

Dates of Tests: Oct 15, 2020 ~ Oct 27, 2020

Test Report S/N: LR500112010Q

Test Site : LTA CO., LTD.

CERTIFICATION OF COMPLIANCE

FCC ID.

2AXFW-ES-F500D

APPLICANT

EPIC SYSTEMS CO., LTD.

Equipment Class	:	Digital Transmission System (DTS)
Manufacturing Description	:	Digital Door Lock
Manufacturer	:	EPIC SYSTEMS CO., LTD.
Model name	:	ES-F500D
Module FCCID	:	SH6MDBT42Q
Test Device Serial No.:	:	Identical prototype
Rule Part(s)	:	FCC Part 15.247 Subpart C ; ANSI C63.10 - 2013
Frequency Range	:	2402 ~ 2480 MHz
Max. Output Power	:	Max 1.58 mW - Conducted
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
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 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-F500D
 Variant Model name : ES-F500D Gold, ES-F500D 24K Gold plating, ES-F500H
 Serial number : Identical prototype
 Date of receipt : Oct 13, 2020
 EUT condition : Pre-production, not damaged
 Antenna type : PCB Antenna (Max Gain : -1.61 dBi)
 Frequency Range : 2402 ~ 2480 MHz
 Type of Modulation : GFSK
 Power Source : DC 6 V

2-3 Tested frequency

	LOW	MID	HIGH
Frequency (MHz)	2402	2442	2480

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)
15.247(a)	6 dB Bandwidth	Conducted	N/A ¹⁾
15.247(b)	Transmitter Peak Output Power		C
15.247(e)	Transmitter Power Spectral Density		N/A ¹⁾
15.247(d)	Band Edge & Conducted Spurious emission		N/A ¹⁾
15.209	Transmitter emission	Radiated	C
15.207	AC Conducted Emissions	Conducted	N/A ¹⁾
15.203	Antenna requirement	-	C

N/A¹⁾ : The product replaces this test with a certificate using an authenticated module.

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-F500D unit complies with the requirement of §15.203.

The antenna type is FPCB Antenna

3.2 Technical Characteristics Test

3.2.1 Peak Output Power Measurement

Procedure:

The following procedure can be used when the maximum available RBW of the instrument is less than the DTS bandwidth :

The spectrum analyzer is set to:

Center frequency = the highest, middle and the lowest channels

RBW \geq DTS Bandwidth

Span $\geq 3 \times$ RBW

VBW = $3 \times$ RBW

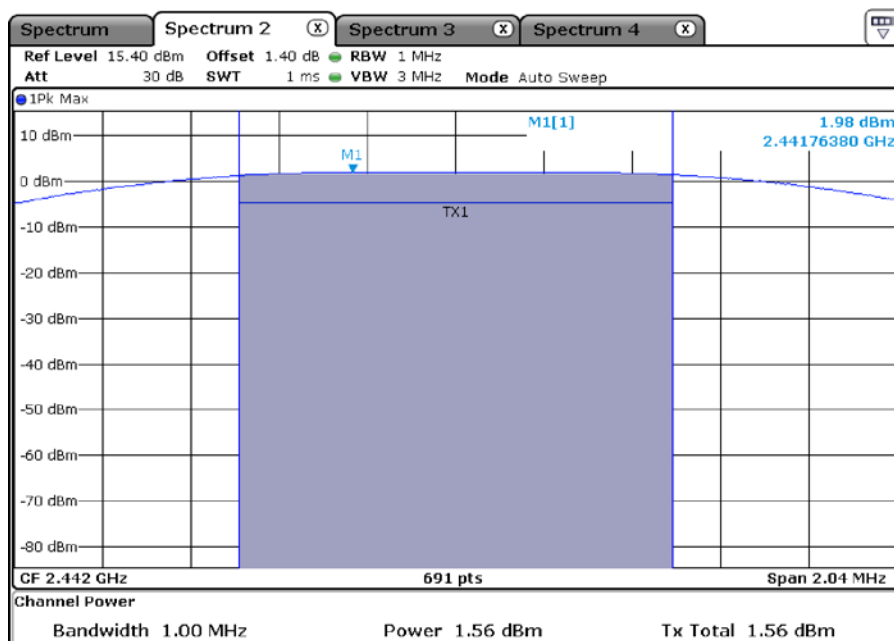
Sweep = auto

Detector function = peak

Measurement Data : Complies

BLE Mode

Frequency (MHz)	Test Results	
	Measured data (dBm)	Result
2442	1.98	Complies



3.2.1 Radiated Spurious Emissions

Procedure:

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

The EUT is a placed on as 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 ≥ RBW

= 1 MHz (1 GHz ~ 10th harmonic)

Trace = max hold

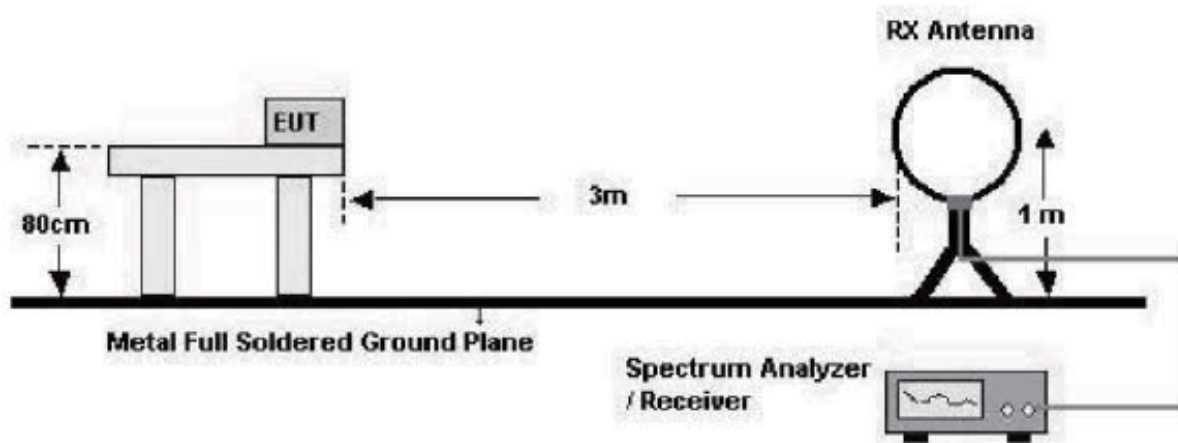
Detector function = peak

Sweep = auto

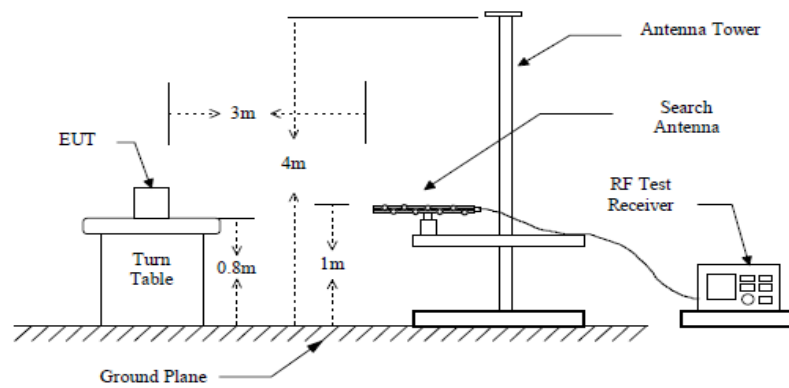
Duty cycle : 98.89 %

The EUT configureal to transmit continuously(D ≥ 98%)/ Duty Factor = 0

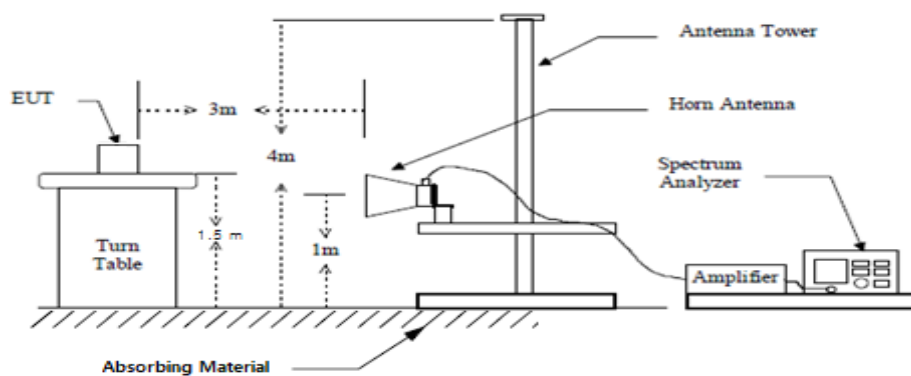
below 30 MHz



below 1 GHz (30 MHz to 1 GHz)



above 1 GHz



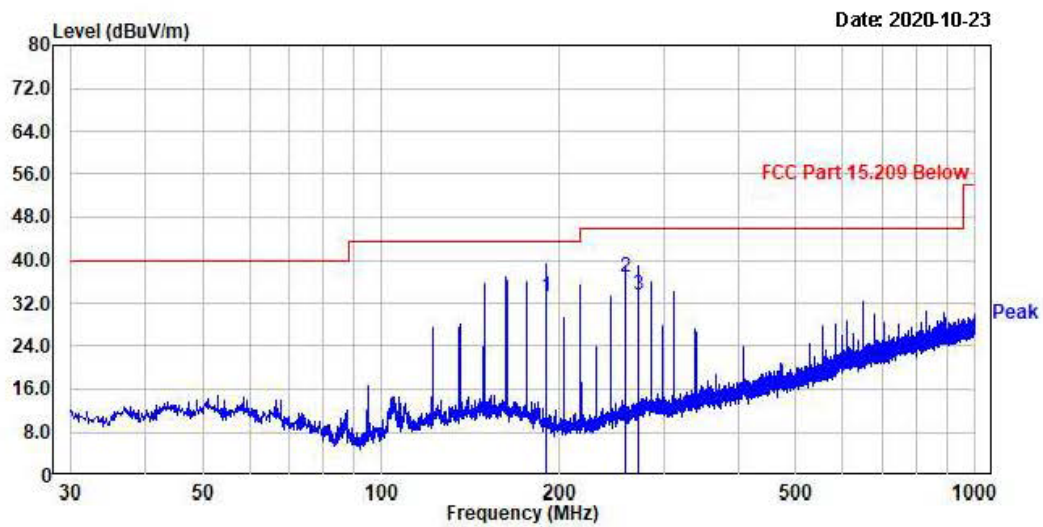
Measurement Data: Complies

- 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)

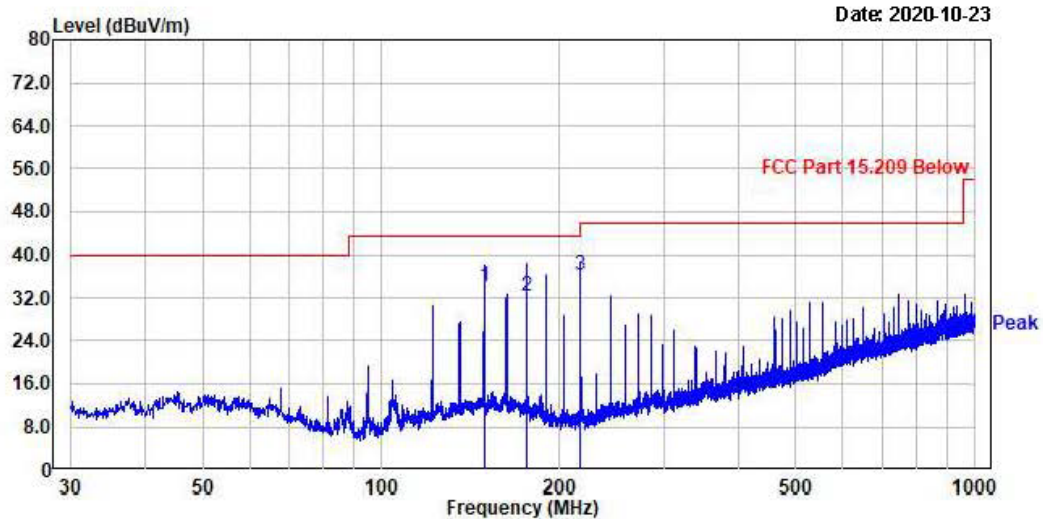
Frequency (MHz)	Limit (uV/m) @ 3 m
0.009 ~ 0.490	2400/F(kHz) (@ 300 m)
0.490 ~ 1.705	24000/F(kHz) (@ 30 m)
1.705 ~ 30	30(@ 30 m)
30 ~ 88	100 **
88 ~ 216	150 **
216 ~ 960	200 **
Above 960	500

** 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 MHz	Reading dBμV	C.F dB	Result QP dBUV/m	Limit dBUV/m	Margin dB	Height cm	Angle deg	Polarity
1.	189.81	52.91	-19.62	33.29	43.52	10.23	100	300	horizontal
2.	257.59	54.61	-17.82	36.79	46.02	9.23	100	80	horizontal
3.	271.17	50.63	-17.12	33.51	46.02	12.51	100	98	horizontal

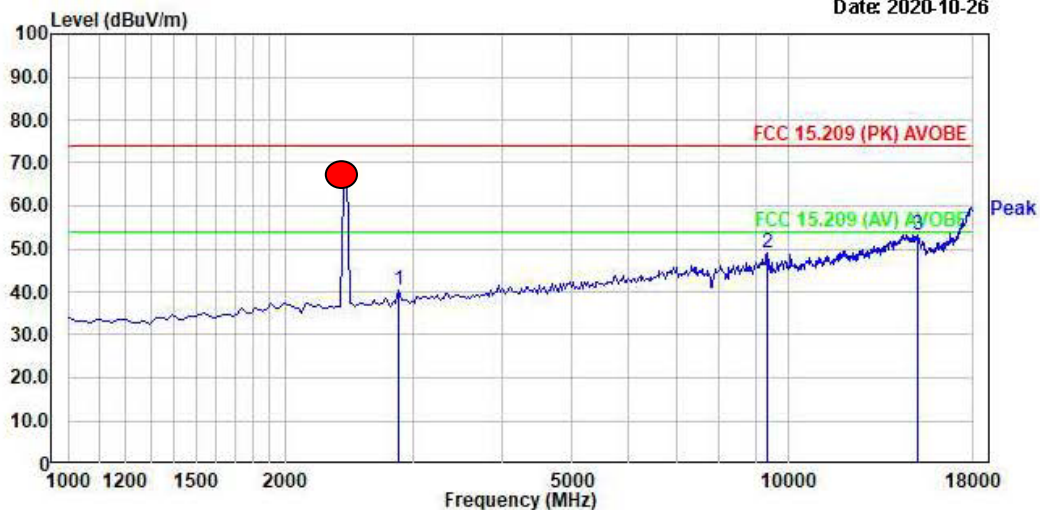
Remarks: C.F (Correction Factor) = Antenna factor + Cable loss - Preamp gain



No.	Freq MHz	Reading dBμV	C.F dB	Result QP dBUV/m	Limit dBUV/m	Margin dB	Height cm	Angle deg	Polarity
1.	149.19	51.22	-17.02	34.20	43.52	9.32	100	11	vertical
2.	176.23	50.15	-17.90	32.25	43.52	11.27	100	0	vertical
3.	216.97	55.93	-19.70	36.23	46.02	9.79	100	141	vertical

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

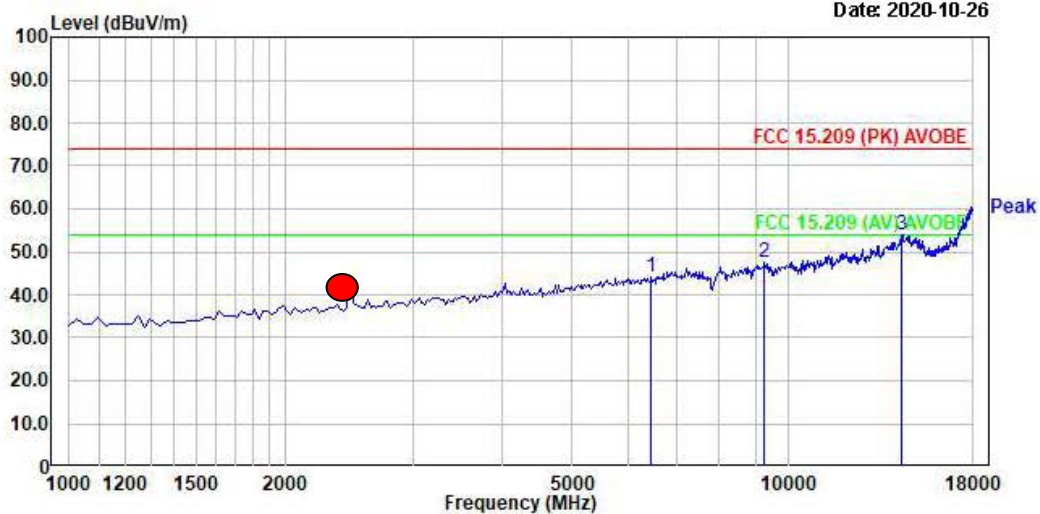
Date: 2020-10-26



No.	Freq	RD	RD	C.F	Result	Result	Limit	Limit	Margin	Margin	Height	Angle	Polarity
	MHz	PK	AV	dB	PK	AV	PK	AV	PK	AV	cm	deg	
		dBμV	dBμV		dBμV	dBμV	dBμV	dBμV	dB	dB			
1.	2872.46	42.22	-----	-1.85	40.37	-----	74.00	-----	33.63	-----	311	306	horizontal
2.	9327.54	38.38	-----	10.51	48.89	-----	74.00	-----	25.11	-----	6	3	horizontal
3.	15142.83	35.71	-----	17.66	53.37	-----	74.00	-----	20.63	-----	340	333	horizontal

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

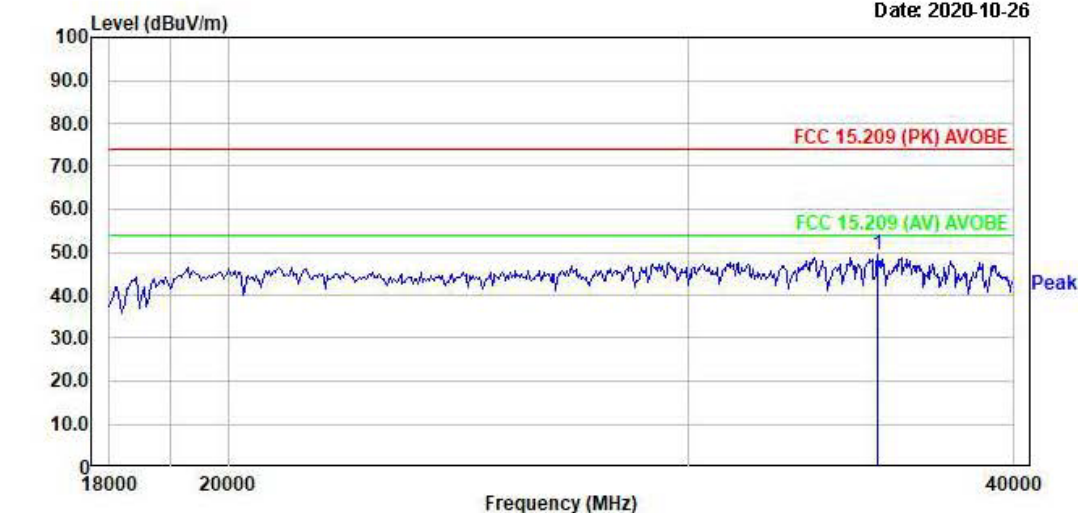
Date: 2020-10-26



No.	Freq	RD	RD	C.F	Result	Result	Limit	Limit	Margin	Margin	Height	Angle	Polarity
	MHz	PK	AV	dB	PK	AV	PK	AV	PK	AV	cm	deg	
		dBμV	dBμV		dBμV	dBμV	dBμV	dBμV	dB	dB			
1.	6444.93	37.19	-----	7.80	44.19	-----	74.00	-----	29.81	-----	1	2	vertical
2.	9253.62	36.95	-----	10.54	47.49	-----	74.00	-----	26.51	-----	153	158	vertical
3.	14328.99	35.09	-----	18.89	53.98	-----	74.00	-----	20.02	-----	62	69	vertical

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

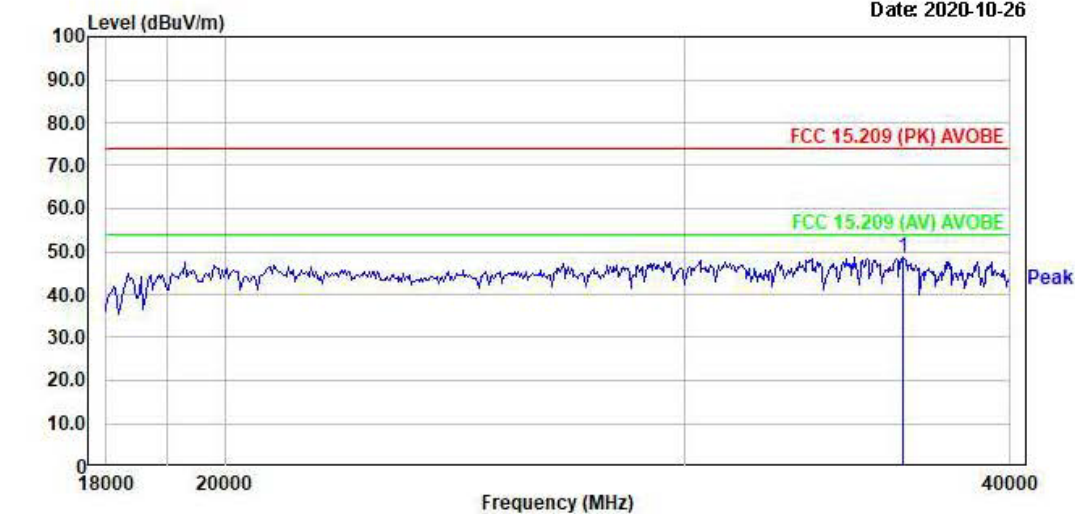
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No.	Freq	RD	RD	C.F	Result	Result	Limit	Limit	Margin	Margin	Height	Angle	Polarity
	MHz	PK	AV	dB	PK	AV	PK	AV	PK	AV	cm	deg	
1.	35584.35	35.94	-----	13.41	49.35	-----	74.00	-----	24.65	-----	358	356	horizontal

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

Date: 2020-10-26



No.	Freq	RD	RD	C.F	Result	Result	Limit	Limit	Margin	Margin	Height	Angle	Polarity
	MHz	PK	AV	dB	PK	AV	PK	AV	PK	AV	cm	deg	
1.	36428.98	34.85	-----	13.79	48.64	-----	74.00	-----	25.36	-----	310	318	vertical

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

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	2022-03-18
11		DRG Horn (Small)	3116B	133350	ETS-Lindgren	2 year	2022-03-18
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		Modulation Analyzer	8901B	3749A05878	HP	1 year	2021-09-07
21		TEMP & HUMIDITY Chamber	YJ-500	LTAS06041	JinYoung 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