TEST REPORT

Application No.:	SEWM2206000084RG
Applicant:	Nauto
Address of Applicant:	220 Portage Avenue, Palo Alto, California 94306
Manufacturer:	Nauto
Address of Manufacturer:	220 Portage Avenue, Palo Alto, California 94306
EUT Description:	AI-enabled fleet management in-vehicle device
Model No.:	Nauto 3-1
Trade Mark:	Nauto
FCC ID:	2AKJ5-N31
Standards:	47 CFR Part 2 47 CFR Part 22 47 CFR Part 24 47 CFR Part 27 47 CFR Part 90
Date of Receipt:	2022/6/20
Date of Test:	2022/6/25 to 2022/7/4
Date of Issue:	2022/7/5
Test Result :	**PASS ***

* In the configuration tested, the EUT detailed in this report complied with the standards specified above.

Authorized Signature:

Panta Sun

Panta Sun
Wireless Laboratory Manager

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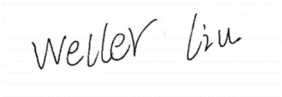
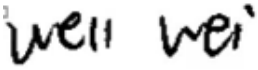
1 Version

Revision Record				
Version	**Chapter**	**Date**	**Modifier**	**Remark**
01		2022/7/5		Original

Prepared By		 **(Weller Liu) / Test Supervisor**
Checked By		 **(Well Wei) / Reviewer**

Contents

2 Test Summary

2.1 UMTS Band 5/LTE Band 5

Test Item	FCC Rule No.	Requirements	Test Result	Verdict
Effective (Isotropic) Radiated Power Output Data	§2.1046, §22.913(a)(5)	ERP ≤ 7 W	Refer to ZR/2020/9005901-01	Pass
Peak-Average Ratio	§22.913(d)	Limit≤13 dB	Refer to ZR/2020/9005901-01	Pass
Modulation Characteristics	§2.1047	Digital modulation	Refer to ZR/2020/9005901-01	Pass
Bandwidth	§2.1049	OBW: No limit. EBW: No limit.	Refer to ZR/2020/9005901-01	Pass
Band Edges Compliance	§2.1051, §22.917(a)	≤ -13 dBm/1%*EBW, in 1 MHz bands immediately outside and adjacent to the frequency block.	Refer to ZR/2020/9005901-01	Pass
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.	Refer to ZR/2020/9005901-01	Pass
Field Strength of Spurious Radiation	§2.1053, §22.917(a)	FCC: ≤ -13 dBm/100 kHz.	Clause 4.7	Pass
Frequency Stability	§2.1055(a)(1)(b) §2.1055(d)(1) §22.355	≤ ±2.5ppm.	Refer to ZR/2020/9005901-01	Pass

2.2 UMTS Band 2 /LTE Band 2

Test Item	FCC Rule No.	Requirements	Test Result	Verdict
Effective (Isotropic) Radiated Power Output Data	§2.1046, §24.232(c)	EIRP ≤ 2 W	Refer to ZR/2020/9005901-01	Pass
Peak-Average Ratio	§24.232(d)	Limit≤13 dB	Refer to ZR/2020/9005901-01	Pass
Modulation Characteristics	§2.1047	Digital modulation	Refer to ZR/2020/9005901-01	Pass
Bandwidth	§2.1049	OBW: No limit. EBW: No limit.	Refer to ZR/2020/9005901-01	Pass
Band Edges Compliance	§2.1051, §24.238(a)	≤ -13 dBm/1%*EBW, in 1 MHz bands immediately outside and adjacent to the frequency block.	Refer to ZR/2020/9005901-01	Pass
Spurious Emission at Antenna Terminals	§2.1051, §24.238(a)	≤ -13 dBm/1 MHz, from 9 kHz to 10th harmonics but outside authorized operating frequency ranges.	Refer to ZR/2020/9005901-01	Pass
Field Strength of Spurious Radiation	§2.1053, §24.238(a)	≤ -13 dBm/1 MHz.	Clause 4.7	Pass
Frequency Stability	§2.1055(a)(1)(b) §2.1055(d)(1) §24.235	Within authorized bands of operation/frequency block.	Refer to ZR/2020/9005901-01	Pass

2.3 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	Refer to ZR/2020/9005901-01	Pass
Peak-Average Ratio	§27.50(d)(5)	Limit≤13 dB	Refer to ZR/2020/9005901-01	Pass
Modulation Characteristics	§2.1047	Digital modulation	Refer to ZR/2020/9005901-01	Pass
Bandwidth	§2.1049	OBW: No limit. EBW: No limit.	Refer to ZR/2020/9005901-01	Pass
Band Edges Compliance	§2.1051, §27.53(h)	≤ -13 dBm/1%*EBW, in 1 MHz bands immediately outside and adjacent to the frequency block.	Refer to ZR/2020/9005901-01	Pass
Spurious Emission at Antenna Terminals	§2.1051, §27.53(h)	≤ -13 dBm/1 MHz, from 9 kHz to 10th harmonics but outside authorized operating frequency ranges.	Refer to ZR/2020/9005901-01	Pass
Field Strength of Spurious Radiation	§2.1053, §27.53(h)	≤ -13 dBm/1 MHz.	Clause 4.7	Pass
Frequency Stability	§2.1055(a)(1)(b) §2.1055(d)(1) §27.54	Within authorized bands of operation/frequency block.	Refer to ZR/2020/9005901-01	Pass

2.4 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.	Refer to ZR/2020/9005901-01	Pass
Peak-Average Ratio	---	Limit≤13 dB	Refer to ZR/2020/9005901-01	Pass
Modulation Characteristics	§2.1047	Digital modulation	Refer to ZR/2020/9005901-01	Pass
Bandwidth	§2.1049	OBW: No limit. EBW: No limit.	Refer to ZR/2020/9005901-01	Pass
Band Edges Compliance	§2.1051, §27.53(g)	≤ -13 dBm/1%*EBW, in 1 MHz bands immediately outside and adjacent to the frequency block.	Refer to ZR/2020/9005901-01	Pass
Spurious Emission at Antenna Terminals	§2.1051, §27.53(g)	FCC: ≤ -13 dBm/100 kHz, from 9 kHz to 10th harmonics but outside authorized operating frequency ranges.	Refer to ZR/2020/9005901-01	Pass
Field Strength of Spurious Radiation	§2.1053, §27.53(g)	FCC: ≤ -13 dBm/100 kHz.	Clause 4.7	Pass
Frequency Stability	§2.1055(a)(1)(b) §2.1055(d)(1) §27.54	Within authorized bands of operation/frequency block.	Refer to ZR/2020/9005901-01	Pass

2.5 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.	Section 1 of Appendix B.1	Pass
Peak-Average Ratio	---	Limit≤13 dB	Section 2 of Appendix B.1	Pass
Modulation Characteristics	§2.1047	Digital modulation	Section 3 of Appendix B.1	Pass
Bandwidth	§2.1049,	OBW: No limit. EBW: No limit.	Section 4 of Appendix B.1	Pass
Band Edges Compliance	§2.1051, §27.53(c)	≤ -13 dBm/1%*EBW, in 1 MHz bands immediately outside and adjacent to the frequency block.	Section 5 of Appendix B.1	Pass
Spurious Emission at Antenna Terminals	§2.1051, §27.53(c) §27.53(f)	≤ -13 dBm/100 kHz, from 9 kHz to 10th 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.	Section 6 of Appendix B.1	Pass
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 B.1	Pass
Frequency Stability	§2.1055(a)(1)(b) §2.1055(d)(1) §27.54	Within authorized bands of operation/frequency block.	Section 8 of Appendix B.1	Pass

2.6 LTE Band 14

Test Item	FCC Rule No.	Requirements	Test Result	Verdict
Effective (Isotropic) Radiated Power Output Data	§2.1046 §90.542(d)	ERP ≤ 3 W.	Refer to ZR/2020/9005901-01	Pass
Peak-Average Ratio	---	Limit≤13 dB	Refer to ZR/2020/9005901-01	Pass
Modulation Characteristics	§2.1047	Digital modulation	Refer to ZR/2020/9005901-01	Pass
Bandwidth	§2.1049	OBW: No limit. EBW: No limit.	Refer to ZR/2020/9005901-01	Pass
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.	Refer to ZR/2020/9005901-01	Pass

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 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.	Refer to ZR/2020/9005901-01	Pass
Spurious Emission at Antenna Terminals	§2.1051, §90.543(c) §90.543(f)	FCC: ≤ -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.	Refer to ZR/2020/9005901-01	Pass
Field Strength of Spurious Radiation	§2.1053, §90.543(c) §90.543(f)	FCC: ≤ -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.	Clause 4.7	Pass
Frequency Stability	§2.1055(a)(1)(b) §2.1055(d)(1) §90.213	Within authorized bands of operation/frequency block.	Refer to ZR/2020/9005901-01	Pass

2.7 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	Refer to ZR/2020/9005901-01	Pass
Peak-Average Ratio	---	Limit≤13 dB	Refer to ZR/2020/9005901-01	Pass
Modulation Characteristics	§2.1047	Digital modulation	Refer to ZR/2020/9005901-01	Pass
Bandwidth	§2.1049	OBW: No limit. EBW: No limit.	Refer to ZR/2020/9005901-01	Pass
Band Edges Compliance	§2.1051, §27.53(g)	≤ -13 dBm/1%*EBW, in 1 MHz bands immediately outside and adjacent to the frequency block.	Refer to ZR/2020/9005901-01	Pass
Spurious Emission at Antenna Terminals	§2.1051, §27.53(g)	≤ -13 dBm/1 MHz, from 9 kHz to 10th harmonics but outside authorized operating frequency ranges.	Refer to ZR/2020/9005901-01	Pass
Field Strength of Spurious Radiation	§2.1053, §27.53(g)	≤ -13 dBm/1 MHz.	Clause 4.7	Pass
Frequency Stability	§2.1055(a)(1)(b) §2.1055(d)(1) §27.54	within the authorized bands of operation.	Refer to ZR/2020/9005901-01	Pass

Remark:

This test report (Report No.: SEWM2206000084RG01 issued on 2022-07-05.) is based on the original test report (Report No.: ZR/2020/9005901-01 issued on 2021-08-13) .

Review this report and original report, this report just changing the parts according to the declaration letter from client.

Considering to the difference, pre-scan were performed on the sample in this report to find the items which can be influential to the result in the original test report for fully retest.

Therefore in this report newly added LTE Band 13 and radiated spurious emissions were performed based on the worst case of the original report with report number ZR/2020/9005901-01 issued on 2021-08-13 and other test data refer to the previous report with ZR/2020/9005901-01 issued on 2021-08-13.

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3 General Information

3.1 Details of Client

Applicant:	Nauto
Address of Applicant:	220 Portage Avenue, Palo Alto, California 94306
Manufacturer:	Nauto
Address of Manufacturer:	220 Portage Avenue, Palo Alto, California 94306

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:	Weller Liu, King-p Li, Nature Shen, Tizzy Song

3.3 Test Facility

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

- **A2LA (Certificate No. 6336.01)**

SGS-CSTC STANDARDS TECHNICAL SERVICES (SUZHOU) CO., LTD. is accredited by the American Association for Laboratory Accreditation(A2LA). Certificate No. 6336.01.

- **Innovation, Science and Economic Development Canada**

SGS-CSTC STANDARDS TECHNICAL SERVICES (SUZHOU) CO., LTD. has been recognized by ISED as an accredited testing laboratory.

CAB identifier: CN0120.

IC#: 27594.

- **FCC –Designation Number: CN1312**

SGS-CSTC STANDARDS TECHNICAL SERVICES (SUZHOU) CO., LTD. has been recognized as an accredited testing laboratory.

Designation Number: CN1312.

Test Firm Registration Number: 717327

3.4 General Description of EUT

EUT Description:	AI-enabled fleet management in-vehicle device			
Model No.:	Nauto 3-1			
Trade Mark:	Nauto			
Hardware Version:	V8			
Software Version:	F50			
Antenna Type:	☐ External, ☒ Integrated			
Antenna Gain*:	☒Provided by client			
	WCDMA Band II:	0.7dBi	WCDMA Band V:	-0.1dBi
	LTE Band 2:	0.7dBi	LTE Band 4:	0.6dBi
	LTE Band 5:	-0.1dBi	LTE Band 12:	-0.2dBi
	LTE Band 13:	0.5dBi	LTE Band 14:	0.1dBi
	LTE Band 66:	0.6dBi	LTE Band 71:	-0.1dBi
RF Cable*:	☒Provided by client			
	0.8dB(Below 1GHz)			

Note: *Since the above data and/or information is provided by the client relevant results or conclusions of this report are only made for these data and/or information , SGS is not responsible for the authenticity, integrity and results of the data and information and/or the validity of the conclusion.
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
LTE/TM3	LTE system, 64QAM 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(℃)	Voltage(V)
NTNV	22~23	12&24
LTLV	-30	5
LTHV	-30	31
HTLV	50	5
HTHV	50	31
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.

3.8 Technical Specification

Characteristics	Description				
Radio System Type	☒ UMTS	☒ LTE			
Supported Frequency Range	Band	TX	RX		
	UMTS Band II	1850 to 1910 MHz	1930 to 1990 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 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 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:	☒5 MHz			
	LTE Band 2	☒1.4 MHz ☒3 MHz ☒5 MHz ☒10 MHz ☒15 MHz ☒20 MHz			
	LTE Band 4	☒1.4 MHz ☒3 MHz ☒5 MHz ☒10 MHz ☒15 MHz ☒20 MHz			
	LTE Band 5	☒1.4 MHz ☒3 MHz ☒5 MHz ☒10 MHz			
	LTE Band 12	☒1.4 MHz ☒3 MHz ☒5 MHz ☒10 MHz			
	LTE Band 13	☒5 MHz ☒10 MHz			
	LTE Band 14	☒5 MHz ☒10 MHz			
	LTE Band66	☒1.4 MHz ☒3 MHz ☒5 MHz ☒10 MHz ☒15MHz ☒20MHz			
	LTE Band71	☒5MHz ☒10MHz ☒15MHz ☒20MHz			
	Note1: WCDMA supports HSUPA, HSDPA, DC-HSDPA,HSPA+, but only the worst case was tested and the data displayed in this report.				
Characteristics	Description				
Designation of Emissions (Remark: the necessary bandwidth of which is the worst value from the	E-UTRA:	QPSK	16QAM	64QAM	
	LTE Band13	4M47G7D	4M47W7D	4M47W7D	

measured occupied bandwidths for each type of channel bandwidth configuration.)		8M91G7D 8M86W7D 8M89W7D

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 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

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	Channel1175
			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	Channel 20175	Channel 20393
			1710.7 MHz	1732.5 MHz	1754.3 MHz
		RX	Channel 1975	Channel 2175	Channel 2375
			2112.5 MHz	2132.5MHz	2152.5 MHz
	3MHz	TX	Channel 19965	Channel 20175	Channel 20385
			1711.5 MHz	1732.5 MHz	1753.5 MHz
		RX	Channel 2000	Channel 2175	Channel 2350
			2115 MHz	2132.5MHz	2150 MHz
	5MHz	TX	Channel 19975	Channel 20175	Channel 20375
			1712.5 MHz	1732.5 MHz	1752.5 MHz
		RX	Channel 1975	Channel 2175	Channel 2375
			2112.5 MHz	2132.5MHz	2152.5 MHz
	10MHz	TX	Channel 20000	Channel 20175	Channel 20350
			1715 MHz	1732.5 MHz	1750 MHz
		RX	Channel 2000	Channel 2175	Channel 2350
			2115 MHz	2132.5MHz	2150 MHz
	15MHz	TX	Channel 20025	Channel 20175	Channel 20325
			1717.5 MHz	1732.5 MHz	1747.5 MHz
		RX	Channel 2025	Channel 2175	Channel 2325
			2117.5 MHz	2132.5MHz	2147.5 MHz
	20MHz	TX	Channel 20050	Channel 20175	Channel 20300
			1720 MHz	1732.5 MHz	1745 MHz
		RX	Channel 2050	Channel 2175	Channel 2300
			2120 MHz	2132.5MHz	2145 MHz

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

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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

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 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

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

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 (dBd)

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

EIRP=ERP+2.15dB

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

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 ≥ 1% of the emission bandwidth
4. VBW ≥ 3 x RBW
5. Detector = RMS
6. Number of sweep points ≥ 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

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 emissinos, 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

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

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 (dBμV/m) = Measured amplitude level (dBμV) + (Cable Loss (dB) + Antenna Factor (dB/m) – AMP(dB))

EIRP (dBm) = E (dBμV/m) + 20 log D − 104.8; 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 (dBμV/m) = Measured amplitude level (dBμV) + (Cable Loss (dB) + Antenna Factor (dB/m) – AMP(dB))

EIRP (dBm) = E (dBμV/m) + 20 log D − 104.8; 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*LOG(3/1) = 9.54 dB.

Remark: Reference test setup 2

1) The field strength is calculated by adding the Antenna Factor, Cable Factor & Preamplifier. The basic equation with a sample calculation is as follows:
Final Test Level =Receiver Reading + Factor(Antenna Factor + Cable Factor – Preamplifier Factor)
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.

Test on the worst case:

Test Band = WCDMA Band II_ TM1
Test Channel = High

Final Data List									
NO.	Frequency [MHz]	Reading [dBμV]	Factor [dB]	Level [dBm]	Limit [dBm]	Margin [dB]	Height [cm]	Angle [°]	Polarity
1	3762	59.51	-110.83	-51.32	-13.00	38.32	125	152	Horizontal
2	5722.8000	48.74	-106.62	-57.88	-13.00	44.88	164	182	Horizontal
3	7630.0000	47.46	-101.80	-54.34	-13.00	41.34	185	31	Horizontal
4	9538.0000	43.68	-96.82	-53.14	-13.00	40.14	196	258	Horizontal
5	11445.6000	40.71	-93.54	-52.83	-13.00	39.83	233	334	Horizontal
6	14575.5	40.24	-90.48	-50.24	-13.00	37.24	161	345	Horizontal

Test Band = WCDMA Band II_ TM1
Test Channel = High

Final Data List									
NO.	Frequency [MHz]	Reading [dBμV]	Factor [dB]	Level [dBm]	Limit [dBm]	Margin [dB]	Height [cm]	Angle [°]	Polarity
1	3758.25	59.16	-110.82	-51.66	-13.00	38.66	112	304	Vertical
2	5722.8000	49.50	-106.62	-57.12	-13.00	44.12	148	360	Vertical
3	7630.0000	46.45	-101.80	-55.35	-13.00	42.35	174	135	Vertical
4	9538.0000	42.77	-96.82	-54.05	-13.00	41.05	195	61	Vertical
5	11445.6000	40.23	-93.54	-53.31	-13.00	40.31	133	304	Vertical
6	15150	41.34	-90.68	-49.34	-13.00	36.34	133	256	Vertical

Test Band = WCDMA Band V_ TM1
Test Channel = Mid

Final Data List									
NO.	Frequency [MHz]	Reading [dBµV]	Factor [dB]	Level [dBm]	Limit [dBm]	Margin [dB]	Height [cm]	Angle [°]	Polarity
1	1672.8000	52.00	-118.07	-66.07	-13.00	53.07	155	26	Horizontal
2	2509.2000	51.28	-114.69	-63.41	-13.00	50.41	194	307	Horizontal
3	3345.6000	51.68	-112.38	-60.70	-13.00	47.70	175	356	Horizontal
4	3345.7143	51.68	-112.38	-60.70	-13.00	47.70	236	356	Horizontal
5	4182.0000	49.63	-110.14	-60.51	-13.00	47.51	164	1	Horizontal
6	5018.4000	48.88	-108.10	-59.22	-13.00	46.22	180	125	Horizontal

Test Band = WCDMA Band V_ TM1
Test Channel = Mid

Final Data List									
NO.	Frequency [MHz]	Reading [dBµV]	Factor [dB]	Level [dBm]	Limit [dBm]	Margin [dB]	Height [cm]	Angle [°]	Polarity
1	1672.8000	52.73	-118.07	-65.34	-13.00	52.34	122	173	Vertical
2	2509.2000	51.17	-114.69	-63.52	-13.00	50.52	154	41	Vertical
3	3345.6000	50.40	-112.38	-61.98	-13.00	48.98	198	121	Vertical
4	4182.0000	49.97	-110.14	-60.17	-13.00	47.17	175	252	Vertical
5	5018.4000	49.77	-108.10	-58.33	-13.00	45.33	133	344	Vertical
6	7398.8571	50.31	-102.03	-51.72	-13.00	38.72	266	106	Vertical

Test Band = LTE Band2_ TM1
Test Channel = Low

Final Data List									
NO.	Frequency [MHz]	Reading [dBµV]	Factor [dB]	Level [dBm]	Limit [dBm]	Margin [dB]	Height [cm]	Angle [°]	Polarity
1	3702	62.19	-110.79	-48.60	-13.00	35.60	214	165	Horizontal
2	5553.2700	53.59	-107.44	-53.85	-13.00	40.85	236	182	Horizontal
3	7404.3600	50.71	-102.17	-51.46	-13.00	38.46	191	360	Horizontal
4	9255.4500	43.19	-97.11	-53.92	-13.00	40.92	174	360	Horizontal
5	11106.5400	40.21	-94.10	-53.89	-13.00	40.89	185	271	Horizontal
6	12957.6300	40.16	-92.71	-52.55	-13.00	39.55	213	360	Horizontal

Test Band = LTE Band2_ TM1
Test Channel = Low

Final Data List									
NO.	Frequency [MHz]	Reading [dBµV]	Factor [dB]	Level [dBm]	Limit [dBm]	Margin [dB]	Height [cm]	Angle [°]	Polarity
1	3702.1800	59.24	-110.79	-51.55	-13.00	38.55	201	300	Vertical
2	5553	54.63	-107.44	-52.81	-13.00	39.81	254	300	Vertical
3	7404.3600	51.87	-102.17	-50.30	-13.00	37.30	196	314	Vertical
4	9255.4500	43.17	-97.11	-53.94	-13.00	40.94	173	194	Vertical
5	11106.5400	38.92	-94.10	-55.18	-13.00	42.18	230	88	Vertical
6	12957.6300	38.04	-92.71	-54.67	-13.00	41.67	163	13	Vertical

Test Band = LTE Band4_ TM1
Test Channel = Mid

Final Data List									
NO.	Frequency [MHz]	Reading [dBμV]	Factor [dB]	Level [dBm]	Limit [dBm]	Margin [dB]	Height [cm]	Angle [°]	Polarity
1	3447	67.81	-112.06	-44.25	-13.00	31.25	123	180	Horizontal
2	5170.7700	60.44	-107.59	-47.15	-13.00	34.15	236	104	Horizontal
3	6894.3600	50.95	-103.41	-52.46	-13.00	39.46	161	135	Horizontal
4	8617.9500	46.86	-98.88	-52.02	-13.00	39.02	145	212	Horizontal
5	10341.5400	42.62	-95.47	-52.85	-13.00	39.85	191	359	Horizontal
6	12065.1300	37.90	-93.68	-55.78	-13.00	42.78	170	195	Horizontal

Test Band = LTE Band4_ TM1
Test Channel = Mid

Final Data List									
NO.	Frequency [MHz]	Reading [dBμV]	Factor [dB]	Level [dBm]	Limit [dBm]	Margin [dB]	Height [cm]	Angle [°]	Polarity
1	3447.1800	63.23	-112.06	-48.83	-13.00	35.83	235	195	Vertical
2	5170.7700	63.10	-107.59	-44.49	-13.00	31.49	164	77	Vertical
3	6894.3600	53.06	-103.41	-50.35	-13.00	37.35	194	286	Vertical
4	8617.9500	46.23	-98.88	-52.65	-13.00	39.65	188	360	Vertical
5	10341.5400	41.41	-95.47	-54.06	-13.00	41.06	251	60	Vertical
6	12065.1300	37.45	-93.68	-56.23	-13.00	43.23	203	60	Vertical

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Test Band = LTE Band5_ TM1
Test Channel = High

Final Data List									
NO.	Frequency [MHz]	Reading [dBµV]	Factor [dB]	Level [dBm]	Limit [dBm]	Margin [dB]	Height [cm]	Angle [°]	Polarity
1	1678.8571	67.97	-118.06	-50.09	-13.00	37.09	298	173	Horizontal
2	2518.7700	66.40	-114.63	-48.23	-13.00	35.23	154	240	Horizontal
3	3358.3600	50.15	-112.38	-62.23	-13.00	49.23	136	94	Horizontal
4	4197.9500	49.01	-110.12	-61.11	-13.00	48.11	251	17	Horizontal
5	5037.5400	48.03	-108.01	-59.98	-13.00	46.98	236	254	Horizontal
6	5887.1300	49.49	-106.27	-56.78	-13.00	43.78	203	94	Horizontal

Test Band = LTE Band5_ TM1
Test Channel = High

Final Data List									
NO.	Frequency [MHz]	Reading [dBµV]	Factor [dB]	Level [dBm]	Limit [dBm]	Margin [dB]	Height [cm]	Angle [°]	Polarity
1	1679.1800	60.91	-118.06	-57.15	-13.00	44.15	294	91	Vertical
2	2518.7700	67.30	-114.63	-47.33	-13.00	34.33	175	265	Vertical
3	3358.3600	50.42	-112.38	-61.96	-13.00	48.96	164	198	Vertical
4	4197.9500	49.58	-110.12	-60.54	-13.00	47.54	128	91	Vertical
5	5037.5400	48.35	-108.01	-59.66	-13.00	46.66	201	331	Vertical
6	5887.1300	49.62	-106.27	-56.65	-13.00	43.65	299	51	Vertical

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Test Band = LTE Band12_ TM1
Test Channel = Mid

Final Data List									
NO.	Frequency [MHz]	Reading [dBµV]	Factor [dB]	Level [dBm]	Limit [dBm]	Margin [dB]	Height [cm]	Angle [°]	Polarity
1	1406.1800	77.45	-117.67	-40.22	-13.00	27.22	269	95	Horizontal
2	2109.2700	69.61	-115.94	-46.33	-13.00	33.33	184	121	Horizontal
3	2812.3600	55.01	-113.60	-58.59	-13.00	45.59	172	188	Horizontal
4	3515.4286	75.51	-112.24	-36.73	-13.00	23.73	132	135	Horizontal
5	4218.5400	58.92	-110.05	-51.13	-13.00	38.13	199	201	Horizontal
6	4921.6300	49.97	-108.23	-58.26	-13.00	45.26	200	188	Horizontal

Test Band = LTE Band12_ TM1
Test Channel = Mid

Final Data List									
NO.	Frequency [MHz]	Reading [dBµV]	Factor [dB]	Level [dBm]	Limit [dBm]	Margin [dB]	Height [cm]	Angle [°]	Polarity
1	1406.1800	70.46	-117.67	-47.21	-13.00	34.21	188	252	Vertical
2	2109.2700	64.33	-115.94	-51.61	-13.00	38.61	197	351	Vertical
3	2812.3600	55.57	-113.60	-58.03	-13.00	45.03	182	13	Vertical
4	3515.4500	68.67	-112.23	-43.56	-13.00	30.56	191	240	Vertical
5	4218.5400	58.39	-110.05	-51.66	-13.00	38.66	230	158	Vertical
6	4921.6300	50.85	-108.23	-57.38	-13.00	44.38	169	66	Vertical

Test Band = LTE Band14_ TM1
Test Channel = Mid

Final Data List									
NO.	Frequency [MHz]	Reading [dBµV]	Factor [dB]	Level [dBm]	Limit [dBm]	Margin [dB]	Height [cm]	Angle [°]	Polarity
1	1577.1429	71.69	-118.17	-46.48	-40.00	6.48	125	185	Horizontal
2	2365.7143	69.18	-115.30	-46.12	-13.00	33.12	184	267	Horizontal
3	3154.3600	51.22	-112.15	-60.93	-13.00	47.93	226	267	Horizontal
4	3942.9500	50.80	-110.81	-60.01	-13.00	47.01	296	15	Horizontal
5	4731.5400	49.21	-108.90	-59.69	-13.00	46.69	251	238	Horizontal
6	5520.1300	48.48	-107.49	-59.01	-13.00	46.01	301	233	Horizontal

Test Band = LTE Band14_ TM1
Test Channel = Mid

Final Data List									
NO.	Frequency [MHz]	Reading [dBµV]	Factor [dB]	Level [dBm]	Limit [dBm]	Margin [dB]	Height [cm]	Angle [°]	Polarity
1	1577.1429	67.48	-118.17	-50.69	-40.00	10.69	188	265	Vertical
2	2365.7143	68.88	-115.30	-46.42	-13.00	33.42	175	240	Vertical
3	3154.3600	50.82	-112.15	-61.33	-13.00	48.33	159	26	Vertical
4	3942.9500	49.84	-110.81	-60.97	-13.00	47.97	112	359	Vertical
5	4731.5400	50.20	-108.90	-58.70	-13.00	45.70	156	332	Vertical
6	5520.1300	49.12	-107.49	-58.37	-13.00	45.37	142	346	Vertical

Test Band = LTE Band66_ TM1
Test Channel = High

Final Data List									
NO.	Frequency [MHz]	Reading [dBµV]	Factor [dB]	Level [dBm]	Limit [dBm]	Margin [dB]	Height [cm]	Angle [°]	Polarity
1	3522	62.90	-111.95	-49.05	-13.00	36.05	184	182	Horizontal
2	5283.75	53.74	-107.47	-53.73	-13.00	40.73	175	90	Horizontal
3	7008.3600	47.94	-102.77	-54.83	-13.00	41.83	169	30	Horizontal
4	8760.4500	44.72	-98.67	-53.95	-13.00	40.95	251	16	Horizontal
5	10512.5400	41.22	-95.05	-53.83	-13.00	40.83	233	318	Horizontal
6	12262.6300	38.37	-93.59	-55.22	-13.00	42.22	266	30	Horizontal

Test Band = LTE Band66_ TM1
Test Channel = High

Final Data List									
NO.	Frequency [MHz]	Reading [dBµV]	Factor [dB]	Level [dBm]	Limit [dBm]	Margin [dB]	Height [cm]	Angle [°]	Polarity
1	3504.1800	49.99	-111.99	-62.00	-13.00	49.00	145	125	Vertical
2	5256.2700	47.30	-107.50	-60.20	-13.00	47.20	184	23	Vertical
3	7008.3600	47.95	-102.77	-54.82	-13.00	41.82	195	135	Vertical
4	8760.4500	44.46	-98.67	-54.21	-13.00	41.21	172	360	Vertical
5	10512.5400	41.17	-95.05	-53.88	-13.00	40.88	166	152	Vertical
6	12262.6300	39.54	-93.59	-54.05	-13.00	41.05	211	44	Vertical

Test Band = LTE Band71_ TM1
Test Channel = Mid

Final Data List									
NO.	Frequency [MHz]	Reading [dBµV]	Factor [dB]	Level [dBm]	Limit [dBm]	Margin [dB]	Height [cm]	Angle [°]	Polarity
1	1348.1800	64.51	-117.72	-53.21	-13.00	40.21	125	21	Horizontal
2	2022.2	63.47	-116.40	-52.93	-13.00	39.93	236	254	Horizontal
3	2696.3600	52.55	-114.02	-61.47	-13.00	48.47	164	147	Horizontal
4	3370.4500	51.14	-112.37	-61.23	-13.00	48.23	185	254	Horizontal
5	4044.5400	48.79	-110.46	-61.67	-13.00	48.67	194	254	Horizontal
6	4718.6300	48.11	-108.96	-60.85	-13.00	47.85	125	275	Horizontal

Test Band = LTE Band71_ TM1
Test Channel = Mid

Final Data List									
NO.	Frequency [MHz]	Reading [dBµV]	Factor [dB]	Level [dBm]	Limit [dBm]	Margin [dB]	Height [cm]	Angle [°]	Polarity
1	1348.1800	60.33	-117.72	-57.39	-13.00	44.39	155	125	Vertical
2	2022.2700	54.32	-116.40	-62.08	-13.00	49.08	148	316	Vertical
3	2696.3600	50.50	-114.02	-63.52	-13.00	50.52	195	254	Vertical
4	3370.4500	49.82	-112.37	-62.55	-13.00	49.55	188	360	Vertical
5	4044.5400	48.40	-110.46	-62.06	-13.00	49.06	176	169	Vertical
6	4718.6300	49.87	-108.96	-59.09	-13.00	46.09	202	232	Vertical

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℃ to +50℃ in 10℃ 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.

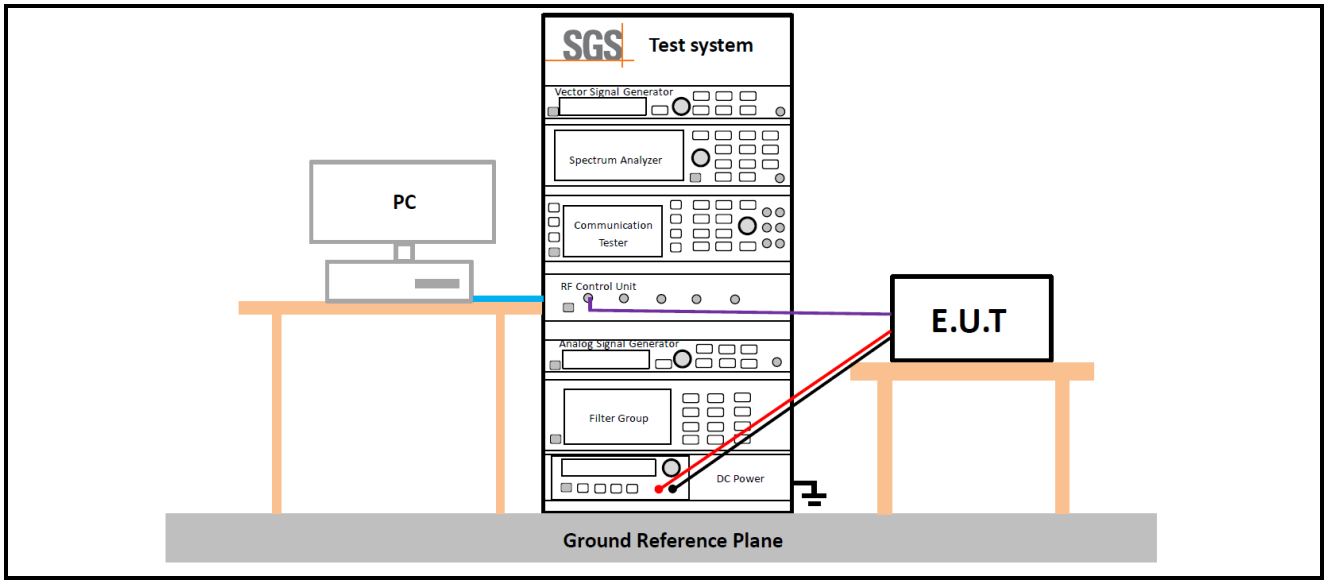
Time Period and Procedure:

1. The carrier frequency of the transmitter is measured at room temperature (20℃ 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℃ intervals ranging from -30℃ to +50℃. 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

4.9 Test Setups

4.9.1 Test Setup 1



4.9.2 Test Setup 2

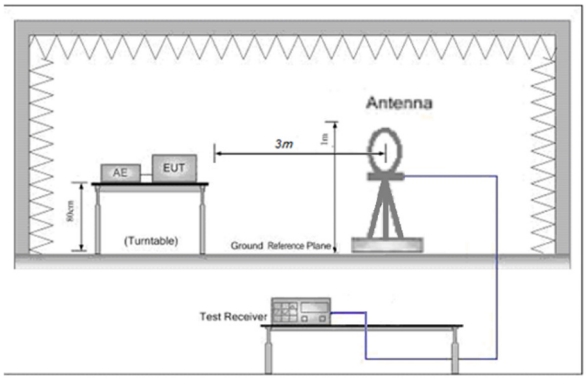


Figure 1. Below 30MHz

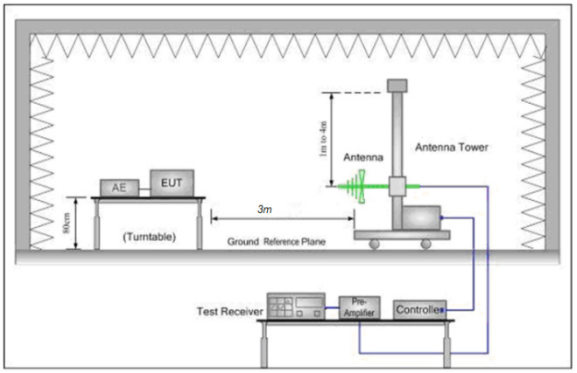


Figure 2. 30MHz to 1GHz

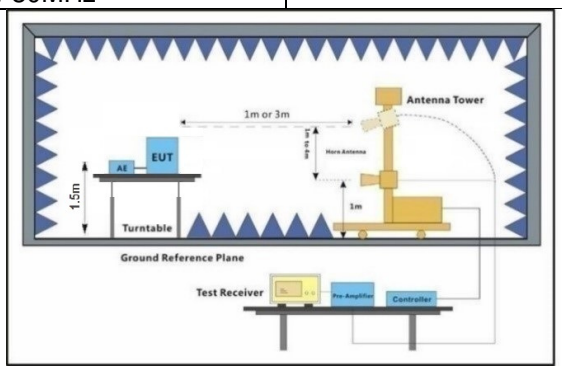
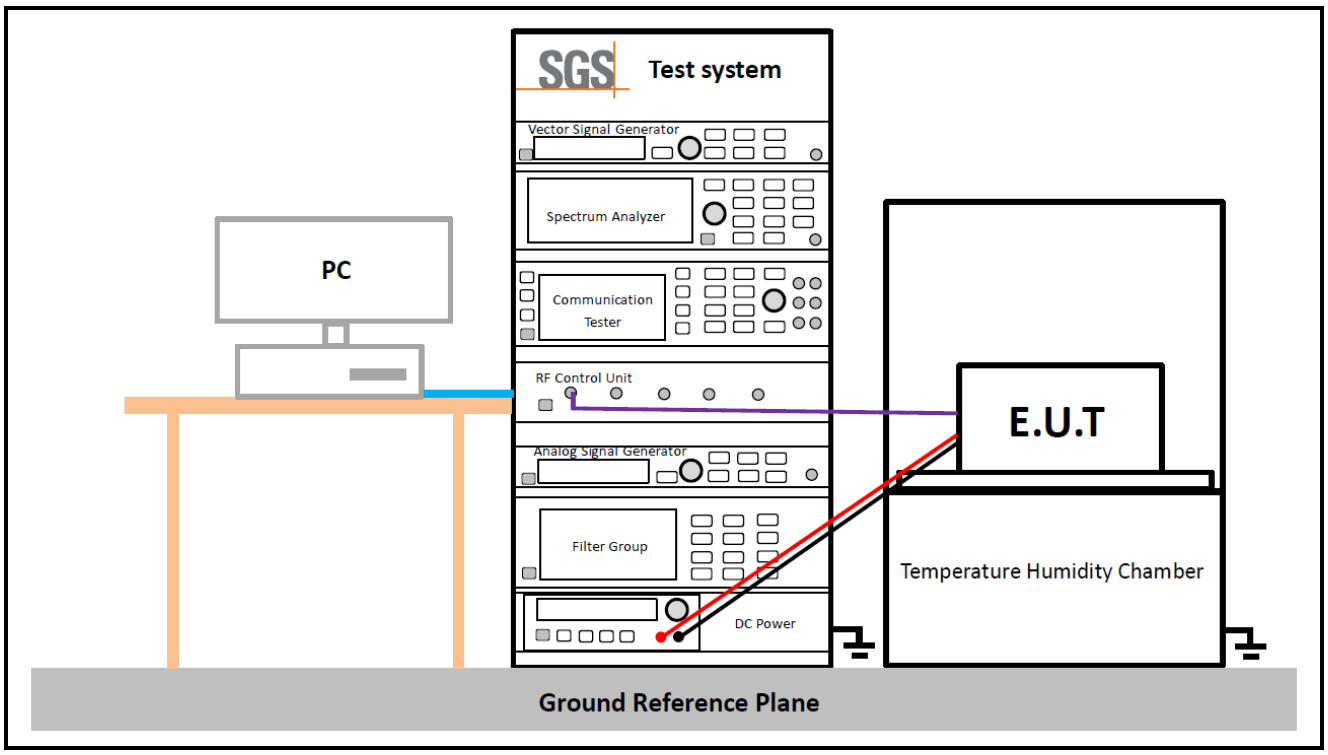


Figure 3. above 1GHz

4.9.3 Test Setup 3



4.10Test Conditions

Transmit Output Power Data - Average Power, Total	
Test Case	**Test Conditions**
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; LTE/TM3
Peak-to-Average Ratio	
Test Case	**Test Conditions**
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; LTE/TM3
Modulation Characteristics	
Test Case	**Test Conditions**
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; LTE/TM3
Bandwidth - Occupied Bandwidth	
Test Case	**Test Conditions**
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; LTE/TM3
Bandwidth - Emission Bandwidth	
Test Case	**Test Conditions**
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; LTE/TM3

Band Edges Compliance	
Test Case	**Test Conditions**
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;

Spurious Emission at Antenna Terminals	
Test Case	**Test Conditions**
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;

Field Strength of Spurious Radiation	
Test Case	**Test Conditions**
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.

Frequency Stability	
Test Case	**Test Conditions**
Test Environment	(1) -30 ℃ to +50 ℃ with step 10 ℃ 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;

5 Main Test Instruments

RF conducted test					
Test Equipment	Manufacturer	Model No.	Inventory No.	Cal. date (yyyy-mm-dd)	Cal.Due date (yyyy-mm-dd)
Shielding Room	Brilliant-emc	N/A	SUWI-04-01-06	2021/5/8	2024/5/7
Temperature and humidity meter	MingGao	TH101B	SUWI-01-01-07	2022/2/16	2023/2/15
Signal Analyzer	ROHDE&SCHWARZ	FSV3030	SUWI-01-02-02	2022/5/17	2023/5/16
Measurement Software	Tonscend	JS1120-3 Test System V 2.6.88.0336	SUWI-02-09-09	NCR	NCR
Radio Communication Analyzer	Anritsu	MT8821C	SUWI-01-26-03	2021/12/4	2022/12/3
Wideband Radio Communication Tester	ROHDE&SCHWARZ	CMW500	SUWI-01-16-05	2022/2/14	2023/2/13
Power meter	Anritsu	ML2495A	SUWI-01-31-01	2021/12/4	2022/12/3
Pulse power sensor	Anritsu	MA2411B	SUWI-01-32-01	2021/12/4	2022/12/3
DC Power Supply	HYELEC	HY3005B	SUWI-01-18-01	2022/2/15	2023/2/14
Temperature Chamber	ESPEC	SU-242	SUWI-01-13-01	2022/2/15	2023/2/14
Signal Analyzer*	ROHDE&SCHWARZ	FSW43	SUWI-01-02-04	2022/5/28	2023/5/27

RSE Test System					
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	2021/5/8	2024/5/7
Temperature and humidity meter	MingGao	TH101B	SUWI-01-01-05	2022/2/16	2023/2/15
Signal Analyzer*	ROHDE&SCHWARZ	FSW43	SUWI-01-02-04	2022/5/28	2023/5/27
Signal Analyzer	KEYSIGHT	N9020A	SUWI-01-02-05	2021/12/4	2022/12/3
Test receiver	ROHDE&SCHWARZ	ESR7	SUWI-01-10-01	2022/2/19	2023/2/18
DC Power Supply	HYELEC	HY3005B	SUWI-01-18-01	2022/2/15	2023/2/14
Receiving antenna	SCHWRZBECK MESS-ELEKTRONIK	VULB 9163	SUWI-01-11-01	2021/5/16	2023/5/15
Receiving antenna	SCHWRZBECK MESS-ELEKTRONIK	BBHA 9120D	SUWI-01-11-02	2021/5/16	2023/5/15
Receiving antenna	SCHWRZBECK MESS-ELEKTRONIK	BBHA 9170	SUWI-01-11-03	2021/5/14	2023/5/13
Amplifier	Tonscend	TAP9K3G40	SUWI-01-14-01	2022/2/14	2023/2/13
Amplifier	Tonscend	TAP01018050	SUWI-01-14-02	2022/2/14	2023/2/13
Amplifier	Tonscend	TAP18040048	SUWI-01-14-03	2022/2/19	2023/2/18
Active Loop Antenna	SCHWRZBECK MESS-ELEKTRONIK	FMZB 1519B	SUWI-01-21-01	2021/6/10	2023/6/9
Wideband Radio Communication Tester	Anritsu	MT8820C	SUWI-01-16-08	2022/2/14	2023/2/13
Wideband Radio Communication Tester	Anritsu	MT8821C	SUWI-01-26-03	2021/12/4	2022/12/3
Measurement Software	Tonscend	JS32-RE V4.0.0.0	SUWI-02-09-04	NCR	NCR
Measurement Software	Tonscend	JS32-RSE V4.0.0.1	SUWI-02-09-06	NCR	NCR

6 Measurement Uncertainty

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

No.	Item	Measurement Uncertainty
1	Total RF power, conducted	±0.54dB
2	RF power density, conducted	±1.03dB
3	Spurious emissions, conducted	±0.54dB
4	Radio Frequency	±1.0%
5	Duty Cycle	±0.37%
6	Occupied Bandwidth	±1.0%
7	Radiated Emission	± 3.13dB (9k -30MHz)
		± 4.8dB (30M -1GHz)
		± 4.8dB (1GHz to 18GHz)
		± 4.8dB (Above 18GHz)

7 Appendixes

Appendix A.3	WWAN Setup Photos
Appendix B.1	LTE Band 13

The End

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