

Dates of Tests: Oct 15, 2020 ~ Oct 27, 2020
 Test Report S/N: LR500112010T
 Test Site : LTA CO., LTD.

CERTIFICATION OF COMPLIANCE

FCC ID.

2AXFW-ES-FF730G

APPLICANT

EPIC SYSTEMS CO., LTD.

| | | |
|----------------------------------|---|---------------------------------------------------|
| Manufacturing Description | : | Digital Door Lock |
| Manufacturer | : | EPIC SYSTEMS CO., LTD. |
| Model name | : | ES-FF730G |
| Test Device Serial No.: | : | Identical prototype |
| Rule Part(s) | : | FCC Part 15 Subpart C ; ANSI C63.10 - 2013 |
| Frequency Range | : | 13.56 MHz |
| Data of issue | : | October 28, 2020 |

This test report is issued under the authority of:



Ja-Beom Koo, Manager

The test was supervised by:



Eun-Hwan Jung, Test Engineer

This test result only responds to the tested sample. It is not allowed to copy this report even partly without the allowance of the test laboratory. The report must not be used by the client to claim product certification, approval, or endorsement by NVLAP, NIST, or any agency of the Federal Government.



NVLAP LAB Code.: 200723-0

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1. General information

1-1 Test Performed

Company name : LTA Co., Ltd.
 Address : 243, Jubug-ri, Yangji-Myeon, Youngin-Si, Kyunggi-Do, Korea. 17159
 Web site : <http://www.ltalab.com>
 E-mail : chahn@ltalab.com
 Telephone : +82-31-323-6008
 Facsimile : +82-31-323-6010

Quality control in the testing laboratory is implemented as per ISO/IEC 17025 which is the “General requirements for the competents of calibration and testing laboratory”.

1-2 Accredited agencies

LTA Co., Ltd. is approved to perform EMC testing by the following agencies:

| Agency | Country | Accreditation No. | Validity | Reference |
|--------|---------|-------------------|------------|-----------------------|
| NVLAP | U.S.A | 200723-0 | 2021-09-30 | ECT accredited Lab. |
| RRA | KOREA | KR0049 | - | EMC accredited Lab. |
| FCC | U.S.A | 649054 | 2021-04-11 | FCC CAB |
| VCCI | JAPAN | C-4948, | 2023-09-10 | VCCI registration |
| VCCI | JAPAN | T-2416, | 2023-09-10 | VCCI registration |
| VCCI | JAPAN | R-4483(10 m), | 2023-08-15 | VCCI registration |
| VCCI | JAPAN | G-847 | 2021-12-13 | VCCI registration |
| IC | CANADA | 5799A-1 | 2021-06-16 | IC filing |
| KOLAS | KOREA | NO.551 | 2021-08-20 | KOLAS accredited Lab. |

2. Information about test item

2-1 Client & Manufacturer

Client Company name : EPIC SYSTEMS CO., LTD.
 Address : Technology Development Center RM. 406, Gyeonggi Technopark, 705,
 Haean-ro, Sangnok-gu, Ansan-si, Gyeonggi-do, Republic Of Korea
 Tel / Fax : + 82-070-4741-1025 / + 82-031-481-8116
 Manufacturer : EPIC SYSTEMS CO., LTD.
 Address : Technology Development Center RM. 406, Gyeonggi Technopark, 705,
 Haean-ro, Sangnok-gu, Ansan-si, Gyeonggi-do, Republic Of Korea
 Tel / Fax : + 82-070-4741-1025 / + 82-031-481-8116

2-2 Equipment Under Test (EUT)

Model name : ES-FF730G
 Variant Model name : ES-FF730 Gold. ES-FF730 24K Gold plating
 Serial number : Identical prototype
 Date of receipt : Oct 13, 2020
 EUT condition : Pre-production, not damaged
 Antenna type : Pattern Antenna
 Frequency Range : 13.56 MHz
 Type of Modulation : FSK
 Power Source : DC 6 V

2-3 Tested frequency

| | LOW | MID | HIGH |
|---------------------|-----|-------|------|
| Frequency (MHz) BLE | | 13.56 | |

2-4 Ancillary Equipment

| Equipment | Model No. | Serial No. | Manufacturer |
|-----------|-----------|------------|--------------|
| - | - | - | - |

3. Test Report

3.1 Summary of tests

| FCC Part Section(s) | Parameter | Test Condition | Status (note 1) |
|------------------------------|------------------------|----------------|--------------------|
| 15.209 15.225(a)(b)(c)(d) | Radiated Emission | Radiated | C |
| 15.225(e) | Frequency Tolerance | | C |
| 15.215(c) | 20dB Bandwidth | | C |
| 15.207 | AC Conducted Emissions | Conducted | N/A |
| 15.203 | Antenna requirement | - | C |

N/A : This product is battery-enabled and excludes the test.

The above equipment was tested by LTA Co., Ltd. The test data, data evaluation, test procedures, and equipment configurations shown in this report were made in accordance with the procedures given in ANSI C63.10-2013 and the energy emitted by the sample EUT tested as described in this report is in compliance with the requirements of FCC Rules Part 2 and Part 15.247. The test results of this report relate only to the tested sample identified in this report.

The tests were performed according to the method of measurements prescribed in KDB No.558074.

→ Antenna Requirement

EPIC SYSTEMS CO., LTD. FCC ID: 2AXFW-ES-FF730G unit complies with the requirement of §15.203.
The antenna type is FPCB Antenna

3.2 Technical Characteristics Test

3.2.1 Radiated Spurious Emissions

Procedure:

Radiated emissions from 30 MHz to 25 GHz were measured according to the methods defined in ANSI C63.10-2013.

The EUT is placed on a turn table. For emissions testing at or below 1 GHz, the table height shall be 0.8 m above the reference ground plane. For emission measurements above 1 GHz, the table height shall be 1.5 m. The turn table shall rotate 360 degrees to determine the position of maximum emission level. EUT is set 3m away from the receiving antenna which varied from 1m to 4m to find out the highest emission. And also, each emission was to be maximized by changing the polarization of receiving antenna both horizontal and vertical. In order to find out the max. emission, the relative positions of this hand-held transmitter (EUT) was rotated through three orthogonal axes and measurement procedures for electric field radiated emissions above 1 GHz the EUT measurement is to be made "while keeping the antenna in the 'cone of radiation' from that area and pointed at the area both in azimuth and elevation, with polarization oriented for maximum response." is still within the 3dB illumination BW of the measurement antenna.

The spectrum analyzer is set to:

Center frequency = the worst channel

Frequency Range = 9 kHz ~ 10th harmonic.

RBW = 120 kHz (30 MHz ~ 1 GHz)

VBW \geq RBW

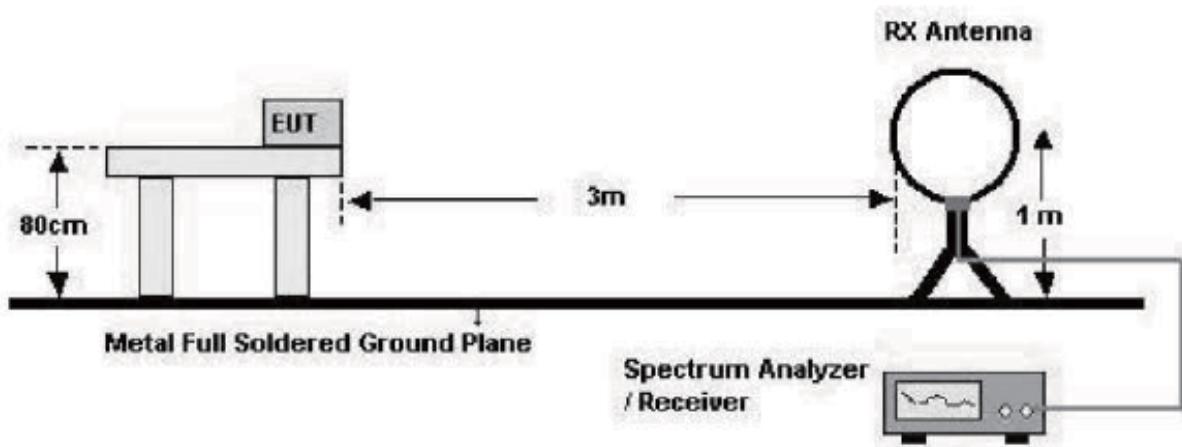
= 1 MHz (1 GHz ~ 10th harmonic)

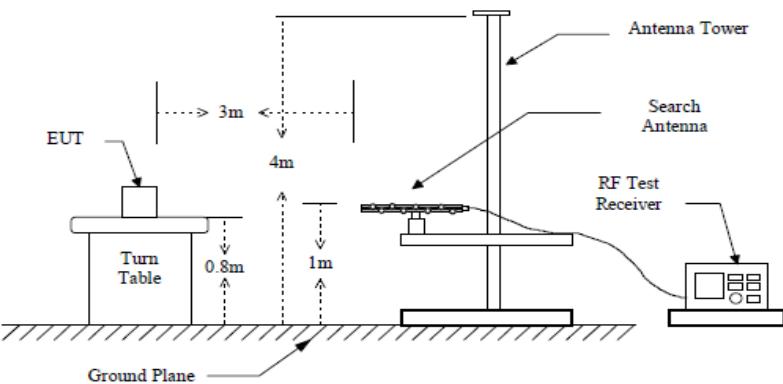
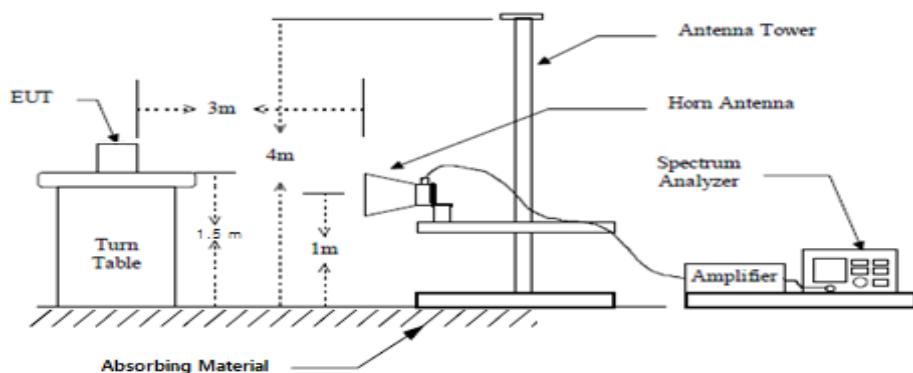
Trace = max hold

Detector function = peak

Sweep = auto

below 30 MHz



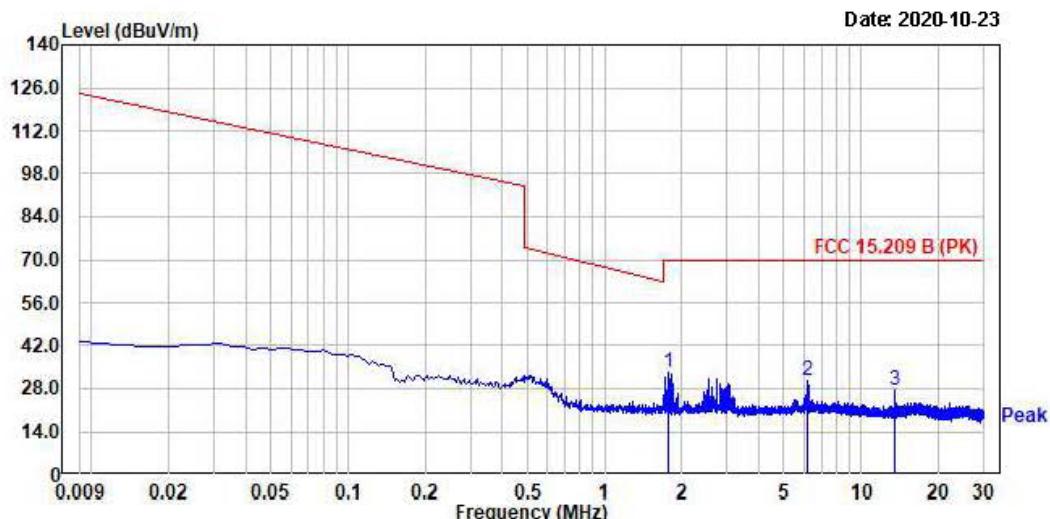
below 1 GHz (30 MHz to 1 GHz)**above 1 GHz****Measurement Data: Complies**

- See next pages for actual measured data.
- No other emissions were detected at a level greater than 20 dB below limit include from 9 kHz to 30MHz.
- The test results for the worst of the various operating modes are presented in accordance with 6.3.4 of ANSI C63.10.
- Checked with a red circle is the fundamental frequency.

Minimum Standard: FCC Part 15.209(a)

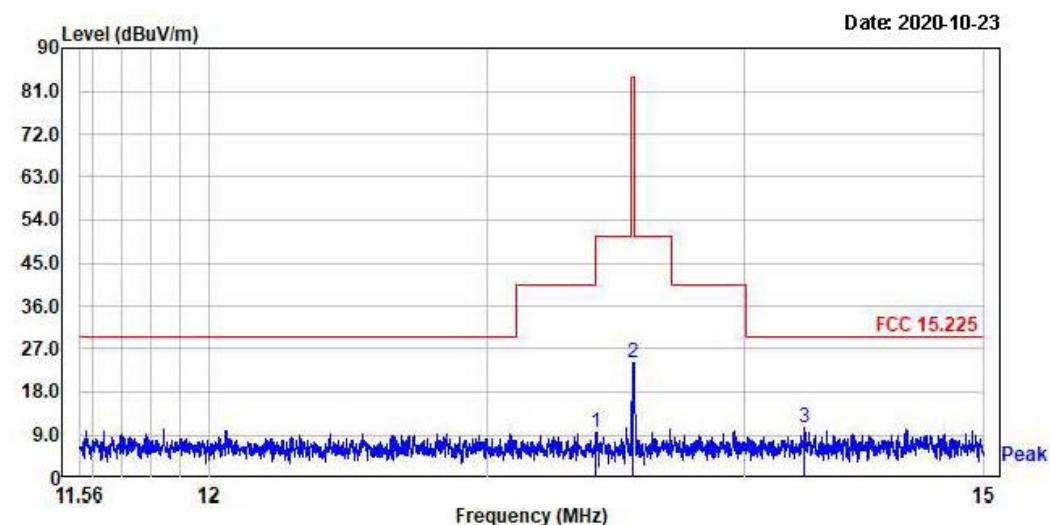
| Frequency (MHz) | Limit (uV/m) @ 3 m |
|------------------------|---------------------------|
| 0.009 ~ 0.490 | 2400/F(kHz) (@ 300 m) |
| 0.490 ~ 1.705 | 24000/F(kHz) (@ 30 m) |
| 1.705 ~ 30 | 30(@ 30 m) |
| 30 ~ 88 | 100 ** |
| 88 ~ 216 | 150 ** |
| 216 ~ 960 | 200 ** |
| Above 960 | 500 |

** Except as provided in 15.209(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. 15.231 and 15.241.

Radiated Emissions

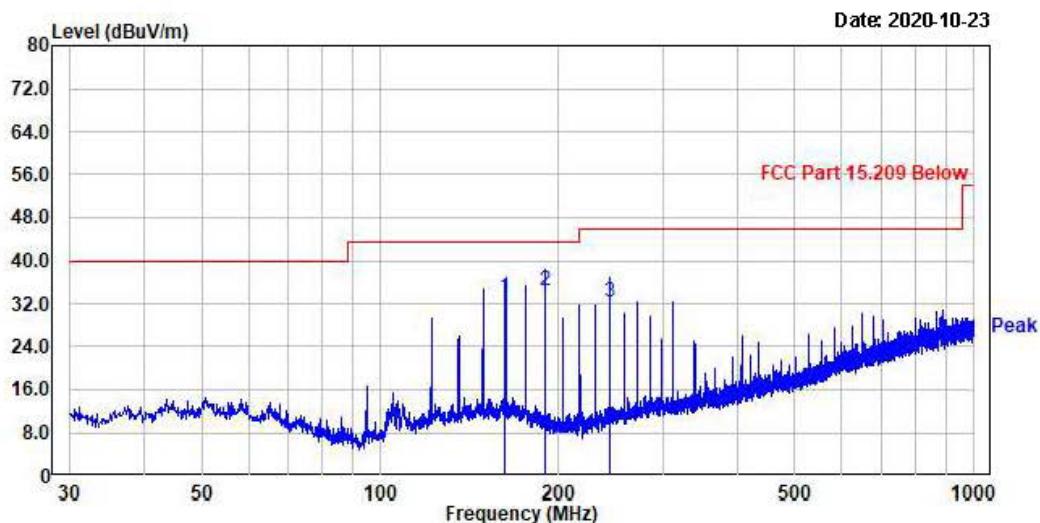
| No. | Freq | Reading | C.F | Result | Limit | Margin | Height | Angle | Polarity |
|-----|-------|------------|--------|--------------|--------------|--------|--------|-------|------------|
| | MHz | dB μ V | dB | dB μ V/m | dB μ V/m | dB | cm | deg | |
| 1. | 1.77 | 64.85 | -31.77 | 33.08 | 70.00 | 36.92 | 100 | 0 | horizontal |
| 2. | 6.20 | 62.10 | -31.54 | 30.56 | 70.00 | 39.44 | 100 | 0 | horizontal |
| 3. | 13.57 | 58.90 | -31.23 | 27.67 | 70.00 | 42.33 | 100 | 0 | horizontal |

Remarks: C.F (Correction Factor) = Antenna factor + Cable loss - Preamp gain



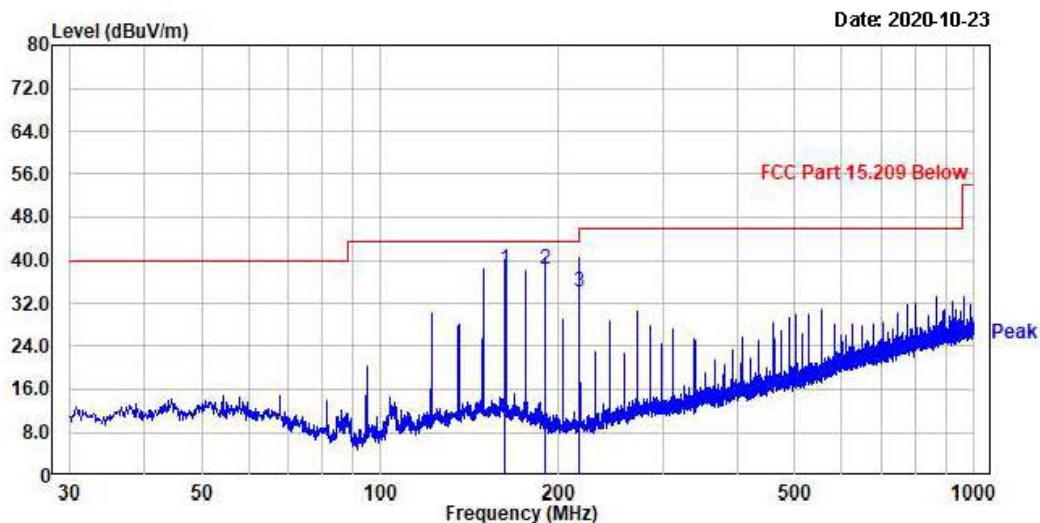
| No. | Freq | Reading | C.F | Result | Limit | Margin | Height | Angle | Polarity |
|-----|-------|------------|--------|--------------|--------------|--------|--------|-------|------------|
| | MHz | dB μ V | dB | dB μ V/m | dB μ V/m | dB | cm | deg | |
| 1. | 13.42 | 40.90 | -31.23 | 9.67 | 50.50 | 40.83 | 100 | 0 | horizontal |
| 2. | 13.56 | 55.32 | -31.23 | 24.09 | 84.00 | 59.91 | 100 | 0 | horizontal |
| 3. | 14.24 | 41.76 | -31.21 | 10.55 | 29.54 | 18.99 | 100 | 0 | horizontal |

Remarks: C.F (Correction Factor) = Antenna factor + Cable loss - Preamp gain



| No. | Freq | Reading | C.F | Result | Limit | Margin | Height | Angle | Polarity |
|-----|--------|------------|--------|--------------|--------------|--------|--------|-------|------------|
| | MHz | dB μ V | dB | dB μ V/m | dB μ V/m | dB | cm | deg | |
| 1. | 162.65 | 49.95 | -16.86 | 33.09 | 43.52 | 10.43 | 100 | 100 | horizontal |
| 2. | 189.81 | 53.94 | -19.62 | 34.32 | 43.52 | 9.20 | 100 | 302 | horizontal |
| 3. | 244.01 | 50.37 | -18.16 | 32.21 | 46.02 | 13.81 | 100 | 116 | horizontal |

Remarks: C.F (Correction Factor) = Antenna factor + Cable loss - Preamp gain



| No. | Freq | Reading | C.F | Result | Limit | Margin | Height | Angle | Polarity |
|-----|--------|------------|--------|--------------|--------------|--------|--------|-------|----------|
| | MHz | dB μ V | dB | dB μ V/m | dB μ V/m | dB | cm | deg | |
| 1. | 162.65 | 55.34 | -16.86 | 38.48 | 43.52 | 5.04 | 100 | 356 | vertical |
| 2. | 189.81 | 57.91 | -19.62 | 38.29 | 43.52 | 5.23 | 100 | 360 | vertical |
| 3. | 216.97 | 53.71 | -19.70 | 34.01 | 46.02 | 12.01 | 100 | 345 | vertical |

Remarks: C.F (Correction Factor) = Antenna factor + Cable loss - Preamp gain

3.2.2 Frequency Tolerance

Procedure:

According to FCC section 15.225, the devices operating in the 13.553~13.567 MHz shall maintain the carrier frequency within 0.01% of the operating frequency over the temperature variation of

-20°C to +50°C using an environmental chamber. The primary supply voltage is varied from 85% to 115% of the voltage normally at the input to the device or at the power supply terminals if cables are not normally supplied.

Measurement Data : **Complies**

| VOLTAGE (%) | Test Conditions | | Fre. Dev. (Hz) | Deviation (%) | Verdict |
|-------------|-----------------|------------------|----------------|---------------|---------|
| | Power (VDC) | Temperature (°C) | | | |
| 100 | 6 | -20 | 100 | -0.0007 | PASS |
| 100 | | -10 | 40 | -0.0003 | |
| 100 | | 0 | 199 | -0.0015 | |
| 100 | | 50 | 1,000 | -0.0074 | |
| 85 | 5.1 | 20 | 809 | -0.0060 | |
| 115 | 6.9 | 50 | 880 | -0.0065 | |

- See next pages for actual measured spectrum plots.

Minimum Standard:

±0.01%

Measurement Setup

The EUT, which is powered by the DC Power Supply directly, is located in the Temperature Chamber. The EUT was measured by transmitter mode continuously.

3.2.3 20 dB Bandwidth

Procedure:

According to FCC section 15.215(c), the 20dB bandwidth should be contained within the frequency band designated in the rule section under which the EUT is operated, it was measured with a spectrum analyzer connected the EUT while the EUT is operating in transmission mode.

The spectrum analyzer is set to:

Center frequency = the highest, middle and the lowest channels

RBW = 1 kHz

VBW = 3 X RBW

Sweep = auto

Trace = max hold

Detector function = peak

Measurement Data : **Complies**

BLE Mode

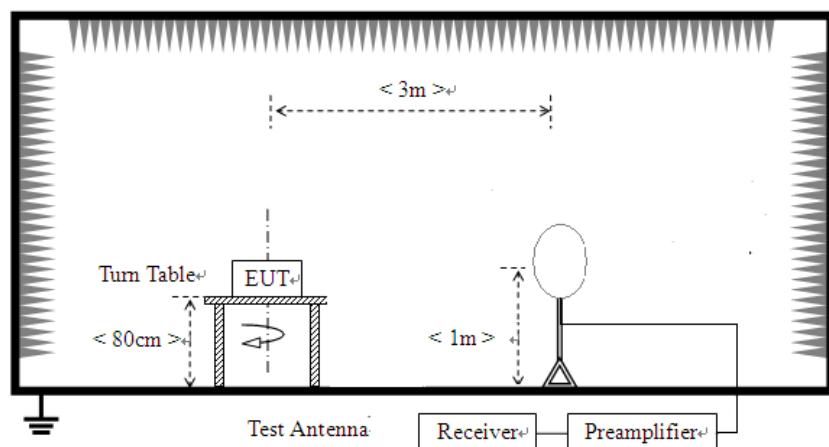
| Frequency (MHz) | Test Results | |
|--------------------|--------------------------|----------|
| | Measured Bandwidth (kHz) | Result |
| 13.56 | 2.600 | Complies |

- See next pages for actual measured spectrum plots.

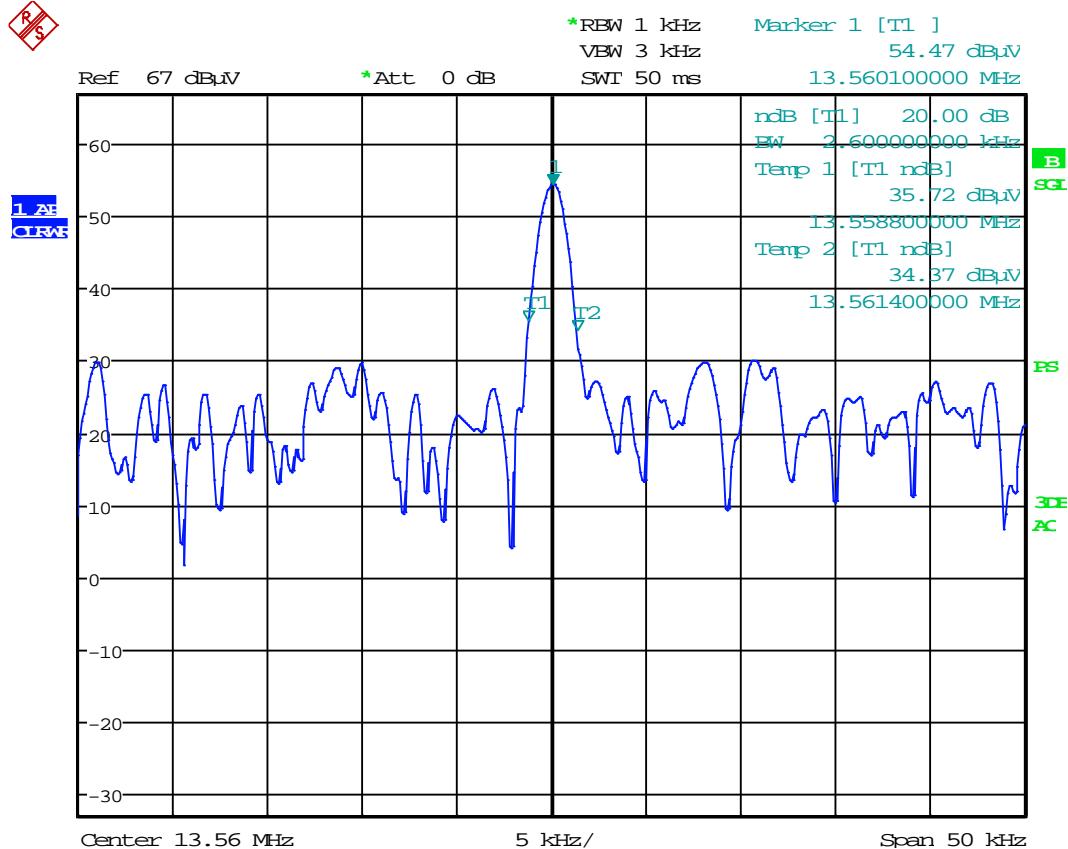
Minimum Standard:

20 dB Bandwidth \leq 14 kHz

Measurement Setup



RS



3.2.4 AC Conducted Emissions

Procedure:

The conducted emissions are measured in the shielded room with a spectrum analyzer in peak hold. While the measurement, EUT had its hopping function disabled at the middle channels in line with Section 15.31(m). Emissions closest to the limit are measured in the quasi-peak mode (QP) with the tuned receiver using a bandwidth of 9 kHz. The emissions are maximized further by cable manipulation and Exerciser operation. The highest emissions relative to the limit are listed.

Measurement Data: N/A

Class B

| Frequency Range | quasi-peak | Average |
|-----------------|------------|------------|
| 0.15 ~ 0.5 | 66 to 56 * | 56 to 46 * |
| 0.5 ~ 5 | 56 | 46 |
| 5 ~ 30 | 60 | 50 |

* Decreases with the logarithm of the frequency

APPENDIX
TEST EQUIPMENT USED FOR TESTS

| | Use | Description | Model No. | Serial No. | Manufacturer | Interval | Next Cal. Date |
|----|------------|--------------------------------------|------------------|-------------------|------------------------|-----------------|-----------------------|
| 1 | ■ | Signal Analyzer (9 kHz ~ 30 GHz) | FSV30 | 100757 | R&S | 1 year | 2021-09-07 |
| 2 | ■ | Signal Generator (~3.2 GHz) | 8648C | 3623A02597 | HP | 1 year | 2021-03-16 |
| 3 | | SYNTHESIZED CW GENERATOR | 83711B | US34490456 | HP | 1 year | 2021-03-16 |
| 4 | | Attenuator (3 dB) | 8491A | 37822 | HP | 1 year | 2021-09-07 |
| 5 | | Attenuator (10 dB) | 8491A | 63196 | HP | 1 year | 2021-09-07 |
| 6 | ■ | EMI Test Receiver (~7 GHz) | ESCI7 | 100722 | R&S | 1 year | 2021-09-07 |
| 7 | | RF Amplifier (~1.3 GHz) | 8447D OPT 010 | 2944A07684 | HP | 1 year | 2021-09-07 |
| 8 | | RF Amplifier (1~26.5 GHz) | 8449B | 3008A02126 | HP | 1 year | 2021-03-16 |
| 9 | ■ | Horn Antenna (1~18 GHz) | 3115 | 00114105 | ETS | 2 year | 2022-09-10 |
| 10 | | DRG Horn (Small) | 3116B | 81109 | ETS-Lindgren | 2 year | 2020-03-18 |
| 11 | | DRG Horn (Small) | 3116B | 133350 | ETS-Lindgren | 2 year | 2020-03-18 |
| 12 | ■ | TRILOG Antenna | VULB 9160 | 9160-3237 | SCHWARZBECK | 2 year | 2021-03-20 |
| 13 | | Temp.Humidity Data Logger | SK-L200TH II A | 00801 | SATO | 1 year | 2021-03-16 |
| 14 | | Splitter (SMA) | ZFSC-2-2500 | SF617800326 | Mini-Circuits | - | - |
| 15 | ■ | DC Power Supply | 6674A | 3637A01657 | Agilent | - | - |
| 17 | ■ | Power Meter | EPM-441A | GB32481702 | HP | 1 year | 2021-03-16 |
| 18 | ■ | Power Sensor | 8481A | 3318A94972 | HP | 1 year | 2021-09-07 |
| 19 | | Audio Analyzer | 8903B | 3729A18901 | HP | 1 year | 2021-09-07 |
| 20 | | Moduleation Analyzer | 8901B | 3749A05878 | HP | 1 year | 2020-09-07 |
| 21 | | TEMP & HUMIDITY Chamber | YJ-500 | LTAS06041 | Jin Young Tech | 1 year | 2021-09-07 |
| 22 | | Stop Watch | HS-3 | 812Q08R | CASIO | 2 year | 2022-03-18 |
| 23 | | LISN | KNW-407 | 8-1430-1 | Kyoritsu | 1 year | 2021-03-16 |
| 24 | | Two-Lime V-Network | ESH3-Z5 | 893045/017 | R&S | 1 year | 2021-03-16 |
| 25 | | UNIVERSAL RADIO COMMUNICATION TESTER | CMU200 | 106243 | R&S | 1 year | 2021-03-16 |
| 26 | | Highpass Filter | WHKX1.5/15G-10SS | 74 | Wainwright Instruments | 1 year | 2021-03-16 |
| 27 | | Highpass Filter | WHKX3.0/18G-10SS | 118 | Wainwright Instruments | 1 year | 2021-03-16 |
| 28 | | OSP120 BASE UNIT | OSP120 | 101230 | R&S | 1 year | 2021-03-16 |
| 29 | | Signal Generator(100 kHz ~ 40 GHz) | SMB100A03 | 177621 | R&S | 1 year | 2021-03-16 |
| 30 | | Signal Analyzer (10 Hz ~ 40 GHz) | FSV40 | 101367 | R&S | 1 year | 2021-02-26 |
| 31 | ■ | Active Loop Antenna | FMZB 1519 | 1519-031 | SCHWARZBECK | 2 year | 2021-09-07 |