FCC TEST REPORT

FOR

Shenzhen Chainway Information Technology Co., Ltd.

Wearable BT RFID Reader

Test Model: R5

Prepared for	:	Shenzhen Chainway Information Technology Co., Ltd.
Address	:	9/F, Building 2, Daqian Industrial Park, Longchang Rd., District 67, Bao'an District, Shenzhen, China
Prepared by	:	Shenzhen LCS Compliance Testing Laboratory Ltd
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Date of receipt of test sample	:	February 25, 2020
Number of tested samples	:	1
Sample number	:	Prototype
Date of Test	:	February 25, 2020 ~ March 17, 2020
Date of Report	:	March 19, 2020

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FCC TEST REPORT

FCC CFR 47 PART 15 C (15.249)

Report Reference No.	**:**	**LCS200221026AEA**
Date of Issue.....	:	March 19, 2020
Testing Laboratory Name	**:**	**Shenzhen LCS Compliance Testing Laboratory Ltd.**
Address.....	:	101, 201 Bldg A & 301 Bldg C, Juji Industrial Park Shajing Street, Baoan District, Shenzhen, China
Testing Location/ Procedure	:	Full application of Harmonised standards ■ Partial application of Harmonised standards □ Other standard testing method □
Applicant's Name.....	**:**	**Shenzhen Chainway Information Technology Co., Ltd.**
Address.....	:	9/F, Building 2, Daqian Industrial Park, Longchang Rd., District 67, Bao'an District, Shenzhen, China
Test Specification		
Standard	:	FCC CFR 47 PART 15 C(15.249) / ANSI C63.10: 2013
Test Report Form No.....	:	LCSEMC-1.0
TRF Originator.....	:	Shenzhen LCS Compliance Testing Laboratory Ltd.
Master TRF.....	:	Dated 2011-03

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Test Item Description.	**:**	**Wearable BT RFID Reader**
Trade Mark	:	Chainway
Test Model.....	:	R5
Ratings.....	:	For Adapter Input: AC 100-240V, 50/60Hz, 0.5A Output: DC 5V, 2000mA
Result	**:**	**Positive**

Compiled by:	**Supervised by:**	**Approved by:**
Jayden Zhuo	Jin Wang	Gavin Liang
Jayden Zhuo/ Administrators	Jin Wang/ Technique principal	Gavin Liang/ Manager

FCC -- TEST REPORT

Test Report No. : LCS200221026AEA	March 19, 2020 Date of issue

Test Model.....	: R5
EUT.....	: Wearable BT RFID Reader
Applicant.....	**: Shenzhen Chainway Information Technology Co., Ltd.**
Address.....	: 9/F, Building 2, Daqian Industrial Park, Longchang Rd., District 67, Bao'an District, Shenzhen, China
Telephone.....	: /
Fax.....	: /
Manufacturer.....	**: Shenzhen Chainway Information Technology Co., Ltd.**
Address.....	: 9/F, Building 2, Daqian Industrial Park, Longchang Rd., District 67, Bao'an District, Shenzhen, China
Telephone.....	: /
Fax.....	: /
Factory.....	**: Shenzhen Chainway Information Technology Co., Ltd.**
Address.....	: 9/F, Building 2, Daqian Industrial Park, Longchang Rd., District 67, Bao'an District, Shenzhen, China
Telephone.....	: /
Fax.....	: /

Test Result	**Positive**

The test report merely corresponds to the test sample.
It is not permitted to copy extracts of these test result without the written permission of the test laboratory.

Revision History

Revision	Issue Date	Revisions	Revised By
000	March 19, 2020	Initial Issue	Gavin Liang

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1.GENERAL INFORMATION

1.1 Description of Device (EUT)

EUT	:	Wearable BT RFID Reader
Test Model	:	R5
Power Supply	:	For Adapter Input: AC 100-240V, 50/60Hz, 0.5A Output: DC 5V, 2000mA
Hardware version	:	PCB_R5_BLOWMOBILE_V10
Software version	:	2.30
900MHz		
Frequency Range	:	920.625MHz, 920.875MHz, 921.125MHz, 921.375MHz, 921.625MHz, 921.875MHz, 922.125MHz, 922.375MHz, 922.625MHz, 922.875MHz, 923.125MHz, 923.375MHz, 923.625MHz, 923.875MHz, 924.125MHz, 924.375MHz
Channel Number	:	16
Channel Spacing	:	250KHz
Modulation Type	:	ASK
Antenna Description	:	Internal Antenna, 3.00dBi (Max.)
Bluetooth		
Bluetooth Operation frequency	:	2402MHz-2480MHz
Bluetooth Channel Number	:	40 channels for Bluetooth V4.0(DTS)
Bluetooth Channel Spacing	:	2MHz for Bluetooth V4.0 (DTS)
Bluetooth Modulation Type	:	GFSK for Bluetooth V4.0(DTS)
Bluetooth Version	:	V4.0
Antenna Description	:	Internal Antenna, 2.1dBi(Max.)

1.2. Support Equipment List

Manufacturer	Description	Model	Serial Number	Certificate
--	Adapter	NA010050020	--	FCC

1.3. External I/O

I/O Port Description	Quantity	Cable
Type-C	1	--

1.4. Description of Test Facility

FCC Registration Number is 254912.

Industry Canada Registration Number is 9642A.

EMSD Registration Number is ARCB0108.

UL Registration Number is 100571-492.

TUV SUD Registration Number is SCN1081.

TUV RH Registration Number is UA 50296516-001.

NVLAP Accreditation Code is 600167-0.

FCC Designation Number is CN5024.

CAB identifier: CN0071.

The 3m-Semi anechoic test site fulfils CISPR 16-1-4 according to ANSI C63.4:2014 and CISPR 16-1-4:2010 SVSWR requirement for radiated emission above 1GHz.

1.5. Statement of the measurement uncertainty

The data and results referenced in this document are true and accurate. The reader is cautioned that there may be errors within the calibration limits of the equipment and facilities. The measurement uncertainty was calculated for all measurements listed in this test report acc. To CISPR 16 – 4 “Specification for radio disturbance and immunity measuring apparatus and methods – Part 4: Uncertainty in EMC Measurements” and is documented in the LCS quality system acc. To DIN EN ISO/IEC 17025. Furthermore, component and process variability of devices similar to that tested may result in additional deviation. The manufacturer has the sole responsibility of continued compliance of the device.

1.6. Measurement Uncertainty

Test Item		Frequency Range	Uncertainty	Note
Radiation Uncertainty	:	9KHz~30MHz	±3.10dB	(1)
		30MHz~200MHz	±2.96dB	(1)
		200MHz~1000MHz	±3.10dB	(1)
		1GHz~26.5GHz	±3.80dB	(1)
		26.5GHz~40GHz	±3.90dB	(1)
Conduction Uncertainty	:	150kHz~30MHz	±1.63dB	(1)
Power disturbance	:	30MHz~300MHz	±1.60dB	(1)

(1). This uncertainty represents an expanded uncertainty expressed at approximately the 95% confidence level using a coverage factor of k=2.

1.7. Description of Test Modes

Operates in the unlicensed ISM Band at 902-928MHz. With basic data rate feature, the data rates can be up to 1 Mb/s by modulating the RF carrier using 2-GFSK techniques. The EUT works in the X-axis, Y-axis, Z-axis. The following operating modes were applied for the related test items. All test modes were tested, only the result of the worst case was recorded in the report.

Mode of Operations	Frequency Range (MHz)	Data Rate (Mbps)
ASK	920.625	/
ASK	922.375	/
ASK	924.375	/
For Conducted Emission		
Test Mode	TX Mode	
For Radiated Emission		
Test Mode	TX Mode	

Worst-case mode and channel used for 9 KHz-1000 MHz radiated emissions was the mode and channel with the highest output power, that was determined to be TX.

2. TEST METHODOLOGY

All measurements contained in this report were conducted with ANSI C63.10: 2013, American National Standard of Procedures for Compliance Testing of Unlicensed Wireless Devices.

The radiated testing was performed at an antenna-to-EUT distance of 3 meters. All radiated and conducted emissions measurement was performed at Shenzhen LCS Compliance Testing Laboratory Ltd.

2.1. EUT Configuration

The EUT configuration for testing is installed on RF field strength measurement to meet the Commissions requirement and operating in a manner that intends to maximize its emission characteristics in a continuous normal application.

2.2. EUT Exercise

The EUT was operated in the engineering mode to fix the TX frequency that was for the purpose of the measurements.

According to its specifications, the EUT must comply with the requirements of the Section 15.203, 15.205, 15.207, 15.209 and 15.249 under the FCC Rules Part 15 Subpart C.

2.3. General Test Procedures

2.3.1 Conducted Emissions

The EUT is directly placed on the ground. According to the requirements in Section 6.2.1 of ANSI C63.10-2013 Conducted emissions from the EUT measured in the frequency range between 0.15 MHz and 30MHz using Quasi-peak and average detector modes.

2.3.2 Radiated Emissions

The EUT is placed on a turntable, which is directly placed on the ground. The turntable shall rotate 360 degrees to determine the position of maximum emission level. EUT is set 3m away from the receiving antenna, which varied from 1m to 4m to find out the highest emission. And also, each emission was to be maximized by changing the polarization of receiving antenna both horizontal and vertical. In order to find out the maximum emissions, exploratory radiated emission measurements were made according to the requirements in Section 6.3 of ANSI C63.10-2013

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3. CONNECTION DIAGRAM OF TEST SYSTEM

3.1. Justification

The system was configured for testing in a continuous transmit condition. Continuous transmitting was pre-programmed.

3.2. EUT Exercise Software

N/A

3.3. Special Accessories

Manufacturer	Description	Model	Serial Number	Certificate
--	Adapter	NA010050020		FCC

3.4. Block Diagram/Schematics

Please refer to the related document

3.5. Equipment Modifications

Shenzhen LCS Compliance Testing Laboratory Ltd. has not done any modification on the EUT.

3.6. Test Setup

Please refer to the test setup photo.

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4. SUMMARY OF TEST RESULTS

Applied Standard: FCC Part 15 Subpart C §15.249		
FCC Rules	**Description Of Test**	**Result**
§15.203	Antenna Requirement	Compliant
§15.207(a)	Power Line Conducted Emissions	Compliant
§15.205(a), §15.209(a), §15.249(a), §15.249(c)	Radiated Emissions Measurement	Compliant
§15.249 (d)	Band Edges Measurement	Compliant
§2.1049	99% and 20 dB Bandwidth	Compliant

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5. ANTENNA REQUIREMENT

5.1. Standard Applicable

According to § 15.203 and RSS-Gen, an intentional radiator shall be designed to ensure that no antenna other than that furnished by the responsible party shall be used with the device. The use of a permanently attached antenna or of an antenna that uses a unique coupling to the intentional radiator shall be considered sufficient to comply with the provisions of this section. The manufacturer may design the unit so that a broken antenna can be replaced by the user, but the use of a standard antenna jack or electrical connector is prohibited.

5.2. Antenna Connected Construction

The EUT use External Antenna and maximum antenna gain is 3.00dBi, antenna cannot replacement, meets FCC Part §15.203 antenna requirement. Please see EUT photo for details.

5.3. Results

Compliance

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6. POWER LINE CONDUCTED EMISSIONS

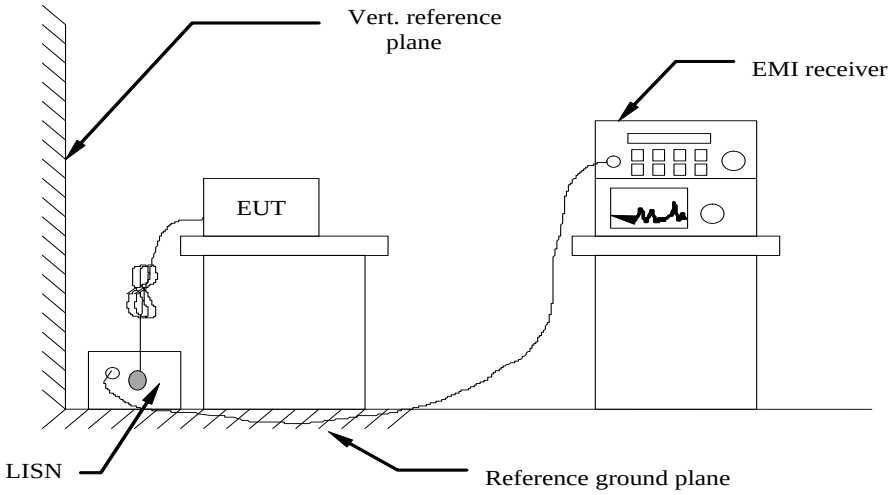
6.1. Standard Applicable

According to §15.207 (a) & RSS-Gen § 8.8: For an intentional radiator which 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 250 microvolts (The limit decreases linearly with the logarithm of the frequency in the range 0.15 MHz to 0.50 MHz). The limits at specific frequency range are listed as follows:

Frequency Range (MHz)	Limits (dBμV)	
	Quasi-peak	Average
0.15 to 0.50	66 to 56	56 to 46
0.50 to 5	56	46
5 to 30	60	50

* Decreasing linearly with the logarithm of the frequency

6.2. Block Diagram of Test Setup



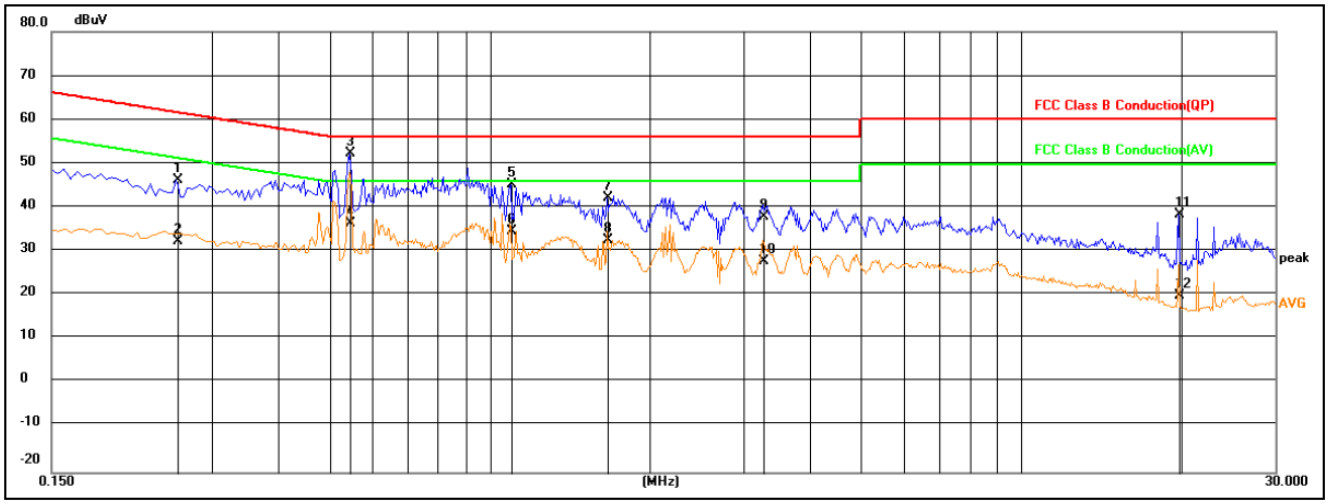
6.3. Test Results

The test data please refer to following page.

Temperature	23.3℃	Humidity	53.7%
Test Engineer	Li Huan		

AC Power Line Conducted Emission (Power input to adapter @ AC 120V/60Hz (Worst Case))

Line

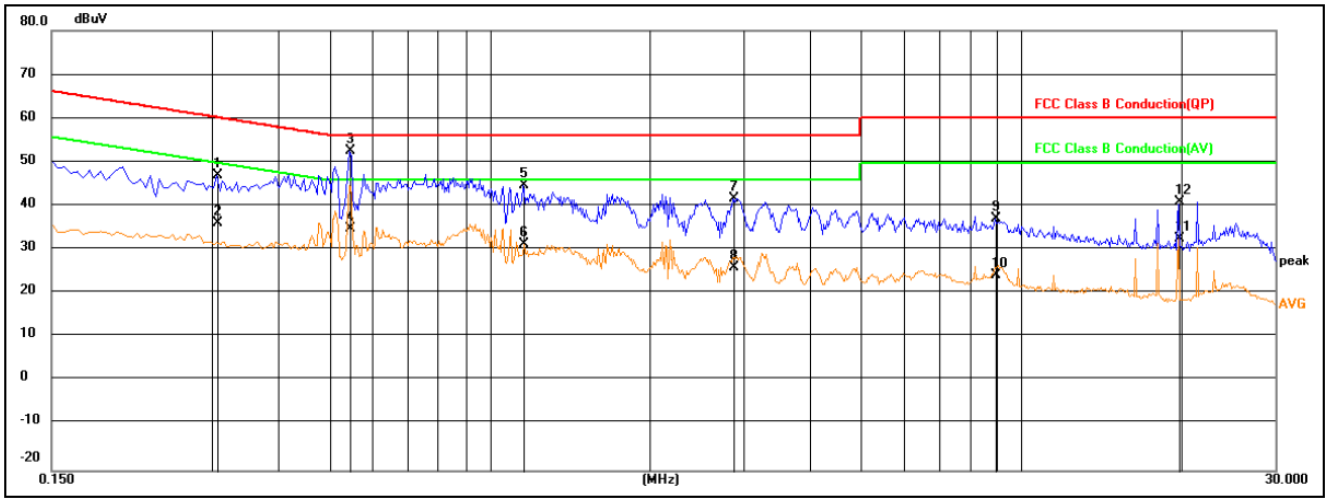


Temp.( )/Hum.(%RH): 23.3 / 53.7 **Time: 14:37:11**

Standard: FCC Class B Conduction(QP) **Test By: LIHUAN**

No.	Frequency (MHz)	Reading (dBuV)	Correct (dB)	Result (dBuV)	Limit (dBuV)	Margin (dB)	Remark
1	0.2580	27.06	19.24	46.30	61.50	-15.20	QP
2	0.2580	13.35	19.24	32.59	51.50	-18.91	AVG
3	0.5460	33.18	19.13	52.31	56.00	-3.69	QP
4	0.5460	17.50	19.13	36.63	46.00	-9.37	AVG
5	1.0950	26.15	19.26	45.41	56.00	-10.59	QP
6	1.0950	15.64	19.26	34.90	46.00	-11.10	AVG
7	1.6710	23.01	19.35	42.36	56.00	-13.64	QP
8	1.6710	13.41	19.35	32.76	46.00	-13.24	AVG
9	3.2730	18.65	19.46	38.11	56.00	-17.89	QP
10	3.2730	8.44	19.46	27.90	46.00	-18.10	AVG
11	19.7430	18.52	20.06	38.58	60.00	-21.42	QP
12	19.7430	0.07	20.06	20.13	50.00	-29.87	AVG

Neutral



Temp.( )/Hum.(%RH): 23.3 / 53.7 **Time: 14:35:10**

Standard: FCC Class B Conduction(QP) **Test By: LIHUAN**

No.	Frequency (MHz)	Reading (dBuV)	Correct (dB)	Result (dBuV)	Limit (dBuV)	Margin (dB)	Remark
1	0.3075	27.90	19.28	47.18	60.04	-12.86	QP
2	0.3075	17.07	19.28	36.35	50.04	-13.69	AVG
3	0.5460	33.47	19.13	52.60	56.00	-3.40	QP
4	0.5460	15.88	19.13	35.01	46.00	-10.99	AVG
5	1.1580	25.71	19.27	44.98	56.00	-11.02	QP
6	1.1580	12.15	19.27	31.42	46.00	-14.58	AVG
7	2.8815	22.36	19.46	41.82	56.00	-14.18	QP
8	2.8815	6.71	19.46	26.17	46.00	-19.83	AVG
9	8.9565	17.68	19.65	37.33	60.00	-22.67	QP
10	8.9565	4.76	19.65	24.41	50.00	-25.59	AVG
11	19.7430	12.81	20.06	32.87	60.00	-27.13	QP
12	19.7430	21.13	20.06	41.19	50.00	-8.81	AVG

****Note: Pre-scan all modes and recorded the worst case results in this report.*

7. RADIATED EMISSION MEASUREMENT

7.1. Standard Applicable

According to FCC § 15.249: Emissions radiated outside of the specified frequency bands, except for harmonics, shall be attenuated by at least 50 dB below the level of the fundamental or to the general radiated emission limits in §15.209, whichever is the lesser attenuation.

20dBc in any 100 kHz bandwidth outside the operating frequency band. In case the emission fall within the restricted band specified on 15.205(a), then the 15.209(a) and 15.249 limit in the table below has to be followed.

Fundamental Frequency	Field Strength of fundamental (millivolts/meter)	Field Strength of harmonics (microvolts/meter)
902-928MHz	50	500
2400-2483.5MHz	50	500
5725-5875MHz	50	500
24.0-24.25GHz	250	2500

Frequencies (MHz)	Field Strength (microvolts/meter)	Measurement Distance (meters)
0.009~0.490	2400/F(KHz)	300
0.490~1.705	24000/F(KHz)	30
1.705~30.0	30	30
30~88	100	3
88~216	150	3
216~960	200	3
Above 960	500	3

According to RSS-210 B.10:

The field strength of fundamental and harmonic emissions, measured at 3 m, shall not exceed 50 mV/m and 0.5 mV/m respectively.

The field strength limits shall be measured using an average detector, except for the fundamental emission in the frequency band 902-928 MHz, which is based on measurements using an International Special Committee on Radio Interference (CISPR) quasi-peak detector.

Emissions radiated outside of the specified frequency bands, except for harmonic emissions, shall be attenuated by at least 50 dB below the level of the fundamental emissions or to the general field strength limits listed in RSS-Gen, whichever is less stringent.

7.2. Instruments Setting

Please refer to equipment list in this report. The following table is the setting of spectrum analyzer and receiver.

Spectrum Parameter	Setting
Attenuation	Auto
Start Frequency	1000 MHz
Stop Frequency	10th carrier harmonic
RB / VB (Emission in restricted band)	1MHz / 1MHz for Peak, 1 MHz / 1/T kHz for Average
RB / VB (Emission in non-restricted band)	1MHz / 1MHz for Peak, 1 MHz / 1/TkHz for Average

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Receiver Parameter	Setting
Attenuation	Auto
Start ~ Stop Frequency	9kHz~150kHz / RB/VB 200Hz/1KHz for QP/AVG
Start ~ Stop Frequency	150kHz~30MHz / RB/VB 9kHz/30KHz for QP/AVG
Start ~ Stop Frequency	30MHz~1000MHz / RB/VB 120kHz/1MHz for QP

7.3. Test Procedure

1) Sequence of testing 9 kHz to 30 MHz

Setup:

--- The equipment was set up to simulate a typical usage like described in the user manual or described by manufacturer.

--- If the EUT is a tabletop system, a rotatable table with 0.8 m height is used.

--- If the EUT is a floor standing device, it is placed on the ground.

--- Auxiliary equipment and cables were positioned to simulate normal operation conditions.

--- The AC power port of the EUT (if available) is connected to a power outlet below the turntable.

--- The measurement distance is 3 meter.

--- The EUT was set into operation.

Premeasurement:

--- The turntable rotates from 0° to 315° using 45° steps.

--- The antenna height is 0.8 meter.

--- At each turntable position the analyzer sweeps with peak detection to find the maximum of all emissions

Final measurement:

--- Identified emissions during the premeasurement the software maximizes by rotating the turntable position (0° to 360°) and by rotating the elevation axes (0° to 360°).

--- The final measurement will be done in the position (turntable and elevation) causing the highest emissions with QPK detector.

--- The final levels, frequency, measuring time, bandwidth, turntable position, correction factor, margin to the limit and limit will be recorded. Also a plot with the graph of the premeasurement and the limit will be stored.

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2) Sequence of testing 30 MHz to 1 GHz

Setup:

--- The equipment was set up to simulate a typical usage like described in the user manual or described by manufacturer.

--- If the EUT is a tabletop system, a table with 0.8 m height is used, which is placed on the ground plane.

--- If the EUT is a floor standing device, it is placed on the ground plane with insulation between both.

--- Auxiliary equipment and cables were positioned to simulate normal operation conditions

--- The AC power port of the EUT (if available) is connected to a power outlet below the turntable.

--- The measurement distance is 3 meter.

--- The EUT was set into operation.

Premeasurement:

--- The turntable rotates from 0° to 315° using 45° steps.

--- The antenna is polarized vertical and horizontal.

--- The antenna height changes from 1 to 3 meter.

--- At each turntable position, antenna polarization and height the analyzer sweeps three times in peak to find the maximum of all emissions.

Final measurement:

--- The final measurement will be performed with minimum the six highest peaks.

--- According to the maximum antenna and turntable positions of premeasurement the software maximize the peaks by changing turntable position (± 45°) and antenna movement between 1 and 4 meter.

--- The final measurement will be done with QP detector with an EMI receiver.

--- The final levels, frequency, measuring time, bandwidth, antenna height, antenna polarization, turntable angle, correction factor, margin to the limit and limit will be recorded. Also a plot with the graph of the premeasurement with marked maximum final measurements and the limit will be stored.

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3) Sequence of testing 1 GHz to 18 GHz

Setup:

--- The equipment was set up to simulate a typical usage like described in the user manual or described by manufacturer.

--- If the EUT is a tabletop system, a rotatable table with 1.5 m height is used.

--- If the EUT is a floor standing device, it is placed on the ground plane with insulation between both.

--- Auxiliary equipment and cables were positioned to simulate normal operation conditions

--- The AC power port of the EUT (if available) is connected to a power outlet below the turntable.

--- The measurement distance is 3 meter.

--- The EUT was set into operation.

Premeasurement:

--- The turntable rotates from 0° to 315° using 45° steps.

--- The antenna is polarized vertical and horizontal.

--- The antenna height scan range is 1 meter to 2.5 meter.

--- At each turntable position and antenna polarization the analyzer sweeps with peak detection to find the maximum of all emissions.

Final measurement:

--- The final measurement will be performed with minimum the six highest peaks.

--- According to the maximum antenna and turntable positions of premeasurement the software maximize the peaks by changing turntable position (± 45°) and antenna movement between 1 and 4 meter. This procedure is repeated for both antenna polarizations.

--- The final measurement will be done in the position (turntable, EUT-table and antenna polarization) causing the highest emissions with Peak and Average detector.

--- The final levels, frequency, measuring time, bandwidth, turntable position, EUT-table position, antenna polarization, correction factor, margin to the limit and limit will be recorded. Also a plot with the graph of the premeasurement with marked maximum final measurements and the limit will be stored.

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4) Sequence of testing above 18 GHz

Setup:

--- The equipment was set up to simulate a typical usage like described in the user manual or described by manufacturer.

--- If the EUT is a tabletop system, a rotatable table with 1.5 m height is used.

--- If the EUT is a floor standing device, it is placed on the ground plane with insulation between both.

--- Auxiliary equipment and cables were positioned to simulate normal operation conditions

--- The AC power port of the EUT (if available) is connected to a power outlet below the turntable.

--- The measurement distance is 1 meter.

--- The EUT was set into operation.

Premeasurement:

--- The antenna is moved spherical over the EUT in different polarizations of the antenna.

Final measurement:

--- The final measurement will be performed at the position and antenna orientation for all detected emissions that were found during the premeasurements with Peak and Average detector.

--- The final levels, frequency, measuring time, bandwidth, correction factor, margin to the limit and limit will be recorded. Also a plot with the graph of the premeasurement and the limit will be stored.

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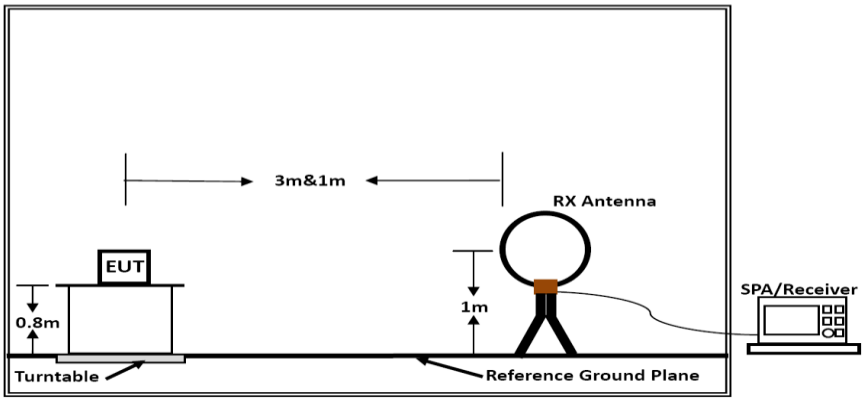
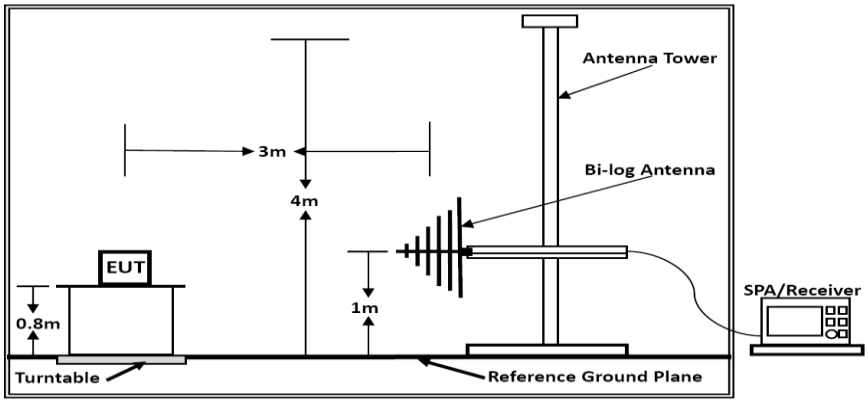
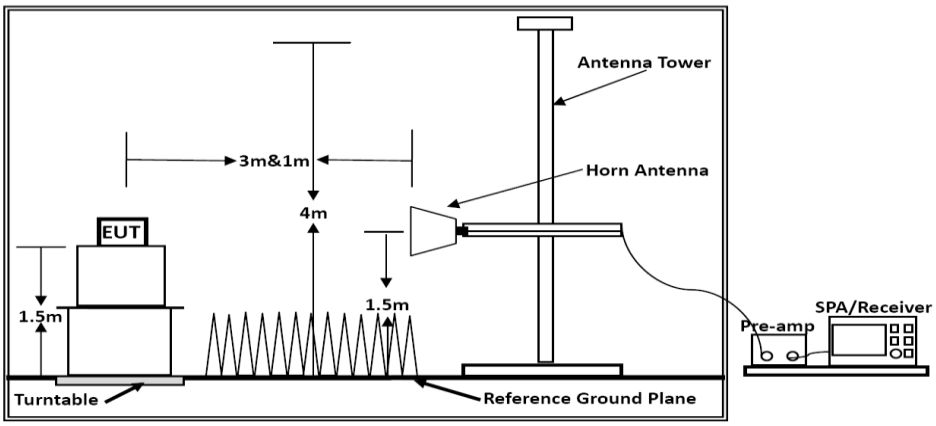
7.4. Block Diagram of Test Setup



Below 30MHz



Below 1GHz



Above 1GHz

Above 18 GHz shall be extrapolated to the specified distance using an extrapolation factor of 20 dB/decade form 3m to 1m.

Distance extrapolation factor = 20 log (specific distance [3m] / test distance [1.5m]) (dB);
Limit line = specific limits (dBuV) + distance extrapolation factor [6 dB].

7.5 EUT Operation during Test

The EUT was programmed to be in continuously transmitting mode.

7.6. Test Results of Radiated Emissions (9 KHz~30 MHz)

Temperature	24.0℃	Humidity	52.2%
Test Engineer	Li Huan		

Freq. (MHz)	Level (dBuV)	Over Limit (dB)	Over Limit (dBuV)	Remark
-	-	-	-	See Note

Note:
The amplitude of spurious emissions which are attenuated by more than 20 dB below the permissible value has no need to be reported.
Distance extrapolation factor = 40 log (specific distance / test distance) (dB);
Limit line = specific limits (dBuV) + distance extrapolation factor.

7.7. Test Results of Radiated Emissions (30 MHz – 1000 MHz)

Temperature	24.0℃	Humidity	52.2%
Test Engineer	Li Huan		

Frequency (MHz)	Pol.	Measure Result (PK, dBuV/m)	Peak Limit (dBuV/m)	AVG Limit (dBuV/m)	Result
920.625	H	89.36	114	94	Pass
920.625	V	88.59	114	94	Pass
922.375	H	88.12	114	94	Pass
922.375	V	89.52	114	94	Pass
924.375	H	90.86	114	94	Pass
924.375	V	89.04	114	94	Pass

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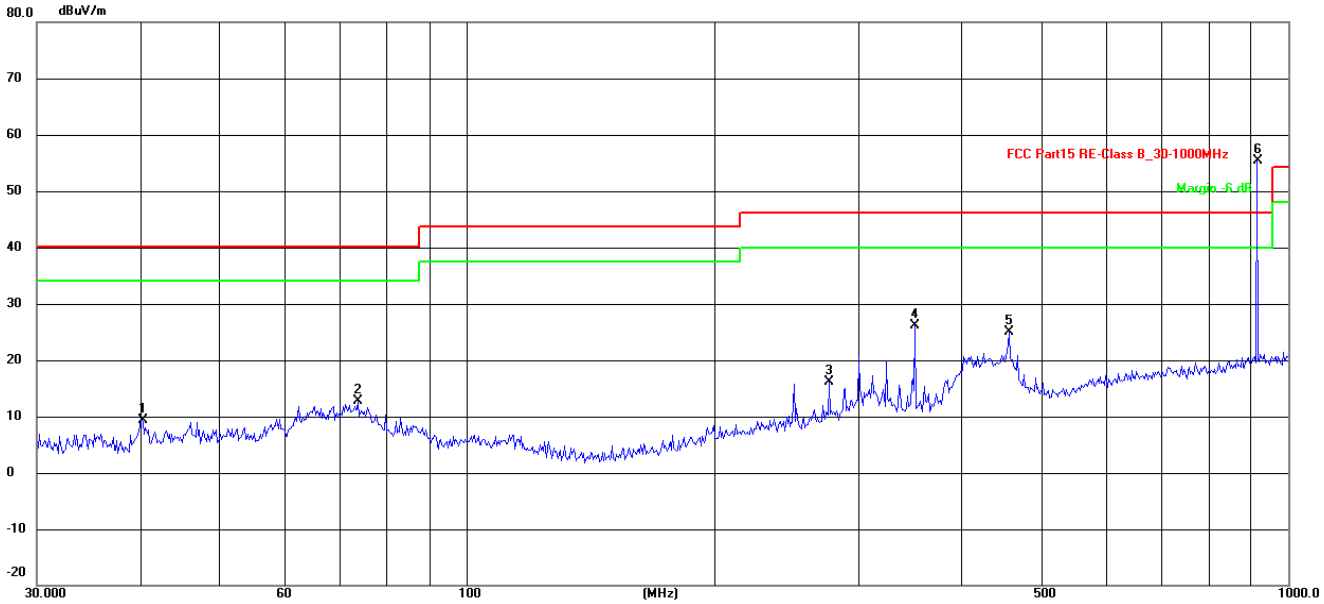
Channel 0 / 920.625MHz

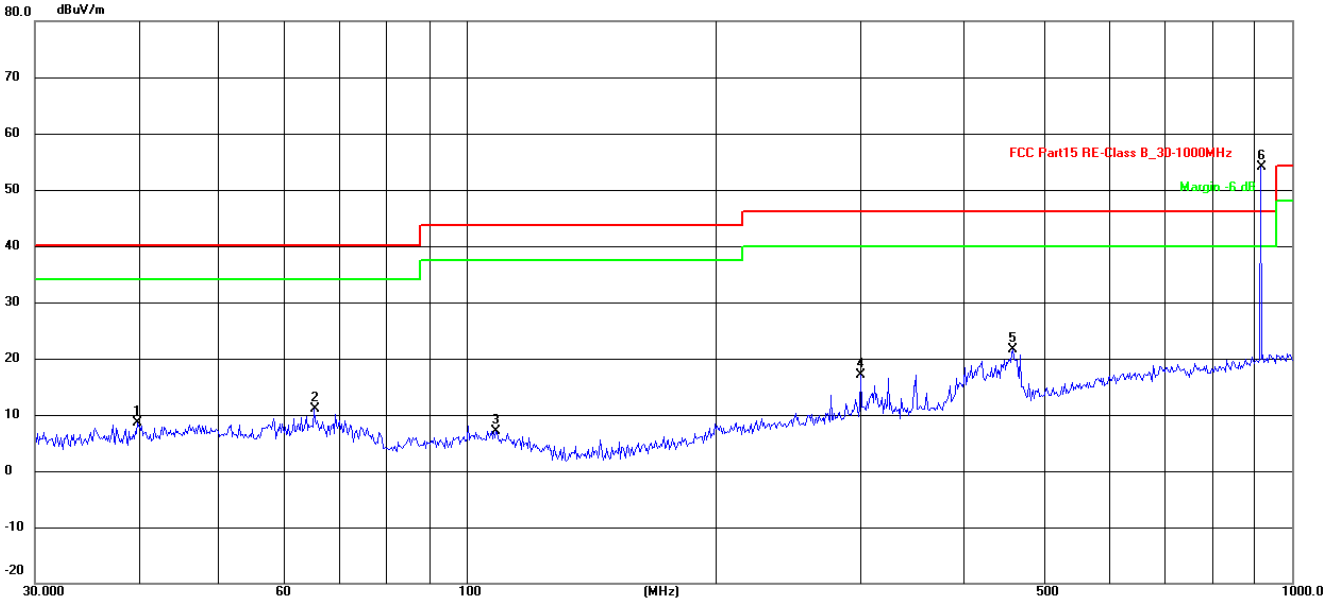
Horizontal



No.	Frequency (MHz)	Reading (dBuV)	Factor (dB/m)	Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Det.
1	40.2757	26.77	-17.36	9.41	40.00	-30.59	QP
2	73.8756	33.85	-21.17	12.68	40.00	-27.32	QP
3	276.1235	32.33	-16.16	16.17	46.00	-29.83	QP
4	351.7079	40.51	-14.37	26.14	46.00	-19.86	QP
5	457.5073	37.15	-12.17	24.98	46.00	-21.02	QP
6 *	920.6247	61.01	-5.58	55.43	46.00	9.43	QP

Channel 0 / 920.625MHz

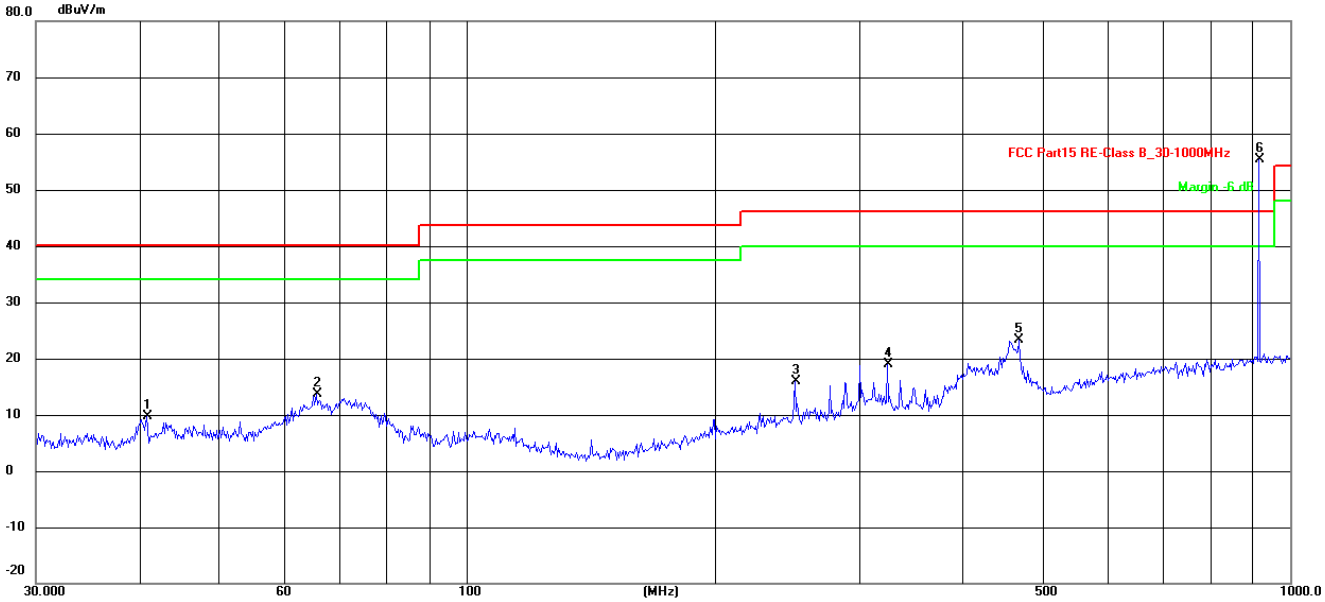
Vertical



No.	Frequency (MHz)	Reading (dBuV)	Factor (dB/m)	Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Det.
1	39.9942	26.07	-17.41	8.66	40.00	-31.34	QP
2	65.3432	30.41	-19.32	11.09	40.00	-28.91	QP
3	108.6470	25.49	-18.37	7.12	43.50	-36.38	QP
4	300.3672	32.70	-15.65	17.05	46.00	-28.95	QP
5	459.1144	33.77	-12.13	21.64	46.00	-24.36	QP
6 *	920.6247	59.63	-5.58	54.05	46.00	8.05	QP

Channel 24 / 922.375MHz

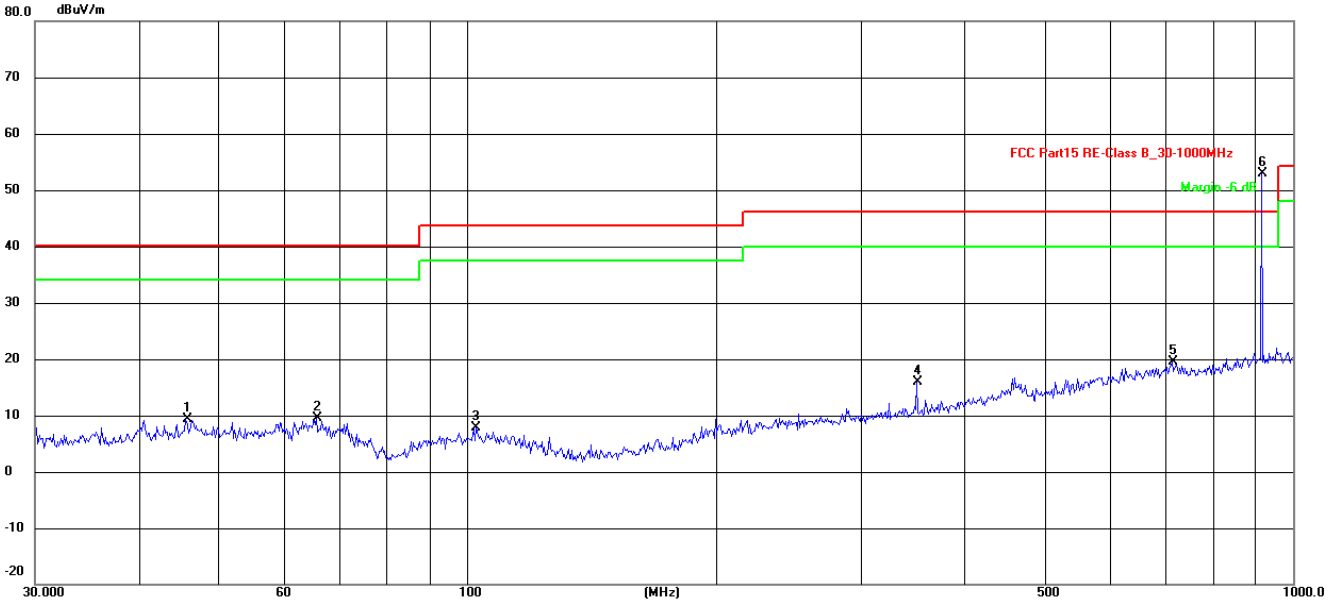
Horizontal



No.	Frequency (MHz)	Reading (dBuV)	Factor (dB/m)	Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Det.
1	40.8446	26.94	-17.25	9.69	40.00	-30.31	QP
2	65.8031	33.10	-19.43	13.67	40.00	-26.33	QP
3	250.3012	32.54	-16.69	15.85	46.00	-30.15	QP
4	324.4561	33.98	-15.02	18.96	46.00	-27.04	QP
5	468.8762	35.26	-12.01	23.25	46.00	-22.75	QP
6 *	922.3737	60.96	-5.58	55.38	46.00	9.38	QP

Channel 24 / 922.375MHz

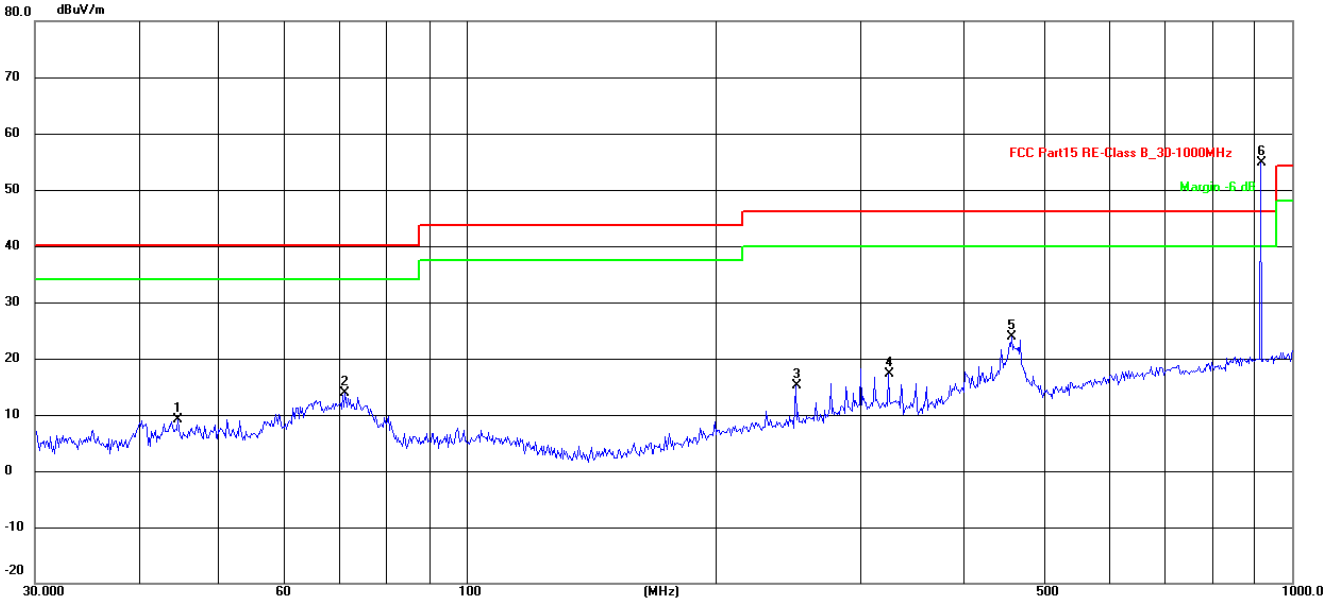
Vertical



No.	Frequency (MHz)	Reading (dBuV)	Factor (dB/m)	Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Det.
1	45.6948	25.72	-16.44	9.28	40.00	-30.72	QP
2	65.8031	29.00	-19.43	9.57	40.00	-30.43	QP
3	102.7192	26.17	-18.37	7.80	43.50	-35.70	QP
4	350.4768	30.32	-14.40	15.92	46.00	-30.08	QP
5	714.1734	27.64	-8.14	19.50	46.00	-26.50	QP
6 *	922.3737	58.47	-5.58	52.89	46.00	6.89	QP

Channel 49 / 924.375MHz

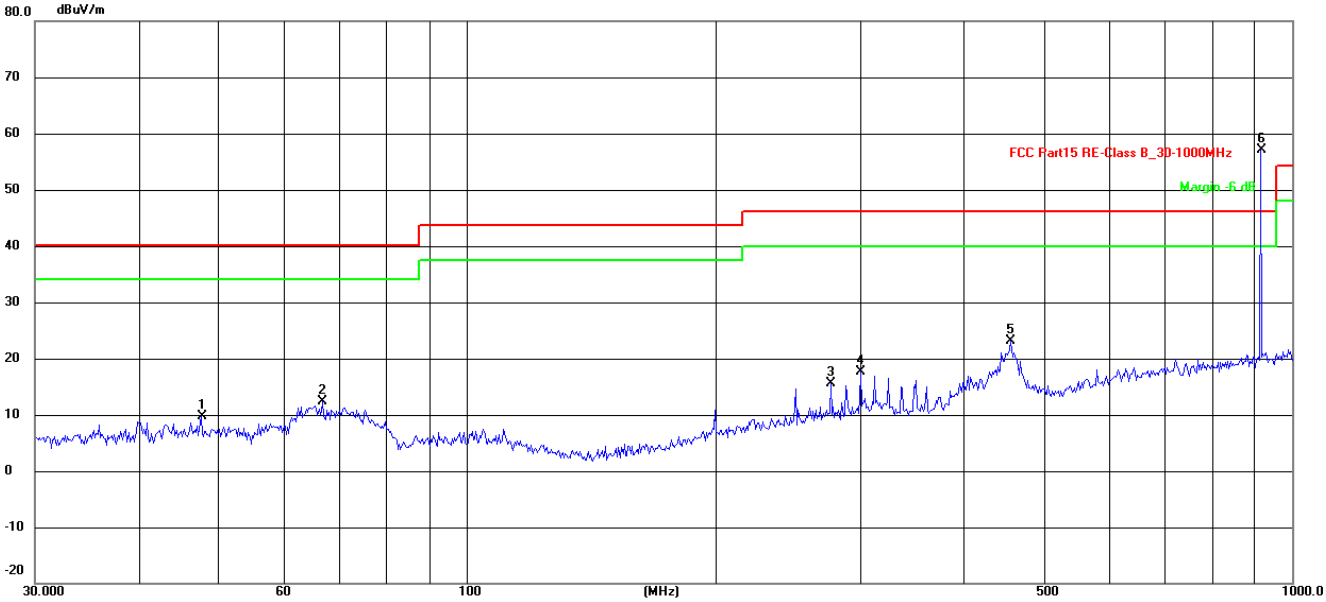
Horizontal



No.	Frequency (MHz)	Reading (dBuV)	Factor (dB/m)	Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Det.
1	44.7433	25.61	-16.50	9.11	40.00	-30.89	QP
2	71.3300	34.64	-20.71	13.93	40.00	-26.07	QP
3	250.3012	31.97	-16.69	15.28	46.00	-30.72	QP
4	324.4561	32.34	-15.02	17.32	46.00	-28.68	QP
5	457.5073	36.02	-12.17	23.85	46.00	-22.15	QP
6 *	923.1277	60.48	-5.58	54.90	46.00	8.90	QP

Channel 49 / 924.375MHz

Vertical



No.	Frequency (MHz)	Reading (dBuV)	Factor (dB/m)	Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Det.
1	47.6586	26.19	-16.42	9.77	40.00	-30.23	QP
2	66.9669	32.03	-19.72	12.31	40.00	-27.69	QP
3	276.1235	31.79	-16.16	15.63	46.00	-30.37	QP
4	300.3672	33.31	-15.65	17.66	46.00	-28.34	QP
5	455.9058	35.23	-12.21	23.02	46.00	-22.98	QP
6 *	923.1277	62.65	-5.58	57.07	46.00	11.07	QP

Note:

1). Pre-scan all modes and recorded the worst case results in this report (GFSK (Low Channel)).

2). Emission level (dBuV/m) = 20 log Emission level (uV/m).

3). Corrected Reading: Antenna Factor + Cable Loss + Read Level = Level.

7.8. Results for Radiated Emissions (1 – 26 GHz)

920.625MHz

Freq. MHz	Reading Level dBuV	Ant. Fac. dB/m	Pre. Fac. dB	Cab. Loss dB	Measured dBuV/m	Limit dBuV/m	Margin dB	Remark	Pol.
1841.25	59.53	33.06	35.04	3.94	61.49	74.00	-12.51	Peak	Horizontal
1841.25	42.93	33.06	35.04	3.94	44.89	54.00	-9.11	Average	Horizontal
1841.25	58.60	33.06	35.04	3.94	60.56	74.00	-13.44	Peak	Vertical
1841.25	42.37	33.06	35.04	3.94	44.33	54.00	-9.67	Average	Vertical

922.375MHz

Freq. MHz	Reading Level dBuV	Ant. Fac. dB/m	Pre. Fac. dB	Cab. Loss dB	Measured dBuV/m	Limit dBuV/m	Margin dB	Remark	Pol.
1844.75	57.19	33.16	35.15	3.96	59.16	74.00	-14.84	Peak	Horizontal
1844.75	42.12	33.16	35.15	3.96	44.09	54.00	-9.91	Average	Horizontal
1844.75	55.52	33.16	35.15	3.96	57.49	74.00	-16.51	Peak	Vertical
1844.75	40.76	33.16	35.15	3.96	42.73	54.00	-11.27	Average	Vertical

924.375MHz

Freq. MHz	Reading Level dBuV	Ant. Fac. dB/m	Pre. Fac. dB	Cab. Loss dB	Measured dBuV/m	Limit dBuV/m	Margin dB	Remark	Pol.
1848.75	57.92	33.26	35.14	3.98	60.02	74.00	-13.98	Peak	Horizontal
1848.75	45.61	33.26	35.14	3.98	47.71	54.00	-6.29	Average	Horizontal
1848.75	59.43	33.26	35.14	3.98	61.53	74.00	-12.47	Peak	Vertical
1848.75	42.69	33.26	35.14	3.98	44.79	54.00	-9.21	Average	Vertical

Notes:

1). Measuring frequencies from 9 KHz - 10th harmonic (ex. 26GHz), No emission found between lowest internal used/generated frequency to 30 MHz.

2). Radiated emissions measured in frequency range from 9 KHz - 10th harmonic (ex. 26GHz) were made with an instrument using Peak detector mode.

3). 18~25 GHz at least have 20dB margin. No recording in the test report.

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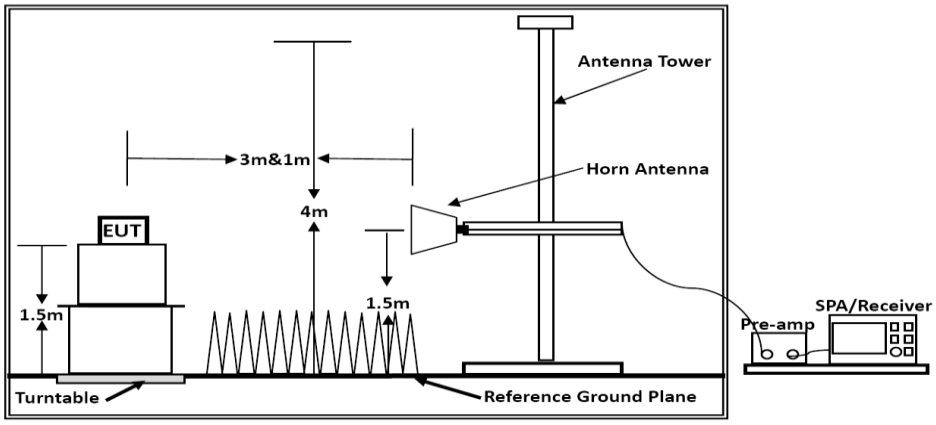
8. RESULTS FOR BAND EDGE TESTING

8.1. Standard Applicable

According to FCC §15.249 (d): Emissions radiated outside of the specified frequency bands, except for harmonics, shall be attenuated by at least 50 dB below the level of the fundamental or to the general radiated emission limits in §15.209, whichever is the lesser attenuation.

According to RSS-210 B.10 (b): Emissions radiated outside of the specified frequency bands, except for harmonic emissions, shall be attenuated by at least 50 dB below the level of the fundamental emissions or to the general field strength limits listed in RSS-Gen, whichever is less stringent.

8.2. Test Setup Layout



Above 1GHz

8.3. Measuring Instruments and Setting

Please refer to equipment list in this report. The following table is the setting of Spectrum Analyzer.

8.4. Test Procedures

3) Sequence of testing 1 GHz to 18 GHz

Setup:

--- The equipment was set up to simulate a typical usage like described in the user manual or described by manufacturer.

--- If the EUT is a tabletop system, a rotatable table with 1.5 m height is used.

--- If the EUT is a floor standing device, it is placed on the ground plane with insulation between both.

--- Auxiliary equipment and cables were positioned to simulate normal operation conditions

--- The AC power port of the EUT (if available) is connected to a power outlet below the turntable.

--- The measurement distance is 3 meter.

--- The EUT was set into operation.

Premeasurement:

--- The turntable rotates from 0° to 315° using 45° steps.

--- The antenna is polarized vertical and horizontal.

--- The antenna height scan range is 1 meter to 2.5 meter.

--- At each turntable position and antenna polarization the analyzer sweeps with peak detection to find the maximum of all emissions.

Final measurement:

--- The final measurement will be performed with minimum the six highest peaks.

--- According to the maximum antenna and turntable positions of premeasurement the software maximize the peaks by changing turntable position (± 45°) and antenna movement between 1 and 4 meter. This procedure is repeated for both antenna polarizations.

--- The final measurement will be done in the position (turntable, EUT-table and antenna polarization) causing the highest emissions with Peak and Average detector.

--- The final levels, frequency, measuring time, bandwidth, turntable position, EUT-table position, antenna polarization, correction factor, margin to the limit and limit will be recorded. Also a plot with the graph of the premeasurement with marked maximum final measurements and the limit will be stored.

8.5. Measuring Instruments and Setting

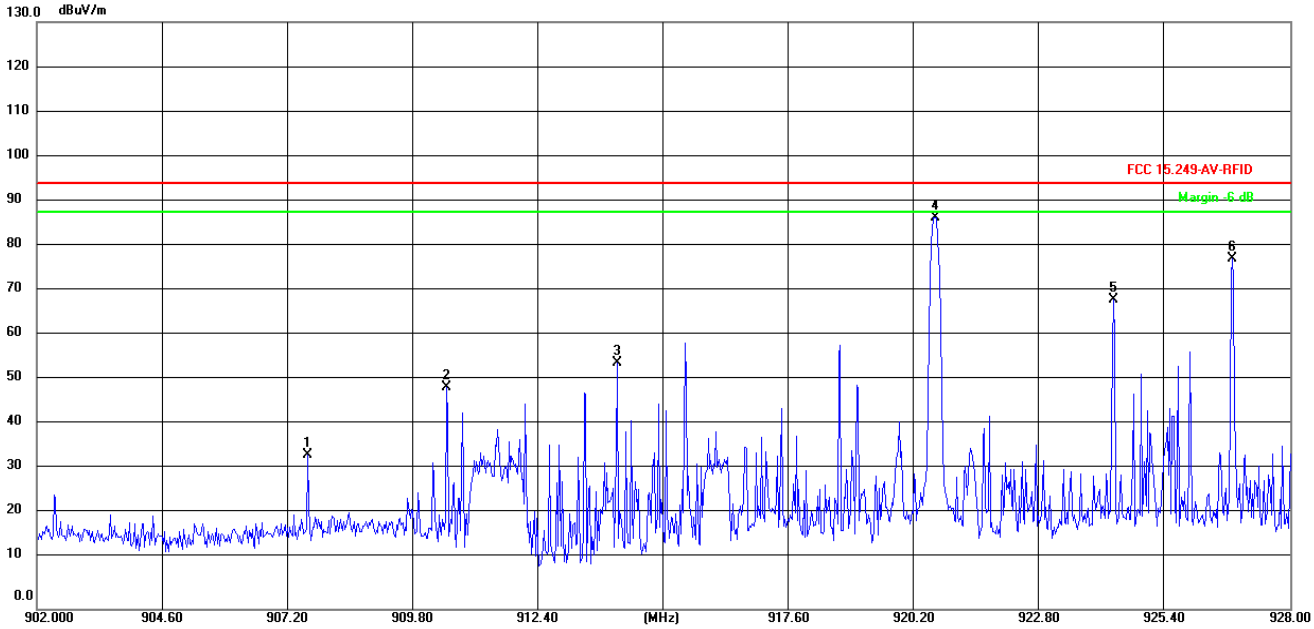
Temperature	24.6℃	Humidity	54.1%
Test Engineer	Li Huan		

PASS

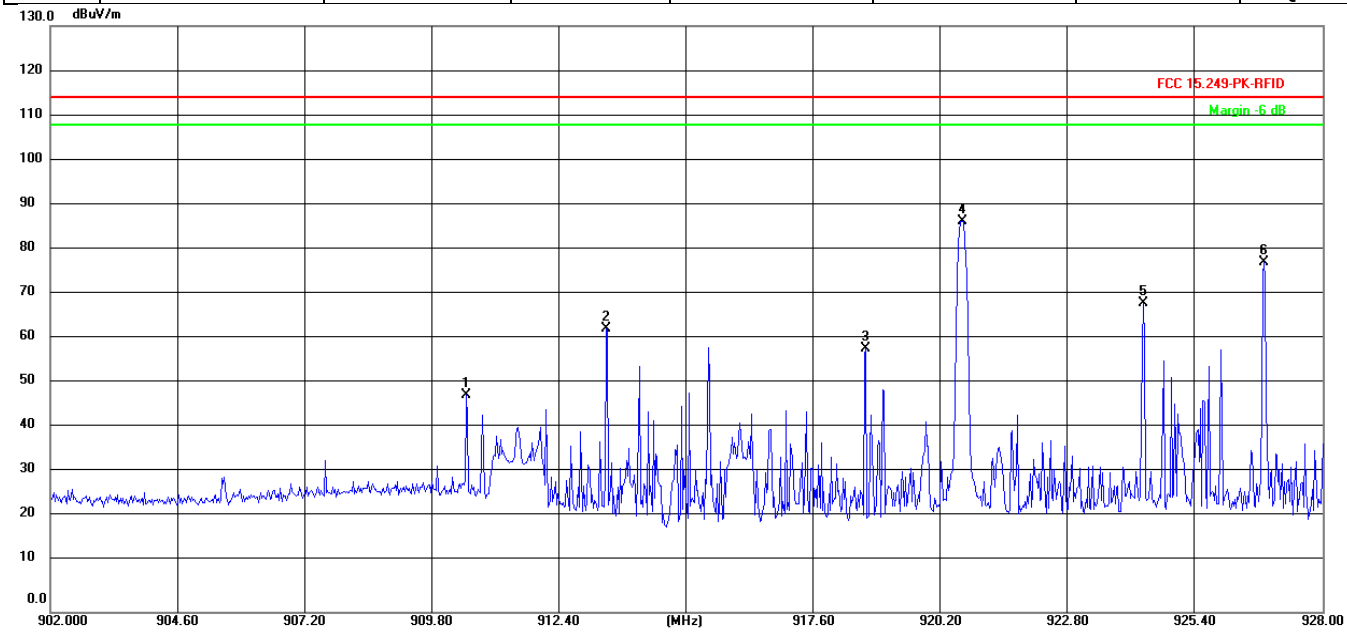
Remark:
1. *The other emission levels were very low against the limit.*
2. *The average measurement was not performed when the peak measured data under the limit of average detection.*
3. *Detector AV is setting spectrum/receiver. RBW=1MHz/VBW=330Hz/Sweep time=Auto/Detector=Peak;*
4. *Please refer to following test plots;*

920.625MHz

Vertical

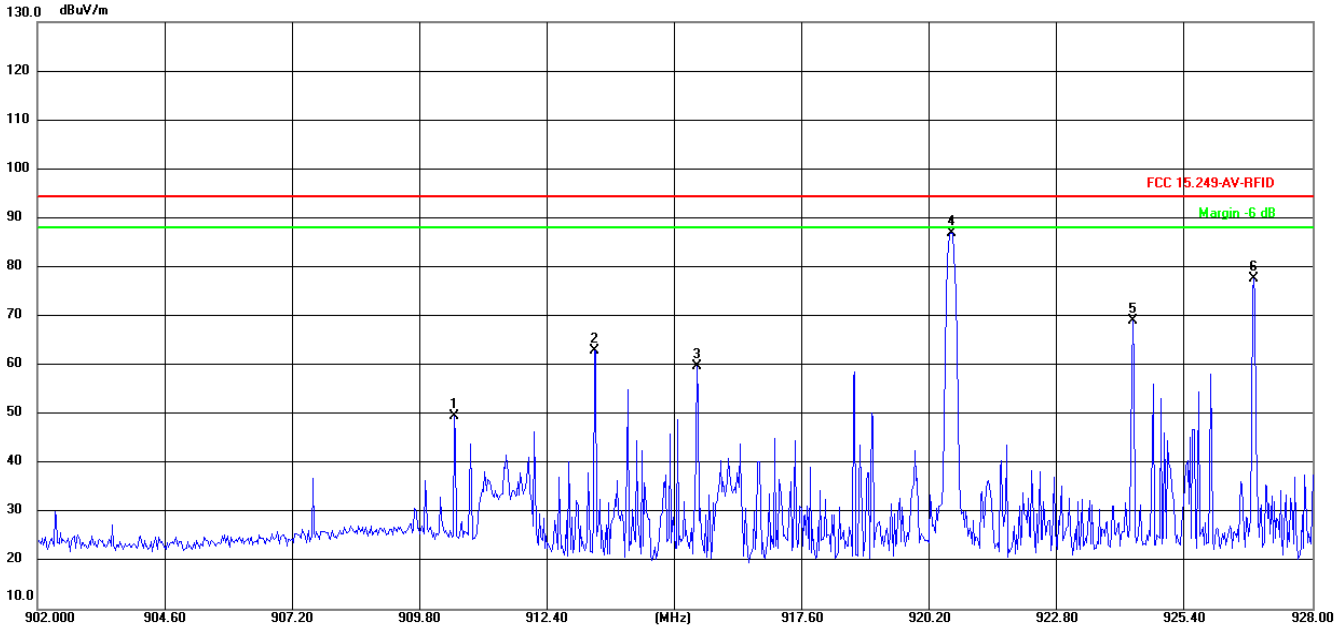


No.	Frequency (MHz)	Reading (dBuV)	Factor (dB/m)	Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Det.
1	907.6160	39.74	-5.60	34.14	94.00	-59.86	QP
2	910.5020	54.72	-5.60	49.12	94.00	-44.88	QP
3	914.0380	60.22	-5.60	54.62	94.00	-39.38	QP
4 *	920.6420	92.36	-5.58	86.78	94.00	-7.22	QP
5	924.3340	74.21	-5.54	68.67	94.00	-25.33	QP
6	926.8040	83.12	-5.53	77.59	94.00	-16.41	QP

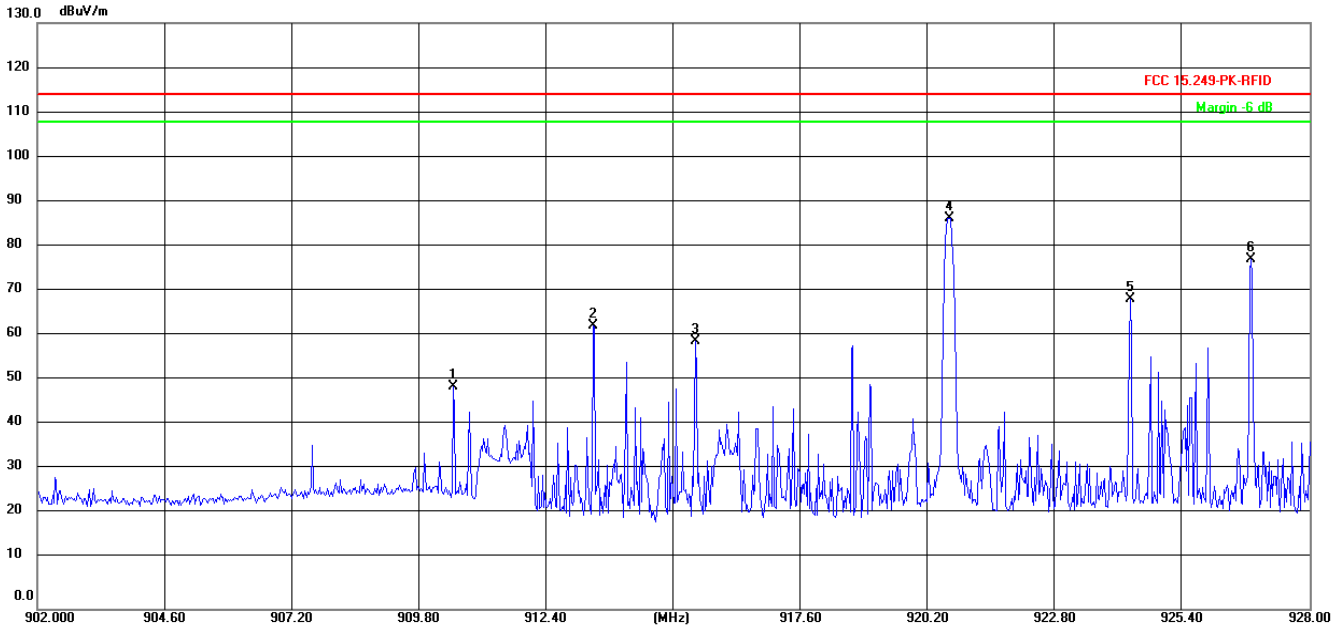


No.	Frequency (MHz)	Reading (dBuV)	Factor (dB/m)	Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Det.
1	910.5020	53.70	-5.60	48.10	114.00	-65.90	QP
2	913.3620	68.50	-5.59	62.91	114.00	-51.09	QP
3	918.6660	64.10	-5.58	58.52	114.00	-55.48	QP
4 *	920.6420	92.36	-5.58	86.78	114.00	-27.22	QP
5	924.3340	74.03	-5.54	68.49	114.00	-45.51	QP
6	926.8040	83.13	-5.53	77.60	114.00	-36.40	QP

Horizontal



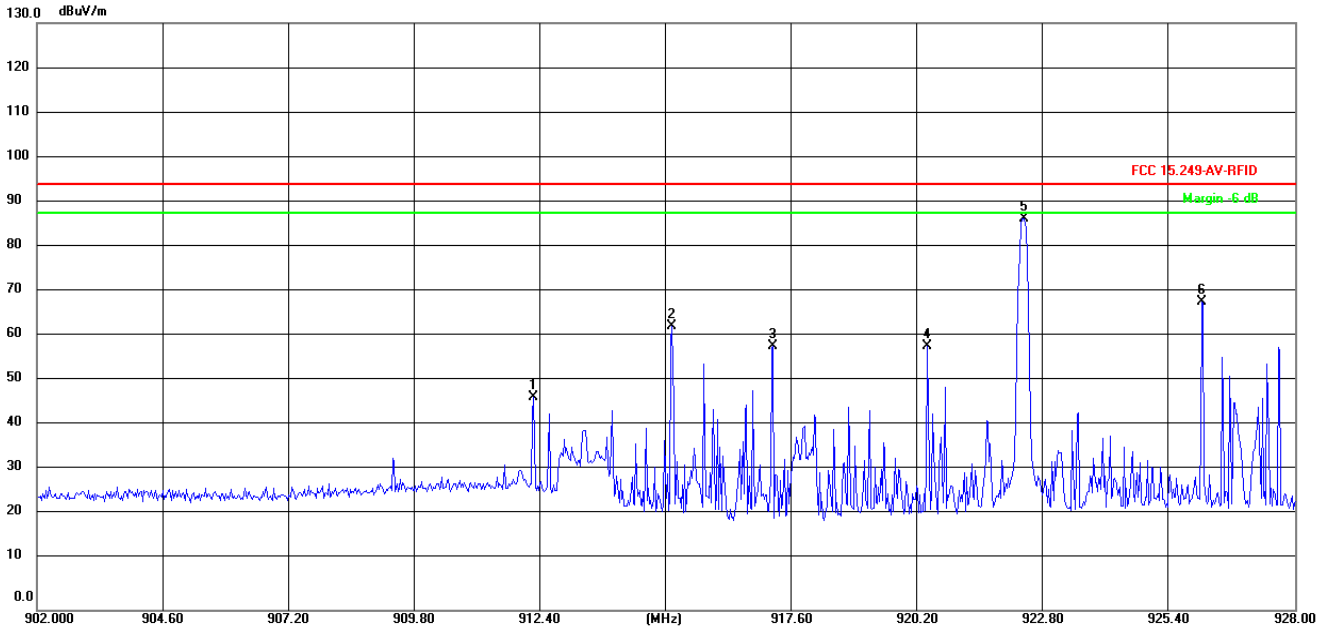
No.	Frequency (MHz)	Reading (dBuV)	Factor (dB/m)	Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Det.
1	910.5020	55.02	-5.60	49.42	94.00	-44.58	QP
2	913.3620	68.49	-5.59	62.90	94.00	-31.10	QP
3	915.4420	65.22	-5.59	59.63	94.00	-34.37	QP
4 *	920.6420	92.36	-5.58	86.78	94.00	-7.22	QP
5	924.3340	74.53	-5.54	68.99	94.00	-25.01	QP
6	926.8040	83.21	-5.53	77.68	94.00	-16.32	QP



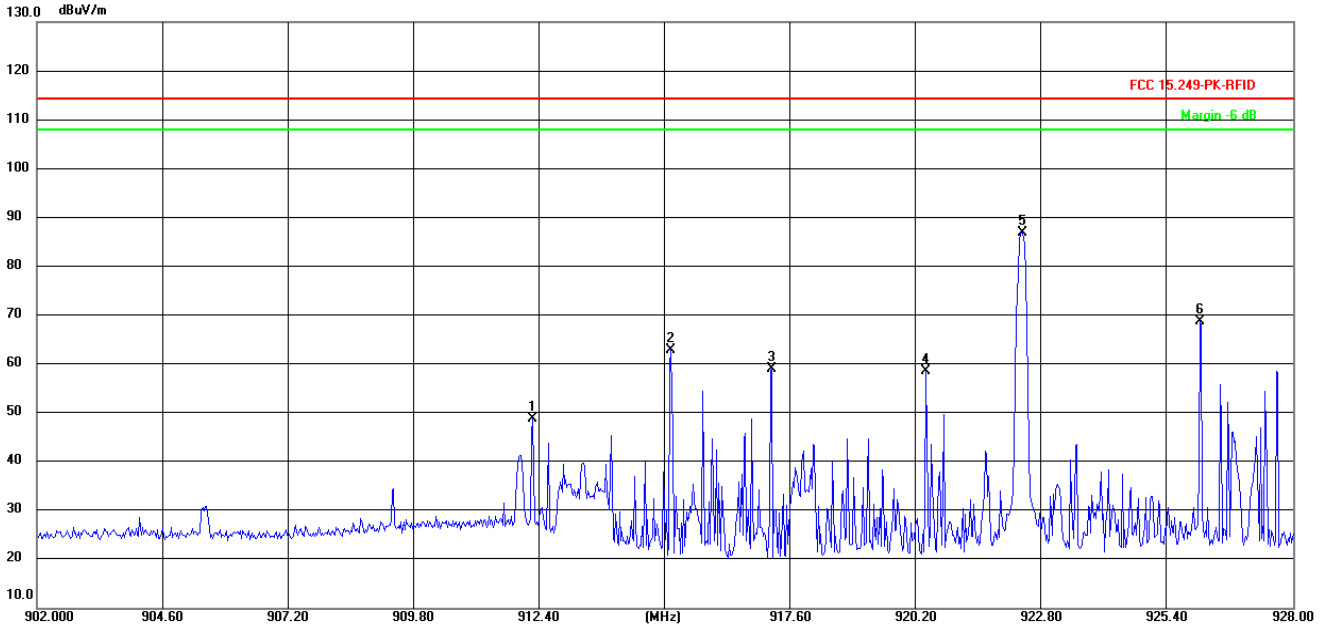
No.	Frequency (MHz)	Reading (dBuV)	Factor (dB/m)	Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Det.
1	910.5020	55.07	-5.60	49.47	114.00	-64.53	QP
2	913.3620	68.48	-5.59	62.89	114.00	-51.11	QP
3	915.4420	65.08	-5.59	59.49	114.00	-54.51	QP
4 *	920.6420	92.36	-5.58	86.78	114.00	-27.22	QP
5	924.3340	74.44	-5.54	68.90	114.00	-45.10	QP
6	926.8040	83.17	-5.53	77.64	114.00	-36.36	QP

922.375MHz

Horizontal

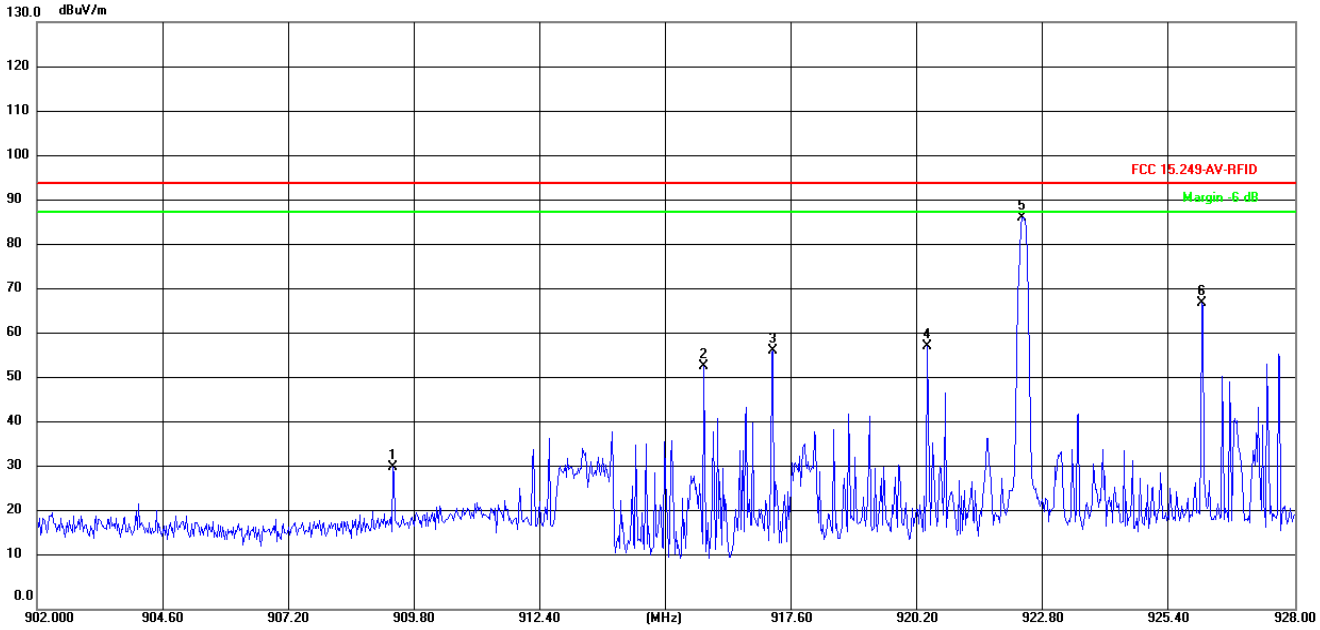


No.	Frequency (MHz)	Reading (dBuV)	Factor (dB/m)	Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Det.
1	912.2700	52.83	-5.60	47.23	94.00	-46.77	QP
2	915.1300	68.46	-5.59	62.87	94.00	-31.13	QP
3	917.2100	64.14	-5.59	58.55	94.00	-35.45	QP
4	920.4080	64.00	-5.58	58.42	94.00	-35.58	QP
5 *	922.4100	92.38	-5.57	86.81	94.00	-7.19	QP
6	926.0760	73.95	-5.53	68.42	94.00	-25.58	QP

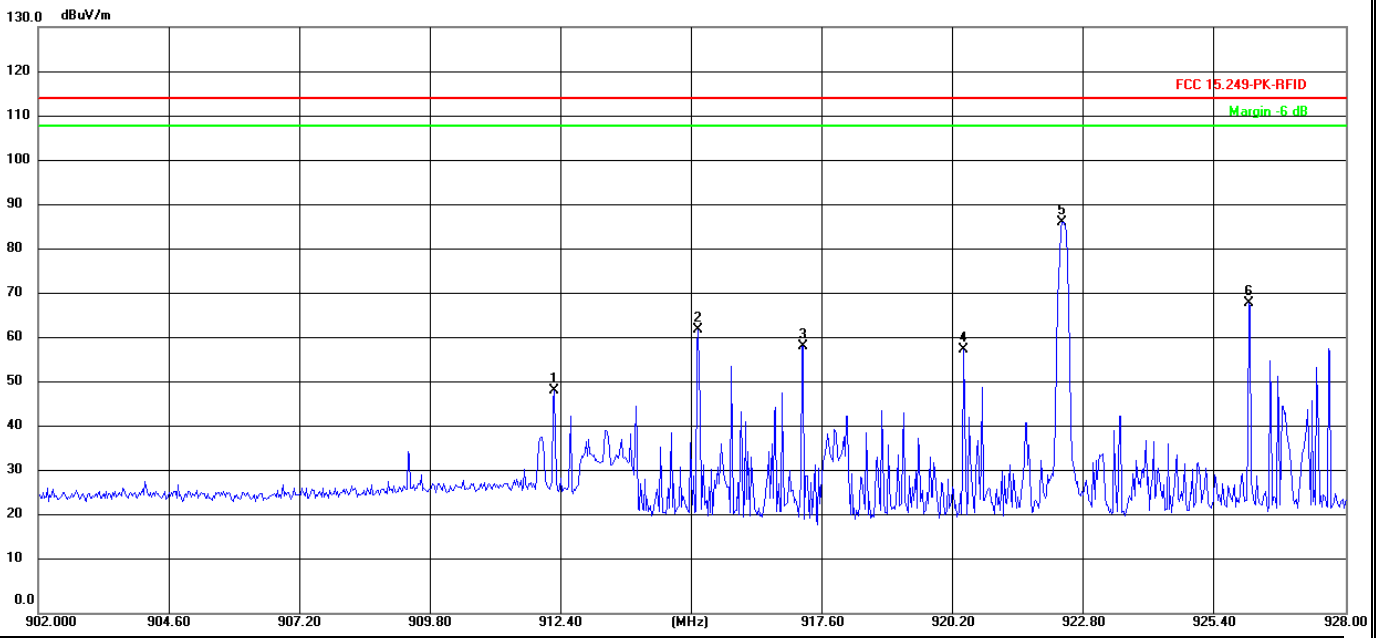


No.	Frequency (MHz)	Reading (dBuV)	Factor (dB/m)	Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Det.
1	912.2700	54.45	-5.60	48.85	114.00	-65.15	QP
2	915.1300	68.49	-5.59	62.90	114.00	-51.10	QP
3	917.2100	64.59	-5.59	59.00	114.00	-55.00	QP
4	920.4080	64.11	-5.58	58.53	114.00	-55.47	QP
5 *	922.4100	92.38	-5.57	86.81	114.00	-27.19	QP
6	926.0760	74.20	-5.53	68.67	114.00	-45.33	QP

Vertical



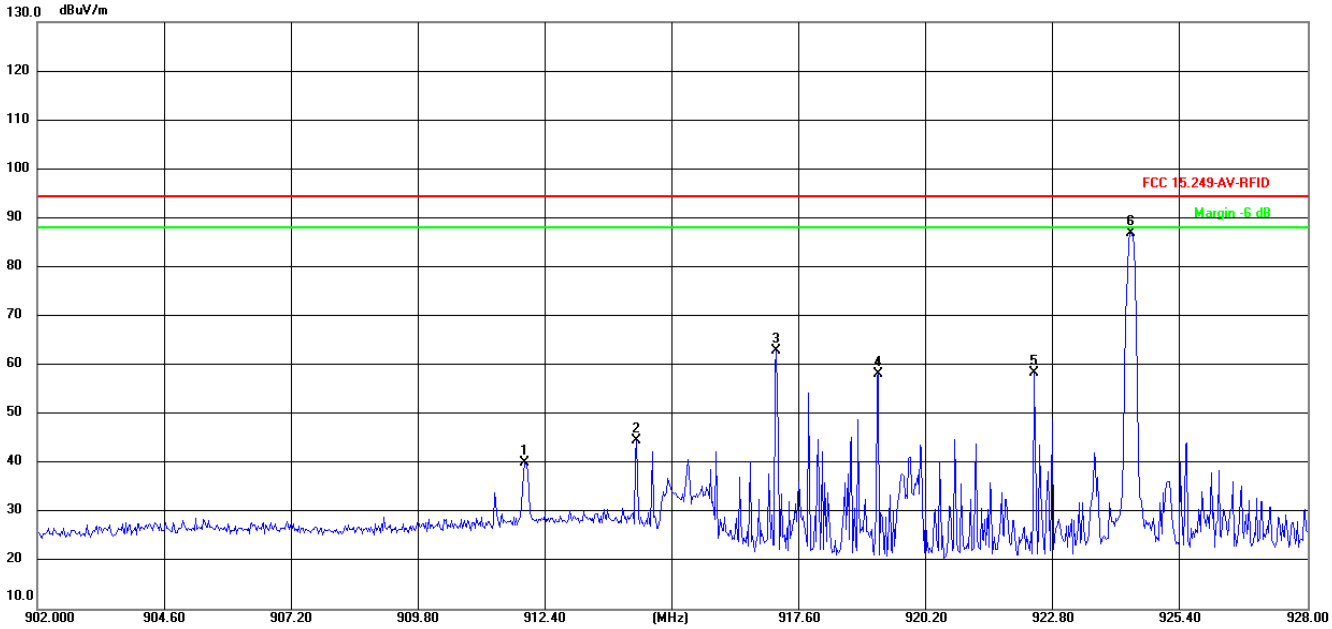
No.	Frequency (MHz)	Reading (dBuV)	Factor (dB/m)	Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Det.
1	909.3579	37.02	-5.60	31.42	94.00	-62.58	QP
2	915.7800	59.31	-5.59	53.72	94.00	-40.28	QP
3	917.2100	62.83	-5.59	57.24	94.00	-36.76	QP
4	920.4080	63.75	-5.58	58.17	94.00	-35.83	QP
5 *	922.3579	92.38	-5.57	86.81	94.00	-7.19	QP
6	926.0760	73.30	-5.53	67.77	94.00	-26.23	QP



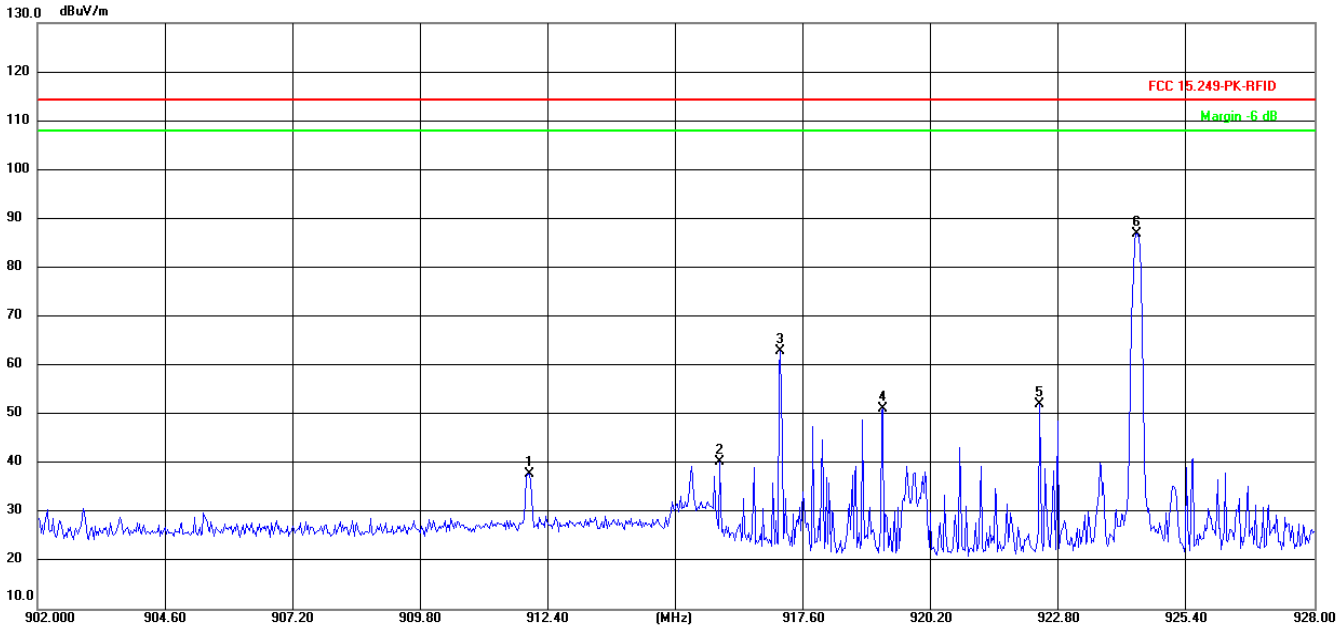
No.	Frequency (MHz)	Reading (dBuV)	Factor (dB/m)	Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Det.
1	912.2700	55.02	-5.60	49.42	114.00	-64.58	QP
2	915.1300	68.47	-5.59	62.88	114.00	-51.12	QP
3	917.2100	64.83	-5.59	59.24	114.00	-54.76	QP
4	920.4080	64.08	-5.58	58.50	114.00	-55.50	QP
5 *	922.3579	92.38	-5.57	86.81	114.00	-27.19	QP
6	926.0760	74.38	-5.53	68.85	114.00	-45.15	QP

924.375MHz

Horizontal

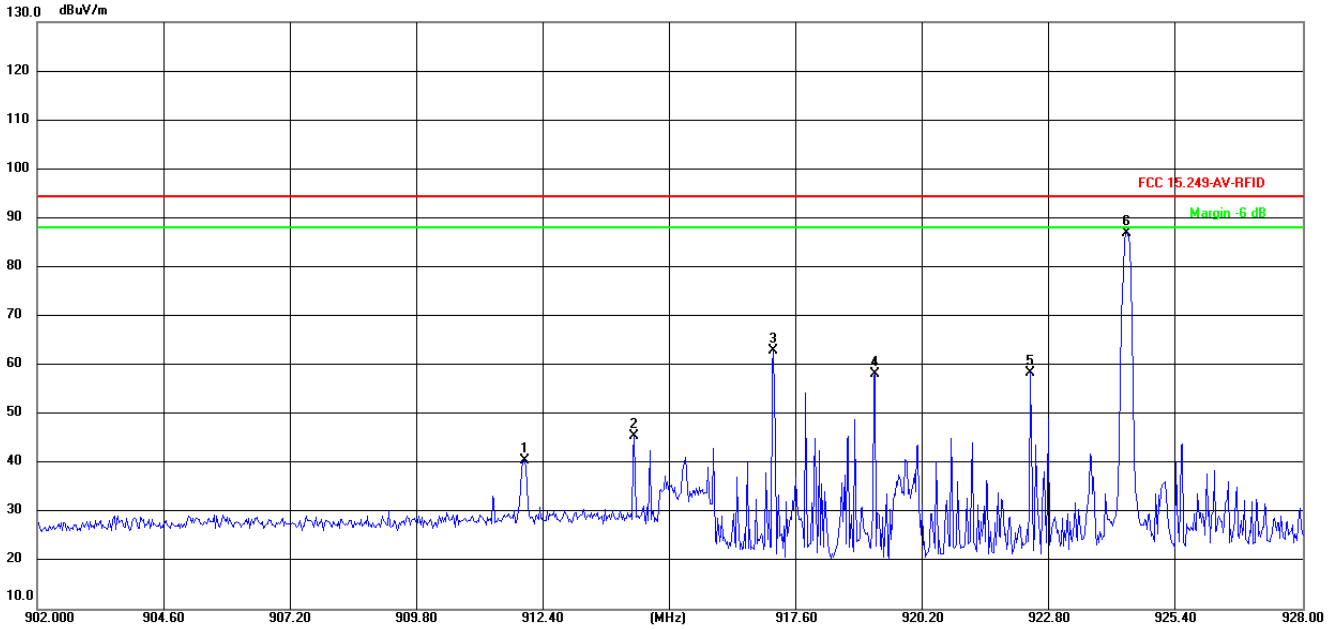


No.	Frequency (MHz)	Reading (dBuV)	Factor (dB/m)	Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Det.
1	911.9840	45.54	-5.60	39.94	94.00	-54.06	QP
2	914.2720	50.20	-5.59	44.61	94.00	-49.39	QP
3	917.1320	68.48	-5.59	62.89	94.00	-31.11	QP
4	919.2120	63.67	-5.58	58.09	94.00	-35.91	QP
5	922.4100	63.98	-5.57	58.41	94.00	-35.59	QP
6 *	924.3860	92.39	-5.54	86.85	94.00	-7.15	QP

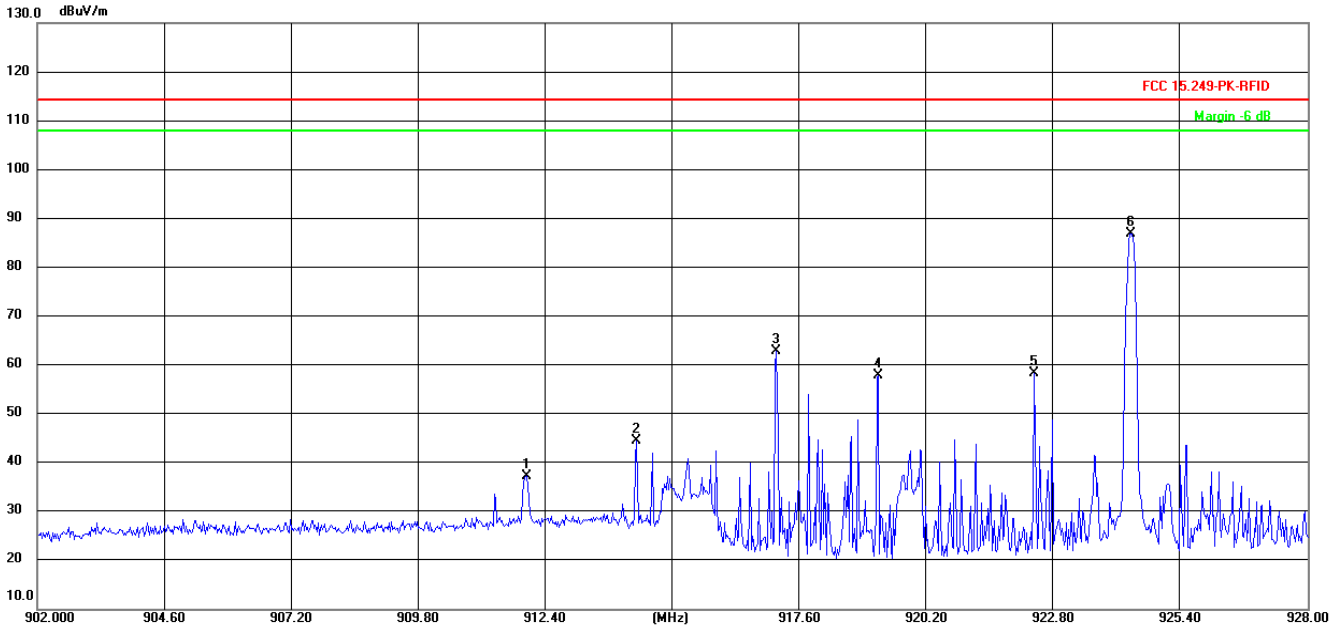


No.	Frequency (MHz)	Reading (dBuV)	Factor (dB/m)	Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Det.
1	912.0100	43.37	-5.60	37.77	114.00	-76.23	QP
2	915.8840	45.89	-5.58	40.31	114.00	-73.69	QP
3	917.1320	68.47	-5.59	62.88	114.00	-51.12	QP
4	919.2120	56.71	-5.58	51.13	114.00	-62.87	QP
5	922.4100	57.48	-5.57	51.91	114.00	-62.09	QP
6 *	924.3860	92.39	-5.54	86.85	114.00	-27.15	QP

Vertical



No.	Frequency (MHz)	Reading (dBuV)	Factor (dB/m)	Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Det.
1	912.0100	45.98	-5.60	40.38	94.00	-53.62	QP
2	914.2720	51.00	-5.59	45.41	94.00	-48.59	QP
3	917.1320	68.50	-5.59	62.91	94.00	-31.09	QP
4	919.2120	63.71	-5.58	58.13	94.00	-35.87	QP
5	922.4100	64.02	-5.57	58.45	94.00	-35.55	QP
6 *	924.3860	92.39	-5.54	86.85	94.00	-7.15	QP



No.	Frequency (MHz)	Reading (dBuV)	Factor (dB/m)	Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Det.
1	912.0100	42.91	-5.60	37.31	114.00	-76.69	QP
2	914.2720	50.03	-5.59	44.44	114.00	-69.56	QP
3	917.1320	68.47	-5.59	62.88	114.00	-51.12	QP
4	919.2120	63.57	-5.58	57.99	114.00	-56.01	QP
5	922.4100	63.98	-5.57	58.41	114.00	-55.59	QP
6 *	924.3860	92.39	-5.54	86.85	114.00	-27.15	QP

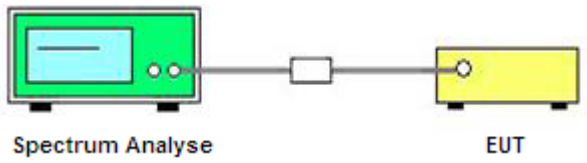
9. 99% OCCUPIED BANDWIDTH AND 20 DB BANDWIDTH MEASUREMENT

9.1. Standard Applicable

According to § 2.1049 and RSS-Gen section 6.7 “The occupied bandwidth or the “99% emission bandwidth” is defined as the frequency range between two points, one above and the other below the carrier frequency, within which 99% of the total transmitted power of the fundamental transmitted emission is contained. The occupied bandwidth shall be reported for all equipment in addition to the specified bandwidth required in the applicable RSSs.”

In some cases, the “x dB bandwidth” is required, which is defined as the frequency range between two points, one at the lowest frequency below and one at the highest frequency above the carrier frequency, at which the maximum power level of the transmitted emission is attenuated x dB below the maximum in band power level of the modulated signal, where the two points are on the outskirts of the in-band emission.

9.2. Block Diagram of Test Setup



9.3. Test Procedure

Use the following spectrum analyzer settings:

Span = 3MHz

RBW = 100 KHz

VBW = 300 KHz

Sweep = auto

Detector function = peak

Trace = max hold

The EUT should be transmitting at its maximum data rate. Allow the trace to stabilize. Use the marker-to-peak function to set the marker to the peak of the emission. Use the marker-delta function to measure 20 dB down one side of the emission. Reset the marker-delta function, and move the marker to the other side of the emission, until it is (as close as possible to) even with the reference marker level. The marker-delta reading at this point is the 20 dB bandwidth of the emission. If this value varies with different modes of operation (e.g., data rate, modulation format, etc.), repeat this test for each variation. The limit is specified in one of the subparagraphs of this Section. Submit this plot(s).

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9.4. Test Results

Temperature	23.6℃	Humidity	52.7%
Test Engineer	Li Huan		

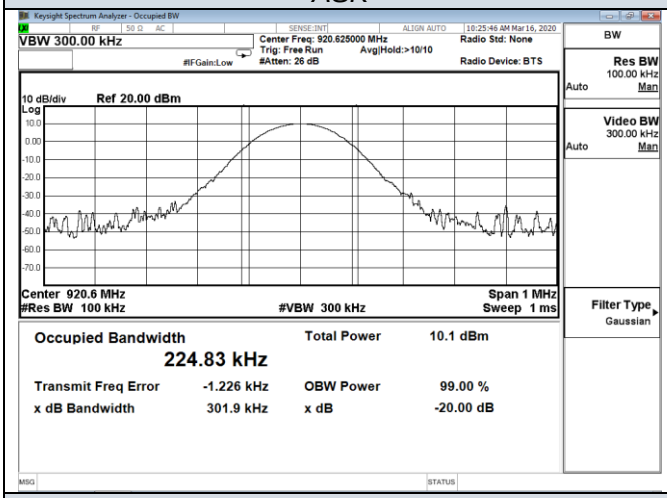
Test Result of 99% and 20dB Bandwidth Measurement			
Test Frequency (MHz)	20dB Bandwidth (KHz)	99% Bandwidth (KHz)	Limit (MHz)
920.625	301.9	224.83	Non-Specified
922.375	301.2	222.31	Non-Specified
924.375	302.9	224.47	Non-Specified

Remark:

1. *Test results including cable loss;*
2. *Please refer following test plots;*

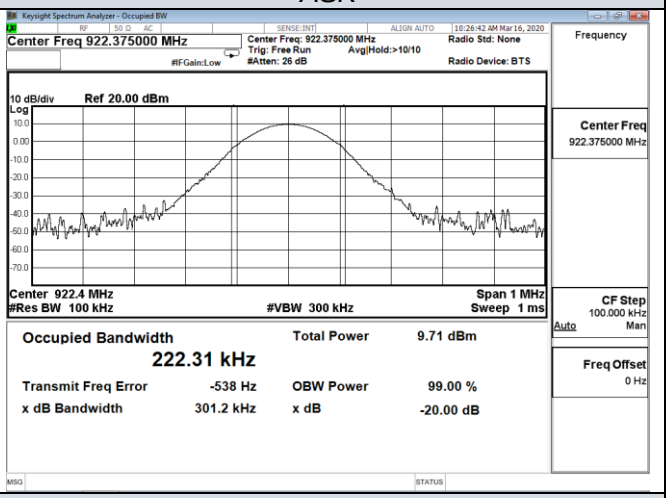
20dB Bandwidth and 99% Bandwidth

ASK

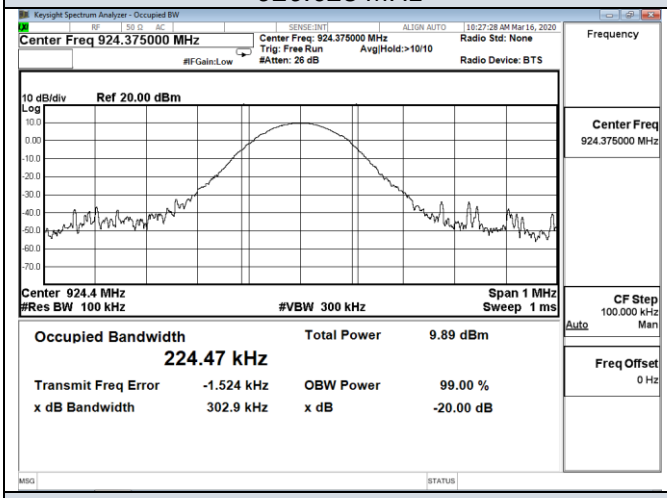


920.625 MHz

ASK



922.375MHz



924.375MHz

10. LIST OF MEASURING EQUIPMENT

Item	Equipment	Manufacturer	Model No.	Serial No.	Cal Date	Due Date
1	MXA Signal Analyzer	Agilent	N9020A	MY4910060	2019-11-22	2020-11-21
2	DC Power Supply	Agilent	E3642A	N/A	2019-11-14	2020-11-13
3	Temperature & Humidity Chamber	GUANGZHOU GOGNWEN	GDS-100	70932	2019-10-09	2020-10-08
4	EMI Test Software	AUDIX	E3	/	N/A	N/A
5	3m Semi Anechoic Chamber	SIDT FRANKONIA	SAC-3M	03CH03-HY	2019-06-12	2020-06-11
6	Positioning Controller	MF	MF-7082	/	2019-06-12	2020-06-11
7	Active Loop Antenna	SCHWARZBECK	FMZB 1519B	00005	2018-07-26	2021-07-25
8	By-log Antenna	SCHWARZBECK	VULB9163	9163-470	2018-07-26	2021-07-25
9	Horn Antenna	SCHWARZBECK	BBHA 9120D	9120D-1925	2018-07-02	2021-07-01
10	EMI Test Receiver	R&S	ESR 7	101181	2019-06-12	2020-06-11
11	RS SPECTRUM ANALYZER	R&S	FSP40	100503	2019-11-14	2020-11-13
12	Broadband Preamplifier	/	BP-01M18G	P190501	2019-07-01	2020-06-30
13	RF Cable-R03m	Jye Bao	RG142	CB021	2019-06-12	2020-06-11
14	RF Cable-HIGH	SUHNER	SUCOFLEX 106	03CH03-HY	2019-06-12	2020-06-11
15	EMI Test Receiver	R&S	ESPI	101840	2019-06-11	2020-06-10
16	Artificial Mains	R&S	ENV216	101288	2019-06-12	2020-06-11
17	10dB Attenuator	SCHWARZBECK	MTS-IMP-136	261115-001-0032	2019-06-11	2020-06-10
Note: All equipment is calibrated through CHINA CEPREI LABORATORY and GUANGZHOU LISAI CALIBRATION AND TEST CO., LTD.						

11. TEST SETUP PHOTOGRAPHS OF THE EUT

Please refer to separated files for Test Setup Photos of the EUT.

12. EXTERIOR PHOTOGRAPHS OF THE EUT

Please refer to separated files for External Photos of the EUT.

13. INTERIOR PHOTOGRAPHS OF THE EUT

Please refer to separated files for Internal Photos of the EUT.

----------THE END OF REPORT----------

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