

# RF TEST REPORT



Report No.: 18070723-FCC-R

Supersede Report No.: N/A

Applicant	REMOTE SOLUTION.CO.,LTD	
Product Name	REMOTE CONTROL UNIT	
Main Model	LiveWire	
Serial Model	RC96XBB (X stands for A~Z, BB stands for 00~99) (Note: The product PCB is the same, and the difference is the simple model name.)	
Test Standard	FCC Part 15.249; ANSI C63.10: 2013	
Test Date	July 19 to August 06, 2018	
Issue Date	August 07, 2018	
Test Result	<input checked="" type="checkbox"/> Pass <input type="checkbox"/> Fail	
Equipment complied with the specification	<input checked="" type="checkbox"/>	
Equipment did not comply with the specification	<input type="checkbox"/>	
		
Aaron Liang Test Engineer	David Huang Checked By	
This test report may be reproduced in full only Test result presented in this test report is applicable to the tested sample only		

Issued by:

**SIEMIC (SHENZHEN-CHINA) LABORATORIES**

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## Laboratories Introduction

SIEMIC, headquartered in the heart of Silicon Valley, with superior facilities in US and Asia, is one of the leading independent testing and certification facilities providing customers with one-stop shop services for Compliance Testing and Global Certifications.



In addition to testing and certification, SIEMIC provides initial design reviews and compliance management throughout a project. Our extensive experience with China, Asia Pacific, North America, European, and International compliance requirements, assures the fastest, most cost effective way to attain regulatory compliance for the global markets.

### Accreditations for Conformity Assessment

Country/Region	Scope
USA	EMC, RF/Wireless, SAR, Telecom
Canada	EMC, RF/Wireless, SAR, Telecom
Taiwan	EMC, RF, Telecom, SAR, Safety
Hong Kong	RF/Wireless, SAR, Telecom
Australia	EMC, RF, Telecom, SAR, Safety
Korea	EMI, EMS, RF, SAR, Telecom, Safety
Japan	EMI, RF/Wireless, SAR, Telecom
Singapore	EMC, RF, SAR, Telecom
Europe	EMC, RF, SAR, Telecom, Safety

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## 1. Report Revision History

Report No.	Report Version	Description	Issue Date
18070723-FCC-R	NONE	Original	August 07, 2018

## 2. Customer information

Applicant Name	REMOTE SOLUTION.CO,.LTD
Applicant Add	92, Chogok-ri, Nammyun, Gimchun city, Kyungsangbukdo, Korea
Manufacturer	REMOTE SOLUTION.CO,.LTD
Manufacturer Add	92, Chogok-ri, Nammyun, Gimchun city, Kyungsangbukdo, Korea

## 3. Test site information

Test Lab A:

Lab performing tests	SIEMIC (Shenzhen-China) LABORATORIES
Lab Address	Zone A, Floor 1, Building 2 Wan Ye Long Technology Park South Side of Zhoushi Road, Bao' an District, Shenzhen, Guangdong China 518108
FCC Test Site No.	535293
IC Test Site No.	4842E-1
Test Software	Radiated Emission Program-To Shenzhen v2.0

Test Lab B:

Lab performing tests	SIEMIC (Nanjing-China) Laboratories
Lab Address	2-1 Longcang Avenue Yuhua Economic and Technology Development Park, Nanjing, China
FCC Test Site No.	694825
IC Test Site No.	4842B-1
Test Software	EZ_EM(ver.lcp-03A1)

Note: We just perform Radiated Spurious Emission above 18GHz in the test Lab. B.

## 4. Equipment under Test (EUT) Information

Description of EUT:	REMOTE CONTROL UNIT
Main Model:	LiveWire
Serial Model:	RC96XBB (X stands for A~Z, BB stands for 00~99) <b>(Note: The product PCB is the same, and the difference is the simple model name.)</b>
Date EUT received:	July 18, 2018
Test Date(s):	July 19 to August 06, 2018
Antenna Gain:	Antenna 0: 0dBi Antenna 1: 0dBi
Antenna Type:	PCB antenna
Power:	92.99dBuV/m
Type of Modulation:	O-QPSK
RF Operating Frequency (ies):	2425MHz, 2450MHz, 2475MHz
Number of Channels:	2425MHz: 15CH 2450MHz: 20CH 2475MHz: 25CH
Input Power:	DC 3.0V(Alkaline battery AA*2EA)
Port:	Please refer to the user' s manual
Trade Name :	N/A
FCC ID:	TX4RC96B

## 5. Test Summary

The product was tested in accordance with the following specifications.

All testing has been performed according to below product classification:

FCC Rules	Description of Test	Result
§15.203	Antenna Requirement	Compliance
§15.207(a)	AC Line Conducted Emissions	N/A
§15.205, §15.209, §15.249(a), §15.249(d)	Radiated Fundamental / Radiated Spurious Emissions	Compliance
§15.249(a)	Field Strength Measurement	Compliance
§15.249©	20 dB Bandwidth	Compliance
§15.249(d)	Band Edge	Compliance

### Measurement Uncertainty

Emissions		
Test Item	Description	Uncertainty
Band Edge and Radiated Spurious Emissions	Confidence level of approximately 95% (in the case where distributions are normal), with a coverage factor of 2 (for EUTs < 0.5m X 0.5m X 0.5m)	+5.6dB/-4.5dB
-	-	-

## 6. MEASUREMENTS, EXAMINATION AND DERIVED RESULTS

### 6.1 Antenna Requirement

#### Standard Requirement:

According to § 15.203, 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 user of a standard antenna jack or electrical connector is prohibited. The structure and application of the EUT were analyzed to determine compliance with section §15.203 of the rules. §15.203 state that the subject device must meet the following criteria:

- a. Antenna must be permanently attached to the unit.
- b. Antenna must use a unique type of connector to attach to the EUT.
- c. Unit must be professionally installed, and installer shall be responsible for verifying that the correct antenna is employed with the unit.

#### Antenna Connector Construction

The EUT has 2 antennas:

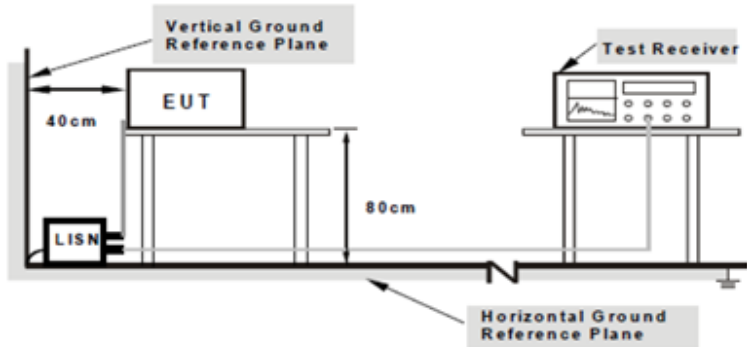
A permanently attached PCB antenna for antenna 0/antenna 1, the gain is 0dBi for antenna 0, the gain is 0dBi for antenna 1.

**Test Result: Pass**



## 6.2 AC Line Conducted Emissions

Temperature	-----
Relative Humidity	-----
Atmospheric Pressure	-----
Test date :	-----
Tested By :	-----

Spec	Item	Requirement	Applicable														
§15.207	a)	For Low-power radio-frequency devices that is designed to be connected to the public utility (AC) power line, the radio frequency voltage that is conducted back onto the AC power line on any frequency or frequencies, within the band 150 kHz to 30 MHz, shall not exceed the limits in the following table, as measured using a 50 [mu]H/50 ohms line impedance stabilization network (LISN). The lower limit applies at the boundary between the frequencies ranges.	☐														
		<table border="1"> <thead> <tr> <th rowspan="2">Frequency ranges (MHz)</th> <th colspan="2">Limit (dBµV)</th> </tr> <tr> <th>QP</th> <th>Average</th> </tr> </thead> <tbody> <tr> <td>0.15 ~ 0.5</td> <td>66 – 56</td> <td>56 – 46</td> </tr> <tr> <td>0.5 ~ 5</td> <td>56</td> <td>46</td> </tr> <tr> <td>5 ~ 30</td> <td>60</td> <td>50</td> </tr> </tbody> </table>		Frequency ranges (MHz)	Limit (dBµV)		QP	Average	0.15 ~ 0.5	66 – 56	56 – 46	0.5 ~ 5	56	46	5 ~ 30	60	50
		Frequency ranges (MHz)			Limit (dBµV)												
				QP	Average												
0.15 ~ 0.5	66 – 56	56 – 46															
0.5 ~ 5	56	46															
5 ~ 30	60	50															
Test Setup	 <p style="text-align: center;"> <b>Note: 1.Support units were connected to second LISN.                  2.Both of LISNs (AMN) are 80cm from EUT and at least 80cm from other units and other metal planes support units.</b> </p>																
Procedure	<ol style="list-style-type: none"> <li>The EUT and supporting equipment were set up in accordance with the requirements of the standard on top of a 1.5m x 1m x 0.8m high, non-metallic table.</li> <li>The power supply for the EUT was fed through a 50W/50mH EUT LISN, connected to filtered mains.</li> <li>The RF OUT of the EUT LISN was connected to the EMI test receiver via a low-loss coaxial cable.</li> </ol>																

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	<p>4. All other supporting equipment were powered separately from another main supply.</p> <p>5. The EUT was switched on and allowed to warm up to its normal operating condition.</p> <p>6. A scan was made on the NEUTRAL line (for AC mains) or Earth line (for DC power) over the required frequency range using an EMI test receiver.</p> <p>7. High peaks, relative to the limit line, The EMI test receiver was then tuned to the selected frequencies and the necessary measurements made with a receiver bandwidth setting of 10 kHz.</p> <p>8. Step 7 was then repeated for the LIVE line (for AC mains) or DC line (for DC power).</p>
Remark	<b>The EUT is powered by battery.</b>
Result	<input type="checkbox"/> Pass <input type="checkbox"/> Fail <input checked="" type="checkbox"/> N/A

Test Data     Yes                       N/A

Test Plot     Yes (See below)               N/A

### 6.3 Radiated Spurious Emissions

Temperature	24°C
Relative Humidity	55%
Atmospheric Pressure	1015mbar
Test date :	August 05, 2018
Tested By :	Aaron Liang

**Requirement(s):**

Spec	Requirement	Applicable																															
§15.209, §15.205, §15.249(a) & §15.249(d)	<p>The emissions from the Low-power radio-frequency devices shall not exceed the field strength levels specified in the following table and the level of any unwanted emissions shall not exceed the level of the fundamental emission. The tighter limit applies at the band edges.</p> <p>The field strength of emissions from intentional radiators operated within these frequency bands shall comply with the following:</p> <table border="1"> <thead> <tr> <th>Fundamental frequency</th> <th>Field strength of fundamental (millivolts/meter)</th> <th>Field strength of harmonics (microvolts/meter)</th> </tr> </thead> <tbody> <tr> <td>902– 928 MHz</td> <td>50</td> <td>500</td> </tr> <tr> <td>2400– 2483.5 MHz</td> <td>50</td> <td>500</td> </tr> <tr> <td>5725– 5875 MHz</td> <td>50</td> <td>500</td> </tr> <tr> <td>24.0– 24.25 GHz</td> <td>250</td> <td>2500</td> </tr> </tbody> </table> <p>(d) Emissions radiated outside of the specified frequency bands, except for harmonics, shall be attenuated by at least 50 dB below the level of the fundamental or to the general radiated emission limits in §15.209, whichever is the lesser attenuation.</p> <table border="1"> <thead> <tr> <th>Frequency range (MHz)</th> <th>Field Strength (µV/m)</th> </tr> </thead> <tbody> <tr> <td>0.009~0.490</td> <td>2400/F(KHz)</td> </tr> <tr> <td>0.490~1.705</td> <td>24000/F(KHz)</td> </tr> <tr> <td>1.705~30.0</td> <td>30</td> </tr> <tr> <td>30 – 88</td> <td>100</td> </tr> <tr> <td>88 – 216</td> <td>150</td> </tr> <tr> <td>216 960</td> <td>200</td> </tr> <tr> <td>Above 960</td> <td>500</td> </tr> </tbody> </table>	Fundamental frequency	Field strength of fundamental (millivolts/meter)	Field strength of harmonics (microvolts/meter)	902– 928 MHz	50	500	2400– 2483.5 MHz	50	500	5725– 5875 MHz	50	500	24.0– 24.25 GHz	250	2500	Frequency range (MHz)	Field Strength (µV/m)	0.009~0.490	2400/F(KHz)	0.490~1.705	24000/F(KHz)	1.705~30.0	30	30 – 88	100	88 – 216	150	216 960	200	Above 960	500	<input checked="" type="checkbox"/>
	Fundamental frequency	Field strength of fundamental (millivolts/meter)	Field strength of harmonics (microvolts/meter)																														
	902– 928 MHz	50	500																														
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88 – 216	150																																
216 960	200																																
Above 960	500																																

<p>Test Setup</p>	
<p>Procedure</p>	<ul style="list-style-type: none"> <li>- Setup the configuration according to figure 1. Turn on EUT and make sure that it is in normal function</li> <li>- For emission frequencies measured below 1GHz, a pre-scan is performed in a shielded chamber to determine the accurate frequencies of higher emissions will be checked on a open test site. As the same purpose, for emission frequencies measured above 1GHZ, a pre-scan also be performed with a meter measuring distance before final test.</li> <li>- For emission frequencies measured below and above 1GHz, set the spectrum analyzer on a 100kHz and 1MHz resolution bandwidth respectively for each frequency measured in step 2.</li> <li>- The search antenna is to be raised and lowered over a range from 1 to 4m in horizontally polarized orientation. Position the highness when the highest value is indicated on spectrum analyzer, the change the orientation of EUT on the test table over a range from 0 to 360°. With a speed as slow as possible, and keep the azimuth that highest emission is indicated on the spectrum analyzer.</li> </ul>

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	<p>Vary the antenna position again and record the highest value as a final reading.</p> <ul style="list-style-type: none"> <li>- Repeat step 4 until all frequencies need to be measured was complete.</li> <li>- Repeat step5 with search antenna in vertical polarized orientations.</li> </ul>
Remark	
Result	<input checked="" type="checkbox"/> Pass <input type="checkbox"/> Fail

Test Data     Yes                       N/A  
 Test Plot     Yes (See below)             N/A

**Test Result:**

<b>Test Mode:</b>	Transmitting Mode
-------------------	-------------------

Frequency range: 9KHz - 30MHz

Freq. (MHz)	Detection value	Factor (dB/m)	Reading (dBuV/m)	Result (dBuV/m)	Limit@3m (dBuV/m)	Margin (dB)
--	--	--	--	--	--	>20
--	--	--	--	--	--	>20

**Note:**

The amplitude of spurious emissions which are attenuated by more than 20dB below the permissible value has no need to be reported.

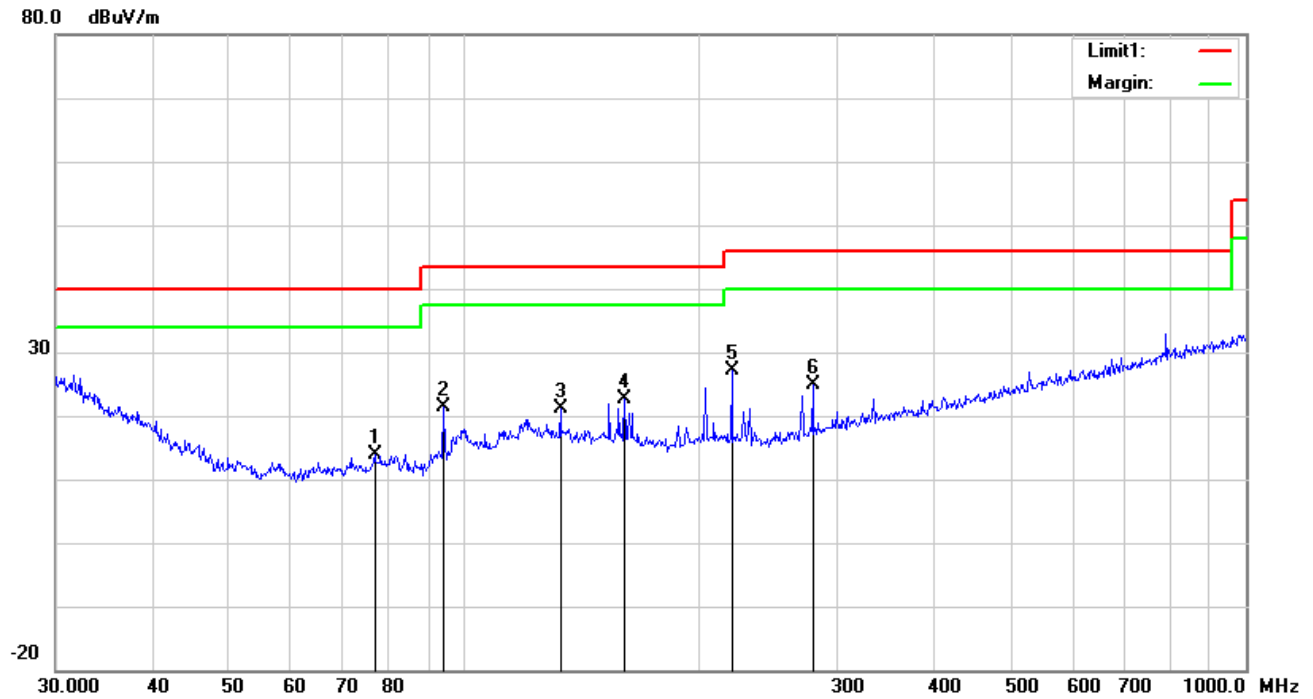
Distance extrapolation factor =  $40 \log (\text{specific distance}/\text{test distance})$ (dB);

Limit line = specific limits(dBuv) + distance extrapolation factor.

Antenna 0:

Test Mode:	Normal Working Mode
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30MHz -1GHz

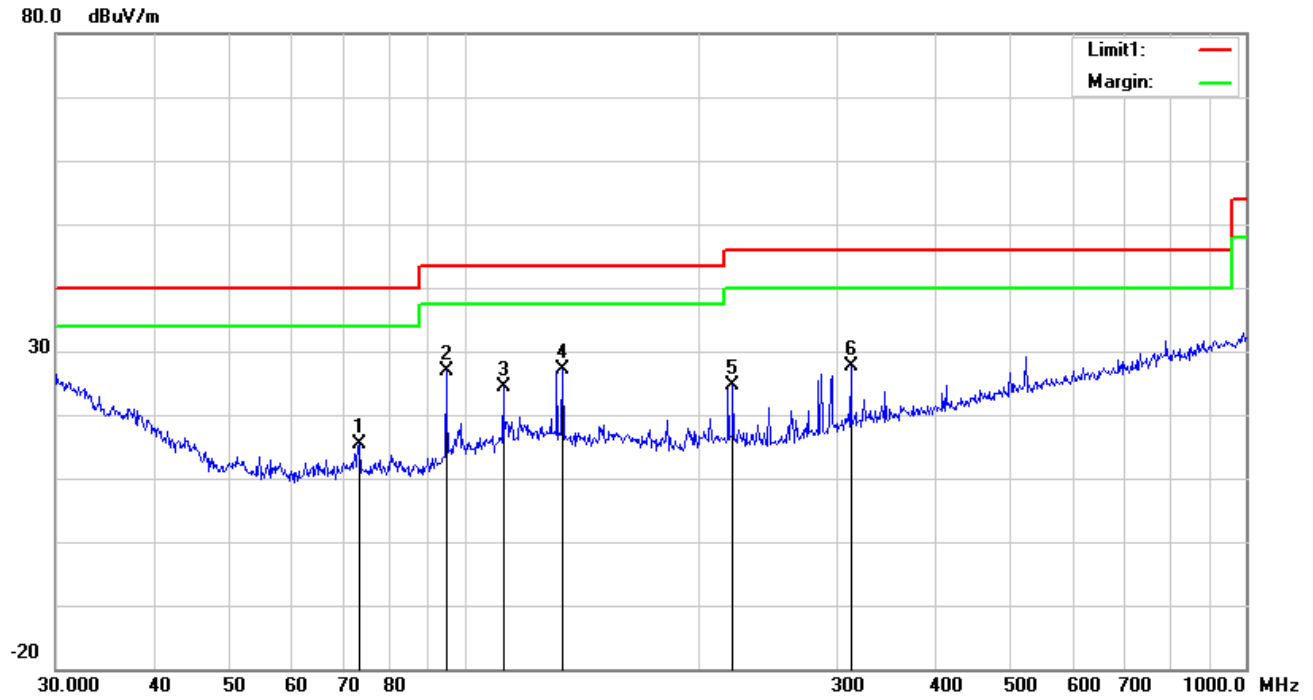


Test Data

Horizontal Polarity Plot @3m

No.	P/L	Frequency (MHz)	Reading (dBuV/m)	Detect or	Ant_F (dB/m)	PA_G (dB)	Cab_L (dB)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Height (cm)	Degr ee ( )
1	H	76.7808	27.74	QP	7.66	22.41	0.99	13.98	40.00	-26.02	100	120
2	H	94.0979	33.73	QP	8.98	22.32	0.98	21.37	43.50	-22.13	100	293
3	H	132.6850	29.23	QP	13.08	22.39	1.22	21.14	43.50	-22.36	100	252
4	H	160.3457	30.89	QP	12.57	22.27	1.39	22.58	43.50	-20.92	100	303
5	H	219.8449	36.04	QP	11.82	22.34	1.60	27.12	46.00	-18.88	100	167
6	H	279.0436	32.78	QP	12.68	22.29	1.75	24.92	46.00	-21.08	100	206

### 30MHz -1GHz



#### Test Data

#### Vertical Polarity Plot @3m

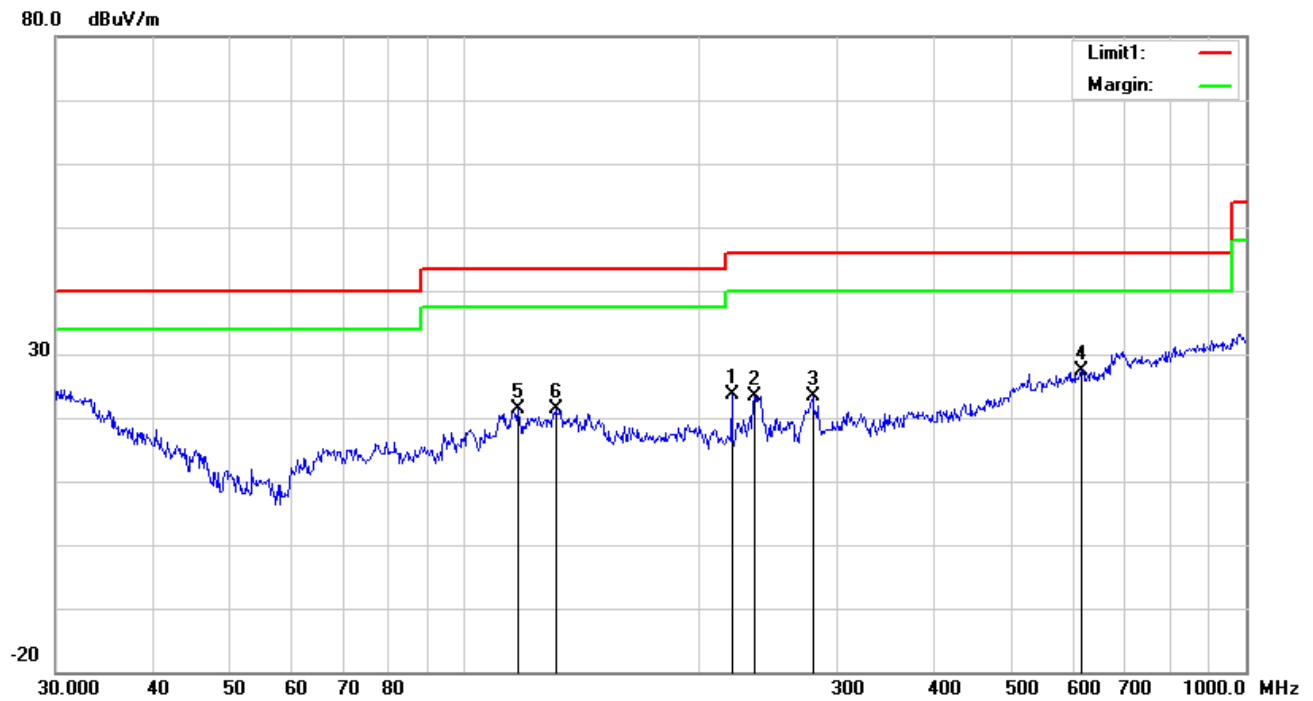
No.	P/L	Frequency	Reading	Detect or	Ant_F	PA_G	Cab_L	Result	Limit	Margin	Height	Degree
		(MHz)	(dBuV/m)		(dB/m)	(dB)	(dB)	(dBuV/m)	(dBuV/m)	(dB)	(cm)	( )
1	V	73.3593	29.12	QP	7.73	22.39	0.97	15.43	40.00	-24.57	200	341
2	V	94.7601	38.96	QP	9.14	22.32	0.99	26.77	43.50	-16.73	100	339
3	V	112.1305	32.96	QP	12.52	22.34	1.17	24.31	43.50	-19.19	100	338
4	V	133.6188	35.21	QP	13.01	22.39	1.23	27.06	43.50	-16.44	100	70
5	V	220.6171	33.53	QP	11.81	22.34	1.61	24.61	46.00	-21.39	100	333
6	V	312.1794	34.19	QP	13.86	22.26	1.85	27.64	46.00	-18.36	100	355



**Antenna 1:**

<b>Test Mode:</b>	<b>Normal Working Mode</b>
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**30MHz -1GHz**

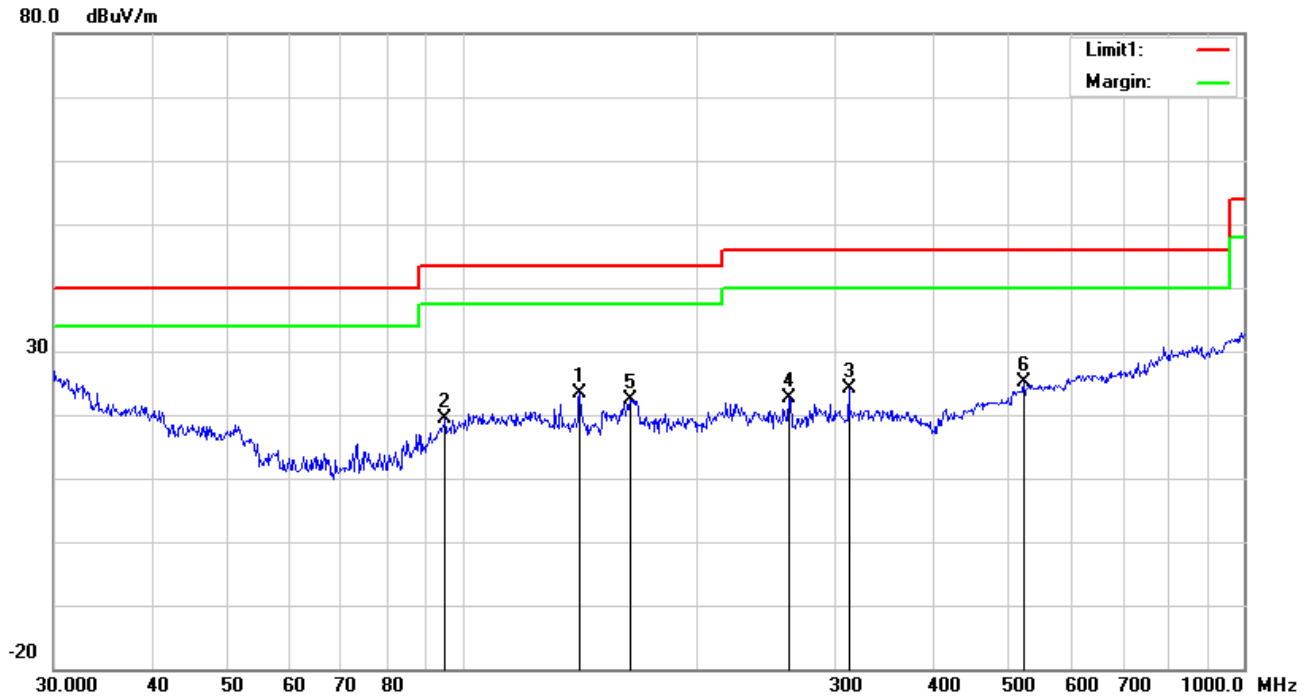


**Test Data**

**Horizontal Polarity Plot @3m**

No.	P/L	Frequency (MHz)	Reading (dBuV/m)	Detect or	Ant_F (dB/m)	PA_G (dB)	Cab_L (dB)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Height (cm)	Degr ee ( )
1	H	219.8449	32.54	QP	11.82	22.34	1.60	23.62	46.00	-22.38	100	59
2	H	234.9909	32.55	QP	11.61	22.32	1.65	23.49	46.00	-22.51	200	349
3	H	279.0436	31.28	QP	12.68	22.29	1.75	23.42	46.00	-22.58	100	184
4	H	616.3718	27.00	QP	19.28	21.54	2.54	27.28	46.00	-18.72	100	199
5	H	116.9495	29.12	QP	13.37	22.35	1.16	21.30	43.50	-22.20	100	295
6	H	130.8369	29.29	QP	13.20	22.39	1.21	21.31	43.50	-22.19	100	59

### 30MHz -1GHz



#### Test Data

#### Vertical Polarity Plot @3m

No.	P/L	Frequency	Reading	Detect or	Ant_F	PA_G	Cab_L	Result	Limit	Margin	Height	Degree
		(MHz)	(dBuV/m)		(dB/m)	(dB)	(dB)	(dBuV/m)	(dBuV/m)	(dB)	(cm)	( )
1	V	141.3298	31.89	QP	12.60	22.40	1.28	23.37	43.50	-20.13	100	86
2	V	95.0930	31.53	QP	9.22	22.32	0.99	19.42	43.50	-24.08	200	308
3	V	312.1794	30.69	QP	13.86	22.26	1.85	24.14	46.00	-21.86	100	74
4	V	261.9753	31.28	QP	11.93	22.29	1.72	22.64	46.00	-23.36	100	260
5	V	163.7550	30.85	QP	12.30	22.27	1.38	22.26	43.50	-21.24	100	4
6	V	522.7180	26.46	QP	18.02	21.76	2.45	25.17	46.00	-20.83	100	277

**Antenna 0:**

**Above 1GHz**

<b>Test Mode:</b>	<b>Normal Working Mode</b>
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**2425 MHz**

Frequency (MHz)	Average Factor (dB)	Polarity (H/V)	Field Strength(PK) (dBuV/m)	Field Strength(AV) (dBuV/m)	Limit(PK) (dBuV/m)	Limit(AV) (dBuV/m)	Margin(PK) (dB)	Margin(AV) (dB)
4850	0	H	46.92	46.92	74	54	-27.08	-7.08
7275	0	H	46.79	46.79	74	54	-27.21	-7.21
2848.5	0	H	40.4	40.4	74	54	-33.6	-13.6
2254	0	H	40.86	40.86	74	54	-33.14	-13.14
4850	0	V	45.88	45.88	74	54	-28.12	-8.12
7275	0	V	46.83	46.83	74	54	-27.17	-7.17
4023	0	V	41.12	41.12	74	54	-32.88	-12.88
2553.2	0	V	39.77	39.77	74	54	-34.23	-14.23

**2450 MHz**

Frequency (MHz)	Average Factor (dB)	Polarity (H/V)	Field Strength(PK) (dBuV/m)	Field Strength(AV) (dBuV/m)	Limit(PK) (dBuV/m)	Limit(AV) (dBuV/m)	Margin(PK) (dB)	Margin(AV) (dB)
4900	0	H	48.63	48.63	74	54	-25.37	-5.37
7350	0	H	49.04	49.04	74	54	-24.96	-4.96
8678.8	0	H	43.15	43.15	74	54	-30.85	-10.85
3775.7	0	H	40.35	40.35	74	54	-33.65	-13.65
4900	0	V	45.77	45.77	74	54	-28.23	-8.23
7350	0	V	47.31	47.31	74	54	-26.69	-6.69
3759.3	0	V	42.53	42.53	74	54	-31.47	-11.47
8221.6	0	V	42.6	42.6	74	54	-31.4	-11.4

**2475 MHz**

Frequency (MHz)	Average Factor (dB)	Polarity (H/V)	Field Strength(PK) (dBuV/m)	Field Strength(AV) (dBuV/m)	Limit(PK) (dBuV/m)	Limit(AV) (dBuV/m)	Margin(PK) (dB)	Margin(AV) (dB)
4950	0	H	47.71	47.71	74	54	-26.29	-6.29
7425	0	H	45.2	45.2	74	54	-28.8	-8.8
3586.3	0	H	39.91	39.91	74	54	-34.09	-14.09
4967.8	0	H	43.28	43.28	74	54	-30.72	-10.72
4950	0	V	44.81	44.81	74	54	-29.19	-9.19
7425	0	V	47.42	47.42	74	54	-26.58	-6.58
5272.1	0	V	40.41	40.41	74	54	-33.59	-13.59
2400.1	0	V	40.69	40.69	74	54	-33.31	-13.31

**Note:**

1, The testing has been conformed to  $10 \times 2475 \text{MHz} = 24,750 \text{MHz}$

2, All other emissions more than 30 dB below the limit

3, X-Axis, Y-Axis and Z-Axis were investigated. The results above show only the worst case.

4, The radiated spurious test above 18GHz is subcontracted to SIEMIC (Nanjing-China) Laboratories. and found 30dB below the limit at least.

**Antenna 1**

**Above 1GHz**

<b>Test Mode:</b>	<b>Normal Working Mode</b>
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**2425 MHz**

Frequency (MHz)	Average Factor (dB)	Polarity (H/V)	Field Strength(PK) (dBuV/m)	Field Strength(AV) (dBuV/m)	Limit(PK) (dBuV/m)	Limit(AV) (dBuV/m)	Margin(PK) (dB)	Margin(AV) (dB)
4850	0	H	43.94	43.94	74	54	-30.06	-10.06
7275	0	H	44.04	44.04	74	54	-29.96	-9.96
8317.2	0	H	43.79	43.79	74	54	-30.21	-10.21
7843.8	0	H	41.11	41.11	74	54	-32.89	-12.89
4850	0	V	45.85	45.85	74	54	-28.15	-8.15
7275	0	V	44.07	44.07	74	54	-29.93	-9.93
7441.8	0	V	41.45	41.45	74	54	-32.55	-12.55
8055.2	0	V	40.42	40.42	74	54	-33.58	-13.58

**2450 MHz**

Frequency (MHz)	Average Factor (dB)	Polarity (H/V)	Field Strength(PK) (dBuV/m)	Field Strength(AV) (dBuV/m)	Limit(PK) (dBuV/m)	Limit(AV) (dBuV/m)	Margin(PK) (dB)	Margin(AV) (dB)
4900	0	H	48.94	48.94	74	54	-25.06	-5.06
7350	0	H	48.29	48.29	74	54	-25.71	-5.71
6607.6	0	H	43.77	43.77	74	54	-30.23	-10.23
5564.8	0	H	44.88	44.88	74	54	-29.12	-9.12
4900	0	V	48.28	48.28	74	54	-25.72	-5.72
7350	0	V	49.1	49.1	74	54	-24.9	-4.9
8409	0	V	40.66	40.66	74	54	-33.34	-13.34
4781.6	0	V	44.35	44.35	74	54	-29.65	-9.65

**2475 MHz**

Frequency (MHz)	Average Factor (dB)	Polarity (H/V)	Field Strength(PK) (dBuV/m)	Field Strength(AV) (dBuV/m)	Limit(PK) (dBuV/m)	Limit(AV) (dBuV/m)	Margin(PK) (dB)	Margin(AV) (dB)
4950	0	H	45.29	45.29	74	54	-28.71	-8.71
7425	0	H	44.65	44.65	74	54	-29.35	-9.35
2919.8	0	H	41.92	41.92	74	54	-32.08	-12.08
1495.7	0	H	45.02	45.02	74	54	-28.98	-8.98
4950	0	V	45.14	45.14	74	54	-28.86	-8.86
7425	0	V	43.71	43.71	74	54	-30.29	-10.29
1830	0	V	44.14	44.14	74	54	-29.86	-9.86
1565.3	0	V	43.61	43.61	74	54	-30.39	-10.39

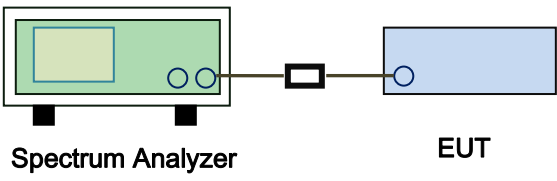
**Note:**

- 1, The testing has been conformed to  $10 \times 2475 \text{MHz} = 24,750 \text{MHz}$
- 2, All other emissions more than 30 dB below the limit
- 3, X-Axis, Y-Axis and Z-Axis were investigated. The results above show only the worst case.
- 4, The radiated spurious test above 18GHz is subcontracted to SIEMIC (Nanjing-China) Laboratories. and found 30dB below the limit at least.

## 6.4 Field Strength Measurement

Temperature	24°C
Relative Humidity	55%
Atmospheric Pressure	1015mbar
Test date :	August 05, 2018
Tested By :	Aaron Liang

### Requirement(s):

Spec	Requirement	Applicable															
§15.249(a)	<table border="1"> <thead> <tr> <th>Fundamental frequency</th> <th>Field strength of fundamental (millivolts/meter)</th> <th>Field strength of harmonics (microvolts/meter)</th> </tr> </thead> <tbody> <tr> <td>902–928 MHz .....</td> <td>50</td> <td>500</td> </tr> <tr> <td>2400–2483.5 MHz .....</td> <td>50</td> <td>500</td> </tr> <tr> <td>5725–5875 MHz .....</td> <td>50</td> <td>500</td> </tr> <tr> <td>24.0–24.25 GHz .....</td> <td>250</td> <td>2500</td> </tr> </tbody> </table>	Fundamental frequency	Field strength of fundamental (millivolts/meter)	Field strength of harmonics (microvolts/meter)	902–928 MHz .....	50	500	2400–2483.5 MHz .....	50	500	5725–5875 MHz .....	50	500	24.0–24.25 GHz .....	250	2500	<input checked="" type="checkbox"/>
Fundamental frequency	Field strength of fundamental (millivolts/meter)	Field strength of harmonics (microvolts/meter)															
902–928 MHz .....	50	500															
2400–2483.5 MHz .....	50	500															
5725–5875 MHz .....	50	500															
24.0–24.25 GHz .....	250	2500															
Test Setup	 <p style="text-align: center;">Spectrum Analyzer                      EUT</p>																
Test Procedure	Emissions radiated outside of the specified frequency bands, except for harmonics, shall be attenuated by at least 50 dB below the level of the fundamental or to the general radiated emission limits in § 15.209, whichever is the lesser attenuation.																
Remark																	
Result	<input checked="" type="checkbox"/> Pass <input type="checkbox"/> Fail																

Test Data     Yes                       N/A

Test Plot     Yes (See below)                       N/A

<b>Test Mode:</b>	<b>Normal Working Mode</b>
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Field Strength Measurement

Antenna 0:

2425MHz

Frequency (MHz)	Average Factor (dB)	Polarity (H/V)	Field Strength(PK) (dBuV/m)	Field Strength(AV) (dBuV/m)	Limit(PK) (dBuV/m)	Limit(AV) (dBuV/m)	Margin(PK) (dB)	Margin(AV) (dB)
2425	0	H	90.3	90.30	114	94	-23.7	-3.7
2425	0	V	80.86	80.86	114	94	-33.14	-13.14

2450MHz

Frequency (MHz)	Average Factor (dB)	Polarity (H/V)	Field Strength(PK) (dBuV/m)	Field Strength(AV) (dBuV/m)	Limit(PK) (dBuV/m)	Limit(AV) (dBuV/m)	Margin(PK) (dB)	Margin(AV) (dB)
2450	0	H	92.99	92.99	114	94	-21.01	-1.01
2450	0	V	80.46	80.46	114	94	-33.54	-13.54

2475MHz

Frequency (MHz)	Average Factor (dB)	Polarity (H/V)	Field Strength(PK) (dBuV/m)	Field Strength(AV) (dBuV/m)	Limit(PK) (dBuV/m)	Limit(AV) (dBuV/m)	Margin(PK) (dB)	Margin(AV) (dB)
2475	0	H	92.51	92.51	114	94	-21.49	-1.49
2475	0	V	78.91	78.91	114	94	-35.09	-15.09



**Antenna 1:**

**2425MHz**

Frequency (MHz)	Average Factor (dB)	Polarity (H/V)	Field Strength(PK) (dBuV/m)	Field Strength(AV) (dBuV/m)	Limit(PK) (dBuV/m)	Limit(AV) (dBuV/m)	Margin(PK) (dB)	Margin(AV) (dB)
2425	0	H	89.72	89.72	114	94	-24.28	-4.28
2425	0	V	83.24	83.24	114	94	-30.76	-10.76

**2450MHz**

Frequency (MHz)	Average Factor (dB)	Polarity (H/V)	Field Strength(PK) (dBuV/m)	Field Strength(AV) (dBuV/m)	Limit(PK) (dBuV/m)	Limit(AV) (dBuV/m)	Margin(PK) (dB)	Margin(AV) (dB)
2450	0	H	89.62	89.62	114	94	-24.38	-4.38
2450	0	V	82.34	82.34	114	94	-31.66	-11.66

**2475MHz**

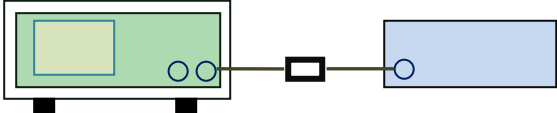
Frequency (MHz)	Average Factor (dB)	Polarity (H/V)	Field Strength(PK) (dBuV/m)	Field Strength(AV) (dBuV/m)	Limit(PK) (dBuV/m)	Limit(AV) (dBuV/m)	Margin(PK) (dB)	Margin(AV) (dB)
2475	0	H	89.77	89.77	114	94	-24.23	-4.23
2475	0	V	82.3	82.3	114	94	-31.7	-11.7

## 6.5 20dB Bandwidth Testing

Temperature	24°C
Relative Humidity	55%
Atmospheric Pressure	1015mbar
Test date :	August 05, 2018
Tested By :	Aaron Liang

### Requirement(s):

Spec	Item	Requirement	Applicable
§15.215(c)	a)	Radiated Emissions Measurement Uncertainty All test measurements carried out are traceable to national standards. The uncertainty of the measurement at a confidence level of approximately 95% (in the case where distributions are normal), with a coverage factor of 2, in the range 30MHz – 1GHz ( 3m & 10m ) & 1GHz above ( 3m ) is +5.6/-4.5dB.	<input checked="" type="checkbox"/>

Test Setup	 <p style="text-align: center;">Spectrum Analyzer                      EUT</p>
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Test Procedure	<ul style="list-style-type: none"> <li>- -Check the calibration of the measuring instrument using either an internal calibrator or a known signal from an external generator.</li> <li>- Position the EUT on the test table without connection to measurement instrument. Turn on the EUT. Then set it to any one convenient frequency within its operating range. Set a reference level on the measuring instrument equal to the highest peak value.</li> <li>- Measure the frequency difference of two frequencies that were attenuated 20 dB from the reference level. Record the frequency difference as the emission bandwidth.</li> <li>- Repeat above procedures until all frequencies measured were complete.</li> </ul>
----------------	--

Remark	
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<b>Result</b>	<input checked="" type="checkbox"/> <b>Pass</b>	<input type="checkbox"/> <b>Fail</b>
<b>Test Data</b>	<input checked="" type="checkbox"/> <b>Yes</b>	<input type="checkbox"/> <b>N/A</b>
<b>Test Plot</b>	<input checked="" type="checkbox"/> <b>Yes (See below)</b>	<input type="checkbox"/> <b>N/A</b>

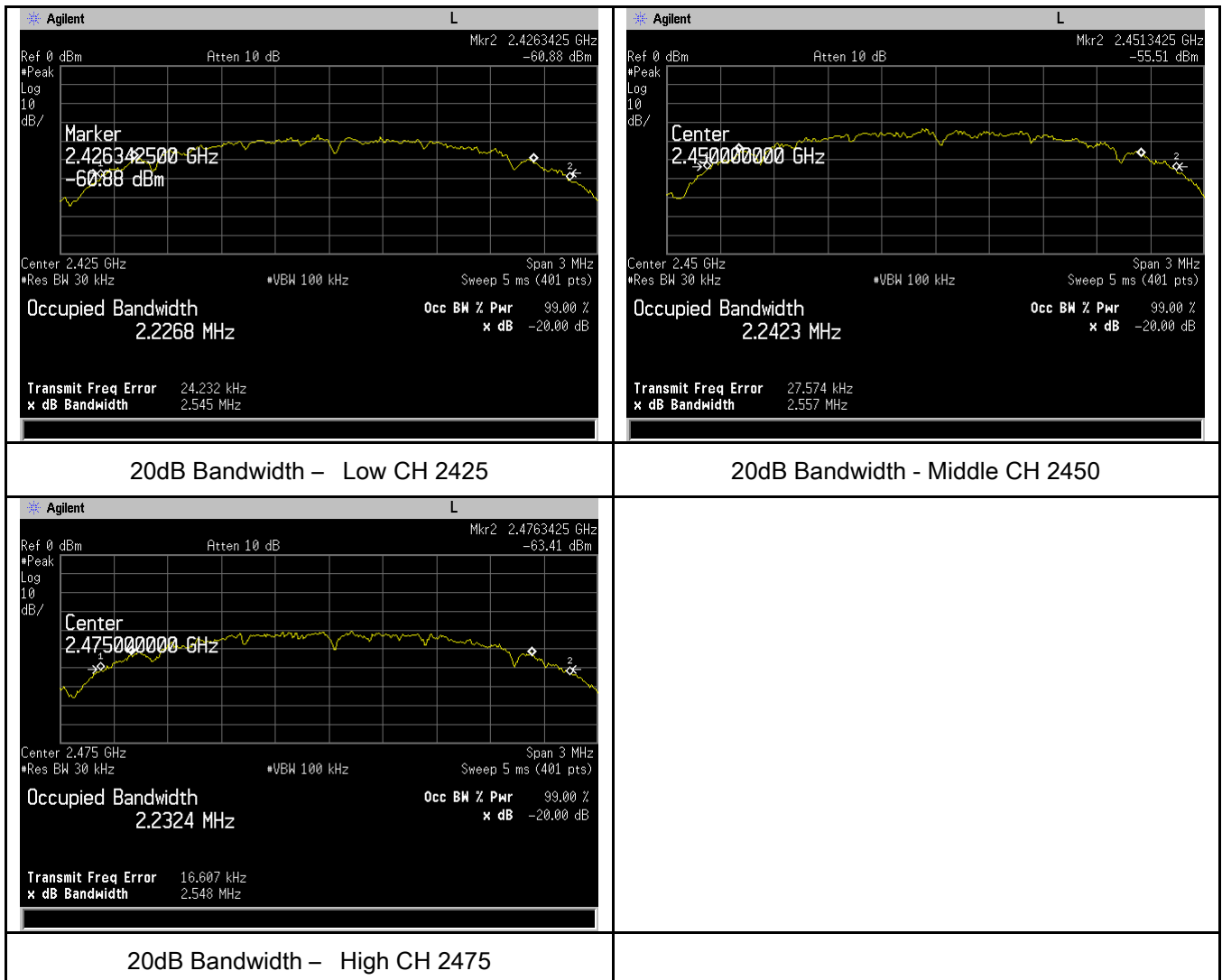
## 20dB Bandwidth measurement result

### Antenna 0:

CH	Fundamental Frequency (MHz)	20dB Bandwidth ( MHz )	Result
Low	2425	2.545	Pass
Middle	2450	2.557	Pass
High	2475	2.548	Pass

## Test Plots

### 20dB Bandwidth measurement result

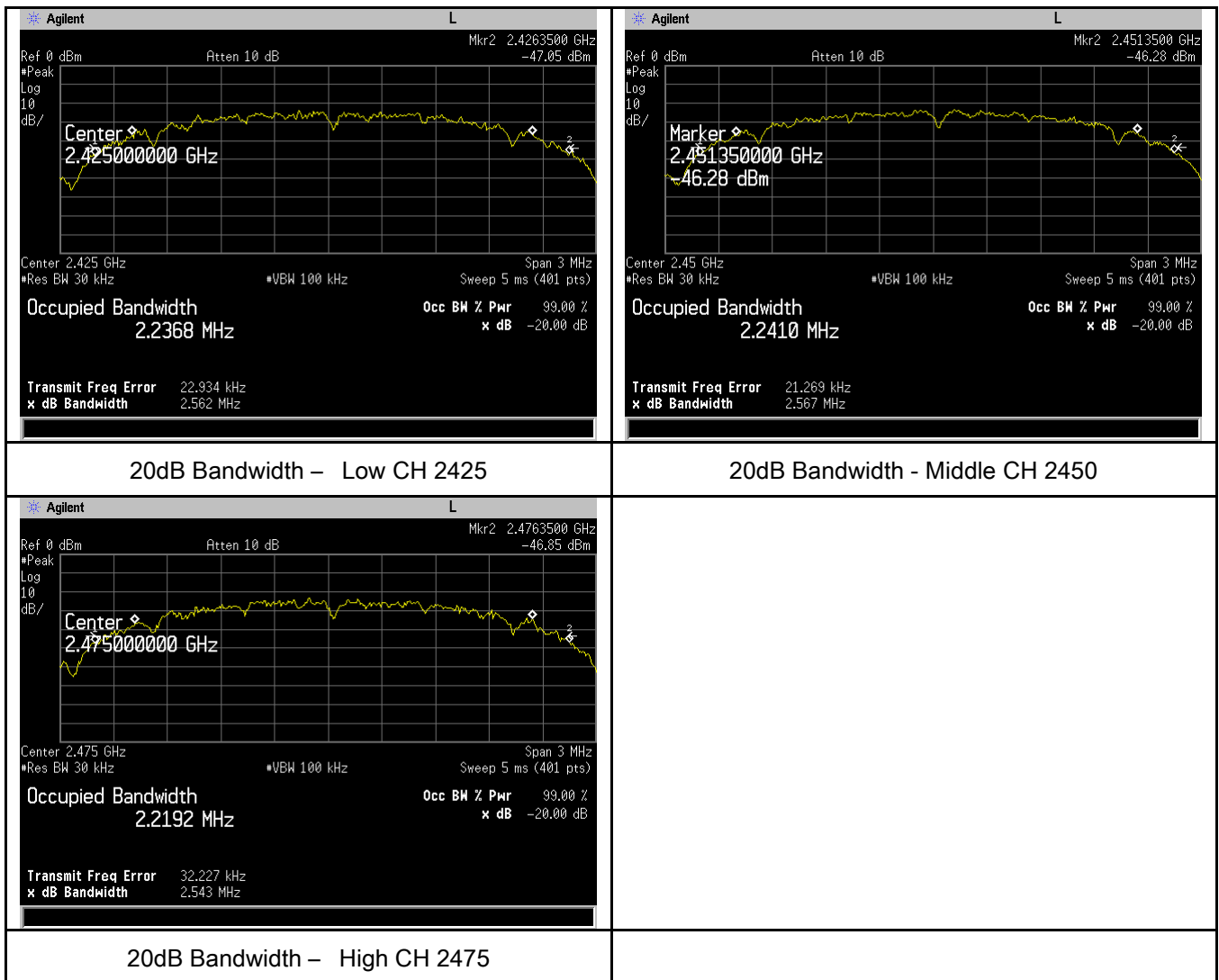


**Antenna 1:**

CH	Fundamental Frequency (MHz)	20dB Bandwidth ( MHz )	Result
Low	2425	2.562	Pass
Middle	2450	2.567	Pass
High	2475	2.543	Pass

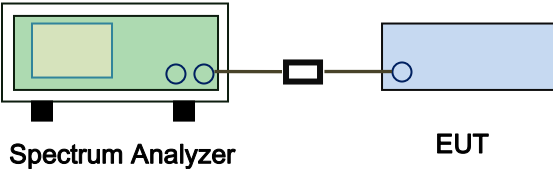
**Test Plots**

**20dB Bandwidth measurement result**



## 6.6 Band Edge

Temperature	26°C
Relative Humidity	59%
Atmospheric Pressure	1015mbar
Test date :	August 03, 2018
Tested By :	Aaron Liang

Spec	Item	Requirement	Applicable
§15.249(d)	a)	Emissions radiated outside of the specified frequency bands, except for harmonics, shall be attenuated by at least 50 dB below the level of the fundamental or to the general radiated emission limits in §15.209, whichever is the lesser attenuation.	<input checked="" type="checkbox"/>
Test Setup	 <p style="text-align: center;">Spectrum Analyzer                      EUT</p>		
Test Procedure	<ul style="list-style-type: none"> <li>- Check the calibration of the measuring instrument using either an internal calibrator or a known signal from an external generator.</li> <li>- Position the EUT without connection to measurement instrument. Put it on the Rotated table and turn on the EUT and make it operate in transmitting mode. Then set it to Low Channel and High Channel within its operating range, and make sure the instrument is operated in its linear range.</li> <li>- Set both RBW and VBW of spectrum analyzer to 1MHz.</li> <li>- Measure the highest amplitude appearing on spectral display and set it as a reference level. Plot the graph with marking the highest point and edge frequency.</li> <li>- Repeat above procedures until all measured frequencies were complete.</li> </ul>		
Remark			
Result	<input checked="" type="checkbox"/> Pass <input type="checkbox"/> Fail		

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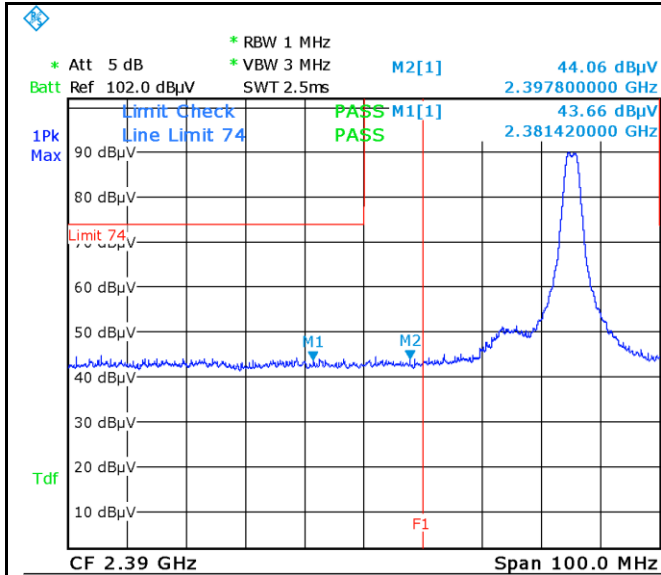
Test Data  Yes  N/A

Test Plot  Yes (See below)  N/A

### Test Plots

#### Band Edge measurement result

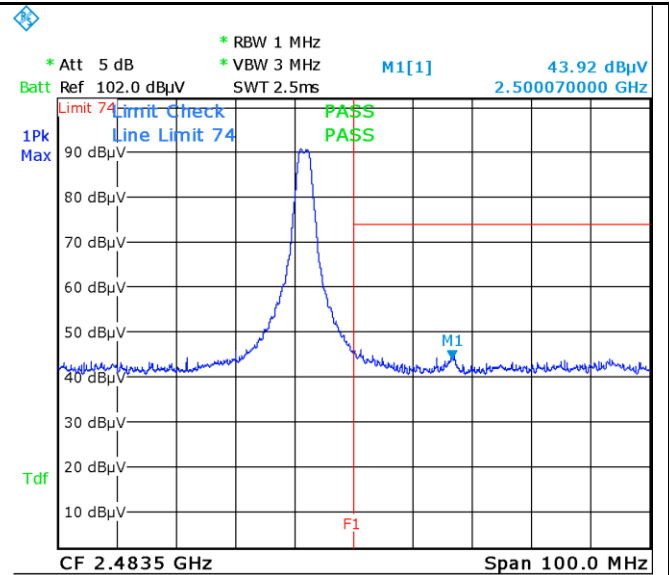
Antenna 0:



Left Side-PK

Note: (no need if PK value less than the AV limit)

GFSK-Left Side-AV



Right Side-PK

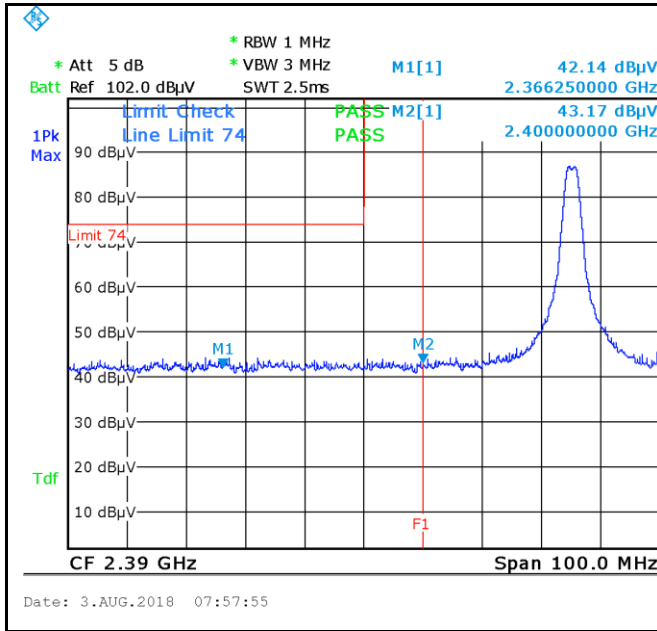
Note: (no need if PK value less than the AV limit)

GFSK-Right Side-AV

Note: Both Horizontal and vertical polarities were investigated.



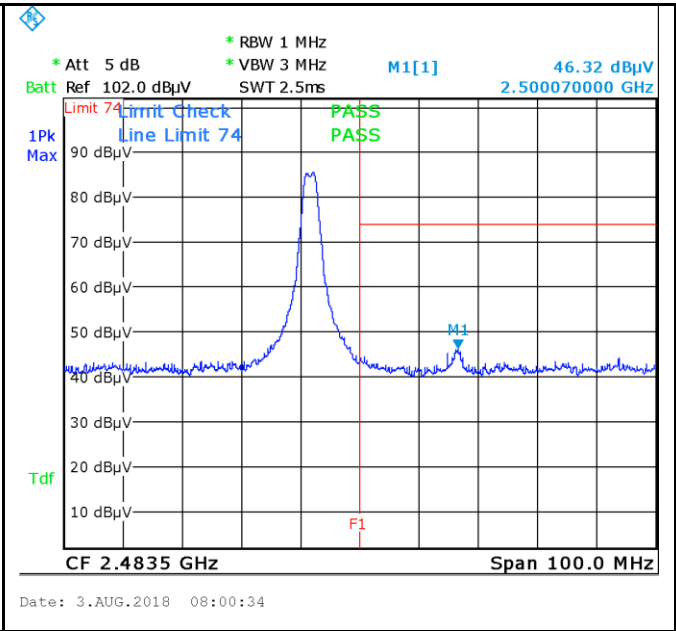
Antenna 1:



Left Side-PK

Note: (no need if PK value less than the AV limit)

GFSK-Left Side-AV



Right Side-PK

Note: (no need if PK value less than the AV limit)

GFSK-Right Side-AV

Note: Both Horizontal and vertical polarities were investigated.

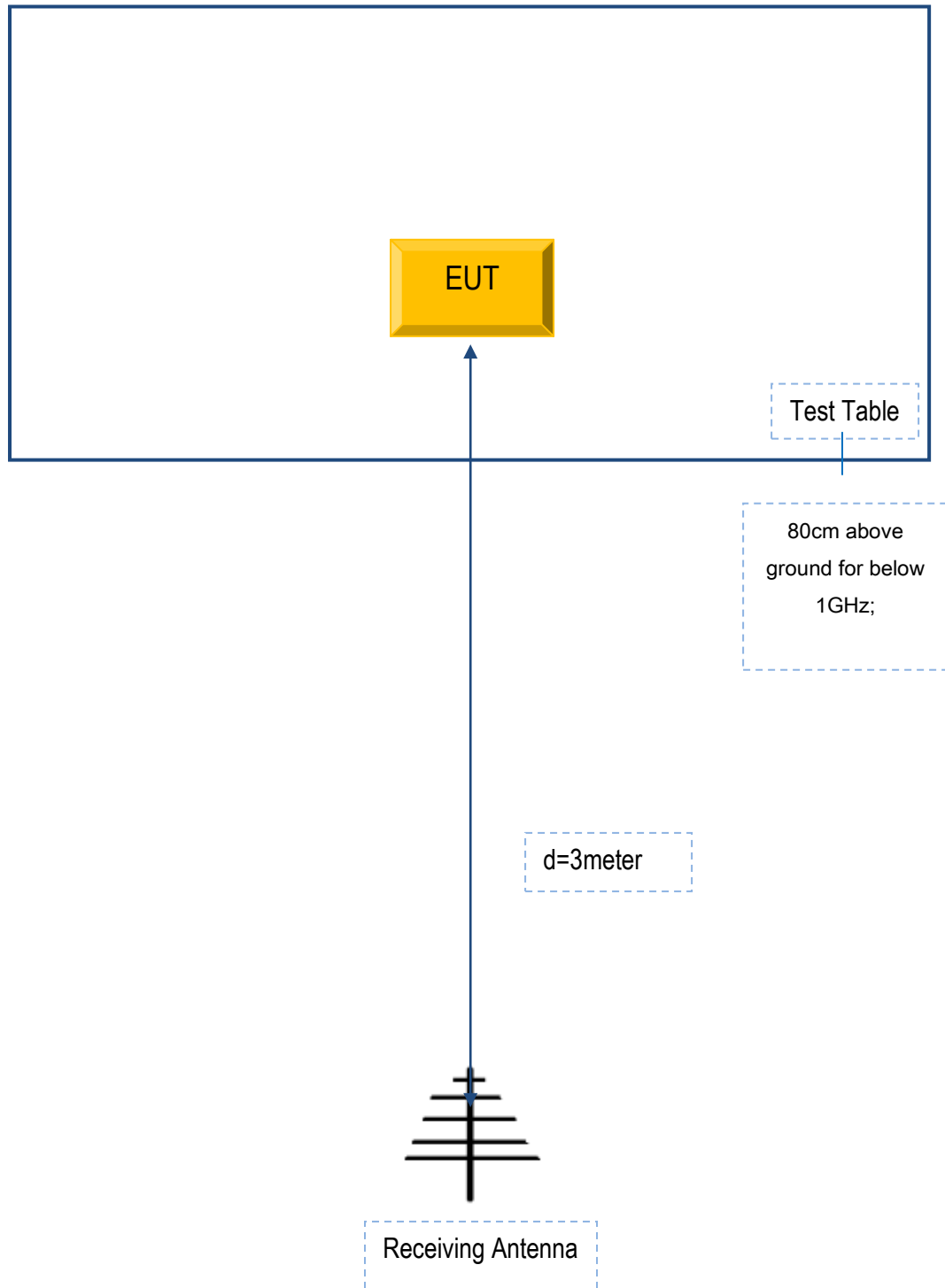
## Annex A. TEST INSTRUMENT

Instrument	Model	Serial #	Cal Date	Cal Due	In use
<b>AC Line Conducted</b>					
EMI test receiver	ESCS30	8471241027	09/15/2017	09/14/2018	<input type="checkbox"/>
Line Impedance	LI-125A	191106	09/23/2017	09/22/2018	<input type="checkbox"/>
Line Impedance	LI-125A	191107	09/23/2017	09/22/2018	<input type="checkbox"/>
ISN	ISN T800	34373	09/23/2017	09/22/2018	<input type="checkbox"/>
Double Ridge Horn Antenna (1 ~18GHz)	AH-118	71283	09/22/2017	09/21/2018	<input type="checkbox"/>
Transient Limiter	LIT-153	531118	08/30/2017	08/29/2018	<input type="checkbox"/>
<b>RF conducted test</b>					
Agilent ESA-E SERIES	E4407B	MY45108319	09/15/2017	09/14/2018	<input checked="" type="checkbox"/>
Power Splitter	1#	1#	08/30/2017	08/29/2018	<input checked="" type="checkbox"/>
DC Power Supply	E3640A	MY40004013	09/15/2017	09/14/2018	<input checked="" type="checkbox"/>
<b>Radiated Emissions</b>					
EMI test receiver	ESL6	100262	09/15/2017	09/14/2018	<input checked="" type="checkbox"/>
Positioning Controller	UC3000	MF780208282	11/17/2017	11/16/2018	<input checked="" type="checkbox"/>
OPT 010 AMPLIFIER (0.1-1300MHz)	8447E	2727A02430	08/30/2017	08/29/2018	<input checked="" type="checkbox"/>
Active Antenna (9kHz-30MHz)	AL-130	121031	10/12/2017	10/11/2018	<input checked="" type="checkbox"/>
Microwave Preamplifier (1 ~ 26.5GHz)	8449B	3008A02402	03/23/2017	03/22/2018	<input checked="" type="checkbox"/>
Active Antenna (9kHz-30MHz)	AL-130	121031	10/12/2017	10/11/2018	<input checked="" type="checkbox"/>
Bilog Antenna (30MHz~6GHz)	JB6	A110712	09/19/2017	09/18/2018	<input checked="" type="checkbox"/>
Double Ridge Horn Antenna (1 ~18GHz)	AH-118	71283	09/22/2017	09/21/2018	<input checked="" type="checkbox"/>
Universal Radio Communication Tester	CMU200	121393	09/23/2017	09/22/2018	<input checked="" type="checkbox"/>

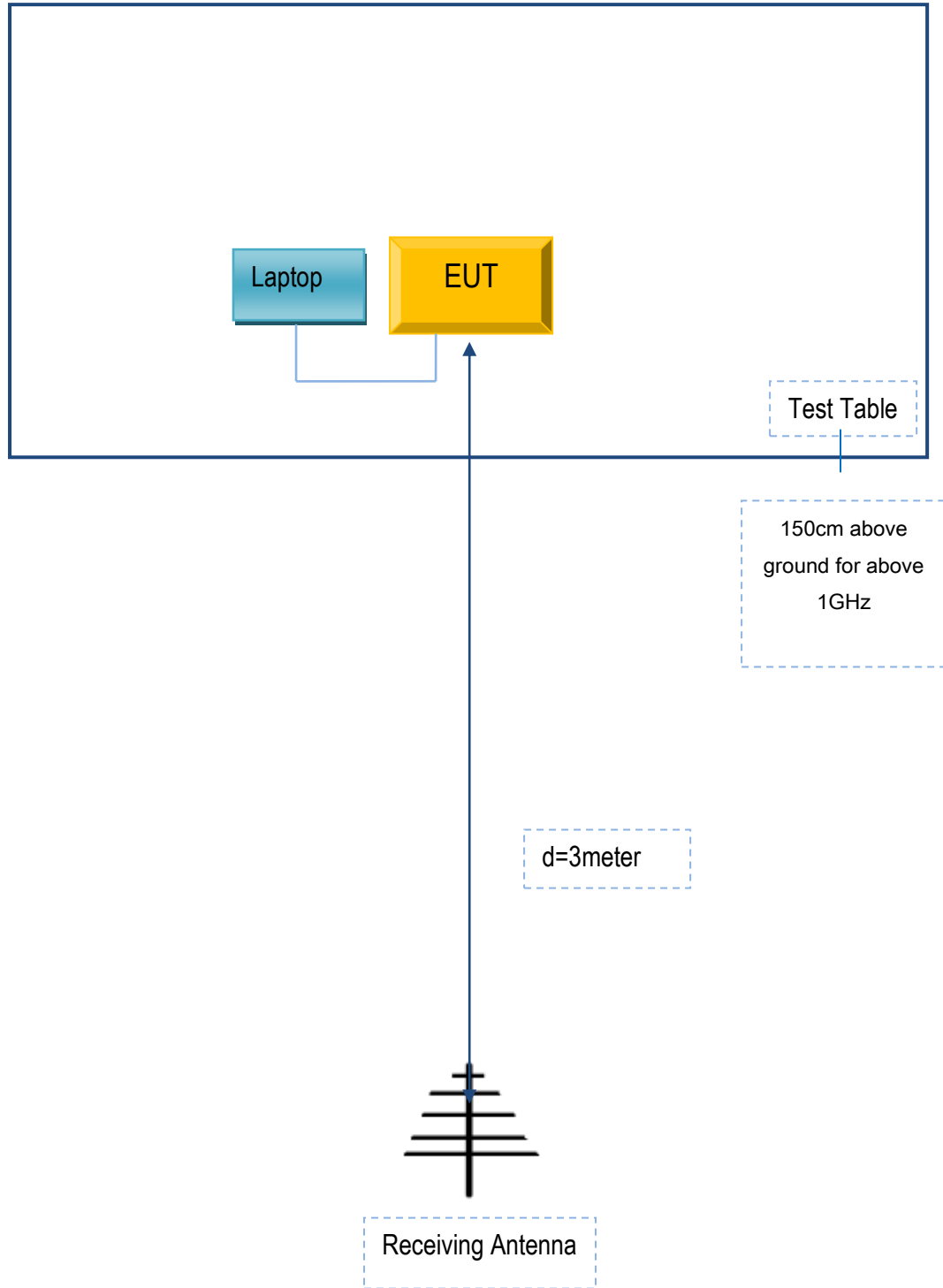
## Annex B. TEST SETUP AND SUPPORTING EQUIPMENT

### Annex B.i. TEST SET UP BLOCK

#### Block Configuration Diagram for Radiated Emissions



**Block Configuration Diagram for Radiated Emissions**



**Annex B. ii. SUPPORTING EQUIPMENT DESCRIPTION**

The following is a description of supporting equipment and details of cables used with the EUT.

<b>Manufacturer</b>	<b>Equipment Description</b>	<b>Model</b>	<b>Serial No.</b>
Lenovo	Laptop	E40	N/A

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**Annex C. User Manual / Block Diagram / Schematics / Partlist/  
DECLARATION OF SIMILARITY**

**Please see attachment**