



FCC PART 15B, CLASS B

TEST REPORT

For

Racing Electronics

840 Derita Road, Concord, North Carolina, United States

FCC ID:WZ5-SWITCH

Report Type: Original Report	Product Type: SWITCH
Report Number: <u>RSZ171123008-00</u>	
Report Date: <u>2018-01-08</u>	
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GENERAL INFORMATION

Product Description for Equipment under Test (EUT)

The Racing Electronics's product, model number: SWITCH (FCC ID: WZ5-SWITCH) or the "EUT" in this report was a SWITCH, which was measured approximately: 76.0 mm (L) * 44.0mm (W) * 20.0mm (H), rated with input voltage: DC 1.5V*2 AAA from battery. The highest operation frequency is 470MHz.

Frequency Range	450-470 MHz
Signal Type	FM

Notes: This series products model: SWITCH RACER and SWITCH are identical; they have the same or similar appearance, structure, PCB, Material and function to the testing products, and only are different for model name. Model SWITCH was selected for fully testing, the detailed information can be referred to the declaration which was stated and guaranteed by the applicant.

**All measurement and test data in this report was gathered from production sample serial number: 1702579. (Assigned by BACL, Shenzhen). The EUT supplied by the applicant was received on 2017-11-23.*

Objective

This test report is prepared on behalf of Racing Electronics ,in accordance with Part 2-Subpart J, Part 15-Subparts A, B of the Federal Communication Commissions rules.

The objective of the manufacturer is to determine the compliance of the EUT with FCC Part 15 B.

Related Submittal(s)/Grant(s)

No related submissions.

Test Methodology

All measurements contained in this report were conducted with ANSI C63.4-2014, American National Standard for Methods of Measurement of Radio-Noise Emissions from Low-Voltage Electrical and Electronic Equipment in the range of 9 kHz to 40 GHz.

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	
Conducted Emissions	$\pm 1.95\text{dB}$	
Emissions, radiated	Below 1GHz	$\pm 4.75\text{dB}$
	Above 1GHz	$\pm 4.88\text{dB}$

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.

Bay Area Compliance Laboratories Corp. (Shenzhen) has been accredited to ISO/IEC 17025 by CNAS(Lab code: L2408). And accredited to ISO/IEC 17025 by NVLAP(Lab code: 200707-0), the FCC Designation No. CN5001 under the KDB 974614 D01.

The Federal Communications Commission has the reports on file and is listed under FCC Registration No.: 382179. The test site has been approved by the FCC for public use and is listed in the FCC Public Access Link (PAL) database.

Bay Area Compliance Laboratories Corp. (Shenzhen) was registered with ISED Canada under ISED Canada Registration Number 3062B.

SYSTEM TEST CONFIGURATION

Description of Test Configuration

The system was configured for testing in a manufacturer testing fashion.

EUT operation mode 1: Receiving

EUT operation mode 2: Scanning

EUT Exercise Software

No exercise software was used.

Special Accessories

No special accessory.

Equipment Modifications

No modification was made to the EUT tested.

Support Equipment List and Details

Manufacturer	Description	Model	Serial Number
Xiaomi	Mobile Phone	MI 4	N/A

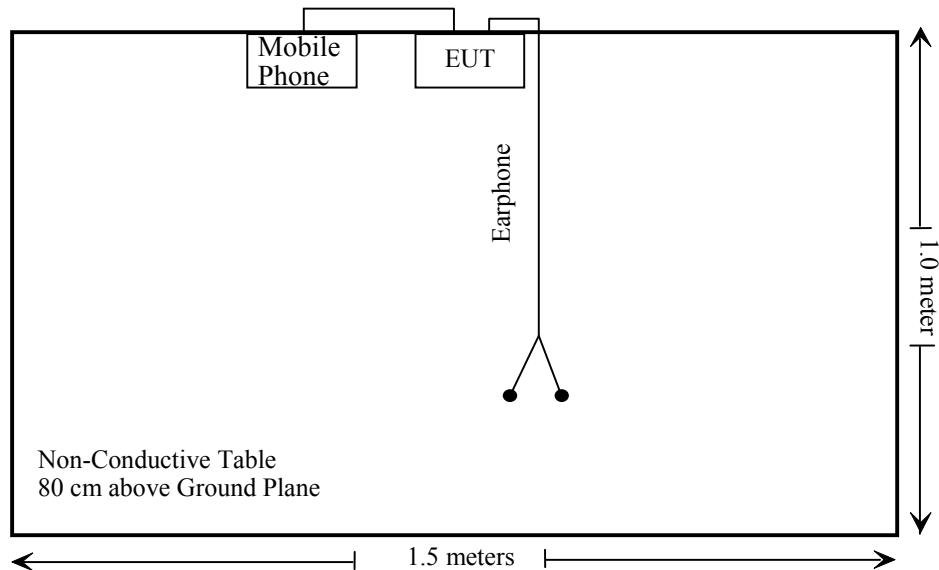
External I/O Cable

Cable Description	Length (m)	From/Port	To
Earpiece	1.5	EUT	/
Audio Cable	1.0	Mobile Phone	EUT

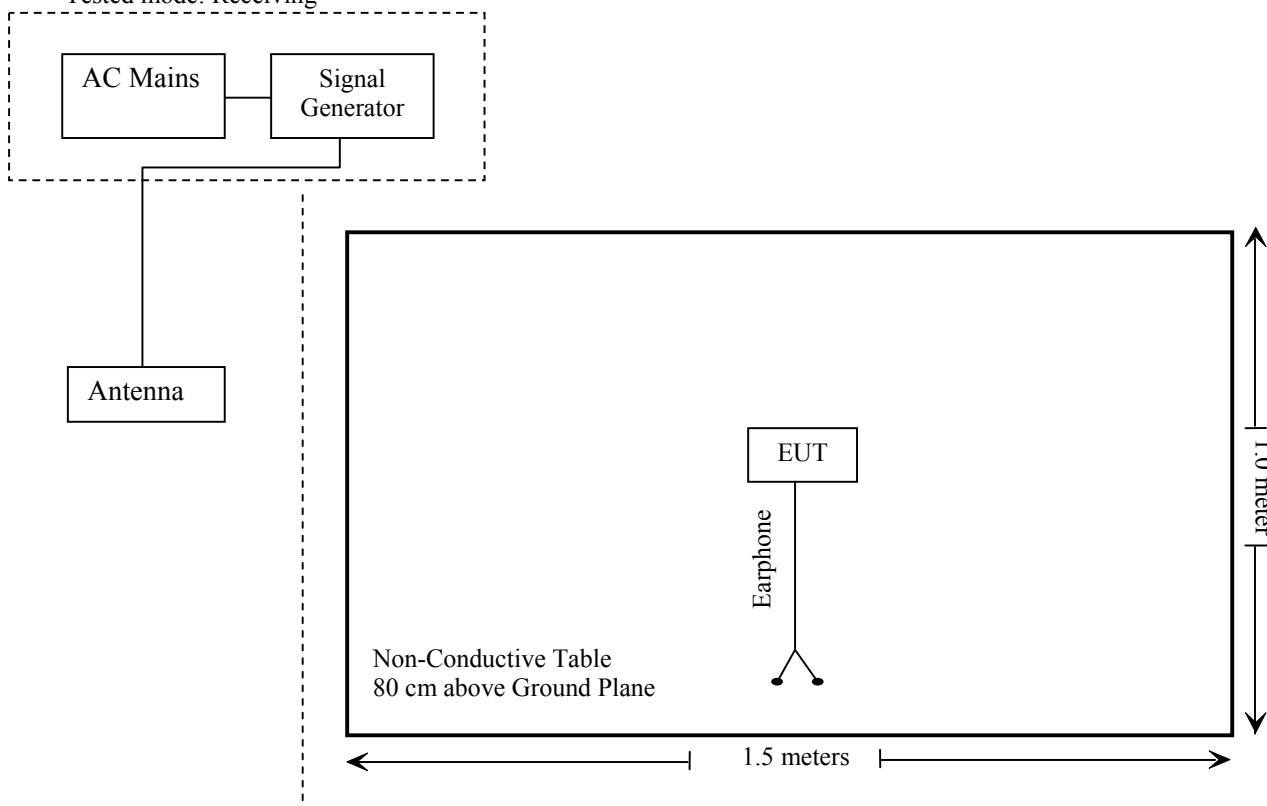
Block Diagram of Test Setup

For Radiation Emission:

Tested mode: Scanning



Tested mode: Receiving



SUMMARY OF TEST RESULTS

FCC Rules	Description of Test	Results
§15.107	AC Line Conducted Emissions	Not Applicable
§15.109	Radiated Spurious Emissions	Compliance
§15.121	Compliance for Scanning Receiver	Compliance

Note: The EUT is powered by battery only.

TEST EQUIPMENT LIST

Manufacturer	Description	Model	Serial Number	Calibration Date	Calibration Due Date
Radiated Emission Test					
Sunol Sciences	Horn Antenna	DRH-118	A052604	2014-12-29	2017-12-28
Rohde & Schwarz	Signal Analyzer	FSIQ26	8386001028	2017-04-24	2018-04-24
Sunol Sciences	Bi-log Antenna	JB1	A040904-2	2014-12-17	2017-12-16
Mini	Pre-amplifier	ZVA-183-S+	5969001149	2017-02-14	2018-02-14
HP	Amplifier	HP8447E	1937A01046	2017-11-19	2018-05-21
Rohde & Schwarz	EMI Test Receiver	ESCI	101120	2017-12-07	2018-12-07
EMCO	Horn Antenna	3115	9903-5766	NCR	NCR
HP	Signal Generator	8648C	3426A01345	2017-04-19	2018-04-19
Ducommun technologies	RF Cable	UFA210A-1-4724-30050U	MFR64369 223410-001	2017-11-19	2018-05-21
Ducommun technologies	RF Cable	104PEA	218124002	2017-11-19	2018-05-21
Ducommun technologies	RF Cable	RG-214	1	2017-11-19	2018-05-21
Ducommun technologies	RF Cable	RG-214	2	2017-11-22	2018-05-22
RF Conducted Test					
HP Agilent	RF Communication Test Set	HP8920	3325U00859	2017-05-07	2018-05-07
Agilent	Signal Generator	8665B	3744A01692	2017-01-12	2018-01-12

*** 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).

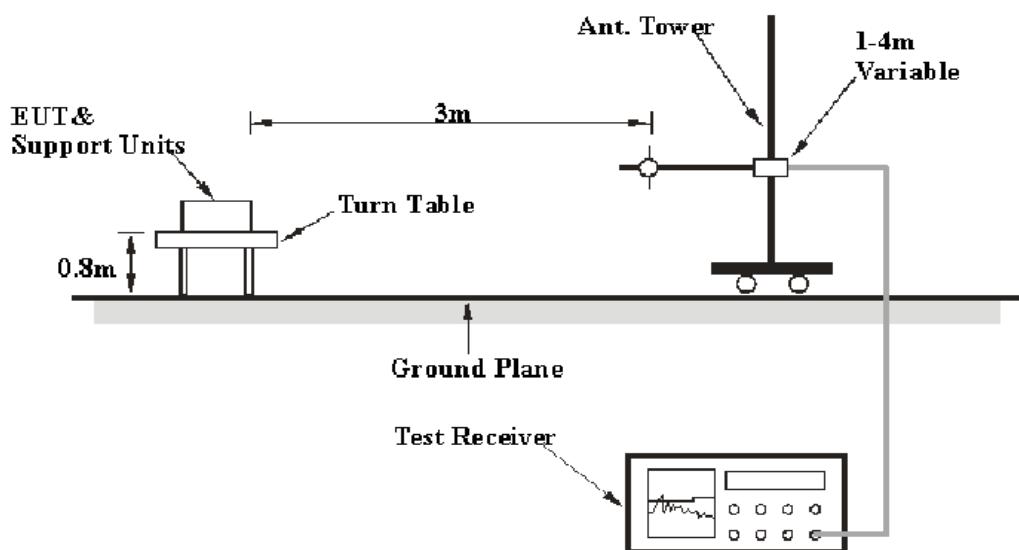
FCC §15.109 - RADIATED SPURIOUS EMISSIONS

Applicable Standard

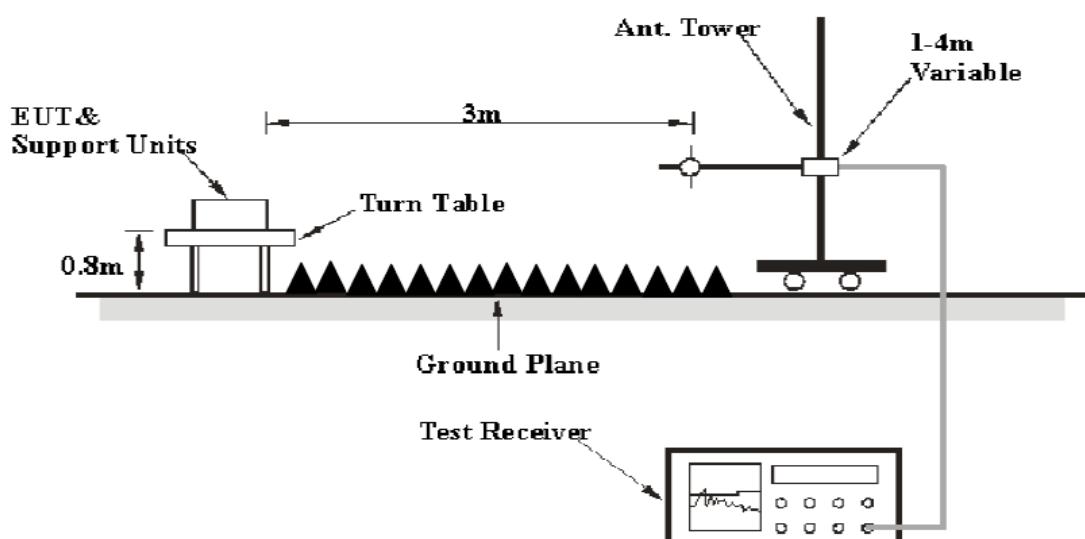
FCC §15.109

EUT Setup

Below 1GHz:



Above 1GHz:



The radiated emission tests were performed in the 3 meters chamber test site, using the setup accordance with the ANSI C63.4-2014. The specification used was the FCC Part 15.109 Class B limits.

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 system was investigated from 30 MHz to 2 GHz.

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

Frequency Range	RBW	Video B/W	IF B/W	Measurement
30 MHz – 1000 MHz	100 kHz	300 kHz	120 kHz	QP
Above 1 GHz	1MHz	3 MHz	/	PK
	1MHz	10 Hz	/	Ave.

Test Procedure

Maximizing procedure was performed on the highest emissions to ensure that the EUT complied with all installation combinations.

All data was recorded in the Quasi-peak detector mode from 30 MHz to 1 GHz and PK and average detector modes for frequencies above 1 GHz.

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:

$$\text{Corrected Amplitude} = \text{Meter Reading} + \text{Antenna Factor} + \text{Cable Loss} - \text{Amplifier Gain}$$

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:

$$\text{Margin} = \text{Limit} - \text{Corrected Amplitude}$$

Test Results Summary

According to the data in the following table, the EUT complied with the FCC §15.109 Class B,

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

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

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

Test Data

Environmental Conditions

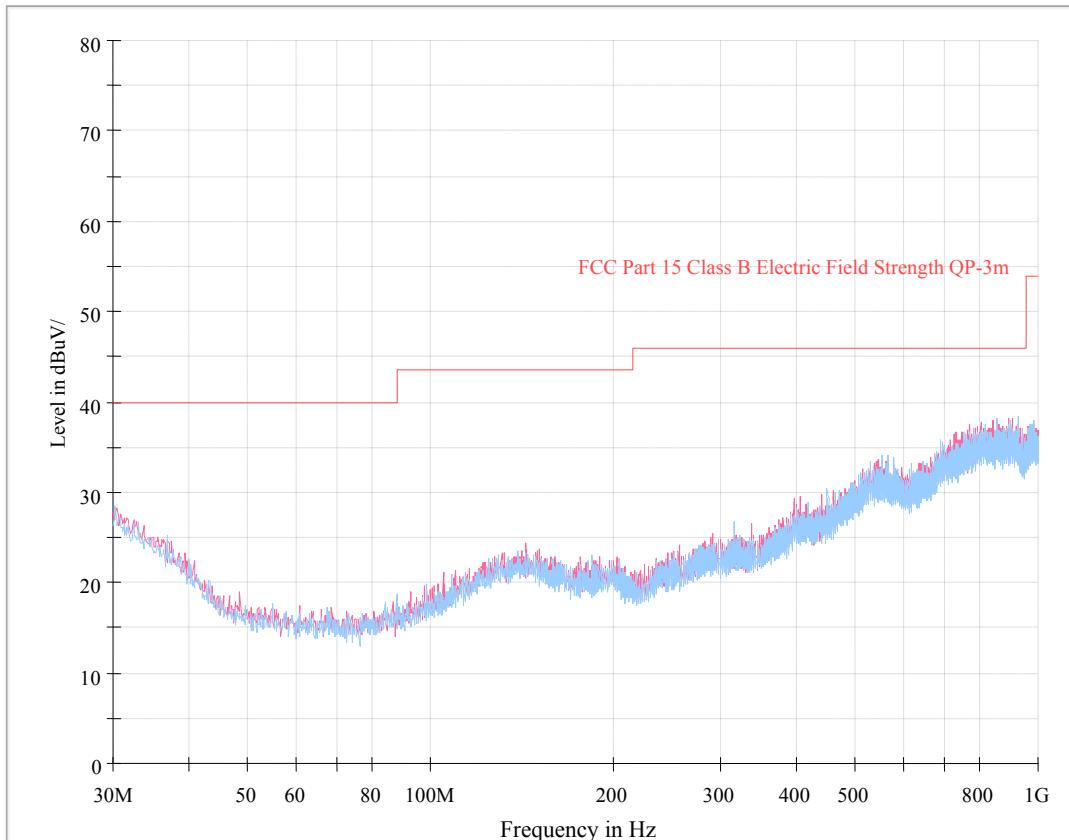
Temperature:	24 °C
Relative Humidity:	56 %
ATM Pressure:	101.0 kPa

The testing was performed by Simon Wang on 2017-12-12 and 2018-01-08.

EUT Operation Mode: Receiving

Frequency: 450.0125MHz

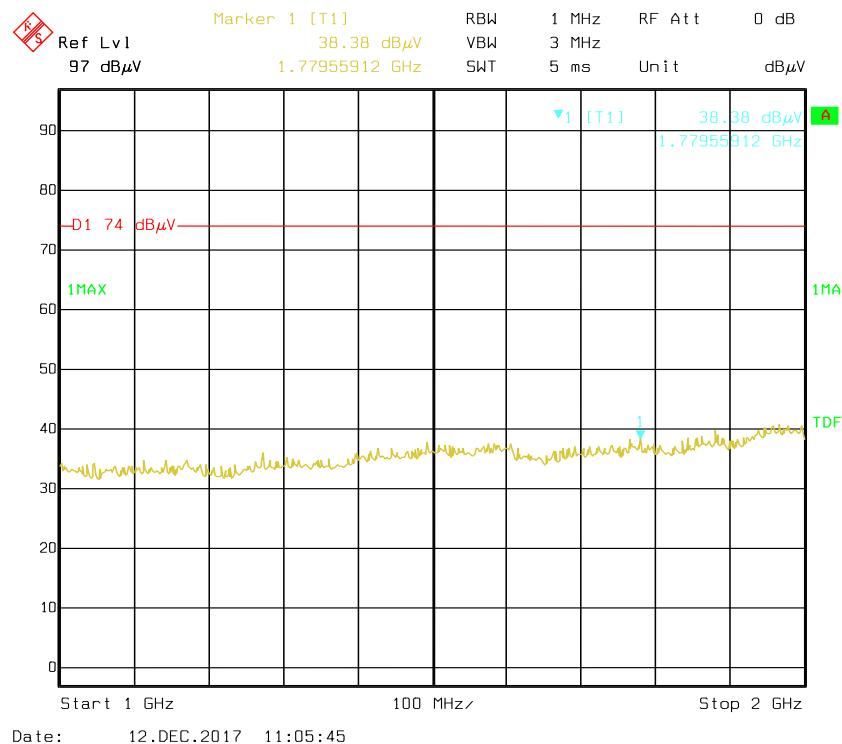
30 MHz~1 GHz:



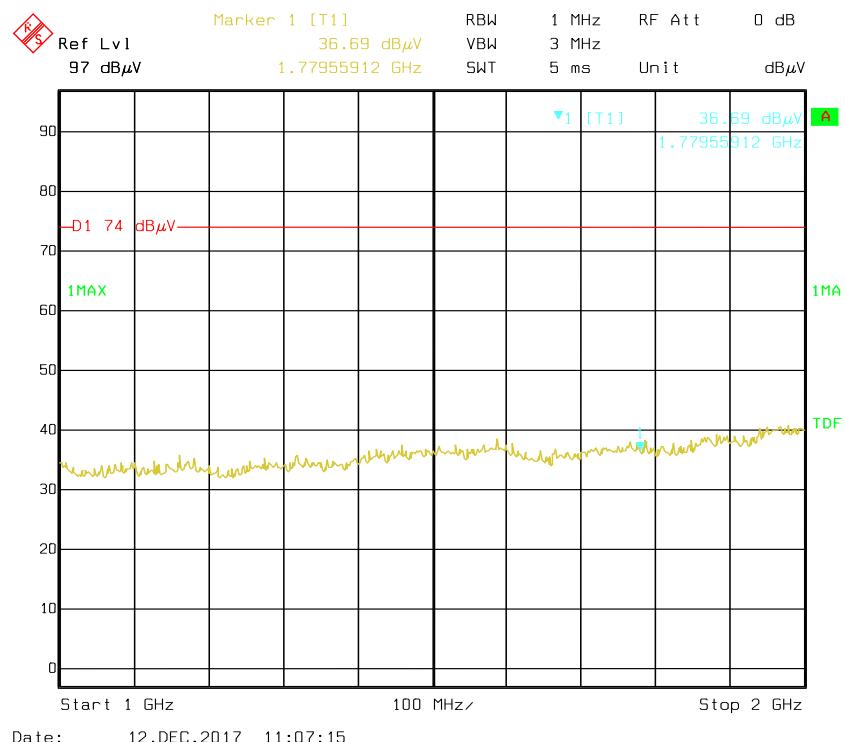
Frequency (MHz)	Corrected Amplitude (dB μ V/m)	Antenna height (cm)	Antenna Polarity	Turntable position (degree)	Correction Factor (dB/m)	Limit (dB μ V/m)	Margin (dB)
All spurious emissions are 20 dB below the limit or are on the system noise floor level.							

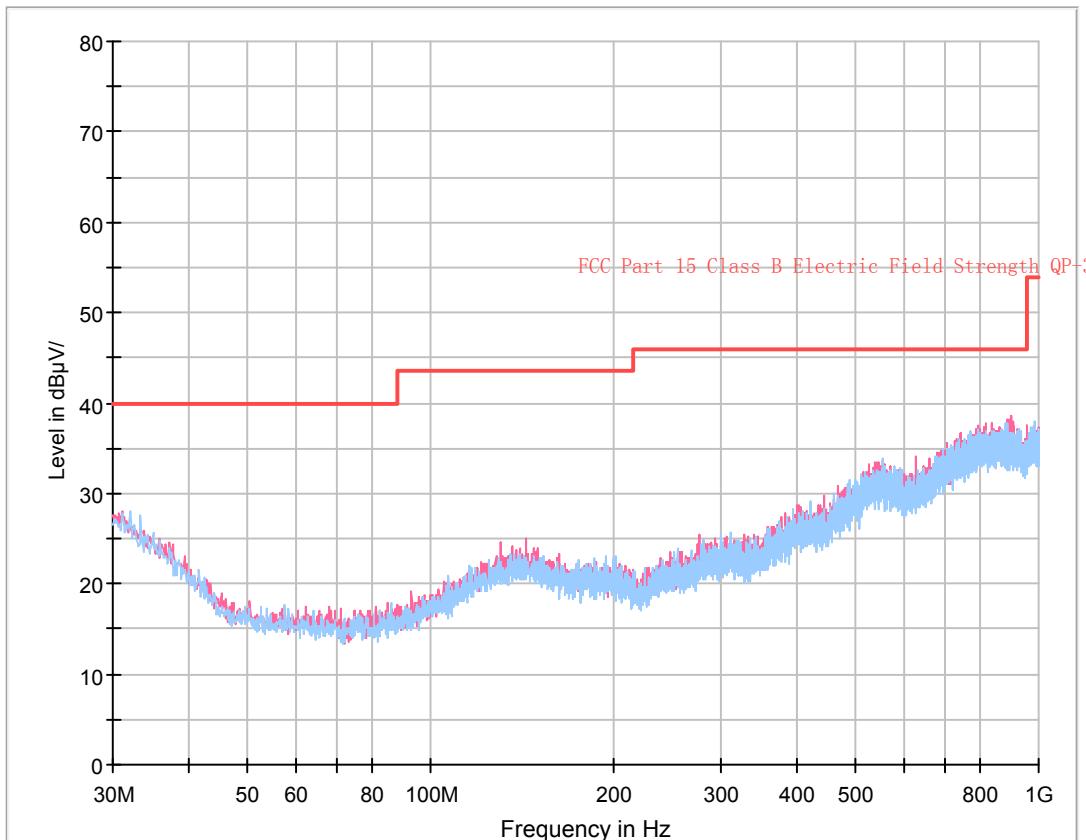
1 GHz – 2 GHz:

Frequency (MHz)	Receiver		Turtable Degree	Rx Antenna		Corrected Factor (dB/m)	Corrected Amplitude (dBuV/m)	FCC Part 15B	
	Reading (dB μ V)	PK/QP/Ave.		Height (m)	Polar (H / V)			Limit (dBuV/m)	Margin (dB)
All spurious emissions are 20 dB below the limit or are on the system noise floor level									

Pre-scan and worst case for Horizontal as below

Pre-scan and worst case for Vertical as below



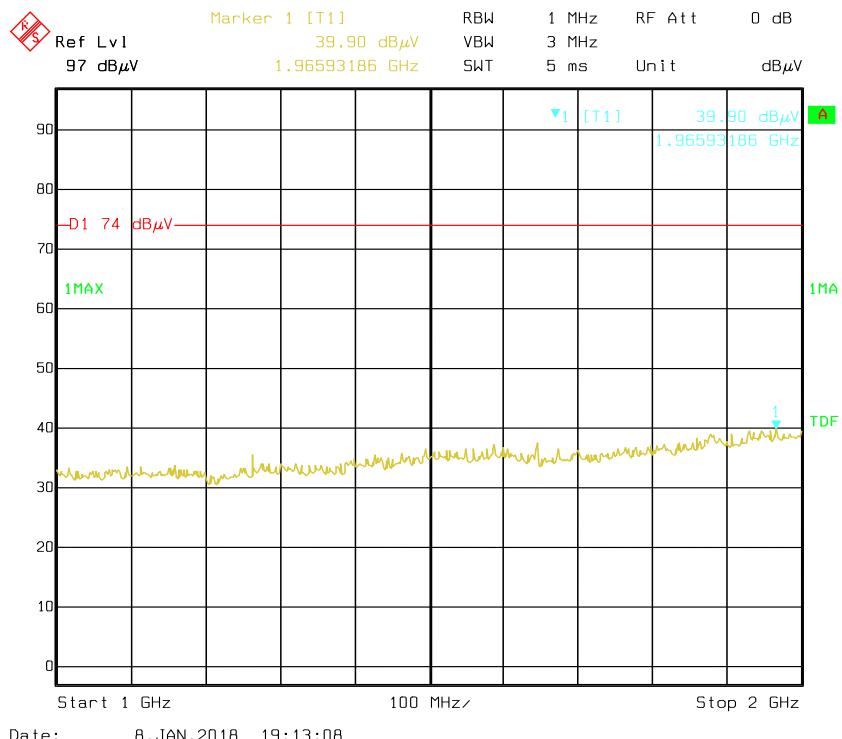
Frequency: 460 MHz**30 MHz~1 GHz:**

Frequency (MHz)	Corrected Amplitude (dB μ V/m)	Antenna height (cm)	Antenna Polarity	Turntable position (degree)	Correction Factor (dB/m)	Limit (dB μ V/m)	Margin (dB)
All spurious emissions are 20 dB below the limit or are on the system noise floor level.							

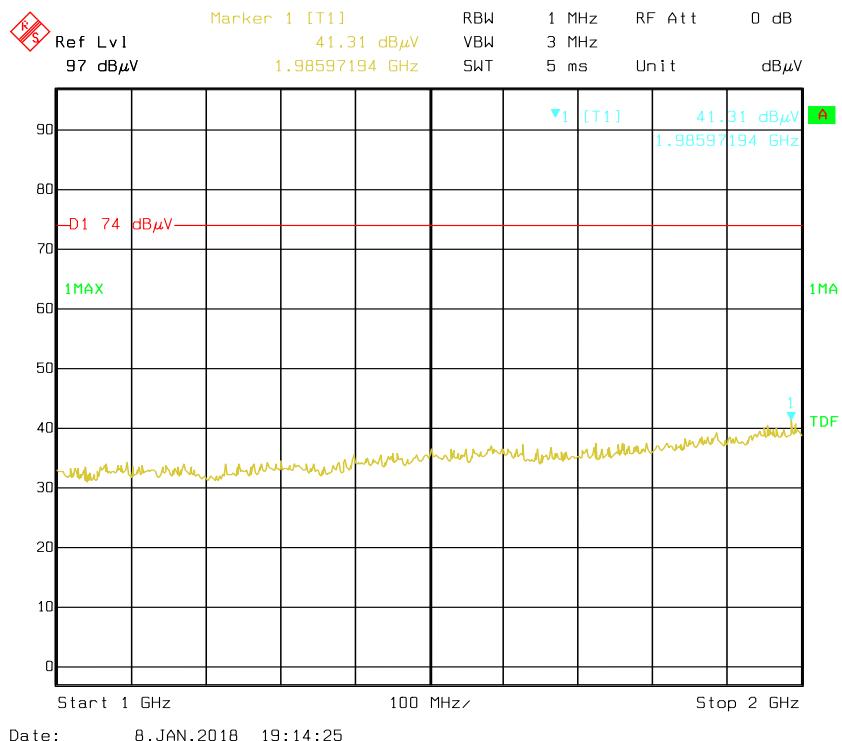
1 GHz – 2 GHz:

Frequency (MHz)	Receiver		Turntable Degree	Rx Antenna		Corrected Factor (dB/m)	Corrected Amplitude (dB μ V/m)	FCC Part 15B	
	Reading (dB μ V)	PK/QP/Ave.		Height (m)	Polar (H / V)			Limit (dB μ V/m)	Margin (dB)
All spurious emissions are 20 dB below the limit or are on the system noise floor level.									

Pre-scan and worst case for Horizontal as below

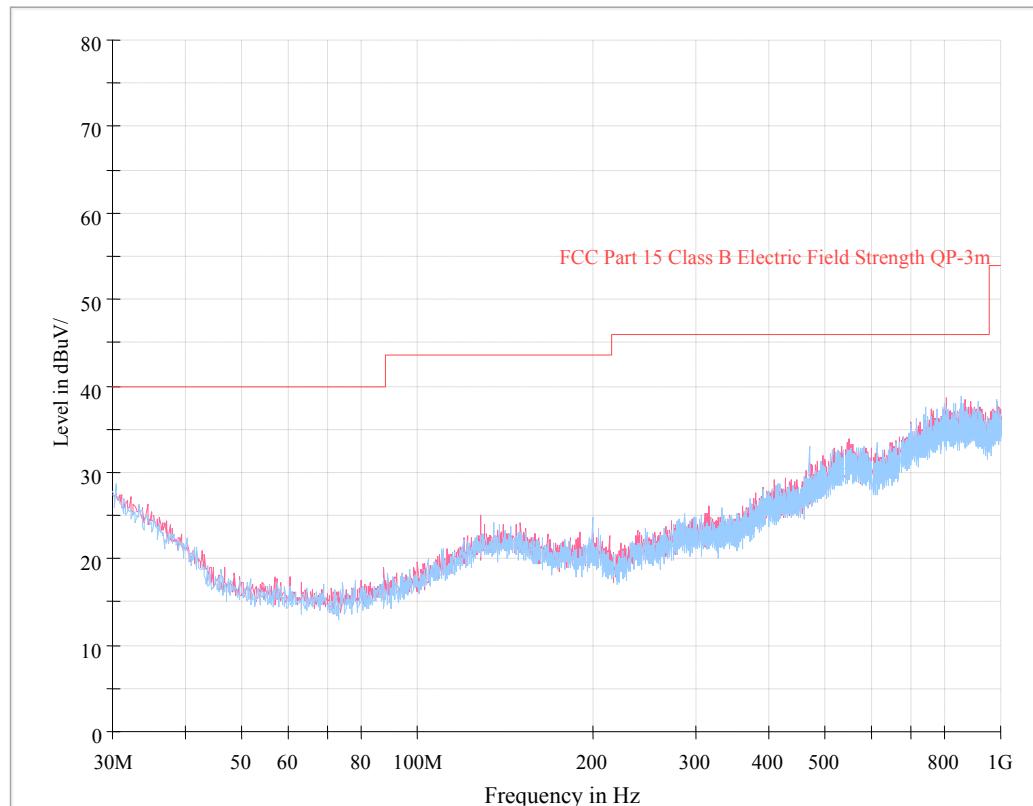


Pre-scan and worst case for Vertical as below



Frequency: 469.9875MHz

30 MHz~1 GHz:

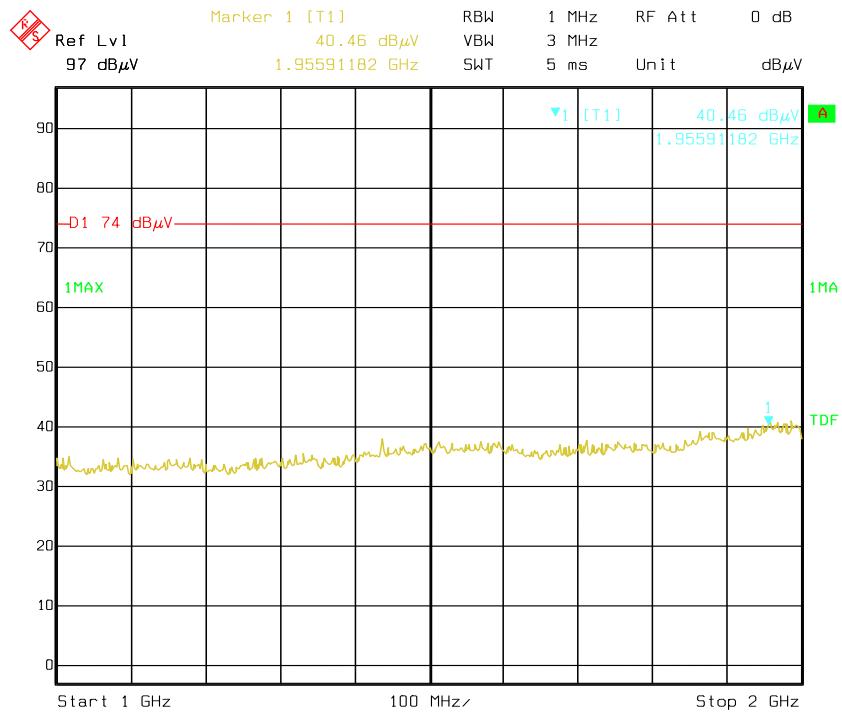


Frequency (MHz)	Corrected Amplitude (dB μ V/m)	Antenna height (cm)	Antenna Polarity	Turntable position (degree)	Correction Factor (dB/m)	Limit (dB μ V/m)	Margin (dB)
All spurious emissions are 20 dB below the limit or are on the system noise floor level.							

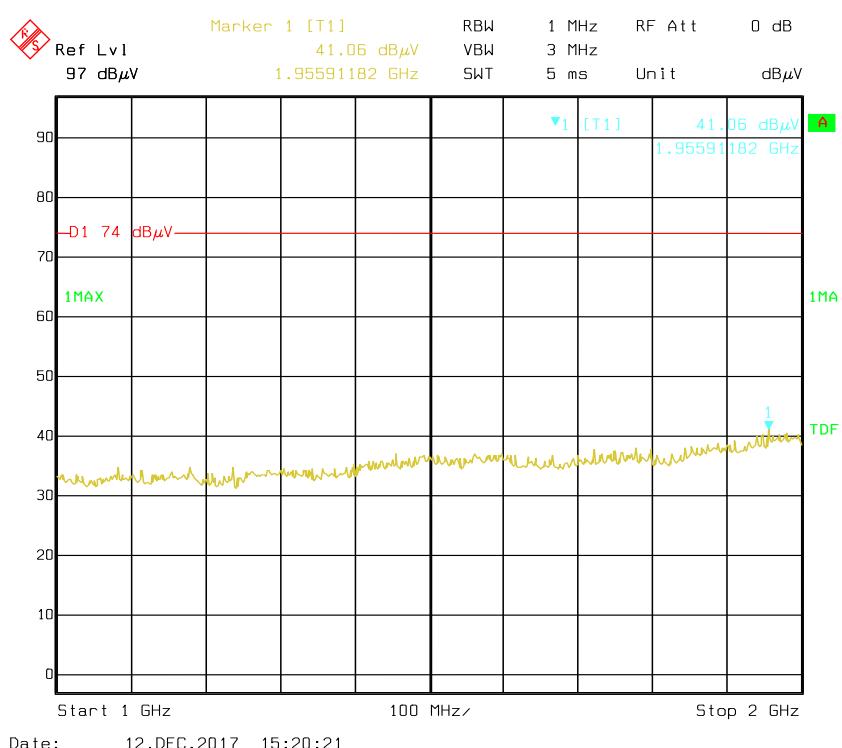
1 GHz – 2 GHz:

Frequency (MHz)	Receiver		Turntable Degree	Rx Antenna		Corrected Factor (dB/m)	Corrected Amplitude (dBuV/m)	FCC Part 15B	
	Reading (dB μ V)	PK/QP/Ave.		Height (m)	Polar (H / V)			Limit (dBuV/m)	Margin (dB)
All spurious emissions are 20 dB below the limit or are on the system noise floor level.									

Pre-scan and worst case for Horizontal as below

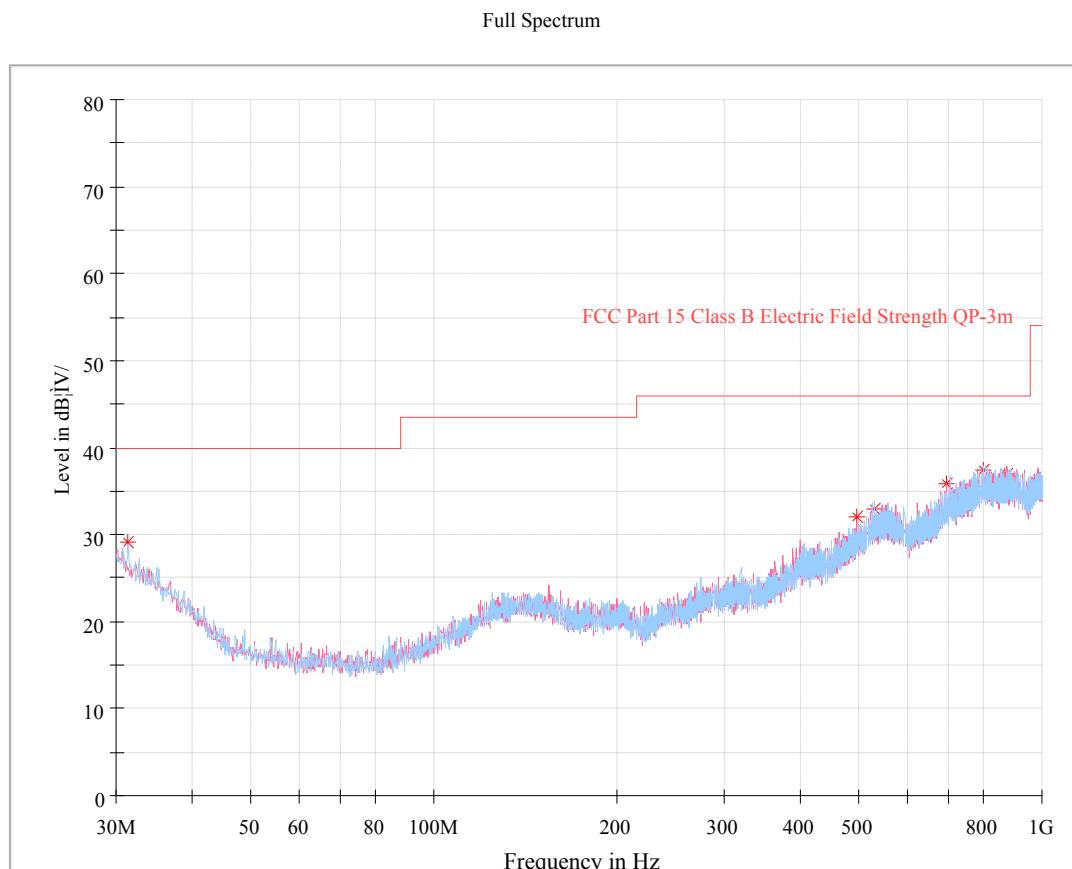


Pre-scan and worst case for Vertical as below



EUT Operation Mode: scanning

30 MHz~1 GHz:



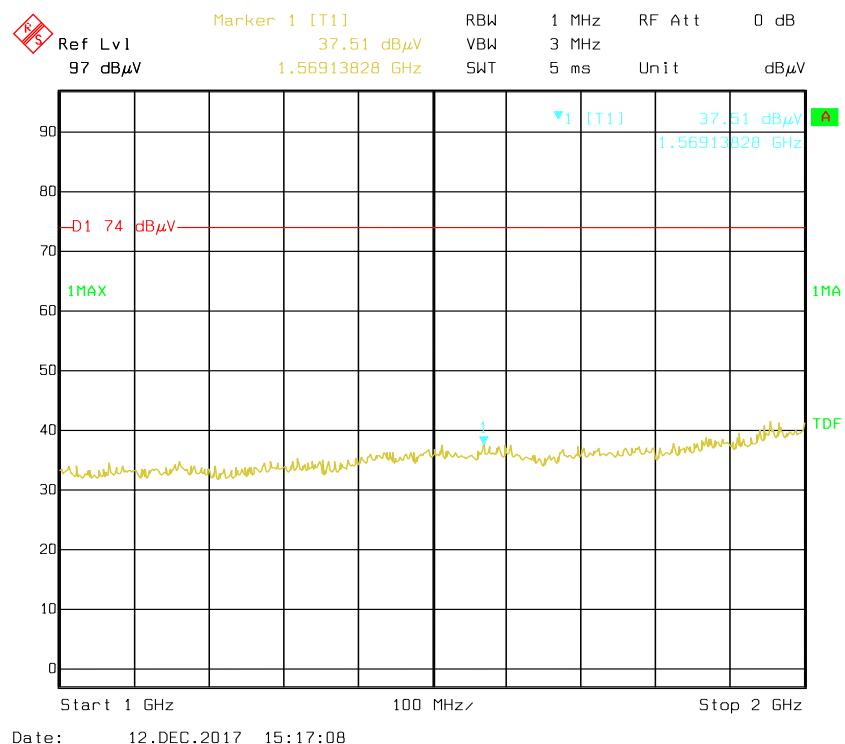
Frequency (MHz)	Corrected Amplitude (dB μ V/m)	Antenna height (cm)	Antenna Polarity	Turntable position (degree)	Correction Factor (dB/m)	Limit (dB μ V/m)	Margin (dB)
All spurious emissions are 20 dB below the limit or are on the system noise floor level.							

1 GHz – 2 GHz:

Frequency (MHz)	Receiver		Turtable Degree	Rx Antenna		Corrected Factor (dB/m)	Corrected Amplitude (dBuV/m)	FCC Part 15B	
	Reading (dB μ V)	PK/QP/Ave.		Height (m)	Polar (H / V)			Limit (dBuV/m)	Margin (dB)
All spurious emissions are 20 dB below the limit or are on the system noise floor level.									

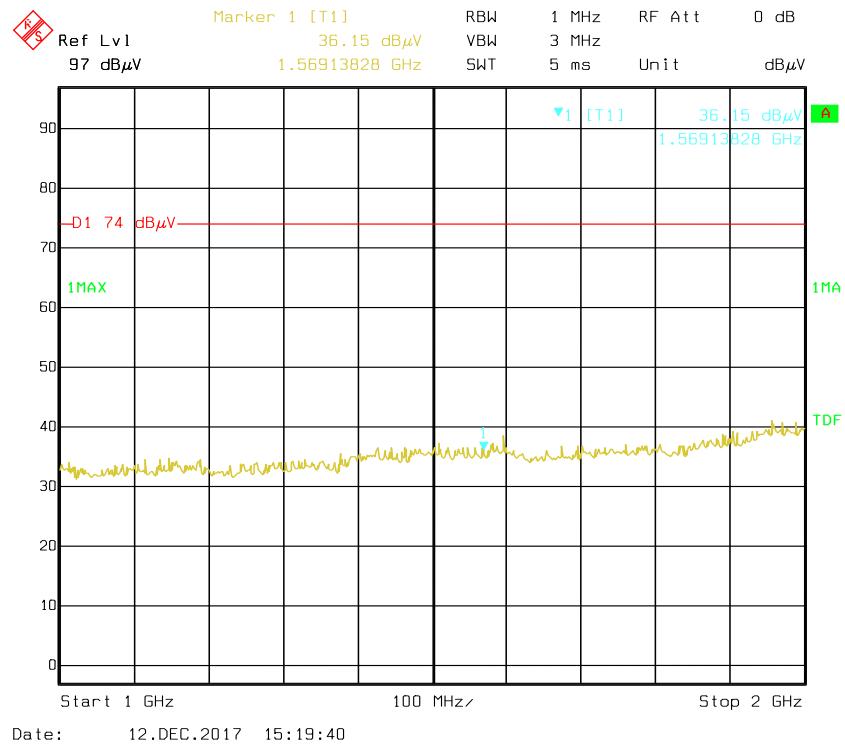
Note:

- 1) Correction Factor=Antenna factor (RX) + cable loss – amplifier factor
- 2) Corrected Amplitude = Correction Factor + Reading
- 3) Margin = Limit - Corrected Amplitude

Pre-scan and worst case for Horizontal as below

Date: 12.DEC.2017 15:17:08

Pre-scan and worst case for Vertical as below



FCC §15.121 - COMPLIANCE FOR SCANNING RECEIVER

Applicable Standard

FCC §15.121

EUT Setup

For FCC §15.121(b) Scanning Receiver Cellular Band Rejection Test



Test Procedure

- 1) Connected the EUT as shown in the above block diagram.
- 2) Apply a RF signal to the receiver input port at lowest, middle and highest channel frequencies of receiver operation band.
- 3) Adjust the audio output level of the receiver to it's rated value with the distortion less than 10%.
- 4) Adjust the RF Signal Generator Output Power to produce 12 dB SINAD without the audio output power dropping by more than 3 dB. This output level of the RF SG at each channel frequency is the sensitivity of the receiver.
- 5) Select the lowest or worse-case sensitivity level for all of the bands as the reference sensitivity.
- 6) Adjust the RF Signal Generator output to a level of +60 dB above the reference sensitivity obtained in step 5) and its frequency to the frequency points in the cellular band.
- 7) Set the receiver in a scanning mode and allow it to scan through it's preset frequencies.
- 8) If the receiver unsquelched or stopped on any frequency, receiving at this frequency, then adjust the signal generator output level until 12 dB SINAD is produced, this level is the spurious value and the difference between the reference sensitivity and the spurious value is the rejection ratio and must be at least 38dB.
- 9) Repeat above procedure at the frequencies 824.5, 836.0, and 848.5 MHz for the mobile band, and 869.1, 881.5, and 893.5MHz for the cellular base band.

Test Results Summary

Comply with FCC 121(a):

- Please refer to the technical informations or the attestation letter conforming compliance with this requirement.

Comply with FCC 121(b):

- Please refer to the following Scanning Receiver Cellular Band Rejection Test Result.

Comply with FCC 121(c):

- Not applicable.

Comply with FCC 121(d):

- Please refer to the User Manual.

Comply with FCC 121(e):

- This Scanning Receiver is not assembled from kits or marketed in kit form.

Comply with FCC 121(f):

- Please refer to the User Manual.

Test Data

For FCC §15.121(b) Scanning Receiver Cellular Band Rejection

Environmental Conditions

Temperature:	25 °C
Relative Humidity:	55 %
ATM Pressure:	101.0 kPa

The testing was performed by Simon Wang on 2017-12-12.

EUT Operation Mode: Scanning+Receiving Mode

Scanning Receiver Cellular Band Rejection Test Data:

Frequency Band (MHz)	Test Frequencies of Cellular Band (MHz)	Spurious Value of Cellular Frequencies for 12 dB SINAD (dBm)	Reference Sensitivity for 12 dB SINAD (dBm)	Rejection Ratio (dB)	Rejection Ratio Limit (dB)
450–470	824.5, 836.0, 848.5, 869.1, 881.5, 893.5	> -49.5	-106.1	< -56.6	< -38.0

Note: Rejection Ratio = Reference Sensitivity - Spurious Value

Result

Compliance with the requirements specified in Part 15.121 for scanning receive
***** END OF REPORT *****