FCC PART 15.225

TEST REPORT

For

i.safe MOBILE GmbH

i_Park Tauberfranken 10 97922 Lauda-Koenigshofen, Germany

FCC ID: 2AACZ-IS9101

Report Type:	Product Type:
Original Report	Intrinsically safe tablet PC

Report Number:	RSZ180529003-00E
Report Date:	2018-07-17
Reviewed By:	Rocky Kang RF Engineer
Prepared By:	Bay Area Compliance Laboratories Corp. (Shenzhen) 6/F., West Wing, Third Phase of Wanli Industrial Building, Shihua Road, Futian Free Trade Zone, Shenzhen, Guangdong, China Tel: +86-755-33320018 Fax: +86-755-33320008 www.baclcorp.com.cn

Note: This report must not be used by the customer to claim product certification, approval, or endorsement by A2LA* or any agency of the Federal Government. * This report may contain data that are not covered by the A2LA accreditation and are marked with an asterisk "*".

TABLE OF CONTENTS

GENERAL INFORMATION

Product Description for Equipment under Test (EUT)

The *i.safe MOBILE GmbH's* product, model number: *IS910.1 (FCC ID: 2AACZ-IS9101)* or the "EUT" in this report was a *Intrinsically safe tablet PC,* which was measured approximately: 234.5 mm (L) * 154 mm (W) * 19.5 mm (H), rated with input voltage: DC 3.7 V battery or DC 5V from adapter.

Adapter Information: (For model IS910.1)
Model: ICP12-050-2000B
Input: AC 100-240V, 50/60Hz, 0.3 A
Output: DC 5V, 2000 mA

Adapter Information: (For model RG910)
Model: HKC0115020-2B
Input: AC 100-240V, 50/60Hz, 0.5 A
Output: DC 5V, 2A

Notes: This series products model: RG910 (Product name: Rugged Tablet Computer) and IS910.1 (Product name: Intrinsically safe tablet PC) are electrically identical, the detailed information can be referred to the declaration letter which was stated and guaranteed by the applicant.

**All measurement and test data in this report was gathered from production sample serial number: 180529003A for IS910.1 and 180529003B for RG910 (Assigned by BACL, Shenzhen). The EUT supplied by the applicant was received on 2018-05-29.*

Objective

This Type approval report is prepared on behalf of *i.safe MOBILE GmbH* in accordance with Part 2- Subpart J, and Part 15-Subparts A and C of the Federal Communication Commissions rules.

The objective is to determine the compliance of the EUT with FCC rules, section 15.203, 15.205, 15.207, 15.209 and 15.225.

Related Submittal(s)/Grant(s)

FCC Part 15B JBP, Part 15.247 DSS & DTS and FCC Part 22H&24E&27 PCB submissions with FCC ID: 2AACZ-IS9101.

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.

All emissions measurement was performed at Bay Area Compliance Laboratories Corp. (Shenzhen). The radiated testing was performed at an antenna-to-EUT distance of 3 meters.

Measurement Uncertainty

Parameter	uncertainty
Occupied Channel Bandwidth	±5%
RF conducted test with spectrum	±1.5dB
AC Power Lines Conducted Emissions	±1.95dB
All emissions, radiated	±4.88dB
Temperature	±3℃
Humidity	±6%
Supply voltages	±0.4%

Test Facility

The Test site used by Bay Area Compliance Laboratories Corp. (Shenzhen) to collect test data is located on the 6/F., West Wing, Third Phase of Wanli Industrial Building, Shihua Road, Futian Free Trade Zone, Shenzhen, Guangdong, China.

The test site has been approved by the FCC under the KDB 974614 D01 and is listed in the FCC Public Access Link (PAL) database, FCC Registration No.: 342867, the FCC Designation No.: CN1221.

The test site has been registered with ISED Canada under ISED Canada Registration Number 3062B.

SYSTEM TEST CONFIGURATION

Justification

The system was configured for testing in a typical fashion (as normally used by a typical user).

EUT Exercise Software

No Exercise Software was used.

Equipment Modifications

No modification on the EUT.

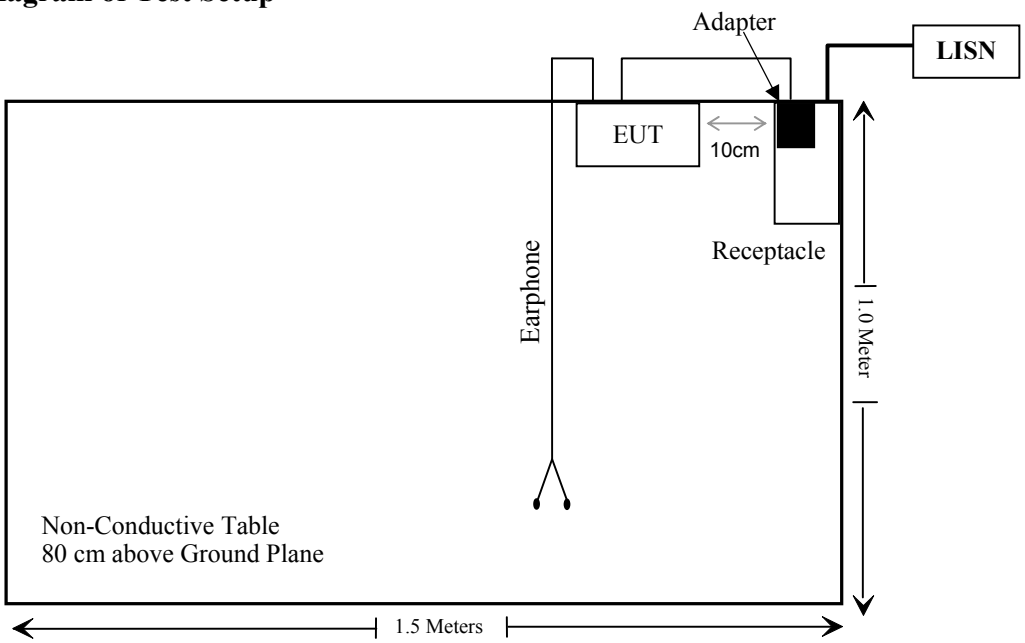
Local Support Equipment

Manufacturer	Description	Model	Serial Number
N/A	N/A	N/A	N/A

External I/O Cable

Cable Description	Length (m)	From Port	To
Un-shielding Detachable Charging Cable	1.2	EUT	Adapter
Shielding Detachable Charging Cable with one case(For model IS910.1)	1.2	EUT	Adapter

Block Diagram of Test Setup



SUMMARY OF TEST RESULTS

FCC Rules	Description of Test	Result
§15.203	Antenna Requirement	Compliance
§15.207	AC Line Conducted Emission	Compliance
§15.225 §15.209 §15.205	Radiated Emission Test	Compliance
§15.225(e)	Frequency Stability	Compliance
§15.215(c)	20dB Emission Bandwidth	Compliance

TEST EQUIPMENT LIST

Manufacturer	Description	Model	Serial Number	Calibration Date	Calibration Due Date
Conducted Emissions Test					
Rohde & Schwarz	EMI Test Receiver	ESCS30	100176	2017-08-04	2018-08-04
Rohde & Schwarz	LISN	ENV216	3560.6650.12-101613-Yb	2017-12-21	2018-12-21
Rohde & Schwarz	Transient Limiter	ESH3Z2	DE25985	2018-05-21	2018-11-19
Rohde & Schwarz	CE Test software	EMC 32	V8.53.0	NCR	NCR
N/A	Conducted Emission Cable	N/A	UF A210B-1-0720-504504	2018-05-12	2018-11-12
Radiated Emission Test					
HP	Amplifier	HP8447E	1937A01046	2018-05-21	2018-11-19
Rohde & Schwarz	EMI Test Receiver	ESCI	101120	2018-01-11	2019-01-11
Sunol Sciences	Broadband Antenna	JB1	A040904-1	2017-12-22	2020-12-21
ETS	Passive Loop Antenna	6512	00029604	2018-03-07	2021-03-06
Sonoma instrument	Amplifier	310N	186238	2018-05-17	2018-11-19
Ducommun technologies	RF Cable	UFA210A-1-4724-30050U	MFR64369 223410-001	2018-05-17	2018-11-19
Ducommun technologies	RF Cable	104PEA	218124002	2018-05-17	2018-11-19
Fluke	Digital Multimeter	287	19000011	2018-04-09	2019-04-09
instek	DC Power Supply	GPS-3030DD	EM832096	NCR	NCR
ESPEC	Temperature & Humidity Chamber	EL-10KA	9107726	2017-12-21	2018-12-21

*** Statement of Traceability:** Bay Area Compliance Laboratories Corp. (Shenzhen) attests that all calibrations have been performed in accordance to requirements that traceable to National Primary Standards and International System of Units (SI).

FCC§15.203 - ANTENNA REQUIREMENT

Applicable Standard

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.

Antenna Connected Construction

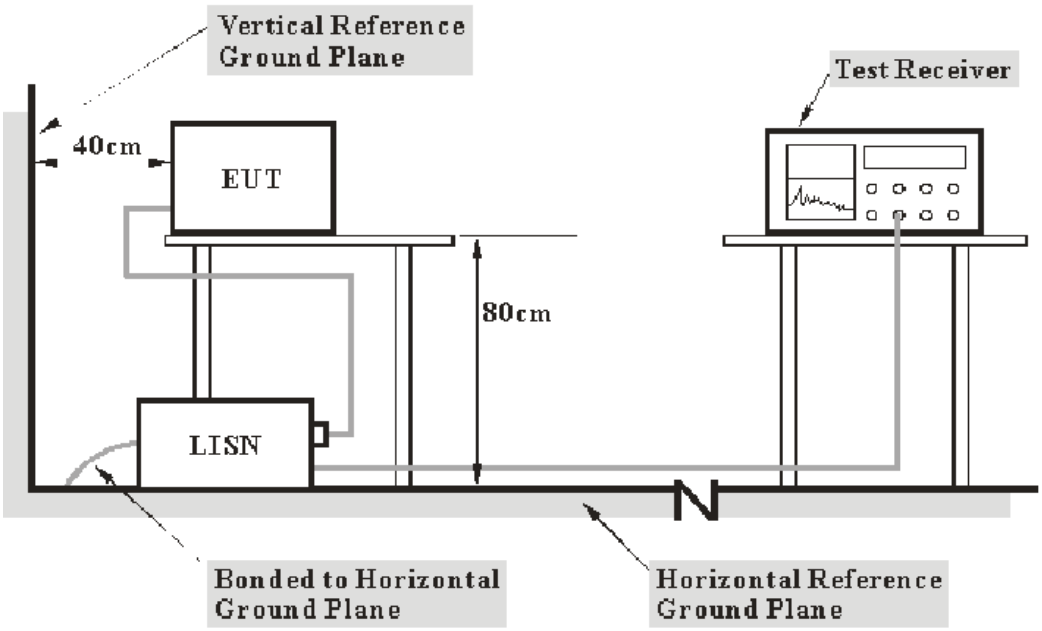
The EUT has an internal antenna arrangement, which was permanently attached, the antenna gain is -0.6 dBi, fulfill the requirement of this section. Please refer to EUT photos for details.

FCC §15.207 – AC LINE CONDUCTED EMISSION

Applicable Standard

FCC§15.207

EUT Setup



Note: 1. Support units were connected to second LISN.
2. Both of LISNs (AMN) 80 cm from EUT and at the least 80 cm from other units and other metal planes support units.

The setup of EUT is according with per ANSI C63.10-2013 measurement procedure. The specification used was with the FCC Part 15.207.

The external I/O cables were draped along the test table and formed a bundle 30 to 40 cm long in the middle.

The spacing between the peripherals was 10 cm.

EMI Test Receiver Setup

The EMI test receiver was set to investigate the spectrum from 150 kHz to 30 MHz.

During the conducted emission test, the EMI test receiver was set with the following configurations:

Frequency Range	IF B/W
150 kHz – 30 MHz	9 kHz

Test Procedure

During the conducted emission test, the adapter of Laptop was connected to the outlet of the LISN.

Maximizing procedure was performed on the six (6) highest emissions of the EUT.

All final data was recorded in the Quasi-peak and average detection mode.

Corrected Factor & Margin Calculation

The Corrected factor is calculated by adding LISN VDF (Voltage Division Factor), Cable Loss and Transient Limiter Attenuation. The basic equation is as follows:

Correction Factor = LISN VDF + Cable Loss + Transient Limiter Attenuation

The "**Margin**" column of the following data tables indicates the degree of compliance with the applicable limit. For example, a margin of 7 dB means the emission is 7 dB below the limit. The equation for margin calculation is as follows:

Margin = Limit – Corrected Amplitude

Test Results Summary

According to the recorded data in following table, the EUT complied with the FCC Part 15.207.

Refer to CISPR16-4-2:2011 and CISPR 16-4-1:2009, the measured level complies with the limit if

$$L_m + U_{(Lm)} \leq L_{lim} + U_{cispr}$$

In BACL, $U_{(Lm)}$ is less than U_{cispr}, if L_m is less than L_{lim}, it implies that the EUT complies with the limit.

Test Data

Environmental Conditions

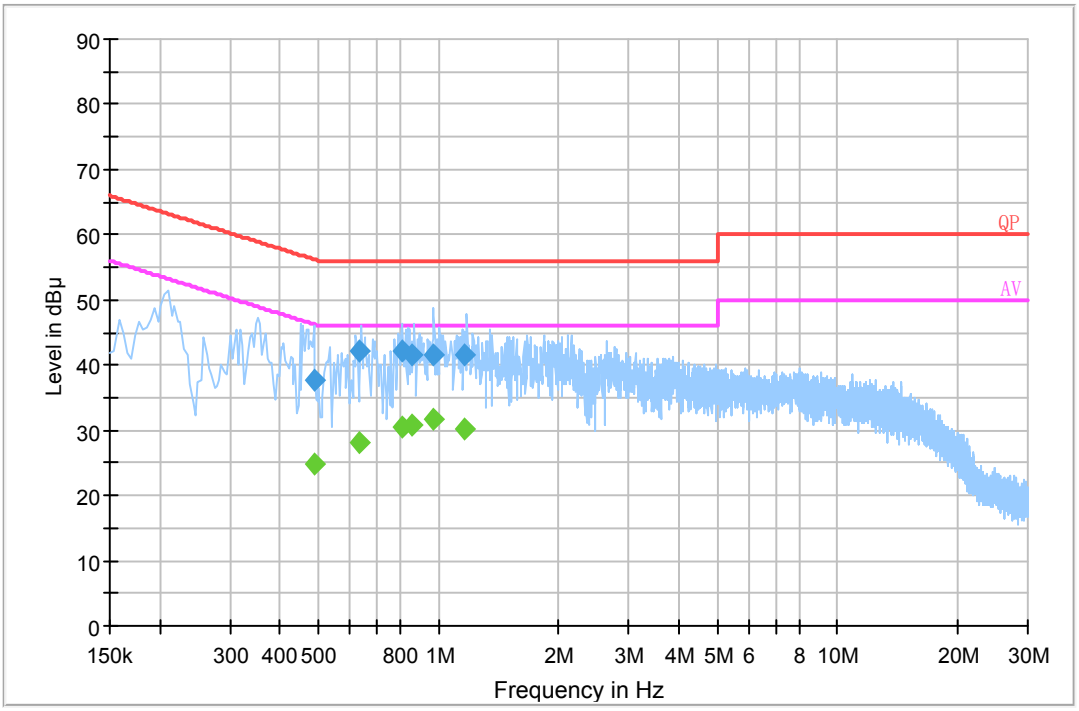
Temperature:	25 ℃
Relative Humidity:	52 %
ATM Pressure:	101.0 kPa

The testing was performed by Nancy Wang on 2018-06-25.

EUT operation mode: Transmitting

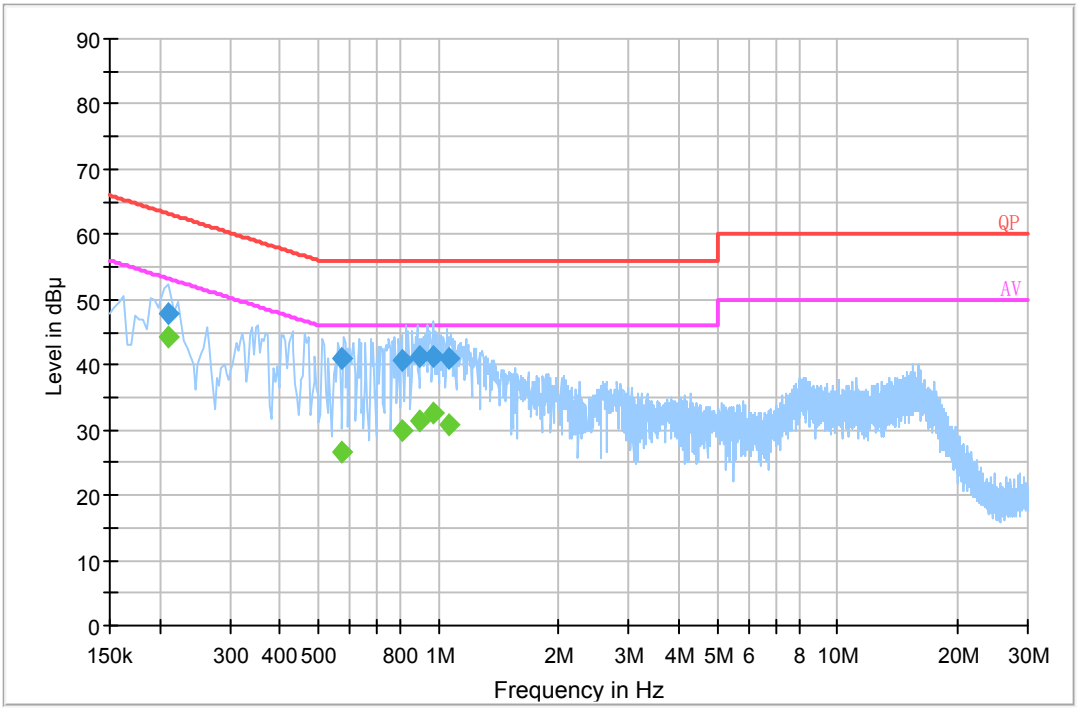
For model IS910.1:

AC 120 V/60 Hz, Line:



Frequency (MHz)	Corrected Amplitude (dBµV)	Correction Factor (dB)	Limit (dBµV)	Margin (dB)	Detector (PK/Ave./QP)
0.490710	37.6	20.1	56.2	18.6	QP
0.632430	42.1	20.0	56.0	13.9	QP
0.809850	42.3	19.9	56.0	13.7	QP
0.860950	41.7	20.0	56.0	14.3	QP
0.975450	41.7	20.0	56.0	14.3	QP
1.160330	41.6	20.0	56.0	14.4	QP
0.490710	24.9	20.1	46.2	21.3	Ave.
0.632430	28.0	20.0	46.0	18.0	Ave.
0.809850	30.4	19.9	46.0	15.6	Ave.
0.860950	30.7	20.0	46.0	15.3	Ave.
0.975450	31.7	20.0	46.0	14.3	Ave.
1.160330	30.2	20.0	46.0	15.8	Ave.

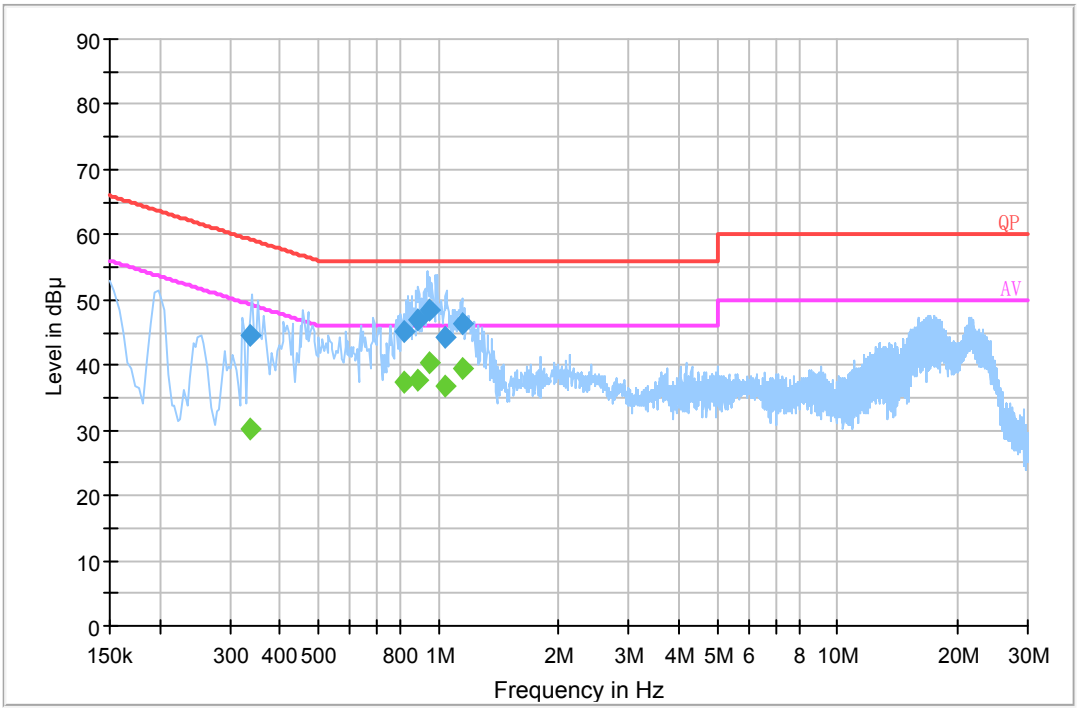
AC 120V/60 Hz, Neutral:



Frequency (MHz)	Corrected Amplitude (dBµV)	Correction Factor (dB)	Limit (dBµV)	Margin (dB)	Detector (PK/Ave./QP)
0.209500	47.9	20.1	63.2	15.3	QP
0.573330	40.9	20.0	56.0	15.1	QP
0.809850	40.6	19.9	56.0	15.4	QP
0.892710	41.2	20.0	56.0	14.8	QP
0.967450	41.4	20.0	56.0	14.6	QP
1.062250	40.8	20.0	56.0	15.2	QP
0.209500	44.2	20.1	53.2	9.0	Ave.
0.573330	26.6	20.0	46.0	19.4	Ave.
0.809850	30.0	19.9	46.0	16.0	Ave.
0.892710	31.4	20.0	46.0	14.6	Ave.
0.967450	32.7	20.0	46.0	13.3	Ave.
1.062250	30.8	20.0	46.0	15.2	Ave.

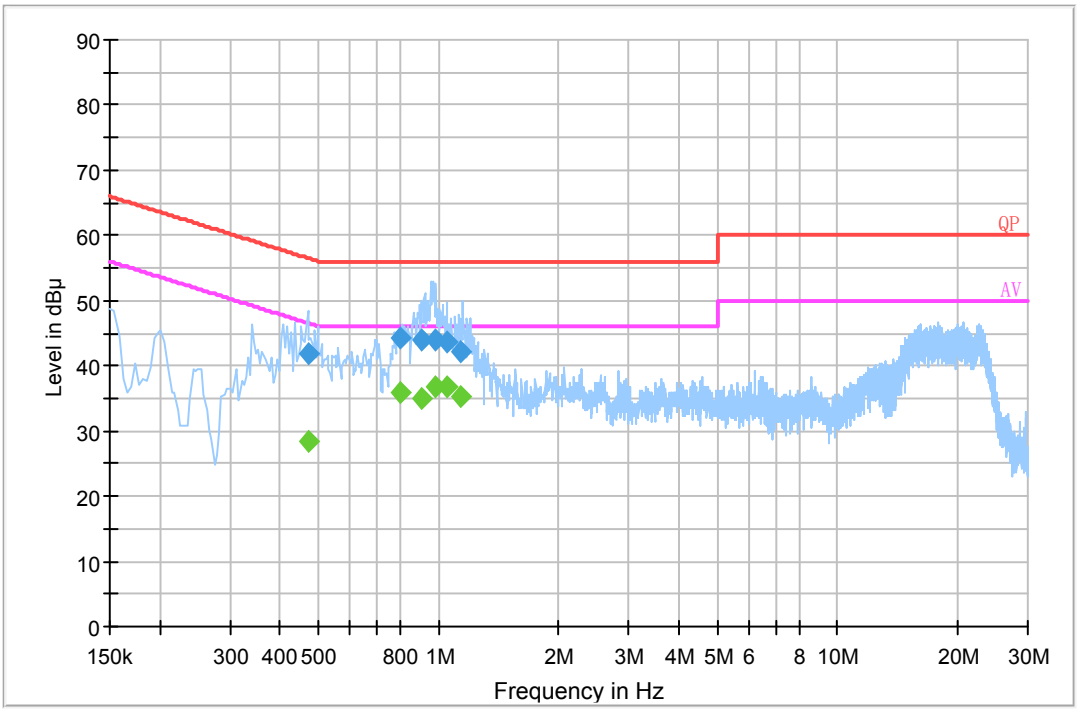
For model RG910:

AC 120 V/60 Hz, Line:



Frequency (MHz)	Corrected Amplitude (dBµV)	Correction Factor (dB)	Limit (dBµV)	Margin (dB)	Detector (PK/Ave./QP)
0.336870	44.5	20.1	59.3	14.8	QP
0.817910	45.2	19.9	56.0	10.8	QP
0.884650	47.1	20.0	56.0	8.9	QP
0.947990	48.4	20.0	56.0	7.6	QP
1.042310	44.4	20.0	56.0	11.6	QP
1.152810	46.2	20.0	56.0	9.8	QP
0.336870	30.2	20.1	49.3	19.1	Ave.
0.817910	37.3	19.9	46.0	8.7	Ave.
0.884650	37.7	20.0	46.0	8.3	Ave.
0.947990	40.4	20.0	46.0	5.6	Ave.
1.042310	36.9	20.0	46.0	9.1	Ave.
1.152810	39.4	20.0	46.0	6.6	Ave.

AC 120V/60 Hz, Neutral:



Frequency (MHz)	Corrected Amplitude (dBµV)	Correction Factor (dB)	Limit (dBµV)	Margin (dB)	Detector (PK/Ave./QP)
0.470950	41.9	20.1	56.5	14.6	QP
0.805790	44.3	19.9	56.0	11.7	QP
0.904410	44.0	20.0	56.0	12.0	QP
0.979510	43.9	20.0	56.0	12.1	QP
1.050250	43.7	20.0	56.0	12.3	QP
1.140750	42.3	20.0	56.0	13.7	QP
0.470950	28.5	20.1	46.5	18.0	Ave.
0.805790	35.8	19.9	46.0	10.2	Ave.
0.904410	35.0	20.0	46.0	11.0	Ave.
0.979510	36.9	20.0	46.0	9.1	Ave.
1.050250	36.8	20.0	46.0	9.2	Ave.
1.140750	35.3	20.0	46.0	10.7	Ave.

Note:
1) Correction Factor =LISN VDF (Voltage Division Factor) + Cable Loss + Transient Limiter Attenuation
2) Corrected Amplitude = Reading + Correction Factor
3) Margin = Limit – Corrected Amplitude

FCC§15.225, §15.205 & §15.209 - RADIATED EMISSIONS TEST

Applicable Standard

As per FCC Part 15.225

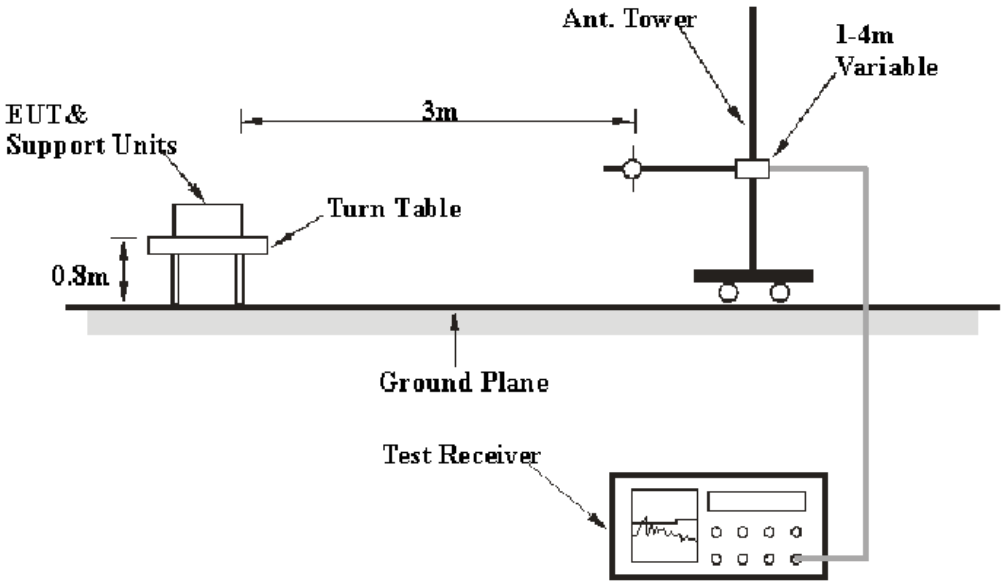
(a) The field strength of any emissions within the band 13.553–13.567 MHz shall not exceed 15,848 microvolts/meter at 30 meters.

(b) Within the bands 13.410–13.553 MHz and 13.567–13.710 MHz, the field strength of any emissions shall not exceed 334 microvolts/meter at 30 meters.

(c) Within the bands 13.110–13.410 MHz and 13.710–14.010 MHz the field strength of any emissions shall not exceed 106 microvolts/meter at 30 meters.

(d) The field strength of any emissions appearing outside of the 13.110–14.010 MHz band shall not exceed the general radiated emission limits in §15.209.

EUT Setup



Note: Antenna is set up at 1m during test for below 30MHz.

The radiated emission tests were performed in the 3-meter chamber a test site, using the setup accordance with the ANSI C63.10-2013. The specification used was the FCC Part Subpart C limits.

EMI Test Receiver Setup

According to FCC Rules, 47 CFR 15.33, the EUT emissions were investigated up to 1000 MHz.

During the radiated emission test, the EMI test Receiver was set with the following configurations:

Frequency Range	RBW	Video B/W	IF B/W	Detector
9 kHz – 150 kHz	200 Hz	1 kHz	/	QP
150 kHz –30 MHz	9 kHz	30 kHz	/	QP
30 MHz – 1000 MHz	120 kHz	500 kHz	/	QP

Corrected Amplitude & Margin Calculation

The Corrected Amplitude is calculated by adding the Antenna Factor and Cable Loss, and subtracting the Amplifier Gain from the Meter Reading. The basic equation is as follows:

Corrected Factor = Antenna Factor + Cable Loss- Amplifier Gain
Corrected Amplitude = Meter Reading + Corrected Factor

The "**Margin**" column of the following data tables indicates the degree of compliance with the applicable limit. For example, a margin of 7 dB means the emission is 7 dB below the limit. The equation for margin calculation is as follows:

Margin = Limit – Corrected Amplitude

Test Results Summary

According to the data in the following table, the EUT complied with the FCC §15.209.

Refer to CISPR16-4-2:2011 and CISPR 16-4-1:2009, the measured level is in compliance with the limit if

$$L_m + U_{(Lm)} \leq L_{lim} + U_{cispr}$$

In BACL, $U_{(Lm)}$ is less than U_{cispr}, if L_m is less than L_{lim}, it implies that the EUT complies with the limit.

Test Data

Environmental Conditions

Temperature:	25 ℃
Relative Humidity:	52 %
ATM Pressure:	101.0 kPa

The testing was performed by Nancy Wang on 2018-06-25 and 2018-06-26.

Test mode: Transmitting

For model IS910.1:

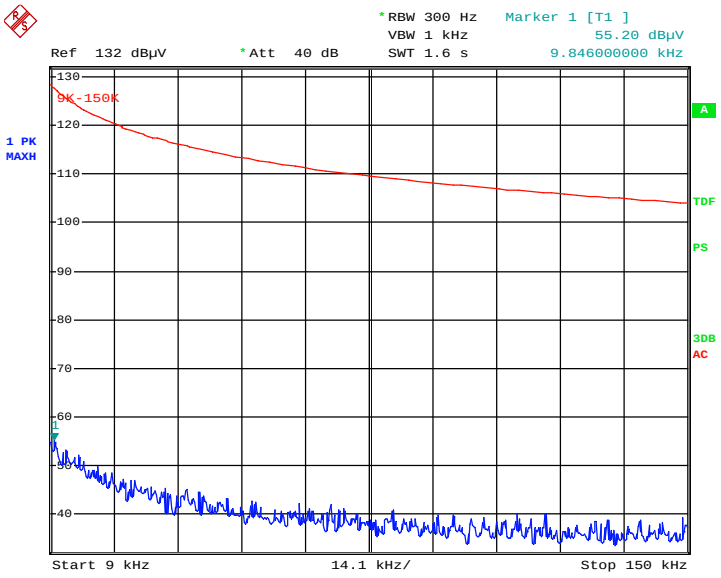
1) Spurious Emissions (9 kHz~30 MHz):

Indicated		Table Angle Degree	Antenna Height (m)	Detector	Correction Factor			Corrected Amplitude (dBμV/m) @3m	FCC part 15.225	
Freq. (MHz)	Corrected Amplitude (dBμV/m) @3m				Ant. Factor (dB)	Cable Loss (dB)	Pre-Amp. Gain (dB)		Limit (dBμV/m) @3m	Result
0.0098	-2.6	0	1	QP	87.8	0.2	30.2	55.20	127.78	Pass
0.2097	25.55	0	1	QP	60.5	0.3	30.2	56.15	101.17	Pass

2) In band:

Indicated			Table Angle Degree	Antenna Height (m)	Detector	Correction Factor			Corrected Amplitude (dBμV/m) @3m	FCC part 15.225	
Frequency Range (MHz)	Mark Point (MHz)	Corrected Amplitude (dBμV/m) @3m				Ant. Factor (dB)	Cable Loss (dB)	Pre-Amp. Gain (dB)		Limit (dBμV/m) @3m	Result
13.110-13.410	13.394	71.24	0	1	QP	32	0.2	30.2	73.24	80.5	Pass
13.410-13.553	13.549	72.88	0	1.1	QP	32	0.2	30.2	74.88	90.5	Pass
13.553-13.567	13.557	73.67	0	1.1	QP	32	0.2	30.2	75.67	124.0	Pass
13.567-13.710	13.571	72.13	0	1	QP	32	0.2	30.2	74.13	90.5	Pass
13.710-14.010	13.812	70.67	0	1.2	QP	32	0.2	30.2	72.67	80.5	Pass

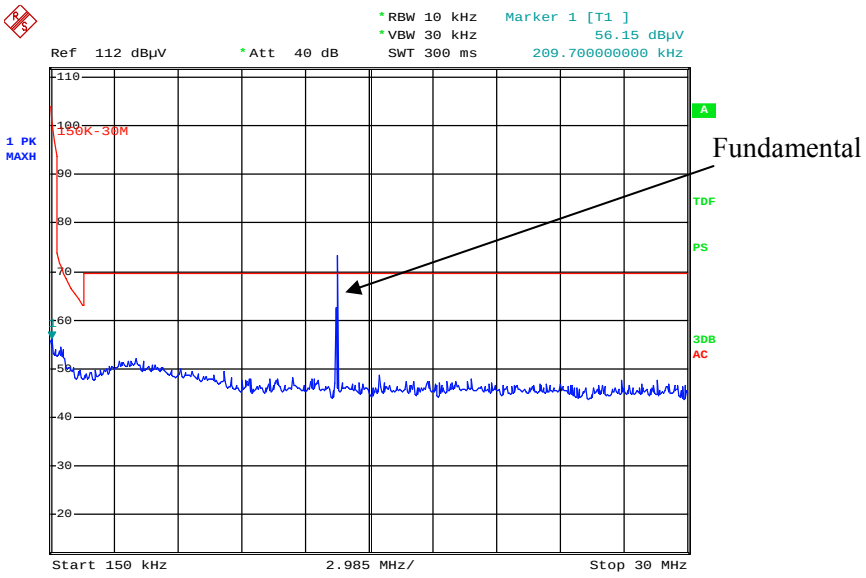
9 kHz~150 kHz



EUT

Date: 25.JUN.2018 09:39:38

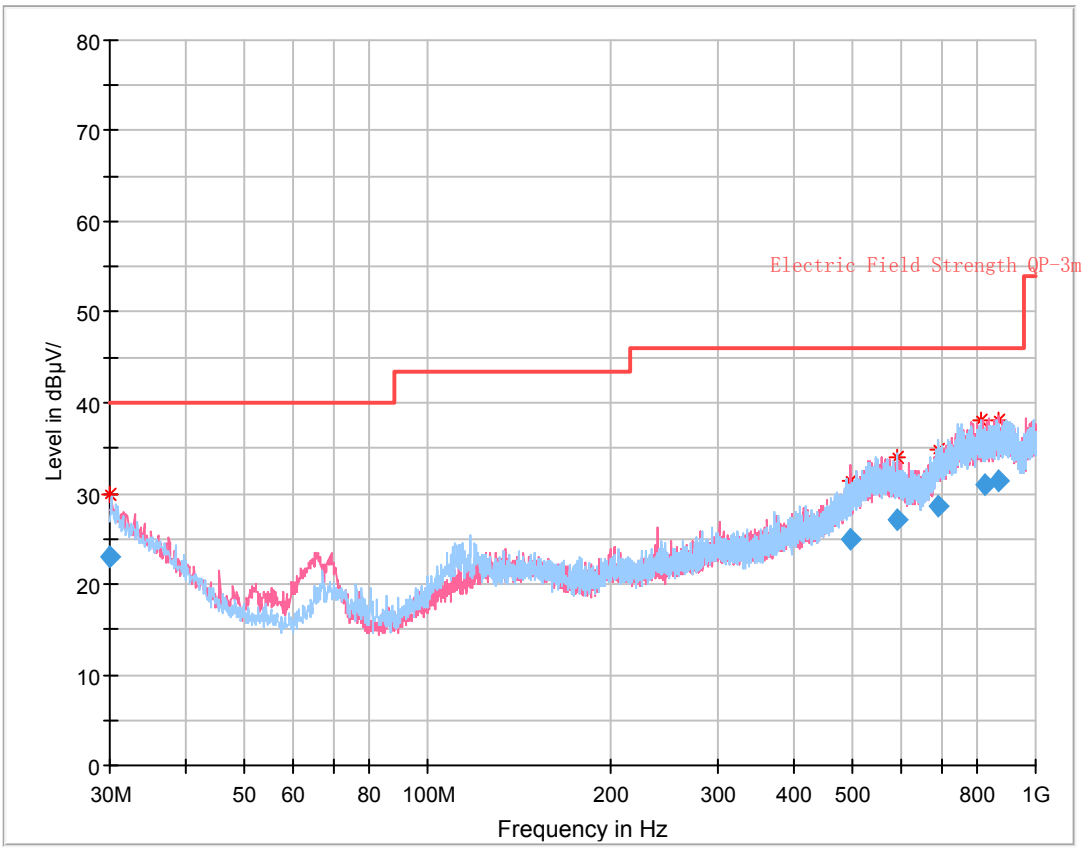
150 kHz~30 MHz



EUT

Date: 25.JUN.2018 09:43:14

3) Spurious Emissions (30 MHz~1GHz):



Frequency (MHz)	Corrected Amplitude (dBµV/m)	Antenna height (cm)	Antenna Polarity	Turntable position (degree)	Correction Factor (dB/m)	Limit (dBµV/m)	Margin (dB)
30.001242	22.95	400.0	H	192.0	0.7	40.00	17.05
495.413000	24.86	376.0	V	0.0	3.1	46.00	21.14
590.060375	27.07	151.0	H	355.0	4.8	46.00	18.93
692.758375	28.65	195.0	H	255.0	6.5	46.00	17.35
827.726750	30.98	378.0	V	308.0	9.4	46.00	15.02
868.138625	31.43	137.0	V	193.0	9.8	46.00	14.57

For model RG910:

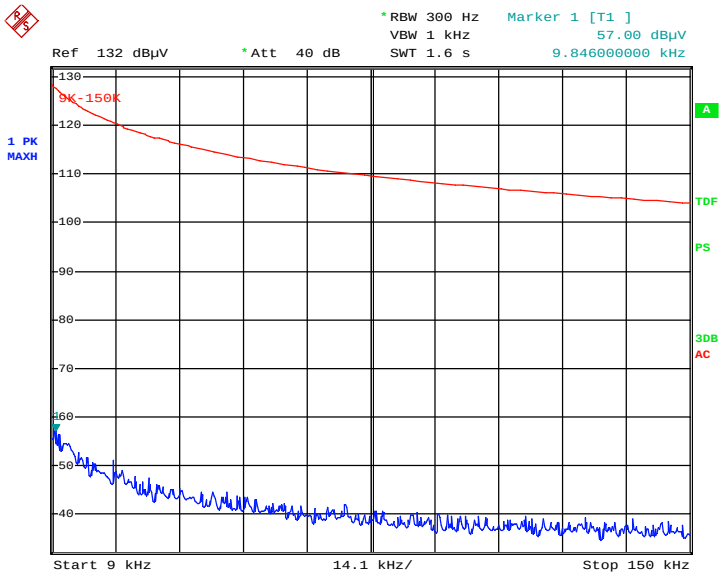
1) Spurious Emissions (9 kHz~30 MHz):

Indicated		Table Angle Degree	Antenna Height (m)	Detector	Correction Factor			Corrected Amplitude (dBμV/m) @3m	FCC part 15.225	
Freq. (MHz)	Corrected Amplitude (dBμV/m) @3m				Ant. Factor (dB)	Cable Loss (dB)	Pre-Amp. Gain (dB)		Limit (dBμV/m) @3m	Result
0.0098	-0.8	0	1	QP	87.8	0.2	30.2	57.00	127.78	Pass
0.15	19.96	0	1	QP	65.7	0.3	30.2	55.76	104.08	Pass

2) In band:

Indicated			Table Angle Degree	Antenna Height (m)	Detector	Correction Factor			Corrected Amplitude (dBμV/m) @3m	FCC part 15.225	
Frequency Range (MHz)	Mark Point (MHz)	Corrected Amplitude (dBμV/m) @3m				Ant. Factor (dB)	Cable Loss (dB)	Pre-Amp. Gain (dB)		Limit (dBμV/m) @3m	Result
13.110-13.410	13.391	71.11	0	1.2	QP	32	0.2	30.2	73.11	80.5	Pass
13.410-13.553	13.544	72.17	0	1	QP	32	0.2	30.2	74.17	90.5	Pass
13.553-13.567	13.559	73.24	0	1.1	QP	32	0.2	30.2	75.24	124.0	Pass
13.567-13.710	13.572	72.56	0	1.1	QP	32	0.2	30.2	74.56	90.5	Pass
13.710-14.010	13.798	70.31	0	1	QP	32	0.2	30.2	72.31	80.5	Pass

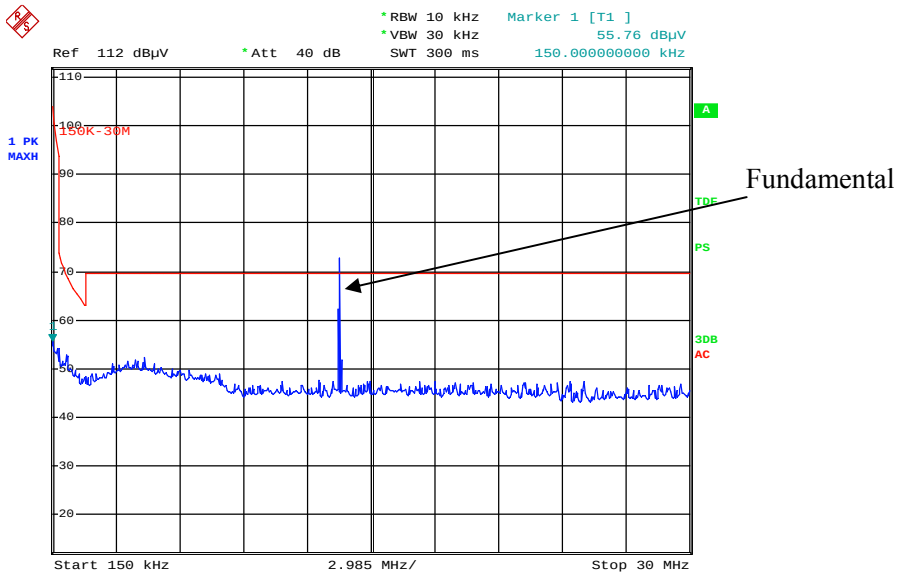
9 kHz~150 kHz



EUT

Date: 26.JUN.2018 09:38:16

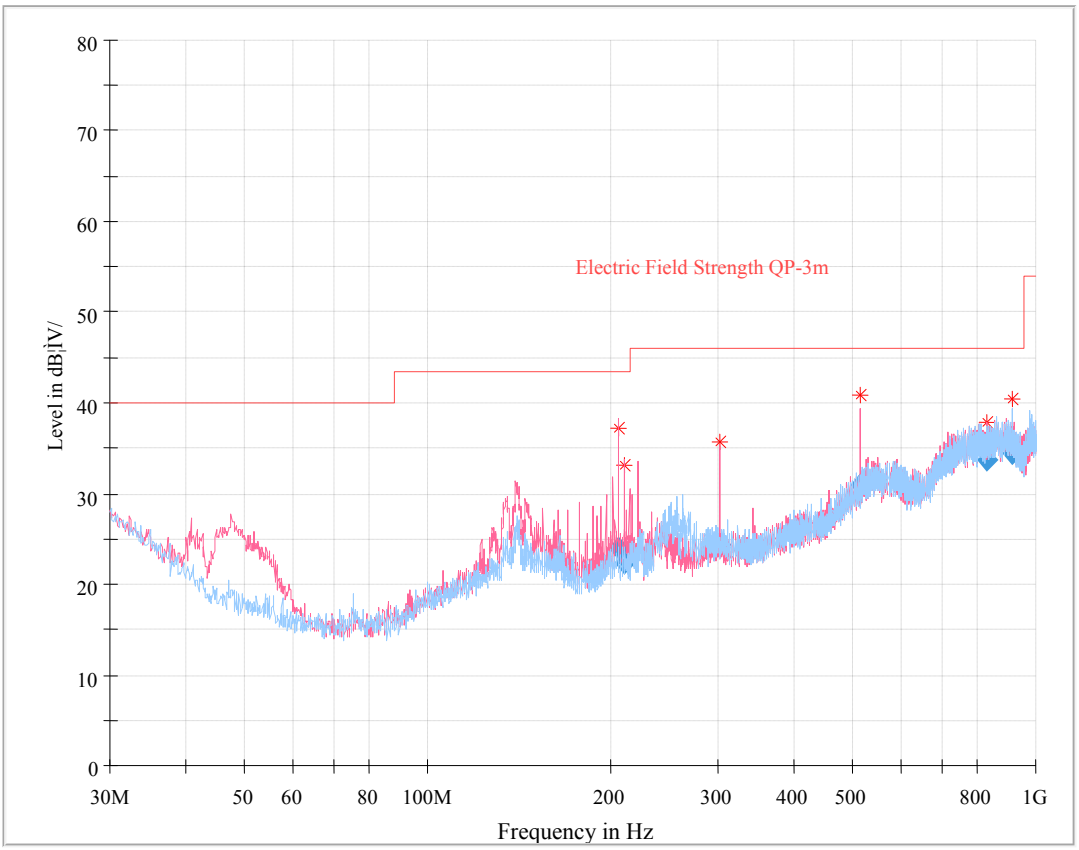
150 kHz~30 MHz



EUT

Date: 26.JUN.2018 09:46:00

3) Spurious Emissions (30 MHz~1GHz):



Frequency (MHz)	Corrected Amplitude (dBµV/m)	Antenna height (cm)	Antenna Polarity	Turntable position (degree)	Correction Factor (dB/m)	Limit (dBµV/m)	Margin (dB)
205.833250	24.63	112.0	V	207.0	-4.3	43.50	18.87
210.015375	22.51	365.0	V	222.0	-4.4	43.50	20.99
302.159375	24.97	262.0	V	228.0	-2.0	46.00	21.03
514.308500	31.18	315.0	V	231.0	3.9	46.00	14.82
829.317000	34.12	377.0	V	131.0	9.4	46.00	11.88
917.414250	34.93	266.0	H	141.0	9.5	46.00	11.07

Note:
1) Correction Factor =Antenna factor(Rx) + Cable Loss – Amplifier factor
2) Corrected Amplitude = Reading + Correction Factor
3) Margin = Limit – Corrected Amplitude

FCC§15.225(e) - FREQUENCY STABILITY

Applicable Standard

The frequency tolerance of the carrier signal shall be maintained within ±0.01% of the operating frequency over a temperature variation of −20 degrees to +50 degrees C at normal supply voltage, and for a variation in the primary supply voltage from 85% to 115% of the rated supply voltage at a temperature of 20 degrees C. For battery operated equipment, the equipment tests shall be performed using a new battery.

Test Procedure

Frequency Stability vs. Temperature: The equipment under test was connected to PC, then to an external AC power supply and inductive antenna was connected to a Spectrum Analyzer. The EUT was placed inside the temperature chamber.

After the temperature stabilized for approximately 20 minutes, the frequency output was recorded from the Spectrum Analyzer.

Frequency Stability vs. Voltage: An external variable AC power supply Source. The voltage was set to 115% of the nominal value and was then decreased until the transmitter light no longer illuminated; i.e., the end point. The output frequency was recorded for each voltage.

Test Data

Environmental Conditions

Temperature:	25 ℃
Relative Humidity:	52 %
ATM Pressure:	101.0 kPa

The testing was performed by Nancy Wang on 2018-06-25.

Test Mode: Transmitting

Test Result: Pass

For model IS910.1:

Voltage Supply (V_{DC})	Temperature (℃)	Measured Frequency (MHz)	Frequency Error	Part 15.225 Limit
3.7V	-20	13.559138	-0.00635%	±0.01%
	-10	13.559184	-0.00602%	±0.01%
	0	13.559099	-0.00664%	±0.01%
	10	13.559283	-0.00529%	±0.01%
	20	13.559296	-0.00519%	±0.01%
	30	13.559328	-0.00495%	±0.01%
	40	13.559376	-0.00460%	±0.01%
	50	13.559586	-0.00306%	±0.01%
3.5V	20	13.559745	-0.00188%	±0.01%
4.2V		13.559404	-0.00439%	±0.01%

FCC§15.215(c) - 20dB EMISSION BANDWIDTH

Requirement

Per 15.215 (c) Intentional radiators operating under the alternative provisions to the general emission limits, as contained in §§ 15.217 through 15.257 and in Subpart E of this part, must be designed to ensure that the 20 dB bandwidth of the emission, or whatever bandwidth may otherwise be specified in the specific rule section under which the equipment operates, is contained within the frequency band designated in the rule section under which the equipment is operated. The requirement to contain the designated bandwidth of the emission within the specified frequency band includes the effects from frequency sweeping, frequency hopping and other modulation techniques that may be employed as well as the frequency stability of the transmitter over expected variations in temperature and supply voltage. If a frequency stability is not specified in the regulations, it is recommended that the fundamental emission be kept within at least the central 80% of the permitted band in order to minimize the possibility of out-of-band operation.

Test Procedure

1. Check the calibration of the measuring instrument using either an internal calibrator or a known signal from an external generator.
2. Position the EUT on the table of the chamber, Turn on the EUT. Then set it to any one convenient frequency within its operating range. Set a reference level on the measuring instrument equal to the highest peak value.
3. Measure the frequency difference of two frequencies that were attenuated 20 dB from the reference level. Record the frequency difference as the emission bandwidth.

Test Data

Environmental Conditions

Temperature:	25 ℃
Relative Humidity:	52 %
ATM Pressure:	101.0 kPa

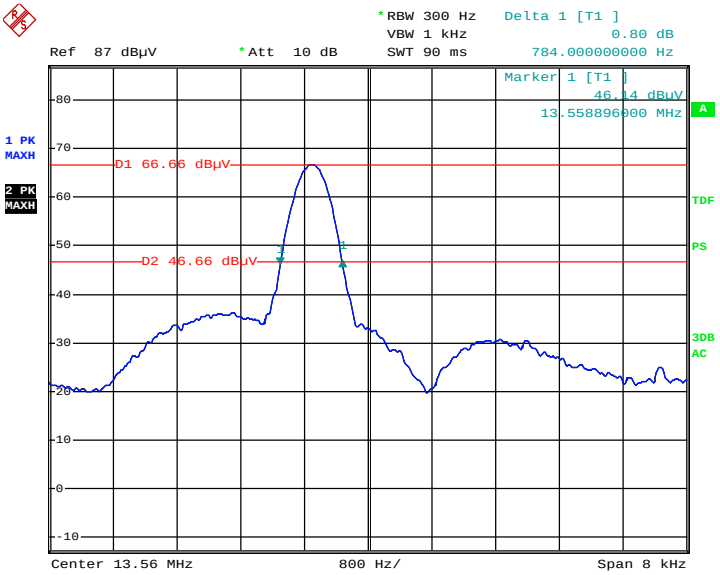
The testing was performed by Nancy Wang on 2018-06-25.

Test Mode: Transmitting

Test Result: Pass

For model IS910.1:

20 dB Emission Bandwidth



EUT

Date: 25.JUN.2018 09:00:29

******* END OF REPORT *******