

FCC TEST REPORT

Product Name: Handheld Smart Terminal

Trade Mark:



or RHINO

Model No.: T5se

Add. Model No.: N/A

Report Number: 220412017RFM-3

Test Standards: FCC 47 CFR Part 22 Subpart H
FCC 47 CFR Part 24 Subpart E
FCC 47 CFR Part 27 Subpart L

FCC ID: 2AUOUT5SE

Test Result: PASS

Date of Issue: August 8, 2022

Prepared for:

Rhino Mobility LLC

8 The Green, Suite A, Dover, Delaware, 19901, USA

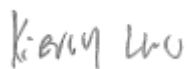
Prepared by:

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Version

Version No.	Date	Description
V1.0	August 8, 2022	Original



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1. GENERAL INFORMATION

1.1 CLIENT INFORMATION

Applicant:	Rhino Mobility LLC
Address of Applicant:	8 The Green, Suite A, Dover, Delaware,19901, USA
Manufacturer:	Rhino Mobility LLC
Address of Manufacturer:	8 The Green, Suite A, Dover, Delaware,19901, USA

1.2 EUT INFORMATION

1.2.1 General Description of EUT

Product Name:	Handheld Smart Terminal		
Model No.:	T5se		
Add. Model No.:	N/A		
Trade Mark:	 or RHINO		
DUT Stage:	Identical Prototype		
EUT Supports Function: (Provided by the customer)	UTRA Bands:	Band II/ Band IV/ Band V	
	E-UTRA Bands:	FDD Band 2/ Band 4/ Band 5/ Band 7/ Band 12/ Band 13/ Band 14/ Band 17/ Band 25/ Band 26/ Band 30/ Band 66/ Band 71	
		TDD Band 41	
	2.4 GHz ISM Band:	IEEE 802.11b/g/n	
		Bluetooth V4.2	
	5 GHz U-NII Bands:	5 150 MHz to 5 250 MHz	IEEE 802.11a/n/ac
		5 250 MHz to 5 350 MHz	IEEE 802.11a/n/ac
		5 725 MHz to 5 850 MHz	IEEE 802.11a/n/ac
RNSS Bands:	1559 MHz to 1610 MHz	GPS/ Galileo/ GLONASS	
NFC:	13.553 MHz to 13.567 MHz		
Software Version:	T5se(001)_20220624 (Provided by the customer)		
Hardware Version:	AL_Z06_MB_V12 (Provided by the customer)		
Sample Received Date:	April 13, 2022		
Sample Tested Date:	April 15, 2022 to June 27, 2022		
Note: The T5se have two LCD modules from different vendors. This report has evaluated and pre-testing of two batches of LCD modules, with only the worst data recorded in the report.			
Remark: The above EUT's information was provided by customer. Please refer to the specifications or user's manual for more detailed description.			

1.2.2 Description of Accessories

Adapter	
Model No.:	XY-PP018U1
Input:	100-240 V~50/60 Hz 0.5A
Output:	3.6-6.0 V $\Rightarrow$ 3.0A, 6.0-9.0 V $\Rightarrow$ 2.0A, 9.0-12.0 V $\Rightarrow$ 1.5A
AC Cable:	N/A
DC Cable:	N/A

Internal Battery	
Model No.:	BPT5se
Battery Type:	Lithium-ion Rechargeable Battery
Rated Voltage:	3.85 Vdc
Limited Charge Voltage:	4.4 Vdc
Rated Capacity:	3000 mAh

External Battery Pack	
Model No.:	T5SE-EBAT-3K-BLK
Battery Type:	Lithium-ion Rechargeable Battery
Rated Voltage:	3.85 Vdc
Limited Charge Voltage:	4.4 Vdc
Rated Capacity:	3030 mAh

Cable	
Description:	USB Type-C Plug Cable
Cable Type:	Shielded without ferrite
Length:	1 Meter

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1.3 PRODUCT SPECIFICATION SUBJECTIVE TO THIS STANDARD

Support Networks:	WCDMA, HSDPA, HSUPA, HSPA+	
Type of Modulation:	WCDMA	BPSK
	HSDPA:	QPSK
	HSUPA:	QPSK
	HSPA+:	16QAM
Frequency Range:	WCDMA Band II:	1852.4-1907.6 MHz
	WCDMA Band IV:	1712.4-1752.6 MHz
	WCDMA Band V:	826.4-846.6 MHz
Max RF Output Power:	WCDMA Band II:	19.86dBm
	WCDMA Band IV:	20.81dBm
	WCDMA Band V:	22.96dBm
Emission Designator:	WCDMA Band II:	4M17F9W
	WCDMA Band IV:	4M17F9W
	WCDMA Band V:	4M19F9W
IEMI:	Radiated: 354657110011383	
	Conducted: 354657110011581, 354657110011771	
Antenna Type: (Provided by the customer)	LDS Antenna	
Antenna Gain: (Provided by the customer)	WCDMA Band II:	1.32 dBi
	WCDMA Band IV:	0.35 dBi
	WCDMA Band V:	-0.54 dBi
Normal Test Voltage: (Provided by the customer)	3.85 Vdc	
Extreme Test Voltage: (Provided by the customer)	3.4 to 4.4Vdc	
Extreme Test Temperature:	-30 °C to +50 °C	

1.4 DESCRIPTION OF SUPPORT UNITS

The EUT has been tested with associated equipment below.

1) Support Equipment

Description	Manufacturer	Model No.	Serial Number	Supplied by
--	--	--	--	--

2) Support Cable

Cable No.	Description	Connector	Length	Supplied by
1	Antenna Cable	SMA	0.3 Meter	UnionTrust

1.5 TEST LOCATION

Shenzhen UnionTrust Quality and Technology Co., Ltd.

Address: Unit D/E of 9/F and 16/F, Block A, Building 6, Baoneng science and technology park, Longhua district, Shenzhen, China, China 518109

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1.6 TEST FACILITY

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

CNAS-Lab Code: L9069

The measuring equipment utilized to perform the tests documented in this report has been calibrated once a year or in accordance with the manufacturer's recommendations, and is traceable under the ISO/IEC 17025 to international or national standards. Equipment has been calibrated by accredited calibration laboratories.

A2LA-Lab Certificate No.: 4312.01

Shenzhen UnionTrust Quality and Technology Co., Ltd. has been accredited by A2LA for technical competence in the field of electrical testing, and proved to be in compliance with ISO/IEC 17025 General Requirements for the Competence of Testing and Calibration Laboratories and any additional program requirements in the identified field of testing.

ISED Wireless Device Testing Laboratories

CAB identifier: CN0032

FCC Accredited Lab.

Designation Number: CN1194

Test Firm Registration Number: 259480

1.7 DEVIATION FROM STANDARDS

None.

1.8 ABNORMALITIES FROM STANDARD CONDITIONS

None.

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1.9 OTHER INFORMATION REQUESTED BY THE CUSTOMER

None.

1.10 MEASUREMENT UNCERTAINTY

Where relevant, the following measurement uncertainty levels have been estimated for tests performed on the Product as specified in CISPR 16-4-2. This uncertainty represents an expanded uncertainty expressed at approximately the 95% confidence level using a coverage factor of k=2.

No.	Item	Measurement Uncertainty
1	Conducted Output Power	±0.7 dB
2	99%&26dB Bandwidth	±1.86 %
3	Emission Mask	±2.7 dBm
4	Spurious emissions at antenna terminals	±2.7 dBm
5	Field strength of spurious radiation	30 MHz-1 GHz: ±4.9 dB 1 GHz-18 GHz: ±4.8 dB 18 GHz-40 GHz: ±5.1 dB
6	Frequency stability	±6.5 x 10 ⁻⁸
7	Humidity	±3.9 %
8	Temperature	±0.62 °C
9	DC Voltages	±0.68 %

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2. TEST SUMMARY

FCC 47 CFR Part 22 Subpart H Test Cases			
Test Item	Test Requirement	Test Method	Result
Effective Radiated Power (ERP)	FCC 47 CFR Part 2.1046(a) & FCC 47 CFR Part 22.913(a)	ANSI C63.26-2015 & KDB 971168 D01v03r01	PASS
Conducted Output Power	FCC 47 CFR Part 2.1046(a) & FCC 47 CFR Part 22.913(a)	ANSI C63.26-2015 & KDB 971168 D01v03r01	PASS
Peak-to-average ratio	FCC 47 CFR Part 22.913(a)	ANSI C63.26-2015 & KDB 971168 D01v03r01	PASS
99%&26dB Bandwidth	FCC 47 CFR Part 2.1049(h)	ANSI C63.26-2015 & KDB 971168 D01v03r01	PASS
Band Edge at antenna terminals	FCC 47 CFR Part 2.1051 & FCC 47 CFR Part 22.917(a)	ANSI C63.26-2015 & KDB 971168 D01v03r01	PASS
Spurious emissions at antenna terminals	FCC 47 CFR Part 2.1051 & FCC 47 CFR Part 22.917(a)(b)	ANSI C63.26-2015 & KDB 971168 D01v03r01	PASS
Field strength of spurious radiation	FCC 47 CFR Part 2.1053 & FCC 47 CFR Part 22.917(a)(b)	ANSI C63.26-2015 & KDB 971168 D01v03r01	PASS
Frequency stability	FCC 47 CFR Part 2.1055 & FCC 47 CFR Part 22.355	ANSI C63.26-2015 & KDB 971168 D01v03r01	PASS

FCC 47 CFR Part 24 Subpart E Test Cases			
Test Item	Test Requirement	Test Method	Result
Equivalent Isotropic Radiated Power (EIRP)	FCC 47 CFR Part 2.1046(a) & FCC 47 CFR Part 24.232(c)	ANSI C63.26-2015 & KDB 971168 D01v03r01	PASS
Conducted Output Power	FCC 47 CFR Part 2.1046(a) & FCC 47 CFR Part 24.232(c)	ANSI C63.26-2015 & KDB 971168 D01v03r01	PASS
Peak-to-average ratio	FCC 47 CFR Part 24.232(d)	KDB 971168 D01v03r01	PASS
99%&26dB Bandwidth	FCC 47 CFR Part 2.1049(h) & FCC 47 CFR Part 24.238(b)	ANSI C63.26-2015 & KDB 971168 D01v03r01	PASS
Band Edge at antenna terminals	FCC 47 CFR Part 2.1051 & FCC 47 CFR Part 24.238(a)	ANSI C63.26-2015 & KDB 971168 D01v03r01	PASS
Spurious emissions at antenna terminals	FCC 47 CFR Part 2.1051 & FCC 47 CFR Part 24.238(a)(b)	ANSI C63.26-2015 & KDB 971168 D01v03r01	PASS
Field strength of spurious radiation	FCC 47 CFR Part 2.1053 & FCC 47 CFR Part 24.238(a)(b)	ANSI C63.26-2015 & KDB 971168 D01v03r01	PASS
Frequency stability	FCC 47 CFR Part 2.1055 & FCC 47 CFR Part 24.235	ANSI C63.26-2015 & KDB 971168 D01v03r01	PASS

FCC 47 CFR Part 27 Subpart L Test Cases			
Test Item	Test Requirement	Test Method	Result
Equivalent Isotropic Radiated Power (EIRP)	FCC 47 CFR Part 2.1046(a) & FCC 47 CFR Part 27.50(d)(4)	ANSI C63.26-2015 & KDB 971168 D01v03r01	PASS
Conducted Output Power	FCC 47 CFR Part 2.1046(a) & FCC 47 CFR Part 27.50(d)(4)	ANSI C63.26-2015 & KDB 971168 D01v03r01	PASS
Peak-to-average ratio	FCC 47 CFR Part 27.50(d)(5)	KDB 971168 D01v03r01	PASS
99%&26dB Bandwidth	FCC 47 CFR Part 2.1049(h) & FCC 47 CFR Part 27.53(h)	ANSI C63.26-2015 & KDB 971168 D01v03r01	PASS
Band Edge at antenna terminals	FCC 47 CFR Part 27.53(h)(1)	ANSI C63.26-2015 & KDB 971168 D01v03r01	PASS
Spurious emissions at antenna terminals	FCC 47 CFR Part 2.1051 & FCC 47 CFR Part 27.53(h)	ANSI C63.26-2015 & KDB 971168 D01v03r01	PASS
Field strength of spurious radiation	FCC 47 CFR Part 2.1053 & FCC 47 CFR Part 27.53(h)	ANSI C63.26-2015 & KDB 971168 D01v03r01	PASS
Frequency stability	FCC 47 CFR Part 2.1055 & FCC 47 CFR Part 27.54	ANSI C63.26-2015 & KDB 971168 D01v03r01	PASS

Disclaimer and Explanations:

The declared of product specification and data (e.g. antenna gain, RF specification, etc) for EUT presented in the report are provided by the customer, and the customer takes all the responsibilities for the accuracy of product specification.

3. EQUIPMENT LIST

Radiated Emission Test Equipment List						
Used	Equipment	Manufacturer	Model No.	Serial Number	Cal. date	Cal. Due date
☒	3M Chamber & Accessory Equipment	ETS-LINDGREN	3M	Euroshiedpn-CT001270-1317	22-Jan-2021	21-Jan-2024
☒	Receiver	R&S	ESIB26	100114	5-Nov-2021	4-Nov-2022
☐	EXA Spectrum Analyzer	KEYSIGHT	N9010A	MY51440197	15-Apr-2022	14-Apr-2023
☐	Loop Antenna	ETS-LINDGREN	6502	00202525	11-Nov-2021	10-Nov-2023
☒	Broadband Antenna	ETS-LINDGREN	3142E	00201566	11-Nov-2021	10-Nov-2023
☒	6dB Attenuator	Talent	RA6A5-N-18	18103001	11-Nov-2021	10-Nov-2023
☒	Preamplifier	HP	8447F	2805A02960	5-Nov-2021	4-Nov-2022
☐	Broadband Antenna (Pre-amplifier)	ETS-LINDGREN	3142E-PA	00201891	30-Apr-2021	29-Apr-2023
☐	6dB Attenuator	Talent	RA6A5-N-18	18103002	5-Nov-2021	4-Nov-2022
☐	Horn Antenna	ETS-LINDGREN	3117	00164202	11-Nov-2021	10-Nov-2023
☒	Horn Antenna (Pre-amplifier)	ETS-LINDGREN	3117-PA	00201874	17-Apr-2022	16-Apr-2024
☒	Pre-amplifier	ETS-LINDGREN	00118385	00201874	6-Nov-2021	5-Nov-2022
☐	Horn Antenna	ETS-LINDGREN	3116C	00200180	17-Apr-2022	16-Apr-2024
☒	Horn Antenna (Pre-amplifier)	ETS-LINDGREN	3116C-PA	00202652	14-Nov-2020	13-Nov-2022
☒	Pre-amplifier	ETS-LINDGREN	00118384	00202652	17-Nov-2020	16-Nov-2022
☒	Multi device Controller	ETS-LINDGREN	7006-001	00160105	N/A	N/A
☒	Test Software	Audix	e3	Software Version: 9.160323		

RF Conducted Test Equipment List						
Used	Equipment	Manufacturer	Model No.	Serial Number	Cal. date	Cal. Due date
☐	EXA Spectrum Analyzer	KEYSIGHT	N9010A	MY51440197	15-Apr-2022	14-Apr-2023
☒	EXA Spectrum Analyzer	KEYSIGHT	N9020A	MY51286807	5-Nov-2021	4-Nov-2022
☐	Spectrum analyzer	R&S	FSV40-N	101653	15-Apr-2022	14-Apr-2023
☒	DC Source	KIKUSUI	PWR400L	LK003024	20-Aug-2021	19-Aug-2022
☐	Temp & Humidity chamber	Espec	GL(U)04KA(W)	16921H201P3	20-Aug-2021	19-Aug-2022
☒	Temp & Humidity chamber	Votisch	VT4002	58566133290020	15-Apr-2022	14-Apr-2023
☐	Wideband Radio Communication Tester	R&S	CMW500	119583	15-Apr-2022	14-Apr-2023
☒	Wideband Radio Communication Tester	R&S	CMW500	120932	15-Apr-2022	14-Apr-2023

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4. TEST CONFIGURATION

4.1 ENVIRONMENTAL CONDITIONS FOR TESTING

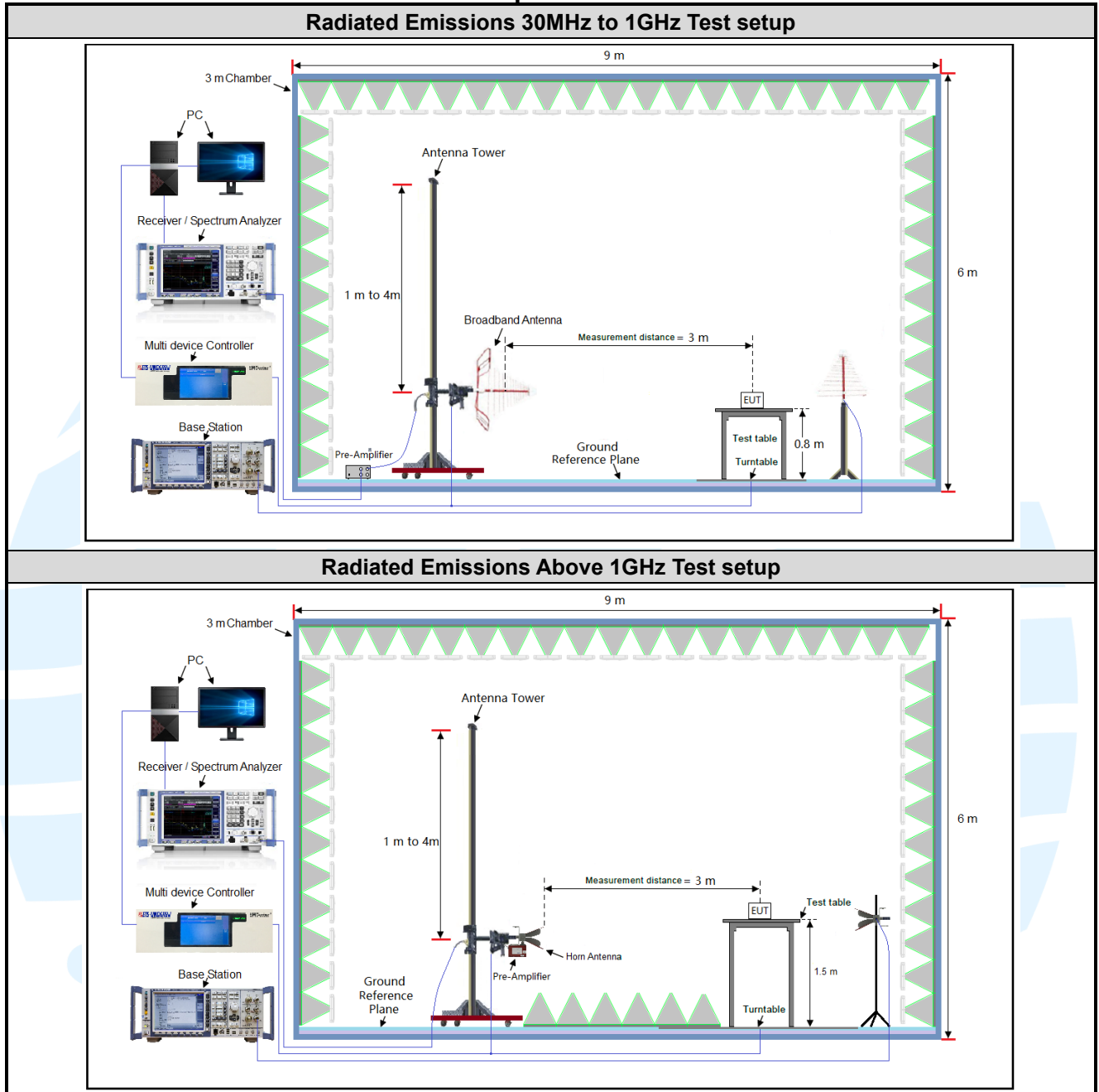
Test Environment	Selected Values During Tests		
Test Condition	Ambient		
	Temperature (°C)	Voltage (V)	Relative Humidity (%)
TN/VN	+15 to +35	3.85	20 to 75
TL/VL	-30	3.4	20 to 75
TH/VL	+50	3.4	20 to 75
TL/VH	-30	4.4	20 to 75
TH/VH	+50	4.4	20 to 75

Remark:

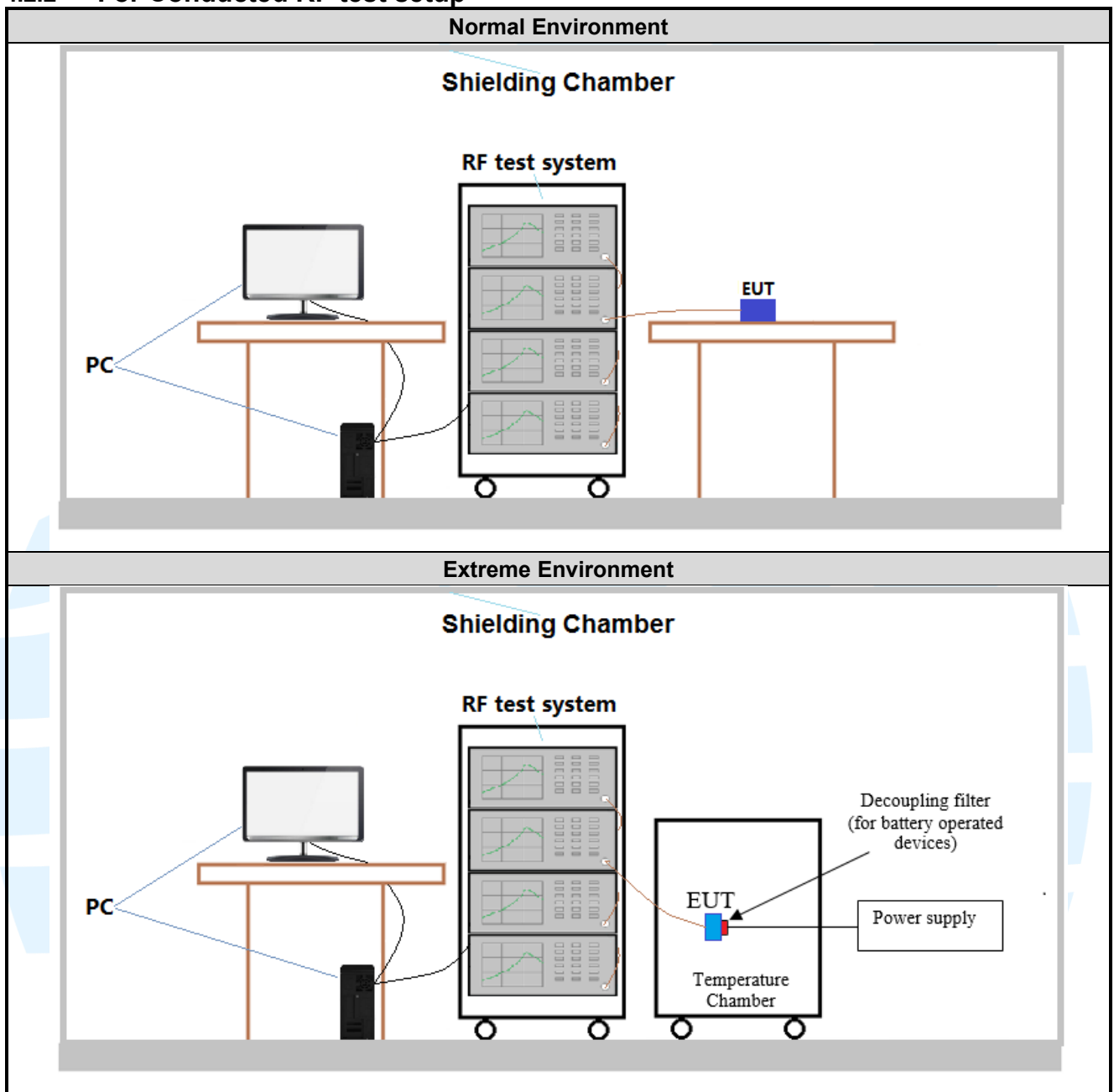
- 1) The EUT just work in such extreme temperature of -30 °C to +50 °C and the extreme voltage of 3.4 V to 4.4 V, so here the EUT is tested in the temperature of -30 °C to +50 °C and the voltage of 3.4 V to 4.4 V.
- 2) VN: Normal Voltage; TN: Normal Temperature;
TL: Low Extreme Test Temperature; TH: High Extreme Test Temperature;
VL: Low Extreme Test Voltage; VH: High Extreme Test Voltage.

4.2 TEST SETUP

4.2.1 For Radiated Emissions test setup



4.2.2 For Conducted RF test setup



4.3 TEST CHANNELS

Bands	Tx/Rx Frequency	RF Channel		
		Low(L)	Middle(M)	High(H)
WCDMA band V	Tx (824 MHz ~ 849 MHz)	Channel 4132	Channel 4182	Channel 4233
		826.4 MHz	836.4 MHz	846.6 MHz

Bands	Tx/Rx Frequency	RF Channel		
		Low(L)	Middle(M)	High(H)
WCDMA Band II	Tx (1850 MHz-1910 MHz)	Channel 9262	Channel 9400	Channel 9538
		1852.4 MHz	1880.0 MHz	1907.6 MHz

Bands	Tx/Rx Frequency	RF Channel		
		Low(L)	Middle(M)	High(H)
WCDMA Band IV	Tx (1710 MHz-1755 MHz)	Channel 1312	Channel 1412	Channel 1513
		1712.4 MHz	1732.4 MHz	1752.6 MHz

4.4 SYSTEM TEST CONFIGURATION

For emissions testing, the equipment under test (EUT) setup to transmit continuously to simplify the measurement methodology. Care was taken to ensure proper power supply voltages during testing. During testing, radiated emission were performed with the EUT set to transmit at the channel with highest output power as worst-case scenario. It was powered by a 3.85Vdc rechargeable Li-on battery. Only the worst-case data were recorded in this test report.

Pre-Scan has been conducted to determine the worst-case mode from all possible combinations between available modulations, data rates, X/Y/Z axis, and antenna ports.

All readings are extrapolated back to the equivalent three meter reading using inverse scaling with distance. Analyzer resolution is 100 kHz or greater for frequencies below 1000MHz. The resolution is 1 MHz or greater for frequencies above 1000MHz. The spurious emissions more than 20 dB below the permissible value are not reported.

Radiated emission measurement were performed from the lowest radio frequency signal generated in the device which is greater than 9 kHz to the tenth harmonic of the highest fundamental frequency or to 40 GHz, whichever is lower.

4.5 PRE-SCAN

During all testing, EUT is in link mode with base station emulator at maximum power level. WCDMA worse case mode applicability and tested channel detail as below:

Item	Mode					Test Channel		
	RMC 12.2kbps	HSDPA	HSUPA	HSPA+	DC-HSDPA	Low	Mid	High
Conducted Output Power	☒	☒	☒	☒	☐	☒	☒	☒
Peak-to-average ratio	☒	☐	☐	☐	☐	☒	☒	☒
99%&26dB Bandwidth	☒	☐	☐	☐	☐	☒	☒	☒
Band Edge at antenna terminals	☒	☐	☐	☐	☐	☒	☒	☒
Spurious emissions at antenna terminals	☒	☐	☐	☐	☐	☒	☒	☒
Field strength of spurious radiation	☒	☐	☐	☐	☐	☒	☒	☒
Frequency stability	☒	☐	☐	☐	☐	☐	☒	☐
Remark: The mark " ☒ " means is chosen for testing; The mark " ☐ " means is not chosen for testing.								

5. RADIO TECHNICAL REQUIREMENTS SPECIFICATION

5.1 REFERENCE DOCUMENTS FOR TESTING

No.	Identity	Document Title
1	FCC 47 CFR Part 2	Frequency allocations and radio treaty matters; general rules and regulations
2	FCC 47 CFR Part 22	Public Mobile Services
3	FCC 47 CFR Part 27	Miscellaneous Wireless Communications Services
4	FCC 47 CFR Part 24	Personal Communications Services
5	ANSI C63.26-2015	American National Standard for Compliance Testing of Transmitters Used in Licensed Radio Services
6	KDB 971168 D01	KDB 971168 D01 Power Meas License Digital Systems v03r01

5.2 CONDUCTED OUTPUT POWER AND ERP/EIRP

Test Requirement: FCC 47 CFR Part 2.1046(a),
FCC 47 CFR Part 22.913(a),
FCC 47 CFR Part 24.232(c),
FCC 47 CFR Part 27.50(d)(4)

Test Method: KDB 971168 D01v03r01 & ANSI C63.26-2015

Limit:

- **Conducted Output Power:** No Limit

- **ERP or EIRP:**

FCC 47 CFR Part 22.913(a): The ERP of mobile transmitters and auxiliary test transmitters must not exceed 7 Watts.

FCC 47 CFR Part 24.232(c): Mobile and portable stations are limited to 2 watts EIRP.

FCC 47 CFR Part 27.50(d)(4): Fixed, mobile, and portable (hand-held) stations operating in the 1710-1755 MHz band and mobile and portable stations operating in the 1695-1710 MHz and 1755-1780 MHz bands are limited to 1 watt EIRP.

Test Procedure:

- **Conducted Output Power:** The EUT was set up for the maximum power with GSM, GPRS, EDGE, WCDMA, CDMA2000, and LTE link data modulation and link up with simulator. Set the EUT to transmit under low, middle and high channel and record the power level shown on simulator.

Note: The cable loss and attenuator loss were offset into measure device as an amplitude offset.

- **ERP or EIRP**

According to KDB 412172 D01 Power Approach,

- **ERP or EIRP = $P_T + G_T - L_c$**
- **ERP = EIRP -2.15**

where

- **P_T** = transmitter output power, expressed in dBW, dBm, or PSD;
- **G_T** = gain of the transmitting antenna, in dBd (ERP) or dBi (EIRP);
- **L_c** = signal attenuation in the connecting cable between the transmitter and antenna, in dB.

Test Setup: Refer to section 4.2.2 for details.

Instruments Used: Refer to section 3 for details

Test Mode: Link mode

Test Results: Pass

Test Data: Please refer to Appendix A

Note: The maximum ERP/EIRP is calculated from max output power and antenna gain, the antenna gain provided by the customer, and the customer takes all the responsibilities for the accuracy of antenna gain.

5.3 PEAK-TO-AVERAGE RATIO

Test Requirement: FCC 47 CFR Part 22.913(a),
FCC 47 CFR Part 24.232(c),
FCC 47 CFR Part 27.50(d)(5)

Test Method: KDB 971168 D01v03r01 Section 5.7

Limit: In measuring transmissions in this band using an average power technique, the peak-to-average ratio (PAR) of the transmission may not exceed 13 dB

Test Procedure:

The transmitter output was connected to a calibrated coaxial cable and coupler, the other end of which was connected to a spectrum analyzer.

- Set resolution/measurement bandwidth $\geq$ signal's occupied bandwidth
- Set the number of counts to a value that stabilizes the measured CCDF curve
- Record the maximum PAPR level associated with a probability of 0.1 %

Note: The cable loss and attenuator loss were offset into measure device as an amplitude offset.

Test Setup: Refer to section 4.2.2 for details.

Instruments Used: Refer to section 3 for details

Test Mode: Link mode

Test Results: Pass

Test Data: Please refer to Appendix A

5.499%&26DB BANDWIDTH

Test Requirement: FCC 47 CFR Part 2.1049(h),
FCC 47 CFR Part 22.917(b),
FCC 47 CFR Part 24.238(b),
FCC 47 CFR Part 27.53(h)

Test Method: ANSI C63.26-2015 & KDB 971168 D01v03r01 Section 4

Limit: No Limit, for reporting purposes only.

Test Procedure:

The transmitter output was connected to a calibrated coaxial cable and coupler, the other end of which was connected to a spectrum analyzer. The occupied bandwidth was measured with the spectrum analyzer at the low, middle and high channel in each band. The 99% and -26dB bandwidths was also measured and recorded.

Note: The cable loss and attenuator loss were offset into measure device as an amplitude offset.

Test Setup: Refer to section 4.2.2 for details.

Instruments Used: Refer to section 3 for details

Test Mode: Link mode

Test Results: Pass

Test Data: Please refer to Appendix A

5.5 BAND EDGE AT ANTENNA TERMINALS

Test Requirement: FCC 47 CFR Part 2.1051,
FCC 47 CFR Part 22.917(a),
FCC 47 CFR Part 24.238(a),
FCC 47 CFR Part 27.53(h)(1)

Test Method: ANSI C63.26-2015 & KDB 971168 D01v03r01

Limit:

The power of any emission outside of the authorized operating frequency ranges must be attenuated below the transmitting power (P) by a factor of at least $43 + 10 \log(P)$ dB. The emission limit equal to -13 dBm.

Test Procedure:

The transmitter output was connected to a calibrated coaxial cable and coupler, the other end of which was connected to a spectrum analyzer.

For each band edge measurement:

- 1) Set the spectrum analyzer span to include the block edge frequency.
- 2) Set a marker to point the corresponding band edge frequency in each test case.
- 3) Set display line at -13 dBm
- 4) Set resolution bandwidth to at least 1% of emission bandwidth.
- 5) Set spectrum analyzer with RMS detector.
- 6) Record the max trace plot into the test report

Note: The cable loss and attenuator loss were offset into measure device as an amplitude offset.

Test Setup: Refer to section 4.2.2 for details.

Instruments Used: Refer to section 3 for details

Test Mode: Link mode

Test Results: Please refer to Appendix A

5.6 SPURIOUS EMISSIONS AT ANTENNA TERMINALS

Test Requirement: FCC 47 CFR Part 2.1051,
FCC 47 CFR Part 22.917(a)(b),
FCC 47 CFR Part 24.238(a)(b),
FCC 47 CFR Part 27.53(h)(1)

Test Method: ANSI C63.26-2015 & KDB 971168 D01v03r01

Limit:

The power of any emission outside of the authorized operating frequency ranges must be attenuated below the transmitting power (P) by a factor of at least $43 + 10 \log(P)$ dB. The emission limit equal to -13 dBm.

Test Procedure:

The EUT makes a phone call to the communication simulator. All measurements were done at low, middle and high operational frequency range. b. Measuring frequency range is from 30 MHz to the tenth harmonic of the highest fundamental frequency or to 40 GHz, whichever is lower. Set RBW & VBW to 100 kHz for the measurement below 1 GHz, and 1 MHz for the measurement above 1 GHz.

Note: The cable loss and attenuator loss were offset into measure device as an amplitude offset.

Test Setup: Refer to section 4.2.2 for details.

Instruments Used: Refer to section 3 for details

Test Mode: Link mode

Test Results: Please refer to Appendix A

5.7 FIELD STRENGTH OF SPURIOUS RADIATION

Test Requirement: FCC 47 CFR Part 2.1053,
FCC 47 CFR Part 22.917(a)(b),
FCC 47 CFR Part 24.238(a)(b),
FCC 47 CFR Part 27.53(h)(1)

Test Method: ANSI C63.26-2015 & KDB 971168 D01v03r01 Section 7

Limits:

The power of any emission outside of the authorized operating frequency ranges must be attenuated below the transmitting power (P) by a factor of at least $43 + 10 \log(P)$ dB. The emission limit equal to -13 dBm.

Test Setup: Refer to section 4.2.1 for details.

Test Procedures: KDB 971168 D01v03r01 Section 7

Equipment Used: Refer to section 3 for details.

Test Result: Pass

The measurement data as follows:

WCDMA Band II							
No.	Frequency	SA Reading	Correction factor	EIRP Result	Limit	Margin	Ant. Pol.
	(MHz)	(dBm)	(dB/m)	(dBm)	(dBm)	(dB)	
RMC 12.2kbps_Lowest Channel							
1	932.141	-82.2	14.1	-68.1	-13.0	-55.1	Horizontal
2	3704.8	-69.1	7.6	-61.5	-13.0	-48.5	Horizontal
3	5557.2	-67.6	11.8	-55.9	-13.0	-42.9	Horizontal
4	945.334	-82.5	14.2	-68.3	-13.0	-55.3	Vertical
5	3704.8	-64.1	7.6	-56.5	-13.0	-43.5	Vertical
6	5557.2	-67.5	11.8	-55.7	-13.0	-42.7	Vertical
RMC 12.2kbps_Middle Channel							
1	979.139	-82.2	14.4	-67.8	-13.0	-54.8	Horizontal
2	3760	-64.5	7.8	-56.7	-13.0	-43.7	Horizontal
3	5640	-67.2	11.6	-55.6	-13.0	-42.6	Horizontal
4	912.695	-82.1	14.0	-68.1	-13.0	-55.1	Vertical
5	3760	-67.2	7.8	-59.4	-13.0	-46.4	Vertical
6	5640	-70.3	11.6	-58.8	-13.0	-45.8	Vertical
RMC 12.2kbps_Highest Channel							
1	992.997	-82.2	14.8	-67.4	-13.0	-54.4	Horizontal
2	3815.2	-65.2	8.0	-57.2	-13.0	-44.2	Horizontal
3	5722.8	-71.2	11.4	-59.8	-13.0	-46.8	Horizontal
4	919.132	-82.5	14.0	-68.5	-13.0	-55.5	Vertical
5	3815.2	-65.3	8.0	-57.3	-13.0	-44.3	Vertical
6	5722.8	-71.2	11.4	-59.8	-13.0	-46.8	Vertical

WCDMA Band IV							
No.	Frequency	SA Reading	Correction factor	EIRP Result	Limit	Margin	Ant. Pol.
	(MHz)	(dBm)	(dB/m)	(dBm)	(dBm)	(dB)	
RMC 12.2kbps_Lowest Channel							
1	906.304	-82.1	13.9	-68.2	-13.0	-55.2	Horizontal
2	3424.8	-64.6	6.5	-58.1	-13.0	-45.1	Horizontal
3	5137.2	-65.1	10.0	-55.1	-13.0	-42.1	Horizontal
4	919.132	-81.7	14.0	-67.7	-13.0	-54.7	Vertical
5	3424.8	-63.1	6.5	-56.6	-13.0	-43.6	Vertical
6	5137.2	-64.7	10.0	-54.7	-13.0	-41.7	Vertical
RMC 12.2kbps_Middle Channel							
1	899.958	-81.7	13.9	-67.8	-13.0	-54.8	Horizontal
2	3464.8	-64.3	6.6	-57.7	-13.0	-44.7	Horizontal
3	5197.2	-65.9	10.2	-55.7	-13.0	-42.7	Horizontal
4	844.803	-81.3	12.7	-68.6	-13.0	-55.6	Vertical
5	3464.8	-63.9	6.6	-57.3	-13.0	-44.3	Vertical
6	5197.2	-64.2	10.2	-54.0	-13.0	-41.0	Vertical
RMC 12.2kbps_Highest Channel							
1	958.714	-82.3	14.3	-68.0	-13.0	-55.0	Horizontal
2	3505.2	-66.1	6.8	-59.4	-13.0	-46.4	Horizontal
3	5257.8	-65.6	10.6	-55.0	-13.0	-42.0	Horizontal
4	919.132	-82.5	14.0	-68.5	-13.0	-55.5	Vertical
5	3505.2	-65.6	6.8	-58.8	-13.0	-45.8	Vertical
6	5257.8	-65.8	10.6	-55.3	-13.0	-42.3	Vertical

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WCDMA Band V							
No.	Frequency	SA Reading	Correction factor	EIRP Result	Limit	Margin	Ant. Pol.
	(MHz)	(dBm)	(dB/m)	(dBm)	(dBm)	(dB)	
RMC 12.2kbps_Lowest Channel							
1	1000	-88.6	43.6	-45.0	-13.0	-32.0	Horizontal
2	1652.8	-67.2	0.2	-67.0	-13.0	-54.0	Horizontal
3	2479.2	-68.5	3.6	-64.9	-13.0	-51.9	Horizontal
4	992.997	-87.9	43.4	-44.5	-13.0	-31.5	Vertical
5	1652.8	-67.0	0.2	-66.7	-13.0	-53.7	Vertical
6	2479.2	-68.5	3.6	-64.9	-13.0	-51.9	Vertical
RMC 12.2kbps_Middle Channel							
1	965.474	-88.0	43.1	-44.9	-13.0	-31.9	Horizontal
2	1672.8	-66.3	0.4	-65.9	-13.0	-52.9	Horizontal
3	2509.2	-67.2	3.7	-63.5	-13.0	-50.5	Horizontal
4	919.132	-87.6	42.9	-44.8	-13.0	-31.8	Vertical
5	1672.8	-66.3	0.4	-66.0	-13.0	-53.0	Vertical
6	2509.2	-68.8	3.7	-65.1	-13.0	-52.1	Vertical
RMC 12.2kbps_Highest Channel							
1	932.141	-87.7	42.9	-44.8	-13.0	-31.8	Horizontal
2	1693.2	-66.5	0.5	-66.0	-13.0	-53.0	Horizontal
3	2539.8	-67.1	3.8	-63.3	-13.0	-50.3	Horizontal
4	881.184	-87.9	42.5	-45.4	-13.0	-32.4	Vertical
5	1693.2	-66.5	0.5	-66.0	-13.0	-53.0	Vertical
6	2539.8	-66.7	3.8	-62.9	-13.0	-49.9	Vertical

Remark:

1. Correct Factor = Antenna Factor + Cable Loss - Amplifier Gain, the value was added to Original Receiver Reading by the software automatically.
2. Result = Reading + Correct Factor.
3. Margin = Result – Limit

5.8 FREQUENCY STABILITY

Test Requirement: FCC 47 CFR Part 2.1055 &
FCC 47 CFR Part 22.355 &
FCC 47 CFR Part 24.235 &
FCC 47 CFR Part 27.54

Test Method: ANSI C63.26-2015 & KDB 971168 D01v03r01

Limits:

FCC 47 CFR Part 22.355,

The carrier frequency shall not depart from the reference frequency in excess of ± 2.5 ppm for mobile stations.

FCC 47 CFR Part 24.235, FCC 47 CFR Part 27.54

The frequency stability shall be sufficient to ensure that the fundamental emission stays within the authorized frequency block.

Test Setup: Refer to section 4.2.2 for details.

Test Procedures:

1) Use CMW 500 with Frequency Error measurement capability.

a) Temp. = -30° to $+50^{\circ}\text{C}$

b) Voltage = low voltage, 3.4 Vdc, Normal, 3.85 Vdc and High voltage, 4.4 Vdc.

2) Frequency Stability vs Temperature:

The EUT is placed inside a temperature chamber. The temperature is set to 20°C and allowed to stabilize. After sufficient soak time, the transmitting frequency error is measured. The temperature is increased by 10 degrees, allowed to stabilize and soak, and then the measurement is repeated. This is repeated until $+50^{\circ}\text{C}$ is reached.

3) Frequency Stability vs Voltage:

The peak frequency error is recorded (worst-case).

Equipment Used: Refer to section 3 for details.

Test Result: Pass

Modulation	Channel/ Frequency (MHz)	Voltage (Vdc)	Temperature ($^{\circ}\text{C}$)	Deviation (Hz)	Deviation (ppm)	Limit (ppm)	Pass/ Fail
WCDMA II RMC 12.2Kbps							
BPSK	9400 / 1880.0	VL	TN	-14	-0.0074	N/A	Pass
		VN		-12	-0.0064		Pass
		VH		-17	-0.0090		Pass
		VN	50	-11	-0.0059		Pass
			40	-13	-0.0069		Pass
			30	-12	-0.0064		Pass
			20	-13	-0.0069		Pass
			10	-12	-0.0064		Pass
			0	-10	-0.0053		Pass
			-10	-14	-0.0074		Pass
			-20	-12	-0.0064		Pass
			-30	-13	-0.0069		Pass

Modulation	Channel/ Frequency	Voltage	Temperature	Deviation	Deviation	Limit	Pass/ Fail
	(MHz)	(Vdc)	(℃)	(Hz)	(ppm)	(ppm)	
WCDMA IV RMC 12.2Kbps							
BPSK	1412 / 1732.4	VL	TN	-11	-0.0063	N/A	Pass
		VN		-12	-0.0069		Pass
		VH		-11	-0.0063		Pass
		VN	50	-11	-0.0063		Pass
			40	-12	-0.0069		Pass
			30	-15	-0.0087		Pass
			20	-12	-0.0069		Pass
			10	-15	-0.0087		Pass
			0	-12	-0.0069		Pass
			-10	-12	-0.0069		Pass
			-20	-12	-0.0069		Pass
			-30	-11	-0.0063		Pass

Modulation	Channel/ Frequency	Voltage	Temperature	Deviation	Deviation	Limit	Pass/ Fail
	(MHz)	(Vdc)	(℃)	(Hz)	(ppm)	(ppm)	
WCDMA V RMC 12.2Kbps							
BPSK	4182 / 836.4	VL	TN	-52	-0.0622	± 2.5	Pass
		VN		-51	-0.0610	± 2.5	Pass
		VH		-59	-0.0705	± 2.5	Pass
		VN	50	-57	-0.0681	± 2.5	Pass
			40	-54	-0.0646	± 2.5	Pass
			30	-55	-0.0658	± 2.5	Pass
			20	-50	-0.0598	± 2.5	Pass
			10	-56	-0.0670	± 2.5	Pass
			0	-58	-0.0693	± 2.5	Pass
			-10	-58	-0.0693	± 2.5	Pass
			-20	-54	-0.0646	± 2.5	Pass
			-30	-59	-0.0705	± 2.5	Pass

APPENDIX A RF TEST DATA

WCDMA Band 2

CONDUCTED OUTPUT POWER

Band	Conducted Power(dBm)		
Channel	9262	9400	9538
Frequency	1852.4	1880	1907.6
RMC 12.2K	19.73	19.86	19.69
HSDPA Subtest-1	19.51	19.58	19.54
HSDPA Subtest-2	18.34	18.40	18.47
HSDPA Subtest-3	17.74	18.04	18.01
HSDPA Subtest-4	17.88	17.83	17.77
HSUPA Subtest-1	18.44	18.56	18.53
HSUPA Subtest-2	18.21	18.34	18.31
HSUPA Subtest-3	17.69	17.83	17.81
HSUPA Subtest-4	18.73	18.91	18.88
HSUPA Subtest-5	18.21	18.32	18.29
HSPA+	17.14	17.24	17.21

ERP/EIRP, (GT - LC) = 1.32 dB

Band	Channel	Freq (MHz)	Conducted Power(dBm)	EIRP (dBm)	EIRP (W)
2	9262	1852.4	19.73	21.05	0.1274
2	9400	1880.0	19.86	21.18	0.1312
2	9538	1907.6	19.69	21.01	0.1262

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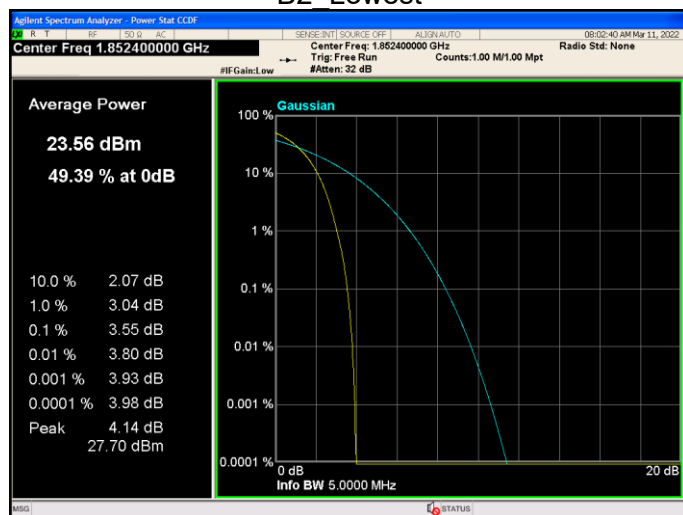
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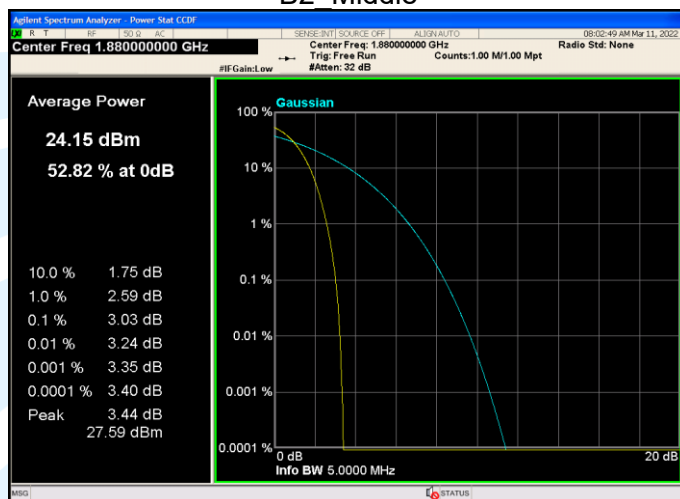
Peak to Average Radio

Band	Channel	Freq (MHz)	Result (dB)	Limit (dB)	Verdict
2	9262	1852.4	3.55	13	PASS
2	9400	1880.0	3.03	13	PASS
2	9538	1907.6	2.97	13	PASS

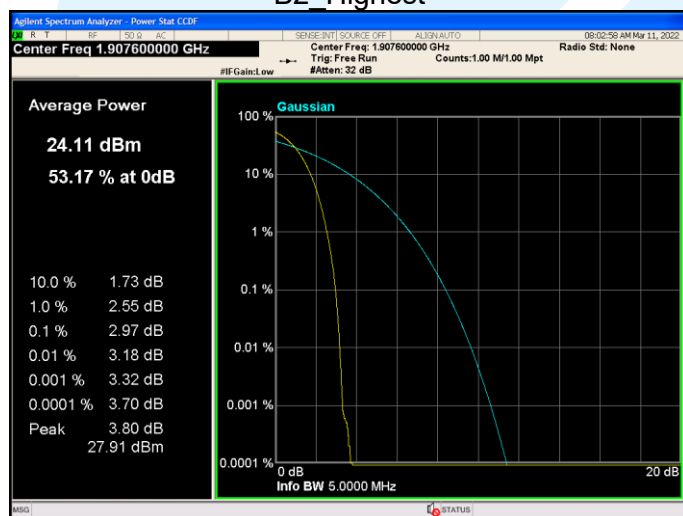
B2 Lowest



B2 Middle



B2 Highest



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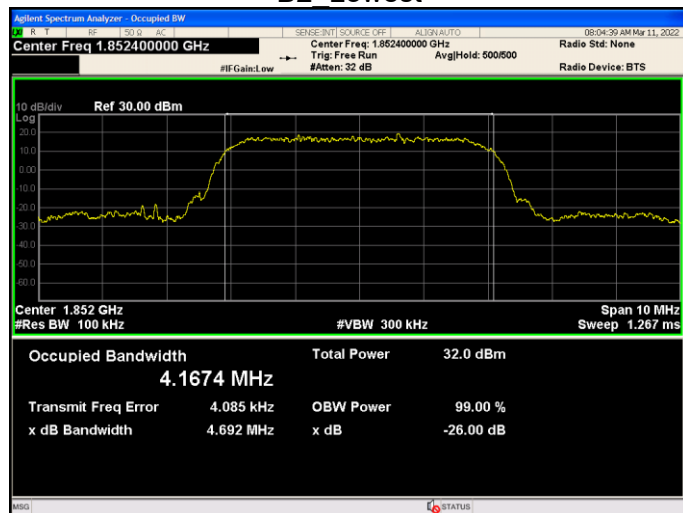
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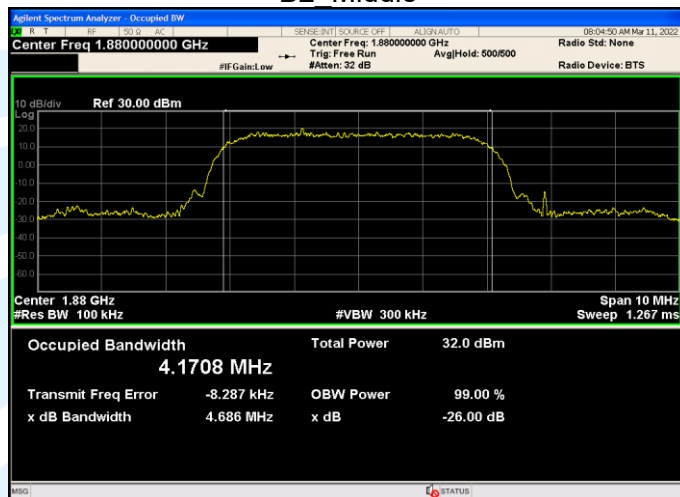
Occupied Bandwidth

Band	Channel	Freq (MHz)	OBW (MHz)	26dB OBW (MHz)
2	9262	1852.4	4.17	4.69
2	9400	1880.0	4.17	4.69
2	9538	1907.6	4.17	4.71

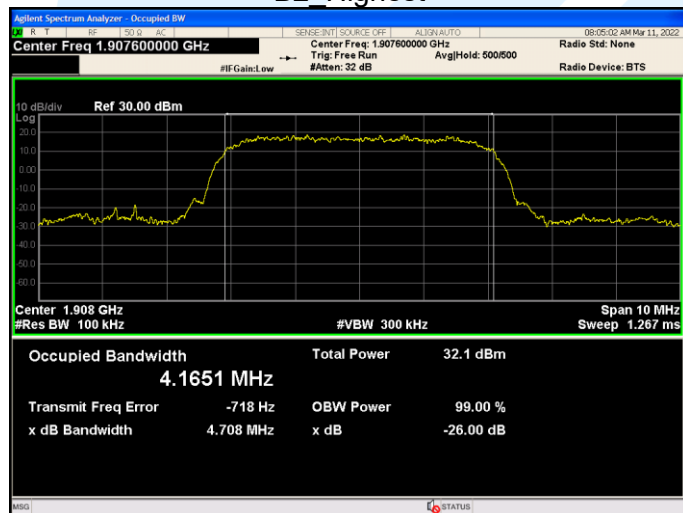
B2 Lowest



B2 Middle



B2 Highest



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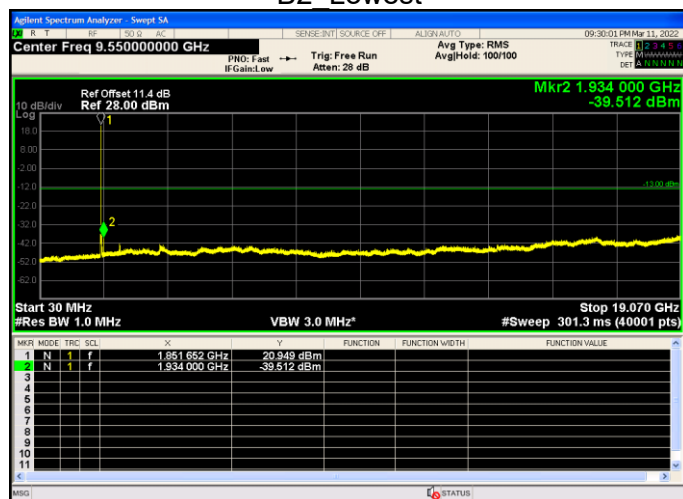
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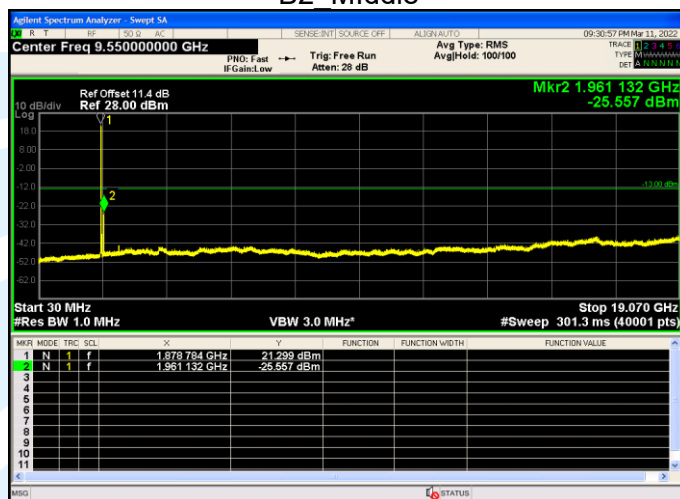
Conducted Spurious Emissions

Band	Channel	Freq (MHz)	Result (dBm)	Limit (dBm)	Verdict
2	9262	1852.4	-39.51	-13	PASS
2	9400	1880.0	-25.56	-13	PASS
2	9538	1907.6	-24.32	-13	PASS

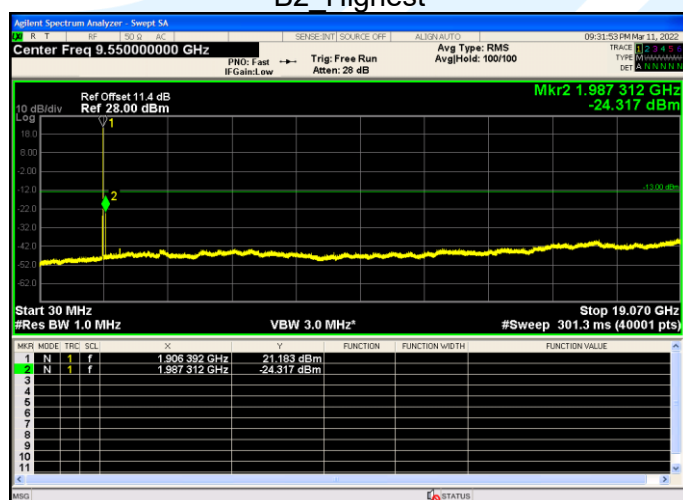
B2 Lowest



B2 Middle



B2 Highest



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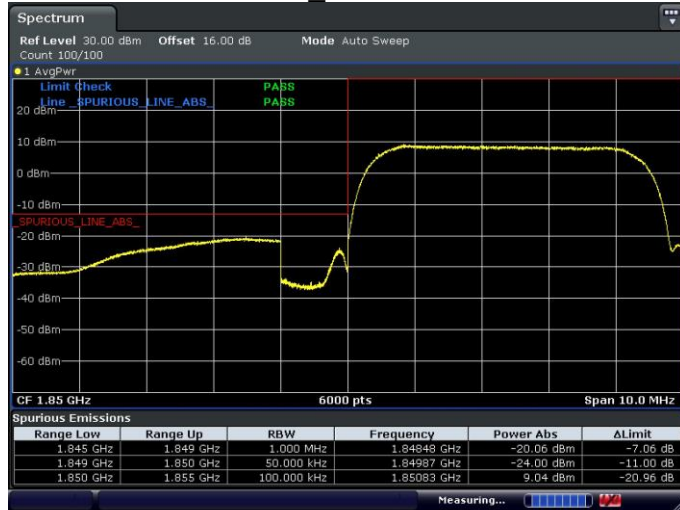
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Conducted Band Edge

Band	Channel	Freq (MHz)	Result	Verdict
2	9262	1852.4	see graph	PASS
2	9538	1907.6	see graph	PASS

B2_Lowest



Date: 17.MAY.2022 17:22:15

B2_Highest



Date: 17.MAY.2022 17:20:26

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WCDMA Band 4

CONDUCTED OUTPUT POWER

Band	Conducted Power(dBm)		
Channel	1312	1413	1513
Frequency	1712.4	1732.4	1752.6
RMC 12.2K	20.81	20.67	20.58
HSDPA Subtest-1	20.59	20.60	20.54
HSDPA Subtest-2	19.77	19.58	19.32
HSDPA Subtest-3	18.89	18.73	18.69
HSDPA Subtest-4	18.91	18.74	18.66
HSUPA Subtest-1	19.41	19.04	18.94
HSUPA Subtest-2	19.44	19.12	19.01
HSUPA Subtest-3	18.78	18.59	18.49
HSUPA Subtest-4	19.30	19.12	19.04
HSUPA Subtest-5	19.28	18.99	18.97
HSPA+	18.36	18.25	18.17

ERP/EIRP, (GT - LC) = 0.35 dB

Band	Channel	Freq (MHz)	Conducted Power(dBm)	EIRP (dBm)	EIRP (W)
4	1312	1712.4	20.81	21.16	0.1306
4	1413	1732.4	20.67	21.02	0.1265
4	1513	1752.6	20.58	20.93	0.1239

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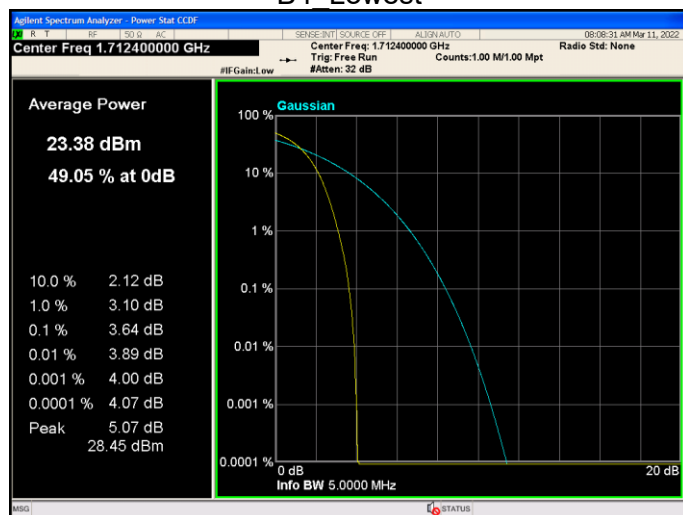
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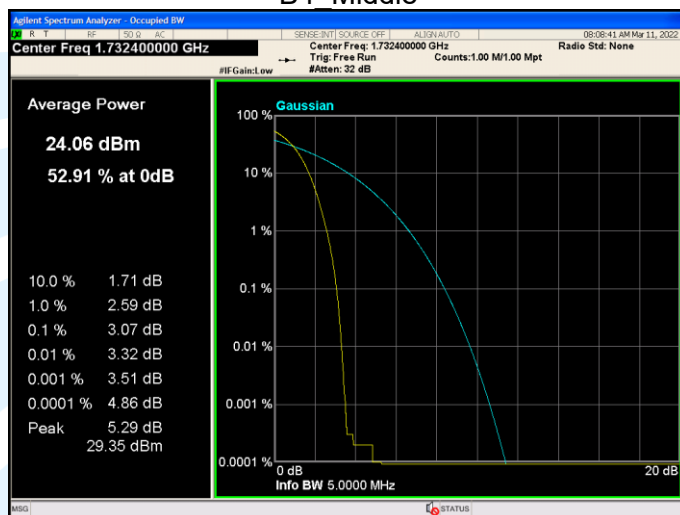
Peak to Average Radio

Band	Channel	Freq (MHz)	Result (dB)	Limit (dB)	Verdict
4	1312	1712.4	3.64	13	PASS
4	1413	1732.4	3.07	13	PASS
4	1513	1752.6	3.07	13	PASS

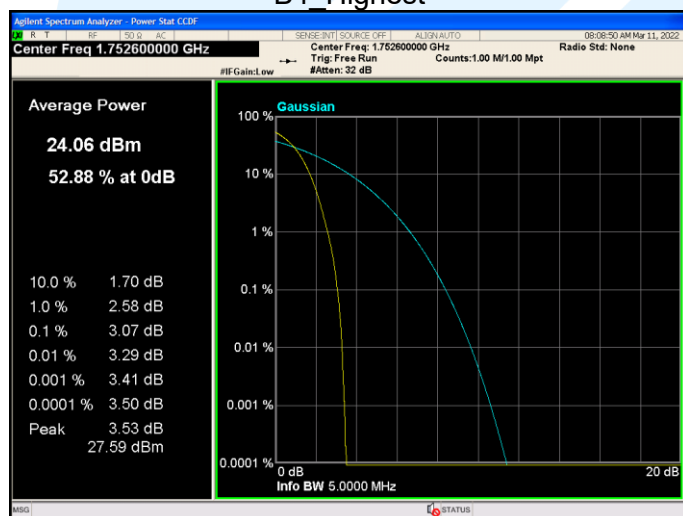
B4 Lowest



B4 Middle



B4 Highest



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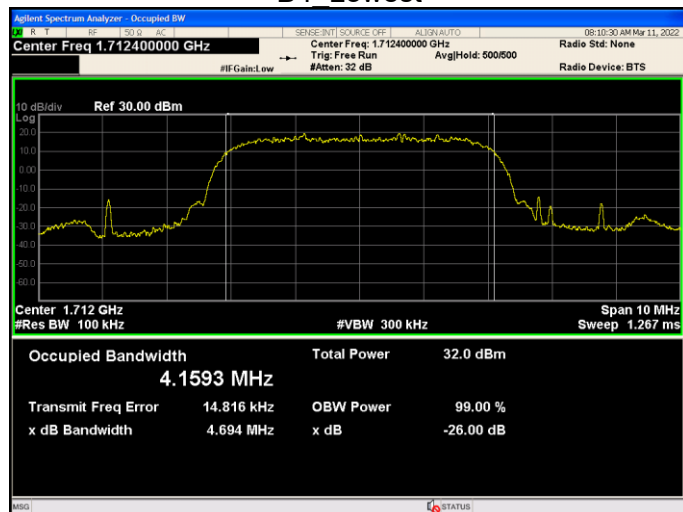
<http://www.uttlab.com>

UTTR-RF-FCC23G-V1.1

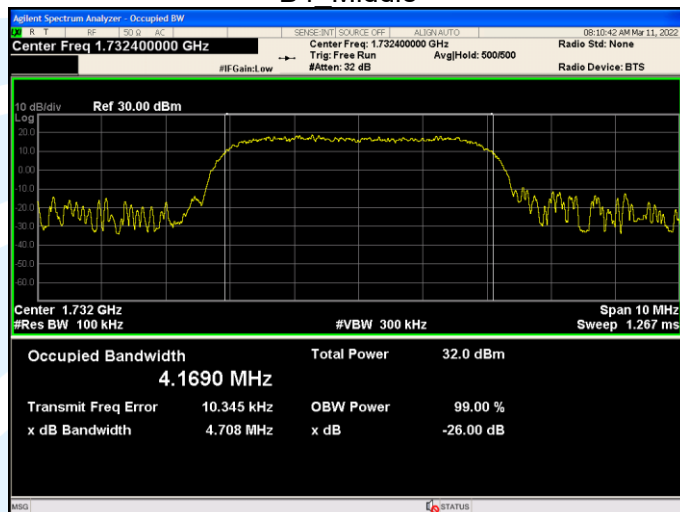
Occupied Bandwidth

Band	Channel	Freq (MHz)	OBW (MHz)	26dB OBW (MHz)
4	1312	1712.4	4.16	4.69
4	1413	1732.4	4.17	4.71
4	1513	1752.6	4.16	4.69

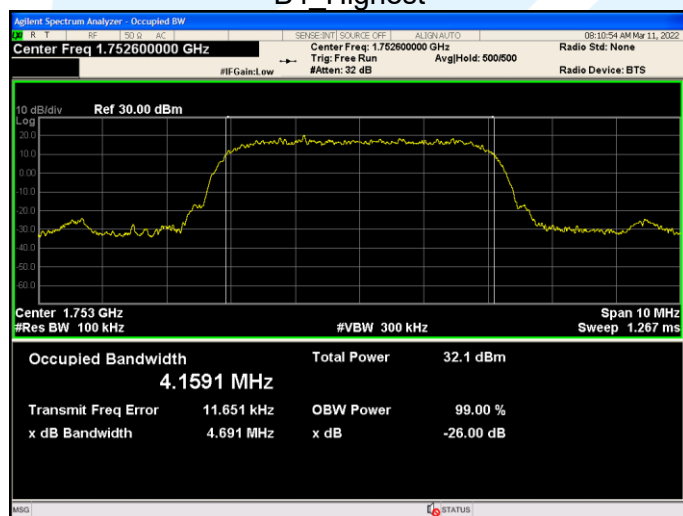
B4 Lowest



B4 Middle



B4 Highest



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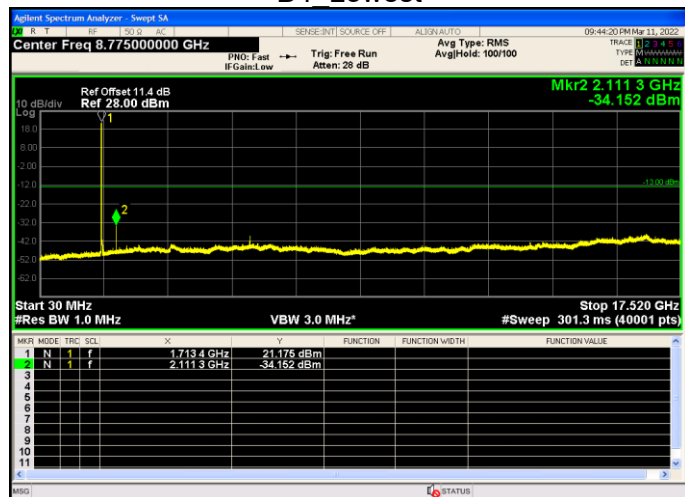
<http://www.uttlab.com>

UTTR-RF-FCC23G-V1.1

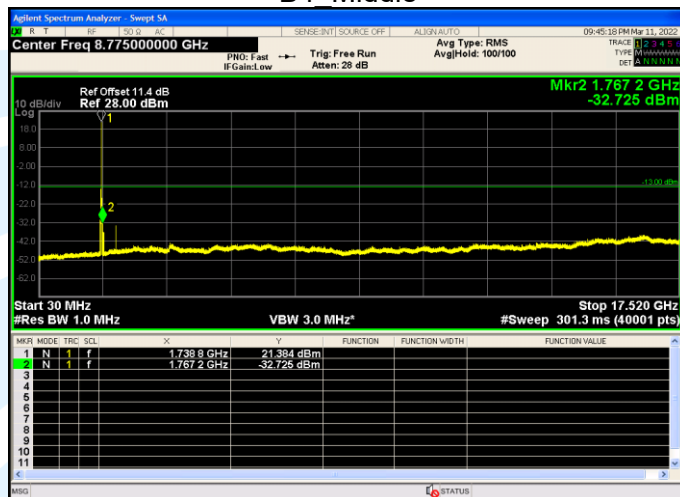
Conducted Spurious Emissions

Band	Channel	Freq (MHz)	Result (dBm)	Limit (dBm)	Verdict
4	1312	1712.4	-34.15	-13	PASS
4	1413	1732.4	-32.73	-13	PASS
4	1513	1752.6	-34.80	-13	PASS

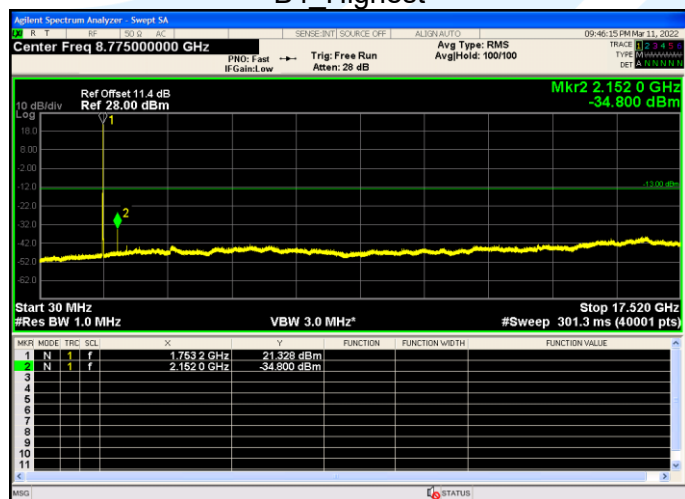
B4 Lowest



B4 Middle



B4 Highest



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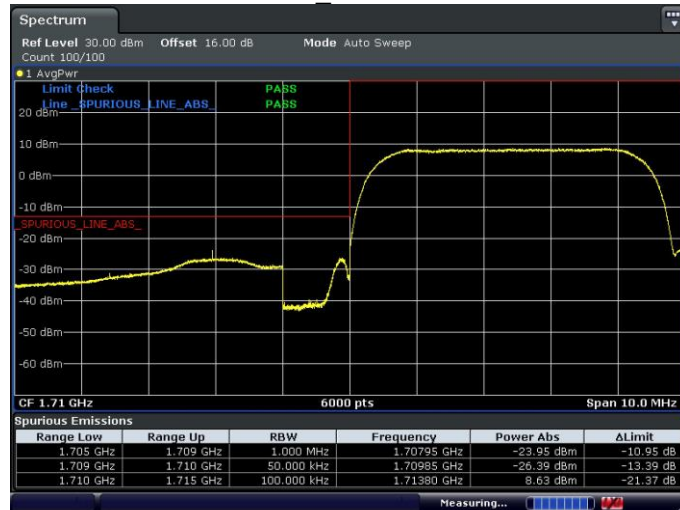
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UTTR-RF-FCC23G-V1.1

Conducted Band Edge

Band	Channel	Freq (MHz)	Result	Verdict
4	1312	1712.4	see graph	PASS
4	1513	1752.6	see graph	PASS

B4 Lowest



B4 Highest



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WCDMA Band 5

CONDUCTED OUTPUT POWER

Band	Conducted Power(dBm)		
Channel	4132	4182	4233
Frequency	826.4	836.4	846.6
RMC 12.2K	22.96	22.88	22.81
HSDPA Subtest-1	22.81	22.78	22.75
HSDPA Subtest-2	21.95	21.87	21.79
HSDPA Subtest-3	21.47	21.40	21.32
HSDPA Subtest-4	21.46	21.36	21.31
HSUPA Subtest-1	21.92	21.85	21.75
HSUPA Subtest-2	21.94	21.86	21.81
HSUPA Subtest-3	21.44	21.36	21.29
HSUPA Subtest-4	21.98	21.88	21.82
HSUPA Subtest-5	21.48	21.39	21.31
HSPA+	20.41	20.38	20.34

ERP, (GT - LC) = -0.54 dB

Band	Channel	Freq (MHz)	Conducted Power(dBm)	ERP (dBm)	ERP (W)
5	4132	826.4	22.96	20.27	0.1064
5	4182	836.4	22.88	20.19	0.1045
5	4233	846.6	22.81	20.12	0.1028

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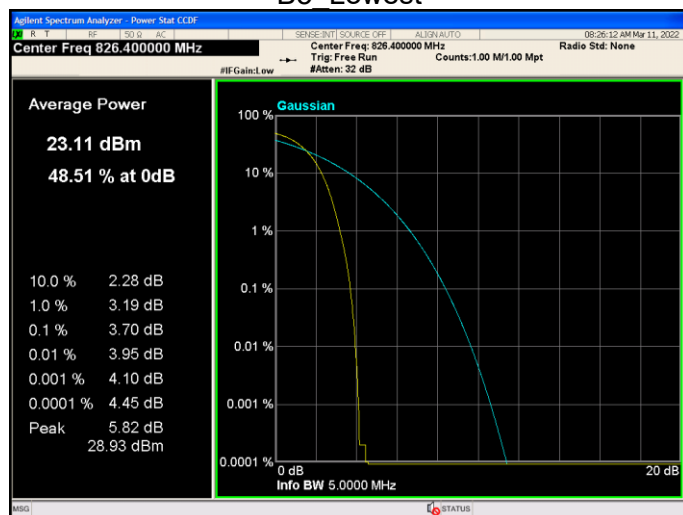
<http://www.uttlab.com>

UTTR-RF-FCC23G-V1.1

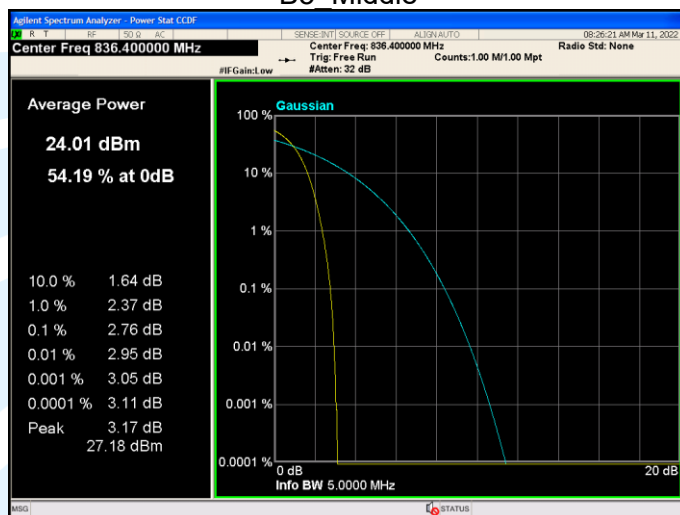
Peak to Average Radio

Band	Channel	Freq (MHz)	Result (dB)	Limit (dB)	Verdict
5	4132	826.4	3.70	13	PASS
5	4182	836.4	2.76	13	PASS
5	4233	846.6	2.71	13	PASS

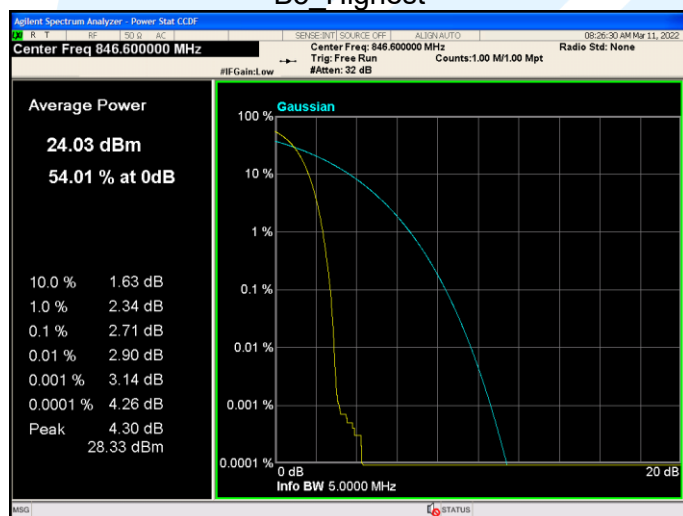
B5 Lowest



B5 Middle



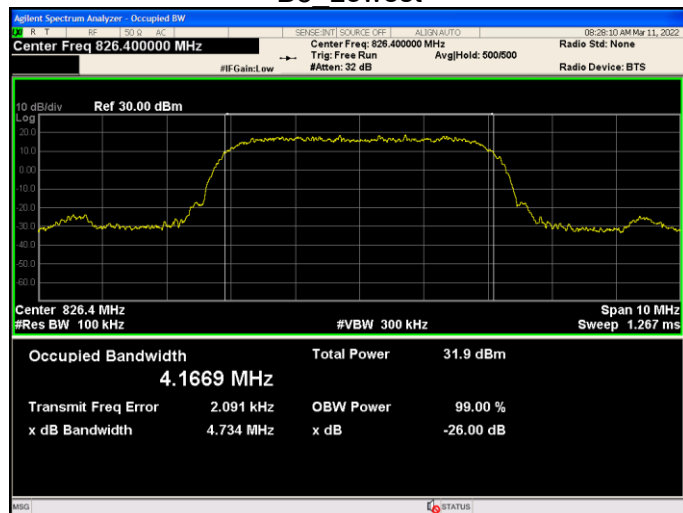
B5 Highest



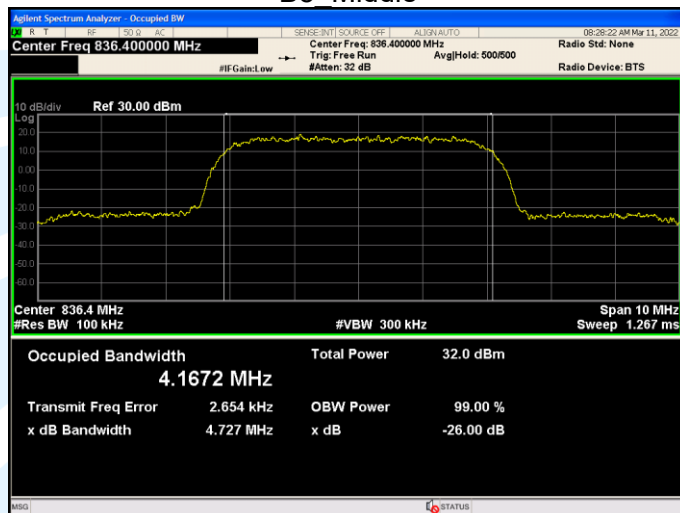
Occupied Bandwidth

Band	Channel	Freq (MHz)	OBW (MHz)	26dB OBW (MHz)
5	4132	826.4	4.17	4.73
5	4182	836.4	4.17	4.73
5	4233	846.6	4.19	4.71

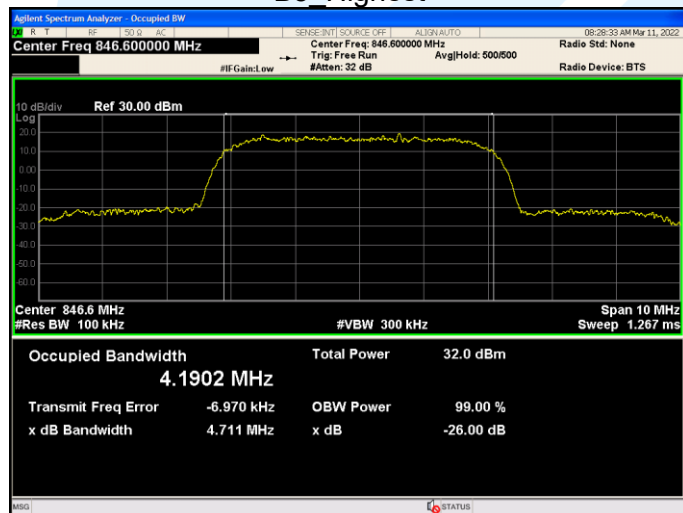
B5 Lowest



B5 Middle



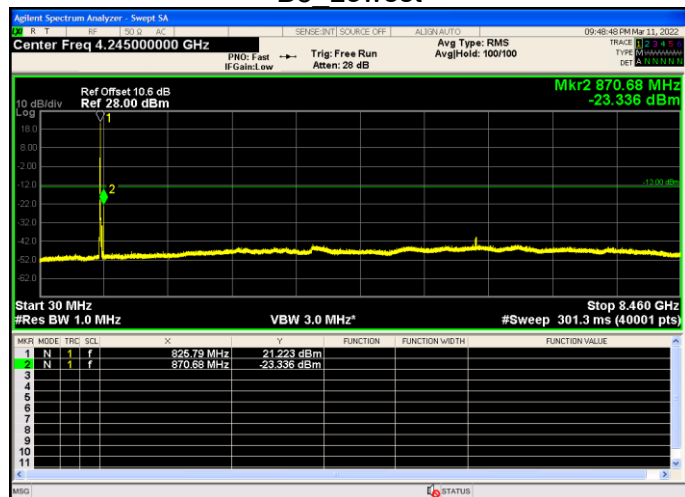
B5 Highest



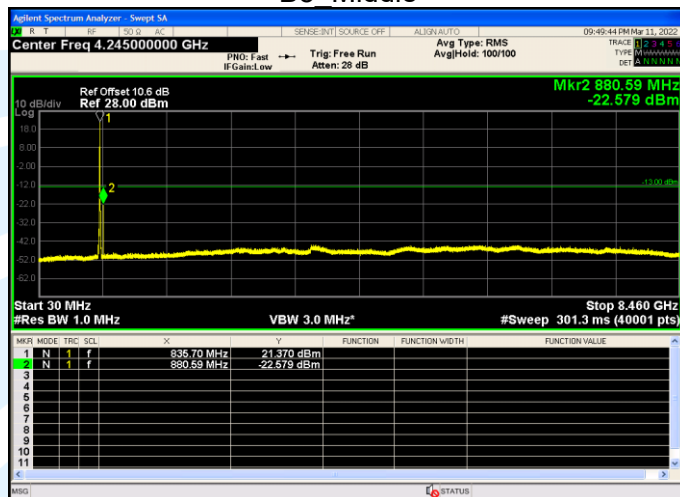
Conducted Spurious Emissions

Band	Channel	Freq (MHz)	Conducted Power(dBm)	EIRP (dBm)	EIRP (W)
5	4132	826.4	-23.34	-13	PASS
5	4182	836.4	-22.58	-13	PASS
5	4233	846.6	-24.16	-13	PASS

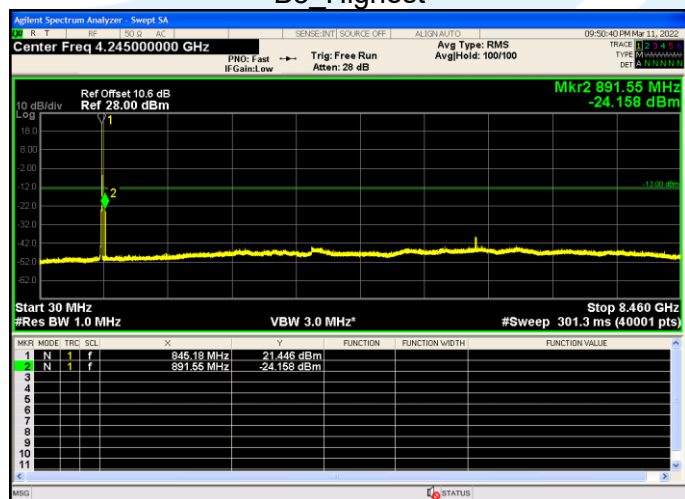
B5_Lowest



B5_Middle



B5_Highest



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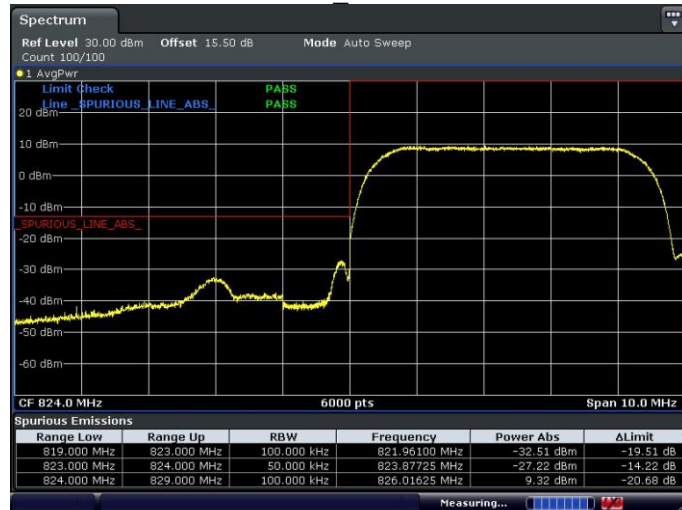
<http://www.uttlab.com>

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Conducted Band Edge

Band	Channel	Freq (MHz)	Result	Verdict
5	4132	826.4	see graph	PASS
5	4233	846.6	see graph	PASS

B5 Low



Date: 17.MAY.2022 17:29:58

B5 High



Date: 17.MAY.2022 17:28:39

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APPENDIX 1 PHOTOS OF TEST SETUP

See test photos attached in Appendix 1 for the actual connections between Product and support equipment.

APPENDIX 2 PHOTOS OF EUT CONSTRUCTIONAL DETAILS

Refer to Appendix 2 for EUT external and internal photos.

*** End of Report ***

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