

FCC TEST REPORT

Name of Sample: Mobile Cellular Phone
Model of Sample: F-53E
Applicant: FCNT LLC.
Issue Date: 2024-09-24



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Trademark	Raku-Raku smartphone	Type Name or ID	FCC ID: 2BEPUFMP201
Applicant No.	RF182765	Sample No.	1#: N0KM220108 2#: N0KM220121
Delivering Date	2024-09-18	Test Date	2024-09-18 to 2024-09-23
Sample Illustration	None		
Standard	47 CFR Part 2; 47 CFR Part 27;		
Conclusion	Pass		
Remarks	N/A		

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Revision History

Report No.	Version	Description	Issued Date
TR-24ADRTCC7018	Rev.01	Initial issue of report.	2024-09-24
TR-24ADRTCC7018	Rev.02	Update n78 NSA description.	2024-10-24

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1. Test Summary

1.1. 5G NR Band n78 (3450-3550)

Test Item	Rule No.	Requirements	Test Result	Verdict
Conducted Power	§2.1046	Report Only	Section 1 of Appendix B	Pass
Effective Isotropic Radiated Power	§27.50(k) (3)	EIRP < 1W		
Peak-Average Ratio	§27.50(k) (4)	<13 dB	Section 2 of Appendix B	Pass
Modulation Characteristics	§2.1047	Digital modulation	Section 3 of Appendix B	Pass
Occupied Bandwidth	§2.1049	No limit	Section 4 of Appendix B	Pass
26dB Emission Bandwidth		No limit		
Conducted Band Edges	§2.1051 §27.53(n) (2)	< -13 dBm/MHz	Section 5 of Appendix B	Pass
Conducted Spurious Emission	§2.1051 §27.53(n) (2)	< -13 dBm/MHz	Section 6 of Appendix B	Pass
Frequency Stability	§27.54	Within authorized bands	Section 7 of Appendix B	Pass

Remark:

- Only 5G NR Bands conducted test performed and the data displayed in this report, the radiated spurious emission refer to the report (FG480803D).
- The maximum E(I)RP is calculated from max output power and max antenna gain, only the max E(I)RP data displayed in this report, n78 for antenna 5.
- 5G NR Bands support SA and NSA mode for n78. But no ENDC combinations applicable for FCC.

2. Maximum Effective Radiated (Isotropic) Power and Emission Designator

2.1. NR System

2.1.1. NR Band n78 (3450-3550)

5G NR SA		Pi/2 BPSK / QPSK		16QAM/64QAM/256QAM	
		Maximum EIRP (W)	Emission Designator (99% OBW)	Maximum EIRP (W)	Emission Designator (99% OBW)
Bandwidth	Frequency Range (MHz)				
20MHz	3460.02-3540.00	0.106660	18M2G7D	0.083753	18M2W7D
40MHz	3470.01-3529.98	0.108143	37M8G7D	0.087297	37M9W7D
80MHz	3490.02-3510.00	0.102094	77M3G7D	0.080168	77M5W7D
100MHz	3500.01	0.098401	97M3G7D	0.077983	97M4W7D

3. General Information

3.1. General Description of EUT

EUT Description:	Mobile Cellular Phone
Brand Name:	Raku-Raku smartphone
Model Name:	F-53E
FCC ID:	2BEPUFMP201
IMEI Code:	1#: 354413330040764/354413330040772 (Conducted); 2#: 354413330040707/354413330040715 (Conducted);
Hardware Version:	DVT2
Software Version:	UUZ34.27
NR Modulation:	DFT-s-OFDM: ☒ Pi/2BPSK; ☒ QPSK; ☒ 16QAM; ☒ 64QAM; ☒ 256QAM; CP-OFDM: ☒ QPSK; ☒ 16QAM; ☒ 64QAM; ☒ 256QAM;
Sample Type:	☒ Portable Device, ☐ Module
Antenna Type:	☐ External, ☒ Integrated
Antenna Gain:	n78 (3450-3550): -2.93dBi (Ant5);

Remark

- The information above was declared by manufacture. Please refer to the specifications or user manual for more detailed description.

3.2. Test Environment

Relative Humidity:	52.0% - 62.0%	
Atmospheric Pressure:	101.32 KPa	
Temperature:	NT (normal temperature)	25.0 °C – 27.5 °C
Voltage:	LV (Low voltage)	3.40V
	NV (Nominal voltage)	3.91V
	HV (High voltage)	4.48V

3.3. Specification of Accessories

Accessory	Brand Name	Model Name
Battery 1	ATL	RA07503-1091
Battery 2	COSMX	RA07503-1092

4. Test Configuration of Equipment Under Test

4.1. Test Mode for NR Configuration

Test Case	5G NR	SCS		Bandwidth	Modulation					Channel			RB	
		15KHz	30KHz		PI/2BPSK	QPSK	16QAM	64QAM	256QAM	LCH	MCH	HCH	1	Full
Effective Isotropic Radiated Power	N78 (3450-3550)	○	●	All Supported BW	●	●	●	●	●	●	●	●	●	●
Peak-Average Ratio	N78 (3450-3550)	○	●	Highest BW	●	●	○	○	○	●	●	●	○	●
Modulation Characteristics	N78 (3450-3550)	○	●	Highest BW	●	●	●	●	●	○	●	○	○	●
Occupied Bandwidth & 26dB Emission Bandwidth	N78 (3450-3550)	○	●	All Supported BW	●	●	●	●	●	○	●	○	○	●
Conducted Band Edges	N78 (3450-3550)	○	●	All Supported BW	●	●	○	○	○	●	○	●	●	●
Conducted Spurious Emission	N78 (3450-3550)	○	●	All Supported BW	●	●	○	○	○	●	●	●	●	○
Frequency Stability	N78 (3450-3550)	○	●	Highest BW	○	●	○	○	○	○	●	○	○	●

Remark:

- 1, the mark “●” means this configuration was chosen for testing, mark “○” means not selected, and the mark “✕” means not applicable.
- 2, All Supported BW means all supported bandwidth for selected SCS configuration.

4.2. Test Frequencies

4.2.1 5G NR System

4.2.1.1. NR Band N78 (3450-3550)

4.2.1.1.1. SCS=30KHz

Bandwidth	LCH		MCH		HCH	
	Arfcn	Freq	Arfcn	Freq	Arfcn	Freq
20MHz	630668	3460.02	633334	3500.01	636000	3540.00
40MHz	631334	3470.01	633334	3500.01	635332	3529.98
80MHz	632668	3490.02	633334	3500.01	634000	3510.00
100MHz	633334	3500.01	633334	3500.01	633334	3500.01

5. Description of Tests

5.1. Conducted Output Power Measurement

5.1.1. Description of Conducted Output Power Measurement

A base station simulator was used to establish communication with the EUT, Its parameters were set to transmit the maximum power on the EUT. The measured power in the radio frequency on the transmitter output terminals shall be reported.

5.1.2. Test Procedures

- 1, The testing follows ANSI C63.26 Section 5.2.
- 2, The transmitter output port was connected to the system simulator.
- 3, Set EUT at maximum power through the system simulator.
- 4, Select lowest, Middle, Highest channels for each band and each modulation.
- 5, Record the reading power from the system simulator.

5.2. Effective (Isotropic) Radiated Power

Measurement Procedure: ANSI C63.26

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

5.3. Peak-to-Average Ratio Measurement

5.3.1. Description of PAR Measurement

Power Complementary Cumulative Distribution Function (CCDF) curves provide a means for characterizing the power peaks of a digitally modulated signal on a statistical basis, A CCDF curve depicts the probability of peak signal amplitude exceeding the average power level. Most contemporary measurement instrumentation include the capability to produce CCDF curves for an input signal provided that the instrument's resolution bandwidth can be set wide enough to accommodate the entire input signal bandwidth. In measuring transmissions in this band using an average power technique, the peak-to-average ratio (PAR) of the transmission may not exceed 13dB.

5.3.2. Test Procedures

- 1, The testing follows ANSI C63.26 Section 5.2.3.4(CCDF)
- 2, Refer to instrument's analyser instruction manual for details on how to use the power statistics/CCDF function.
- 3, Centre Frequency = Carrier centre frequency.
- 4, Set resolution bandwidth $\geq$ signal's occupied bandwidth.
- 5, Set the number of counts to a value that stabilizes the measured CCDF curve.
- 6, Set the measurement interval as follows:
 - 1) for continuous transmissions (>98% duty cycle), set to 1ms.
 - 2) for burst transmissions, employ an external trigger that is synchronized with the EUT burst timing sequence, or use the internal burst trigger with a trigger level that allows the burst to stabilize and set the measurement interval to a time that is less than or equal to the burst duration.
- 7, Record the maximum PAR level associated with a probability of 0.1%.

5.3.3. Alternate procedure for PAR

Measurement Procedure: 5.2.6 of ANSI C63.26

Some regulatory requirements specify a PAR limit when the output power limits are specified in terms of average power. If it becomes necessary to provide measurement data to demonstrate compliance to a PAR limit, then the appropriate procedure from those provided in 5.2.3 shall be utilized to determine the peak power

(or peak PSD) and the appropriate procedure from those provided in 5.2.4 shall be used to determine the average power (or average PSD). The data from these measurements is then used in Equation (2) to determine the PAR of a narrowband CW-like signal. See 5.2.3.4 for guidance on determining the PAR of a broadband noise-like signal.

$$\text{PAR (dB)} = P_{\text{Pk}} (\text{dBm or dBW}) - P_{\text{Avg}} (\text{dBm or dBW})$$

where

PAR peak-to-average power ratio, in dB

P_{Pk} measured peak power or peak PSD level, in dBm or dBW

P_{Avg} measured average power or average PSD level, in dBm or dBW

5.4. 99% Occupied Bandwidth & 26dB Emission Bandwidth

5.4.1. Description of 99% Occupied Bandwidth & 26dB Emission Bandwidth Measurement

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 analyser 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.

5.4.2. Test Procedures

- 1, The testing follows ANSI C63.26 Section 5.4
- 2, The signal analyzer's automatic measurement capability was used to perform the 99% occupied bandwidth and the 26dB emission bandwidth. The bandwidth measurement was not influenced by any intermediate power nulls in the fundamental emission.
- 3, $\text{RBW} \geq 1\% - 5\%$ of the expected OBW.
- 4, $\text{VBW} \geq 3 * \text{RBW}$
- 5, Detector=Peak
- 6, Trace Mode= Max Hold.
- 7, Sweep Time=Auto
- 8, The trace was allowed to stabilize.
- 9, 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.

5.5. Conducted Band Edge Measurement

5.5.1. Description of Conducted Band Edge Measurement

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 emissions are attenuated at least 26dB below the transmitter power. The video bandwidth of the spectrum analyser was set at thrice the resolution bandwidth. Detector Mode was set to peak or peak hold power.

5.5.2. Test Procedures

- 1, The testing follows ANSI C63.26 Section 5.7
- 2, Start and stop frequency were set such that the band edge would be placed in the centre of the spectrum analyzer screen.
- 3, Span was set large enough to capture all out of band emissions near the band edge.
- 4, $RBW \geq 1\%$ of the emission bandwidth (2% of the emission bandwidth for n7/n38/n41 except when 1MHz band is 2495-2496MHz);
- 5, $VBW \geq 3 * RBW$
- 6, Detector=RMS
- 7, Trace Mode=Trace Average for continuous emissions, Max Hold for pulse emissions.
- 8, Sweep Points $\geq 2 \times \text{Span}/RBW$
- 9, Sweep Time = Auto
- 10, The trace was allowed to stabilize.

5.6. Conducted Spurious Emission Measurement

5.6.1. Description of Conducted Spurious Emission Measurement

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 and high channel). The level of the carrier and the various conducted spurious and harmonic frequencies is measured by means of a calibrated spectrum analyser. The spectrum is scanned from 9KHz up to a frequency including its 10th harmonic or 40GHz, which is lower.

5.6.2. Test Procedures

- 1, The testing follows ANSI C63.26 Section 5.7
- 2, $RBW \geq 100\text{KHz}$ for emissions below 1GHz, 1MHz for emissions above 1GHz.
- 3, $VBW \geq 3 * RBW$
- 4, Detector = RMS
- 5, Trace Mode = Average.
- 6, Sweep Points $\geq 2 * \text{Span}/RBW$
- 7, Sweep Time = Auto
- 8, The trace was allowed to stabilize.

5.7. Frequency Stability Measurement

5.7.1. Description of Frequency Stability Measurement

The Frequency Stability should be measured by variation of ambient temperature and variation of primary supply voltage to ensure that the fundamental emissions stays within the authorized frequency block.

5.7.2. Measurement Procedure for Temperature Variation

- 1, The testing follows ANSI C63.26 section 5.6.4.
- 2, The EUT was set up in the thermal chamber and connected with the system simulator.
- 3, With power off, the temperature was decreased to -30°C and the EUT was stabilized before testing. Power was applied and the maximum change in frequency was recorded within one minute.
- 4, With power off, the temperature was raised in 10°C step up to 50°C. The EUT was stabilized at each step for at least half an hour. Power was applied and the maximum change in frequency was recorded within one minute.

5.7.3. Measurement Procedure for Voltage Variation

- 1, The testing follows ANSI C63.26 section 5.6.5.
- 2, The EUT was placed in a thermal chamber at 20±5°C and connected with the system simulator.
- 3, The power supply voltage to the EUT was varied from 85% to 115% of the nominal value for other than hand carried battery equipment.
- 4, For hand carried, battery powered equipment, reduce the primary ac or dc supply voltage to the battery operating end point, which shall be specified by the manufacturer.
- 5, The variation in frequency was measured for the worst case.

6. List of Measuring Equipment

Equipment	Model	Manufacture	Device No.	Cal Date	Cal Due
Radio Communication Analyzer	MT8000A	Anritsu	6272478367	2023-12-07	2024-12-06
	MT8821C	Anritsu	6272498303	2023-12-07	2024-12-06
Radio Communication Analyzer	E7515E	Keysight	MY59296045	2023-12-07	2024-12-06
Spectrum Analyzer (50Hz-40GHz)	FSV	R&S	101046	2023-12-07	2024-12-06
Spectrum Analyzer (50Hz-40GHz)	FSV	R&S	101334	2024-01-30	2025-01-29
Power Supply	2036	Keithley	4058748	2023-12-07	2024-12-06
Temperature Chamber	C/64/40/3	Weiss	56246017780020	2024-04-01	2025-03-31
Power Divider	-	WOKEN	0120A04051801O	NCR	
Power Divider	-	WOKEN	0120A02051801M	NCR	

Remark:

- 1, For equipment listed above that has a calibration date or calibration due date that falls within the test date range, and the equipment was used after calibrate date and before calibrate due date.
- 2, "NCR" means no calibration required.

7. Measurement Uncertainty

The measurement uncertainties shown below were calculated in accordance with the requirements of ANSI 63.26. All the measurement uncertainties value were shown with a coverage K=2 to indicate 95% level of confidence. The measurement data show herein meets or exceeds the CISPR measurement uncertainty values specified in CISPR 16-4-2 and can be directly to specified limit to determine compliance.

7.1. Uncertainty of Conducted Measurement

Contribution	Expanded Uncertainty
Conducted Power	± 0.77
Conducted Emission	± 0.76
Channel Bandwidth	± 0.08%

8. Appendixes

Appendix B.1	NR Band n78A (3450-3550)
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The End