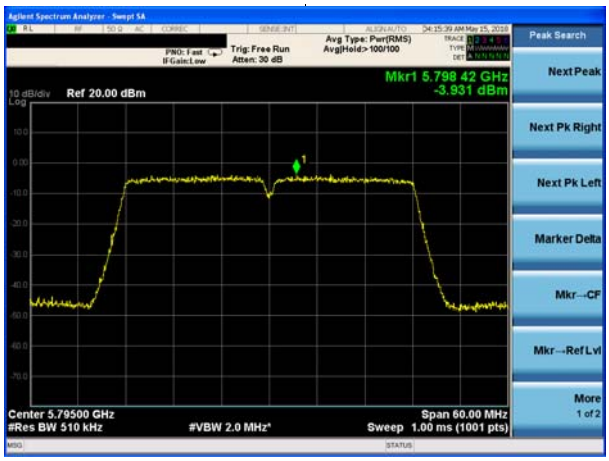
(802.11n40) PSD plot on channel 151



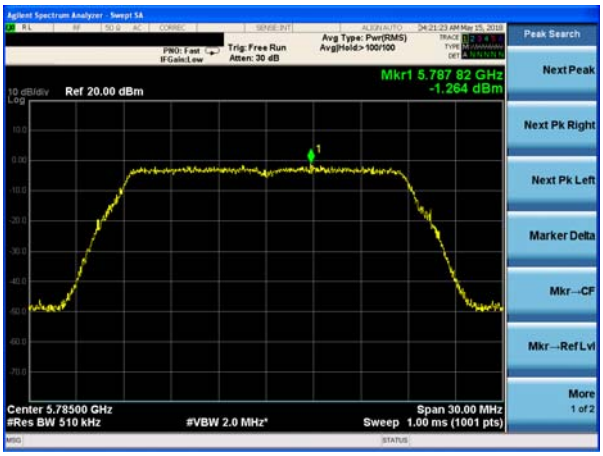
(802.11ac20) PSD plot on channel 149



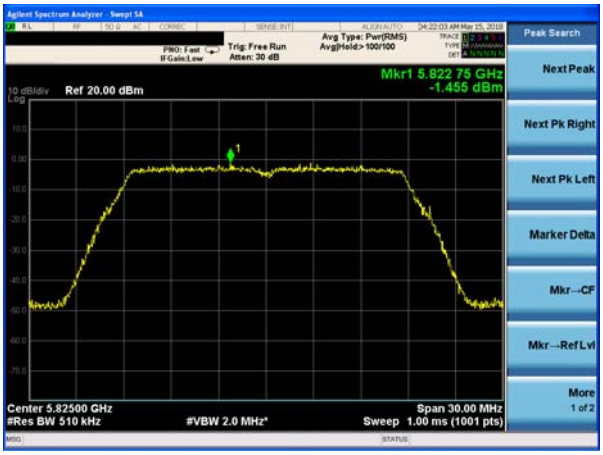
(802.11n40) PSD plot on channel 159



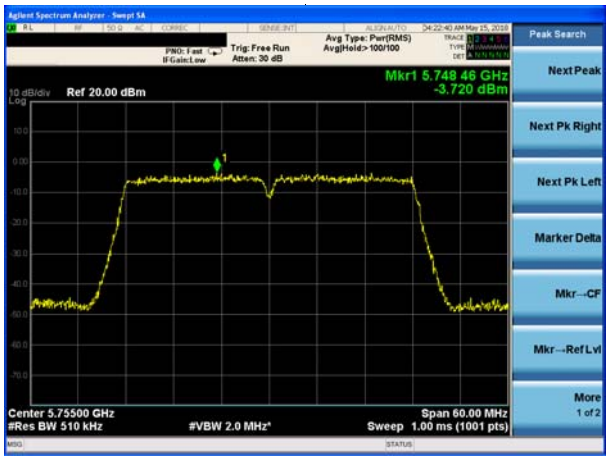
(802.11ac20) PSD plot on channel 157



(802.11ac20) PSD plot on channel 165

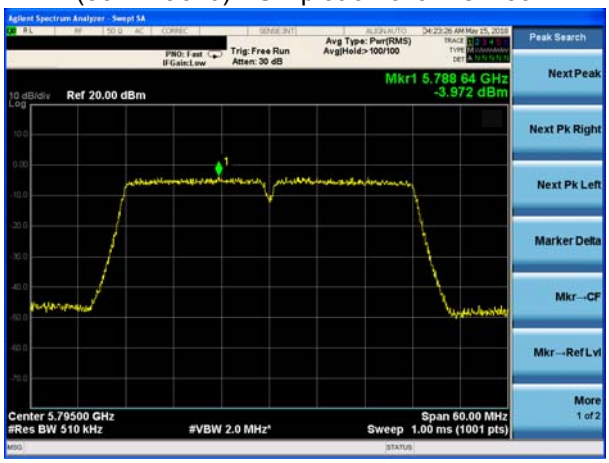


(802.11ac40) PSD plot on channel 151



(802.11ac80) PSD plot on channel 155

(802.11ac40) PSD plot on channel 159



5. 26DB & 99% EMISSION BANDWIDTH

5.1 APPLIED PROCEDURES / LIMIT

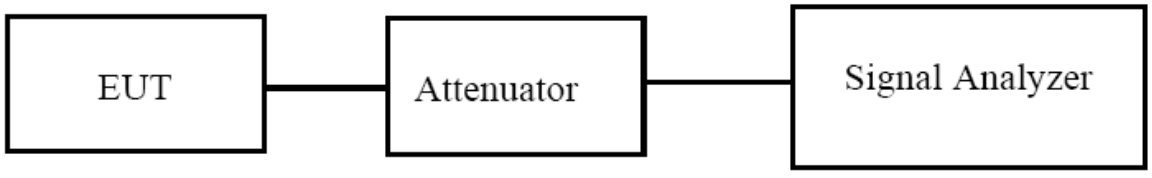
The maximum power spectral density is measured as a conducted emission by direct connection of a calibrated test instrument to the equipment under test. If the device cannot be connected directly, alternative techniques acceptable to the Commission may be used. Measurements in the 5.725-5.85 GHz band are made over a reference bandwidth of 500 kHz or the 26 dB emission bandwidth of the device, whichever is less. Measurements in the 5.15-5.25 GHz, 5.25-5.35 GHz, and the 5.47-5.725 GHz bands are made over a bandwidth of 1 MHz or the 26 dB emission bandwidth of the device, whichever is less. A narrower resolution bandwidth can be used, provided that the measured power is integrated over the full reference bandwidth.

5.2 TEST PROCEDURE

a) Set RBW = approximately 1% of the emission bandwidth.
b) Set the VBW > RBW.
c) Detector = Peak.
d) Trace mode = max hold.
e) Measure the maximum width of the emission that is 26 dB down from the maximum of the emission. Compare this with the RBW setting of the analyzer. Readjust RBW and repeat measurement as needed until the RBW/EBW ratio is approximately 1%.

The following procedure shall be used for measuring (99 %) power bandwidth:

1. Set center frequency to the nominal EUT channel center frequency.
2. Set span = 1.5 times to 5.0 times the OBW.
3. Set RBW = 1 % to 5 % of the OBW
4. Set VBW ≥ 3 · RBW
5. Video averaging is not permitted. Where practical, a sample detection and single sweep mode shall be used. Otherwise, peak detection and max hold mode (until the trace stabilizes) shall be used.
6. Use the 99 % power bandwidth function of the instrument (if available).
7. If the instrument does not have a 99 % power bandwidth function, the trace data points are recovered and directly summed in power units. The recovered amplitude data points, beginning at the lowest frequency, are placed in a running sum until 0.5 % of the total is reached; that frequency is recorded as the lower frequency. The process is repeated until 99.5 % of the total is reached; that frequency is recorded as the upper frequency. The 99% occupied bandwidth is the difference between these two frequencies.



5.3 EUT OPERATION CONDITIONS

The EUT tested system was configured as the statements of 2.4 Unless otherwise a special operating condition is specified in the follows during the testing.

5.4 TEST RESULTS

EUT：	PIQS Virtual Touch Projector	Model Name. ：	F1
Temperature：	25 ℃	Relative Humidity：	56%
Pressure：	1012 hPa	Test Voltage ：	DC 19V
Test Mode ：	TX Frequency Band I (5150-5250MHz)		

Note: A(B) Represent the value of antenna A and B, The worst data is Antenna B, only shown Antenna B Plot.

EUT has two antennas, and different modes support different transmit mode what describe as Following form:

Mode	Tx/Rx
802.11a	1Tx, 2Rx
802.11n/ac	1Tx /2Tx, 2Rx

Mode	Channel	Frequency (MHz)	99% bandwidth(MHz)	99% bandwidth(MHz)	26dB bandwidth (MHz)	26dB bandwidth (MHz)	Result
			Antenna A	Antenna B	Antenna A	Antenna B	
802.11a	CH36	5180	17.090	17.173	21.82	21.77	Pass
	CH40	5200	17.082	17.197	21.78	21.68	Pass
	CH48	5240	17.139	17.147	21.65	21.80	Pass
802.11 n20	CH36	5180	18.131	18.189	21.87	21.82	Pass
	CH40	5200	18.182	18.184	21.75	21.88	Pass
	CH48	5240	18.168	18.243	21.92	21.87	Pass
802.11 n40	CH 38	5190	36.465	36.515	40.36	40.20	Pass
	CH 46	5230	36.488	36.504	40.40	40.35	Pass
802.11 ac20	CH36	5180	18.153	18.200	21.66	21.97	Pass
	CH40	5200	18.113	18.162	21.94	21.86	Pass
	CH48	5240	18.177	18.196	21.93	21.79	Pass
802.11 ac40	CH 38	5190	36.434	36.579	40.41	40.27	Pass
	CH 46	5230	36.430	36.461	40.25	40.32	Pass
802.11 ac80	CH 42	5210	75.785	75.893	81.91	82.24	Pass

Test plot

(802.11a) -26dB&99%Bandwidth plot on channel 36

(802.11 n20) -26dB&99%Bandwidth plot on channel 36

(802.11a) -26dB&99%Bandwidth plot on channel 40

(802.11 n20) -26dB&99%Bandwidth plot on channel 40

(802.11a) -26dB&99%Bandwidth plot on channel 48

(802.11 n20) -26dB&99%Bandwidth plot on channel 48

Test plot

(802.11 n40) -26dB&99%Bandwidth plot on channel 38

(802.11 ac20) -26dB&99%Bandwidth plot on channel 36

(802.11 n40) -26dB&99%Bandwidth plot on channel 46

(802.11 ac20) -26dB&99%Bandwidth plot on channel 40

(802.11 ac20) -26dB&99%Bandwidth plot on channel 48

Test plot

(802.11 ac40) -26dB&99%Bandwidth plot on channel 38

(802.11 ac80) -26dB&99%Bandwidth plot on channel 42

(802.11 ac40) -26dB&99%Bandwidth plot on channel 46

EUT：	PIQS Virtual Touch Projector	Model Name. ：	F1
Temperature：	25 ℃	Relative Humidity：	56%
Pressure：	1012 hPa	Test Voltage ：	DC 19V
Test Mode ：	TX Frequency Band IV(5745-5850MHz)		

Note: A(B) Represent the value of antenna A and B, The worst data is Antenna B, only shown Antenna B Plot.

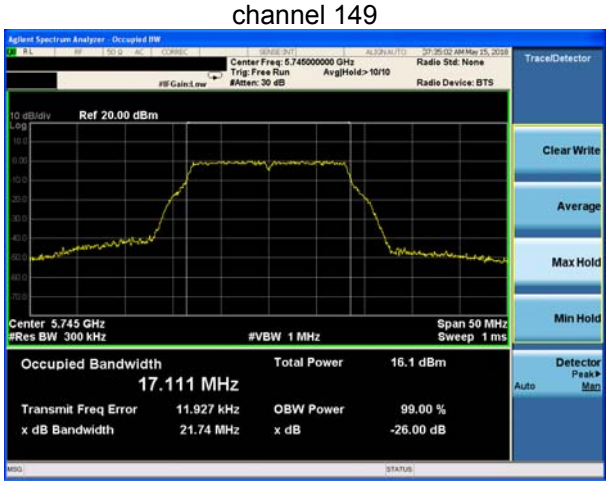
EUT has two antennas, and different modes support different transmit mode what describe as Following form:

Mode	Tx/Rx
802.11a	1Tx, 2Rx
802.11n/ac	1Tx /2Tx, 2Rx

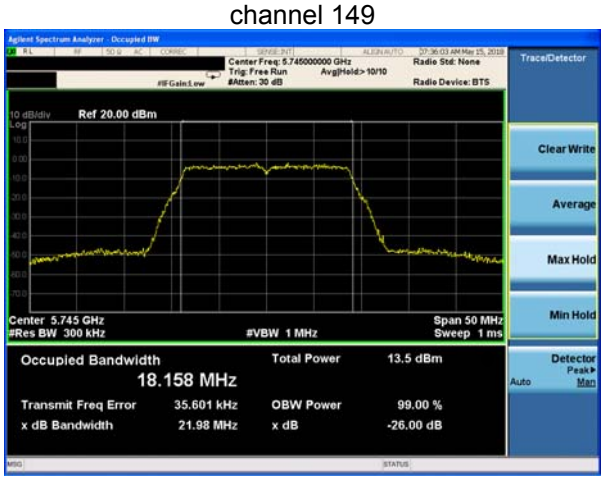
Mode	Channel	Frequency (MHz)	99% bandwidth(MHz)	99% bandwidth(MHz)	26dB bandwidth (MHz)	26dB bandwidth (MHz)	Result
			Antenna A	Antenna B	Antenna A	Antenna B	
802.11a	CH149	5745	17.108	17.111	21.64	21.74	Pass
	CH157	5785	17.071	17.110	21.73	21.76	Pass
	CH165	5825	17.107	17.135	21.69	21.65	Pass
802.11 n20	CH149	5745	18.169	18.158	22.14	21.98	Pass
	CH157	5785	18.175	18.168	21.90	21.91	Pass
	CH165	5825	18.132	18.181	21.83	21.82	Pass
802.11 n40	CH151	5755	36.463	36.494	40.22	40.44	Pass
	CH159	5795	36.486	36.519	40.50	40.41	Pass
802.11 ac20	CH149	5745	18.197	18.180	21.90	21.95	Pass
	CH157	5785	18.170	18.136	21.89	21.97	Pass
	CH165	5825	18.199	18.173	21.89	21.92	Pass
802.11 ac40	CH151	5755	36.472	36.467	40.42	40.18	Pass
	CH159	5795	36.532	36.463	40.46	40.23	Pass
802.11 ac80	CH155	5775	75.814	75.873	81.82	82.60	Pass

Test plot

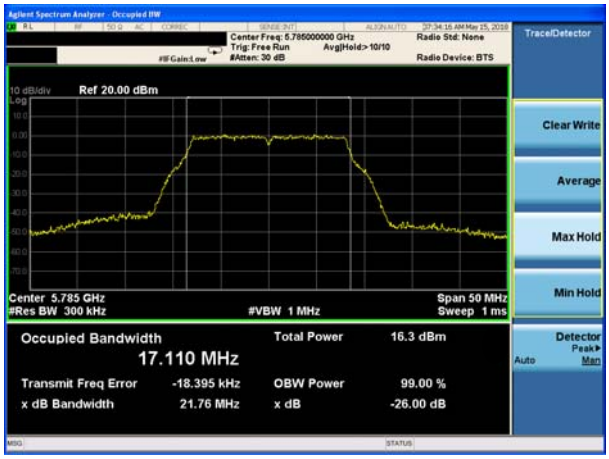
(802.11a) -26dB&99%Bandwidth plot on channel 149



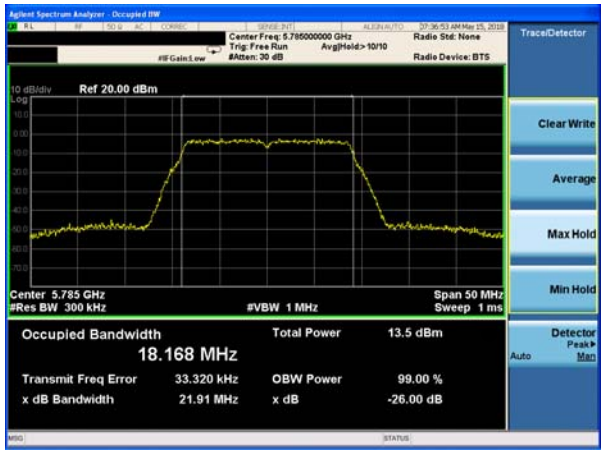
(802.11 n20) -26dB&99%Bandwidth plot on channel 149



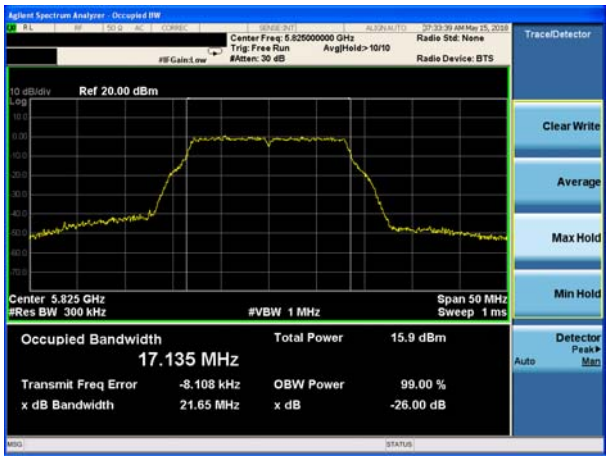
(802.11a) -26dB&99%Bandwidth plot on channel 157



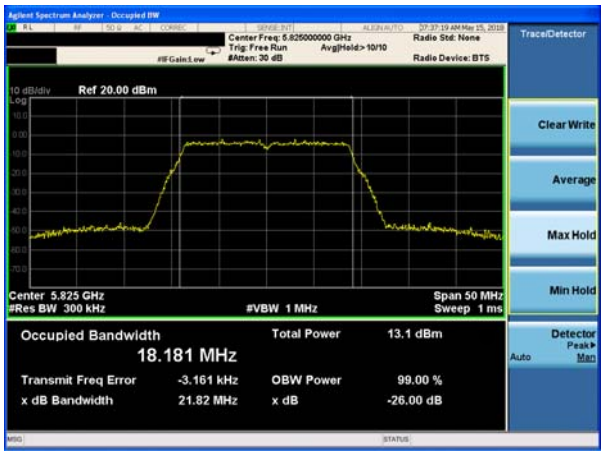
(802.11 n20) -26dB&99%Bandwidth plot on channel 157



(802.11a) -26dB&99%Bandwidth plot on channel 165

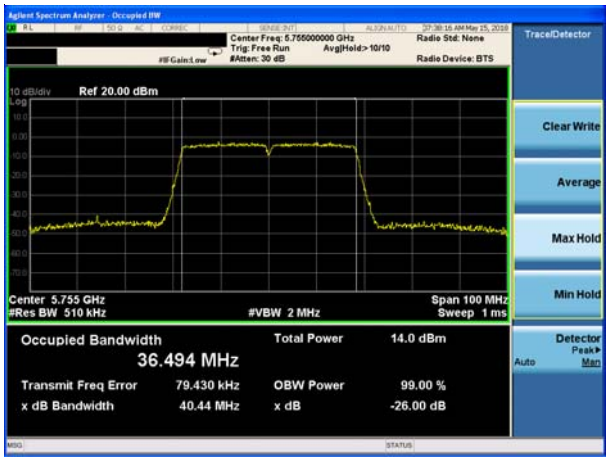


(802.11 n20) -26dB&99%Bandwidth plot on channel 165

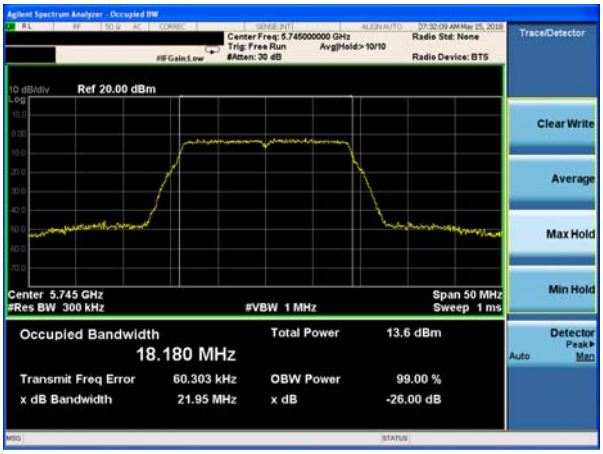


Test plot

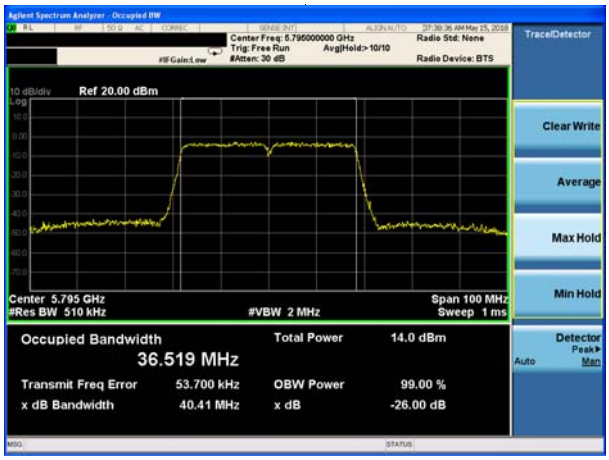
(802.11 n40) -26dB&99%Bandwidth plot on channel 151



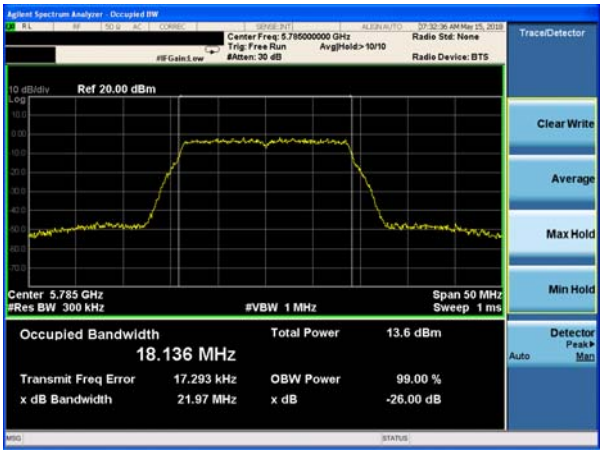
(802.11 ac20) -26dB&99%Bandwidth plot on channel 149



(802.11 n40) -26dB&99%Bandwidth plot on channel 159



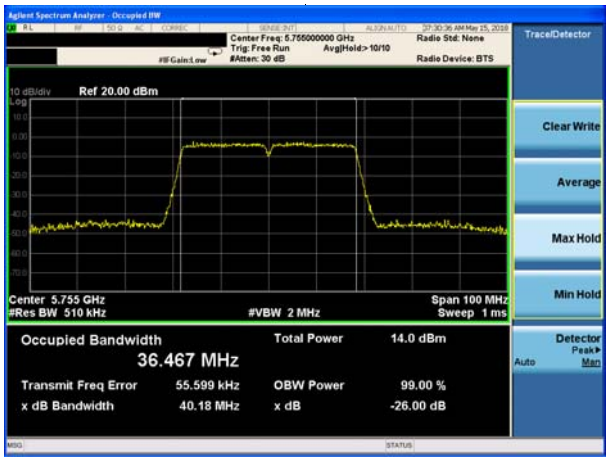
(802.11 ac20) -26dB&99%Bandwidth plot on channel 157



(802.11 ac20) -26dB&99%Bandwidth plot on channel 165

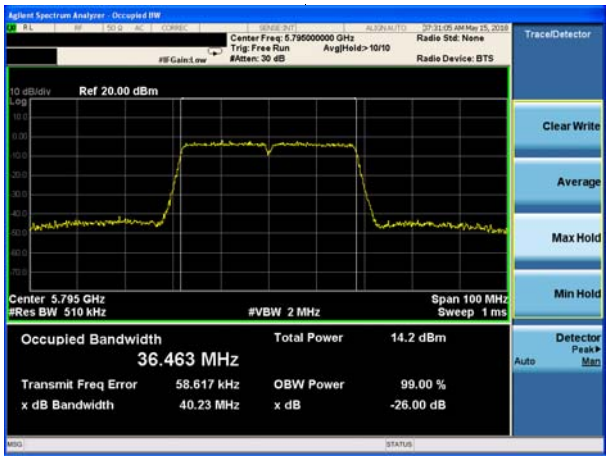
Test plot

(802.11 ac40) -26dB&99%Bandwidth plot on channel 151



(802.11 ac80) -26dB&99%Bandwidth plot on channel 155

(802.11 ac40) -26dB&99%Bandwidth plot on channel 159



6. MINIMUM 6 DB BANDWIDTH

6.1 APPLIED PROCEDURES / LIMIT

According to FCC §15.407(e)
(e) Within the 5.725-5.85 GHz band, the minimum 6 dB bandwidth of U-NII devices shall be at least 500 kHz.

6.2 TEST PROCEDURE

Section 15.407(e) specifies the minimum 6 dB emission bandwidth of at least 500 KHz for the band 5.715-5.85 GHz. The following procedure shall be used for measuring this bandwidth:

a) Set RBW = 100 kHz.

b) Set the video bandwidth (VBW) ≥ 3 × RBW.

c) Detector = Peak.

d) Trace mode = max hold.

e) Sweep = auto couple.

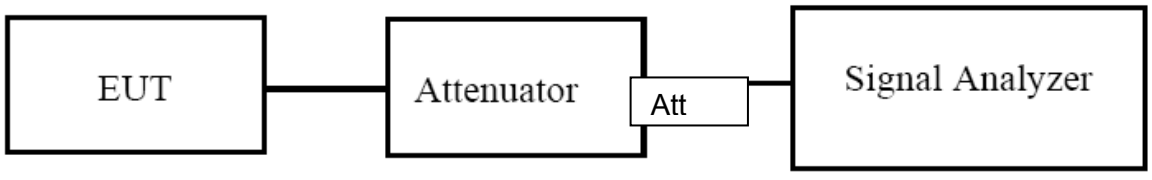
f) Allow the trace to stabilize.

g) Measure the maximum width of the emission that is constrained by the frequencies associated with the two outermost amplitude points (upper and lower frequencies) that are attenuated by 6 dB relative to the maximum level measured in the fundamental emission.

6.3 DEVIATION FROM STANDARD

No deviation.

6.4 TEST SETUP



6.5 EUT OPERATION CONDITIONS

The EUT tested system was configured as the statements of 2.4 Unless otherwise a special operating condition is specified in the follows during the testing.

6.6 TEST RESULTS

EUT：	PIQS Virtual Touch Projector	Model Name. ：	F1
Temperature：	25 ℃	Relative Humidity：	56%
Pressure：	1012 hPa	Test Voltage ：	DC 19V
Test Mode ：	TX Frequency Band I (5150-5250MHz)		

Note: A(B) Represent the value of antenna A and B, The worst data is Antenna B, only shown Antenna B Plot.

EUT has two antennas, and different modes support different transmit mode what describe as Following form:

Mode	Tx/Rx
802.11a	1Tx, 2Rx
802.11n/ac	1Tx /2Tx, 2Rx

Mode	Channel	Frequency (MHz)	6dB bandwidth (MHz)	6dB bandwidth (MHz)	Limit (KHz)	Result
			Antenna A	Antenna B		
802.11a	CH36	5180	16.38	16.40	≧500	Pass
	CH40	5200	16.42	16.40	≧500	Pass
	CH48	5240	16.39	16.39	≧500	Pass
802.11 n20	CH36	5180	17.64	17.62	≧500	Pass
	CH40	5200	17.65	17.63	≧500	Pass
	CH48	5240	17.64	17.60	≧500	Pass
802.11 n40	CH 38	5190	36.44	36.42	≧500	Pass
	CH 46	5230	36.42	36.41	≧500	Pass
802.11 ac20	CH36	5180	17.66	17.63	≧500	Pass
	CH40	5200	17.63	17.62	≧500	Pass
	CH48	5240	17.63	17.61	≧500	Pass
802.11 ac40	CH 38	5190	36.42	36.43	≧500	Pass
	CH 46	5230	36.42	36.43	≧500	Pass
802.11 ac80	CH 42	5210	75.78	75.65	≧500	Pass

Test plot

(802.11a) 6dB Bandwidth plot on channel 36

(802.11 n20) 6dB Bandwidth plot on channel 36

(802.11a) 6dB Bandwidth plot on channel 40

(802.11 n20) 6dB Bandwidth plot on channel 40

(802.11a) 6dB Bandwidth plot on channel 48

(802.11 n20) 6dB Bandwidth plot on channel 48