



Report No: FCC 1603013  
File reference No: 2016-04-11

Applicant: Amcrest Technologies LLC

Product: walkie talkie

Model No: ATR-22

Trademark: Amcrest

Test Standards: FCC Part 90

Test result: It is herewith confirmed and found to comply with the requirements set up by ANSI C63.4 and FCC Part 90, regulations for the evaluation of electromagnetic compatibility

Approved By

*Jack Chung*

Jack Chung

Manager

Dated: April 11, 2016

**Results appearing herein relate only to the sample tested**

**The technical reports is issued errors and omissions exempt and is subject to withdrawal at**

**SHENZHEN TIMEWAY TESTING LABORATORIES**

Room 512-519, 5/F., East Tower, Building 4, Anhua Industrial Zone, Futian District, Shenzhen, Guangdong, China

Tel (755) 83448688, Fax (755) 83442996, E-Mail:info@timeway-lab.com



### **Special Statement:**

The testing quality ability of our laboratory meet with "Quality Law of People's Republic of China" Clause 19.

The testing quality system of our laboratory meet with ISO/IEC-17025 requirements, which is approved by CNAL. This approval result is accepted by MRA of APLAC.

Our test facility is recognized, certified, or accredited by the following organizations:

#### **CNAL-LAB Code: L2292**

The EMC Laboratory has been assessed and in compliance with CNAL/AC01:2002 accreditation criteria for testing Laboratories (identical to ISO/IEC 17025:1999 General Requirements) for the Competence of testing Laboratories.

#### **FCC-Registration No.: 899988**

The EMC Laboratory has been registered and fully described in a report filed with the (FCC) Federal Communications commission. The acceptance letter from the FCC is maintained in our files. Registration No.: 899988.

#### **IC- Registration No.: IC5205A-02**

The EMC Laboratory has been registered and fully described in a report filed with the (IC) Industry Canada. The acceptance letter from the IC is maintained in our files. Registration IC No.: 5205A-02.

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Test Report Conclusion

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## 1.0 General Details

### 1.1 Test Lab Details

Name : SHENZHEN TIMEWAY TESTING LABORATORIES.  
Address: Room 512-519,5/F., East Tower,Building 4, Anhua Industrial Zone, Futian District,Shenzhen, Guangdong China  
Telephone: (755) 83448688  
Fax: (755) 83442996  
Site on File with the Federal Communications Commission – United Sates  
Registration Number: 899988  
For 3m & 10 m OATS  
Site Listed with Industry Canada of Ottawa, Canada  
Registration Number: IC: 5205A-02  
For 3m & 10 m OATS

### 1.2 Applicant Details

Applicant: Amcrest Technologies LLC  
Address: 16727 Park Row Dr., Houston, TX 77084  
Telephone: (315) 790-0466  
Fax: (713) 893-7863

### 1.3 Description of EUT

Product: walkie talkie  
Manufacturer: PO FUNG ELECTRONIC (HK) IN  
Brand Name: Amcrest  
Model Number: ATR-22  
Type of Modulation FM  
Frequency range UHF:406.1MHz-470MHz  
Channel Bandwidth 12.5 kHz and 6.25kHz  
Frequency Selection By operation  
Antenna: Whip antenna with gain 1.0dBi  
Emission Designer 7K41F3E for 12.5kHz channel Bandwidth ;  
300HF3E for 6.25 kHz channels Bandwidth

Note: EUT has 6.25kHz bandwidth and uses FM modulation. So it meets the requirement of part90.203(j)(5)

### 1.4 Submitted Sample: 2 Samples

### 1.5 Test Duration

2016-03-04-2016-04-09

### 1.6 Test Uncertainty

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Conducted Emissions Uncertainty =3.6dB

Radiated Emissions Uncertainty =4.7dB

1.7 Test Engineer

*Terry Tang*

The sample tested by \_\_\_\_\_

Print Name: Terry Tang

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<b>2.0 Test Equipments</b>					
Instrument Type	Manufacturer	Model	Serial No.	Date of Cal.	Due Date
ESPI Test Receiver	R&S	ESPI 3	100379	2015-08-22	2016-08-21
TWO Line-V-NETW	R&S	EZH3-Z5	100294	2015-08-22	2016-08-21
TWO Line-V-NETW	R&S	EZH3-Z5	100253	2015-08-22	2016-08-21
Ultra Broadband ANT	R&S	HL562	100157	2015-08-23	2016-08-22
ESDV Test Receiver	R&S	ESDV	100008	2015-08-22	2016-08-21
Impuls-Begrenzer	R&S	ESH3-Z2	100281	2015-08-22	2016-08-21
System Controller	CT	SC100	-	--	--
Printer	EPSON	PHOTO EX3	CFNH234850	--	--
Computer	IBM	8434	1S8434KCE99BLXLO*	-	-
Loop Antenna	EMCO	6502	00042960	2015-08-23	2016-08-22
ESPI Test Receiver	R&S	ESI26	838786/013	2015-08-22	2016-08-21
3m OATS	--	--	N/A	2015-08-24	2016-08-23
Horn Antenna	R&S	BBHA 9170	BBHA9170265	2015-08-24	2016-08-23
Horn Antenna	R&S	BBHA 9120D	9120D-631	2015-08-24	2016-08-23
Power meter	Anritsu	ML2487A	6K00003613	2015-08-22	2016-08-21
Power sensor	Anritsu	MA2491A	32263	2015-08-22	2016-08-21
Bilog Antenna	Schwarebeck	VULB9163	9163/340	2015-08-23	2016-08-21
LISN	AFJ	LS16C	10010947251	2015-08-22	2016-08-21
LISN (Three Phase)	Schwarebeck	NSLK 8126	8126453	2015-08-23	2016-08-22
9*6*6 Anechoic	--	--	N/A	2015-08-24	2016-08-23
EMI Test Receiver	RS	ESCS30	100139	2015-08-22	2016-08-21
Modulation Analyzer	HP	8901B	3104A03367	2016-06-11	2017-06-10

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### 3.0 Technical Details

#### 3.1 Summary of test results

The EUT has been tested according to the following specifications:			
	Standard	Test Type	Result
	FCC Part 15.207	Conducted Emission	Compliant
	FCC Part 90.205	Maximum Transmitter Power	Compliant
	FCC Part 90.207	Modulation Characteristic	Compliant
	FCC Part 90.209	Occupied Bandwidth	Compliant
	FCC Part 90.210	Emission Mask	Compliant
	FCC Part 90.213	Frequency Tolerance	Compliant
	FCC Part 90.214	Transient Frequency Behaviour	Compliant

#### 3.2 The tests were performed according to following standards:

**FCC Part 90**

**TIA-603-D-2010**

**ANSI C63.4-2014**

#### 4.0 EUT Modification

**No modification by SHENZHEN TIMEWAY TESTING LABORATORIES**

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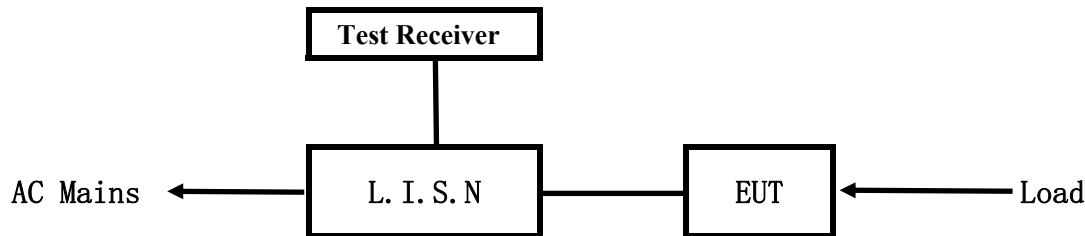
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## 5. Power Line Conducted Emission Test

### 5.1 Schematics of the test



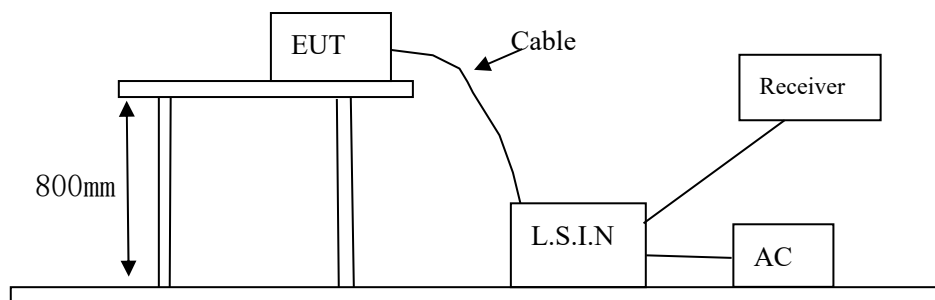
EUT: Equipment Under Test

### 5.2 Test Method and test Procedure

The EUT was tested according to ANSI C63.4-2014. The Frequency spectrum From 0.15MHz to 30MHz was investigated. The LISN used was 50ohm/50uH as specified by section 5.1 of ANSI C63.4-2014

Test Voltage: 120V/240V~, 60Hz

Block diagram of Test setup



### 5.3 Configuration of The EUT

The EUT was configured according to ANSI C63.4-2014. All interface ports were connected to the appropriate peripherals. All peripherals and cables are listed below.

One channels are provided to the EUT

#### A. EUT

Device	Manufacturer	Model	FCC ID
walkie talkie	Fujian Nan'an Baofeng Electronic Co., Ltd.	ATR-22	ZZ2-ATR-22

#### B. Internal Device

Device	Manufacturer	Model	FCC ID/DOC
N/A			

#### C. Peripherals

Device	Manufacturer	Model	FCC ID/DOC	Cable
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N/A				
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#### 5.4 EUT Operating Condition

Operating condition is according to ANSI C63.4-2014

A Setup the EUT and simulators as shown on follow

B Enable AF signal and confirm EUT active to normal condition

#### 5.5 Power line conducted Emission Limit according to Paragraph 15.107

Frequency(MHz)	Class A Limits (dB $\mu$ V)		Class B Limits (dB $\mu$ V)	
	Quasi-peak Level	Average Level	Quasi-peak Level	Average Level
0.15 ~ 0.50	79.0	66.0	66.0~56.0*	56.0~46.0*
0.50 ~ 5.00	73.0	60.0	56.0	46.0
5.00 ~ 30.00	73.0	60.0	60.0	50.0

Notes: 1. \*Decreasing linearly with logarithm of frequency.  
2. The tighter limit shall apply at the transition frequencies

#### 5.6 Test Results

The frequency spectrum from 0.15MHz to 30MHz was investigated. All reading are quasi-peak values with a resolution bandwidth of 9kHz.

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**A Conducted Emission on Line Terminal of the power line (150kHz to 30MHz)**

EUT set Condition: Charging Mode

Test Voltage: 120V~

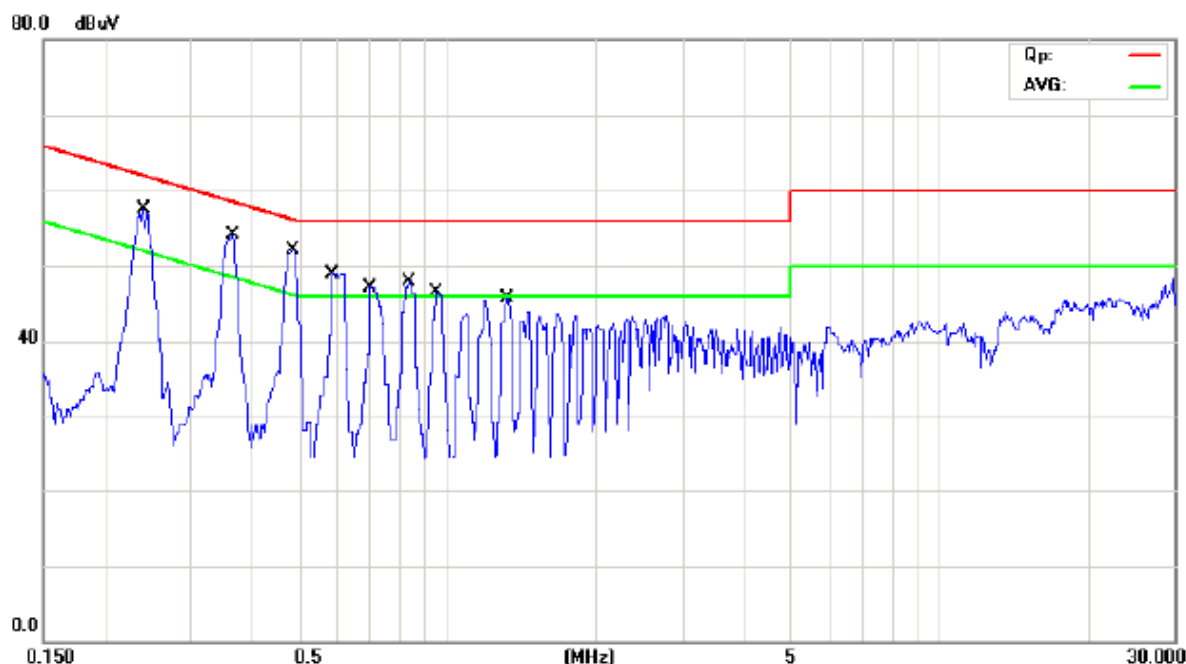
**Results: Pass**

Please refer to following diagram for individual

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No.	Mk.	Freq. MHz	Reading Level dBuV	Correct Factor dB	Measure- ment dBuV	Limit dBuV	Over dB	Detector	Comment
1		0.2401	43.35	11.10	54.45	62.09	-7.64	QP	
2		0.2401	29.34	11.10	40.44	52.09	-11.65	AVG	
3	*	0.3617	40.78	11.22	52.00	58.69	-6.69	QP	
4		0.3617	27.49	11.22	38.71	48.69	-9.98	AVG	
5		0.4790	37.62	11.35	48.97	56.36	-7.39	QP	
6		0.4790	24.53	11.35	35.88	46.36	-10.48	AVG	
7		0.5900	34.42	11.47	45.89	56.00	-10.11	QP	
8		0.5900	20.31	11.47	31.78	46.00	-14.22	AVG	
9		0.7024	35.49	11.58	47.07	56.00	-8.93	QP	
10		0.7024	21.68	11.58	33.26	46.00	-12.74	AVG	
11		0.8374	33.20	11.73	44.93	56.00	-11.07	QP	
12		0.8374	18.39	11.73	30.12	46.00	-15.88	AVG	
13		0.9500	30.68	11.85	42.53	56.00	-13.47	QP	
14		0.9500	15.37	11.85	27.22	46.00	-18.78	AVG	
15		1.3210	30.70	12.03	42.73	56.00	-13.27	QP	
16		1.3210	15.92	12.03	27.95	46.00	-18.05	AVG	

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**B Conducted Emission on Neutral Terminal of the power line (150kHz to 30MHz)**

EUT set Condition: Charging Mode

Test Voltage: 120V~

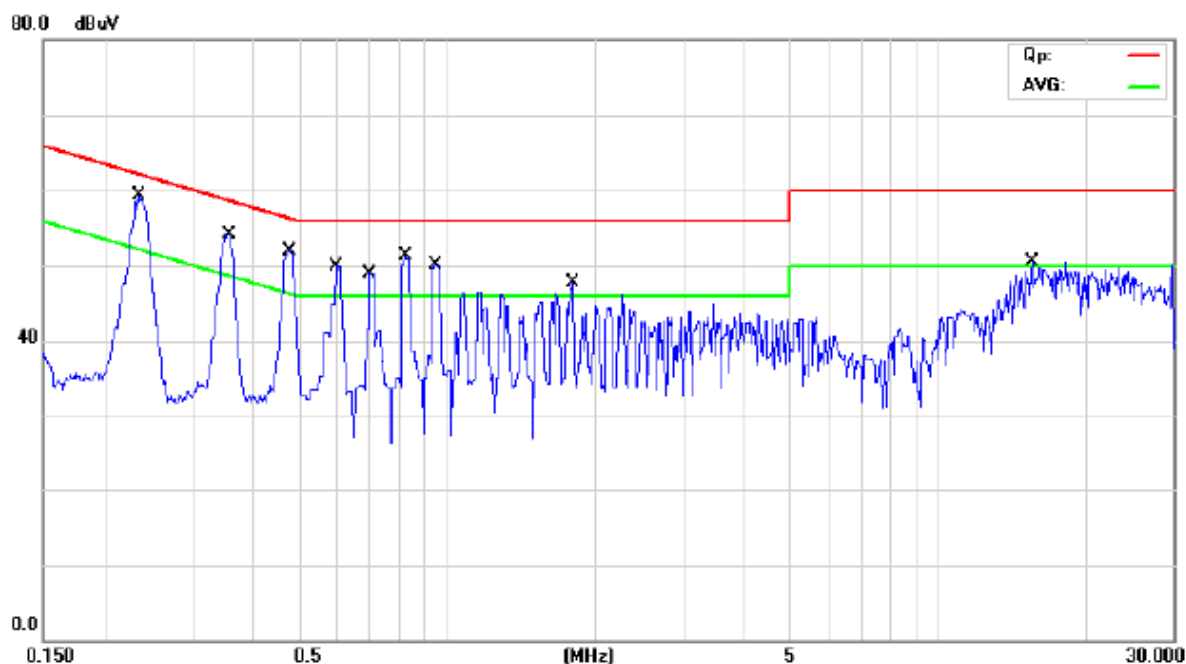
**Results: Pass**

Please refer to following diagram for individual

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No.	Mk.	Freq. MHz	Reading Level dBuV	Correct Factor dB	Measure- ment dBuV	Limit dBuV	Over dB	Detector	Comment
1		0.2356	44.17	11.09	55.26	62.25	-6.99	QP	
2		0.2356	30.52	11.09	41.61	52.25	-10.64	AVG	
3		0.3582	40.89	11.22	52.11	58.77	-6.66	QP	
4		0.3582	27.31	11.22	38.53	48.77	-10.24	AVG	
5	*	0.4763	39.57	11.35	50.92	56.40	-5.48	QP	
6		0.4763	26.29	11.35	37.64	46.40	-8.76	AVG	
7		0.6010	36.50	11.48	47.98	56.00	-8.02	QP	
8		0.6010	22.59	11.48	34.07	46.00	-11.93	AVG	
9		0.7024	36.40	11.58	47.98	56.00	-8.02	QP	
10		0.7024	22.64	11.58	34.22	46.00	-11.78	AVG	
11		0.8262	37.11	11.72	48.83	56.00	-7.17	QP	
12		0.8262	23.48	11.72	35.20	46.00	-10.80	AVG	
13		0.9500	35.18	11.85	47.03	56.00	-8.97	QP	
14		0.9500	22.12	11.85	33.97	46.00	-12.03	AVG	
15		1.7937	32.41	12.22	44.63	56.00	-11.37	QP	
16		1.7937	18.92	12.22	31.14	46.00	-14.86	AVG	
17		15.5000	36.28	11.28	47.56	60.00	-12.44	QP	
18		15.5000	20.52	11.28	31.80	50.00	-18.20	AVG	

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**C Conducted Emission on Line Terminal of the power line (150kHz to 30MHz)**

EUT set Condition: Charging Mode

Test Voltage: 240V~

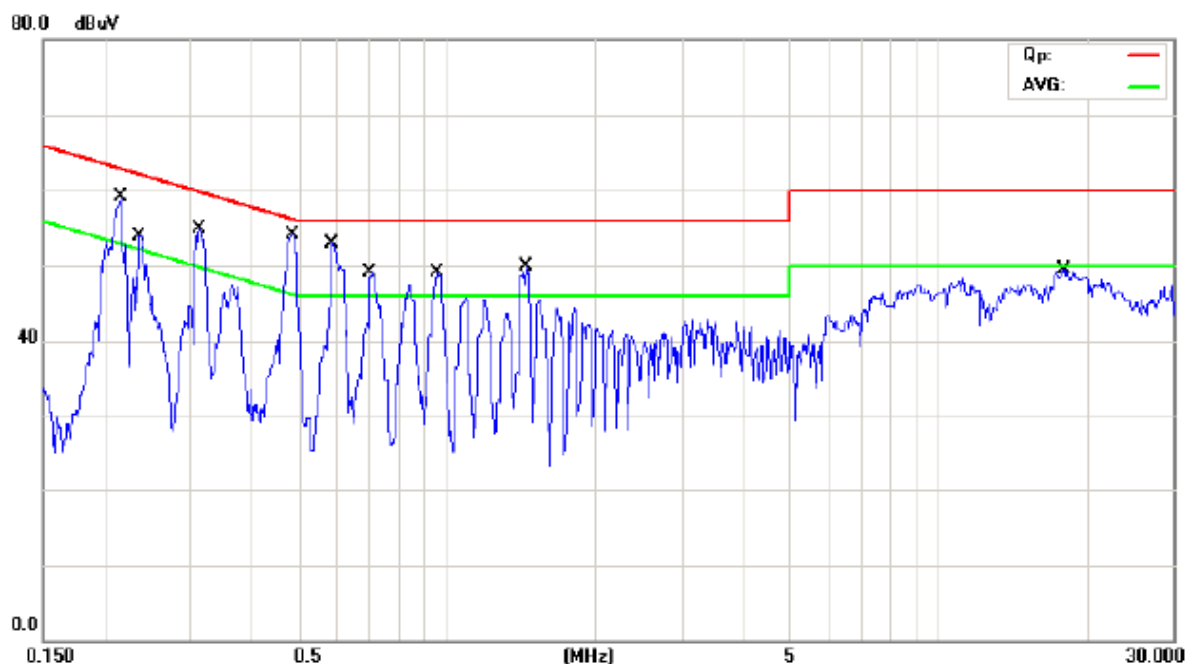
**Results: Pass**

Please refer to following diagram for individual

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No.	Mk.	Freq. MHz	Reading Level dBuV	Correct Factor dB	Measure- ment dBuV	Limit dBuV	Over dB	Detector	Comment
1		0.2156	45.10	11.07	56.17	62.99	-6.82	QP	
2		0.2156	31.00	11.07	42.07	52.99	-10.92	AVG	
3		0.2348	39.55	11.09	50.64	62.28	-11.64	QP	
4		0.2348	25.89	11.09	36.98	52.28	-15.30	AVG	
5		0.3110	41.73	11.17	52.90	59.94	-7.04	QP	
6		0.3110	27.55	11.17	38.72	49.94	-11.22	AVG	
7	*	0.4807	39.63	11.35	50.98	56.33	-5.35	QP	
8		0.4807	25.87	11.35	37.22	46.33	-9.11	AVG	
9		0.5900	38.38	11.47	49.85	56.00	-6.15	QP	
10		0.5900	25.02	11.47	36.49	46.00	-9.51	AVG	
11		0.7024	33.49	11.58	45.07	56.00	-10.93	QP	
12		0.7024	19.58	11.58	31.16	46.00	-14.84	AVG	
13		0.9500	31.67	11.85	43.52	56.00	-12.48	QP	
14		0.9500	17.39	11.85	29.24	46.00	-16.76	AVG	
15		1.4450	32.69	12.08	44.77	56.00	-11.23	QP	
16		1.4450	20.65	12.08	32.73	46.00	-13.27	AVG	
17		17.8750	31.39	11.18	42.57	60.00	-17.43	QP	
18		17.8750	18.65	11.18	29.83	50.00	-20.17	AVG	

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**D Conducted Emission on Neutral Terminal of the power line (150kHz to 30MHz)**

EUT set Condition: Charging Mode

Test Voltage: 240V~

**Results: Pass**

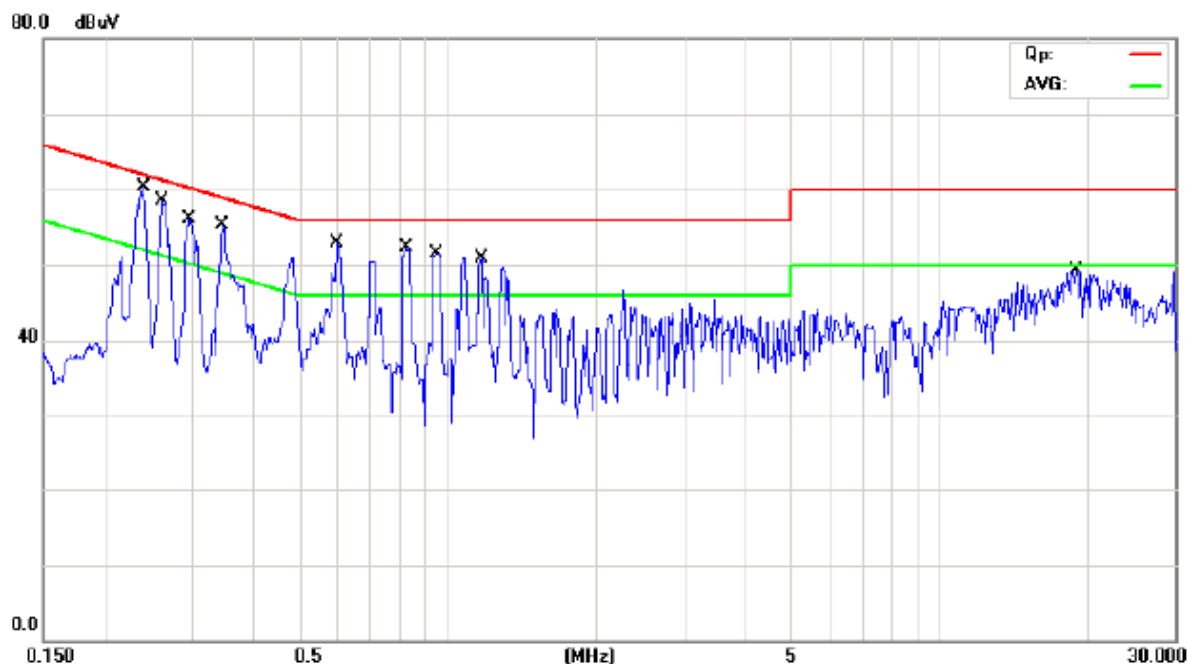
Please refer to following diagram for individual

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No.	Mk.	Freq.	Reading	Correct	Measure-	Limit	Over		
		MHz	Level	Factor	ment			Detector	Comment
			dBuV	dB	dBuV	dBuV	dB		
1		0.2391	45.33	11.09	56.42	62.13	-5.71	QP	
2		0.2391	30.85	11.09	41.94	52.13	-10.19	AVG	
3		0.2610	43.12	11.12	54.24	61.40	-7.16	QP	
4		0.2610	29.02	11.12	40.14	51.40	-11.26	AVG	
5		0.2970	42.79	11.16	53.95	60.33	-6.38	QP	
6		0.2970	28.33	11.16	39.49	50.33	-10.84	AVG	
7	*	0.3467	44.02	11.21	55.23	59.04	-3.81	QP	
8		0.3467	28.51	11.21	39.72	49.04	-9.32	AVG	
9		0.6010	39.45	11.48	50.93	56.00	-5.07	QP	
10		0.6010	23.86	11.48	35.34	46.00	-10.66	AVG	
11		0.8262	38.17	11.72	49.89	56.00	-6.11	QP	
12		0.8262	22.61	11.72	34.33	46.00	-11.67	AVG	
13		0.9500	37.68	11.85	49.53	56.00	-6.47	QP	
14		0.9500	21.79	11.85	33.64	46.00	-12.36	AVG	
15		1.1632	38.94	11.97	50.91	56.00	-5.09	QP	
16		1.1632	23.79	11.97	35.76	46.00	-10.24	AVG	
17		18.8750	30.07	11.14	41.21	60.00	-18.79	QP	
18		18.8750	17.83	11.14	28.97	50.00	-21.03	AVG	

Remark: 1. scanning with PK detector and final measurement with QP and AV detector.

2. \* means the worse case

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## 6. Frequency Tolerance

### 6.1 Applicable standard

According to FCC Part 90 Section 90.213,

In the 150-174 MHz band, mobile stations designed to operate with a 12.5 kHz channel bandwidth or designed to operate on a frequency specifically designated for itinerant use or designed for low-power operation of two watts or less, must have a frequency stability of 5.0 ppm. Mobile stations designed to operate with a 6.25 kHz channel bandwidth must have a frequency stability of 2.0 ppm.

In the 421-512 MHz band, mobile stations designed to operate with a 12.5 kHz channel bandwidth must have a frequency stability of 2.5 ppm. Mobile stations designed to operate with a 6.25 kHz channel bandwidth must have a frequency stability of 1.0 ppm.

### 6.2 Measurement Procedure

#### 6.2.1 Frequency stability versus environmental temperature

1. Setup the configuration per figure 1 for frequencies measurement inside an environment chamber, Install new battery in the EUT.
2. Turn on EUT and set SA center frequency to the EUT radiated frequency. Set SA Resolution Bandwidth to 1kHz and Video Resolution Bandwidth to 1kHz and Frequency Span to 50kHz. Record this frequency as reference frequency.
3. Set the temperature of chamber to 50°C. Allow sufficient time (approximately 30 min) for the temperature of the chamber to stabilize. While maintaining a constant temperature inside the chamber, turn the EUT on and measure the EUT operating frequency.
4. Repeat step 2 with a 10°C decreased per stage until the lowest temperature -30°C is measured, record all measured frequencies on each temperature step.

#### 6.2.2 Frequency stability versus input voltage

1. Setup the configuration per figure 1 for frequencies measured at temperature if it is within 15°C to 25°C. Otherwise, an environment chamber set for a temperature of 20°C shall be used. The EUT shall be powered by DC 3.3-3.7V
2. Set SA center frequency to the EUT radiated frequency. Set SA Resolution Bandwidth to 1 KHz and Video Resolution Bandwidth to 1KHz. Record this frequency as reference frequency.
3. Supply the EUT primary voltage at the operating end point which is specified by manufacturer and record the frequency.

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### 6.3 TEST SETUP BLOCK DIAGRAM

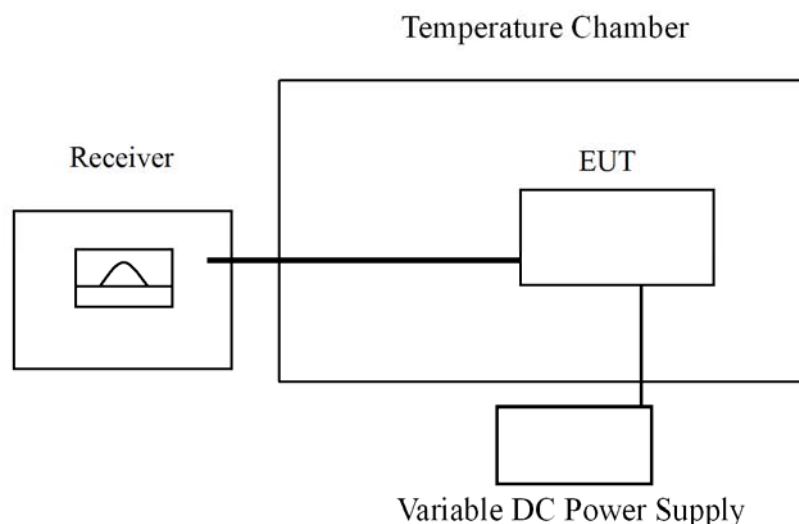


Figure 1

### 6.5 TEST RESULT

(1) Frequency stability versus input voltage (battery operation end point voltage is 3.3V)

UHF Band: (12.5 kHz Channel Bandwidth)

Channel	Power Supplied (Vdc)	Frequency Measured (MHz)	Frequency Deviation (ppm)	Nominal Frequency	Limit(ppm)
Top channel	3.3V	469.97532	0.68	469.975MHz	2.5
Middle channel	3.3V	439.97530	0.73	439.975MHz	2.5
Bottom channel	3.3V	406.12522	0.54	406.125MHz	2.5

(2)Frequency stability versus ambient temperature

Test Results

UHF Band: (12.5 kHz Channel Bandwidth)

Top channel

Environment Temperature(°C)	Power Supplied (Vdc)	Frequency Measured (MHz)	Frequency Deviation (ppm)	Nominal Frequency	Limit(ppm)
50	3.7	469.97526	0.55	469.975MHz	2.5

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40	3.7	469.97542	0.89	469.975MHz	2.5
30	3.7	469.97528	0.60	469.975MHz	2.5
20	3.7	469.97556	1.19	469.975MHz	2.5
10	3.7	469.97538	0.81	469.975MHz	2.5
0	3.7	469.97551	1.09	469.975MHz	2.5
-10	3.7	469.97532	0.68	469.975MHz	2.5
-20	3.7	469.97548	1.02	469.975MHz	2.5
-30	3.7	469.97543	0.91	469.975MHz	2.5

**Middle channel**

Environment Temperature(°C)	Power Supplied (Vdc)	Frequency Measured (MHz)	Frequency Error (ppm)	Nominal Frequency	Limit(ppm)
50	3.7	439.97539	0.89	439.975MHz	2.5
40	3.7	439.97546	1.05	439.975MHz	2.5
30	3.7	439.97522	0.50	439.975MHz	2.5
20	3.7	439.97546	1.05	439.975MHz	2.5
10	3.7	439.97553	1.20	439.975MHz	2.5
0	3.7	439.97555	1.25	439.975MHz	2.5
-10	3.7	439.97536	0.82	439.975MHz	2.5
-20	3.7	439.97545	1.02	439.975MHz	2.5
-30	3.7	439.97549	1.11	439.975MHz	2.5

**Bottom channel**

Environment Temperature(°C)	Power Supplied (Vdc)	Frequency Measured (MHz)	Frequency Error (ppm)	Nominal Frequency	Limit(ppm)
50	3.7	406.12539	0.96	406.125MHz	2.5

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40	3.7	406.12538	0.94	406.125MHz	2.5
30	3.7	406.12535	0.86	406.125MHz	2.5
20	3.7	406.12527	0.66	406.125MHz	2.5
10	3.7	406.12541	1.01	406.125MHz	2.5
0	3.7	406.12532	0.79	406.125MHz	2.5
-10	3.7	406.12539	0.96	406.125MHz	2.5
-20	3.7	406.12538	0.94	406.125MHz	2.5
-30	3.7	406.12544	1.08	406.125MHz	2.5

(1) Frequency stability versus input voltage (battery operation end point voltage is 3.3V)

UHF Band: (6.25 kHz Channel Bandwidth)

Channel	Power Supplied (Vdc)	Frequency Measured (MHz)	Frequency Deviation (ppm)	Nominal Frequency	Limit(ppm)
Top channel	3.3V	469.97527	0.57	469.975MHz	1.0
Middle channel	3.3V	439.97521	0.48	439.975MHz	1.0
Bottom channel	3.3V	406.12519	0.47	400.025MHz	1.0

(2)Frequency stability versus ambient temperature

**Test Results**

UHF Band: (6.25 kHz Channel Bandwidth)

**Top channel**

Environment Temperature(°C)	Power Supplied (Vdc)	Frequency Measured (MHz)	Frequency Deviation (ppm)	Nominal Frequency	Limit(ppm)
50	3.7	469.97529	0.62	469.975MHz	1.0
40	3.7	469.97520	0.43	469.975MHz	1.0
30	3.7	469.97522	0.47	469.975MHz	1.0
20	3.7	469.97530	0.64	469.975MHz	1.0
10	3.7	469.97533	0.70	469.975MHz	1.0

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0	3.7	469.97526	0.55	469.975MHz	1.0
-10	3.7	469.97524	0.51	469.975MHz	1.0
-20	3.7	469.97535	0.74	469.975MHz	1.0
-30	3.7	469.97535	0.74	469.975MHz	1.0

**Middle channel**

Environment Temperature(°C)	Power Supplied (Vdc)	Frequency Measured (MHz)	Frequency Error (ppm)	Nominal Frequency	Limit(ppm)
50	3.7	439.97533	0.75	439.975MHz	1.0
40	3.7	439.97532	0.73	439.975MHz	1.0
30	3.7	439.97513	0.30	439.975MHz	1.0
20	3.7	439.97526	0.59	439.975MHz	1.0
10	3.7	439.97521	0.48	439.975MHz	1.0
0	3.7	439.97528	0.64	439.975MHz	1.0
-10	3.7	439.97523	0.52	439.975MHz	1.0
-20	3.7	439.97520	0.45	439.975MHz	1.0
-30	3.7	439.97525	0.57	439.975MHz	1.0

**Bottom channel**

Environment Temperature(°C)	Power Supplied (Vdc)	Frequency Measured (MHz)	Frequency Error (ppm)	Nominal Frequency	Limit(ppm)
50	3.7	406.12522	0.54	406.125MHz	1.0
40	3.7	406.12521	0.52	406.125MHz	1.0
30	3.7	406.12519	0.47	406.125MHz	1.0
20	3.7	406.12525	0.62	406.125MHz	1.0
10	3.7	406.12523	0.57	406.125MHz	1.0

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0	3.7	406.12519	0.48	406.125MHz	1.0
-10	3.7	406.12524	0.59	406.125MHz	1.0
-20	3.7	406.12520	0.49	406.125MHz	1.0
-30	3.7	406.12526	0.64	406.125MHz	1.0

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## 7. EMISSION BANDWIDTH and Mask

### 7.1 PROVISIONS APPLICABLE

**Emission Mask D**—12.5 kHz channel bandwidth equipment. For transmitters designed to operate with a 12.5 kHz channel bandwidth, any emission must be attenuated below the power (P) of the highest emission contained within the authorized bandwidth as follows:

- (1) On any frequency from the center of the authorized bandwidth  $f_0$  to 5.625 kHz removed from  $f_0$ : Zero dB.
- (2) On any frequency removed from the center of the authorized bandwidth by a displacement frequency ( $f_d$  in kHz) of more than 5.625 kHz but no more than 12.5 kHz: At least  $7.27(f_d - 2.88 \text{ kHz})$  dB.
- (3) On any frequency removed from the center of the authorized bandwidth by a displacement frequency ( $f_d$  in kHz) of more than 12.5 kHz: At least  $50 + 10 \log (P)$  dB or 70 dB, whichever is the lesser attenuation.
- (4) The reference level for showing compliance with the emission mask shall be established using a resolution bandwidth sufficiently wide (usually two to three times the channel bandwidth) to capture the true peak emission of the equipment under test. In order to show compliance with the emissions mask up to and including 50 kHz removed from the edge of the authorized bandwidth, adjust the resolution bandwidth to 100 Hz with the measuring instrument in a peak hold mode. A sufficient number of sweeps must be measured to insure that the emission profile is developed. If video filtering is used, its bandwidth must not be less than the instrument resolution bandwidth. For emissions beyond 50 kHz from the edge of the authorized bandwidth, see paragraph (m) of this section. If it can be shown that use of the above instrumentation settings do not accurately represent the true interference potential of the equipment under test, then an alternate procedure may be used provided prior Commission approval is obtained.

#### **Emission Mask-E:**

6.25 kHz or less channel bandwidth equipment. For transmitters designed to operate with a 6.25 kHz or less bandwidth, any emission must be attenuated below the power (P) of the highest emission contained within the authorized bandwidth as follows:

- (1) On any frequency from the center of the authorized bandwidth  $f_0$  to 3.0 kHz removed from  $f_0$ : Zero dB.
- (2) On any frequency removed from the center of the authorized bandwidth by a displacement frequency ( $f_d$  in kHz) of more than 3.0 kHz but no more than 4.6 kHz: At least  $30 + 16.67(f_d - 3 \text{ kHz})$  or  $55 + 10 \log (P)$  or 65 dB, whichever is the lesser attenuation.
- (3) On any frequency removed from the center of the authorized bandwidth by more than 4.6 kHz: At least  $55 + 10 \log (P)$  or 65 dB, whichever is the lesser attenuation.
- (4) The reference level for showing compliance with the emission mask shall be established using a resolution bandwidth sufficiently wide (usually two or three times the channel bandwidth) to capture the true peak emission of the equipment under test. In order to show compliance with the emission mask up to and including 50 kHz removed from the edge of the authorized bandwidth, adjust the resolution bandwidth to 100 Hz with the measuring instrument in a peak hold mode. A sufficient number of sweeps must be measured to insure that the emission profile is developed. If video filtering is used, its bandwidth must not be less than the instrument

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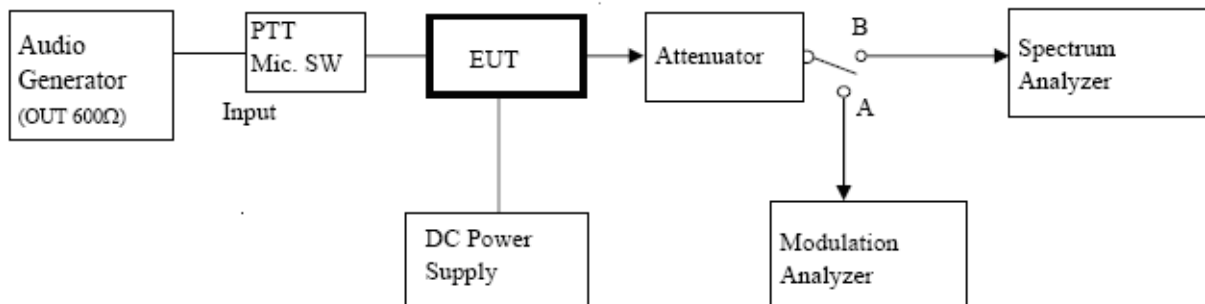


resolution bandwidth. For emissions beyond 50 kHz from the edge of the authorized bandwidth, see paragraph (o) of this section. If it can be shown that use of the above instrumentation settings do not accurately represent the true interference potential of the equipment under test, an alternate procedure may be used provided prior Commission approval is obtained.

## 7.2 MEASUREMENT PROCEDURE

- 1). The EUT was modulated by 2.5 kHz Sine wave audio signal, The level of the audio signal employed is 16 dB greater than that necessary to produce 50% of rated system deviation. Rated system deviation is 2.5 kHz
- 2). Set SPA Center Frequency = fundamental frequency, RBW=100Hz or 300Hz (300Hz for 12.5 kHz Channel Bandwidth, 100Hz for 6.25 kHz Channel Bandwidth), VBW= 300 Hz, Span =50 kHz
- 3). Set SPA Max hold. Mark peak, -26 dB.

## 7.3 Test Setup Block Diagram



## 7.4 Measurement Result:

### For 12.5 kHz Channel Bandwidth

Bandwidth				
Operating Frequency	26dB Bandwidth	99% Bandwidth	Limits	Result
439.975MHz (Middle)	7.72kHz	7.41kHz	11.25 kHz	Pass

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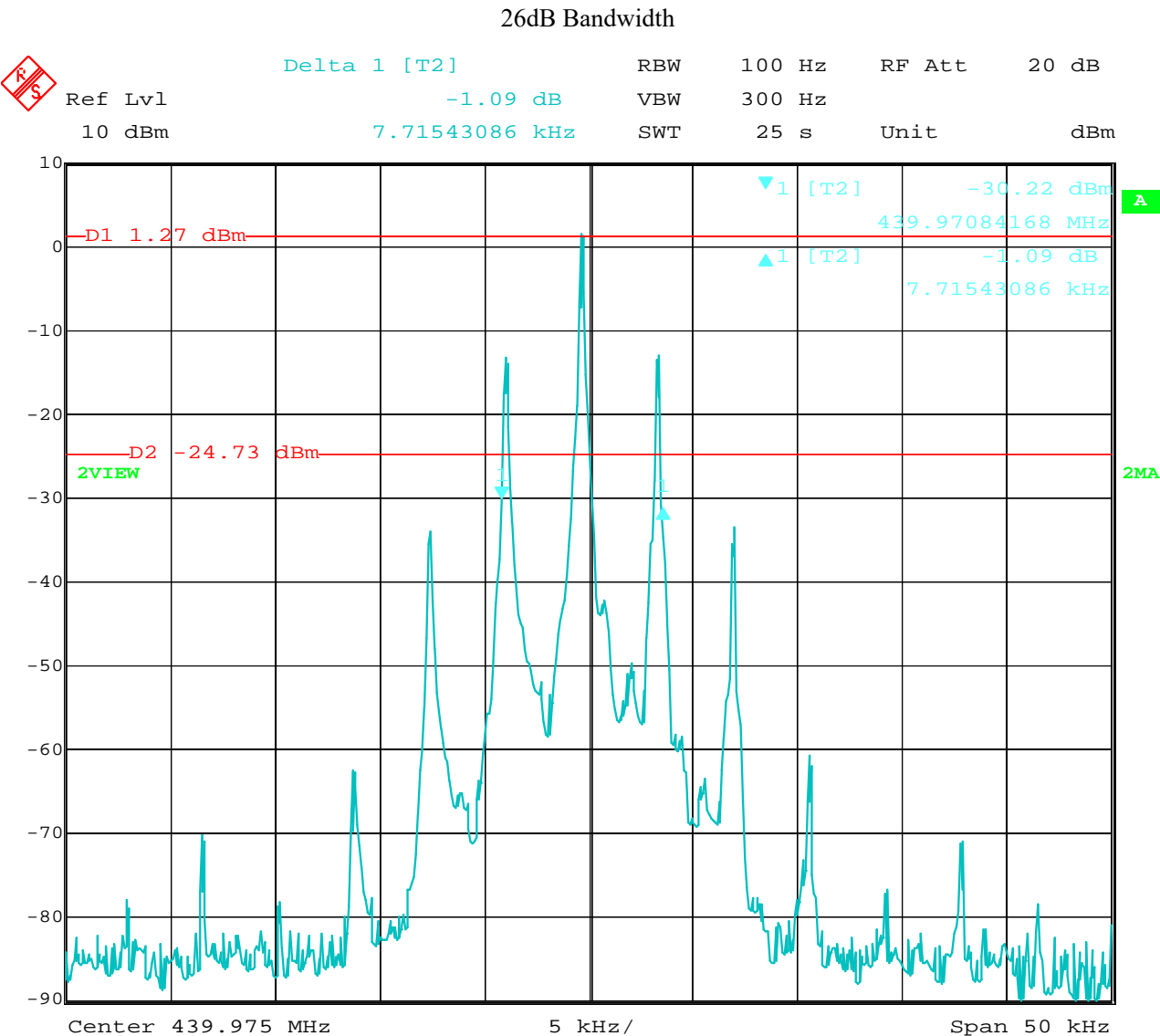
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7.5 Test Plots:

UHF Band-Middle Channel

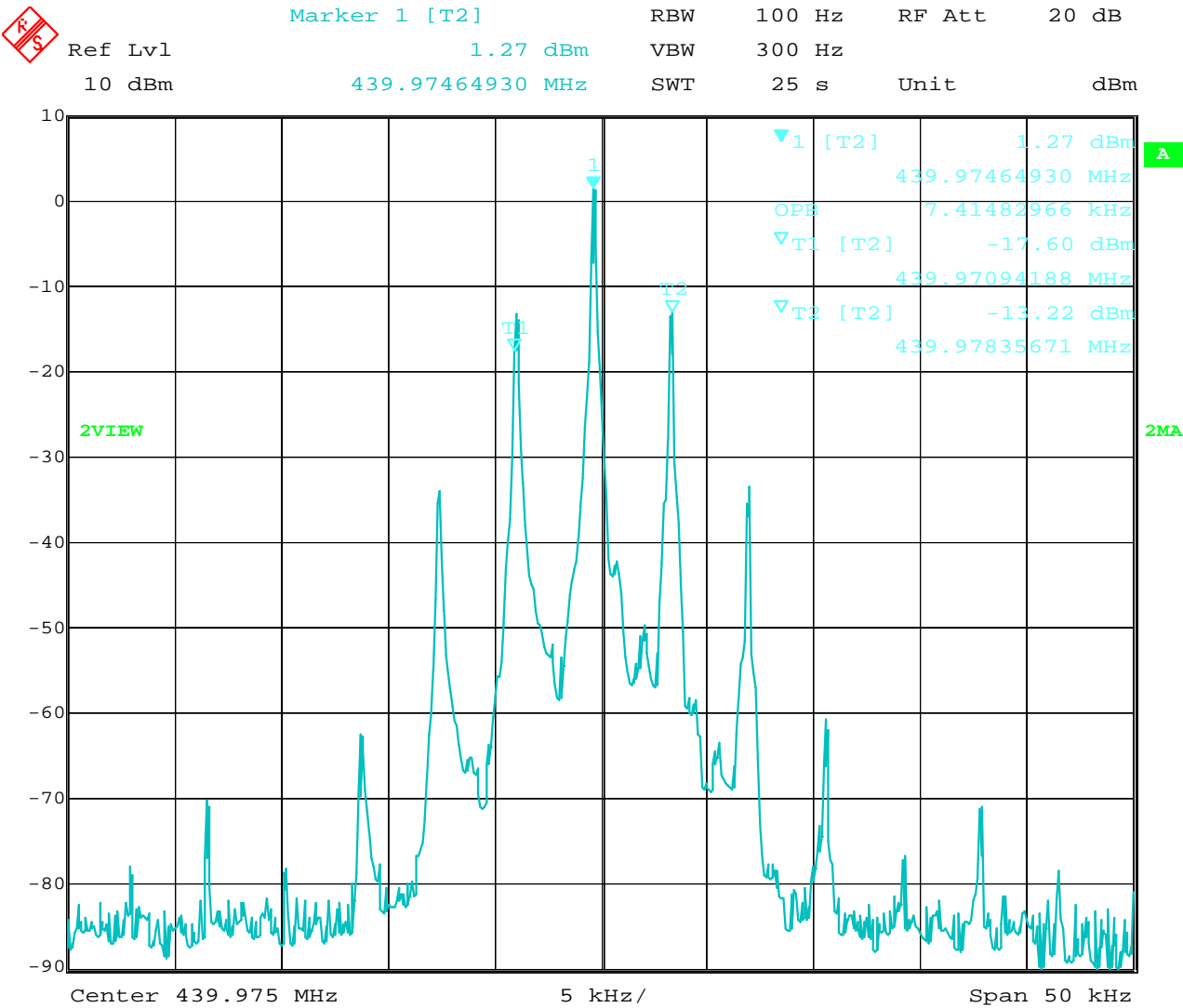


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UHF Band-Middle Channel

99% Bandwidth



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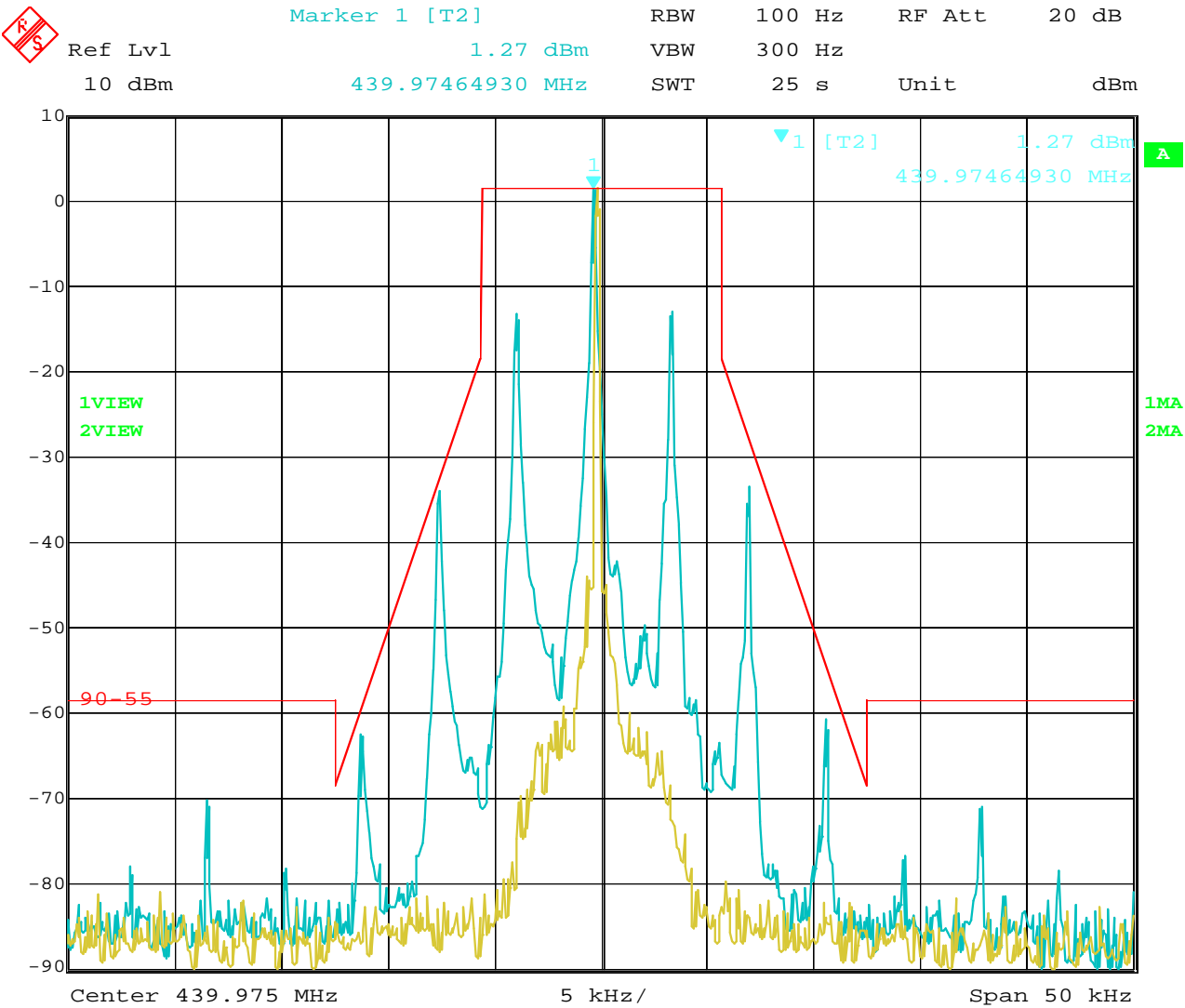
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UHF Band-Middle Channel

Emission Mask D



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Ref Lvl 10 dBm  
 Delta 1 [T2] 8.37 dB  
 RBW 100 Hz  
 VBW 300 Hz  
 RF Att 20 dB  
 Unit dBm

Center 439.975 MHz  
 Span 50 kHz

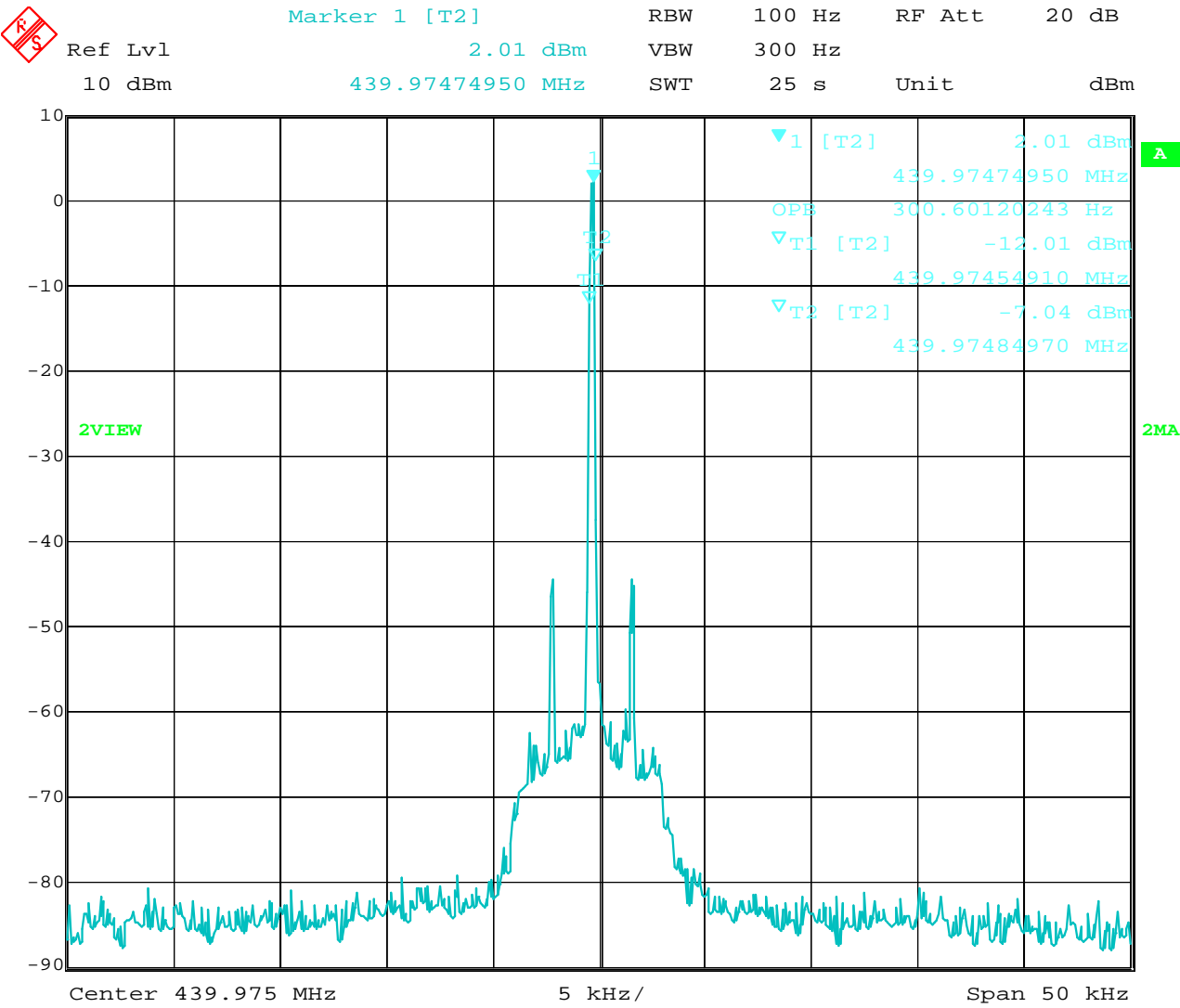
Signal Level: -46.13 dBm  
 Noise Floor: -85 dBm

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UHF Band-Middle Channel

99% Bandwidth



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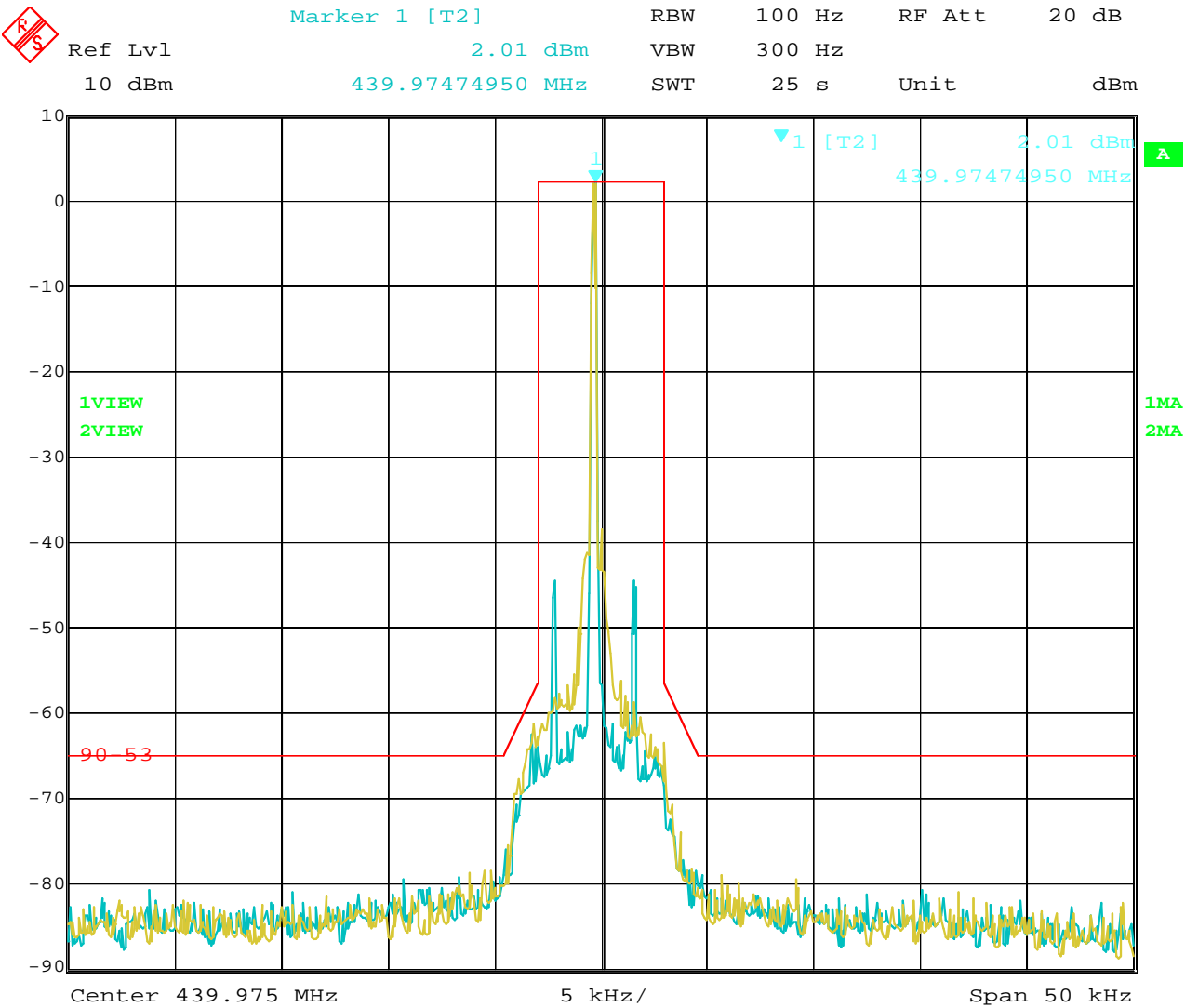
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UHF Band-Middle Channel

Emission Mask E



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## 8. UNWANTED RADIATION

### 8.1 PROVISIONS APPLICABLE

8.1.1 **Emission Mask D-**According to Section 90.210, the power of each unwanted emission shall be less than Transmitted Power as specified below for transmitters designed to operate with 12.5 kHz channel bandwidth:

- (1) On any frequency from the centre of the authorized bandwidth  $f_0$  to 5.625 kHz removed from  $f_0$ : Zero dB
- (2) On any frequency removed from the center of the authorized bandwidth by a displacement frequency ( $f_d$  in kHz) of more than 5.625 kHz but no more than 12.5 kHz: At least  $7.27(f_d - 2.88 \text{ KHz})$  dB
- (3) On any frequency removed from the center of the authorized bandwidth by a displacement frequency ( $f_d$  in kHz) of more than 12.5 kHz: At least  $50 + 10 \log(P)$  dB or 70 dB, whichever is the lesser attenuation.

#### **Emission Mask-E:**

6.25 kHz or less channel bandwidth equipment. For transmitters designed to operate with a 6.25 kHz or less bandwidth, any emission must be attenuated below the power (P) of the highest emission contained within the authorized bandwidth as follows:

- (1) On any frequency from the center of the authorized bandwidth  $f_0$  to 3.0 kHz removed from  $f_0$ : Zero dB.
- (2) On any frequency removed from the center of the authorized bandwidth by a displacement frequency ( $f_d$  in kHz) of more than 3.0 kHz but no more than 4.6 kHz: At least  $30 + 16.67(f_d - 3 \text{ kHz})$  or  $55 + 10 \log(P)$  or 65 dB, whichever is the lesser attenuation.
- (3) On any frequency removed from the center of the authorized bandwidth by more than 4.6 kHz: At least  $55 + 10 \log(P)$  or 65 dB, whichever is the lesser attenuation.
- (4) The reference level for showing compliance with the emission mask shall be established using a resolution bandwidth sufficiently wide (usually two or three times the channel bandwidth) to capture the true peak emission of the equipment under test. In order to show compliance with the emission mask up to and including 50 kHz removed from the edge of the authorized bandwidth, adjust the resolution bandwidth to 100 Hz with the measuring instrument in a peak hold mode. A sufficient number of sweeps must be measured to insure that the emission profile is developed. If video filtering is used, its bandwidth must not be less than the instrument resolution bandwidth. For emissions beyond 50 kHz from the edge of the authorized bandwidth, see paragraph (o) of this section. If it can be shown that use of the above instrumentation settings do not accurately represent the true interference potential of the equipment under test, an alternate procedure may be used provided prior Commission approval is obtained.

### 8.2 MEASUREMENT PROCEDURE (Radiated Emissions)

- (1). On a test site, the EUT shall be placed on a turntable, and in the position closest to the normal use as declared by the user.
- (2). The test antenna shall be oriented initially for vertical polarization located 3m from the EUT to correspond to the transmitter.
- (3). The output of the antenna shall be connected to the measuring receiver and either a peak or quasi-peak detector was used for the measurement as indicated on the report. The detector selection is based on how

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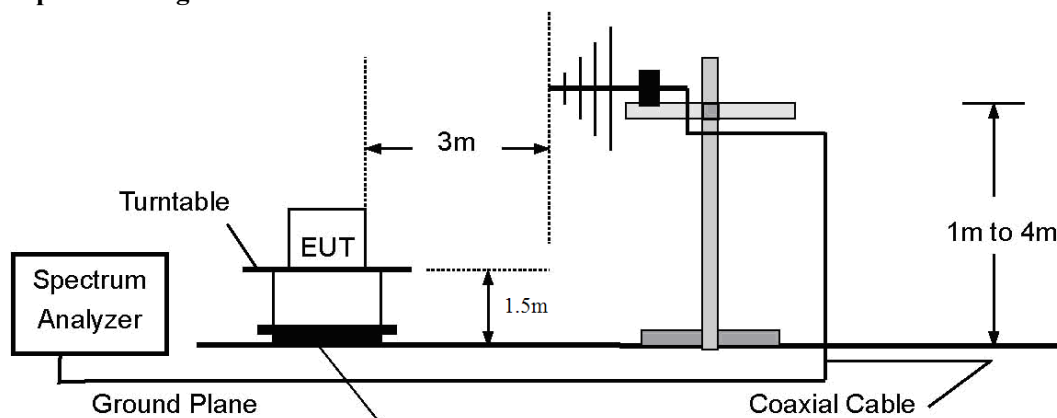




close the emission level was approaching the limit.

- (4). The transmitter shall be switched on; if possible, without the modulation and the measurement receiver shall be tuned to the frequency of the transmitter under test.
- (5). The test antenna shall be raised and lowered through the specified range of height until the measuring receiver detects a maximum signal level.
- (6). The transmitter shall then be rotated through  $360^\circ$  in the horizontal plane, until the maximum signal level is detected by the measuring receiver.
- (7). The test antenna shall be raised and lowered again through the specified range of height until the measuring receiver detects a maximum signal level.
- (8). The maximum signal level detected by the measuring receiver shall be noted.
- (9). The measurement shall be repeated with the test antenna set to horizontal polarization.
- (10). Replace the antenna with a proper Antenna (substitution antenna).
- (11). The substitution antenna shall be oriented for vertical polarization and, if necessary, the length of the substitution antenna shall be adjusted to correspond to the frequency of transmitting.
- (12). The substitution antenna shall be connected to a calibrated signal generator.
- (13). If necessary, the input attenuator setting of the measuring receiver shall be adjusted in order to increase the sensitivity of the measuring receiver.
- (14). The test antenna shall be raised and lowered through the specified range of the height to ensure that the maximum signal is received.
- (15). The input signal to substitution antenna shall be adjusted to the level that produces a level detected by the measuring receiver, that is equal to the level noted while the transmitter radiated power was measured, corrected for the change of input attenuation setting of the measuring receiver and Gain of Substitution antenna.
- (16). The input level to the substitution antenna shall be recorded as power level in dBm, corrected for any change of input attenuator setting of the measuring receiver and Gain of Substitution antenna. So the EIRP is obtained.
- (17). The measurement shall be repeated with the test antenna and the substitution antenna oriented for horizontal polarization.

### 8.3 Test setup Block Diagram



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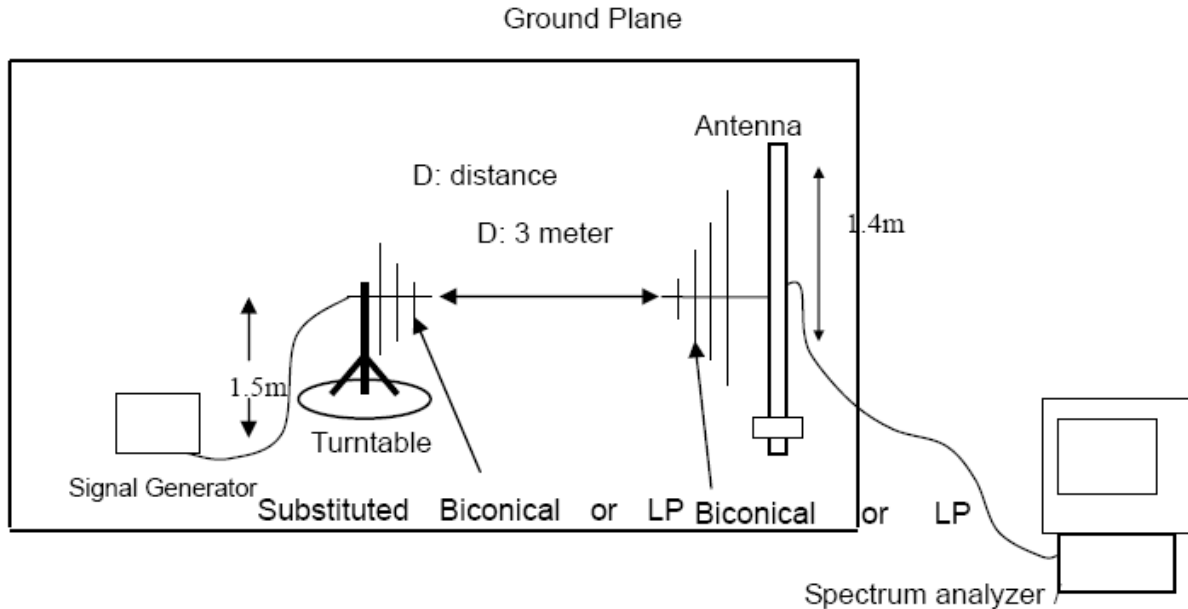
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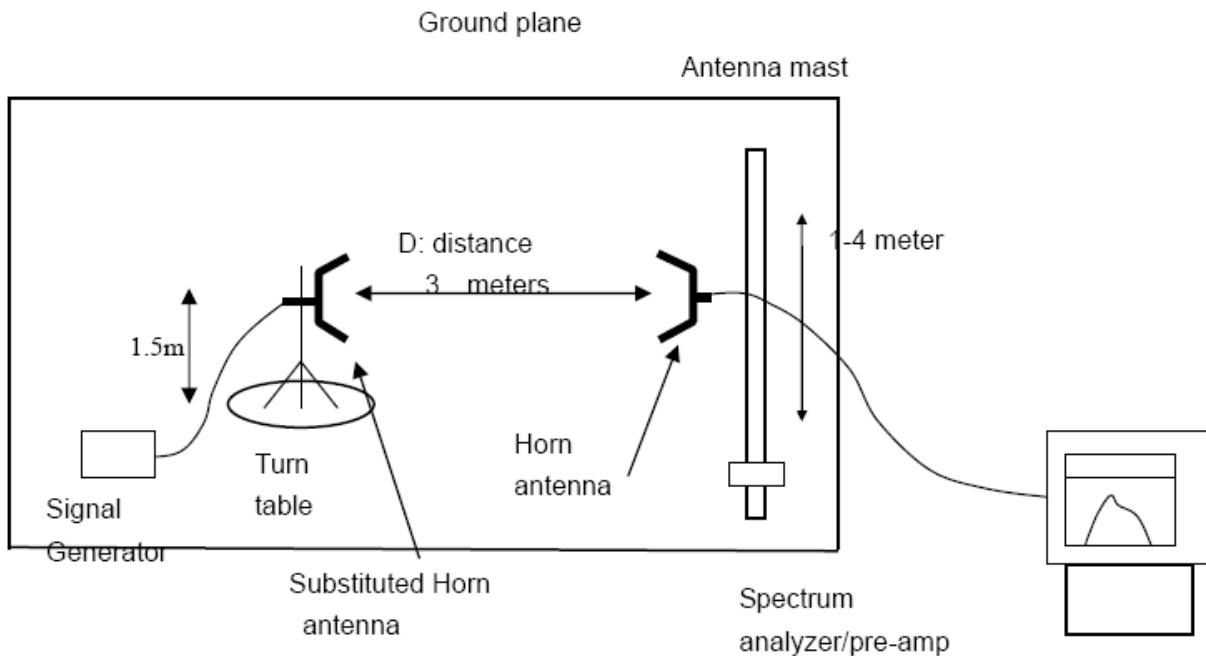


#### 8.4 Substitution Method: (Radiated Emissions)

##### Radiated Below 1GHz



##### Radiated Above 1 GHz



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## 8.5 MEASUREMENT RESULTS:

Limit:  $43 + 10 \log (P)$  dB, (-13 dBm)

**Note: The results were peak values and worse case was recorded**

UHF Band

Bottom channel

Frequency (MHz)	Substituted Level (dBm)	Cable Loss (dBm)	Antennal Polarity	Antenna Gain (dB)	Emission (dBm)	Limit (dBm)
812.25	-40.3	2.1	Vertical	6.2	-36.2	-13
1218.38	-45.5	3.3	Vertical	7.3	-41.5	-13
1624.5	-49.0	3.9	Vertical	8.7	-44.2	-13
812.25	48.0	2.1	Horizontal	6.2	-43.9	-13
1218.38	-54.2	3.3	Horizontal	7.3	-50.2	-13

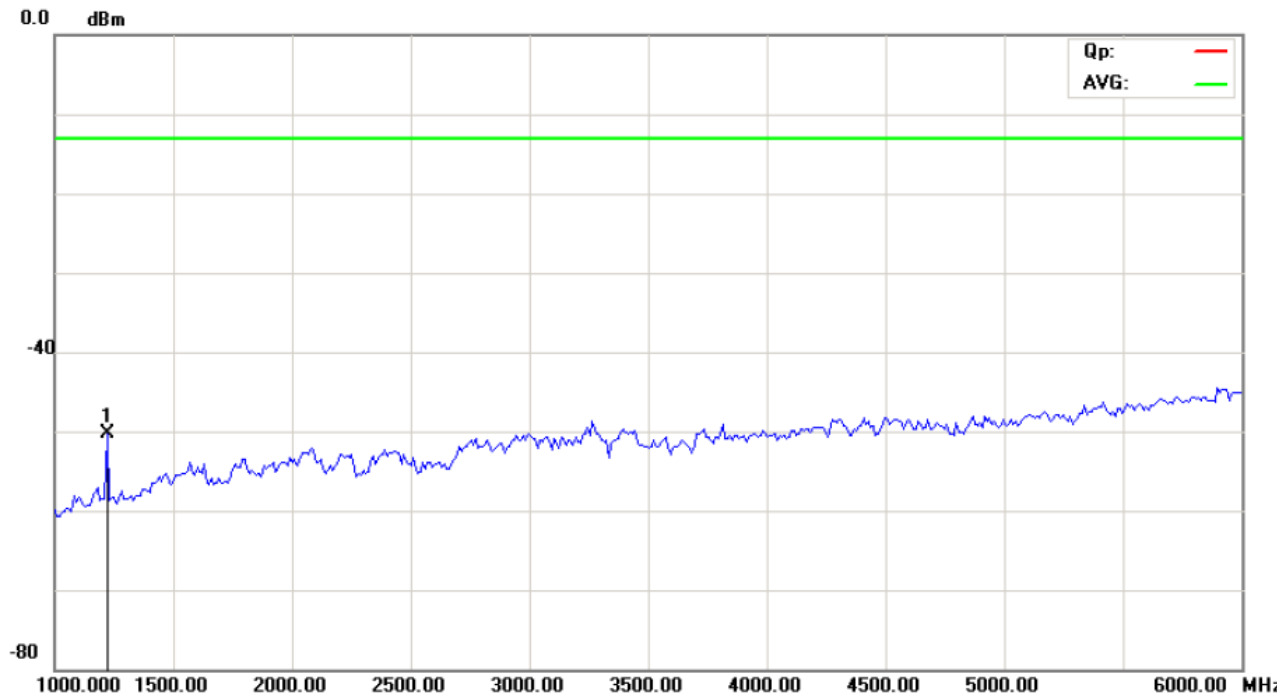
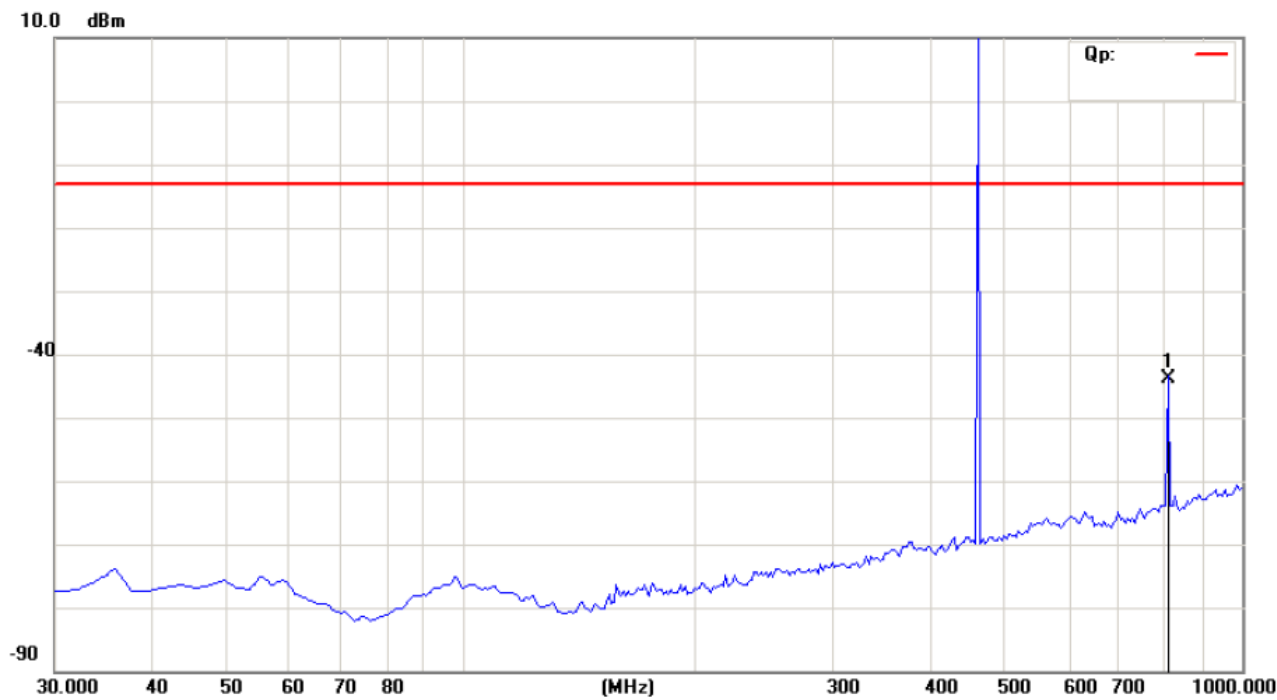
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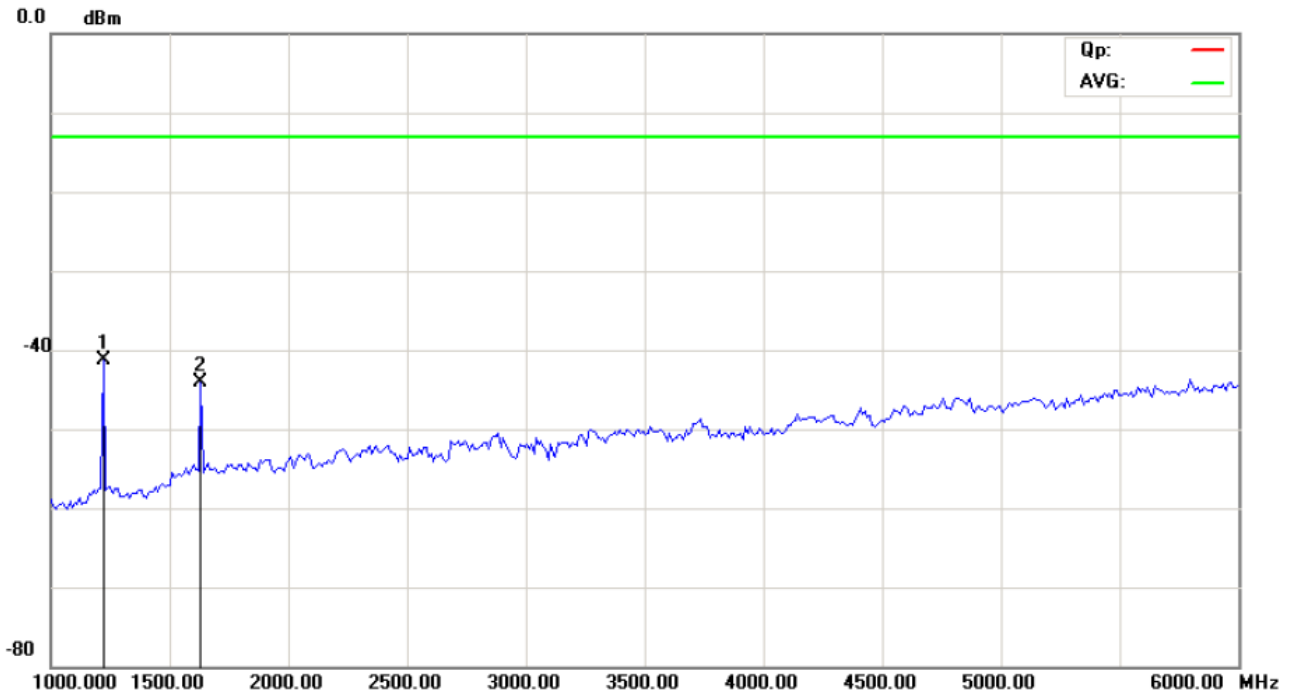
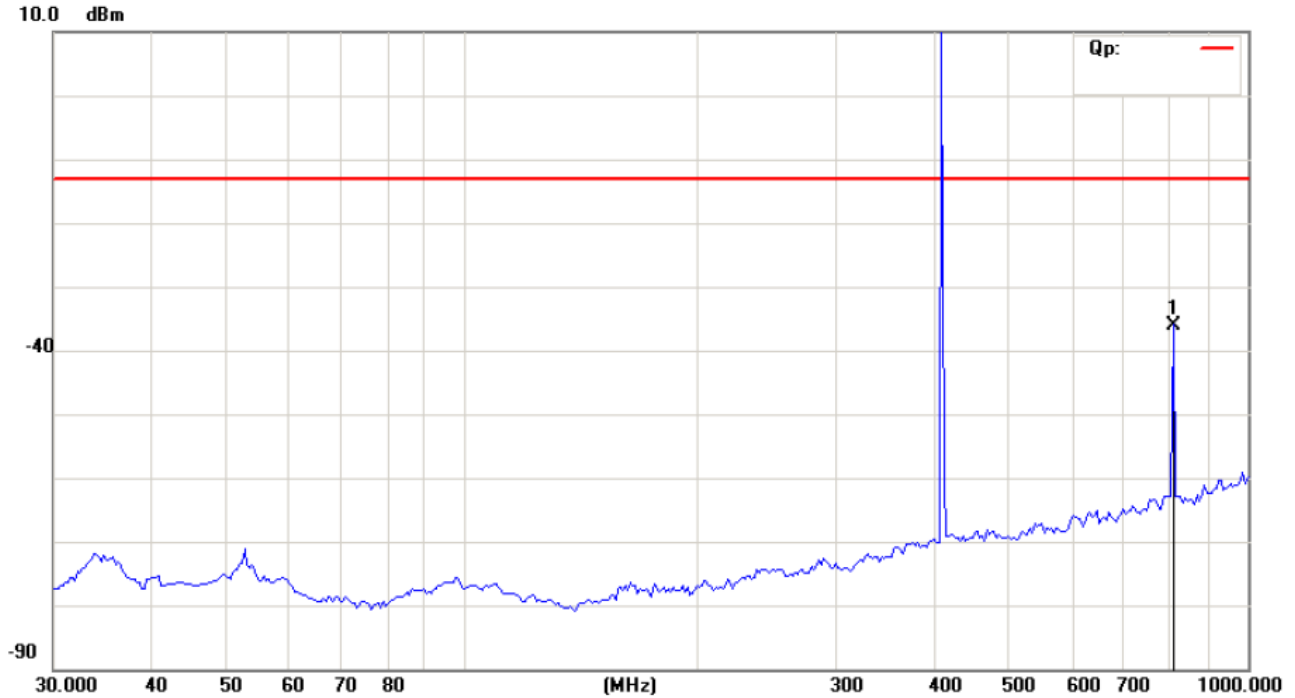
Horizontal-Bottom Channel



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Vertical-Bottom Channel



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Middle channel

Frequency (MHz)	Substituted Level (dBm)	Cable Loss (dBm)	Antennal Polarity	Antenna Gain (dB)	Emission (dBm)	Limit (dBm)
879.95	-40.1	2.3	Vertical	6.3	-36.1	-13
1319.93	-46.5	3.6	Vertical	7.3	-42.8	-13
1759.90	-52.7	4.4	Vertical	8.9	-48.2	-13
879.95	-48.2	2.3	Horizontal	6.3	-44.2	-13
1319.93	-51.3	3.6	Horizontal	7.3	-47.6	-13

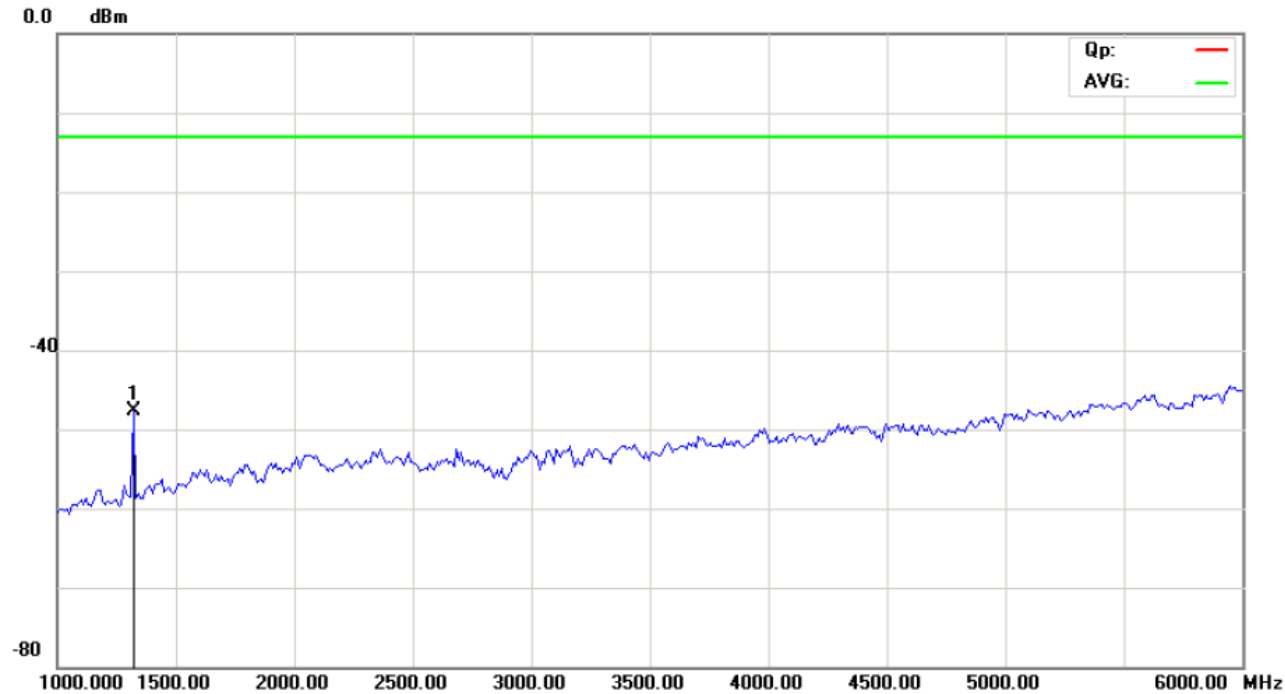
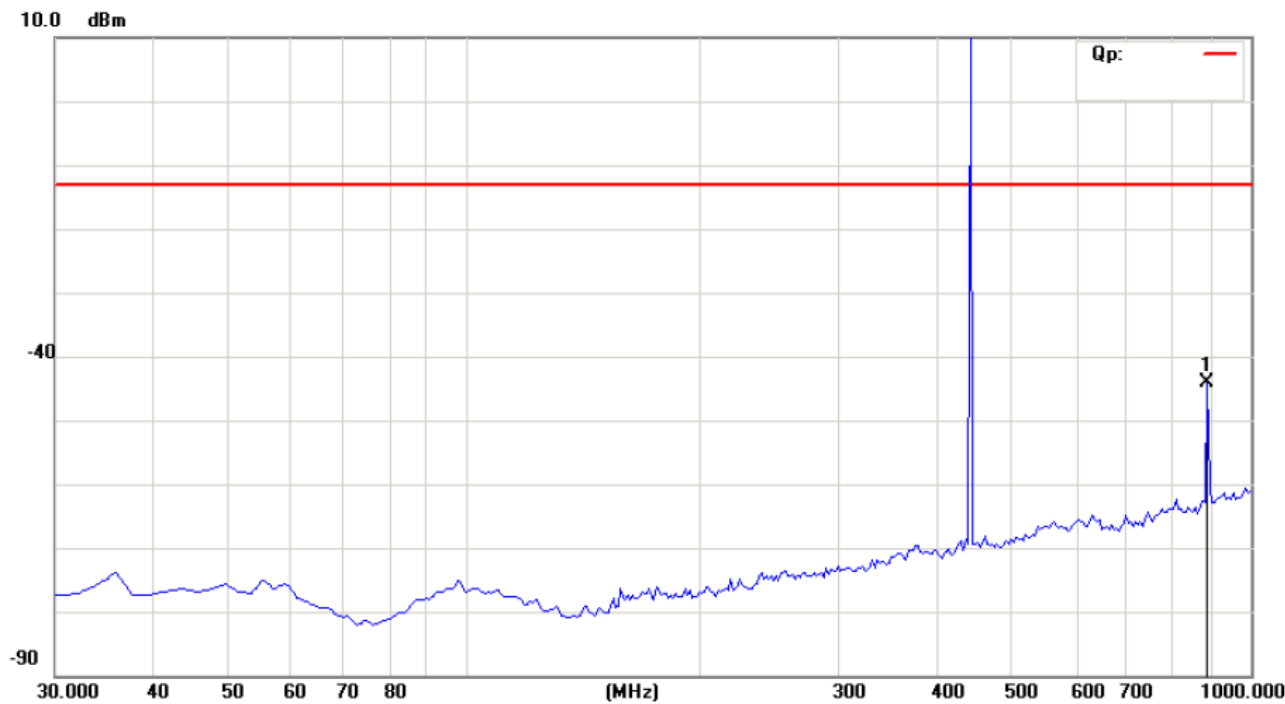
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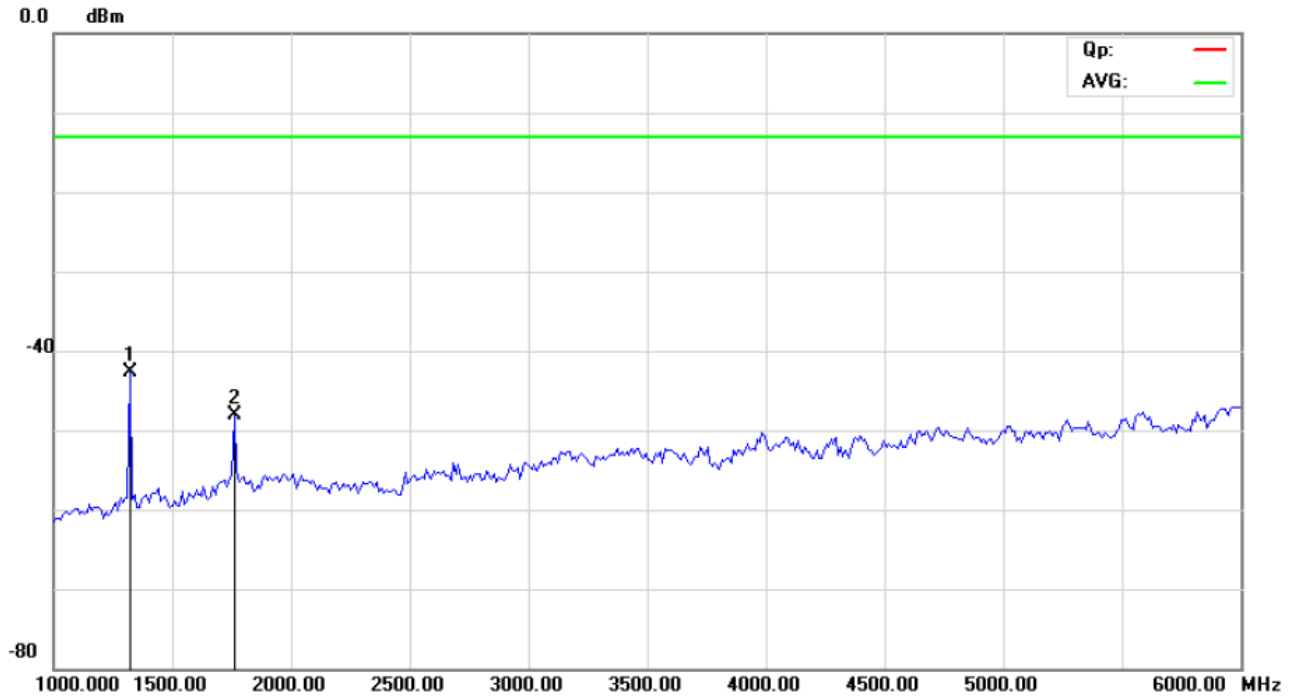
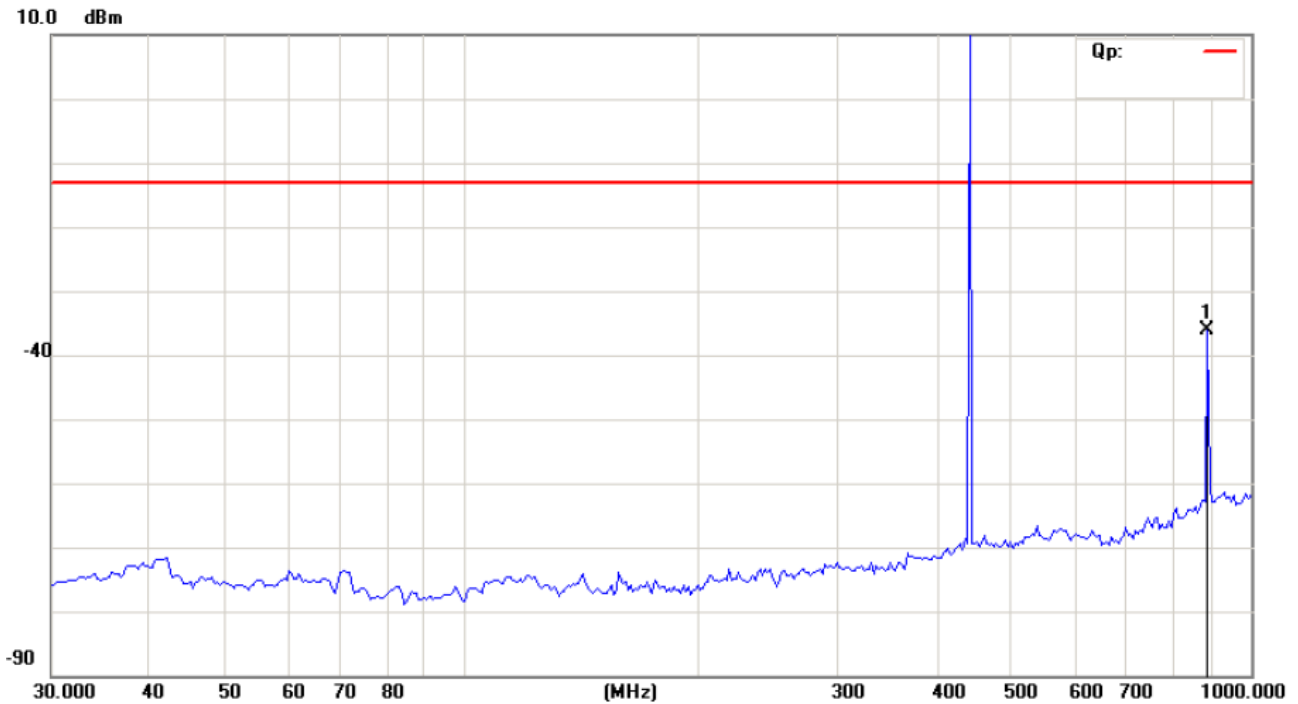
Horizontal-Bottom Channel



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Vertical-Bottom Channel



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Top channel

Frequency (MHz)	Substituted Level (dBm)	Cable Loss (dBm)	Antennal Polarity	Antenna Gain (dB)	Emission (dBm)	Limit (dBm)
939.95	-41.0	2.7	Vertical	6.6	-37.1	-13
1409.93	-47.2	3.8	Vertical	7.8	-43.2	-13
1979.90	-53.3	4.9	Vertical	9.1	-49.1	-13
939.95	-49.2	2.7	Horizontal	6.6	-45.3	-13
1409.93	52.2	3.8	Horizontal	7.8	-48.2	-13

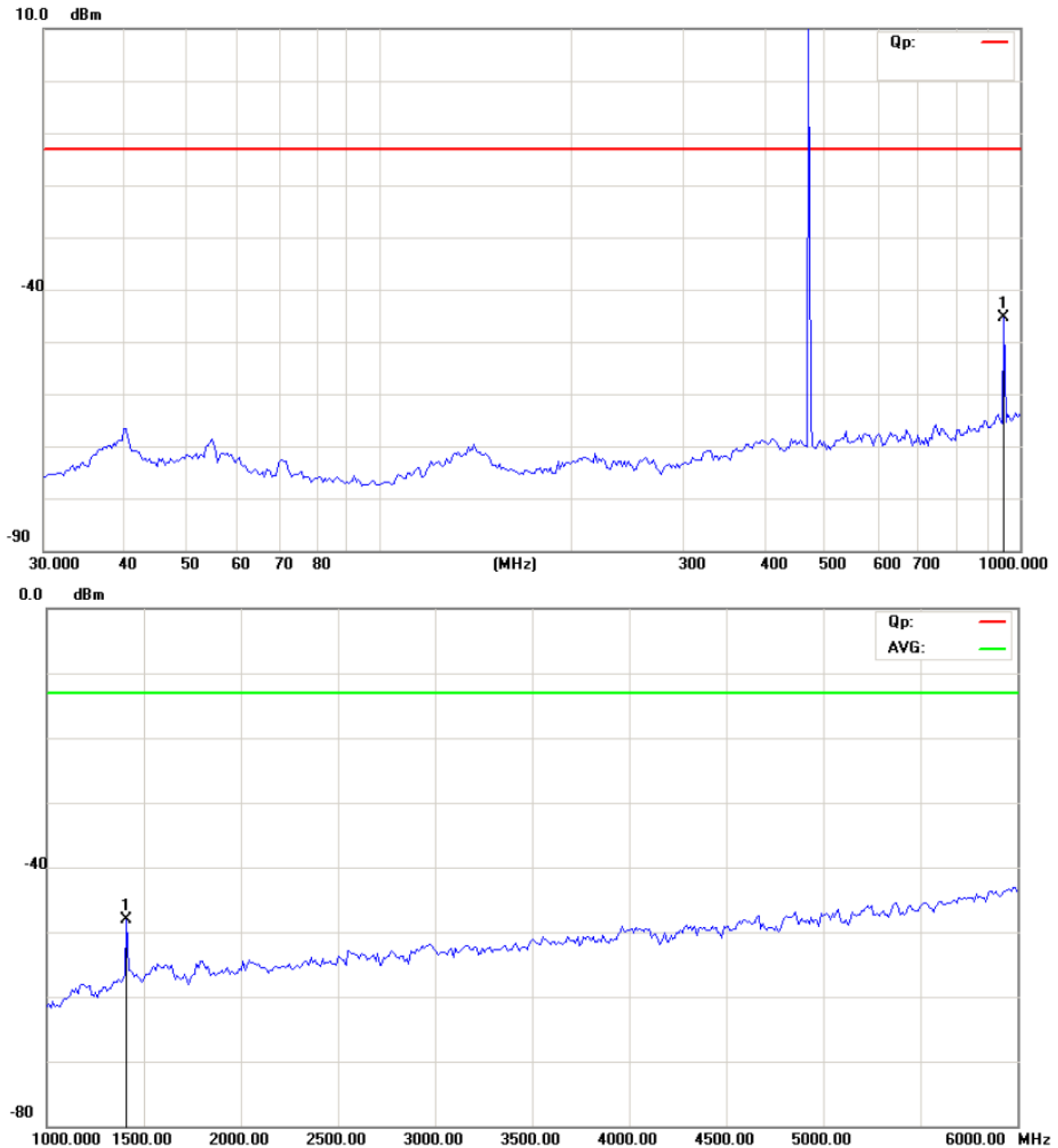
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Horizontal-Bottom Channel



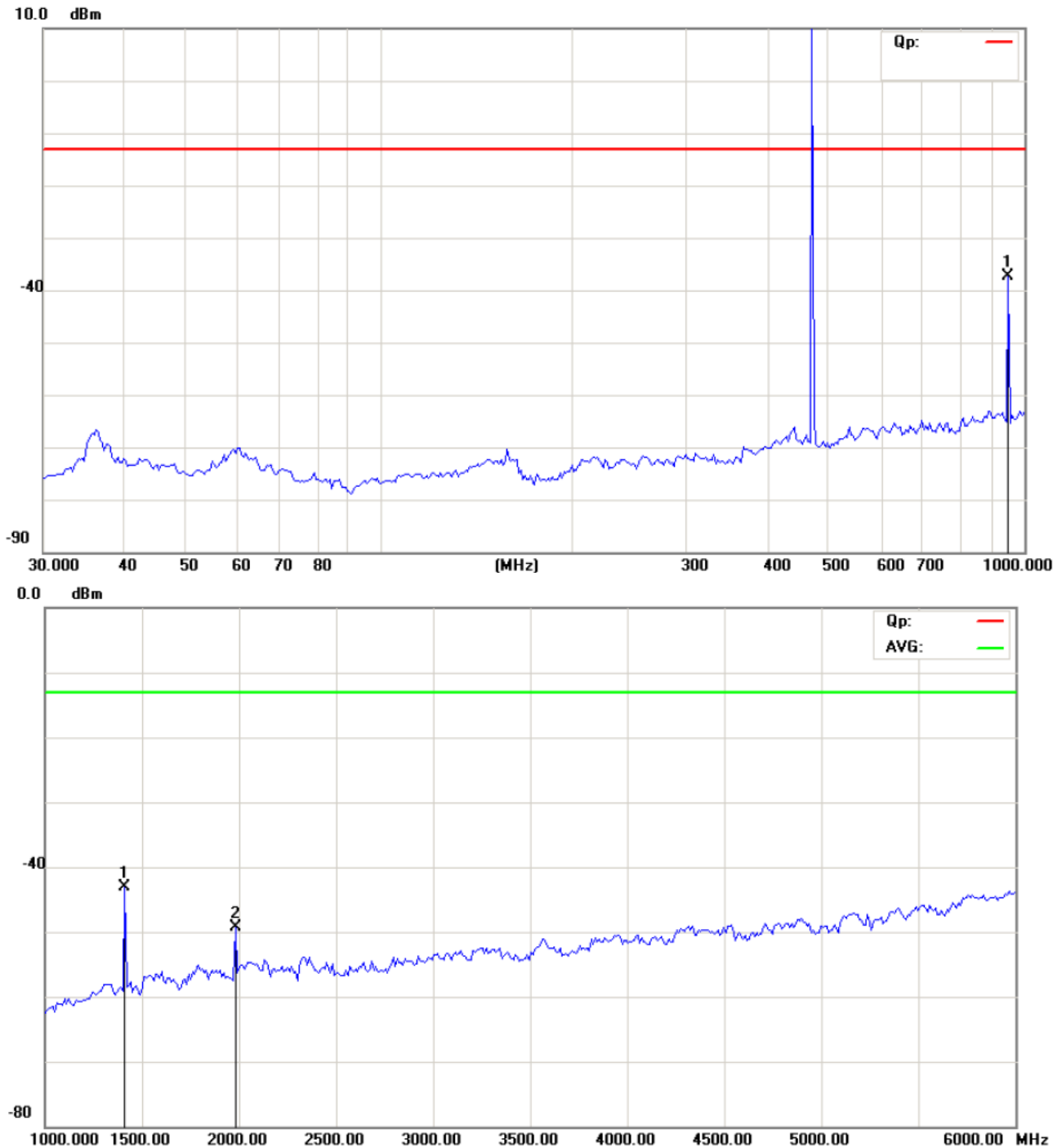
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Vertical-Bottom Channel



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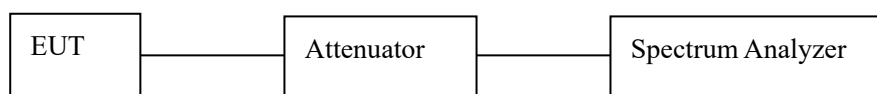
## 8.6 Conducted Emissions

### 8.6.1. Measurement Procedure

- 1). The eut antenna port connect to the spectrum analyzer through a attenuator.
- 2). Let the eut working in transmitter and used the spectrum to measure the conducted emission.
- 3). The output of the antenna shall be connected to the spectrum.

The setup of test receiver: Detector: Peak RBW: 100 kHz for 30-1000MHz, 1MHz for above1GHz  
VBW: 300 kHz for 30-1000MHz 3MHz for above1GHz

### 8.6.2.Test Setup Block Diagram (block diagram of configuration)



### 8.6.3 Test Result

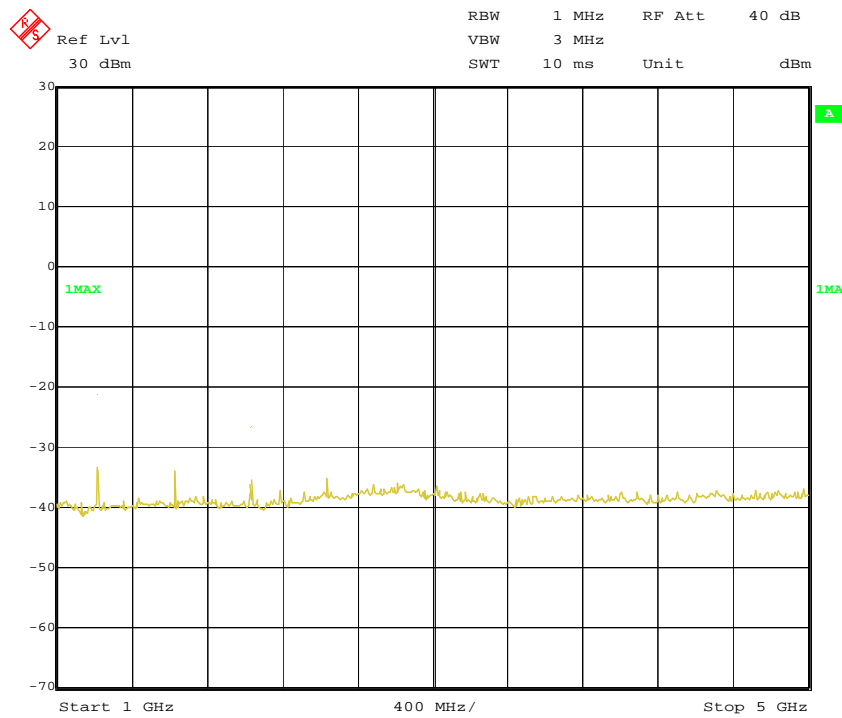
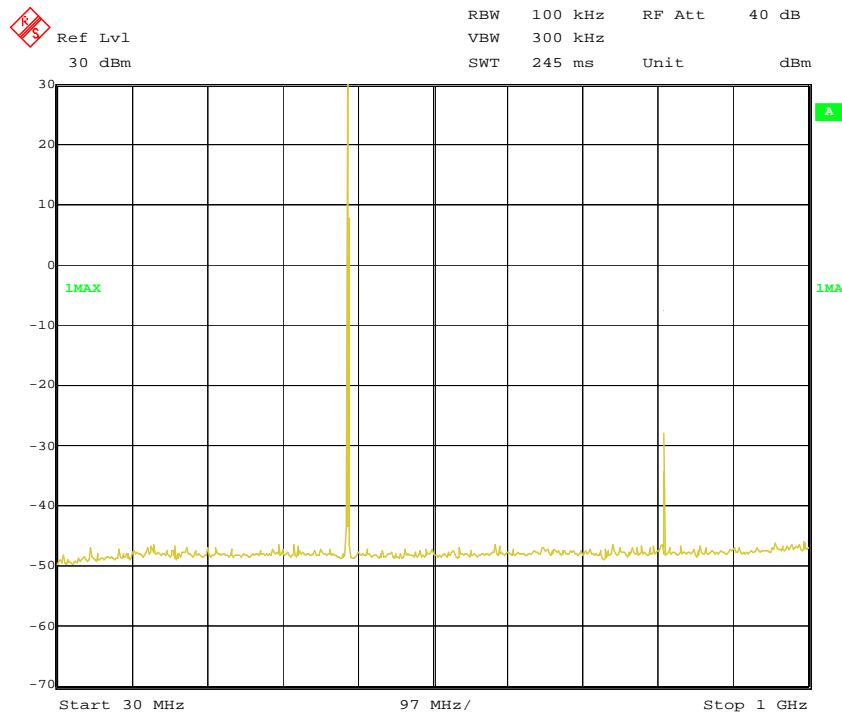
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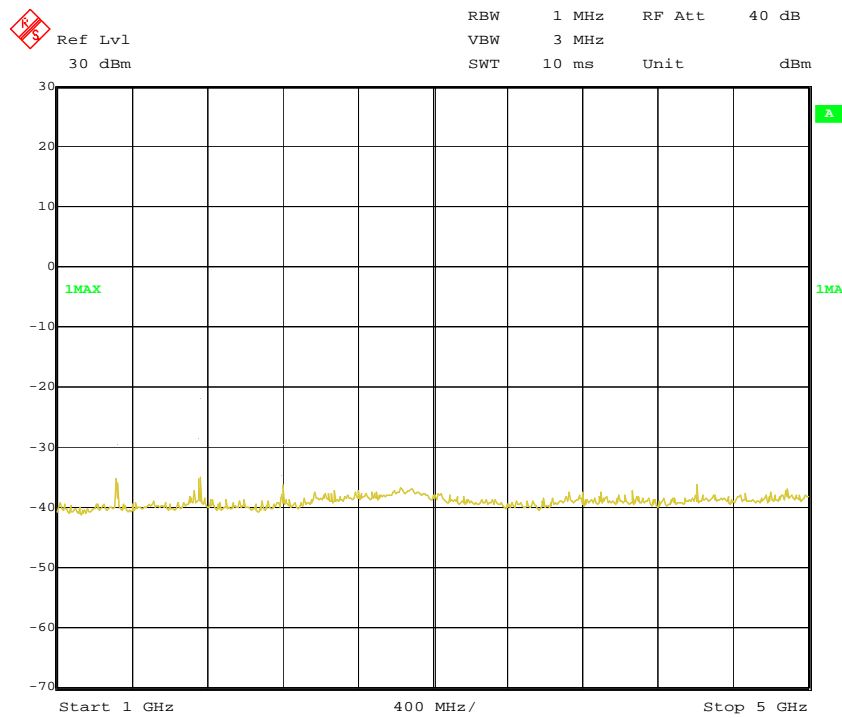
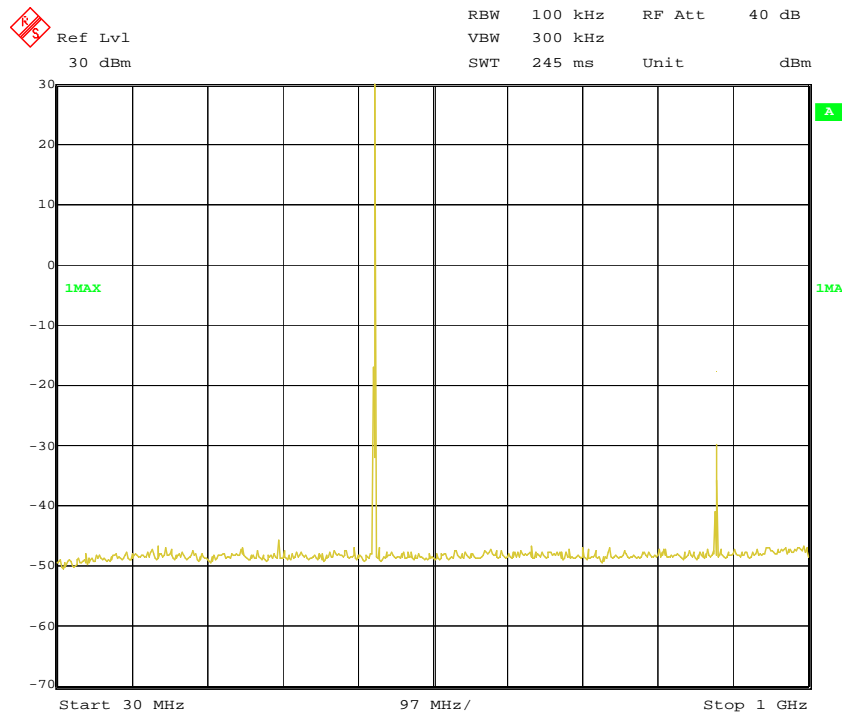
Bottom Channel



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Middle Channel



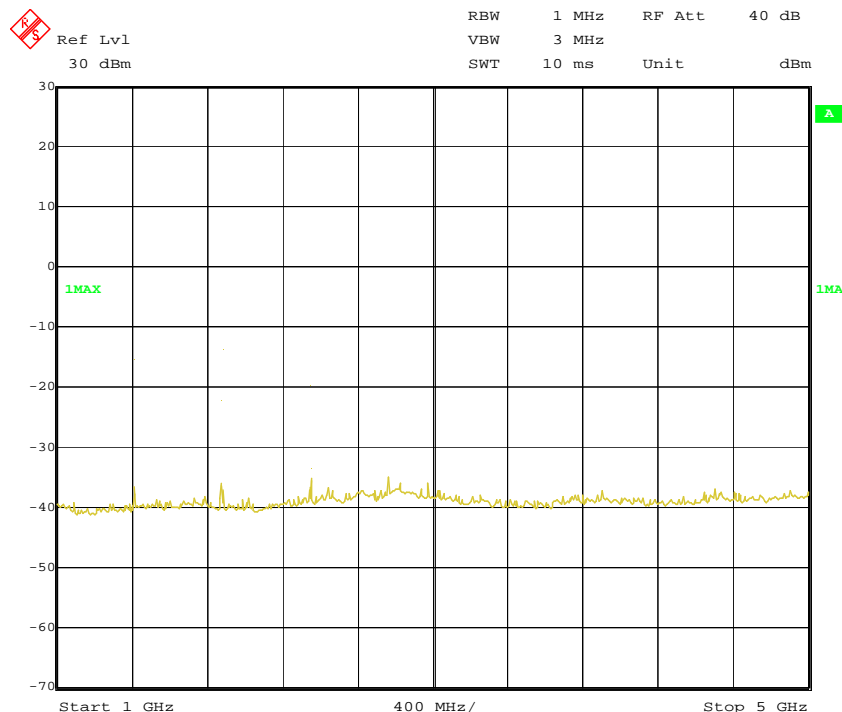
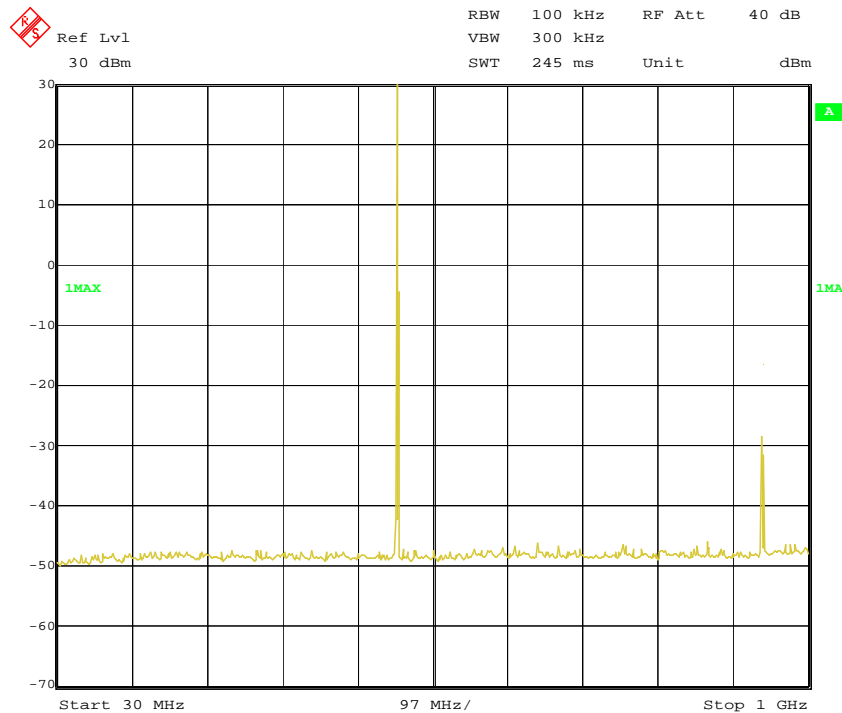
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Top Channel



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## 9. Modulation Characteristics

### 9.1 PROVISIONS APPLICABLE

According to CFR 47 section 2.1047(a), for Voice Modulation Communication Equipment, the frequency response of the audio modulation circuit over a range of 100 to 5000Hz shall be measured.

### 9.2 MEASUREMENT METHOD

#### 9.2.1 Modulation Limit

- (1). Configure the EUT as shown in figure 1, adjust the audio input for 60% of rated system deviation at 1kHz using this level as a reference (0dB) and vary the input level from -20 to +20dB. Record the frequency deviation obtained as a function of the input level.
- (2). Repeat step 1 with input frequency changing to 300, 1000, 1500 and 3000Hz in sequence.

#### 9.2.2 Audio Frequency Response

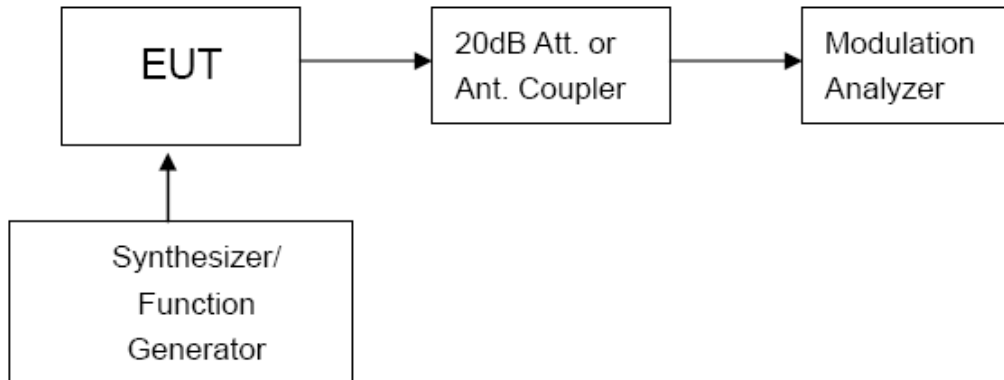
- (1). The EUT and test equipment were set up as shown in figure 2.
- (2). Adjust the Modulation Analyzer for the following setting:
  - a) High-pass filter : off
  - b) Low-pass filter : 15 kHz
  - c) Detector : positive peak
  - d) Function : FM
- (3). The audio signal input was adjusted to obtain 20 % modulation at 1 kHz, and this point was taken as the 0 dB reference level.
- (4). With input levels held constant and below limiting at all frequencies, the audio signal generator was varied from 300 Hz to 5 kHz.
- (5). The response in dB relative to 1 kHz was then measured, using the Modulation Analyzer.

The report refers only to the sample tested and does not apply to the bulk.

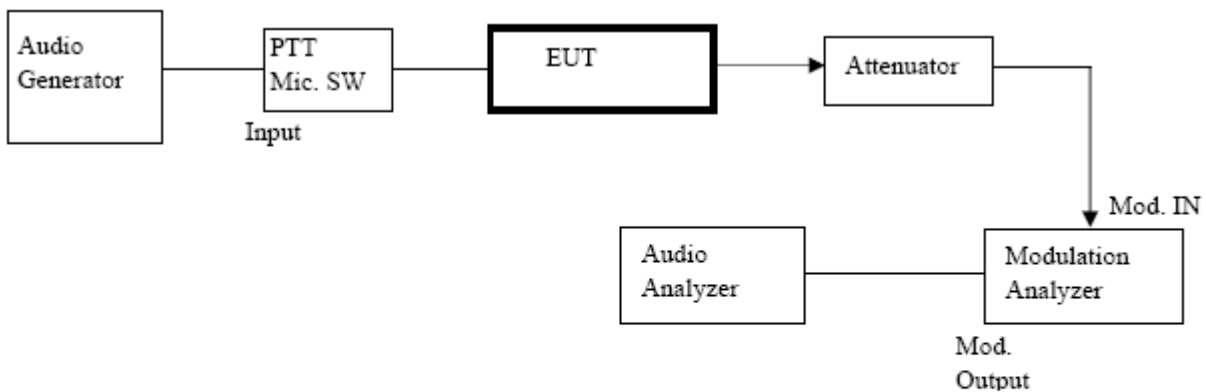
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**Figure 1: Modulation characteristic measurement configuration**



**Figure 2: Audio Frequency Response Measurement Configure**

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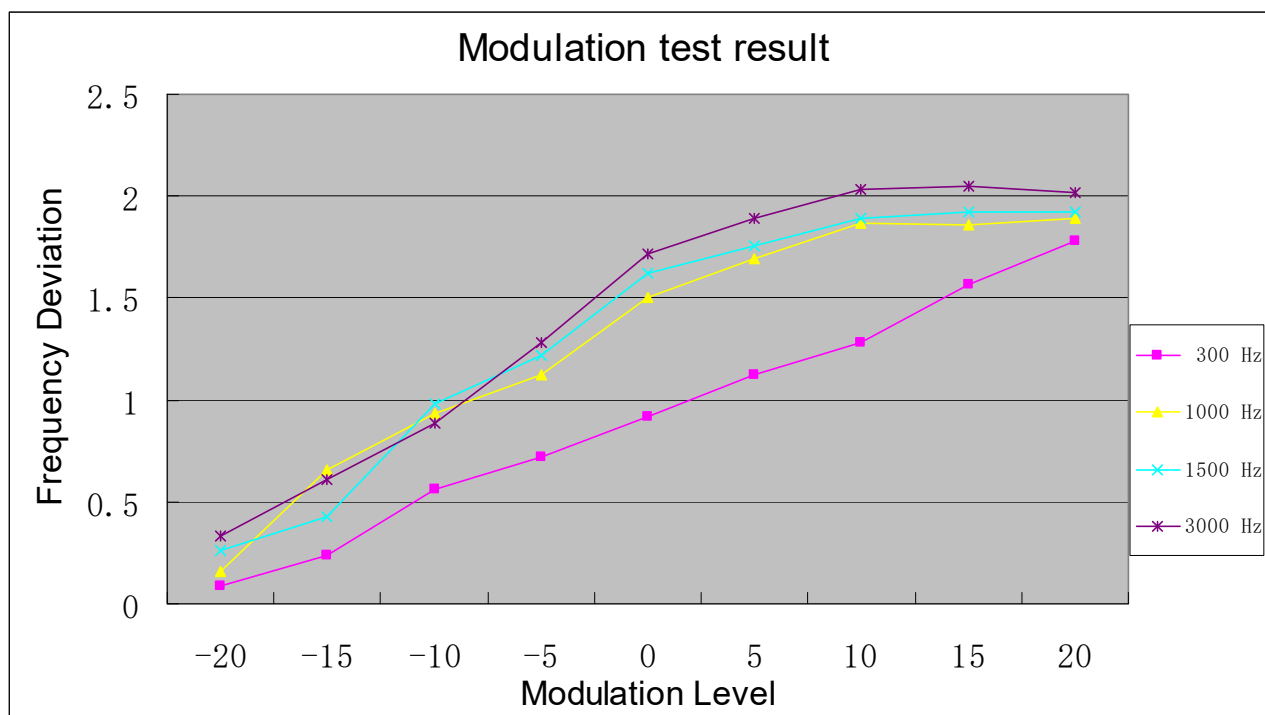


## 9.4 MEASUREMENT RESULT

### (a). Modulation Limit:

**Middle channel (For UHF Band, 12.5 kHz Channel Bandwidth)**

Modulation Level (dB)	Peak Freq. Deviation At 300 Hz	Peak Freq. Deviation At 1000 Hz	Peak Freq. Deviation At 1500 Hz	Peak Freq. Deviation At 3000 Hz
-20	0.09	0.16	0.26	0.33
-15	0.24	0.66	0.43	0.61
-10	0.56	0.93	0.98	0.89
-5	0.72	1.12	1.22	1.28
0	0.92	1.5	1.62	1.72
5	1.12	1.69	1.76	1.89
10	1.28	1.87	1.89	2.03
15	1.57	1.86	1.92	2.05
20	1.78	1.89	1.92	2.02



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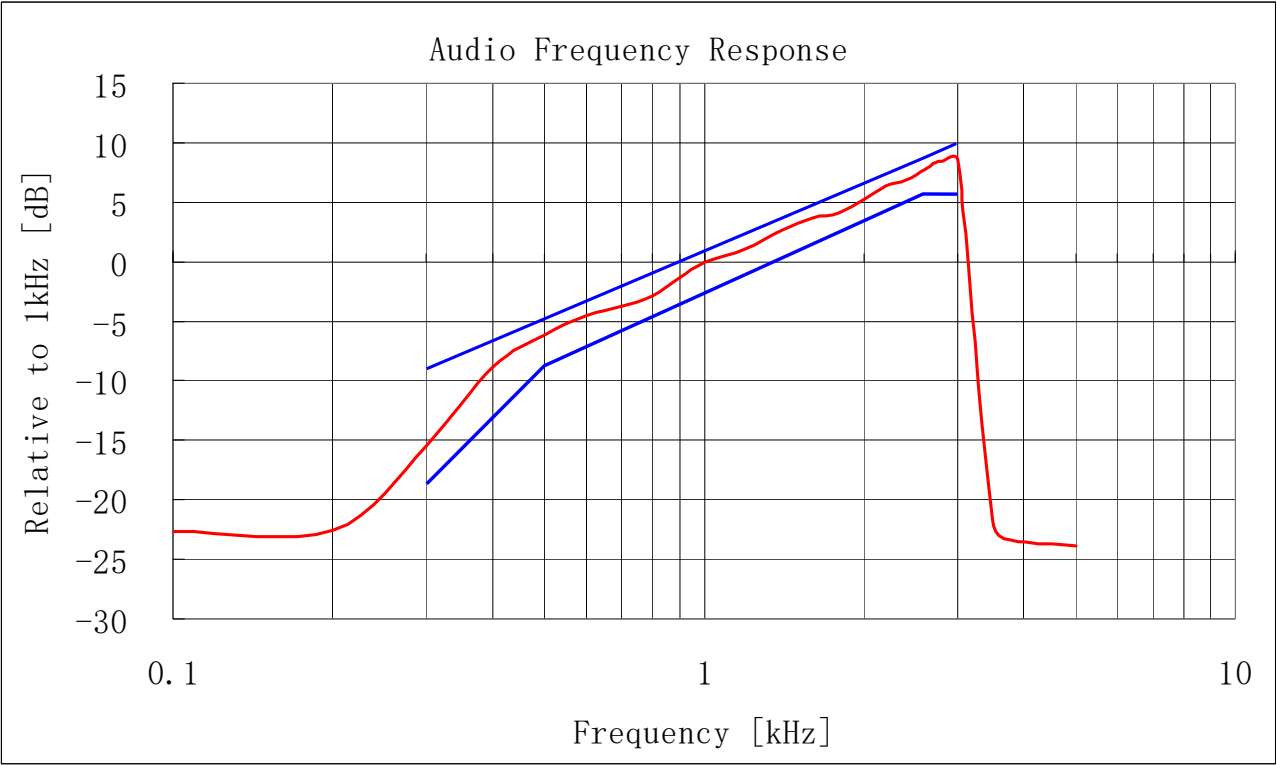
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**(b). Audio Frequency Response:**

**For UHF Band, 12.5 kHz Channel Bandwidth**



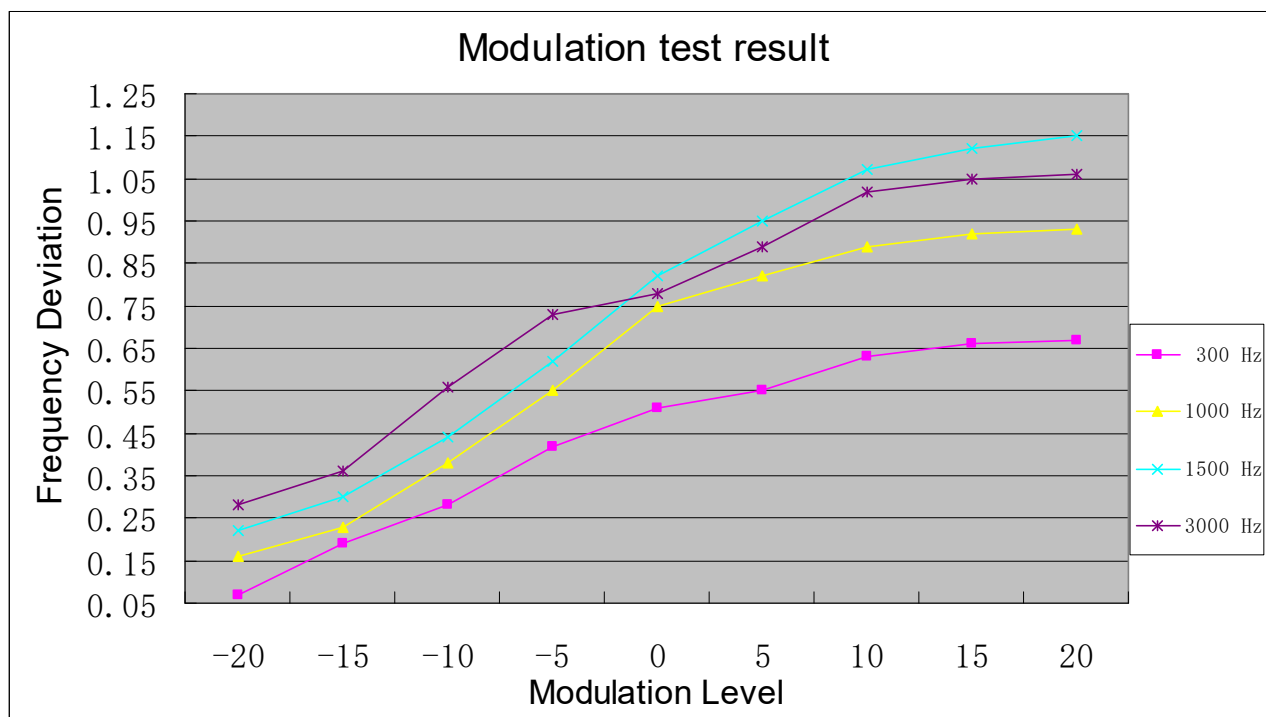
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**(a). Modulation Limit:**

**Middle channel (For UHF Band, 6.25 kHz Channel Bandwidth)**

Modulation Level (dB)	Peak Freq. Deviation At 300 Hz	Peak Freq. Deviation At 1000 Hz	Peak Freq. Deviation At 1500 Hz	Peak Freq. Deviation At 3000 Hz
-20	0.07	0.16	0.22	0.28
-15	0.19	0.23	0.3	0.36
-10	0.28	0.38	0.44	0.56
-5	0.42	0.55	0.62	0.73
0	0.51	0.75	0.82	0.78
5	0.55	0.82	0.95	0.89
10	0.63	0.89	1.07	1.02
15	0.66	0.92	1.12	1.05
20	0.67	0.93	1.15	1.06



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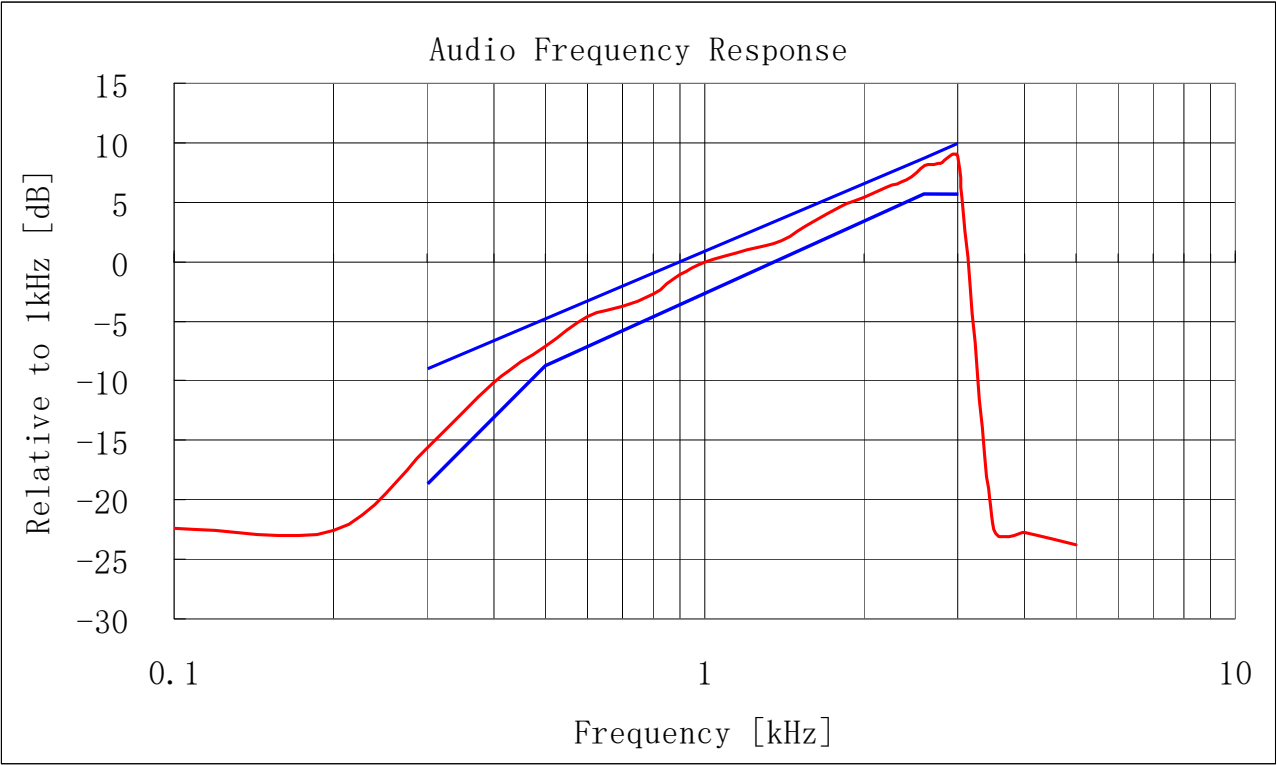
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**(b). Audio Frequency Response:**

**For UHF Band, 6.25 kHz Channel Bandwidth**



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## 10. MAXIMUM TRANSMITTER POWER (CONDUCTED OUTPUT POWER)

### 10.1 PROVISIONS APPLICABLE

Per FCC §2.1046 and §90.205: Maximum ERP is dependent upon the station's antenna HAAT and required service area.

### 10.2 TEST PROCEDURE

The RF output of Two-way Radio was conducted to a spectrum analyzer through an appropriate attenuator.

Spectrum analyzer setting: RBW=10 kHz, VBW=30 kHz, PK detector

### 10.3 TEST RESULT

Calculation Formula:  $CP = R + A + L$

\* Note:

CP: The final Conducted Power

R : The reading value from spectrum analyzer

A : The attenuation value of the used attenuator

L : The loss of all connection cables

#### For 12.5 kHz Channel Bandwidth

Conducted Power Measurement Results		
Channel Separation	Channel	Measurement Result (dBm)
UHF Band	Bottom channel	32.19
	Middle Channel	32.09
	Top channel	32.12

Measured Maximum ERP=31.22dBm

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**For 6.25 kHz Channel Bandwidth**

Conducted Power Measurement Results		
Channel Separation	Channel	Measurement Result (dBm)
UHF Band	Bottom channel	32.07
	Middle Channel	31.90
	Top channel	31.96

Measured Maximum ERP =31.06dBm

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## 11. TRANSMITTER FREQUENCY BEHAVIOR

### 11.1 PROVISIONS APPLICABLE

Transmitters designed to operate in the 150–174 MHz and 421–512 MHz frequency bands must maintain transient frequencies within the maximum frequency difference limits during the time intervals indicated:

$t_3$  is the time period from the instant when the transmitter is turned off until  $t_{\text{off}}$ .

$t_{\text{off}}$  is the instant when the 1 kHz test signal starts to rise.

<sup>2</sup> During the time from the end of  $t_2$  to the beginning of  $t_3$ , the frequency difference must not exceed the limits specified in § 90.213.

Time intervals <sup>1,2</sup>	Maximum frequency difference <sup>3</sup>	All equipment	
		150 to 174 MHz	421 to 512 MHz

#### Transient Frequency Behavior for Equipment Designed to Operate on 25 kHz Channels

$t_1$ <sup>4</sup> .....	±25.0 kHz	5.0 ms	10.0 ms
$t_2$ .....	±12.5 kHz	20.0 ms	25.0 ms
$t_3$ <sup>4</sup> .....	±25.0 kHz	5.0 ms	10.0 ms

#### Transient Frequency Behavior for Equipment Designed to Operate on 12.5 kHz Channels

$t_1$ <sup>4</sup> .....	±12.5 kHz	5.0 ms	10.0 ms
$t_2$ .....	±6.25 kHz	20.0 ms	25.0 ms
$t_3$ <sup>4</sup> .....	±12.5 kHz	5.0 ms	10.0 ms

#### Transient Frequency Behavior for Equipment Designed to Operate on 6.25 kHz Channels

$t_1$ <sup>4</sup> .....	±6.25 kHz	5.0 ms	10.0 ms
$t_2$ .....	±3.125 kHz	20.0 ms	25.0 ms
$t_3$ <sup>4</sup> .....	±6.25 kHz	5.0 ms	10.0 ms

<sup>1</sup><sub>on</sub> is the instant when a 1 kHz test signal is completely suppressed, including any capture time due to phasing.

$t_1$  is the time period immediately following  $t_{\text{on}}$ .

$t_2$  is the time period immediately following  $t_1$ .

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$t_3$  is the time period from the instant when the transmitter is turned off until  $t_{\text{off}}$ .

$t_{\text{off}}$  is the instant when the 1 kHz test signal starts to rise.

<sup>2</sup> During the time from the end of  $t_2$  to the beginning of  $t_3$ , the frequency difference must not exceed the limits specified in § 90.213.

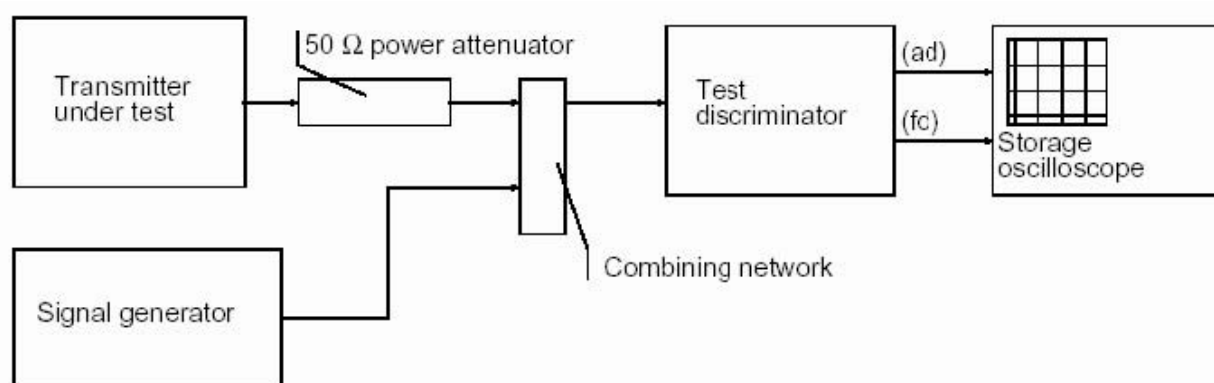
<sup>3</sup> Difference between the actual transmitter frequency and the assigned transmitter frequency.

<sup>4</sup> If the transmitter carrier output power rating is 6 watts or less, the frequency difference during this time period may exceed the maximum frequency difference for this time period.

## 11.2 Test Method

TIA-603-D-2010

## 11.3 Test setup Block Diagram



## 11.4 MEASURE RESULT

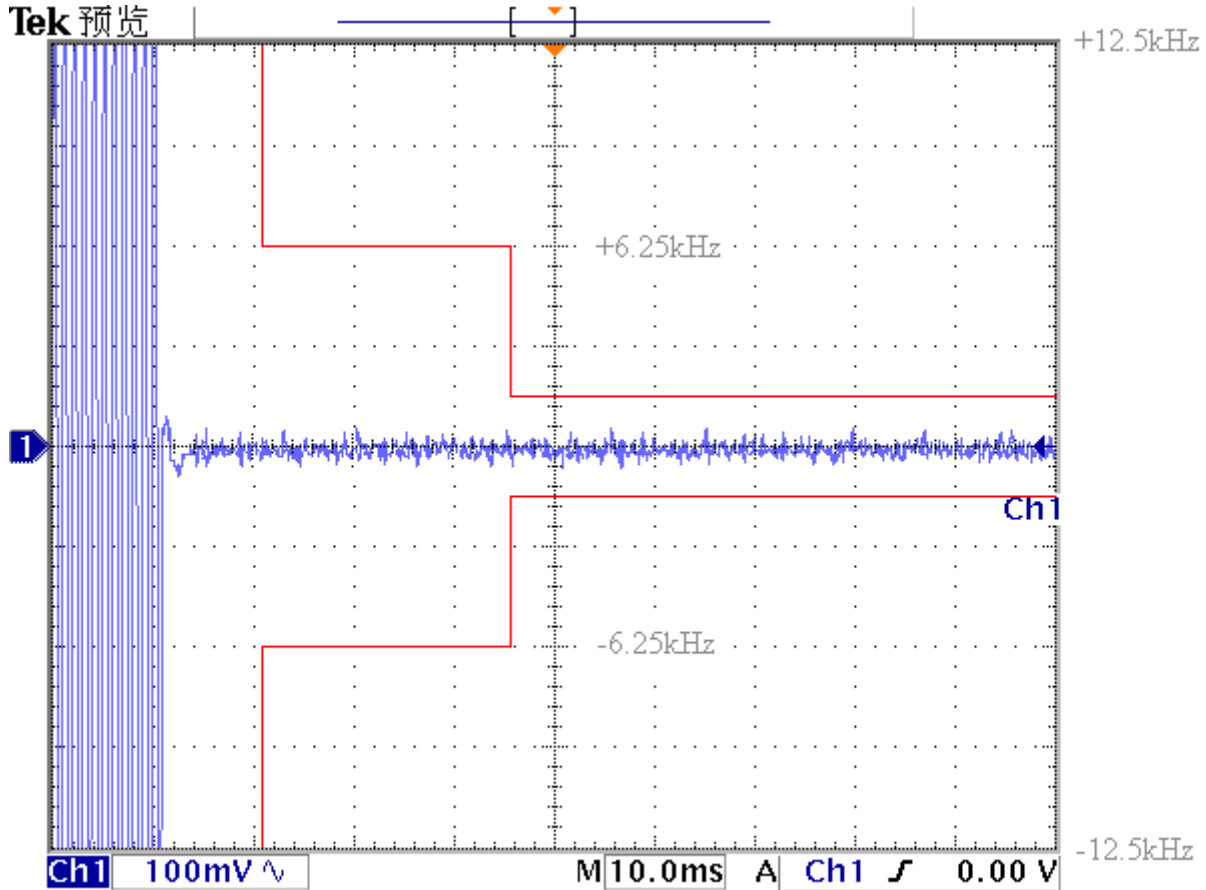
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Transmitter Frequency Behaviour @ 12.5 kHz Channel Bandwidth --Off to On at UHF Band



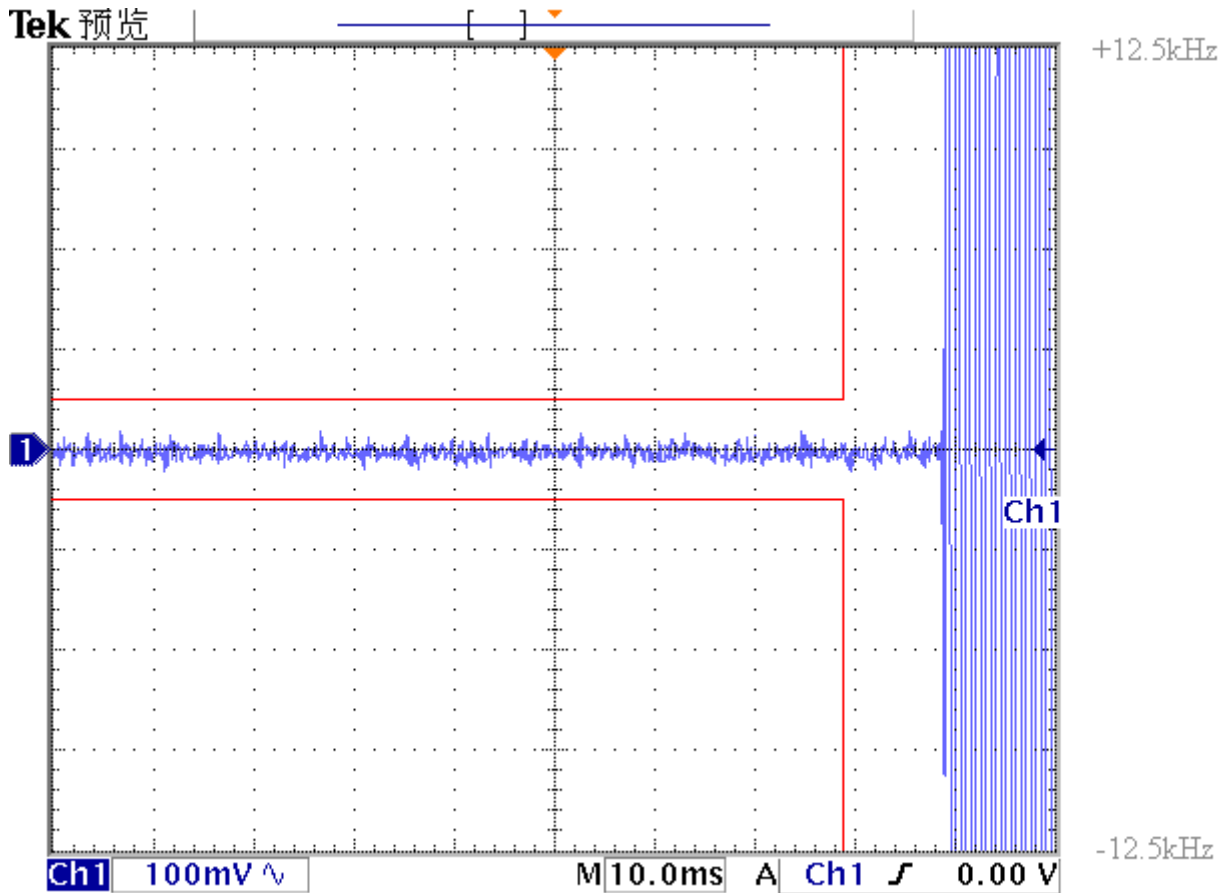
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Transmitter Frequency Behaviour @ 12.5 kHz Channel Bandwidth—On to Off at UHF Band



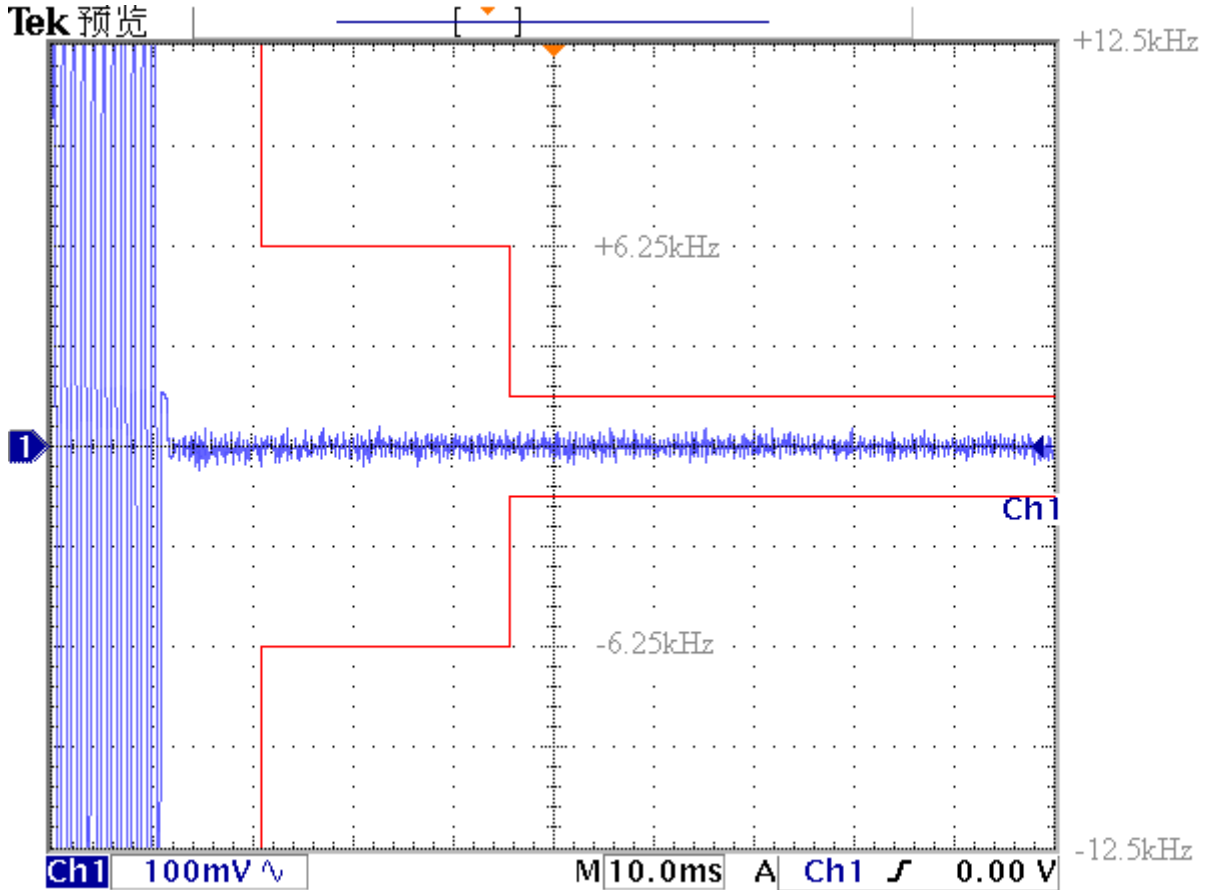
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Transmitter Frequency Behaviour @ 6.25 kHz Channel Bandwidth --Off to On at UHF Band



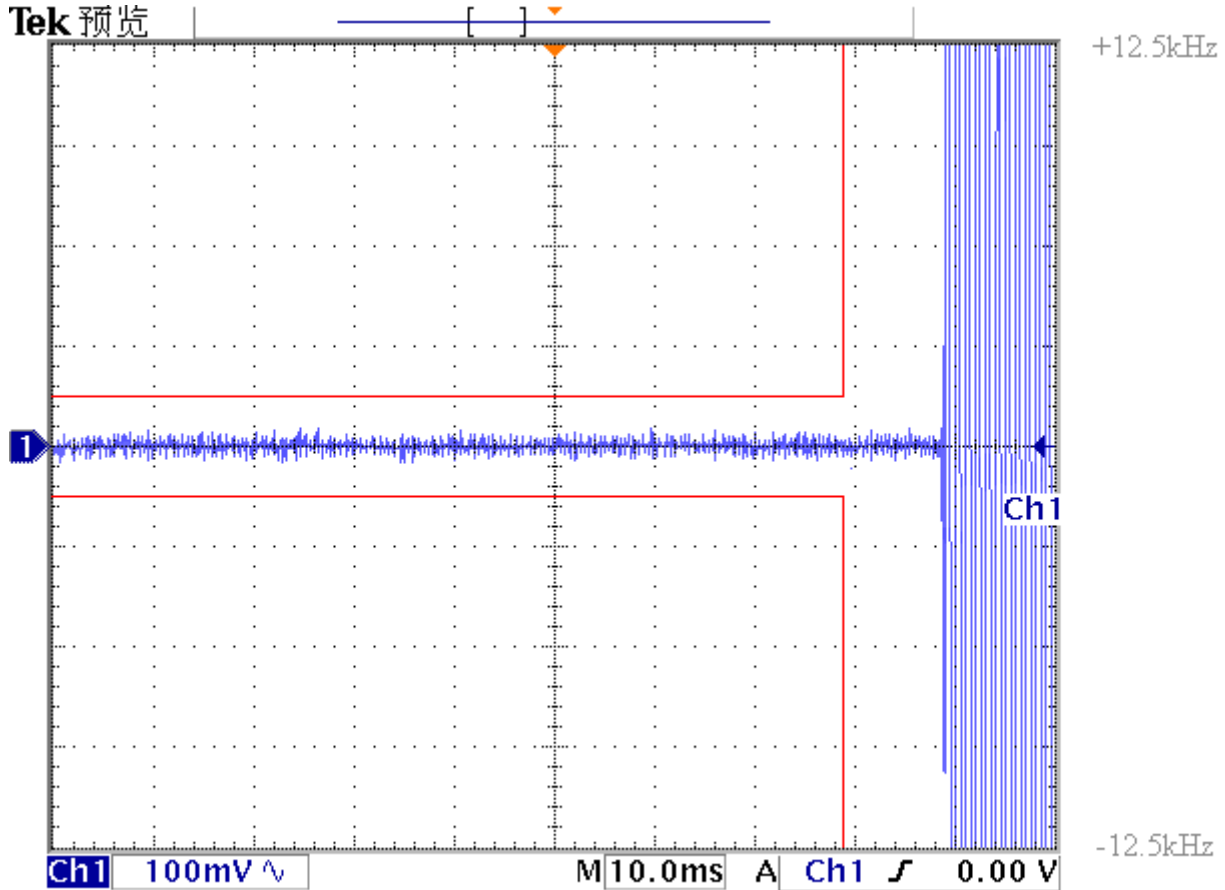
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Transmitter Frequency Behaviour @ 6.25 kHz Channel Bandwidth—On to Off at UHF Band



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## **12. Radiated Emission on Receiving Mode**

### **12.1 Provisions Applicable**

FCC Part 15 Subpart B Section 15.109

### **12.2 TEST METHOD**

ANSI C 63.4: 2014

### **12.4 MEASURE RESULT (MEASURED AT 3M USING FCC PART15 B LIMITS)**

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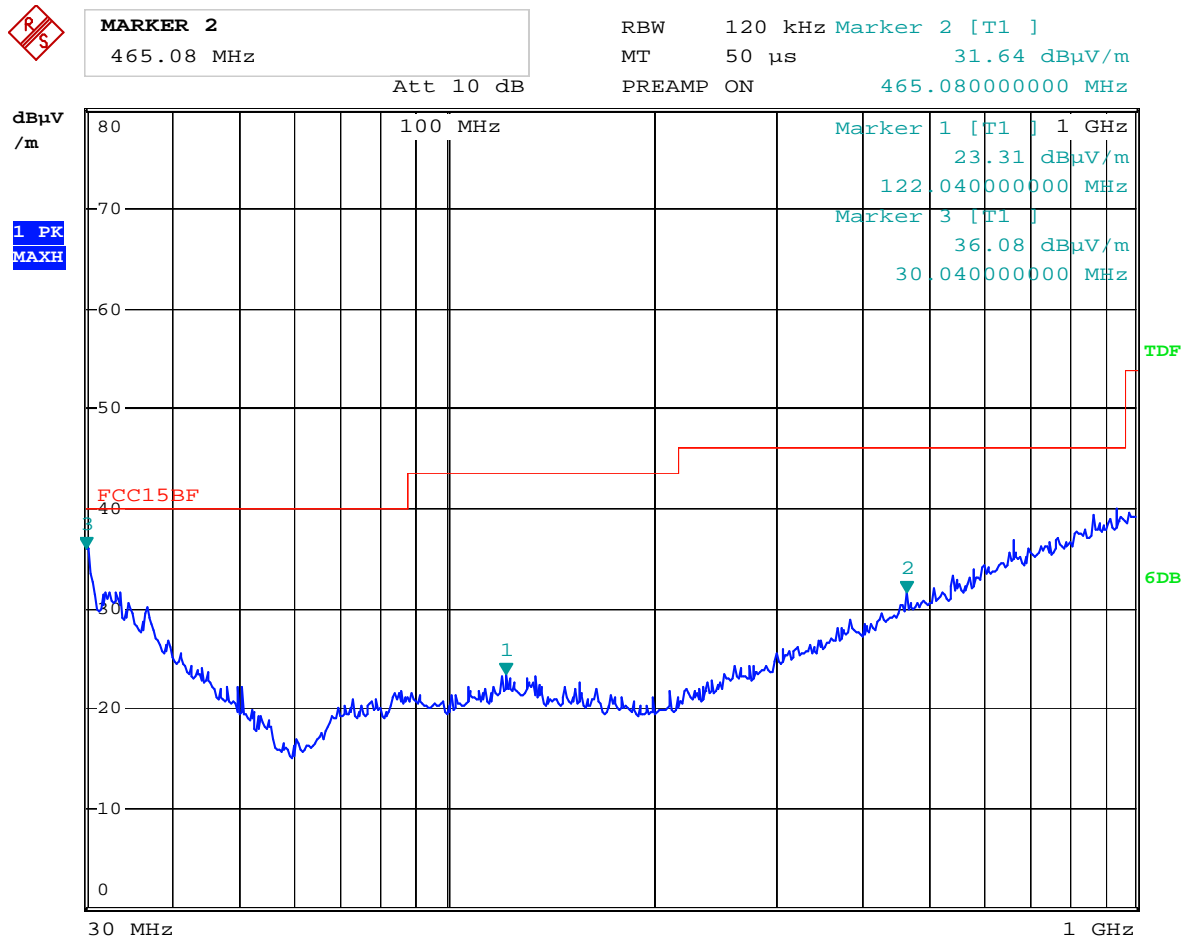


## Radiated Emission In Horizontal (30MHz---1000MHz)

EUT set Condition: Charging and Receiving

**Results: Pass**

Please refer to following diagram for individual



Frequency (MHz)	Level@3m (dB μ V/m)	Antenna Polarity	Limit@3m (dB μ V/m)
465.080	31.64	H	46.00
122.040	23.31	H	43.50
30.040	36.08	H	40.00

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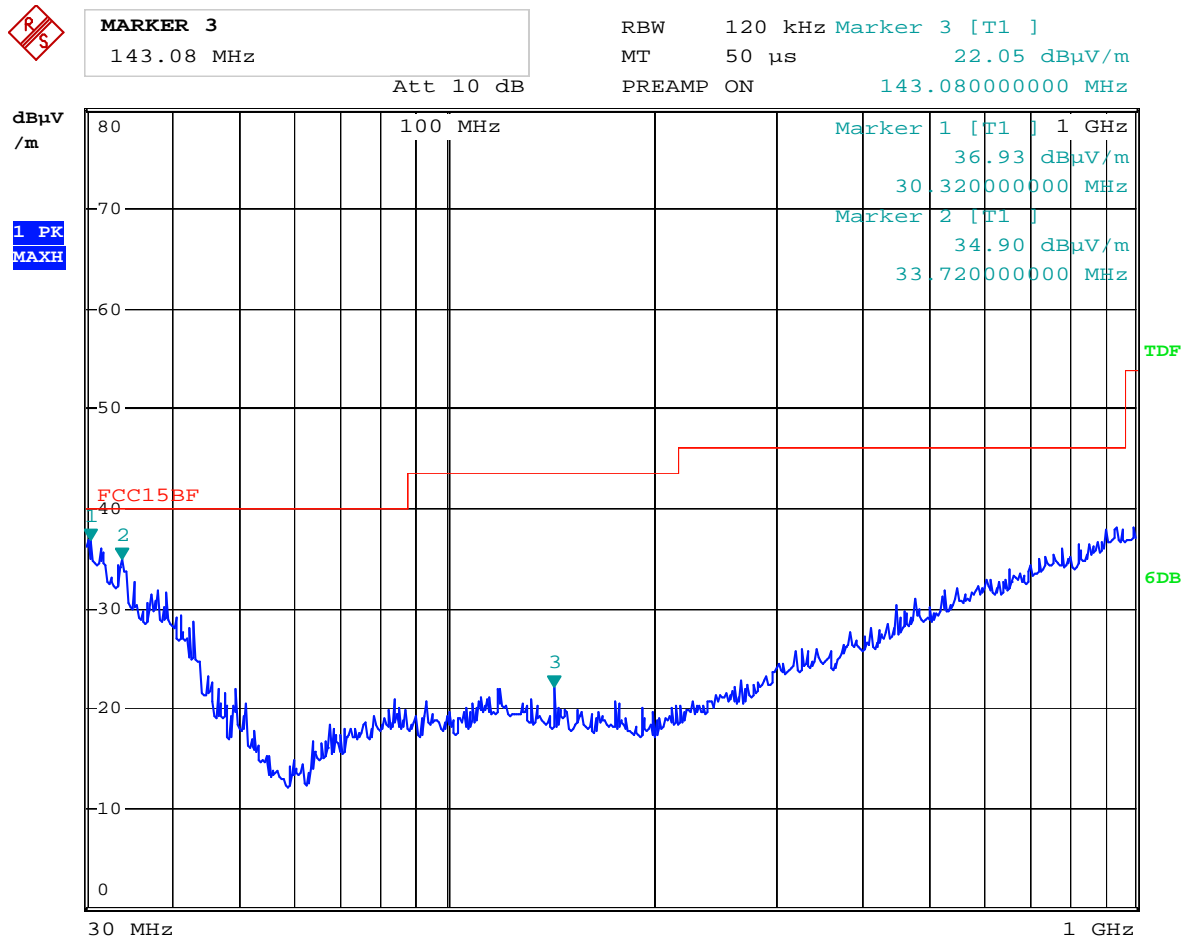


## Radiated Emission In Vertical (30MHz----1000MHz)

EUT set Condition: Charging and Receiving

**Results: Pass**

Please refer to following diagram for individual



Frequency (MHz)	Level@3m (dB μ V/m)	Antenna Polarity	Limit@3m (dB μ V/m)
143.080	22.05	V	43.50
30.320	36.93	V	40.00
33.720	34.90	V	40.00

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### 13.0 FCC ID Label

**FCC ID: ZZ2-ATR-22**

The label must not be a stick-on paper label. The label on these products must be permanently affixed to the product and readily visible at the time of purchase and must last the expected lifetime of the equipment not be readily detachable.

#### Mark Location:



FCC ID Label Location

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#### 14.0 Photo of testing

##### 14.1 Conducted test View--



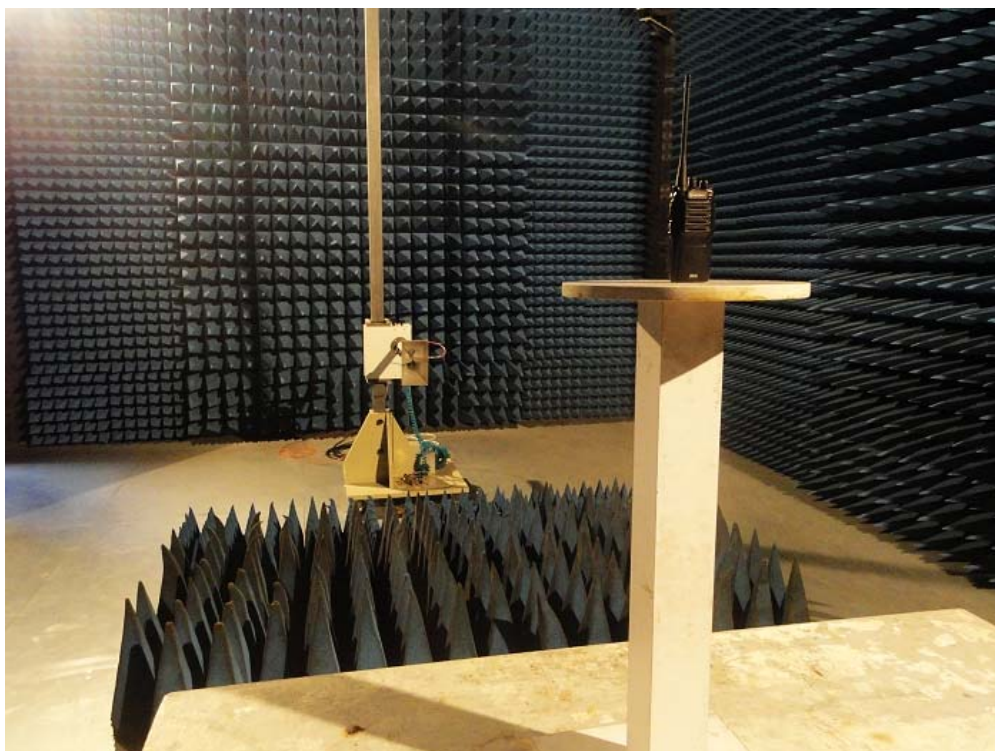
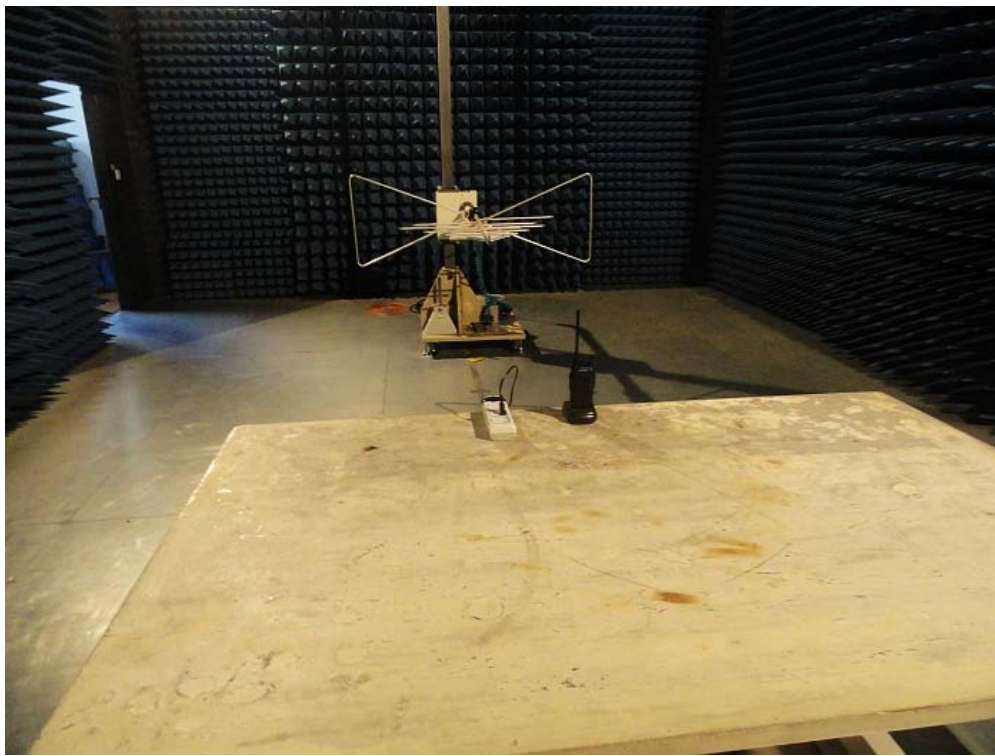
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#### 14.2 Radiated emission test view



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Outside View



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Outside View



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Body-worn accessory



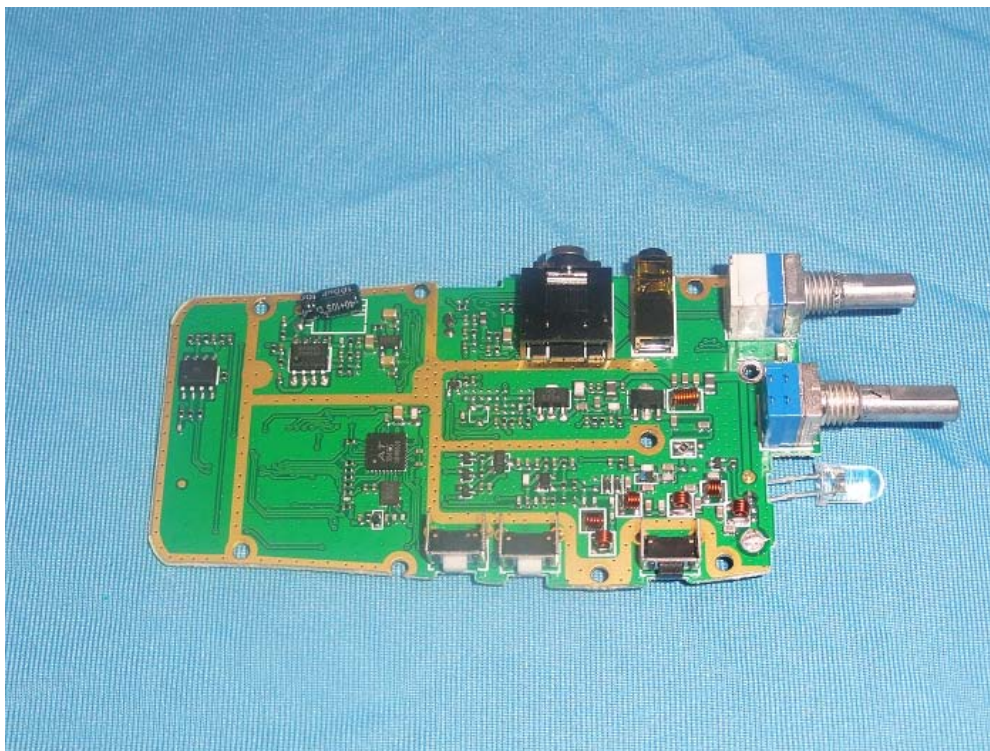
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Interior View



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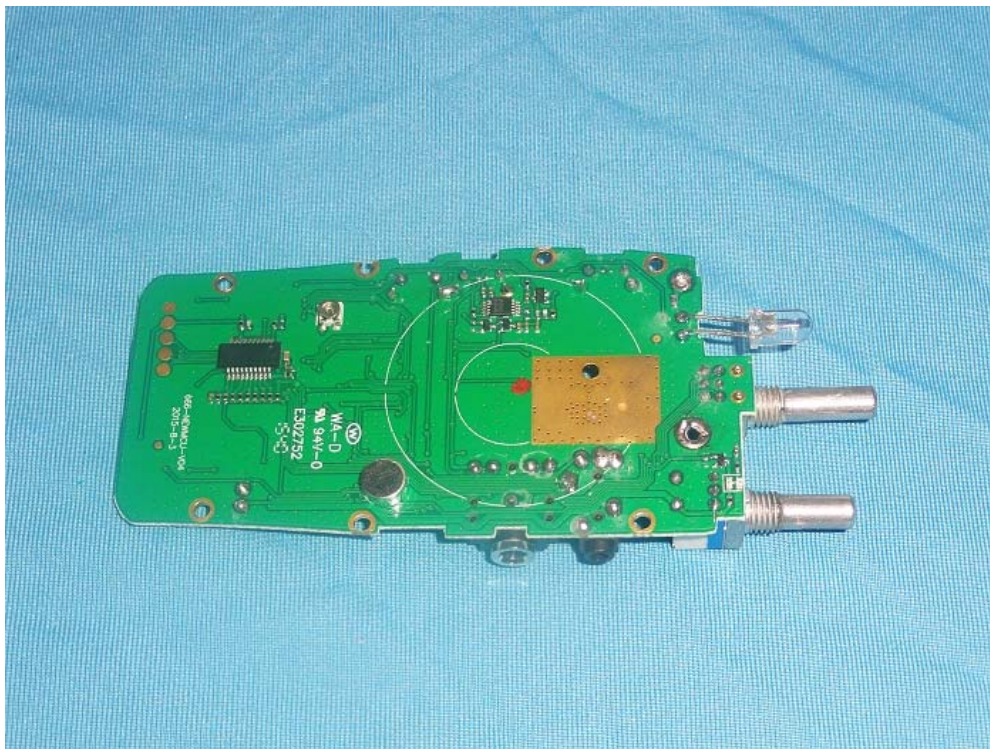
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Interior View



**-End of the report-**

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