RF MEASUREMENT REPORT

Applicant:	Luda Technology (shenzhen) Co., Ltd.
Address:	1901, Jinhua Building, Taoxia, Taoyuan Community, Dalang Street, Longhua, Shenzhen 518109, China
Product:	24GHz speed radar
Model No.:	LDTR20
Standards:	EN 300 440 V2.2.1 (2018-07)
Result:	Complies
Received Date:	2024-03-27
Test Date:	2024-04-16 ~ 2024-04-24

Reviewed By: Yuri Li

Yuri Li

Approved By: Robin Wu

Robin Wu

Revision History

Report No.	Version	Description	Issue Date	Note
2403RSU063-E1	V01	Initial Report	2024-04-28	Valid

CONTENTS

1. General Information

1.1. Applicant

Luda Technology (Shenzhen) Co., Ltd.

1901, Jinhua Building, Taoxia, Taoyuan Community, Dalang Street, Longhua, Shenzhen 518109, China

1.2. Manufacturer

Luda Technology (Shenzhen) Co., Ltd.

1901, Jinhua Building, Taoxia, Taoyuan Community, Dalang Street, Longhua, Shenzhen 518109, China

1.3. Testing Facility

☒	**Test Site – MRT Suzhou Laboratory**				
	Laboratory Location (Suzhou - Wuzhong)				
	D8 Building, No.2 Tian'edang Rd., Wuzhong Economic Development Zone, Suzhou, China				
	Laboratory Location (Suzhou - SIP)				
	4b Building, Liando U Valley, No.200 Xingpu Rd., Shengpu Town, Suzhou Industrial Park, China				
	Laboratory Accreditations				
	A2LA: 3628.01		CNAS: L10551		
	FCC: CN1166		ISED: CN0001		
	VCCI:	☐R-20025	☐G-20034	☐C-20020	☐T-20020
		☐R-20141	☐G-20134	☐C-20103	☐T-20104
☐	**Test Site – MRT Shenzhen Laboratory**				
	Laboratory Location (Shenzhen)				
	1G, Building A, Junxiangda Building, Zhongshanyuan Road West, Nanshan District, Shenzhen, China				
	Laboratory Accreditations				
	A2LA: 3628.02		CNAS: L10551		
	FCC: CN1284		ISED: CN0105		
☐	**Test Site – MRT Taiwan Laboratory**				
	Laboratory Location (Taiwan)				
	No. 38, Fuxing 2nd Rd., Guishan Dist., Taoyuan City 333, Taiwan (R.O.C.)				
	Laboratory Accreditations				
	TAF: 3261				
	FCC: 291082, TW3261		ISED: TW3261		

1.4. Product Information

Product Name	24GHz speed radar
Model No.	LDTR20
EUT Identification No.	202404415Sample#03
Temperature	-20~85°C
Power Supply	9~24V (Standard 12V)
Receiver Category	Category 3
Note: The information of EUT was provided by the manufacturer, and the accuracy of the information shall be the responsibility of the manufacturer.	

1.5. Radio Specification under Test

Frequency Range	24.00 ~ 24.25GHz
Type of Modulation	CW
Antenna Type	Planar Microstrip Antenna
Max. Antenna Gain	16dBi for transmit 18.4dBi for receive

2. Test Configuration

2.1. Test Mode

Mode 1: Power on the EUT + Collocate T_X/R_X Work Simultaneously

2.2. Description of Test Software

There is no test utility software used during testing, the device can transmit continuously after powering on. The EUT was configured by the manufacturer.

2.3. Test Environment Condition

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

3. Measuring Instrument

Instrument	Manufacturer	Model No.	Asset No.	Cali. Interval	Cali. Due Date	Test Site
Signal Analyzer	Keysight	N9010B	MRTSUE06559	1 year	2024-05-23	SIP-AC2
Horn Antenna	Schwarzbeck	BBHA 9170	MRTSUE06598	1 year	2024-11-04	SIP-AC2
Preamplifier	EMCI	EMC184045SE	MRTSUE06602	1 year	2024-10-09	SIP-AC2
Thermohygrometer	testo	608-H1	MRTSUE06622	1 year	2024-11-03	SIP-AC2
Anechoic Chamber	RIKEN	SIP-AC2	MRTSUE06781	1 year	2024-12-21	SIP-AC2
EMI Test Receiver	R&S	ESR3	MRTSUE06185	1 year	2024-12-17	SIP-AC3
Preamplifier	EMCI	EMC184045SE	MRTSUE06602	1 year	2024-10-09	SIP-AC3
Horn Antenna	Schwarzbeck	BBHA 9170	MRTSUE06599	1 year	2024-09-24	SIP-AC3/SIP-TR1
Signal Analyzer	Keysight	N9010B	MRTSUE06603	1 year	2024-09-27	SIP-AC3
Horn Antenna	R&S	HF907	MRTSUE06611	1 year	2024-07-14	SIP-AC3
EMI Test Receiver	R&S	ESR3	MRTSUE06613	1 year	2024-10-23	SIP-AC3
Thermohygrometer	testo	608-H1	MRTSUE06619	1 year	2024-10-28	SIP-AC3
Preamplifier	EMCI	EMC012645SE	MRTSUE06642	1 year	2025-01-11	SIP-AC3
TRILOG Antenna	Schwarzbeck	VULB 9168	MRTSUE06646	1 year	2024-08-04	SIP-AC3
Anechoic Chamber	RIKEN	SIP-AC3	MRTSUE06782	1 year	2024-12-21	SIP-AC3
mmWave Antenna	MI-WWAVE	261U-25/383	MRTSUE06273	N/A	N/A	SIP-AC3
Signal Analyzer	Keysight	N9030B	MRTSUE06395	1 year	2024-06-29	SIP-AC3/SIP-TR1
Temperature Chamber	BAOYT	BYG-408CS	MRTSUE06847	1 year	2025-02-03	SIP-TR1

Software	Version	Function
EMI Software	V3.0.0	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.

Parameters	Uncertainty
Radio frequency	±1 x 10^{-7}
RF power (conducted)	±1,5 dB
Radiated emission of transmitter, valid to 26,5 GHz	±6 dB
Radiated emission of transmitter, valid between 26,5 GHz and 66 GHz	±8 dB
Radiated emission of receiver, valid to 26,5 GHz	±6 dB
Radiated emission of receiver, valid between 26,5 GHz and 66 GHz	±8 dB
Temperature	±1 °C
Humidity	±5 %
Voltage (dc)	±1 %
Voltage (ac, < 10 kHz)	±2%
NOTE: For radiated emissions above 26,5 GHz it may not be possible to achieve measurement uncertainties complying with the levels specified in this table. In these cases alone it is acceptable to employ the alternative interpretation procedure specified in EN 300 440 clause 5.9.1.	

5. Test Result

5.1. Summary

Standard Clause	Test Items	Verdict
4.2.2	Equivalent Isotropic Radiated Power (EIRP)	Pass
4.2.3	Permitted Range of Operating Frequencies	Pass
4.2.4	Unwanted Emission in The Spurious Domain	Pass
4.2.5	Duty Cycle	Pass
4.2.6	Additional Requirements for FHSS Equipment	N/A
4.3.3	Adjacent Channel Selectivity	N/A
4.3.4	Blocking or Desensitization	N/A
4.3.5	Receiver Spurious Emission	N/A
Note 1: For radiated spurious emission test, the test results shown in the following sections represent the worst-case emissions. Note 2: “N/A” means that the test item is not applicable, and the detailed information refers to relevant section.		

5.2. Equivalent Isotropic Radiated Power (EIRP)

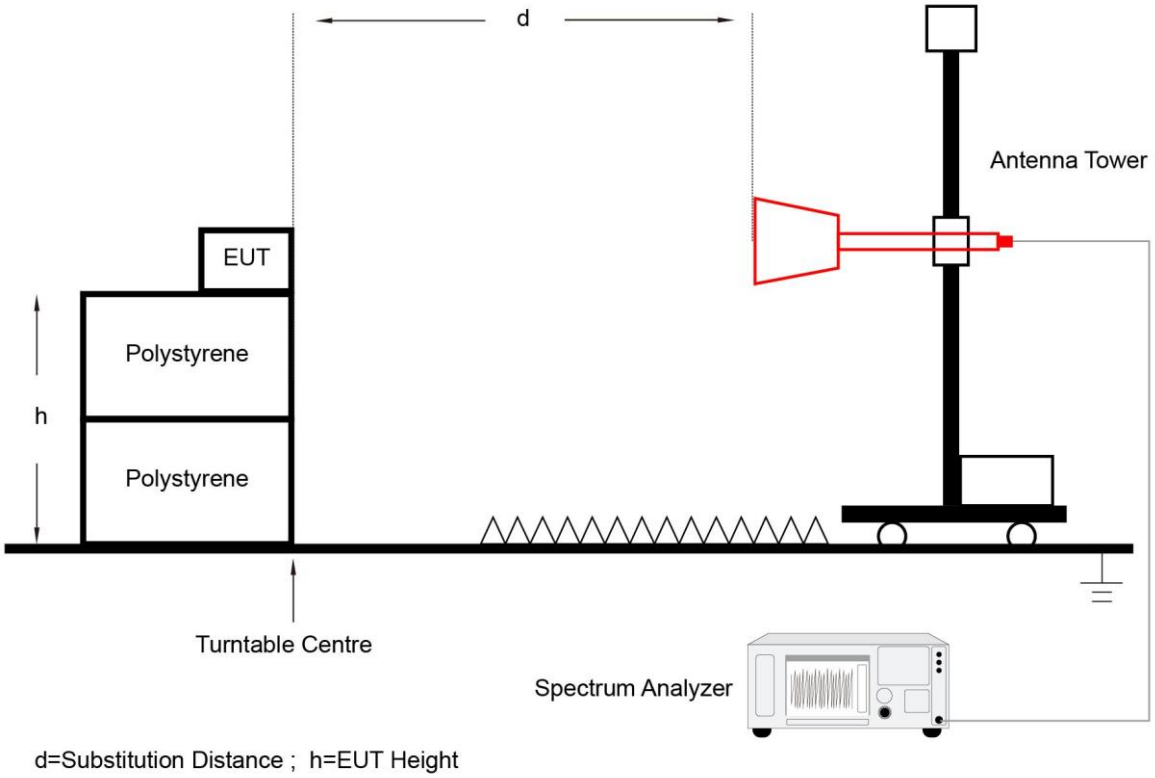
5.2.1. Test Limit

The transmitter maximum e.i.r.p. under normal and extreme test conditions is as below table.

Maximum Radiated Peak Power (e.i.r.p.)		
Frequency Bands	Power	Application
24.00GHz to 24.25GHz	100 mW e.i.r.p.	Non-specific short range devices and radiodetermination devices

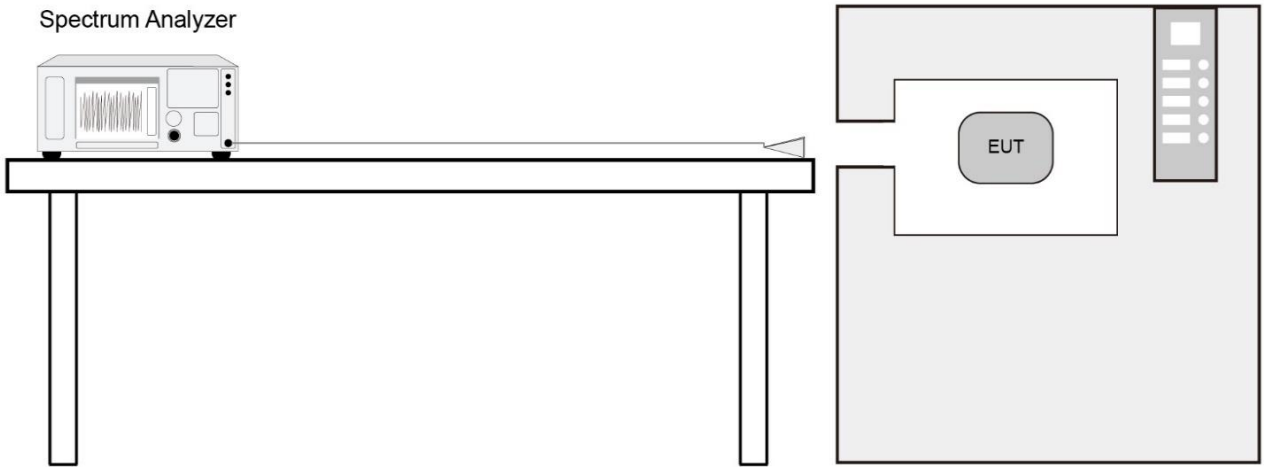
5.2.2. Test Setup

Normal Condition:



d=Substitution Distance ; h=EUT Height

Extreme Condition:



5.2.3. Test Procedure

Refer to EN 300 440 V2.2.1 (2018-07) Clause 4.2.2.3.

5.2.4. Testing setting

1. The EIRP is measured accurately in normal condition and record power value.
2. The EUT was sent to standard temperature & humidity chamber and record EIRP value under normal and extreme conditions respectively.
3. Difference between the EIRP in normal condition and the power in extreme conditions obtained in step 2 and record delta value.
4. Adding up the values obtained from step1 and 3 to achieve EIRP values in extreme conditions.

5.2.5. Test Result

Test Site	SIP-TR1 & SIP-AC3	Test Engineer	Chase Zhu & Arvin Ding
Test Date	2024-04-18 ~ 2024-04-22		

EIRP (dBm)					Duty Cycle (%)	Duty Cycle Factor (dB)	Max EIRP (dBm)	EIRP Limit (dBm)	Result
T_{NOM} (25°C)	T_{MIN} (-20°C)		T_{MAX} (85°C)						
DC 12V	DC 24V	DC 9V	DC 24V	DC 9V					
14.25	15.75	15.74	14.98	14.99	100	0	15.75	≤ 20	Pass

Note: Duty Cycle Factor (dB) = 10 * Log10(1 / Duty Cycle);

Max EIRP (dBm) = Max. EIRP (dBm) + Duty Cycle Factor (dB).

5.3. Permitted Range of Operating Frequencies

5.3.1. Test Limit

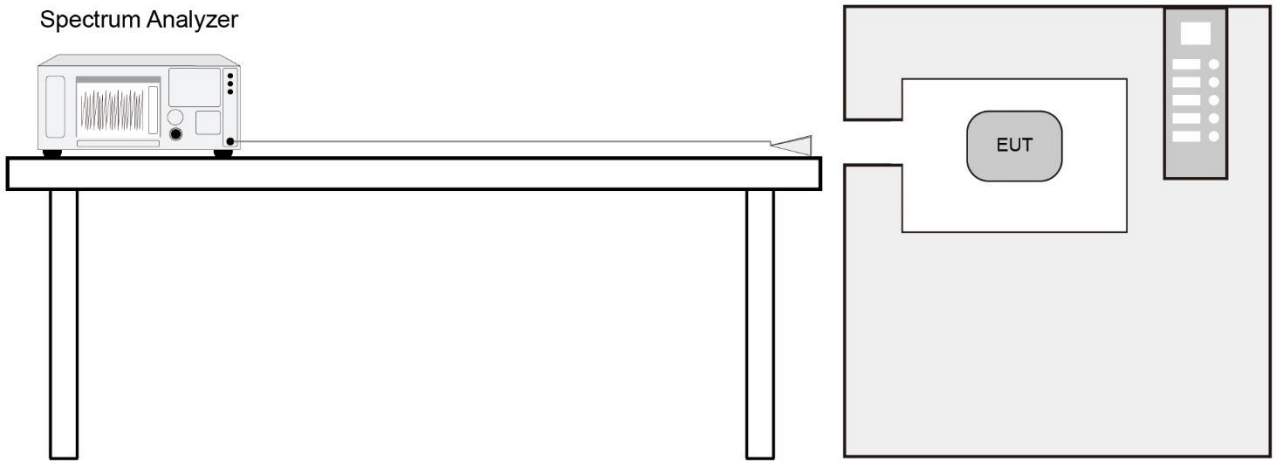
The width of the power envelope is F_H - F_L for a given operating frequency. In equipment that allows adjustment or selection of different operating frequencies, the power envelope takes up different positions in the allowed band. The frequency range is determined by lowest value of FL and the highest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

The occupied bandwidth (i.e. the bandwidth in which 99 % of the wanted emission is contained) of the transmitter shall fall within the assigned frequency band.

For all equipment the frequency range shall lie within the frequency band given by below table.

Frequency Bands	Application
24.00GHz to 24.25GHz	Non-specific short-range devices and radiodetermination devices

5.3.2. Test Setup



5.3.3. Test Procedure

Refer to EN 300 440 V2.2.1 (2018-07) Clause 4.2.3.3.

5.3.4. Test Result

Test Site	SIP-TR1	Test Engineer	Chase Zhu
Test Date	2024-04-22		

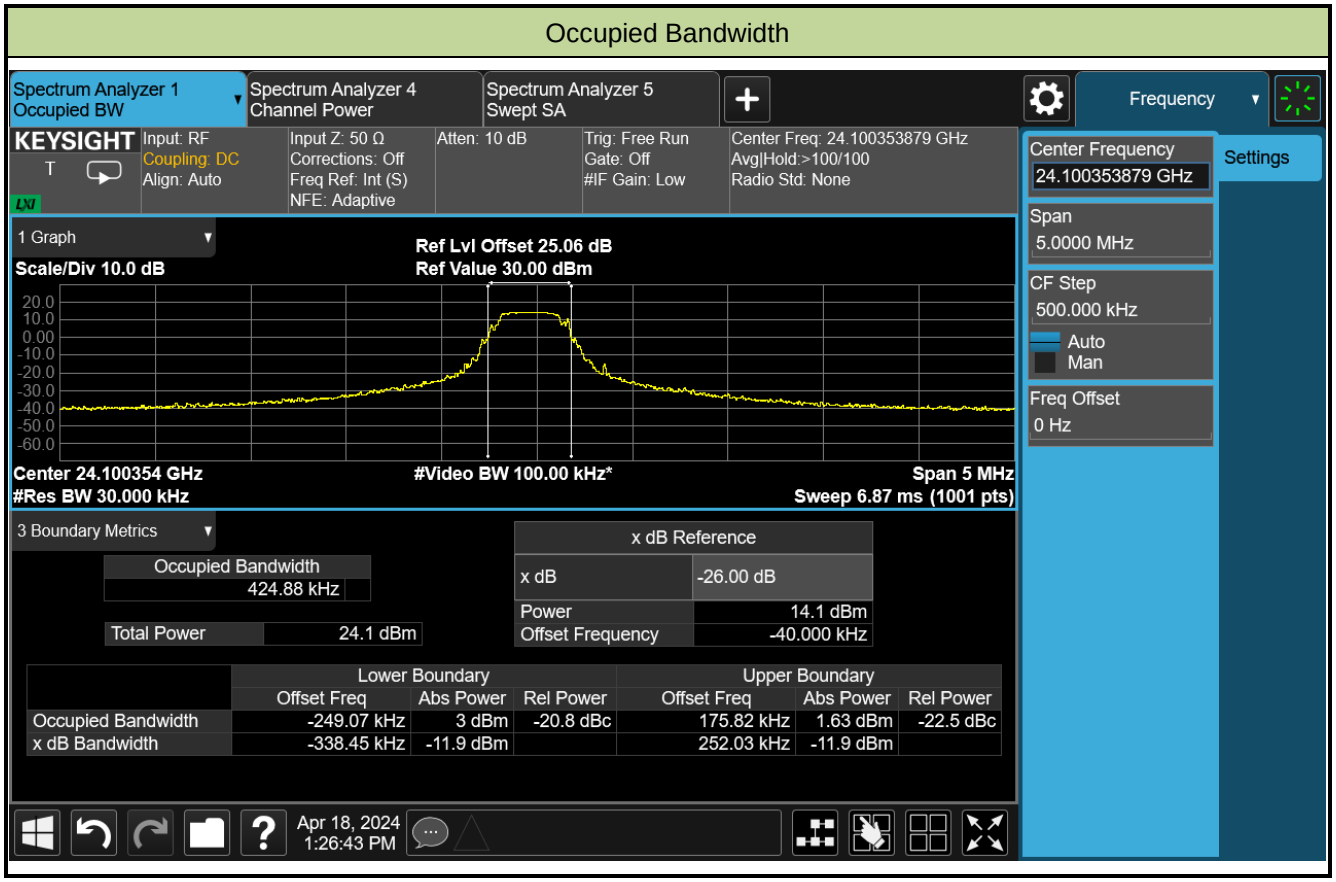
Test Conditions		F_L (MHz)	F_L Limit (MHz)	F_H (MHz)	F_H Limit (MHz)
T_{NOM} (25°C)	V_{NOM} (DC 12V)	24100.3681	≥ 24000	24101.8156	≤ 24250
T_{MIN} (-20°C)	V_{MIN} (DC 9V)	24109.4531	≥ 24000	24110.7481	≤ 24250
	V_{MAX} (DC 24V)	24109.9206	≥ 24000	24111.1956	≤ 24250
T_{MAX} (85°C)	V_{MIN} (DC 9V)	24088.3306	≥ 24000	24089.5806	≤ 24250
	V_{MAX} (DC 24V)	24087.2931	≥ 24000	24088.5956	≤ 24250

Note: F_H is the highest frequency of the power envelope, F_L is the lowest frequency of the power envelope.

Test Site	SIP-AC3	Test Engineer	Arvin Ding
Test Date	2024-04-18		

Test Condition		F_L of 99% Bandwidth (MHz)	F_L Limit (MHz)	F_H of 99% Bandwidth (MHz)	F_H Limit (MHz)	Result
T_{NOM} (25°C)	V_{NOM} (DC 12V)	24100.1049	≥ 24000	24100.5298	≤ 24250	Pass

Occupied Bandwidth



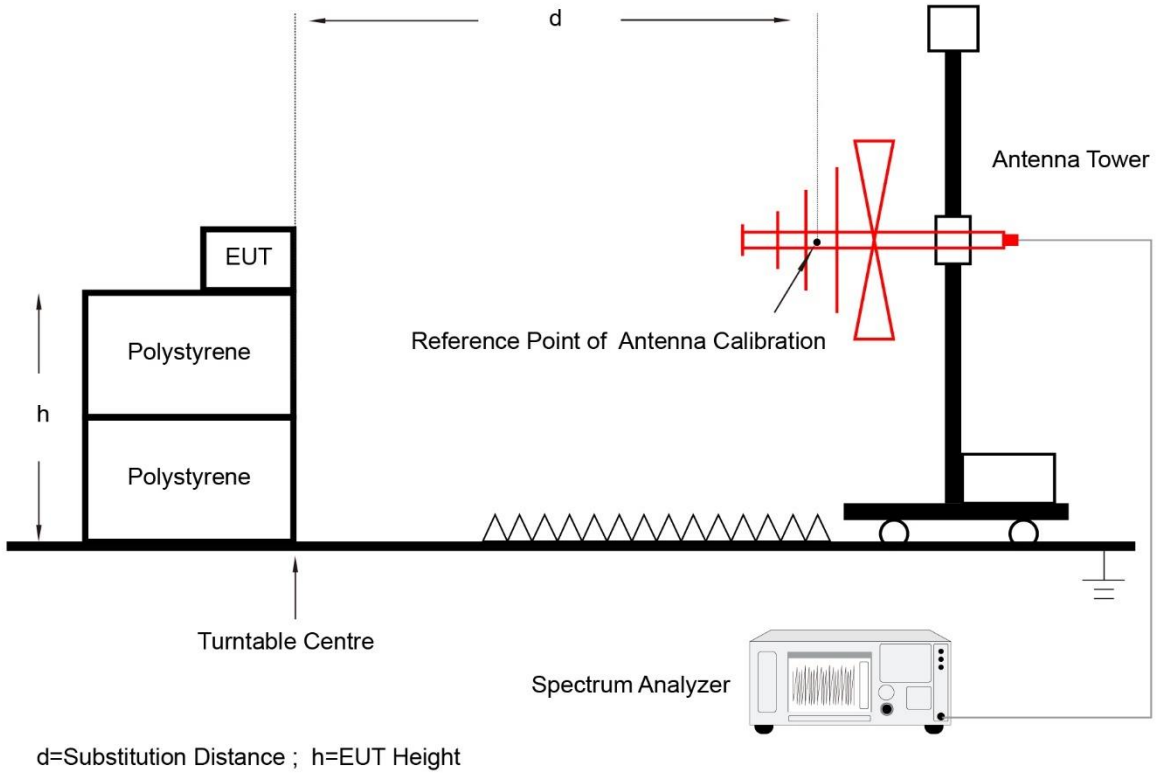
5.4. Transmitter Spurious Emissions

5.4.1. Test Limit

Radiated Spurious Emissions for Transmitter			
Frequency Ranges	47 MHz to 74 MHz 87.5 MHz to 108 MHz	Other Frequencies ≤ 1000 MHz	Frequencies > 1000 MHz
State	174 MHz to 230 MHz 470 MHz to 862 MHz		
Operating	4 nW	250 nW	1 μW
Standby	2 nW	2 nW	20 nW

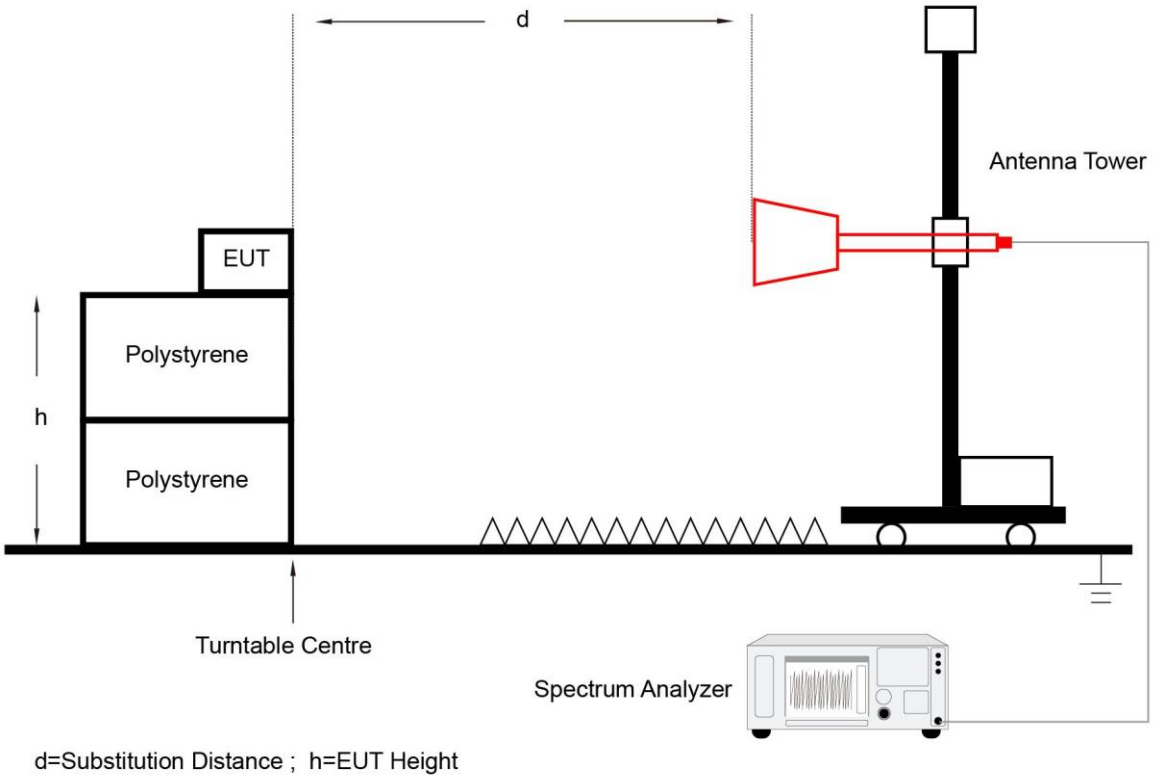
5.4.2. Test Setup

Below 1GHz Test Setup:

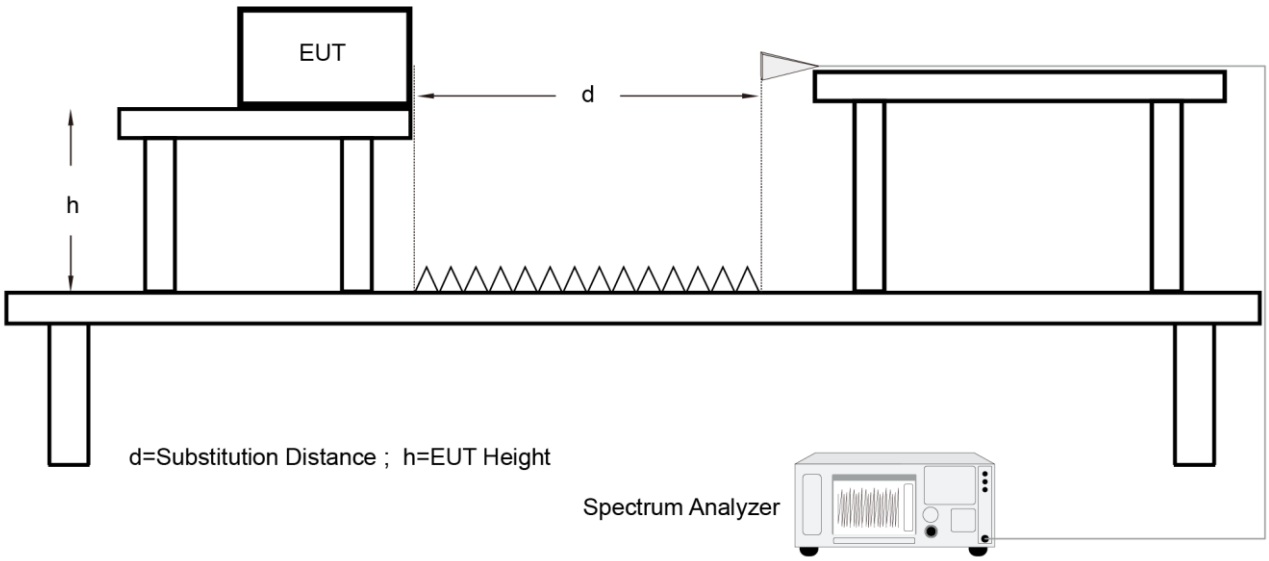


d=Substitution Distance ; h=EUT Height

Between 1GHz ~ 40GHz Test Setup:



Above 40GHz Test Setup:



5.4.3. Test Procedure

Refer to EN 300 440 V2.2.1 (2018-07) Clause 4.2.4.3.3.

5.4.4. Test Result

Test Site	SIP-AC2 & SIP-AC3	Test Engineer	Avrin Ding
Test Date	2024-04-22 ~ 2024-04-24	Test Frequency Range	25MHz ~ 40 GHz

Frequency (MHz)	Reading Level (dBm)	Substitution Factor (dB)	Measure Level (dBm)	Limit (dBm)	Margin (dB)	Detector	Polarization
73.3	-100.4	29.3	-71.1	-54.0	-17.1	Peak	Horizontal
831.8	-106.5	35.9	-70.6	-54.0	-16.6	Peak	Horizontal
51.3	-97.2	20.4	-76.8	-54.0	-22.8	Peak	Vertical
856.7	-105.5	35.7	-69.8	-54.0	-15.8	Peak	Vertical
12050.0	-52.7	9.8	-42.9	-30.0	-12.9	Peak	Horizontal
16920.5	-59.4	17.1	-42.3	-30.0	-12.3	Peak	Horizontal
12050.0	-53.5	10.5	-43.0	-30.0	-13.0	Peak	Vertical
16504.0	-58.5	17.2	-41.3	-30.0	-11.3	Peak	Vertical
33994.0	-46.7	5.2	-41.5	-30.0	-11.5	Peak	Horizontal
36975.0	-47.5	6.6	-40.9	-30.0	-10.9	Peak	Horizontal
32784.0	-45.1	3.6	-41.5	-30.0	-11.5	Peak	Vertical
36227.0	-48.1	7.3	-40.8	-30.0	-10.8	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.

Note 4: Quasi-Peak measurement was not performed when peak measure level was lower than the Quasi-Peak limit for emission below 1GHz.

Note 5: RMS measurement was not performed when peak measure level was lower than the RMS limit for emission above 1GHz.

Test Site	SIP-AC3	Test Engineer	Arvin Ding
Test Date	2024-04-16	Test Mode	40 GHz ~ 50 GHz

Frequency (GHz)	Reading Level (dBm)	Substitution Factor (dB)	Measure Level (dBm)	Limit (dBm)	Margin (dB)	Detector	Polarization
48.199	-88.328	48.27	-40.058	-30.0	-10.058	RMS	Horizontal
49.200	-91.346	48.27	-43.076	-30.0	-13.076	RMS	Vertical

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

Note 2: Substitution Factor (dB) = Cable Loss (dB) + Space Attenuation (dB) - Antenna Gain (dBi)

Note 3: Test Distance “d” = 1m, Test height “h” = 0.7m.

Note 4: RMS measurement was not performed when peak measure level was lower than the RMS limit for emission above 1GHz.

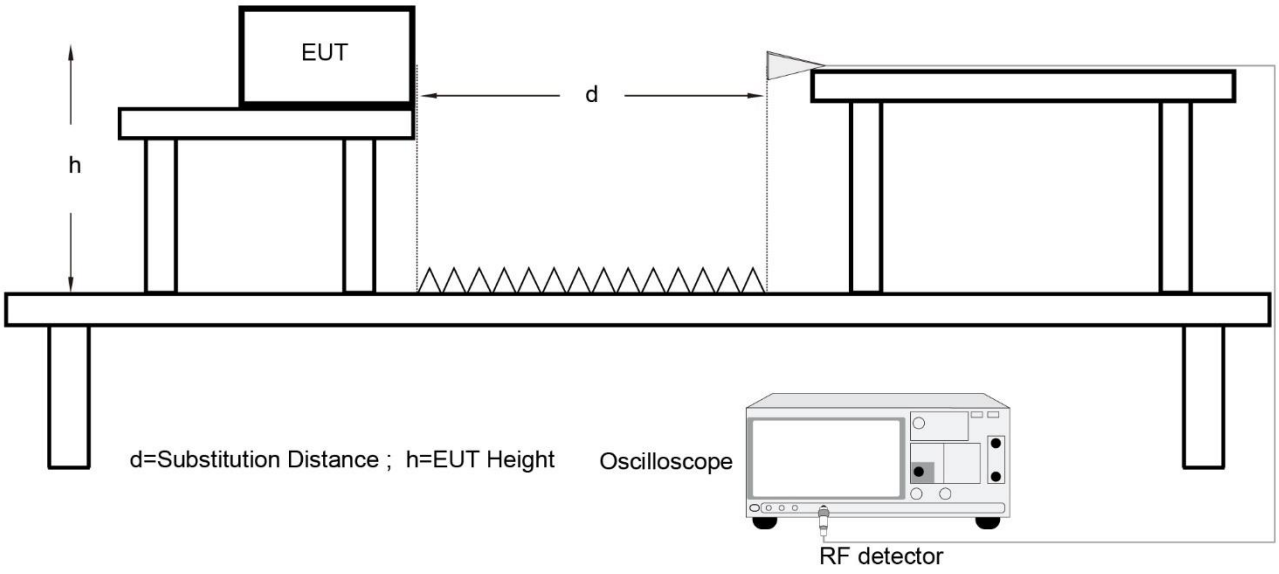
5.5. Duty Cycle

5.5.1. Test Limit

Duty Cycle Limits			
Frequency Band	Duty Cycle	Application	Notes
24.00 GHz to 24.25 GHz	No Restriction	Generic use and for radiodetermination	--

For devices with a 100 % duty cycle transmitting an unmodulated carrier most of the time, a time-out shut-off facility shall be implemented in order to improve the efficient use of spectrum. The method of implementation shall be declared by the manufacturer.

5.5.2. Test Setup



5.5.3. Test Procedure

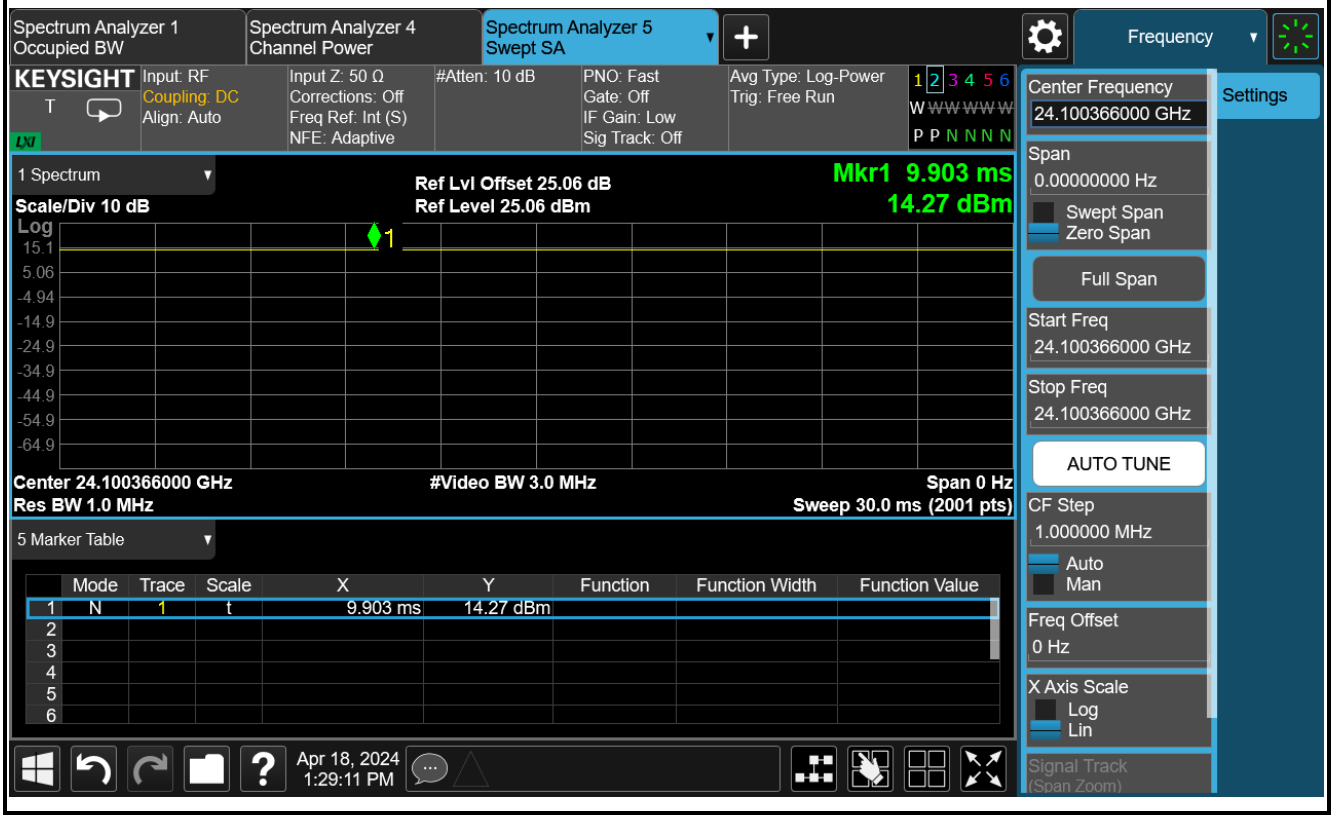
Refer to EN 300 440 V2.2.1 (2018-07) Clause 4.2.5.3.

5.5.4. Test Result

Test Site	SIP-AC3	Test Engineer	Chase Zhu
Test Date	2024-04-18		

Test Mode	Duty Cycle
Mode 1	100%

Duty Cycle

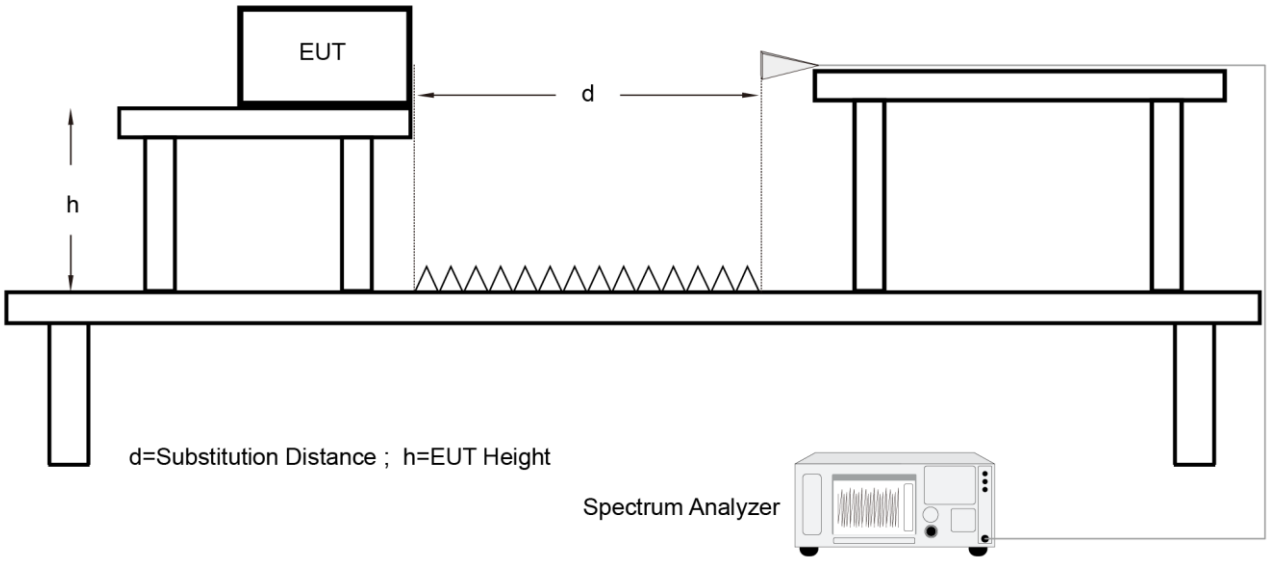


5.6. Additional Requirements for FHSS Equipment

5.6.1. Test Limit

FHSS modulation shall make use of at least 20 channels hopping over > 90 % of the assigned frequency band. The dwell time per channel shall not exceed 1 s. While the equipment is operating (transmitting and/or receiving) each channel of the hopping sequence shall be occupied at least once during a period not exceeding four times the product of the dwell time per hop and the number of channels.

5.6.2. Test Setup



5.6.3. Test Procedure

Refer to EN 300 440 V2.2.1 (2018-07) Clause 4.2.6.3.

5.6.4. Test Result

The requirements apply only to equipment using FHSS modulation.

5.7. Adjacent Channel Selectivity

5.7.1. Test Limit

The adjacent channel selectivity of the equipment under specified conditions shall not be less than the levels of the unwanted signal as stated in below table.

Limit for adjacent channel selectivity	
Receiver category	Limit
1	-30 dBm + *k*

The correction factor, *k*, is as follows:

$$k = -20\log F - 10\log BW$$

Where:

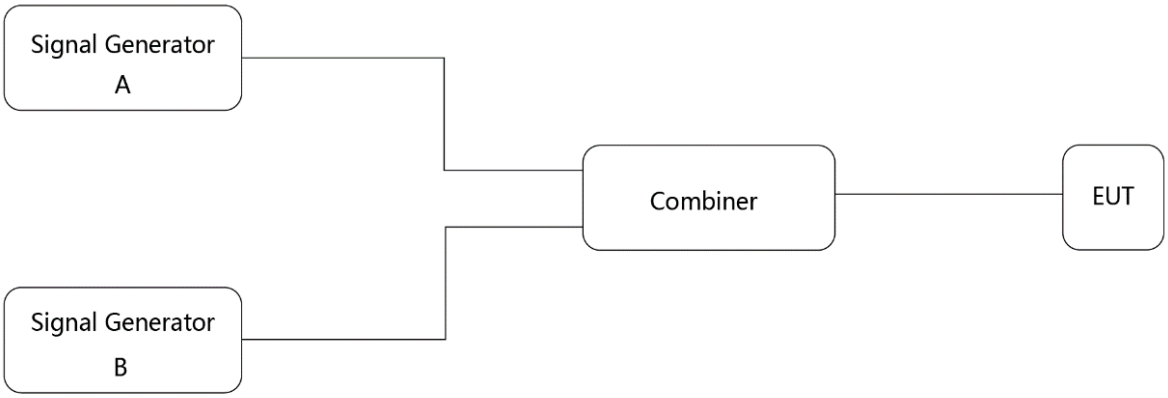
- F is the frequency in GHz;
- BW is the channel bandwidth in MHz;

The factor k is limited within the following:

$-40 < k < 0$ dB.

The measured adjacent channel selectivity shall be stated in the test report.

5.7.2. Test Setup



5.7.3. Test Procedure

Refer to EN 300 440 V2.2.1 (2018-07) Clause 4.3.3.3.

5.7.4. Test Result

The EUT belongs to category 3, so this requirement is not applicable.

5.8. Blocking or Desensitization

5.8.1. Test Limit

The blocking level, for any frequency within the specified ranges, shall not be less than the values given in below table, except at frequencies on which spurious responses are found.

Limits for blocking or desensitization	
Receiver category	**Limit**
1	-30 dBm + k
2	-45 dBm + k
3	-60 dBm + k

The correction factor, k, is as follows:

$$k = -20\log f - 10\log BW$$

Where:

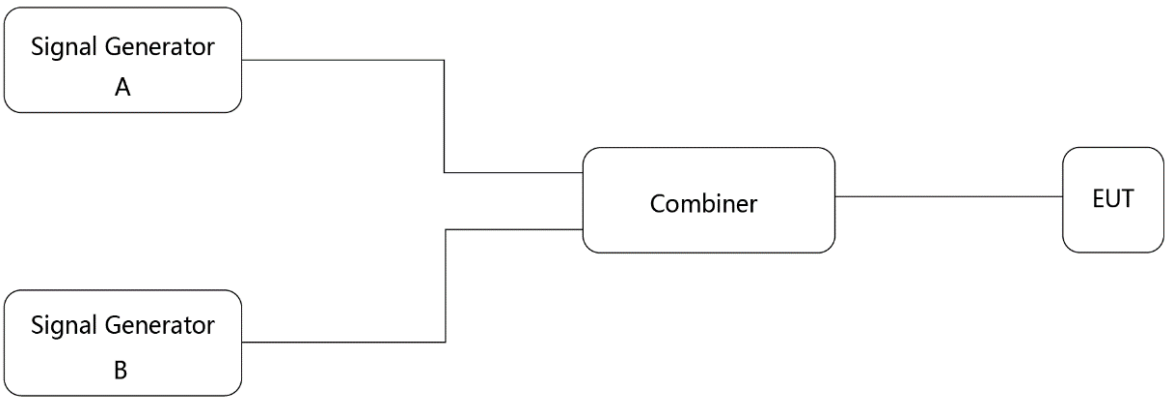
- f is the frequency in GHz;
- BW is the occupied bandwidth in MHz;

The factor k is limited within the following:

- -40 dB < k < 0 dB.

The measured blocking level shall be stated in the test report.

5.8.2. Test Setup



5.8.3. Test Procedure

Refer to EN 300 440 V2.2.1 (2018-07) Clause 4.3.4.3.

5.8.4. Test Result

The EUT belongs to category 3 and also belongs to radiodetermination device, so this requirement is not applicable.

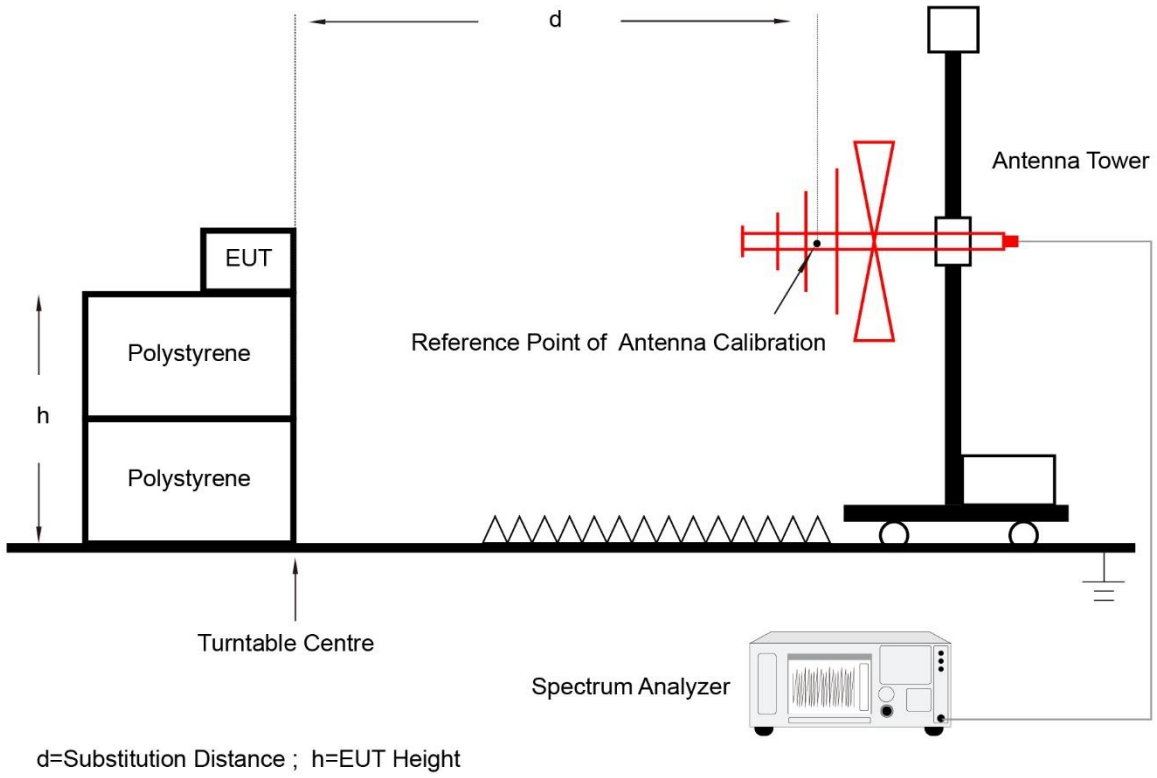
5.9. Receiver Spurious Emissions

5.9.1. Test Limit

The power of any spurious emission shall not exceed 2 nW in the range 25 MHz to 1 GHz and shall not exceed 20 nW on frequencies above 1 GHz.

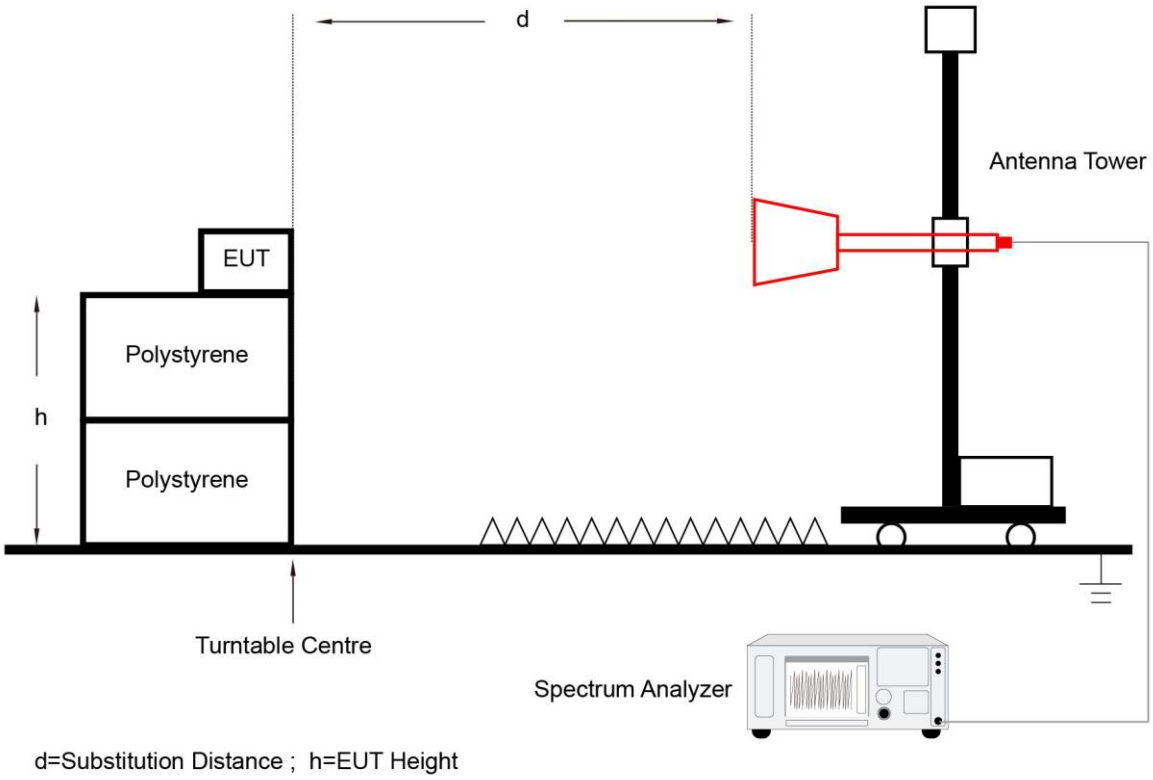
5.9.2. Test Setup

Below 1GHz Test Setup:

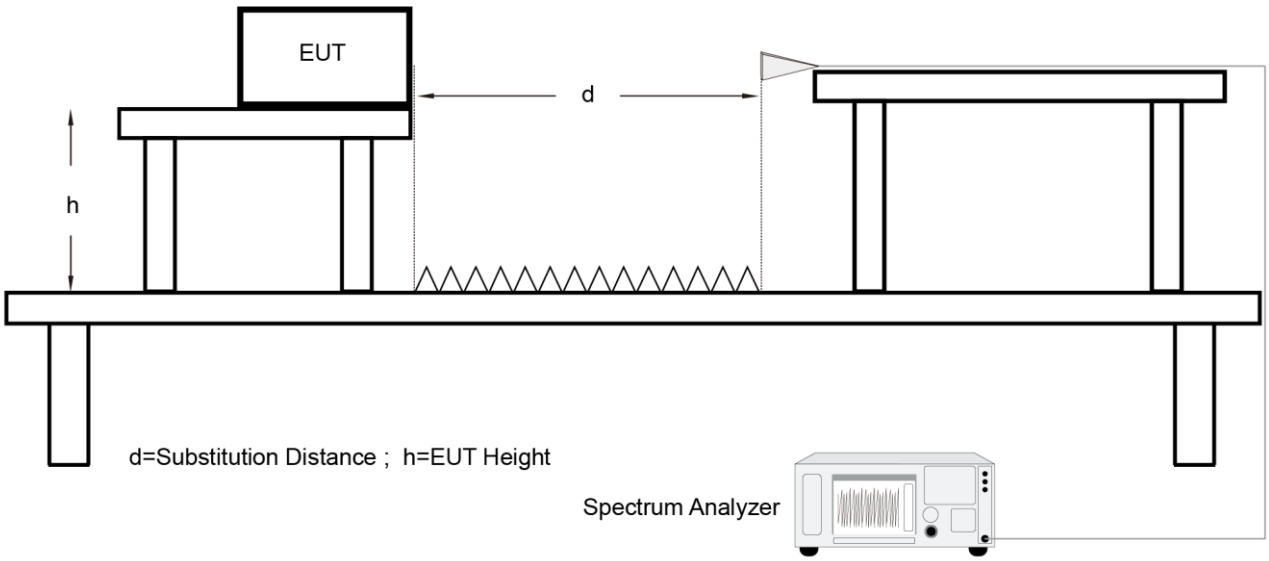


d=Substitution Distance ; h=EUT Height

Between 1GHz ~ 40GHz Test Setup:



Above 40GHz Test Setup:



5.9.3. Test Procedure

Refer to EN 300 440 V2.2.1 (2018-07) Clause 4.3.5.3.3.

5.9.4. Test Result

This requirement applies to all receivers, except receivers used in combination with permanently co-located transmitters continuously transmitting. Co-located is defined as < 3 m. In these cases the receivers will be tested together with the transmitter in operating mode, so the requirement is not applicable.

Appendix A - Test Setup Photograph

Refer to “2403RSU063-ET” file.

Appendix B - EUT Photograph

Refer to “2403RSU063-EE” file.

The End