

FCC/IC TEST REPORT

Test report No.: EMC- FCC- R0217
FCC ID: SY5JFRGE04
IC: 8325A-JFRGE04
Type of equipment: Remote Keyless Entry System (Transmitter)
Basic Model Name: SVI-JFRGE04
Applicant: Continental Automotive Systems Corporation
Max.RF Output Power: 85.0 dB μ V/m
FCC Rule Part(s): FCC Part 15 Subpart C
Section 15.209, Section 15.231
IC Rule: RSS-210 Issue 8, December 2010
RSS-GEN Issue 4, November 2014
Frequency Range: 433.92 MHz (Tx)
Test result: Complied

The above equipment was tested by EMC compliance Testing Laboratory for compliance with the requirements of FCC Rules and Regulations.

The results of testing in this report apply to the product/system which was tested only. Other similar equipment will not necessarily produce the same results due to production tolerance and measurement uncertainties.

Date of receipt: 2015. 01. 20

Date of test: 2015. 01. 30 ~ 02. 05

Issued date: 2015. 02. 10

Tested by:



NAM, TACK YONG

Approved by:



YU, SANG HOON

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1. Client information

Applicant: Continental Automotive Systems Corporation
Address: 45-29, Saeum-ro, Icheon-si, Gyeonggi-Do, 467-080, Korea
Telephone number: 82-31-645-4864
Facsimile number: 82-31-637-0371
Contact person: Jang, SungMin / Sungmin.Jang@continental-corporation.com

Manufacturer: Continental Automotive Systems Corporation
Address: 45-29, Saeum-ro, Icheon-si, Gyeonggi-Do, 467-080, Korea

2. Laboratory information

Address

EMC compliance Ltd.

480-5, Sin-dong, Yeongtong-gu, Suwon-si, Gyeonggi-do, Korea

Telephone Number: 82-31-336-9919 Facsimile Number: 82-505-299-8311

Certificate

KOLAS No.: 231

FCC Site Designation No.: KR0040

FCC Site Registration No.: 687132

VCCI Site Registration No.: R-3327, G-198, C-3706, T-1849

IC Site Registration No.:8035A-2

SITE MAP



EMC compliance Ltd.

480-5, Sin-dong, Yeongtong-gu, Suwon-si, Gyeonggi-do, Korea

82-31-336-9919 (Main) 82-505-299-8311 (Fax)

3. Description of E.U.T.

3.1 Basic description

Applicant	Continental Automotive Systems Corporation
Address of Applicant	45-29, Saeum-ro, Icheon-si, Gyeonggi-Do, 467-080, Korea
Manufacturer	Continental Automotive Systems Corporation
Address of Manufacturer	45-29, Saeum-ro, Icheon-si, Gyeonggi-Do, 467-080, Korea
Type of equipment	Remote Keyless Entry System (Transmitter)
Basic Model	SVI-JFRGE04
Serial number	N/A

3.2 General description

Frequency Range	433.92 MHz (Tx)
Type of Modulation	FSK
Number of Channels	1 channel
Antenna Gain	-12.43 dBm
Type of Antenna	PCB Antenna
Power supply	DC 3 V*
Product SW/HW version	1.0
Radio SW/HW version	1.0
Test SW Version	N/A ¹⁾
RF power setting in TEST SW	N/A ²⁾

*Declared by the client

*Note. N/A¹⁾ No test SW was used during testing.

N/A²⁾ RF power setting was not able to alter during testing.

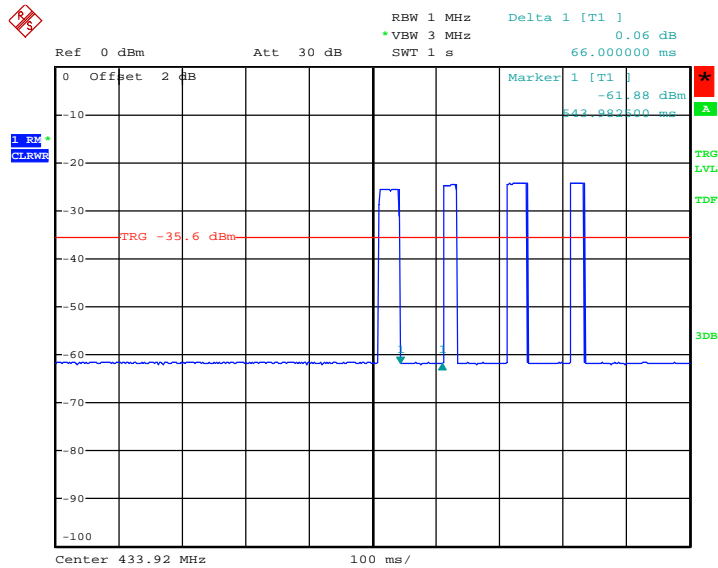
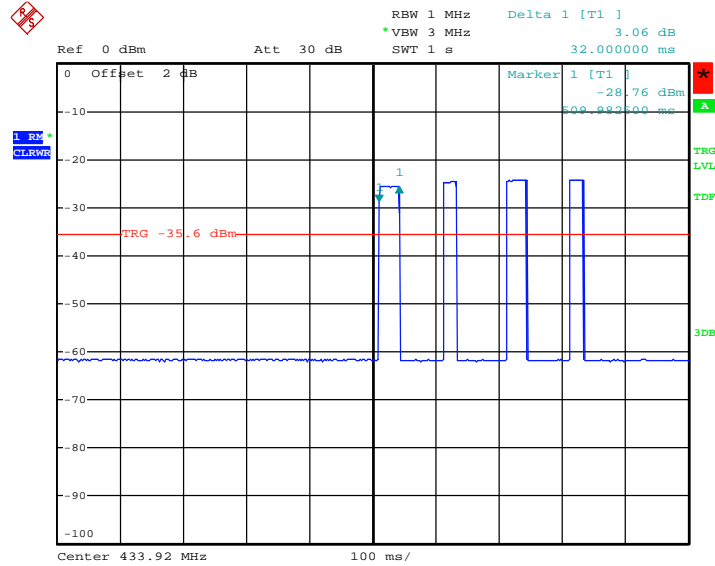
3.3 Test frequency

Frequency	433.92 MHz
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3.4 Test Voltage

mode	Voltage
Norminal voltage	DC 3 V

*** Duty Cycle**



Tx ontime : 32.00 ms

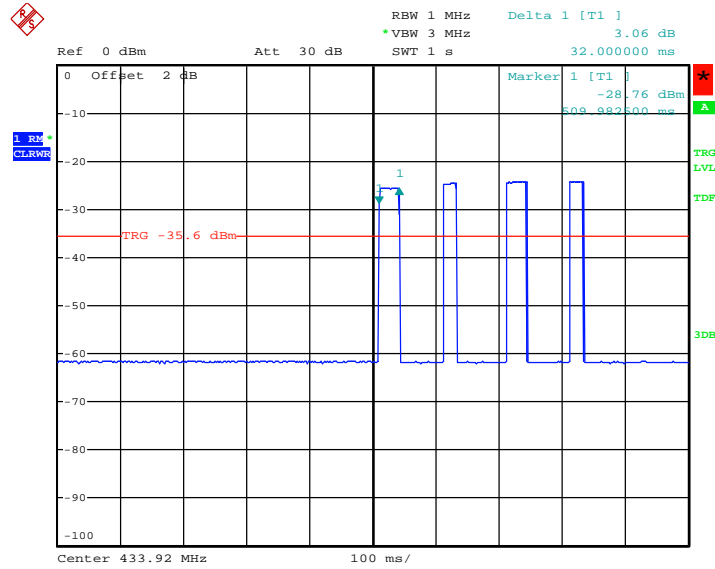
Tx on+off time: 98.00 ms

Duty cycle(x) =(Tx ontime)/(Tx on+off time) = 0.33

Duty cycle factor = 20log(Dwell time/100ms) = -9.7 dB

***PDCF**

1/PW < RBW = 31.25 Hz < 120 kHz
 *RBW (1 GHz below = 120 kHz, 1 GHz above = 1 MHz)
 1/PW = 1/0.032 s = 31.25 Hz
 PW=32.00 ms



4. Summary of test results

4.1 Standards & results

FCC Rule	IC Rule	Parameter	Test Result
15.203	-	Antenna Requirement	C
15.209(a) 15.231(b)	RSS-210, Issue 8, Table B	Radiated emission, Spurious Emission and Field Strength of Fundamental	C
15.231(c)	RSS-210, Issue 8, A1.1.3 RSS-GEN Issue 4, 6.6	Bandwidth Measurement	C
15.231(a)	RSS-210, Issue 8, A1.1.1	Transmission Time	C
Note: C = complies NC = Not complies NT = Not tested NA = Not Applicable			

4.2 Uncertainty

Measurement Item	Expanded Uncertainty $U = KUc (K = 2)$	
Conducted RF power	± 1.36 dB	
Conducted Spurious Emissions	± 1.52 dB	
Radiated Spurious Emissions	30 MHz ~ 300 MHz	+ 4.94 dB, - 5.06 dB
		+ 4.93 dB, - 5.05 dB
	300 MHz ~ 1 000 MHz	+ 4.97 dB, - 5.08 dB
		+ 4.84 dB, - 4.96 dB
Conducted Emissions	1 GHz ~ 25 GHz	+ 6.03 dB, - 6.05 dB
	9 kHz ~ 150 kHz	± 3.75 dB
	150 kHz ~ 30 MHz	± 3.36 dB

5. Test results

5.1 Antenna Requirement

5.1.1 Regulation

According to §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. The manufacturer may design the unit so that a broken antenna can be replaced by the user, but the use of a standard antenna jack or electrical connector is prohibited.

5.1.2 Result

-Complied

The PCB antenna is an integral antenna, and no antenna other than that furnished by the responsible party shall be used with the device.

5.2 Field strength of Fundamental

5.2.1 Regulation

According to §15.209(a),

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: 83

Frequency (MHz)	Field Strength (microvolts/meter)	Measurement Distance (meters)
0.009 - 0.490	2 400/F(kHz)	300
0.490 - 1.705	24 000/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..

According to §15.231(b)

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

5.2.2 Test procedure

- 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.
- g. It tested x,y and z – 3 axis each, mentioned only worst case data at this report.
- h. normally, output is measured with average result. but in this case, average result is calculated by measuring peak result and applying DCCF.

5.2.3 Test Result

- Complied

Frequency [MHz]	Receiver Bandwidth [kHz]	Detector	Pol. [V/H]	Reading [dB (μV)]	Factor [dB]	DCCF [dB]	Result [dB (μV/m)]	Limit [dB (μV/ m)]	Margin [dB]
433.97	120	Peak	H	89.20	-4.20	0	85.00	100.83	15.83
433.97	120	Average	H	89.20	-4.20	-9.70	75.30	80.83	5.53

NOTE:

1. Avg Limit = $20\log(10998.54) = 80.83$ / PK Limit = $80.83 + 20 = 100.83$ dB
2. Factor(dB) = ANT Factor - Amp Gain + Cable Loss
3. DCCF(Duty Cycle Correction Factor)
DCCF = $20 \log(\text{Dwell time} / 100\text{ms})$ dB = $20 \log(32/98) = -9.70$ dB

5.3 Spurious Emission

5.3.1 Regulation

According to §15.209(a),

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: 83

Frequency (MHz)	Field Strength (microvolts/meter)	Measurement Distance (meters)
0.009 - 0.490	2 400/F(kHz)	300
0.490 - 1.705	24 000/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..

According to §15.231(b)

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 (MHz)	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

5.3.2 Measurement Procedure

- 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.
- g. It tested x,y and z – 3 axis each, mentioned only worst case data at this report.

Note

1. The resolution bandwidth and video bandwidth of test receiver/spectrum analyzer is 120 kHz for Peak detection (PK) and Quasi-peak detection (QP) at frequency below 1 GHz.
2. The resolution bandwidth and video bandwidth of test receiver/spectrum analyzer is 1 MHz for Peak detection and frequency above 1 GHz.
3. The resolution bandwidth of test receiver/spectrum analyzer is 1 MHz and the video bandwidth is 1/T for Average detection (AV) at frequency above 1 GHz. (where T = pulse width)
4. The radiated restricted band edge and Spurious radiated emissions average measurements use a duty cycle correction factor (DCCF).

5.3.3 Test Result

- Complied

*** Below 1 GHz data**

Frequency [MHz]	Receiver Bandwidth [kHz]	Pol. [V/H]	Reading [dB(μV)]	Factor [dB]	Result [dB(μV/m)]	Limit [dB(μV/m)]	Margin [dB]
Quasi-Peak DATA. Emissions below 30 MHz							
Below 30.00	Not Detected	-	-	-	-	-	-
Quasi-Peak DATA. Emissions below 1 GHz							
867.81	120	H	26.80	3.10	29.90	46.00	16.10
Above 900.00	Not Detected	-	-	-	-	-	-

*** Above 1 GHz data**

Frequency [MHz]	Receiver Bandwidth [kHz]	Pol. [V/H]	Reading [dB(μV)]	Factor [dB]	DCCF [dB]	Result [dB(μV/m)]	Limit [dB(μV/m)]	Margin [dB]
Peak DATA. Emissions above 1 GHz								
1 301.50	1 000	H	51.10	-7.80	0	43.30	74.00	30.70
Above 2 000.00	Not Detected	-	-	-	-	-	-	-
Average DATA. Emissions above 1 GHz								
1 301.50	1 000	H	51.10	-7.80	-9.70	33.60	54.00	20.40
Above 2 000.00	Not Detected	-	-	-	-	-	-	-

Note.

1. Avg Limit = $20\log(1099.85) = 60.83$ / PK Limit = $60.83 + 20 = 80.83$ dB
2. Margin (dB) = Limit - Result
3. Average Result = Reading + Factor + DCCF
4. Factor(dB) = ANT Factor - Amp Gain + Cable Loss
5. DCCF(Duty Cycle Correction Factor)
DCCF = $20 \text{ Log}(\text{Dwell Time} / 100 \text{ ms}) \text{ dB} = 20 \text{ Log}(32 \text{ ms} / 98 \text{ ms}) = -9.70$ dB

5.4 Bandwidth Measurement

5.4.1 Regulation

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 point 20 dB down from the modulated carrier.

5.4.2 Measurement 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= 500 kHz.
3. The bandwidth of fundamental frequency was measured and recorded.

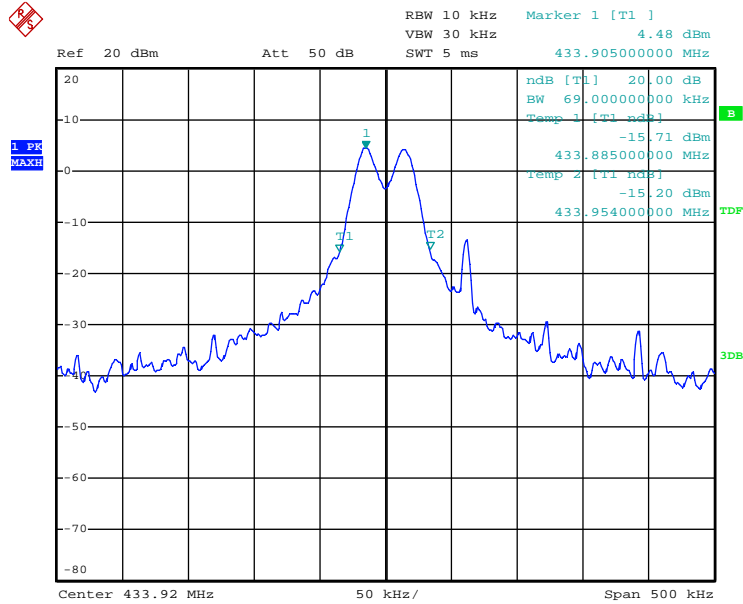
5.4.3 Test Result

- Complied

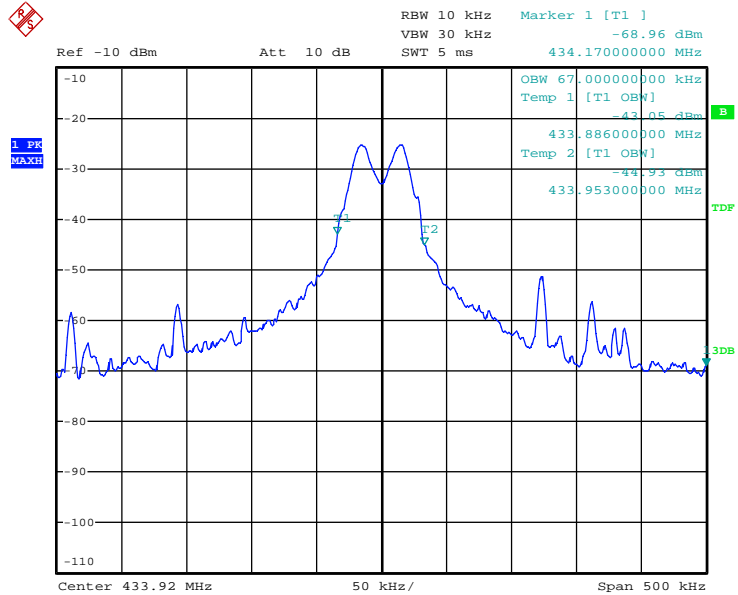
Frequency [MHz]	Bandwidth of the emission [kHz]	Limit [kHz]
433.92	69.00	108.48

Frequency [MHz]	Occupied Bandwidth [kHz]	Limit [kHz]	Remark
433.92	67.00	108.48	99 % Occupied Bandwidth

5.4.4 Test plot
 -20 dB Bandwidth



-OBW



5.5 Transmission Time

5.5.1 Regulation

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

5.5.2 Measurement Procedure

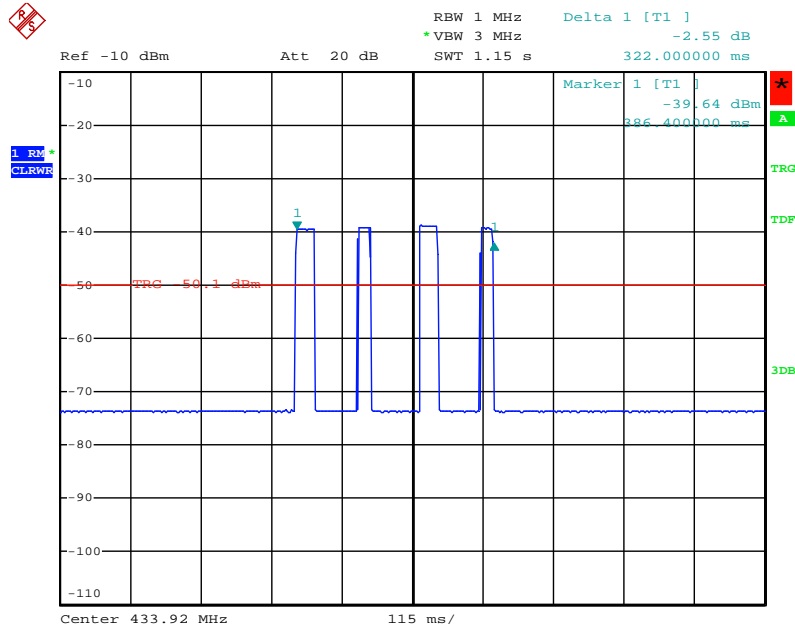
1. The transmitter output is connected to the spectrum analyzer.
2. The bandwidth of the fundamental frequency was measured with the spectrum analyzer using RBW=1 MHz, VBW=1 MHz, Span=0 Hz, Sweep Time=10 sec
3. The bandwidth of fundamental frequency was measured and recorded.

5.5.3 Test Result

- Complied

Frequency [MHz]	Transmission Time [ms]	Limit [s]
433.92	324.00	5.00

5.5.4 Test plot



6. Test equipment used for test

	Description	Manufacturer	Model No.	Serial No.	Next Cal Date.
■	Spectrum Analyzer	R&S	FSP40	100209	15.11.07
■	EMI Test Receiver	Schwarzbeck	ESR7	101078	15.02.24
■	DC Power Supply	Agilent	66312A	SG43000104	15.03.11
■	Signal Generator	R&S	SMR40	100007	15.06.10
■	Amplifier	Sonoma Instrument	310N	293004	15.09.25
■	Loop Antenna	R&S	HFH2-Z2	100355	15.06.19
■	Bi-Log Antenna	Schwarzbeck	VULB9163	552	16.05.14
■	Horn Antenna	ETS-LINDGREN	3117	155787	15.02.26
■	Broadband Preamplifier	Schwarzbeck	BBV9718	216	15.04.22
■	Attenuator	HP	8491A	16861	15.07.01
■	Highpass Filter	Wainwright Instruments GmbH	WHK0.5/13G-10SS	4	15.04.08
■	Turn Table	Innco Systems	DT2000S-1t	79	-
■	Antenna Mast	Innco Systems	MA4000-EP	303	-