FCC RADIO TEST REPORT

FCC ID	:	**VUIMD100**
Equipment	:	**Module**
Brand Name	:	**PEGATRON**
Model Name	:	**MD100-Q62**
Applicant	:	**PEGATRON CORPORATION** **5F., NO. 76, LIGONG ST., BEITOU DISTRICT,TAIPEI CITY,Taiwan**
Manufacturer	:	**PEGATRON CORPORATION** **5F., NO. 76, LIGONG ST., BEITOU DISTRICT,TAIPEI CITY,Taiwan**
Standard	:	**FCC 47 CFR Part 2, Part 27(D)**

The product was received on Mar. 16, 2023 and testing was performed from Mar. 28, 2023 to May 05, 2023. We, Sporton International Inc. EMC & Wireless Communications Laboratory, would like to declare that the tested sample has been evaluated in accordance with the test procedures given in ANSI / TIA-603-E and has been in compliance with the applicable technical standards.

The test results in this partial report apply exclusively to the tested model / sample. Without written approval of Sporton International Inc. EMC & Wireless Communications Laboratory, the test report shall not be reproduced except in full.

Louis Wu

Approved by: Louis Wu

Sporton International Inc. EMC & Wireless Communications Laboratory
No. 52, Huaya 1st Rd., Guishan Dist., Taoyuan City 333, Taiwan (R.O.C.)

Table of Contents

History of this test report

Report No.	Version	Description	Issue Date
FG2O0623-01E	01	Initial issue of report	May 24, 2023

Summary of Test Result

Report Clause	Ref Std. Clause	Test Items	Result (PASS/FAIL)	Remark
3.2	§2.1046	Conducted Output Power	Reporting only	-
-	-	Peak-to-Average Ratio	-	See Note
3.3	§27.50 (a)(3)	Effective Isotropic Radiated Power	Pass	-
-	§2.1049	Occupied Bandwidth	-	See Note
-	§2.1051 §27.53 (a)(4)	Conducted Band Edge Measurement	-	See Note
-	§2.1051 §27.53 (a)(4)	Conducted Spurious Emission	-	See Note
-	§2.1055 §27.54	Frequency Stability Temperature & Voltage	-	See Note
4.2	§2.1053 §27.53 (a)(4)	Radiated Spurious Emission	Pass	5.49 dB under the limit at 4614.000 MHz

Note:
1. The certified module (model: VUIMD100).
2. The conducted power has been verified to be consistent with the original modular certification, therefore, the conducted signal test will be re-used.
3. To perform a spot check on the radiated spurious emission of the host.

Conformity Assessment Condition:

1. The test results (PASS/FAIL) with all measurement uncertainty excluded are presented against the regulation limits or in accordance with the requirements stipulated by the applicant/manufacturer who shall bear all the risks of non-compliance that may potentially occur if measurement uncertainty is taken into account.
2. The measurement uncertainty please refer to each test result in the section “Measurement Uncertainty”.

Disclaimer:

The product specifications of the EUT presented in the test report that may affect the test assessments are declared by the manufacturer who shall take full responsibility for the authenticity.

Reviewed by: Sheng Kuo

Report Producer: Rachel Hsieh

1 General Description

1.1 Product Feature of Equipment Under Test

Product Feature	
General Specs LTE/5G NR. **Antenna Type** WWAN: PIFA Antenna	
Installed into Host	Equipment Name: 5G Dongle Brand Name: PEGATRON Model Name: MD100-Q62
Antenna Gain	-2.15 dBi

Remark: The EUT's information above is declared by manufacturer. Please refer to Disclaimer in report summary.

1.2 Modification of EUT

No modifications are made to the EUT during all test items.

1.3 Testing Site

Test Site	Sporton International Inc. EMC & Wireless Communications Laboratory	
Test Site Location	No.52, Huaya 1st Rd., Guishan Dist., Taoyuan City 333, Taiwan (R.O.C.) TEL: +886-3-327-3456 FAX: +886-3-328-4978	
Test Site No.	**Sporton Site No.**	
	TH03-HY	03CH07-HY
Test Engineer	Luffy Lin	Jesse Wang, Stan Hsieh and Ken Wu
Temperature (℃)	23.5~24.1	22.6~25.8
Relative Humidity (%)	48~52	53.2~63.4

Note: The test site complies with ANSI C63.4 2014 requirement.

FCC Designation No.: TW1190

1.4 Applied Standards

According to the specifications of the manufacturer, the EUT must comply with the requirements of the following standards:

- ANSI C63.26-2015
- FCC 47 CFR Part 2, Part 27(D)
- ANSI / TIA-603-E
- FCC KDB 971168 Power Meas License Digital Systems D01 v03r01
- FCC KDB 412172 D01 Determining ERP and EIRP v01r01
- FCC KDB 414788 D01 Radiated Test Site v01r01

Remark:

1. All test items were verified and recorded according to the standards and without any deviation during the test.
2. The TAF code is not including all the FCC KDB listed without accreditation.

2 Test Configuration of Equipment Under Test

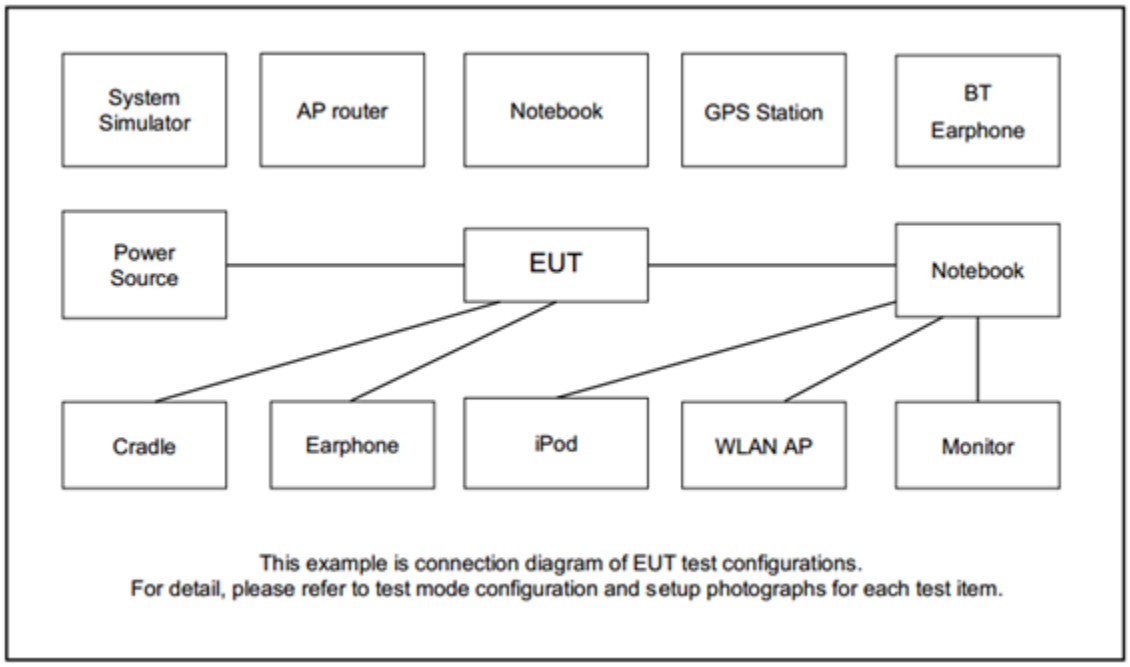
2.1 Test Mode

Antenna port conducted and radiated test items listed below are performed according to KDB 971168 D01 Power Meas. License Digital Systems v03r01 with maximum output power.

For radiated measurement, the measured emission level of the EUT was maximized by rotating the EUT on a turntable, adjusting the orientation of the EUT and EUT antenna in three orthogonal axis (X: flat, Y: portrait, Z: landscape), and adjusting the measurement antenna orientation, following C63.26 exploratory test procedures and only the worst case emissions were reported in this report.

Test Items	Band	Bandwidth (MHz)						Modulation					RB #			Test Channel		
		1.4	3	5	10	15	20	PI/2 BPSK	QPSK	16QAM	64QAM	256QAM	1	Half	Full	L	M	H
Max. Output Power	n30	-	-	v	v	-	-	v	v	v	v	v	v	v	v	v	v	v
E.I.R.P	n30	-	-	v	v	-	-	v	v	v	v	v	Max. Power					
Radiated Spurious Emission	n30	-	-	v	v	-	-	v					v			v	v	v
Remark	1. The mark "**v** " means that this configuration is chosen for testing 2. The mark "-" means that this bandwidth is not supported. 3. The device is investigated from 30MHz to 10 times of fundamental signal for radiated spurious emission test under different RB size/offset and modulations in exploratory test. Subsequently, only the worst case emissions are reported. 4. For radiated measurement, pre-scanned in two modes, DFT-s OFDM and CP OFDM. The worst cases (DFT-s OFDM) were recorded in this report.																	

2.2 Connection Diagram of Test System



2.3 Support Unit used in test configuration and system

Item	Equipment	Brand Name	Model No.	FCC ID	Data Cable	Power Cord
1.	5G Wireless Test Platform	Anritsu	MT8000A	N/A	N/A	Unshielded, 1.8 m
2.	System Simulator	Anritsu	MT8821C	N/A	N/A	Unshielded, 1.8 m
3.	Adapter	PHILIPS	DLP6341C	N/A	N/A	N/A

2.4 Frequency List of Low/Middle/High Channels

5G NR n30 Channel and Frequency List				
BW [MHz]	**Channel/Frequency(MHz)**	**Lowest**	**Middle**	**Highest**
10	Channel	-	27710	-
	Frequency	-	2310	-
5	Channel	27685	27710	27735
	Frequency	2307.5	2310	2312.5

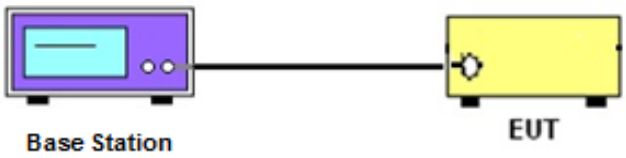
3 Conducted Test Items

3.1 Measuring Instruments

See list of measuring instruments of this test report.

3.1.1 Test Setup

3.1.2 Conducted Output Power



3.1.3 Test Result of Conducted Test

Please refer to Appendix A.

3.2 Conducted Output Power Measurement

3.2.1 Description of the 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.

3.2.2 Test Procedures

1. The transmitter output port was connected to the system simulator.
2. Set EUT at maximum power through the system simulator.
3. Select lowest, middle, and highest channels for each band and different modulation.
4. Measure and record the power level from the system simulator.

3.3 Effective Isotropic Radiated Power

3.3.1 Description of EIRP Power

For mobile and portable stations transmitting in the 2305-2315 MHz band or the 2350-2360 MHz band, the average EIRP must not exceed 50 milliwatts within any 1 megahertz of authorized bandwidth, *except that* for mobile and portable stations compliant with 3GPP LTE standards or another advanced mobile broadband protocol that avoids concentrating energy at the edge of the operating band the average EIRP must not exceed 250 milliwatts within any 5 megahertz of authorized bandwidth but may exceed 50 milliwatts within any 1 megahertz of authorized bandwidth. For mobile and portable stations using time division duplexing (TDD) technology, the duty cycle must not exceed 38 percent in the 2305-2315 MHz and 2350-2360 MHz bands. Mobile and portable stations using FDD technology are restricted to transmitting in the 2305-2315 MHz band. Power averaging shall not include intervals in which the transmitter is off.

Remark: EIRP use worst case measure the total power to cover per 5MHz Power.
According to KDB 412172 D01 Power Approach,
EIRP = $P_T + G_T – L_C$, where
P_T = transmitter output power in dBm
G_T = gain of the transmitting antenna in dBi
L_C = signal attenuation in the connecting cable between the transmitter and antenna in dB

3.3.2 Test Procedures

The testing follows ANSI C63.26-2015 Section 5.2.4.5

1. Determine the EIRP by adding the effective antenna gain to the adjusted power level.

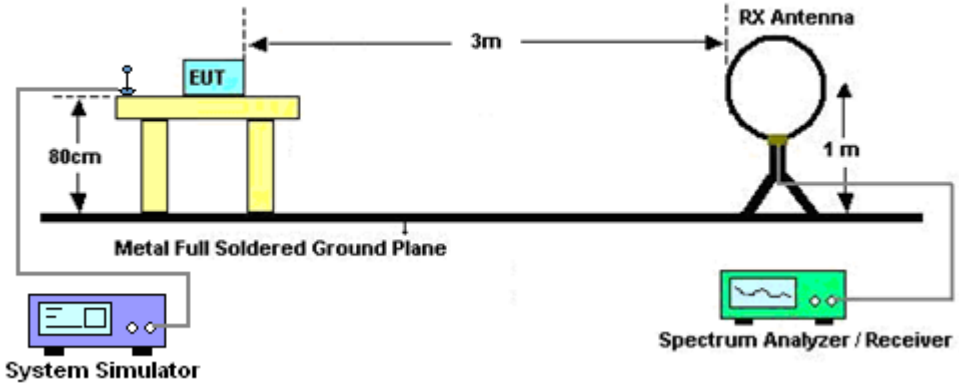
4 Radiated Test Items

4.1 Measuring Instruments

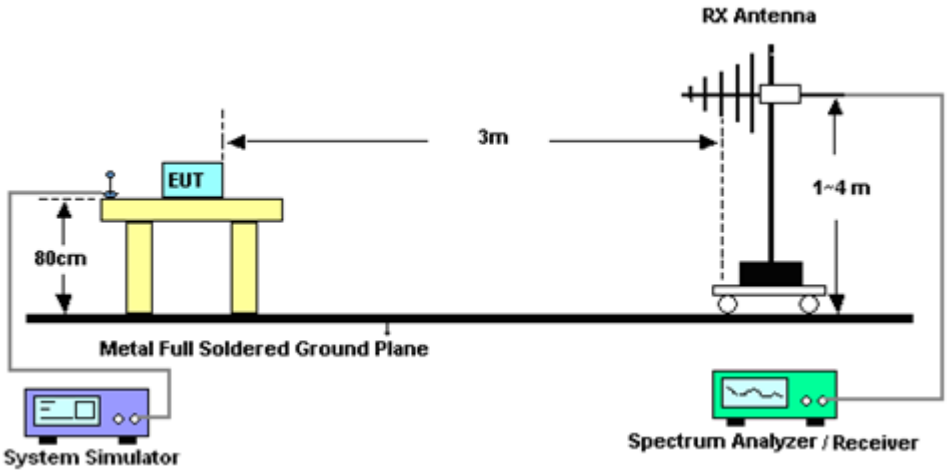
See list of measuring instruments of this test report.

4.1.1 Test Setup

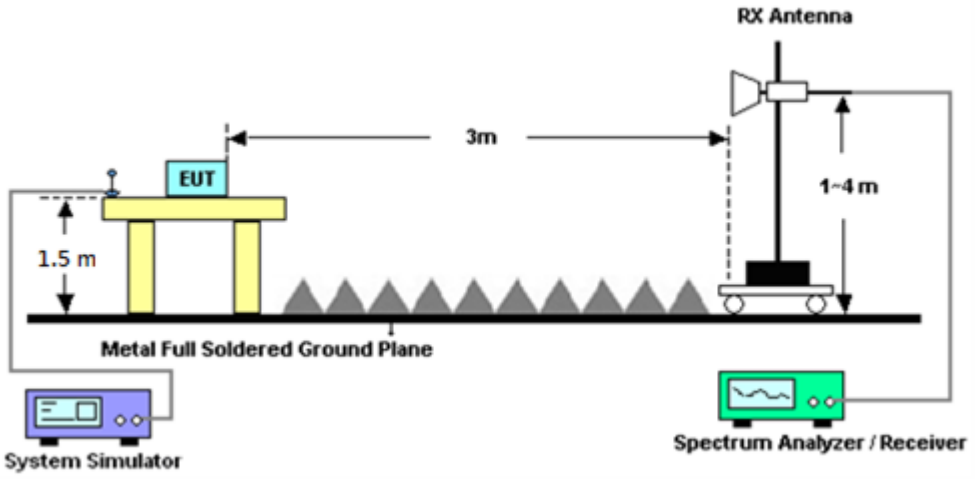
For radiated test below 30MHz



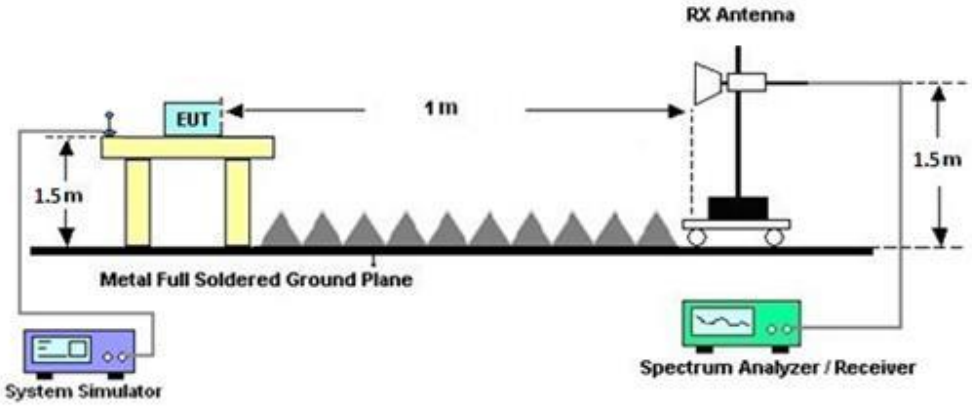
For radiated test from 30MHz to 1GHz



For radiated test from 1GHz to 18GHz



For radiated test above 18GHz



4.1.2 Test Result of Radiated Test

Please refer to Appendix B.

Note:

The low frequency, which started from 9 kHz to 30MHz, was pre-scanned and the result which was 20dB lower than the limit line was not reported.

There is adequate comparison measurement of both open-field test site and alternative test site - semi-Anechoic chamber according to 414788 D01 Radiated Test Site v01r01, and the result came out very similar.

4.2 Radiated Spurious Emission Measurement

4.2.1 Description of Radiated Spurious Emission Measurement

The radiated spurious emission was measured by substitution method according to ANSI / TIA-603-E

The power of any emission outside of the authorized operating frequency ranges must be attenuated below the transmitter power (P) by a factor of at least 70 + 10 log (P) dB.

The spectrum is scanned from 30 MHz up to a frequency including its 10th harmonic.

4.2.2 Test Procedures

The testing follows FCC KDB 971168 D01 v03r01 Section 7 and ANSI / TIA-603-E Section 2.2.12.

1. The EUT was placed on a turntable with 0.8 meter height for frequency below 1GHz and 1.5 meter height for frequency above 1GHz respectively above ground.
2. The EUT was set 3 meters from the receiving antenna mounted on the antenna tower.
3. The table was rotated 360 degrees to determine the position of the highest spurious emission.
4. The height of the receiving antenna is varied between 1m to 4m to search the maximum spurious emission for both horizontal and vertical polarizations.
5. During the measurement, the system simulator parameters were set to force the EUT transmitting at maximum output power.
6. Make the measurement with the spectrum analyzer's RBW = 1MHz, VBW = 3MHz, taking the record of maximum spurious emission.
7. A horn antenna was substituted in place of the EUT and was driven by a signal generator.
8. Tune the output power of signal generator to the same emission level with EUT maximum spurious emission.
   EIRP (dBm) = S.G. Power – Tx Cable Loss + Tx Antenna Gain
   ERP (dBm) = EIRP - 2.15
9. The RF fundamental frequency should be excluded against the limit line in the operating frequency band.
   The limit line is derived from 70 + 10log(P)dB below the transmitter power P(Watts)
   = P(W)- [70 + 10log(P)] (dB)
   = [30 + 10log(P)] (dBm) - [70 + 10log(P)] (dB)
   = -40dBm.

5 List of Measuring Equipment

Instrument	Brand Name	Model No.	Serial No.	Characteristics	Calibration Date	Test Date	Due Date	Remark
Loop Antenna	Rohde & Schwarz	HFH2-Z2	100488	9 kHz~30 MHz	Sep. 20, 2022	Apr. 25, 2023 ~ May 05, 2023	Sep. 19, 2023	Radiation (03CH07-HY)
Bilog Antenna	TESEQ	CBL 6111D & 00800N1D01N -06	35419 & 03	30MHz~1GHz	Apr. 23, 2023	Apr. 25, 2023 ~ May 05, 2023	Apr. 22, 2024	Radiation (03CH07-HY)
Double Ridge Horn Antenna	ESCO	3117	00075962	1GHz ~ 18GHz	Dec. 01, 2022	Apr. 25, 2023 ~ May 05, 2023	Nov. 30, 2023	Radiation (03CH07-HY)
Preamplifier	MITEQ	AMF-7D-0010 1800-30-10P	1590075	1GHz~18GHz	Apr. 20, 2023	Apr. 25, 2023 ~ May 05, 2023	Apr. 19, 2024	Radiation (03CH07-HY)
Preamplifier	COM-POWER	PA-103A	161241	10MHz~1GHz	Oct. 03, 2022	Apr. 25, 2023 ~ May 05, 2023	Oct. 02, 2023	Radiation (03CH07-HY)
Preamplifier	Agilent	8449B	3008A02362	1GHz~26.5GHz	Mar. 24, 2023	Apr. 25, 2023 ~ May 05, 2023	Mar. 23, 2024	Radiation (03CH07-HY)
Preamplifier	EMEC	EM18G40G	0600789	18-40GHz	Jul. 21, 2022	Apr. 25, 2023 ~ May 05, 2023	Jul. 20, 2023	Radiation (03CH07-HY)
Spectrum Analyzer	Agilent	N9030A	MY52350276	3Hz~44GHz	Mar. 28, 2023	Apr. 25, 2023 ~ May 05, 2023	Mar. 27, 2024	Radiation (03CH07-HY)
RF Cable	HUBER + SUHNER	SUCOFLEX 104	MY15682/4	30MHz to 18GHz	Feb. 22, 2023	Apr. 25, 2023 ~ May 05, 2023	Feb. 21, 2024	Radiation (03CH07-HY)
RF Cable	HUBER + SUHNER	SUCOFLEX 104	MY24971/4	9kHz to 18GHz	Feb. 22, 2023	Apr. 25, 2023 ~ May 05, 2023	Feb. 21, 2024	Radiation (03CH07-HY)
RF Cable	HUBER + SUHNER	SUCOFLEX 104	MY28655/4	9kHz to 18GHz	Feb. 22, 2023	Apr. 25, 2023 ~ May 05, 2023	Feb. 21, 2024	Radiation (03CH07-HY)
RF Cable	HUBER + SUHNER	SUCOFLEX 102	MY2858/2	18GHz~40GHz	Feb. 22, 2023	Apr. 25, 2023 ~ May 05, 2023	Feb. 21, 2024	Radiation (03CH07-HY)
RF Cable	HUBER + SUHNER	SUCOFLEX 102	801606/2	9KHz ~ 40GHz	Apr. 20, 2023	Apr. 25, 2023 ~ May 05, 2023	Apr. 19, 2024	Radiation (03CH07-HY)
Controller	EMEC	EM1000	N/A	Control Ant Mast	N/A	Apr. 25, 2023 ~ May 05, 2023	N/A	Radiation (03CH07-HY)
Controller	MF	MF-7802	N/A	Control Turn table	N/A	Apr. 25, 2023 ~ May 05, 2023	N/A	Radiation (03CH07-HY)
Antenna Mast	EMEC	AM-BS-4500E	N/A	Boresight mast 1M~4M	N/A	Apr. 25, 2023 ~ May 05, 2023	N/A	Radiation (03CH07-HY)
Turn Table	ChainTek	Chaintek 3000	N/A	0~360 Degree	N/A	Apr. 25, 2023 ~ May 05, 2023	N/A	Radiation (03CH07-HY)
Software	Audix	E3	N/A	N/A	N/A	Apr. 25, 2023 ~ May 05, 2023	N/A	Radiation (03CH07-HY)
USB Data Logger	TECPEL	TR-32	HE17XB2495	N/A	Mar. 14, 2023	Apr. 25, 2023 ~ May 05, 2023	Mar. 13, 2024	Radiation (03CH07-HY)
Horn Antenna	ETS-Lindgren	3117	00143261	1GHz~18GHz	Feb. 24, 2023	Apr. 25, 2023 ~ May 05, 2023	Feb. 23, 2024	Radiation (03CH07-HY)
SHF-EHF Horn Antenna	SCHWARZBECK	BBHA 9170	BBHA9170251	18GHz~40GHz	Nov. 24, 2022	Apr. 25, 2023 ~ May 05, 2023	Nov. 23, 2023	Radiation (03CH07-HY)
Signal Generator	Anritsu	MG3710A	6261943042	2G / 3G / LTE / 5G FR1	May 23, 2022	Apr. 25, 2023 ~ May 05, 2023	May 22, 2023	Radiation (03CH07-HY)
Hygrometer	TECPEL	DTM-303A	TP201996	NA	Nov. 17, 2022	Mar. 28, 2023~ Apr. 13, 2023	Nov. 16, 2023	Conducted (TH03-HY)
Base Station (Measure)	Anritsu	MT8821C	6262116730	LTE	Jun. 15, 2022	Mar. 28, 2023~ Apr. 13, 2023	Jun. 14, 2023	Conducted (TH03-HY)
Base Station (Measure)	Anritsu	MT8000A	6262134933	FR1	Jun. 13, 2022	Mar. 28, 2023~ Apr. 13, 2023	Jun. 12, 2023	Conducted (TH03-HY)

6 Measurement Uncertainty

Uncertainty of Radiated Emission Measurement (30 MHz ~ 1000 MHz)

Measuring Uncertainty for a Level of Confidence of 95% (U = 2Uc(y))	**3.25 dB**

Uncertainty of Radiated Emission Measurement (1 GHz ~ 18 GHz)

Measuring Uncertainty for a Level of Confidence of 95% (U = 2Uc(y))	**3.50 dB**

Uncertainty of Radiated Emission Measurement (18 GHz ~ 40 GHz)

Measuring Uncertainty for a Level of Confidence of 95% (U = 2Uc(y))	**4.08 dB**

Appendix A. Test Results of Conducted Test

Conducted Output Power(Average power) and EIRP

NR n30 Maximum Average Power [dBm] (GT - LC = -2.15 dB)								
BW [MHz]	RB Size	RB Offset	Mod	Lowest	Middle	Highest	EIRP (dBm)	EIRP(W)
5	1	1	PI/2 BPSK	22.65	22.78	22.85	20.71	0.1178
5	1	23		22.68	22.85	22.76		
5	12	6		22.71	22.78	22.86		
5	1	0		22.13	22.25	22.35		
5	1	24		22.09	22.24	22.39		
5	25	0		22.54	22.63	22.76		
5	1	1	QPSK	22.62	22.75	22.84		
5	1	23		22.68	22.85	22.72		
5	12	6		22.75	22.81	22.86		
5	1	0		21.67	21.78	21.99		
5	1	24		21.66	21.77	21.87		
5	25	0		21.79	21.89	21.86		
5	1	1	16-QAM	21.57	21.75	21.85	19.70	0.0933
5	1	1	64-QAM	20.16	20.45	20.56		
5	1	1	256-QAM	17.71	17.74	17.88		
Limit	EIRP < 250 mW/5MHz			Result			Pass	

NR n30 Maximum Average Power [dBm] (GT - LC = -2.15 dB)								
BW [MHz]	RB Size	RB Offset	Mod	Lowest	Middle	Highest	EIRP (dBm)	EIRP(W)
10	1	1	PI/2 BPSK	-	22.84	-	20.74	0.1186
10	1	50		-	22.75	-		
10	25	12		-	22.78	-		
10	1	0		-	22.32	-		
10	1	51		-	22.23	-		
10	50	0		-	22.57	-		
10	1	1	QPSK	-	22.89	-		
10	1	50		-	22.61	-		
10	25	12		-	22.76	-		
10	1	0		-	21.92	-		
10	1	51		-	21.82	-		
10	50	0		-	21.75	-		
10	1	1	16-QAM	-	21.71	-	19.56	0.0904
10	1	1	64-QAM	-	20.54	-		
10	1	1	256-QAM	-	17.80	-		
Limit	EIRP < 250 mW/5MHz			Result			Pass	

Total EIRP power is less than partial EIRP limit 250 mW/5MHz.

Appendix B. Test Results of Radiated Test

5G NR n30_Ant 0

5G NR n30/ 5MHz / PI/2 BPSK									
Channel	Frequency (MHz)	EIRP (dBm)	Limit (dBm)	Margin (dB)	SPA Reading (dBm)	S.G. Power (dBm)	TX Cable loss (dB)	TX Antenna Gain (dBi)	Polarization (H/V)
Lowest	4610	-45.99	-40	-5.99	-69.34	-52.8	2.11	8.92	H
	6918	-52.02	-40	-12.02	-79.66	-60.1	2.62	10.70	H
	9220	-50.02	-40	-10.02	-81.82	-60.1	2.53	12.61	H
									H
									H
									H
	4610	-49.49	-40	-9.49	-72.82	-56.3	2.11	8.92	V
	6918	-50.82	-40	-10.82	-78.9	-58.9	2.62	10.70	V
	9220	-50.02	-40	-10.02	-81.97	-60.1	2.53	12.61	V
									V
									V
									V
Middle	4614	-45.49	-40	-5.49	-68.51	-52.3	2.11	8.93	H
	6924	-51.31	-40	-11.31	-79.35	-59.4	2.62	10.71	H
	9230	-50.22	-40	-10.22	-81.67	-60.3	2.53	12.61	H
									H
									H
									H
	4614	-49.69	-40	-9.69	-72.64	-56.5	2.11	8.93	V
	6924	-51.01	-40	-11.01	-78.78	-59.1	2.62	10.71	V
	9230	-49.42	-40	-9.42	-81.73	-59.5	2.53	12.61	V
									V
									V
									V

Highest	4620	-46.48	-40	-6.48	-69.2	-53.3	2.12	8.94	H
	6930	-50.70	-40	-10.70	-78.62	-58.8	2.61	10.72	H
	9240	-49.53	-40	-9.53	-81.73	-59.6	2.53	12.60	H
									H
									H
									H
									H
	4620	-48.88	-40	-8.88	-72.32	-55.7	2.12	8.94	V
	6930	-49.80	-40	-9.80	-77.87	-57.9	2.61	10.72	V
	9240	-49.73	-40	-9.73	-81.99	-59.8	2.53	12.60	V
									V
									V
									V
									V

Remark: Spurious emissions within 30-1000MHz were found more than 20dB below limit line.

5G NR n30/ 10MHz / PI/2 BPSK									
Channel	Frequency (MHz)	EIRP (dBm)	Limit (dBm)	Margin (dB)	SPA Reading (dBm)	S.G. Power (dBm)	TX Cable loss (dB)	TX Antenna Gain (dBi)	Polarization (H/V)
Middle	4614	-48.69	-40	-8.69	-71.97	-55.5	2.11	8.93	H
	6918	-52.02	-40	-12.02	-79.64	-60.1	2.62	10.70	H
	9216	-50.32	-40	-10.32	-81.82	-60.4	2.53	12.61	H
									H
									H
									H
									H
	4614	-50.89	-40	-10.89	-74.03	-57.7	2.11	8.93	V
	6918	-50.12	-40	-10.12	-78.32	-58.2	2.62	10.70	V
	9216	-49.62	-40	-9.62	-81.85	-59.7	2.53	12.61	V
									V
									V
									V
									V

Remark: Spurious emissions within 30-1000MHz were found more than 20dB below limit line.