

ELECTROMAGNETIC EMISSIONS COMPLIANCE REPORT



FCC Applicant: Fortrend Engineering
2220 O'Toole Avenue, San Jose, CA 95131
Product Name: RFID Reader
Brand Name: N/A
Model No.: RFT-200
Model Difference: N/A
Report Number: E2/2021/70078
FCC ID 2ALBARFIDMODULEV20
Issue Date: Nov.02,2021
Date of Test: Jul.20,2021~Oct.28,2021
Date of EUT Received: Jul.23,2021

Approved By


Jay Lin

We hereby certify that:

The above equipment was tested by SGS Taiwan Ltd. Central RF Lab 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 comply with FCC rule part §15C.

The results of this report relate only to the sample identified in this report.

Unless otherwise stated the results shown in this test report refer only to the sample(s) tested and such sample(s) are retained for 90 days only.

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Revision History

Report Number	Revision	Description	Issue Date	Revised By
E2/2021/70078	Rev.00	Original.	Nov.02,2021	Viola Su

Note:

- 1、Antenna information is provided by the applicant, test results of this report are applicable to the sample EUT received.

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1 GENERAL INFORMATION

1.1 Product Description

Product Name:	RFID Reader
Brand Name:	N/A
Model No.:	RFT-200
Model Difference:	N/A
Hardware Version:	N/A
Firmware Version:	N/A
EUT Series No.:	PJ217137010
Power Supply:	5V DC

1.2 RF specification

Radio Technology:	NFC
Operating Frequency	134.2 kHz
Transmit Power	8.73dBuV/m at 3m.
Number of Channels	1
Modulation Type	FSK
Antenna Type	LF

Note: Antenna information is provided by the applicant.

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1.3 Test Methodology

FCC Part 15, Subpart C
ANSI C63.10:2013

1.4 Test Facility

Laboratory	Test Site Address	Test Site Name	FCC Designation number	IC CAB identifier
SGS Taiwan Ltd. Central RF Lab. (TAF code 3702)	No.134, Wu Kung Road, New Taipei Industrial Park, Wuku District, New Taipei City, Taiwan.	SAC 1	TW0027	TW3702
		SAC 3		
		Conduction 1		
		Conducted 1		
		Conducted 2		
		Conducted 3		
		Conducted 4		
		Conducted 5		
		Conducted 6		
	No.2, Keji 1st Rd., Guishan District, Taoyuan City, Taiwan 333	Conduction C	TW0028	
		SAC C		
		SAC D		
		SAC G		
		Conducted A		
		Conducted B		
		Conducted C		
		Conducted D		
		Conducted E		
		Conducted F		
		Conducted G		
Note: Test site name is remarked on the equipment list in each section of this report as an indication where measurements occurred in specific test site and address.				

1.5 Special Accessories

There is no other accessory attached. This is the worst case condition.

1.6 Equipment Modifications

There was no modification incorporated into the EUT.

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2 SYSTEM TEST CONFIGURATION

2.1 EUT Configuration

The EUT configuration for testing is installed on RF field strength measurement to meet the Commissions requirement and operating in a manner which intends to maximize its emission characteristics in a continuous normal application.

2.2 EUT Exercise

The Transmitter was operated in the normal operating mode. The Tx frequency was fixed which was for the purpose of the measurements.

2.3 Test Procedure

2.3.1 Conducted Emissions

The EUT is placed on a table which is 0.8 m above ground plane. Conducted emissions from the EUT measured in the frequency range between 0.15 MHz and 30 MHz. The CISPR Quasi-Peak and Average detector mode is employed. The two LISNs provide 50uH/50 ohm of coupling impedance for the measuring instrument. Both lines of the power mains connected to the EUT were checked for maximum conducted interference.

2.3.2 Radiated Emissions

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. 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 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.

2.3.3 Radiated Emission Test Sites For Measurements From 9 kHz To 30 MHz

Radiated emission below 30MHz is measured in a 9m*6m*6m semi-anechoic chamber, the measurements correspond to those obtained at an open-field test site.

There is a comparison data of both open-field test site and semi-Anechoic chamber, and the result came out very similar.

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- Remark 1. Emission level in dBuV/m= $20 \log (\mu\text{V/m})$
:
2. Measurement was performed at an antenna to the closed point of EUT distance of 3 meters.
3. Distance extrapolation factor = $40 \log (\text{required distance/ test distance})$ (dB);
4. The measurement was undertaken in closer distance at 3m, where extrapolation factor is offset to convert the limit of the measurement.
Ex. $20 \cdot \log(30) + 40 \cdot \log(30/3) = 69.54 \text{ dBuV/m}$
5. Only spurious frequency is permitted to locate within the Restricted Bands specified in provision of §15.205.
6. The general radiated emission limits in §15.209 apply for the spurious emission generate from UE, except for the fundamental emission where the respective section specifies otherwise.

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2.4 Test Configuration

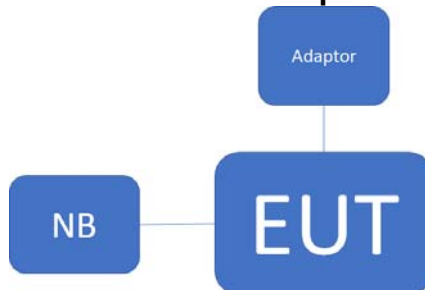
2.4.1 AC Power Line Conducted Emission



2.4.2 Conducted Setup



2.4.3 Radiated Setup



2.4.4 Equipment used for test

Equipment	Mfr/Brand	Model/Type No.	Series No.	Version
RS232 Tester	N/A	N/A	N/A	v1.2
Notebook	Lenovo	L480	P0002332	N/A
Test Software	SGS Taiwan	EMI Tool Function Alpha	Ver.1.0	N/A
Test Software	audix	e3	20923 sgs Ver.9	N/A
Notebook	Lenovo	L440	P0000367	N/A
Test Software	audix	e3	E3 20923 SGS Ver.9 (C)	N/A
Notebook	Lenovo	T470	P0001293	N/A

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3 SUMMARY OF TEST RESULTS

FCC Rules	Description Of Test	Result
§15.207	AC Power Line Conducted Emission	Compliant
§15.209	Radiated Emission Limits, general requirement	Compliant
§15.215 (c)	20 dB OCCUPIED BANDWIDTH	Compliant
§15.203	Antenna Requirement	Compliant

4 DESCRIPTION OF TEST MODES

The EUT stay in continuous transmitting mode. The frequency is the default channel to test, where it is the only manipulative channel as this application supports.

The field strength of radiation emission was measured as EUT three orthogonal planes, E1 / E2 / H, are positioned to pre-scan the emission generating the highest one. The worst position is tested and recorded.

The data rate as the lowest supported is selected while tests are conducted.

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5 MEASUREMENT UNCERTAINTY

Test Items	Uncertainty		
AC Power Line Conducted Emission	+/-	2.34	dB
Frequency Stability	+/-	1.53	Hz
Emission Bandwidth	+/-	1.53	Hz
Temperature	+/-	0.4	°C
Humidity	+/-	3.5	%
DC / AC Power Source	+/-	1	%

Radiated Spurious Emission Measurement Uncertainty			
Polarization: Vertical	+/-	2.64 dB	9kHz~30MHz
	+/-	4.93 dB	30MHz - 1000MHz
	+/-	4.81 dB	1GHz - 18GHz
	+/-	4.52 dB	18GHz - 40GHz
Polarization: Horizontal	+/-	2.64 dB	9kHz~30MHz
	+/-	4.45 dB	30MHz - 1000MHz
	+/-	4.81 dB	1GHz - 18GHz
	+/-	4.52 dB	18GHz - 40GHz

Note:

1. This uncertainty represents an expanded uncertainty expressed at approximately the 95% confidence level using a coverage factor of k=2.
2. The conformity assessment statement in this report is based solely on the test results, measurement uncertainty is excluded.

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6 CONDUCTED EMISSIONS TEST

6.1 Standard Applicable

According to §15.207 and frequency within 150 kHz to 30MHz shall not exceed the limit table as below.

Frequency range MHz	Limits (dBuV)	
	Quasi-peak	Average
0.15 to 0.50	66 to 56	56 to 46
0.50 to 5	56	46
5 to 30	60	50

Note

1. The lower limit shall apply at the transition frequencies
2. The limit decreases linearly with the logarithm of the frequency in the range 0.15 MHz to 0.50 MHz.

6.2 Measurement Equipment Used:

AC Power-Line Conducted Emission Test Site: Conduction C					
EQUIPMENT TYPE	MFR/BRAND	MODEL NUMBER	SERIAL NUMBER	LAST CAL.	CAL DUE.
LISN	SCHWARZBECK Mess-Elektronik	NSLK8127	974	04/19/2021	04/18/2022
EMI Test Receiver	R&S	ESCI	101342	04/28/2021	04/27/2022
Coaxial Cable	EC Lab	RF-HY- CAB-250	RF-HY-CAB- 250-01	03/27/2021	03/26/2022
Pulse Limiter	EC Lab	VTSD 9561F-N	485	03/27/2021	03/26/2022
Test Software	audix	e3	E3 20923 SGS Ver.9 (C)	N.C.R	N.C.R

Note: N.C.R refers to Not Calibrated Required

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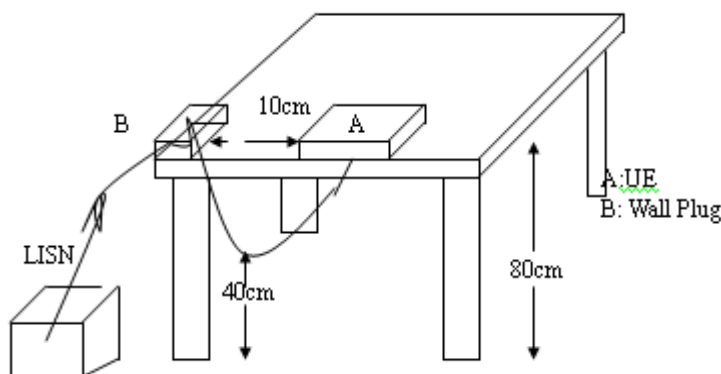
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6.3 EUT Setup

1. The conducted emission tests were performed in the test site, using the setup in accordance with the ANSI C63.10:2013.
2. The AC/DC Power adaptor of EUT was plug-in LISN. The EUT was placed flushed with the rear of the table.
3. The LISN was connected with 120Vac/60Hz power source.

6.4 Test SET-UP (Block Diagram of Configuration)



6.5 Measurement Procedure

1. The EUT was placed on a table which is 0.8m above ground plane.
2. Maximum procedure was performed on the six highest emissions to ensure EUT compliance.
3. Repeat above procedures until all frequency measured were complete.

6.6 Measurement Result

Note: Refer to next page for measurement data and plots.

Note2: The * reveals the worst-case results that closet to the limit.

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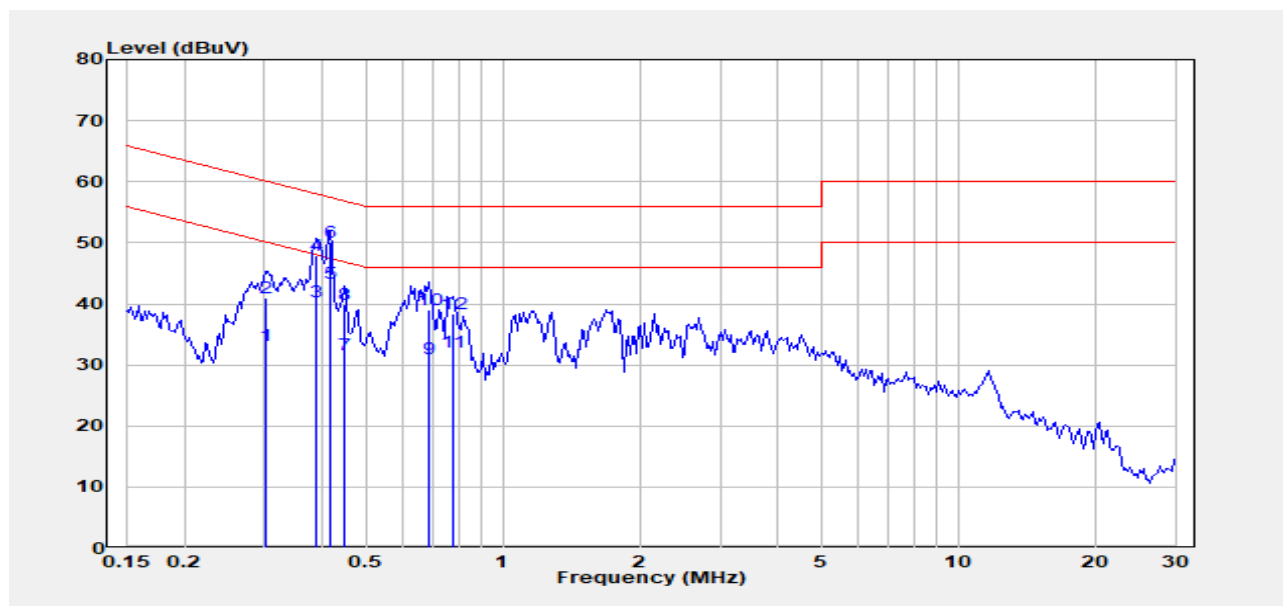
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AC POWER LINE CONDUCTED EMISSION TEST DATA

Report Number	:E2-2021-70078	Test Site	:Conduction C
Test Mode	:RFID	Test Date	:2021-10-19
Power	:120V/60Hz	Temp./Humi.	:23.2/66
Probe	:L1	Engineer	:Jack Tseng
Note:	: Adaptor:GS15U-1		



Freq. MHz	Detector Mode PK/QP/AV	Spectrum Reading Level dBμV	Factor dB	Actual FS dBμV	Limit dBμV	Margin dB
0.302	Average	22.80	10.30	33.10	50.19	-17.09
0.302	QP	30.60	10.30	40.90	60.19	-19.29
0.389	Average	30.00	10.31	40.31	48.08	-7.77
0.389	QP	37.60	10.31	47.91	58.08	-10.17
0.419	Average	33.00	10.31	43.31	47.46	-4.15
0.419	QP	39.80	10.31	50.11	57.46	-7.35
0.447	Average	21.40	10.31	31.71	46.93	-15.22
0.447	QP	29.60	10.31	39.91	56.93	-17.02
0.690	Average	20.60	10.33	30.93	46.00	-15.07
0.690	QP	28.70	10.33	39.03	56.00	-16.97
0.775	Average	21.80	10.33	32.13	46.00	-13.87
0.775	QP	28.00	10.33	38.33	56.00	-17.67

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Report Number :E2-2021-70078

Test Site :Conduction C

Test Mode :RFID

Test Date :2021-10-19

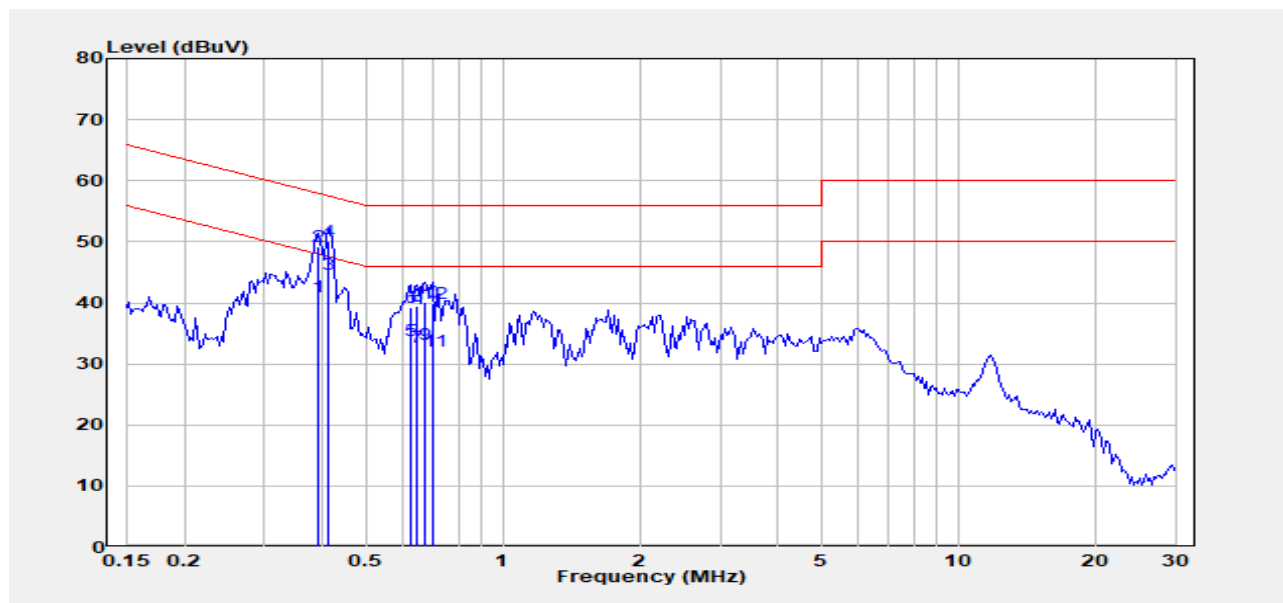
Power :120V/60Hz

Temp./Humi. :23.2/66

Probe :N

Engineer :Jack Tseng

Note: : Adaptor:GS15U-1



Freq. MHz	Detector Mode PK/QP/AV	Spectrum Reading Level dBuV	Factor dB	Actual FS dBuV	Limit dBuV	Margin dB
0.393	Average	30.60	10.32	40.92	47.99	-7.07
0.393	QP	38.90	10.32	49.22	57.99	-8.77
0.415	Average	34.40	10.32	44.72	47.55	-2.83
0.415	QP	39.70	10.32	50.02	57.55	-7.53
0.627	Average	23.40	10.33	33.73	46.00	-12.27
0.627	QP	29.00	10.33	39.33	56.00	-16.67
0.647	Average	22.30	10.33	32.63	46.00	-13.37
0.647	QP	29.10	10.33	39.43	56.00	-16.57
0.675	Average	22.90	10.33	33.23	46.00	-12.77
0.675	QP	29.80	10.33	40.13	56.00	-15.87
0.705	Average	21.70	10.34	32.04	46.00	-13.96
0.705	QP	29.50	10.34	39.84	56.00	-16.16

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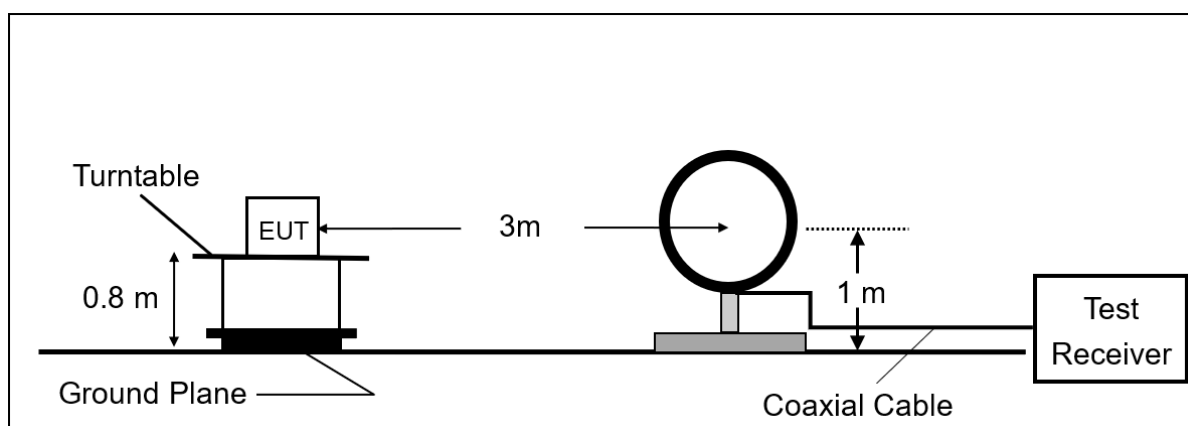
7 RADIATED EMISSION TEST

7.1 Measurement Procedure

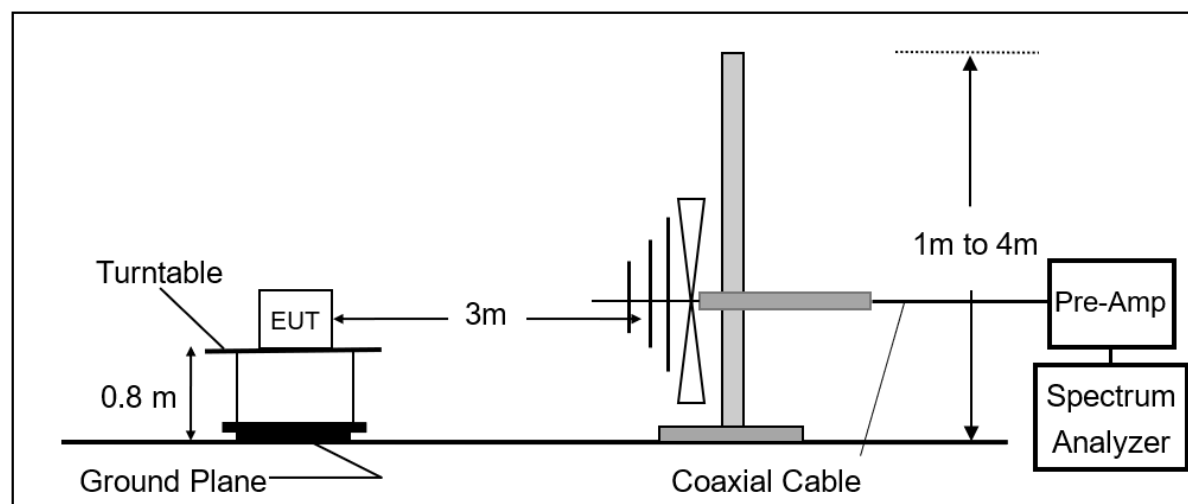
1. The EUT was placed on a turn table which is 0.8m above ground plane.
2. Maximum procedure was performed on the six highest emissions to ensure EUT compliance.
3. And also, each emission was to be maximized by changing the polarization of receiving antenna both horizontal and vertical.

7.2 Test SET-UP:

(A) Radiated Emission Test Set-Up, Frequency Below 30MHz.



(B) Radiated Emission Test Set-Up, Frequency From 30MHz to 1000MHz.



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7.3 Measurement Equipment Used:

Radiated Emission Test Site: SAC C					
EQUIPMENT TYPE	MFR/BRAND	MODEL NUMBER	SERIAL NUMBER	LAST CAL.	CAL DUE.
Broadband Antenna	TESEQ	CBL 6112D	35240	09/10/2021	09/09/2022
Loop Antenna	ETS.LINDGREN	6502	143303	05/07/2021	05/06/2022
EMI Test Receiver	R&S	ESU 40	100363	04/28/2021	04/27/2022
Pre-Amplifier	EMC Instruments	EMC330	980096	11/19/2020	11/18/2021
Coaxial Cable	Huber Suhner	RG 214/U	W22.03	11/19/2020	11/18/2021
Test Software	audix	e3	20923 sgs Ver.9	N.C.R	N.C.R
Notebook	Lenovo	L440	P0000367	N/A	N/A

Note: N.C.R refers to Not Calibrated Required

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7.1 Field Strength Calculation

The field strength is calculated by adding the Antenna Factor and Cable Factor and subtracting the Amplifier Gain and Duty Cycle Correction Factor (if any) from the measured reading. The basic equation with a sample calculation is as follows:

$$FS = RA + AF + CL - AG$$

Where	FS = Field Strength	CL = Cable Attenuation Factor (Cable Loss)
	RA = Reading Amplitude	AG = Amplifier Gain
	AF = Antenna Factor	

7.2 Limit

The field strength of any emissions appearing outside of operation frequency shall not exceed the general radiated emission limits in section 15.209 as below.

Frequency (MHz)	Field strength (μV/m)	Distance (meters)
0.009~0.490	2400/F(kHz)	300
0.490~1.705	24000/F(kHz)	30
1.705-30	30	30
30-88	100	3
88-216	150	3
216-960	200	3
Above 960	500	3

Note:

1. Emission level in dBμV/m = 20 log (μV/m)
2. Distance extrapolation factor = 40 log (required distance/ test distance) (dB)
3. 20*log(30μV/m) + 40dB = 69.54 dBuV/m
4. The lower limit shall apply at the transition frequencies.
5. The measurement was undertaken in closer distance at 3m, where extrapolation factor is offset to convert the limit of the measurement.
6. Only spurious frequency is permitted to locate within the Restricted Bands specified in provision of §15.205.
7. The general radiated emission limits in §15.209 apply for the spurious emission generate from UE, except for the fundamental emission where the respective section specifies otherwise.
8. Actual FS(dBμV/m) = Spectrum. Reading level(dBμV) + Factor(dB)
Factor(dB) = Antenna Factor(dB) + Cable Loss(dB) – Pre_Amplifier Gain(dB)

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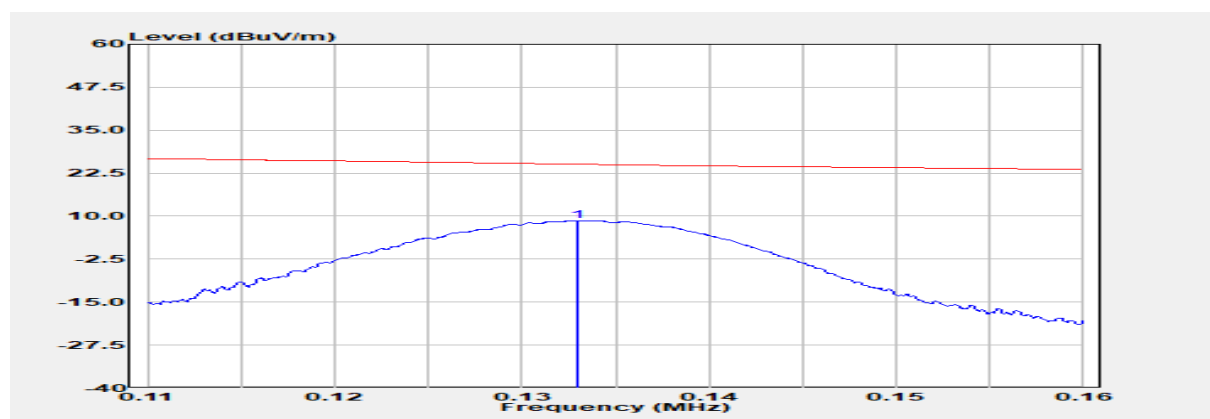
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7.3 Main

Report Number :E2/2021/70078
 Operation Mode :RFID
 Test Frequency :134.2 kHz
 Test Mode :Main
 EUT Pol :H Plane

Test Site :SAC C
 Test Date :2021-09-28
 Temp./Humi. :24.1/62
 Antenna Pol. :Vertical
 Engineer :Enzo Chang



Freq. MHz	Detector Mode PK/QP/AV	Spectrum Reading Level dBμV	Factor dB	Actual FS dBμV/m	Limit @300m dBμV/m	Margin dB
0.133	Peak	77.72	-68.99	8.73	25.14	-16.41

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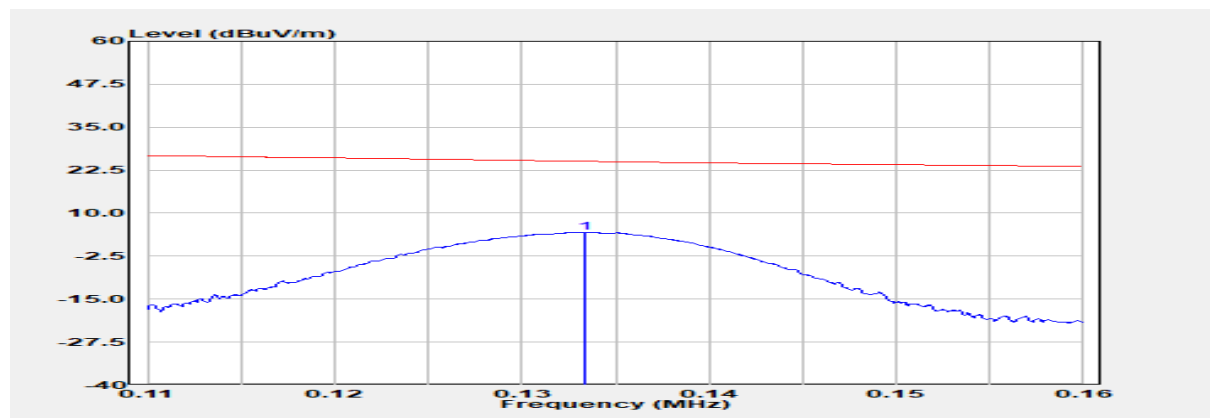
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Report Number :E2/2021/70078
Operation Mode :RFID
Test Frequency :134.2 kHz
Test Mode :Main
EUT Pol :H Plane

Test Site :SAC C
Test Date :2021-09-28
Temp./Humi. :24.1/62
Antenna Pol. :Horizontal
Engineer :Enzo Chang



Freq. MHz	Detector Mode PK/QP/AV	Spectrum Reading Level dBUV	Factor dB	Actual FS dBUV/m	Limit @300m dBUV/m	Margin dB
0.133	Peak	73.41	-68.99	4.43	25.11	-20.68

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7.4 TX

Report Number :E2/2021/70078

Test Site :SAC C

Operation Mode :RFID

Test Date :2021-09-28

Test Frequency :134.2 kHz

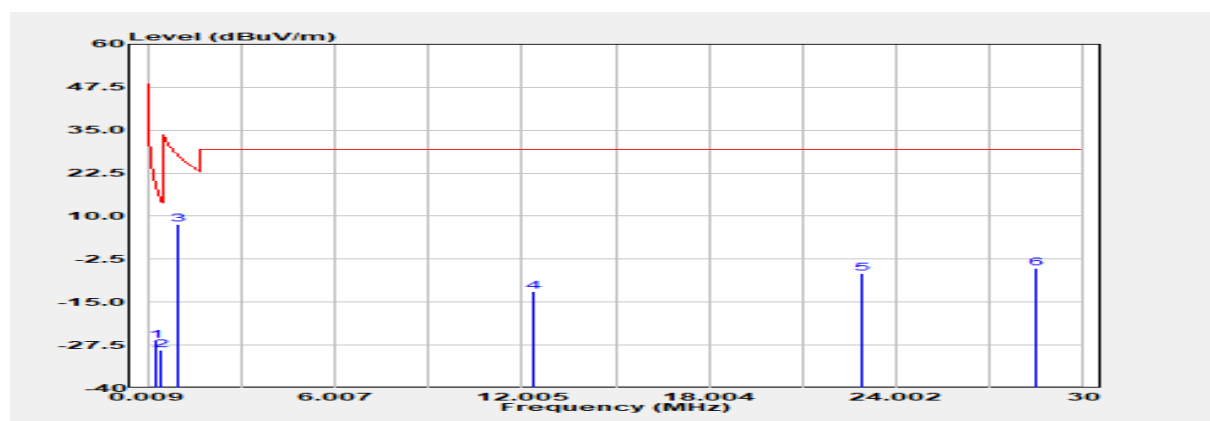
Temp./Humi. :23.9/63

Test Mode :Tx

Antenna Pol. :Vertical

EUT Pol :H Plane

Engineer :Enzo Chang



Freq. MHz	Detector Mode PK/QP/AV	Spectrum Reading Level dB μ V	Factor dB	Actual FS dB μ V/m	Limit @300m dB μ V/m	Margin dB
0.268	Peak	42.38	-68.63	-26.25	19.03	-45.28
0.403	Peak	39.58	-68.61	-29.04	15.50	-44.54
0.970	Peak	35.92	-28.42	7.50	27.87	-20.37
12.409	Peak	16.03	-28.02	-11.99	29.54	-41.53
22.887	Peak	22.60	-29.17	-6.57	29.54	-36.11
28.510	Peak	24.88	-30.15	-5.27	29.54	-34.81

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Report Number :E2/2021/70078

Test Site :SAC C

Operation Mode :RFID

Test Date :2021-09-28

Test Frequency :134.2 kHz

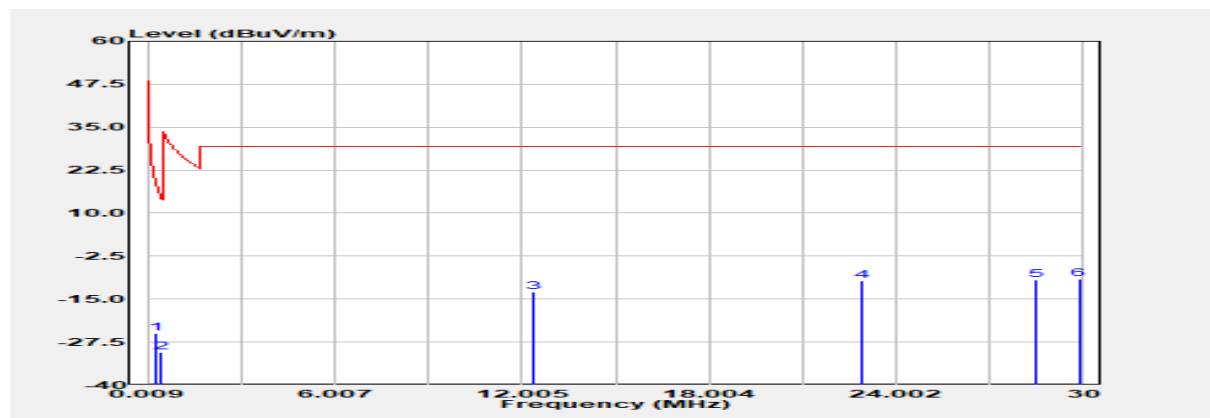
Temp./Humi. :23.9/63

Test Mode :Tx

Antenna Pol. :Horizontal

EUT Pol :H Plane

Engineer :Enzo Chang



Freq. MHz	Detector Mode PK/QP/AV	Spectrum Reading Level dBμV	Factor dB	Actual FS dBμV/m	Limit @300m dBμV/m	Margin dB
0.268	Peak	43.74	-68.63	-24.89	19.03	-43.92
0.403	Peak	38.07	-68.61	-30.54	15.50	-46.05
12.409	Peak	15.13	-28.02	-12.89	29.54	-42.43
22.887	Peak	19.43	-29.17	-9.74	29.54	-39.28
28.510	Peak	20.76	-30.15	-9.39	29.54	-38.93
29.856	Peak	21.10	-30.35	-9.26	29.54	-38.80

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Report Number :E2/2021/70078

Test Site :SAC C

Operation Mode :RFID

Test Date :2021-09-28

Test Frequency :134.2 kHz

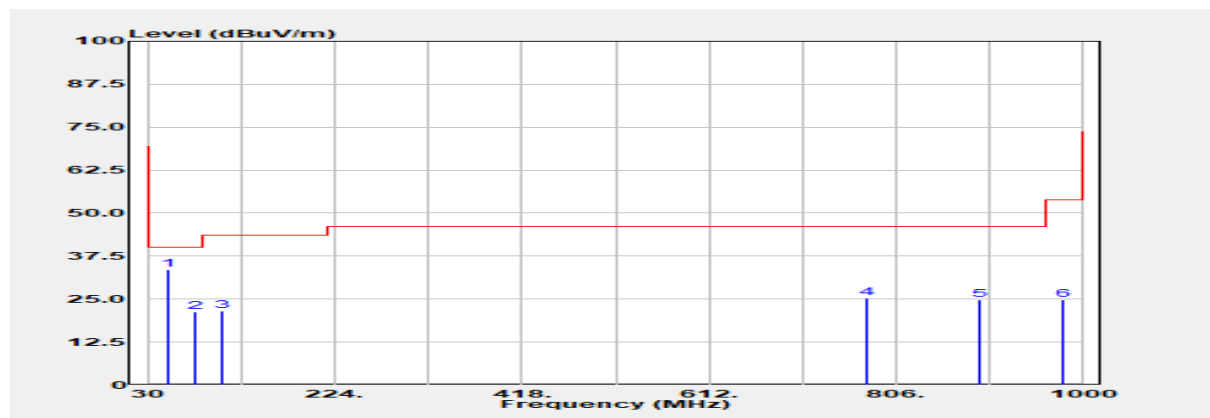
Temp./Humi. :23.9/63

Test Mode :Tx

Antenna Pol. :VERTICAL

EUT Pol :H Plane

Engineer :Enzo Chang



Freq. MHz	Detector Mode PK/QP/AV	Spectrum Reading Level dBμV	Factor dB	Actual FS dBμV/m	Limit @3m dBμV/m	Margin dB
50.208	Peak	53.40	-19.90	33.50	40.00	-6.50
78.189	Peak	42.92	-21.71	21.22	40.00	-18.78
106.170	Peak	40.30	-18.69	21.61	43.50	-21.89
774.599	Peak	32.40	-7.17	25.24	46.00	-20.76
892.740	Peak	30.53	-5.82	24.71	46.00	-21.29
979.792	Peak	29.51	-4.79	24.72	54.00	-29.28

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Test Date :2021-09-28

Test Frequency :134.2 kHz

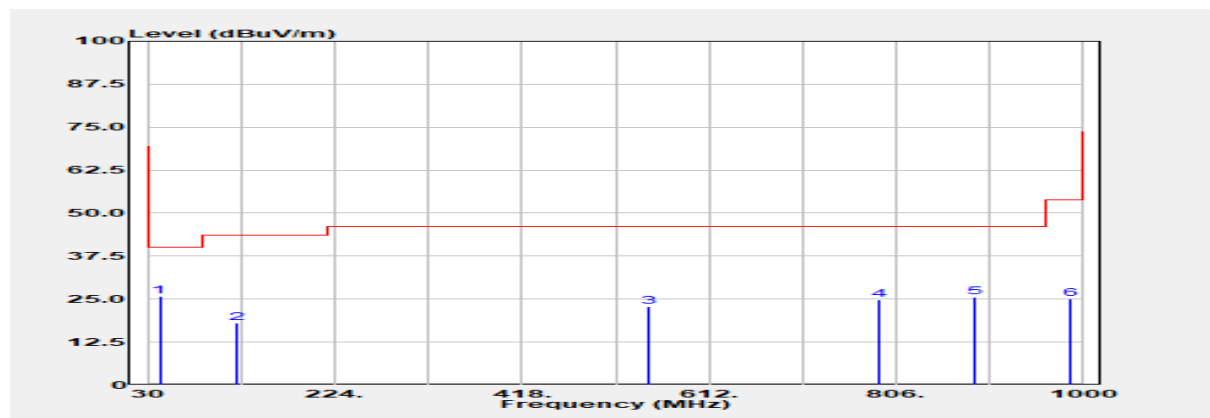
Temp./Humi. :23.9/63

Test Mode :Tx

Antenna Pol. :HORIZONTAL

EUT Pol :H Plane

Engineer :Enzo Chang



Freq. MHz	Detector Mode PK/QP/AV	Spectrum Reading Level dBμV	Factor dB	Actual FS dBμV/m	Limit @3m dBμV/m	Margin dB
42.436	Peak	39.36	-13.64	25.71	40.00	-14.29
123.269	Peak	34.85	-16.83	18.02	43.50	-25.48
549.199	Peak	31.67	-8.80	22.87	46.00	-23.13
788.590	Peak	31.91	-7.12	24.79	46.00	-21.21
888.077	Peak	31.70	-6.22	25.48	46.00	-20.52
987.564	Peak	30.08	-4.99	25.08	54.00	-28.92

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8 20 dB OCCUPIED BANDWIDTH MEASUREMENT

8.1 Standard Applicable:

§2.1049 & §15.215 (c)

8.2 Limit:

None

8.3 Test Set-up

Refer to section 6.2 in this report

8.4 Measurement Procedure

20dB bandwidth

1. The transmitter output (antenna port) was connected to the spectrum analyzer in peak mode.
2. 20dB Bandwidth the resolution bandwidth of 1kHz and the video bandwidth of 3 kHz were used.
3. Measured the spectrum width with power higher than 20dB below carrier.

8.5 Measurement Equipment Used:

Conducted Emission Test Site: Conducted B					
EQUIPMENT TYPE	MFR	MODEL NUMBER	SERIAL NUMBER	LAST CAL.	CAL DUE.
H-Loop Near Field Antenna	LANGER EMV-Technik	LF-R 400	02-1597	N.C.R	N.C.R
Spectrum Analyzer	KEYSIGHT	N9010A	MY51440113	07/13/2021	07/12/2022
Test Software	SGS Taiwan	EMI Tool Function Alpha	Ver.1.0	N.C.R	N.C.R
DC Block	PASTERNAK	PE8210	RF157	11/19/2020	11/18/2021

8.6 Measurement Result

-20dB Bandwidth

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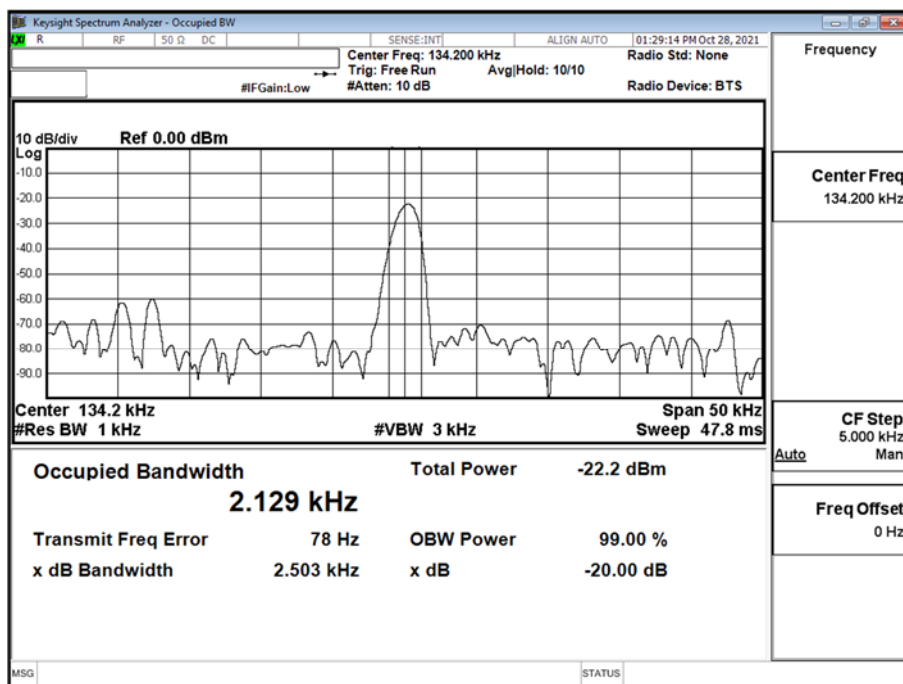
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20dB Bandwidth	Limit
2.503 Hz	No requirement

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9 ANTENNA REQUIREMENT

9.1 Standard Applicable:

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. The manufacturer may design the unit so that a broken antenna can be replaced by the user, but the use of a standard antenna jack or electrical connector is prohibited. This requirement does not apply to carrier current devices or to devices operated under the provisions of §§ 15.211, 15.213, 15.217, 15.219, 15.221, or § 15.236. Further, this requirement does not apply to intentional radiators that must be professionally installed, such as perimeter protection systems and some field disturbance sensors, or to other intentional radiators which, in accordance with § 15.31(d), must be measured at the installation site. However, the installer shall be responsible for ensuring that the proper antenna is employed so that the limits in this part are not exceeded.

9.2 Antenna Connected Construction:

The antenna is connected through a proprietary RP-SMA connector with no possibility of replacement with a non-approved antenna by the end-user.

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10 PHOTOGRAPHS OF EUT

Please refer to the attached file(EUT Photo)

~ End of Report ~

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