

## ELECTROMAGNETIC EMISSIONS COMPLIANCE REPORT



**Applicant:** GIGA-TMS INC.  
9F-2, No.31, Lane 169, Kang-Ning St., Hsi-Chih, New Taipei  
City 22180, Taiwan

**Product Name:** Time Recorder

**Brand Name:** PROMAG, GIGATEK, ProxData

**Model No.:** TR515A

**Model Difference:** N/A

**Report Number:** E2/2021/90012

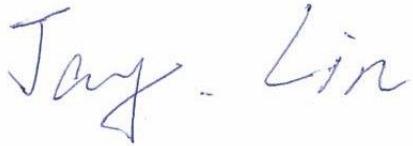
**FCC ID** WXATR515AR

**Issue Date:** November 17, 2021

**Date of Test:** August 17, 2021 ~ September 11, 2021

**Date of EUT Received:** August 17, 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 §15.225.

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

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## Revision History

Report Number	Revision	Description	Issue Date	Revised By
E2/2021/90012	00	Original	November 17, 2021	Ariel Chang

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## 1 GENERAL INFORMATION

### 1.1 Product Description

Product Name	Time Recorder
Brand Name	PROMAG, GIGATEK, ProxData
Model No.	TR515A
Model Difference	N/A
Power Supply	5Vdc to 12Vdc (Typical: 9Vdc)

### 1.2 RF specification

Radio Technology:	NFC
Operating Frequency	13.56MHz
Transmit Power	11.69 dBuV/m at 30m.
Number of Channels	1
Modulation Type	ASK
Antenna Type	PCB Antenna

**Note:** Antenna information is provided by the applicant.

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### 1.3 Test Methodology

FCC Part 15, Subpart C §15.225

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 SAC 3 Conduction 1 Conducted 1 Conducted 2 Conducted 3 Conducted 4 Conducted 5 Conducted 6	TW0027	
	No.2, Keji 1st Rd., Guishan District, Taoyuan City, Taiwan 333	Conduction C SAC C SAC D SAC G Conducted A Conducted B Conducted C Conducted D Conducted E Conducted F Conducted G	TW3702 TW0028	

**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 a 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 30MHz. 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 a 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 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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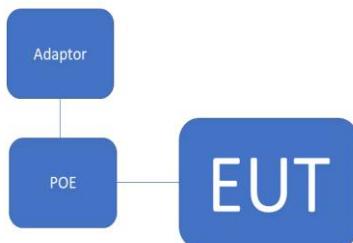
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## 2.4 Test Configuration

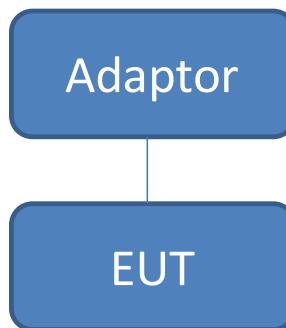
### 2.4.1 AC Power Line Conducted Emission\_ Adapter



### 2.4.2 AC Power Line Conducted Emission \_ POE



### 2.4.3 Emission Measurements



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#### 2.4.4 Equipment used for test

Equipment	Mfr/Brand	Model/Type No.	Series No.
Adaptor	Kircuit	AD41-0900500DU	N/A
Adaptor for PoE	LEI	MU24-B480050-A1	N/A
PoE	N/A	N/A	N/A

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### 3 SUMMARY OF TEST RESULTS

FCC Rules	ISED Rules	Description Of Test	Result
§15.207	RSS-Gen § 8.8	AC Power Line Conducted Emission	Compliant
§15.225 (a)-(d)	RSS210 Annex B B.6	Radiated Emission	Compliant
§15.209	RSS-Gen § 8.9	Radiated Emission Limits, general requirement	Compliant
§15.225 (e)	RSS210 Annex B B.6 (b)	Frequency Stability	Compliant
§2.1049 §15.215 (c)	RSS-Gen § 6.7	Emission Bandwidth	Compliant
§15.203	N/A	Antenna Requirement	Compliant

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## 4 DESCRIPTION OF TEST MODES

### 4.1 The Worst Test Modes and Channel Details

1. The EUT stay in continuous transmission mode.
2. The frequency 13.56 MHz is the default channel to test, where it is the only manipulative channel as this application supports.
3. Only one configuration is supported/applicable as follows.

RADIATED EMISSION TEST			
MODE	AVAILABLE CHANNEL	TESTED CHANNEL	MODULATION
NFC	1	1	ASK
FREQUENCY STABILITY			
MODE	AVAILABLE CHANNEL	TESTED CHANNEL	MODULATION
NFC	1	1	ASK
20dB BANDWIDTH			
MODE	AVAILABLE CHANNEL	TESTED CHANNEL	MODULATION
NFC	1	1	ASK

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.

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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:

Radiated Emission Test Site: Conduction C					
EQUIPMENT TYPE	MFR	MODEL NUMBER	SERIAL NUMBER	LAST CAL.	CAL DUE.
Test Software	audix	e3	Ver. 6.11-20180419c	N.C.R	N.C.R
LISN	SCHWARZBECK Mess-Elektronik	NSLK8127	973	03/25/2021	03/24/2022
EMI Test Receiver	R&S	ESCI	101342	04/28/2021	04/27/2022
Coaxial Cable	EC Lab	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

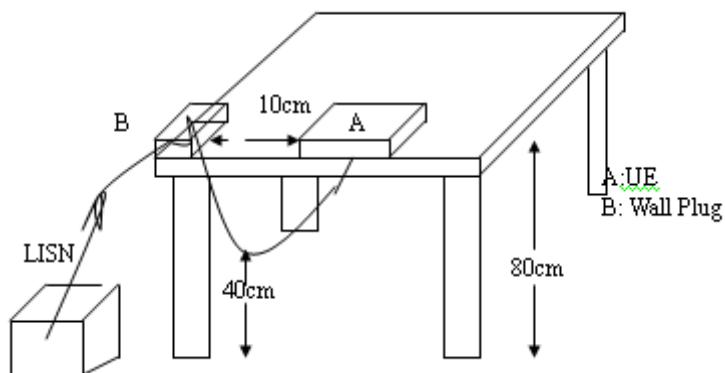
### 6.3 EUT Setup

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.

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## 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.

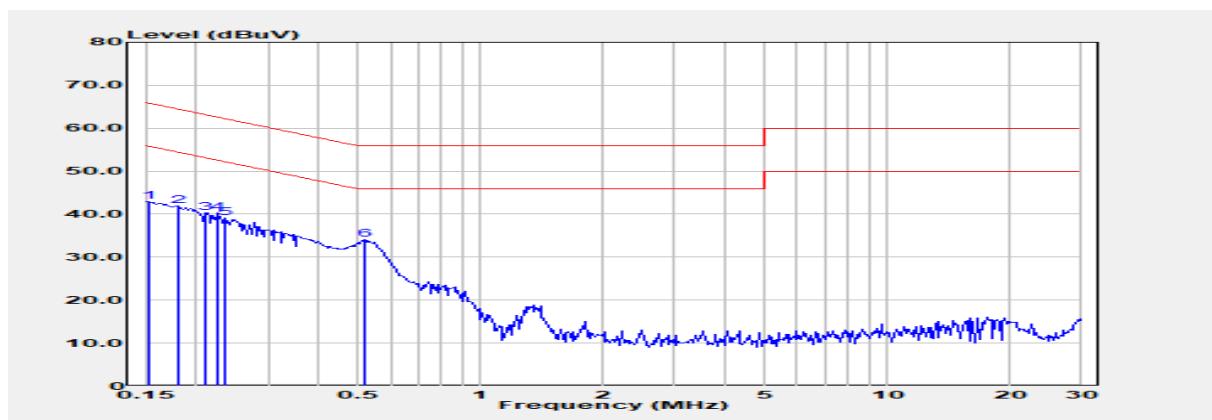
Note2: The \* reveals the worst-case results that closet to the limit.

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**AC POWER LINE CONDUCTED EMISSION TEST DATA**

Report Number :E2/2021/90012 Test Site :Conduction C  
Test Mode :RFID 13.56 KHz Test Date :2021-09-09  
Power :120V/60Hz Temp./Humi. :23.5/61  
Probe :L1 Engineer :Ashton Chiu  
Note: : Adapter:AD41-0900500DU



Freq. MHz	Detector Mode PK/QP/AV	Spectrum Reading Level dB $\mu$ V	Factor dB	Actual FS dB $\mu$ V/m	Limit @3m dB $\mu$ V/m	Margin dB
0.153	Peak	32.65	10.30	42.95	65.82	-22.87
0.182	Peak	31.54	10.30	41.84	64.42	-22.58
0.211	Peak	30.01	10.30	40.31	63.18	-22.88
0.227	Peak	29.91	10.30	40.21	62.57	-22.36
0.237	Peak	28.80	10.30	39.10	62.22	-23.11
0.518	Peak	23.80	10.31	34.11	56.00	-21.89

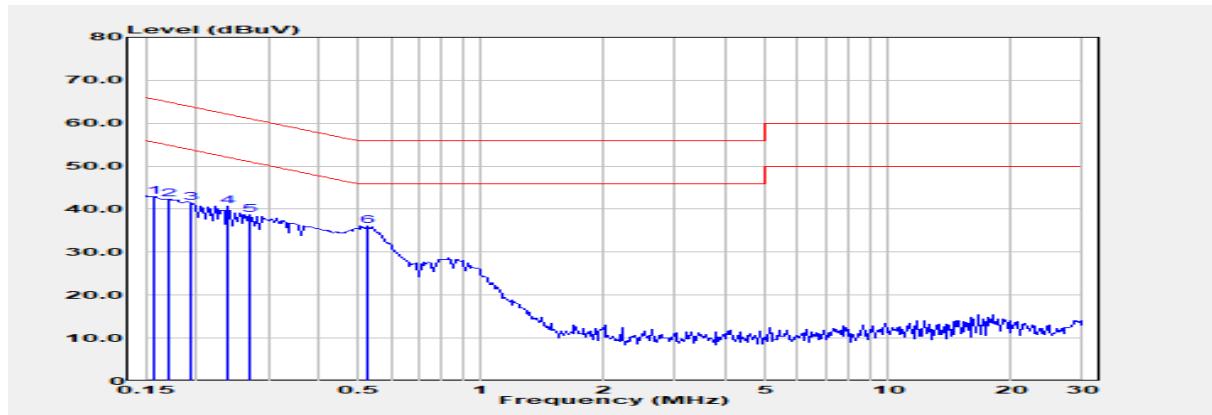
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Report Number :E2/2021/90012  
Test Mode :RFID 13.56 KHz  
Power :120V/60Hz  
Probe :N  
Note: : Adapter:AD41-0900500DU

Test Site :Conduction C  
Test Date :2021-09-09  
Temp./Humi. :23.5/61  
Engineer :Ashton Chiu



Freq. MHz	Detector Mode PK/QP/AV	Spectrum Reading Level dB $\mu$ V	Factor dB	Actual FS dB $\mu$ V/m	Limit @3m dB $\mu$ V/m	Margin dB
0.158	Peak	32.68	10.31	42.99	65.56	-22.57
0.170	Peak	32.07	10.31	42.37	64.94	-22.57
0.193	Peak	31.28	10.30	41.58	63.89	-22.31
0.239	Peak	30.45	10.30	40.75	62.13	-21.38
0.272	Peak	28.40	10.31	38.71	61.07	-22.36
0.524	Peak	25.78	10.32	36.10	56.00	-19.90

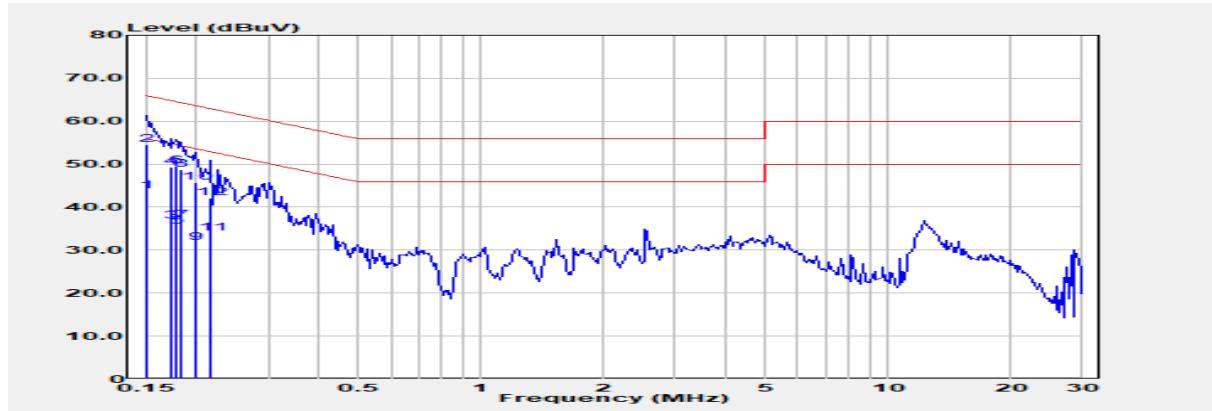
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Report Number :E2/2021/90012  
Test Mode :RFID 13.56 KHz  
Power :120V/60Hz  
Probe :L1  
Note: : POE

Test Site :Conduction C  
Test Date :2021-09-09  
Temp./Humi. :23.5/61  
Engineer :Ashton Chiu



Freq. MHz	Detector Mode PK/QP/AV	Spectrum Reading Level dB $\mu$ V	Factor dB	Actual FS dB $\mu$ V/m	Limit @3m dB $\mu$ V/m	Margin dB
0.152	Average	33.50	10.30	43.80	55.91	-12.11
0.152	QP	44.30	10.30	54.60	65.91	-11.31
0.174	Average	26.30	10.30	36.60	54.77	-18.17
0.174	QP	39.00	10.30	49.30	64.77	-15.47
0.178	Average	25.20	10.30	35.50	54.59	-19.09
0.178	QP	39.20	10.30	49.50	64.59	-15.09
0.183	Average	26.60	10.30	36.90	54.33	-17.43
0.183	QP	38.40	10.30	48.70	64.33	-15.63
0.200	Average	21.40	10.30	31.70	53.62	-21.92
0.200	QP	35.50	10.30	45.80	63.62	-17.82
0.217	Average	23.60	10.30	33.90	52.92	-19.02
0.217	QP	31.80	10.30	42.10	62.92	-20.82

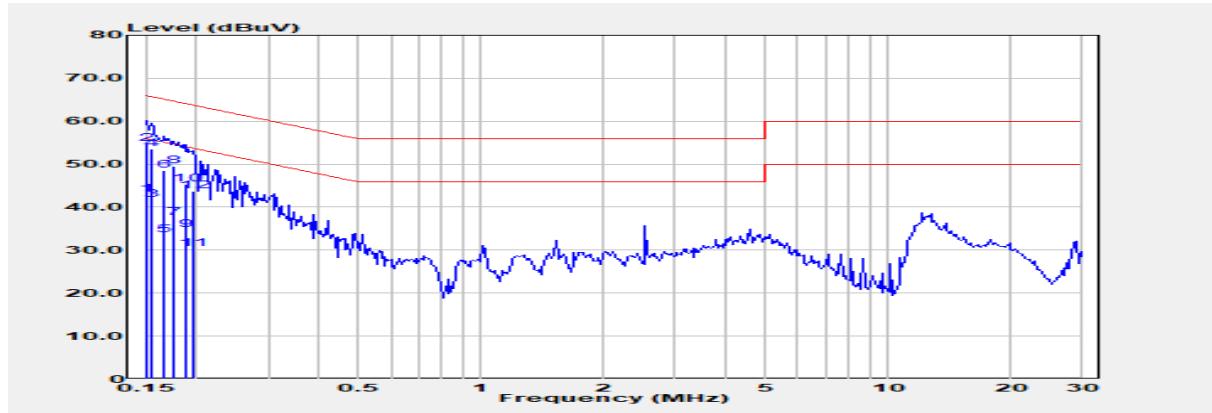
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Report Number :E2/2021/90012  
Test Mode :RFID 13.56 KHz  
Power :120V/60Hz  
Probe :N  
Note: : POE

Test Site :Conduction C  
Test Date :2021-09-09  
Temp./Humi. :23.5/61  
Engineer :Ashton Chiu



Freq. MHz	Detector Mode PK/QP/AV	Spectrum Reading Level dB $\mu$ V	Factor dB	Actual FS dB $\mu$ V/m	Limit @3m dB $\mu$ V/m	Margin dB
0.152	Average	32.60	10.31	42.91	55.91	-13.00
0.152	QP	44.40	10.31	54.71	65.91	-11.20
0.155	Average	31.40	10.31	41.71	55.74	-14.03
0.155	QP	43.20	10.31	53.51	65.74	-12.23
0.167	Average	23.10	10.31	33.41	55.12	-21.71
0.167	QP	38.20	10.31	48.51	65.12	-16.61
0.176	Average	27.10	10.30	37.40	54.68	-17.28
0.176	QP	39.20	10.30	49.50	64.68	-15.18
0.189	Average	24.30	10.30	34.60	54.06	-19.46
0.189	QP	35.00	10.30	45.30	64.06	-18.76
0.195	Average	19.90	10.30	30.20	53.80	-23.60
0.195	QP	33.50	10.30	43.80	63.80	-20.00

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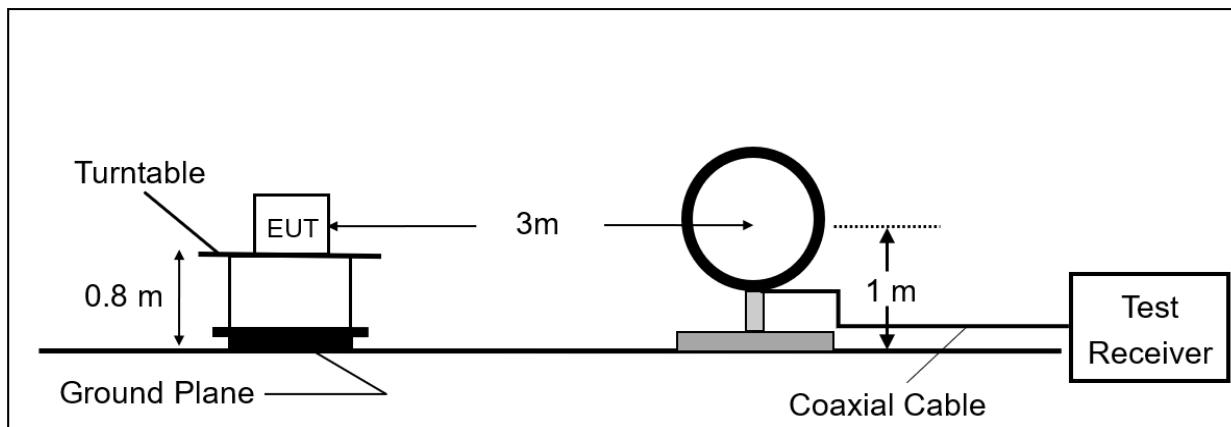
## 7 RADIATED EMISSION TEST

### 7.1 Measurement Procedure

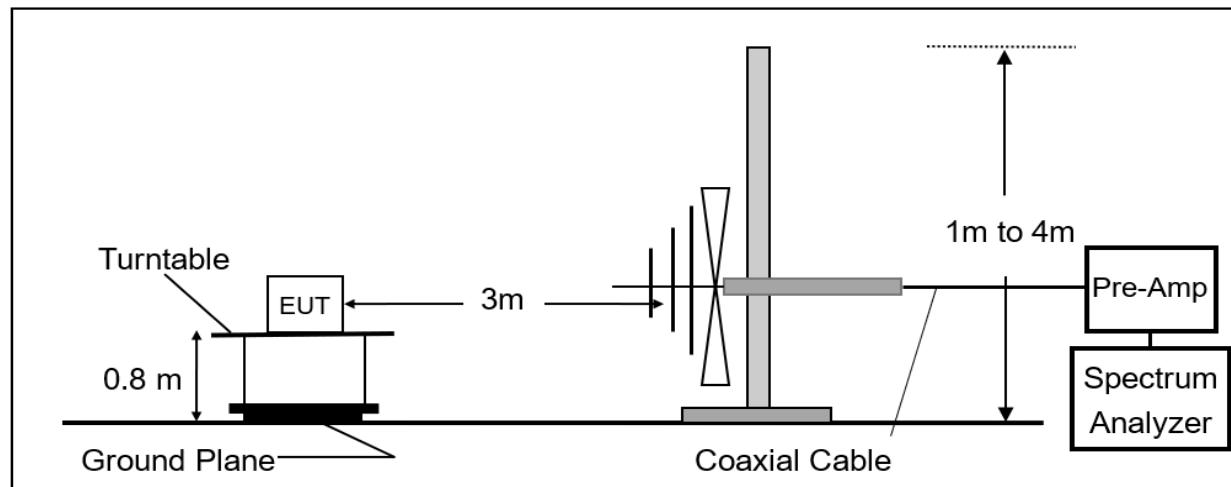
1. Configure the EUT according to ANSI C63.10.
2. The EUT was placed on a turn table which is 0.8m above ground plane and been measured in the frequency range between 0.009MHz to 30MHz and 30MHz to 1GHz.
3. The turn table shall rotate 360 degrees to determine the position of maximum emission level.
4. EUT is set 3m away from the receiving antenna which varied from 1m to 4m to find out the highest emission.
5. Maximum procedure was performed on the six highest emissions to ensure EUT compliance.
6. And also, each emission was to be maximized by changing the polarization of receiving antenna both horizontal and vertical.
7. Repeat above procedures until all default test channel measured were complete.

### 7.2 Test SET-UP (Block Diagram of Configuration)

(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	MODEL NUMBER	SERIAL NUMBER	LAST CAL.	CAL DUE.
Broadband Antenna	TESEQ	CBL 6112D	35240	09/08/2020	09/07/2021
Broadband Antenna	TESEQ	CBL 6112D	35243	10/07/2020	10/06/2021
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

### 7.4 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	

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## 7.5 Field Strength of Fundamental Emission

### 7.5.1 Applicable standard

Rules and specifications	CFR 47 Part 15 section 15.225(a)-(d)	
Frequency of Emission (MHz)	Field Strength ( $\mu$ V/m) at 30m	Field Strength (dB $\mu$ V/m) at 30m
1.705~13.110	30	29.5
13.110~13.410	106	40.5
13.410~13.553	334	50.5
13.553~13.567	15848	84
13.567~13.710	334	50.5
13.710~14.010	106	40.5
14.010~30.00	30	29.5

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## 7.5.2 Distance Extrapolation Factor

### 30m to 3m

Distance extrapolation =  $40 * \log (30/3) = 40$  dB

### 30m to 10m

Distance extrapolation =  $40 * \log (30/10) = 19.08$  dB

### 10m to 3m

Distance extrapolation =  $40 * \log (10/3) = 20.92$  dB

#### Note:

1. Distance extrapolation factor =  $40 \log (\text{required distance} / \text{test distance})$  (dB)
2. The lower limit shall apply at the transition frequencies.
3. KDB 414788 D01 OATS and 3m semi-anechoic chamber Justification:  
Base on FCC 15.31 (f) (2): measurements may be performed at a distance closer than that specified in the regulations; however, an attempt should be made to avoid making measurements in the near field. OATS and 3m SAC chamber testing had been performed and 3m SAC measured test result is the worst case test result.

Actual FS(dB $\mu$ V/m) = Spectrum. Reading level(dB $\mu$ V) + Factor(dB)

Below 30 MHz of Factor(dB) = Antenna Factor(dB $\mu$ V/m) + Cable Loss(dB) – Distance Factor (dB)

Above 30 MHz of Factor(dB) = Antenna Factor(dB $\mu$ V/m) + Cable Loss(dB) – Pre\_Amp Gain (dB)

The trace on RE(radiation emission) plot is as colored blue, and the detection manner we've employed is peak detector.

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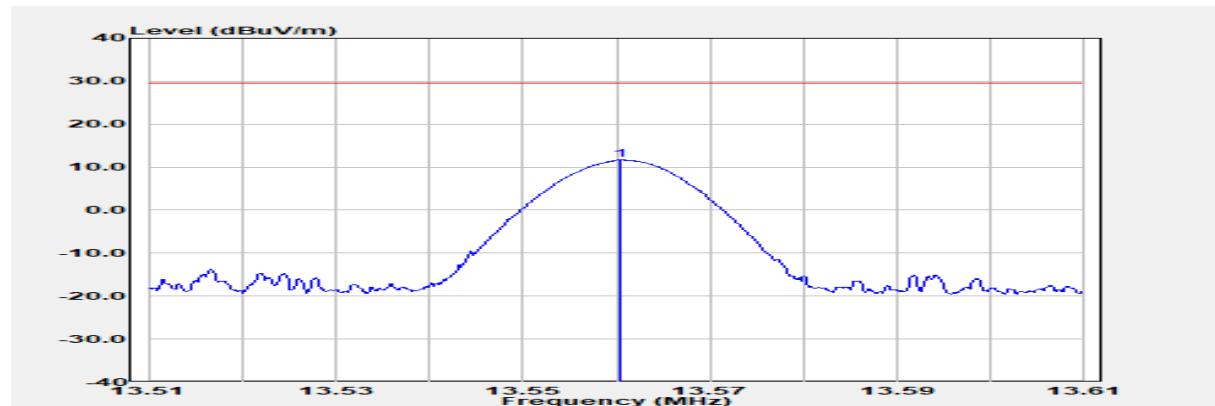
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### 7.5.3 Field Strength of Fundamental Emission Measurement Result

#### Main

Report Number	:E2/2021/90012	Test Site	:SAC C
Operation Mode	:RFID	Test Date	:2021-08-25
Test Frequency	:13.56 MHz	Temp./Humi.	:24.4/57
Test Mode	:Main	Antenna Pol.	:Vertical
EUT Pol	:H Plane	Engineer	:Enzo Chang



Freq. MHz	Detector Mode PK/QP/AV	Spectrum Reading Level dB $\mu$ V	Factor dB	Actual dB $\mu$ V/m	Limit dB $\mu$ V/m	Margin dB
13.560	Peak	39.81	-28.12	11.69	29.50	-17.81

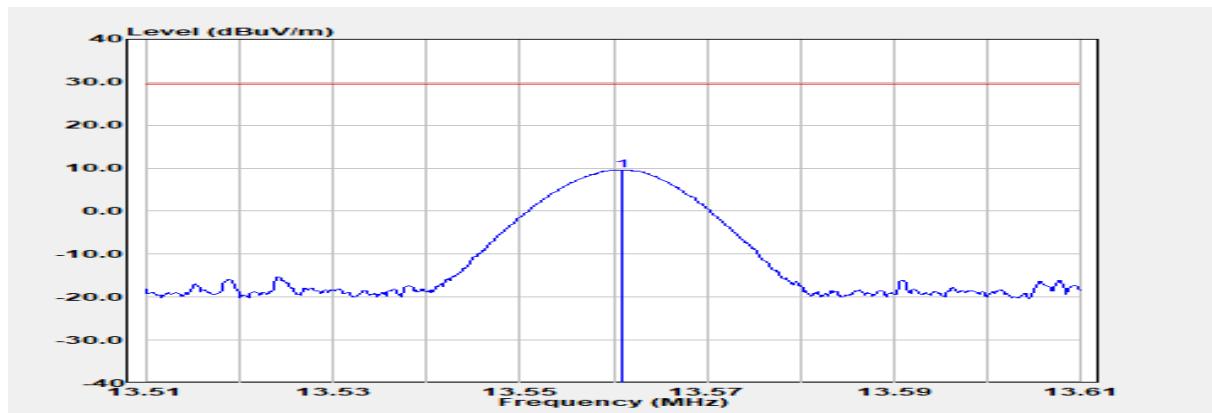
Actual level = Reading level + Factor

Factor = Antenna factor + cable loss – distance factor(3m to 30m and 3m to 300m)

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Report Number :E2/2021/90012 Test Site :SAC C  
Operation Mode :RFID Test Date :2021-08-25  
Test Frequency :13.56 MHz Temp./Humi. :24.4/57  
Test Mode :Main Antenna Pol. :Horizontal  
EUT Pol :H Plane Engineer :Enzo Chang



Freq. MHz	Detector Mode PK/QP/AV	Spectrum Reading Level dB $\mu$ V	Factor dB	Actual dB $\mu$ V/m	Limit dB $\mu$ V/m	Margin dB
13.561	Peak	37.71	-28.12	9.60	29.50	-19.90

Actual level = Reading level + Factor

Factor = Antenna factor + cable loss – distance factor(3m to 30m and 3m to 300m)

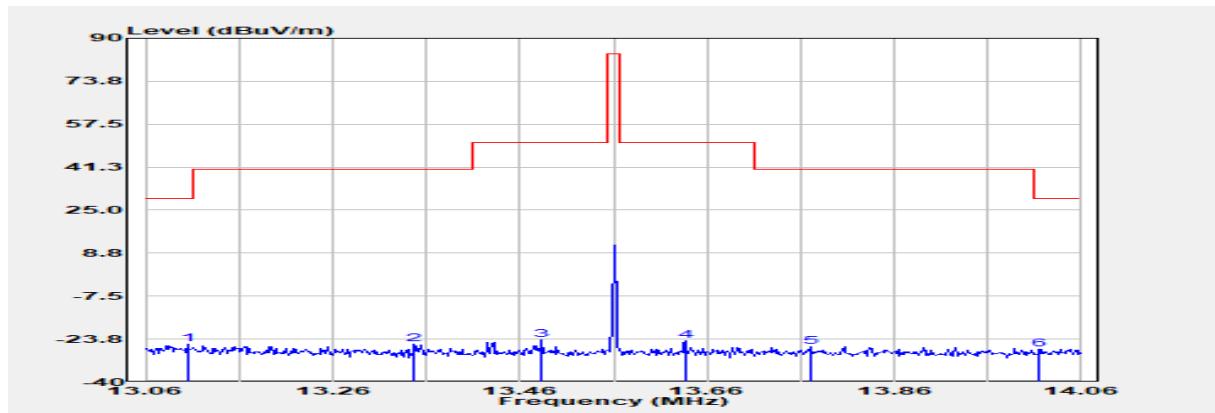
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## Mask

Report Number	:E2/2021/90012	Test Site	:SAC C
Operation Mode	:RFID	Test Date	:2021-08-25
Test Frequency	:13.56 MHz	Temp./Humi.	:24.4/57
Test Mode	:Mask	Antenna Pol.	:Vertical
EUT Pol	:H Plane	Engineer	:Enzo Chang



Freq. MHz	Detector Mode PK/QP/AV	Spectrum Reading Level dB $\mu$ V	Factor dB	Actual dB $\mu$ V/m	Limit dB $\mu$ V/m	Margin dB
13.105	Peak	2.40	-28.08	-25.68	29.54	-55.22
13.347	Peak	2.49	-28.10	-25.61	40.50	-66.11
13.483	Peak	4.23	-28.11	-23.87	50.47	-74.34
13.637	Peak	3.70	-28.12	-24.42	50.47	-74.89
13.770	Peak	1.39	-28.13	-26.75	40.50	-67.25
14.015	Peak	0.58	-28.15	-27.57	29.54	-57.11

Actual level = Reading level + Factor

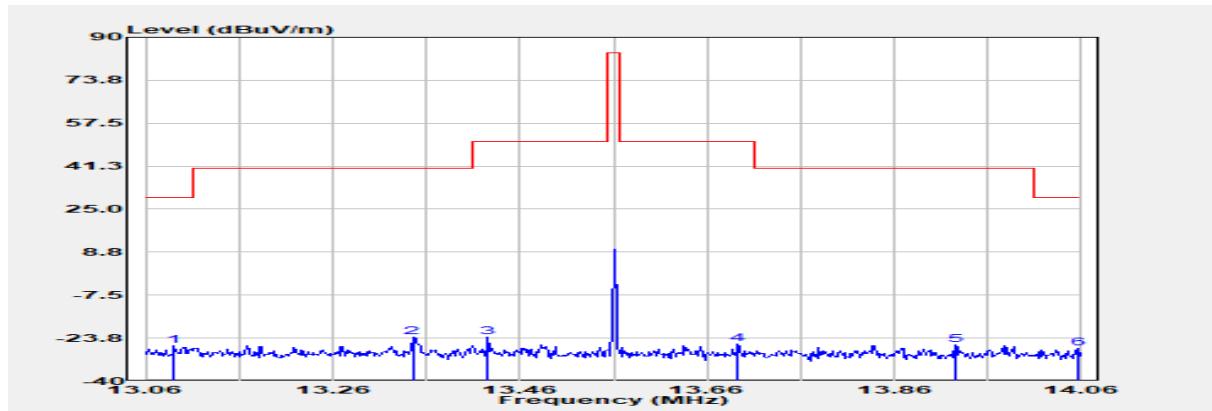
Factor = Antenna factor + cable loss – distance factor(3m to 30m and 3m to 300m)

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Report Number :E2/2021/90012      Test Site :SAC C  
 Operation Mode :RFID      Test Date :2021-08-25  
 Test Frequency :13.56 MHz      Temp./Humi. :24.4/57  
 Test Mode :Mask      Antenna Pol. :Horizontal  
 EUT Pol :H Plane      Engineer :Enzo Chang



Freq. MHz	Detector Mode PK/QP/AV	Spectrum Reading Level dB $\mu$ V	Factor dB	Actual dB $\mu$ V/m	Limit dB $\mu$ V/m	Margin dB
13.090	Peak	1.49	-28.08	-26.59	29.54	-56.13
13.345	Peak	4.56	-28.10	-23.54	40.50	-64.04
13.425	Peak	4.74	-28.10	-23.37	50.47	-73.84
13.693	Peak	2.12	-28.13	-26.01	50.47	-76.48
13.925	Peak	1.69	-28.14	-26.46	40.50	-66.96
14.057	Peak	0.69	-28.15	-27.46	29.54	-57.00

Actual level = Reading level + Factor

Factor = Antenna factor + cable loss – distance factor(3m to 30m and 3m to 300m)

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## 7.6 Radiated Spurious Emission Measurement

### 7.6.1 Standard Applicable

The field strength of any emissions appearing outside of the 13.110-14.010 MHz shall not exceed the general radiated emission limits in section 15.209 as below.

Frequency (MHz)	Field strength ( $\mu$ V/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  $\text{dB}\mu\text{V}/\text{m} = 20 \log (\mu\text{V}/\text{m})$
2. Distance extrapolation factor =  $40 \log (\text{required distance}/ \text{test distance})$  (dB)
3.  $20 * \log(30\mu\text{V}/\text{m}) = 29.54 \text{ dB}\mu\text{V}/\text{m}$
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.

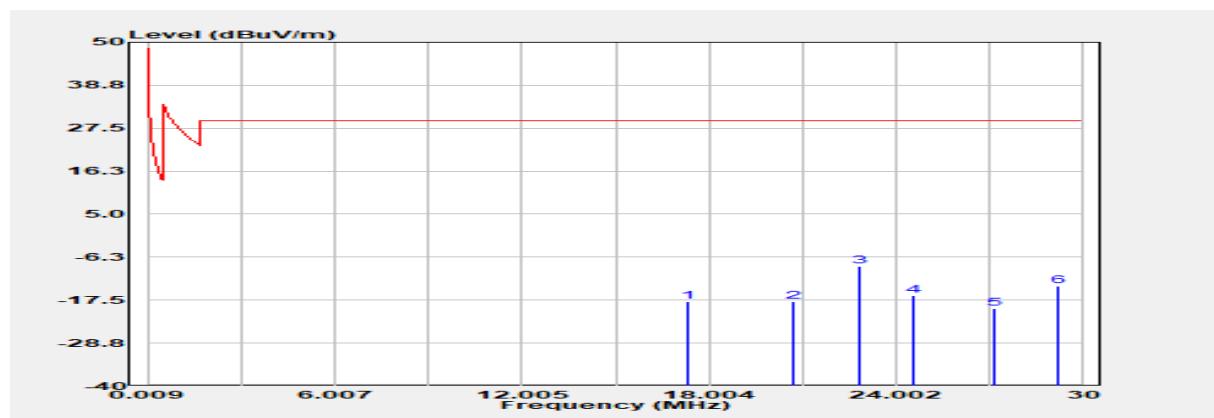
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## 7.6.2 Radiated Spurious Emission Measurement Result

Report Number	:E2/2021/90012	Test Site	:SAC C
Operation Mode	:RFID	Test Date	:2021-08-25
Test Frequency	:13.56 MHz	Temp./Humi.	:24.4/57
Test Mode	:Tx	Antenna Pol.	:Vertical
EUT Pol	:H Plane	Engineer	:Enzo Chang



Freq. MHz	Detector Mode PK/QP/AV	Spectrum Reading Level dB $\mu$ V	Factor dB	Actual dB $\mu$ V/m	Limit dB $\mu$ V/m	Margin dB
17.312	Peak	10.43	-28.38	-17.95	29.54	-47.49
20.724	Peak	10.85	-28.71	-17.85	29.54	-47.39
22.839	Peak	20.45	-29.16	-8.71	29.54	-38.25
24.569	Peak	13.24	-29.50	-16.25	29.54	-45.79
27.120	Peak	10.20	-29.93	-19.73	29.54	-49.27
29.183	Peak	16.34	-30.25	-13.92	29.54	-43.46

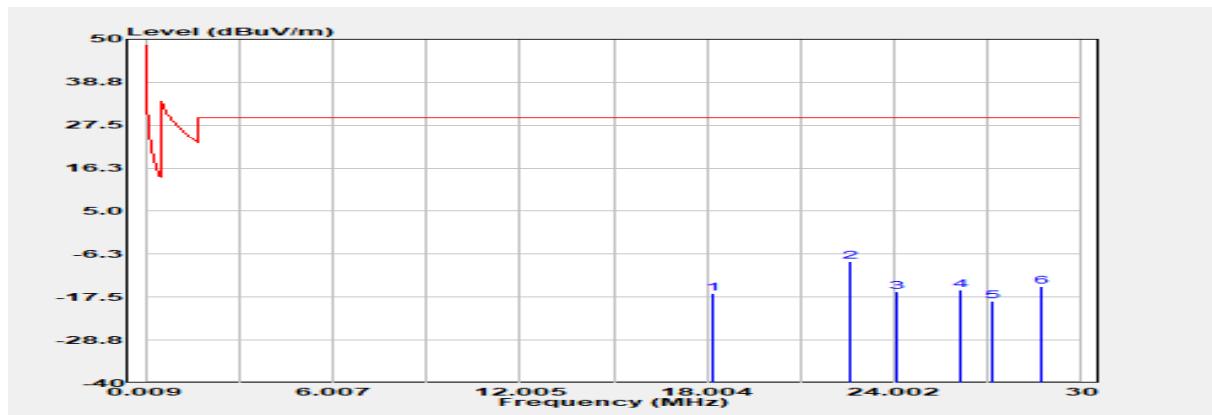
Actual level = Reading level + Factor

Factor = Antenna factor + cable loss – distance factor(3m to 30m and 3m to 300m)

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Report Number :E2/2021/90012      Test Site :SAC C  
 Operation Mode :RFID      Test Date :2021-08-25  
 Test Frequency :13.56 MHz      Temp./Humi. :24.4/57  
 Test Mode :Tx      Antenna Pol. :Horizontal  
 EUT Pol :H Plane      Engineer :Enzo Chang



Freq. MHz	Detector Mode PK/QP/AV	Spectrum Reading Level dB $\mu$ V	Factor dB	Actual dB $\mu$ V/m	Limit dB $\mu$ V/m	Margin dB
18.225	Peak	11.79	-28.44	-16.65	29.54	-46.19
22.598	Peak	21.01	-29.11	-8.10	29.54	-37.64
24.088	Peak	13.38	-29.40	-16.03	29.54	-45.57
26.107	Peak	14.11	-29.77	-15.66	29.54	-45.20
27.120	Peak	11.33	-29.93	-18.60	29.54	-48.14
28.702	Peak	15.36	-30.18	-14.82	29.54	-44.36

Actual level = Reading level + Factor

Factor = Antenna factor + cable loss – distance factor(3m to 30m and 3m to 300m)

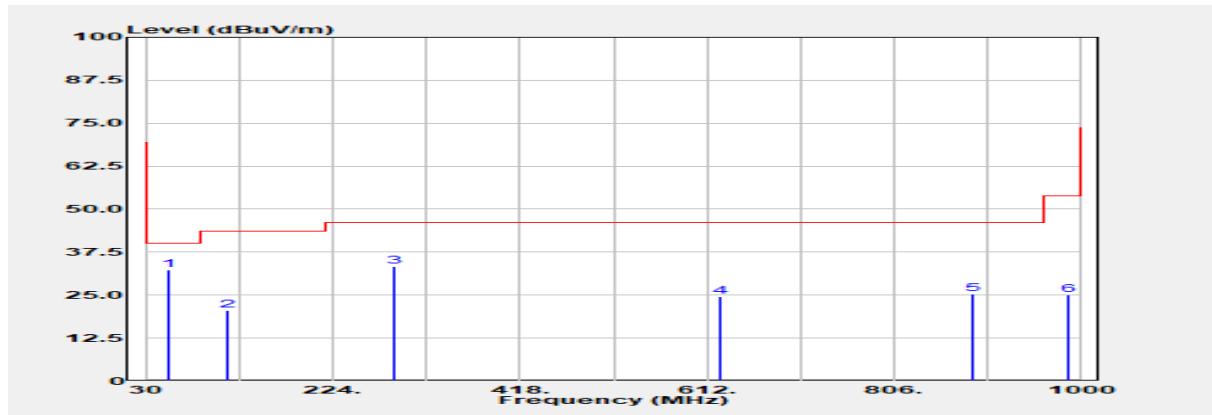
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Report Number :E2/2021/90012  
Operation Mode :RFID  
Test Frequency :13.56 MHz  
Test Mode :Tx  
EUT Pol :H Plane

Test Site :SAC C  
Test Date :2021-08-25  
Temp./Humi. :24.4/57  
Antenna Pol. :VERTICAL  
Engineer :Enzo Chang



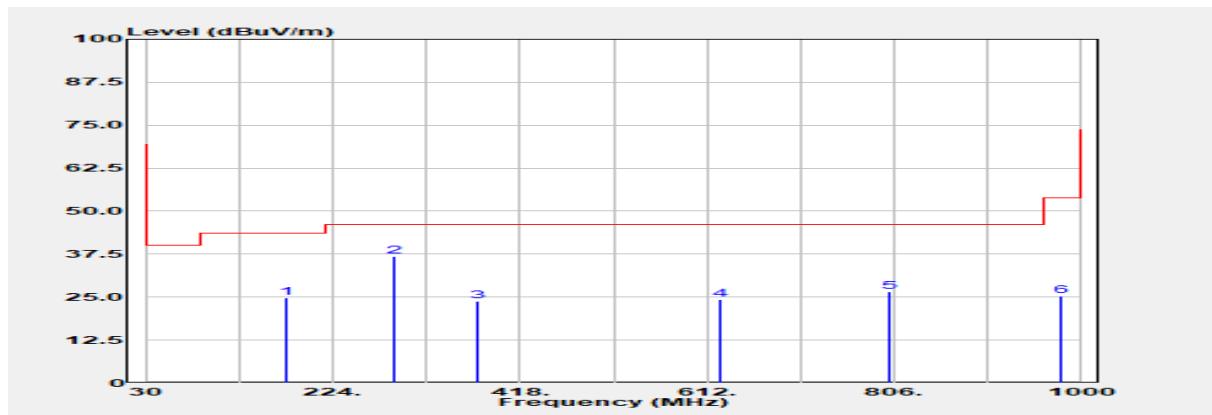
Freq. MHz	Detector Mode PK/QP/AV	Spectrum Reading Level dB $\mu$ V	Factor dB	Actual FS dB $\mu$ V/m	Limit @3m dB $\mu$ V/m	Margin dB
53.317	Peak	54.54	-22.16	32.37	40.00	-7.63
113.942	Peak	38.12	-17.52	20.60	43.50	-22.90
288.045	Peak	48.87	-15.54	33.33	46.00	-12.67
625.369	Peak	32.91	-8.26	24.66	46.00	-21.34
888.077	Peak	31.48	-6.22	25.26	46.00	-20.74
986.010	Peak	30.27	-5.14	25.13	54.00	-28.87

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Report Number :E2/2021/90012  
 Operation Mode :RFID  
 Test Frequency :13.56 MHz  
 Test Mode :Tx  
 EUT Pol :H Plane

Test Site :SAC C  
 Test Date :2021-08-25  
 Temp./Humi. :24.4/57  
 Antenna Pol. :HORIZONTAL  
 Engineer :Enzo Chang



Freq. MHz	Detector Mode PK/QP/AV	Spectrum Reading Level dB $\mu$ V	Factor dB	Actual FS dB $\mu$ V/m	Limit @3m dB $\mu$ V/m	Margin dB
176.122	Peak	44.90	-20.06	24.84	43.50	-18.66
288.045	Peak	52.50	-15.54	36.97	46.00	-9.03
375.096	Peak	37.30	-13.46	23.85	46.00	-22.15
625.369	Peak	32.46	-8.26	24.21	46.00	-21.79
801.026	Peak	34.05	-7.36	26.69	46.00	-19.31
979.792	Peak	30.08	-4.79	25.29	54.00	-28.71

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## 8 FREQUENCY STABILITY

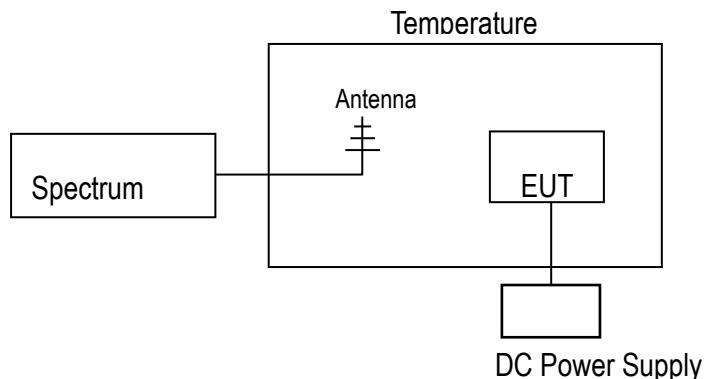
### 8.1 Applicable Standard

The frequency tolerance of the carrier signal shall be maintained within +/- 0.01% of the operating frequency over a temperature variation of -20 degrees to +50 degrees C at normal supply voltage, and for a variation in the primary supply voltage from 85% to 115% of the rated supply voltage at a temperature of 20 degrees C. For battery operated equipment, the equipment tests shall be performed using a new battery.

### 8.2 Measurement Procedure

1. The EUT was placed on a turn table which is 0.8m above ground plane.
2. Set EUT as normal operation
3. Set SPA Center Frequency = fundamental frequency, RBW, VBW= 10kHz, Span =100kHz.
4. Set SPA Max hold. Mark peak.

### 8.3 Test SET-UP (Block Diagram of Configuration)



### 8.4 Measurement Equipment Used:

Conducted Emission Test Site: Conducted B					
EQUIPMENT TYPE	MFR	MODEL NUMBER	SERIAL NUMBER	LAST CAL.	CAL DUE.
Spectrum Analyzer	KEYSIGHT	N9010A	MY51440113	07/13/2021	07/12/2022
DC Block	PASTERNACK	PE8210	RF157	11/19/2020	11/18/2021
Coaxial Cables	Woken	00100A1F1A185C	RF54	11/19/2020	11/18/2021
Loop Antenna	ETS.LINDGREN	6502	00143303	05/07/2021	05/06/2022
Temperature Chamber	TERCHY	MHK-120LK	1020582	07/01/2021	06/30/2022
Test Software	EMI Tool	Alpha	Ver.1	N.C.R	N.C.R

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## 8.5 Measurement Results

## Startup

## A. Temperature Variation

Power Supply	Environment	Frequency	Delta (KHz)	Limit (KHz)
Vdc	Temperature (°C)	(MHz)		
9	-20	13.5608	0.80000	+/- 1.356
9	-10	13.5606	0.60000	+/- 1.356
9	0	13.5606	0.60000	+/- 1.356
9	10	13.5606	0.60000	+/- 1.356
9	20	13.5608	0.80000	+/- 1.356
9	30	13.5606	0.60000	+/- 1.356
9	40	13.5608	0.80000	+/- 1.356
9	50	13.5605	0.50000	+/- 1.356

## B. Supply Voltage Variation

Power Supply	Environment	Frequency	Delta (KHz)	Limit (KHz)
Vdc	Temperature (°C)	(MHz)		
10.35	20	13.5607	0.70000	+/- 1.356
9	20	13.5608	0.80000	+/- 1.356
7.65	20	13.5609	0.90000	+/- 1.356

## 2 minutes

## A. Temperature Variation

Power Supply	Environment	Frequency	Delta (KHz)	Limit (KHz)
Vdc	Temperature (°C)	(MHz)		
9	-20	13.5605	0.50000	+/- 1.356
9	-10	13.5609	0.90000	+/- 1.356
9	0	13.5606	0.60000	+/- 1.356
9	10	13.5609	0.90000	+/- 1.356
9	20	13.5609	0.90000	+/- 1.356
9	30	13.5609	0.90000	+/- 1.356
9	40	13.5606	0.60000	+/- 1.356
9	50	13.5605	0.50000	+/- 1.356

## B. Supply Voltage Variation

Power Supply	Environment	Frequency	Delta (KHz)	Limit (KHz)
Vdc	Temperature (°C)	(MHz)		
10.35	20	13.5607	0.70000	+/- 1.356
9	20	13.5609	0.90000	+/- 1.356
7.65	20	13.5605	0.50000	+/- 1.356

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**5 minutes****A. Temperature Variation**

Power Supply	Environment	Frequency	Delta (KHz)	Limit (KHz)
Vdc	Temperature (°C)	(MHz)		
9	-20	13.5609	0.90000	+/- 1.356
9	-10	13.5607	0.70000	+/- 1.356
9	0	13.5607	0.70000	+/- 1.356
9	10	13.5605	0.50000	+/- 1.356
9	20	13.5609	0.90000	+/- 1.356
9	30	13.5608	0.80000	+/- 1.356
9	40	13.5607	0.70000	+/- 1.356
9	50	13.5609	0.90000	+/- 1.356

**B. Supply Voltage Variation**

Power Supply	Environment	Frequency	Delta (KHz)	Limit (KHz)
Vdc	Temperature (°C)	(MHz)		
10.35	20	13.5608	0.80000	+/- 1.356
9	20	13.5609	0.90000	+/- 1.356
7.65	20	13.5609	0.90000	+/- 1.356

**10 minutes****A. Temperature Variation**

Power Supply	Environment	Frequency	Delta (KHz)	Limit (KHz)
Vdc	Temperature (°C)	(MHz)		
9	-20	13.5605	0.50000	+/- 1.356
9	-10	13.5606	0.60000	+/- 1.356
9	0	13.5606	0.60000	+/- 1.356
9	10	13.5606	0.60000	+/- 1.356
9	20	13.5608	0.80000	+/- 1.356
9	30	13.5607	0.70000	+/- 1.356
9	40	13.5609	0.90000	+/- 1.356
9	50	13.5606	0.60000	+/- 1.356

**B. Supply Voltage Variation**

Power Supply	Environment	Frequency	Delta (KHz)	Limit (KHz)
Vdc	Temperature (°C)	(MHz)		
10.35	20	13.5607	0.70000	+/- 1.356
9	20	13.5608	0.80000	+/- 1.356
7.65	20	13.5608	0.80000	+/- 1.356

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## 9 EMISSION BANDWIDTH MEASUREMENT

### 9.1 Applicable Standard:

The 20 dB bandwidth shall be specified in operating frequency band.

### 9.2 Limit:

None

### 9.3 Test Set-up

Refer to section 8.3 in this report

### 9.4 Measurement Equipment Used:

Refer to section 8.4 in this report

### 9.5 Measurement Procedure

1. Placed the EUT on the testing table.
2. Set the EUT under transmission condition continuously at specific channel frequency.
3. The resolution bandwidth of 1 kHz and the video bandwidth of 3 kHz were used.
4. Measured the spectrum width with power higher than 20dB below carrier.

### 9.6 Measurement Result

FCC			
20dB BW (kHz)	Operation range	Frequency (MHz)	Limit (MHz)
2.893	Low	13.55955	>13.11
	High	13.56205	<14.01

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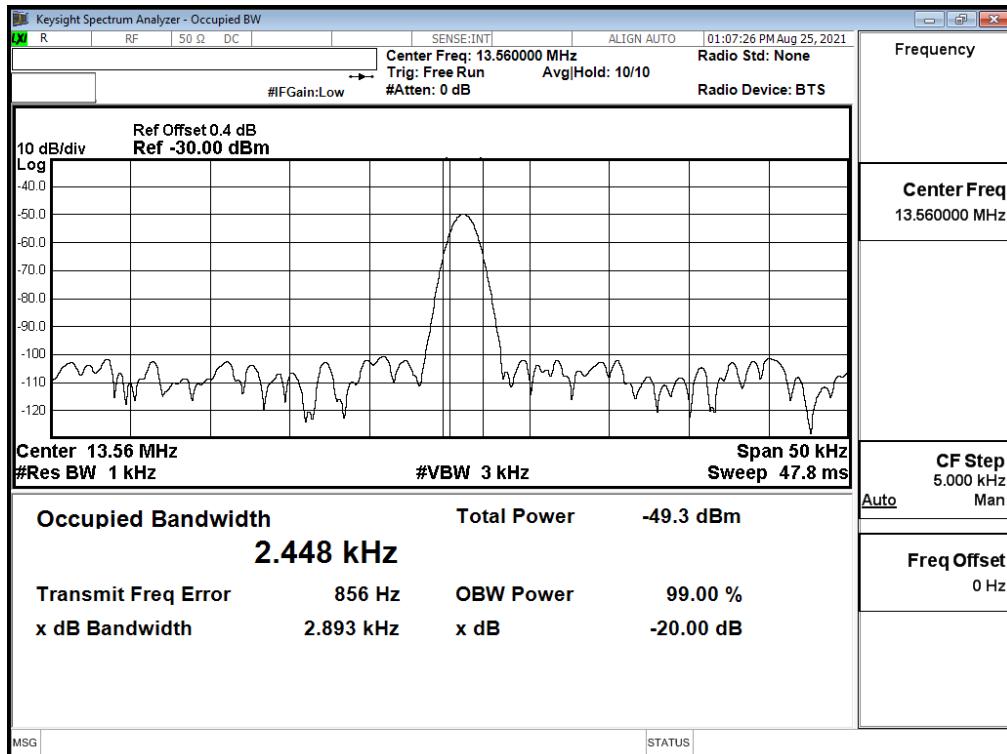
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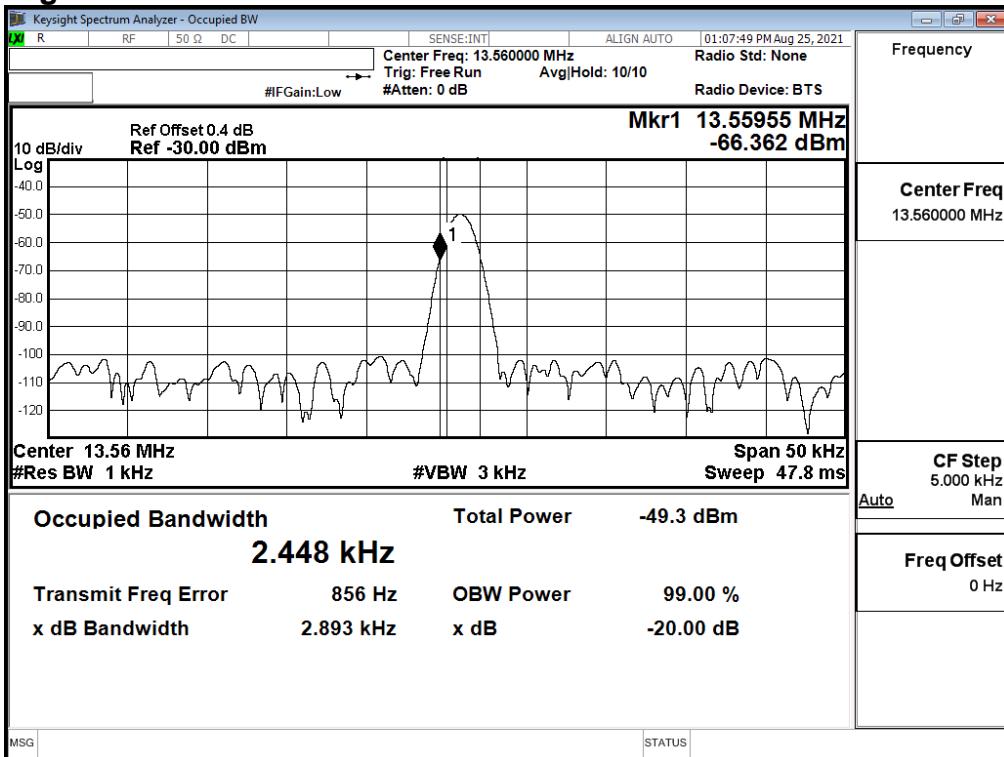
## Bandwidth



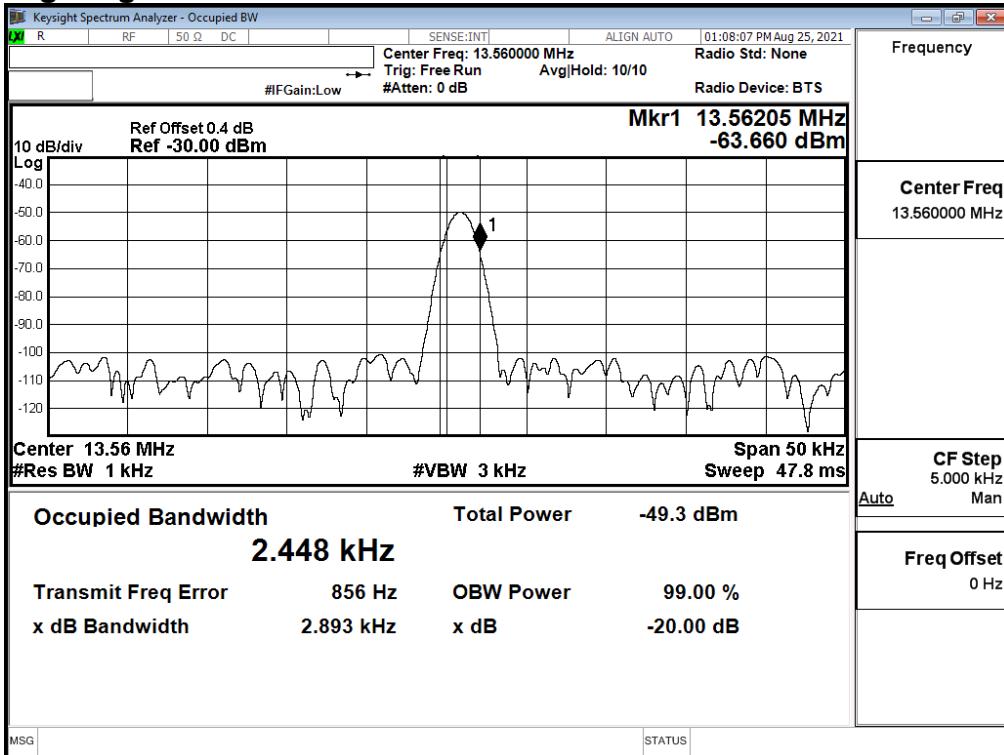
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## Operation range low



## Operation range High



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## 10 ANTENNA REQUIREMENT

### 10.1 Standard Applicable:

For intentional device, according to §15.203, an intentional radiator shall be designed to ensure that no antenna other than furnished by the responsible party shall be used with the device.

### 10.2 Antenna Connected Construction:

The antenna is designed as permanently attached and no consideration of replacement. Please see EUT photo for details.

*~ End of Report ~*

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