



Report No: SYBH(R)80052007EB-1  
FCC ID: QISE960

# FCC TEST REPORT OF Huawei E960 Wireless Gateway

M/N: E960

**Jul. 18, 2007**

Reliability Laboratory of Huawei Technologies Co., Ltd.

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**REPORT ON** **FCC Test of Huawei E960 Wireless Gateway**

**M/N: E960**

**Report No:**

**REGULATION** **FCC CFR47 Part 2: Subpart J;**  
**FCC CFR47 Part 22: Subpart H;**  
**FCC CFR47 Part 15: Subpart B;**

**CONCLUSION** There are 10 items need to be tested, 10 items have been tested. The sample of the model completely meets the requirements

**Final Judgement: Pass**

**General Manager**

2007.07.20  
Date

Guo Xiaoqi  
Name

signature



**Technical Responsibility  
For Area of Testing**

2007.07.18  
Date

Zhang Xinghai  
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2007.07.16  
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# 1 Summary

The table below summarizes the measurements and results for the Huawei GPRS/GSM/EDGE Wireless Gateway. Detailed results and descriptions are shown in the following pages.

Table 1 Summary of results

<b>FCC Measurement Specification</b>	<b>FCC Limits Part(s)</b>	<b>Description</b>	<b>Result</b>
2.1046	22.913	Effective Radiated Power of Transmitter	PASS
2.1046	22.913	Conducted Power of Transmitter	PASS
2.1047		Modulation Characteristics	PASS
2.1049		Occupied Bandwidth	PASS
2.1051	22.917	Band Edges compliance	PASS
2.1051	22.917	Spurious Emission at Antenna Terminal	PASS
2.1053	22.917	Radiated Spurious Emission	PASS
2.1055	22.355	Frequency Stability	PASS
-	15.107	Conducted Emission at Power Port	PASS
-	15.109	Radiated Emission of Enclosure in Idle Mode	PASS

## 2 Product Description

### 2.1 Production Information

#### 2.1.1 General Description

HUAWEI E960 Wireless gateway is subscriber equipment in the UMTS/GSM system, also supports wireless Internet accessing function, routing function, and network address translation (NAT) function. The WCDMA frequency is Band 1. The GSM/GPRS/EDGE frequency band includes 850M, EGSM900, DCS1800 and PCS1900, but only 900MHz & 1800MHz band and WCDMA Band 1's test data are included in this report, the WLAN frequency is 2.4G. E960 implements such functions as RF signal receiving/transmitting, HSDPA/WCDMA and EDGE/GPRS/GSM protocol processing, data service, etc. Externally it provides USB interface (to connect to the notebook etc.), USIM card interface, RJ11 interface (to connect to fixed telephone), and RJ45 interface (to connect to pc). It has four internal antennas as default.

#### 2.1.2 Support function and Service

The Wireless Gateway support the function and service as follows:

Table 2 Service and Test mode List

Service Name	Characteristic	Corresponding Test Mode	Note
Voice and data	Modulation: GMSK	TM1	GPRS/GSM
Data	Modulation: 8PSK	TM2	EDGE

### 2.2 Modification Information

For original equipment, following table is not application.

Table 3 Modification Information

Model Number	Board/Module	Original Version	New Version	Modify Information
Not applicable				

### 3 Test Site Description

The test site of:

***Huawei Technologies Co. Ltd.  
P.O. Box 518129  
Huawei base, bantian,  
Longgang District, Shenzhen, China***

The test site description has been submitted to  and registration granted under the registration number **97456** on March 11, 2003. The test site has been accredited by



and the accredited number is **2174.01** in Jan of 2004.

#### 3.1 Testing Period

The test have been performed during the period of

Jul. 14, 2007 to Jul. 21, 2007

#### 3.2 General Set up Description

HUAWEI E960 Wireless gateway is subscriber equipment in the UMTS/GSM system, also supports wireless Internet accessing function, routing function, and network address translation (NAT) function. The WCDMA frequency is Band 1. The GSM/GPRS/EDGE frequency band includes 850M, EGSM900, DCS1800 and PCS1900 , but only 900MHz & 1800MHz band and WCDMA Band 1's test data are included in this report, the wlan frequency is 2.4G . E960 implements such functions as RF signal receiving/transmitting, HSDPA/WCDMA and EDGE/GPRS/GSM protocol processing, data service ,etc. Externally it provides USB interface (to connect to the notebook etc.), USIM card interface , RJ11 interface(to connect to fixed telephone), RJ45 interface(to connect to pc ). It has four internal antennas as default.

**TM1:** GPRS/GSM Mode with GMSK Modulation

**TM2:** EDGE Mode with 8PSK Modulation

## 4 Product Description

### 4.1 Technical Characteristics

#### 4.1.1 Frequency Range

Table 4 Frequency Range

Uplink band:	824 to 849 MHz
Downlink band:	869 to 894 MHz

#### 4.1.2 Channel Spacing / Separation

Table 5 Channel Spacing / Separation

	EDGE/GPRS/GSM
Channel spacing	200k Hz
Channel separation:	200k Hz

#### 4.1.3 Type of Emission

Table 6 Type of Emission

	EDGE/GPRS/GSM
Emission Designation:	300kGXW

According to CFR 47 (FCC) part 2, subpart C, section 2.201 and 2.202

#### 4.1.4 Environmental Requirements

Table 7 Environmental Requirements

Minimum temperature:	- 10 °C
Maximum temperature:	+ 45 °C
Relative Humidity:	5%-95%RH

#### 4.1.5 Power Source

Table 8 Power Source

AC voltage nominal:	~220V
AC voltage range	~100V-240V
AC current maximal:	0.5A

#### 4.1.6 Tune-up Procedure

According to CFR (FCC) part 2, subpart 2, section 2.1033(c) (9).

Please reference the document Tune-up Procedure in TCF.

#### 4.1.7 Applied DC Voltages and Currents

According to CFR (FCC) part 2, subpart 2, section 2.1033(c) (8).

The voltage and current in the final RF stage is:

Table 9 Applied DC Voltages and Currents

Voltage:	 5V
Current:	2A According to CFR (FCC) part 2, subpart 2, section 2.1033(c) (8)

## 4.2 EUT Identification List

### 4.2.1 Board Information

Table 10 Board Information

E960 Wireless Gateway			
E960			
Board and Module			
Equipment Designation / Description	Hardware Version	Serial Number	Remarks
-Main board	WLA1GCPU Ver.C WLA1TIPU Ver.C	020DYN1076000300 020DYN1076000303	E960

### 4.2.2 Adapter Technical Data

AC/DCAdapter Model	UE15W1-050200SPAV
Manufacturer	Huawei Technologies CO.,LTD
Input Voltage	100-240V ~50/60Hz 0.5 A
Output Voltage	5V  2A
Rated Power	<9W
S/N	UEP7328002672

### 4.2.3 FCC Identification

**Grantee Code:** QIS  
**Product Code:** E960  
**FCC Identification:** QISE960

## 5 Main Test Instruments

Table 11 Main Test Equipments

Equipment Description	Manufacturer	Model	Serial Number	Calibrated until (MM.DD.YYYY)
3m Semi Anechoic Chamber	S+M	N/A	N/A	12.24.2007
3m Full Anechoic Chamber	S+M	N/A	N/A	12.05.2007
Signal Analyzer	R&S	FSQ 26	100266	12.18.2007
Test Receiver Display Unit	R&S	ESMI 804.8932.52	829214/011	12.30.2007
Test Receiver RF Unit	R&S	ESMI 1032.5640.53	829550/008	12.30.2007
Receiver	R&S	ESIB 26	100318	12.17.2007
Receiver	R&S	ESCS30	830245/018	12.30.2007
Pre-Amplifier	Agilent	8447D	2944A10146	12.30.2007
Pre-Amplifier	Agilent	83017A	3950M00246	12.03.2007
Loop Antenna	Schwarzbeck	FMZB1516	1516115	12.08.2007
BiLog Antenna	Schaffner	CBL 6112B	2747	12.30.2007
BiLog Antenna	Schaffner	CBL 6112B	2536	12.30.2007
Horn Antenna	R&S	HF906 4044.4507.02	359287/005	12.05.2007
Horn Antenna	R&S	HF906 4044.4507.02	359287/006	12.05.2007
Horn Antenna	ETS-Lindgren	3117	00062533	09.14.2007
Horn Antenna	ETS-Lindgren	3117	00062549	09.14.2007
Horn Antenna	ETS-Lindgren	3116	00031541	12.15.2007
Dipole	Schwarzbeck	D69250-UHAP/D69250-VHAP	979/917	08.28.2007
Signal Generator	R&S	SMT06	830264/009	09.29.2007
Signal Generator	R&S	SMR 40	100325	12.09.2007
Artificial Mains Network	Schwarzbeck	NNLK8121	8121416	09.29.2007
Power Supply	Keithley	2306	1045337	12.20.2007
Climate Chamber	WEISS	ACS-1	3604040034	08.24.2007
Universal Radio Communication Tester	R&S	CMU200	108035	12.04.2007
Wireless communication test set	Agilent	8960	GB43461081	09.24.2007

## 6 Transmitter Measurements

### 6.1 Effective Radiated Power of Transmitter (ERP)

#### 6.1.1 Test Conditions

Table 12 Test Conditions

Preconditioning:	0.5 hour
Measured at:	enclosure
Ambient temperature:	25
Relative humidity:	55%
Test Configurations:	TM1/TM2 at frequency Bottom、 Mid、 Top

#### 6.1.2 Test Specifications and Limits

##### 6.1.2.1 Specification

CFR 47 (FCC) part 2.1046 and part 22.913

##### 6.1.2.2 Supporting Standards

Table 13 Supporting Standards:

ANSI/TIA-603-C:2004	Land Mobile FM or PM Communications Equipment Measurement and Performance Standards
3GPP TS51.010 V6.1.0:2005	Digital cellular telecommunications system Mobile Station (MS) conformance specification;

##### 6.1.2.3 Limits

Compliance with part 22.913, mobile/portable stations are limited to 7 watts ERP peak power.  $W(\text{dBm}) = 10 \cdot \log(W_{\text{watts}})$ .

Table 14 Limits

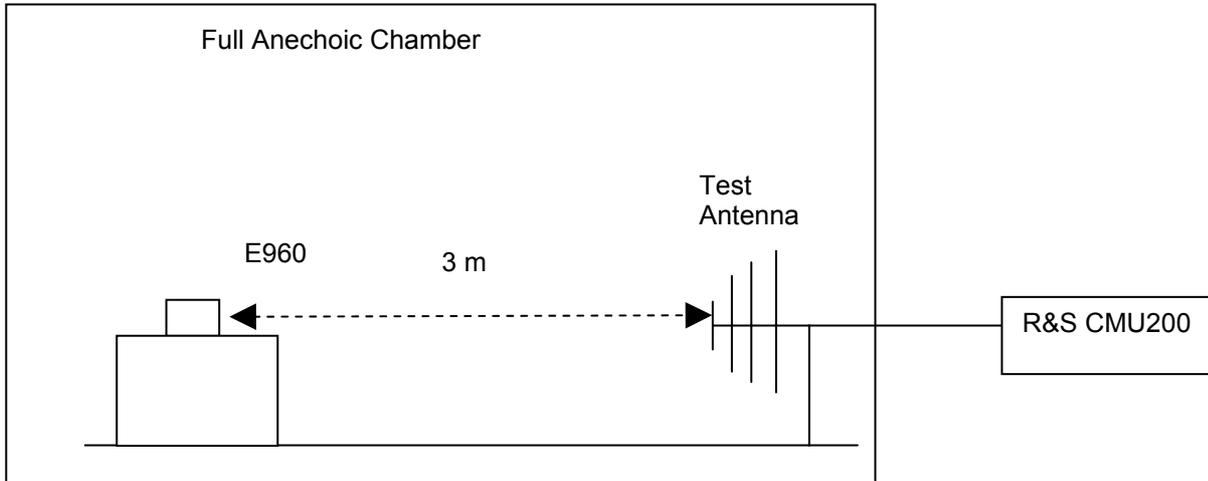
Maximum Output Power (Watts)	< 7 Watts
Maximum Output Power (dBm)	< 38.5 dBm

#### 6.1.3 Test Method and Setup

- For transmitters other than single sideband, independent sideband and controlled carrier radiotelephone, ERP shall be measured when the transmitter is adjusted in accordance with the tune-up procedure to give the values of current and voltage on the circuit elements specified in 2.1033(c)(8). Connect the Wireless Gateway to the wireless communication tester R&S CMU200 via the air interface. The band class is set as 850M.
- Test the Radiated maximum output power by the R&S CMU200 received from test antenna.
- Use substitution method to verify the maximum output power. The EUT is substituted by a dipole antenna. The dipole is connected to a signal generator. And then adjust the output level of the signal generator to get the same received power recorded in step (b) on R&S CMU200, and record the power level of Signal Generator. Of course, the cable loss at the test frequency should be compensated.

**Test setup**

**Step 1: Pre-test**



**Step 2: Substitution method to verify the maximum EIRP**

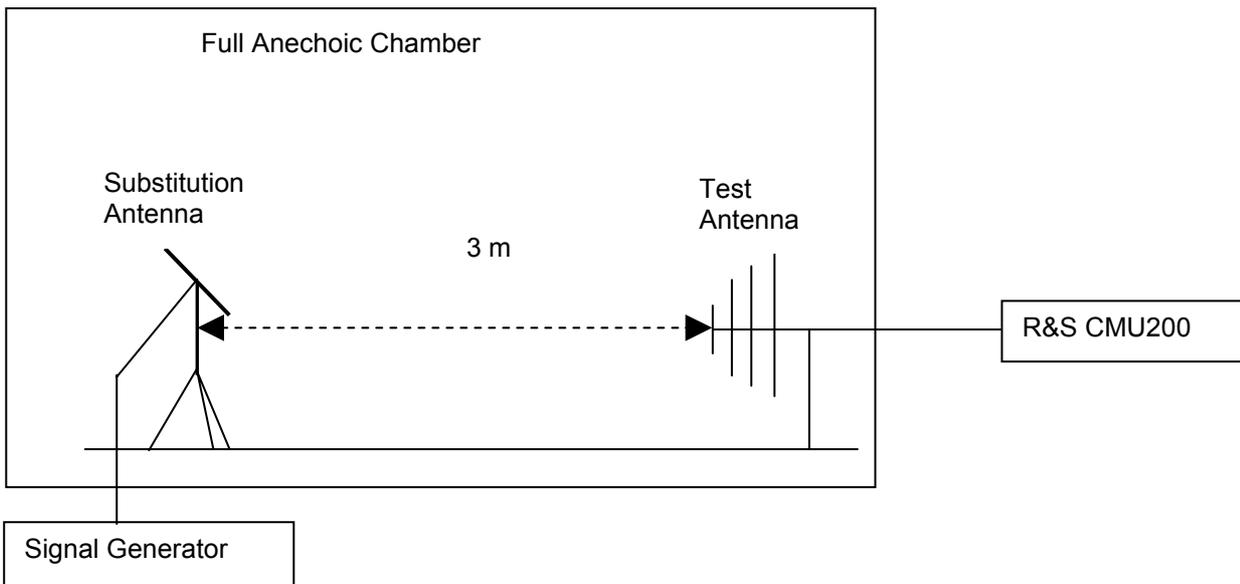


Figure 1. Test Set-up

NOTE: Effective radiated power (ERP) refers to the radiation power output of the EUT, assuming all emissions are radiated from half-wave dipole antennas.

There is a constant difference of 2.15 dB between EIRP and ERP.

ERP (dBm) = EIRP (dBm) – 2.15 (ITU-R Recommendation SM.329-10).

**6.1.4 Measurement Results**

Table 15 Measurement Results

TEST CONDITIONS	RF Output Power (ERP)		
	Channel128(B)	Channel 192(M)	Channel251(T)

		824.2MHz		837MHz		848.8MHz	
		dBm		dBm		dBm	
		Measured	Limit	Measured	Limit	Measured	Limit
TM1	T <sub>nom</sub> (25 °C) V <sub>nom</sub> (5V)	32.33	38.5	32.45	38.5	32.36	38.5
TM2	T <sub>nom</sub> (25 °C) V <sub>nom</sub> (5V)	26.35	38.5	26.08	38.5	26.59	38.5

#### 6.1.4.1 Substitution Results

Table 16 Substitution Results

Test Mode	Freq. [MHz]	Meas. Level [dBm]	Substitution Antenna Type	Substitution Gain [dBd]	Cable Loss [dB]	Substitution Level (ERP) [dBm]	FCC limit [dBm]	Result
TM1	824.2	32.33	Dipole Ant.	-2.95	0.6	32.20	38.5	Pass
TM1	837	32.45	Dipole Ant.	-3.02	0.6	32.44	38.5	Pass
TM1	848.8	32.36	Dipole Ant.	-3.11	0.6	32.49	38.5	Pass
TM2	824.2	26.35	Dipole Ant.	-2.95	0.6	26.48	38.5	Pass
TM2	837	26.08	Dipole Ant.	-3.02	0.6	25.93	38.5	Pass
TM2	848.8	26.59	Dipole Ant.	-3.11	0.6	26.69	38.5	Pass

Note: a, For get the ERP (Efficient Radiated Power) in substitution method, the following formula should take to calculate it,

$$\text{ERP [dBm]} = \text{SGP [dBm]} - \text{Cable Loss [dB]} + \text{Gain [dBd]}$$

NOTE: SGP- Signal Generator Level

b, A GSM signal with bandwidth of 200kHz is created by the vector generator R&S SMU200A.

c, RBW=10kHz, VBW=300kHz, and integrated by the instrument to 200kHz for TM1 and TM2.

#### 6.1.5 Conclusion

The equipment **PASSED** the requirement of this clause.

## 6.2 Conducted Power of Transmitter

### 6.2.1 Test Conditions

Table 17 Test Conditions

Preconditioning:	0.5 hour
Measured at:	Antenna connector
Ambient temperature:	23.5
Relative humidity:	55%
Test Configurations:	TM1/TM2 at frequency Bottom、 Mid、 Top

### 6.2.2 Test Specifications and Limits

#### 6.2.2.1 Specification

CFR 47 (FCC) part 2.1047 and part 22 subpart H

#### 6.2.2.2 Supporting Standards

Table 18 Supporting Standards:

ANSI/TIA-603-C: 2004	Land Mobile FM or PM Communications Equipment Measurement and Performance Standards
3GPP TS51.010 V6.1.0:2005	Digital cellular telecommunications system Mobile Station (MS) conformance specification;

#### 6.2.2.3 Limits

Compliance with part 22.913, in no any case may the peak power of a mobile station transmitter exceed 7 W. The calculated longitude ERP by following formula:

$$ERP(dBm) = 10 * \log(ERP_{in\ watts}).$$

And for conducted power, we can use Antenna Gain to calculate the limit. So the conducted power:

$$P_{cod.}(dBm) = ERP(dBm) - Gain(dBd).$$

and Gain (dBd) = Gain(dBi) - 2.15dB

Table 19 Limits

Maximum Output Power (Watts)	< 7 Watts
Antenna Gain(dBd):	-0.15
Maximum Conducted Output Power (dBm)	< 38.5dBm

### 6.2.3 Test Method and Setup

(a) For transmitters other than single sideband, independent sideband and controlled carrier radiotelephone, Conducted maximum power shall be measured when the transmitter is adjusted in accordance with the tune-up procedure to give the values of current and voltage on the circuit elements

specified in 2.1033(c)(8). Connect the Wireless Gateway to the wireless communication tester R&S CMU200 via the antenna connector. The band class is set as US Cellular.

(b)Test the Conducted maximum output power by the R&S CMU200.

**Test setup**

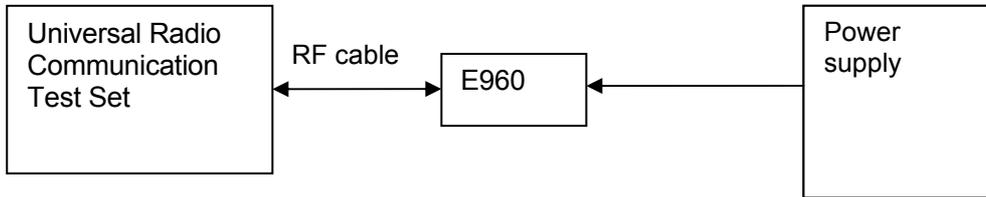


Figure 2. Test Set-up

**6.2.4 Measurement Results**

Table 20 Measurement Results

TEST CONDITIONS		RF Output Power					
		Channel 128(B) 824.2MHz		Channel 192(M) 837MHz		Channel 251(T) 848.8MHz	
		dBm		dBm		dBm	
		Measured	Limit	Measured	Limit	Measured	Limit
TM1	T <sub>nom</sub> (25 °C) V <sub>nom</sub> (5V)	32.37	38.5	32.56	38.5	32.48	38.5
TEST CONDITIONS		RF Output Power					
		Channel 128(B) 824.2MHz		Channel 192(M) 837MHz		Channel 251(T) 848.8MHz	
		dBm		dBm		dBm	
		Measured	Limit	Measured	Limit	Measured	Limit
TM2	T <sub>nom</sub> (25 °C) V <sub>nom</sub> (5V)	26.44	38.5	26.67	38.5	26.72	38.5

**6.2.5 Conclusion**

The equipment **PASSED** the requirement of this clause.

## 6.3 Modulation Characteristics

### 6.3.1 Test Conditions

Table 21 Test Conditions

Preconditioning:	0.5 hour
Measured at:	Antenna connector
Ambient temperature:	25 °C
Relative humidity:	55 %
Test Configurations:	TM1/TM2 at frequency Middle

### 6.3.2 Test Specifications and Limits

#### 6.3.2.1 Specification

CFR 47 (FCC) part 2.1047 and part 22 subpart H

#### 6.3.2.2 Supporting Standards

Table 22 Supporting Standards:

ANSI/TIA-603-C: 2004	Land Mobile FM or PM Communications Equipment Measurement and Performance Standards
3GPP TS51.010 V6.1.0:2005	Digital cellular telecommunications system Mobile Station (MS) conformance specification;

#### 6.3.2.3 Limits

No specific modulation characteristics requirement limits in part 2.1047 and part 22 subpart H.

Table 23 Limits

Limits	Not applicable
--------	----------------

### 6.3.3 Test Method and Setup

Connect the Wireless Gateway to Wireless Communication Test Set R&S CMU200 via the antenna connector. The band class is set as GSM850M; the Wireless Gateway's output is matched with 50 Ω loads, test method was according to 3GPP TS 51.010 and TS 34.121. The waveform quality and constellation of the Wireless Gateway was tested.

#### Test setup

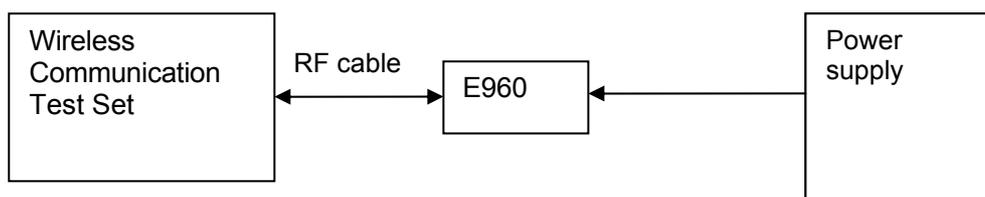


Figure 3. Test Set-up

### 6.3.4 Measurement Results

Table 24 Measurement Results

		Modulation Characteristic	
TEST CONDITIONS		Channel192(M) 837MHz	
		Measured	
		TM1	TM2
$T_{nom}$ (25 °C)	$V_{nom}$ (5V)	Refer to Appendix A	Refer to Appendix A

### 6.3.5 Conclusion

The equipment **PASSED** the requirement of this clause.

For the measurement results refer to appendix A.

## 6.4 Occupied Bandwidth

### 6.4.1 Test Conditions

Table 25 Test Conditions

Preconditioning:	0.5 hour
Measured at:	Antenna connector
Ambient temperature:	25 °C
Relative humidity:	55 %
Test Configurations:	TM1, TM2 at frequency Bottom、 Mid、 Top

### 6.4.2 Test Specifications and Limits

#### 6.4.2.1 Specification

CFR 47 (FCC) part 2.1049 and part 22 subpart H

#### 6.4.2.2 Supporting Standards

Table 26 Supporting Standards:

ANSI/TIA-603-C: 2004	Land Mobile FM or PM Communications Equipment Measurement and Performance Standards
3GPP TS51.010 V6.1.0:2005	Digital cellular telecommunications system Mobile Station (MS) conformance specification;

#### 6.4.2.3 Limits

No specific occupied bandwidth requirement in part 22 subpart H, but the occupied bandwidth was defined in part 2.1049: the frequency bandwidth such that, below its lower and above its upper frequency limits, the mean powers radiated are each equal to 0.5 percent of the total mean power radiated by a given emission shall be measured.

Table 27 Limits

Upper /lower frequency limits	0.5% of the mean power
-------------------------------	------------------------

### 6.4.3 Test Method and Setup

Wireless Gateway was connected to the Spectrum Analyzer R&S FSU26 via the one RF connector. The band class is set as GSM850M; Wireless Gateway was controlled to transmit maximum power. Measure and record the occupied bandwidth of the Wireless Gateway by the R&S FSU26.

The OBW, that is the frequency bandwidth such that, below its lower and above its upper frequency limits, the mean powers radiated are each equal to 0.5 percent of the total mean power radiated by a given emission shall be measured under the following conditions as applicable:

Refer to 47CFR part2.1049 section (g)&(h).

(g) Transmitter in which the modulating base band comprises not more than three independent channels - when modulated by the full complement of signals for which the transmitter is rated. The level of modulation for each channel should be set to that prescribed in rule parts applicable to the services for which the transmitter is intended. If specific modulation levels are not set forth in the rules,

the tests should provide the manufacturer’s maximum rated condition.

(h) Transmitters employing digital modulation techniques - when modulated by an input signal such that its amplitude and symbol rate represent the maximum rated conditions under which the equipment will be operated. The signal shall be applied through any filter networks, pseudorandom generators or other devices required in normal service. Additionally, the occupied bandwidth shall be shown for operation with any devices used for modifying the spectrum when such devices are optional at discretion of the user.

**For TM1/TM2 following RBW and VBW are employed:**

**Measurement bandwidth (RBW): 3 kHz (Resolution bandwidth)**

**Video bandwidth (VBW): 10 kHz**

**For TM3 system following RBW and VBW are employed:**

**Measurement bandwidth (RBW): 50 kHz (Resolution bandwidth)**

**Video bandwidth (VBW): 500 kHz**

**Test Set-up**

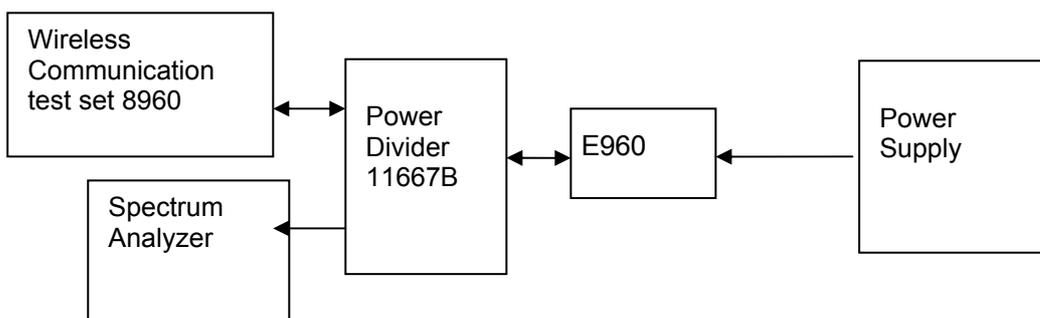


Figure 4. Test Set-up

**6.4.4 Measurement Results**

Table 28 Measurement Results

TEST CONDITIONS		Occupied Bandwidth					
		Channel128 (B) 824.2MHz		Channel192 (M) 837MHz		Channel251 (T) 848.8MHz	
		Measured (kHz)		Measured (kHz)		Measured (kHz)	
		TM1	TM2	TM1	TM2	TM1	TM2
$T_{nom}$ (25 °C)	99%	245.19	243.59	245.19	241.99	241.99	240.38
$V_{nom}$ (5V)							

**6.4.5 Conclusion**

The equipment **PASSED** the requirement of this clause.

For the measurement results refer to appendix B.

## 6.5 Band Edges Compliance

### 6.5.1 Test Conditions

Table 29 Test Conditions

Preconditioning:	0.5 hour
Measured at:	Antenna connector
Ambient temperature:	25°C
Relative humidity:	55 %
Test Configurations:	TM1/TM2 at frequency Bottom、 Top

### 6.5.2 Test Specifications and Limits

#### 6.5.2.1 Specification

CFR 47 (FCC) part 2.1051 and part 22.917

#### 6.5.2.2 Supporting Standards

Table 30 Supporting Standards:

ANSI/TIA-603-C: 2004	Land Mobile FM or PM Communications Equipment Measurement and Performance Standards
3GPP TS51.010 V6.1.0:2005	Digital cellular telecommunications system Mobile Station (MS) conformance specification;

#### 6.5.2.3 Limits

Compliance with part 22.917, all spurious emission must be attenuated below the transmitter power by at least  $43 + 10 \log_{10} P$ . (Whereas P is the rated power of the EUT).

Table 31 Limits

	TM1	TM2	TM3
Rated Power:	33 dBm	27 dBm	24 dBm
Required attenuation:	$43 + 10 \log(2) = 46$ , 33 dBm - 46 dB	$43 + 10 \log(0.5) = 40$ , 27 dBm - 40 dB	$43 + 10 \log(0.25) = 37$ ; 24 dBm - 37 dB
Absolute level	- 13 dBm	- 13 dBm	- 13 dBm

### 6.5.3 Test Method and Setup

Wireless Gateway was connected to the Spectrum Analyzer E4445A via the one RF connector, the band class is set as GSM850M and W850. Wireless Gateway was controlled to transmit maximum power. Measure and record band edges compliance of the Spectrum Analyzer E4445A.

In the 1 MHz bands immediately outside and adjacent to the frequency block a resolution bandwidth of at least 1% of the emission bandwidth of the fundamental emission of the transmitter may be employed. According to FCC part 22.917. The FCC rules define the fundamental emission as -26dBc bandwidth. The limit is -13dBm.

**Test Set-up**

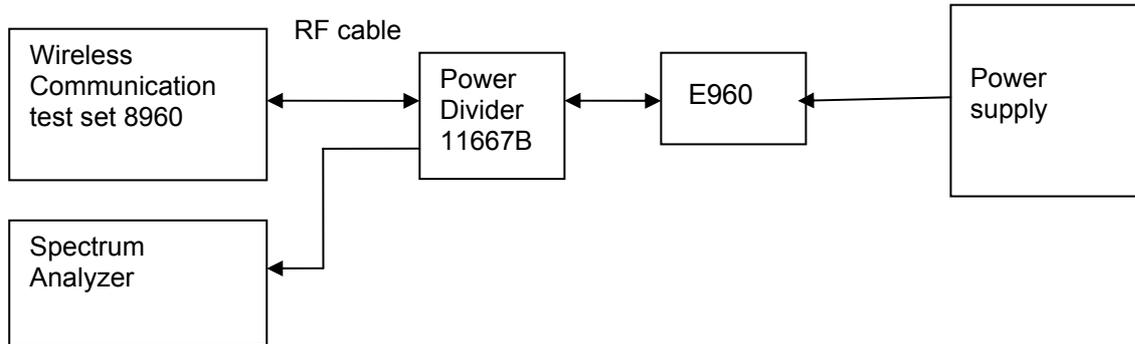


Figure 5. Test Set-up

**6.5.4 Measurement Results**

Table 32 Measurement Results outside Band Edges-- Single Carrier

Band	Frequency of Band edges [MHz]	Channel Number	Test Mode	Spurious Level measured [dBm]	FCC limit	Result
$T_{nom} (25\text{ }^{\circ}\text{C}), V_{nom} (5\text{V})$						
Celluar	824.2	128	TM1	<-13(See appendix C)	- 13 dBm	Pass
	848.8	251	TM1	<-13(See appendix C)	- 13 dBm	Pass
	824.2	128	TM2	<-13(See appendix C)	- 13 dBm	Pass
	848.8	251	TM2	<-13(See appendix C)	- 13 dBm	Pass

**6.5.5 Conclusion**

The equipment **PASSED** the requirement of this clause.  
 For the measurement results refer to appendix C.

## 6.6 Spurious Emission at Antenna Terminal

### 6.6.1 Test Conditions

Table 33 Test Conditions

Preconditioning:	0.5 hour
Measured at:	Antenna connector
Ambient temperature:	25°C
Relative humidity:	55 %
Test Configurations:	TM1/TM2 at frequency B、 T

### 6.6.2 Test Specifications and Limits

#### 6.6.2.1 Specification

CFR 47 (FCC) part 2.1051 and part 22.917

#### 6.6.2.2 Supporting Standards

Table 34 Supporting Standards:

ANSI/TIA-603-C: 2004	Land Mobile FM or PM Communications Equipment Measurement and Performance Standards
3GPP TS51.010 V6.1.0:2005	Recommended GSM/EDGE MS conformance specification

#### 6.6.2.3 Limits

Compliance with part 22.917, all spurious emission must be attenuated below the transmitter power by at least  $43 + 10 \log_{10} P$ . (Whereas P is the rated power of the EUT).

Table 35 Limits

	TM1	TM2	TM3
Rated Power:	33dBm	27 dBm	24 dBm
Required attenuation:	$43 + 10 \log(2) = 46$ , 33 dBm - 46 dB	$43 + 10 \log(0.5) = 40$ , 27 dBm - 40 dB	$43 + 10 \log(0.25) = 37$ ; 24 dBm - 37 dB
Absolute level	- 13 dBm	- 13 dBm	- 13 dBm

### 6.6.3 Test Method and Setup

Wireless Gateway was connected to the Spectrum Analyzer R&S FSU26 via the one RF connector, the band class is set as 850M. Wireless Gateway was controlled to transmit maximum power. Measure and record the Conducted Spurious Emission of the Wireless Gateway by the R&S FSU26.

According to part 22.917, the defined measurement bandwidth as following:

22.917 (b) Measurement procedure: Compliance with these provisions is based on the use of measurement instrumentation employing a resolution bandwidth of 100kHz or greater.

**Measurement bandwidth (RBW) for 9 kHz up to 1 GHz: 100 kHz;**

**Measurement bandwidth (RBW) for 1 GHz up to 12.75 GHz: 1 MHz;**

**Test Set-up**

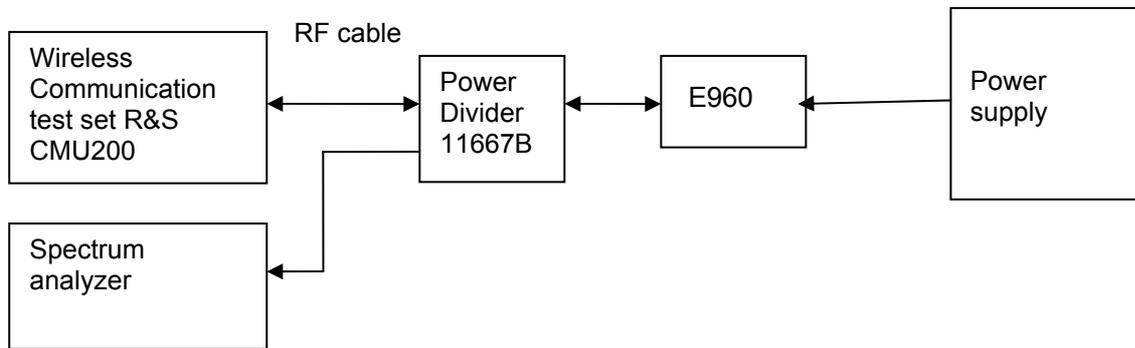


Figure 6. Test Set-up

**6.6.4 Measurement Results**

Table 36 Measurement Results

Channel Number	Test Mode	Test Range (Frequency)	Output Power [dBm]	Spurious Level measured [dBm]	FCC limit	Result
Channel 128(B)	TM1	9 kHz ~12.75GHz	33	<- 13 dBm (See appendix D)	- 13 dBm	Pass
	TM2	9 kHz ~12.75GHz	27	<- 13 dBm (See appendix D)	- 13 dBm	Pass
Channel 251(T)	TM1	9 kHz ~12.75GHz	33	<- 13 dBm (See appendix D)	- 13 dBm	Pass
	TM2	9 kHz ~12.75GHz	27	<- 13 dBm (See appendix D)	- 13 dBm	Pass

**6.6.5 Conclusion**

The equipment **PASSED** the requirement of this clause. For the measurement results refer to appendix D.

## 6.7 Radiated Spurious Emission

### 6.7.1 Test Conditions

Table 37 Test Conditions

Preconditioning:	0.5 hour
Measured at:	enclosure
Ambient temperature:	25 °C
Relative humidity:	53 %
Test Configurations:	TM1, TM2 at middle channel

### 6.7.2 Test Specifications and Limits

#### 6.7.2.1 Specification

CFR 47 (FCC) part 2.1053 and part 22.917

#### 6.7.2.2 Supporting Standards

Table 38 Supporting Standards:

ANSI/TIA-603-C: 2004	Land Mobile FM or PM Communications Equipment Measurement and Performance Standards
3GPP TS51.010 V6.1.0:2005	Digital cellular telecommunications system Mobile Station (MS) conformance specification;

#### 6.7.2.3 Limits

Compliance with part 22.917, all spurious emission must be attenuated below the transmitter power by at least  $43 + 10 \log_{10} P$ . (Whereas P is the rated power of the EUT).

Table 39 Limits

	TM1	TM2
Rated Power:	33dBm	27 dBm
Required attenuation:	$43 + 10 \log(2) = 46$ , 33 dBm - 46 dB	$43 + 10 \log(0.5) = 40$ , 27 dBm - 40 dB
Absolute level	- 13 dBm	- 13 dBm

### 6.7.3 Test Method and Setup

(a) Measurements were made to detect spurious emissions radiated directly from the cabinet, control circuits, power leads, or intermediate circuit elements under normal conditions of installation and operation. Curves or equivalent data were supplied showing the magnitude of each harmonic and other spurious emission. For this test, single sideband, independent sideband, and controlled carrier transmitters shall be modulated under the conditions specified in paragraph 2.1049(c) as appropriate. For equipment operating on frequencies below 890 MHz, an Open Field Test is normally required with the measuring instrument antenna located in the far field at all test frequencies. In the event it is either

impractical or impossible to make open field measurements (e.g. a broadcast transmitter installed in a building) measurement will be accepted of the equipment as installed. Such measurements must be accompanied by a description of the site where the measurements were made showing the location of any possible source of reflections, which might distort the field strength measurements. Information submitted shall include the relative radiated power of each spurious emission with the reference to the rated power output of the transmitter, assuming all emissions are radiated from half-wave dipole antennas.

(b) Measurements specified in paragraph (a) of this section shall be made for the following equipment:

- (1) Those in which the spurious emission are required to be 60 dB or more below the mean power of the transmitter.
- (2) All equipment operating on frequencies higher than 25 MHz
- (3) All equipment where the antenna is an integral part of, and attached directly to the transmitter.
- (4) Other types of equipment as required, when deemed necessary by the Commission.

E960 is equipment with non-integral antenna. And it should test according to part (b) of above section.

BTS simulator is connected to a communication antenna, by which communicate with E960 inside the test site. The BTS simulator controls E960 to transmit at maximum power which defined in specification of product when in traffic mode, field strength of spurious emission in idle mode were also tested. E960 operates on a typical channel (Middle Channel).

### **The test procedure:**

- (a) For transmitters other than single sideband, independent sideband and controlled carrier radiotelephone, EIRP. shall be measured when the transmitter is adjusted in accordance with the tune-up procedure to give the values of current and voltage on the circuit elements specified in 2.1033(c)(8). Connect E960 to the BTS simulator via the air interface. The band class is set as 850M.
- (b) Test the Radiated maximum output power by the Rohde and Schwarz ESMI Test Receiver from test antenna.
- (c) Use substitution method to verify the maximum output power. The EUT is substituted by a dipole antenna. The dipole is connected to a signal generator. And then adjust the output level of the signal generator to get the same received power recorded in step (b) on ESMI Test Receiver, and record the power level of Signal Generator. Of course, the cable loss at the test frequency should be compensated.

According to part 22.917, the defined measurement bandwidth as following:

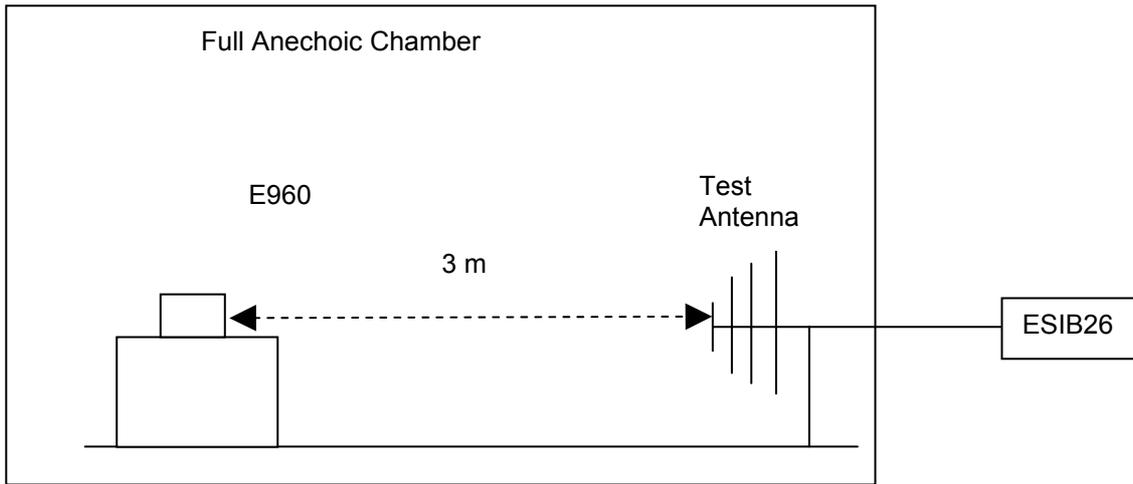
22.917 (b) Measurement procedure: Compliance with these provisions is based on the use of measurement instrumentation employing a resolution bandwidth of 100kHz or greater.

Measurement bandwidth (RBW) for 30 MHz up to 1 GHz: 100 kHz;

Measurement bandwidth (RBW) for 1 GHz up to 18GHz: 1 MHz;

### **Test setup**

#### **Step 1: Pre-test**



**Step 2: Substitution method to verify the maximum ERP**

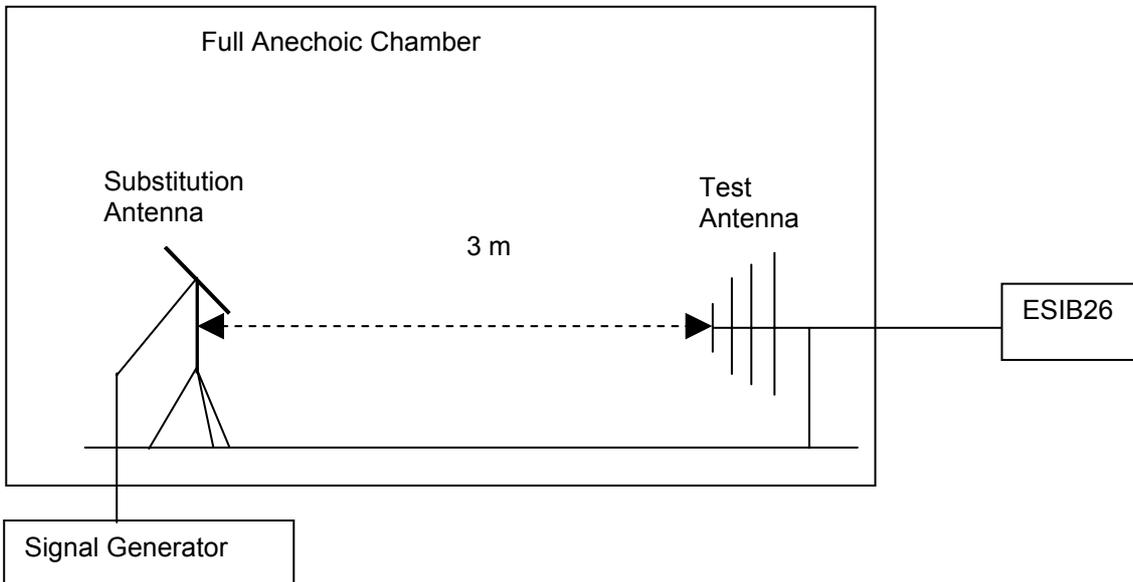


Figure 7. Test Set-up

NOTE: Effective radiated power (ERP) refers to the radiation power output of the EUT, assuming all emissions are radiated from half-wave dipole antennas.

**6.7.4 Measurement Results**

**6.7.4.1 Pre-test Measurement Results**

Channel Number	Mode	Test Range (Frequency)	Power [dBm]	Spurious Level measured [dBm]	FCC limit	Result
192	TM1	30MHz ~18GHz	33	<- 13 dBm (See appendix E)	- 13 dBm	Pass
192	TM2	30MHz ~18GHz	27	<- 13 dBm (See appendix E)	- 13 dBm	Pass

**6.7.4.2 Substitution Results**

No peak found in pre- test.

Calculation Sample:

Table 40 Substitution Results

Test Mode	Freq. [MHz]	Meas. Level [dBm]	Substitution Antenna Type	Gain [dBd]	Cable Loss [dB]	Substitution Level [dBm]	FCC limit [dBm]	Result

Note: For get the EIRP. (Efficient Radiated Power) in substitution method, the following formula should take to calculate it,

$$ERP [dBm] = SGP [dBm] - Cable Loss [dB] + Gain [dBd]$$

NOTE: SGP- Signal Generator Level

### 6.7.5 Conclusion

The equipment **PASSED** the requirement of this clause.  
For the measurement results refer to appendix E.

## 6.8 Frequency Stability

### 6.8.1 Test Conditions

Table 41 Test Conditions

Preconditioning:	0.5 hour
Measured at:	Antenna connector
Ambient temperature:	25°C
Relative humidity:	55 %
Test Configurations:	TM1/TM2 at frequency M

### 6.8.2 Test Specifications and Limits

#### 6.8.2.1 Specification

CFR 47 (FCC) part 2.1055 and part 22.355

#### 6.8.2.2 Supporting Standards

Table 42 Supporting Standards:

ANSI/TIA-603-C: 2004	Land Mobile FM or PM Communications Equipment Measurement and Performance Standards
3GPP TS51.010 V6.1.0:2005	Digital cellular telecommunications system Mobile Station (MS) conformance specification;

#### 6.8.2.3 Limits

According to part 22.355, from 821MHz to 896MHz, for mobile device, the carrier frequency of each transmitter in the Public Mobile Services must be maintained within the tolerances 2.5ppm.

### 6.8.3 Test Method and Setup

The frequency stability shall be measured with variation of ambient temperature as follows:

- (1) From  $-30^{\circ}$  to  $+50^{\circ}$  centigrade for all equipment except that specified in subparagraphs (2) and (3) of paragraph 2.1055

(b) Frequency measurements shall be made at the extremes of the specified temperature range and at intervals of not more than  $10^{\circ}$  centigrade through the range. A period of time sufficient to stabilize all of the components of the oscillator circuit at each temperature level shall be allowed prior to frequency measurement. The short-term transient effects on the frequency of the transmitter due to keying (except for broadcast transmitters) and any heating element cycling normally occurring at each ambient temperature level also shall be shown. Only the portion or portions of the transmitter containing the frequency determining and stabilizing circuitry need be subjected to the temperature variation test.

(d) The frequency stability shall be measured with variation of primary supply voltage as follows:

- (1) Vary primary supply voltage from 85 to 115 percent of the nominal value for other than hand carried battery equipment.
- (2) For hand carried, battery powered equipment, reduce primary supply voltage to the battery operating end point, which shall be specified by the manufacturer.
- (3) The supply voltage shall be measured at the input to the cable normally provided with the equipment, or at the power supply terminals if cables are not normally provided. Effects on frequency of transmitter keying (except for broadcast transmitters) and any heating element cycling at the nominal supply voltage and at each extreme also shall be shown.
- (e) When deemed necessary, the Commission may require tests of frequency stability under conditions

in addition to those specifically set out in paragraphs (a), (b), (c) and (d) of this section. (For example, measurements showing the effect of proximity to large metal objects, or of various types of antennas, may be required for portable equipment.)

**Test Set up**

Connect the Wireless Gateway to the Wireless Communication test set R&S CMU200 via the connector. Then measure the frequency error by the Wireless Communication test set R&S CMU200. The Wireless Gateway's output is matched with a 50 Ω load.

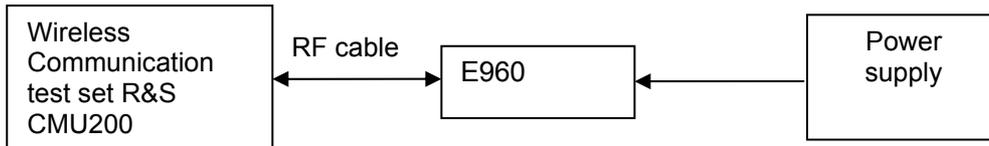


Figure 8. Test Set up

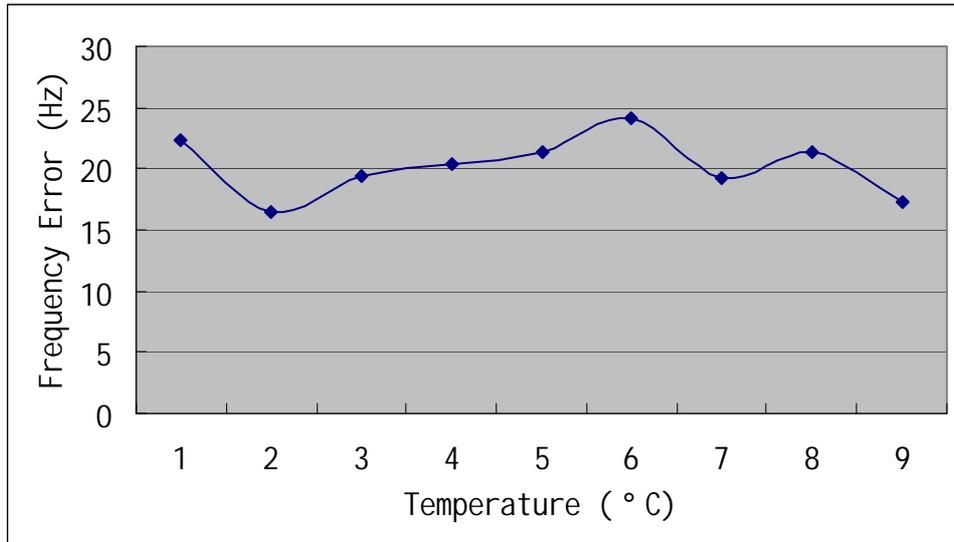
**6.8.4 Measurement Results**

**6.8.4.1 Measurement Results vs. Variation of Temperature**

- **TM1, 5V DC Channel No.192(837.0MHz)**

Table 43 Measurement Results vs. Variation of Temperature

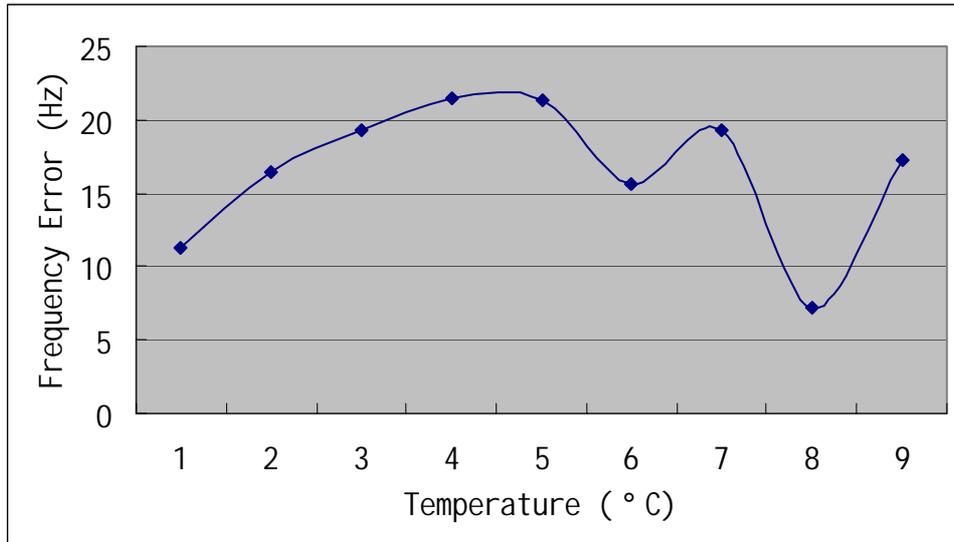
Temperature	Power (dBm)	Nominal Frequency (MHz)	Measured Frequency Error(Hz)	Result
-30	33	837.0	22.32	Pass
-20	33	837.0	16.5	Pass
-10	33	837.0	19.34	Pass
0 °C	33	837.0	20.32	Pass
+10 °C	33	837.0	21.28	Pass
+20 °C	33	837.0	24.16	Pass
+30 °C	33	837.0	19.27	Pass
+40 °C	33	837.0	21.35	Pass
+50 °C	33	837.0	17.25	Pass



● **TM2, 5V DC Channel No.192(837.0MHz)**

Table 44 Measurement Results vs. Variation of Temperature

Temperature	Power (dBm)	Nominal Frequency (MHz)	Measured Frequency Error(Hz)	Result
-30°C	27	837.0	11.21	Pass
-20°C	27	837.0	16.5	Pass
-10 °C	27	837.0	19.34	Pass
0 °C	27	837.0	21.45	Pass
+10 °C	27	837.0	21.28	Pass
+20 °C	27	837.0	15.68	Pass
+30 °C	27	837.0	19.27	Pass
+40 °C	27	837.0	7.25	Pass
+50 °C	27	837.0	17.25	Pass



**6.8.4.2 Measurement Results vs. Variation of Voltage**

- **TM1, 25 °C ,Channel No. 192(837.0MHz)**

Table 45 Measurement Results vs. Variation of Voltage

Voltage	Power (dBm)	Nominal Frequency (MHz)	Measured Frequency Error(Hz)	Result
4.75	33	837.0	14.53	Pass
5	33	837.0	15.85	Pass
5.6	33	837.0	-11.06	Pass

- **TM2, 25 °C ,Channel No. 192(837.0MHz)**

Table 46 Measurement Results vs. Variation of Voltage

Voltage	Power (dBm)	Nominal Frequency (MHz)	Measured Frequency Error(Hz)	Result
4.75	33	837.0	-15.63	Pass
5	33	837.0	15.35	Pass
5.6	33	837.0	17.51	Pass

**6.8.5 Conclusion**

The equipment **PASSED** the requirement of this clause.

## 7 EMC Test

### 7.1 Conducted Emission at Power Port

#### 7.1.1 Test Conditions

Table 47 Test Conditions

Preconditioning:	0.5 hour
Measured at:	Power port
Ambient temperature:	23.5°C
Relative humidity:	55 %
Test Configurations:	TM1 at frequency M

#### 7.1.2 Test Specifications and Limits

##### 7.1.2.1 Specification

CFR 47 (FCC) part 15.107

##### 7.1.2.2 Supporting Standards

Table 48 Supporting Standards:

ANSI C63.4: 2003	Methods of Measurement of Radio-Noise Emissions from Low Voltage Electrical and Electronic Equipment in the Range of 9 kHz to 40 GHz
------------------	--

##### 7.1.2.3 Limits

Compliance with part15.107, conducted emission must meet the requirement of following table.

Table 49 Limits

Frequency of Emission (MHz)	Conducted Limit (dB $\mu$ V)	
	Quasi-peak	Average
0.15-0.5	66 to 56 *	56 to 46 *
0.5-5	56	46
5-30	60	50

Note: \* Decreases with the logarithm of the frequency.

#### 7.1.3 Test Method and Setup

The Table-top EUT was placed upon a non-metallic table 0.8 m above the horizontal metal reference ground plane. EUT was connected to LISN and LISN was connected to reference Ground Plane. EUT was 80cm from LISN. The set-up and test methods were according to ANSI C63.4: 2003.

Conducted Disturbance at AC Port measurements were undertaken on the L and N Lines. The emissions were measured using a Quasi-Peak Detector and Average Detector.

Huawei Wireless Gateway was communicated with the BTS simulator through Air interface, the BTS simulator controls the Wireless Gateway to transmitter the maximum power which defined in specification of product. The Wireless Gateway operated on the typical channel.

Measurement bandwidth (RBW) for 150kHz to 30 MHz: 9 kHz;

**Test Set-up**

The Wireless Gateway was setup in the screened chamber and operated under nominal conditions.

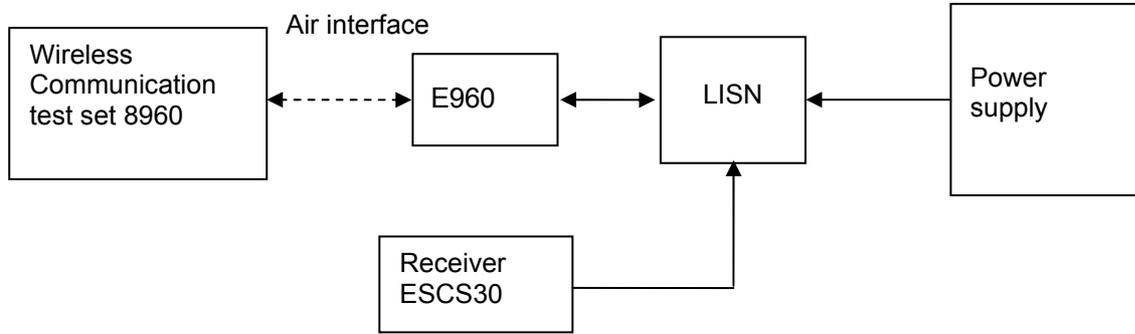


Figure 9. Test Set-up

**7.1.4 Measurement Results**

Table 50 MEASUREMENT RESULT:QP DECTECTOR

Frequency MHz	Level dBμV	Transd dB	Limit dBμV	Margin dB	Detector	Line	PE
0.303000	41.50	10.3	60	18.7	QP	L3	GND
0.519000	46.40	10.0	56	9.6	QP	L3	GND
1.545000	44.50	9.9	56	11.5	QP	L3	GND
2.161500	42.40	10.1	56	13.6	QP	L3	GND
5.257500	35.70	10.2	60	24.3	QP	N	GND
19.990500	30.60	13.1	60	29.4	QP	N	GND

Table 51 MEASUREMENT RESULT:AV DECTECTOR

Frequency MHz	Level dBμV	Transd dB	Limit dBμV	Margin dB	Detector	Line	PE
0.186000	40.90	10.6	54	13.3	AV	L3	GND
0.519000	37.50	10.0	46	8.5	AV	L3	GND
1.500000	37.10	9.9	46	8.9	AV	L3	GND
2.125500	34.90	10.1	46	11.1	AV	L3	GND
5.140500	28.80	10.1	50	21.2	AV	N	GND
19.612500	25.40	12.9	50	24.6	AV	L3	GND

**7.1.5 Conclusion**

The equipment **PASSED** the requirement of this clause.  
For the measurement results refer to appendix F.

## 7.2 Radiated Emission of Enclosure in Idle Mode

### 7.2.1 Test Conditions

Table 52 Test Conditions

Preconditioning:	0.5 hour
Measured at:	enclosure
Ambient temperature:	25 °C
Relative humidity:	45 %
Test Configurations:	TM1 at frequency M

### 7.2.2 Test Specifications and Limits

#### 7.2.2.1 Specification

CFR 47 (FCC) part 15.109

#### 7.2.2.2 Supporting Standards

Table 53 Supporting Standards:

ANSI C63.4: 2003	Methods of Measurement of Radio-Noise Emissions from Low Voltage Electrical and Electronic Equipment in the Range of 9 kHz to 40 GHz
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#### 7.2.2.3 Limits

The Radiated Emission of enclosure of EUT should compliance with the requirement of part 15.109. The limit showed in following table.

Table 54 Limits

Frequency of Emission (MHz)	Radiated Limit	
	Unit( $\mu$ v/m)	Unit(dB $\mu$ V/m)
30-88	100	40
88-216	150	43.5
216-960	200	46
960-1000	500	54

### 7.2.3 Test Method and Setup

The test site semi-anechoic chamber has met the requirement of NSA tolerance 4dB according to the standards: ANSI C63.4 (2003). The test distance was 3m. The EUT was set-up on insulator 80cm above the Ground Plane. The set-up and test methods were according to ANSI C63.4. The Radiated Disturbance measurements were made using a Rohde and Schwarz ESMI Test Receiver and control software ES-K1.

A preliminary scan and a final scan of the emissions were made from 30 MHz to 1GHz by using test script of software; the emissions were measured using a Quasi-Peak Detector. The maximal emission

value was acquired by adjusting the antenna height, polarisation and turntable azimuth in accordance with the software setup. Normally, the height range of antenna was 1m to 4m, the azimuth range of turntable was 0° to 360°, The receive antenna has two polarizations V and H.

Huawei Wireless Gateway was communicated with the BTS simulator through Air interface. The Wireless Gateway operated on the typical channel and the Wireless Gateway worked in idle mode, transmitter was not work in this test.

Measurement bandwidth: 30 MHz – 1000 MHz: 120 k Hz

**Test set up**

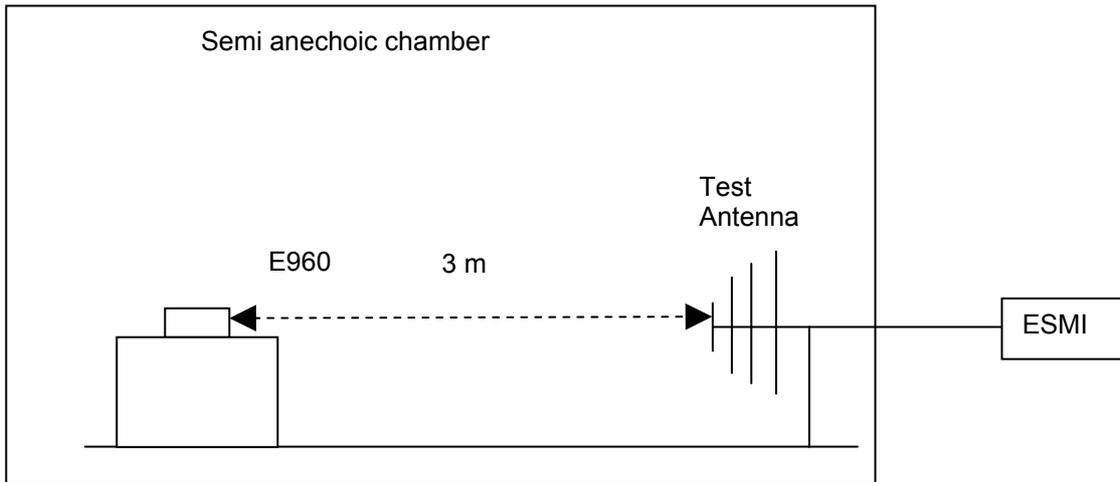


Figure 10. Test set up

**7.2.4 Measurement Results**

Table 55 MEASUREMENT RESULT: QP DETECTOR

Frequency ( MHz )	Level ( dBμV/m )	Transd ( dB )	Limit ( dBμV/m )	Margin ( dB )	Height ( cm )	Azimuth ( deg )	Polarisation
56.280000	34.90	-15.8	40.0	5.1	120.0	343.00	VERTICAL
96.780000	32.80	-11.3	43.5	10.7	100.0	11.00	VERTICAL
204.000000	34.00	-11.5	43.5	9.5	133.0	0.00	HORIZONTAL
208.680000	33.10	-11.7	43.5	10.4	126.0	0.00	HORIZONTAL
336.000000	34.70	-5.9	46.0	11.3	100.0	178.00	HORIZONTAL
900.000000	36.60	1.4	46.0	9.4	120.0	171.00	VERTICAL

**7.2.5 Conclusion**

The equipment **PASSED** the requirement of this clause. For the measurement results refer to appendix G.

## 8 System Measurement Uncertainty

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

Table 56 System Measurement Uncertainty

Items		Extended Uncertainty
Effective Radiated Power of Transmitter	EIRP (dBm)	U=2.2dB; k=2
Band Width	Magnitude (%)	U = 0.2%; k=2
Band Edge Compliance	Disturbance Power ( dBm )	U = 2.0dB; k=2
Conducted Spurious Emission at Antenna Terminal	Disturbance Power ( dBm )	U = 2.0dB; k=2
Frequency Stability	Frequency Accuracy(ppm)	U = 0.21ppm; k=2
Field Strength of Spurious Radiation	ERP(dBm)	U=2.2dB; k=2
Conducted Output Power	Power(dBm)	U=0.39dB; k=2
Conducted Emission at Power Port	Disturbance Voltage ( dB $\mu$ V )	U=4dB; k=2
Radiated Emission of enclosure at ideal mode	Field strength ( dB $\mu$ V/m )	U=5dB; k=2

## 9 Appendices

Appendix A	Measurement Results Modulation Characteristics	3 pages
Appendix B	Measurement Results Occupied Bandwidth	7 pages
Appendix C	Measurement Results Band Edges	5 pages
Appendix D	Measurement Results Spurious Emission at Antenna Terminal	13 pages
Appendix E	Measurement Results Radiated Spurious Emission	13 pages
Appendix F	Measurement Results Conducted Emission at Power Port	2 pages
Appendix G	Measurement Results Radiated Emission of Enclosure at Ideal Mode	2 pages
Appendix H	Photos of Test Setup	6 pages