

TEST REPORT

KCTL Inc.

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Report No.: KCTL16-SFR0043

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KCTL
<http://www.kctl.co.kr>

1. Applicant

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

2. Sample Description:

FCC ID: SY5IGRGE04
IC ID: 8325A-IGRGE04
Type of equipment: Remote Keyless Entry System (Transmitter)
Basic Model: SVI-IGRGE04



3. Date of Test: June 09 ~ June 14, 2016

4. Test method used: FCC Part 15 Subpart C
Section 15.209, Section 15.231
RSS-210 Issue 8, December 2010
RSS-GEN Issue 4, November 2014

5. Test Results

Test Item: Refer to page 9
Result: Complied (Refer to page 10 ~ page 20)
Measurement Uncertainty: Refer to page 9

This result shown in this report refer only to the sample(s) tested unless otherwise stated.

Affirmation	Tested by	Technical Manager
	 Name: DO WON, AHN	 Name: MIN GI, SON

2016. 06. 17

KCTL Inc.

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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: Sung-Min Jang / 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

KCTL Inc.

65 Sinwon-ro, Yeongtong-gu, Suwon-si, Gyeonggi-do, Korea

Telephone Number: 82-70-5008-1016 Facsimile Number: 82-505-299-8311

Certificate

KOLAS No.: KT231

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



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-IGRGE04
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	-22.42 dBi
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

-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
Nominal Voltage	DC 3 V

- Duty Cycle

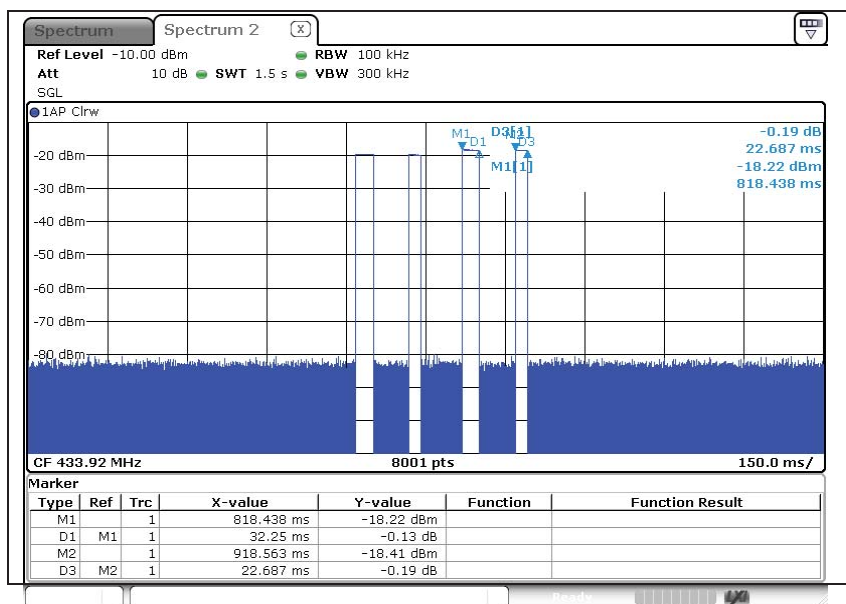
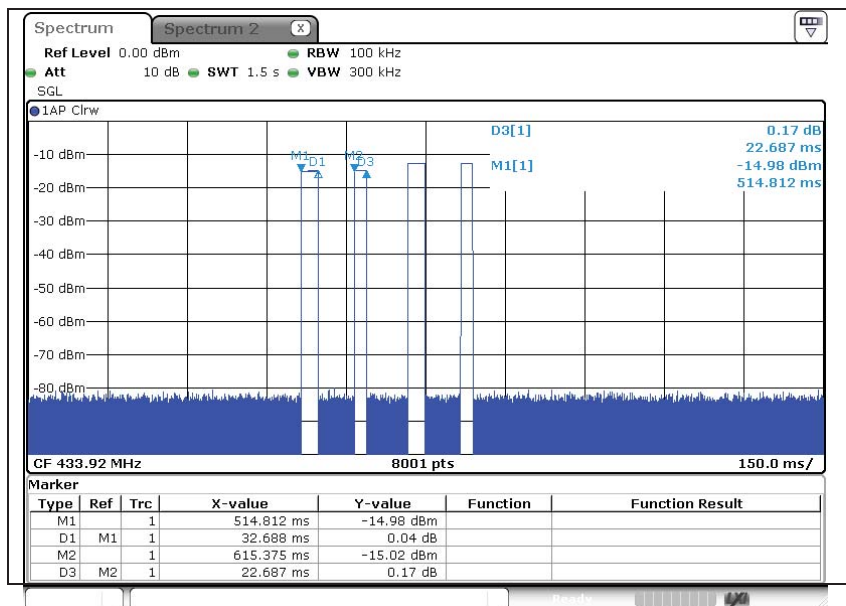
Tx On time : 32.69 ms

Tx On time+Off time : 100 ms

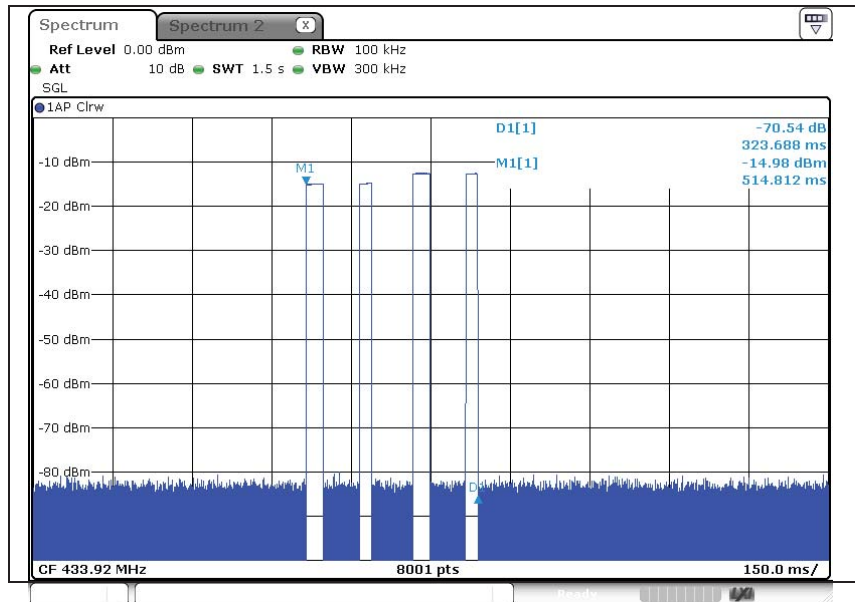
Duty cycle(x) =(Tx ontime)/(Tx on+off time) = 0.33

Duty cycle factor = 20log(Duty Cycle) = -9.71 dB

- Tx On time:



- Tx On time + Off time:



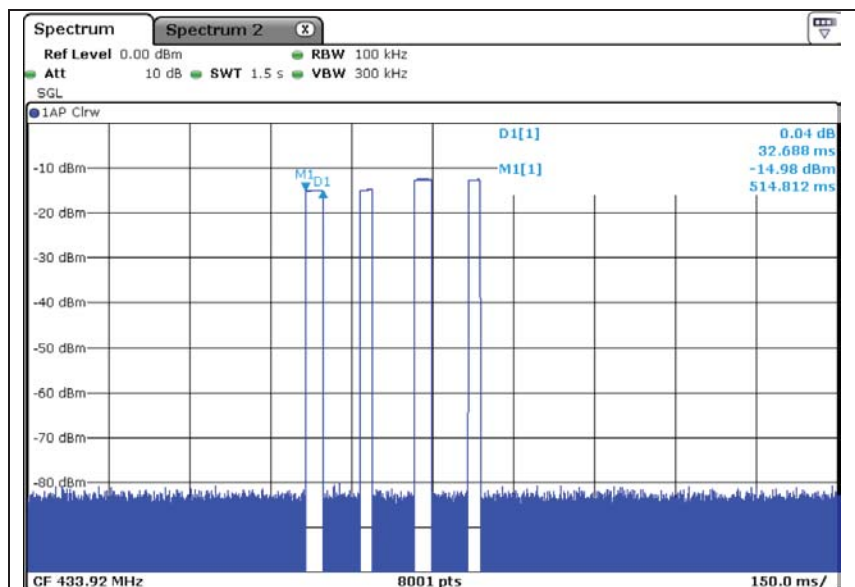
- PDCF

$$2/PW < RBW = 88.16 \text{ Hz} < 120 \text{ kHz}$$

※RBW (1 GHz below = 120 kHz, 1 GHz above = 1 MHz)

$$2/PW = 2/0.022687 \text{ s} = 88.16 \text{ Hz}$$

$$PW = 22.687 \text{ ms}$$



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 $U = kU_c (k = 2)$	
Conducted RF power	1.44 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]	Result [dB(μV/m)]	Limit [dB(μV/m)]	Margin [dB]
433.92	120	Peak	H	66.20	23.60	89.80	100.80	11.00

NOTE:

1. PK Limit = 80.80 + 20 = 100.80 dB
2. Factor(dB) = ANT Factor - Amp Gain + Cable Loss

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)
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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							
109.54	120	V	15.20	16.40	31.60	43.50	11.90
247.40	120	V	13.70	18.70	32.40	46.00	13.60
341.98	120	V	16.30	21.20	37.50	46.00	8.50
578.17	120	V	31.70	-8.30	23.40	46.00	22.60
745.50	120	V	39.80	-6.20	33.60	46.00	12.40
867.96	120	H	39.50	-3.70	35.80	46.00	10.20
Above 1 000.00	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								
1 904.50	1 000	V	36.50	1.70	-	38.20	80.83	42.63
2 460.25	1 000	V	48.90	4.10	-	53.00	80.83	27.83
2 879.88	1 000	V	36.70	4.10	-	40.80	80.83	40.03
3 905.88	1 000	H	41.10	6.30	-	47.40	80.83	33.43
4 339.00	1 000	H	39.50	8.00	-	47.50	80.83	33.33
4 773.25	1 000	H	44.60	9.40	-	54.00	80.83	26.83
Above 5 000.00	Not Detected	-	-	-	-	-	-	-
Average DATA. Emissions above 1 GHz								
1 904.50	1 000	V	38.70	1.70	-9.71	30.69	60.83	30.14
2 460.25	1 000	V	36.20	4.10	-9.71	30.59	60.83	30.24
2 879.88	1 000	V	36.70	4.10	-9.71	31.09	60.83	29.74
3 905.88	1 000	H	37.60	6.30	-9.71	34.19	60.83	26.64
4 339.00	1 000	H	35.50	8.00	-9.71	33.79	60.83	27.04
4 773.25	1 000	H	40.20	9.40	-9.71	39.89	60.83	20.94
Above 5 000.00	Not Detected	-	-	-	-	-	-	-

※ This sign means restricted band.

Note.

1. Restricted Avg Limit = 54 dB / Restricted PK Limit = 54 + 20 = 74 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)
Duty cycle factor = $20\log(\text{Duty Cycle}) = -9.71 \text{ dB}$

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=30 kHz and Span= 300 kHz.
3. The bandwidth of fundamental frequency was measured and recorded.

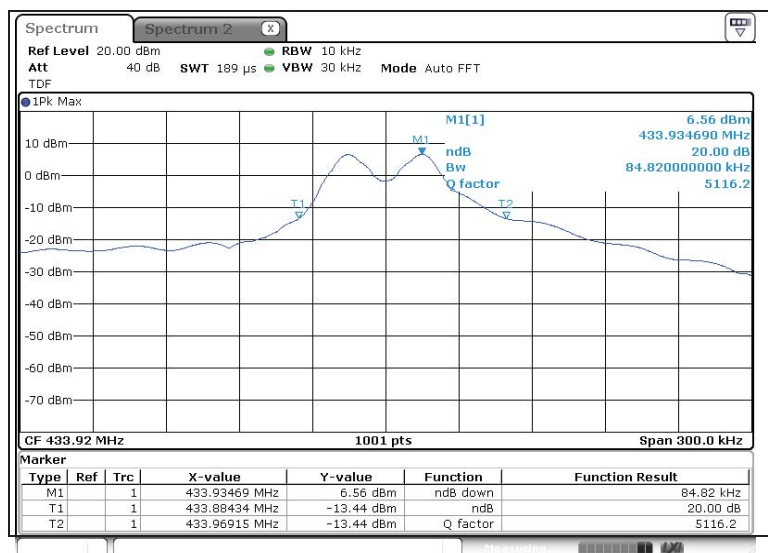
5.4.3 Test Result

- Complied

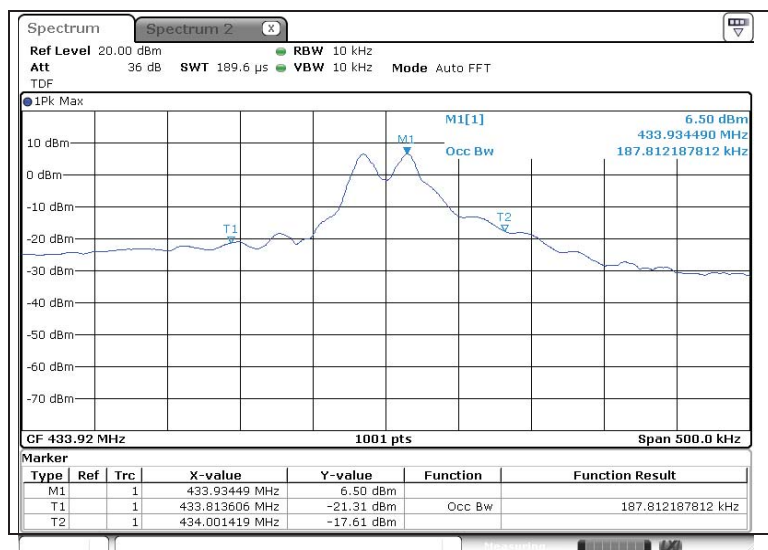
Frequency [MHz]	20 dB Bandwidth [kHz]	Limit [kHz]	Occupied Bandwidth (99 % BW) [kHz]
433.92	187.81	1 084.80	84.82

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

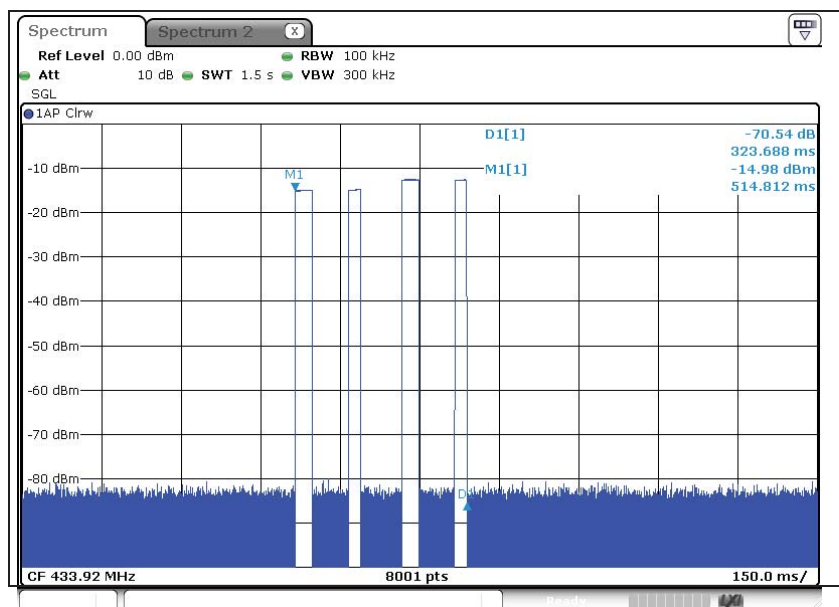
1. The transmitter output is connected to the spectrum analyzer.
2. The bandwidth of the fundamental frequency was measured with the spectrum analyzer using RBW=100 kHz, VBW=300 kHz, Span=0 Hz.
3. The bandwidth of fundamental frequency was measured and recorded.

5.5.3 Test Result

- Complied

Frequency [MHz]	Transmission Time [ms]	Limit [s]
433.92	323.688	5.00

5.5.4 Test plot



6. Test equipment used for test

	Description	Manufacturer	Model No.	Serial No.	Next Cal Date.
■	EMI Test Receiver	R&S	ESCI	101408	17.02.26
■	Highpass Filter	Mini-Circuits	NHP-800+	vuul6801113	16.07.15
■	Bi-Log Ant.	SCHWARZBECK	VULB9163	552	16.07.10
■	LOOP Antenna	R&S	HFH2-Z2	100355	18.03.03
■	Amplifier	SONOMA INSTRUMENT	310N	186280	16.09.01
■	3 dB Attenuator	HP	8491B	22981	16.09.01
■	Antenna Mast	Innco Systems	MA4000-EP	303	-
■	Turn Table	Innco Systems	DT2000S-1t	79	-
■	Broadband Preamplifier	SCHWARZBECK	BBV9718	9718-233	17.01.09
■	Double Bridge Horn Antenna	ETS	3117	155787	16.11.25
■	Spectrum Analyzer	R&S	FSV30	100806	16.09.02
■	Vector Signal Generator	R&S	SMBV100A	257566	17.01.07
■	Signal Generator	R&S	SMB100A	176206	17.03.14