RADIO PERFORMANCE TEST REPORT

Test Report No.	**: OT-203-RWD-012**
AGR No.	**: A201A-152**
Applicant	**: Continental Automotive Systems Corporation**
Address	**: 45-29, Saeum-ro, Icheon-City, Gyeonggi-Do, Korea**
Manufacturer	**: Continental Automotive Systems Corporation**
Address	**: 45-29, Saeum-ro, Icheon-City, Gyeonggi-Do, Korea**
Type of Equipment	**: Smart Key Fob**
FCC ID	**: SY5KA4FGE07**
Model No.	**: SVI-KA4FGE07**
Serial number	**: N/A**
Total page of Report	**: 23 pages (including this page)**
Date of Incoming	**: January 31, 2020**
Date of issuing	**: March 02, 2020**

SUMMARY

The equipment complies with the regulation; ***FCC PART 15 SUBPART C Section 15.209 and Section 15.231***

This test report only contains the result of a single test of the sample supplied for the examination.

It is not a generally valid assessment of the features of the respective products of the mass-production.

Reviewed by: Ha-Ram Lee / Assistant Manager, ONETECH Corp.

Approved by: Jae-Ho Lee / Chief Engineer, ONETECH Corp.

ONETECH Corp.: 43-14, Jinsaegol-gil, Chowol-eup, Gwangju-si, Gyeonggi-do, 12735, Korea (TEL: 82-31-799-9500, FAX: 82-31-799-9599)

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ONETECH Corp.: 43-14, Jinsaegol-gil, Chowol-eup, Gwangju-si, Gyeonggi-do, 12735, Korea (TEL: 82-31-799-9500, FAX: 82-31-799-9599)

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REVISION HISTORY

Issued Report No.	Issued Date	Revisions	Effect Section
OT-203-RWD-012	March 02, 2020	Initial Issue	All

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1. VERIFICATION OF COMPLIANCE

Applicant : Continental Automotive Systems Corporation

Address : 45-29, Saeum-ro, Icheon-City, Gyeonggi-Do, Korea

Contact Person : S. M. Jang / Representative

Telephone No. : 82-31-645-4864

FCC ID : SY5KA4FGE07

Model Name : SVI-KA4FGE07

Brand Name : N/A

Serial Number : N/A

Date : March 02, 2020

EQUIPMENT CLASS	**DSC - Part 15, Security/Remote Control Transmitter**
E.U.T. DESCRIPTION	Smart Key Fob
THIS REPORT CONCERNS	Original Grant
MEASUREMENT PROCEDURES	ANSI C63.10: 2013
TYPE OF EQUIPMENT TESTED	Pre-Production
KIND OF EQUIPMENT AUTHORIZATION REQUESTED	Certification
EQUIPMENT WILL BE OPERATED UNDER IC RULES PART(S)	FCC PART 15 SUBPART C Section 15.209 and Section 15.231
MODIFICATIONS ON THE EQUIPMENT TO ACHIEVE COMPLIANCE	None
FINAL TEST WAS CONDUCTED ON	3 m, Semi Anechoic Chamber

The above equipment was tested by ONETECH Corp. for compliance with the requirement set forth in the FCC Rules and Regulations. This said equipment in the configuration described in this report, shows the maximum emission levels emanating from equipment are within the compliance requirements.

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2. TEST SUMMARY

2.1 Test items and results

SECTION	TEST ITEMS	RESULTS
15.231(c)	Bandwidth Measurement	Met the Limit / PASS
15.231(a)	Transmission Time	Met the Limit / PASS
15.231(b) 15.209(a)	Field Strength of Fundamental and Spurious Emission	Met the Limit / PASS
15.205	Restricted Band	Met the Limit / PASS
15.207	AC Conducted Emissions	N / A (See Note)

Note: This test is not applicable because the EUT uses battery and it's not to be connected to the public utility (AC) power line.

2.2 Additions, deviations, exclusions from standards

No additions, deviations or exclusions have been made from standard.

2.3 Related Submittal(s) / Grant(s)

Original submittal only

2.4 Purpose of the test

To determine whether the equipment under test fulfills the requirements of the regulation stated in section 2.1.

2.5 Test Methodology

Both conducted and radiated testing was performed according to the procedures in ANSI C63.10: 2013. Radiated testing was performed at a distance of 3 m from EUT to the antenna.

2.6 Test Facility

The Onetech Corp. has been designated to perform equipment testing in compliance with ISO/IEC 17025.

The Electromagnetic compatibility measurement facilities are located at 43-14, Jinsaegol-gil, Chowol-eup, Gwangju-si, Gyeonggi-do, 12735, Korea

-. Site Filing:

VCCI (Voluntary Control Council for Interference) – Registration No. R-4112/ C-14617/ G-10666 / T-1842

-. Lab Accreditation:

KOLAS (Korea Laboratory Accreditation Scheme) - Accreditation NO. KT085

ISED (Innovation, Science and Economic Development Canada) – Registration No. Site# 3736A-3

FCC (Federal Communications Commission) - Accreditation No. KR0013

RRA (Radio Research Agency) – Designation No. KR0013

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3. GENERAL INFORMATION

3.1 Product Description

The Continental Automotive Systems Corporation, Model: SVI-KA4FGE07 (referred to as the EUT in this report) is a Transmitter that it controls locking and unlocking the door of a vehicle. Product specification information described herein was obtained from product data sheet or user's manual.

CHASSIS TYPE	Plastic
TX FREQUENCY	433.92 MHz
RX FREQUENCY	125 kHz
MODULATION	FSK
LIST OF EACH OSC. OR CRY. FREQ.(FREQ.>= 1 MHz)	27.6 MHz
DUTY CYCLE FACTOR	9.68 dB (Duty Cycle : 32.8 %)
ANTENNA TYPE	Built-in on the PCB in EUT
ANTEENA GAIN	-20.96 dBi
RATED SUPPLY VOLTAGE	DC 3 V from a battery

3.2 Alternative type(s)/model(s); also covered by this test report.

-. None

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4. EUT MODIFICATIONS

-. None

5. SYSTEM TEST CONFIGURATION

5.1 Justification

This device was configured for testing in a typical way as a normal customer is supposed to be used. During the test, the following components were installed inside of the EUT.

DEVICE TYPE	MANUFACTURER	MODEL/PART NUMBER	FCC ID
MAIN BOARD	N/A	N/A	-

5.2 Peripheral equipment

Defined as equipment needed for correct operation of the EUT, but not considered as tested:

Model	Manufacturer	Description	Connected to
-	-	-	-
-	-	-	-

5.3 Mode of operation during the test

Software was programmed into the EUT to maintain continuous transfer mode. The EUT was set at 433.92 MHz. To get a maximum radiated emission levels from the EUT, the EUT was moved throughout the XY, XZ, and YZ planes and the worst case is “XY” axis. So, the worst data was recorded in this test report.

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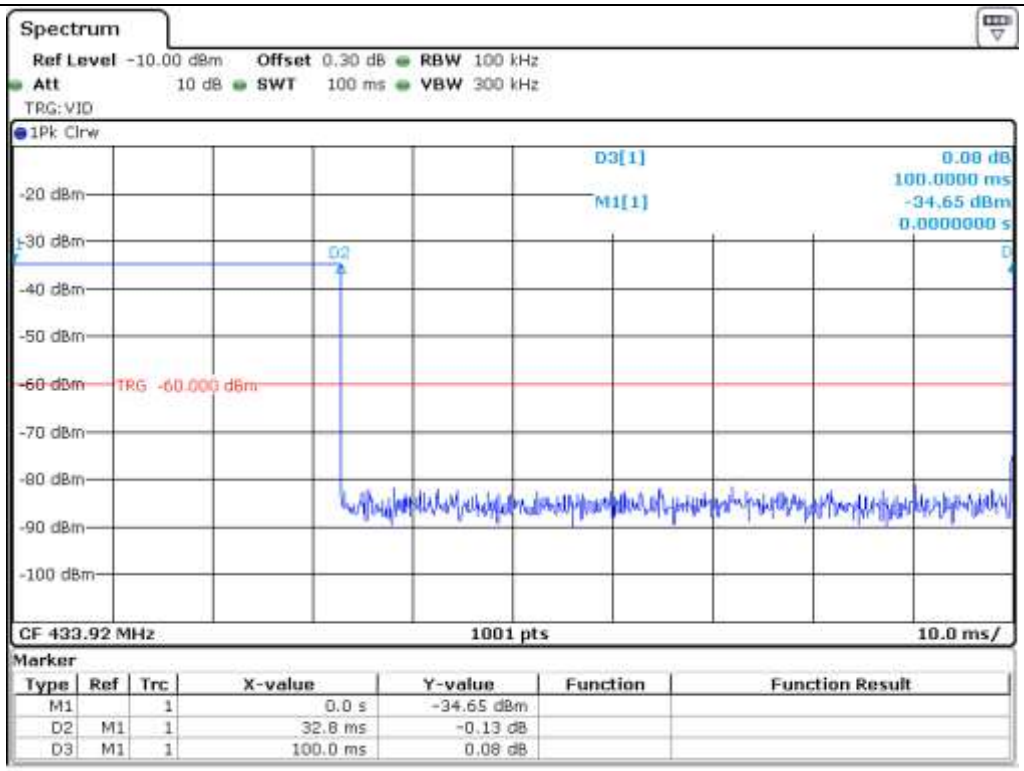
-. Duty Cycle

Mode	Tx On Time [ms]	Tx Off Time [ms]	Duty Cycle [%]	Duty Cycle Factor [dB]
433.92 MHz	32.8	67.2	32.8	9.68

Note – Duty Cycle : (Tx On Time / (Tx On Time + Tx Off Time)) * 100

Duty Cycle Factor : 20 * Log(1 / (Duty Cycle / 100))

-. Test Plot



433.92 MHz

The average field strength may be found by measuring the peak pulse amplitude (in log equivalent units) and determining the duty cycle correction factor (in dB) associated with the pulse modulation as shown in Equation. (ANSI C63.10: 2013)

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5.4 Configuration of Test System

Radiated Emission Test: Preliminary radiated emissions test were conducted using the procedure in ANSI C63.10: 2013 to determine the worse operating conditions. Final radiated emission tests were conducted at 3 meter open area test site.

The turntable was rotated through 360 degrees and the EUT was tested by positioned three orthogonal planes to obtain the highest reading on the field strength meter. Once maximum reading was determined, the search antenna was raised and lowered in both vertical and horizontal polarization.

5.5 Antenna Requirement

For intentional device, according to 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.

Antenna Construction:

The transmitter antenna of the EUT is PCB Antenna, so no consideration of replacement by the user.

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6. PRELIMINARY TEST

6.1 AC Power line Conducted Emissions Tests

- It is not need to test this requirement, because the power of the EUT is supplied from a DC battery.

6.2 General Radiated Emissions Tests

During Preliminary Test, the following operating mode was investigated.

Operation Mode	The Worse operating condition (Please check one only)
Transmitting Mode	X

7. Bandwidth Measurement

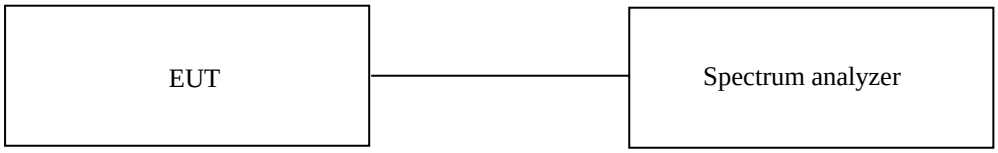
7.1 Operating environment

Temperature : 22 ℃

Relative humidity : 54 % R.H.

7.2 Test set-up

The antenna output of the EUT was connected to the spectrum analyzer. The resolution bandwidth is set to 3 kHz, and peak detection was used. The bandwidth of fundamental frequency was measured and recorded.



7.3 Test equipment used

	Model Number	Manufacturer	Description	Serial Number	Last Cal.
■ -	FSV30	Rohde & Schwarz	Signal Analyzer	101200	Jul. 24, 2019 (1Y)

All test equipment used is calibrated on a regular basis.

7.4 Test data

-. Test Date : February 06, 2020

-. Test Result : Pass

Frequency (MHz)	20 dB Bandwidth (MHz)	99 % Bandwidth (MHz)	Limit (MHz)
433.92	0.075	0.074	1.085

Remark: See next page for measurement data.

Tested by: Sieon Lee / Assistant Manager

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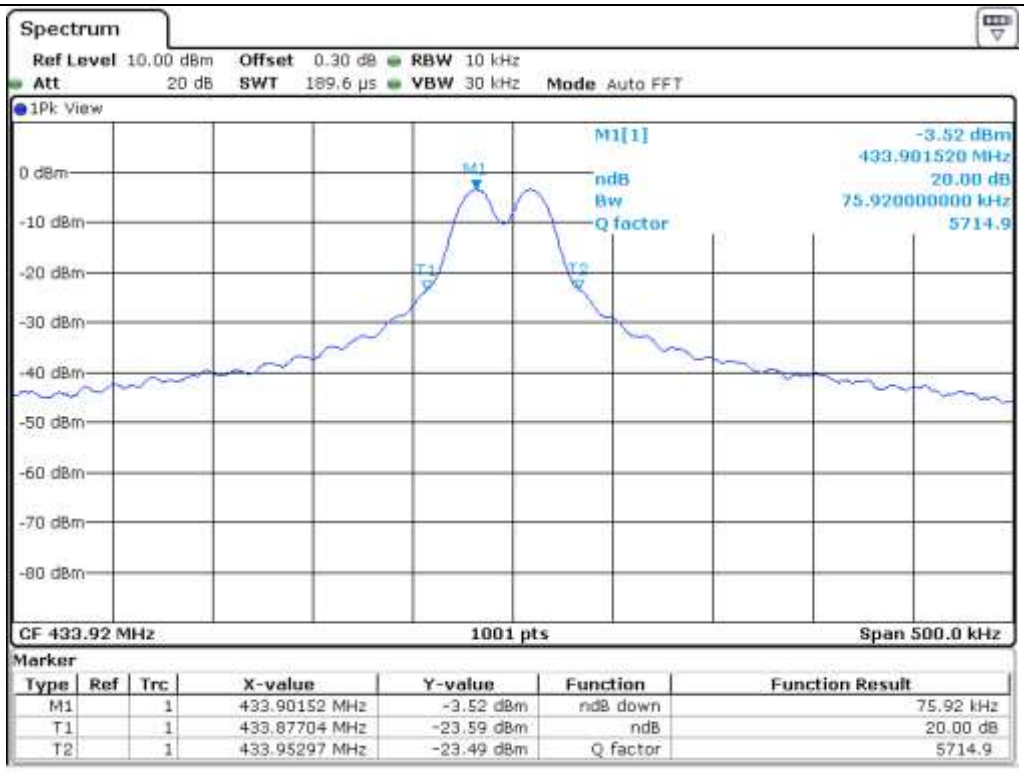
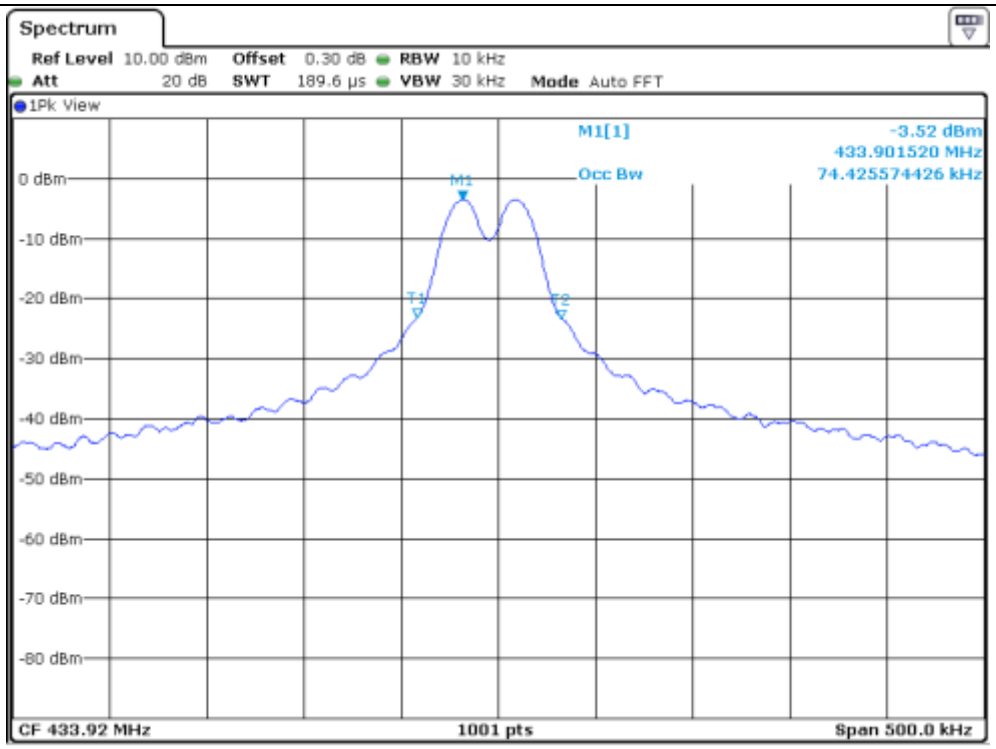


20 dB Bandwidth



99% Bandwidth

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8. Transmission Time

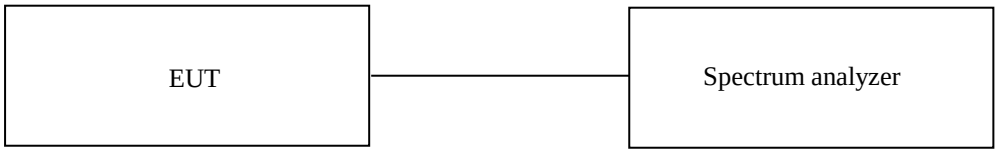
8.1 Operating environment

Temperature : 22 ℃

Relative humidity : 54 % R.H.

8.2 Test set-up

The antenna output of the EUT was connected to the spectrum analyzer. The resolution bandwidth is set to 100 kHz, and peak detection was used. The bandwidth of fundamental frequency was measured and recorded.



8.3 Test equipment used

	Model Number	Manufacturer	Description	Serial Number	Last Cal.
■ -	FSV30	Rohde & Schwarz	Signal Analyzer	101200	Jul. 24, 2019 (1Y)

All test equipment used is calibrated on a regular basis.

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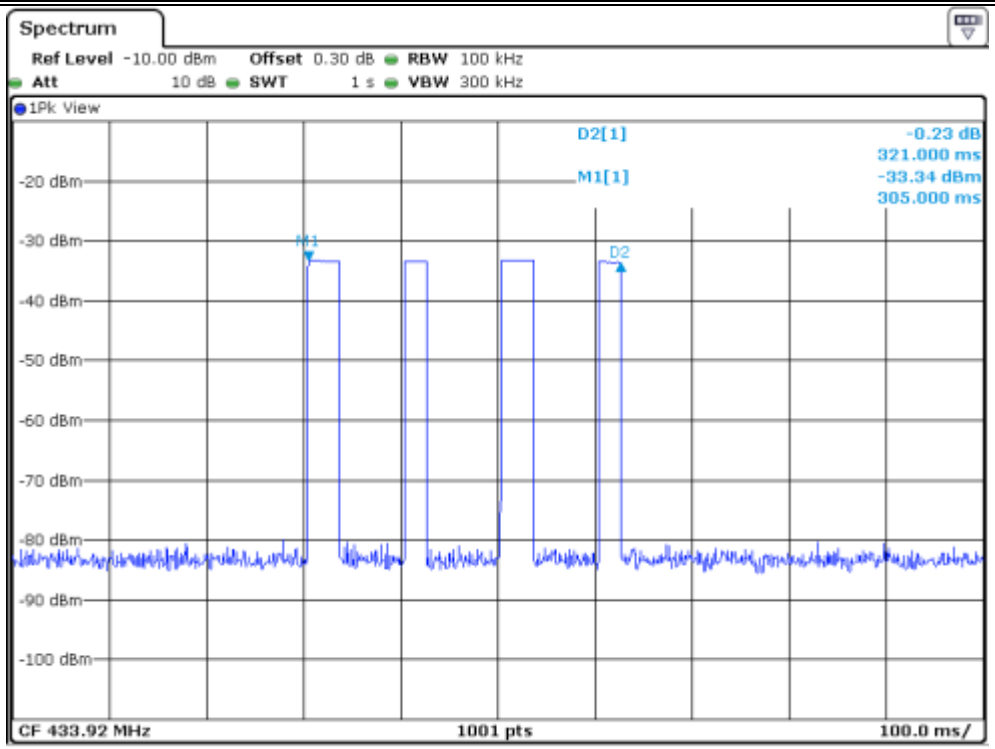
8.4 Test data

-. Test Date : February 06, 2020

-. Test Result : Pass

-. Test Applies : 15.231 (a) (1)

Frequency (MHz)	Transmission Time (s)	Limit (s)	Result
433.92	0.321	5.000	Pass



Tested by: Sieon Lee / Assistant Manager

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9. Radiated Emission Test

9.1 Regulation

According to §15.209(a), for an intentional device, the general requirement of field strength of radiated emissions from intentional radiators at a distance of 3 meters shall not exceed the following values:

Frequency [MHz]	Field strength [μ V/m]	Field strength [dBμ V/m]	Measurement distance [m]
0.009 ~ 0.490	2 400 / F (kHz)	-	300
0.490 ~ 1.705	24 000 / F (kHz)	-	30
1.705 ~ 30	30	29.50	30
30 ~ 88	*100	40.00	3
88 ~ 216	*150	43.52	3
216 ~ 960	*200	46.02	3
Above 960	500	53.98	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), for an intentional device, the general requirement of field strength of radiated emissions from intentional radiators at a distance of 3 meters shall not exceed the following values:

Frequency [MHz]	Field strength of Fundamental [μ V/m]	Field strength of Spurious Emissions [μ V/m]
40.66 ~ 40.70	2 250	225
70 ~ 130	1 250	125
130 ~ 174	1 250 ~ 3 750 **	125 ~ 375 **
174 ~ 260	3 750	375
260 ~ 470	3 750 ~ 12 500 **	375 ~ 1 250 **
Above 470	12 500	1 250

** Linear interpolations

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9.2 Test set-up

The radiated emissions measurements were on the 3 m semi anechoic chamber. The EUT and other support equipment were placed on a non-conductive turntable above the ground plane. The interconnecting cables from outside test site were inserted into ferrite clamps at the point where the cables reach the turntable.

The frequency spectrum from 30 kHz to 1 GHz was scanned and maximum emission levels at each frequency recorded. The system was rotated 360°, and the antenna was varied in the height between 1.0 m and 4.0 m in order to determine the maximum emission levels. This procedure was performed for horizontal and vertical polarization of the receiving antenna.

9.3 Test equipment used

	Model Number	Manufacturer	Description	Serial Number	Last Cal.(Interval)
☐ -	ESCI	Rohde & Schwarz	EMI Test Receiver	101012	Oct. 22, 2019 (1Y)
■ -	ESR	Rohde & Schwarz	EMI Test Receiver	101470	Oct. 22, 2019 (1Y)
☐ -	FSP	Rohde & Schwarz	Spectrum Analyzer	100017	Jul. 25, 2019 (1Y)
■ -	310N	Sonoma Instrument	AMPLIFIER	392756	Oct. 16, 2019 (1Y)
■ -	FSV30	Rohde & Schwarz	Signal Analyzer	101200	Jul. 24, 2019 (1Y)
☐ -	BBV 9718 B	Schwarzbeck	Pre-Amplifier	009	Mar. 20, 2019 (1Y)
■ -	MA-4640-XPET	Innco Systems GmbH	Antenna Master	MA4640/652	N/A
■ -	HD100	HD GmbH	Position Controller	N/A	N/A
■ -	DT2000-2t	Innco Systems GmbH	Turn Table	N/A	N/A
■ -	FMZB 1513	Schwarzbeck	LOOP ANTENNA	1513-235	May. 13, 2018 (2Y)
■ -	VULB9163	Schwarzbeck	TRILOG Broadband Antenna	9163-419	Aug. 09, 2018 (2Y)
■ -	BBHA9120D	Schwarzbeck	Horn Antenna	1349	Jul. 16, 2019 (2Y)
☐ -	BBHA9170	Schwarzbeck	Horn Antenna	BBHA91700179	Jan. 16, 2019 (2Y)
■ -	SCU18F	Rohde & Schwarz	Pre-Amplifier	180117	July 11, 2019 (1Y)

All test equipment used is calibrated on a regular basis

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9.4 Test data

9.4.1 Field Strength of Fundamental

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

Humidity Level : 54 % R.H. Temperature: 22 ℃

Limits apply to : FCC CFG 47, PART 15, SUBPART C, SECTION 15.231(b)

Result : PASSED

EUT : Smart Key Fob Date: February 04, 2020

Operating Condition : TX mode

Distance : 3 m

Frequency (MHz)	Reading (dBμV)	Detector Mode	Ant. Pol. (H/V)	Ant. Factor	Cable Loss	Amp Gain	Duty Factor	Total (dBμV/m)	Limits (dBμV/m)	Margin (dB)
433.92	99.24	Peak	H	16.30	2.00	32.40	0.00	85.14	100.83	15.69
	98.82	Avg	H				9.68	75.04	80.83	5.79
	87.01	Peak	V				0.00	72.91	100.83	27.92
	86.61	Avg	V				9.68	62.83	80.83	18.00

Remark : “H”: Horizontal, “V”: Vertical

Total (dBμV/m) = Reading (dBμV) + Ant Factor (dB) + Cable Loss (dB) – Amp Gain (dB) – Duty Factor (dB)

Margin (dB) = Limits (dBμV/m) - Total (dBμV/m)

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9.4.2 Spurious Emission Test

9.4.2.1 Test data for 9 kHz to 30 MHz

-. Test Date : February 04, 2020

-. Resolution bandwidth : 200 Hz (from 9 kHz to 0.15 MHz), 9 kHz (from 0.15 MHz to 30 MHz)

-. Frequency range : 9 kHz ~ 30 MHz

-. Measurement distance : 3 m

Frequency (MHz)	Reading (dBµV)	Ant. Pol. (H/V)	Ant. Height (m)	Angle (°)	Ant. Factor (dB/m)	Cable Loss	Emission Level(dBµV/m)	Limits (dBµV/m)	Margin (dB)
All emissions observed were 20 dB below the limit.									

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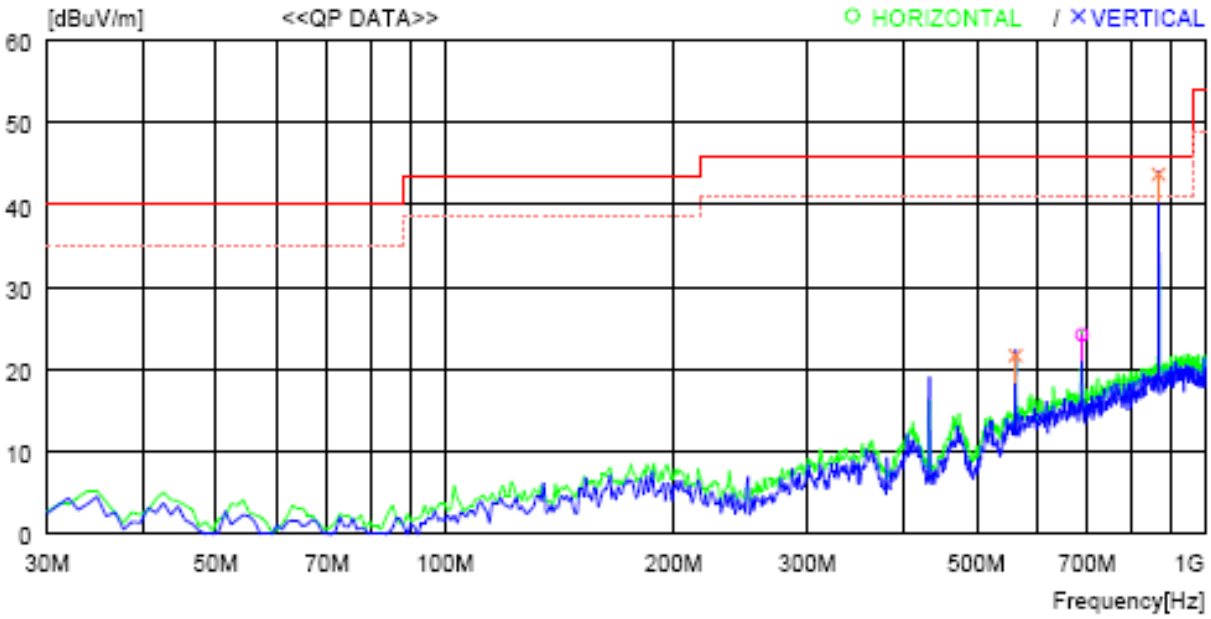
9.4.2.2 Test data for 30 MHz to 1 000 MHz

-. Test Date : February 04, 2020

-. Resolution bandwidth : 120 kHz

-. Frequency range : 30 MHz ~ 1 000 MHz

-. Measurement distance : 3 m



No.	FREQ [MHz]	READING QP [dBuV]	ANT FACTOR [dB]	LOSS [dB]	GAIN [dB]	RESULT [dBuV/m]	LIMIT [dBuV/m]	MARGIN [dB]	ANTENNA [cm]	TABLE [DEG]
----- Horizontal ------										
1	687.655	32.9	**20.8**	3.4	32.9	24.2	46.0	21.8	400	359
----- Vertical ------										
2	562.529	32.7	**19.1**	2.9	33.0	21.7	46.0	24.3	100	90
3	868.070	48.6	**22.9**	4.4	32.2	43.7	46.0	2.3	100	90

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9.4.2.3 Test data for above 1 GHz

-. Test Date : February 04, 2020

-. Resolution bandwidth : 1 MHz for Peak and Average Mode

-. Video bandwidth : 1 MHz for Peak and Average Mode

-. Frequency range : 1 GHz ~ 40 GHz

-. Measurement distance : 3 m

-.Operating mode : Transmitting mode

Frequency (GHz)	Reading (dBµV)	Detector Mode	Ant. Pol. (H/V)	Ant. Factor	Cable Loss	Amp Gain	Duty Factor	Total (dBµV/m)	Limits (dBµV/m)	Margin (dB)
1 301.76	47.09	Peak	H	25.70	3.70	40.10	0.00	36.39	80.83	44.44
1 301.76	42.95	Average	H				9.68	22.57	60.83	38.26
1 301.76	42.58	Peak	V				0.00	31.88	80.83	48.95
1 301.76	36.83	Average	V				9.68	16.45	60.83	44.38
1 735.68	52.74	Peak	H	25.10	4.30	40.70	0.00	41.44	80.83	39.39
1 735.68	50.23	Average	H				9.68	29.25	60.83	31.58
1 735.68	52.37	Peak	V				0.00	41.07	80.83	39.76
1 735.68	50.15	Average	V				9.68	29.17	60.83	31.66
2 169.60	49.63	Peak	H	27.50	4.80	41.20	0.00	40.73	80.83	40.10
2 169.60	45.36	Average	H				9.68	26.78	60.83	34.05
2 169.60	48.80	Peak	V				0.00	39.90	80.83	40.93
2 169.60	44.12	Average	V				9.68	25.54	60.83	35.29
2 603.52	49.93	Peak	H	27.40	5.20	41.50	0.00	41.03	80.83	39.80
2 603.52	46.13	Average	H				9.68	27.55	60.83	33.28
2 603.52	48.81	Peak	V				0.00	39.91	80.83	40.92
2 603.52	44.90	Average	V				9.68	26.32	60.83	34.51
3 037.44	52.87	Peak	H	28.50	5.60	41.60	0.00	45.37	80.83	35.46
3 037.44	50.32	Average	H				9.68	33.14	60.83	27.69
3 037.44	51.84	Peak	V				0.00	44.34	80.83	36.49
3 037.44	49.12	Average	V				9.68	31.94	60.83	28.89
3 471.36	51.38	Peak	H	28.90	6.00	41.10	0.00	45.18	80.83	35.65
3 471.36	48.98	Average	H				9.68	33.10	60.83	27.73
3 471.36	45.83	Peak	V				0.00	39.63	80.83	41.20
3 471.36	42.96	Average	V				9.68	27.08	60.83	33.75

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Frequency (GHz)	Reading (dBμV)	Detector Mode	Ant. Pol. (H/V)	Ant. Factor	Cable Loss	Amp Gain	Duty Factor	Total (dBμV/m)	Limits (dBμV/m)	Margin (dB)
3 905.28	56.64	Peak	H	29.60	6.50	41.10	0.00	51.64	80.83	29.19
3 905.28	55.31	Average	H				9.68	40.63	60.83	20.20
3 905.28	54.17	Peak	V				0.00	49.17	80.83	31.66
3 905.28	52.43	Average	V				9.68	37.75	60.83	23.08
4 339.20	62.26	Peak	H	30.40	7.00	41.20	0.00	58.46	80.83	22.37
4 339.20	61.35	Average	H				9.68	47.87	60.83	12.96
4 339.20	60.04	Peak	V				0.00	56.24	80.83	24.59
4 339.20	58.97	Average	V				9.68	45.49	60.83	15.34
4 773.12	60.43	Peak	H	31.20	7.10	41.20	0.00	57.53	80.83	23.30
4 773.12	59.26	Average	H				9.68	46.68	60.83	14.15
4 773.12	58.64	Peak	V				0.00	55.74	80.83	25.09
4 773.12	57.55	Average	V				9.68	44.97	60.83	15.86

Remark : “H”: Horizontal, “V”: Vertical

Total (dBμV/m) = Reading (dBμV) + Ant Factor (dB) + Cable Loss (dB) – Amp Gain (dB) – Duty Factor (dB)

Margin (dB) = Limits (dBμV/m) - Total (dBμV/m)

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9.5 Restricted Band Test

-. Test Date : February 04, 2020

-. Resolution bandwidth : 1 MHz for Peak and Average Mode

-. Video bandwidth : 1 MHz for Peak and Average Mode

-. Frequency range : 1 GHz ~ 40 GHz

-. Measurement distance : 3 m

-.Operating mode : Transmitting mode

Frequency (GHz)	Reading (dBμV)	Detector Mode	Ant. Pol. (H/V)	Ant. Factor	Cable Loss	Amp Gain	Duty Factor	Total (dBμV/m)	Limits (dBμV/m)	Margin (dB)
1 301.71	47.13	Peak	H	25.70	3.70	40.10	0.00	36.43	74.00	37.57
1 301.71	42.50	Average	H				9.68	22.12	54.00	31.88
1 301.71	43.37	Peak	V				0.00	32.67	74.00	41.33
1 301.71	36.43	Average	V				9.68	16.05	54.00	37.95
4 339.66	62.19	Peak	H	30.40	7.00	41.20	0.00	58.39	74.00	15.61
4 339.66	60.74	Average	H				9.68	47.26	54.00	6.74
4 339.66	59.74	Peak	V				0.00	55.94	74.00	18.06
4 339.66	58.14	Average	V				9.68	44.66	54.00	9.34
4 773.05	60.03	Peak	H	31.20	7.10	41.20	0.00	57.13	74.00	16.87
4 773.05	58.85	Average	H				9.68	46.27	54.00	7.73
4 773.05	58.51	Peak	V				0.00	55.61	74.00	18.39
4 773.05	57.19	Average	V				9.68	44.61	54.00	9.39

Remark : “H”: Horizontal, “V”: Vertical

Total (dBμV/m) = Reading (dBμV) + Ant Factor (dB) + Cable Loss (dB) – Amp Gain (dB) – Duty Factor (dB)

Margin (dB) = Limits (dBμV/m) - Total (dBμV/m)

Tested by: Sieon Lee / Assistant Manager

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