

ELECTROMAGNETIC EMISSION COMPLIANCE REPORT FOR LOW POWER TRANSMITTER BELOW 1 705 kHz

Test Report No. : W167R-D029
AGR No. : A164A-026R
Applicant : SEOYON ELECTRONICS CO., LTD.
Address : 424, Sinwon-ro, Danwon-gu, Ansan-Si, Kyonggi-Do, South Korea
Manufacturer : SEOYON ELECTRONICS CO., LTD.
Address : 424, Sinwon-ro, Danwon-gu, Ansan-Si, Kyonggi-Do, South Korea
Type of Equipment : UNIT ASSY – SMART KEY
FCC ID : NYOSYECSMK1608
Model No. : SYECSMK1608
Serial number : N/A
Total page of Report : 18 pages (including this page)
Date of Incoming : April 11, 2016
Date of issuing : July 08, 2016

SUMMARY

The equipment complies with the regulation; *FCC PART 15 SUBPART C § 15.209*

This test report contains only the result of a single test of the sample supplied for the examination. It is not a general valid assessment of the features of the respective products of the mass-production.

Reviewed by: 

 Ki-Hong, Nam / Asst, Chief Engineer
 ONETECH Corp.

Approved by: 

 Sung-Ik, Han/ Managing Director
 ONETECH Corp.

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1. VERIFICATION OF COMPLIANCE

APPLICANT : SEOYON ELECTRONICS CO., LTD.
 ADDRESS : 424, Sinwon-ro, Danwon-gu, Ansan-Si, Kyonggi-Do, South Korea
 CONTACT PERSON : KEUNSU KIM / Assistant Manager
 TELEPHONE NO : +82-31-420-3489
 FCC ID : NYOSYECSMK1608
 MODEL NAME : SYECSMK1608
 BRAND NAME : HYUNDAI, KIA
 SERIAL NUMBER : N/A
 DATE : July 08, 2016

EQUIPMENT CLASS	CYY - Communications Receiver used w/ Pt 15 Tx
E.U.T. DESCRIPTION	UNIT ASSY – SMART KEY-SUPERHETRODYNE RECEIVER
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 FCC RULES PART(S)	FCC PART 15 SUBPART C § 15.209
MODIFICATIONS ON THE EQUIPMENT TO ACHIEVE COMPLIANCE	None
FINAL TEST WAS CONDUCTED ON	3 m, Semi Anechoic Chamber and 10 m open area test site

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.

2. GENERAL INFORMATION

2.1 Product Description

The SEOYON ELECTRONICS CO., LTD., Model SYEC3SMK1608 (referred to as the EUT in this report) is a receiver that is fixed inside the vehicle and receives the signal from the transmitter, Model: SYEC3FOB1608 has FCC ID: NYOSYEC3FOB1608, IC certification No.: 3109A-SYEC3FOB1608 which was manufactured by SEOYON ELECTRONICS CO., LTD., and then decided locking and unlocking the door of the vehicle. The product specification described herein was obtained from product data sheet or user's manual.

CHASSIS TYPE	Plastic
RECEIVING FREQUENCY	433.92 MHz
TRANSMITTING FREQUENCY	134.2 kHz
LIST OF EACH OSC. OR CRY. FREQ.(FREQ.>= 1 MHz)	40.66 MHz
ANTENNA TYPE	External Antenna, Internal Antenna
RATED SUPPLY VOLTAGE	DC 12.0 V
OPERATING VOLTAGE	DC 9 V ~ DC 16 V
NUMBER OF LAYERS	4 Layers

2.2 Model Differences:

-. None

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 FCC PART 15 SUBPART C, section 15.209

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 (301-14, Daessangnyeong-ri, Chowol-eup, Gwangju-si, Gyeonggi-do, 464-862 Korea.)

-. Site Filing:

VCCI (Voluntary Control Council for Interference) – Registration No. R-4112/ C-4617/ G-666/ T-1842

IC (Industry Canada) – Registration No. Site# 3736-3

-. Site Accreditation:

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

FCC (Federal Communications Commission) - Accreditation No. KR0013

RRA (Radio Research Agency) – Designation No. KR0013

3. SYSTEM TEST CONFIGURATION

3.1 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	SEOYON ELECTRONICS CO., LTD.	SMK 2.7 V3.0	N/A

3.2 Peripheral equipment

-. None

3.3 Mode of operation during the test

-. The EUT was operated with receiving mode continuously during the test.

3.4 Equipment Modifications

-. None

3.5 Configuration of Test System

- Line Conducted Test:** It is not need to test this requirement, because the power of the EUT supplies from a car battery.
- Radiated Emission Test:** Preliminary radiated emissions tests were conducted using the procedure in ANSI C63.10: 2013 to determine the worse operating conditions. Final radiated emission tests were conducted at 3 m semi anechoic chamber and 3 m 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.
- Coherent Test:** During Radiated Emission Tests, the EUT was operated with standby mode of receiving condition.
- Antenna Power Conduction Test:** This equipment was only with a permanently attached antenna, so the radiated emission measurement was performed with this condition.

4. PRELIMINARY TEST

4.1 AC Power line Conducted Emissions Tests

During Preliminary Tests, the following operating mode was investigated

Operation Mode	The Worse operating condition (Please check one only)
It is not need to test this requirement, because the power of the EUT is supplied from a car battery.	

4.2 Radiated Emissions Tests

During Preliminary Tests, the following operating modes were investigated

Operation Mode	The Worse operating condition (Please check one only)
TX mode	X
RX mode	X

5. FINAL RESULT OF MEASUREMENT

Preliminary test was done in normal operation mode. And the final measurement was selected for the maximized emission level.

Radiated emission electric field intensity, 30 MHz ~ 300 MHz : ± 4.43 dB

Radiated emission electric field intensity, 300 MHz ~ 1 000 MHz : ± 3.80 dB

Measurement uncertainty is calculated in accordance with CISPR 16-4-2. The measurement uncertainty is given with a confidence of 95 % with the coverage factor, $k = 2$.

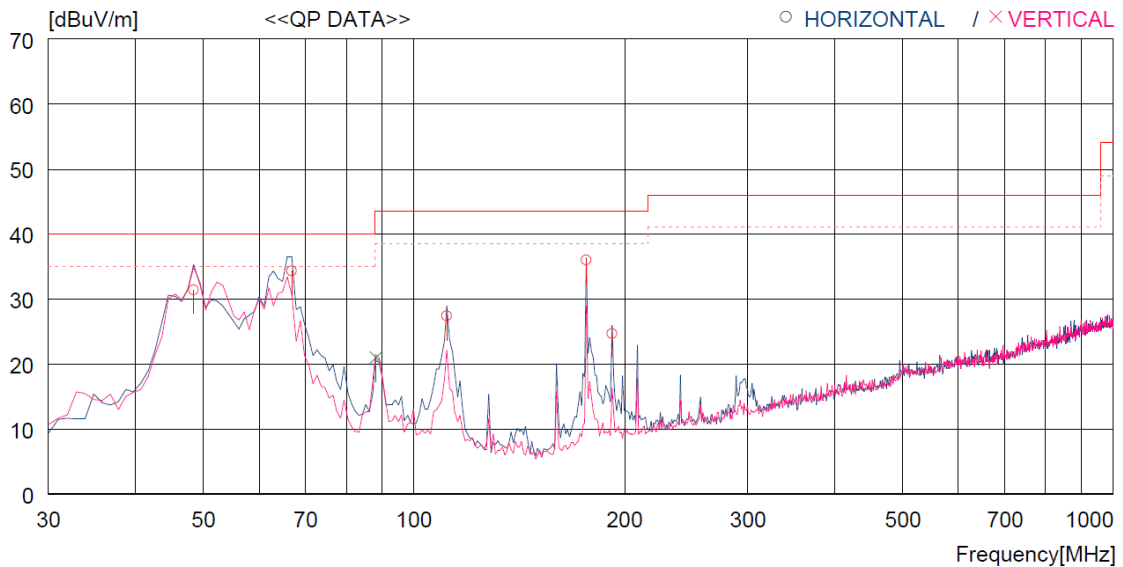
5.1 Radiated Emission Test for External Antenna

5.1.2 Test data for 30 MHz to 1 000 MHz

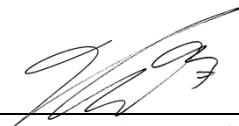
The following table shows the highest levels of radiated emission on both polarizations of horizontal and vertical.

Humidity Level	: <u>48.2 % R.H.</u>	Temperature: <u>23.4 °C</u>
Limits apply to	: <u>FCC CFR 47, Part 15, Subpart C (Section: 15.209)</u>	
Detector	: <u>CISPR Quasi-Peak (6 dB Bandwidth: 120 kHz)</u>	
Type of Test	: <u>Low Power Transmitter below 1 705 kHz</u>	
Result	: <u>PASSED</u>	

EUT	: UNIT ASSY – SMART KEY	Date: May 09, 2016
Operating Condition	: TX mode	
Distance	: 3 m	
Frequency Range	: 30 MHz ~ 1 000 MHz	
Test was conducted on	: 3 m semi anechoic chamber	



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	66.860	54.2	10.9	2.3	33.1	34.3	40.0	5.7	300	359
2	48.430	48.6	13.8	2.0	33.0	31.4	40.0	8.6	300	162
3	111.480	46.8	11.0	2.9	33.3	27.4	43.5	16.1	300	153
4	176.470	55.8	9.5	3.6	32.9	36.0	43.5	7.5	200	138
5	191.990	43.5	10.3	3.7	32.8	24.7	43.5	18.8	100	359
----- Vertical -----										
6	88.200	42.1	9.6	2.6	33.3	21.0	43.5	22.5	100	0


Tested by: Seok-Jun, Lee / Engineer

5.1.2 Test data for Blow 30 MHz


- Test Date : July 08, 2016
- 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 : 10 m
- Test was conducted on : 10 m open area test site

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)
0.019	34.28	H	1	180	21.54	0.12	55.94	101.1	45.16
0.031	25.78	H	1	360	19.43	0.12	45.33	96.9	51.57
0.048	33.23	H	1	360	18.95	0.14	52.32	93.1	40.78
0.134 2	60.69	H	1	360	19.03	0.19	79.91	84.1	4.19
0.264	39.13	H	1	180	19.01	0.21	58.35	78.3	19.95
0.443	40.02	H	1	180	18.94	0.23	59.19	73.8	14.61

5.1.3 Test data for above 1 GHz

- Test Date : July 07, 2016
- Resolution bandwidth : 1 MHz
- Frequency range : 1 GHz ~ 2 GHz
- Measurement distance : 3 m
- Test was conducted on : 3 m open area test site

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)
Any emissions less than 20 dB below the limit were not observed.									



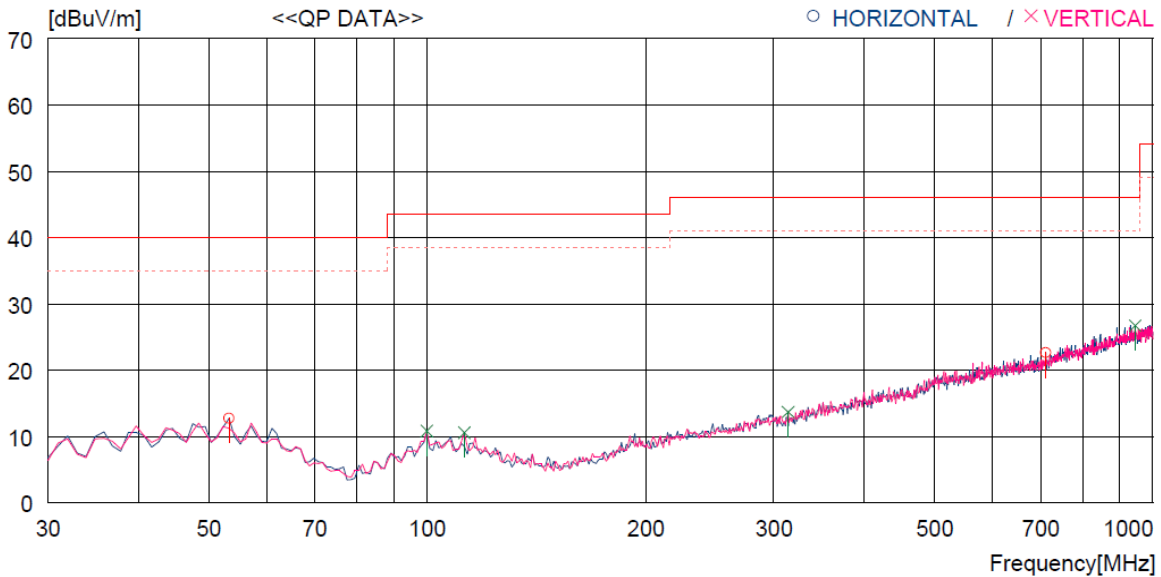
Tested by: Seok-Jun, Lee / Engineer

5.1.4 Test data for 30 MHz to 1 000 MHz RX Mode


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

Humidity Level : 48.2 % R.H. Temperature: 23.4 °C
 Limits apply to : FCC CFR 47, Part 15, Subpart C (Section: 15.209)
 Detector : CISPR Quasi-Peak (6 dB Bandwidth: 120 kHz)
 Type of Test : Low Power Transmitter below 1 705 kHz
 Result : PASSED

EUT : UNIT ASSY – SMART KEY Date: May 09, 2016
 Operating Condition : RX mode
 Distance : 3 m
 Frequency Range : 30 MHz ~ 1 000 MHz
 Test was conducted on : 3 m semi anechoic chamber



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	53.280	30.0	13.6	2.1	33.0	12.7	40.0	27.3	200	12
2	711.905	29.2	19.8	7.3	33.7	22.6	46.0	23.4	100	0
----- Vertical -----										
3	99.840	29.5	11.9	2.7	33.3	10.8	43.5	32.7	200	282
4	112.450	30.0	10.9	3.0	33.3	10.6	43.5	32.9	200	0
5	314.210	27.8	13.9	4.7	32.7	13.7	46.0	32.3	300	359
6	944.698	28.0	22.5	8.6	32.4	26.7	46.0	19.3	300	359



Tested by: Seok-Jun, Lee / Engineer

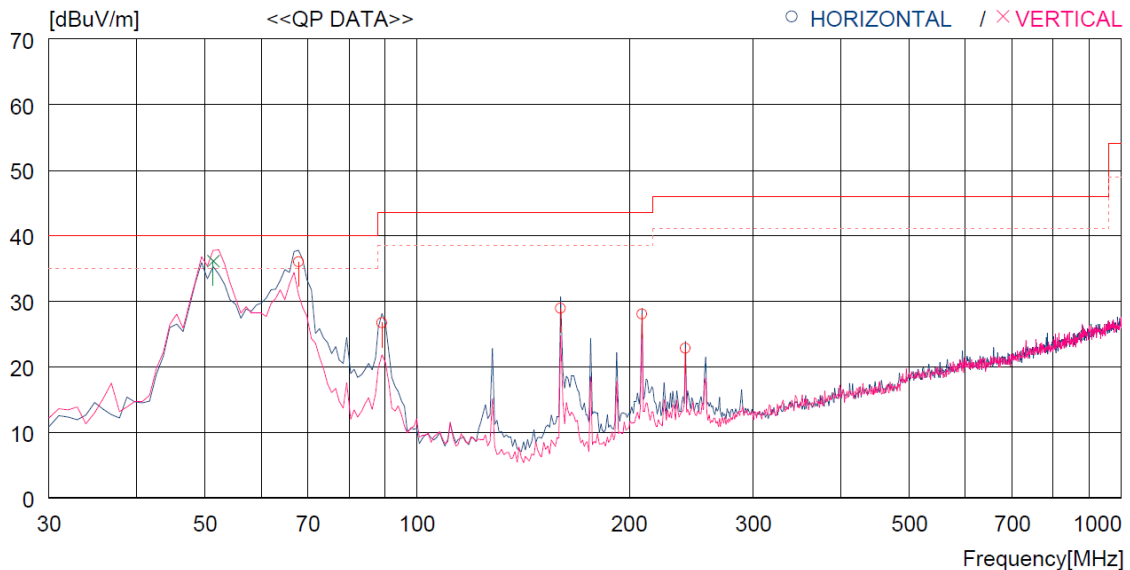
5.2 Radiated Emission Test for Internal Antenna

5.2.2 Test data for 30 MHz to 1 000 MHz

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

Humidity Level : 48.2 % R.H. Temperature: 23.4 °C
 Limits apply to : FCC CFR 47, Part 15, Subpart C (Section: 15.209)
 Detector : CISPR Quasi-Peak (6 dB Bandwidth: 120 kHz)
 Type of Test : Low Power Transmitter below 1 705 kHz
 Result : PASSED

EUT : UNIT ASSY – SMART KEY Date: May 09, 2016
 Operating Condition : TX mode
 Distance : 3 m
 Frequency Range : 30 MHz ~ 1 000 MHz
 Test was conducted on : 3 m semi anechoic chamber



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	67.830	56.5	10.3	2.3	33.1	36.0	40.0	4.0	300	0
2	89.170	47.5	9.9	2.6	33.3	26.7	43.5	16.8	200	359
3	159.980	50.2	8.3	3.4	33.0	28.9	43.5	14.6	200	124
4	208.480	46.5	10.5	3.8	32.8	28.0	43.5	15.5	100	0
5	240.490	39.8	11.8	4.0	32.8	22.8	46.0	23.2	100	201
----- Vertical -----										
6	51.340	53.2	13.9	2.0	33.0	36.1	40.0	3.9	100	87

(Signature)
Tested by: Seok-Jun, Lee / Engineer

5.2.2 Test data for Blow 30 MHz


- Test Date : July 08, 2016
- 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 : 10m
- Test was conducted on : 10 m open area test site

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)
0.016	31.78	H	1	180	21.54	0.12	53.44	102.6	49.16
0.029	27.59	H	1	180	19.43	0.12	47.14	97.4	50.26
0.050	30.44	H	1	180	18.95	0.14	49.53	92.7	43.17
0.134 2	61.58	H	1	360	19.03	0.19	80.80	84.1	3.30
0.261	32.15	H	1	360	19.01	0.21	51.37	78.4	27.03
0.441	36.52	H	1	180	18.94	0.23	55.69	73.8	18.11

5.2.3 Test data for above 1 GHz

- Test Date : July 07, 2016
- Resolution bandwidth : 1 MHz
- Frequency range : 1 GHz ~ 2 GHz
- Measurement distance : 3 m
- Test was conducted on : 3 m open area test site

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)
Any emissions less than 20 dB below the limit were not observed.									



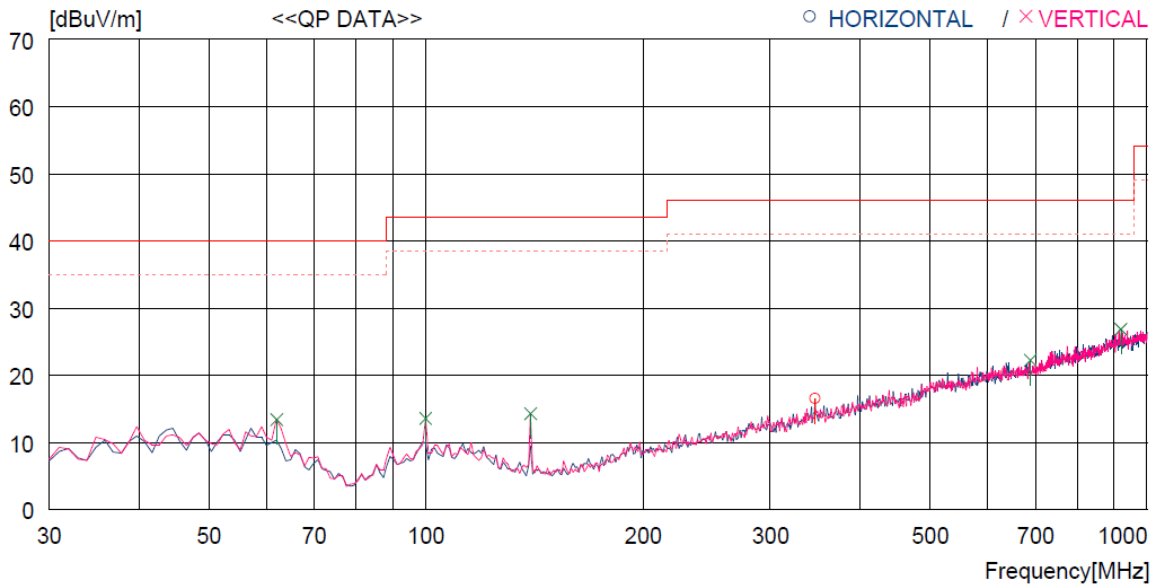
Tested by: Seok-Jun, Lee / Engineer

5.2.4 Test data for 30 MHz to 1 000 MHz RX Mode

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

Humidity Level : 48.2 % R.H. Temperature: 23.4 °C
 Limits apply to : FCC CFR 47, Part 15, Subpart C (Section: 15.209)
 Detector : CISPR Quasi-Peak (6 dB Bandwidth: 120 kHz)
 Type of Test : Low Power Transmitter below 1 705 kHz
 Result : PASSED

EUT : UNIT ASSY – SMART KEY Date: May 09, 2016
 Operating Condition : RX mode
 Distance : 3 m
 Frequency Range : 30 MHz ~ 1 000 MHz
 Test was conducted on : 3 m semi anechoic chamber



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	346.220	29.7	14.4	5.0	32.6	16.5	46.0	29.5	400	257
----- Vertical -----										
2	62.010	31.6	12.7	2.2	33.1	13.4	40.0	26.6	100	79
3	99.840	32.4	11.8	2.7	33.3	13.6	43.5	29.9	100	252
4	139.610	36.3	7.9	3.2	33.1	14.3	43.5	29.2	100	359
5	688.625	29.5	19.2	7.1	33.6	22.2	46.0	23.8	200	0
6	919.478	29.2	21.7	8.5	32.6	26.8	46.0	19.2	300	87

(Signature)

 Tested by: Seok-Jun, Lee / Engineer


5.3 Bandwidth of the operating frequency

Humidity Level : 47.6 % R.H. Temperature: 23.5°C
 Limits apply to : FCC CFR 47, PART 15, SUBPART C, SECTION 15.209
 Type of Test : Low Power Transmitter below 1 705 kHz

EUT : UNIT ASSY – SMART KEY Date: July 07, 2016
 Resolution Bandwidth : 0.3 kHz
 Video Bandwidth : 1.0 kHz
 SPAN : 10.00 kHz

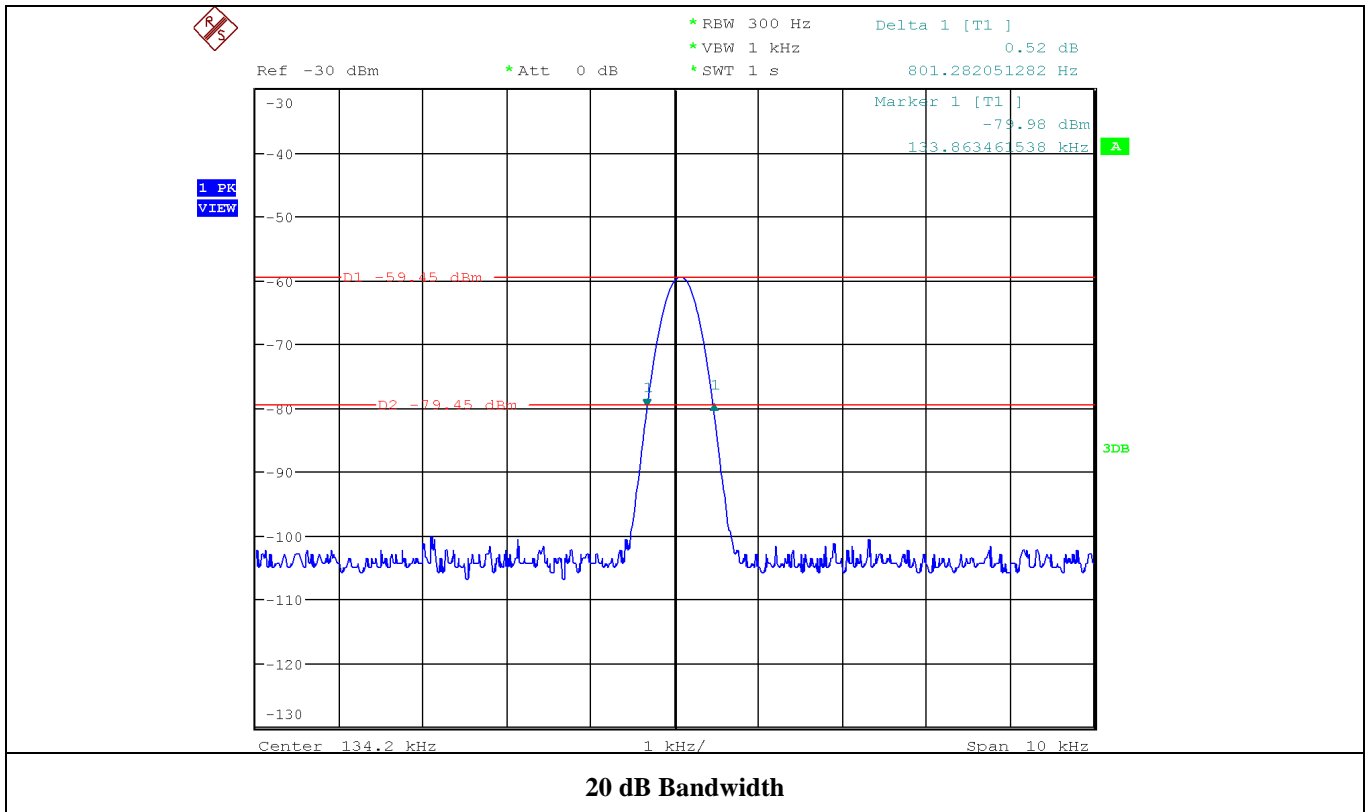
Carrier Freq. (kHz)	Bandwidth of the emission. (Hz)	Limit (kHz)	Remark
134.2	801	None	<u>The point 20 dB down from the modulated carrier</u>

Remark: Please refer to Photo Data for bandwidth for test data.



Tested by: Seok-Jun, Lee / Engineer

Photo Data for bandwidth



20 dB Bandwidth

6. FIELD STRENGTH CALCULATION

Meter readings are compared to the specification limit correcting for antenna and cable losses

+ Meter reading	(dB μ V)
+ Cable Loss	(dB)
+ Antenna Factor (Loss)	(dB/m)
- Amplifier Gain	(dB)
<hr/>	
= Corrected Reading	(dB μ V/m)
- Specification Limit	(dB μ V/m)
<hr/>	
= dB Relative to Spec	(\pm dB)

7. LIST OF TEST EQUIPMENT

No.	EQUIPMENTS	MFR.	MODEL	SER. NO.	LAST CAL	DUE CAL	USE
1.	Test receiver	R/S	ESCI	101013	Apr. 05, 2016	12MONTH	■
2.	Test Receiver	R/S	ESU	100261	Apr. 06, 2016	12MONTH	■
3.	Amplifier	Sonoma Instrument	310N	312544	Apr. 05, 2016	12MONTH	■
4.	Amplifier	Sonoma Instrument	310N	312545	Apr. 05, 2016	12MONTH	■
5.	TRILOG Broadband Antenna	Schwarzbeck	VULB9163	9163-255	May 20, 2016	24MONTH	■
6.	TRILOG Broadband Antenna	Schwarzbeck	VULB9163	9163-421	Apr. 15, 2016	24MONTH	■
7.	Controller	Innco System	CO2000	619/27030611/L	N/A	N/A	■
8.	Turn Table	Innco System	DT3000	930611	N/A	N/A	■
9.	Antenna Master	Innco System	MA4000-EP	3320611	N/A	N/A	■
10.	Antenna Master	Innco System	MA4000-EP	3350611	N/A	N/A	■
11.	Pre-Amplifier	R/S	SCU-18	102209	May 31, 2016	12MONTH	■
12.	Horn Antenna	Schwarzbeck	BBHA9120D	BBHA9120D295	Aug. 31, 2015	24MONTH	■
13.	Loop Antenna	R/S	HFH2-Z2	879285/26	Dec. 09, 2014	24MONTH	■
14.	Position Controller	HD GmbH	HD100	N/A	N/A	N/A	■
15.	Turn Table	HD GmbH	DS420S	N/A	N/A	N/A	■
16.	Isolation Transformer	Digitek Power	DPT	DPF-22027	N/A	N/A	■
17.	Isolation Transformer	Digitek Power	DPT	DPF-22028	N/A	N/A	■
18.	Frequency Converter	Digitek Power	VFS/DEFC	N/A	N/A	N/A	■