Prüfbericht - Nr.: 18000340 001 *Test Report No.:*			**Seite 1 von 27** *Page 1 of 27*
Auftraggeber: *Client:*	**Beijing Hailin Electric Equipment Co., Ltd** Shahe Industrial Zone, Changping District, Beijing 102206 P.R.China		
Gegenstand der Prüfung: *Test item:*	**Wireless Thermostat**		
Bezeichnung: *Identification:*	**RV01-W**	**Serien-Nr.:** *Serial No.:*	**Engineering Sample**
Wareneingangs-Nr.: *Receipt No.:*	**1143001493**	**Eingangsdatum:** *Date of receipt:*	**2009-06-22**
Prüfort: *Testing location:*	**Refer to section 1.1**		
Prüfgrundlage: *Test specification:*	**FCC Part 15 Subpart C: 2009**		
Prüfergebnis: *Test Result:*	**Der Prüfgegenstand entspricht oben genannter Prüfgrundlage(n).** *The test items passed the test specification(s).*		
Prüflaboratorium: *Testing Laboratory:*	**Refer to section 1.1**		

geprüft/ *tested by:*

2011-01-27	Yang, Kai/PE	Yang Kai
Datum *Date*	**Name/Stellung** *Name/Position*	**Unterschrift** *Signature*

kontrolliert/ *reviewed by:*

2011-01-27	Sun, Lixun/TC	Sun Lixun
Datum *Date*	**Name/Stellung** *Name/Position*	**Unterschrift** *Signature*

Sonstiges/ *Other Aspects:*

Abkürzungen:	***P(ass)***	***=***	***entspricht Prüfgrundlage***	***Abbreviations:***	***P(ass)***	***=***	***passed***
	F(ail)	***=***	***entspricht nicht Prüfgrundlage***		***F(ail)***	***=***	***failed***
	N/A	***=***	***nicht anwendbar***		***N/A***	***=***	***not applicable***
	N/T	***=***	***nicht getestet***		***N/T***	***=***	***not tested***

TEST SUMMARY

4.1.1 SECTION 15.203 ANTENNA REQUIREMENT
Result:
Passed

4.1.2 SECTION 15.207 MAINS TERMINAL CONTINUOUS DISTURBANCE VOLTAGE
Result:
Passed

4.1.3 SECTION 15.231 (C) 20DB BANDWIDTH TESTING
Result:
Passed

4.1.4 SECTION 15.205, SECTION 15.209, SECTION 15.231 (B) RADIATED EMISSION
Result:
Passed

4.1.5 SECTION 15.231 (A) LIMITING OPERATIONS AND DURATION OF TRANSMISSION

Contents

1 Test Sites

1.1 Test Facilities

Laboratory: Audix Technology (Shenzhen) Co., Ltd. (2.948 listed)
Address: No.6 Ke Feng Road, Block 52, Shenzhen Science & Industry park Nantou, Shenzhen, Guangdong, China

The used test equipment is in accordance with CISPR 16-1 for measurement of radio interference.

1.2 List of Test and Measurement Instruments

Table 1: List of Test and Measurement Equipment

No.	Equipment	Model	Serial no. / Inventory no.	Manufacturer	Cal. due date
1	Spectrum Analyzer	E4446A	US44300459	Agilent	2011-05-08
2	Amplifier	8447D	2944A11159	Agilent	2011-05-08
3	Amplifier	8449B	3008A02495	Agilent	2011-05-08
4	Signal Generator	83732B	VS3449051	HP	2011-05-08
5	Bilog Antenna	CBL6111C	2768	Schaffner	2011-12-14
6	Dipole antenna	UHAP	1101	Schwarzbeck	2012-06-16
7	Horn Antenna	3115	9607-4877	EMCO	2011-05-15
8	Horn Antenna	3116	00060089	EMCO	2011-05-15
9	Test Receiver	ESHS10	838693/001	Rohde & Schwarz	2011-11-05
10	L.I.S.N.#1	ESH2-Z5	834066/011	Rohde & Schwarz	2011-03-30
11	Pulse Limiter	ESH3-Z2	100341	Rohde & Schwarz	2011-05-08

2 General Product Information

2.1 Product Function and Intended Use

The EUT (equipment under test) is a room thermostat. For the further information, refer to the user's manual.

2.2 Ratings and System Details

Type	:	Room Thermostat
Rated Voltage	:	AC 24V (±10%)
Maximum Current	:	<1A
Frequency		50Hz/60Hz
Type of antenna		dedicated
Protection Class	:	II
Class	:	B
FCC ID	:	XLXRV01-W

Channel information

Channel No.	Centre Frequency	Allowable Frequency Error
1	433.594MHz	±30kHz
2	433.794MHz	±30kHz
3	433.994MHz	±30kHz
4	434.194MHz	±30kHz
5	434.394MHz	±30kHz
6	434.594MHz	±30kHz

The product is a receiver that transmit control signal by 6 channels, so the test item of radiated emission were performed on two frequency points that the lowest 433.594MHz and the highest 434.594MHz.

2.3 Independent Operation Modes

The basic operation modes are: "On", "Off".

2.4 Noise Generating and Noise Suppressing Parts

Refer to the circuit diagram for further information.

2.5 Submitted Documents

Circuit diagram, PCB layout, BOM, User's manual, Nameplate.

3 Test Set-up and Operation Modes

3.1 Test Specification

FCC Part 15 Subpart C
Section 15.203
Section 15.205
Section 15.207
Section 15.209
Section 15.231

3.2 Principle of Configuration Selection

Emission: The equipment under test (EUT) was configured to measure its highest possible radiation level. The test conditions were adapted accordingly in reference to the instructions for use.
Refer to the related paragraph of this report.

3.3 Physical Configuration for Testing

Refer to the related paragraph of this report.

3.4 Test Operation and Test Software

Refer to the related paragraph of this report. No software was used.

3.5 Special Accessories and Auxiliary Equipment

None.

3.6 Countermeasures to achieve EMC Compliance

None.

4 Summary of Test Results

Description of Test	Result
Section 15.203 Antenna Requirement	Compliant
Section 15.205 Restricted Band	Compliant
Section 15.207 Conducted limits	Compliant
Section 15.209 General Requirement	Compliant
Section 15.231 (c) 20dB Bandwidth Testing	Compliant
Section 15.231 (a) Radiated Emission	Compliant
Section 15.231 (b) Radiated Emission	Compliant

4.1 Test Result

4.1.1 Section 15.203 Antenna Requirement

Result:	**Passed**

According to section 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. The use of a permanently attached antenna or of an antenna that uses a unique coupling to the intentional radiator shall be considered sufficient to comply with the provisions of this section.
This product has a permanent antenna, fulfil the requirement of this section.

4.1.2 Section 15.207 Mains Terminal Continuous Disturbance Voltage

Result:	**Passed**

Date of testing	:	2011-01-19
Test procedure	:	FCC Part 15 Subpart C:2009
Limits	:	Quasi-peak: 0.15-0.5MHz, 66dBµV to 56 dBµV decreases linearly with the logarithm; 0.5-5MHz, 56dBµV; 5-30MHz, 60dBµV. Average: 0.15-0.5MHz, 56dBµV to 46 dBµV decreases linearly with the logarithm; 0.5-5MHz, 46dBµV; 5-30MHz, 50dBµV.
Kind of test site	:	Shielded room

Test Setup

Input voltage	:	AC 24V; 50/60Hz
Operational mode	:	On
Earthing	:	Earthing through the power cord (as class I equipment.)

The measurement setup was made according to FCC Part 15 Subpart C:2009 in a shielded room.

The measurement equipment like test receivers, quasi-peak detector, average detector and LISN are in compliance with CISPR 16-1 series standards and ANSI C63.4-2003. The tested object was operated under its rated voltage and its rated frequency. Prior to the measurements the test object operated about 5 minutes (warm-up) in order to stabilize its operating conditions and to ensure reliable measurement values.

Furthermore an internal calibration with the test receiver was conducted prior to each measurement.

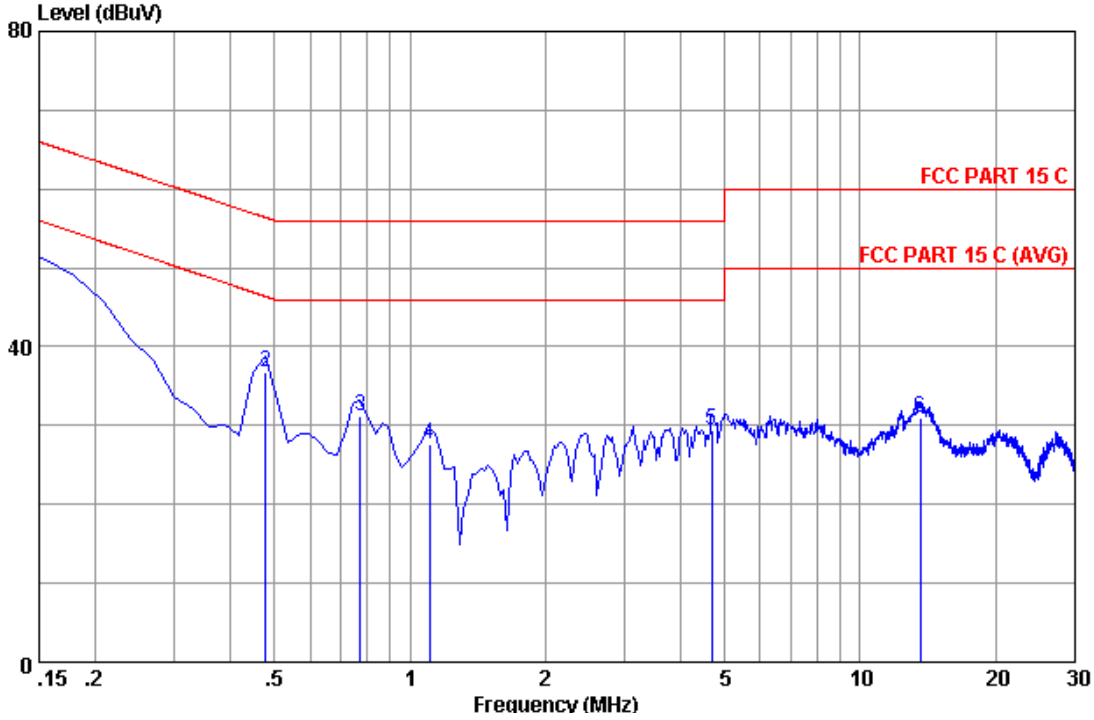
The EUT was set 0.8m away from the LISN. The cord longer than necessary to be connected to the LISN was folded forth and back parallel so as to form a bundle with a length between 0.3m and 0.4m.

The interference voltage was determined according to FCC Part 15 Subpart C:2009 while measuring the line conductor by turns.

A test was made the rated voltage 24V and frequency 50Hz and 60Hz in order to check whether the level of disturbance varies considerably with the frequency and the measurements are to be made at the frequency that causes maximum disturbance.

The following figures and tables were those measured by an automatic measuring system. A preview test was first made with peak detector. Final test with quasi-peak detector and average detector was only performed at these critical frequencies found via preview test.

Figure 1: Spectral diagrams and measurement results, line L

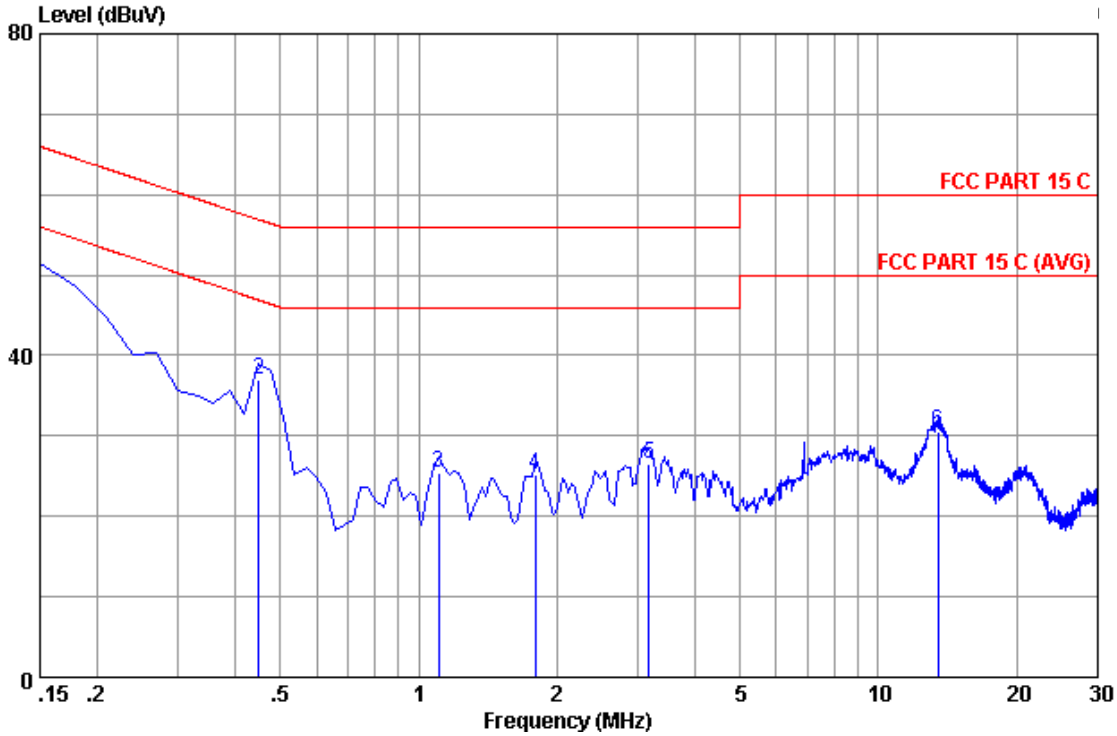


Final quasi-peak measurement results:

Frequency(MHz)	Level(dBuV)	Limit(dBuV)	Margin(dBuV)	Detector	RBW(Hz)
0.150	46.58	66.00	19.42	QP	9.0 k
0.478	36.82	56.37	19.55	QP	9.0 k
0.777	31.12	56.00	24.88	QP	9.0 k
1.105	27.73	56.00	28.27	QP	9.0 k
4.687	29.47	56.00	26.53	QP	9.0 k
13.583	31.04	60.00	28.96	QP	9.0 k

In case the quasi-peak value of the radio-interference voltage did not exceed the average limit, the average value was not measured.

Figure 2: Spectral diagrams and measurement results, line N



Final quasi-peak measurement results:

Frequency(MHz)	Level(dBuV)	Limit(dBuV)	Margin(dBuV)	Detector	RBW(Hz)
0.150	46.53	66.00	19.47	QP	9.0 k
0.449	36.99	56.90	19.91	QP	9.0 k
1.105	25.33	56.00	30.67	QP	9.0 k
1.792	25.09	56.00	30.91	QP	9.0 k
3.165	26.49	56.00	29.51	QP	9.0 k
13.493	30.55	60.00	29.45	QP	9.0 k

In case the quasi-peak value of the radio-interference voltage did not exceed the average limit, the average value was not measured.

4.1.3 Section 15.231 (c) 20dB Bandwidth Testing

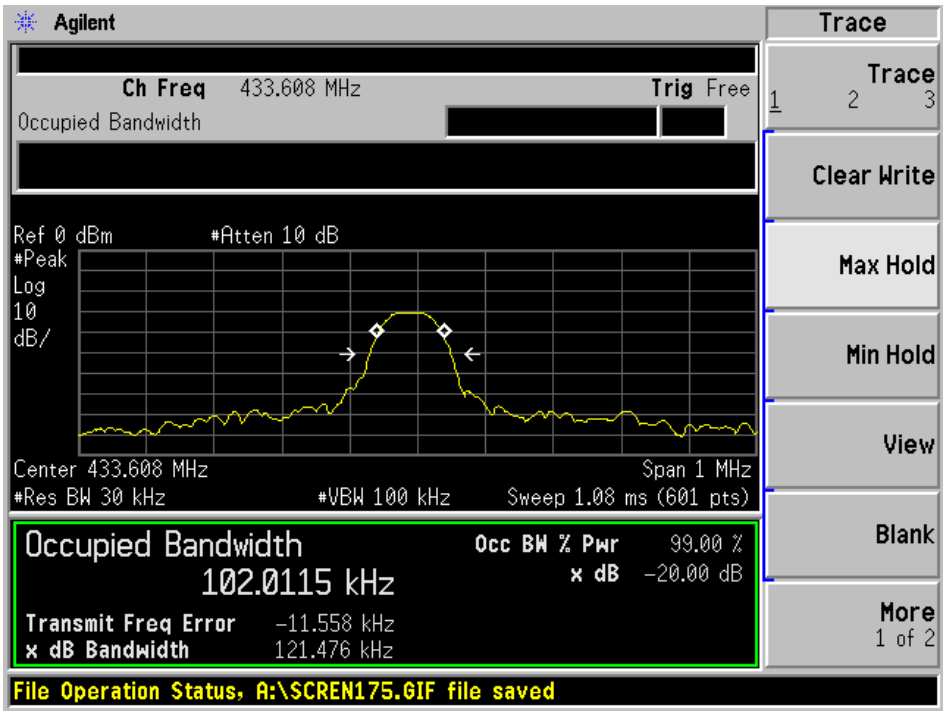
Result:	**Passed**

Date of testing	:	2010-11-30
Test procedure	:	FCC Part 15 Subpart C:2009
Frequency range	:	30 – 1000MHz
Limits	:	The bandwidth of the emission shall be no wider than 0.25% of the center frequency for devices operating above 70MHz and below 900MHz. Bandwidth is determined at the point 20dB down from the modulated carrier.
Kind of test site	:	Semi-anechoic chamber
Operation mode	:	On

Calculation of bandwidth limit

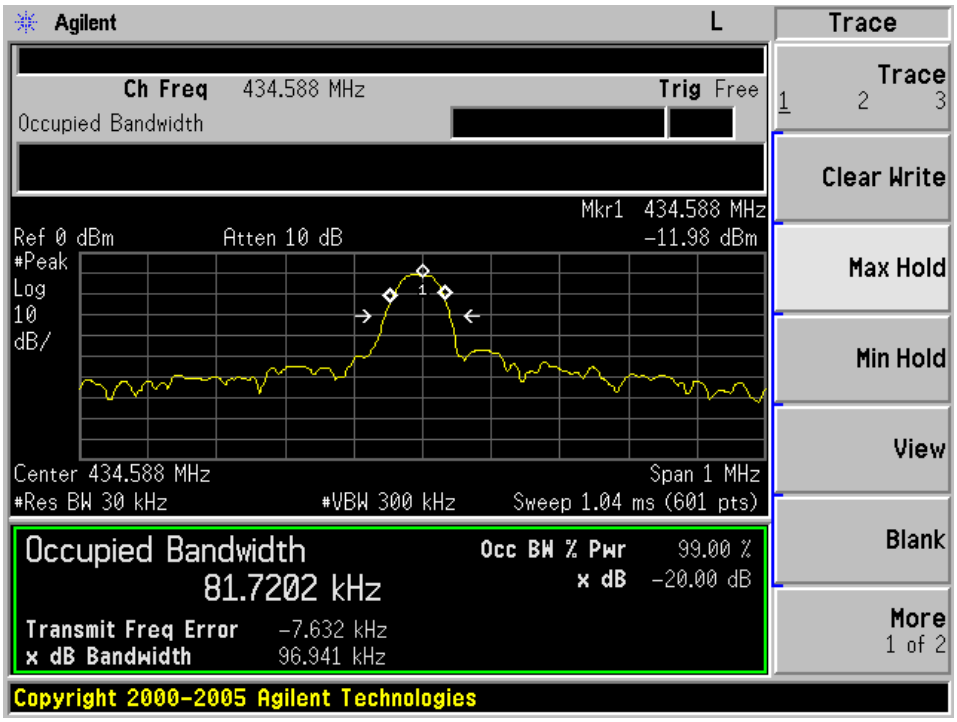
The lowest frequency
433.594MHz * 0.0025 = 1083.985kHz
The bandwidth of EUT is 121.476 kHz

Figure 3: 20dB Bandwidth of the lowest frequency



The highest frequency
434.594MHz * 0.0025 = 1086.485kHz
The bandwidth of EUT is 96.941 kHz

Figure 4: 20dB Bandwidth of the highest frequency



4.1.4 Section 15.205, Section 15.209, Section 15.231 (b) Radiated Emission

Result:	**Passed**

Date of testing	:	2010-11-30
Test procedure	:	FCC Part 15 Subpart C:2009
Frequency range	:	30MHz – 10th harmonic emission
Limits	:	According to section 15.209 and section 15.231 (b)
Kind of test site	:	Semi-anechoic chamber
Operation mode	:	On

Measuring configuration and description

The measurement setup was made according to FCC Part 15 Subpart C: 2009.

The test equipment listed in 1.1, table 1 of this report are as specified in CISPR 16-1 and ANSI C63.4-2003.

The EUT was placed on a turntable. The turntable can turn in 360º. A Bi-Log antenna is fixed 10m from centre of the turntable and a horn antenna is fixed 3m from centre of the turntable.

According to section 15.35, unless otherwise specified, on any frequency or frequencies above 1000 MHz, the radiated emission limits are based on the use of measurement instrumentation employing an average detector function. Unless otherwise specified, measurements above 1000 MHz shall be performed using a minimum resolution bandwidth of 1 MHz. When average radiated emission measurements are specified in this part, including average emission measurements below 1000 MHz, there also is a limit on the peak level of the radio frequency emissions. Unless otherwise specified, e.g., see §§ 15.250, 15.252, 15.255, and 15.509-15.519 of this part, the limit on peak radio frequency emissions is 20 dB above the maximum permitted average emission limit applicable to the equipment under test. This peak limit applies to the total peak emission level radiated by the device, e.g., the total peak power level. Note that the use of a pulse desensitization correction factor may be needed to determine the total peak emission level. The instruction manual or application note for the measurement instrument should be consulted for determining pulse desensitization factors, as necessary.

During the test, the turntable was rotated fully with a measurement antenna oriented for both horizontal and vertical polarisation. The antenna was adjusted between 1m and 4m in height above the ground plane to find the max disturbance.

Calculation of field strength limit:

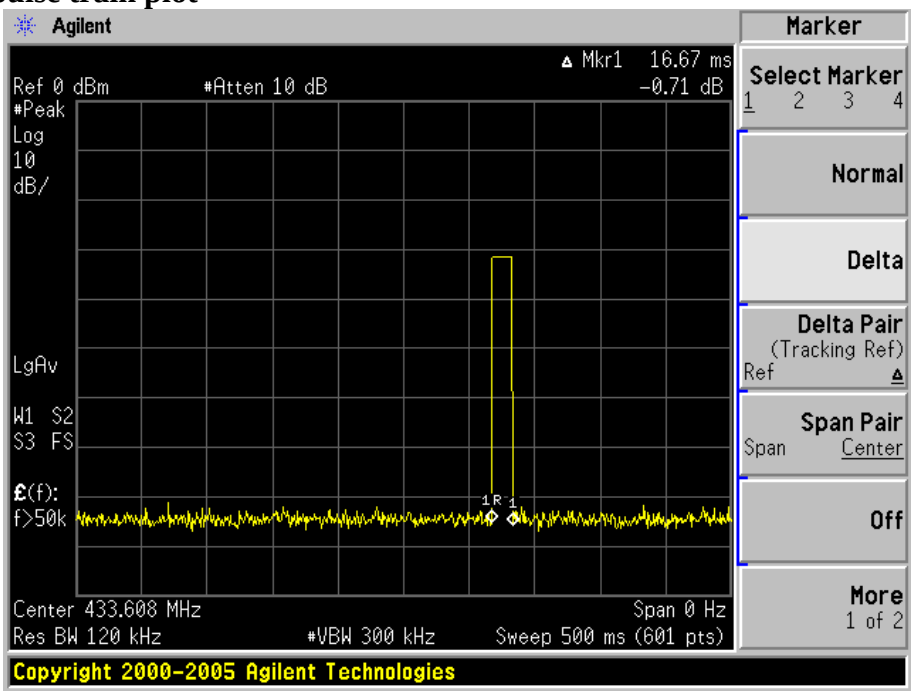
According to section 15.231, the formulas for calculating the maximum permitted fundamental field strengths are as follows:
For the band 260-470 MHz, µV/m at 3 meters = 41.6667(F) - 7083.3333
Where F is the frequency in MHz,
The maximum permitted field strength of any unwanted emission must be 20 dB below the maximum allowable fundamental field strength or to the general limits of section 15.209, whichever limit permits higher field strength.

The frequency range from 30 MHz to the tenth harmonic of the highest fundamental frequency was investigated to measure any radiated emission.

Pulsed emission averaging factor:

The EUT is a pulsed emission device. Therefore, the method of section 15.35 for averaging a pulsed emission may be used. The plot of the pulse train and average factor calculations are shown below:

Figure 5: 200ms pulse train plot

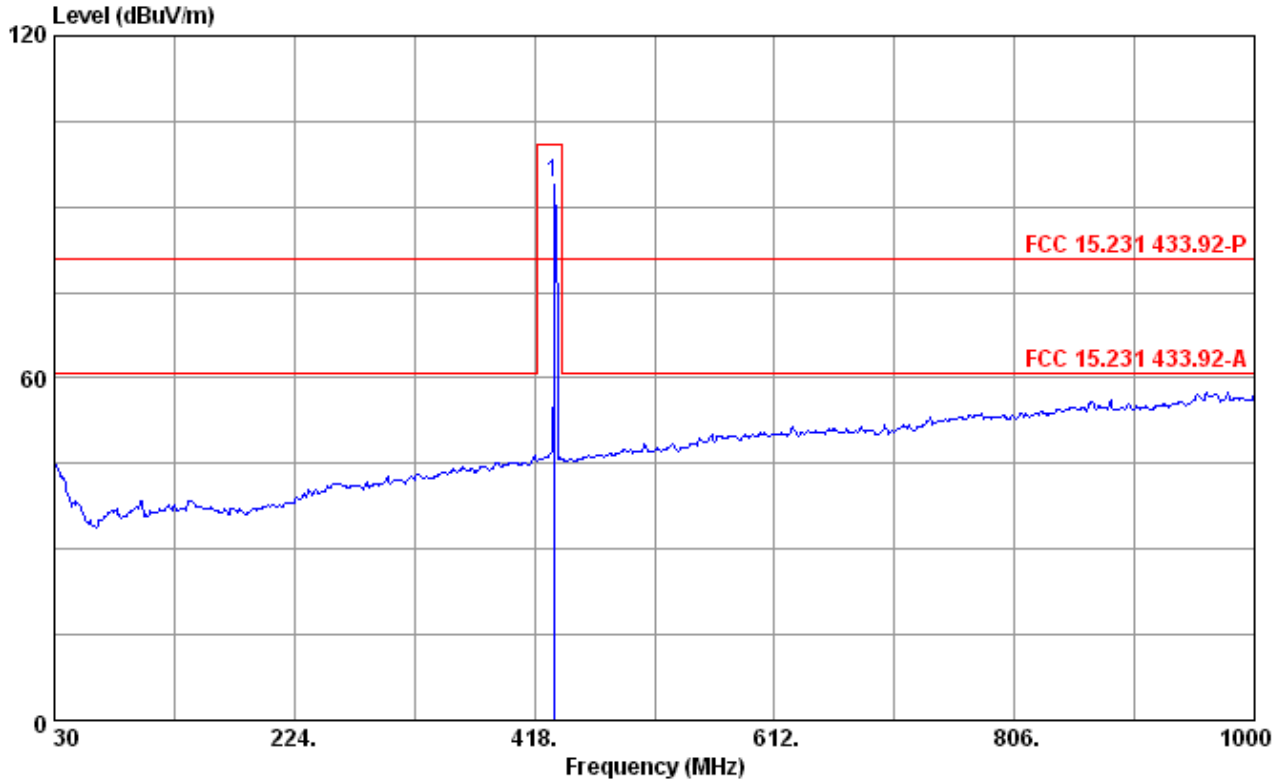


Average factor calculation:

Average factor = 20 Log (16.67ms / 100ms) = -15.56 dB

The following diagram and table show the measurement value:

Figure 6: Spectral diagrams and measurement results, Horizontal polarization, 30MHz-1GHz, 3m, the lowest frequency.

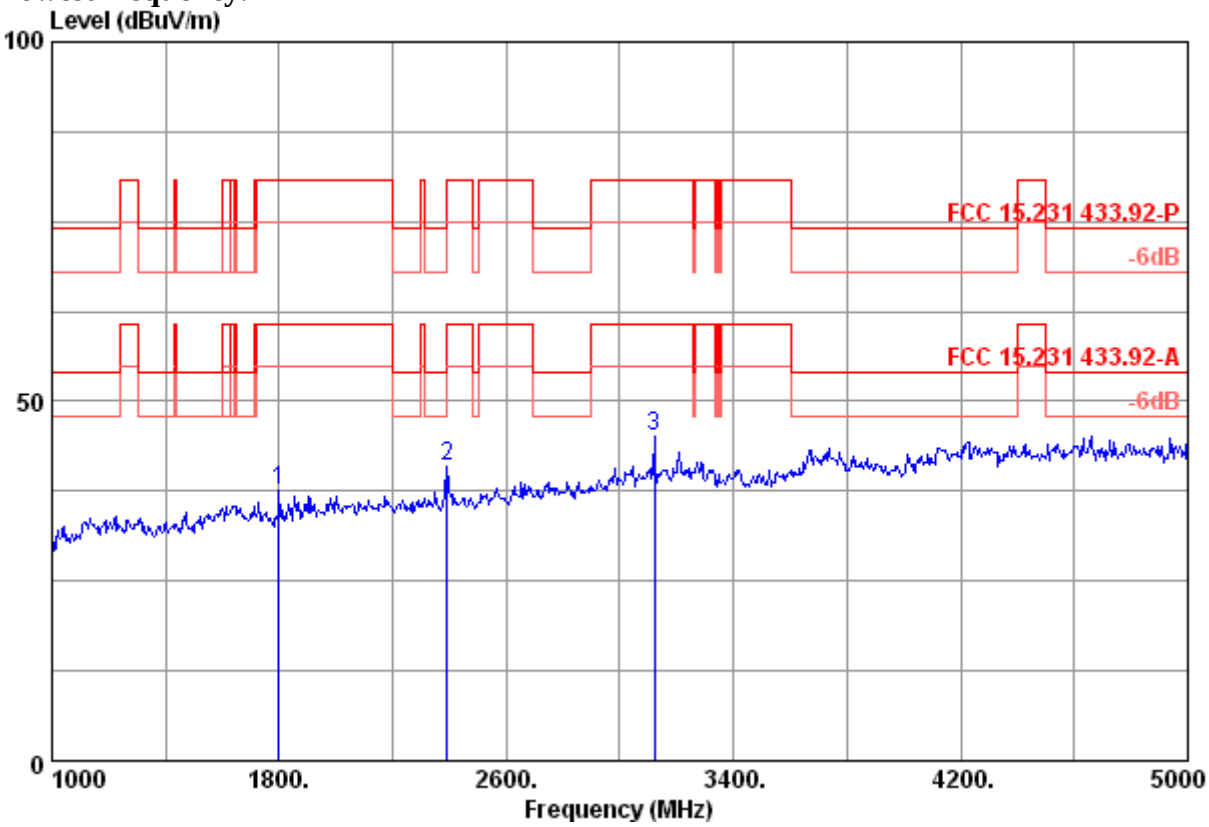


Final measurement result:

Frequency (MHz)	Antenna Factor (dB)	Cable Loss (dB)	Average Factor (dB)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dBuV/m)	Remark
433.57	17.39	3.13	/	94.20	100.81	6.61	PK
433.57	/	/	-15.56	78.64	80.81	2.17	AV

Note: PK reading level = PK result, because it has already included the antenna factor and cable loss.
AV result = PK result + Average factor

Figure 7: Spectral diagrams and measurement results, Horizontal polarization, >1GHz, 3m, the lowest frequency.

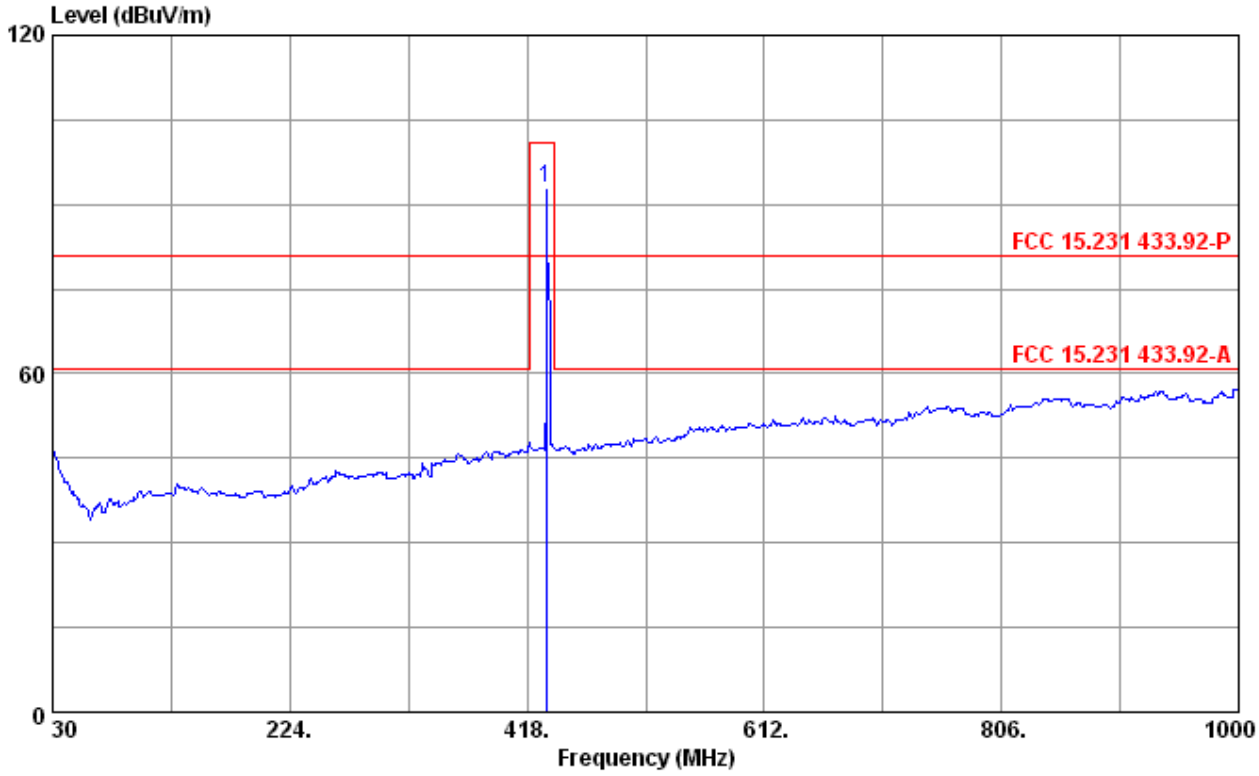


Final measurement result:

Frequency (MHz)	Antenna Factor (dB)	Cable Loss (dB)	Average Factor (dB)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dBuV/m)	Remark
1800.00	28.08	6.29	/	37.65	80.81	43.16	PK
1800.00	/	/	-15.56	22.09	60.81	38.72	AV
2392.00	29.44	7.39	/	41.05	80.81	39.76	PK
2392.00	/	/	-15.56	25.49	60.81	35.32	AV
3120.00	32.31	8.70	/	45.10	80.81	35.71	
3120.00	/	/	-15.56	29.54	60.81	31.27	

Note: PK reading level = PK result, because it has already included the antenna factor and cable loss.
AV result = PK result + Average factor

Figure 8: Spectral diagrams and measurement results, Vertical polarization, 30MHz-1GHz, 3m, the lowest frequency.

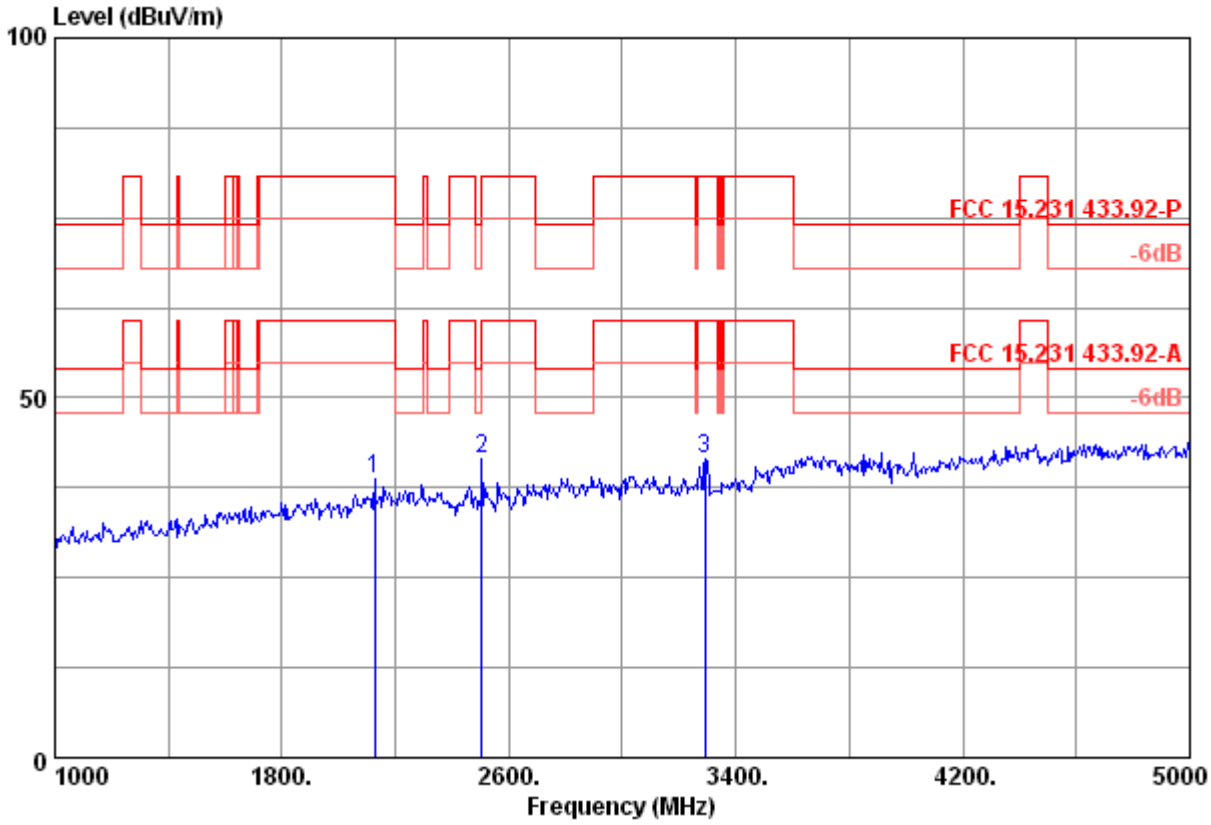


Final measurement result:

Frequency (MHz)	Antenna Factor (dB)	Cable Loss (dB)	Average Factor (dB)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dBuV/m)	Remark
433.57	17.39	3.13	/	92.97	100.81	7.84	PK
433.57	/	/	-15.56	77.41	80.81	3.4	AV

Note: PK reading level = PK result, because it has already included the antenna factor and cable loss.
AV result = PK result + Average factor

Figure 9: Spectral diagrams and measurement results, Vertical polarization, >1GHz, 3m, the lowest frequency.

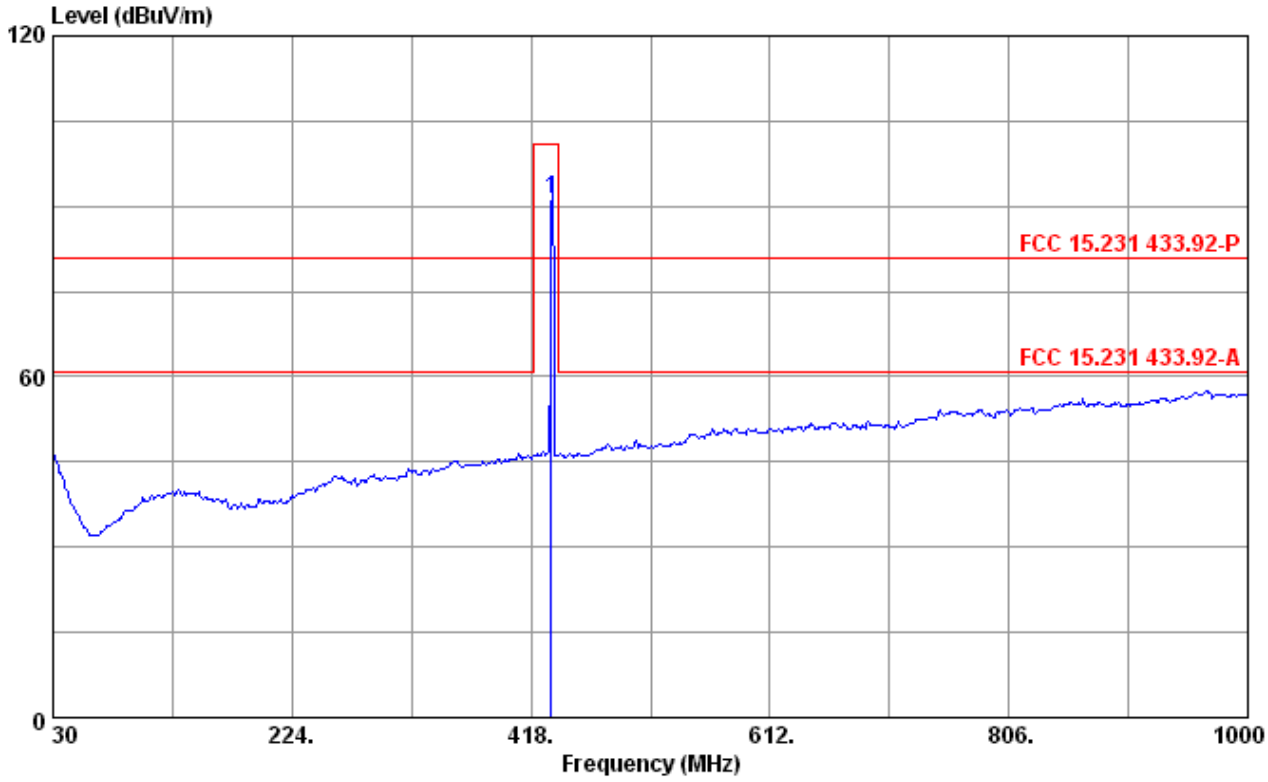


Final measurement result:

Frequency (MHz)	Antenna Factor (dB)	Cable Loss (dB)	Average Factor (dB)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dBuV/m)	Remark
2128.00	29.27	6.90	/	38.85	80.81	41.96	PK
2128.00	/	/	-15.56	23.29	60.81	37.52	AV
2504.00	29.50	7.62	/	41.61	80.81	39.2	PK
2504.00	/	/	-15.56	26.05	60.81	34.76	AV
3292.00	32.76	8.88	/	41.61	80.81	39.2	PK
3292.00	/	/	-15.56	26.05	60.81	34.76	AV

Note: PK reading level = PK result, because it has already included the antenna factor and cable loss.
AV result = PK result + Average factor

Figure 10: Spectral diagrams and measurement results, Horizontal polarization, 30MHz-1GHz, 3m, the highest frequency.

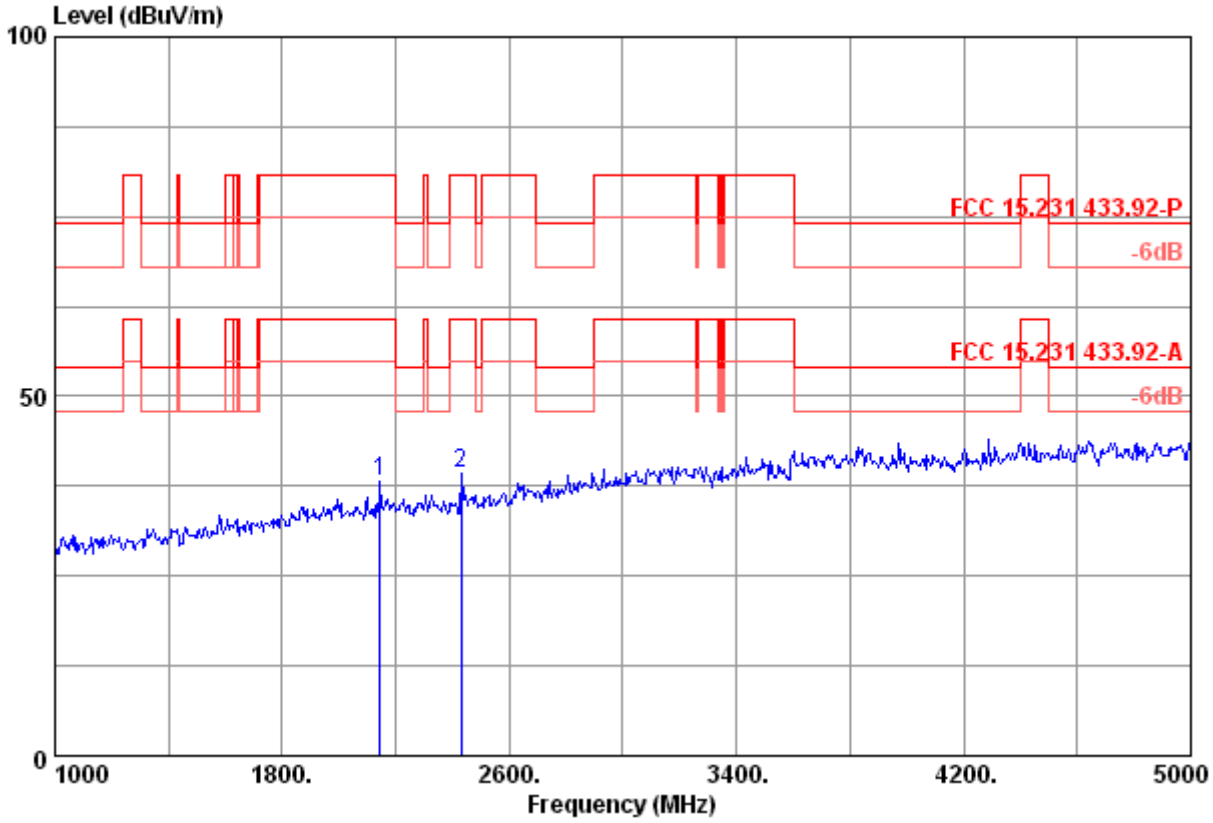


Final measurement result:

Frequency (MHz)	Antenna Factor (dB)	Cable Loss (dB)	Average Factor (dB)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dBuV/m)	Remark
434.55	17.36	3.13	/	91.41	100.84	9.43	PK
434.55	/	/	-15.56	75.56	80.84	5.28	AV

Note: PK reading level = PK result, because it has already included the antenna factor and cable loss.
AV result = PK result + Average factor

Figure 11: Spectral diagrams and measurement results, Horizontal polarization, >1GHz, 3m, the highest frequency.

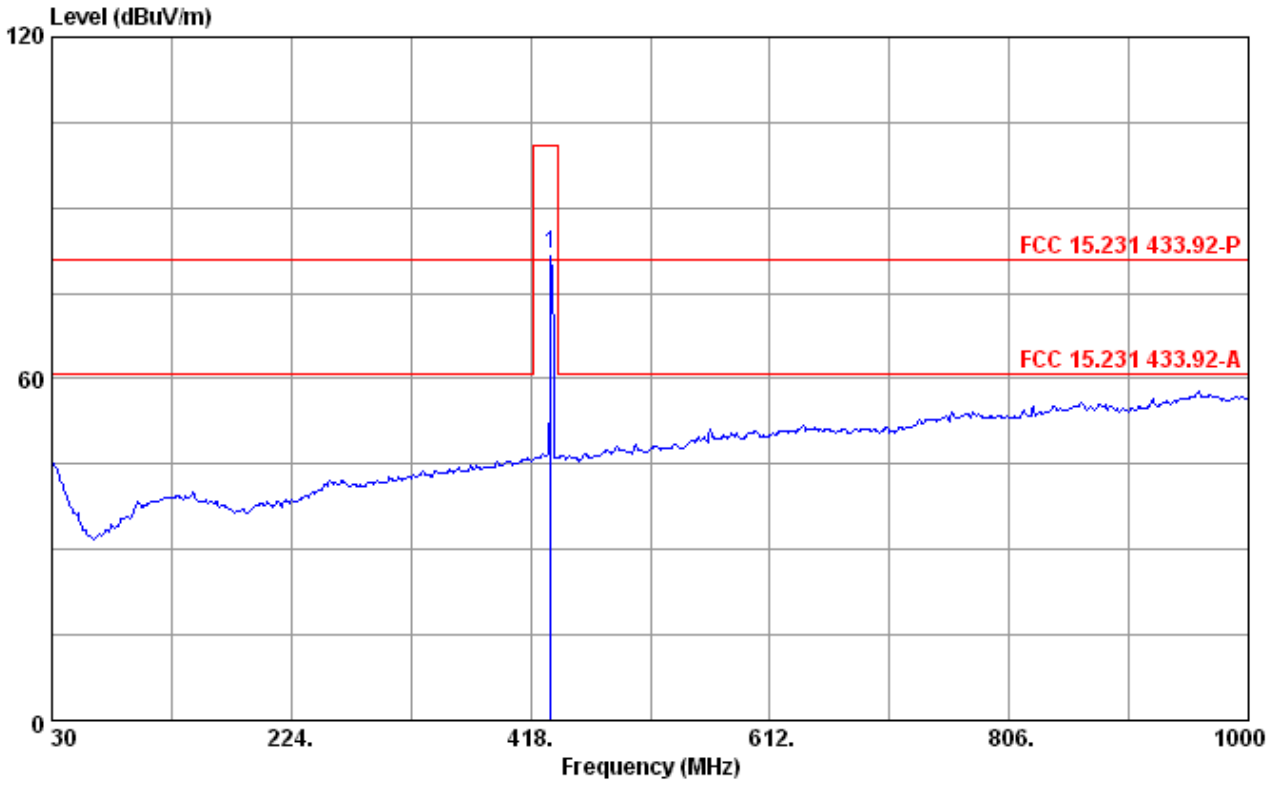


Final measurement result:

Frequency (MHz)	Antenna Factor (dB)	Cable Loss (dB)	Average Factor (dB)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dBuV/m)	Remark
2144.00	29.28	6.93	/	38.14	80.84	42.70	PK
2144.00	/	/	-15.56	22.58	60.84	38.26	AV
2432.00	29.46	7.46	/	39.20	80.84	41.64	PK
2432.00	/	/	-15.56	23.64	60.84	37.20	AV

Note: PK reading level = PK result, because it has already included the antenna factor and cable loss.
AV result = PK result + Average factor

Figure 12: Spectral diagrams and measurement results, Vertical polarization, 30MHz-1GHz, 3m, the highest frequency.

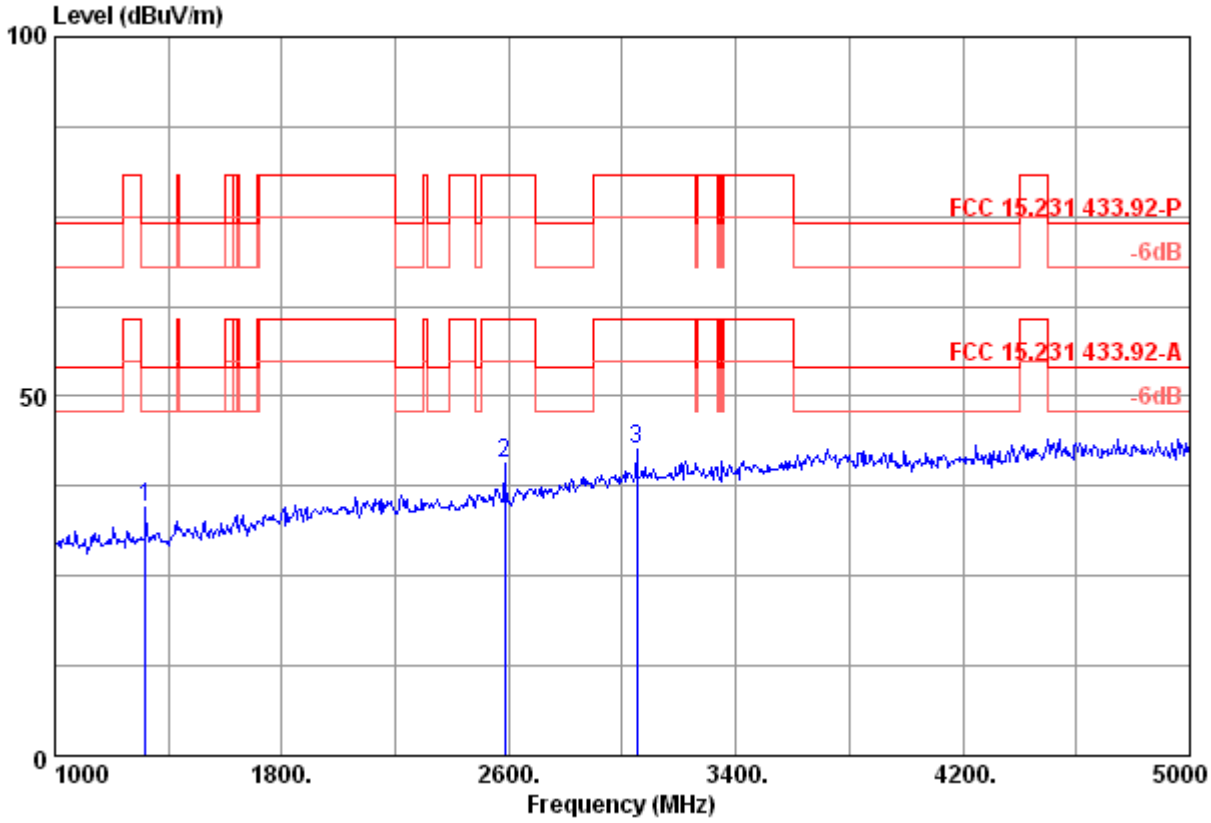


Final measurement result:

Frequency (MHz)	Antenna Factor (dB)	Cable Loss (dB)	Average Factor (dB)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dBuV/m)	Remark
434.55	6.00	2.52	/	82.66	100.84	18.15	PK
434.55	/	/	-15.56	69.08	80.84	11.73	AV

Note: PK reading level = PK result, because it has already included the antenna factor and cable loss.
AV result = PK result + Average factor

Figure 13: Spectral diagrams and measurement results, Vertical polarization, >1GHz, 3m, the highest frequency.



Final measurement result:

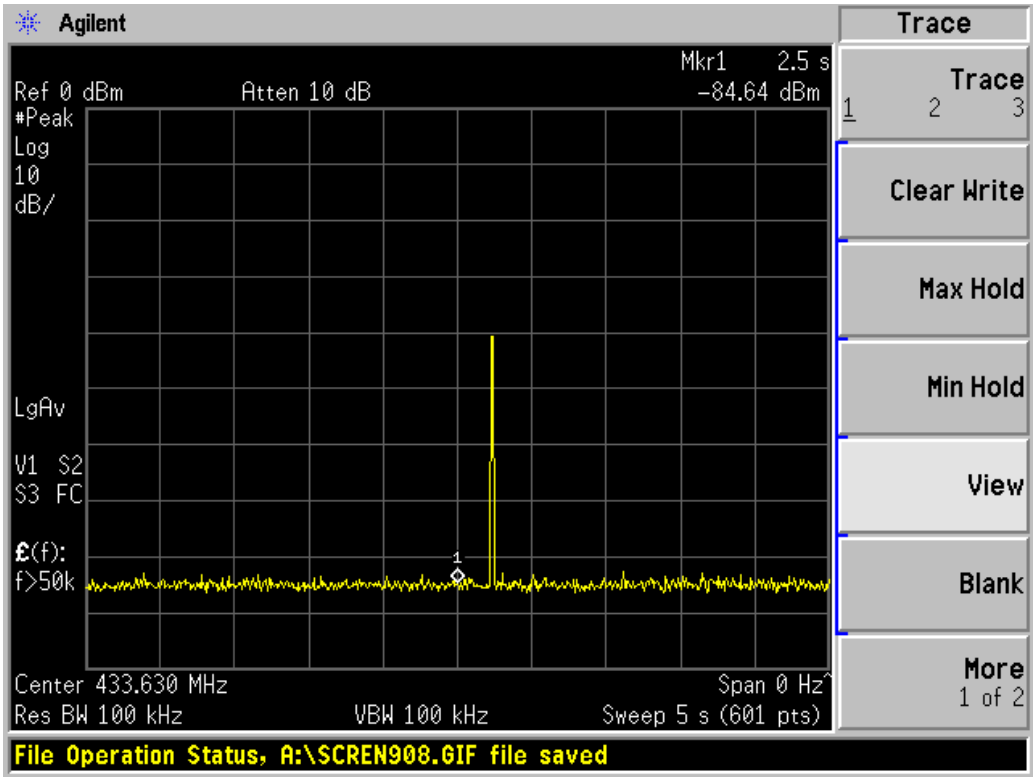
Frequency (MHz)	Antenna Factor (dB)	Cable Loss (dB)	Average Factor (dB)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dBuV/m)	Remark
1320.00	26.06	5.38	/	34.64	74.00	39.36	PK
1320.00	/	/	-15.56	19.08	54.00	41.92	AV
2584.00	29.92	7.77	/	40.62	80.84	40.22	PK
2584.00	/	/	-15.56	25.06	60.84	35.78	AV
3052.00	32.13	8.61	/	42.58	80.84	38.26	PK
3052.00	/	/	-15.56	27.02	60.84	33.82	AV

Note: PK reading level = PK result, because it has already included the antenna factor and cable loss.
AV result = PK result + Average factor

4.1.5 Section 15.231 (a) Limiting operations and duration of transmission

A transmitter activated automatically cease transmission within 5 seconds after activation.

Figure 14: Duration of transmission



According to the figure 12, the EUT can automatically cease transmission within 5 seconds after activation, therefore the EUT meet the requirement of section 15.231(a).

5 Photographs of the Test Set-Up

Photograph 1: Set-up for mains terminal continuous disturbance voltage

Photograph 2: Set-up for measurement of radiated emission, <1GHz

Photograph 3: Set-up for measurement of radiated emission, >1GHz

6 List of Tables

7 List of Figures

8 List of Photographs