TEST REPORT

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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 : 2019-06-13

2. Use of Report : -

3. Name of Product and Model : Smart Key ECU / IBU 2.0 non-SMK

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

5. FCC ID : SY5IBU20NONSMK

6. IC Certification : 8325A-IBU20NONSMK

7. Date of Test : 2019-06-17 to 2019-07-30

8. Test Standards : FCC Part 15 Subpart C, 15.209
RSS-210 Issue 9 August 2016
RSS Gen Issue 5 March 2019

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

Affirmation	Tested by Name : Euijung Kim (Signature)	Technical Manager Name : Jaehyong Lee (Signature)

2019-08-08

KCTL Inc.

Report revision history

Date	Revision	Page No
2019-08-01	Initial report	-
2019-08-07	Updated	All pages
2019-08-08	Updated	4~6, 9

CONTENTS

1. General information

Client	:	Continental Automotive Systems Corporation
Address	:	45-29, Saeum-ro, Icheon-si, Gyeonggi-Do, 467-080, Korea
Manufacturer	:	Continental Automotive Systems Corporation
Address	:	45-29, Saeum-ro, Icheon-si, Gyeonggi-Do, 467-080, Korea
Laboratory	:	KCTL Inc.
Address	:	65, Sinwon-ro, Yeongtong-gu, Suwon-si, Gyeonggi-do, 16677, Korea
Accreditations	:	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

2. Device information

Equipment under test	:	Smart Key ECU
Model	:	IBU 2.0 non-SMK
Frequency range	:	Tx: 125 ㎑, Rx: 433.92 ㎒
Modulation technique	:	ASK (125 ㎑)
Number of channels	:	1 ch
Power source	:	DC 12 V [1)]
Antenna specification	:	Immobilizer antenna
Software version	:	1.0
Hardware version	:	1.0
Test device serial No.	:	N/A
Operation temperature	:	-20 ℃ ~ 50 ℃

Note.

[1)] This EUT is only supplied by vehicle battery.

2.1. Accessory information

Equipment	Manufacturer	Model	Serial No.	Power source
LF homologation JIG	Continental Automotive Systems Corporation	-	-	DC 12 V

2.2. Frequency/channel operations

Ch.	Frequency (㎑)
01	125

3. Antenna requirement

Requirement of FCC part section 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.

Requirement of RSS-Gen Section 6.8:

The applicant for equipment certification shall provide a list of all antenna types that may be used with the transmitter, where applicable (i.e. for transmitters with detachable antenna), indicating the maximum permissible antenna gain (in dBi) and the required impedance for each antenna. The test report shall demonstrate the compliance of the transmitter with the limit for maximum equivalent isotropically radiated power (e.i.r.p.) specified in the applicable RSS, when the transmitter is equipped with any antenna type, selected from this list.

For expediting the testing, measurements may be performed using only the antenna with highest gain of each combination of transmitter and antenna type, with the transmitter output power set at the maximum level. However, the transmitter shall comply with the applicable requirements under all operational conditions and when in combination with any type of antenna from the list provided in the test report (and in the notice to be included in the user manual, provided below).

When measurements at the antenna port are used to determine the RF output power, the effective gain of the device's antenna shall be stated, based on a measurement or on data from the antenna's manufacturer.

The test report shall state the RF power, output power setting and spurious emission measurements with each antenna type that is used with the transmitter being tested.

Immediately following the above notice, the manufacturer shall provide a list of all antenna types which can be used with the transmitter, indicating the maximum permissible antenna gain (in dBi) and the required impedance for each antenna type.

- The IMMOBILIZER Antenna and LF Antenna is an external antenna that uses unique antenna connector, and no antenna other than that furnished by the responsible party shall be used with the device. The antenna connector is not available to general public. Please refer to the internal photos.

4. Summary of tests

FCC Part section(s)	IC Rule reference	Parameter	Test results
15.209	RSS-210 Issue 9	Field Strength of Fundamental and Spurious Emission	Pass
-	RSS-Gen Issue 5	Occupied Bandwidth	Pass
15.203	RSS-Gen Issue 5	Antenna requirement	Pass
15.207	RSS-Gen Issue 5	AC Power Line Conducted Emission	N/A(Note3)

Notes: (N/A: Not Applicable)

1. The fundamental of the EUT was investigated in three orthogonal orientations X, Y and Z. It was determined that X orientation was worst-case orientation. Therefore, all final radiated testing was performed with the EUT in X orientation.
2. The test procedure(s) in this report were performed in accordance as following.
   - ANSI C63.10-2013
3. This EUT is only supplied by vehicle battery.

5. Measurement uncertainty

The measurement uncertainties shown below were calculated in accordance with the requirements of ANSI C63.10-2013.

All measurement uncertainty values are shown with a coverage factor of k=2 to indicated a 95 % level of confidence. The measurement data shown herein meets of exceeds the U_{CISPR} measurement uncertainty values specified in CISPR 16-4-2 and thus, can be compared directly to specified limits to determine compliance.

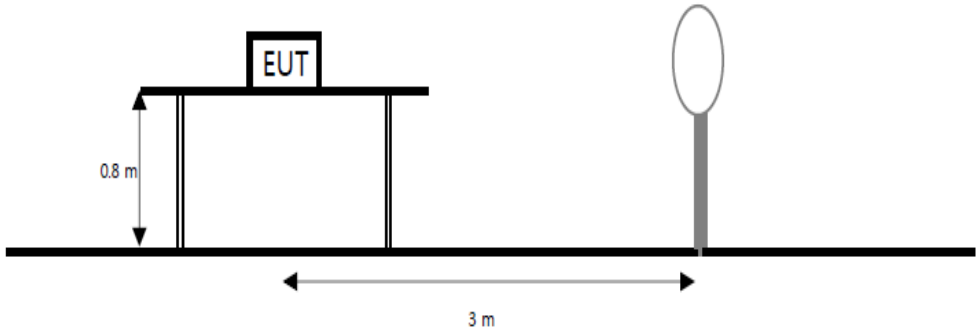
Parameter	Expanded uncertainty (±)	
Radiated spurious emissions	9 ㎑ ~ 30 ㎒	2.28 ㏈

6. Test results

6.1. Field Strength of Fundamental and Spurious Emission

Test setup

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



Limit

FCC

According to section 15.209(a), RSS-Gen(8.9) 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 (㎶/m)	Measurement distance (m)
0.009 - 0.490	2 400/F(㎑)	300
0.490 - 1.705	24 000/F(㎑)	30
1.705 - 30	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., Section15.231 and 15.241.

IC

According to section RSS-Gen(8.9), except where otherwise indicated in the applicable RSS, radiated emissions shall comply with the field strength limits shown in table 5 and table 6. Additionally, the level of any transmitter unwanted emission shall not exceed the level of the transmitter's fundamental emission.

Table 5 – General field strength limits at frequencies above 30 MHz

Frequency (MHz)	Field strength (µV/m at 3 m)
30 – 88	100
88 – 216	150
216 – 960	200
Above 960	500

Table 6 – General field strength limits at frequencies below 30 MHz

Frequency	Magnetic field strength (H-Field) (µA/m)	Measurement distance (m)
9 - 490 kHz [1]	6.37/F (F in kHz)	300
490 - 1705 kHz	63.7/F (F in kHz)	30
1.705 - 30 MHz	0.08	30

Note 1: The emission limits for the ranges 9-90 kHz and 110-490 kHz are based on measurements employing a linear average detector.

Test procedure

ANSI C63.10-2013

Test settings

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 and Average Detect Function and Specified Bandwidth with Maximum Hold Mode.

Notes:

1. *f* <30 ㎒, extrapolation factor of 40 ㏈/decade of distance. $F_d = 40\log(D_m/Ds)$
   Where:
   F_d = Distance factor in ㏈
   D_m = Measurement distance in meters
   D_s = Specification distance in meters
2. The test measurement distance is 3 meter
3. Limit (㏈(㎶/m)) = For 0.009 ㎒ - 0.490 ㎒, 20*log(2 400/F(㎑)) ㏈(㎶/m)
   For 0.490 ㎒ - 1.705 ㎒, 20*log(24 000/F(㎑)) ㏈(㎶/m)
   For 1.705 ㎒ - 30 ㎒, 20*log(30) = 29.54 ㏈(㎶/m)

Test results

Radiated Emissions Fundamental & 9 ㎑ to 30 ㎒

Horizontal

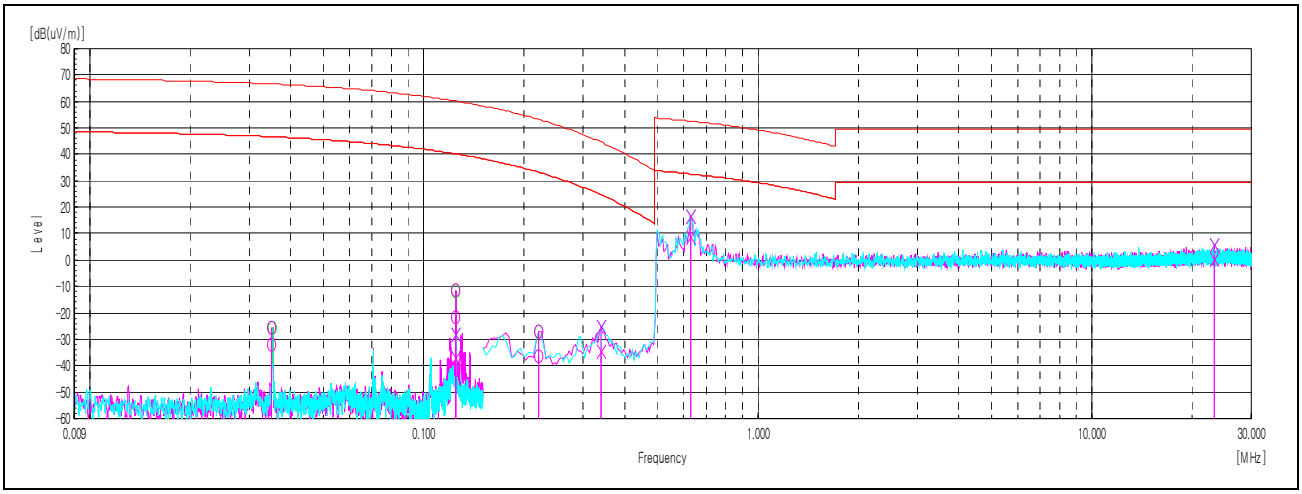
Frequency	Reading	Detector	Ant. Factor	Amp. + Cable	Distance factor	Factor	Result at 3m	Result at 300m	Limit at 300m	Margin
(㎒)	(dB(㎶))	Mode	(dB)	(dB)	(dB)	(dB)	(dB(㎶/m))	(dB(㎶/m))	(dB(㎶/m))	(dB)
0.125	38.20	AV	19.9	0.1	-80.0	-60.0	58.2	-21.80	25.67	47.47

Frequency	Reading	Detector	Ant. Factor	Amp. + Cable	Distance factor	Factor	Result at 3m	Result at 300m	Limit at 30m or 300m	Margin
(㎒)	(dB(㎶))	Mode	(dB)	(dB)	(dB)	(dB)	(dB(㎶/m))	(dB(㎶/m))	(dB(㎶/m))	(dB)
0.035	27.80	AV	20.2	-0.1	-80.0	-59.9	47.9	-32.10	36.72	68.82
0.221	23.50	AV	19.9	0.1	-80.0	-60.0	43.5	-36.50	20.72	57.22

Vertical

Frequency	Reading	Detector	Ant. Factor	Amp. + Cable	Distance factor	Factor	Result at 3m	Result at 300m	Limit at 300m	Margin
(㎒)	(dB(㎶))	Mode	(dB)	(dB)	(dB)	(dB)	(dB(㎶/m))	(dB(㎶/m))	(dB(㎶/m))	(dB)
0.125	23.20	AV	19.9	0.1	-80.0	-60.0	43.2	-36.80	25.67	62.47

Frequency	Reading	Detector	Ant. Factor	Amp. + Cable	Distance factor	Factor	Result at 3m	Result at 300m	Limit at 30m or 300m	Margin
(㎒)	(dB(㎶))	Mode	(dB)	(dB)	(dB)	(dB)	(dB(㎶/m))	(dB(㎶/m))	(dB(㎶/m))	(dB)
0.340	25.80	AV	19.9	0.0	-80.0	-60.1	45.7	-34.30	36.97	71.27
0.631	28.60	QK	20.0	0.1	-40.0	-19.9	48.7	8.70	31.60	22.90
23.265	18.40	QK	21.0	1.0	-40.0	-18.0	40.4	0.40	29.54	29.14



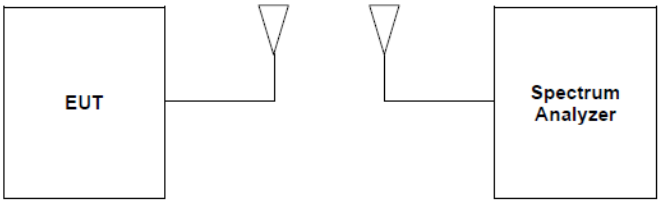
Note.

1) Factor(dB) = Antenna Factor + Amp. Gain + Cable Loss + distance factor(dB)

2) -80 is distance factor = 40*log(3/300), -40 is distance factor = 40*log(3/30)

6.2. Occupied Bandwidth

Test setup



Limit

For reporting purpose only

Test settings

The transmitter shall be operated at its maximum carrier power measured under normal test conditions.

- The span of the analyzer shall be set to capture all products of the modulation process, including the emission skirts.
- The resolution bandwidth (RBW) shall be in the range of 1% to 5% of the occupied bandwidth (OBW) and video bandwidth (VBW) shall be approximately 3x RBW.

A peak, or peak hold, may be used in place of the sampling detector as this may produce a wider bandwidth than the actual bandwidth (worst-case measurement). Use of a peak hold may be necessary to determine the occupied bandwidth if the device is not transmitting continuously.

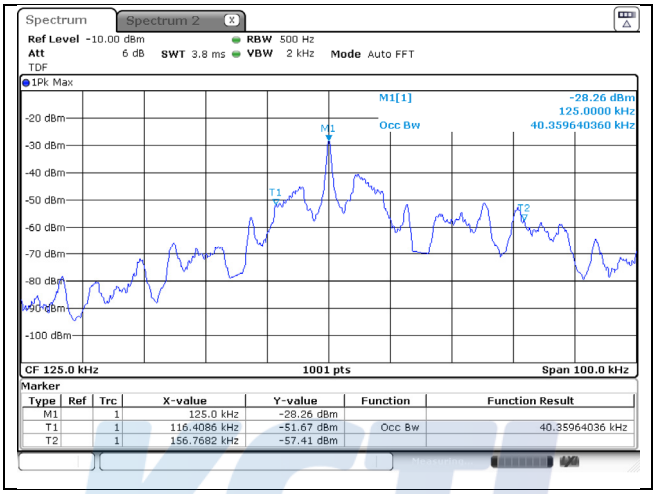
The trace data points are recovered and are directly summed in linear power level terms. The recovered amplitude data points, beginning at the lowest frequency, are placed in a running sum until 0.5% of the total is reached and that frequency recorded. The process is repeated for the highest frequency data points (starting at the highest frequency, at the right side of the span, and going down in frequency). This frequency is then recorded.

The difference between the two recorded frequencies is the 99% occupied bandwidth.

Test results

Frequency (㎑)	Occupied Bandwidth (㎑)	Limit
125	40.36	Reporting purpose only

Test Plots



7. Measurement equipment

Equipment Name	Manufacturer	Model No.	Serial No.	Next Cal. Date
Vector Signal Generator	R&S	SMBV100A	257566	20.07.16
Signal Generator	R&S	SMB100A	176206	20.01.25
Spectrum Analyzer	R&S	FSV30	100914	19.09.10
DC Power Supply	AGILENT	E3632A	MY40001543	20.05.13
EMI TEST RECEIVER	R&S	ESCI7	100732	19.08.23
Loop Antenna	R&S	HFH2-Z2	100355	20.08.24
AMPLIFIER	SONOMA	310N	284608	19.08.23
Antenna Mast	Innco Systems	MA4000-EP	303	-
Turn Table	Innco Systems	DT2000	79	-

End of test report