



## RF MEASUREMENT REPORT

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**Applicant:** Shenzhen EPS Technology Co. LTD.  
**Address:** 901, Tower 1, Louhu Investment Holding Building,  
Qingshuihe 1 Road, Luohu, Shenzhen  
**Product:** USB2.0 contactless connectivity  
**Model No.:** SKL5010A, SKL5010B  
**Trade Mark:** EPS  
**Standards:** EN 305 550-2 V1.2.1 (2014-10)  
**Test Procedure:** EN 305 550-1 V1.2.1 (2014-10)  
**Result:** Complies  
**Received Date:** 2023-09-19  
**Test Date:** 2023-09-28 ~ 2023-10-24

**Reviewed By:**

\_\_\_\_\_  
Jame Yuan

**Approved By:**

\_\_\_\_\_  
Robin Wu



The test results relate only to the samples tested.

The test results shown in the test report are traceable to the national/international standards through the calibration of the equipment and evaluated measurement uncertainty herein.

The test report shall not be reproduced except in full without the written approval of MRT Technology (Suzhou) Co., Ltd.

## Revision History

Report No.	Version	Description	Issue Date	Note
2309RSU048-E1	V01	Initial Report	2023-12-01	Valid

## CONTENTS

Description	Page
<b>1. General Information .....</b>	<b>5</b>
1.1. Applicant .....	5
1.2. Manufacturer .....	5
1.3. Testing Facility .....	5
1.4. Product Information .....	6
1.5. Radio Specification under Test .....	6
<b>2. Test Configuration .....</b>	<b>7</b>
2.1. Test Mode .....	7
2.2. Test Environment Condition .....	7
<b>3. Measuring Instrument.....</b>	<b>8</b>
<b>4. Decision Rules and Measurement Uncertainty.....</b>	<b>9</b>
4.1. Decision Rules.....	9
4.2. Measurement Uncertainty .....	9
<b>5. Test Result .....</b>	<b>10</b>
5.1. Test Summary .....	10
5.2. Power Spectral Density .....	11
5.2.1. Test Limit .....	11
5.2.2. Test Setup .....	11
5.2.3. Test Procedure .....	12
5.2.4. Test Result .....	13
5.3. RF Output Power .....	14
5.3.1. Test Limit .....	14
5.3.2. Test Setup .....	14
5.3.3. Test Procedure .....	15
5.3.4. Test Result .....	16
5.4. Permitted Range of Operating Frequencies .....	18
5.4.1. Test Limit .....	18
5.4.2. Test Setup .....	18
5.4.3. Test Procedure .....	18
5.4.4. Test Result .....	19
5.5. Transmitter Emissions In The Out-of-band Domain .....	20
5.5.1. Test Limit .....	20
5.5.2. Test Setup .....	21
5.5.3. Test Procedure .....	21
5.5.4. Test Result .....	22
5.6. Transmitter Unwanted Emissions In The Spurious Domain .....	23
5.6.1. Test Limit .....	23
5.6.2. Test Setup .....	24

5.6.3. Test Procedure .....	25
5.6.4. Test Result .....	26
5.7. Receiver Spurious Emissions .....	34
5.7.1. Test Limit .....	34
5.7.2. Test Setup .....	35
5.7.3. Test Procedure .....	36
5.7.4. Test Result .....	37
<b>Appendix A - Test Setup Photograph .....</b>	<b>42</b>
<b>Appendix B - EUT Photograph .....</b>	<b>43</b>

## 1. General Information

### 1.1. Applicant

Shenzhen EPS Technology Co. LTD.

901, Tower 1, Louhu Investment Holding Building, Qingshuihe 1 Road, Luohu, Shenzhen

## 1.2. Manufacturer

Shenzhen EPS Technology Co. LTD.

901, Tower 1, Louhu Investment Holding Building, Qingshuihe 1 Road, Luohu, Shenzhen

### 1.3. Testing Facility

<input checked="" type="checkbox"/>	<b>Test Site – MRT Suzhou Laboratory</b>  <b>Laboratory Location (Suzhou - Wuzhong)</b> D8 Building, No.2 Tian’edang Rd., Wuzhong Economic Development Zone, Suzhou, China <b>Laboratory Location (Suzhou - SIP)</b> 4b Building, Liando U Valley, No.200 Xingpu Rd., Shengpu Town, Suzhou Industrial Park, China <b>Laboratory Accreditations</b>  <div style="display: flex; justify-content: space-between;"> <span>A2LA: 3628.01</span> <span>CNAS: L10551</span> </div> <div style="display: flex; justify-content: space-between;"> <span>FCC: CN1166</span> <span>ISED: CN0001</span> </div> <div style="display: flex; justify-content: space-around; margin-top: 10px;"> <span>VCCI:</span> <input type="checkbox"/>R-20025     <input type="checkbox"/>G-20034     <input type="checkbox"/>C-20020     <input type="checkbox"/>T-20020 </div> <div style="display: flex; justify-content: space-around;"> <input type="checkbox"/>R-20141     <input type="checkbox"/>G-20134     <input type="checkbox"/>C-20103     <input type="checkbox"/>T-20104 </div>
<input type="checkbox"/>	<b>Test Site – MRT Shenzhen Laboratory</b>  <b>Laboratory Location (Shenzhen)</b> 1G, Building A, Junxiangda Building, Zhongshanyuan Road West, Nanshan District, Shenzhen, China <b>Laboratory Accreditations</b>  <div style="display: flex; justify-content: space-between;"> <span>A2LA: 3628.02</span> <span>CNAS: L10551</span> </div> <div style="display: flex; justify-content: space-between;"> <span>FCC: CN1284</span> <span>ISED: CN0105</span> </div>
<input type="checkbox"/>	<b>Test Site – MRT Taiwan Laboratory</b>  <b>Laboratory Location (Taiwan)</b> No. 38, Fuxing 2nd Rd., Guishan Dist., Taoyuan City 333, Taiwan (R.O.C.) <b>Laboratory Accreditations</b>  <div style="display: flex; justify-content: space-between;"> <span>TAF: 3261</span> <span></span> </div> <div style="display: flex; justify-content: space-between;"> <span>FCC: 291082, TW3261</span> <span>ISED: TW3261</span> </div>

#### 1.4. Product Information

Product Name	USB2.0 contactless connectivity
Model No.	SKL5010A, SKL5010B
Product Brand Name	EPS
EUT Identification No.	20230920Sample#01 & 20230920Sample#03(Low Rate) 20230920Sample#07 & 20230920Sample#08(High Rate)
Software Version	V1.3
Hardware Version	V1.0
Temperature	-20°C ~ +85°C
<p>Note:</p> <ol style="list-style-type: none"> <li>The information of EUT was provided by the manufacturer, and the accuracy of the information shall be the responsibility of the manufacturer.</li> <li>SKL5010A: USB Type-C female connector with MCU, host mode; SKL5010B: USB Type-C male connector without MCU, device mode The above differences do not affect RF, so we selected SKL5010A to perform complete testing and SKL5010B for power and spurious verification testing.</li> </ol>	

#### 1.5. Radio Specification under Test

Frequency Range	60.5GHz
Type of Modulation	2ASK
Antenna Type	Patch single antenna
Antenna Gain	4 dBi

## 2. Test Configuration

### 2.1. Test Mode

Mode 1: Power the SKL5010A by USB + Transmit by signal generator(High Rate = 480Mbps)
Mode 2: Power the SKL5010B by USB + Transmit by signal generator(High Rate = 480Mbps)
Mode 3: Power the SKL5010A by USB + Transmit by signal generator(Low Rate = 6Mbps)
Mode 4: Power the SKL5010B by USB + Transmit by signal generator(Low Rate = 6Mbps)

### 2.2. Test Environment Condition

Ambient Temperature	15°C ~ 35°C
Relative Humidity	20%RH ~75%RH

### 3. Measuring Instrument

Instrument Name	Manufacturer	Model No.	Asset No.	Cali. Interval	Cal. Due Date	Test Site
EMI Test Receiver	R&S	ESR3	MRTSUE06185	1 year	2023-12-28	SIP-AC3
Signal Analyzer	Keysight	N9010B	MRTSUE06559	1 year	2024-05-23	SIP-AC3
Horn Antenna	Schwarzbeck	BBHA 9170	MRTSUE06599	1 year	2024-09-24	SIP-AC3
Preamplifier	EMCI	EMC184045SE	MRTSUE06602	1 year	2024-10-09	SIP-AC3
Horn Antenna	R&S	HF907	MRTSUE06611	1 year	2024-07-14	SIP-AC3
Thermohygrometer	testo	608-H1	MRTSUE06619	1 year	2023-11-01	SIP-AC3
Preamplifier	EMCI	EMC012645SE	MRTSUE06642	1 year	2024-01-12	SIP-AC3
TRILOG Antenna	Schwarzbeck	VULB 9168	MRTSUE06646	1 year	2024-08-04	SIP-AC3
Anechoic Chamber	RIKEN	SIP-AC3	MRTSUE06782	1 year	2023-12-22	SIP-AC3
Thermohygrometer	testo	608-H1	MRTSUE11255	1 year	2024-08-13	SIP-AC3
Signal Analyzer	Keysight	N9030B	MRTSUE06395	1 year	2024-06-29	SIP-TR2/SIP-AC3
Thermohygrometer	testo	608-H1	MRTSUE11109	1 year	2024-03-03	SIP-TR2
Waveguide Harmonic Mixer	Keysight	M1970V	MRTSUE06271	N/A	N/A	SIP-TR2/SIP-AC3
Waveguide Harmonic Mixer	Keysight	M1970W	MRTSUE06272	N/A	N/A	SIP-AC3
mmWave Antenna	MI-WWAVE	261U-25/383	MRTSUE06273	N/A	N/A	SIP-AC3
mmWave Antenna	MI-WWAVE	261G/387	MRTSUE06274	N/A	N/A	SIP-AC3
mmWave Antenna	MI-WWAVE	261F/387	MRTSUE06275	N/A	N/A	SIP-AC3
mmWave Antenna	A-INFO	LB-15-25-A	MRTSUE06409	N/A	N/A	SIP-TR2/SIP-AC3
mmWave Antenna	A-INFO	LB-10-25-A	MRTSUE06410	N/A	N/A	SIP-AC3
mmWave Extension Module	Keysight	E8257DV15	MRTSUE06456	N/A	N/A	SIP-AC3
mmWave Extension Module	Keysight	E8257DV10	MRTSUE06458	N/A	N/A	SIP-AC3

Software	Version	Function
EMI Software	V3	EMI Test Software
Controller_MF 7802BS	1.02	RE Antenna & Turntable
MotorContor	V 2	mmw



## 4. Decision Rules and Measurement Uncertainty

### 4.1. Decision Rules

The Decision Rule is based on Simple Acceptance in accordance with ISO Guide 98-4: 2012 Clause 8.2. (Measurement uncertainty is not taken into account when stating conformity with a specified requirement.)

### 4.2. Measurement Uncertainty

Where relevant, the following measurement uncertainty levels have been estimated for tests performed on the apparatus. This uncertainty represents an expanded uncertainty expressed at approximately the 95% confidence level using a coverage factor of  $k = 2$ .

Parameter	Uncertainty
Radio frequency	$\pm 1 \times 10^{-7}$
Radiated RF power (up to 40 GHz)	$\pm 6$ dB
Radiated RF power (above 40 GHz up to 66 GHz)	$\pm 8$ dB
Radiated RF power (above 66 GHz up to 100 GHz)	$\pm 10$ dB (see note 1)
Radiated RF power (above 100 GHz)	See note 2
Temperature	$\pm 1$ °C
Humidity	$\pm 5$ %
DC and low frequency voltages	$\pm 3$ %

NOTE 1: Achieved sensitivity and measurement uncertainty are a direct result of the chosen test suites. The values mentioned together with the concerns should therefore be considered illustrational rather than absolute for measurements above 66 GHz, given the absence of some relevant information. For radiated emissions above 66 GHz the given measurement uncertainties are based on the assumption of the deployment of a cable based measurement set-up. In the cases of other measurement set-up (e.g. wave guides) it may not be possible to reduce measurement uncertainty to the levels specified in table 4.

NOTE 2: For measurements above 100 GHz, the expanded measurement uncertainty shall also be recorded in the test report and a detailed calculation be added. A future revision of the present document may include a value for frequencies for expanded measurement uncertainty that is still under development.

## 5. Test Result

### 5.1. Test Summary

Standard Clause	Test Items	Verdict
4.2.1.1	Power Spectral Density	Pass
4.2.1.2	RF Output Power	Pass
4.2.1.3	Permitted Range of Operating Frequencies	Pass
4.2.1.4	Transmitter Emissions In The Out-of-band Domain	Pass
4.2.1.5	Transmitter Unwanted Emissions In The Spurious Domain	Pass
4.2.2.1	Receiver Spurious Emissions	Pass
Note 1: The test results shown in the following sections represent the worst case emissions.		
Note 2: For “Permitted Range of Operating Frequencies” and “Transmitter Emissions In The Out-of-band Domain” test item, only the high rate mode was performed in the report.		

## 5.2. Power Spectral Density

### 5.2.1. Test Limit

The maximum mean power spectral density is applicable to the system as a whole when operated at the highest stated power level. For a smart antenna system and directional antennas, the limit applies to the configuration that results in the highest PSD (e.i.r.p) and shall not exceed the values given in table 9.

Table 9: Mean Power Spectral Density Limit (PSD) (e.i.r.p)

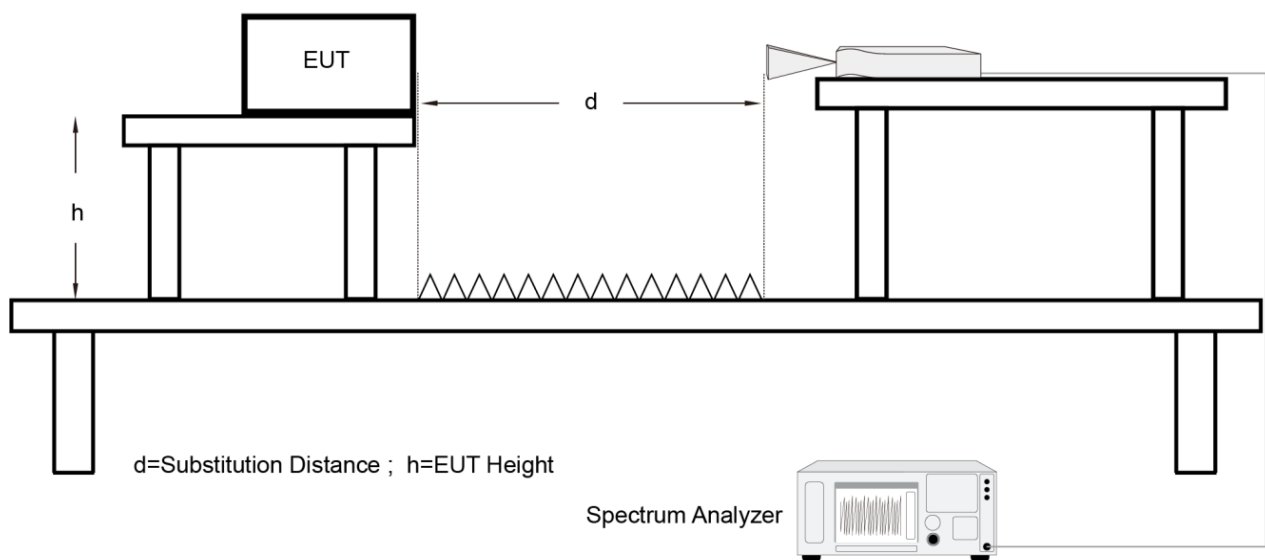
Frequency Bands	Power Spectral Density	Application	Notes
57 GHz to 64 GHz	13dBm/MHz e.i.r.p	Non-specific SRD	
61.0 GHz to 61.5 GHz	No limit defined yet	Non-specific SRD	
122GHz to 122.25GHz	10dBm/ 250MHz and -48dBm/MHz > 30° elevatiton	Non-specific SRD	Note 1, 2 and 3
122.25GHz to 123GHz	No limit defined	Non-specific SRD	
244 GHz to 246 GHz	No limit defined	Non-specific SRD	

NOTE 1: These limits should be measured with an rms detector and an averaging time of 1 ms or less.

NOTE 2: The limit of -48 dBm/MHz applies for the normal operation mode of handheld and mobile devices and for fixed installation.

NOTE 3: See for declaration requirements, clause 5.1 of EN 305 550-1.

### 5.2.2. Test Setup



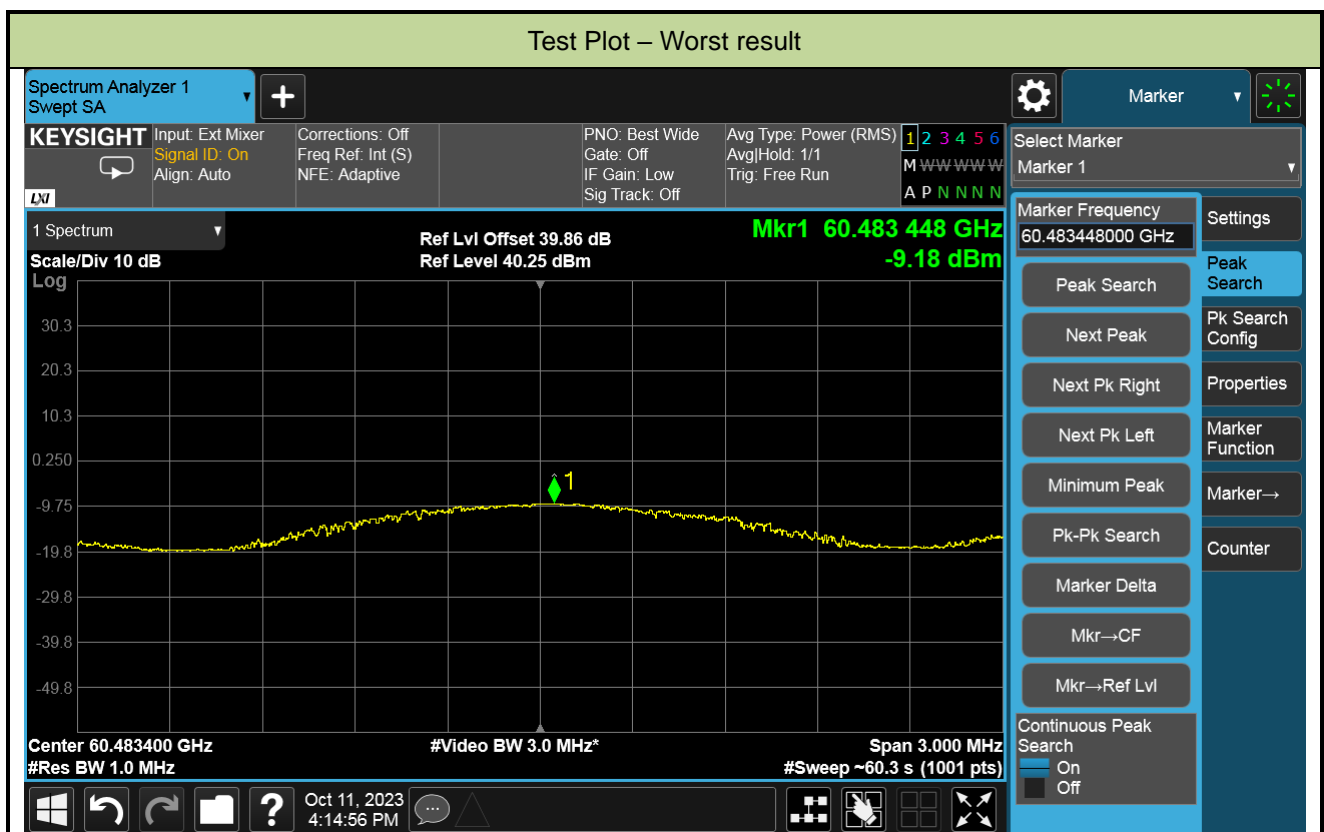
### **5.2.3. Test Procedure**

Refer to EN 305 550-1 V1.2.1 (2014-10) Clause 7.1.3.

#### 5.2.4. Test Result

Test Site	SIP-TR2	Test Engineer	Chase Zhu
Test Date	2023-10-11		

Test Mode	Test Conditions		Power Spectral Density (dBm/MHz)	Limit (dBm/MHz)
	Temperature	Voltage		
Mode 1	25°C	DC 5V	-9.23	13
	25°C	DC 4.5V	-9.18	13
	25°C	DC 5.5V	-9.18	13
Mode 3	25°C	DC 5V	-28.17	13
	25°C	DC 4.5V	-28.81	13
	25°C	DC 5.5V	-28.54	13



### 5.3. RF Output Power

#### 5.3.1. Test Limit

The maximum RF output power is applicable to the system as a whole when operated at the highest stated power level. For a smart antenna system and directional antennas, the limit applies to the configuration which results in the highest EIRP. The maximum RF output power in normal wideband operation shall be limited by usage as indicated in table 10.

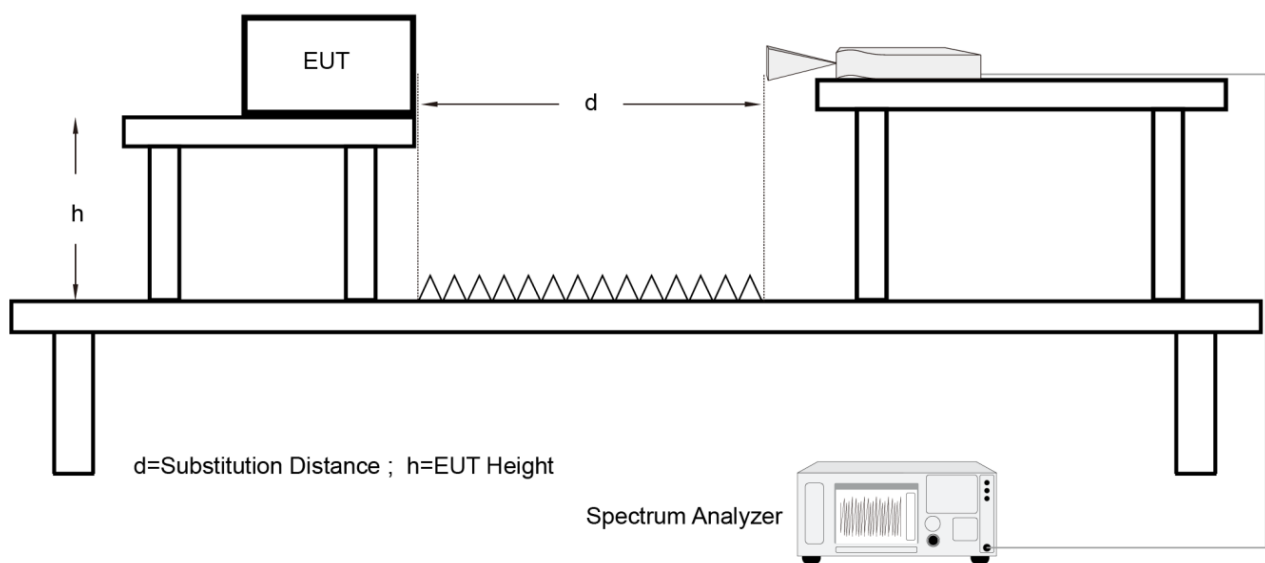
Table 10: RF output limit [i.12]

Frequency Bands	RF output power	Application	Notes
57 GHz to 64GHz	100 mW e.i.r.p / 20 dBm e.i.r.p.	Non-specific SRD	Note 1
61.0GHz to 61.5GHz	100 mW e.i.r.p / 20 dBm e.i.r.p.	Non-specific SRD	
122GHz to 123GHz	100 mW e.i.r.p / 20 dBm e.i.r.p.	Non-specific SRD	Note 2
244GHz to 246GHz	100 mW e.i.r.p / 20 dBm e.i.r.p.	Non-specific SRD	

NOTE 1: A max transmitter output power of 10 dBm.

NOTE 2: Some countries may permit higher output power according to CEPT/ERC Recommendation 70-03 [i.1].

#### 5.3.2. Test Setup



### **5.3.3. Test Procedure**

Refer to EN 305 550-1 V1.2.1 (2014-10-12) Clause 7.2.3.

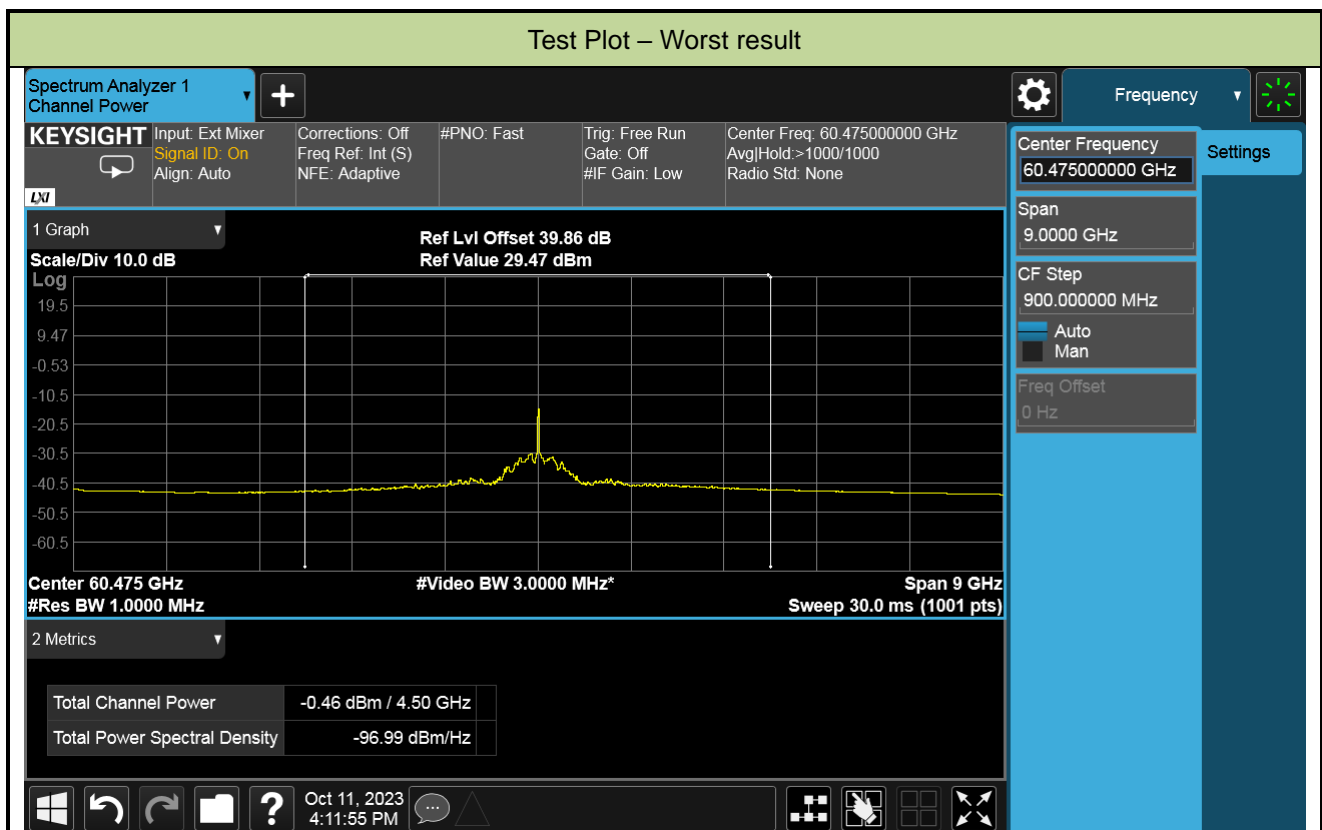
### 5.3.4. Test Result

Test Site	SIP-TR2	Test Engineer	Chase Zhu
Test Date	2023-10-11		

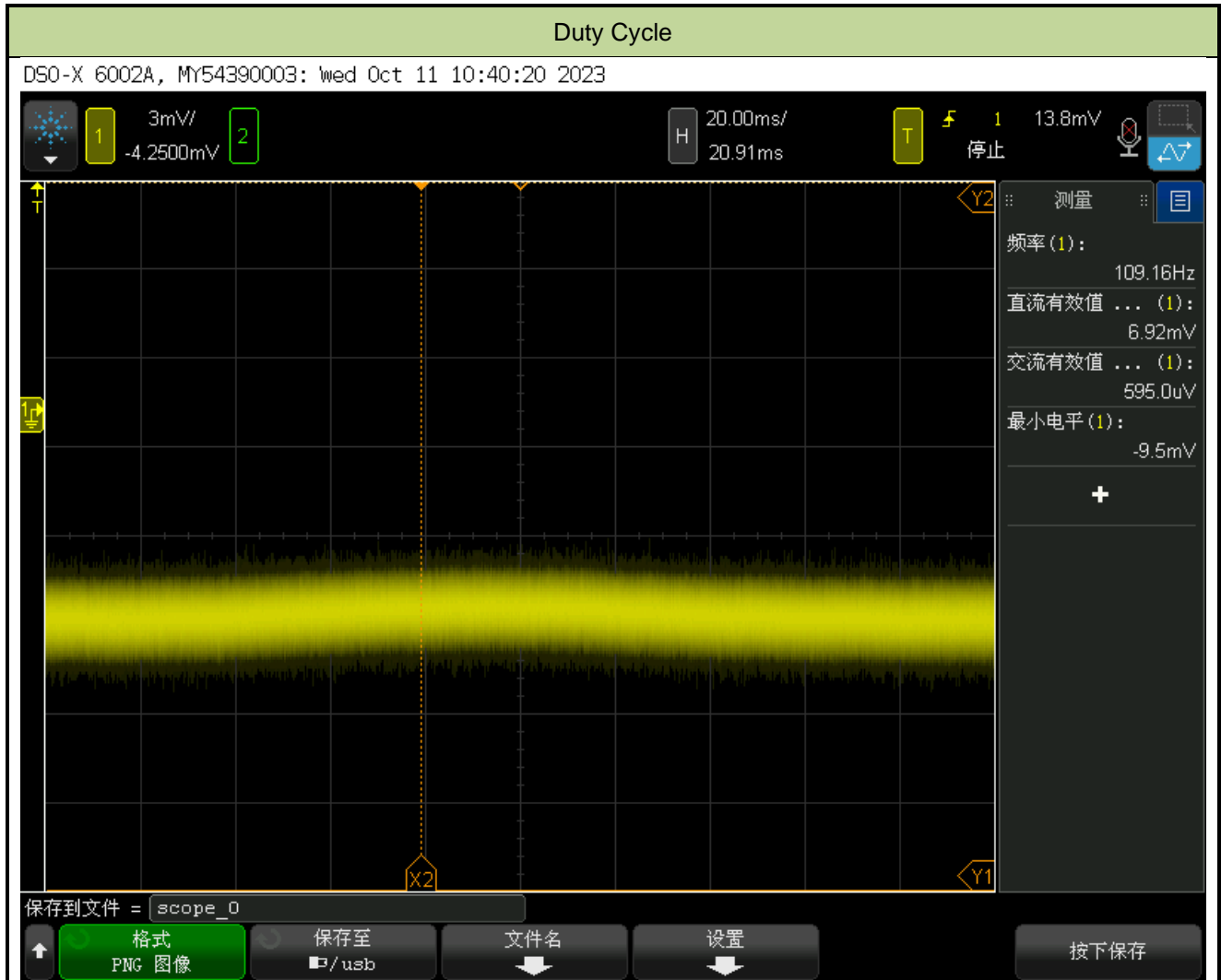
Test Mode	Test Conditions		Output Power (dBm)	Duty cycle (%)	EIRP (dBm)	Limit (dBm)
	Temperature	Voltage				
Mode 1	25°C	DC 5V	-0.47	100	-0.47	20
	25°C	DC 4.5V	-0.47	100	-0.47	20
	25°C	DC 5.5V	-0.46	100	-0.46	20
Mode 3	25°C	DC 5V	-13.80	100	-13.80	20
	25°C	DC 4.5V	-13.80	100	-13.80	20
	25°C	DC 5.5V	-13.82	100	-13.82	20

Note: The product using 2ASK modulation, the duty cycle is 100%.

EIRP (dBm)= Output Power (dBm) + 10\*log(1/x) (dB), x=duty cycle.







## 5.4. Permitted Range of Operating Frequencies

### 5.4.1. Test Limit

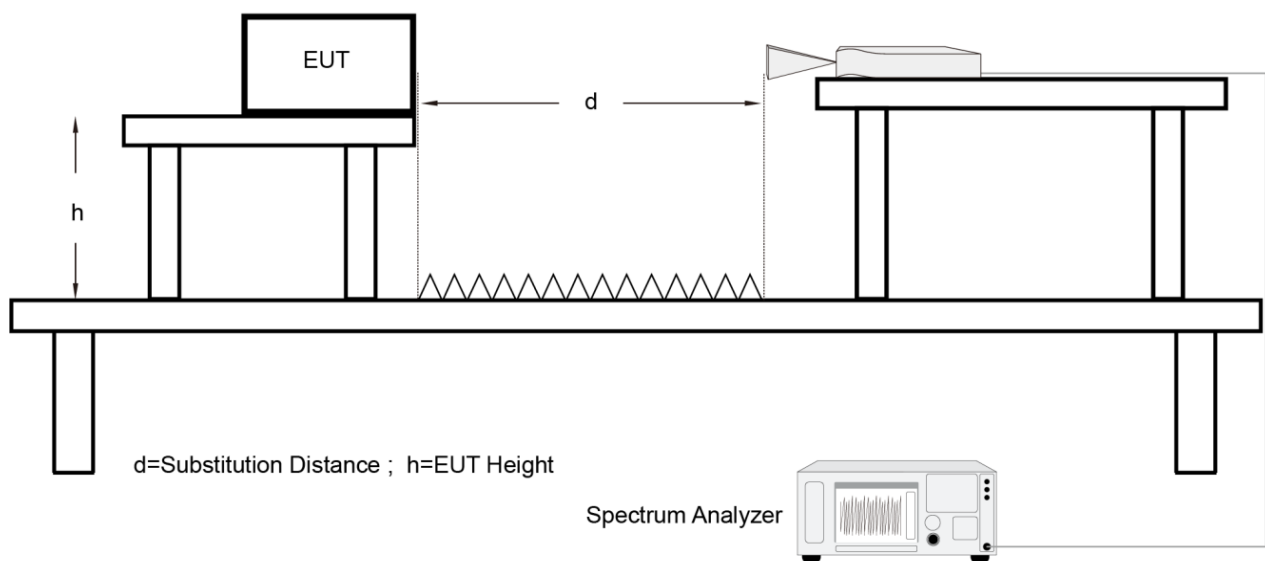
The width of the power spectrum envelope is  $f_H - f_L$  for a given operating frequency. In equipment that allows adjustment or selection of different operating frequencies, the power envelope takes up different positions in the allowed band. The frequency range is determined by the lowest value of  $f_L$  and the highest value of  $f_H$  resulting from the adjustment of the equipment to the lowest and highest operating frequencies.

The occupied bandwidth, the bandwidth in which 99 % of the wanted emission is contained, and the necessary bandwidth of the transmitter shall fall within the assigned frequency band. The 99% occupied bandwidth corresponds to the -23dBc bandwidth of the signal.

For all equipment the frequency range shall lie within the frequency band given in tables 9 and 10 of EN 305 550-1.

For this product ,the Permitted range of operating frequencies is 57GHz~64GHz.

### 5.4.2. Test Setup



### 5.4.3. Test Procedure

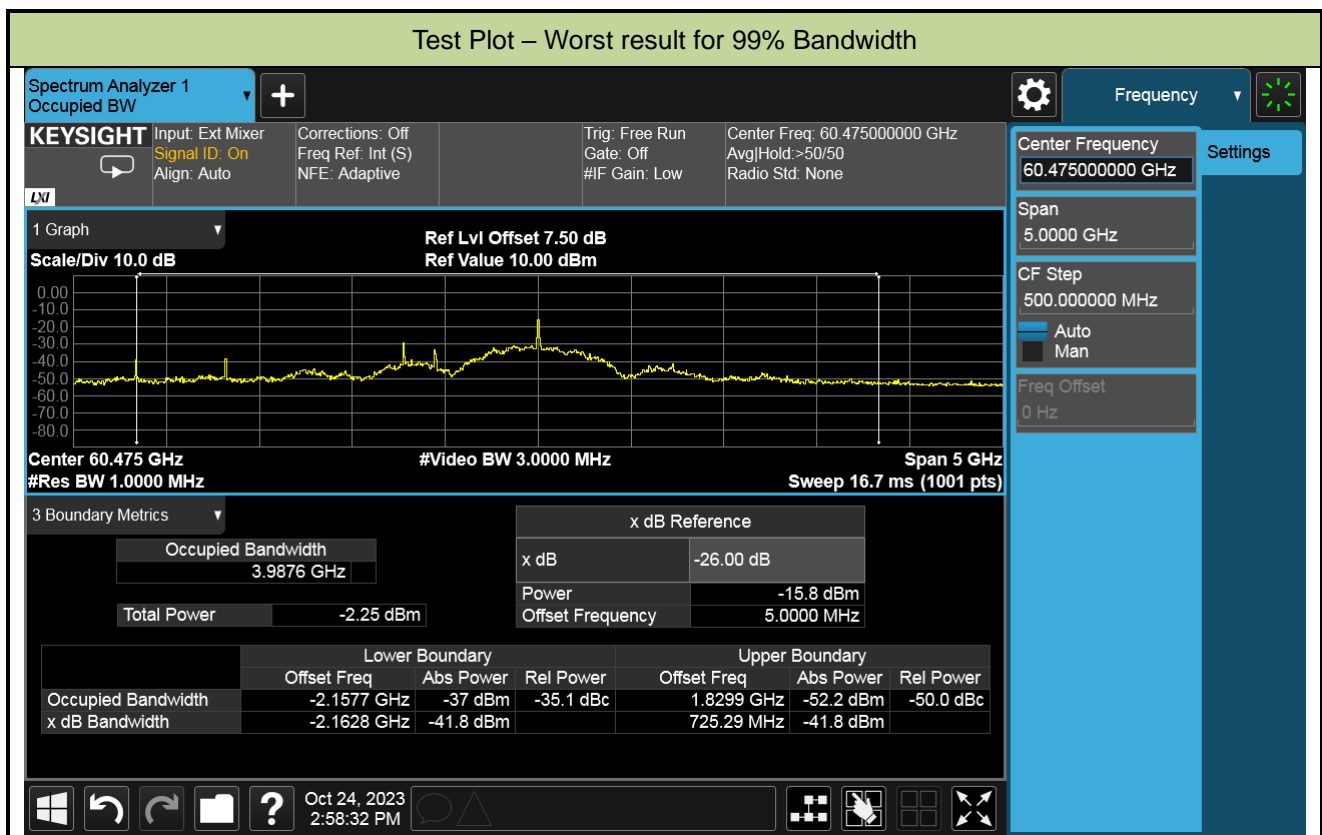
Refer to EN 305 550-1 V1.2.1 (2014-10-12) Clause 7.3.2.

#### 5.4.4. Test Result

Test Site	SIP-TR2	Test Engineer	Chase Zhu
Test Date	2023-10-24		

Test Conditions		Low Frequency for 99% bandwidth (MHz)	F <sub>L</sub> Limit (MHz)	High Frequency for 99% bandwidth (MHz)	F <sub>H</sub> Limit (MHz)
Temperature	Voltage				
25°C	DC 5V	<b>58317.3</b>	≥ 57000	62304.9	≤ 64000
25°C	DC 4.5V	58322.3	≥ 57000	<b>62354.5</b>	≤ 64000
25°C	DC 5.5V	58359.2	≥ 57000	62307.7	≤ 64000

Note: For DC 5V normal condition,  $f_c = (60760.975\text{MHz} + 62350.335\text{MHz}) / 2 = 61555.655\text{MHz}$ .



## 5.5. Transmitter Emissions In The Out-of-band Domain

### 5.5.1. Test Limit

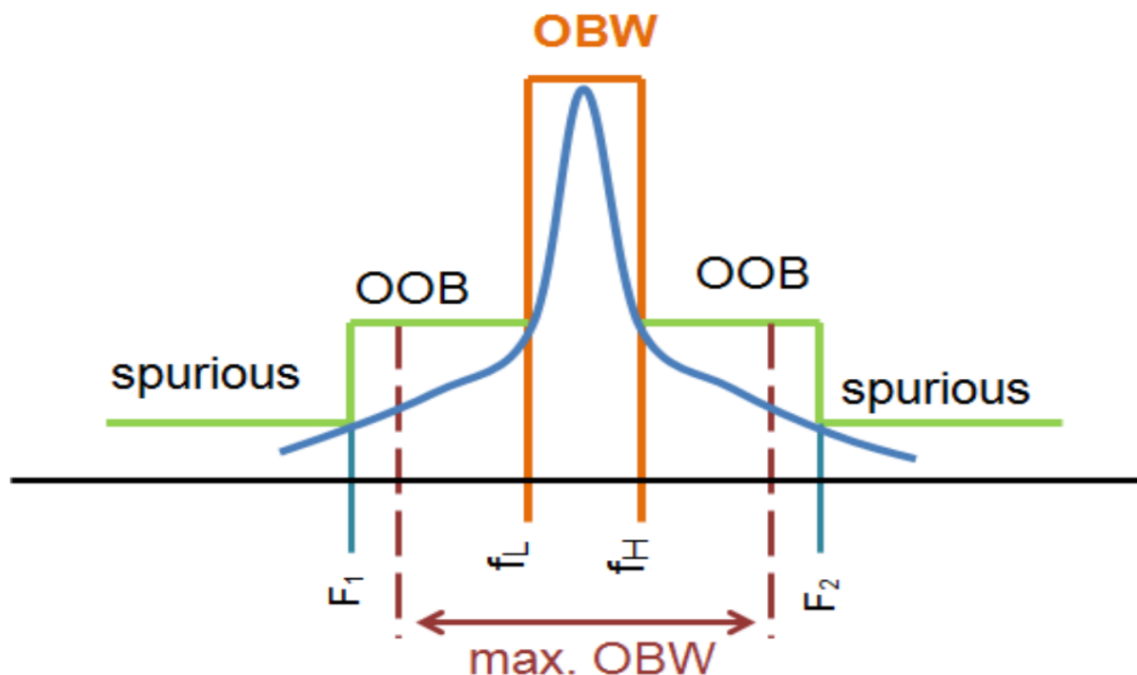
The borders for the OOB and spurious domain are dependent on the Occupied Bandwidth of the EUT.

The borders are calculated as follows:

$$F_1 = \text{centre frequency of OBW [GHz]} - (2,5 * (f_H - f_L))$$

$$F_2 = \text{centre frequency of OBW [GHz]} + (2,5 * (f_H - f_L))$$

This calculation taken into account that the border between OOB and spurious will be larger/ smaller the maximum permitted range of operation (see figure 9)



**Figure 9: Overview OOB / spurious, dependent from OBW**

An additional requirement introduced: if the calculated F1/F2 will be theoretical below or above the frequency which came out of the calculation based on 250 % of the maximum allowed OBW (see tables 9 and 10).

Therefore the border between OOB / spurious will be fixed at the frequencies in table 11b (normal 250 % rule based on the Centre frequency of the signal).

Table 11b: Limits for the max. F1 and F2 frequency, based on the max. theoretical OBW of the EUT

Frequency Bands	Centre frequency	Max OBW	F <sub>1</sub>	F <sub>2</sub>
57 GHz to 64GHz	60.5GHz	7GHz	43GHz	78GHz
61.0GHz to 61.5GHz	61.25GHz	500MHz	60GHz	62.5GHz
122GHz to 123GHz	122.5GHz	1GHz	120GHz	125GHz
244GHz to 246GHz	245GHz	2GHz	240GHz	250GHz

The rms power density radiated in the calculated OOB domain (between  $F_1 \leq f < f_L$  and  $f_H < f \leq F_2$ ) band shall not exceed the values shown in tables 12 and 13 [i.4].

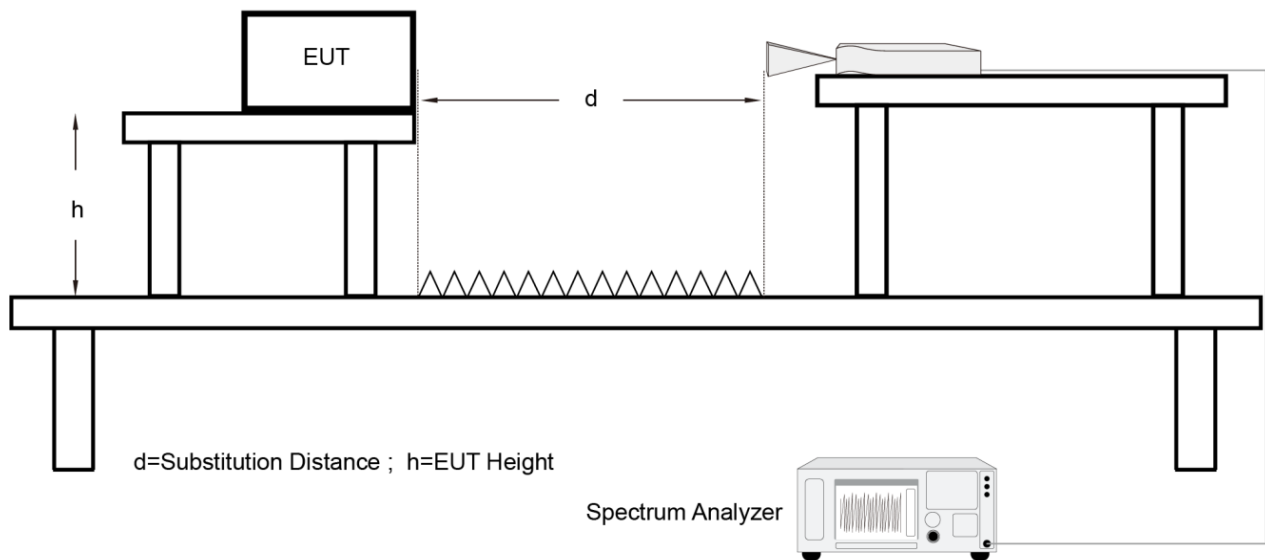
Table 12: Out of band domain

Frequency [GHz]	Rms power density [dBm/MHz]
$F_1 \leq f < f_L$	See table 13
$f_L < f \leq F_2$	See table 13

Table 13: Limits for out of band radiation

Frequency Bands	OOB limit [dBm/MHz]
57 GHz to 64GHz	-20 dBm/MHz
61.0GHz to 61.5GHz	-10 dBm/MHz
122GHz to 123GHz	-10 dBm/MHz
244GHz to 246GHz	-15 dBm/MHz

### 5.5.2. Test Setup



### 5.5.3. Test Procedure

Refer to EN 305 550-1 V1.2.1 (2014-10) Clause 7.4.3.

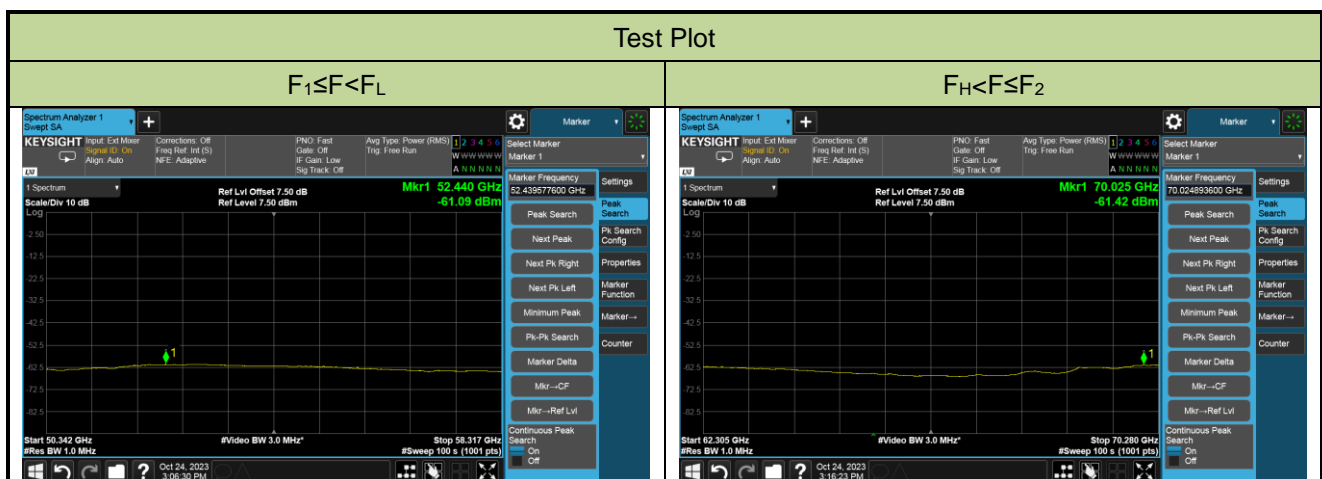
#### 5.5.4. Test Result

Test Site	SIP-TR2	Test Engineer	Chase Zhu
Test Date	2023-10-24		

Frequency Range (MHz)	Measure Value (dBm/MHz)	Limit (dBm/MHz)	Result
50342.1 ~ 58317.3	-61.09	-20	Pass
62304.9 ~ 70280.1	-61.42	-20	Pass

Note:

- According to Clause 5.4.4 result of this report, in the normal condition,  $F_L = 58317.3$  MHz,  $F_H = 62304.9$  MHz,  $f_c = 60311.1$  MHz
- $F_1 = f_c - [2.5 \times (f_H - f_L)] = 50342.1$  MHz
- $F_2 = f_c + [2.5 \times (f_H - f_L)] = 70280.1$  MHz



## 5.6. Transmitter Unwanted Emissions In The Spurious Domain

### 5.6.1. Test Limit

The effective radiated power of any radiated spurious emission shall not exceed the values given in table 14.

Table 14: Limits of radiated spurious emissions

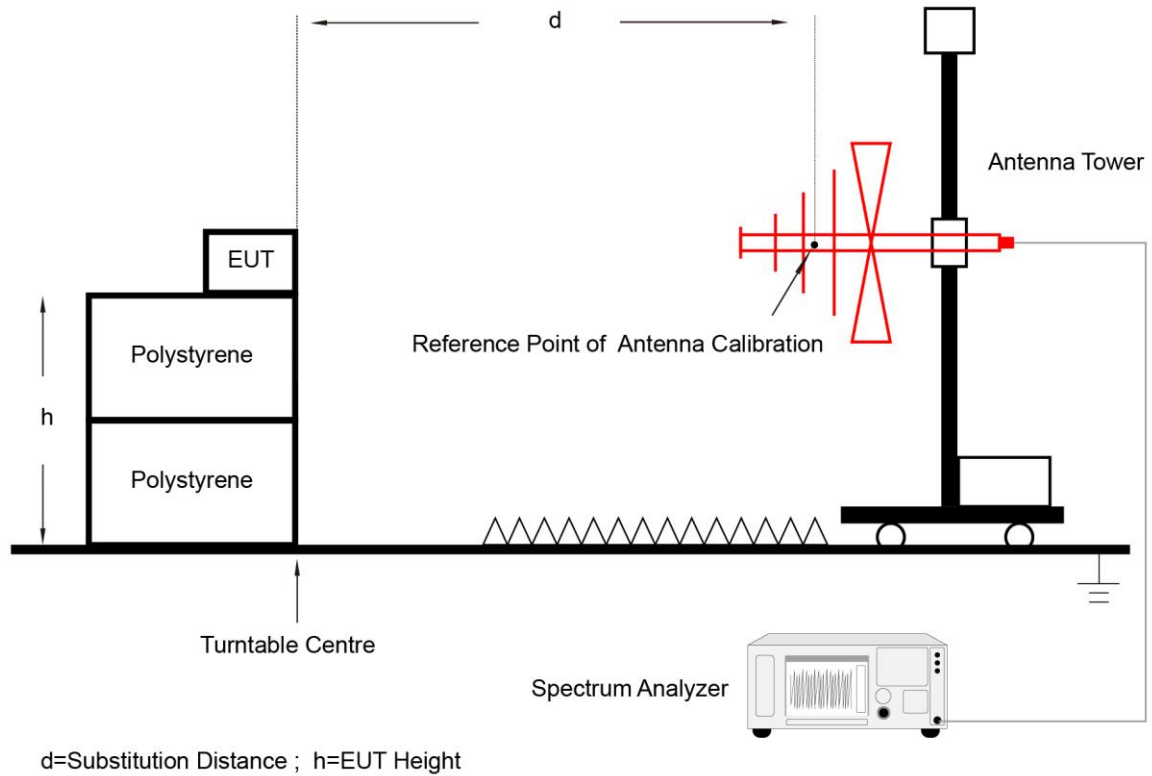
Frequency range (MHz)	Limit values for spurious radiation (Measuring receiver bandwidths see table 2)	Detector type
47 to 74	-54 dBm e.r.p.	Quasi-Peak
87.5 to 118	-54 dBm e.r.p.	Quasi-Peak
174 to 230	-54 dBm e.r.p.	Quasi-Peak
470 to 862	-54 dBm e.r.p.	Quasi-Peak
Otherwise in band 30 to 1000	-36 dBm e.r.p.	Quasi-Peak
f > 1000 to 300000	-30 dBm e.i.r.p.	Mean (see note)
NOTE: Parameter for measurement: - RBW: 1 MHz - VBW: 3 MHz - Detector: rms - Sweep time: minimum 1 radar cycle, maximum 100 ms.		

The following reference bandwidths shall be used:

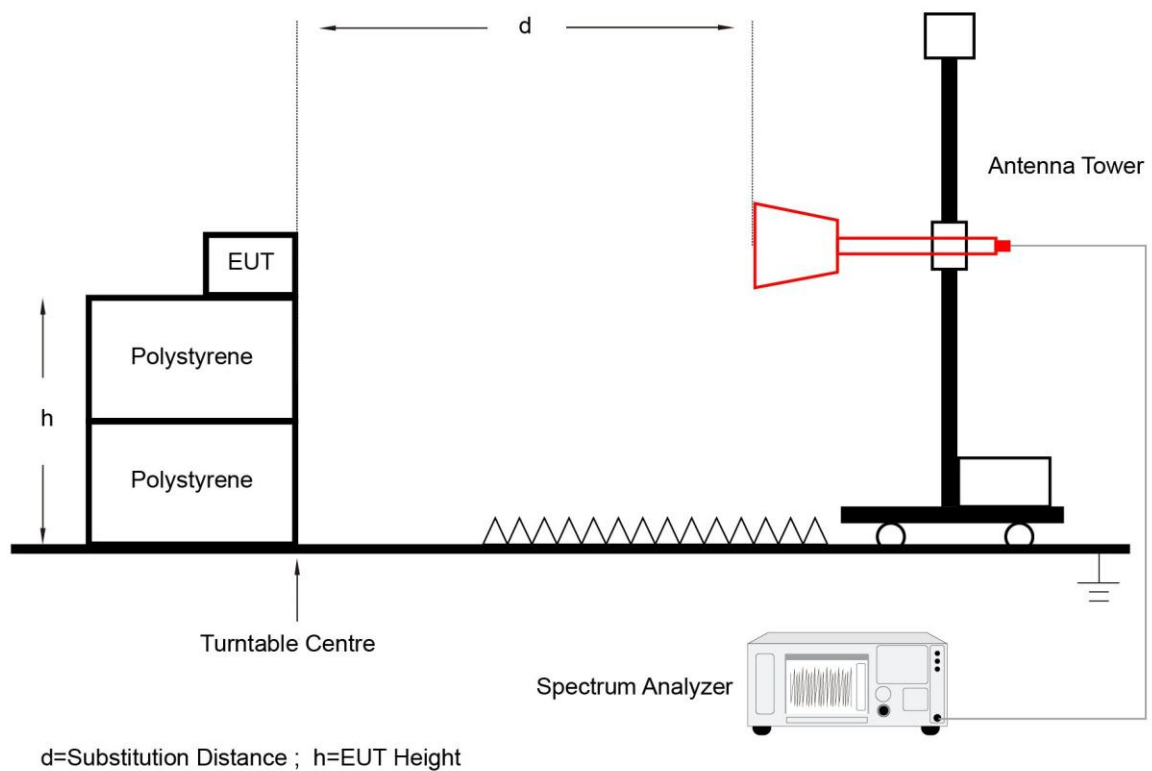
- 100 kHz between 30 MHz and 1 GHz;
- 1 MHz above 1 GHz.

### 5.6.2. Test Setup

Below 1GHz Test Setup:

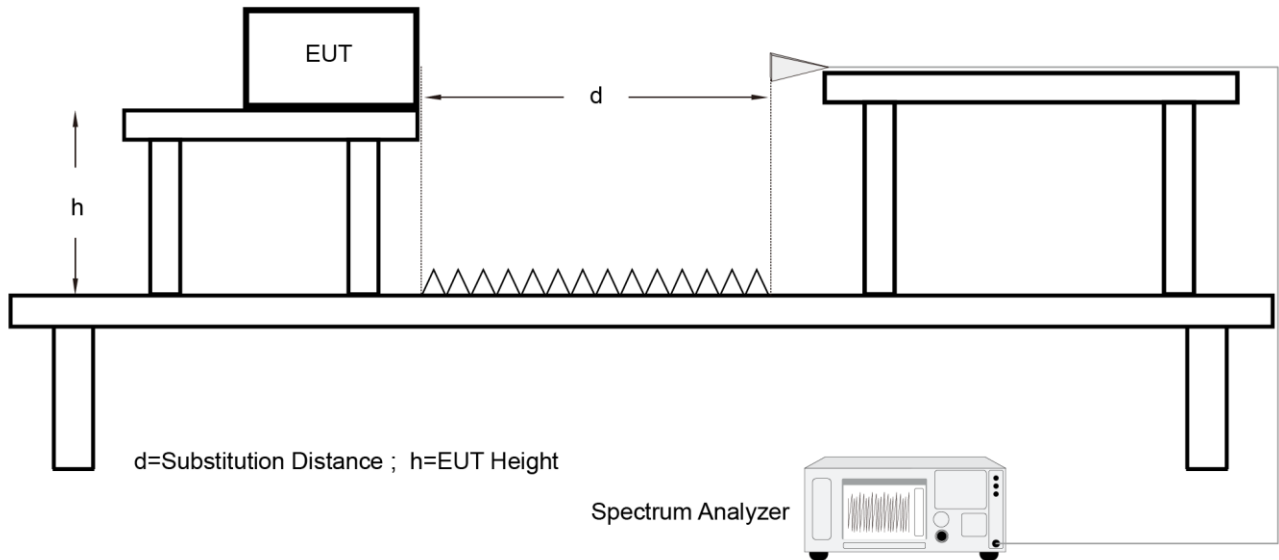


1GHz ~ 40GHz Test Setup:

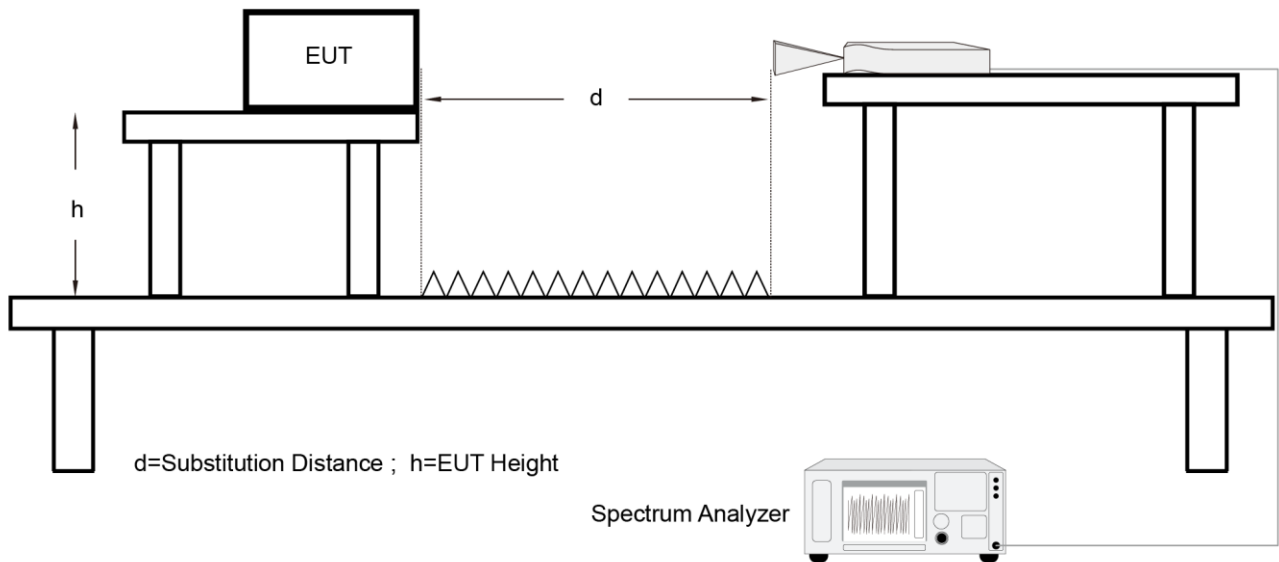




#### 40GHz ~ 50GHz Test Setup:



#### Above 50GHz Test Setup:



#### 5.6.3. Test Procedure

Refer to EN 305 550-1 V1.2.1 (2014-10) Clause 7.5.3.

#### 5.6.4. Test Result

Test Site	SIP-AC3	Test Engineer	Arvin Ding
Test Date	2023-09-28	Test Mode	Mode 1

Frequency (MHz)	Reading Level (dBm)	Substitution Factor (dB)	Measure Level (dBm)	Limit (dBm)	Margin (dB)	Detector	Polarization
30MHz ~ 40GHz							
48.9	-101.6	31.1	-70.5	-54.0	-16.5	Peak	Horizontal
720.2	-104.8	38.0	-66.8	-54.0	-12.8	Peak	Horizontal
71.7	-89.9	28.0	-61.9	-54.0	-7.9	Peak	Vertical
791.5	-102.2	37.7	-64.5	-54.0	-10.5	Peak	Vertical
9296.0	-58.6	10.2	-48.4	-30.0	-18.4	Peak	Horizontal
17847.0	-60.5	21.0	-39.5	-30.0	-9.5	Peak	Horizontal
3201.5	-49.1	1.8	-47.3	-30.0	-17.3	Peak	Vertical
17192.5	-60.3	20.0	-40.3	-30.0	-10.3	Peak	Vertical
28725.0	-49.0	4.0	-45.0	-30.0	-15.0	Peak	Horizontal
39252.0	-53.4	12.2	-41.2	-30.0	-11.2	Peak	Horizontal
28571.0	-49.1	3.7	-45.4	-30.0	-15.4	Peak	Vertical
39142.0	-52.7	9.9	-42.8	-30.0	-12.8	Peak	Vertical

Note 1: Measure Level (dBm) = Reading Level (dBm) + Substitution Factor (dB)

Note 2: For emission below 1GHz:

Substitution Factor (dB) = Cable Loss (dB) + Space Attenuation (dB) - Antenna Gain (dBi) - 2.15 (dB)

For emission above 1GHz:

Substitution Factor (dB) = Cable Loss (dB) + Space Attenuation (dB) - Antenna Gain (dBi) -

Pre\_Amplifier Gain (dB)

Note 3: Test Distance "d" = 3m, Test height "h" = 1.5m.

Test Site	SIP-AC3	Test Engineer	Chase Zhu
Test Date	2023-10-05 ~ 2023-10-07	Test Mode	Mode 1

Frequency (GHz)	Reading Level (dBm)	Substitution Factor (dB)	Measure Level (dBm)	Limit (dBm)	Margin (dB)	Detector	Polarization
Above 40 GHz							
49.410	-85.210	48.010	-37.200	-30.000	-7.200	RMS	Horizontal
49.173	-85.990	48.010	-37.980	-30.000	-7.980	RMS	Vertical
72.463	-82.490	44.650	-37.840	-30.000	-7.840	RMS	Horizontal
72.563	-82.440	44.650	-37.790	-30.000	-7.790	RMS	Vertical
82.926	-80.526	46.460	-34.066	-30.000	-4.066	RMS	Horizontal
83.228	-80.542	46.460	-34.082	-30.000	-4.082	RMS	Vertical
128.105	-94.770	59.780	-34.990	-30.000	-4.990	RMS	Horizontal
135.647	-94.450	59.360	-35.090	-30.000	-5.090	RMS	Vertical

Note 1: Measure Level (dBm) = Reading Level (dBm) + Substitution Factor (dB)

Note 2: For emission 40 - 50GHz:

Substitution Factor (dB) = Cable Loss (dB) + Space Attenuation (dB) - Antenna Gain (dBi)

For emission above 50GHz:

Substitution Factor (dB) = Cable Loss (dB) + Space Attenuation (dB) - Antenna Gain (dBi) + Mixer Conversion Loss (dB)

Note 3: Test Distance "d" = 1m, Test height "h" = 0.8m.

Test Site	SIP-AC3	Test Engineer	Arvin Ding
Test Date	2023-09-28	Test Mode	Mode 2

Frequency (MHz)	Reading Level (dBm)	Substitution Factor (dB)	Measure Level (dBm)	Limit (dBm)	Margin (dB)	Detector	Polarization
30MHz ~ 40GHz							
48.9	-97.8	31.1	-66.7	-54.0	-12.7	Peak	Horizontal
570.8	-98.6	35.6	-63.0	-54.0	-9.0	Peak	Horizontal
67.8	-89.0	26.3	-62.7	-54.0	-8.7	Peak	Vertical
786.6	-102.7	37.9	-64.8	-54.0	-10.8	Peak	Vertical
11421.0	-57.2	11.4	-45.8	-30.0	-15.8	Peak	Horizontal
17498.5	-60.4	20.4	-40.0	-30.0	-10.0	Peak	Horizontal
3201.5	-49.7	1.8	-47.9	-30.0	-17.9	Peak	Vertical
17439.0	-60.9	20.2	-40.7	-30.0	-10.7	Peak	Vertical
33202.0	-47.2	3.9	-43.3	-30.0	-13.3	Peak	Horizontal
39274.0	-53.1	12.3	-40.8	-30.0	-10.8	Peak	Horizontal
24248.0	-50.8	5.7	-45.1	-30.0	-15.1	Peak	Vertical
36821.0	-49.7	6.8	-42.9	-30.0	-12.9	Peak	Vertical

Note 1: Measure Level (dBm) = Reading Level (dBm) + Substitution Factor (dB)

Note 2: For emission below 1GHz:

Substitution Factor (dB) = Cable Loss (dB) + Space Attenuation (dB) - Antenna Gain (dBi) - 2.15 (dB)

For emission above 1GHz:

Substitution Factor (dB) = Cable Loss (dB) + Space Attenuation (dB) - Antenna Gain (dBi) -  
Pre\_Amplifier Gain (dB)

Note 3: Test Distance "d" = 3m, Test height "h" = 1.5m.

Test Site	SIP-AC3	Test Engineer	Chase Zhu
Test Date	2023-10-05 ~ 2023-10-07	Test Mode	Mode 2

Frequency (GHz)	Reading Level (dBm)	Substitution Factor (dB)	Measure Level (dBm)	Limit (dBm)	Margin (dB)	Detector	Polarization
Above 40 GHz							
49.141	-99.943	48.010	-51.933	-30.000	-21.933	RMS	Horizontal
49.139	-100.102	48.010	-52.092	-30.000	-22.092	RMS	Vertical
72.470	-80.200	44.650	-35.550	-30.000	-5.550	RMS	Horizontal
72.638	-87.790	44.650	-43.140	-30.000	-13.140	RMS	Vertical
82.842	-80.545	46.460	-34.085	-30.000	-4.085	RMS	Horizontal
83.382	-80.442	46.460	-33.982	-30.000	-3.982	RMS	Vertical
127.159	-94.600	59.420	-35.180	-30.000	-5.180	RMS	Horizontal
119.052	-94.720	60.050	-34.670	-30.000	-4.670	RMS	Vertical

Note 1: Measure Level (dBm) = Reading Level (dBm) + Substitution Factor (dB)

Note 2: For emission 40 - 50GHz:

Substitution Factor (dB) = Cable Loss (dB) + Space Attenuation (dB) - Antenna Gain (dBi)

For emission above 50GHz:

Substitution Factor (dB) = Cable Loss (dB) + Space Attenuation (dB) - Antenna Gain (dBi) + Mixer Conversion Loss (dB)

Note 3: Test Distance "d" = 1m, Test height "h" = 0.8m.

Test Site	SIP-AC3	Test Engineer	Arvin Ding
Test Date	2023-09-28	Test Mode	Mode 3

Frequency (MHz)	Reading Level (dBm)	Substitution Factor (dB)	Measure Level (dBm)	Limit (dBm)	Margin (dB)	Detector	Polarization
30MHz ~ 40GHz							
59.6	-89.8	25.1	-64.7	-54.0	-10.7	Peak	Horizontal
726.0	-102.9	38.1	-64.8	-54.0	-10.8	Peak	Horizontal
59.6	-86.5	24.5	-62.0	-54.0	-8.0	Peak	Vertical
606.2	-99.0	35.6	-63.4	-54.0	-9.4	Peak	Vertical
11421.0	-58.1	11.4	-46.7	-30.0	-16.7	Peak	Horizontal
17524.0	-60.8	20.5	-40.3	-30.0	-10.3	Peak	Horizontal
3193.0	-49.8	1.5	-48.3	-30.0	-18.3	Peak	Vertical
15288.5	-58.4	17.6	-40.8	-30.0	-10.8	Peak	Vertical
34005.0	-48.3	5.4	-42.9	-30.0	-12.9	Peak	Horizontal
39109.0	-52.8	11.8	-41.0	-30.0	-11.0	Peak	Horizontal
33653.0	-48.3	4.9	-43.4	-30.0	-13.4	Peak	Vertical
37360.0	-50.6	7.2	-43.4	-30.0	-13.4	Peak	Vertical

Note 1: Measure Level (dBm) = Reading Level (dBm) + Substitution Factor (dB)

Note 2: For emission below 1GHz:

Substitution Factor (dB) = Cable Loss (dB) + Space Attenuation (dB) - Antenna Gain (dBi) - 2.15 (dB)

For emission above 1GHz:

Substitution Factor (dB) = Cable Loss (dB) + Space Attenuation (dB) - Antenna Gain (dBi) -  
Pre\_Amplifier Gain (dB)

Note 3: Test Distance "d" = 3m, Test height "h" = 1.5m.

Test Site	SIP-AC3	Test Engineer	Chase Zhu
Test Date	2023-10-05 ~ 2023-10-07	Test Mode	Mode 3

Frequency (GHz)	Reading Level (dBm)	Substitution Factor (dB)	Measure Level (dBm)	Limit (dBm)	Margin (dB)	Detector	Polarization
Above 40 GHz							
49.157	-100.378	48.010	-52.368	-30.000	-22.368	RMS	Horizontal
49.107	-100.638	48.010	-52.628	-30.000	-22.628	RMS	Vertical
73.310	-82.670	44.720	-37.950	-30.000	-7.950	RMS	Horizontal
73.310	-87.720	44.720	-43.000	-30.000	-13.000	RMS	Vertical
83.476	-80.646	46.460	-34.186	-30.000	-4.186	RMS	Horizontal
82.342	-80.482	46.460	-34.022	-30.000	-4.022	RMS	Vertical
135.204	-95.230	59.330	-35.900	-30.000	-5.900	RMS	Horizontal
110.458	-95.190	60.300	-34.890	-30.000	-4.890	RMS	Vertical

Note 1: Measure Level (dBm) = Reading Level (dBm) + Substitution Factor (dB)

Note 2: For emission 40 - 50GHz:

Substitution Factor (dB) = Cable Loss (dB) + Space Attenuation (dB) - Antenna Gain (dBi)

For emission above 50GHz:

Substitution Factor (dB) = Cable Loss (dB) + Space Attenuation (dB) - Antenna Gain (dBi) + Mixer Conversion Loss (dB)

Note 3: Test Distance "d" = 1m, Test height "h" = 0.8m.

Test Site	SIP-AC3	Test Engineer	Arvin Ding
Test Date	2023-09-28	Test Mode	Mode 4

Frequency (MHz)	Reading Level (dBm)	Substitution Factor (dB)	Measure Level (dBm)	Limit (dBm)	Margin (dB)	Detector	Polarization
30MHz ~ 40GHz							
47.9	-98.7	31.8	-66.9	-54.0	-12.9	Peak	Horizontal
581.9	-99.2	35.4	-63.8	-54.0	-9.8	Peak	Horizontal
106.6	-90.2	30.8	-59.4	-54.0	-5.4	QP	Vertical
533.9	-98.0	34.0	-64.0	-54.0	-10.0	Peak	Vertical
3193.0	-53.0	2.4	-50.6	-30.0	-20.6	Peak	Horizontal
15025.0	-61.7	17.3	-44.4	-30.0	-14.4	Peak	Horizontal
3193.0	-49.1	1.5	-47.6	-30.0	-17.6	Peak	Vertical
17005.5	-64.6	19.9	-44.7	-30.0	-14.7	Peak	Vertical
34016.0	-47.4	5.6	-41.8	-30.0	-11.8	Peak	Horizontal
39109.0	-52.6	11.8	-40.8	-30.0	-10.8	Peak	Horizontal
34005.0	-47.8	4.8	-43.0	-30.0	-13.0	Peak	Vertical
39087.0	-52.8	9.9	-42.9	-30.0	-12.9	Peak	Vertical

Note 1: Measure Level (dBm) = Reading Level (dBm) + Substitution Factor (dB)

Note 2: For emission below 1GHz:

Substitution Factor (dB) = Cable Loss (dB) + Space Attenuation (dB) - Antenna Gain (dBi) - 2.15 (dB)

For emission above 1GHz:

Substitution Factor (dB) = Cable Loss (dB) + Space Attenuation (dB) - Antenna Gain (dBi) -  
Pre\_Amplifier Gain (dB)

Note 3: Test Distance "d" = 3m, Test height "h" = 1.5m.



Test Site	SIP-AC3	Test Engineer	Chase Zhu
Test Date	2023-10-05 ~ 2023-10-07	Test Mode	Mode 4

Frequency (GHz)	Reading Level (dBm)	Substitution Factor (dB)	Measure Level (dBm)	Limit (dBm)	Margin (dB)	Detector	Polarization
Above 40 GHz							
49.152	-100.555	48.010	-52.545	-30.000	-22.545	RMS	Horizontal
49.118	-100.342	48.010	-52.332	-30.000	-22.332	RMS	Vertical
72.537	-82.880	44.650	-38.230	-30.000	-8.230	RMS	Horizontal
72.537	-87.930	44.650	-43.280	-30.000	-13.280	RMS	Vertical
83.247	-80.645	46.460	-34.185	-30.000	-4.185	RMS	Horizontal
83.350	-80.580	46.460	-34.120	-30.000	-4.120	RMS	Vertical
138.236	-94.530	59.470	-35.060	-30.000	-5.060	RMS	Horizontal
135.284	-94.880	59.330	-35.550	-30.000	-5.550	RMS	Vertical

Note 1: Measure Level (dBm) = Reading Level (dBm) + Substitution Factor (dB)

Note 2: For emission 40 - 50GHz:

Substitution Factor (dB) = Cable Loss (dB) + Space Attenuation (dB) - Antenna Gain (dBi)

For emission above 50GHz:

Substitution Factor (dB) = Cable Loss (dB) + Space Attenuation (dB) - Antenna Gain (dBi) + Mixer Conversion Loss (dB)

Note 3: Test Distance "d" = 1m, Test height "h" = 0.8m.

## **5.7. Receiver Spurious Emissions**

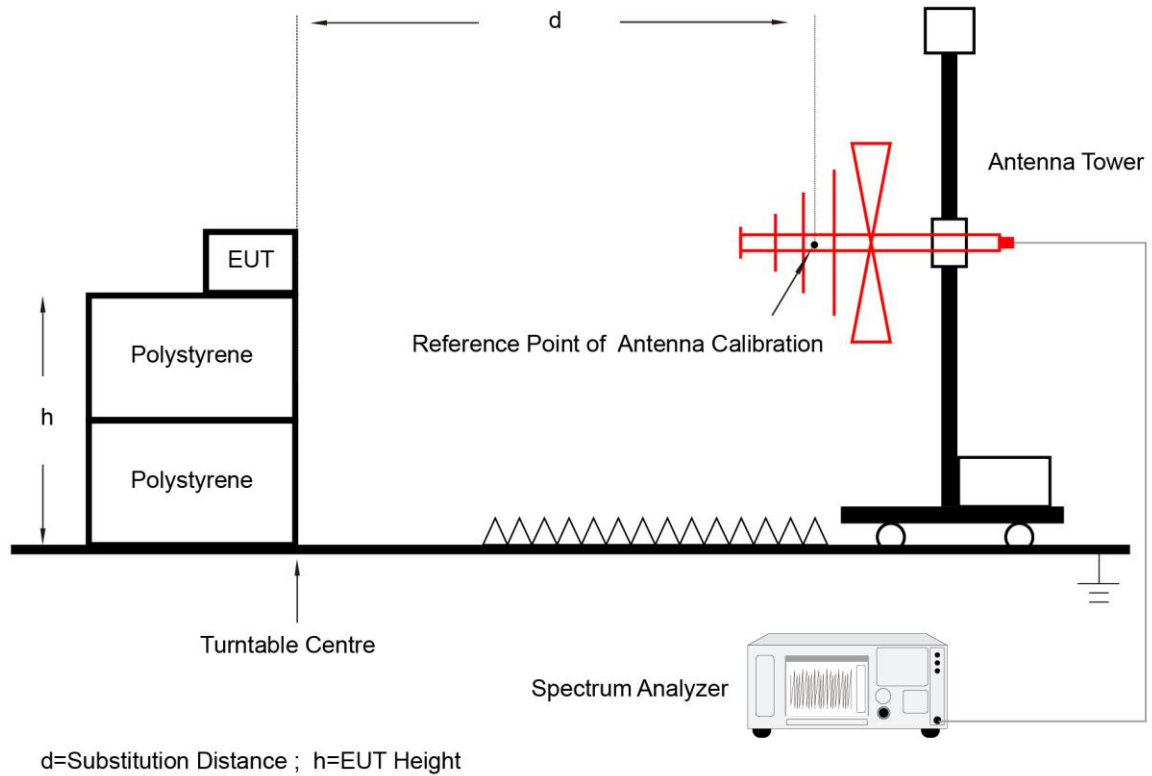
### **5.7.1. Test Limit**

The power of any unwanted emission:

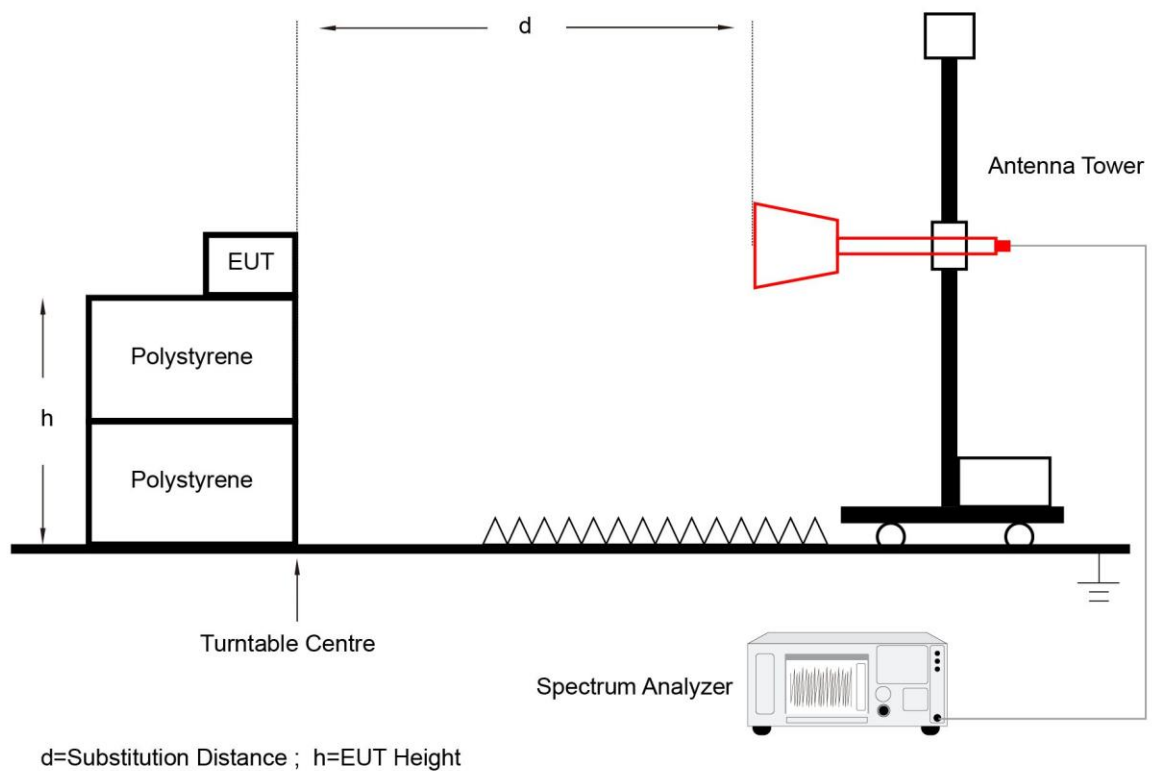
- 1) shall not exceed 2 nW (-57 dBm) in the range 30 MHz to 1 GHz;
- 2) shall not exceed 20 nW (-47 dBm in reference measurement bandwidth of 1 MHz) on frequencies above 1 GHz. The upper frequency is to include the second harmonic of the EUT or 300 GHz whichever is lower.

### 5.7.2. Test Setup

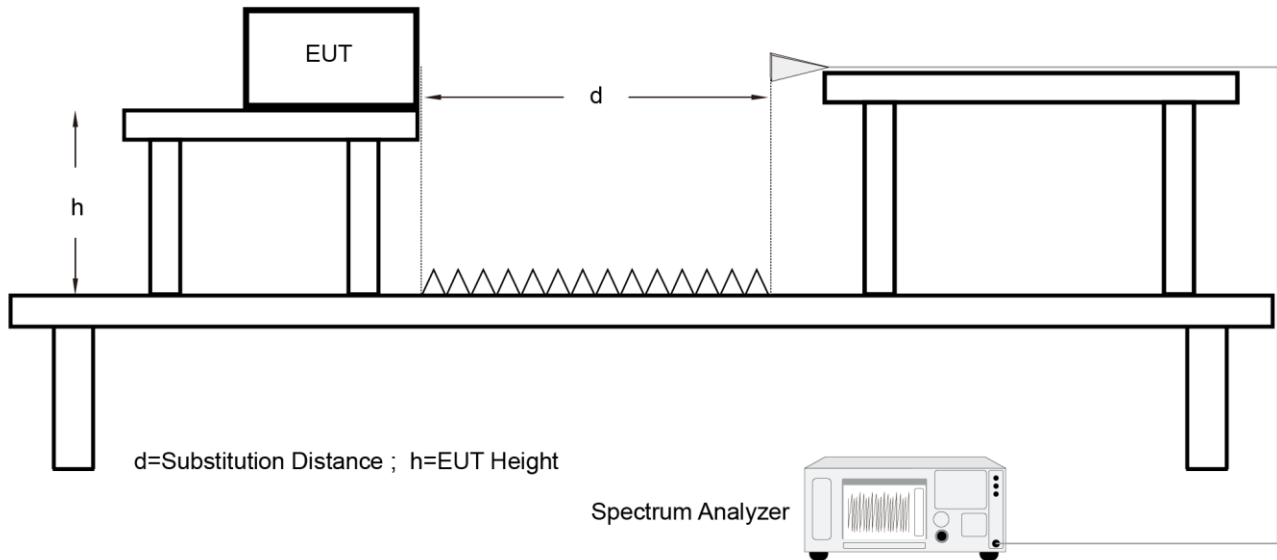
Below 1GHz Test Setup:



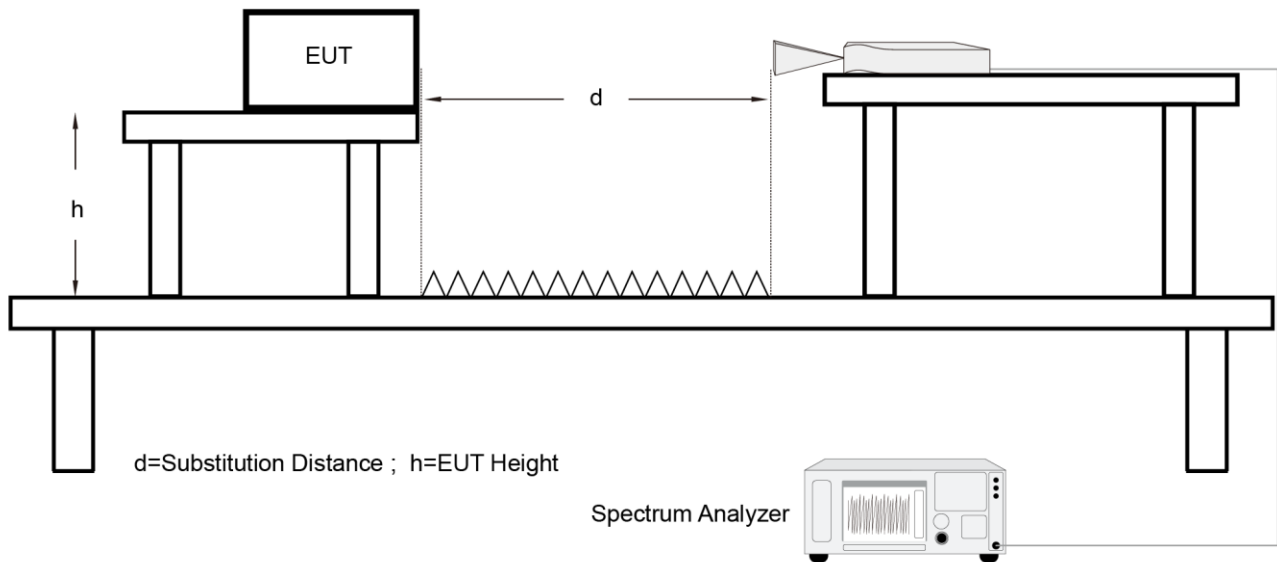
1GHz ~ 40GHz Test Setup:



#### 40GHz ~ 50GHz Test Setup:



#### Above 50GHz Test Setup:



#### 5.7.3. Test Procedure

Refer to EN 305 550-1 V1.2.1 (2014-10) Clause 8.1.2.

#### 5.7.4. Test Result

Test Site	SIP-AC3	Test Engineer	Arvin Ding
Test Date	2023-09-28	Test Mode	Mode 1

Frequency (MHz)	Reading Level (dBm)	Substitution Factor (dB)	Measure Level (dBm)	Limit (dBm)	Margin (dB)	Detector	Polarization
30MHz ~ 40GHz							
398.6	-96.9	31.4	-65.5	-57.0	-8.5	QP	Horizontal
725.0	-104.4	38.1	-66.3	-57.0	-9.3	Peak	Horizontal
86.7	-110.3	41.6	-68.7	-57.0	-11.7	QP	Vertical
399.6	-98.1	30.9	-67.2	-57.0	-10.2	QP	Vertical
3048.5	-56.3	0.8	-55.5	-47.0	-8.5	Peak	Horizontal
5156.5	-57.8	3.8	-54.0	-47.0	-7.0	Peak	Horizontal
3626.5	-55.7	1.7	-54.0	-47.0	-7.0	Peak	Vertical
5819.5	-58.6	4.4	-54.2	-47.0	-7.2	Peak	Vertical
34016.0	-59.2	5.6	-53.6	-47.0	-6.6	RMS	Horizontal
39241.0	-63.3	12.2	-51.1	-47.0	-4.1	RMS	Horizontal
34016.0	-58.7	5.0	-53.7	-47.0	-6.7	RMS	Vertical
37558.0	-61.8	7.9	-53.9	-47.0	-6.9	RMS	Vertical

Note 1: Measure Level (dBm) = Reading Level (dBm) + Substitution Factor (dB)

Note 2: For emission below 1GHz:

Substitution Factor (dB) = Cable Loss (dB) + Space Attenuation (dB) - Antenna Gain (dBi) - 2.15 (dB)

For emission above 1GHz:

Substitution Factor (dB) = Cable Loss (dB) + Space Attenuation (dB) - Antenna Gain (dBi) -  
Pre\_Amplifier Gain (dB)

Note 3: Test Distance "d" = 3m, Test height "h" = 1.5m.

Test Site	SIP-AC3	Test Engineer	Arvin Ding
Test Date	2023-09-28	Test Mode	Mode 2

Frequency (MHz)	Reading Level (dBm)	Substitution Factor (dB)	Measure Level (dBm)	Limit (dBm)	Margin (dB)	Detector	Polarization
30MHz ~ 40GHz							
398.6	-96.5	31.4	-65.1	-57.0	-8.1	Peak	Horizontal
530.0	-106.0	35.2	-70.8	-57.0	-13.8	QP	Horizontal
87.2	-105.5	40.6	-64.9	-57.0	-7.9	QP	Vertical
400.1	-99.2	30.9	-68.3	-57.0	-11.3	QP	Vertical
2972.0	-55.7	0.2	-55.5	-47.0	-8.5	Peak	Horizontal
4697.5	-58.2	3.9	-54.3	-47.0	-7.3	Peak	Horizontal
3346.0	-55.7	1.2	-54.5	-47.0	-7.5	Peak	Vertical
5403.0	-58.5	4.3	-54.2	-47.0	-7.2	Peak	Vertical
33686.0	-58.5	5.5	-53.0	-47.0	-6.0	RMS	Horizontal
39274.0	-63.8	12.3	-51.5	-47.0	-4.5	RMS	Horizontal
34016.0	-58.9	5.0	-53.9	-47.0	-6.9	RMS	Vertical
39098.0	-63.6	10.2	-53.4	-47.0	-6.4	RMS	Vertical

Note 1: Measure Level (dBm) = Reading Level (dBm) + Substitution Factor (dB)

Note 2: For emission below 1GHz:

Substitution Factor (dB) = Cable Loss (dB) + Space Attenuation (dB) - Antenna Gain (dBi) - 2.15 (dB)

For emission above 1GHz:

Substitution Factor (dB) = Cable Loss (dB) + Space Attenuation (dB) - Antenna Gain (dBi) -  
Pre\_Amplifier Gain (dB)

Note 3: Test Distance "d" = 3m, Test height "h" = 1.5m.

Test Site	SIP-AC3	Test Engineer	Arvin Ding
Test Date	2023-09-28	Test Mode	Mode 3

Frequency (MHz)	Reading Level (dBm)	Substitution Factor (dB)	Measure Level (dBm)	Limit (dBm)	Margin (dB)	Detector	Polarization
30MHz ~ 40GHz							
128.0	-94.0	23.6	-70.4	-57.0	-13.4	Peak	Horizontal
728.9	-106.1	38.1	-68.0	-57.0	-11.0	Peak	Horizontal
89.2	-101.2	37.0	-64.2	-57.0	-7.2	QP	Vertical
105.2	-93.1	31.3	-61.8	-57.0	-4.8	QP	Vertical
3048.5	-55.9	0.8	-55.1	-47.0	-8.1	Peak	Horizontal
5318.0	-58.1	4.1	-54.0	-47.0	-7.0	Peak	Horizontal
3499.0	-56.7	2.2	-54.5	-47.0	-7.5	Peak	Vertical
5420.0	-58.6	4.5	-54.1	-47.0	-7.1	Peak	Vertical
34016.0	-58.6	5.6	-53.0	-47.0	-6.0	RMS	Horizontal
39274.0	-63.5	12.3	-51.2	-47.0	-4.2	RMS	Horizontal
33642.0	-59.0	5.1	-53.9	-47.0	-6.9	RMS	Vertical
39098.0	-63.7	10.2	-53.5	-47.0	-6.5	RMS	Vertical

Note 1: Measure Level (dBm) = Reading Level (dBm) + Substitution Factor (dB)

Note 2: For emission below 1GHz:

Substitution Factor (dB) = Cable Loss (dB) + Space Attenuation (dB) - Antenna Gain (dBi) - 2.15 (dB)

For emission above 1GHz:

Substitution Factor (dB) = Cable Loss (dB) + Space Attenuation (dB) - Antenna Gain (dBi) -  
Pre\_Amplifier Gain (dB)

Note 3: Test Distance "d" = 3m, Test height "h" = 1.5m.

Test Site	SIP-AC3	Test Engineer	Arvin Ding
Test Date	2023-09-28	Test Mode	Mode 4

Frequency (MHz)	Reading Level (dBm)	Substitution Factor (dB)	Measure Level (dBm)	Limit (dBm)	Margin (dB)	Detector	Polarization
30MHz ~ 40GHz							
249.7	-97.6	28.8	-68.8	-57.0	-11.8	Peak	Horizontal
714.8	-105.6	37.7	-67.9	-57.0	-10.9	Peak	Horizontal
90.6	-101.1	35.2	-65.9	-57.0	-8.9	QP	Vertical
106.6	-91.8	30.8	-61.0	-57.0	-4.0	QP	Vertical
2589.5	-55.3	-0.5	-55.8	-47.0	-8.8	Peak	Horizontal
4663.5	-58.4	3.9	-54.5	-47.0	-7.5	Peak	Horizontal
3541.5	-56.1	2.0	-54.1	-47.0	-7.1	Peak	Vertical
5819.5	-58.5	4.4	-54.1	-47.0	-7.1	Peak	Vertical
33686.0	-58.8	5.5	-53.3	-47.0	-6.3	RMS	Horizontal
39274.0	-63.7	12.3	-51.4	-47.0	-4.4	RMS	Horizontal
33631.0	-59.0	4.8	-54.2	-47.0	-7.2	RMS	Vertical
39098.0	-63.8	10.2	-53.6	-47.0	-6.6	RMS	Vertical

Note 1: Measure Level (dBm) = Reading Level (dBm) + Substitution Factor (dB)

Note 2: For emission below 1GHz:

Substitution Factor (dB) = Cable Loss (dB) + Space Attenuation (dB) - Antenna Gain (dBi) - 2.15 (dB)

For emission above 1GHz:

Substitution Factor (dB) = Cable Loss (dB) + Space Attenuation (dB) - Antenna Gain (dBi) -

Pre\_Amplifier Gain (dB)

Note 3: Test Distance "d" = 3m, Test height "h" = 1.5m.



Test Site	SIP-AC3	Test Engineer	Chase Zhu
Test Date	2023-10-05 ~ 2023-10-07	Test Mode	Above 40 GHz

Frequency (GHz)	Reading Level (dBm)	Substitution Factor (dB)	Measure Level (dBm)	Limit (dBm)	Margin (dB)	Detector	Polarization
Mode 1							
49.134	-99.888	48.010	-51.878	-47.000	-4.878	RMS	Horizontal
49.147	-99.138	48.010	-51.128	-47.000	-4.128	RMS	Vertical
Mode 2							
49.157	-98.901	48.010	-50.891	-47.000	-3.891	RMS	Horizontal
49.155	-98.410	48.010	-50.400	-47.000	-3.400	RMS	Vertical
Mode 3							
49.142	-100.416	48.010	-52.406	-47.000	-5.406	RMS	Horizontal
49.141	-100.459	48.010	-52.449	-47.000	-5.449	RMS	Vertical
Mode 4							
49.116	-100.520	48.010	-52.510	-47.000	-5.510	RMS	Horizontal
49.215	-100.811	48.010	-52.801	-47.000	-5.801	RMS	Vertical
<p>Note 1: Measure Level (dBm) = Reading Level (dBm) + Substitution Factor (dB)</p> <p>Note 2: For emission 40 - 50GHz:</p> <p style="padding-left: 40px;">Substitution Factor (dB) = Cable Loss (dB) + Space Attenuation (dB) - Antenna Gain (dBi)</p> <p style="padding-left: 40px;">For emission above 50GHz:</p> <p style="padding-left: 40px;">Substitution Factor (dB) = Cable Loss (dB) + Space Attenuation (dB) - Antenna Gain (dBi) + Mixer Conversion Loss (dB)</p> <p>Note 3: Test Distance "d" = 1m, Test height "h" = 0.8m.</p> <p>Note 4: For emission above 50GHz, there is no signal except floor noise, so the data is not presented in the report.</p>							

## **Appendix A - Test Setup Photograph**

Refer to “2309RSU048-ET” file.

## Appendix B - EUT Photograph

Refer to "2309RSU048-EE" file.

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The End