JQA File No. : KL80160621R
Issue Date : February 6, 2017

TEST REPORT

Applicant	:	SEKONIC CORPORATION
Address	:	7-24-14, OIZUMI-GAKUEN-CHO, NERIMA-KU, TOKYO 178-8686 JAPAN
Products	:	Wireless Module
Model No.	:	RT-20PW
Serial No.	:	8
FCC ID	:	PFK-RT20-01
Test Standard	:	CFR 47 FCC Rules and Regulations Part 15
Test Results	:	**Passed**
Date of Test	:	January 17 ~ 20, 2017

Kousei Shibata
Manager
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KITA-KANSAI Testing Center
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Lab Accreditation
VLAC-001-2

- The test results in this test report was made by using the measuring instruments which are traceable to national standards of measurement in accordance with ISO/IEC 17025.
- The applicable standard, testing condition and testing method which were used for the tests are based on the request of the applicant.
- The test results presented in this report relate only to the offered test sample.
- The contents of this test report cannot be used for the purposes, such as advertisement for consumers.
- This test report shall not be reproduced except in full without the written approval of JQA.
- VLAC does not approve, certify or warrant the product by this test report.

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DEFINITIONS FOR ABBREVIATION AND SYMBOLS USED IN THIS TEST REPORT

EUT : Equipment Under Test
AE : Associated Equipment
N/A : Not Applicable
N/T : Not Tested
EMC : Electromagnetic Compatibility
EMI : Electromagnetic Interference
EMS : Electromagnetic Susceptibility

☑ - indicates that the listed condition, standard or equipment is applicable for this report.
☐ - indicates that the listed condition, standard or equipment is not applicable for this report.

1 Description of the Equipment Under Test

1.	Manufacturer	:	SEKONIC CORPORATION 7-24-14, OIZUMI-GAKUEN-CHO, NERIMA-KU, TOKYO 178-8686 JAPAN
2.	Products	:	Wireless Module
3.	Model No.	:	RT-20PW
4.	Serial No.	:	8
5.	Product Type	:	Prototype
6.	Date of Manufacture	:	December, 2016
7.	Power Rating	:	3.0 VDC (for host battery)
8.	Grounding	:	None
9.	Transmitting Frequency	:	340 MHz – 354 MHz
10.	Modulation	:	ON/OFF Keying
11.	Antenna Type	:	Integral PCB Antenna (built in the host)
12.	EUT Authorization	:	Certification
13.	Received Date of EUT	:	January 16, 2017

2 Summary of Test Results

Applied Standard : CFR 47 FCC Rules and Regulations Part 15
Subpart C – Intentional Radiators

The EUT described in clause 1 was tested according to the applied standard shown above.
Details of the test configuration is shown in clause 6.
The conclusion for the test items of which are required by the applied standard is indicated under the test result.

☑ - The test result was **passed** for the test requirements of the applied standard.

☐ - The test result was **failed** for the test requirements of the applied standard.

☐ - The test result was **not judged** the test requirements of the applied standard.

In the approval of test results,
- Determining compliance with the limits in this report was based on the results of the compliance measurement, not taking into account measurement instrumentation uncertainty.
- No deviations were employed from the applied standard.
- No modifications were conducted by JQA to achieve compliance to the limitations.

Reviewed by:

S. Kino

Shigeru Kinoshita
Assistant Manager
JQA KITA-KANSAI Testing Center
SAITO EMC Branch

Tested by:

Shigeru Osawa

Shigeru Osawa
Deputy Manager
JQA KITA-KANSAI Testing Center
SAITO EMC Branch

3 Test Procedure

Test Requirements : §15.231, §15.207 and §15.209

Test Procedure : ANSI C63.10–2013
Testing unlicensed wireless devices.

KDB937606 (Publication Date: October 10, 2014)
Test Site Requirements for Part 15 and 18 Devices Operating Below 30MHz.

4 Test Location

Japan Quality Assurance Organization (JQA)
KITA-KANSAI Testing Center
7-7, Ishimaru, 1-chome, Minoh-shi, Osaka, 562-0027, Japan
SAITO EMC Branch
7-3-10, Saito-asagi, Ibaraki-shi, Osaka 567-0085, Japan

5 Recognition of Test Laboratory

JQA KITA-KANSAI Testing Center SAITO EMC Branch is accredited under ISO/IEC 17025 by following accreditation bodies and the test facility is registered by the following bodies.

VLAC Accreditation No. : VLAC-001-2 (Expiry date : March 30, 2018)
VCCI Registration No. : A-0002 (Expiry date : March 30, 2018)
BSMI Registration No. : SL2-IS-E-6006, SL2-IN-E-6006, SL2-R1/R2-E-6006, SL2-A1-E-6006 (Expiry date : September 14, 2019)
IC Registration No. : 2079E-3, 2079E-4 (Expiry date : July 16, 2017)

Accredited as conformity assessment body for Japan electrical appliances and material law by METI. (Expiry date : February 22, 2019)

6 Description of Test Setup

6.1 Test Configuration

The equipment under test (EUT) consists of :

	Item	Manufacturer	Model No.	Serial No.	FCC ID
A	Wireless Module	SEKONIC CORPORATION	RT-20PW	8	PFK-RT20-01

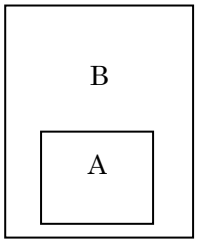
The auxiliary equipment used for testing :

	Item	Manufacturer	Model No.	Serial No.	FCC ID
B	Light Meter	SEKONIC CORPORATION	L-858D	16 *1) 10 *2)	N/A

*1) Used for Field Strength of Spurious Emission
*2) Used for Antenna Conducted Emission

Type of Cable:
None

6.2 Test Arrangement (Drawings)



6.3 Operating Condition

Power Supply Voltage : 3.0 VDC (for host battery)

Operation Mode :
The EUT is set with the test mode, the specification of the test mode is as followings.
(1) Tx Mode (340 MHz)
(2) Tx Mode (347 MHz)
(3) Tx Mode (354 MHz)

Used application to controlled: The test mode is instructed by the applicant.
Internal Test Mode

The EUT was rotated through three orthogonal axis (X, Y and Z axis) in radiated measurement.
The EUT with temporary antenna port was used in conducted measurement.

7 Test Requirements

7.0 Summary of the Test Results

Test Item	FCC Specification	Reference of the Test Report	Results	Remarks
Antenna Requirement	Section 15.203	Section 1.11	Passed	-
Occupied Bandwidth	Section 15.231(c)	Section 7.1	Passed	-
AC Powerline Conducted Emission	Section 15.207	Section 7.2	N/A	-
Radiated Emission	Section 15.231(a)(1),(b)	Section 7.3	Passed	-

7.1 Occupied Bandwidth

For the requirements, ☑ - Applicable [☑ - Tested. ☐ - Not tested by applicant request.]
☐ - Not Applicable

7.1.1 Test Results

For the standard, ☑ - **Passed** ☐ - **Failed** ☐ - **Not judged**

The 99% Bandwidth is 729.0 kHz at 347.0 MHz
The 20dB Bandwidth is 213.2 kHz at 347.0 MHz

Uncertainty of Measurement Results ± 0.9 %(2σ)

Remarks : 20dB Bandwidth minimum margin is 0.189 % at 347 MHz.

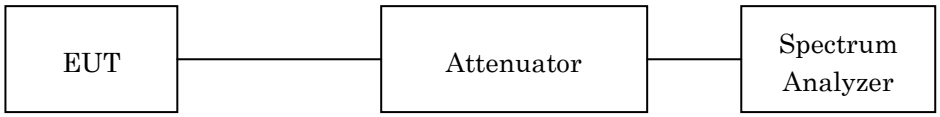
7.1.2 Test Instruments

Shielded Room S4				
Type	**Model**	**Serial No. (ID)**	**Manufacturer**	**Cal. Due**
Spectrum Analyzer	E4446A	US44300388 (A-39)	Agilent	2017/08/02
Attenuator	54A-10	W5675 (D-28)	Weinschel	2017/08/02

NOTE : The calibration interval of the above test instruments is 12 months.

7.1.3 Test Method and Test Setup (Diagrammatic illustration)

The test system is shown as follows:



The setting of the spectrum analyzer are shown as follows:

Res. Bandwidth	10 kHz
Video Bandwidth	30 kHz
Span	2 MHz
Sweep Time	AUTO
Trace	Maxhold

7.1.4 Test Data

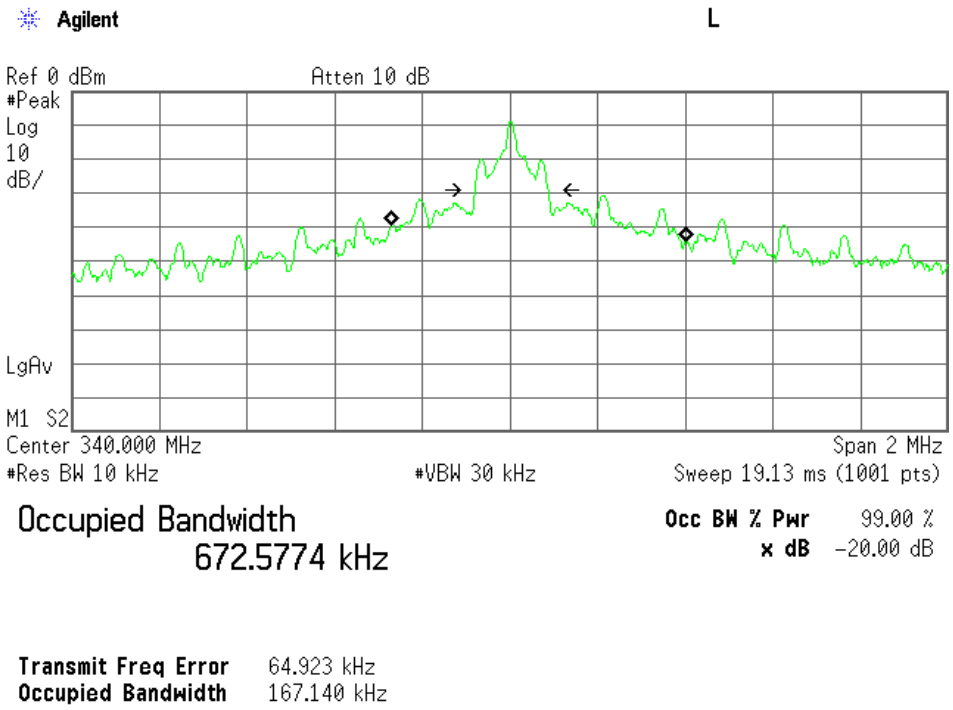
Test Date : January 17, 2017
Temp.:21°C, Humi:30%

The resolution bandwidth was set to about 1% to 5 % of emission bandwidth, -20dBc display line was placed on the screen (or 99% bandwidth), the occupied bandwidth is the delta frequency between the two points where the display line intersects the signal trace.

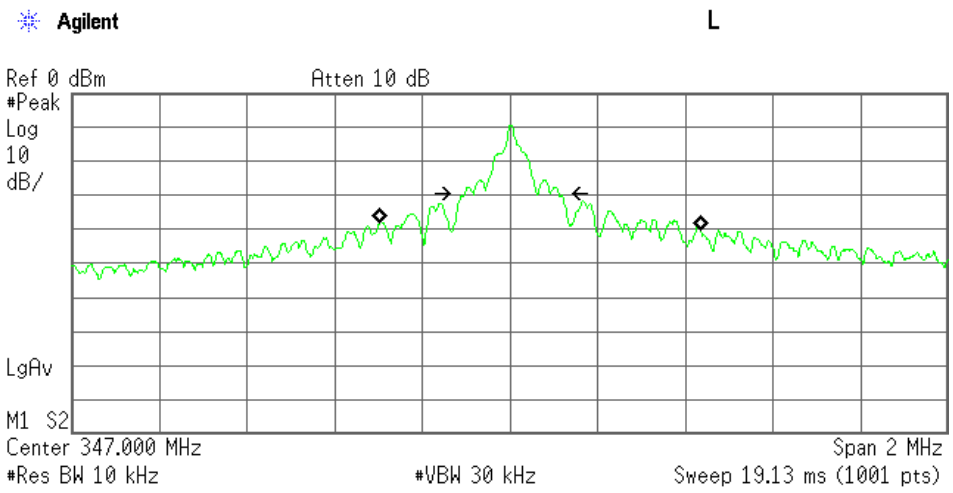
Mode of EUT: Tx Mode
Test Port: Temporary antenna connector

Frequency (MHz)	99% Bandwidth (kHz)	-20dBc Bandwidth (kHz))	-20dBc Deviation (%)	-20dBc Limit (%)	Margin (%)
340.00	672.6	167.1	0.049	0.25	0.201
347.00	729.0	213.2	0.061	0.25	0.189
354.00	561.6	157.6	0.045	0.25	0.205

Low Channel



Middle Channel

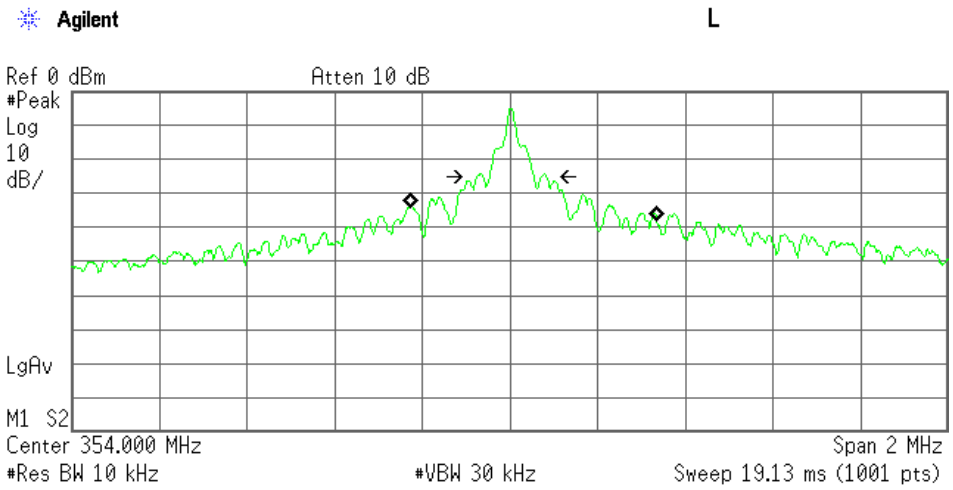


Occupied Bandwidth
728.9771 kHz

Occ BW % Pwr 99.00 %
x dB -20.00 dB

Transmit Freq Error 69.441 kHz
Occupied Bandwidth 213.166 kHz

High Channel



Occupied Bandwidth
561.5888 kHz

Occ BW % Pwr 99.00 %
x dB -20.00 dB

Transmit Freq Error 55.114 kHz
Occupied Bandwidth 157.586 kHz

7.2 AC Powerline Conducted Emission

For the requirements, ☐ - Applicable [☐ - Tested. ☐ - Not tested by applicant request.]
☑ - Not Applicable

Remarks : The transmitter mode is only operated in the host battery.

7.3 Radiated Emission

For the requirements, ☑ - Applicable [☑ - Tested. ☐ - Not tested by applicant request.]
☐ - Not Applicable

7.3.1 Test Results

For the standard, ☑ - **Passed** ☐ - **Failed** ☐ - **Not judged**

Min. Limit Margin (Average) (Fundamental)	5.9	dB	at	354.0	MHz
Min. Limit Margin (Average) (Other)	18.0	dB	at	708.0	MHz

Uncertainty of Measurement Results	9 kHz – 30 MHz	± 3.0	dB(2σ)
	30 MHz – 300 MHz	± 3.8	dB(2σ)
	300 MHz – 1000 MHz	± 4.8	dB(2σ)
	1 GHz – 6 GHz	± 4.7	dB(2σ)

Remarks : Fundamental: Y axis position, Other: Y axis position.

7.3.2 Test Instruments

Anechoic Chamber A2				
Type	**Model**	**Serial No. (ID)**	**Manufacturer**	**Cal. Due**
Test Receiver	ESU 26	100070	Rohde & Schwarz	2018/01/11
Loop Antenna	HFH2-Z2	872096/25 (C-2)	Rohde & Schwarz	2017/07/21
RF Cable	RG213/U	--- (H-28)	HUBER+SUHNER	2017/07/21
Biconical Antenna	VHA9103/BBA9106	2355 (C-30)	Schwarzbeck	2017/05/18
Log-periodic Antenna	UHALP9108-A1	0694 (C-31)	Schwarzbeck	2017/05/18
RF Cable	S 10162 B-11 etc.	--- (H-4)	HUBER+SUHNER	2017/04/03
Pre-Amplifier	TPA0118-36	1010 (A-37)	TOYO	2017/05/17
Horn Antenna	91888-2	562 (C-41-1)	EATON	2017/06/12
Horn Antenna	91889-2	568 (C-41-2)	EATON	2017/06/12
Attenuator	54A-10	W5713 (D-29)	Weinschel	2017/08/02
Attenuator	2-10	BA6214 (D-79)	Weinschel	2017/11/21
RF Cable	SUCOFLEX104	267479/4 (C-66)	HUBER+SUHNER	2018/01/10
RF Cable	SUCOFLEX104	267414/4 (C-67)	HUBER+SUHNER	2018/01/10
Spectrum Analyzer	FSL3	100229 (A-40)	Rohde & Schwarz	2017/04/27
Attenuator	54A-10	W5675 (D-28)	Weinschel	2017/08/02

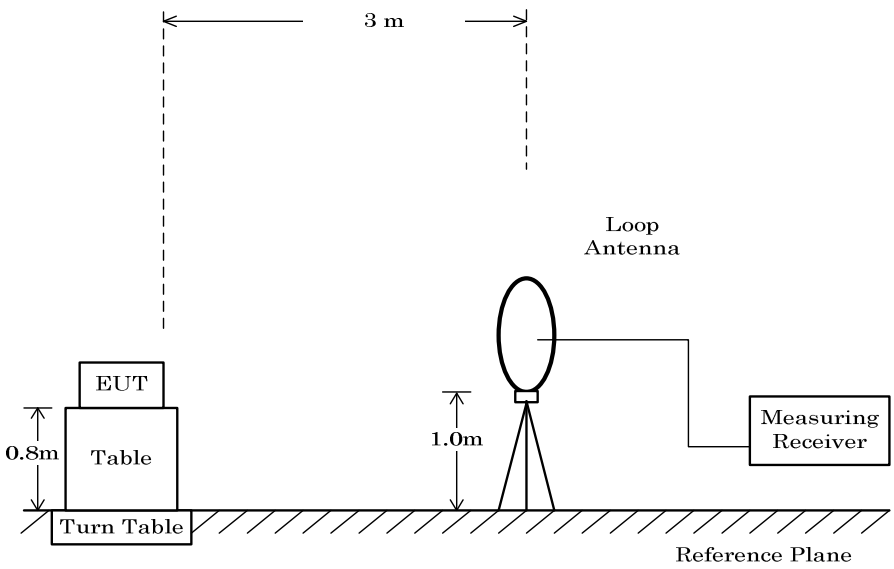
NOTE : The calibration interval of the above test instruments is 12 months.

7.3.3 Test Method and Test Setup (Diagrammatic illustration)

7.3.3.1 Radiated Emission 9 kHz – 30 MHz

The preliminary tests were performed at the measurement distance that specified for compliance to determine the emission characteristics of the EUT.
The EUT configuration(in X, Y and Z axis), cable configuration and mode of operation were determined for producing the maximum level of emissions.
The measurement were performed about three antenna orientations (parallel, perpendicular, and ground-parallel).
According to KDB 937606, a used anechoic chamber were equivalent to those on an open fields site based on comparison measurements.
This configurations was used for the final tests.

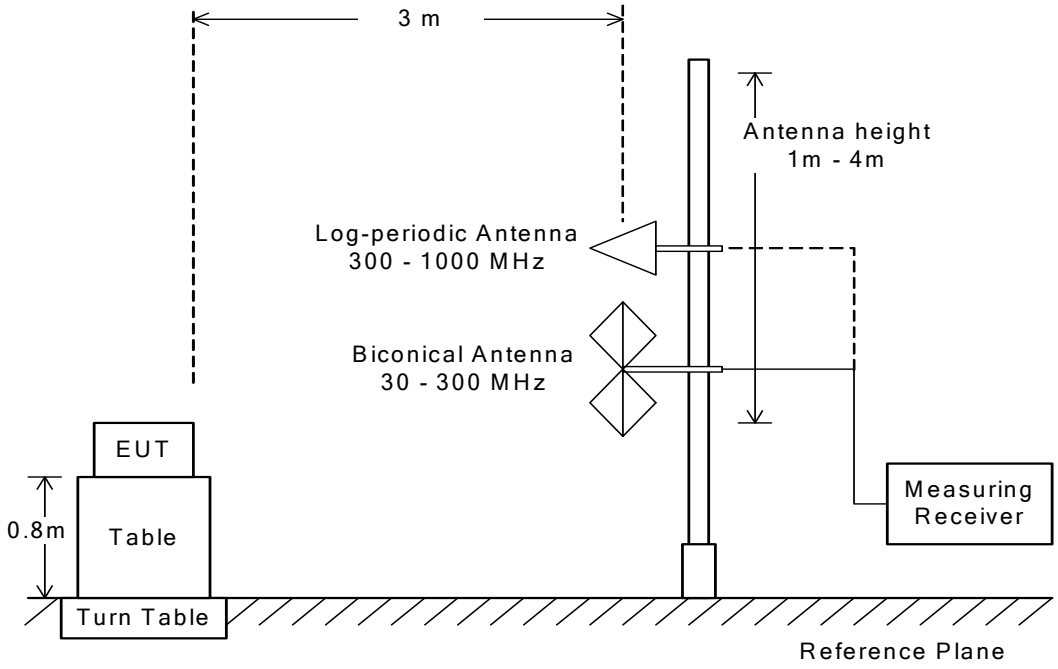
– Side View –



7.3.3.2 Radiated Emission 30 MHz – 1000 MHz

The preliminary tests were performed at the measurement distance that specified for compliance to determine the emission characteristics of the EUT.
The EUT configuration(in X, Y and Z axis), cable configuration and mode of operation were determined for producing the maximum level of emissions.
This configurations was used for the final tests.

– Side View –



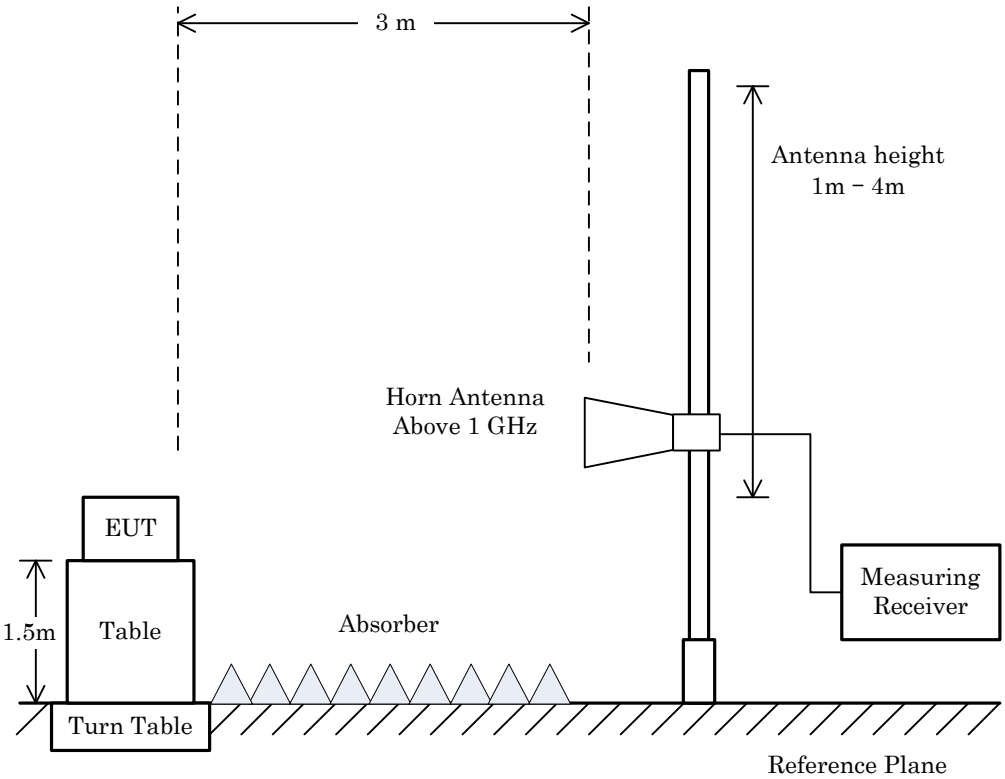
7.3.3.3 Radiated Emission above 1 GHz

The preliminary tests were performed at the measurement distance that specified for compliance to determine the emission characteristics of the EUT.
The EUT configuration(in X, Y and Z axis), cable configuration and mode of operation were determined for producing the maximum level of emissions.
This configurations was used for the final tests.

The setting of the measuring instruments are shown as follows:

Type	Peak	Average
Detector Function	Peak	Peak
Res. Bandwidth	1 MHz	1 MHz
Video Bandwidth	3 MHz	10 Hz
Video Filtering	Linear Voltage	Linear Voltage
Sweep Time	AUTO	AUTO
Trace	Max Hold	Max Hold

– Side View –



NOTE
When the EUT is manipulated through three different orientations, the scan height upper range for the measurement antenna is limited to 2.5 m or 0.5 m above the top of the EUT.

7.3.4 Test Data

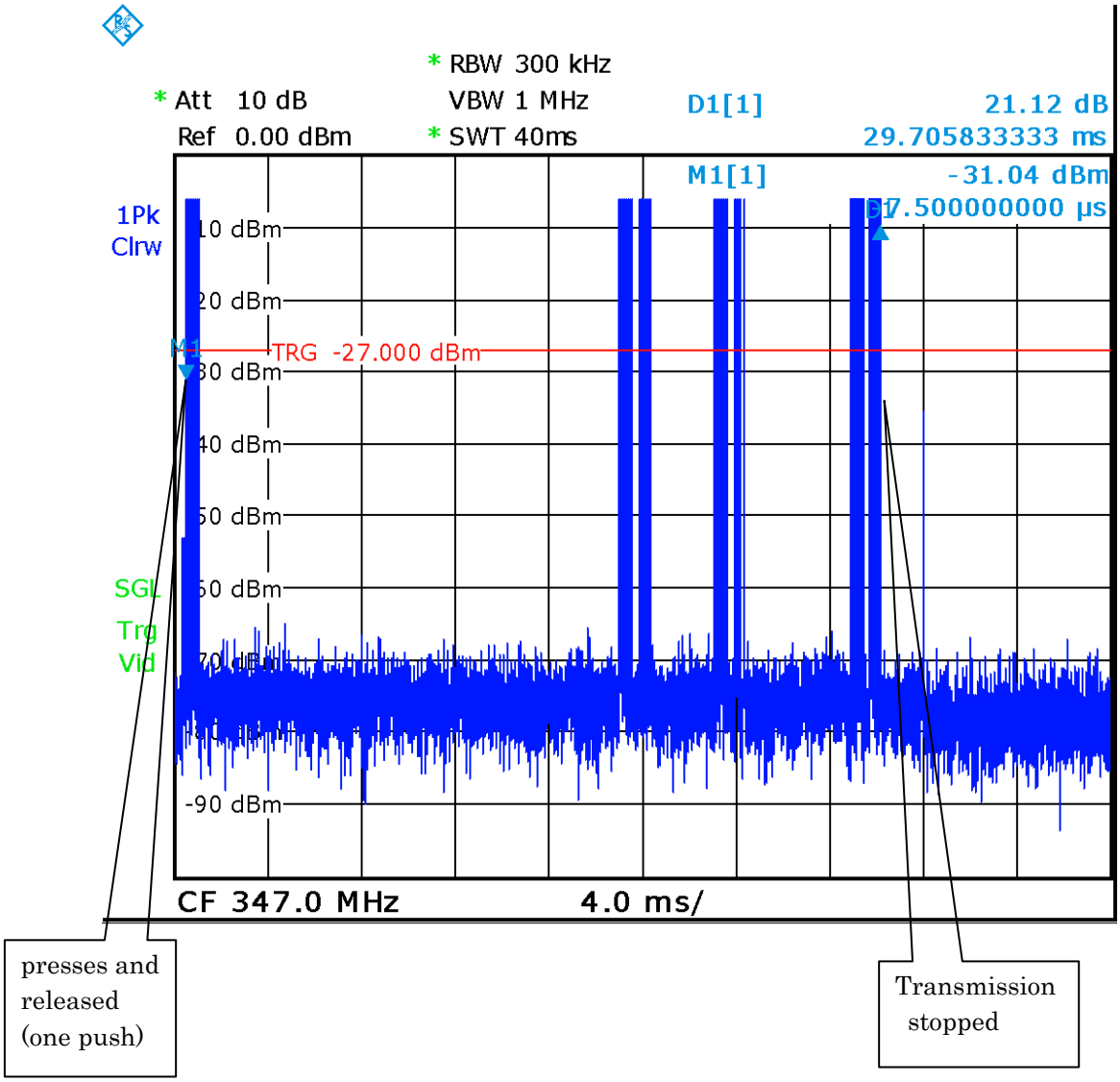
7.3.4.1 Holdover time manual release

Holdover time after manual release[§15.231(a)(1)] 19 ms(Typical)
(Manufacturer designed)

Note: The above values equal to the maximum transmission time, when the switch is pressed once.

(Worst case)

	Measured(ms)	Limits(ms)
Holdover time after manual release	29.7	5000



7.3.4.2 Maximum Modulation Percentage

§ 15.35 (c) & ISED RSS-Gen Issue 4 §6.10
The measurement field strength shall be determined by averaging over one complete pulse train, including blanking intervals, as long as the pulse train does not exceed 0.1 seconds. As an alternative(provided the transmitter operates for longer than 0.1 seconds) or in cases where the pulse train exceeds 0.1 seconds, the measured field strength shall be determined from the average absolute voltage during a 0.1 seconds interval during which the field strength is at its maximum value. The exact method of calculating the average field strength shall be submitted with any application for certification or shall be retained in the measurement data file for equipment subject to notification or verification.

TEST PROCEDURE

The transmitter output is connected to a spectrum analyzer or radiated field strength. The RBW is set to 300 kHz and the VBW is set to 1 MHz. The sweep time is coupled and the span is set to 0 Hz. The number of pulses is measured and calculated in 13.62 ms scan.

CALCULATION

Average Reading = Peak Reading(dBuV/m) + 20log (Duty Cycle),
Where Duty Cycle is (# of pulses *pulse width)/100 or T (One Period(13.62))
= Peak Reading(dBuV/m) - 16.3

RESULTS

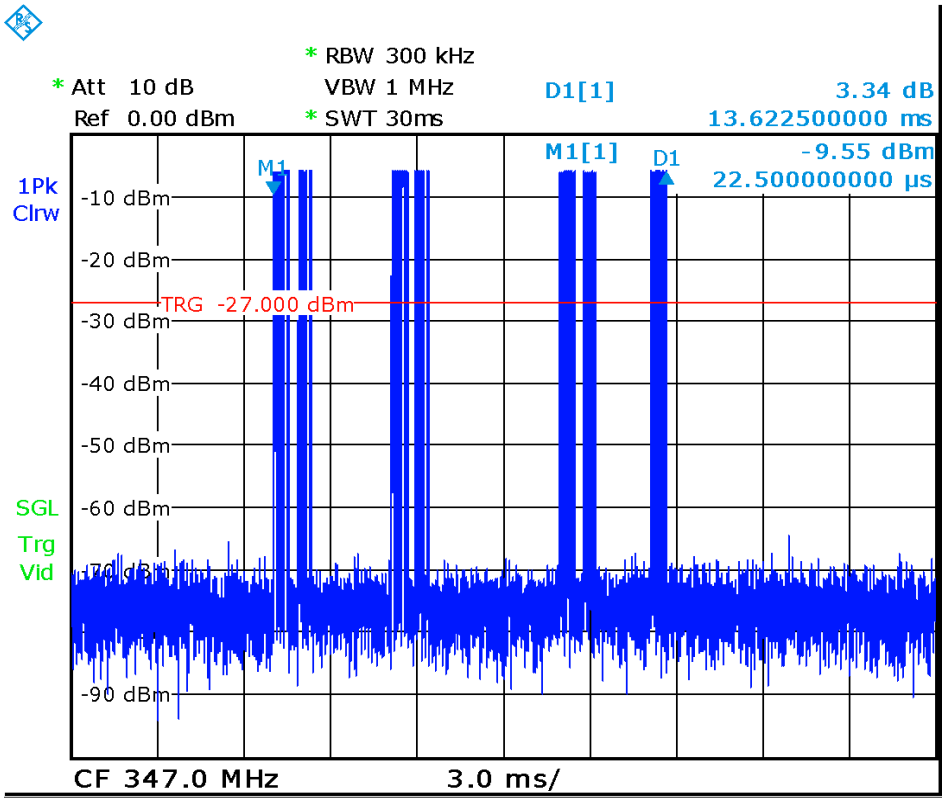
No non-compliance noted:

MAXIMUM MODULATION PERCENTAGE (Worst case)

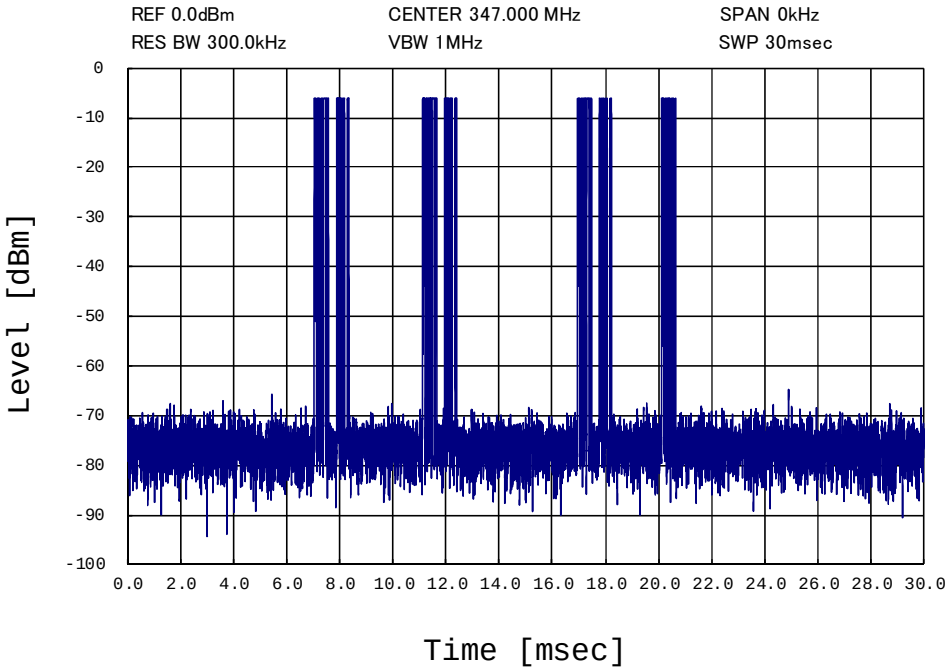
One Period (ms)	Pulse Width(*1 (ms)	Number of Pulses (*2)	Duty Cycle	Duty Cycle (%)	Peak to Average Factor (dB)
13.62	2.5E-03	832	0.1527	15.27	-16.3

Note : (1) Pulse width(ms) = Spectrum Analyzer Trace Width per point
= 30 ms / 12000 (Number of Trace Data)
= $2.5 * 10^{-3}$
(2) Number of Pulses : Total number of Trace Data On-time points

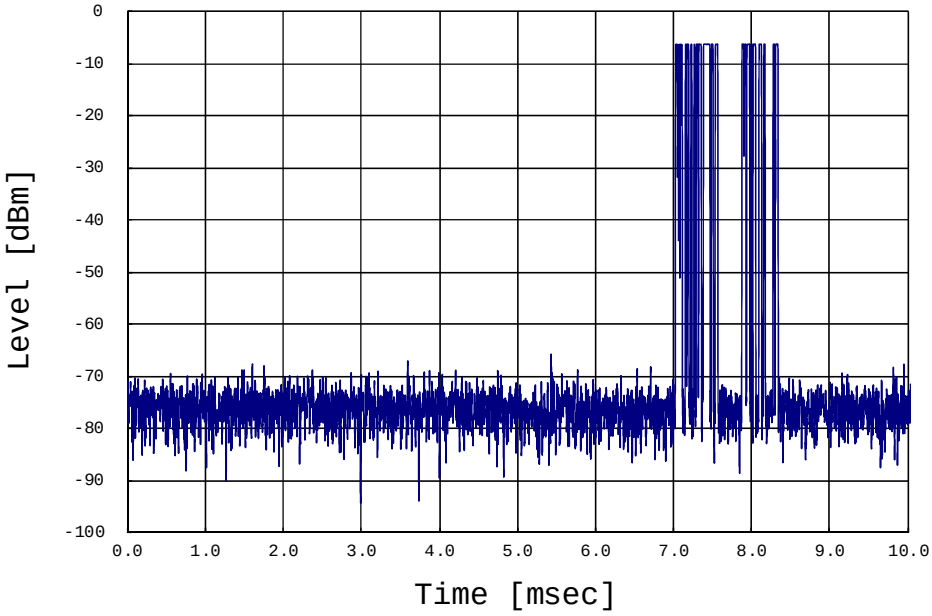
Spectrum Analyzer Screen Copy



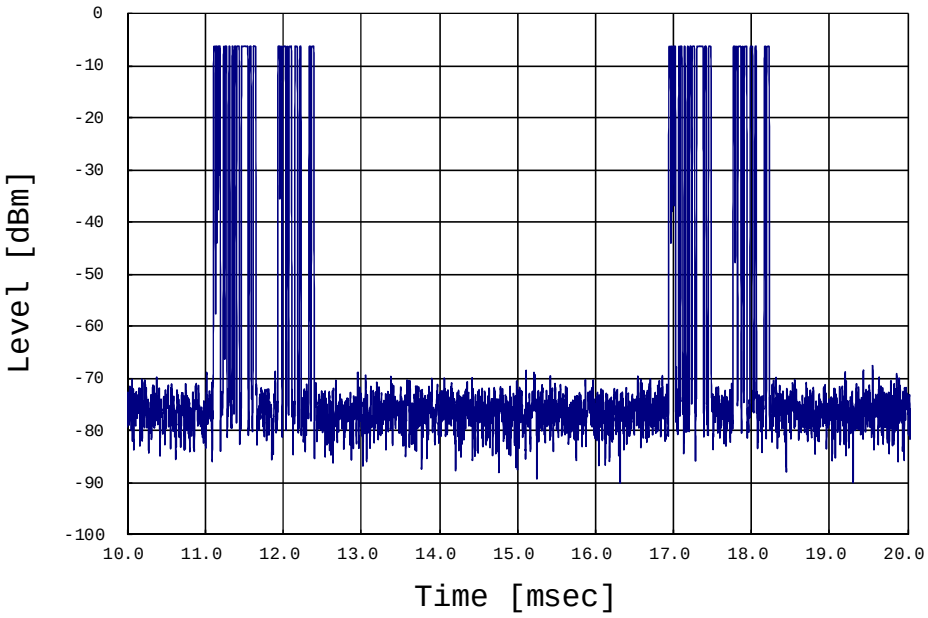
Trace Data (Full Data)



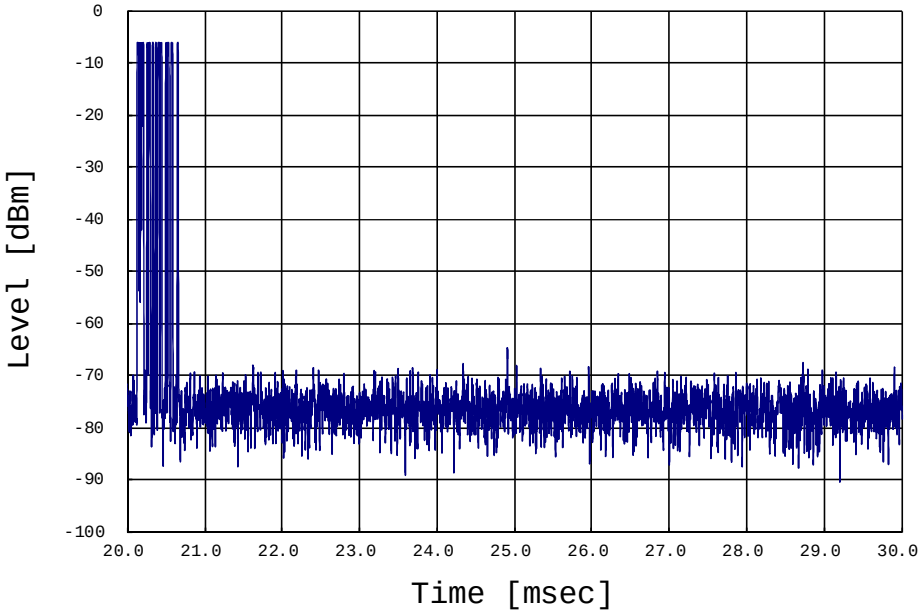
Trace Data (0 ms to 10 ms)



Trace Data (10 ms to 20 ms)



Trace Data (20 ms to 30 ms)



7.3.4.3 Radiated Emission (9kHz – 30MHz)

Test Date : January 19, 2017
Temp.:22°C, Humi:48%

Mode of EUT : All modes have been investigated and the worst case mode has been listed.
Results : No spurious emissions in the range 20dB below the limit.

7.3.4.4 Radiated Emission above 30 MHz

Test Date : January 19, 2017
Temp.:22°C, Humi:48%
Test Date : January 20, 2017
Temp.:23°C, Humi:35%

Mode of EUT: Tx Mode (340 MHz)
Test Port : Enclosure

Frequ-ency (MHz)	P-A Factor (dB)	Correction Factor (dB)	Polari-zation	Meter Reading (dBuV) QP	AV	Peak	Limits (dBuV/m) QP/AV	Peak	Emission Levels (dBuV/m) QP/AV	Peak	Margins (dB) QP/AV	Peak
340.0	-16.3	17.7	H	-	-	65.4	77.0	97.0	66.8	83.1	10.2	13.9
680.0	-16.3	24.6	H	-	-	27.7	57.0	77.0	36.0	52.3	21.0	24.7
1020.0	-16.3	1.3	H	-	-	49.0	54.0	74.0	34.0	50.3	20.0	23.7
1360.0	-16.3	1.8	H	-	-	42.7	54.0	74.0	28.2	44.5	25.8	29.5
2380.0	-16.3	2.9	H	-	-	41.0	54.0	74.0	27.6	43.9	26.4	30.1
3060.0	-16.3	3.9	H	-	-	39.7	57.0	77.0	27.3	43.6	29.7	33.4

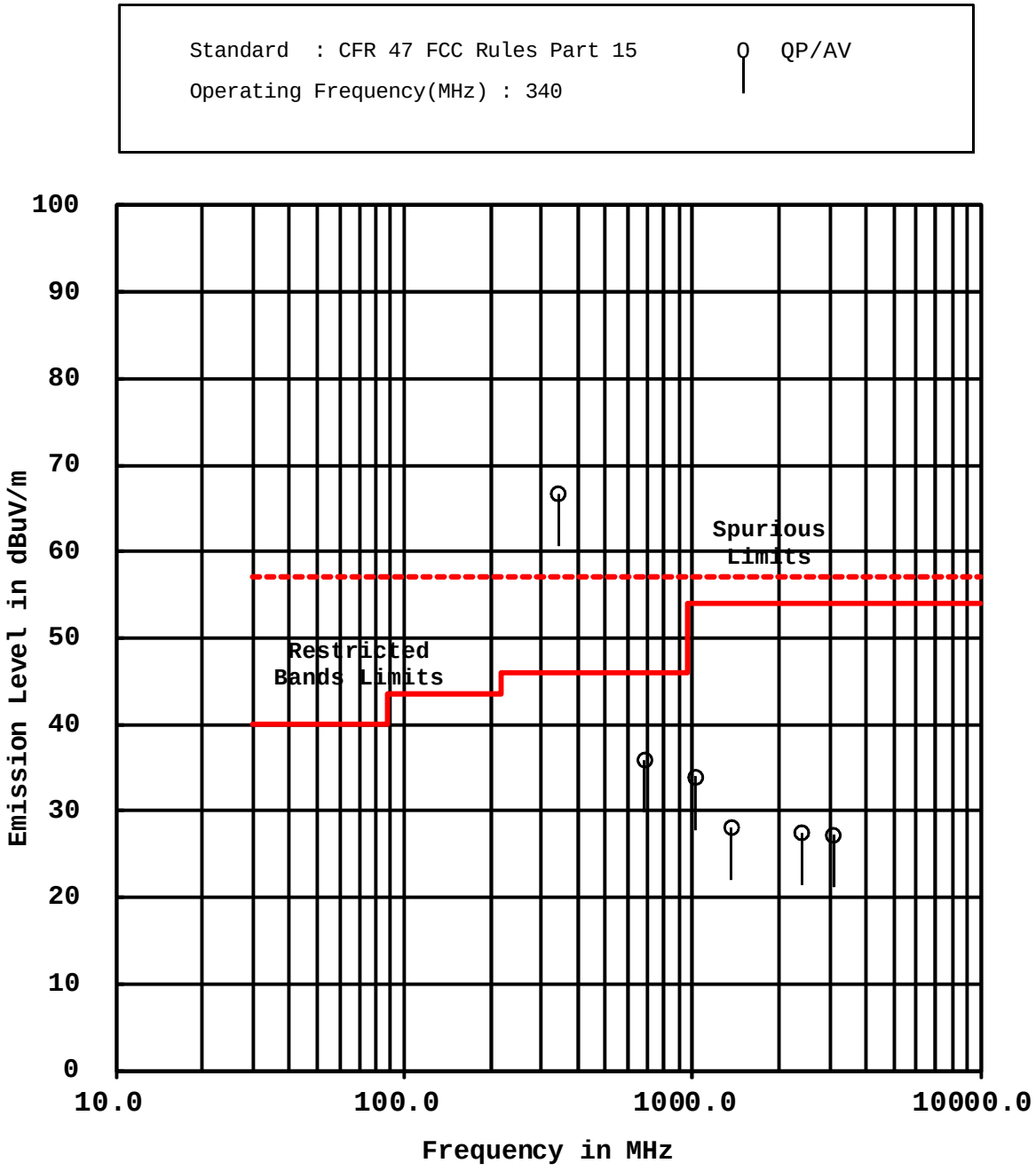
Frequ-ency (MHz)	P-A Factor (dB)	Correction Factor (dB)	Polari-zation	Meter Reading (dBuV) QP	AV	Peak	Limits (dBuV/m) QP/AV	Peak	Emission Levels (dBuV/m) QP/AV	Peak	Margins (dB) QP/AV	Peak
340.0	-16.3	17.7	V	-	-	63.6	77.0	97.0	65.0	81.3	12.0	15.7
680.0	-16.3	24.6	V	-	-	24.5	57.0	77.0	32.8	49.1	24.2	27.9
1020.0	-16.3	1.3	V	-	-	47.8	54.0	74.0	32.8	49.1	21.2	24.9
1360.0	-16.3	1.8	V	-	-	41.1	54.0	74.0	26.6	42.9	27.4	31.1
2380.0	-16.3	2.9	V	-	-	40.7	54.0	74.0	27.3	43.6	26.7	30.4
3060.0	-16.3	3.9	V	-	-	39.1	57.0	77.0	26.7	43.0	30.3	34.0

Notes :

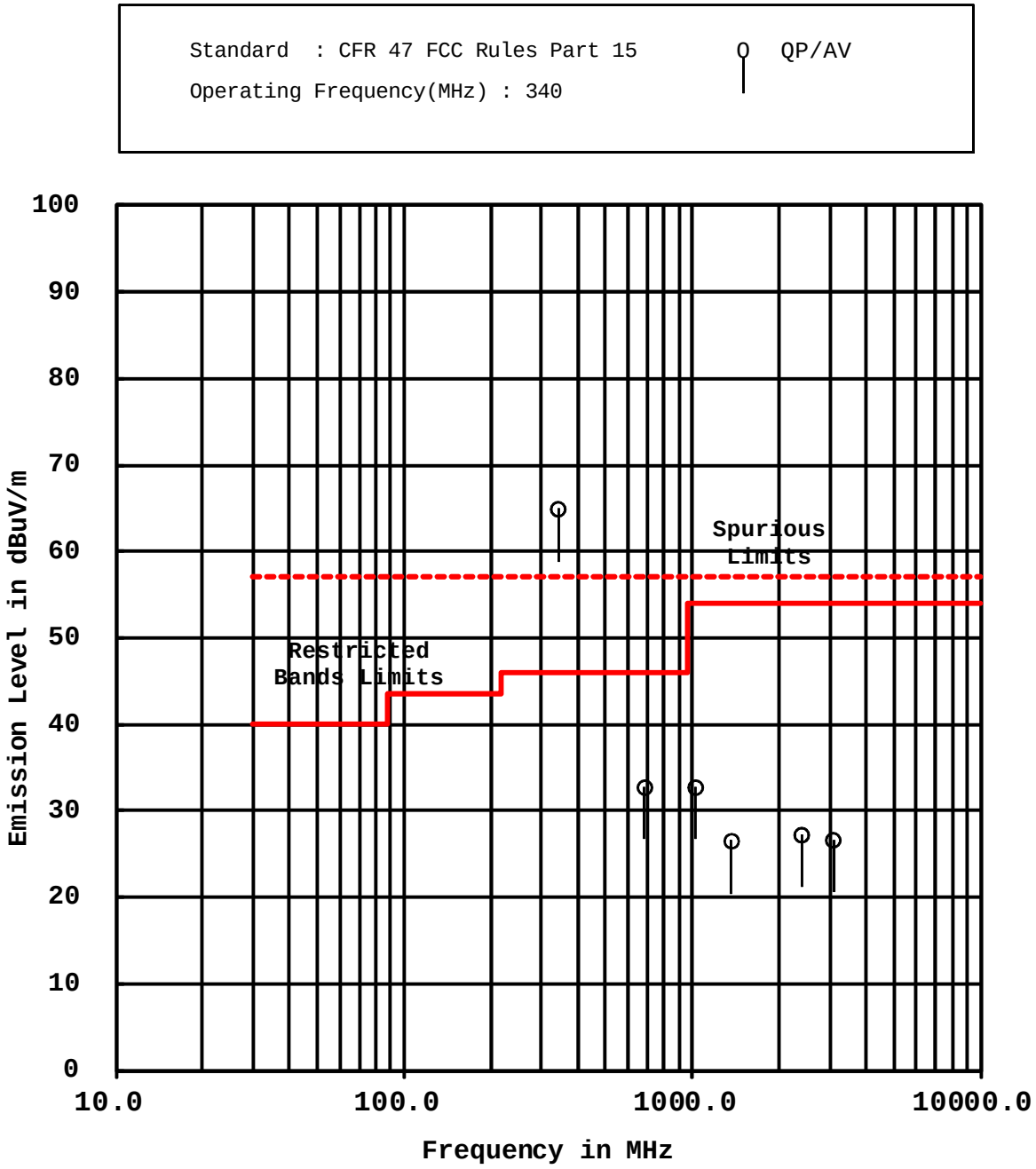
1) The spectrum was checked from 30 MHz to tenth harmonics.
2) The cable loss, amp. gain and antenna factor are included in the correction factor.
3) The symbol of "<"means "or less".
4) The symbol of ">"means "or greater".
5) A sample calculation(QP/AV) was made at 340 (MHz).
   PA + Cf + Mr = -16.3 + 17.7 + 65.4(Peak) = 66.8 (dBuV/m)
   PA = Peak to Average Factor(P-A Factor)
   Cf = Correction Factor
   Mr = Meter Reading
6) Measuring Instrument Setting :

Detector function	Resolution Bandwidth	Video Bandwidth
Quasi-peak(QP)	120 kHz	-
Average(AV)	1 MHz	10 Hz
Peak	1 MHz	3 MHz

Antenna Pole: Horizontal



Antenna Pole: Vertical



Mode of EUT: Tx Mode (347 MHz)
Test Port : Enclosure

Frequ-ency (MHz)	P-A Factor (dB)	Correction Factor (dB)	Polari-zation	Meter Reading (dBuV) QP	AV	Peak	Limits (dBuV/m) QP/AV	Peak	Emission Levels (dBuV/m) QP/AV	Peak	Margins (dB) QP/AV	Peak
347.0	-16.3	17.9	H	-	-	68.4	77.4	97.4	70.0	86.3	7.4	11.1
694.0	-16.3	24.8	H	-	-	30.8	57.4	77.4	39.3	55.6	18.1	21.8
1041.0	-16.3	1.1	H	-	-	45.7	54.0	74.0	30.5	46.8	23.5	27.2
1388.0	-16.3	1.7	H	-	-	42.7	54.0	74.0	28.1	44.4	25.9	29.6
1735.0	-16.3	2.1	H	-	-	41.7	57.4	77.4	27.5	43.8	29.9	33.6
3123.0	-16.3	4.0	H	-	-	41.1	57.4	77.4	28.8	45.1	28.6	32.3

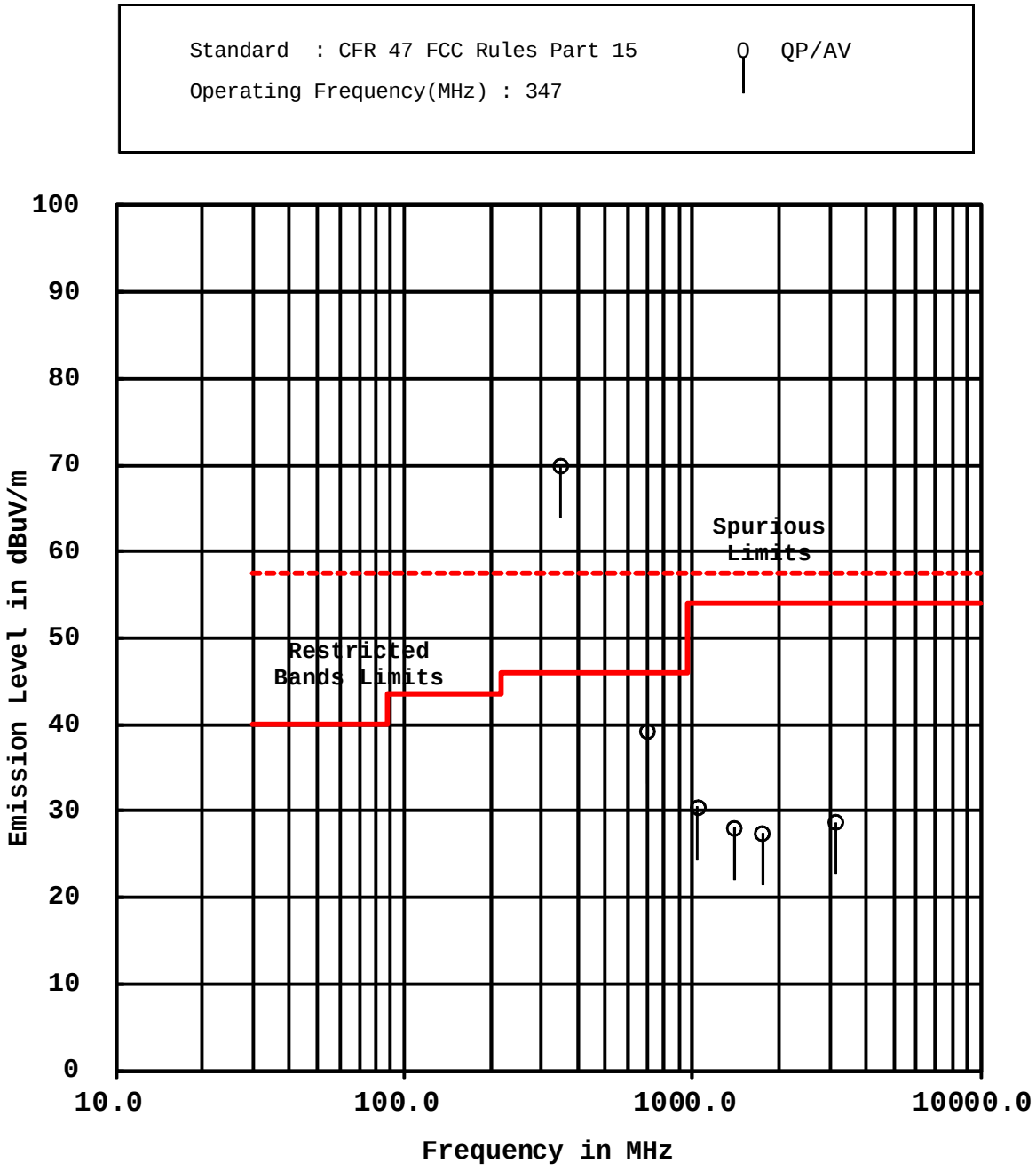
Frequ-ency (MHz)	P-A Factor (dB)	Correction Factor (dB)	Polari-zation	Meter Reading (dBuV) QP	AV	Peak	Limits (dBuV/m) QP/AV	Peak	Emission Levels (dBuV/m) QP/AV	Peak	Margins (dB) QP/AV	Peak
347.0	-16.3	17.9	V	-	-	67.1	77.4	97.4	68.7	85.0	8.7	12.4
694.0	-16.3	24.8	V	-	-	28.0	57.4	77.4	36.5	52.8	20.9	24.6
1041.0	-16.3	1.1	V	-	-	45.6	54.0	74.0	30.4	46.7	23.6	27.3
1388.0	-16.3	1.7	V	-	-	42.7	54.0	74.0	28.1	44.4	25.9	29.6
1735.0	-16.3	2.1	V	-	-	39.1	57.4	77.4	24.9	41.2	32.5	36.2
3123.0	-16.3	4.0	V	-	-	39.9	57.4	77.4	27.6	43.9	29.8	33.5

Notes :

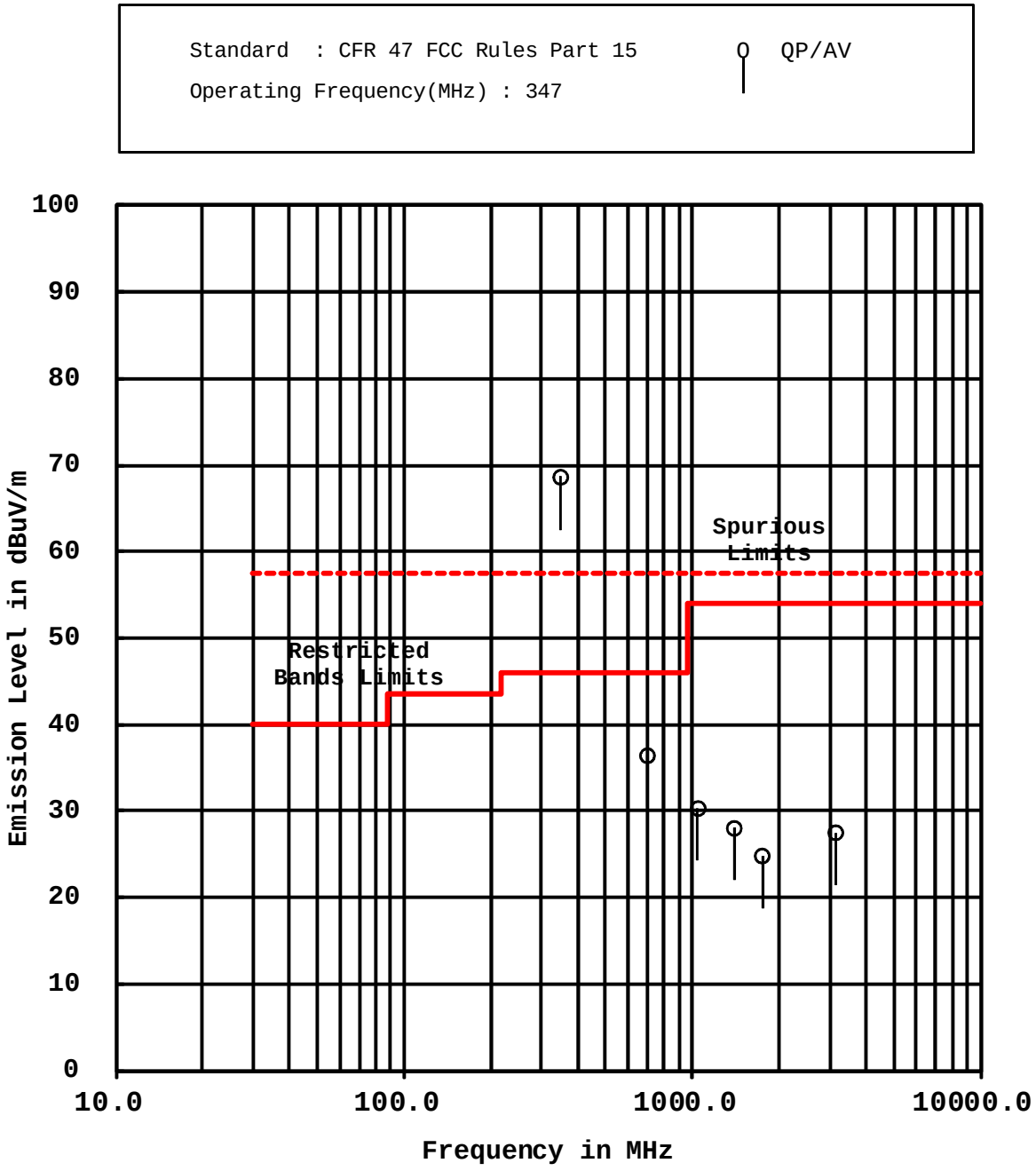
1) The spectrum was checked from 30 MHz to tenth harmonics.
2) The cable loss, amp. gain and antenna factor are included in the correction factor.
3) The symbol of "<"means "or less".
4) The symbol of ">"means "or greater".
5) A sample calculation(QP/AV) was made at 347 (MHz).
   PA + Cf + Mr = -16.3 + 17.9 + 68.4(Peak) = 70 (dBuV/m)
   PA = Peak to Average Factor(P-A Factor)
   Cf = Correction Factor
   Mr = Meter Reading
6) Measuring Instrument Setting :

Detector function	Resolution Bandwidth	Video Bandwidth
Quasi-peak(QP)	120 kHz	-
Average(AV)	1 MHz	10 Hz
Peak	1 MHz	3 MHz

Antenna Pole: Horizontal



Antenna Pole: Vertical



Mode of EUT: Tx Mode (354 MHz)
Test Port : Enclosure

Frequ-ency (MHz)	P-A Factor (dB)	Correction Factor (dB)	Polari-zation	Meter Reading (dBuV) QP	AV	Peak	Limits (dBuV/m) QP/AV	Peak	Emission Levels (dBuV/m) QP/AV	Peak	Margins (dB) QP/AV	Peak
354.0	-16.3	18.1	H	-	-	70.0	77.7	97.7	71.8	88.1	5.9	9.6
708.0	-16.3	25.0	H	-	-	31.0	57.7	77.7	39.7	56.0	18.0	21.7
1062.0	-16.3	1.1	H	-	-	49.2	54.0	74.0	34.0	50.3	20.0	23.7
1416.0	-16.3	1.7	H	-	-	41.3	54.0	74.0	26.7	43.0	27.3	31.0
1770.0	-16.3	2.3	H	-	-	41.5	57.7	77.7	27.5	43.8	30.2	33.9
3186.0	-16.3	4.0	H	-	-	42.2	57.7	77.7	29.9	46.2	27.8	31.5

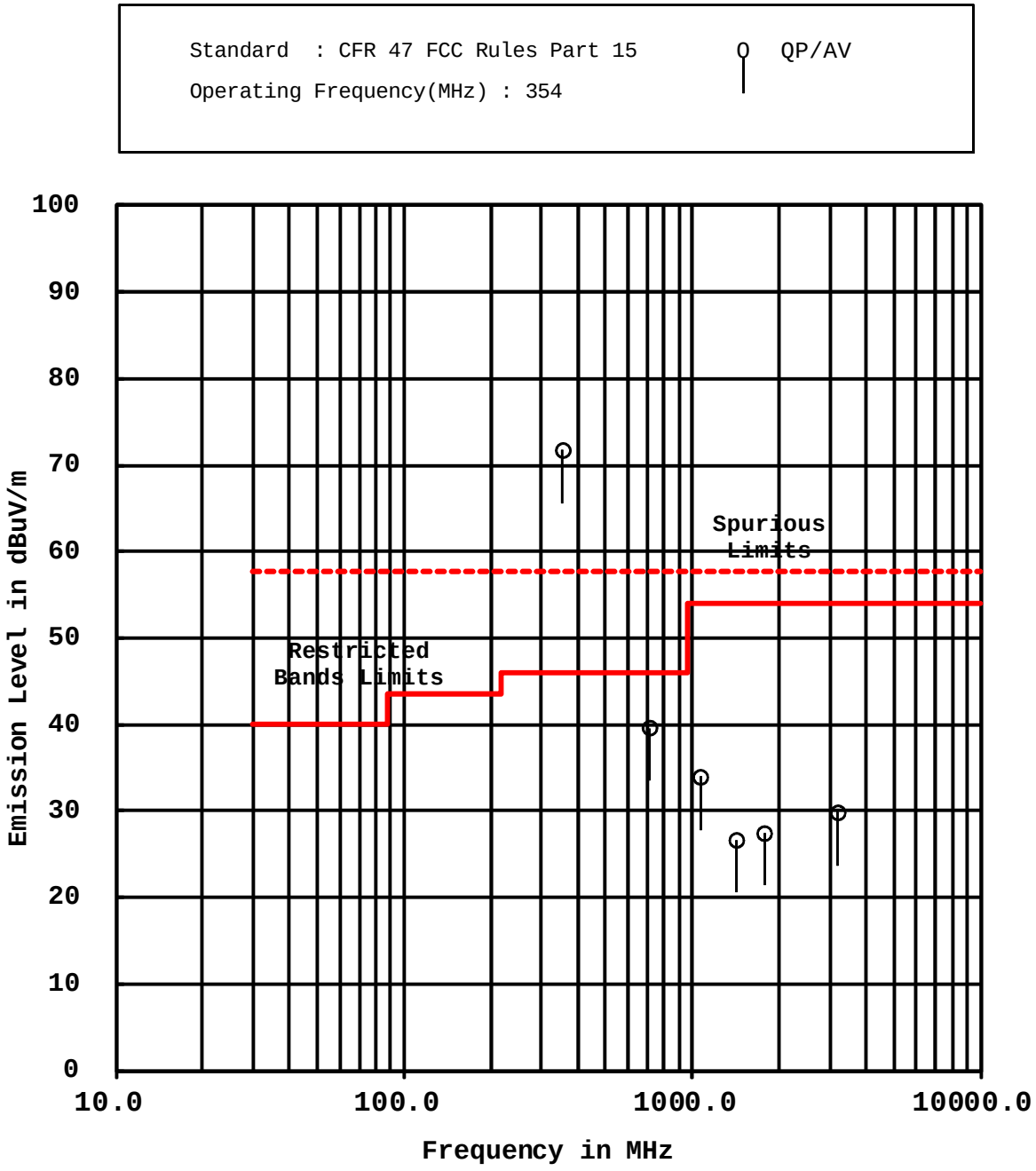
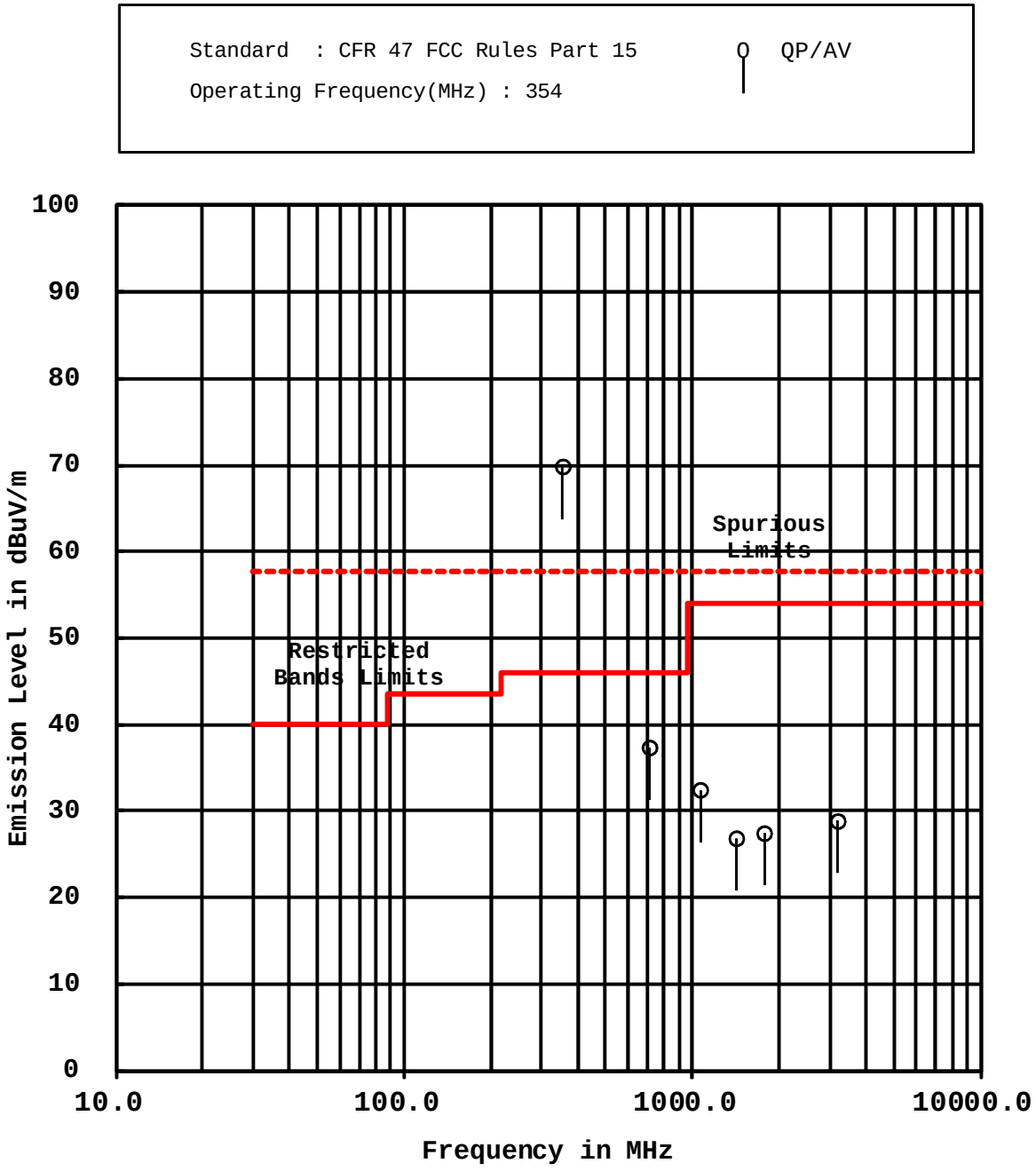
Frequ-ency (MHz)	P-A Factor (dB)	Correction Factor (dB)	Polari-zation	Meter Reading (dBuV) QP	AV	Peak	Limits (dBuV/m) QP/AV	Peak	Emission Levels (dBuV/m) QP/AV	Peak	Margins (dB) QP/AV	Peak
354.0	-16.3	18.1	V	-	-	68.1	77.7	97.7	69.9	86.2	7.8	11.5
708.0	-16.3	25.0	V	-	-	28.7	57.7	77.7	37.4	53.7	20.3	24.0
1062.0	-16.3	1.1	V	-	-	47.7	54.0	74.0	32.5	48.8	21.5	25.2
1416.0	-16.3	1.7	V	-	-	41.5	54.0	74.0	26.9	43.2	27.1	30.8
1770.0	-16.3	2.3	V	-	-	41.5	57.7	77.7	27.5	43.8	30.2	33.9
3186.0	-16.3	4.0	V	-	-	41.2	57.7	77.7	28.9	45.2	28.8	32.5

Notes :

1) The spectrum was checked from 30 MHz to tenth harmonics.
2) The cable loss, amp. gain and antenna factor are included in the correction factor.
3) The symbol of "<"means "or less".
4) The symbol of ">"means "or greater".
5) A sample calculation(QP/AV) was made at 354 (MHz).
   PA + Cf + Mr = -16.3 + 18.1 + 70(Peak) = 71.8 (dBuV/m)
   PA = Peak to Average Factor(P-A Factor)
   Cf = Correction Factor
   Mr = Meter Reading
6) Measuring Instrument Setting :

Detector function	Resolution Bandwidth	Video Bandwidth
Quasi-peak(QP)	120 kHz	-
Average(AV)	1 MHz	10 Hz
Peak	1 MHz	3 MHz

Antenna Pole: Horizontal



Antenna Pole: Vertical