

Report No.: SEWM2212000291RG01  
 Rev.: 01  
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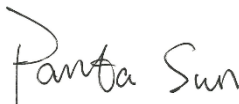
# TEST REPORT

**Application No.:** SEWM2212000291RG  
**Applicant:** Quectel Wireless Solutions Co., Ltd.  
**Address of Applicant:** Building 5, Shanghai Business Park Phase III (Area B), No.1016 Tianlin Road, Minhang District, Shanghai, China, 200233  
**Manufacturer:** Quectel Wireless Solutions Co., Ltd.  
**Address of Manufacturer:** Building 5, Shanghai Business Park Phase III (Area B), No.1016 Tianlin Road, Minhang District, Shanghai, China, 200233  
**EUT Description:** LTE Module  
**Model No.:** EM05-G  
**Trade Mark:** Quectel  
**FCC ID:** XMR2022EM05G  
**Standards:** 47 CFR Part 2  
 47 CFR Part 22  
 47 CFR Part 24  
 47 CFR Part 27  
 47 CFR Part 90  
**Date of Receipt:** 2021/04/12  
**Date of Test:** 2021/04/12 to 2021/05/05 (for original report SHR/2021/3000701)  
 2021/06/02 to 2021/06/08 (for original report SZCR210602131701)  
 2022/12/08 to 2022/12/09 (for new report SEWM2212000291RG01)  
**Date of Issue:** 2022/12/12

<b>Test Result :</b>	<b>PASS *</b>
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\* In the configuration tested, the EUT detailed in this report complied with the standards specified above.

Authorized Signature:



Pantu Sun  
 Wireless Laboratory Manager



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# 1 Version

Revision Record				
Version	Chapter	Date	Modifier	Remark
01		2022/12/12		Original

<b>Prepared By</b>		 <hr/> (Weller Liu) / Test Engineer
<b>Checked By</b>		 <hr/> (Well Wei) / Reviewer



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## 2 Test Summary

### 2.1 UMTS Band 5/LTE Band 5/26(824~849 MHz)

Test Item	FCC Rule No.	Requirements	Test Result	Verdict
Effective (Isotropic) Radiated Power Output Data	§2.1046, §22.913(a)(5)	ERP ≤ 7 W	Reference report SHR/2021/3000701	
Peak-Average Ratio	§22.913(d)	Limit≤13 dB		
Modulation Characteristics	§2.1047	Digital modulation		
Bandwidth	§2.1049	OBW: No limit. EBW: No limit.		
Band Edges Compliance	§2.1051, §22.917(a)	≤ -13 dBm/1%*EBW, in 1 MHz bands immediately outside and adjacent to the frequency block.		
Spurious Emission at Antenna Terminals	§2.1051, §22.917(a)	FCC: ≤ -13 dBm/100 kHz, from 9 kHz to 10th harmonics but outside authorized operating frequency ranges.		
Field Strength of Spurious Radiation	§2.1053, §22.917(a)	FCC: ≤ -13 dBm/100 kHz.	Section 7 of Appendix	Pass
Frequency Stability	§2.1055(a)(1)(b) §2.1055(d)(1) §22.355	≤ ±2.5ppm.	Reference report SHR/2021/3000701	



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**2.2 UMTS Band 2 /LTE Band 2 /25**

Test Item	FCC Rule No.	Requirements	Test Result	Verdict
Effective (Isotropic) Radiated Power Output Data	§2.1046, §24.232(c)	EIRP ≤ 2 W	Reference report SHR/2021/3000701	
Peak-Average Ratio	§24.232(d)	Limits≤13 dB		
Modulation Characteristics	§2.1047	Digital modulation		
Bandwidth	§2.1049	OBW: No limit. EBW: No limit.		
Band Edges Compliance	§2.1051, §24.238(a)	≤ -13 dBm/1%*EBW, in 1 MHz bands immediately outside and adjacent to the frequency block.		
Spurious Emission at Antenna Terminals	§2.1051, §24.238(a)	≤ -13 dBm/1 MHz, from 9 kHz to 10 <sup>th</sup> harmonics but outside authorized operating frequency ranges.		
Field Strength of Spurious Radiation	§2.1053, §24.238(a)	≤ -13 dBm/1 MHz.	Section 7 of Appendix	Pass
Frequency Stability	§2.1055(a)(1)(b) §2.1055(d)(1) §2.235	Within authorized bands of operation/frequency block.	Reference report SHR/2021/3000701	



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**2.3 UMTS Band 4 /LTE Band 4 /66**

Test Item	FCC Rule No.	Requirements	Test Result	Verdict
Effective (Isotropic) Radiated Power Output Data	§2.1046, §27.50(d)(4)	EIRP ≤ 1 W	Reference report SHR/2021/3000701	
Peak-Average Ratio	§27.50(d)(5)	Limit≤13 dB		
Modulation Characteristics	§2.1047	Digital modulation		
Bandwidth	§2.1049	OBW: No limit. EBW: No limit.		
Band Edges Compliance	§2.1051, §27.53(h)	≤ -13 dBm/1%*EBW, in 1 MHz bands immediately outside and adjacent to the frequency block.		
Spurious Emission at Antenna Terminals	§2.1051, §27.53(h)	≤ -13 dBm/1 MHz, from 9 kHz to 10 <sup>th</sup> harmonics but outside authorized operating frequency ranges.		
Field Strength of Spurious Radiation	§2.1053, §27.53(h)	≤ -13 dBm/1 MHz.	Section 7 of Appendix	Pass
Frequency Stability	§2.1055(a)(1)(b) §2.1055(d)(1)(2) §27.54	Within authorized bands of operation/frequency block.	Reference report SHR/2021/3000701	



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2.4 LTE Band 7/38/41

Test Item	FCC Rule No.	Requirements	Test Result	Verdict
Effective (Isotropic) Radiated Power Output Data	§2.1046, §27.50(h)(2)	EIRP ≤ 2W	Reference report SHR/2021/3000701	
Peak-Average Ratio	---	≤13 dB		
Modulation Characteristics	§2.1047	Digital modulation		
Bandwidth	§2.1049	OBW: No limit. EBW: No limit.		
Band Edges Compliance	§2.1051, §27.53(m4)	For mobile digital stations, the attenuation factor shall be not less than 40 + 10 log (P) dB on all frequencies between the channel edge and 5 megahertz from the channel edge, 43 + 10 log (P) dB on all frequencies between 5 megahertz and X megahertz from the channel edge, and 55 + 10 log (P) dB on all frequencies more than X megahertz from the channel edge, where X is the greater of 6 megahertz or the actual emission bandwidth as defined in paragraph (m)(6) of this section. In addition, the attenuation factor shall not be less that 43 + 10 log (P) dB on all frequencies between 2490.5 MHz and 2496 MHz and 55 + 10 log (P) dB at or below 2490.5 MHz.		
Spurious Emission at Antenna Terminals	§2.1051, §27.53(m)			
Field Strength of Spurious Radiation	§2.1053, §27.53(m)		Section 7 of Appendix	Pass
Frequency Stability	§2.1055(a)(1)(b) §2.1055(d)(1) §27.54	Within authorized bands of operation/frequency block.	Reference report SHR/2021/3000701	



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### 2.5 LTE Band 12

Test Item	FCC Rule No.	Requirements	Test Result	Verdict
Effective (Isotropic) Radiated Power Output Data	§2.1046 §27.50(c)(10)	ERP ≤ 3 W.	Reference report SHR/2021/3000701	
Peak-Average Ratio	---	Limit≤13 dB		
Modulation Characteristics	§2.1047	Digital modulation		
Bandwidth	§2.1049	OBW: No limit. EBW: No limit.		
Band Edges Compliance	§2.1051, §27.53(g)	≤ -13 dBm/1%*EBW, in 1 MHz bands immediately outside and adjacent to the frequency block.		
Spurious Emission at Antenna Terminals	§2.1051, §27.53(g)	FCC: ≤ -13 dBm/100 kHz, from 9 kHz to 10 <sup>th</sup> harmonics but outside authorized operating frequency ranges.		
Field Strength of Spurious Radiation	§2.1053, §27.53(g)	FCC: ≤ -13 dBm/100 kHz.	Section 7 of Appendix	Pass
Frequency Stability	§2.1055(a)(1)(b) §2.1055(d)(1) §27.54	Within authorized bands of operation/frequency block.	Reference report SHR/2021/3000701	



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2.6 LTE Band 13

Test Item	FCC Rule No.	Requirements	Test Result	Verdict
Effective (Isotropic) Radiated Power Output Data	§2.1046, §27.50(b)(10)	ERP ≤ 3 W.	Reference report SHR/2021/3000701	
Peak-Average Ratio	---	Limits ≤ 13 dB		
Modulation Characteristics	§2.1047	Digital modulation		
Bandwidth	§2.1049,	OBW: No limit. EBW: No limit.		
Band Edges Compliance	§2.1051, §27.53(c)	≤ -13 dBm/1%*EBW, in 1 MHz bands immediately outside and adjacent to the frequency block.		
Spurious Emission at Antenna Terminals	§2.1051, §27.53(c) §27.53(f)	≤ -13 dBm/100 kHz, from 9 kHz to 10 <sup>th</sup> harmonics but outside authorized operating frequency ranges. On all frequencies between 763–775 MHz and 793–805 MHz, by a factor not less than 65 + 10 log (P) dB in a 6.25 kHz band segment, for mobile and portable stations. For operations in the 746-758 MHz, 775-788 MHz, and 805-806 MHz bands, emissions in the band 1559-1610 MHz shall be limited to -70 dBW/MHz equivalent isotropically radiated power (EIRP) for wideband signals, and -80 dBW EIRP for discrete emissions of less than 700 Hz bandwidth.		
Field Strength of Spurious Radiation	§2.1053, §27.53(c) §27.53(f)	FCC: ≤ -13 dBm/100 kHz. For operations in the 746-758 MHz, 775-788 MHz, and 805-806 MHz bands, emissions in the band 1559-1610 MHz shall be limited to -70 dBW/MHz equivalent isotropically radiated power (EIRP) for wideband signals, and -80 dBW EIRP for discrete emissions of less than 700 Hz bandwidth.	Section 7 of Appendix	Pass
Frequency Stability	§2.1055(a)(1)(b) §2.1055(d)(1) §27.54	Within authorized bands of operation/frequency block.	Reference report SHR/2021/3000701	



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**2.7 LTE Band 14**

Test Item	FCC Rule No.	Requirements	Test Result	Verdict
Effective (Isotropic) Radiated Power Output Data	§2.1046 §90.542(c) §90.542(d)	ERP ≤ 3 W.		
Peak-Average Ratio	---	Limit≤13 dB		
Modulation Characteristics	§2.1047	Digital modulation		
Bandwidth	§2.1049	OBW: No limit. EBW: No limit.		
Emission Mask	§2.1051 §90.210(n)	Transmitters designed for operation under this part on frequencies other than listed in this section must meet the emission mask requirements of Emission Mask B. Equipment operating under this part on frequencies allocated to but shared with the Federal Government, must meet the applicable Federal Government technical standards  (b) Emission Mask B. For transmitters that are equipped with an audio low-pass filter, the power of any emission must be attenuated below the unmodulated carrier power (P) as follows: (1) On any frequency removed from the assigned frequency by more than 50 percent, but not more than 100 percent of the authorized bandwidth: At least 25 dB.(2) On any frequency removed from the assigned frequency by more than 100 percent, but not more than 250 percent of the authorized bandwidth: At least 35 dB..(3) On any frequency removed from the assigned frequency by more than 250 percent of the authorized bandwidth: At least 43 + 10 log (P) dB.	Reference report SHR/2021/3000701	
Band Edges Compliance	§2.1051 §90.543(e)(2)(3)	(1) On all frequencies between 769-775 MHz and 799-805 MHz, by a factor not less than 76 + 10 log (P) dB in a 6.25 kHz band segment, for base and fixed stations.(2) On all		



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		frequencies between 769-775 MHz and 799-805 MHz, by a factor not less than $65 + 10 \log(P)$ dB in a 6.25 kHz band segment, for mobile and portable stations.(3) On any frequency between 775-788 MHz, above 805 MHz, and below 758 MHz, by at least $43 + 10 \log(P)$ dB.		
Spurious Emission at Antenna Terminals	§2.1051, §90.543(c) §90.543(f)	FCC: $\leq -13$ dBm/100 kHz, from 9 kHz to 10th harmonics but outside authorized operating frequency ranges. For operations in the 758–775 MHz and 788–805 MHz bands, all emissions including harmonics in the band 1559–1610 MHz shall be limited to -70 dBW/ MHz equivalent isotropically radiated power (EIRP) for wideband signals, and -80 dBW EIRP for discrete emissions of less than 700 Hz bandwidth.		
Field Strength of Spurious Radiation	§2.1053, §90.543(c) §90.543(f)	FCC: $\leq -13$ dBm/100 kHz. For operations in the 758–775 MHz and 788–805 MHz bands, all emissions including harmonics in the band 1559–1610 MHz shall be limited to -70 dBW/ MHz equivalent isotropically radiated power (EIRP) for wideband signals, and -80 dBW EIRP for discrete emissions of less than 700 Hz bandwidth.	Section 7 of Appendix	Pass
Frequency Stability	§2.1055(a)(1)(b) §2.1055(d)(1) §90.213	Within authorized bands of operation/frequency block.	Reference report SHR/2021/3000701	



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### 2.8 LTE Band 26(814~824 MHz)

Test Item	FCC Rule No.	Requirements	Test Result	Verdict
Transmitter Conducted Power Output	§2.1046, §90.635(b)	< 100 W.	Reference report SHR/2021/3000701	
Peak-Average Ratio	---	Limit≤13 dB		
Modulation Characteristics	§2.1047	Digital modulation		
Bandwidth	§2.1049	OBW: No limit. EBW: No limit.		
Emission Mask	§2.1051 § 90.691(a)	For any frequency removed from the EA licensee's frequency block by up to and including 37.5 kHz, the power of any emission shall be attenuated below the transmitter power (P) in watts by at least 116 Log <sub>10</sub> (f/6.1) decibels or 50+10Log <sub>10</sub> (P) decibels or 80 decibels, whichever is the lesser attenuation, where f is the frequency removed from the center of the outer channel in the block in kilohertz and where f is greater than 12.5 kHz.		
Spurious Emission at Antenna Terminals	§2.1051, §90.691	< 43 + 10Log <sub>10</sub> (P[Watts]) for all out-of-band emissions		
Field Strength of Spurious Radiation	§2.1053, §90.691	< 43 + 10Log <sub>10</sub> (P[Watts]) for all out-of-band emissions	Section 7 of Appendix	Pass
Frequency Stability	§2.1055(a)(1)(b) §2.1055(d)(1) §90.213	Within authorized bands of operation/frequency block.	Reference report SHR/2021/3000701	



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### 2.9 LTE Band 71

Test Item	FCC Rule No.	Requirements	Test Result	Verdict
Effective (Isotropic) Radiated Power Output Data	§2.1046 §27.50(c)(10)	ERP ≤ 3 W	Reference report SHR/2021/3000701	
Peak-Average Ratio	---	Limit≤13 dB		
Modulation Characteristics	§2.1047	Digital modulation		
Bandwidth	§2.1049	OBW: No limit. EBW: No limit.		
Band Edges Compliance	§2.1051, §27.53(g)	≤ -13 dBm/1%*EBW, in 1 MHz bands immediately outside and adjacent to the frequency block.		
Spurious Emission at Antenna Terminals	§2.1051, §27.53(g)	≤ -13 dBm/1 MHz, from 9 kHz to 10 <sup>th</sup> harmonics but outside authorized operating frequency ranges.		
Field Strength of Spurious Radiation	§2.1053, §27.53(g)	≤ -13 dBm/1 MHz.	Section 7 of Appendix	Pass
Frequency Stability	§2.1055(a)(1)(b) §2.1055(d)(1) §27.54	within the authorized bands of operation.	Reference report SHR/2021/3000701	

**Remark:**

This test report (Report No.: SEWM2212000291RG01 issue on 2022/12/12) copies the original report; Original test report (Report No.: SHR/2021/3000701 issue on 2021/05/06 and SZCR210602131701 issue on 2021/06/09).

Since the original report comes from different labs.

Therefore in this report only radiated spurious emissions were performed based on the worst case of the original report with report number SHR/2021/3000701 issue on 2021/05/06 and SZCR210602131701 issue on 2021/06/09 and all test data please refer to the previous report with report number SHR/2021/3000701 issue on 2021/05/06 and SZCR210602131701 issue on 2021/06/09.



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### 3 General Information

#### 3.1 Details of Client

Applicant:	Quectel Wireless Solutions Co., Ltd.
Address of Applicant:	Building 5, Shanghai Business Park Phase III (Area B), No.1016 Tianlin Road, Minhang District, Shanghai, China, 200233
Manufacturer:	Quectel Wireless Solutions Co., Ltd.
Address of Manufacturer:	Building 5, Shanghai Business Park Phase III (Area B), No.1016 Tianlin Road, Minhang District, Shanghai, China, 200233

#### 3.2 Test Location

Company:	SGS-CSTC Standards Technical Services (Suzhou) Co., Ltd.
Address:	South of No. 6 Plant, No. 1, Runsheng Road, Suzhou Industrial Park, Suzhou Area, China (Jiangsu) Pilot Free Trade Zone
Post code:	215000
Test engineer:	King-p Li

#### 3.3 Test Facility

The test facility is recognized, certified, or accredited by the following organizations:

<ul style="list-style-type: none"> <li>• <b>A2LA (Certificate No. 6336.01)</b>            SGS-CSTC STANDARDS TECHNICAL SERVICES (SUZHOU) CO., LTD. is accredited by the American Association for Laboratory Accreditation(A2LA). Certificate No. 6336.01.</li> <li>• <b>Innovation, Science and Economic Development Canada</b>            SGS-CSTC STANDARDS TECHNICAL SERVICES (SUZHOU) CO., LTD. has been recognized by ISED as an accredited testing laboratory.            CAB identifier: CN0120.            IC#: 27594.</li> <li>• <b>FCC –Designation Number: CN1312</b>            SGS-CSTC STANDARDS TECHNICAL SERVICES (SUZHOU) CO., LTD. has been recognized as an accredited testing laboratory.            Designation Number: CN1312.            Test Firm Registration Number: 717327</li> </ul>
--



### 3.4 General Description of EUT

EUT Description:	LTE Module
Model No.:	EM05-G
Trade Mark:	Quectel
Hardware Version:	R1.0
Software Version:	EM05GFAR07A05M1G
IMEI:	869283050003062
Antenna Type:	ANT1: External Antenna ANT2: PIFA Antenna
Antenna Gain:	WCDMA Band II: 1.59dBi(ANT1); 3.07dBi(ANT2);
	WCDMA Band IV: 1.94dBi(ANT1); 3.38dBi(ANT2);
	WCDMA Band V: 2.29dBi(ANT1); 3.96dBi(ANT2);
	LTE Band 2: 1.59dBi(ANT1); 3.07dBi(ANT2);
	LTE Band 4: 1.94dBi(ANT1); 3.38dBi(ANT2);
	LTE Band 5: 2.29dBi(ANT1); 3.96dBi(ANT2);
	LTE Band 7: 2.68dBi(ANT1); 3.15dBi(ANT2);
	LTE Band 12: 2.26dBi(ANT1); 3.60dBi(ANT2)
	LTE Band 13: 4.45dBi(ANT1); 3.55dBi(ANT2);
	LTE Band 14: 3.65dBi(ANT1); 3.55dBi(ANT2);
	LTE Band 25: 1.59dBi(ANT1); 3.07dBi(ANT2);
	LTE Band 26: 2.53dBi(ANT1); 3.96dBi(ANT2);
	LTE Band 38: 2.06dBi(ANT1); 3.22dBi(ANT2);
	LTE Band 41: 2.68dBi(ANT1); 3.31dBi(ANT2);
	LTE Band 66: 1.94dBi(ANT1); 3.70dBi(ANT2);
	LTE Band 71: 1.66dBi(ANT1); 3.07dBi(ANT2);
	Note:
Remark:	As above information is provided and confirmed by the applicant. SGS is not liable to the accuracy, suitability, reliability or/and integrity of the information.





### 3.5 Test Mode

Test Mode	Test Modes Description
UMTS/TM1	UMTS system, WCDMA, QPSK modulation
LTE/TM1	LTE system, QPSK modulation
LTE/TM2	LTE system, 16QAM modulation

Remark: The test mode(s) are selected according to relevant radio technology specifications.

### 3.6 Test Environment

Environment Parameter	101.0 kPa Selected Values During Tests	
Relative Humidity	44~46 % RH Ambient	
Value	Temperature(°C)	Voltage(V)
NTNV	22~23	3.3
LTLV	-30	3.135
LTHV	-30	4.4
HTLV	50	3.135
HTHV	50	4.4

Remark:  
 NV: Normal Voltage      LV: Low Extreme Test Voltage      HV: High Extreme Test Voltage  
 NT: Normal Temperature      LT: Low Extreme Test Temperature      HT: High Extreme Test Temperature

### 3.7 Description of Support Units

The EUT has been tested as an independent unit.



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### 3.8 Technical Specification

Characteristics	Description			
Radio System Type	<input checked="" type="checkbox"/> UMTS	<input checked="" type="checkbox"/> LTE		
Supported Frequency Range	Band	TX		RX
	UMTS Band II	1850 to 1910 MHz		1930 to 1990 MHz
	UMTS Band IV	1710 to 1755 MHz		2110 to 2155 MHz
	UMTS Band V	824 to 849 MHz		869 to 894 MHz
	LTE Band 2	1850 to 1910 MHz		1930 to 1990 MHz
	LTE Band 4	1710 to 1755 MHz		2110 to 2155 MHz
	LTE Band 5	824 to 849 MHz		869 to 894 MHz
	LTE Band 7	2500 to 2570 MHz		2620 to 2690 MHz
	LTE Band 12	699 to 716 MHz		729 to 746 MHz
	LTE Band 13	777 to 787 MHz		746 to 756 MHz
	LTE Band 14	788 to 798 MHz		758 to 768 MHz
	LTE Band 25	1850 to 1915MHz		1930 to 1995 MHz
	LTE Band 26 (814 to 824 MHz)	814 to 824MHz		859 to 869 MHz
	LTE Band 26 (824 to 849 MHz)	824 to 849 MHz		869 to 894 MHz
	LTE Band 38	2570 to 2620 MHz		2570 to 2620 MHz
	LTE Band 41	2496 to 2690MHz		2496 to 2690MHz
	LTE Band 66	1710 to 1780 MHz		2110 to 2200 MHz
LTE Band 71	663 to 698 MHz		617 to 652 MHz	
Supported Channel Bandwidth	UMTS system:	<input checked="" type="checkbox"/> 5 MHz		
	LTE Band 2	<input checked="" type="checkbox"/> 1.4 MHz	<input checked="" type="checkbox"/> 3 MHz	<input checked="" type="checkbox"/> 5 MHz <input checked="" type="checkbox"/> 10 MHz <input checked="" type="checkbox"/> 15 MHz <input checked="" type="checkbox"/> 20 MHz
	LTE Band 4	<input checked="" type="checkbox"/> 1.4 MHz	<input checked="" type="checkbox"/> 3 MHz	<input checked="" type="checkbox"/> 5 MHz <input checked="" type="checkbox"/> 10 MHz <input checked="" type="checkbox"/> 15 MHz <input checked="" type="checkbox"/> 20 MHz
	LTE Band 5	<input checked="" type="checkbox"/> 1.4 MHz	<input checked="" type="checkbox"/> 3 MHz	<input checked="" type="checkbox"/> 5 MHz <input checked="" type="checkbox"/> 10 MHz
	LTE Band 7	<input checked="" type="checkbox"/> 5 MHz	<input checked="" type="checkbox"/> 10 MHz	<input checked="" type="checkbox"/> 15 MHz <input checked="" type="checkbox"/> 20 MHz
	LTE Band 12	<input checked="" type="checkbox"/> 1.4 MHz	<input checked="" type="checkbox"/> 3 MHz	<input checked="" type="checkbox"/> 5 MHz <input checked="" type="checkbox"/> 10 MHz
	LTE Band 13	<input checked="" type="checkbox"/> 5 MHz	<input checked="" type="checkbox"/> 10 MHz	
	LTE Band 14	<input checked="" type="checkbox"/> 5 MHz	<input checked="" type="checkbox"/> 10 MHz	
	LTE Band 25	<input checked="" type="checkbox"/> 1.4 MHz	<input checked="" type="checkbox"/> 3 MHz	<input checked="" type="checkbox"/> 5 MHz <input checked="" type="checkbox"/> 10 MHz



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	<input checked="" type="checkbox"/> 15 MHz	<input checked="" type="checkbox"/> 20 MHz		
LTE Band 26(814-824)	<input checked="" type="checkbox"/> 1.4 MHz	<input checked="" type="checkbox"/> 3 MHz	<input checked="" type="checkbox"/> 5 MHz	<input checked="" type="checkbox"/> 10 MHz
LTE Band 26(824-849)	<input checked="" type="checkbox"/> 1.4 MHz	<input checked="" type="checkbox"/> 3 MHz	<input checked="" type="checkbox"/> 5 MHz	<input checked="" type="checkbox"/> 10 MHz
	<input checked="" type="checkbox"/> 15 MHz			
LTE Band38	<input checked="" type="checkbox"/> 5 MHz	<input checked="" type="checkbox"/> 10 MHz	<input checked="" type="checkbox"/> 15 MHz	<input checked="" type="checkbox"/> 20 MHz
LTE Band41	<input checked="" type="checkbox"/> 5 MHz	<input checked="" type="checkbox"/> 10 MHz	<input checked="" type="checkbox"/> 15 MHz	<input checked="" type="checkbox"/> 20 MHz
LTE Band66	<input checked="" type="checkbox"/> 1.4 MHz	<input checked="" type="checkbox"/> 3 MHz	<input checked="" type="checkbox"/> 5 MHz	<input checked="" type="checkbox"/> 10 MHz
	<input checked="" type="checkbox"/> 15MHz	<input checked="" type="checkbox"/> 20MHz		
LTE Band71	<input checked="" type="checkbox"/> 5MHz	<input checked="" type="checkbox"/> 10MHz	<input checked="" type="checkbox"/> 15MHz	<input checked="" type="checkbox"/> 20MHz
Note1: WCDMA supports HSUPA, HSDPA, DC-HSDPA,HSPA+, but only the worst case was tested and the data displayed in this report.				



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### 3.9 Test Frequencies

Test Mode	TX / RX	RF Channel		
		Low (L)	Middle (M)	High (H)
WCDMA Band II	TX	Channel 9262	Channel 9400	Channel 9538
		1852.4 MHz	1880.0 MHz	1907.6 MHz
	RX	Channel 9662	Channel 9800	Channel 9938
		1932.4 MHz	1960.0 MHz	1987.6 MHz

Test Mode	TX / RX	RF Channel		
		Low (L)	Middle (M)	High (H)
WCDMA Band IV	TX	Channel 1312	Channel 1413	Channel 1513
		1712.4MHz	1732.6 MHz	1752.6 MHz
	RX	Channel 1537	Channel 1638	Channel 1738
		2112.4 MHz	2132.6 MHz	2152.6 MHz

Test Mode	TX / RX	RF Channel		
		Low (L)	Middle (M)	High (H)
WCDMA Band V	TX	Channel 4132	Channel 4182	Channel 4233
		826.4MHz	836.4 MHz	846.6 MHz
	RX	Channel 4357	Channel 4407	Channel 4458
		871.4 MHz	881.4 MHz	891.6 MHz



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Test Mode	Bandwidth	TX / RX	RF Channel		
			Low (L)	Middle (M)	High (H)
LTE Band 2	1.4MHz	TX	Channel 18607	Channel 18900	Channel 19193
			1850.7 MHz	1880 MHz	1909.3 MHz
		RX	Channel 607	Channel 900	Channel 1193
			1930.7 MHz	1960 MHz	1989.3 MHz
	3MHz	TX	Channel 18615	Channel 18900	Channel 19185
			1851.5 MHz	1880 MHz	1908.5 MHz
		RX	Channel 615	Channel 900	Channel 1185
			1931.5 MHz	1960 MHz	1988.5 MHz
	5MHz	TX	Channel 18625	Channel 18900	Channel 19175
			1852.5 MHz	1880 MHz	1907.5 MHz
		RX	Channel 625	Channel 900	Channel 1175
			1932.5 MHz	1960 MHz	1987.5 MHz
	10MHz	TX	Channel 18650	Channel 18900	Channel 19150
			1855 MHz	1880 MHz	1905 MHz
		RX	Channel 650	Channel 900	Channel 1150
			1935 MHz	1960 MHz	1985 MHz
	15MHz	TX	Channel 18675	Channel 18900	Channel 19125
			1857.5 MHz	1880 MHz	1902.5 MHz
		RX	Channel 675	Channel 900	Channel 1125
			1937.5 MHz	1960 MHz	1982.5 MHz
	20MHz	TX	Channel 18700	Channel 18900	Channel 19100
			1860 MHz	1880 MHz	1900 MHz
		RX	Channel 700	Channel 900	Channel 1100
			1940 MHz	1960 MHz	1980 MHz



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Test Mode	Bandwidth	TX / RX	RF Channel		
			Low (L)	Middle (M)	High (H)
LTE Band 4	1.4MHz	TX	Channel 19957 1710.7 MHz	Channel 20175 1732.5 MHz	Channel 20393 1754.3 MHz
		RX	Channel 1975 2112.5 MHz	Channel 2175 2132.5MHz	Channel 2375 2152.5 MHz
	3MHz	TX	Channel 19965 1711.5 MHz	Channel 20175 1732.5 MHz	Channel 20385 1753.5 MHz
		RX	Channel 2000 2115 MHz	Channel 2175 2132.5MHz	Channel 2350 2150 MHz
	5MHz	TX	Channel 19975 1712.5 MHz	Channel 20175 1732.5 MHz	Channel 20375 1752.5 MHz
		RX	Channel 1975 2112.5 MHz	Channel 2175 2132.5MHz	Channel 2375 2152.5 MHz
	10MHz	TX	Channel 20000 1715 MHz	Channel 20175 1732.5 MHz	Channel 20350 1750 MHz
		RX	Channel 2000 2115 MHz	Channel 2175 2132.5MHz	Channel 2350 2150 MHz
	15MHz	TX	Channel 20025 1717.5 MHz	Channel 20175 1732.5 MHz	Channel 20325 1747.5 MHz
		RX	Channel 2025 2117.5 MHz	Channel 2175 2132.5MHz	Channel 2325 2147.5 MHz
	20MHz	TX	Channel 20050 1720 MHz	Channel 20175 1732.5 MHz	Channel 20300 1745 MHz
		RX	Channel 2050 2120 MHz	Channel 2175 2132.5MHz	Channel 2300 2145 MHz

Test Mode	Bandwidth	TX / RX	RF Channel		
			Low (L)	Middle (M)	High (H)
LTE Band 5	1.4MHz	TX	Channel 20407 824.7 MHz	Channel 20525 836.5 MHz	Channel 20643 848.3 MHz
		RX	Channel 2407 869.7 MHz	Channel 2525 881.5 MHz	Channel 2643 893.3 MHz
	3MHz	TX	Channel 20415 825.5 MHz	Channel 20525 836.5 MHz	Channel 20635 847.5 MHz
		RX	Channel 2415 870.5 MHz	Channel 2525 881.5 MHz	Channel 2635 892.5 MHz
	5MHz	TX	Channel 20425 826.5 MHz	Channel 20525 836.5 MHz	Channel 20625 846.5 MHz
		RX	Channel 2425 871.5 MHz	Channel 2525 881.5 MHz	Channel 2625 891.5 MHz
	10MHz	TX	Channel 20450 829 MHz	Channel 20525 836.5 MHz	Channel 20600 844 MHz
		RX	Channel 2450 874 MHz	Channel 2525 881.5 MHz	Channel 2600 889 MHz



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Test Mode	Bandwidth	TX / RX	RF Channel		
			Low (L)	Middle (M)	High (H)
LTE Band 7	5MHz	TX	Channel 20775	Channel 21100	Channel 21425
			2502.5 MHz	2535 MHz	2567.5 MHz
		RX	Channel 2775	Channel 3100	Channel 5825
			2622.5 MHz	2655 MHz	2687.5 MHz
	10MHz	TX	Channel 20800	Channel 21100	Channel 21400
			2505 MHz	2535 MHz	2565 MHz
		RX	Channel 2800	Channel 3100	Channel 3400
			2625 MHz	2655 MHz	2685 MHz
	15MHz	TX	Channel 20825	Channel 21100	Channel 21375
			2507.5 MHz	2535 MHz	2562.5 MHz
		RX	Channel 2825	Channel 3100	Channel 3375
			2627.5 MHz	2655 MHz	2682.5 MHz
20MHz	TX	Channel 20850	Channel 21100	Channel 21350	
		2510 MHz	2535 MHz	2560 MHz	
	RX	Channel 2850	Channel 3100	Channel 3350	
		2630 MHz	2655 MHz	2680 MHz	

Test Mode	Bandwidth	TX / RX	RF Channel		
			Low (L)	Middle (M)	High (H)
LTE Band 12	1.4MHz	TX	Channel 23017	Channel 23095	Channel 23173
			699.7 MHz	707.5 MHz	715.3 MHz
		RX	Channel 5017	Channel 5095	Channel 5173
			729.7 MHz	737.5 MHz	745.3 MHz
	3MHz	TX	Channel 23025	Channel 23095	Channel 23165
			700.5 MHz	707.5 MHz	714.5 MHz
		RX	Channel 5025	Channel 5095	Channel 5165
			730.5 MHz	737.5 MHz	744.5 MHz
	5MHz	TX	Channel 23035	Channel 23095	Channel 23155
			701.5 MHz	707.5 MHz	713.5 MHz
		RX	Channel 5035	Channel 5095	Channel 5155
			731.5 MHz	737.5 MHz	743.5 MHz
10MHz	TX	Channel 23060	Channel 23095	Channel 23130	
		704 MHz	707.5 MHz	711 MHz	
	RX	Channel 5060	Channel 5095	Channel 5130	
		734 MHz	737.5 MHz	741 MHz	



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Test Mode	Bandwidth	TX / RX	RF Channel		
			Low (L)	Middle (M)	High (H)
LTE Band 13	5MHz	TX	Channel 23025	Channel 23230	Channel 23255
			779.5 MHz	782 MHz	784.5 MHz
		RX	Channel 5205	Channel 5230	Channel 5255
			748.5 MHz	751 MHz	753.5 MHz
	10MHz	TX	Channel 23230	Channel 23230	Channel 23230
		782 MHz	782 MHz	782 MHz	
RX	Channel 5230	Channel 5230	Channel 5230		
751 MHz	751 MHz	751 MHz			

Test Mode	Bandwidth	TX / RX	RF Channel		
			Low (L)	Middle (M)	High (H)
LTE Band 14	5MHz	TX	Channel 23305	Channel 23330	Channel 23355
			790.5 MHz	793 MHz	795.5 MHz
		RX	Channel 5305	Channel 5330	Channel 5355
			760.5 MHz	763 MHz	765.5 MHz
	10MHz	TX	Channel 23330	Channel 23330	Channel 23330
		793MHz	793 MHz	793 MHz	
RX	Channel 5330	Channel 5330	Channel 5330		
763MHz	763 MHz	763 MHz			

Test Mode	Bandwidth	TX / RX	RF Channel		
			Low (L)	Middle (M)	High (H)
LTE Band 25	1.4MHz	TX	Channel 26047	Channel 26365	Channel 26683
			1850.7 MHz	1882.5 MHz	1914.3 MHz
		RX	Channel 8047	Channel 8365	Channel 8683
			1930.7 MHz	1962.5 MHz	1994.3 MHz
	3MHz	TX	Channel 26055	Channel 26365	Channel 26675
			1851.5 MHz	1882.5 MHz	1913.5 MHz
		RX	Channel 8055	Channel 8365	Channel 8675
			1931.5 MHz	1962.5 MHz	1993.5 MHz
	5MHz	TX	Channel 26065	Channel 26365	Channel 26665
			1852.5 MHz	1882.5 MHz	1912.5 MHz
		RX	Channel 8065	Channel 8365	Channel 8665
			1932.5 MHz	1962.5 MHz	1992.5 MHz
	10MHz	TX	Channel 26090	Channel 26365	Channel 26640
			1855 MHz	1882.5 MHz	1910 MHz
		RX	Channel 8090	Channel 8365	Channel 8640
			1935 MHz	1962.5 MHz	1990 MHz
	15MHz	TX	Channel 26115	Channel 26365	Channel 26615
			1857.5 MHz	1882.5 MHz	1907.5 MHz
		RX	Channel 8115	Channel 8365	Channel 8615
			1937.5 MHz	1962.5 MHz	1987.5 MHz
	20MHz	TX	Channel 26140	Channel 26365	Channel 26590
			1860 MHz	1882.5 MHz	1905 MHz
		RX	Channel 8140	Channel 8365	Channel 8590
			1940 MHz	1962.5 MHz	1985 MHz



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Test Mode	Bandwidth	TX / RX	RF Channel		
			Low (L)	Middle (M)	High (H)
LTE Band 26 (814-824)	1.4MHz	TX	Channel 26697	Channel 26740	Channel 26783
			814.7 MHz	819 MHz	823.3 MHz
		RX	Channel 8697	Channel 8740	Channel 8783
			859.7 MHz	864MHz	868.3 MHz
	3MHz	TX	Channel 26705	Channel 26740	Channel 26775
			815.5 MHz	819 MHz	822.5 MHz
		RX	Channel 8705	Channel 8740	Channel 8775
			860.5 MHz	864MHz	867.5 MHz
	5MHz	TX	Channel 26715	Channel 26740	Channel 26765
			816.5 MHz	819 MHz	821.5 MHz
		RX	Channel 8715	Channel 8740	Channel 8755
			861.5 MHz	864MHz	866.5 MHz
10MHz	TX	Channel 26740	Channel 26740	Channel 26740	
		819 MHz	819 MHz	819 MHz	
	RX	Channel 8740	Channel 8740	Channel 8740	
		864MHz	864MHz	864MHz	

Test Mode	Bandwidth	TX / RX	RF Channel		
			Low (L)	Middle (M)	High (H)
LTE Band26 (824-849)	1.4MHz	TX	Channel 26797	Channel 26915	Channel 27033
			824.7 MHz	836.5 MHz	848.3 MHz
		RX	Channel 8697	Channel 8915	Channel 9033
			859.7 MHz	881.5 MHz	893.3 MHz
	3MHz	TX	Channel 26805	Channel 26915	Channel 27025
			825.5 MHz	836.5 MHz	847.5 MHz
		RX	Channel 8805	Channel 8915	Channel 9025
			860.5 MHz	881.5 MHz	892.5 MHz
	5MHz	TX	Channel 26815	Channel 26915	Channel 27015
			826.5 MHz	836.5 MHz	846.5 MHz
		RX	Channel 8815	Channel 8915	Channel 9015
			871.5 MHz	881.5 MHz	891.5 MHz
	10MHz	TX	Channel 26840	Channel 26915	Channel 26990
			829 MHz	836.5 MHz	844 MHz
		RX	Channel 8840	Channel 8915	Channel 8990
			874 MHz	881.5 MHz	889 MHz
15MHz	TX	Channel 26865	Channel 26915	Channel 26965	
		831.5 MHz	836.5 MHz	841.5 MHz	
	RX	Channel 8865	Channel 8915	Channel 8965	
		876.5 MHz	881.5 MHz	886.5 MHz	



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Test Mode	Bandwidth	TX / RX	RF Channel		
			Low (L)	Middle (M)	High (H)
LTE Band 38	5MHz	TX/RX	Channel 37775	Channel38000	Channel 38225
			2572.5 MHz	2595 MHz	2617.5 MHz
	10MHz	TX/RX	Channel 37800	Channel38000	Channel 38200
			2575 MHz	2595 MHz	2615 MHz
	15MHz	TX/RX	Channel 37825	Channel38000	Channel 38175
			2577.5 MHz	2595 MHz	2612.5 MHz
	20MHz	TX/RX	Channel 37850	Channel38000	Channel 38150
			2580 MHz	2595 MHz	2610 MHz

Test Mode	Bandwidth	TX / RX	RF Channel		
			Low (L)	Middle (M)	High (H)
LTE Band 41 (2496-2690)	5MHz	TX / RX	Channel 39675	Channel40620	Channel 41565
			2498.5 MHz	2593 MHz	2687.5 MHz
	10MHz	TX / RX	Channel 39700	Channel40620	Channel 41540
			2501 MHz	2593 MHz	2685 MHz
	15MHz	TX / RX	Channel 39725	Channel40620	Channel 41515
			2503.5 MHz	2593 MHz	2682.5 MHz
	20MHz	TX / RX	Channel 39750	Channel40620	Channel 41490
			2506 MHz	2593 MHz	2680 MHz



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Test Mode	Bandwidth	TX / RX	RF Channel		
			Low (L)	Middle (M)	High (H)
LTE Band66	1.4MHz	TX	Channel 131979	Channel 132322	Channel 132665
			1710.7 MHz	1745 MHz	1779.3 MHz
		RX	Channel 66443	Channel 66786	Channel 67329
			2110.7 MHz	2145MHz	2199.3 MHz
	3MHz	TX	Channel 131987	Channel 132322	Channel 132657
			1711.5 MHz	1745 MHz	1778.5MHz
		RX	Channel 66451	Channel 66786	Channel 67321
			2111.5 MHz	2145MHz	2198.5MHz
	5MHz	TX	Channel 131997	Channel 132322	Channel 132647
			1712.5 MHz	1745 MHz	1777.5 MHz
		RX	Channel 66461	Channel 66786	Channel 67311
			2112.5 MHz	2145MHz	2197.5 MHz
	10MHz	TX	Channel 132022	Channel 132322	Channel 132622
			1715 MHz	1745 MHz	1775 MHz
		RX	Channel 66486	Channel 66786	Channel 67286
			2115 MHz	2145MHz	2195 MHz
	15MHz	TX	Channel 132047	Channel 132322	Channel 132597
			1717.5 MHz	1745 MHz	1772.5 MHz
		RX	Channel 66511	Channel 66786	Channel 67261
			2117.5 MHz	2145MHz	2192.5 MHz
	20MHz	TX	Channel 132072	Channel 132322	Channel 132572
			1720 MHz	1745 MHz	1770 MHz
		RX	Channel 66536	Channel 66786	Channel 67236
			2120 MHz	2145MHz	2190 MHz



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Test Mode	Bandwidth	TX / RX	RF Channel		
			Low (L)	Middle (M)	High (H)
LTE Band71	5MHz	TX	Channel 133147	Channel 133297	Channel 133447
			665.5 MHz	680.5 MHz	695.5 MHz
		RX	Channel 68611	Channel 68761	Channel 68911
			619.5 MHz	634.5 MHz	649.5 MHz
	10MHz	TX	Channel 133172	Channel 133297	Channel 133422
			668 MHz	680.5 MHz	693 MHz
		RX	Channel 68636	Channel 68761	Channel 68886
			622 MHz	634.5 MHz	647 MHz
	15MHz	TX	Channel 133197	Channel 133297	Channel 133397
			670.5 MHz	680.5 MHz	690.5 MHz
		RX	Channel 68661	Channel 68761	Channel 68861
			624.5 MHz	634.5 MHz	644.5 MHz
20MHz	TX	Channel 133222	Channel 133297	Channel 133372	
		673 MHz	680.5 MHz	688 MHz	
	RX	Channel 68686	Channel 68761	Channel 68836	
		627 MHz	634.5 MHz	642 MHz	



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## 4 Description of Tests

### 4.1 Conducted Output Power

Measurement Procedure: FCC KDB 971168 D01 V03r01 Section 5.2.1

The transmitter output was connected to a calibrated coaxial cable, attenuator and power meter, the other end of which was connected to a Base Station Simulator. The Base Station Simulator was set to force the EUT to its maximum power setting. The power output at the transmitter antenna port was determined by adding the value of the cable insertion loss to the power reading. The tests were performed at three frequencies (low channel, middle channel and high channel) and on the highest power levels, which can be setup on the transmitters.

**Remark: Reference test setup 1**



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## 4.2 Effective (Isotropic) Radiated Power of Transmitter

Measurement Procedure: FCC KDB 971168 D01 V03r01 Section 5.8.4

Calculate power in dBm by the following formula:

ERP (dBm) = Conducted Power (dBm) + antenna gain (dBi)

EIRP(dBm) = Conducted Power (dBm) + antenna gain (dBi)

EIRP=ERP+2.15dB



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### 4.3 Occupied Bandwidth

Measurement Procedure: FCC KDB 971168 D01 V03r01 Section 4.2 & 4.3

The occupied bandwidth, 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. The transmitter output was connected to a calibrated coaxial cable, attenuator and Spectrum analyser, the other end of which was connected to a Base Station Simulator. The Base Station Simulator was set to force the EUT to its maximum power setting. The tests were performed at three frequencies (low channel, middle channel and high channel). The span of the analyzer shall be set to capture all products of the modulation process, including the emission skirts. The resolution bandwidth shall be set to as close to 1 percent of the selected span as is possible without being below 1 percent. The video bandwidth shall be set to 3 times the resolution bandwidth. Video averaging is not permitted. Where practical, a sampling detector shall be used since a peak or, peak hold, may produce a wider bandwidth than actual. The trace data points are recovered and are directly summed in linear terms. The recovered amplitude data points, beginning at the lowest frequency, are placed in a running sum until 0.5 percent of the total is reached and that frequency recorded. The process is repeated for the highest frequency data points. This frequency is recorded. The span between the two recorded frequencies is the occupied bandwidth.

**Remark: Reference test setup 1**

Test Settings

1. The signal analyzer's automatic bandwidth measurement capability was used to perform the 99% occupied bandwidth and the 26dB bandwidth. The bandwidth measurement was not influenced by any intermediate power nulls in the fundamental emission.
2. RBW = 1 – 5% of the expected OBW
3. VBW ≥ 3 x RBW
4. Detector = Peak
5. Trace mode = max hold
6. Sweep = auto couple
7. The trace was allowed to stabilize
8. If necessary, steps 2 – 7 were repeated after changing the RBW such that it would be within 1 – 5% of the 99% occupied bandwidth observed in Step 7



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#### 4.4 Band Edge at Antenna Terminals

Measurement Procedure: FCC KDB 971168 D01 V03r01 Section 6.0

The transmitter output was connected to a calibrated coaxial cable, attenuator and Spectrum analyser, the other end of which was connected to a Base Station Simulator. The Base Station Simulator was set to force the EUT to its maximum power setting. The tests were performed at two frequencies (low channel and high channel).in the 1MHz bands immediately outside and adjacent to the frequency block a resolution bandwidth of 100kHz or 1% of the emission bandwidth of the fundamental emission of the transmitter may be employed. The EUT emission bandwidth is measured as the width of the signal between two points, outside of which all emission are attenuated at least 26dB below the transmitter power. The video bandwidth of the spectrum analyzer was set at thrice the resolution bandwidth. Detector Mode was set to rms.

**Remark: Reference test setup 1**

Test Settings

1. Start and stop frequency were set such that the band edge would be placed in the center of the plot
2. Span was set large enough so as to capture all out of band emissions near the band edge
3. RBW  $\geq$  1% of the emission bandwidth
4. VBW  $\geq$  3 x RBW
5. Detector = RMS
6. Number of sweep points  $\geq$  2 x Span/RBW
7. Trace mode = trace average for continuous emissions, max hold for pulse emissions
8. Sweep time = auto couple
9. The trace was allowed to stabilize



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## 4.5 Spurious And Harmonic Emissions at Antenna Terminal

Measurement Procedure: FCC KDB 971168 D01 V03r01 Section 6.0

The transmitter output was connected to a calibrated coaxial cable, attenuator and Spectrum analyzer, the other end of which was connected to a Base Station Simulator. The Base Station Simulator was set to force the EUT to its maximum power setting. The tests were performed at three frequencies (low channel and high channel). The level of the carrier and the various conducted spurious and harmonic frequencies is measured by means of a calibrated spectrum analyzer. The spectrum is scanned from the lowest frequency generated in the equipment up to a frequency including its 10th harmonic. On any frequency outside a licensee's frequency block, the power of any emission shall be attenuated below the transmitter power (P) by at least  $43 + 10 \log(P)$  dB. Compliance with these provisions is based on the use of measurement instrumentation employing a resolution bandwidth of 1 MHz or greater. However, in the 1 MHz bands immediately outside and adjacent to the frequency block a resolution bandwidth of at least one percent of the emission bandwidth of the fundamental emission of the transmitter may be employed. The emission bandwidth is defined as the width of the signal between two points, one below the carrier center frequency and one above the carrier center frequency, outside of which all emission are attenuated at least 26 dB below the transmitter power.

### Remark: Reference test setup 1

#### Test Settings

1. Start frequency was set to 9kHz and stop frequency was set to at least 10\* the fundamental frequency (Separated into at least two plots per channel)
2. Detector = RMS
3. Trace mode = trace average for continuous emissions, max hold for pulse emissions
4. Sweep time = auto couple
5. The trace was allowed to stabilize
6. Please see test notes below for RBW and VBW settings



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## 4.6 Peak-Average Ratio

Measurement Procedure: FCC KDB 971168 D01 V03r01 Section 5.7.2

A peak to average ratio measurement is performed at the conducted port of the EUT. For WCDMA signals, the spectrum analyzers Complementary Cumulative Distribution Function (CCDF) measurement profile is used to determine the largest deviation between the average and the peak power of the EUT in a given bandwidth. The CCDF curve shows how much time the peak waveform spends at or above a given average power level. The percent of time the signal spends at or above the level defines the probability for that particular power level. For GSM signals, an average and a peak trace are used on a spectrum analyzer to determine the largest deviation between the average and the peak power of the EUT in a bandwidth greater than the emission bandwidth. The traces are generated with the spectrum analyzer set to zero span mode.

### Remark: Reference test setup 1

#### Test Settings

1. The signal analyzer's CCDF measurement profile is enabled
2. Frequency = carrier center frequency
3. Measurement BW > Emission bandwidth of signal
4. The signal analyzer was set to collect one million samples to generate the CCDF curve
5. The measurement interval was set depending on the type of signal analyzed. For continuous signals (>98% duty cycle), the measurement interval was set to 1ms. For burst transmissions, the spectrum analyzer is set to use an internal "RF Burst" trigger that is synced with an incoming pulse and the measurement interval is set to less than the duration of the "on time" of one burst to ensure that energy is only captured during a time in which the transmitter is operating at maximum power



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### 4.7 Field Strength of Spurious Radiation

Measurement Procedure: FCC KDB 971168 D01 V03r01 Section 5.8

**Below 1GHz test procedure as below:**

- 1). The EUT was powered ON and placed on a 80cm high table in the chamber. The antenna of the transmitter was extended to its maximum length.
- 2). The disturbance of the transmitter was maximized on the test receiver display by raising and lowering from 1m to 4m (for the test frequency of below 30MHz, the antenna was tuned to heights 1 meter) the receive antenna and by rotating through 360° the turntable. After the fundamental emission was maximized, a field strength measurement was made.
- 3). Steps 1) and 2) were performed with the EUT and the receive antenna in both vertical and horizontal polarization.
- 4). Test the EUT in the lowest channel, the middle channel ,the Highest channel.
- 5). The radiation measurements are performed in X, Y, Z axis positioning. And found the X axis positioning which it is worse case, Only the test worst case mode is recorded in the report.
- 6). Repeat above procedures until all frequencies measured was complete.

$$E \text{ (dB}\mu\text{V/m)} = \text{Measured amplitude level (dB}\mu\text{V)} + (\text{Cable Loss (dB)} + \text{Antenna Factor (dB/m)} - \text{AMP(dB)})$$

$$\text{EIRP (dBm)} = E \text{ (dB}\mu\text{V/m)} + 20 \log D - 104.8; \text{ where D is the measurement distance in meters}$$

**Above 1GHz test procedure as below:**

- 1) Different between above is the test site, change from Semi- Anechoic Chamber to fully Anechoic Chamber
- 2) Calculate power in dBm by the following formula:  

$$E \text{ (dB}\mu\text{V/m)} = \text{Measured amplitude level (dB}\mu\text{V)} + (\text{Cable Loss (dB)} + \text{Antenna Factor (dB/m)} - \text{AMP(dB)})$$

$$\text{EIRP (dBm)} = E \text{ (dB}\mu\text{V/m)} + 20 \log D - 104.8; \text{ where D is the measurement distance in meters}$$
- 3). Test the EUT in the lowest channel, the middle channel the Highest channel
- 4). The radiation measurements are performed in X, Y, Z axis positioning. And found the X axis positioning which it is worse case, Only the test worst case mode is recorded in the report.
- 5). Repeat above procedures until all frequencies measured was complete

Remark1: Reference test setup 2

Remark2: The emission below 18G were measured at a 3m test distance, while emissions above 18GHz were measured at a 1m test distance. At a measurement distance of 1 meter the limit line was increased by  $20 \cdot \text{LOG}(3/1) = 9.54 \text{ dB}$ .

**Remark: Reference test setup 2**

Remark:

- 1) The field strength is calculated by adding the Antenna Factor, Cable Factor & AMP. The basic equation with a sample calculation is as follows:  

$$\text{AF} = \text{Antenna Factor(dB/m)}$$

$$\text{Factor} = \text{Cable Factor(dB)} - \text{Preamplifier (dB)}$$

$$\text{Level} = \text{Reading Level} + \text{AF} + \text{Factor} - 95.26$$

$$\text{Margin} = \text{Limit} - \text{Level}$$
- 2) Scan from 9kHz to 40GHz, The disturbance between 9kHz to 30MHz and 18GHz to 40GHz was very low, and the harmonics were the highest point could be found when testing, so only the harmonics had been displayed. The amplitude of spurious emissions from the radiator which are attenuated more than 20dB below the limit need not be reported.
- 3) All modes have been tested, but only the worst case data displayed in this report.



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### 4.8 Frequency Stability / Temperature Variation

Measurement Procedure:

Frequency stability testing is performed in accordance with the guidelines of FCC KDB 971168 D01 V03r01; Section 9

. The frequency stability of the transmitter is measured by:

- a.) **Temperature:** The temperature is varied from -30°C to +50°C in 10°C increments using an environmental chamber.
- b.) **Primary Supply Voltage:** The primary supply voltage is varied from 85% to 115% of the nominal value for non hand-carried battery and AC powered equipment. For hand-carried, battery-powered equipment, primary supply voltage is reduced to the battery operating end point which shall be specified by the manufacturer.

Specification – The frequency stability shall be sufficient to ensure that the fundamental emission stays within the authorized frequency block. The frequency stability of the transmitter shall be maintained within ±0.00025% (±2.5 ppm ) of the center frequency.

#### Time Period and Procedure:

1. The carrier frequency of the transmitter is measured at room temperature (20°C to provide a reference).
2. The equipment is turned on in a “standby” condition for fifteen minutes before applying power to the transmitter. Measurement of the carrier frequency of the transmitter is made within one minute after applying power to the transmitter.
3. Frequency measurements are made at 10°C intervals ranging from -30°C to +50°C. A period of at least one half-hour is provided to allow stabilization of the equipment at each temperature level.

**Remark: Reference test setup 3**

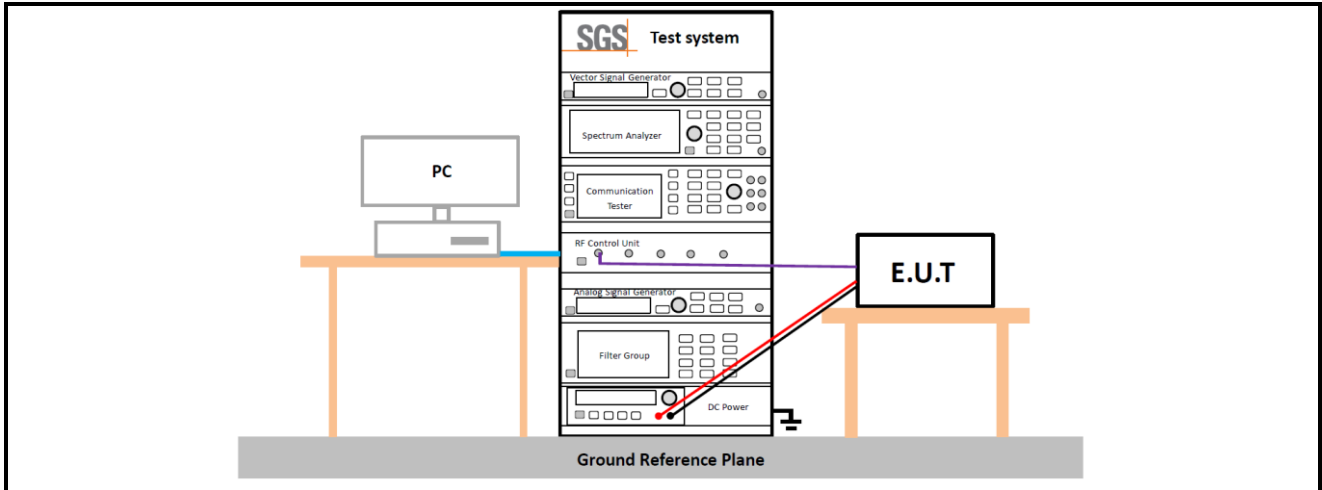


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## 4.9 Test Setups

### 4.9.1 Test Setup 1



### 4.9.2 Test Setup 2

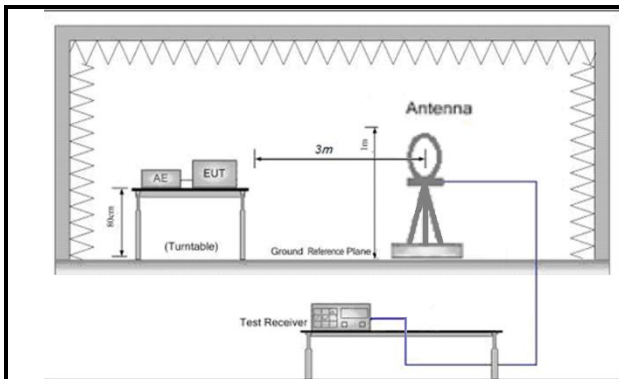


Figure 1. Below 30MHz

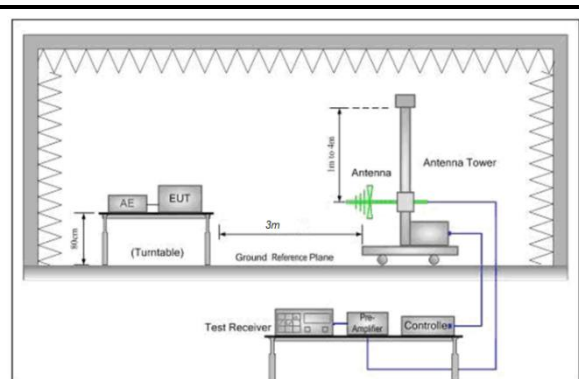


Figure 2. 30MHz to 1GHz

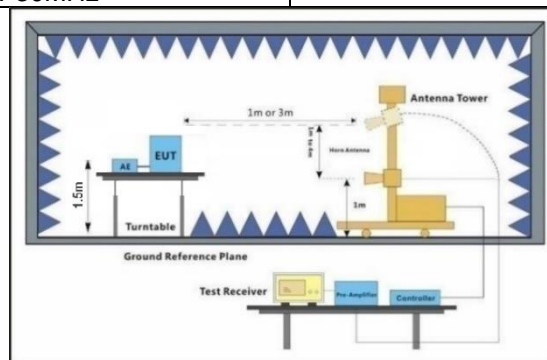


Figure 3. above 1GHz



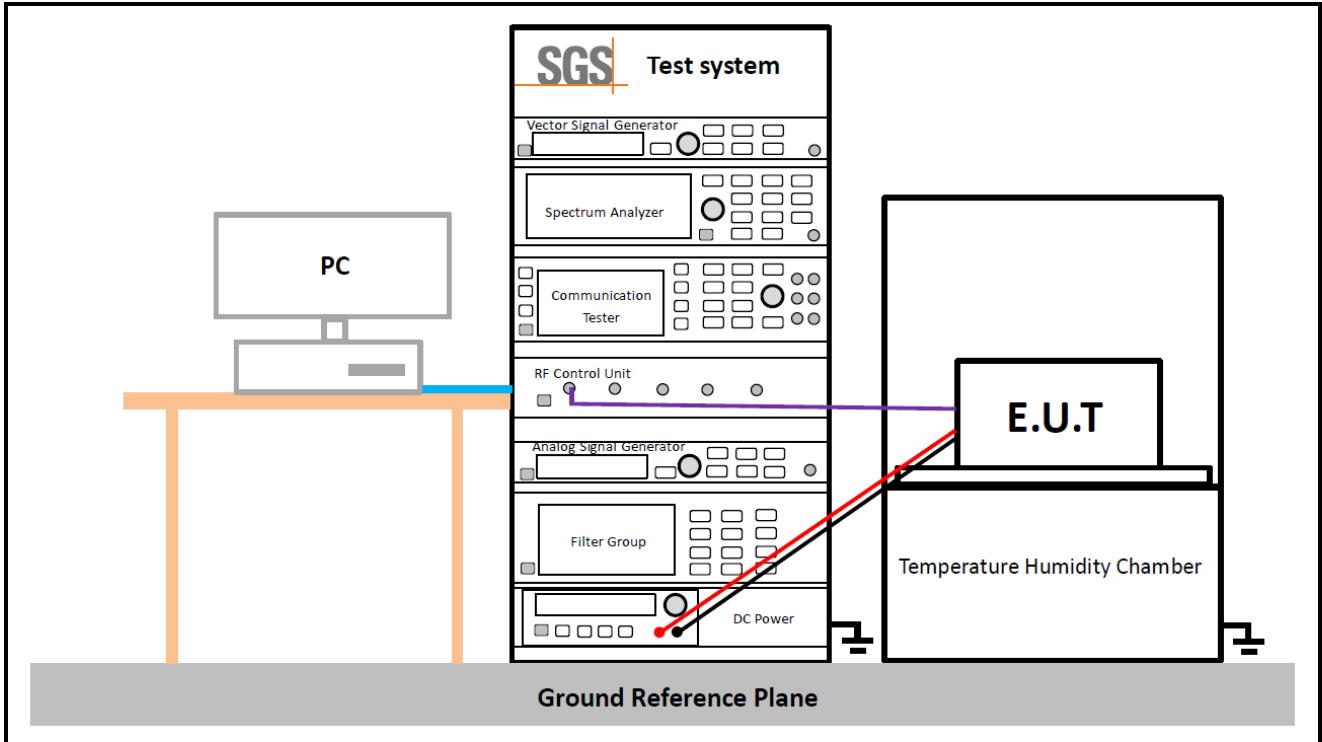
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4.9.3 Test Setup 3



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**4.10 Test Conditions**

<b>Transmit Output Power Data - Average Power, Total</b>	
<b>Test Case</b>	<b>Test Conditions</b>
Test Environment	Ambient Climate & Rated Voltage
Test Setup	Test Setup 1
RF Channels (TX)	L, M, H (L= low channel, M= middle channel, H= high channel)
Test Mode	UMTS/TM1;LTE/TM1;LTE/TM2
<b>Peak-to-Average Ratio</b>	
<b>Test Case</b>	<b>Test Conditions</b>
Test Environment	Ambient Climate & Rated Voltage
Test Setup	Test Setup 1
RF Channels (TX)	L, M, H (L= low channel, M= middle channel, H= high channel)
Test Mode	UMTS/TM1;LTE/TM1;LTE/TM2
<b>Modulation Characteristics</b>	
<b>Test Case</b>	<b>Test Conditions</b>
Test Environment	Ambient Climate & Rated Voltage
Test Setup	Test Setup 1
RF Channels (TX)	M (M= middle channel)
Test Mode	UMTS/TM1;LTE/TM1;LTE/TM2
<b>Bandwidth - Occupied Bandwidth</b>	
<b>Test Case</b>	<b>Test Conditions</b>
Test Environment	Ambient Climate & Rated Voltage
Test Setup	Test Setup 1
RF Channels (TX)	L, M, H (L= low channel, M= middle channel, H= high channel )
Test Mode	UMTS/TM1;LTE/TM1;LTE/TM2
<b>Bandwidth - Emission Bandwidth</b>	
<b>Test Case</b>	<b>Test Conditions</b>
Test Environment	Ambient Climate & Rated Voltage
Test Setup	Test Setup 1
RF Channels (TX)	L, M, H (L= low channel, M= middle channel, H= high channel )
Test Mode	UMTS/TM1;LTE/TM1;LTE/TM2
<b>Band Edges Compliance</b>	
<b>Test Case</b>	<b>Test Conditions</b>



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Test Environment	Ambient Climate & Rated Voltage
Test Setup	Test Setup 1
RF Channels (TX)	L, H (L= low channel, H= high channel)
Test Mode	UMTS/TM1;LTE/TM1;LTE/TM2
<b>Spurious Emission at Antenna Terminals</b>	
<b>Test Case</b>	<b>Test Conditions</b>
Test Environment	Ambient Climate & Rated Voltage
Test Setup	Test Setup 1
RF Channels (TX)	L, M, H (L= low channel, M= middle channel, H= high channel)
Test Mode	UMTS/TM1;LTE/TM1;LTE/TM2
<b>Field Strength of Spurious Radiation</b>	
<b>Test Case</b>	<b>Test Conditions</b>
Test Environment	Ambient Climate & Rated Voltage
Test Setup	Test Setup 2
RF Channels (TX)	L, M, H (L= low channel, M= middle channel, H= high channel)
Test Mode	UMTS/TM1;LTE/TM1 Remark: If applicable, the EUT conf. that has maximum power density (based on the equivalent power level) is selected.
<b>Frequency Stability</b>	
<b>Test Case</b>	<b>Test Conditions</b>
Test Environment	(1) -30 °C to +50 °C with step 10 °C at Rated Voltage (2) VL, VN and VH of Rated Voltage at Ambient Climate.
Test Setup	Test Setup 3
RF Channels (TX)	M (M= middle channel)
Test Mode	UMTS/TM1;LTE/TM1;LTE/TM2



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## 5 Main Test Instruments

RSE Test System					
Test Equipment	Manufacturer	Model No.	Inventory No.	Cal. date (yyyy/mm/dd)	Cal.Due date (yyyy/mm/dd)
Semi-Anechoic Chamber	Brilliant-emc	N/A	SUWI-04-02-01	2021/05/08	2024/05/07
Temperature and humidity meter	MingGao	TH101B	SUWI-01-01-05	2022/02/16	2023/02/15
Signal Analyzer	ROHDE&SCHWARZ	FSW43	SUWI-01-02-04	2022/05/28	2023/05/27
Signal Analyzer	KEYSIGHT	N9020A	SUWI-01-02-05	2022/11/23	2023/11/22
Test receiver	ROHDE&SCHWARZ	ESR7	SUWI-01-10-01	2022/02/19	2023/02/18
Receiving antenna	SCHWRZBECK MESS-ELEKTRONIK	VULB 9163	SUWI-01-11-01	2021/05/16	2023/05/15
Receiving antenna	SCHWRZBECK MESS-ELEKTRONIK	BBHA 9120D	SUWI-01-11-02	2021/05/16	2023/05/15
Receiving antenna	SCHWRZBECK MESS-ELEKTRONIK	BBHA 9170	SUWI-01-11-03	2021/05/14	2023/05/13
Amplifier	Tonscend	TAP9K3G40	SUWI-01-14-01	2022/02/14	2023/02/13
Amplifier	Tonscend	TAP01018050	SUWI-01-14-02	2022/02/14	2023/02/13
Amplifier	Tonscend	TAP18040048	SUWI-01-14-03	2022/02/19	2023/02/18
Active Loop Antenna	SCHWRZBECK MESS-ELEKTRONIK	FMZB 1519B	SUWI-01-21-01	2021/06/10	2023/06/09
Wideband Radio Communication Tester	Anritsu	MT8820C	SUWI-01-16-08	2022/02/14	2023/02/13
Measurement Software	Tonscend	JS32-RE 4.0.0.0	SUWI-02-09-04	NCR	NCR



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## 6 Measurement Uncertainty

No.	Item	Measurement Uncertainty
1	Radiated Emission	± 3.13dB (9k - 30MHz)
		± 4.8dB (30M - 1GHz)
		± 4.8dB (1GHz to 18 GHz)
		± 4.8dB (Above 18GHz)

**Remark:**

The  $U_{lab}$  (lab Uncertainty) is less than  $U_{CISPR/ETSI}$  (CISPR/ETSI Uncertainty), so the test results  
 – compliance is deemed to occur if no measured disturbance level exceeds the disturbance limit;  
 – non-compliance is deemed to occur if any measured disturbance level exceeds the disturbance limit.



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## 7 Appendixes

Appendix A.1	WWAN Setup Photos
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# Appendix



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**Test on the worst case:**

**Test Band = WCDMA IV ANT1\_ TM1**

**Test Channel = Low Channel**

Final Data List										
NO.	Frequency [MHz]	Reading [dBμV]	Factor [dB]	AF[dB/m]	Level [dBm]	Limit [dBm]	Margin [dB]	Height [cm]	Angle [°]	Polarity
1	3424.8	56.62	-45.87	29.43	-55.08	-13.00	42.08	241	346	Horizontal
2	5137.2	61.99	-44.24	32.60	-44.91	-13.00	31.91	142	283	Horizontal
3	6849.6	48.02	-42.50	35.90	-53.84	-13.00	40.84	241	249	Horizontal
4	8562	48.22	-39.70	38.12	-48.62	-13.00	35.62	142	346	Horizontal
5	10274.4	43.76	-36.76	38.80	-49.46	-13.00	36.46	233	167	Horizontal
6	11986.8	42.79	-35.35	38.61	-49.20	-13.00	36.20	214	331	Horizontal

Final Data List										
NO.	Frequency [MHz]	Reading [dBμV]	Factor [dB]	AF[dB/m]	Level [dBm]	Limit [dBm]	Margin [dB]	Height [cm]	Angle [°]	Polarity
1	3424.8	51.41	-45.87	29.43	-60.29	-13.00	47.29	296	68	Vertical
2	5139.75	64.98	-44.23	32.60	-41.91	-13.00	28.91	241	148	Vertical
3	6851.25	52.86	-42.49	35.90	-48.99	-13.00	35.99	174	248	Vertical
4	8562	46.14	-39.70	38.12	-50.70	-13.00	37.70	142	296	Vertical
5	10274.4	42.40	-36.76	38.80	-50.82	-13.00	37.82	255	265	Vertical
6	11986.8	42.98	-35.35	38.61	-49.01	-13.00	36.01	263	279	Vertical



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**Test Band = WCDMA IV ANT1\_ TM1**

**Test Channel = Mid Channel**

Final Data List										
NO.	Frequency [MHz]	Reading [dBμV]	Factor [dB]	AF[dB/m]	Level [dBm]	Limit [dBm]	Margin [dB]	Height [cm]	Angle [°]	Polarity
1	3467.25	58.97	-45.77	29.41	-52.65	-13.00	39.65	296	1	Horizontal
2	5198.25	62.46	-44.15	32.60	-44.35	-13.00	31.35	265	357	Horizontal
3	6931.5	57.53	-42.48	36.06	-44.15	-13.00	31.15	241	1	Horizontal
4	8663	46.08	-39.54	38.23	-50.49	-13.00	37.49	263	31	Horizontal
5	10395.6	42.16	-36.49	38.94	-50.65	-13.00	37.65	225	1	Horizontal
6	12128.2	42.83	-35.20	38.73	-48.90	-13.00	35.90	296	83	Horizontal

Final Data List										
NO.	Frequency [MHz]	Reading [dBμV]	Factor [dB]	AF[dB/m]	Level [dBm]	Limit [dBm]	Margin [dB]	Height [cm]	Angle [°]	Polarity
1	3465.2	50.13	-45.77	29.41	-61.49	-13.00	48.49	142	130	Vertical
2	5200.5	64.09	-44.15	32.60	-42.72	-13.00	29.72	296	1	Vertical
3	6927.75	53.48	-42.47	36.06	-48.20	-13.00	35.20	243	1	Vertical
4	8663	46.56	-39.54	38.23	-50.01	-13.00	37.01	241	17	Vertical
5	10395.6	42.62	-36.49	38.94	-50.19	-13.00	37.19	175	230	Vertical
6	12128.2	42.37	-35.20	38.73	-49.36	-13.00	36.36	266	357	Vertical



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**Test Band = WCDMA IV ANT1\_ TM1**  
**Test Channel = High Channel**

Final Data List										
NO.	Frequency [MHz]	Reading [dBμV]	Factor [dB]	AF[dB/m]	Level [dBm]	Limit [dBm]	Margin [dB]	Height [cm]	Angle [°]	Polarity
1	3502.5	58.13	-45.68	29.41	-53.40	-13.00	40.40	296	167	Horizontal
2	5261.25	69.42	-44.06	32.60	-37.30	-13.00	24.30	265	251	Horizontal
3	7011.75	51.79	-42.58	36.21	-49.84	-13.00	36.84	241	53	Horizontal
4	8763	47.64	-39.21	38.34	-48.49	-13.00	35.49	142	0	Horizontal
5	10515.6	42.36	-36.35	39.07	-50.19	-13.00	37.19	263	118	Horizontal
6	12268.2	42.91	-35.12	38.87	-48.60	-13.00	35.60	275	357	Horizontal

Final Data List										
NO.	Frequency [MHz]	Reading [dBμV]	Factor [dB]	AF[dB/m]	Level [dBm]	Limit [dBm]	Margin [dB]	Height [cm]	Angle [°]	Polarity
1	3504	58.28	-45.67	29.41	-53.24	-13.00	40.24	296	114	Vertical
2	5256	71.27	-44.07	32.60	-35.46	-13.00	22.46	355	231	Vertical
3	7005	59.11	-42.58	36.20	-42.53	-13.00	29.53	241	7	Vertical
4	8763	46.02	-39.21	38.34	-50.11	-13.00	37.11	142	312	Vertical
5	10510.5	50.12	-36.37	39.06	-42.44	-13.00	29.44	263	328	Vertical
6	12268.2	41.55	-35.12	38.87	-49.96	-13.00	36.96	221	248	Vertical



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Rev.: 01

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Test Band = LTE Band 41 ANT1\_ TM1

Test Channel = Low Channel

Final Data List										
NO.	Frequency [MHz]	Reading [dBμV]	Factor [dB]	AF[dB/m]	Level [dBm]	Limit [dBm]	Margin [dB]	Height [cm]	Angle [°]	Polarity
1	4997.1429	61.26	-44.94	32.59	-46.35	-25.00	21.35	153	108	Horizontal
2	7493.5714	62.40	-41.62	36.50	-37.99	-25.00	12.99	296	340	Horizontal
3	9988.36	45.23	-37.16	38.50	-48.69	-25.00	23.69	265	161	Horizontal
4	12485.45	43.01	-35.26	39.09	-48.42	-25.00	23.42	241	223	Horizontal
5	14982.54	41.88	-33.99	39.22	-48.15	-25.00	23.15	186	18	Horizontal
6	17479.63	39.84	-31.91	40.53	-46.80	-25.00	21.80	326	188	Horizontal

Final Data List										
NO.	Frequency [MHz]	Reading [dBμV]	Factor [dB]	AF[dB/m]	Level [dBm]	Limit [dBm]	Margin [dB]	Height [cm]	Angle [°]	Polarity
1	4997.1429	61.74	-44.94	32.59	-45.87	-25.00	20.87	196	357	Vertical
2	7493.5714	59.44	-41.62	36.50	-40.95	-25.00	15.95	265	206	Vertical
3	9987.8571	54.65	-37.16	38.50	-39.27	-25.00	14.27	241	179	Vertical
4	12482.1429	49.99	-35.25	39.08	-41.44	-25.00	16.44	142	206	Vertical
5	14982.54	42.70	-33.99	39.22	-47.33	-25.00	22.33	263	125	Vertical
6	17479.63	40.19	-31.91	40.53	-46.45	-25.00	21.45	201	170	Vertical



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**Test Band = LTE Band 41 ANT1\_ TM1**  
**Test Channel = Mid Channel**

Final Data List										
NO.	Frequency [MHz]	Reading [dBμV]	Factor [dB]	AF[dB/m]	Level [dBm]	Limit [dBm]	Margin [dB]	Height [cm]	Angle [°]	Polarity
1	5168.18	50.26	-44.19	32.60	-56.59	-25.00	31.59	142	179	Horizontal
2	7752.63	66.06	-40.95	37.01	-33.15	-25.00	8.15	196	1	Horizontal
3	10336.36	43.90	-36.70	38.87	-49.19	-25.00	24.19	263	0	Horizontal
4	12920.45	43.29	-34.87	39.52	-47.32	-25.00	22.32	295	3	Horizontal
5	15504.54	40.89	-34.15	38.54	-49.98	-25.00	24.98	241	358	Horizontal
6	17982.8571	42.30	-31.37	42.53	-41.80	-25.00	16.80	102	224	Horizontal

Final Data List										
NO.	Frequency [MHz]	Reading [dBμV]	Factor [dB]	AF[dB/m]	Level [dBm]	Limit [dBm]	Margin [dB]	Height [cm]	Angle [°]	Polarity
1	5168.18	52.67	-44.19	32.60	-54.18	-25.00	29.18	265	7	Vertical
2	7752.27	50.24	-40.95	37.01	-48.97	-25.00	23.97	241	313	Vertical
3	10336.36	57.34	-36.70	38.87	-35.75	-25.00	10.75	198	322	Vertical
4	12920.45	43.23	-34.87	39.52	-47.38	-25.00	22.38	201	313	Vertical
5	15504.54	42.13	-34.15	38.54	-48.74	-25.00	23.74	145	170	Vertical
6	17826.4286	42.13	-30.88	41.91	-42.10	-25.00	17.10	263	145	Vertical



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**Test Band = LTE Band 41 ANT1\_ TM1**  
**Test Channel = High Channel**

Final Data List										
NO.	Frequency [MHz]	Reading [dBμV]	Factor [dB]	AF[dB/m]	Level [dBm]	Limit [dBm]	Margin [dB]	Height [cm]	Angle [°]	Polarity
1	5255.18	52.55	-44.07	32.60	-54.18	-25.00	29.18	163	0	Horizontal
2	7882.77	47.06	-40.65	37.27	-51.59	-25.00	26.59	254	109	Horizontal
3	10510.36	43.91	-36.37	39.06	-48.65	-25.00	23.65	142	190	Horizontal
4	13137.95	43.87	-34.60	39.68	-46.31	-25.00	21.31	296	1	Horizontal
5	15765.54	43.11	-34.12	38.20	-48.07	-25.00	23.07	201	101	Horizontal
6	17865	41.79	-30.97	42.06	-42.38	-25.00	17.38	142	172	Horizontal

Final Data List										
NO.	Frequency [MHz]	Reading [dBμV]	Factor [dB]	AF[dB/m]	Level [dBm]	Limit [dBm]	Margin [dB]	Height [cm]	Angle [°]	Polarity
1	5255.18	51.00	-44.07	32.60	-55.73	-25.00	30.73	241	357	Vertical
2	7882.77	47.35	-40.65	37.27	-51.30	-25.00	26.30	178	108	Vertical
3	10566.4286	60.95	-36.24	39.12	-31.42	-25.00	6.42	296	91	Vertical
4	13200	58.05	-34.82	39.72	-32.31	-25.00	7.31	241	277	Vertical
5	16050	57.76	-33.50	37.93	-33.06	-25.00	8.06	122	0	Vertical
6	17914.2857	42.14	-31.11	42.26	-41.98	-25.00	16.98	296	207	Vertical

**Remark:**

1) The field strength is calculated by adding the Antenna Factor, Cable Factor & AMP. The basic equation with a sample calculation is as follows:

AF = Antenna Factor(dB/m)

Factor = Cable Factor(dB) - Preamplifier (dB)

Level = Reading Level + AF + Factor -95.26

Margin = Limit – Level

---End of Report---



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