



FCC RADIO TEST REPORT

FCC ID:YVV-AEEF5000001

Product : Unmanned Aircraft Systems (Unmanned Aircraft)

Trade Name : AEE

Model Name : F50

Serial Model : F51,F52,F53,F55,F56,F57,F58,F59

Report No. : NTEK-2014NT0911373F

Prepared for

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TEST RESULT CERTIFICATION

Applicant's name : SHENZHEN AEE TECHNOLOGY CO., LTD.
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Manufacture's Name : SHENZHEN AEE TECHNOLOGY CO., LTD.
Address : AEE Hi-Tech Park, Tangtou Crossroads, Shiyan Town, Bao'an District, Shenzhen, China 518000

Product description

Product name : Unmanned Aircraft Systems (Unmanned Aircraft)
Model and/or type reference : F50
Serial Model : F51, F52, F53, F55, F56, F57, F58, F59
Rating(s) : DC 14.8V

Standards : FCC Part15.249: 01 Oct. 2013

Test procedure ANSI C63.4-2003

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. And it is applicable only to the tested sample identified in the report.

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Date of Test

Date (s) of performance of tests : 11 Sep. 2014 ~18 Oct. 2014

Date of Issue : 18 Oct. 2014

Test Result : **Pass**

Testing Engineer : Kyle Xu
(Kyle Xu)

Technical Manager : Brown Lu
(Brown Lu)

Authorized Signatory : Bill Yao
(Bill Yao)

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1. SUMMARY OF TEST RESULTS

Test procedures according to the technical standards:

FCC Part15, Subpart C (15.249)			
Standard Section	Test Item	Judgment	Remark
15.207	Conducted Emission	N/A	
15.203	Antenna Requirement	Pass	
15.249	Radiated Spurious Emission	Pass	
15.205	Band Edge Emission	Pass	
15.249	Occupied Bandwidth	Pass	

1.1 TEST FACILITY

NTEK Testing Technology Co., Ltd

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

FCC FRN Registration No.:238937; IC Registration No.:9270A-1

CNAS Registration No.:L5516

1.2 MEASUREMENT UNCERTAINTY

The reported uncertainty of measurement $y \pm U$, where expanded 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	$\pm 1.38\text{dB}$
2	RF power,conducted	$\pm 0.16\text{dB}$
3	Spurious emissions,conducted	$\pm 0.21\text{dB}$
4	All emissions,radiated(<1G)	$\pm 4.68\text{dB}$
5	All emissions,radiated(>1G)	$\pm 4.89\text{dB}$
6	Temperature	$\pm 0.5^{\circ}\text{C}$
7	Humidity	$\pm 2\%$

2. GENERAL INFORMATION

2.1 GENERAL DESCRIPTION OF EUT

Equipment	Unmanned Aircraft Systems (Unmanned Aircraft)	
Trade Name	AEE	
Model Name	F50	
Serial Model	F51,F52,F53,F55,F56,F57,F58,F59	
Model Difference	All the model are the same circuit and RF module, except the model name and colour.	
Product Description	The EUT is a Unmanned Aircraft Systems (Unmanned Aircraft)	
	Operation Frequency:	2468MHz
	Modulation Type:	COFDN
	Antenna Designation:	Integration Antenna
	Antenna Gain(Peak)	4.0 dBi
	Based on the application, features, or specification exhibited in User's Manual, the EUT is considered as an ITE/Computing Device. More details of EUT technical specification, please refer to the User's Manual.	
Channel List	Please refer to the Note 2.	
Adapter	N/A	
Battery	14.8V,6000mAh	

Note:

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

2.

Channel	Frequency (MHz)
01	2468

3.

Table for Filed Antenna

Ant .	Brand	Model Name	Antenna Type	Connector	Gain (dBi)	NOTE
1	N/A	N/A	Integration	NA	4.0	Antenna

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	TX

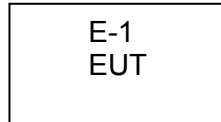
For Conducted Emission	
Final Test Mode	Description
N/A	N/A

For Radiated Emission	
Final Test Mode	Description
Mode 1	TX

Note:

- (1) The measurements are performed at the highest, middle, lowest available channels.
- (2) The EUT use new battery.

2.3 BLOCK DIGRAM SHOWING THE CONFIGURATION OF SYSTEM TESTED



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	Mfr/Brand	Model/Type No.	Series No.	Note
E-1	Unmanned Aircraft Systems (Unmanned Aircraft)	AEE	F50	N/A	EUT

Item	Shielded Type	Ferrite Core	Length	Note

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 Test equipment**

Item	Kind of Equipment	Manufacturer	Type No.	Serial No.	Calibrated until
1	Spectrum Analyzer	Agilent	E4407B	160400005	Jul. 06. 2015
2	Test Receiver	R&S	ESPI	101318	Jul. 06. 2015
3	Bilog Antenna	TESEQ	CBL6111D	31216	Jul. 06. 2015
4	50Ω Coaxial Switch	Anritsu	MP59B	6200264416	Jul. 06. 2015
5	Spectrum Analyzer	ADVANTEST	R3132	150900201	Jul. 06. 2015
6	Horn Antenna	EM	EM-AH-10180	2011071402	Jul. 06. 2015
7	Horn Ant	Schwarzbeck	BBHA 9170	9170-181	Jul. 06. 2015
8	Amplifier	EM	EM-30180	060538	Jul. 06. 2015
9	Loop Antenna	ARA	PLA-1030/B	1029	Jul. 06. 2015
10	Power Meter	R&S	NRVS	100696	Jul. 06. 2015

Conduction Test equipment

Item	Kind of Equipment	Manufacturer	Type No.	Serial No.	Calibrated until
1	Test Receiver	R&S	ESCI	101160	Jul. 06. 2015
2	LISN	R&S	ENV216	101313	Jul. 06. 2015
3	LISN	EMCO	3816/2	00042990	Jul. 06. 2015
4	50Ω Coaxial Switch	Anritsu	MP59B	6200264417	Jul. 06. 2015
5	Passive Voltage Probe	R&S	ESH2-Z3	100196	Jul. 06. 2015
6	Absorbing clamp	R&S	MOS-21	100423	Jul. 06. 2015

3. ANTENNA REQUIREMENT

3.1 STANDARD REQUIREMENT

15.203 requirement: For intentional device, according to 15.203: an intentional radiator shall be designed to ensure that no antenna other than that furnished by the responsible party shall be used with the device.

3.2 EUT ANTENNA

The EUT antenna is Integration Antenna. It comply with the standard requirement.

3.3 CONDUCTED EMISSION MEASUREMENT

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

FREQUENCY (MHz)	Class A (dBuV)		Class B (dBuV)		Standard
	Quasi-peak	Average	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 *	LP002.
0.50 -5.0			56.00	46.00	LP002.
5.0 -30.0			60.00	50.00	LP002.

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

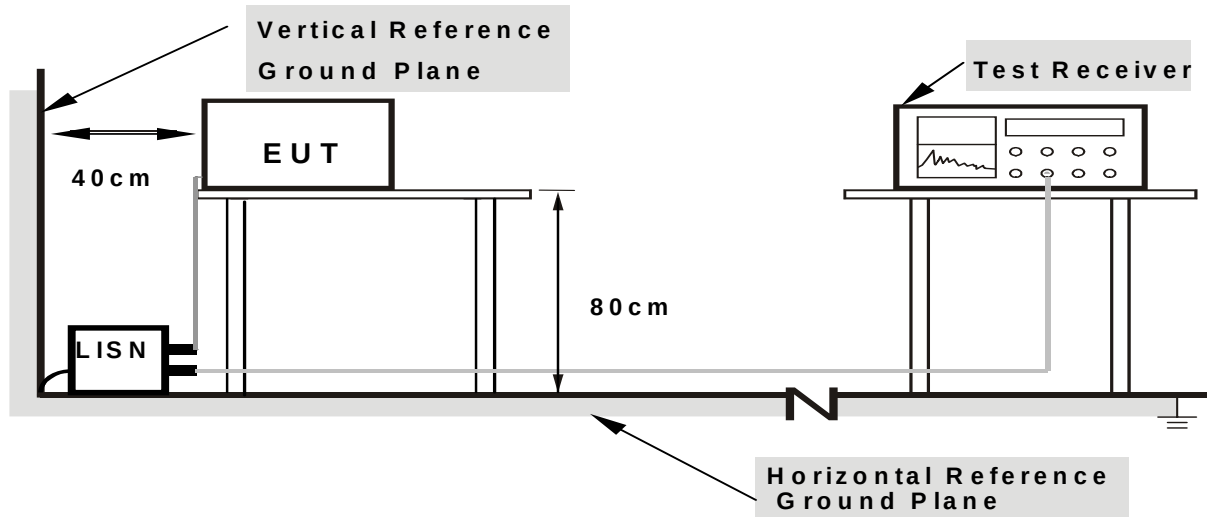
3.3.2 TEST PROCEDURE

- The EUT was placed 0.4 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.
- 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.
- 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.
- LISN at least 80 cm from nearest part of EUT chassis.
- For the actual test configuration, please refer to the related Item –EUT Test Photos.

3.3.3 DEVIATION FROM TEST STANDARD

No deviation

3.3.4 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

3.2.5 TEST RESULT

EUT :	Unmanned Aircraft Systems (Ground Control Station)	Model Name. :	D01
Temperature :	26 °C	Relative Humidity :	54%
Pressure :	1010hPa	Phase :	N/A
Test Voltage :	N/A	Test Mode :	N/A

3.4 RADIATED EMISSION MEASUREMENT

3.4.1 Radiated Emission Limits (FCC 15.209)

Frequencies (MHz)	Field Strength (micorvolts/meter)	Measurement Distance (meters)
0.009~0.490	2400/F(KHz)	300
0.490~1.705	24000/F(KHz)	30
1.705~30.0	30	30
Frequency (MHz)	Limit (dBuV)	
30~88	40	3
88~216	43.5	3
216~960	46	3
960 -10000	54.00	3

Note:

- (1) The tighter limit applies at the band edges.
- (2) Emission level (dBuV/m)=20log Emission level (uV/m).
- (3) *Note: This is the limit for the fundamental frequency.

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

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

3.4.2 TEST PROCEDURE

- 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 meters above the ground at a 3m meter open area test site. 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; the height of the test antenna shall vary between 1 m to 4 m.
- 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:

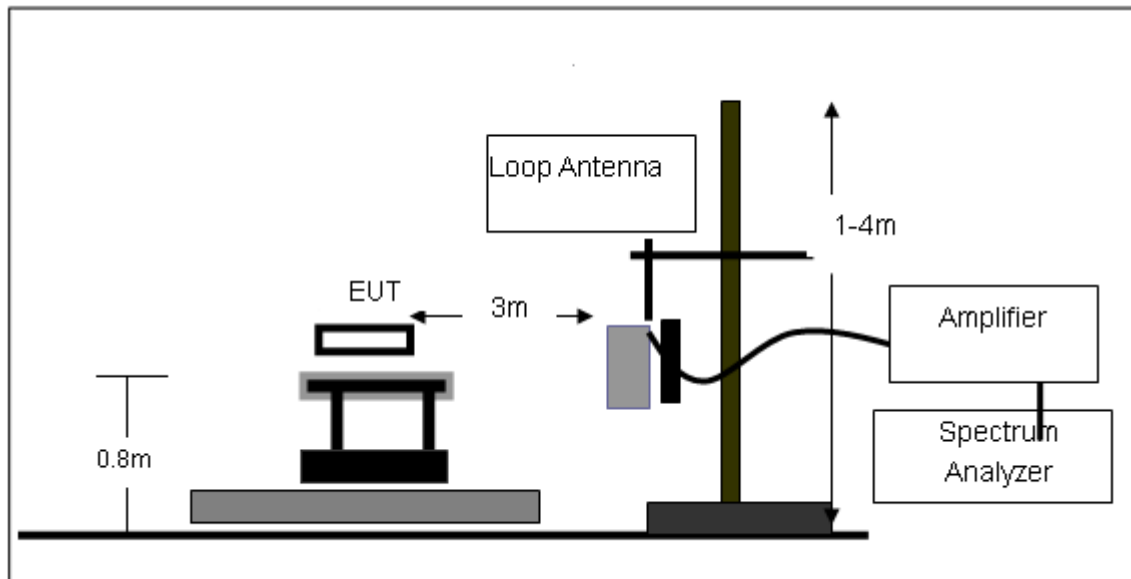
Frequency Band (MHz)	Function	Resolution bandwidth	Video Bandwidth
30 to 1000	QP	120 kHz	300 kHz
Above 1000	Peak	1 MHz	1 MHz
	Peak	1 MHz	10 Hz

3.4.3 DEVIATION FROM TEST STANDARD

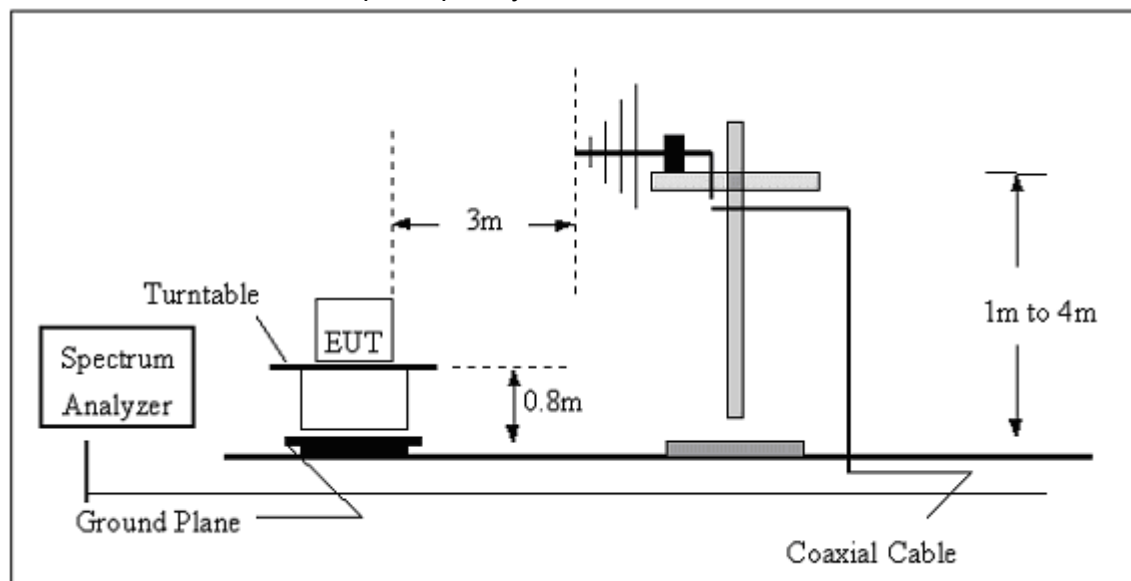
No deviation

3.4.4 TEST SETUP

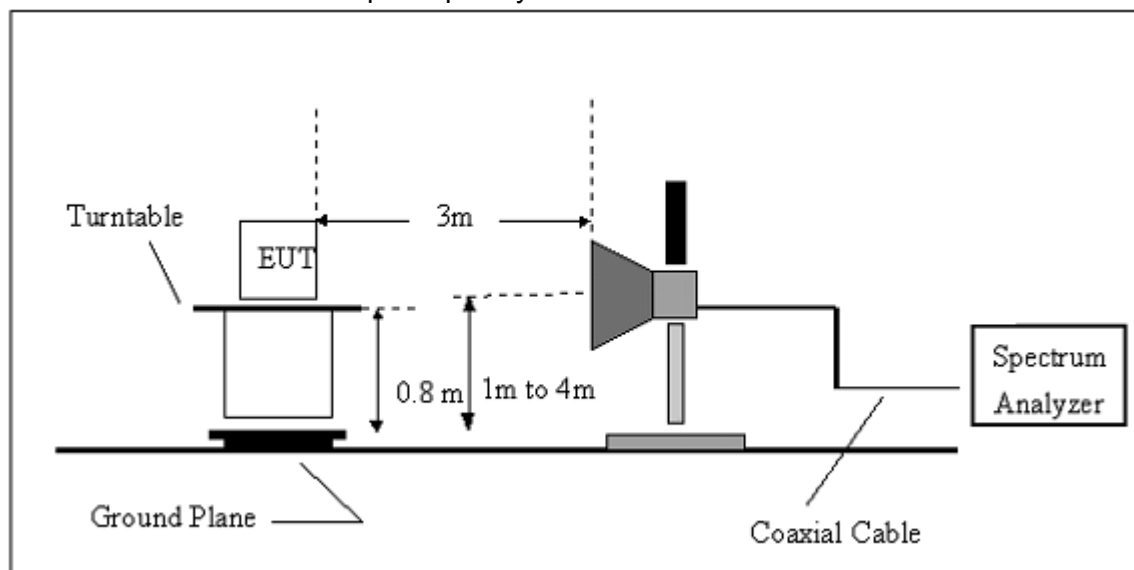
(A) Radiated Emission Test-Up Frequency Below 30MHz



(B) Radiated Emission Test-Up Frequency 30MHz~1GHz



(C) Radiated Emission Test-Up Frequency Above 1GHz



3.4.5 TEST RESULTS (BLOW 30MHz)

EUT :	Unmanned Aircraft Systems (Unmanned Aircraft)	Model Name. :	F50
Temperature :	20 °C	Relative Humidity :	48%
Pressure :	1010 hPa	Test Voltage :	DC 14.8V
Test Mode :	TX	Polarization :	--

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

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 = $20 \log (\text{specific distance/test distance})(\text{dB})$;

Limit line = specific limits(dBuv) + distance extrapolation factor.

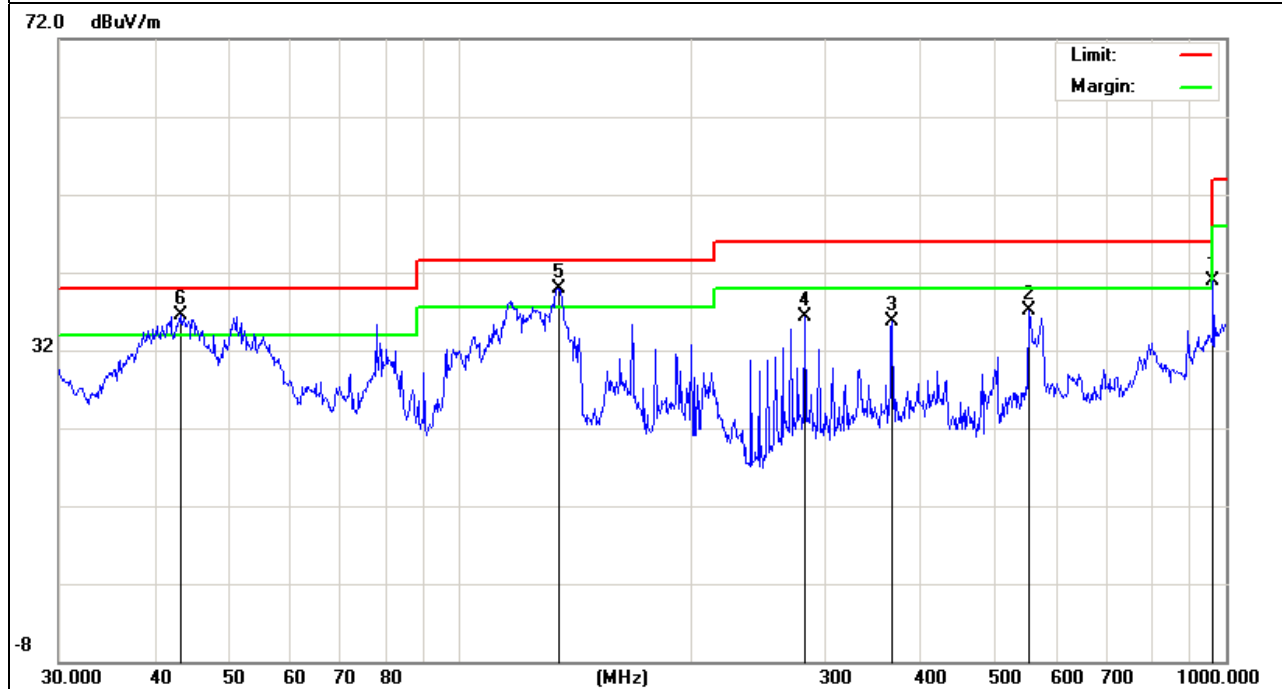
3.4.6 TEST RESULTS (BETWEEN 30 – 1000 MHZ)

EUT :	Unmanned Aircraft Systems (Unmanned Aircraft)	Model Name :	F50
Temperature :	20 °C	Relative Humidity :	48%
Pressure :	1010 hPa	Test Voltage :	DC 14.8V
Test Mode :	TX 2468MHz	Polarization :	Vertical

Frequency (MHz)	Meter Reading (dBμV)	Factor (dB)	Emission Level (dBμV/m)	Limits (dBμV/m)	Margin (dB)	Remark
962.1621	14.01	26.95	40.96	54.00	-13.04	QP
552.8831	17.23	19.94	37.17	46.00	-8.83	QP
366.8231	19.36	16.25	35.61	46.00	-10.39	QP
281.9945	22.32	13.91	36.23	46.00	-9.77	QP
134.5592	28.43	11.47	39.90	43.50	-3.60	QP
43.2017	24.10	12.33	36.43	40.00	-3.57	QP

Remark:

1. Factor = Antenna Factor + Cable Loss – Pre-amplifier.

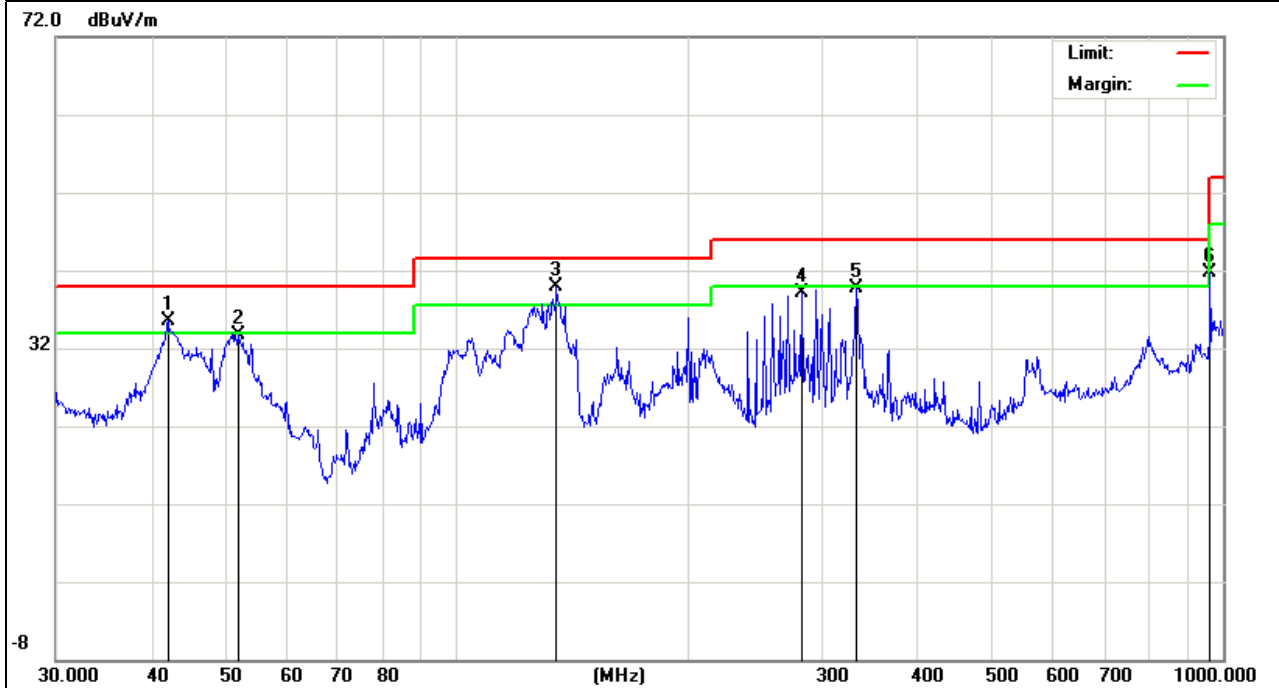


EUT :	Unmanned Aircraft Systems (Unmanned Aircraft)	Model Name :	F50
Temperature :	20 °C	Relative Humidity :	48%
Pressure :	1010 hPa	Test Voltage :	DC 14.8V
Test Mode :	TX 2468MHz	Polarization :	Horizontal

Frequency (MHz)	Meter Reading (dBμV)	Factor (dB)	Emission Level (dBμV/m)	Limits (dBμV/m)	Margin (dB)	Remark
42.0066	22.38	13.03	35.41	40.00	-4.59	QP
51.8430	25.38	8.41	33.79	40.00	-6.21	QP
135.0319	28.43	11.45	39.88	43.50	-3.62	QP
281.9946	25.26	13.91	39.17	46.00	-6.83	QP
332.5187	24.00	15.69	39.69	46.00	-6.31	QP
962.1621	14.76	26.95	41.71	54.00	-12.29	QP

Remark:

1. Factor = Antenna Factor + Cable Loss – Pre-amplifier.



3.4.7 TEST RESULTS (ABOVE 1000 MHZ)

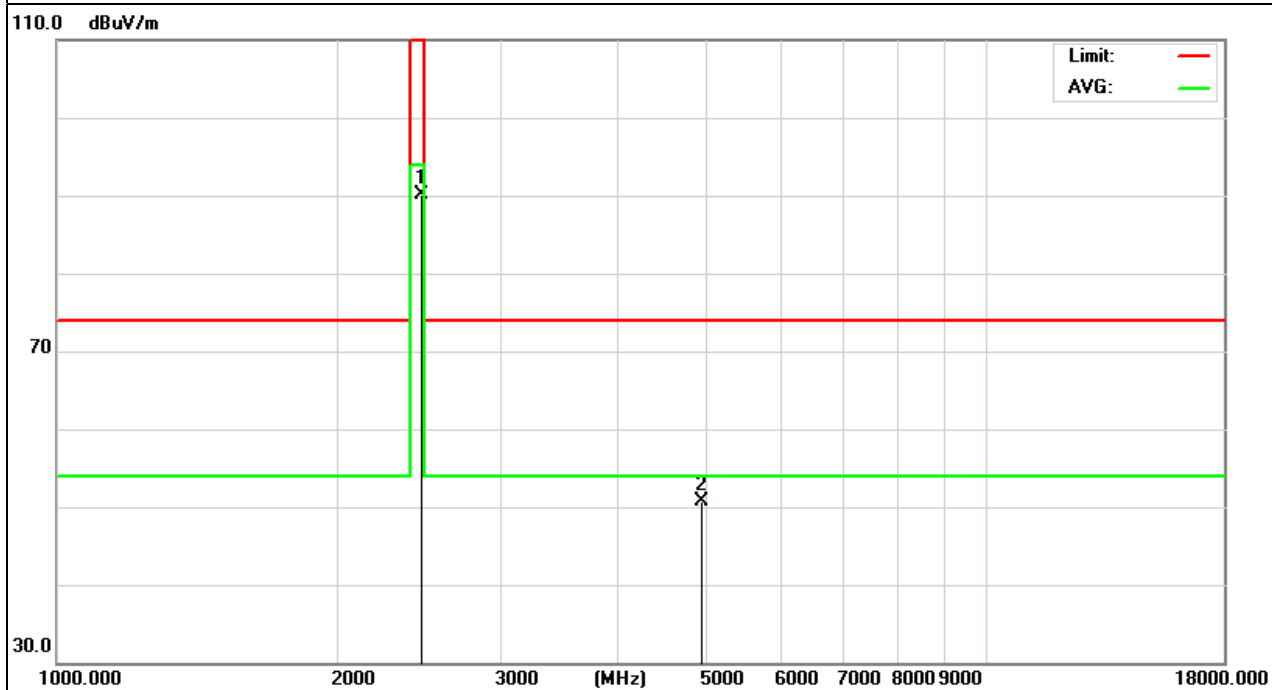
EUT :	Unmanned Aircraft Systems (Unmanned Aircraft)	Model Name :	F50
Temperature :	20 °C	Relative Humidity :	48%
Pressure :	1010 hPa	Test Voltage :	DC 14.8V
Test Mode :	TX 2468MHz	Polarization :	Horizontal

Frequency (MHz)	Meter Reading (dBμV)	Factor (dB)	Emission Level (dBμV/m)	Limits (dBμV/m)	Margin (dB)	Remark
2468.367	101.58	-11.54	90.04	114	-23.96	peak
4936.126	55.03	-3.67	51.36	74	-22.64	peak
2468.367	87.46	-12.93	74.53	94	-19.47	Av
4936.126	42.31	-3.65	38.66	54	-15.34	Av

Remark:

Factor = Antenna Factor + Cable Loss – Pre-amplifier.

No emission above 18GHz.



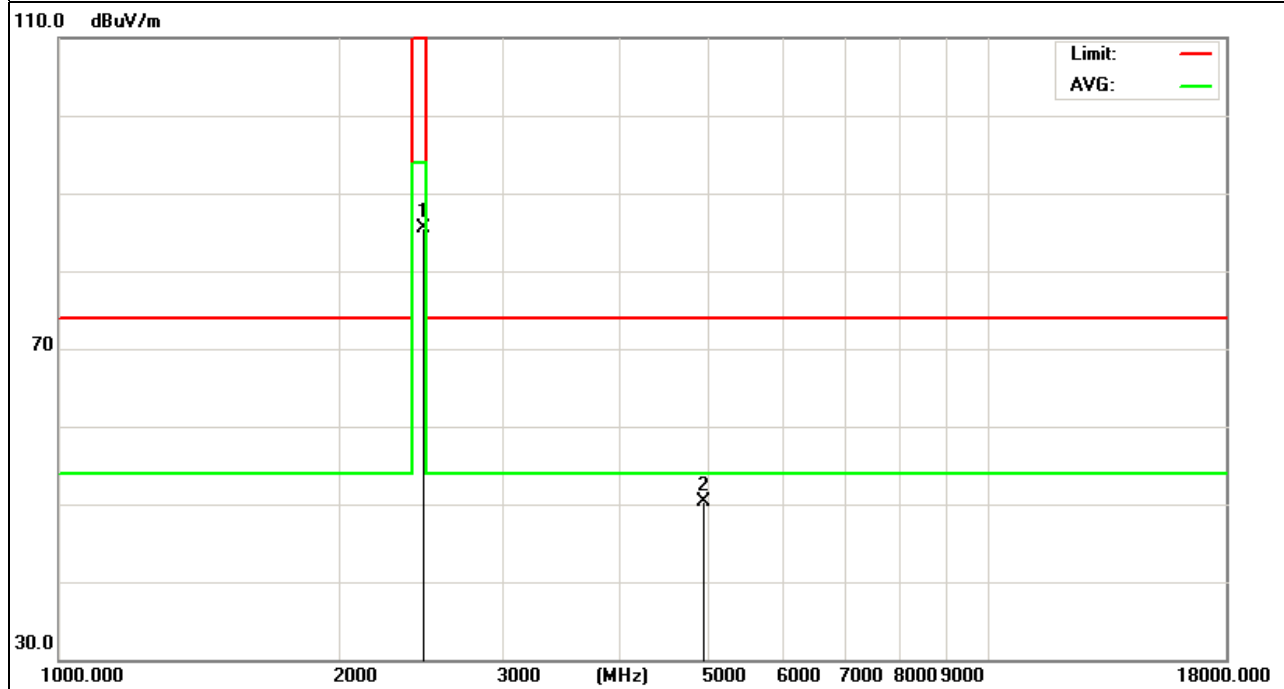
EUT :	Unmanned Aircraft Systems (Unmanned Aircraft)	Model Name :	F50
Temperature :	20 °C	Relative Humidity :	48%
Pressure :	1010 hPa	Test Voltage :	DC 14.8V
Test Mode :	TX 2468MHz	Polarization :	Vertical

Frequency (MHz)	Meter Reading (dBμV)	Factor (dB)	Emission Level (dBμV/m)	Limits (dBμV/m)	Margin (dB)	Remark
2468.367	97.14	-11.54	85.6	114	-28.4	peak
4936.126	54.65	-3.67	50.98	74	-23.02	peak
2468.367	82.45	-12.93	69.52	94	-24.48	Av
4936.126	41.08	-3.65	37.43	54	-16.57	Av

Remark:

Factor = Antenna Factor + Cable Loss – Pre-amplifier.

No emission above 18GHz.



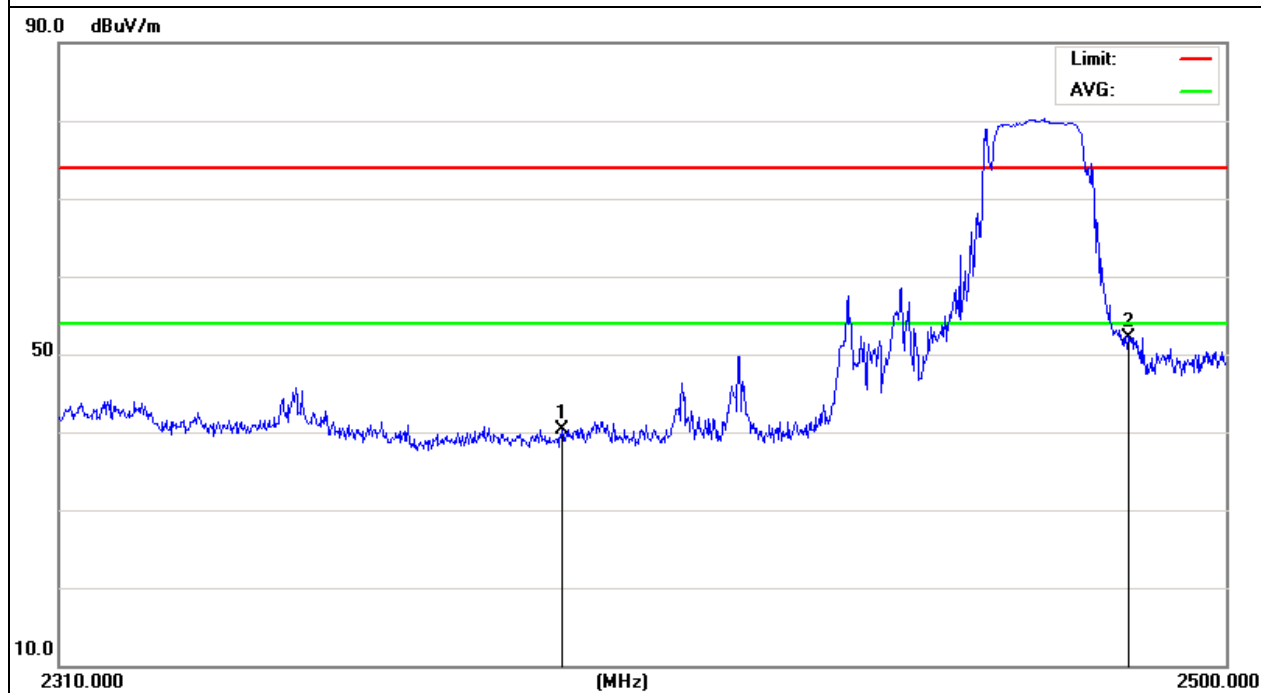
3.4.8 TEST RESULTS (RESTRICTED BANDS REQUIREMENTS)

EUT :	Unmanned Aircraft Systems (Unmanned Aircraft)	Model Name :	F50
Temperature :	20 °C	Relative Humidity :	48%
Pressure :	1010 hPa	Test Voltage :	DC 14.8V
Test Mode :	TX 2468MHz	Polarization :	Vertical

Frequency	Meter Reading	Factor	Emission Level	Limits	Margin	Remark
(MHz)	(dBμV)	(dB)	(dBμV/m)	(dBμV/m)	(dB)	
2390	53.08	-13.06	40.02	74	-33.98	peak
2483.5	64.87	-12.78	52.09	74	-21.91	peak

Remark:

Factor = Antenna Factor + Cable Loss – Pre-amplifier.

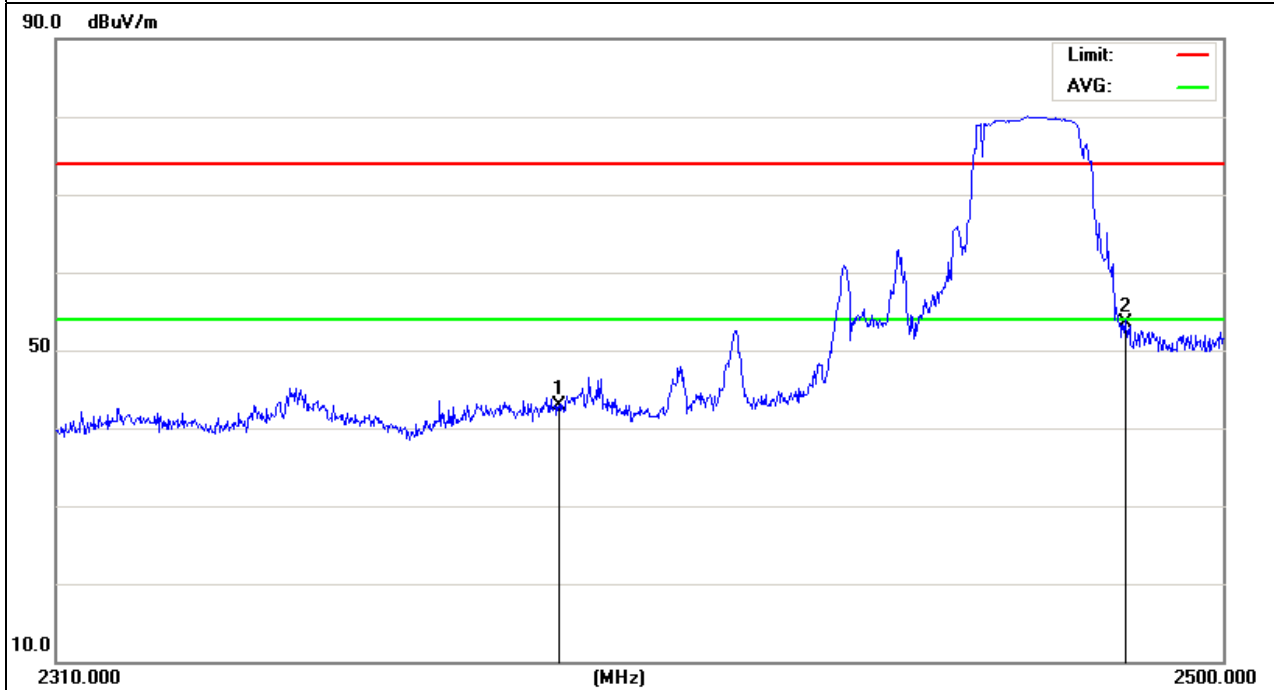


EUT :	Unmanned Aircraft Systems (Unmanned Aircraft)	Model Name :	F50
Temperature :	20 °C	Relative Humidity :	48%
Pressure :	1010 hPa	Test Voltage :	DC 14.8V
Test Mode :	TX 2468MHz	Polarization :	Horizontal

Frequency (MHz)	Meter Reading (dBμV)	Factor (dB)	Emission Level (dBμV/m)	Limits (dBμV/m)	Margin (dB)	Remark
2390	56.71	-13.06	43.65	74	-30.35	peak
2483.5	66.04	-12.78	53.26	74	-20.74	peak

Remark:

Factor = Antenna Factor + Cable Loss – Pre-amplifier.



4. BANDWIDTH TEST

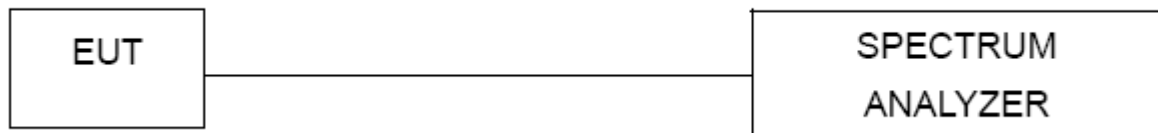
4.1 TEST PROCEDURE

- a. The EUT was directly connected to the spectrum analyzer and antenna output port as show in the block diagram below,
- b. Spectrum Setting : RBW= 100KHz, VBW $\geq$ RBW, Sweep time = Auto.

4.2 DEVIATION FROM STANDARD

No deviation.

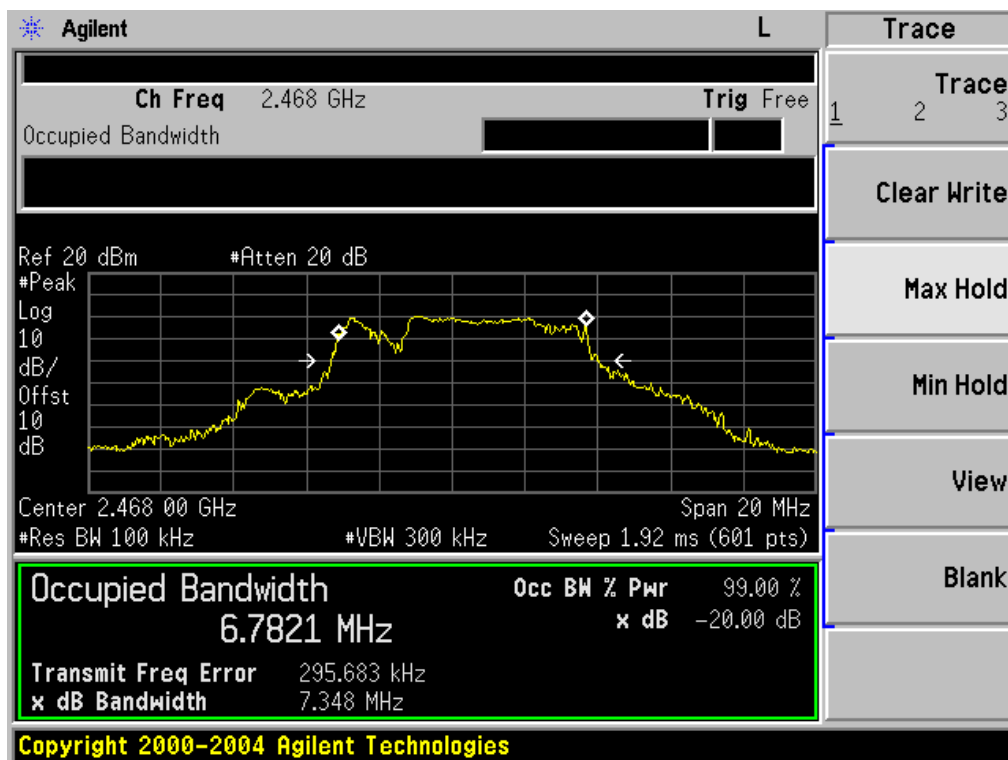
4.3 TEST SETUP



4.4 TEST RESULTS

EUT :	Unmanned Aircraft Systems (Unmanned Aircraft)	Model Name :	F50
Temperature :	26 °C	Relative Humidity :	53%
Pressure :	1020 hPa	Test Power :	DC 14.8V
Test Mode :	TX 2468MHz		

Test Channel	Frequency (MHz)	20 dBc Bandwidth (MHz)
CH1	2468	7.348



5. EUT TEST PHOTO

Radiated Measurement Photos

