



FCC Test Report

APPLICANT : Republic Wireless Inc.
EQUIPMENT : Relay+
BRAND NAME : Relay by Republic Wireless
MODEL NAME : RW2266
FCC ID : 2AMBHRW2266
STANDARD : 47 CFR Part 15 Subpart B
CLASSIFICATION : Certification

The product was received on May 08, 2019 and testing was completed on Dec. 18, 2019. We, Sporton International (Kunshan) Inc., would like to declare that the tested sample has been evaluated in accordance with the test procedures given in ANSI C63.4-2014 and has been in compliance with the applicable technical standards.

The test results in this report apply exclusively to the tested model / sample. Without written approval of Sporton International (Kunshan) Inc., the test report shall not be reproduced except in full.

Jason Jia

Reviewed by: Jason Jia / Supervisor

James Huang

Approved by: James Huang / Manager



Sporton International (Kunshan) Inc.

No. 1098, Pengxi North Road, Kunshan Economic Development Zone Jiangsu Province 215300
People's Republic of China



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REVISION HISTORY

REPORT NO.	VERSION	DESCRIPTION	ISSUED DATE
FC950807	Rev. 01	Initial issue of report	Mar. 03, 2020

SUMMARY OF TEST RESULT

Report Section	FCC Rule	Description	Limit	Result	Remark
3.1	15.107	AC Conducted Emission	< 15.107 limits	PASS	Under limit 17.48 dB at 0.433 MHz
3.2	15.109	Radiated Emission	< 15.109 limits	PASS	Under limit 11.43 dB at 53.280 MHz

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.



1. General Description

1.1. Applicant

Republic Wireless Inc.

940 Main Campus Drive, Ste 300, Raleigh, NC 27606, USA

1.2. Manufacturer

Republic Wireless Inc.

940 Main Campus Drive, Ste 300, Raleigh, NC 27606, USA

1.3. Product Feature of Equipment Under Test

Product Feature	
Equipment	Relay+
Brand Name	Relay by Republic Wireless
Model Name	RW2266
FCC ID	2AMBHRW2266
EUT supports Radios application	WCDMA/HSPA/DC-HSDPA/ HSPA+(16QAM Uplink is not supported)/LTE/NFC/LoRa WLAN 2.4GHz 802.11b/g/n HT20/HT40 WLAN 5GHz 802.11a/n HT20/HT40 Bluetooth BR/EDR/LE GNSS/WPC(QI)
IMEI Code	Conduction/ Radiation: N/A
HW Version	B2
SW Version	1.15.0.28-DF
EUT Stage	Identical Prototype

Remark: The above EUT's information was declared by manufacturer. Please refer to the specifications or user's manual for more detailed description.

1.4. Product Specification of Equipment Under Test

Standards-related Product Specification	
Tx Frequency	WCDMA Band V: 826.4 MHz ~ 846.6 MHz WCDMA Band IV : 1712.4 MHz ~ 1752.6 MHz WCDMA Band II: 1852.4 MHz ~ 1907.6 MHz LTE Band 2 : 1850.7 MHz ~ 1909.3 MHz LTE Band 4 : 1710.7 MHz ~ 1754.3 MHz LTE Band 5 : 824.7 MHz ~ 848.3 MHz LTE Band 7 : 2502.5 MHz ~ 2567.5 MHz LTE Band 12 : 699.7 MHz ~ 715.3 MHz LTE Band 13 : 779.5 MHz ~ 784.5 MHz LTE Band 25 : 1850.7 MHz ~ 1914.3 MHz LTE Band 26 : 814.7 MHz ~ 848.3 MHz LTE Band 41 : 2498.5 MHz ~ 2687.5 MHz LTE Band 66 : 1710.7 MHz ~ 1779.3 MHz 802.11b/g/n: 2412 MHz ~ 2462 MHz 802.11a/n: 5180 MHz ~ 5240 MHz; 5260 MHz ~ 5320 MHz; 5500 MHz ~ 5700 MHz 5745 MHz ~ 5825 MHz Bluetooth: 2402 MHz ~ 2480 MHz NFC : 13.56 MHz LoRa: 902 MHz ~ 928 MHz
Rx Frequency	WCDMA Band V: 871.4 MHz ~ 891.6 MHz WCDMA Band IV : 2112.4 MHz ~ 2152.6 MHz WCDMA Band II: 1932.4 MHz ~ 1987.6 MHz LTE Band 2 : 1930.7 MHz ~ 1989.3 MHz LTE Band 4 : 2110.7 MHz ~ 2154.3 MHz LTE Band 5 : 869.7 MHz ~ 893.3 MHz LTE Band 7 : 2622.5 MHz ~ 2687.5 MHz LTE Band 12 : 729.7 MHz ~ 745.3 MHz LTE Band 13 : 748.5 MHz ~ 753.5 MHz LTE Band 25 : 1930.7 MHz ~ 1994.3 MHz LTE Band 26 : 859.7 MHz ~ 893.3 MHz LTE Band 41 : 2498.5 MHz ~ 2687.5 MHz LTE Band 66 : 2110.7 MHz ~ 2179.3 MHz 802.11b/g/n: 2412 MHz ~ 2462 MHz 802.11a/n: 5180 MHz ~ 5240 MHz; 5260 MHz ~ 5320 MHz; 5500 MHz ~ 5700 MHz 5745 MHz ~ 5825 MHz Bluetooth: 2402 MHz ~ 2480 MHz NFC : 13.56 MHz LoRa: 902 MHz ~ 928 MHz GNSS : 1559 MHz ~ 1610 MHz; 1164 MHz ~ 1215 MHz WPC(QI): 100 kHz ~ 205 kHz
Antenna Type	WWAN : LDS Antenna WLAN : LDS Antenna Bluetooth : LDS Antenna GNSS: LDS Antenna NFC : FPC Antenna LoRa: Internal Antenna

Type of Modulation	WCDMA : BPSK HSDPA/DC-HSDPA : QPSK HSUPA : QPSK HSPA+ : 16QAM (Uplink is not supported) DC-HSDPA : 64QAM LTE: QPSK / 16QAM 802.11b : DSSS (DBPSK / DQPSK / CCK) 802.11a/g/n : OFDM (BPSK / QPSK / 16QAM / 64QAM) Bluetooth LE : GFSK Bluetooth (1Mbps) : GFSK Bluetooth (2Mbps) : $\pi/4$ -DQPSK Bluetooth (3Mbps) : 8-DPSK GNSS : BPSK WPC: ASK LoRa: FSK
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Note: The EUT supports for wireless charging receive function only.

1.5. Modification of EUT

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

1.6. Test Location

Sporton International (Kunshan) Inc. is accredited to ISO/IEC 17025:2017 by American Association for Laboratory Accreditation with Certificate Number 5145.02.

Test Firm	Sporton International (Kunshan) Inc.		
Test Site Location	No. 1098, Pengxi North Road, Kunshan Economic Development Zone Jiangsu Province 215300 People's Republic of China TEL : +86-512-57900158 FAX : +86-512-57900958		
Test Site No.	Sporton Site No.	FCC Designation No.	FCC Test Firm Registration No.
	CO01-KS 03CH02-KS	CN1257	314309

1.7. Test Software

Item	Site	Manufacture	Name	Version
1.	03CH02-KS	AUDIX	E3	6.2009-8-24a
2.	CO01-KS	AUDIX	E3	6.2009-8-24

1.8. Applicable Standards

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

- ♦ 47 CFR Part 15 Subpart B
- ♦ ANSI C63.4-2014

Remark: All test items were verified and recorded according to the standards and without any deviation during the test.

2. Test Configuration of Equipment Under Test

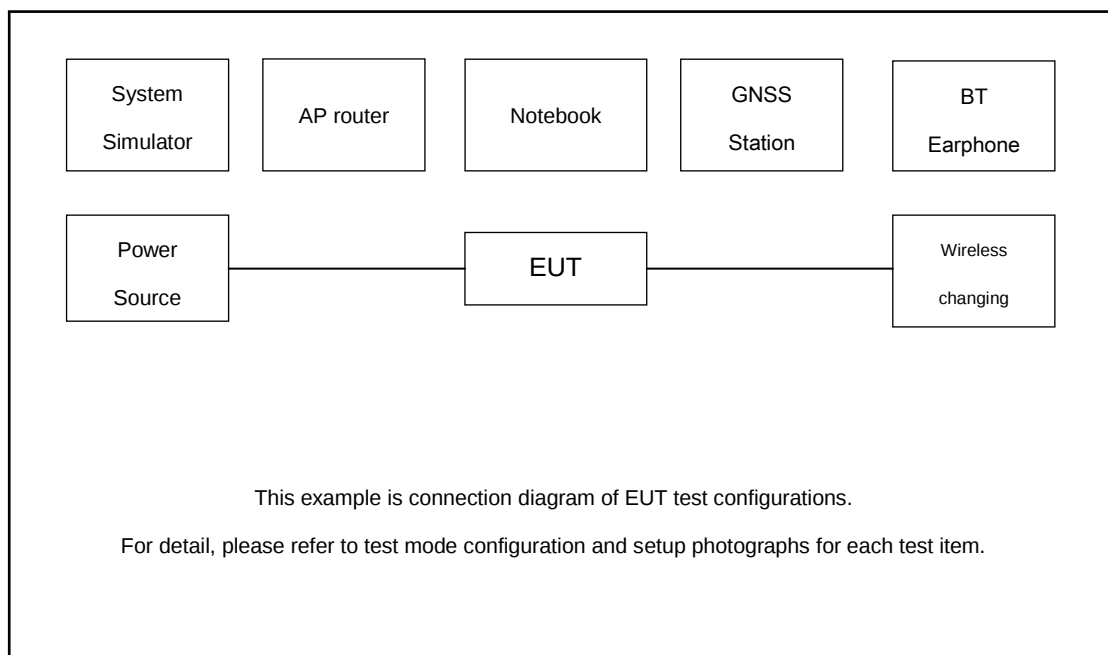
2.1. Test Mode

The EUT has been associated with peripherals pursuant to ANSI C63.4-2014 and configuration operated in a manner tended to maximize its emission characteristics in a typical application.

Frequency range investigated: conduction emission (150 kHz to 30 MHz), radiation emission (30MHz to the 5th harmonic of the highest fundamental frequency or to 40 GHz, whichever is lower).

Test Items	Function Type
AC Conducted Emission	Mode 1: WCDMA Band V Idle (Middle CH) + Bluetooth Idle + WLAN (2.4G) Idle + LoRa Idle + MP3 + USB Cable(Charging from Adapter)
	Mode 2: WCDMA Band II Idle + Bluetooth Idle + WLAN (5G) Idle + LoRa Idle + NFC on + USB Cable(Charging from Adapter)
	Mode 3: LTE Band 12 Idle (Low CH) + Bluetooth Idle + WLAN (2.4G) Idle + LoRa Idle + GNSS Rx + Wireless Charger
	Mode 4: LTE Band 13 Idle (High CH) + Bluetooth Idle + WLAN (2.4G) Idle + LoRa Idle + MP3 + USB Cable(Charging from Adapter)
	Mode 5: LTE Band 26 Idle (Low CH) + Bluetooth Idle + WLAN (2.4G) Idle + LoRa Idle + MP3 + USB Cable(Charging from Adapter)
Radiated Emissions	Mode 1: WCDMA Band V Idle (Middle CH) + Bluetooth Idle + WLAN (2.4G) Idle + LoRa Idle + MP3 + USB Cable(Charging from Adapter)
	Mode 2: WCDMA Band II Idle + Bluetooth Idle + WLAN (5G) Idle + LoRa Idle + NFC on + USB Cable(Charging from Adapter)
	Mode 3: LTE Band 12 Idle (Low CH) + Bluetooth Idle + WLAN (2.4G) Idle + LoRa Idle + GNSS Rx + Wireless Charger
	Mode 4: LTE Band 13 Idle (High CH) + Bluetooth Idle + WLAN (2.4G) Idle + LoRa Idle + MP3 + USB Cable(Charging from Adapter)
	Mode 5: LTE Band 26 Idle (Low CH) + Bluetooth Idle + WLAN (2.4G) Idle + LoRa Idle + MP3 + USB Cable(Charging from Adapter)
Remark: 1. The worst case of AC is mode 1; only the test data of this mode is reported. 2. The worst case of RE is mode 1; only the test data of this mode is reported. 3. Pre-scanned Low/Middle/High channel for WCDMA Band V and LTE Band 12/13/26, the worst channel was recorded in this report.	

2.2.Connection Diagram of Test System



The EUT has been associated with peripherals pursuant to ANSI C63.4-2014 and configuration operated in a manner tended to maximize its emission characteristics in a typical application

2.3. Support Unit used in test configuration and system

Item	Equipment	Trade Name	Model Name	FCC ID	Data Cable	Power Cord
1.	LTE Base Station	Anritsu	MT8820C	N/A	N/A	Unshielded,1.8m
2.	GNSS Station	R&S	SMBV100A	N/A	N/A	Unshielded,1.8m
3.	WLAN AP	D-link	DIR-655	KA21R655B1	N/A	Unshielded,1.8m
4.	WLAN AP	TP-Link	TL-WDR5600	N/A	N/A	Unshielded,1.8m
5.	Bluetooth Earphone	Lenovo	LBH308	N/A	N/A	N/A
6.	Bluetooth Earphone	Xiaomi	LYEJ02LM	N/A	N/A	N/A
7.	Notebook	Lenovo	G480	QDS-BRCM1050I	N/A	AC I/P: Unshielded, 1.8 m DC O/P: Shielded, 1.8 m
8.	Wireless Charger	Huawei	CP60	N/A	N/A	N/A

2.4. EUT Operation Test Setup

The EUT was in WCDMA or LTE idle mode during the testing. The EUT was synchronized to the BCCH, and is in continuous receiving mode by setting system simulator's paging reorganization.

At the same time, the EUT was attached to the Bluetooth earphone or WLAN AP, and the following programs installed in the EUT were programmed during the test.

1. Turn on GNSS function to make the EUT receive continuous signals from GNSS station.
2. Turn on NFC Function.
3. Execute "Music Player" to play MP3 file.
4. Turn on Lora function.

3. Test Result

3.1. Test of AC Conducted Emission Measurement

3.1.1 Limits of AC Conducted Emission

For equipment that is designed to be connected to the public utility (AC) power line, the radio frequency voltage that is conducted back onto the AC power line on any frequency or frequencies within the band 150 kHz to 30 MHz shall not exceed the limits in the following table.

<Class B Limit>

Frequency of emission (MHz)	Conducted limit (dBuV)	
	Quasi-peak	Average
0.15-0.5	66 to 56*	56 to 46*
0.5-5	56	46
5-30	60	50

*Decreases with the logarithm of the frequency.

3.1.2 Measuring Instruments

The measuring equipment is listed in the section 4 of this test report.

3.1.3 Test Procedure

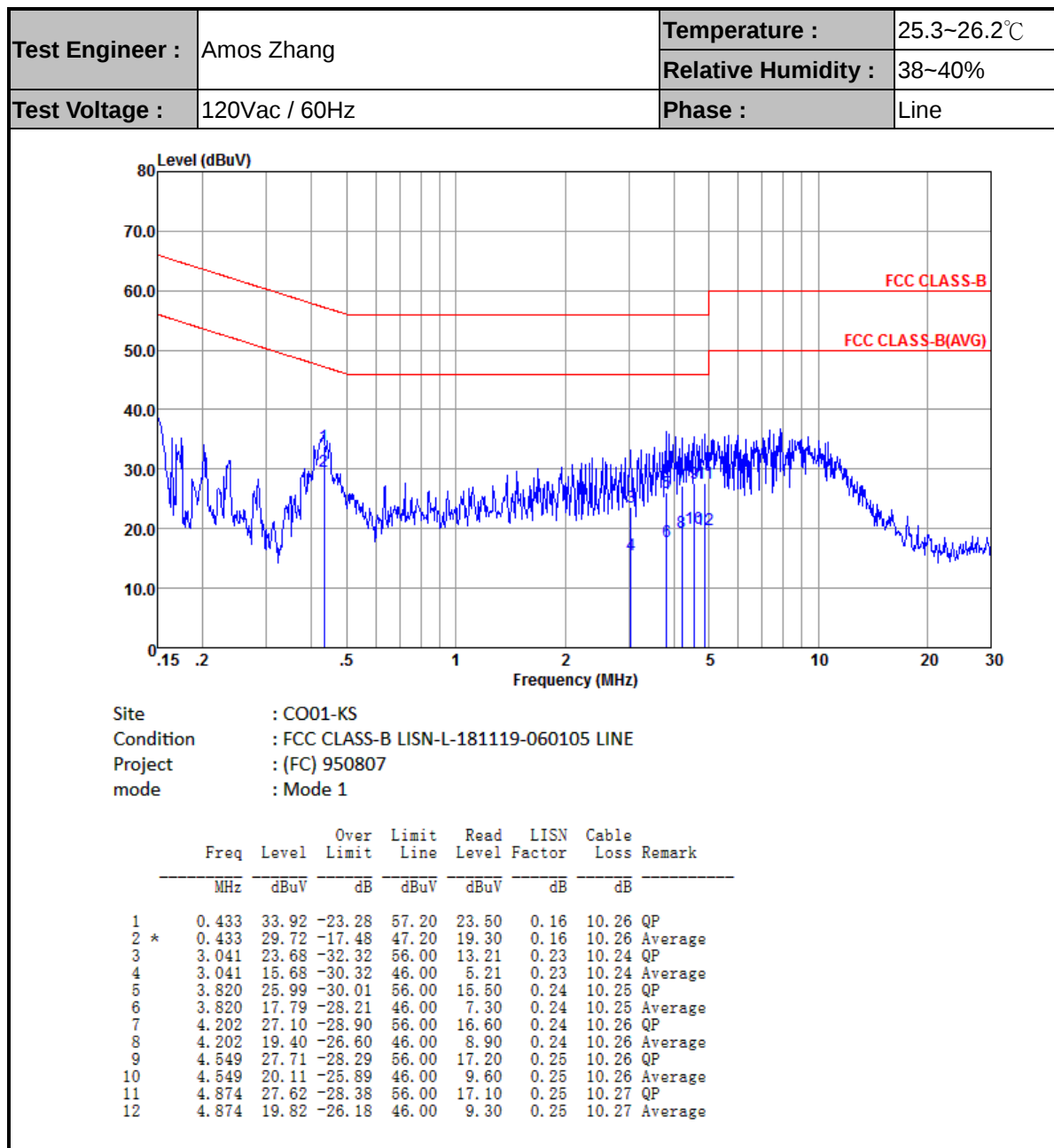
1. The EUT was placed 0.4 meter from the conducting wall of the shielding room was kept at least 80 centimeters from any other grounded conducting surface.
2. Connect EUT to the power mains through a line impedance stabilization network (LISN).
3. All the support units are connecting to the other LISN.
4. The LISN provides 50 ohm coupling impedance for the measuring instrument.
5. The FCC states that a 50 ohm, 50 microhenry LISN should be used.
6. Both sides of AC line were checked for maximum conducted interference.
7. The frequency range from 150 kHz to 30 MHz was searched.
8. Set the test-receiver system to Peak Detect Function and specified bandwidth (IF Bandwidth = 9kHz) with Maximum Hold Mode. Then measurement is also conducted by Average Detector and Quasi-Peak Detector Function respectively.

3.1.4 Test Setup



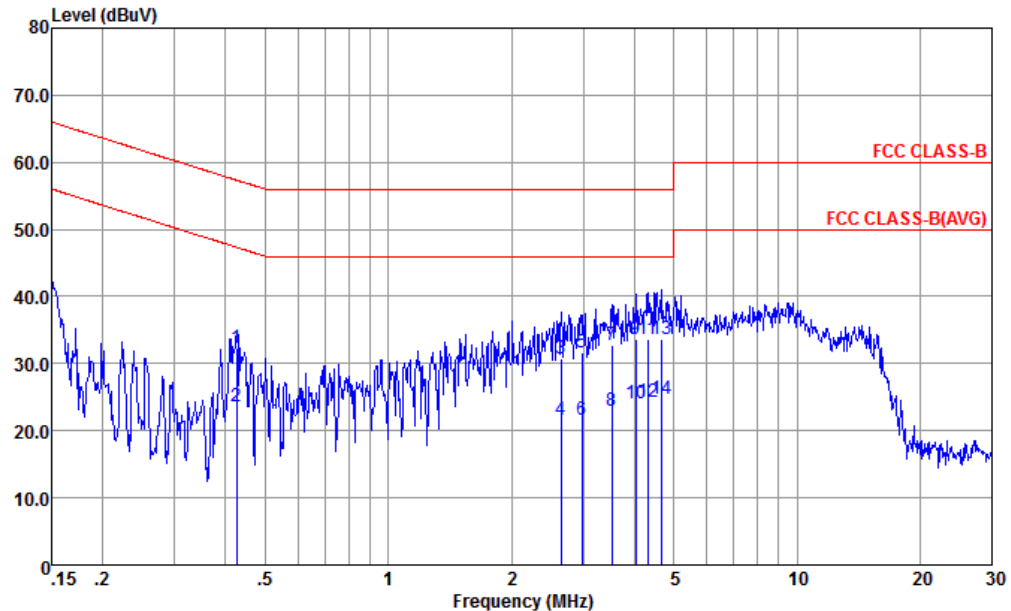


3.1.5 Test Result of AC Conducted Emission





Test Engineer :	Amos Zhang	Temperature :	25.3~26.2℃
		Relative Humidity :	38~40%
Test Voltage :	120Vac / 60Hz	Phase :	Neutral



Site : CO01-KS
Condition : FCC CLASS-B LISN-N-181119-060105 NEUTRAL
Project : (FC) 950807
mode : Mode 1

	Freq	Level	Over	Limit	Read	LISN	Cable	Remark
	MHz	dBuV	Limit	Line	Level	Factor	Loss	
			dB	dBuV	dBuV	dB	dB	
1	0.426	32.31	-25.02	57.33	21.90	0.15	10.26	QP
2	0.426	23.61	-23.72	47.33	13.20	0.15	10.26	Average
3	2.650	30.70	-25.30	56.00	20.30	0.16	10.24	QP
4	2.650	21.70	-24.30	46.00	11.30	0.16	10.24	Average
5	2.978	31.60	-24.40	56.00	21.20	0.16	10.24	QP
6	2.978	21.70	-24.30	46.00	11.30	0.16	10.24	Average
7	3.528	32.72	-23.28	56.00	22.30	0.17	10.25	QP
8	3.528	23.02	-22.98	46.00	12.60	0.17	10.25	Average
9	4.027	33.62	-22.38	56.00	23.20	0.17	10.25	QP
10	4.027	24.02	-21.98	46.00	13.60	0.17	10.25	Average
11	4.315	33.73	-22.27	56.00	23.29	0.18	10.26	QP
12	4.315	24.33	-21.67	46.00	13.89	0.18	10.26	Average
13	4.647	33.74	-22.26	56.00	23.30	0.18	10.26	QP
14 *	4.647	24.64	-21.36	46.00	14.20	0.18	10.26	Average

Note:

- Level(dBμV) = Read Level(dBμV) + LISN Factor(dB) + Cable Loss(dB)
- Over Limit(dB) = Level(dBμV) – Limit Line(dBμV)

3.2. Test of Radiated Emission Measurement

3.2.1. Limit of Radiated Emission

The emissions from an unintentional radiator shall not exceed the field strength levels specified in the following table:

<Class B Limit>

Frequency (MHz)	Field Strength (microvolts/meter)	Measurement Distance (meters)
30 – 88	100	3
88 – 216	150	3
216 - 960	200	3
Above 960	500	3

3.2.2. Measuring Instruments

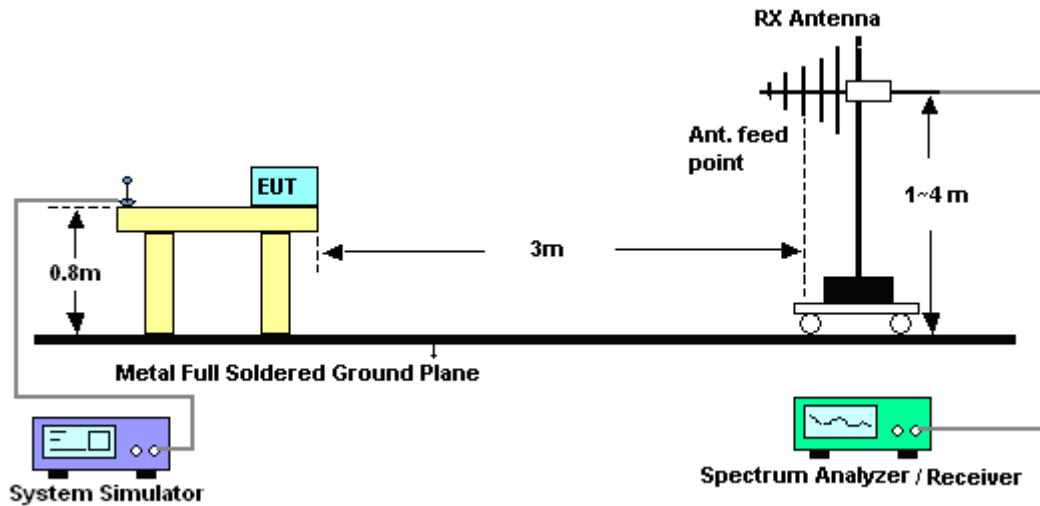
The measuring equipment is listed in the section 4 of this test report.

3.2.3. Test Procedures

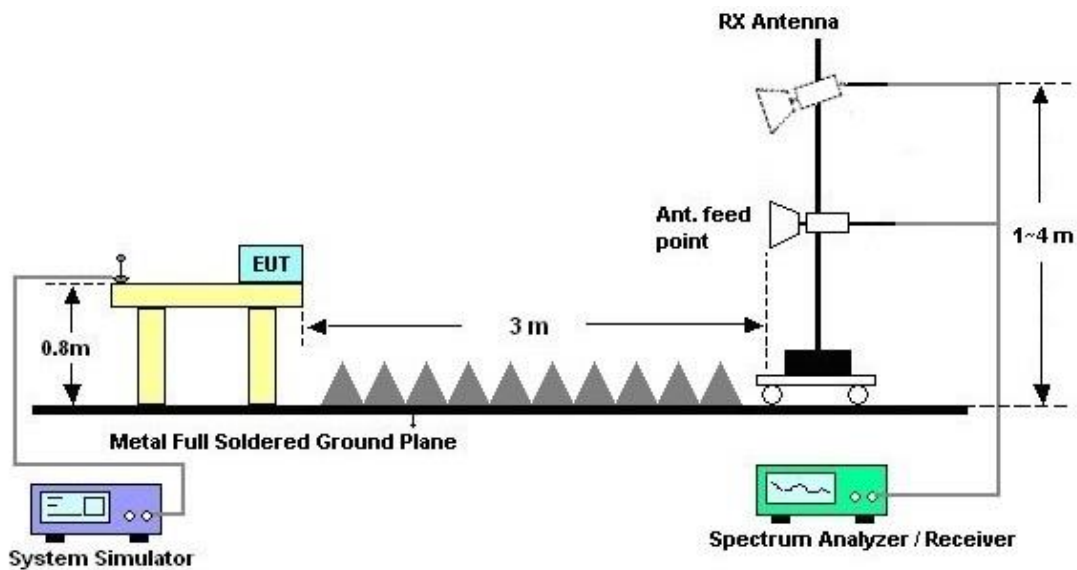
1. The EUT was placed on a turntable with 0.8 meter above ground.
2. The EUT was set 3 meters from the interference receiving antenna, which was mounted on the top of a variable height antenna tower.
3. The table was rotated 360 degrees to determine the position of the highest radiation.
4. The antenna is a Bi-Log antenna and its height is adjusted between one to four meters above ground to find the maximum value of the field strength for both horizontal polarization and vertical polarization of the antenna.
5. For each suspected emission, the EUT was arranged to its worst case and then tune the antenna tower (from 1 m to 4 m) and turntable (from 0 degree to 360 degrees) to find the maximum reading.
6. Set the test-receiver system to Peak Detect Function and specified bandwidth with Maximum Hold Mode (RBW=120kHz/VBW=300kHz for frequency below 1GHz; RBW=1MHz VBW=3MHz (Peak), RBW=1MHz/VBW=10Hz (Average) for frequency above 1GHz).
7. If the emission level of the EUT in peak mode was 3 dB lower than the limit specified, peak values of EUT will be reported. Otherwise, the emission will be repeated by using the quasi-peak method and reported.
8. Emission level (dBμV/m) = 20 log Emission level (μV/m)
9. Corrected Reading: Antenna Factor + Cable Loss + Read Level - Preamp Factor = Level

3.2.4. Test Setup of Radiated Emission

For radiated emissions from 30MHz to 1GHz

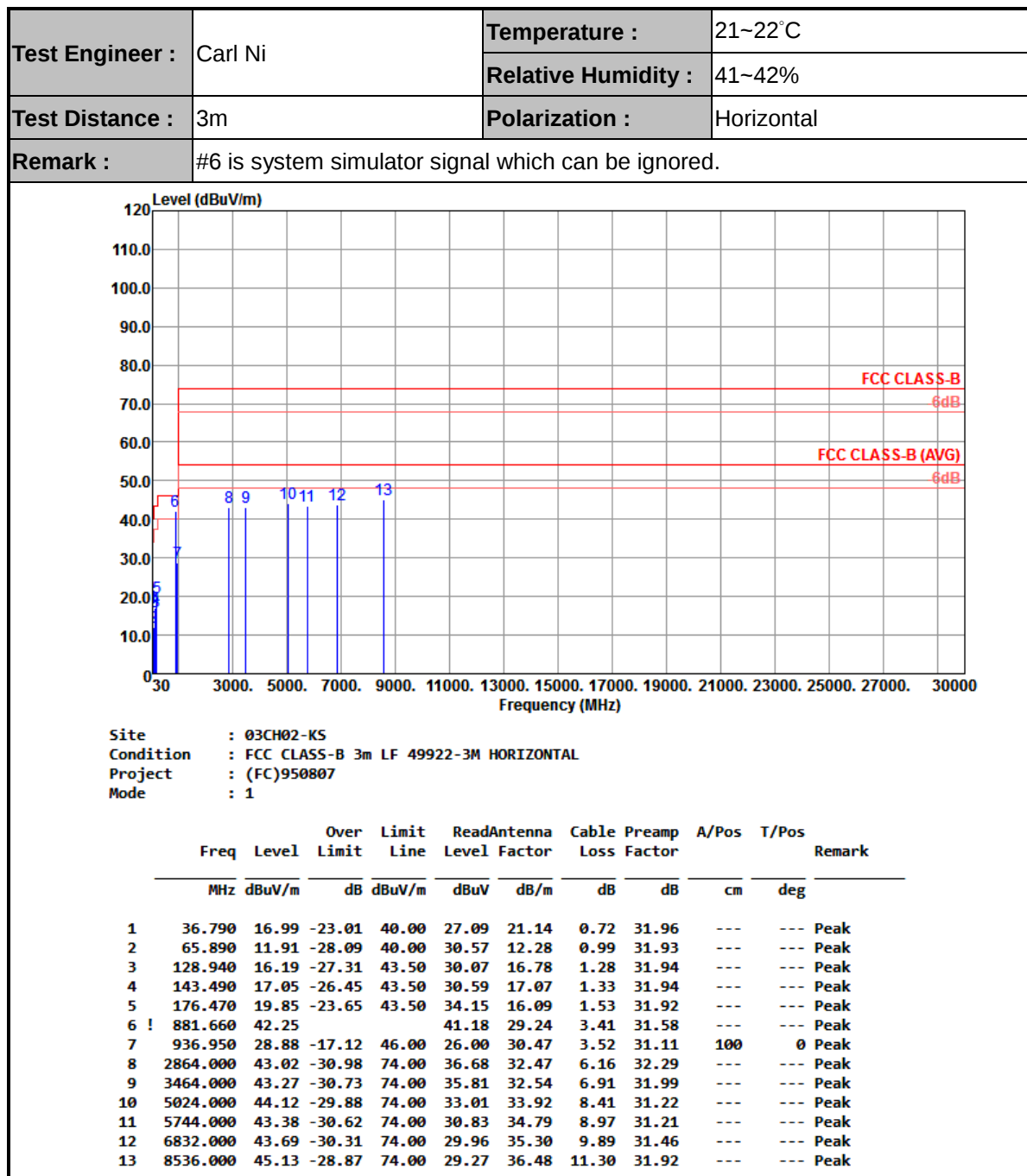


For radiated emissions above 1GHz



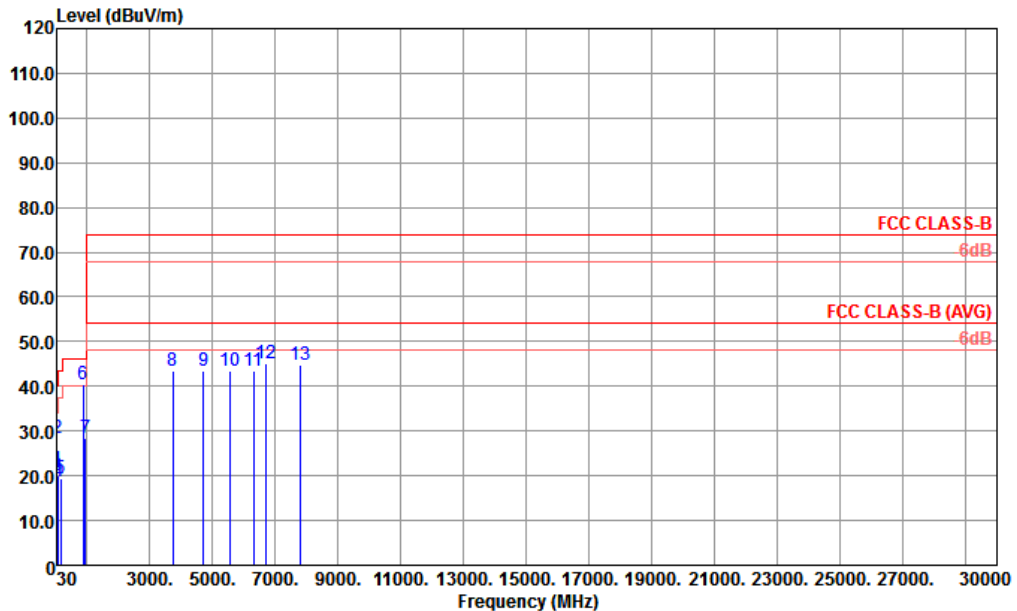


3.2.5. Test Result of Radiated Emission





Test Engineer :	Carl Ni	Temperature :	21~22°C
		Relative Humidity :	41~42%
Test Distance :	3m	Polarization :	Vertical
Remark :	#6 is system simulator signal which can be ignored.		



Site : 03CH02-KS
 Condition : FCC CLASS-B 3m LF 49922-3M VERTICAL
 Project : (FC)950807
 Mode : 1

	Freq	Level	Over	Limit	ReadAntenna	Cable	Preamp	A/Pos	T/Pos	Remark
	MHz	dBuV/m	Limit	Line	Level	Factor	Loss	Factor	cm	deg
			dB	dBuV/m	dBuV	dB/m	dB	dB		
1	34.850	21.55	-18.45	40.00	30.68	22.10	0.73	31.96	---	Peak
2	53.280	28.57	-11.43	40.00	45.96	13.72	0.84	31.95	100	Peak
3	64.920	20.08	-19.92	40.00	38.84	12.20	0.97	31.93	---	Peak
4	84.320	18.87	-21.13	40.00	35.46	14.26	1.08	31.93	---	Peak
5	169.680	19.30	-24.20	43.50	33.32	16.38	1.52	31.92	---	Peak
6 !	880.690	40.39			39.33	29.24	3.41	31.59	---	Peak
7	950.530	28.28	-17.72	46.00	24.82	30.89	3.55	30.98	---	Peak
8	3728.000	43.38	-30.62	74.00	34.78	33.40	7.16	31.96	---	Peak
9	4704.000	43.38	-30.62	74.00	33.25	33.60	8.02	31.49	---	Peak
10	5552.000	43.45	-30.55	74.00	31.00	34.59	8.88	31.02	---	Peak
11	6296.000	43.54	-30.46	74.00	30.54	35.11	9.45	31.56	---	Peak
12	6680.000	45.09	-28.91	74.00	31.68	35.29	9.76	31.64	---	Peak
13	7816.000	44.89	-29.11	74.00	29.92	36.14	10.85	32.02	---	Peak

Note:

- Level(dBμV/m) = Read Level(dBμV) + Antenna Factor(dB/m) + Cable Loss(dB) - Preamp Factor(dB)
- Over Limit(dB) = Level(dBμV/m) – Limit Line(dBμV/m)



4. List of Measuring Equipment

Instrument	Manufacturer	Model No.	Serial No.	Characteristics	Calibration Date	Test Date	Due Date	Remark
EMI Receiver	R&S	ESC17	100768	9kHz~7GHz;	Apr. 16, 2019	Oct. 31, 2019	Apr. 15, 2020	Conduction (CO01-KS)
AC LISN (for auxiliary equipment)	MessTec	AN3016	060103	9kHz~30MHz	Oct. 18, 2019	Oct. 31, 2019	Oct. 17, 2020	Conduction (CO01-KS)
AC LISN	MessTec	AN3016	060105	9kHz~30MHz	Oct. 28, 2019	Oct. 31, 2019	Oct. 27, 2020	Conduction (CO01-KS)
AC Power Source	Chroma	61602	ABP000000811	AC 0V~300V, 45Hz~1000Hz	Oct. 18, 2019	Oct. 31, 2019	Oct. 17, 2020	Conduction (CO01-KS)
EMI Test Receiver	R&S	ESR7	101403	9kHz~7GHz;Max 30dBm	Oct. 18, 2019	Dec. 18, 2019	Oct. 17, 2020	Radiation (03CH02-KS)
EXA Spectrum Analyzer	Keysight	N9010A	MY55150208	10Hz~44G,MAX 30dB	Apr. 15, 2019	Dec. 18, 2019	Apr. 16, 2020	Radiation (03CH02-KS)
Bilog Antenna	TeseQ	CBL6111D	49922	30MHz~1GHz	May 30, 2019	Dec. 18, 2019	May 29, 2020	Radiation (03CH02-KS)
Double Ridge Horn Antenna	ETS-Lindgren	3117	75959	1GHz~18GHz	Jan. 27, 2019	Dec. 18, 2019	Jan. 26, 2020	Radiation (03CH02-KS)
SHF-EHF Horn	Com-power	AH-840	101070	18GHz~40GHz	Jan. 05, 2019	Dec. 18, 2019	Jan. 04, 2020	Radiation (03CH02-KS)
Amplifier	MITEQ	TTA1840-35-HG	1887435	18~40GHz	Feb. 08, 2019	Dec. 18, 2019	Feb. 07, 2020	Radiation (03CH02-KS)
Amplifier	SONOMA	310N	187289	9KHz~1GHz	Aug. 06, 2019	Dec. 18, 2019	Aug. 05, 2020	Radiation (03CH02-KS)
Amplifier	Keysight	83017A	MY57280106	500MHz~26.5G Hz	Apr. 15, 2019	Dec. 18, 2019	Apr. 14, 2020	Radiation (03CH02-KS)
AC Power Source	Chroma	61601	616010002473	N/A	NCR	Dec. 18, 2019	NCR	Radiation (03CH02-KS)
Turn Table	MF	MF7802	N/A	0~360 degree	NCR	Dec. 18, 2019	NCR	Radiation (03CH02-KS)
Antenna Mast	MF	MF7802	N/A	1 m~4 m	NCR	Dec. 18, 2019	NCR	Radiation (03CH02-KS)

NCR: No Calibration Required

5. Uncertainty of Evaluation

Uncertainty of Conducted Emission Measurement (150 kHz ~ 30 MHz)

Measuring Uncertainty for a Level of Confidence of 95% ($U = 2Uc(y)$)	2.9dB
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Uncertainty of Radiated Emission Measurement (30 MHz ~ 1000 MHz)

Measuring Uncertainty for a Level of Confidence of 95% ($U = 2Uc(y)$)	4.9dB
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Uncertainty of Radiated Emission Measurement (1000 MHz ~ 18000 MHz)

Measuring Uncertainty for a Level of Confidence of 95% ($U = 2Uc(y)$)	5.0dB
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Uncertainty of Radiated Emission Measurement (18000 MHz ~ 40000 MHz)

Measuring Uncertainty for a Level of Confidence of 95% ($U = 2Uc(y)$)	5.1dB
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