



FCC RADIO TEST REPORT

FCC ID : B94HNI41C5TKR
Equipment : Notebook Computer
Brand Name : HP
Model Name : HSN-I41C-5
Applicant : HP Inc.
1501 Page Mill Road, Palo Alto CA 94304 USA
Standard : FCC 47 CFR Part 2, 90(R)

The product was received on Aug. 27, 2020 and testing was started from Sep. 15, 2020 and completed on Sep. 24, 2020. 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, Taiwan (R.O.C.)



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History of this test report

Report No.	Version	Description	Issued Date
FG082404-01E	01	Initial issue of report	Oct. 16, 2020



Summary of Test Result

Report Clause	Ref Std. Clause	Test Items	Result (PASS/FAIL)	Remark
-	§2.1046	Conducted Output Power	-	See Note
-	§90.542 (a)(7)	Effective Radiated Power	-	See Note
-	-	Peak-to-Average Ratio	-	See Note
-	§2.1049	Occupied Bandwidth	-	See Note
-	§2.1053 §90.543 (e)(2)	Conducted Band Edge Measurement	-	See Note
-	§2.1051 §90.210 (n)	Emission Mask	-	See Note
-	§2.1053 §90.543 (e)(3)	Conducted Spurious Emission	-	See Note
-	§2.1055 §90.539 (e)	Frequency Stability Temperature & Voltage	-	See Note
-	§90.542 (a)(7)	Effective Radiated Power	-	See Note
3.2	§2.1053 §90.543 (e)(3) §90.543 (f)	Radiated Spurious Emission	Pass	Under limit 14.05 dB at 1577.000 MHz

Note: The module (Model: T99W175) makes no difference after verifying output power, this report reuses test data from the module report.

Declaration of Conformity:

The test results with all measurement uncertainty excluded are presented in accordance with the regulation limits or requirements declared by manufacturers.

Comments and Explanations:

The declared of product specification for EUT presented in the report are provided by the manufacturer, and the manufacturer takes all the responsibilities for the accuracy of product specification.

Reviewed by: Wii Chang

Report Producer: Celery Wei



1 General Description

1.1 Product Feature of Equipment Under Test

WCDMA/LTE/5G NR, Bluetooth, Wi-Fi 2.4GHz 802.11b/g/n/ax, Wi-Fi 5GHz 802.11a/n/ac/ax, NFC and GNSS.

Product Specification subjective to this standard	
Sample 1	EUT with WNC Antenna
Sample 2	EUT with Hong-bo Antenna
Sample 3	EUT with AWAN Antenna
Antenna Type	WWAN <Ant. 1>: PIFA Antenna <Ant. 2>: PIFA Antenna <Ant. 3>: PIFA Antenna <Ant. 4>: PIFA Antenna WLAN <Ant. 1>: PIFA Antenna <Ant. 2>: PIFA Antenna Bluetooth: PIFA Antenna GPS/Glonass/BDS/Galileo: PIFA Antenna NFC: Loop Antenna



WWAN Antenna Information

Vendor	AWAN															
Antenna	PIFA															
Part Number	6036B0256001 (AUP6Y-100037) (Main)(5)(Tx1/Rx1)															
Frequency	B2 1850-1910MHz	B4 1710-1755MHz	B5 824-849MHz	B7 2500-2570MHz	B12 699-716MHz	B13 777-787MHz	B14 788-798MHz	B17 704-716MHz	B25 1850-1915MHz	B26 814-849MHz	B30 2305-2315MHz	B38 2570-2620MHz	B41 2496-2690MHz	B42 3400-3600MHz	B48 3550-3700MHz	B66 1710-1780MHz
Gain (dBi)	1.98	0.47	-4.45	-0.59	-2.03	-3.80	-4.15	-2.21	1.98	-4.45	0.42	0.47	0.75	-0.79	0.28	0.47
Part Number	6036B0256801 (AUP6Y-100038) (Aux)(6)(Rx2)															
Frequency	B2 1930-1990MHz	B4 2110-2155MHz	B5 869-894MHz	B7 2620-2690MHz	B12 729-746MHz	B13 746-756MHz	B14 758-768MHz	B17 734-746MHz	B25 1930-1995MHz	B26 859-894MHz	B30 2350-2360MHz	B38 2570-2620MHz	B41 2496-2690MHz	B42 3400-3600MHz	B48 3550-3700MHz	B66 2110-2200MHz
Gain (dBi)	-2.76	-1.78	-5.86	-4.02	-1.75	-1.48	-1.41	-1.85	-2.40	-5.36	-3.43	-3.05	-2.01	-1.94	-1.58	-1.78
Vendor	HONG-BO															
Antenna	PIFA															
Part Number	6036B0259101 (260-27377) (Main)(5)(Tx1/Rx1)															
Frequency	B2 1850-1910MHz	B4 1710-1755MHz	B5 824-849MHz	B7 2500-2570MHz	B12 699-716MHz	B13 777-787MHz	B14 788-798MHz	B17 704-716MHz	B25 1850-1915MHz	B26 814-849MHz	B30 2305-2315MHz	B38 2570-2620MHz	B41 2496-2690MHz	B42 3400-3600MHz	B48 3550-3700MHz	B66 1710-1780MHz
Gain (dBi)	0.95	0.85	-0.32	0.18	-1.67	0.20	-0.68	-1.67	0.95	-0.32	-3.72	0.14	0.18	-0.63	-0.73	0.85
Part Number	6036B0258901 (260-27378) (Aux)(6)(Rx2)															
Frequency	B2 1930-1990MHz	B4 2110-2155MHz	B5 869-894MHz	B7 2620-2690MHz	B12 729-746MHz	B13 746-756MHz	B14 758-768MHz	B17 734-746MHz	B25 1930-1995MHz	B26 859-894MHz	B30 2350-2360MHz	B38 2570-2620MHz	B41 2496-2690MHz	B42 3400-3600MHz	B48 3550-3700MHz	B66 2110-2200MHz
Gain (dBi)	-0.22	-1.74	-3.56	-3.36	-3.75	-3.50	-3.50	-3.75	-0.22	-3.56	-2.79	-3.68	-3.36	-2.35	-1.44	-1.74
Vendor	WNC															
Antenna	PIFA															
Part Number	6036B0254501 (81EABB15.G47) (Main)(5)(Tx1/Rx1)															
Frequency	B2 1850-1910MHz	B4 1710-1755MHz	B5 824-849MHz	B7 2620-2690MHz	B12 699-716MHz	B13 777-787MHz	B14 788-798MHz	B17 704-716MHz	B25 1850-1915MHz	B26 814-849MHz	B30 2305-2315MHz	B38 2570-2620MHz	B41 2496-2690MHz	B42 3400-3600MHz	B48 3550-3700MHz	B66 1710-1780MHz
Gain (dBi)	1.63	2.49	0.15	-0.96	-2.73	-0.73	-0.89	-2.73	1.63	0.15	-0.37	-0.42	-0.42	0.23	0.34	2.49
Part Number	6036B0254101 (81EABB15.G48) (Aux)(6)(Rx2)															
Frequency	B2 1930-1990MHz	B4 2110-2155MHz	B5 869-894MHz	B7 2620-2690MHz	B12 729-746MHz	B13 746-756MHz	B14 758-768MHz	B17 734-746MHz	B25 1930-1995MHz	B26 859-894MHz	B30 2350-2360MHz	B38 2570-2620MHz	B41 2496-2690MHz	B42 3400-3600MHz	B48 3550-3700MHz	B66 2110-2200MHz
Gain (dBi)	-2.37	-2.85	-3.03	-1.45	-4.62	-4.29	-4.49	-4.62	-2.37	-3.03	-3.08	-2.88	-1.45	-1.80	0.46	-2.07



Vendor	AWAN					
Antenna	PIFA					
Part Number	6036B0256001 (AUP6Y-100037) (Main)(5)(Tx1/Rx1)					
Frequency	n2 1850-1910MHz	n5 824-849MHz	n7 2500-2570MHz	n12 699-716MHz	n41 2496-2690MHz	n66 1710-1780MHz
Gain (dBi)	1.98	-4.45	-0.59	-2.03	0.75	0.47
Vendor	AWAN					
Antenna	PIFA					
Part Number	6036B0280901 (AUP6Y-100076) (Aux3)(8)(Tx2/Rx4)					
Frequency	n2 1850-1910MHz	n5 869-894MHz	n7 2620-2690MHz	n12 729-746MHz	n41 2496-2690MHz	n66 1710-1780MHz
Gain (dBi)	-1.14	-0.71	-5.02	-0.71	-3.42	-0.13
Vendor	HONG-BO					
Antenna	PIFA					
Part Number	6036B0259101 (260-27377) (Main)(5)(Tx1/Rx1)					
Frequency	n2 1850-1910MHz	n5 824-849MHz	n7 2500-2570MHz	n12 699-716MHz	n41 2496-2690MHz	n66 1710-1780MHz
Gain (dBi)	0.95	-0.32	0.18	-1.67	-0.73	0.85
Vendor	HONG-BO					
Antenna	PIFA					
Part Number	6036B0278101 (260-27443) (Aux3)(8)(Tx2/Rx4)					
Frequency	n2 1850-1910MHz	n5 869-894MHz	n7 2500-2570MHz	n12 729-746MHz	n41 2496-2690MHz	n66 2110-2200MHz
Gain (dBi)	0.32	0.21	-4.74	0.21	-0.39	-0.39
Vendor	WNC					
Antenna	PIFA					
Part Number	6036B0254501 (81EABB15.G47) (Main)(5)(Tx1/Rx1)					
Frequency	n2 1850-1910MHz	n5 824-849MHz	n7 2500-2570MHz	n12 699-716MHz	n41 2496-2690MHz	n66 1710-1780MHz
Gain (dBi)	1.63	0.15	-0.96	-2.73	-0.42	2.49
Vendor	WNC					
Antenna	PIFA					
Part Number	6036B0277401 (81EABD15.G10) (Aux3)(8)(Tx2/Rx4)					
Frequency	n2 1850-1910MHz	n5 869-894MHz	n7 2500-2570MHz	n12 729-746MHz	n41 2496-2690MHz	n66 2110-2200MHz
Gain (dBi)	-3.29	-1.31	-2.78	-1.31	-2.15	-0.60



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.58, Aly. 75, Ln. 564, Wenhua 3rd, Rd., Guishan Dist., Taoyuan City, Taiwan (R.O.C.) TEL: +886-3-327-0868 FAX: +886-3-327-0855
Test Site No.	Sporton Site No. 03CH12-HY
Test Engineer	Jack Cheng, Lance Chiang and Chuan Chu
Temperature	22.8~26.2°C
Relative Humidity	56.5~68.6%

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

FCC Designation No.: TW0007

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 90(R)
- ♦ ANSI / TIA-603-E
- ♦ FCC KDB 971168 D01 Power Meas. License Digital Systems v03r01
- ♦ 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.

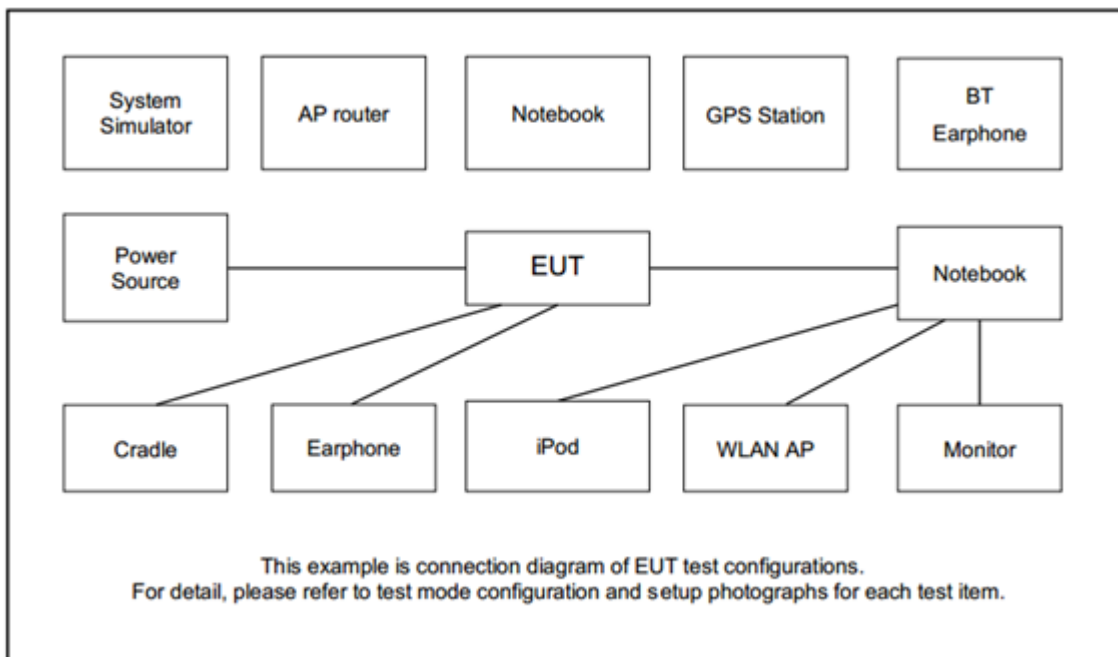
2 Test Configuration of Equipment Under Test

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.

Conducted Test Cases	Band	Bandwidth (MHz)						Modulation				RB #			Test Channel			
		1.4	3	5	10	15	20	QPSK	16QAM	64QAM	256QAM	1	Half	Full	L	M	H	
Radiated Spurious Emission	14	-	-		v	-	-					v	v					v
Remark	<ol style="list-style-type: none"> The mark "v" means that this configuration is chosen for testing The mark "-" means that this bandwidth is not supported. 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. All the radiated test cases were performed with Sample 2. 																	

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.	iPod Earphone	Apple	N/A	Verification	Unshielded, 1.0 m	N/A
2.	System Simulator	Anritsu	MT8821C	N/A	N/A	Unshielded, 1.8 m

2.4 Frequency List of Low/Middle/High Channels

LTE Band 14 Channel and Frequency List				
BW [MHz]	Channel/Frequency(MHz)	Lowest	Middle	Highest
10	Channel	-	23330	-
	Frequency	-	793	-

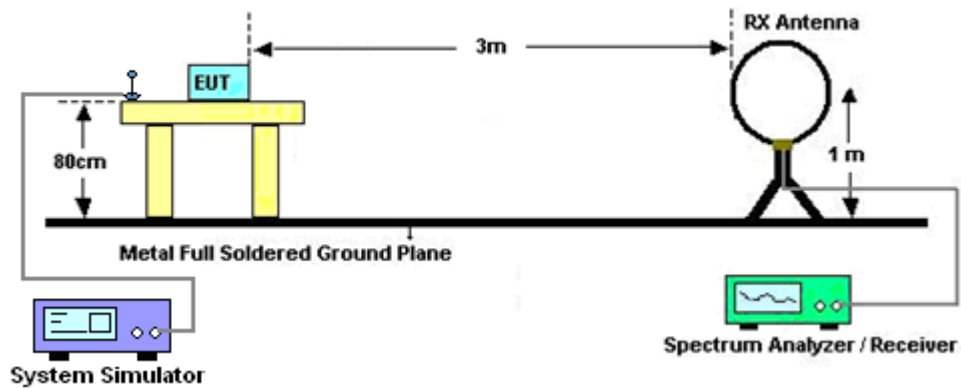
3 Radiated Test Items

3.1 Measuring Instruments

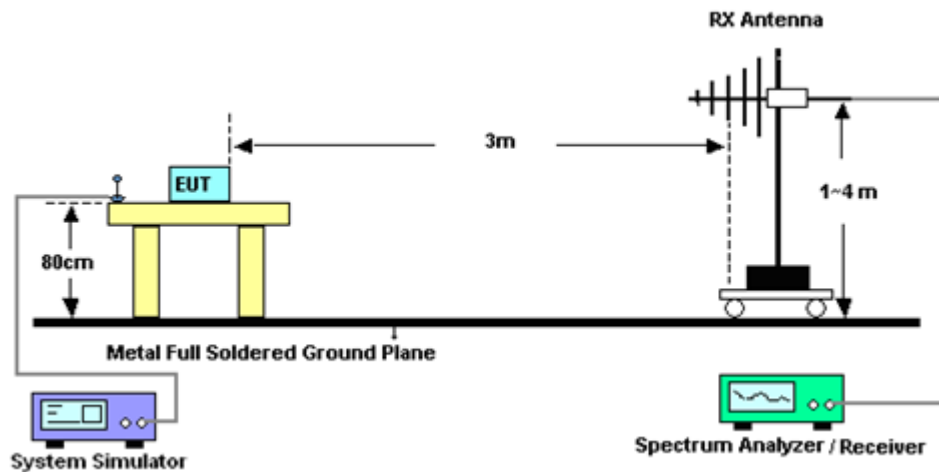
See list of measuring instruments of this test report.

3.1.1 Test Setup

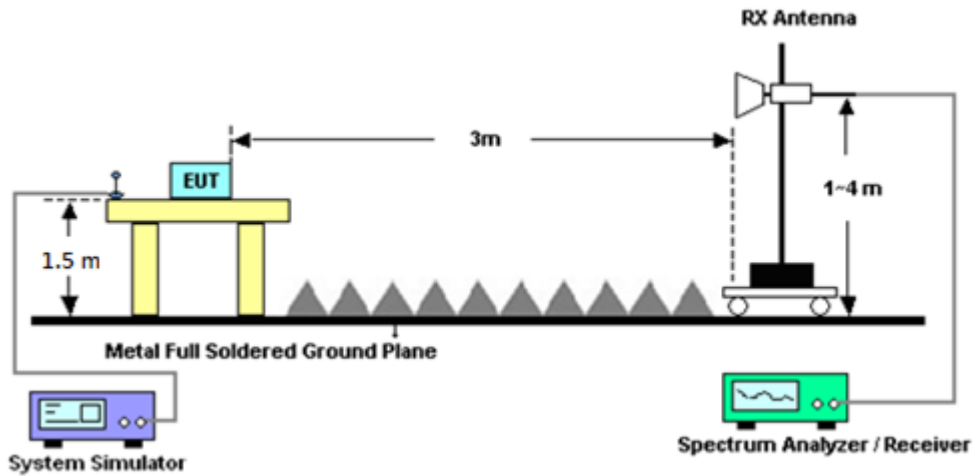
For radiated test below 30MHz



For radiated test from 30MHz to 1GHz



For radiated test above 1GHz



3.1.2 Test Result of Radiated Test

Please refer to Appendix A.

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 a comparison data 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.



3.2 Radiated Spurious Emission

3.2.1 Description of Radiated Spurious Emission

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 $43 + 10 \log (P)$ dB.

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. For the purpose of equipment authorization, a transmitter shall be tested with an antenna that is representative of the type that will be used with the equipment in normal operation.

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

3.2.2 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 for frequency below 1GHz and 1.5 meter for frequency above 1GHz respectively above ground.
2. The EUT was set 3 meters from the receiving antenna, which was 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 one meter and four meters to search the maximum spurious emission for both horizontal and vertical polarizations.
5. Make the measurement with the spectrum analyzer's RBW = 1MHz, VBW = 3MHz, Sweep = 500ms, Taking the record of maximum spurious emission.
6. A horn antenna was substituted in place of the EUT and was driven by a signal generator.
7. Tune the output power of signal generator to the same emission level with EUT maximum spurious emission.
8. Taking the record of output power at antenna port.
9. Repeat step 7 to step 8 for another polarization.
10. The RF fundamental frequency should be excluded against the limit line in the operating frequency band.
11. The limit line is derived from $43 + 10\log(P)$ dB below the transmitter power P(Watts)



4 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	100315	9 kHz~30 MHz	Dec. 26, 2019	Sep. 15, 2020~ Sep. 24, 2020	Dec. 25, 2020	Radiation (03CH12-HY)
Bilog Antenna	TESEQ	CBL 6111D & 00800N1D01N -06	37059 & 01	30MHz~1GHz	Oct. 12, 2019	Sep. 15, 2020~ Sep. 24, 2020	Oct. 11, 2020	Radiation (03CH12-HY)
Horn Antenna	SCHWARZBE CK	BBHA 9120 D	9120D-132 8	1GHz~18GHz	Nov. 14, 2019	Sep. 15, 2020~ Sep. 24, 2020	Nov. 13, 2020	Radiation (03CH12-HY)
Horn Antenna	SCHWARZBE CK	BBHA 9120D	9120D-162 0	1GHz ~ 18GHz	Oct. 28, 2019	Sep. 15, 2020~ Sep. 24, 2020	Oct. 27, 2020	Radiation (03CH12-HY)
Preamplifier	COM-POWE R	PA-103	161075	10MHz~1GHz	Mar. 25, 2020	Sep. 15, 2020~ Sep. 24, 2020	Mar. 24, 2021	Radiation (03CH12-HY)
Preamplifier	Keysight	83017A	MY572801 20	1GHz~26.5GHz	Jul. 20, 2020	Sep. 15, 2020~ Sep. 24, 2020	Jul. 19, 2021	Radiation (03CH12-HY)
Preamplifier	Jet-Power	JPA0118-55-30 3K	171000180 0054002	1GHz~18GHz	Feb. 07, 2020	Sep. 15, 2020~ Sep. 24, 2020	Feb. 06, 2021	Radiation (03CH12-HY)
Spectrum Analyzer	Agilent	N9010A	MY542004 85	10Hz~44GHz	Feb. 10, 2020	Sep. 15, 2020~ Sep. 24, 2020	Feb. 09, 2021	Radiation (03CH12-HY)
Signal Generator	Anritsu	MG3694C	163401	0.1Hz~40GHz	Feb. 15, 2020	Sep. 15, 2020~ Sep. 24, 2020	Feb. 14, 2021	Radiation (03CH12-HY)
RF Cable	HUBER + SUHNER	SUCOFLEX 104	MY9837/4 PE	9kHz~30MHz	Mar. 12, 2020	Sep. 15, 2020~ Sep. 24, 2020	Mar. 11, 2021	Radiation (03CH12-HY)
RF Cable	HUBER + SUHNER	SUCOFLEX 126E	0058/126E	30MHz~18GHz	Dec. 12, 2019	Sep. 15, 2020~ Sep. 24, 2020	Dec. 11, 2020	Radiation (03CH12-HY)
RF Cable	HUBER + SUHNER	SUCOFLEX 102	505134/2	30MHz~40GHz	Feb. 25, 2020	Sep. 15, 2020~ Sep. 24, 2020	Feb. 24, 2021	Radiation (03CH12-HY)
RF Cable	HUBER + SUHNER	SUCOFLEX 102	800740/2	30MHz~40GHz	Feb. 25, 2020	Sep. 15, 2020~ Sep. 24, 2020	Feb. 24, 2021	Radiation (03CH12-HY)
Controller	EMEC	EM1000	N/A	Control Turn table & Ant Mast	N/A	Sep. 15, 2020~ Sep. 24, 2020	N/A	Radiation (03CH12-HY)
Antenna Mast	EMEC	AM-BS-4500-B	N/A	1m~4m	N/A	Sep. 15, 2020~ Sep. 24, 2020	N/A	Radiation (03CH12-HY)
Turn Table	EMEC	TT2000	N/A	0~360 Degree	N/A	Sep. 15, 2020~ Sep. 24, 2020	N/A	Radiation (03CH12-HY)
Software	Audix	E3 6.2009-8-24	RK-00098 9	N/A	N/A	Sep. 15, 2020~ Sep. 24, 2020	N/A	Radiation (03CH12-HY)



5 Uncertainty of Evaluation

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

Measuring Uncertainty for a Level of Confidence of 95% ($U = 2Uc(y)$)	3.07
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Uncertainty of Radiated Emission Measurement (1 GHz ~ 18 GHz)

Measuring Uncertainty for a Level of Confidence of 95% ($U = 2Uc(y)$)	3.21
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Appendix A. Test Results of Radiated Test

LTE Band 14

LTE Band 14 / 10MHz / 256QAM									
Channel	Frequency (MHz)	ERP (dBm)	Limit (dBm)	Over Limit (dB)	SPA Reading (dBm)	S.G. Power (dBm)	TX Cable loss (dB)	TX Antenna Gain (dBi)	Polarization (H/V)
Middle	1577	-62.27	-42.15	-20.12	-70.72	-67.62	0.90	8.39	H
	2365	-54.03	-13	-41.03	-67.6	-61.27	1.12	10.51	H
	3154	-57.43	-13	-44.43	-72.89	-65.65	1.30	11.67	H
	1577	-56.20	-42.15	-14.05	-64.13	-61.55	0.90	8.39	V
	2365	-53.15	-13	-40.15	-66.47	-60.39	1.12	10.51	V
	3154	-56.93	-13	-43.93	-72.81	-65.15	1.30	11.67	V

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