TEST REPORT

OF

FCC Part 15 Subpart C §15.209, §15.231
FCC ID : UVNTP2-TRUCKER-MA

Equipment Under Test	:	Monitor-AM
Model Name	:	TP2-TRUCKER-MA
Applicant	:	SEETRON INC.
Manufacturer	:	SEETRON INC.
Date of Test(s)	:	2015. 07. 20 ~ 2015. 10. 25
Date of Issue	:	2015. 12. 18

In the configuration tested, the EUT complied with the standards specified above.

Tested By: **Jinhyoung Cho** **Date:** **2015. 12. 18**

Approved By: **Hyunchae You** **Date:** **2015. 12. 18**

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1. General Information

1.1. Testing Laboratory

SGS Korea Co., Ltd. (Gunpo Laboratory)
- Wireless Div. 2FL, 10-2, LS-ro 182beon-gil, Gunpo-si, Gyeonggi-do, Korea, 15807

All SGS services are rendered in accordance with the applicable SGS conditions of service available on request and accessible at http://www.sgs.com/en/Terms-and-Conditions.aspx.

Phone No. : + 82 31 688 0901
Fax No. : + 82 31 688 0921

1.2. Details of applicant

Applicant : SEETRON INC.
Address : 201-403, 388 Songnae-daero, Wonmi-gu, Bucheon-si, Gyeonggi-do, 14502
Contact Person : Cho, Byoum-Youn
Phone No. : + 82 32 327 3123

1.3. Description of EUT

Kind of Product	Monitor-AM
Model Name	TP2-TRUCKER-MA
Power Supply	DC 24.0 V (Lead-acid battery)
Frequency Range	Tx : 433.92 ㎒, 125 ㎑ Rx : 433.92 ㎒
Modulation Technique	433.92 ㎒ : FSK 125 ㎑ : ASK
Number of Channels	2
Antenna Type	Ant 1 (433.92 ㎒) : Dipole Antenna
	Ant 2 (125 ㎑) : Helical Antenna

1.4. Declarations by the manufacturer

- The antennas of EUT cannot operate at the same time.
- This EUT Automatically stop after transmitting and it can not stop transmitting manually.
- For the test, this EUT transmits continuously.

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1.5. Test Equipment List

Equipment	Manufacturer	Model	S/N	Cal Date	Cal Interval	Cal Due.
Signal Generator	Agilent	E8257D	MY51501169	Jul. 13, 2015	Annual	Jul. 13, 2016
Spectrum Analyzer	R&S	FSV30	101004	Jun. 22, 2015	Annual	Jun. 22, 2016
DC power Supply	Agilent	U8002A	MY48490027	Dec. 22, 2014	Annual	Dec. 22, 2015
Attenuator	Mini-Circuits	BW-N20W5+	0950-4	Dec. 23, 2014	Annual	Dec. 23, 2015
Preamplifier	H.P.	8447F	2944A03909	Aug. 27, 2015	Annual	Aug. 27, 2016
Preamplifier	R&S	SCU-18	10117	Apr. 10, 2015	Annual	Apr. 10, 2016
High Pass Filter	Mini-Circuits	NHP-800+	VUU16801113-2	Jun. 23, 2015	Annual	Jun. 23, 2016
High Pass Filter	Wainwright	WHK3.0/18G-10SS	344	Jun. 08, 2015	Annual	Jun. 08, 2016
Test Receiver	R&S	ESU26	100109	Mar. 03, 2015	Annual	Mar. 03, 2016
Loop Antenna	R&S	HFH2-Z2	100118	Jun. 04, 2015	Biennial	Jun. 04, 2017
Trilog Broadband Antenna	SCHWARZBECK Mess-Elektronik	VULB9163	396	Jun. 18, 2015	Biennial	Jun. 18, 2017
Horn Antenna	R&S	HF906	100326	Dec. 10, 2013	Biennial	Dec. 10, 2015
Antenna Master	INN-CO	MM4000	N/A	N.C.R.	N/A	N.C.R.
Turn Table	INN-CO	DS 1200S	N/A	N.C.R.	N/A	N.C.R.
Anechoic Chamber	SY Corporation	L × W × H (9.6 m × 6.4 m × 6.6 m)	N/A	N.C.R.	N/A	N.C.R.

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1.6. Summary of Test Results

The EUT has been tested according to the following specifications:

APPLIED STANDARD : FCC Part 15 Subpart C §15.209, §15.231		
Section in FCC Part 15	**Test Item**	**Result**
15.209(a) 15.231(b)	Radiated Emission, Spurious Emission and Field Strength of Fundamental	Complied
15.231(c)	Bandwidth of Operation Frequency	Complied
15.231(a)	Transmission Time	Complied

1.7. Test Report Revision

Revision	Report number	Date of issue	Description
0	F690501/RF-RTL009060	2015. 10. 26	Initial
1	F690501/RF-RTL009060-1	2015. 12. 18	Revised test procedure

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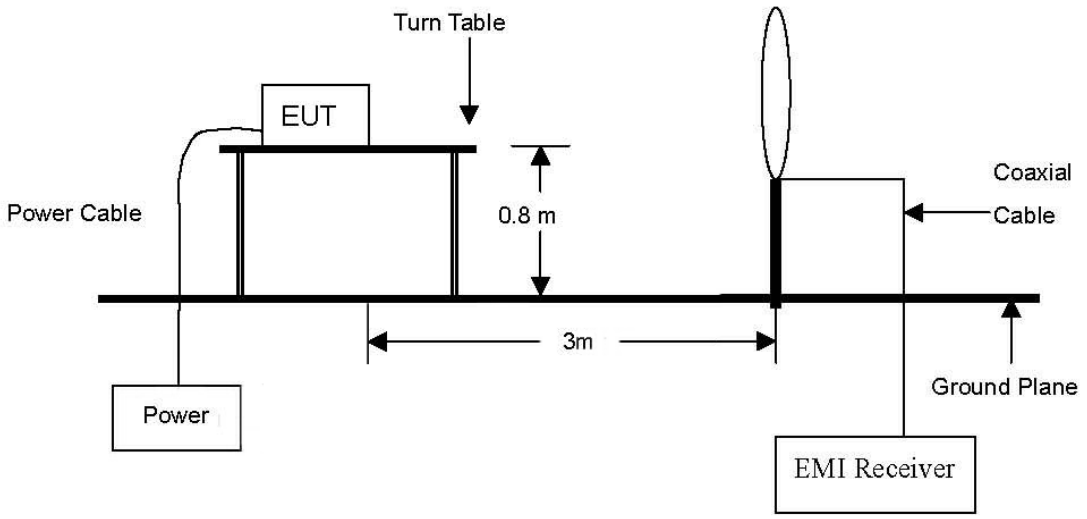
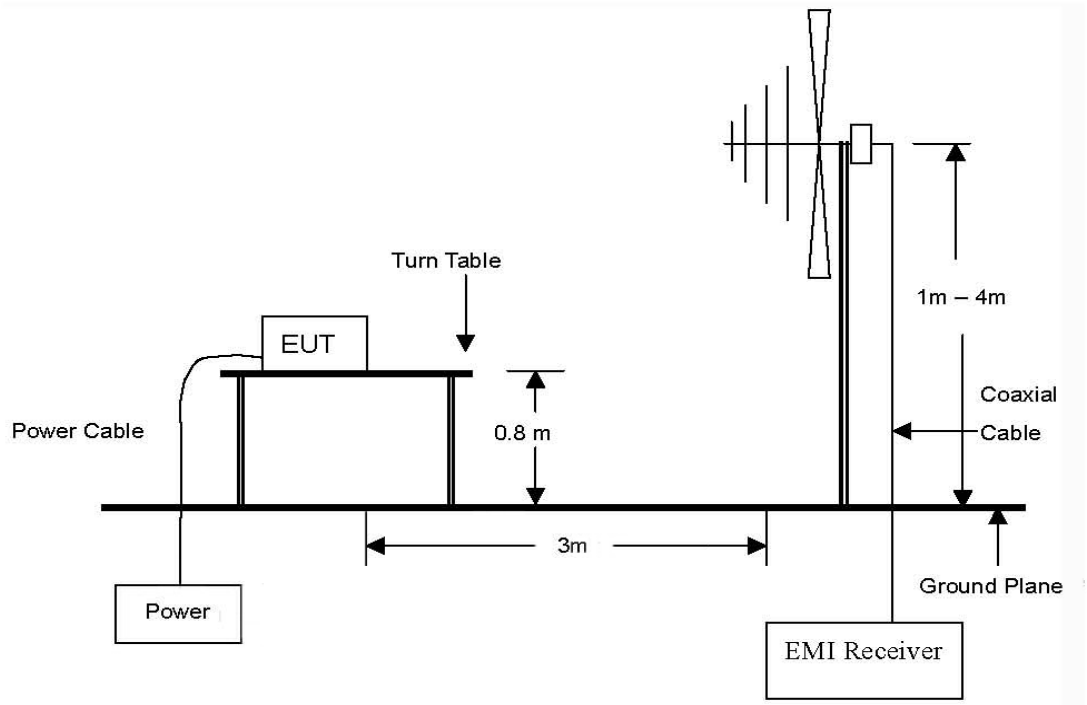
2. Field Strength of Fundamental

2.1. Test Setup

The diagram below shows the test setup that is utilized to make the measurements for emission from 9 ㎑ to 30 ㎒ Emissions.



The diagram below shows the test setup that is utilized to make the measurements for emission from 30 ㎒ to 1 ㎓ Emissions.



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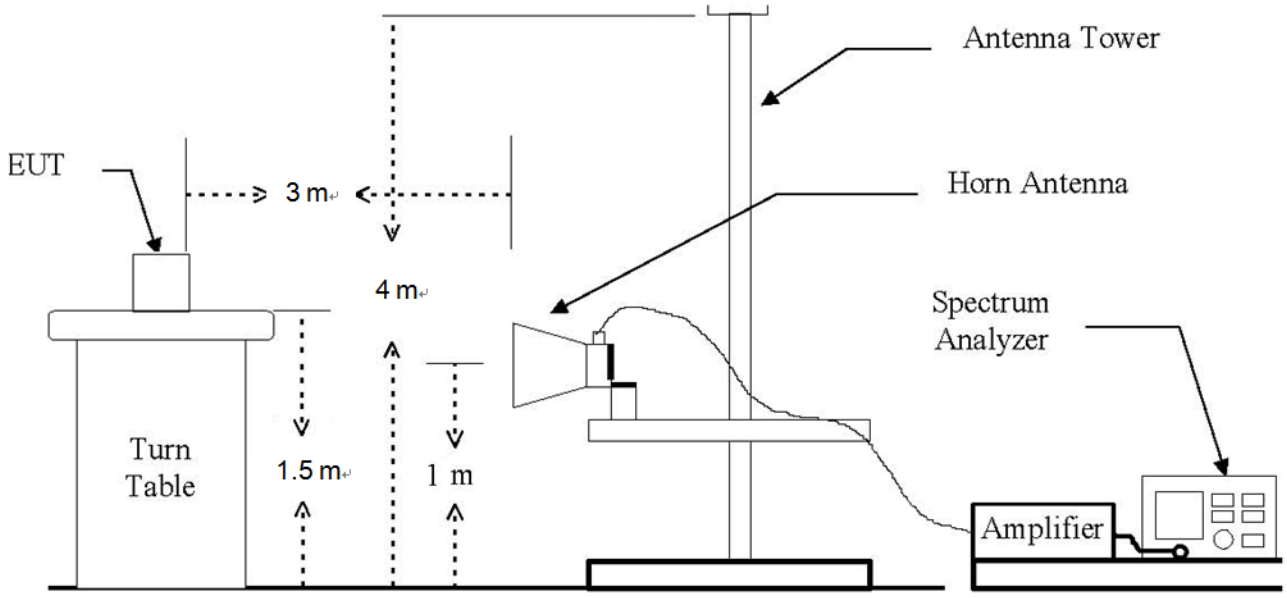
The diagram below shows the test setup that is utilized to make the measurements for emission .The spurious emissions were investigated form 1 ㎓ to the 10th harmonic of the highest fundamental frequency or 40 ㎓, whichever is lower.



2.2. Limit

2.2.1. Radiated emission limits, general requirements

Except as provided elsewhere in this Subpart, the emissions from an intentional radiator shall not exceed the field strength levels specified in the following table:

Frequency (㎒)	Field Strength (microvolts/meter)	Measurement Distance (meter)
0.009 – 0.490	2400/F(㎑)	300
0.490 – 1.705	24000/F(㎑)	30
1.705 – 30.0	30	30
30 -88	100**	3
88 -216	150**	3
216 - 960	200**	3
Above 960	500	3

** Except as provided in paragraph (g), fundamental emissions from intentional radiators operating under this Section shall not be located in the frequency bands 54-72 ㎒, 76-88 ㎒, 174-216 ㎒ or 470-806 ㎒. However, operation within these frequency bands is permitted under other sections of this Part, e.g., Sections 15.231 and 15.241

2.2.2. Periodic operation in the band 40.66-40.70 ㎒ and above 70 ㎒

In addition to the provisions of Section 15.205, the field strength of emissions from intentional radiators operated under this Section shall not exceed the following:

Fundamental Frequency (㎒)	Field Strength of Fundamental (microvolts/meter)	Field Strength of Spurious Emissions (microvolts/meter)
40.66 – 40.70	2,250	225
70 - 130	1,250	125
130 – 174	1,250 to 3,750 **	125 to 375 **
174 – 260	3,750	375
260 – 470	3,750 to 12,500 **	375 to 1,250 **
Above 470	12,500	1,250

** linear interpolations

Where F is the frequency in ㎒, the formulas for calculating the maximum permitted fundamental field strengths are as follows : for the band 130-174 ㎒, ㎶/m at 3 meters = 56.81818(F)-6136.3636; for the band 260-470 ㎒, ㎶/m at 3 meters = 41.6667(F)-7083.3333. The maximum permitted unwanted emission level is 20 ㏈ below the maximum permitted fundamental level.

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2.3. Test Procedures

Radiated emissions from the EUT were measured according to the dictates of ANSI C63.4:2009.

Remark:

Testing for radiated emissions above 1 ㎓ was performed with the EUT elevated at 1.5 m instead of 0.8 m. 1.5 m is the required height in ANSI C63.10:2013 as referenced by RSS GEN issue 4. This test height has been permitted by FCC as discussed in FCC-TCB conference call in December 2014.

2.3.1. Test Procedures for emission from 9 ㎑ to 30 ㎒

a. The EUT was placed on the top of a rotating table 0.8 meters above the ground at a 3 meter anechoic chamber test site. The table was rotated 360 degrees to determine the position of the highest radiation.
b. Then antenna is a loop antenna is fixed at one meter above the ground to determine the maximum value of the field strength. Both parallel and perpendicular of the antenna are set to make the measurement.
c. For each suspected emission, the EUT was arranged to its worst case and then the table was turned from 0 degrees to 360 degrees to find the maximum reading.
d. The test-receiver system was set to Peak Detect Function and Specified Bandwidth with Maximum Hold Mode.

Note;

Although these tests were performed other than open field test site, adequate comparison measurements were confirmed against 30 meter open field test site. Therefore sufficient tests were made to demonstrate that the alternative site produces results that correlate with the ones of tests made in an open field based on KDB 937606.

2.3.2. Test Procedures for emission from 30 ㎒ to 1 000 ㎒

a. The EUT was placed on the top of a rotating table 0.8 meters above the ground at a 3 meter anechoic chamber test site. The table was rotated 360 degrees to determine the position of the highest radiation.
b. During performing radiated emission below 1 ㎓, the EUT was set 3 meters away from the interference receiving antenna, which was mounted on the top of a variable-height antenna tower. During performing radiated emission above 1 ㎓, the EUT was set 3 meter away from the interference-receiving antenna.
c. The antenna is a broadband antenna, and its height is varied from one meter to four meters above the ground to determine the maximum value of the field strength. Both horizontal and vertical polarizations of the antenna are set to make the measurement.
d. For each suspected emission, the EUT was arranged to its worst case and then the antenna was tuned to heights from 1 meter to 4 meters and the table was turned from 0 degrees to 360 degrees to find the maximum reading.
e. The test-receiver system was set to Peak Detect Function and Specified Bandwidth with Maximum Hold Mode.
f. If the emission level of the EUT in peak mode was 10 ㏈ lower than the limit specified, then testing could be stopped and the peak values of the EUT would be reported. Otherwise the emissions that did not have 10 ㏈ margin would be re-tested one by one using peak, quasi-peak or average method as specified and then reported in a data sheet.

2.3.3. Test Procedures for emission above 1 ㎓

a. The EUT was placed on the top of a rotating table 1.5 meters above the ground at a 3 meter anechoic chamber test site. The table was rotated 360 degrees to determine the position of the highest radiation.
b. The resolution bandwidth and video bandwidth of test receiver/spectrum analyzer is 1 ㎒ for Peak detection and frequency above 1 ㎓.

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2.4. Test Result

Ambient temperature : (23 ± 1) ℃
Relative humidity : 47 % R.H.

The following table shows the highest levels of radiated emissions on both polarizations of horizontal and vertical.

Freq. (㎒)	Detector	Ant. Pol.	Reading (dBμV)	Antenna Factor (dB)	Cable Loss (dB)	Result (dBμV/m)	Limit (dBμV/m)	Margin (dB)
433.92	Peak	H	74.80	17.42	3.60	95.82	100.83	5.01
433.92	Average	H	57.11	17.42	3.60	78.13	80.83	2.70
433.92	Peak	V	67.81	17.12	3.60	88.53	100.83	12.30
433.92	Average	V	50.12	17.12	3.60	70.84	80.83	9.99

Remark:
To get a maximum emission level from the EUT, the EUT was moved throughout the X-axis, Y-axis and Z-axis. Worst case is X-axis.
Definition of DUT for three orthogonal planes is described in the test setup photo.

Note:

1. 3 m Average Limit (dBμV/m) = 20log[41.6667($F_{(㎒)}$)-7083.3333] = 80.83
   3 m Peak Limit (dBμV/m) = Average Limit + 20 = 100.83
2. Average Reading = Peak Reading + Duty Cycle Correction Factor
3. Duty Cycle Correction Factor : 20log(T_{on} / 100 ㎳) = 20log(13.043 / 100) = -17.69
   - $Tx_{on\ time}$ = 13.043 ㎳
   - Tx_{on+off} ≥ 100 ㎳ (pulse train is 100 ㎳)

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3. Spurious Emission

3.1. Test Setup

Same as section 2.1. of this report

3.2. Limit

Same as section 2.2. of this report

3.3. Test Procedures

Radiated emissions from the EUT were measured according to the dictates of ANSI C63.4:2003.

3.3.1. Test Procedures for emission from 9 ㎑ to 30 ㎒

a. The EUT was placed on the top of a rotating table 0.8 meters above the ground at a 3 meter anechoic chamber test site. The table was rotated 360 degrees to determine the position of the highest radiation.
b. Then antenna is a loop antenna is fixed at one meter above the ground to determine the maximum value of the field strength. Both parallel and perpendicular of the antenna are set to make the measurement.
c. For each suspected emission, the EUT was arranged to its worst case and then the table was turned from 0 degrees to 360 degrees to find the maximum reading.
d. The test-receiver system was set to Peak Detect Function and Specified Bandwidth with Maximum Hold Mode.

Note;

Although these tests were performed other than open field test site, adequate comparison measurements were confirmed against 30 meter open field test site. Therefore sufficient tests were made to demonstrate that the alternative site produces results that correlate with the ones of tests made in an open field based on KDB 937606.

3.3.2. Test Procedures for emission from 30 ㎒ to 1 000 ㎒

a. The EUT was placed on the top of a rotating table 0.8 meters above the ground at a 3 meter anechoic chamber test site. The table was rotated 360 degrees to determine the position of the highest radiation.
b. During performing radiated emission below 1 ㎓, the EUT was set 3 meters away from the interference receiving antenna, which was mounted on the top of a variable-height antenna tower. During performing radiated emission above 1 ㎓, the EUT was set 3 meter away from the interference-receiving antenna.
c. The antenna is a broadband antenna, and its height is varied from one meter to four meters above the ground to determine the maximum value of the field strength. Both horizontal and vertical polarizations of the antenna are set to make the measurement.
d. For each suspected emission, the EUT was arranged to its worst case and then the antenna was tuned to heights from 1 meter to 4 meters and the table was turned from 0 degrees to 360 degrees to find the maximum reading.
e. The test-receiver system was set to Peak Detect Function and Specified Bandwidth with Maximum Hold Mode.
f. If the emission level of the EUT in peak mode was 10 ㏈ lower than the limit specified, then testing could be stopped and the peak values of the EUT would be reported. Otherwise the emissions that did not have 10 ㏈ margin would be re-tested one by one using peak, quasi-peak or average method as specified and then reported in a data sheet.

3.3.3. Test Procedures for emission above 1 ㎓

a. The EUT was placed on the top of a rotating table 1.5 meters above the ground at a 3 meter anechoic chamber test site. The table was rotated 360 degrees to determine the position of the highest radiation.
b. The resolution bandwidth and video bandwidth of test receiver/spectrum analyzer is 1 ㎒ for Peak detection and frequency above 1 ㎓.

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3.4. Test Result

Ambient temperature : (23 ± 1) ℃
Relative humidity : 47 % R.H.

The following table shows the highest levels of radiated emissions on both polarizations of horizontal and vertical. The frequency spectrum from 9 ㎑ to 4 340.00 ㎒ was investigated

Radiated Emissions			Ant.	Correction Factors		Total	FCC Limit	
Frequency (㎒)	Reading (dBμV)	Detect Mode	Pol.	A.F. (dB/m)	Amp. Gain + CL (dB)	Actual (dBμV/m)	Limit (dBμV/m)	Margin (dB)
867.84	40.00	Qusi-Peak	H	22.65	-22.47	40.18	60.83	20.65
*1 301.78	59.09	Peak	V	25.16	-37.77	46.48	74.00	27.52
Above 1 400.00	Not detected	-	-	-	-	-	-	-

Remark:

1. To get a maximum emission level from the EUT, the EUT was moved throughout the X-axis, Y-axis and Z-axis. Worst Case is Z-axis.
   Definition of DUT for three orthogonal planes is described in the test setup photo.
2. 3 m Peak Limit (dBμV/m) = 20log[41.666 7(F(㎒)) – 7 083.333 3] = 80.83
   3 m Average Limit (dBμV/m) = Peak Limit - 20 = 60.83
3. Correction Factors = Antenna Factor + Cable Loss + Amp. Gain
4. "*" means the restricted band.
5. Average test would not be applied if the peak results were lower than the average limit.
6. Average Reading = Peak Reading + Duty Cycle Correction Factor
7. Duty Cycle Correction Factor : 20log(T_{on} / 100 ㎳) = 20log(13.043 / 100) = -17.69
   - $Tx_{on\ time}$ = 13.043 ㎳
   - Tx_{on+off} ≥ 100 ㎳ (pulse train is 100 ㎳)

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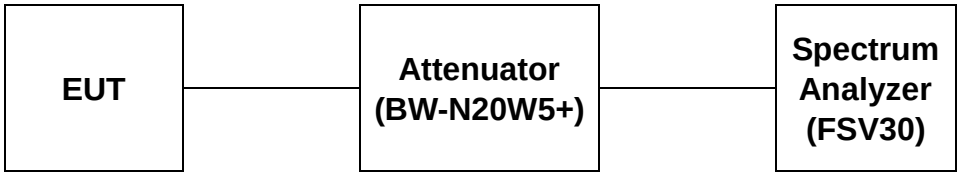
4. Bandwidth of Operation Frequency

4.1. Test Setup



4.2. Limit

The bandwidth of the emission shall be no wider than 0.25 % of the center frequency for devices operating above 70 ㎒ and below 900 ㎒. Bandwidth is determined at the points 20 ㏈ down from the modulated carrier.

4.3. Test Procedure

1. The transmitter output is connected to the spectrum analyzer.
2. The bandwidth of the fundamental frequency was measured with the spectrum analyzer using RBW = 10 ㎑, VBW = 10 ㎑ and Span = 1 ㎒.
3. The bandwidth of fundamental frequency was measured and recorded.

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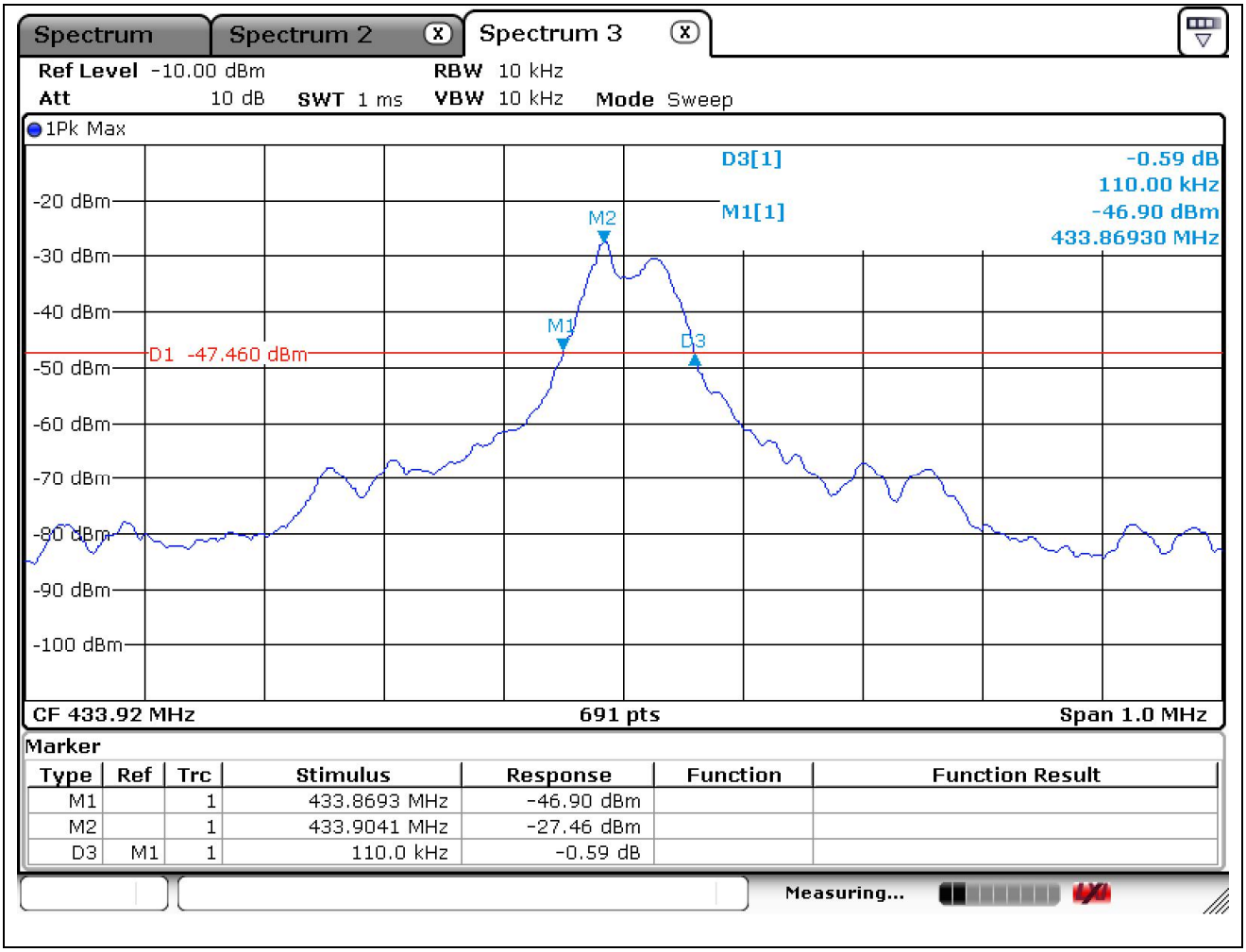
4.4. Test Result

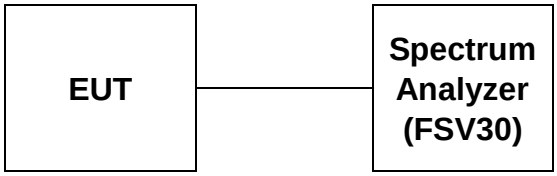
Ambient temperature : (23 ± 1) ℃
Relative humidity : 47 % R.H.

Carrier Frequency (MHz)	Bandwidth of the emission (kHz)	Limit (kHz)	Remark
433.92	110.00	1 084.80	The point 20 dB down from the modulated carrier



5. Transmission Time

5.1. Test Setup



5.2. Limit

A manually operated transmitter shall employ a switch that will automatically deactivate the transmitter within not more than 5 seconds of being released.

5.3. Test Procedure

1. The transmitter output is connected to the spectrum analyzer.
2. The bandwidth of the fundamental frequency was measured with the spectrum analyzer using RBW = 100 ㎑, VBW = 100 ㎑, Span= 0 ㎐, Sweep Time = 6 sec.
3. The bandwidth of fundamental frequency was measured and recorded.

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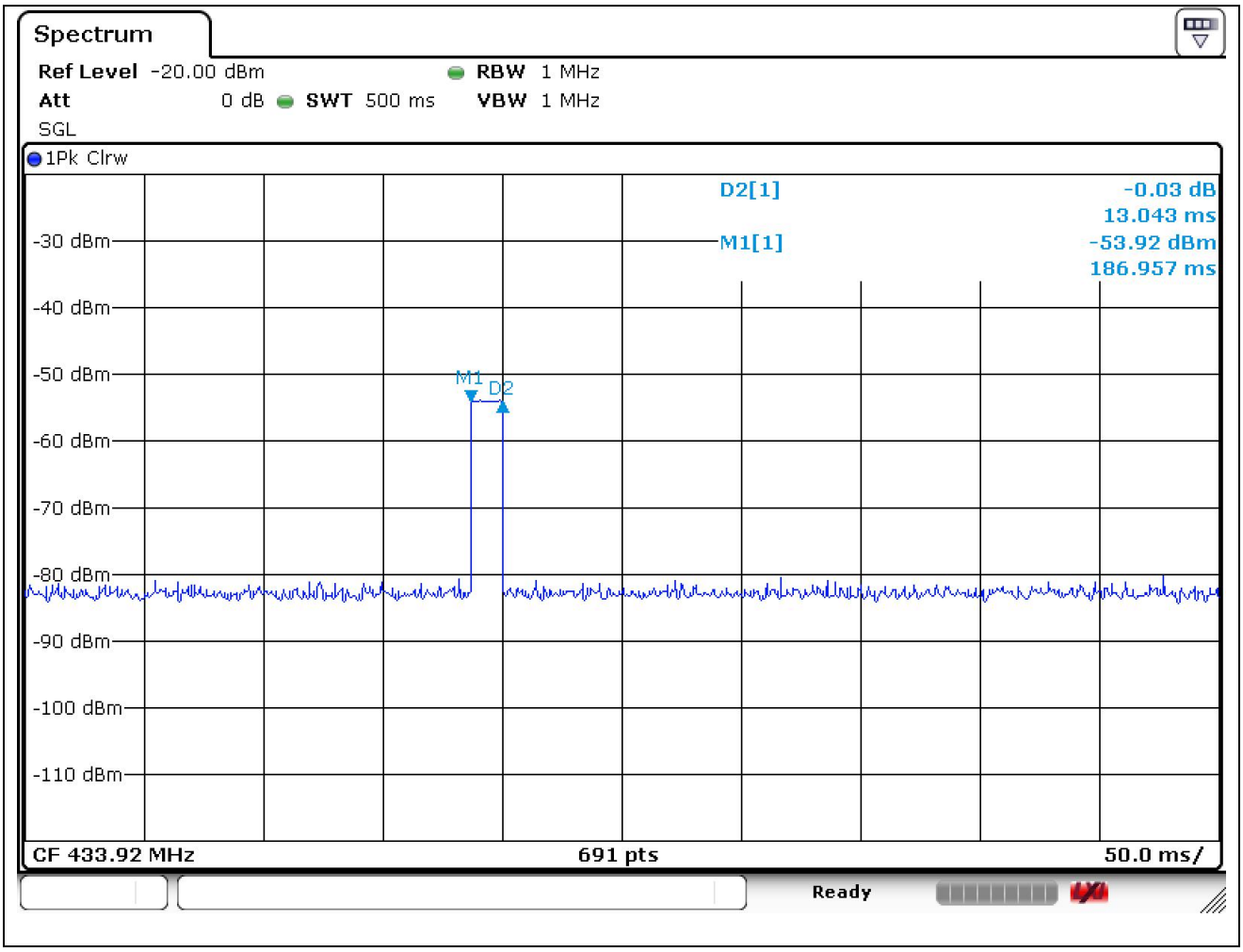
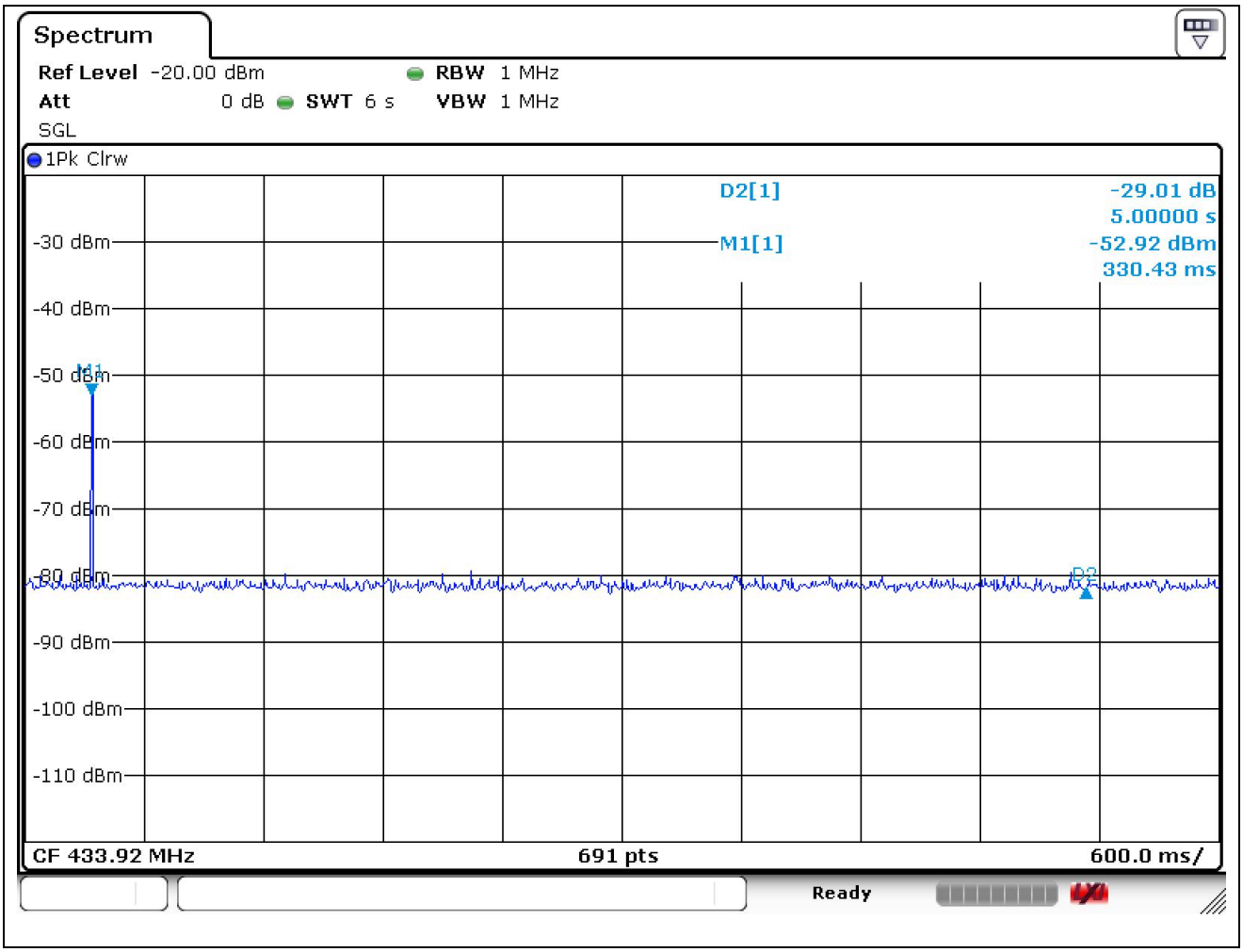
5.4. Test Result

Ambient temperature : (23 ± 1) ℃
Relative humidity : 47 % R.H.

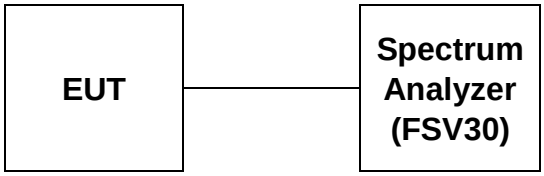
Carrier Frequency (㎒)	Transmission Time (㎳)	Limit (sec)	Remark
433.920	13.043	Same or less than 5 s	Pass




Spectrum
Ref Level -20.00 dBm
RBW 1 MHz
Att 0 dB
SWT 6 s
VBW 1 MHz
SGL
1Pk Clrw
D2[1]
-29.01 dB
5.00000 s
M1[1]
-52.92 dBm
330.43 ms
-30 dBm
-40 dBm
-50 dBm
-60 dBm
-70 dBm
-80 dBm
-90 dBm
-100 dBm
-110 dBm
CF 433.92 MHz
691 pts
600.0 ms/
Ready

6. Duty Cycle Correction Factor

6.1. Test Setup



6.2. Limit

Nil (No dedicated Limit specified in the Rules)

6.3. Test Procedure

1. Place the EUT on the table and set it is set in a transmitting mode.
2. Remove the antenna from the EUT and then connect a low loss RF cable from the antenna ort to the spectrum analyzer.
3. Set center frequency of spectrum analyzer = operating frequency.
4. Set the spectrum analyzer as RBW = 1 ㎒, VBW = 1 ㎒, Span = 0 ㎐

6.4. Test Result

Ambient temperature	:	(23 ± 1) ℃
Relative humidity	:	47 % R.H.

CALCULATION :

Average Reading = Peak Reading (㏈㎶/m) + 20log(Duty Cycle)

In order to determine possible Maximum Modulation percentage, alternations are made to the EUT.
We measured :

T_{on+off}	T_{on}	M % = (T_{on} / T_{on+off}) * 100 %	Duty Correction Factor
100 ㎳	13.043 ㎳	13.043	-17.69

T_{on+off} = 100 ㎳
T_{on} = 13.043 ㎳
Duty Cycle = 20log(T_{on} / T_{on+off}) = 20log(13.043 / 100) = -17.36

Remark:
1. T_{on+off} >100 ㎳. Use 100 ㎳ for calculation

6.4. Test Plot

Please refer to Transmission Time section.

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