TEST REPORT

OF

FCC Part 15 Subpart C §15.209, §15.231

FCC ID : UVNTP2-REPEATER

Equipment Under Test	:	TPMS Repeater
Model Name	:	TP2-Repeater
Serial No.	:	N/A
Applicant	:	SEETRON.Inc
Manufacturer	:	SEETRON.Inc
Date of Test(s)	:	2009.03.25 ~ 2009.04.06
Date of Issue	:	2009.04.09

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

Tested By: **Date** **2009.04.09**

Duke Ko

Approved By **Date** **2009.04.09**

Denny Ham

INDEX

TABLE OF CONTENTS

Page

1. General Information ---------- 3

2. Field Strength of Fundamental ---------- 6

3. Spurious Emission---------- 11

4. Bandwidth of Operation Frequency---------- 13

5. Limits of Transmission Time---------- 15

1. General Information

1.1. Testing Laboratory

SGS Testing Korea Co., Ltd.
Wireless Div. 2FL, 18-34, Sanbon-dong, Gunpo-si, Gyeonggi-do, Korea 435-040
www.electrolab.kr.sgs.ccom
Telephone : +82 +31 428 5700
FAX : +82 +31 427 2371

1.2. Details of Applicant

Applicant : SEETRON.Inc
Address : 201-403, BUCHEON Techno-Park, 192, Yakdae-Dong, Wonmi-Gu, Bucheon-City, Korea
Contact Person : Joo, Jaeyun
Phone No. : +82 +32 327 3123
Fax No. : +82 +32 327 3125

1.3. Description of EUT

Kind of Product	TPMS Repeater
Model Name	TP2-Repeater
Serial Number	N/A
Power Supply	DC 24 V
Frequency Range	433.92 MHz
Modulation Technique	FSK
Number of Channels	1
Antenna Type	Integral Type

1.4. Details of Modification

-N/A

1.5. Test Equipment List

EQUIPMENT	MANUFACTURER	MODEL	CAL DUE.
Signal Generator	Agilent	E4438C	Apr. 01, 2010
Spectrum Analyzer	Rohde & Schwarz	FSP40	Oct. 01, 2009
Preamplifier	Agilent	8449B	Apr. 01, 2010
Attenuator	Agilent	8494B	Apr. 01, 2010
Test Receiver	Rohde & Schwarz	ESVS10	Jun. 30, 2009
Ultra-Broadband Antenna	Rohde & Schwarz	HL562	Oct. 02, 2009
Horn Antenna	Rohde & Schwarz	HF906	Nov. 13, 2009
Anechoic Chamber	SY Corporation	L x W x H (9.6 m x 6.4 m x 6.6 m)	Jan. 31, 2010

1.6. Summary of Test Results

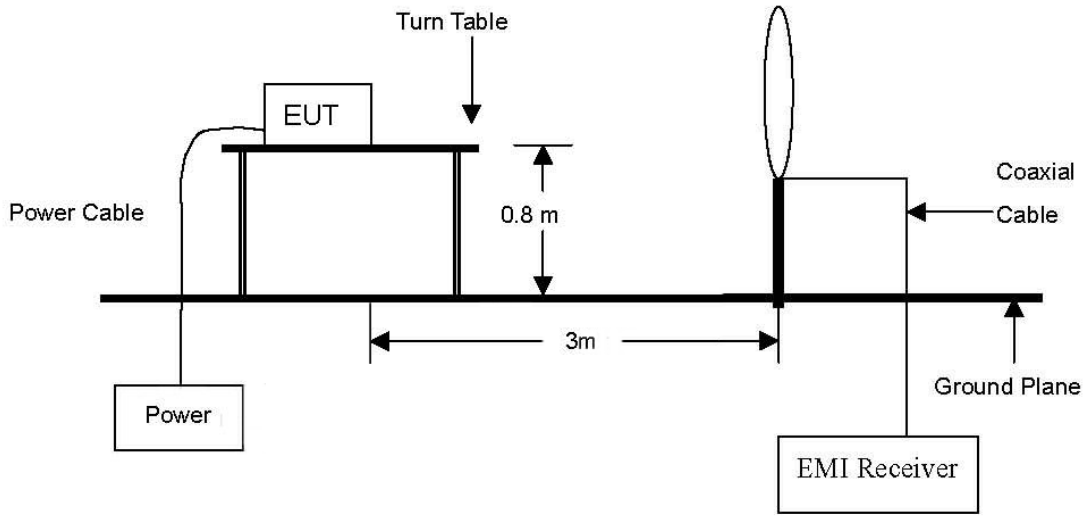
The EUT has been tested according to the following specifications:

APPLIED STANDARD:FCC Part15, Subpart C		
Standard Section	**Test Item**	**Result**
15.231(e) 15.209(a)	Radiated emission, Spurious Emission and Field Strength of Fundamental	Complied
15.231(c)	Bandwidth of Operation frequency	Complied
15.231(a)	Transmission Time	Complied
15.231(e)	Limit of Transmission Time	Complied

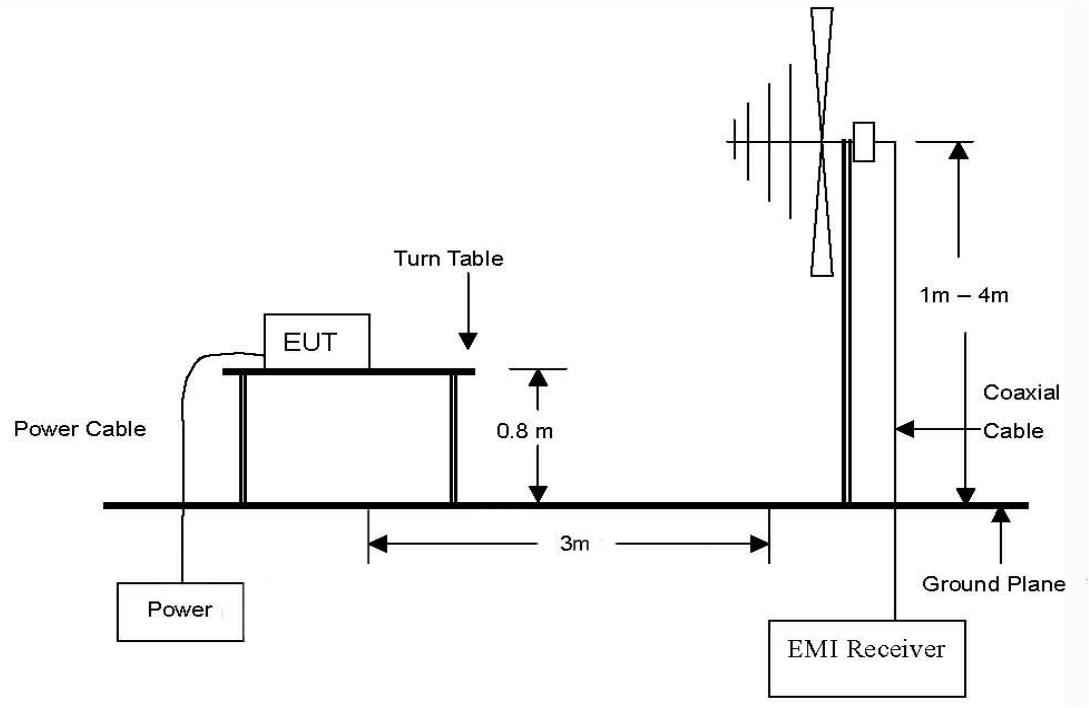
2. Field Strength of Fundamental

2.1. Test Setup

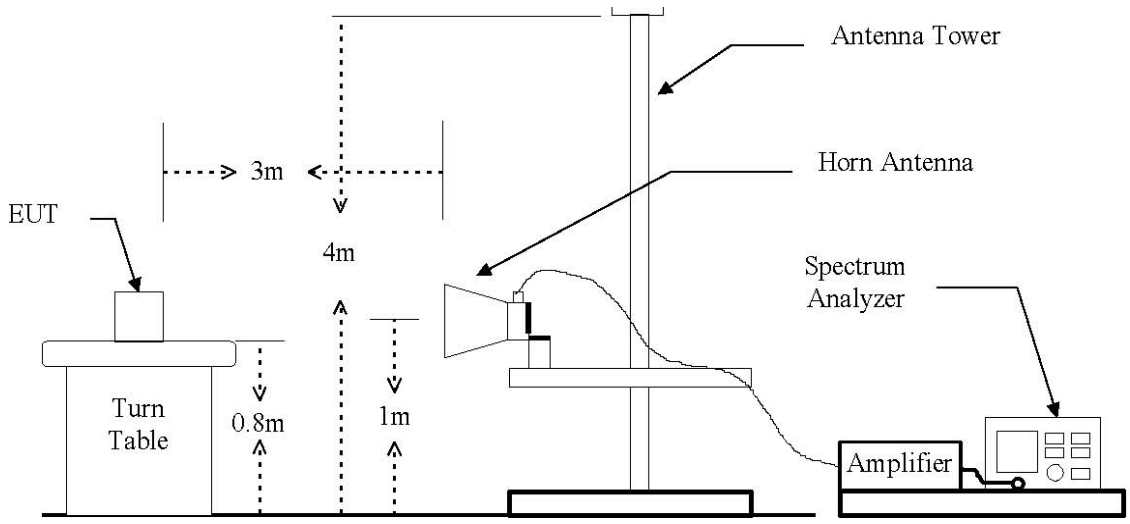
The diagram below shows the test setup that is utilized to make the measurements for emission from 9 kHz to 30 MHz Emissions.



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



The diagram below shows the test setup that is utilized to make the measurements for emission from 1 GHz to 18 GHz Emissions.



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 (MHz)	Field Strength (microvolts/meter)	Measurement Distance (meter)
0.009 – 0.490	2400/F(kHz)	300
0.490 – 1.705	2400/F(kHz)	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 MHz, 76-88 MHz, 174-216 MHz or 470-806 MHz. 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 MHz and above 70 MHz

According to 15.231(e), intentional radiators may operate at a periodic rate exceeding that specified in paragraph (a) and may be employed for any type of operation, including operation prohibited in paragraph (a), provided the intentional radiator complies with the provisions of paragraph (b) through (d) of this Section, except the field strength table in paragraph (b) is replaced by the following:

Fundamental Frequency (MHz)	Field Strength of Fundamental (microvolts/meter)	Field Strength of Spurious Emissions (microvolts/meter)
40.66 – 47.70	1,000	100
70 - 130	500	50
130 – 174	500 to 1,500 **	50 to 150 **
174 – 260	1,500	150
260 – 470	1,500 to 5,000 **	150 to 500 **
Above 470	5,000	500

** linear interpolations

Where F is the frequency in MHz, the formulas for calculating the maximum permitted fundamental field strengths are as follows : for the band 130-174 MHz,, uV/m at 3 meters = 22.72727(F)-2454.545; for the band 260-470 MHz, uV/m at 3 meters = 16.6667(F)-2833.333. The maximum permitted unwanted emission level is 20 dB below the maximum permitted fundamental level.

2.3. Test Procedures

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

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

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.

2.3.2. Test Procedures for emission from 30 MHz to 1000 MHz

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 GHz, 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 GHz, 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 dB 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 dB margin would be re-tested one by one using peak, quasi-peak or average method as specified and then reported in a data sheet.

2.4. Test Result

Ambient temperature : 24 ℃
Relative humidity : 47 % R.H.

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

Freq. (MHz)	Ant. Pol	Reading (Peak) (dBuV)	Correction Factor (dB/m)	Result (Peak) (dBuV/m)	Duty Cycle Correction Factor (dBuV)	Result (Average/ Quasi-peak) (dBuV/m)	Limit (Average/ Quasi-peak) (dBuV/m)	Margin (dB)	Detect Mode
433.92	H	70.60	17.06	87.66	-20.00	67.66	72.87	5.21	Average

Remark:
To get a maximum emission level from the EUT, the EUT was moved throughout the XY, XZ and YZ planes. The worst case is XY.

Note:
1. A Peak limit is 20 dB above the average limit.
2. 3m Limit(dBuV/m) = 20log[16.6667($F_{(MHz)}$)-2833.3333] = 72.87
3. Average Reading = Peak Reading + Duty Cycle Correction Factor
   - Duty Cycle Correction Factor : 20log(T_{on} / T_{on+off}) = 20log(0.23/126.00) = -54.77 (< -20.00)
   - Please refer to captured images on page 16.
4. Correction Factor = Antenna Factor + Cable Loss

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 kHz to 30 MHz

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.

3.3.2. Test Procedures for emission from 30 MHz to 1000 MHz

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 GHz, 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 GHz, 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 dB 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 dB margin would be re-tested one by one using peak, quasi-peak or average method as specified and then reported in a data sheet.

3.4. Test Result

Ambient temperature : 24 ℃
Relative humidity : 47 % R.H.

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

Freq. (MHz)	Ant. Pol	Reading (Peak) (dBuV)	Correction Factor (dB/m)	Result (Peak) (dBuV/m)	Duty Cycle Correction Factor (dBuV)	Result (Average/ Quasi-peak) (dBuV/m)	Limit (Average/ Quasi-peak) (dBuV/m)	Margin (dB)	Detect Mode
867.82	H	20.60	23.90	44.50	-20.00	24.50	52.87	28.37	Average

- Correction Factor = Antenna Factor + Cable Loss

Freq. (MHz)	Ant. Pol	Reading (Peak) (dBuV)	Correction Factor (dB/m)	Result (Peak) (dBuV/m)	Duty Cycle Correction Factor (dBuV)	Result (Average/ Quasi-peak) (dBuV/m)	Limit (peak) (dBuV/m)	Margin (dB)	Detect Mode
1301.65	V	56.28	-8.35	47.93	-	-	74.00	26.07	Peak
1735.72	V	48.99	-5.92	43.07	-	-	74.00	30.93	Peak
Above 1800.00	Not detected								

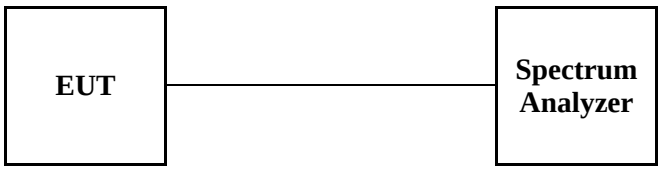
- Correction Factor = Antenna Factor + Cable Loss – AMP gain

Remark:
To get a maximum emission level from the EUT, the EUT was moved throughout the XY, XZ and YZ planes. The worst case is XY.

Note:
1. A Peak limit is 20 dB above the average limit.
2. Other Spurious Frequencies were not detected up to 5000 MHz.

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 MHz and below 900 MHz. Bandwidth is determined at the points 20 dB down from the modulated carrier.

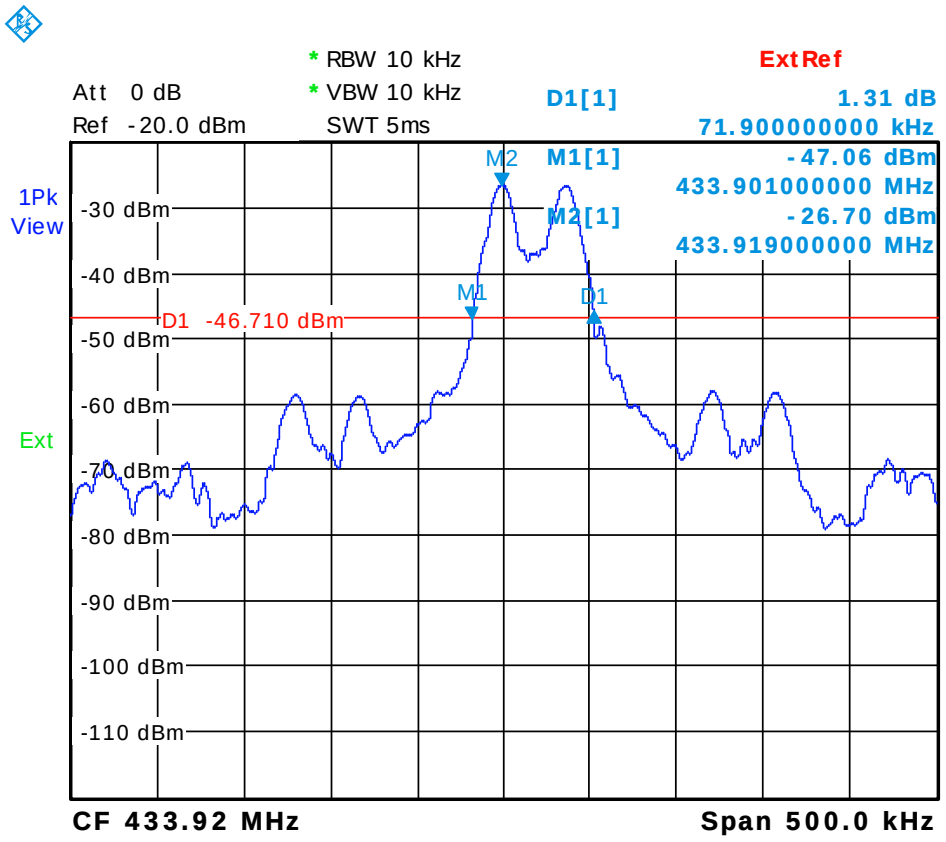
4.3. Test Procedure

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 kHz, VBW=10 kHz and Span=1 MHz.
3. The bandwidth of fundamental frequency was measured and recorded.

4.4. Test Result

Ambient temperature : 24 ℃
Relative humidity : 47 % R.H.

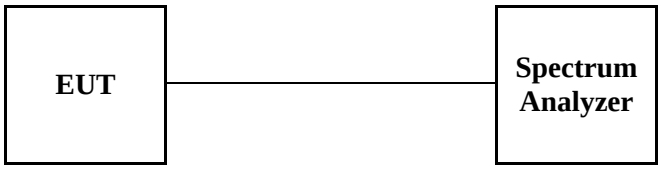
Carrier Frequency (MHz)	Bandwidth of the emission (kHz)	Limit (kHz)	Remark
433.92	71.90	1084.80	The point 20 dB down from the modulated carrier



Date: 3.APR.2009 05:48:58

5. Limit of Transmission Time

5.1. Test Setup



5.2. Limit

Devices Operated under the provisions of this paragraph shall be provided with a means for automatically limiting operation so that the duration of shall not be greater than one second and the silent period between transmissions shall be at least 30 times the duration of the transmission but in no case less than 10 seconds.

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=1 MHz, VBW=1 MHz, Span=0 Hz.
3. The bandwidth of fundamental frequency was measured and recorded.

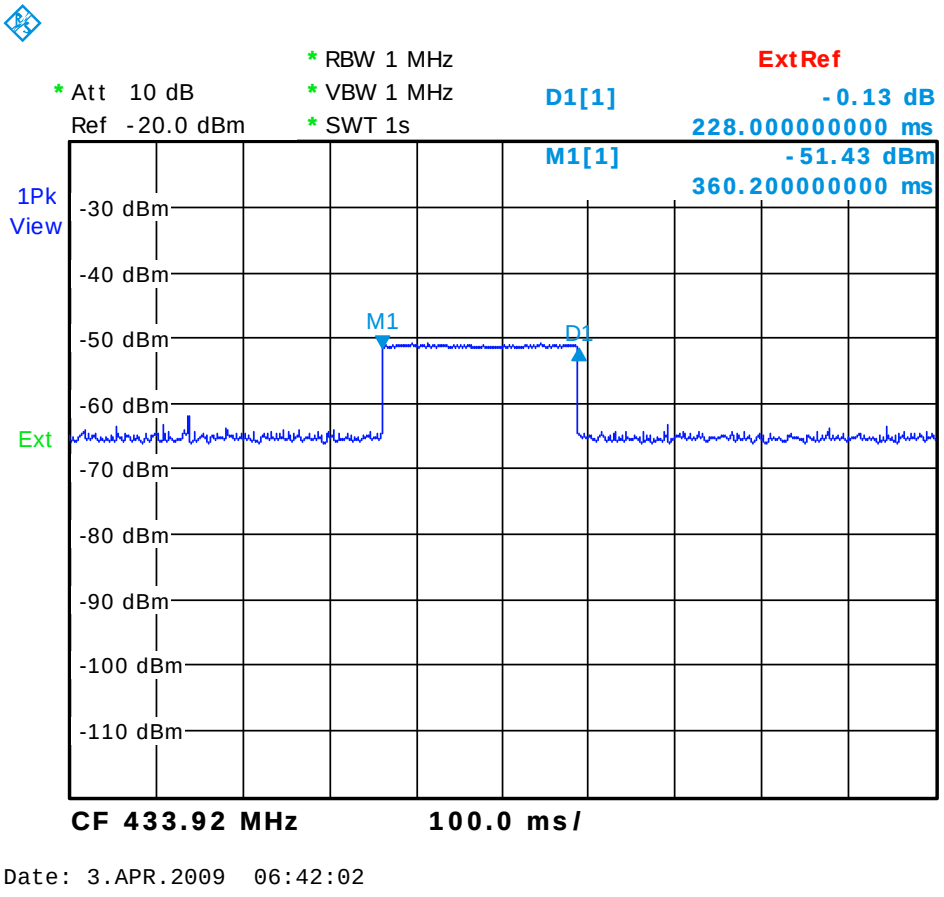
5.4. Test Result

Ambient temperature : 24 ℃
Relative humidity : 47 % R.H.

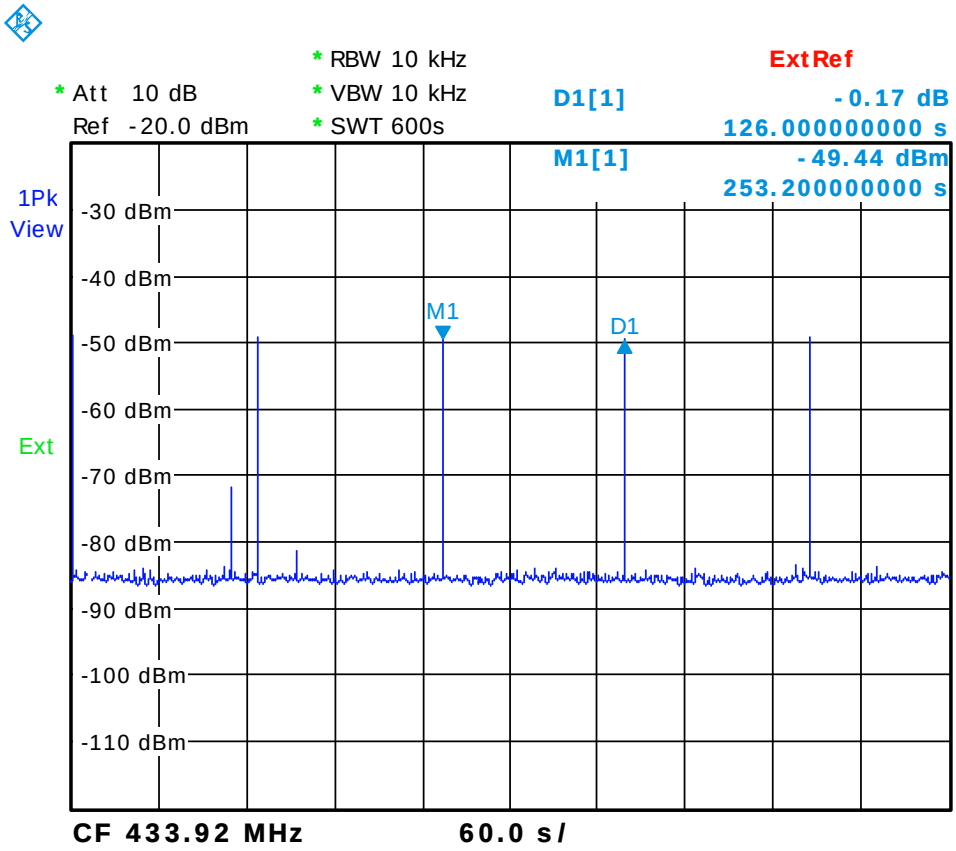
Frequency (MHz)	Transmission Time (s)		Silent Duration (s)		Silent Period Versus Transmission Time Ratio		Result
	Measured	Limit	Measured	Limit	Measured	Limit	
433.92	0.23	Same or less than 1 s	126.00	Same or greater than 10 s	552.63	At least 30 times	Pass

Note:
1. Silent Period Versus Transmission Time Ratio
   - Silent Period : 126.00 s
   - Transmission Time : 0.23 s
   - Ratio : Silent Period / Transmission Time
     = 126.00 (s) / 0.23 (s) = 552.63

Transmission Time



Silent Duration



Date: 3.APR.2009 06:35:06