



FCC RF Report (Licensed Equipment)

Product Name: Remote Radio Unit

Product Model: RRU5303

Report Number: SYBH(R)04027254EB-1

FCC ID: QISRRU5303

Reliability Laboratory of Huawei Technologies Co., Ltd.

(Global Compliance and Testing Center of Huawei Technologies Co., Ltd.)

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NOTICE

1. The laboratory has passed the accreditation by China National Accreditation Service for Conformity Assessment (CNAS). The accreditation number is L0310.
2. The laboratory has passed the accreditation by The American Association for Laboratory Accreditation (A2LA). The accreditation number is 2174.01.
3. The laboratory has been recognized by the US Federal Communications Commission (FCC) to perform compliance testing subject to the Commission's Certification rules. The Designation Number is CN1173, and the Test Firm Registration Number is 294140.
4. The laboratory has been listed by Innovation, Science and Economic Development Canada (ISED) to perform electromagnetic emission measurements.
 - The recognition number for the test site located in Shenzhen is 6369A-1.
 - The recognition number for the test site located in Dongguan is 21741-1.
 - The recognition numbers for the test site located in Shanghai is 6369D, which contains 6369D-1 (3m chamber) and 6369D-2 (10m chamber).
 - The recognition number for the test site located in Chengdu is 6369E-1.
5. The laboratory (Reliability Laboratory of Huawei Technologies Co., Ltd.) is also named as "Global Compliance and Testing Center of Huawei Technologies Co., Ltd."; the both names have coexisted since 2009.
6. The test report is invalid if not marked with the signatures of the persons responsible for preparing and approving the test report.
7. The test report is invalid if there is any evidence of erasure and/or falsification.
8. The test report is only valid for the test samples.
9. Content of the test report, in part or in full, cannot be used for publicity and/or promotional purposes without prior written approval from the laboratory.
10. All dates in the test report, including attachment document(s) (if applicable), have the format of "yyyy-MM-dd".



Applicant: Huawei Technologies Co., Ltd.
Address: Administration Building, Headquarters of Huawei Technologies Co., Ltd.,
Bantian, Longgang District, Shenzhen, 518129, P.R.C
Product Name: Remote Radio Unit
Product Model: RRU5303

Date of Receipt Sample: 2018-05-07
Start Date of Test: 2018-05-09
End Date of Test: 2018-05-17

Test Result: Pass

**Approved by Senior
Engineer:**

2018-06-22

Date

Li Jing

Name

Signature

Prepared by:

2018-06-22

Date

Zhang Weimin

Name

Signature



MODIFICATION RECORD

No.	Report No.	Modification Description
1	SYBH(R)04027254EB-1	First release (with modifications based on TCB comments).

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1 General Information

1.1 Applied Standard

Rules/Standards: 47 CFR FCC Part 2
47 CFR FCC Part 27

Note: The most up to date FCC rules are applied, see
http://www.ecfr.gov/cgi-bin/text-idx?tpl=/ecfrbrowse/Title47/47tab_02.tpl.

Test Methods: ANSI C63.26-2015
FCC KDB Publication 971168 (04/09/2018)
FCC KDB Publication 662911 (10/31/2013)

1.2 Test Location

Test Location 1 (TL1): Global Compliance and Testing Center of Huawei Technologies Co., Ltd.
(Reliability Laboratory of Huawei Technologies Co., Ltd.)
Address: Administration Building, Headquarters of Huawei Technologies Co., Ltd., Bantian,
Longgang District, Shenzhen, 518129, P.R.C

2 Test Summary

2.1 2000-2020 MHz and 2180-2200 MHz bands

2.1.1 Basic Technical Requirements

The detailed TEST RECORDS (TEST INFORMATION, TEST PLANS and TEST RESULTS) for the following test items refer to the attachment document of "SYBH(R04027254EB-1-TR1".

Test Item	Requirements	Verdict
RF power output	<u>FCC §2.1046, §27.50(d), §27.50(i):</u> - Fixed or base station transmitting in 2180-2200 MHz: - When population density ≤ 100 persons/mile²: RMS EIRP ≤ 3280 W (EBW ≤ 1 MHz); and RMS EIRP ≤ 3280 W/MHz (EBW > 1 MHz); and PAR ≤ 13 dB @ 0.1%. - Other cases: RMS EIRP ≤ 1640 W (EBW ≤ 1 MHz); and RMS EIRP ≤ 1640 W/MHz (EBW > 1 MHz); and PAR ≤ 13 dB @ 0.1%. - Fixed, mobile, and portable (hand-held) station operating in 2000-2020 MHz: - If any portion of emission falling in 2000-2005 MHz: RMS EIRP ≤ 5 mW; and PAR ≤ 13 dB @ 0.1%. - Other cases: RMS EIRP ≤ 2 W; and PAR ≤ 13 dB @ 0.1%. 3. For 2000-2020 MHz downlink transmitters (e.g., base station, industrial booster/DAS coverage unit) (According to FCC DA 13-2409): ***CAUTION 1***: Associated grant condition needed, confirm via KDB inquiry. ***CAUTION 2***: FCC §27.50(d)(1) or §27.50(d)(2) power limits are applicable, rather than 27.50(d)(7). Also see: https://transition.fcc.gov/oet/ea/presentations/files/nov17/55-Licensed-Services-Devices-Misc-Review-r1-TH.pdf - When population density ≤ 100 persons/mile²: RMS EIRP ≤ 3280 W (EBW ≤ 1 MHz); and RMS EIRP ≤ 3280 W/MHz (EBW > 1 MHz); and PAR ≤ 13 dB @ 0.1%. - Other cases: RMS EIRP ≤ 1640 W (EBW ≤ 1 MHz); and RMS EIRP ≤ 1640 W/MHz (EBW > 1 MHz); and PAR ≤ 13 dB @ 0.1%. Note: EBW is not clearly defined. The -26 dBc EBW is assumed.	Pass, Waiver grant condition

Test Item	Requirements	Verdict
Modulation characteristics	<u>FCC §2.1047:</u> No limit.	Pass
Bandwidth	<u>FCC §2.1049, §27.50(c), §27.53(h)(3):</u> 1. OBW: no limit. 2. -26 dBc EBW: no limit.	Pass
Band Edges Compliance / Emission Mask	<u>FCC §2.1051, §27.53(h):</u> 1. For operations in 2000-2020 MHz band: (a) In 1 MHz bands immediately outside and adjacent to the licensee's frequency block: $\leq -13 \text{ dBm/RefBW}$. (b) Unwanted emissions in [1999 MHz, 2000 MHz]: $\leq -40 \text{ dBm/RefBW}$. 2. For operations in 2180-2200 MHz band: (a) In 1 MHz bands immediately outside and adjacent to the licensee's frequency block: $\leq -13 \text{ dBm/RefBW}$. (b) Unwanted emissions in [2200 MHz, 2201 MHz]: $\text{EIRP} \leq -70.6 \text{ dBm/RefBW2}$. (Note: though not mentioned, for the purpose of equipment authorization, a transmitter shall be tested with an antenna that is representative of the type that will be used with the equipment in normal operation) 3. For 2000-2020 MHz downlink transmitters (e.g., base station, industrial booster/DAS coverage unit) (According to FCC DA 13-2409): ***CAUTION 1***: Associated grant condition needed, confirm via KDB inquiry. ***CAUTION 2***: FCC §27.53(h)(1) emission limit is applicable, rather than §27.53(h)(2)(ii). Also see: https://transition.fcc.gov/oet/ea/presentations/files/nov17/55-Licensed-Services-Devices-Misc-Review-r1-TH.pdf (a) In 1 MHz bands immediately outside and adjacent to the licensee's frequency block: $\leq -13 \text{ dBm/RefBW}$. (b) Void. Note 1: $\text{RefBW} \geq 1\% \cdot \text{EBW}$, where EBW is 26 dBc EBW. (also $\text{RefBW} \leq 1 \text{ MHz}$). Note 2: $\text{RefBW2} \geq 1\% \cdot \text{EBW}$, where EBW is 26 dBc EBW. (also $\text{RefBW2} \leq 4 \text{ kHz}$). Note 3: All emissions are RMS-based (same as power requirements). Note 4: When measuring the emission limits, the nominal carrier frequency shall be adjusted as close to the licensee's frequency block edges, both upper and lower, as the design permits.	Pass, Waiver grant condition
Spurious emissions at antenna terminals (NOTE 1)	<u>FCC §2.1051, §2.1057, §27.53(h):</u> 1. For operations in 2000-2020 MHz band: (a) From $\max(\text{lowest internal frequency, } 9 \text{ kHz})$ to $\min(10 \cdot \text{highest fundamental frequency, } 40 \text{ GHz})$, after 1 MHz bands immediately outside and adjacent to the licensee's frequency block: $\leq -13 \text{ dBm/1 MHz}$. (b) Unwanted emissions < 2 GHz, after 1 MHz bands immediately outside and	Pass, Waiver grant condition

Test Item	Requirements	Verdict
	adjacent to the licensee's frequency block: ≤ -40 dBm/1 MHz. 2. For operations in 2180-2200 MHz band: (a) From max(lowest internal frequency, 9 kHz) to min(10 * highest fundamental frequency, 40 GHz), after 1 MHz bands immediately outside and adjacent to the licensee's frequency block: ≤ -13 dBm/1 MHz. (b) Unwanted emissions in [2200 MHz, 2290 MHz] and after 1 MHz bands immediately outside and adjacent to the licensee's frequency block, i.e. in [2201 MHz, 2290 MHz]: EIRP ≤ -70.6 dBm/4 kHz. (Note: though not mentioned, for the purpose of equipment authorization, a transmitter shall be tested with an antenna that is representative of the type that will be used with the equipment in normal operation) 3. For 2000-2020 MHz downlink transmitters (e.g., base station, industrial booster/DAS coverage unit) (According to FCC DA 13-2409): ***CAUTION 1***: Associated grant condition needed, confirm via KDB inquiry. ***CAUTION 2***: FCC §27.53(h)(1) emission limit is applicable, rather than §27.53(h)(2)(ii). Also see: https://transition.fcc.gov/oet/ea/presentations/files/nov17/55-Licensed-Services-Devices-Misc-Review-r1-TH.pdf (a) From max(lowest internal frequency, 9 kHz) to min(10 * highest fundamental frequency, 40 GHz), after 1 MHz bands immediately outside and adjacent to the licensee's frequency block: ≤ -13 dBm/1 MHz. (b) Void. _____ Note 1: All emissions are RMS-based (same as power requirements). Note 2: When measuring the emission limits, the nominal carrier frequency shall be adjusted as close to the licensee's frequency block edges, both upper and lower, as the design permits.	
Field strength of spurious radiation (NOTE 1)	<u>FCC §2.1053, §2.1057, §27.53(h):</u> (the same as those for Spurious emissions at antenna terminals)	Pass
Frequency stability	<u>FCC §2.1055, §27.54:</u> Fundamental emissions (f_meas) @ { NV & -30 /.../+50°C step=+10°C; NT & $\pm 15\% \cdot NV$ }: Within the authorized frequency bands.	Pass
NOTE 1: As to unwanted emission, according to §7 of FCC KDB publication 971168 D01: (1) When antenna-port conducted measurements (hereinafter as "CSE", per FCC §2.1051) are performed to demonstrate compliance to the applicable unwanted emission limits, a separate radiated measurement (hereinafter as "FSE", per FCC §2.1053) is required to detect spurious emissions that may be radiated directly from the cabinet, control circuits, power leads, or intermediate circuit elements under normal conditions of installation and operation. Note that when radiated measurements considerations for spurious emissions at antenna terminals (hereinafter as "RSE", see §6.2 of KDB 971168 D01) are performed to demonstrate compliance to the unwanted emission limits (e.g., for an EUT with integral transmit antenna), the "FSE" measurement is not required. In summary, unwanted emissions can be performed by "CSE" +		

Test Item	Requirements	Verdict
	“FSE”, or by “RSE”. (2) The “FSE” measurements are performed with the transmit antenna port(s) terminated. (3) Unless otherwise specified in the applicable rule section, the same limits applicable to spurious (unwanted) emissions at the antenna terminals (“CSE”) also apply to radiated spurious emissions (“FSE” and “RSE”). (4) The descriptions above are accepted by ISED according to RSS-Gen §3.2. NOTE 2: As to receiver emissions: (1) For FCC: receiver emission requirements as specified in FCC §15.111 (antenna power conduction) and/or §15.109 (radiated emission) applied for receivers that operate (tune) in the frequency range 30 to 960 MHz and CB receivers, are subject to the equipment authorization procedures of Certification OR Supplier's Declaration of Conformity (SDoC) according to FCC §15.101. This document does NOT present the demonstration to these requirements. (2) For ISED: the stand-alone receiver receivers operating in the band 30-960 MHz, as well as all other receivers excluding scanner receivers, are NOT subject to equipment certification according to ISED RSS-Gen §5, though they are subject to technology requirements in RSS-Gen §7. This document does NOT present the demonstration to these requirements.	

2.1.2 Other Technical Requirements

Item	Requirements	Exhibition
Frequency plan	<u>FCC §27.5(j):</u> 2000-2020 MHz and 2180-2200 MHz bands (AWS-4): paired Block A, B. Block A Block B 200020102020 Block A Block B 218021902200	See specifications
RF Safety	<u>FCC §27.52:</u> RF exposure requirements in §1.1307(b), §2.1091, and §2.1093.	Shall be verified and determined by final user

3 Description of the EUT

3.1 General Description

The RRU5303 is an outdoor remote radio unit. It is the radio frequency (RF) part of a distributed base station and can be located near antennas. The RRU5303 can modulate, demodulate, combine, and divide baseband and RF signals. It also processes baseband and RF signal data.

Adopting an innovative design, RRU5303 is able to work in 2T4R mode and therefore supports higher output power and larger carrier capacity.

3.2 EUT Identity

NOTE: Unless otherwise noted in the report, the functional boards installed in the units shall be selected from the below list, but not means all the functional boards listed below shall be installed in one unit.

3.2.1 Board

Name	Hardware Version	Description
WD5LBRXGSS	Ver.A	Manufactured Board,MARP RRU,WD5LBRXGSS,Transceiver Board
WD5AJRAG20B	Ver.A	Manufactured Board,MARP FDD,WD5AJRAG20B,Power Amplifier Board

3.2.2 Sub-Assembly

Name	Model	Manufacturer	Description
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3.3 Technical Specification

NOTE: For the detailed technical descriptions, see the applicant/manufacture's specifications or user manual.

3.3.1 General

Characteristics	Description	
Radio System Type	NB-IoT stand-alone	
Supported Frequency Range (Transmission (TX) and Receiving (RX))	#1:	TX: 2000 to 2020 MHz RX: 1915 to 1920 MHz
TX and RX Antenna Ports (see more in §3.3.2)	TX & RX port:	2
	TX-only port:	0
	RX-only port:	2
Multiple Carrier Supported	2	
TX Output Power (General Information)	Max. 40 W (per antenna port) Max. 80 W (two antenna ports)	
Supported Channel Bandwidth	200 kHz	
Modulation Type	NB-IoT system: QPSK	
Designation of Emissions	Note: The necessary bandwidth of the designation of emission is the worst value from the measured occupied bandwidths for each type of channel bandwidth configuration. NB-IoT system: 184KD9W	
Power Supply	Power supply type	☐ External AC mains ☒ External DC mains ☐ AC/DC Adapter ☐ Powered over Ethernet (PoE)
	Nominal voltage, input to EUT	-48 VDC
	Voltage range, input to EUT	-36 to -57 VDC
Environment (Working/Operating)	Temperature	-40 to +55 °C
	Relative humidity	5 to 100 %

3.3.2 Antenna System

NOTE: For the antenna type:

(1) the "No antenna supplied":

If the antenna is not supplied by the equipment manufacturer, and also will not be equipped on sale, the

antenna characteristics will NOT be considered in RF report and RF exposure evaluation report. However, when the EUT is put into service, the combination of the practical output power (may be degraded) and the practical antenna gain should not exceed the required ERP/EIRP limit.

(2) the “dedicated antenna”:

- It refers to the removable antenna supplied with the EUT, designed as an indispensable part of EUT, using an antenna connector with or without a cable and which has been designed or developed for one or more specific types of equipment.
- It is the combination of dedicated antenna and radio equipment that is expected to be compliant with the regulations.

(3) “integral antenna”:

- It refers to the antenna designed as a permanent fixed part of the EUT, without the use of an external connector and which cannot be disconnected from the equipment by a user with the intent to connect another antenna.
- For the testing purpose, a temporary RF connector may be provided.

Characteristics	Description
Antenna Type	☒ No antenna supplied ☐ Dedicated antenna ☐ Integral antenna
(The following is based on FCC KDB publication 662911, and apply for dedicated or integral antenna type)	
Antenna gain	dBi (for all ports) dBi (for port TRXA, TRXB, ...) dBi (for port TRXY, TRXZ, ...)
Transmitter output signal correlation categorization	☐ Correlated ☐ Completely Uncorrelated
Directional gain calculation (In-band measurement)	Power Overall directional gain: _____ dBi Case #: clause F)2) _____
	Power spectral density Overall directional gain: _____ dBi Case #: clause F)2) _____
Directional gain calculation (Out-of-band and spurious measurement)	☐ If falling into Case # clause F)3)a): Not applicable ☐ Otherwise: Overall directional gain: _____ dBi Case #: clause F)3) _____

3.3.3 Special for Operating Bands

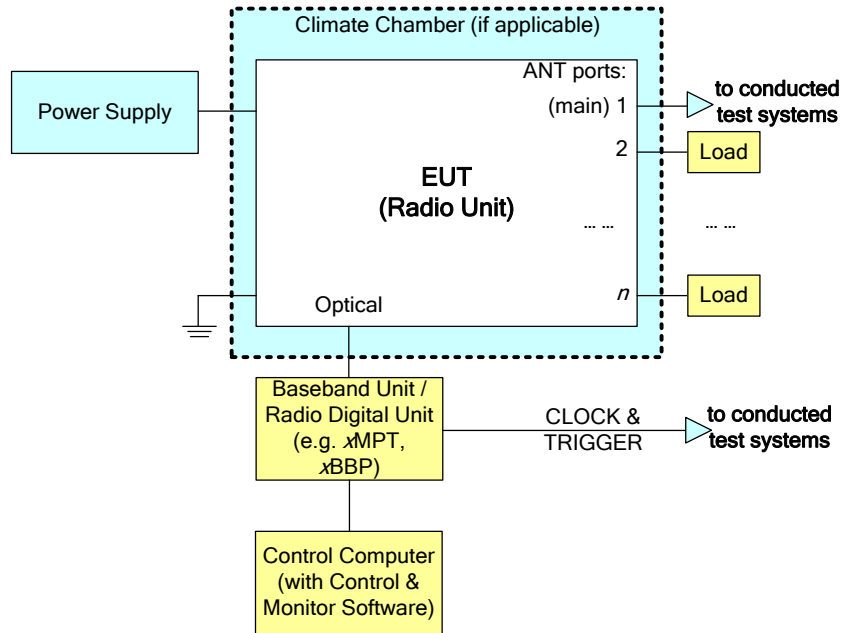
3.3.3.1 2000-2020 MHz and 2180-2200 MHz bands

Parameters	Description
Equipment type	☐ Fixed station ☒ Base station ☐ Mobile station ☐ Portable station ☐ Hand-held portable
Deployment scenes for base station	☒ Population density ≤ 100 persons/mile*mile ☒ Other cases
Antenna that is representative of the type that will be used with the equipment in normal operation	Note: used for measurement of Unwanted emissions in [2200 MHz, 2290 MHz]. (not applicable for Waiver grant condition)

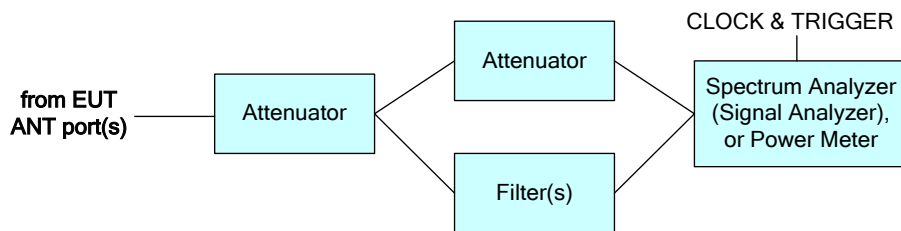
4 Test Setups and Test Procedures

4.1 Test Setup for Conducted Test Items

4.1.1 EUT Arrangement

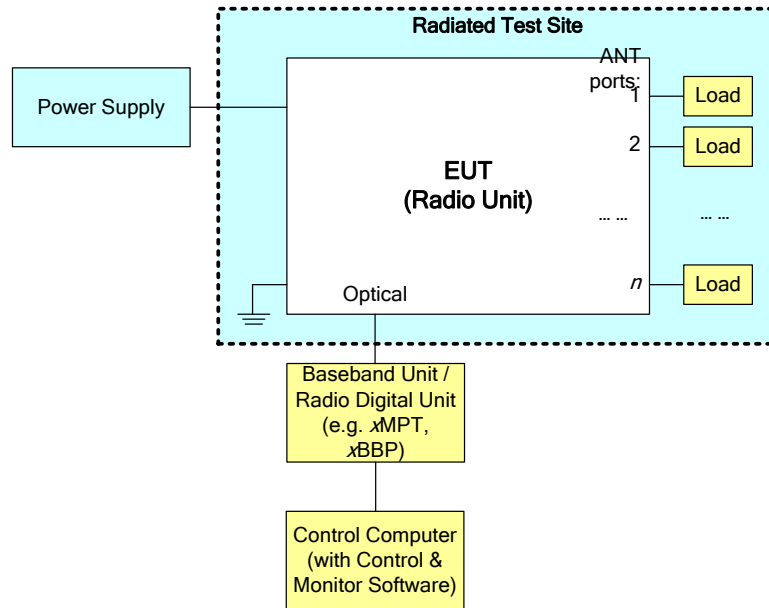


4.1.2 Test Setup



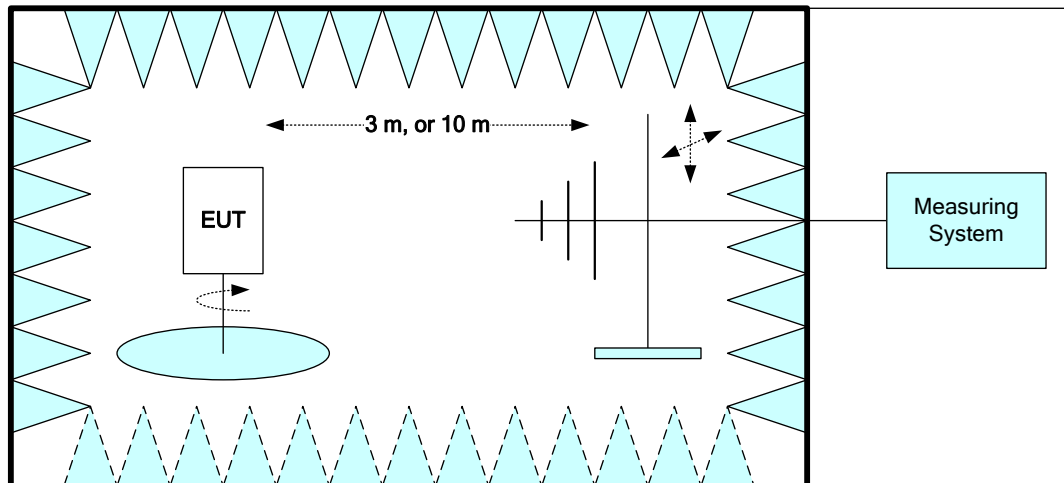
4.2 Test Setup for Radiated Test Items (ERP/EIRP)

4.2.1 EUT Arrangement

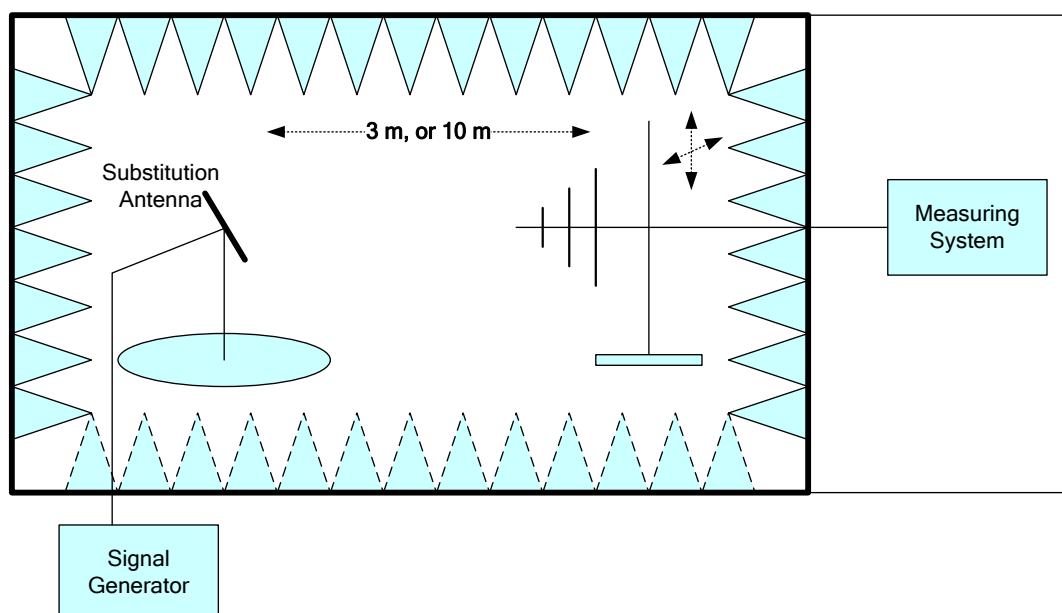


4.2.2 Test Setup

(1) Pre-test:



(2) Substitution method to verify the maximum ERP/EIRP:



5 System Measurement Uncertainty

For a 95% confidence level ($k = 2$), the measurement expanded uncertainties for defined systems, in accordance with the recommendations of ISO 17025 as following:

Test Item		Extended Uncertainty
Transmitter Output Power	Power [dBm]	U = 0.39 dB
Bandwidth	Magnitude [%]	U = 0.2%
Band Edge Compliance	Disturbance Power [dBm]	U = 2.0 dB
Spurious Emissions, Conducted	Disturbance Power [dBm]	U = 2.0 dB
Radiation Emission	Power [dBm] / Field Strength [dB μ V/m]	U = 4.9 dB (30 MHz-1 GHz)
		U = 4.4 dB (1 GHz-18 GHz)
		U = 4.5 dB (18 GHz-26.5 GHz)
Frequency Stability	Frequency Accuracy [ppm]	U = 0.21 ppm



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