



TEST REPORT

KCTL Inc.

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TEL: 82-31-285-0894 FAX: 82-505-299-8311
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Report No.:
KR18-SRF0058
Page (1) of (22)

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1. Client

- Name : Continental Automotive Systems Corporation
- Address : 45-29, Saeum-ro, Icheon-si, Gyeonggi-Do, 467-080, Korea
- Date of Receipt : 2018-02-23

2. Use of Report : -

3. Name of Product and Model : Smart Key Fob / SVI-SKFGE04

4. Manufacturer and Country of Origin : Continental Automotive Systems Corporation / Korea

5. FCC ID : SY5SKFGE04

6. IC : 8325A-SKFGE04

7. Date of Test : 2018-05-08 to 2018-05-09

8. Test Standards : FCC Part 15 Subpart C Section 15.209, Section 15.231 RSS-210 Issue 9, August 2016 RSS-Gen Issue 5, April 2018

9. Test Results : Refer to the test result in the test report

| | | |
|-------------|---|---|
| Affirmation | Tested by | Technical Manager |
| |  Name : Dowon Ahn (Signature) |  Name : Jongha Choi (Signature) |

2018-05-15

KCTL Inc.

As a test result of the sample which was submitted from the client, this report does not guarantee the whole product quality. This test report should not be used and copied without a written agreement by KCTL Inc.

REPORT REVISION HISTORY


| Date | Revision | Page No |
|------------|-----------------|---------|
| 2018-05-15 | Original Issued | - |
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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
Contact person: Sungmin Jang / Sungmin.Jang@continental-corporation.com

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

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2. Laboratory information

Address

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Facsimile Number: +82 505 299 8311

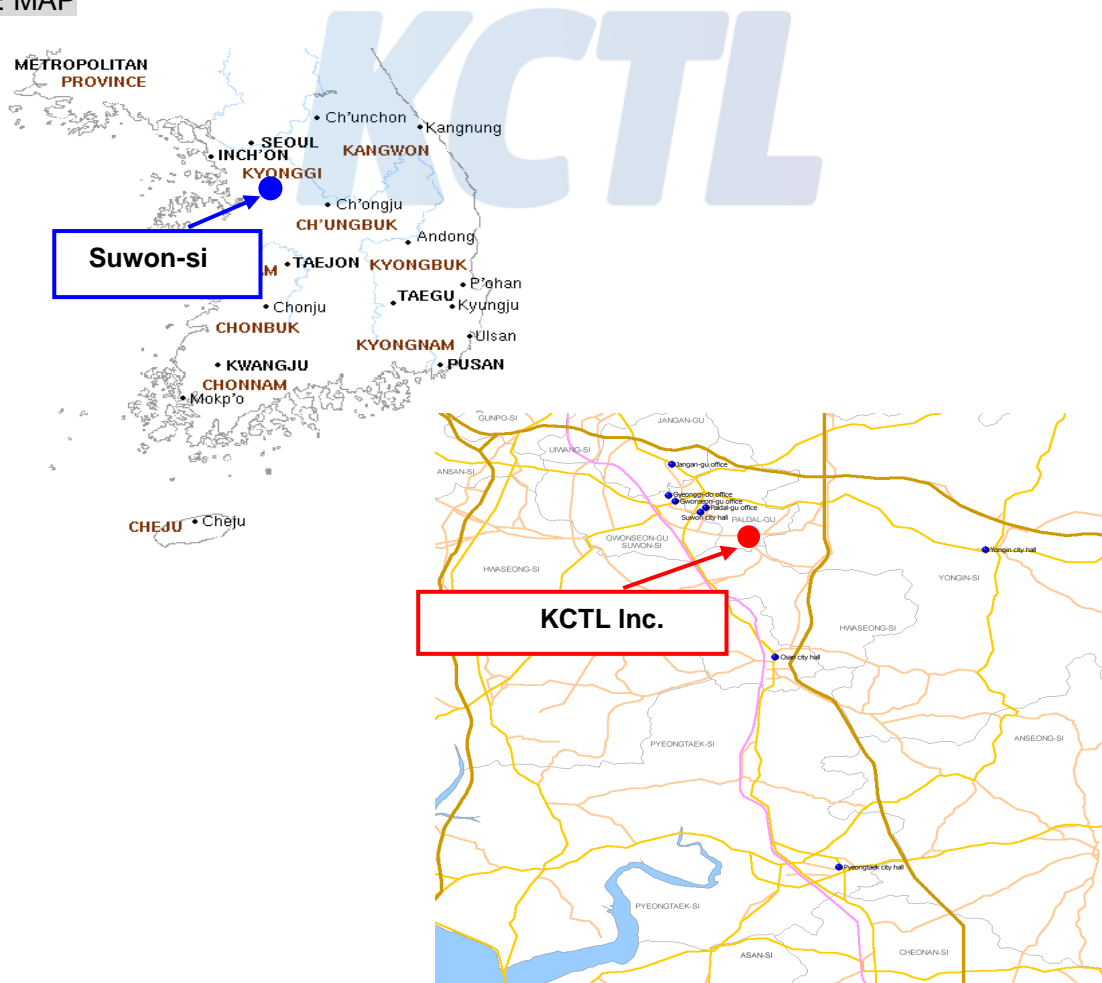
FCC Site Designation No: KR0040, FCC Site Registration No: 687132

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

Industry Canada Registration No. : 8035A

KOLAS NO.: KT231

SITE MAP



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KCTL-TIR001-003/2

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 | Smart Key Fob |
| Basic Model | SVI-SKFGE04 |
| Serial number | N/A |

3.2 General description

| | |
|-----------------------------|------------------|
| Frequency Range | 433.92 MHz (Tx) |
| Type of Modulation | FSK |
| The number of channels | 1 Channel |
| Type of Antenna | PCB Antenna |
| Antenna Gain | -24.14 dBi |
| 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 |

Note₁) : The above EUT information was declared by the manufacturer.

Note₂) : 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

| Test Frequency [MHz] |
|----------------------|
| 433.92 MHz |

3.4 Normal and extreme test conditions

| Test condition | Temperature [°C] | Voltage [V] |
|----------------|------------------|-------------|
| NTNV | 21 | DC 3 V |

Note 1 : N:Normal T:Temperature V:Voltage

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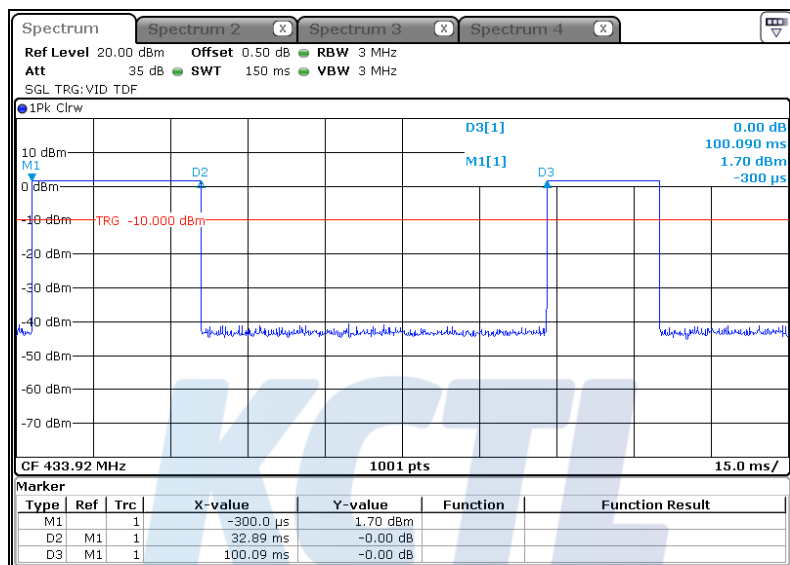
- Duty Cycle

Tx On time : 32.89 ms

Tx On time+Off time : 100 ms (pulse train is 100 ms instead of 100.09 ms)

Duty cycle Correction factor = $20\log(32.89/100) = -9.66$ dB

- Tx On time:



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 9, Table A1 | Radiated emission, Spurious Emission and Field Strength of Fundamental | C |
| 15.231(c) | RSS-210, Issue 9, A1.3 RSS-GEN Issue 5, 6.7 | Bandwidth Measurement | C |
| 15.231(a) | RSS-210, Issue 9, A1.1(a) | Transmission Time | C |
| 15.207(a) | RSS-GEN, 8.8 | Conducted Emissions | N/A (Note ₂) |
| Note ₁) : C = Complies, NC = Not Complies, NT = Not Tested, NA = Not Applicable Note ₂) : This test is not applicable because the EUT uses battery and it's not to be connected to the public utility(AC) power line. | | | |

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 |
| | 1 GHz ~ 25 GHz: | +6.03 dB, -6.05 dB |
| Conducted Emissions | 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.

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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 | $2\,400/F(\text{kHz})$ | 300 |
| 0.490 - 1.705 | $24\,000/F(\text{kHz})$ | 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, $\mu\text{V}/\text{m}$ at 3 meters = $56.81818(F) - 6136.3636$; for the band 260-470 MHz, $\mu\text{V}/\text{m}$ 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

The method of measurement used to test this Unlicensed Wireless device is ANSI C63.10-2013.

- 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

Peak DATA.

| Frequency [MHz] | Receiver Bandwidth [kHz] | Pol. [V/H] | Reading [dB(μV)] | Cable Loss [dB] | Amp Gain [dB] | Antenna Factor [dB] | Factor [dB] | Result [dB(μV/m)] | Limit [dB(μV/m)] | Margin [dB] |
|--------------------|--------------------------------|---------------|---------------------|-----------------------|---------------------|---------------------------|----------------|----------------------|---------------------|----------------|
| 433.92 | 120 | H | 90.10 | 4.76 | -35.74 | 22.24 | -8.74 | 81.36 | 100.83 | 19.47 |

NOTE:

1. Peak Limit = 80.83 dBμV/m + 20 dB = 100.83 dBμV/m
2. Factor(dB) = ANT Factor + Amp Gain + Cable Loss

Average DATA.

| Frequency [MHz] | Receiver Bandwidth [kHz] | Pol. [V/H] | Reading [dB(μV)] | Cable Loss [dB] | Amp Gain [dB] | Antenna Factor [dB] | Factor [dB] | Result [dB(μV/m)] | Limit [dB(μV/m)] | Margin [dB] |
|--------------------|--------------------------------|---------------|---------------------|-----------------------|---------------------|---------------------------|----------------|----------------------|---------------------|----------------|
| 433.92 | 120 | H | 80.44 | 4.76 | -35.74 | 22.24 | -8.74 | 71.70 | 80.83 | 9.13 |

NOTE:

1. Average Limit = 80.83 dBμV/m
2. Factor(dB) = ANT Factor + Amp Gain + Cable Loss
3. Average reading = Peak Reading + Duty Cycle Correction Factor
4. Duty Cycle Correction Factor : -9.66dB

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

The method of measurement used to test this Unlicensed Wireless device is ANSI C63.10-2013.

- a. The EUT was placed on the top of a rotating table 0.8 meters, 1.5 meter 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)] | Cable Loss [dB] | Amp Gain [dB] | Antenna Factor [dB] | Factor [dB] | Result [dB(μV/m)] | Limit [dB(μV/m)] | Margin [dB] |
|--|--------------------------------|---------------|---------------------|-----------------------|---------------------|---------------------------|----------------|----------------------|---------------------|----------------|
| Quasi-Peak DATA. Emissions below 30 MHz | | | | | | | | | | |
| Not Detected | | | | | | | | | | |
| Quasi-Peak DATA. Emissions below 1 GHz | | | | | | | | | | |
| 45.40 | 120 | V | 44.72 | 1.38 | -31.39 | 16.21 | -13.80 | 30.92 | 40.00 | 9.08 |
| 66.62 | 120 | V | 38.72 | 1.70 | -31.03 | 12.43 | -16.90 | 21.82 | 40.00 | 18.18 |
| 146.89 | 120 | V | 33.58 | 2.63 | -38.18 | 16.89 | -18.66 | 14.93 | 43.50 | 28.58 |
| 515.36 | 120 | V | 32.99 | 5.22 | -35.82 | 23.50 | -7.10 | 25.89 | 46.00 | 20.11 |
| 559.86 | 120 | V | 42.34 | 5.49 | -35.57 | 24.08 | -6.00 | 36.34 | 46.00 | 9.66 |
| 867.84 | 120 | H | 31.88 | 7.29 | -36.27 | 28.08 | -0.90 | 30.98 | 46.00 | 15.02 |

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**- Above 1 GHz data**

| Frequency [MHz] | Receiver Bandwidth [kHz] | Pol. [V/H] | Reading [dB(μV)] | Cable Loss [dB] | Amp Gain [dB] | Antenna Factor [dB] | Factor [dB] | Result [dB(μV/m)] | Limit [dB(μV/m)] | Margin [dB] |
|--|--------------------------------|---------------|---------------------|-----------------------|---------------------|---------------------------|----------------|----------------------|---------------------|----------------|
| Peak DATA. Emissions above 1 GHz | | | | | | | | | | |
| 1 301.50 ^{1,2)} | 1 000 | H | 70.70 | 2.76 | -60.98 | 25.01 | -33.21 | 36.16 | 74.00 | 37.84 |
| 1 735.75 ²⁾ | 1 000 | H | 70.42 | 3.17 | -60.11 | 26.74 | -30.20 | 38.48 | 80.83 | 42.35 |
| 2 165.78 ²⁾ | 1 000 | H | 69.29 | 3.54 | -58.99 | 28.11 | -27.34 | 38.81 | 80.83 | 42.02 |
| 3 473.31 ²⁾ | 1 000 | H | 72.55 | 4.44 | -60.11 | 30.98 | -24.69 | 41.43 | 80.83 | 39.40 |
| 4 339.56 ^{1,2)} | 1 000 | H | 67.19 | 5.02 | -60.25 | 32.57 | -22.66 | 39.73 | 74.00 | 34.27 |
| 4 772.97 ^{1,2)} | 1 000 | H | 78.01 | 5.32 | -59.85 | 32.79 | -21.74 | 50.32 | 74.00 | 23.68 |
| Average DATA. Emissions above 1 GHz | | | | | | | | | | |
| 1 301.50 ^{1,2)} | 1 000 | H | 61.04 | 2.76 | -60.98 | 25.01 | -36.66 | 24.37 | 54.00 | 29.63 |
| 1 735.75 ²⁾ | 1 000 | H | 60.76 | 3.17 | -60.11 | 26.74 | -34.32 | 26.44 | 60.83 | 34.39 |
| 2 165.78 ²⁾ | 1 000 | H | 59.63 | 3.54 | -58.99 | 28.11 | -28.16 | 31.47 | 60.83 | 29.36 |
| 3 473.31 ²⁾ | 1 000 | H | 62.89 | 4.44 | -60.11 | 30.98 | -26.26 | 36.63 | 60.83 | 24.20 |
| 4 339.56 ^{1,2)} | 1 000 | H | 57.53 | 5.02 | -60.25 | 32.57 | -24.15 | 33.39 | 54.00 | 20.61 |
| 4 772.97 ^{1,2)} | 1 000 | H | 68.35 | 5.32 | -59.85 | 32.79 | -23.20 | 45.15 | 54.00 | 8.85 |

¹⁾ Restricted band

²⁾ Harmonic

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

The method of measurement used to test this Unlicensed Wireless device is ANSI C63.10-2013.

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

5.4.3 Test Result

- Complied

| Frequency [MHz] | 20 dB Bandwidth [MHz] | Limit [MHz] | Occupied Bandwidth (99 % BW) [MHz] |
|--------------------|--------------------------|----------------|---------------------------------------|
| 433.92 | 0.081 | 1.085 | 0.099 |

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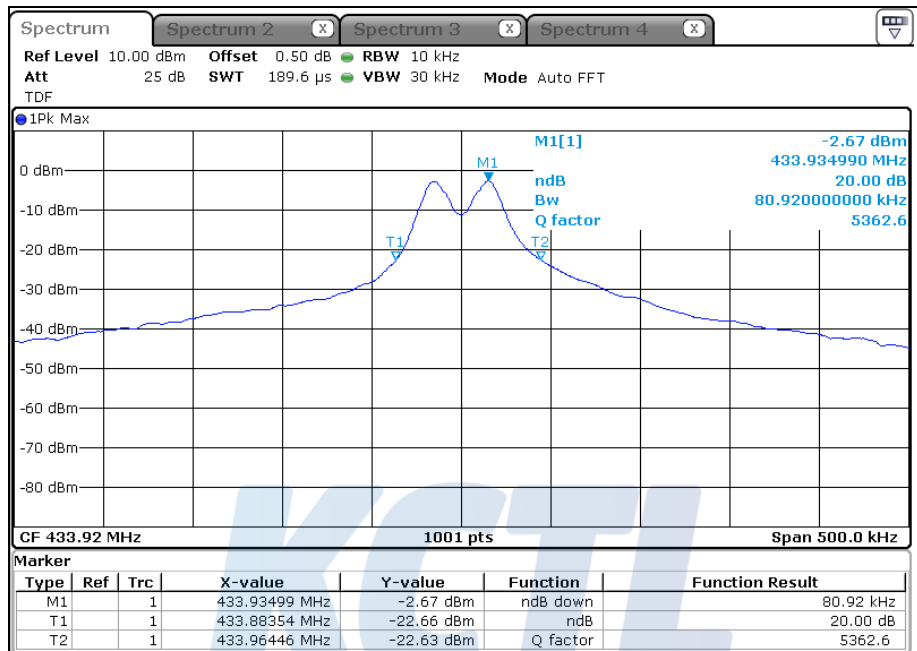
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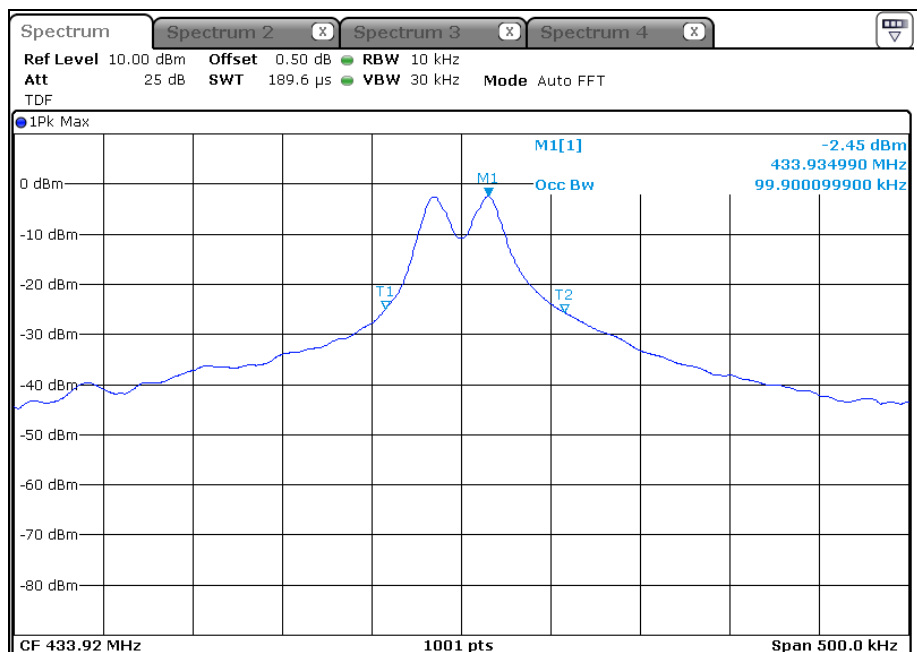
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5.4.4 Test plot

-20 dB Bandwidth



-OBW



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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

The method of measurement used to test this Unlicensed Wireless device is ANSI C63.10-2013.

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.

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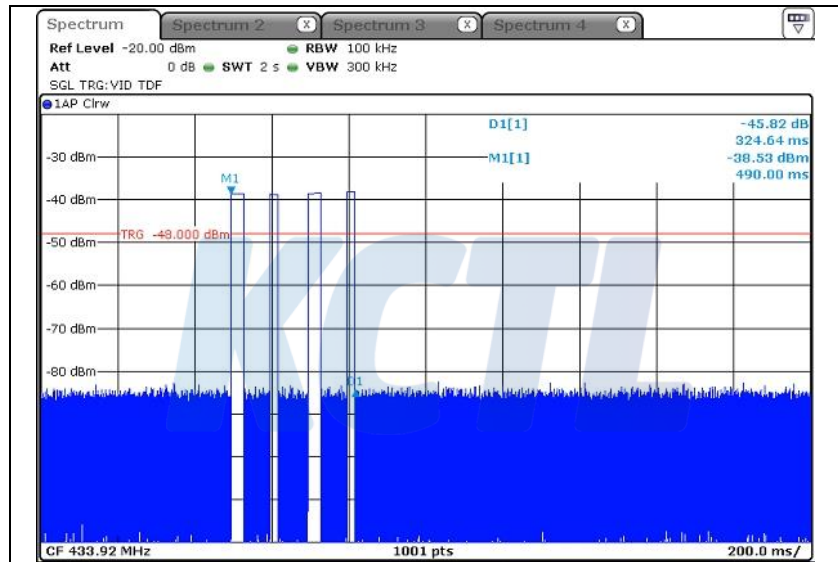
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5.5.3 Test Result

- Complied

| Frequency [MHz] | Transmission Time [ms] | Limit [s] |
|--------------------|------------------------|-----------|
| 433.92 | 324.64 | 5.00 |

5.5.4 Test plot



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6. Test equipment used for test

| | Equipment Name | Manufacturer | Model No. | Serial No. | Next Cal. Date |
|---|-------------------------|-----------------|------------------------|------------|----------------|
| ■ | Spectrum Analyzer | R&S | FSV40 | 100988 | 19.01.05 |
| ■ | EMI TEST RECEIVER | R&S | ESCI 3 | 100710 | 18.08.24 |
| ■ | EMI TEST RECEIVER | R&S | ESCI 3 | 101408 | 18.08.24 |
| ■ | DC Power Supply | AGILENT | E3632A | MY40001543 | 18.07.06 |
| ■ | Signal Generator | R&S | SMR40 | 100007 | 18.05.15 |
| ■ | Vector Signal Generator | R&S | SMBV100A | 257566 | 19.01.05 |
| ■ | Horn Antenna | ETS.lindgren | 3117 | 155787 | 18.10.20 |
| ■ | Loop Antenna | R&S | HFH2-Z2 | 892665/035 | 19.01.25 |
| ■ | Bilog Antenna | SCHWARZBECK | VULB9163 | 552 | 18.05.10 |
| ■ | Attenuator | Agilent | 8491B-6dB | MY39270293 | 18.10.25 |
| ■ | AMPLIFIER | SONOMA | 310N | 101408 | 18.08.24 |
| ■ | AMPLIFIER | SONOMA | 310N | 284608 | 18.08.24 |
| ■ | Amplifier | L-3 Narda-MITEQ | AMF-7D-01001800-22-10P | 2003683 | 18.06.12 |
| ■ | Turn Table | Innco Systems | DT2000 | 79 | - |
| ■ | Antenna Mast | Innco Systems | MA4640-XP-ET | - | - |
| ■ | Turn Table | Innco Systems | DT2000 | 79 | - |
| ■ | Cable Assembly | RadiAll | 2301761768000PJ | - | - |
| ■ | Cable Assembly | HUER+SUHNER | SUCOFLEX 104 | MY4342/4 | - |
| ■ | Cable Assembly | RadiAll | 2301762000PJ | 1724.66 | - |
| ■ | Cable Assembly | Gigalane | RF-400 | - | - |