

FCC/ISED  
**RF**  
**TEST REPORT**

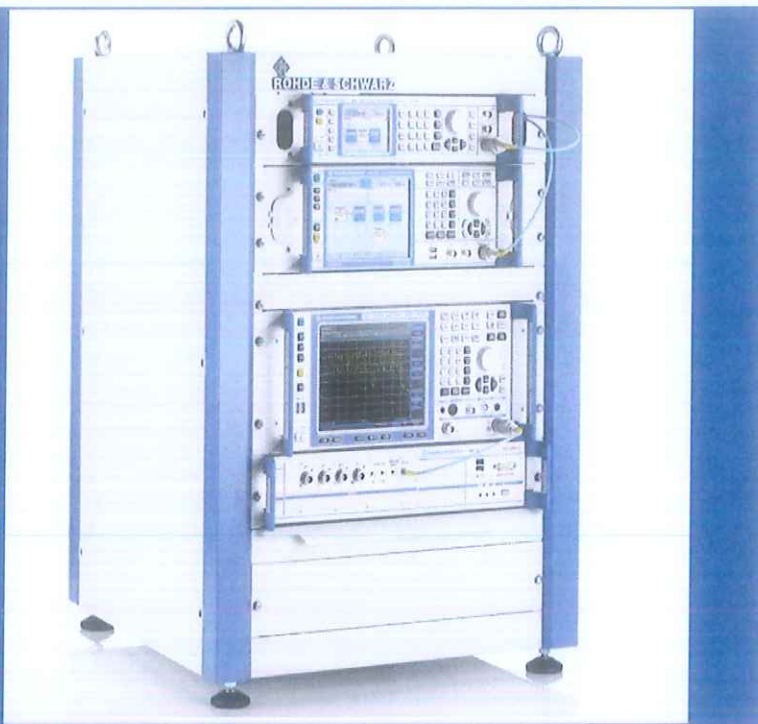
ISSUED BY  
Shenzhen BALUN Technology Co., Ltd.



FOR  
**RFID Reader**

ISSUED TO  
CONVERGENCE SYSTEMS LIMITED

11/F., Tower 1, Tern Centre, 237 Queen's Road, Central, Hong Kong



Tested by: *Hu Chao*  
Hu Chao  
(Engineer)  
Date: *May 20, 2018*

Approved by: *[Signature]*  
Liao Jiansheng  
(Technical Director)  
Date: *May 20, 2018*

Report No.: BL-HK1830324-604  
EUT Name: RFID Reader  
Model Name: CS463-2  
Brand Name: CSL  
Test Standard: 47 CFR Part 15 Subpart C  
RSS-Gen (Issue 4, November 2014)  
RSS-247 (Issue 2, February 2017)  
FCC ID: UB4CS463C1GEN2  
ISED Number: 8073A-CS4632CA

Test Conclusion: Pass  
Test Date: Apr. 16, 2018 ~ Apr. 24, 2018  
Date of Issue: May 30, 2018

*NOTE: This test report of test results only related to testing samples, which can be duplicated completely for the legal use with the approval of the applicant; it shall not be reproduced except in full, without the written approval of Shenzhen BALUN Technology Co., Ltd. BALUN Laboratory. Any objections should be raised within thirty days from the date of issue. To validate the report, please contact us.*

### Revision History

<u>Version</u>	<u>Issue Date</u>	<u>Revisions Content</u>
<u>Rev. 01</u>	<u>May 24, 2018</u>	<u>Initial Issue</u>
<u>Rev. 02</u>	<u>May 30, 2018</u>	<u>Add the E.I.R.P data on page 30.</u>

## TABLE OF CONTENTS

1	ADMINISTRATIVE DATA (GENERAL INFORMATION) .....	5
1.1	Identification of the Testing Laboratory .....	5
1.2	Identification of the Responsible Testing Location .....	5
1.3	Laboratory Condition .....	5
1.4	Announce .....	5
2	PRODUCT INFORMATION .....	6
2.1	Applicant Information .....	6
2.2	Manufacturer Information .....	6
2.3	Factory Information .....	6
2.4	General Description for Equipment under Test (EUT) .....	6
2.5	Ancillary Equipment .....	6
2.6	Technical Information .....	7
2.7	Additional Instructions .....	8
3	SUMMARY OF TEST RESULTS .....	9
3.1	Test Standards .....	9
3.2	Verdict .....	10
4	GENERAL TEST CONFIGURATIONS .....	11
4.1	Test Environments .....	11
4.2	Test Equipment List .....	11
4.3	Measurement Uncertainty .....	13
4.4	Description of Test Setup .....	13
4.4.1	For Antenna Port Test .....	13
4.4.2	For AC Power Supply Port Test .....	14
4.4.3	For Radiated Test (Below 30 MHz) .....	14
4.4.4	For Radiated Test (30 MHz-1 GHz) .....	15
4.4.5	For Radiated Test (Above 1 GHz) .....	15
4.5	Measurement Results Explanation Example .....	16

4.5.1	For conducted test items: .....	16
4.5.2	For radiated band edges and spurious emission test:.....	16
5	TEST ITEMS.....	17
5.1	Antenna Requirements.....	17
5.1.1	Relevant Standards.....	17
5.1.2	Antenna Anti-Replacement Construction .....	17
5.1.3	Antenna Gain .....	18
5.2	Number of Hopping Frequencies .....	19
5.2.1	Limit.....	19
5.2.2	Test Procedure .....	19
5.2.3	Test Result .....	19
5.3	Peak Output Power and E.I.R.P.....	20
5.3.1	Test Limit.....	20
5.3.2	Test Setup .....	20
5.3.3	Test Procedure .....	20
5.3.4	Test Result .....	20
5.4	Occupied Bandwidth .....	21
5.4.1	Limit.....	21
5.4.2	Test Setup .....	21
5.4.3	Test Procedure .....	21
5.4.4	Test Result .....	21
5.5	Carrier Frequency Separation .....	22
5.5.1	Limit.....	22
5.5.2	Test Setup .....	22
5.5.3	Test Procedure .....	22
5.5.4	Test Result .....	22
5.6	Time of Occupancy (Dwell time) .....	23
5.6.1	Limit.....	23
5.6.2	Test Setup .....	23
5.6.3	Test Procedure .....	23
5.6.4	Test Result .....	23
5.7	Conducted Spurious Emission & Authorized-band band-edge .....	24
5.7.1	Limit.....	24

5.7.2	Test Setup .....	24
5.7.3	Test Procedure .....	24
5.7.4	Test Result .....	24
5.8	Conducted Emission .....	25
5.8.1	Limit.....	25
5.8.2	Test Setup .....	25
5.8.3	Test Procedure .....	25
5.8.4	Test Result .....	25
5.9	Radiated Spurious Emission .....	26
5.9.1	Limit.....	26
5.9.2	Test Setup .....	26
5.9.3	Test Procedure .....	26
5.9.4	Test Result .....	27
5.10	Band Edge (Restricted-band band-edge).....	28
5.10.1	Limit.....	28
5.10.2	Test Setup .....	28
5.10.3	Test Procedure .....	28
5.10.4	Test Result .....	28
ANNEX A	TEST RESULT .....	29
A.1	Number of Hopping Frequency .....	29
A.2	Peak Output Power .....	30
A.3	20 dB and 99% bandwidth .....	31
A.4	Hopping Frequency Separation.....	33
A.5	Average Time of Occupancy .....	34
A.6	Conducted Spurious Emissions & Authorized-band band-edge .....	35
A.7	Conducted Emissions.....	39
A.8	Radiated Spurious Emission .....	41
A.9	Band Edge (Restricted-band band-edge).....	51
ANNEX B	TEST SETUP PHOTOS .....	52
ANNEX C	EUT EXTERNAL PHOTOS .....	52
ANNEX D	EUT INTERNAL PHOTOS .....	52

# 1 ADMINISTRATIVE DATA (GENERAL INFORMATION)

## 1.1 Identification of the Testing Laboratory

Company Name	Shenzhen BALUN Technology Co., Ltd.
Address	Block B, 1st FL, Baisha Science and Technology Park, Shahe Xi Road, Nanshan District, Shenzhen, Guangdong Province, P. R. China
Phone Number	+86 755 6685 0100
Fax Number	+86 755 6182 4271

## 1.2 Identification of the Responsible Testing Location

Test Location	Shenzhen BALUN Technology Co., Ltd.
Address	Block B, 1st FL, Baisha Science and Technology Park, Shahe Xi Road, Nanshan District, Shenzhen, Guangdong Province, P. R. China
Accreditation Certificate	<p>The laboratory has been listed by Industry Canada to perform electromagnetic emission measurements. The recognition numbers of test site are 11524A-1.</p> <p>The laboratory is a testing organization accredited by FCC as a accredited testing laboratory. The designation number is CN1196.</p> <p>The laboratory is a testing organization accredited by American Association for Laboratory Accreditation (A2LA) according to ISO/IEC 17025. The accreditation certificate is 4344.01.</p> <p>The laboratory is a testing organization accredited by China National Accreditation Service for Conformity Assessment (CNAS) according to ISO/IEC 17025. The accreditation certificate number is L6791.</p>
Description	All measurement facilities used to collect the measurement data are located at Block B, FL 1, Baisha Science and Technology Park, Shahe Xi Road, Nanshan District, Shenzhen, Guangdong Province, P. R. China 518055

## 1.3 Laboratory Condition

Ambient Temperature	20°C to 25°C
Ambient Relative Humidity	45% to 55%
Ambient Pressure	100 kPa to 102 kPa

## 1.4 Announce

- (1) The test report reference to the report template version v2.2.
- (2) The test report is invalid if not marked with the signatures of the persons responsible for preparing and approving the test report.
- (3) The test report is invalid if there is any evidence and/or falsification.
- (4) The results documented in this report apply only to the tested sample, under the conditions and modes of operation as described herein.
- (5) This document may not be altered or revised in any way unless done so by BALUN and all revisions are duly noted in the revisions section.
- (6) Content of the test report, in part or in full, cannot be used for publicity and/or promotional purposes without prior written approval from the laboratory.

## 2 PRODUCT INFORMATION

### 2.1 Applicant Information

Applicant	CONVERGENCE SYSTEMS LIMITED
Address	11/F., Tower 1, Tern Centre, 237 Queen's Road, Central, Hong Kong

### 2.2 Manufacturer Information

Manufacturer	DongGuan DongHongXingYe Electronics Science and Technology Limited
Address	1 Jianxiang Street, Hanxishui, Chashan Town Dongguan, China

### 2.3 Factory Information

Factory	DongGuan DongHongXingYe Electronics Science and Technology Limited
Address	1 Jianxiang Street, Hanxishui, Chashan Town Dongguan, China

### 2.4 General Description for Equipment under Test (EUT)

EUT Name	RFID Reader
Model Name Under Test	CS463-2
Series Model Name	N/A
Description of Model name differentiation	N/A
Hardware Version	V2.2
Software Version	U11.10.1.1
Dimensions (Approx.)	N/A
Weight (Approx.)	N/A

### 2.5 Ancillary Equipment

Ancillary Equipment 1	Adapter	
	Brand Name	DVE
	Model No.	DSA-60PFE-12
	Serial No.	N/A
	Rated Input	100-240 V~, 50/60 Hz, 2 A
	Rated Output	12 V= 5 A



## 2.6 Technical Information

Network and Wireless connectivity	Bluetooth 2.1 (BR+EDR+BLE) WIFI 802.11b, 802.11g and 802.11n (HT20/40) RFID 902-928M
-----------------------------------	--

The requirement for the following technical information of the EUT was tested in this report:

Modulation Technology	Frequency hopping system
Modulation Type	FHSS
Data Type	DSB-ASK,PR-ASK
Product Type	<input checked="" type="checkbox"/> Mobile <input type="checkbox"/> Portable <input type="checkbox"/> Fix Location
Frequency Range	The frequency range used is 902 MHz to 928 MHz.
Number of channel	50
Tested Channel	1 (902.75 MHz), 26 (915.25 MHz), 50 (927.25 MHz)
Antenna Type	SMA Antenna
Antenna Gain	5 dBi (In test items related to antenna gain, the final results reflect this figure.)
Antenna System(MIMO Smart Antenna)	N/A

All channel was listed on the following table:

Channel number	Freq. (MHz)	Channel number	Freq. (MHz)	Channel number	Freq. (MHz)	Channel number	Freq. (MHz)
1	902.75	14	909.25	27	915.75	40	922.25
2	903.25	15	909.75	28	916.25	41	922.75
3	903.75	16	910.25	29	916.75	42	923.25
4	904.25	17	910.75	30	917.25	43	923.75
5	904.75	18	911.25	31	917.75	44	924.25
6	905.25	19	911.75	32	918.25	45	924.75
7	905.75	20	912.25	33	918.75	46	925.25
8	906.25	21	912.75	34	919.25	47	925.75
9	906.75	22	913.25	35	919.75	48	926.25
10	907.25	23	913.75	36	920.25	49	926.75
11	907.75	24	914.25	37	920.75	50	927.25
12	908.25	25	914.75	38	921.25	-	-
13	908.75	26	915.25	39	921.75	-	-

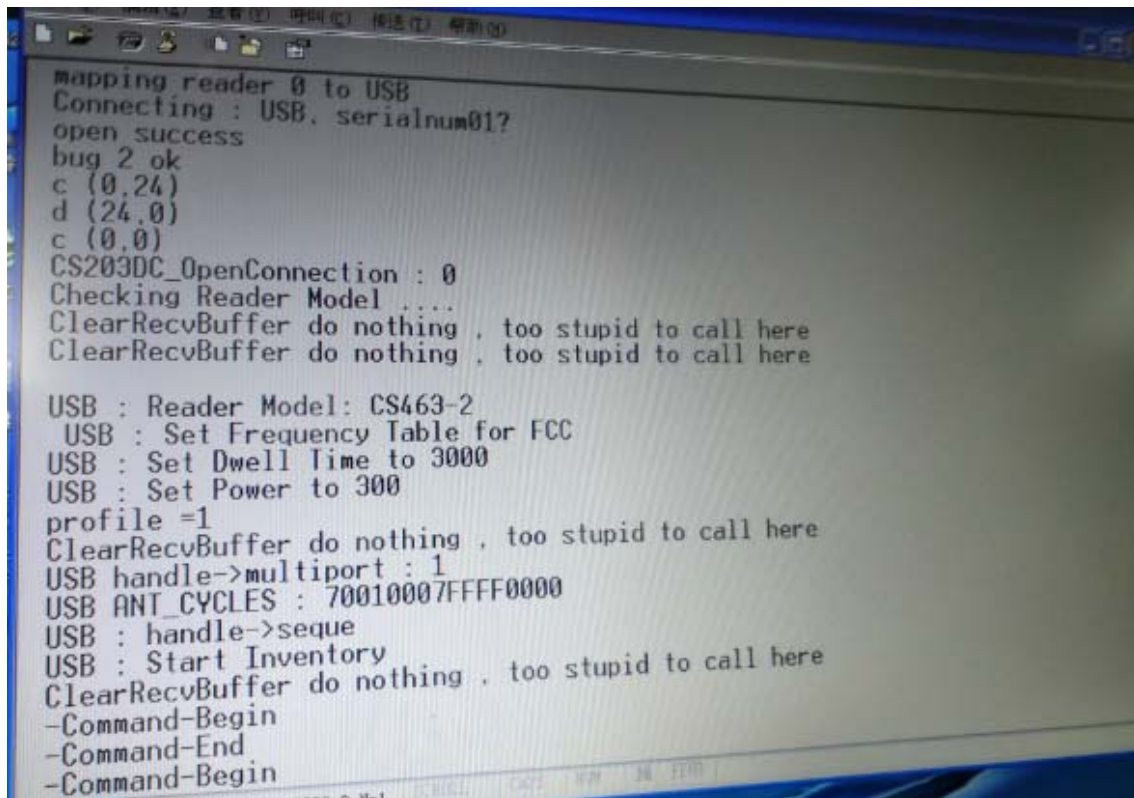
## 2.7 Additional Instructions

EUT Software Settings:

Mode	<input checked="" type="checkbox"/> Special software is used. The software provided by client to enable the EUT under transmission condition continuously at specific channel frequencies individually.
------	--

Power level setup in software		
Test Software Version	N/A	
Mode	Channel	Soft Set
ASK	ALL	TX LEVEL is built-in set parameters and cannot be changed and selected.

Run Software



```

mapping reader 0 to USB
Connecting : USB, serialnum01?
open success
bug 2 ok
c (0,24)
d (24,0)
c (0,0)
CS203DC_OpenConnection : 0
Checking Reader Model ....
ClearRecvBuffer do nothing , too stupid to call here
ClearRecvBuffer do nothing , too stupid to call here

USB : Reader Model: CS463-2
USB : Set Frequency Table for FCC
USB : Set Dwell Time to 3000
USB : Set Power to 300
profile =1
ClearRecvBuffer do nothing , too stupid to call here
USB handle->multiport : 1
USB ANT_CYCLES : 70010007FFFF0000
USB : handle->seque
USB : Start Inventory
ClearRecvBuffer do nothing , too stupid to call here
-Command-Begin
-Command-End
-Command-Begin
  
```



### 3 SUMMARY OF TEST RESULTS

#### 3.1 Test Standards

No.	Identity	Document Title
1	47 CFR Part 15, Subpart C (10-1-16 Edition)	Miscellaneous Wireless Communications Services
2	FCC PUBLIC NOTICE DA 00-705 (Mar. 30, 2000)	Filling and Measurement Guidelines for Frequency Hopping Spread Spectrum Systems
3	RSS-Gen (Issue 4, Nov. 2014)	General Requirements for Compliance of Radio Apparatus
4	RSS-247 (Issue 2, February 2017)	Digital Transmission Systems (DTSS), Frequency Hopping Systems(FHSs) and Licence-Exemp Local Area Network (LE-LAN) Devices
5	ANSI C63.10-2013	American National Standard for Testing Unlicensed Wireless Devices

### 3.2 Verdict

No.	Description	FCC Part No.	ISED Part No.	Modulation Technology	Channel	Test Result	Verdict	Remark
1	Antenna Requirement	15.203	RSS-247, 5.4 (6)	N/A	N/A	--	Pass	Note
2	Number of Hopping Frequencies	15.247(a)	RSS-247, 5.1 (4)	Frequency hopping system	Hopping Mode	ANNEX A.1	Pass	
3	Peak Output Power	15.247(b)	RSS-247, 5.4 (2)	Frequency hopping system, Hybrid system	Low/Middle /High	ANNEX A.2	Pass	
4	Occupied Bandwidth	15.247(a)	RSS-247, 5.1 (1)	Frequency hopping system, Hybrid system	Low/Middle /High	ANNEX A.3	Pass	
5	Carrier Frequency Separation	15.247(a)	RSS-247, 5.1 (2)	Frequency hopping system, Hybrid system	Hopping Mode	ANNEX A.4	Pass	
6	Time of Occupancy (Dwell time)	15.247(a)	RSS-247, 5.1 (4)	Frequency hopping system, Hybrid system	Hopping Mode	ANNEX A.5	Pass	
7	Conducted Spurious Emission & Authorized-band band-edge	15.247(d)	RSS-247, 5.5	Frequency hopping system, Hybrid system	Low/Middle /High, Hopping Mode	ANNEX A.6	Pass	
8	Conducted Emission	15.207	RSS-GEN, 8.8	Frequency hopping system, Hybrid system	Low/Middle /High	ANNEX A.7	Pass	
9	Radiated Spurious Emission	15.209 15.247(d)	RSS-247, 5.5	Frequency hopping system, Hybrid system	Low/Middle /High, Hopping Mode	ANNEX A.8	Pass	
10	Band Edge(Restricted-band band-edge)	15.209 15.247(d)	RSS-247, 5.5	Frequency hopping system, Hybrid system	Low/Middle /High, Hopping Mode	ANNEX A.9	Pass	

Note: Please refer to section 5.1

## 4 GENERAL TEST CONFIGURATIONS

### 4.1 Test Environments

During the measurement, the normal environmental conditions were within the listed ranges:

Relative Humidity	45% to 55%	
Atmospheric Pressure	100 kPa to 102 kPa	
Temperature	NT (Normal Temperature)	+22°C to +25°C
Working Voltage of the EUT	NV (Normal Voltage)	110 V

### 4.2 Test Equipment List

Description	Manufacturer	Model	Serial No.	Cal. Date	Cal. Due
Spectrum Analyzer	ROHDE&SCHWARZ	FSV-30	103118	2017.06.12	2018.06.11
Vector Signal Generator	ROHDE&SCHWARZ	SMBV100A	260592	2017.06.12	2018.06.11
Signal Generator	ROHDE&SCHWARZ	SMB100A	177746	2017.06.12	2018.06.11
Switch Unit with OSP-B157	ROHDE&SCHWARZ	OSP120	101270	2017.06.12	2018.06.11
Spectrum Analyzer	AGILENT	E4440A	MY45304434	2017.11.07	2018.11.06
EMI Receiver	ROHDE&SCHWARZ	ESRP	101036	2017.06.22	2018.06.21
LISN	SCHWARZBECK	NSLK 8127	8127-687	2017.06.22	2018.06.21
Bluetooth Tester	ROHDE&SCHWARZ	CBT	101005	2017.06.12	2018.06.11
Power Splitter	KMW	DCPD-LDC	1305003215	--	--
Power Sensor	ROHDE&SCHWARZ	NRP-Z21	103971	2017.06.12	2018.06.11
Attenuator (20 dB)	KMW	ZA-S1-201	110617091	--	--
Attenuator (6 dB)	KMW	ZA-S1-61	1305003189	--	--
DC Power Supply	ROHDE&SCHWARZ	HMP2020	018141664	2017.06.22	2018.06.21
Temperature Chamber	ANGELANTIONI SCIENCE	NTH64-40A	1310	2017.06.27	2018.06.26
Test Antenna-Loop(9 kHz-30 MHz)	SCHWARZBECK	FMZB 1519	1519-037	2017.11.07	2019.11.08
Test Antenna-Bi-Log(30 MHz-3 GHz)	SCHWARZBECK	VULB 9163	9163-624	2017.07.22	2019.07.21
Test Antenna-Horn(1-18 GHz)	SCHWARZBECK	BBHA 9120D	9120D-1148	2016.07.12	2018.07.11
Test Antenna-Horn(15-26.5 GHz)	SCHWARZBECK	BBHA 9170	9170-305	2017.06.22	2018.06.21
Test Antenna-Horn (18-40 GHz)	A-INFO	LB-180400KF	J211060273	N/A	2019.01.06
Anechoic Chamber	RAINFORD	9m*6m*6m	N/A	2017.02.21	2019.02.20
Anechoic Chamber	EMC TECHNOLOGY LTD	21.1m*11.6m*7.35m	N/A	2016.08.09	2018.08.08
Shielded Enclosure	ChangNing	CN-130701	130703	--	--
Signal Generator	ROHDE&SCHWARZ	SMB100A	177746	2017.06.12	2018.06.11
Power Amplifier	OPHIR RF	5225F	1037	2018.02.16	2019.02.15
Power Amplifier	OPHIR RF	5273F	1016	2018.02.16	2019.02.15

Description	Manufacturer	Model	Serial No.	Cal. Date	Cal. Due
Directional Coupler	Werlantone	C5982-10	109275	N/A	N/A
Directional Coupler	Werlantone	CHP-273E	S00801z-01	N/A	N/A
Feld Strength Meter	Narda	EP601	511WX51129	2017.05.22	2018.05.21
Mouth Simulator	B&K	4227	2423931	2017.11.16	2018.11.15
Sound Calibrator	B&K	4231	2430337	2017.11.16	2018.11.15
Sound Level Meter	B&K	NL-20	00844023	2017.11.16	2018.11.15
Ear Simulator	B&K	4185	2409449	2017.11.16	2018.11.15
Ear Simulator	B&K	4195	2418189	2017.11.16	2018.11.15
Audio analyzer	B&K	UPL 16	100129	2017.11.16	2018.11.15

### 4.3 Measurement Uncertainty

The following measurement uncertainty levels have been estimated for tests performed on the EUT as specified in CISPR 16-4-2.

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

Measurement	Value
Occupied Channel Bandwidth	±4%
RF output power, conducted	±1.4 dB
Power Spectral Density, conducted	±2.5 dB
Unwanted Emissions, conducted	±2.8 dB
All emissions, radiated	±5.4 dB
Temperature	±1°C
Humidity	±4%

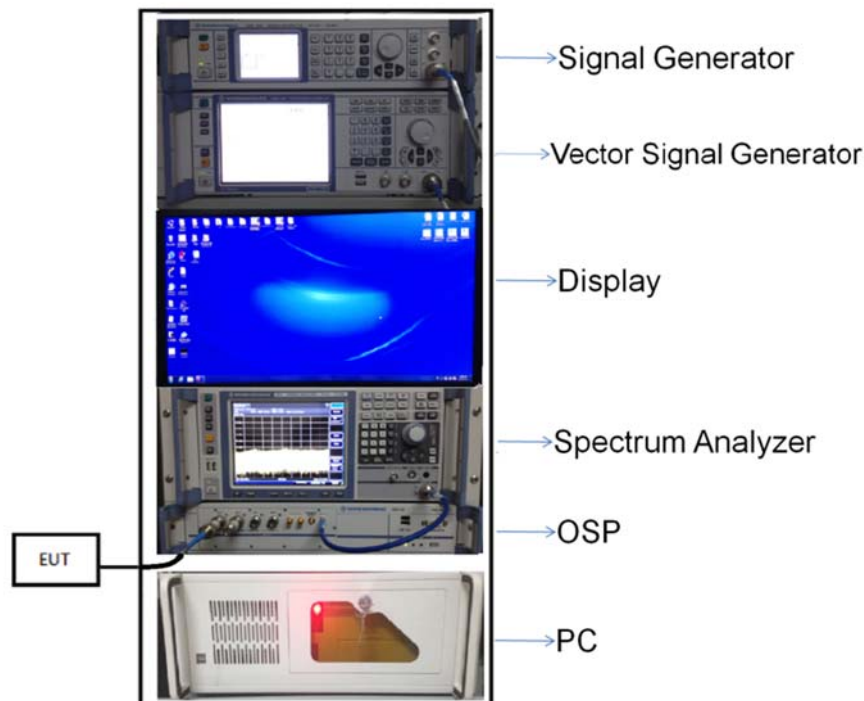
### 4.4 Description of Test Setup

#### 4.4.1 For Antenna Port Test

Conducted value (dBm) = Measurement value (dBm) + cable loss (dB)

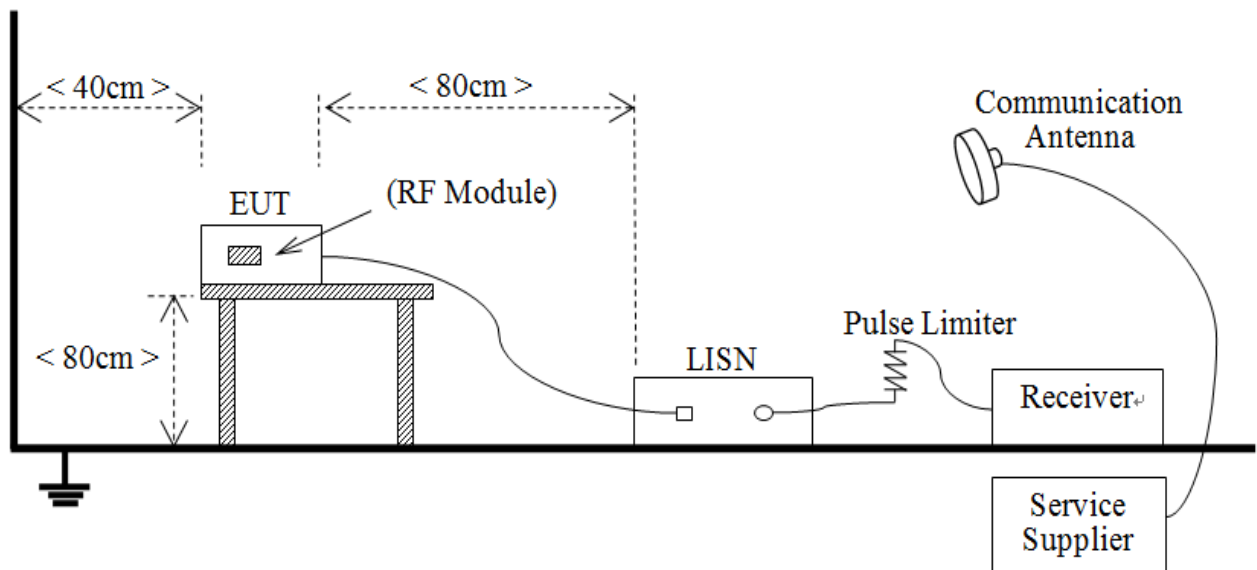
For example: the measurement value is 10 dBm and the cable 0.5dBm used, then the final result of EUT:

Conducted value (dBm) = 10 dBm + 0.5 dB = 10.5 dBm



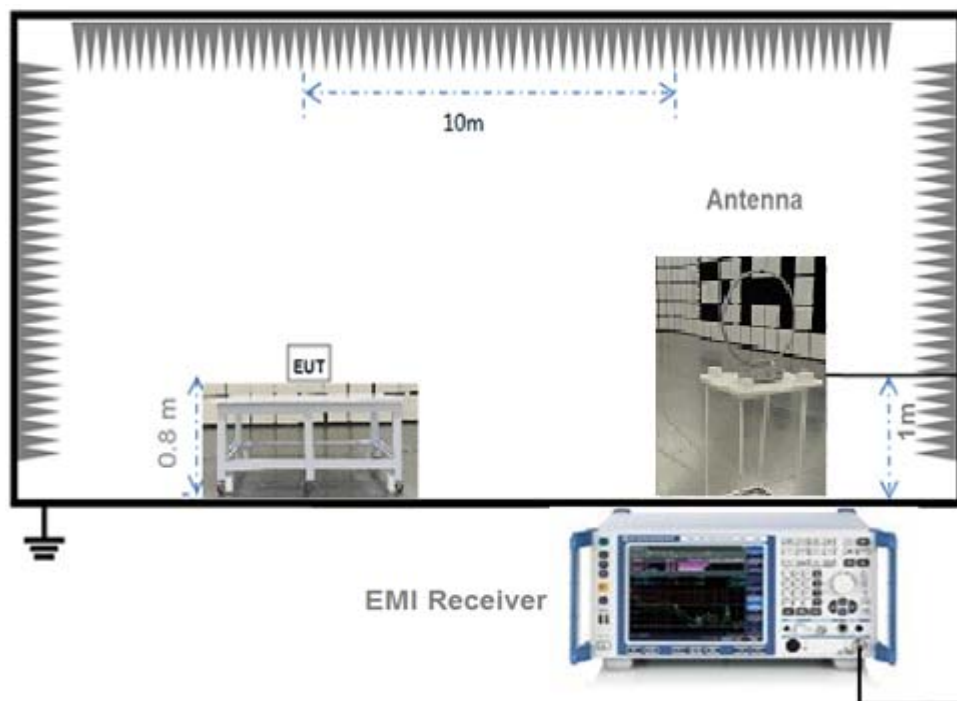
(Diagram 1)

#### 4.4.2 For AC Power Supply Port Test



(Diagram 2)

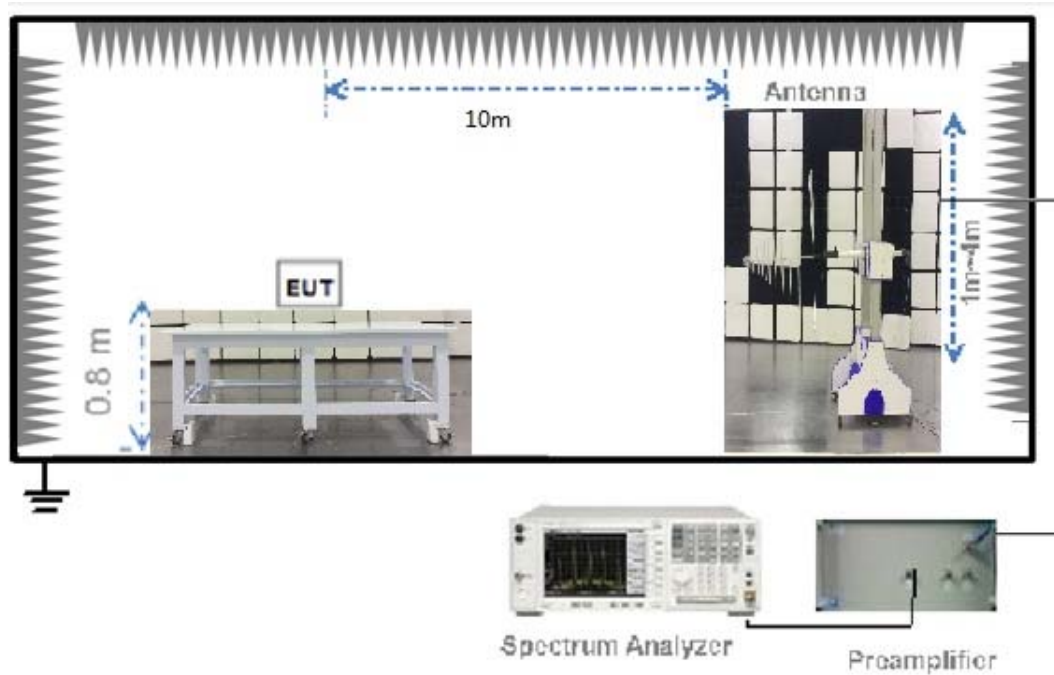
#### 4.4.3 For Radiated Test (Below 30 MHz)



(Diagram 3)

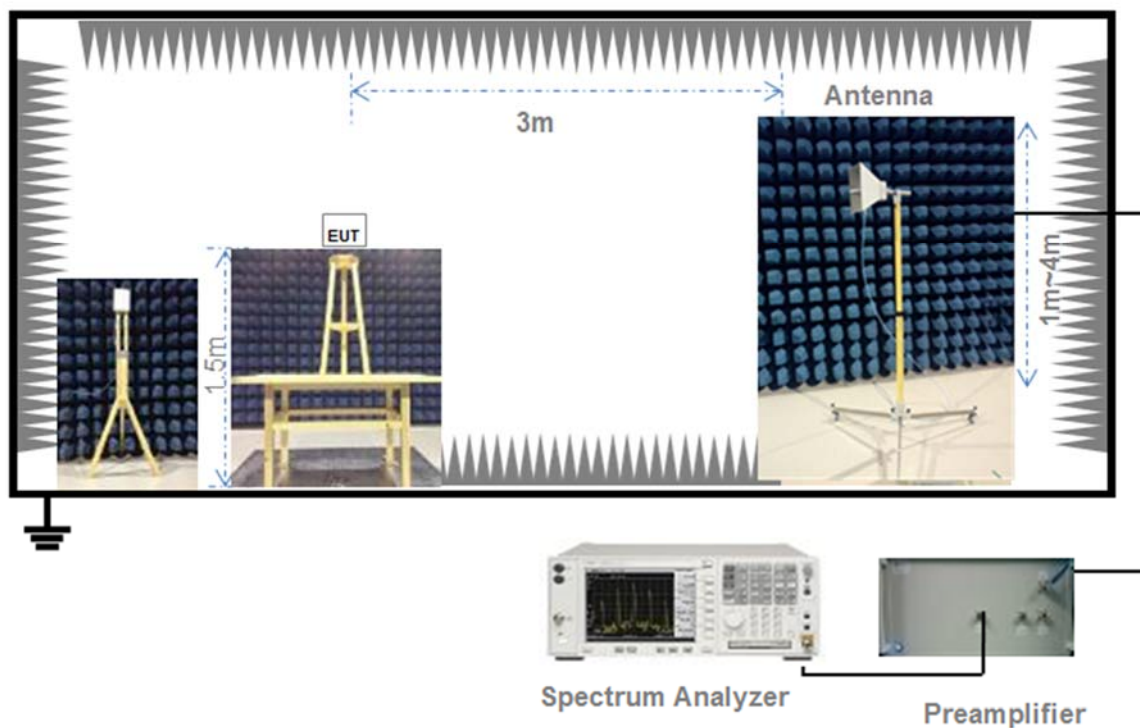


#### 4.4.4 For Radiated Test (30 MHz-1 GHz)



(Diagram 4)

#### 4.4.5 For Radiated Test (Above 1 GHz)



(Diagram 5)

## 4.5 Measurement Results Explanation Example

### 4.5.1 For conducted test items:

The offset level is set in the spectrum analyzer to compensate the RF cable loss and attenuator between EUT conducted output port and spectrum analyzer. With the offset compensation, the spectrum analyzer reading level is exactly the EUT RF output level.

The spectrum analyzer offset is derived from RF cable loss and attenuator factor.

Offset = RF cable loss + attenuator factor.

### 4.5.2 For radiated band edges and spurious emission test:

Per part 15.35(c), the EUT Bluetooth average emission level could be determined by the peak emission level applying duty cycle correction factor, to represent averaging over the whole pulse train.

The average level is derived from the peak level corrected with "Duty cycle correction factor".

Average Emission Level (dBuV/m) = Peak Emission Level (dBuV/m) + Duty cycle correction factor (dB)

Duty cycle correction factor (dB) =  $20 * \log (\text{Duty cycle})$ .

Duty cycle = on time / 100 milliseconds

On time = dwell time \* hopping number in 100 ms

For example: bluetooth with dwell time 2.9 ms and 3 hops in 100 ms, then

Duty cycle correction factor (dB) =  $20 * \log ((2.9 * 3) / 100) = -21.21 \text{ dB}$

Following shows an average computation example with duty cycle correction factor = -21.21 dB, and the peak emission level is 45.61 dBuV/m.

Example:

Average Emission Level (dBuV/m) = Peak Emission Level (dBuV/m) + duty cycle correction factor (dB)

=  $45.61 + (-21.21) = 24.4 \text{ (dBuV/m)}$

## 5 TEST ITEMS

### 5.1 Antenna Requirements

#### 5.1.1 Relevant Standards

FCC §15.203 & 15.247(b); RSS-247, 5.4 (6)


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. This requirement does not apply to carrier current devices or to devices operated under the provisions of § 15.211, § 15.213, § 15.217, § 15.219, or § 15.221. Further, this requirement does not apply to intentional radiators that must be professionally installed, such as perimeter protection systems and some field disturbance sensors, or to other intentional radiators which, in accordance with § 15.31(d), must be measured at the installation site. However, the installer shall be responsible for ensuring that the proper antenna is employed so that the limits in this part are not exceeded.

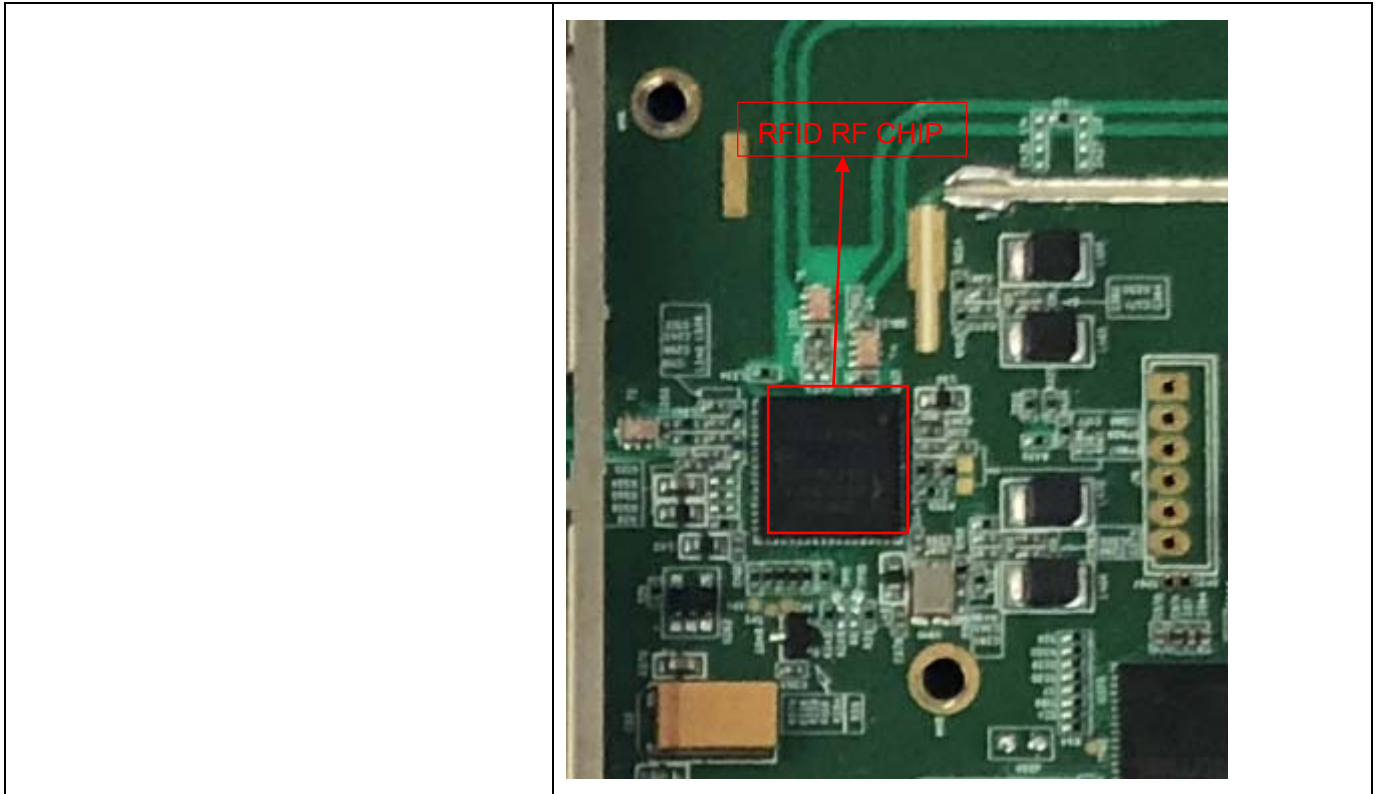
If directional gain of transmitting antennas is greater than 6 dBi, the power shall be reduced by the same level in dB comparing to gain minus 6 dBi. For the fixed point-to-point operation, the power shall be reduced by one dB for every 3 dB that the directional gain of the antenna exceeds 6 dBi. The 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 FCC rule.

#### 5.1.2 Antenna Anti-Replacement Construction

The Antenna Anti-Replacement as following method:

Protected Method	Description
Protected method: Compliance with 15.203, use of a standard antenna jack or electrical connector is prohibited.	The antenna has a RP-SMA male connector.

Reference Documents	Item
Photo	



### 5.1.3 Antenna Gain

The antenna peak gain of EUT is less than 6 dBi. Therefore, it is not necessary to reduce maximum peak output power limit.

## 5.2 Number of Hopping Frequencies

### 5.2.1 Limit

FCC §15.247(a) (1) (i); RSS-247, 5.1 (4)

For frequency hopping systems operating in the 902-928 MHz band: the system shall use at least 50 hopping frequencies.

#### Test Setup

See section 4.4.1 for test setup description for the antenna port. The photo of test setup please refer to ANNEX B.

### 5.2.2 Test Procedure

The EUT must have its hopping function enabled. Use the following spectrum analyzer settings:

Span = the frequency band of operation

RBW  $\geq$  1% of the span

VBW  $\geq$  RBW

Sweep = auto

Detector function = peak

Trace = max hold

Allow the trace to stabilize

### 5.2.3 Test Result

Please refer to ANNEX A.1.

## 5.3 Peak Output Power and E.I.R.P

### 5.3.1 Test Limit

FCC § 15.247(b)(1)

For frequency hopping systems operating in the 902-928 MHz band: 1 watt for systems employing at least 50 hopping channels; and, 0.25 watts for systems employing less than 50 hopping channels, but at least 25 hopping channels, as permitted under paragraph (a)(1)(i) of this section.

RSS-247, 5.4 (2)

For FHSs operating in the band 902-928 MHz, the maximum peak conducted output power shall not exceed 1.0 W and the e.i.r.p. shall not exceed 4 W if the hopset uses 50 or more hopping channels; the maximum peak conducted output power shall not exceed 0.125 W and the e.i.r.p. shall not exceed 0.5 W if the hopset uses less than 50 hopping channels (see Section 5.4(5) for exceptions).

### 5.3.2 Test Setup

See section 4.4.1 for test setup description for the antenna port. The photo of test setup please refer to ANNEX B.

### 5.3.3 Test Procedure

The Module operates at hopping-off test mode. The lowest, middle and highest channels are selected to perform testing to verify the conducted RF output peak power of the Module.

Use the following spectrum analyzer settings:

Span = approximately 5 times the 20 dB bandwidth, centered on a hopping channel

RBW > the 20 dB bandwidth of the emission being measured

VBW ≥ RBW

Sweep = auto

Detector function = peak

Trace = max hold

Allow the trace to stabilize.

### 5.3.4 Test Result

Please refer to ANNEX A.2.



## 5.4 Occupied Bandwidth

### 5.4.1 Limit

FCC §15.247(a)(1)(i); RSS-247, 5.1 (1)

Measurement of the 20dB bandwidth of the modulated signal. The maximum allowed 20 dB bandwidth of the hopping channel is 500 kHz.

### 5.4.2 Test Setup

See section 4.4.1 for test setup description for the antenna port. The photo of test setup please refer to ANNEX B.

### 5.4.3 Test Procedure

Use the following spectrum analyzer settings:

Span = approximately 2 to 3 times the 20 dB bandwidth, centered on a hopping channel

RBW = in the range of 1% to 5% of the OBW

VBW  $\geq$  RBW

Sweep = auto

Detector function = peak

Trace = max hold

The EUT should be transmitting at its maximum data rate, Allow the trace to stabilize.

### 5.4.4 Test Result

Please refer to ANNEX A.3.

## 5.5 Carrier Frequency Separation

### 5.5.1 Limit

FCC §15.247(a)(1); RSS-247, 5.1 (2)

Frequency hopping systems shall have hopping channel carrier frequencies separated by a minimum of 25 kHz or the 20 dB bandwidth of the hopping channel, whichever is greater.

### 5.5.2 Test Setup

See section 4.4.1 for test setup description for the antenna port. The photo of test setup please refer to ANNEX B.

### 5.5.3 Test Procedure

The EUT must have its hopping function enabled. Use the following spectrum analyzer settings:

Span = wide enough to capture the peaks of two adjacent channels

Resolution (or IF) Bandwidth (RBW)  $\geq 1\%$  of the span

Video (or Average) Bandwidth (VBW)  $\geq$  RBW

Sweep = auto

Detector function = peak

Trace = max hold

Allow the trace to stabilize. Use the marker-delta function to determine the separation between the peaks of the adjacent channels.

### 5.5.4 Test Result

Please refer to ANNEX A.4.

## 5.6 Time of Occupancy (Dwell time)

### 5.6.1 Limit

FCC §15.247(a)(1)(i); RSS-247, 5.1 (4)

For frequency hopping systems operating in the 902-928 MHz band: if the 20 dB bandwidth of the hopping channel is less than 250 kHz, the system shall use at least 50 hopping frequencies and the average time of occupancy on any frequency shall not be greater than 0.4 seconds within a 20 second period; if the 20 dB bandwidth of the hopping channel is 250 kHz or greater, the system shall use at least 25 hopping frequencies and the average time of occupancy on any frequency shall not be greater than 0.4 seconds within a 10 second period.

### 5.6.2 Test Setup

See section 4.4.1 for test setup description for the antenna port. The photo of test setup please refer to ANNEX B.

### 5.6.3 Test Procedure

The lowest, middle and highest channels are selected to perform testing to record the dwell time of each occupation measured in this channel, which is called Pulse Time here.

### 5.6.4 Test Result

Please refer to ANNEX A.5

## 5.7 Conducted Spurious Emission & Authorized-band band-edge

### 5.7.1 Limit

FCC §15.247(d); RSS-247, 5.5

In any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power, based on either an RF conducted or a radiated measurement.

### 5.7.2 Test Setup

See section 4.4.1 for test setup description for the antenna port. The photo of test setup please refer to ANNEX B.

### 5.7.3 Test Procedure

Use the following spectrum analyzer settings:

Span = wide enough to capture the peak level of the in-band emission and all spurious emissions (e.g., harmonics) from the lowest frequency generated in the EUT up through the 10th harmonic. Typically, several plots are required to cover this entire span.

RBW = 100 kHz

VBW  $\geq$  RBW

Sweep = auto

Detector function = peak

Trace = max hold

Allow the trace to stabilize

### 5.7.4 Test Result

Please refer to ANNEX A.6 and A.7

## 5.8 Conducted Emission

### 5.8.1 Limit

FCC §15.207; RSS-GEN, 8.8

For an intentional radiator 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 within the band 150 kHz to 30 MHz shall not exceed the limits in the following table, as measured using a 50 $\mu$ H/50 $\Omega$  line impedance stabilization network (LISN).

Frequency range (MHz)	Conducted Limit (dB $\mu$ V)	
	Quai-peak	Average
0.15 - 0.50	66 to 56	56 to 46
0.50 - 5	56	46
0.50 - 30	60	50

### 5.8.2 Test Setup

See section 4.4.2 for test setup description for the AC power supply port. The photo of test setup please refer to ANNEX B.

### 5.8.3 Test Procedure

The maximum conducted interference is searched using Peak (PK), if the emission levels more than the AV and QP limits, and that have narrow margins from the AV and QP limits will be re-measured with AV and QP detectors. Tests for both L phase and N phase lines of the power mains connected to the EUT are performed. Refer to recorded points and plots below.

Devices subject to Part 15 must be tested for all available U.S. voltages and frequencies (such as a nominal 120 VAC, 50/60 Hz and 240 VAC, 50/60 Hz) for which the device is capable of operation. A device rated for 50/60 Hz operation need not be tested at both frequencies provided the radiated and line conducted emissions are the same at both frequencies.

### 5.8.4 Test Result

Please refer to ANNEX A.7.

## 5.9 Radiated Spurious Emission

### 5.9.1 Limit

FCC §15.209&15.247(d); RSS-247, 5.5

Radiated emission outside the frequency band attenuation below the general limits specified in FCC section 15.209(a) is not required. In addition, radiated emissions which fall in the restricted bands, as defined in FCC section 15.205(a), must also comply with the radiated emission limits specified in FCC section 15.209(a).

According to FCC section 15.209 (a), except as provided elsewhere in this subpart, the emissions from an intentional radiator shall not exceed the field strength levels specified in the following table:

Frequency (MHz)	Field Strength (μV/m)	Measurement Distance (m)
0.009 - 0.490	902/F(kHz)	300
0.490 - 1.705	9020/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

Note:

1. Field Strength (dBμV/m) =  $20 \cdot \log[\text{Field Strength } (\mu\text{V/m})]$ .
2. In the emission tables above, the tighter limit applies at the band edges.
3. For Above 1000 MHz, the emission limit in this paragraph is based on measurement instrumentation employing an average detector, measurement using instrumentation with a peak detector function, corresponding to 20dB above the maximum permitted average limit.
4. For above 1000 MHz, limit field strength of harmonics: 54dBuV/m@3m (AV) and 74dBuV/m@3m (PK).

### 5.9.2 Test Setup

See section 4.4.3 to 4.4.5 for test setup description for the antenna port. The photo of test setup please refer to ANNEX B.

### 5.9.3 Test Procedure

The measurement frequency range is from 9 kHz to the 10th harmonic of the fundamental frequency. The Turn Table is actuated to turn from 0° to 360°, and both horizontal and vertical polarizations of the Test Antenna are used to find the maximum radiated power. Mid channels on all channel bandwidth verified. Only the worst RB size/offset presented.

The power of the EUT transmitting frequency should be ignored.

All Spurious Emission tests were performed in X, Y, Z axis direction. And only the worst axis test condition was recorded in this test report.

Use the following spectrum analyzer settings:

Span = wide enough to fully capture the emission being measured

RBW = 1 MHz for  $f \geq 1$  GHz, 100 kHz for  $f < 1$  GHz

VBW  $\geq$  RBW



Sweep = auto

Detector function = peak

Trace = max hold

For measurement below 1GHz, If the emission level of the EUT measured by the peak detector is 3 dB lower than the applicable limit, the peak emission level will be reported, Otherwise, the emission measurement will be repeated using the quasi-peak detector and reported.

#### 5.9.4 Test Result

Please refer to ANNEX A.8.

## 5.10 Band Edge (Restricted-band band-edge)

### 5.10.1 Limit

FCC §15.209&15.247(d)

Radiated emission outside the frequency band attenuation below the general limits specified in FCC section 15.209(a) is not required. In addition, radiated emissions which fall in the restricted bands, as defined in FCC section 15.205(a), must also comply with the radiated emission limits specified in FCC section 15.209(a).

### 5.10.2 Test Setup

See section 4.4.3 to 4.4.5 for test setup description for the antenna port. The photo of test setup please refer to ANNEX B.

### 5.10.3 Test Procedure

The measurement frequency range is from 9 kHz to the 10th harmonic of the fundamental frequency. The Turn Table is actuated to turn from 0° to 360°, and both horizontal and vertical polarizations of the Test Antenna are used to find the maximum radiated power. Mid channels on all channel bandwidth verified. Only the worst RB size/offset presented.

The power of the EUT transmitting frequency should be ignored.

All Spurious Emission tests were performed in X, Y, Z axis direction. And only the worst axis test condition was recorded in this test report.

Use the following spectrum analyzer settings:

Span = wide enough to fully capture the emission being measured

RBW = 1 MHz for  $f \geq 1$  GHz, 100 kHz for  $f < 1$  GHz

VBW  $\geq$  RBW

Sweep = auto

Detector function = peak

Trace = max hold

For measurement below 1GHz, If the emission level of the EUT measured by the peak detector is 3 dB lower than the applicable limit, the peak emission level will be reported, Otherwise, the emission measurement will be repeated using the quasi-peak detector and reported.

### 5.10.4 Test Result

Please refer to ANNEX A.9.

## ANNEX A TEST RESULT

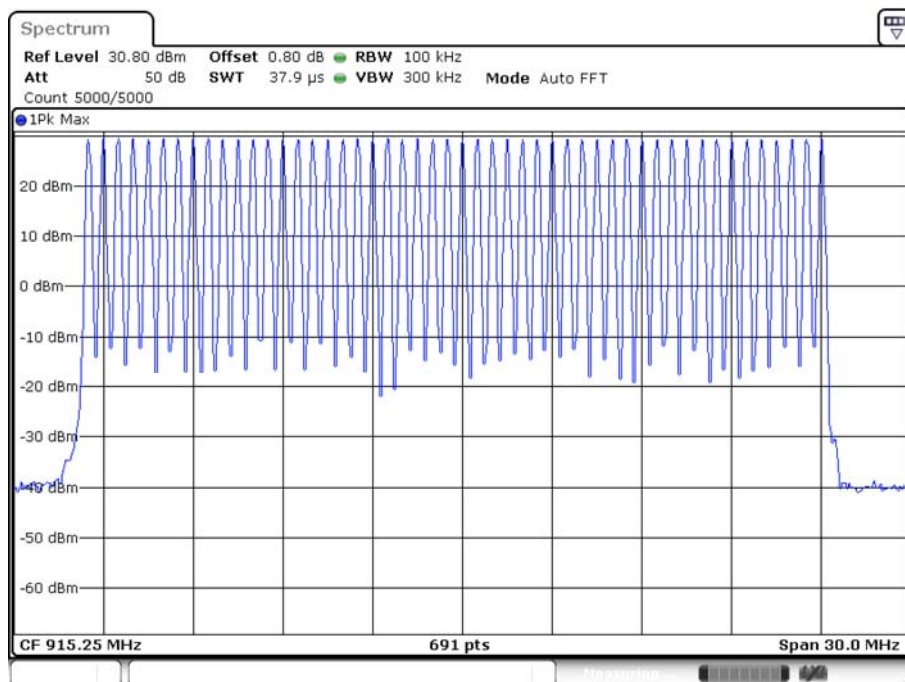
### A.1 Number of Hopping Frequency

#### Test Data

Test Mode	Frequency Block (MHz)	Measured Channel Numbers	Min. Limit	Verdict
FHSS	902-928	50	15	Pass

#### Test plots

ASK



Date: 27. MAR. 2018 10:37:24

## A.2 Peak Output Power

### Peak Power Test Data

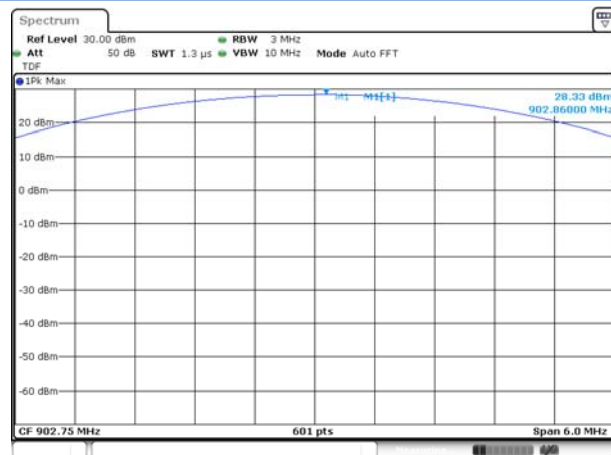
Channel	Measured Output Peak Power		Limit		Verdict
	ASK		dBm	mW	
	dBm	mW			
Low	28.33	680.77	30	1000	Pass
Middle	29.09	810.96			Pass
High	28.93	781.63			Pass

### E.I.R.P Test Data (For ISED)

Channel	EIRP		Limit		Verdict
	ASK		dBm	mW	
	dBm	mW			
Low	33.33	2152.78	36	4000	Pass
Middle	34.09	2564.48			Pass
High	33.93	2471.72			Pass

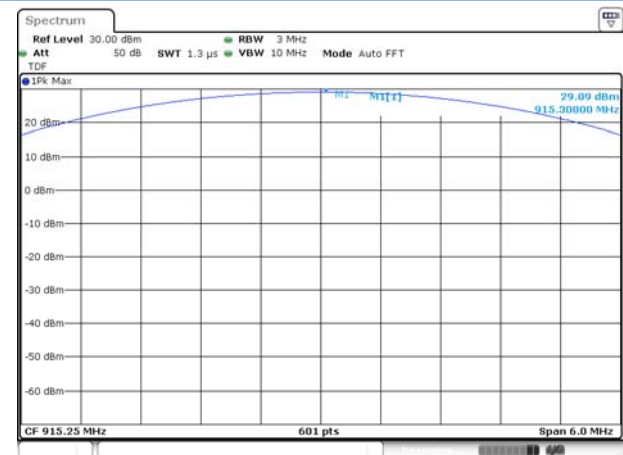
### Test plots

#### LOW CHANNEL



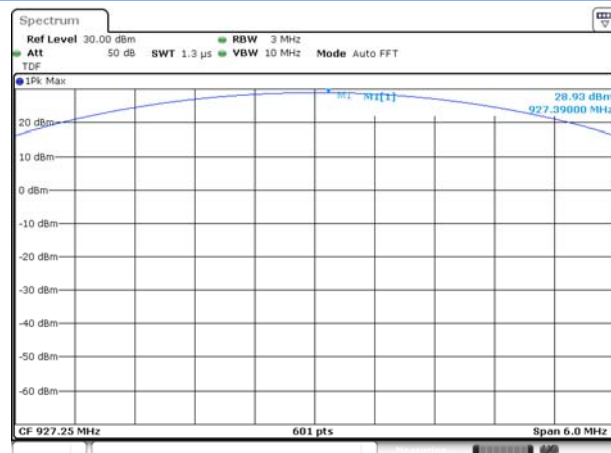
Date: 27.MAR.2018 10:17:20

#### MIDDLE CHANNEL



Date: 27.MAR.2018 10:24:24

#### HIGH CHANNEL



Date: 27.MAR.2018 10:29:05

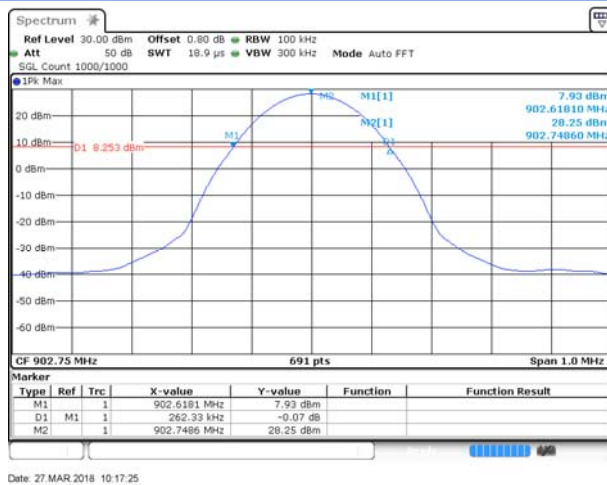
## A.3 20 dB and 99% bandwidth

### Test Data

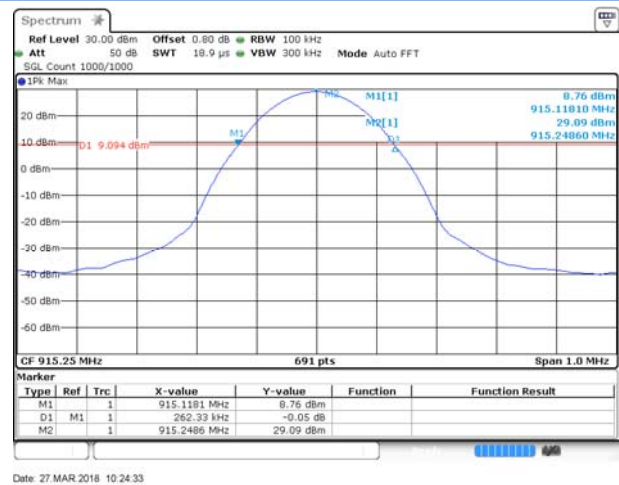
ASK			
Channel	20 dB Bandwidth (MHz)	99% Bandwidth (MHz)	Verdict
Low	0.262329	0.079595	Pass
Middle	0.262329	0.079595	Pass
High	0.262329	0.079595	Pass

### Test plots (20 dB Bandwidth)

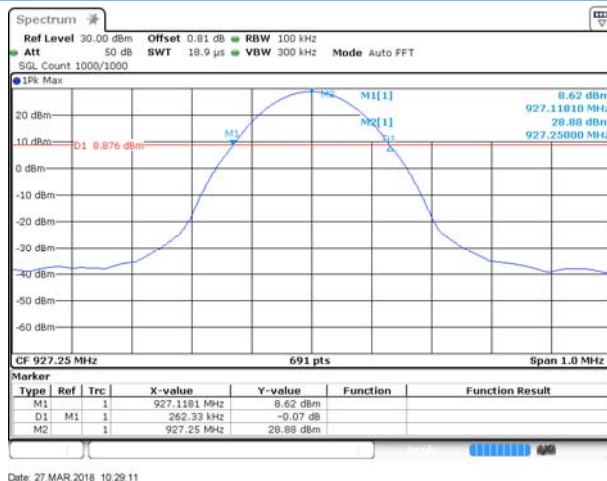
#### LOW CHANNEL



#### MIDDLE CHANNEL



#### HIGH CHANNEL



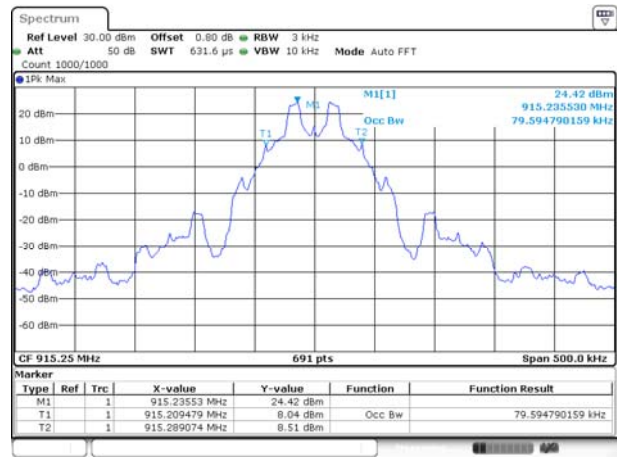
## Test plots (99% Bandwidth)

### LOW CHANNEL



Date: 27 MAR 2018 10:19:17

### MIDDLE CHANNEL



Date: 27 MAR 2018 10:24:55

### HIGH CHANNEL



Date: 27 MAR 2018 10:29:26



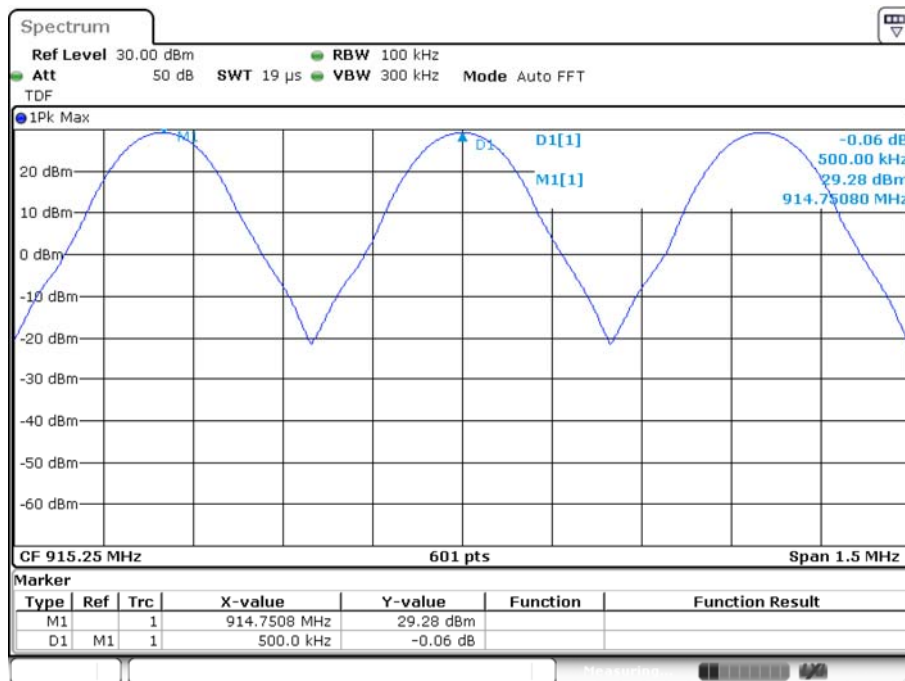
## A.4 Hopping Frequency Separation

### Test Data

Mode	Frequency separation (MHz)	Max 20 dB Bandwidth (MHz)	Verdict
FHSS	0.5	0.262	Pass

### Test Plots

ASK



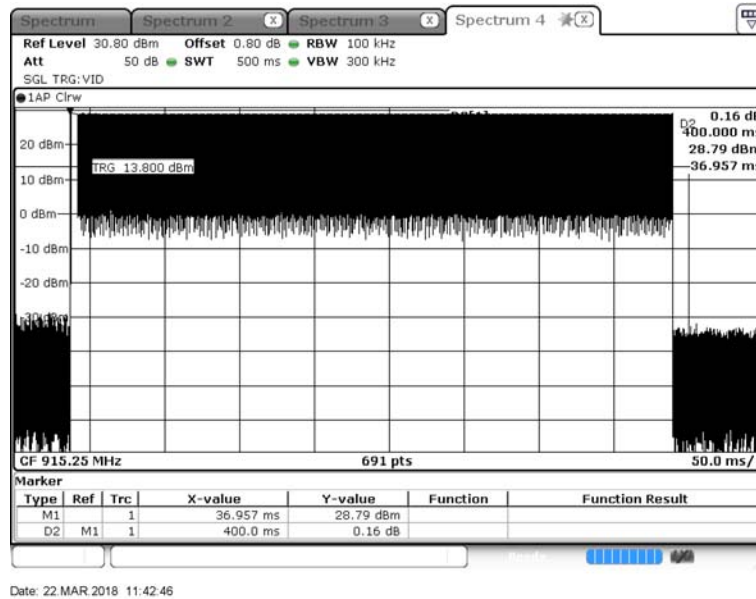
Date: 27.MAR.2018 10:39:16

## A.5 Average Time of Occupancy

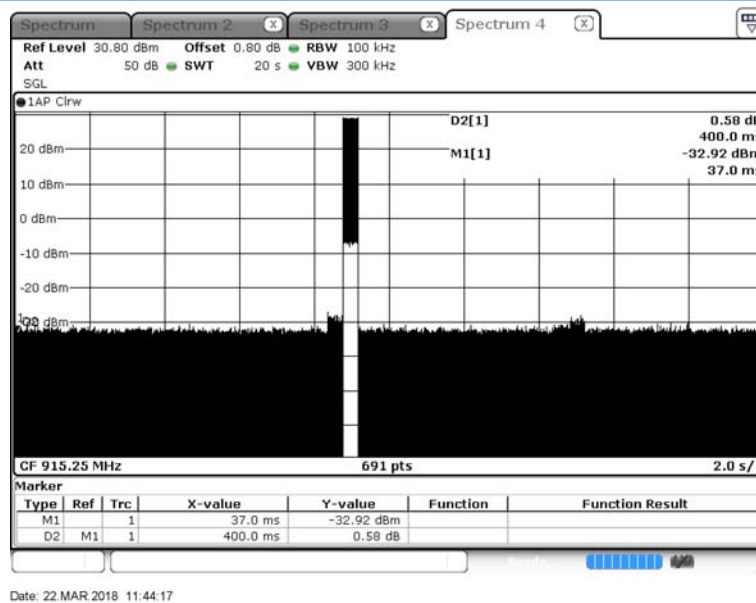
### Test Data

Total of Dwell(ms)	Limit (sec)	Verdict
400.0	0.4	Pass

### ASK



### ASK



## A.6 Conducted Spurious Emissions & Authorized-band band-edge

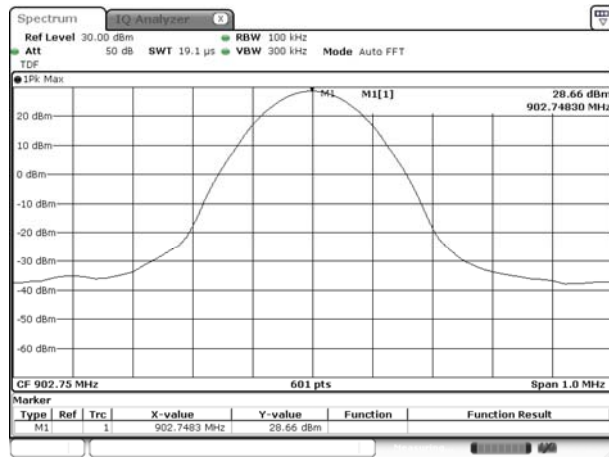
### Test Data

ASK				
Channel	Measured Max. Out of Band Emission (dBm)	Limit (dBm)		Verdict
		Carrier Level	Calculated 20 dBc Limit	
Low	-24.38	28.66	8.66	Pass
Middle	-23.64	28.93	8.93	Pass
High	-15.91	28.65	8.65	Pass

FHSS				
Mode	Measured Max. Out of Band Emission (dBm)	Limit (dBm)		Verdict
		Carrier Level	Calculated 20 dBc Limit	
Hopping	-26.88	29.37	9.37	Pass

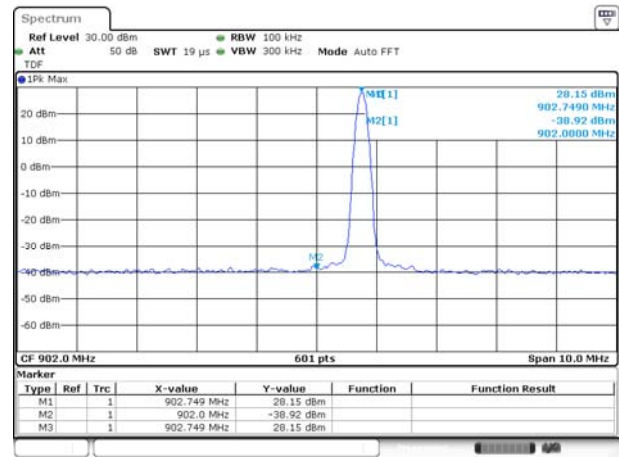
## Test Plots

### LOW CHANNEL, CARRIER LEVEL



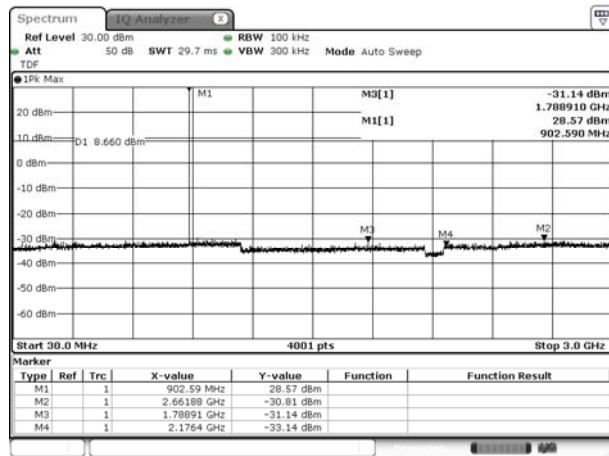
Date: 24 APR 2018 17:17:55

### LOW CHANNEL, Band Edge



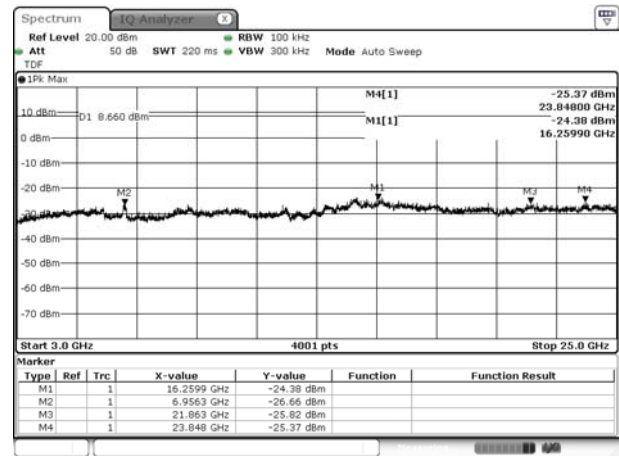
Date: 27 MAR 2018 10:20:53

### LOW CHANNEL, SPURIOUS 30 MHz ~ 1 GHz



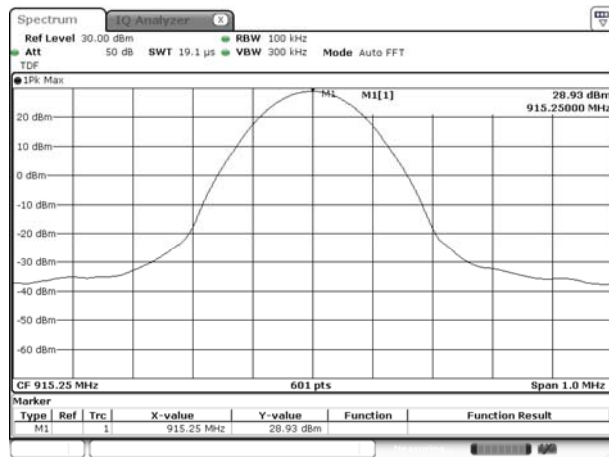
Date: 24 APR 2018 17:18:52

### LOW CHANNEL, SPURIOUS 1 GHz ~ 10 GHz



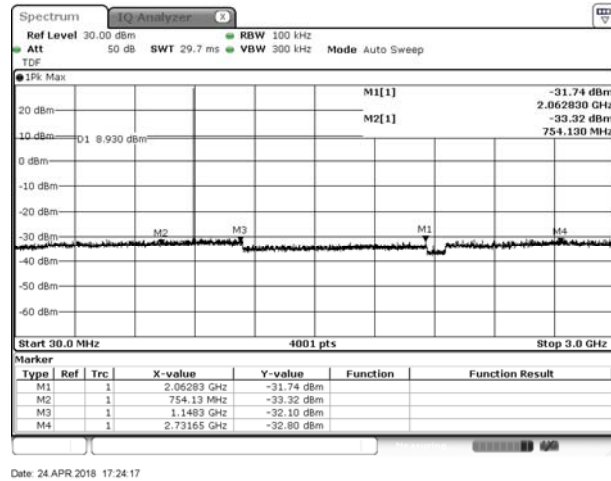
Date: 24 APR 2018 17:21:51

### MIDDLE CHANNEL, CARRIER LEVEL

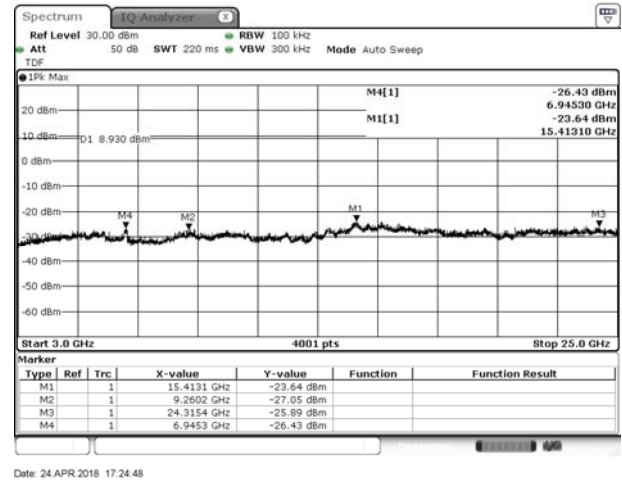


Date: 24 APR 2018 17:23:28

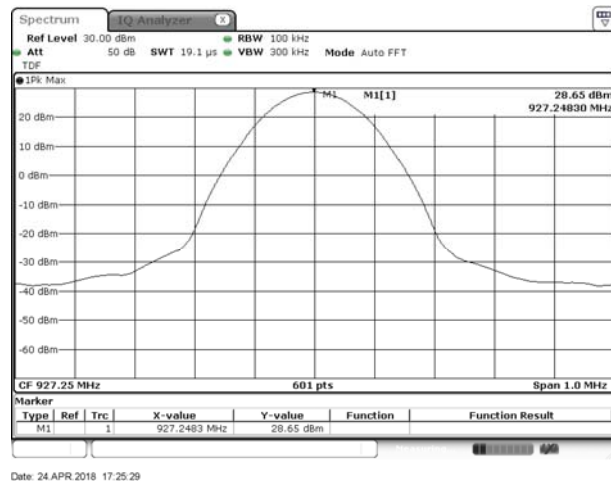
## MIDDLE CHANNEL, SPURIOUS 30 MHz ~ 1 GHz



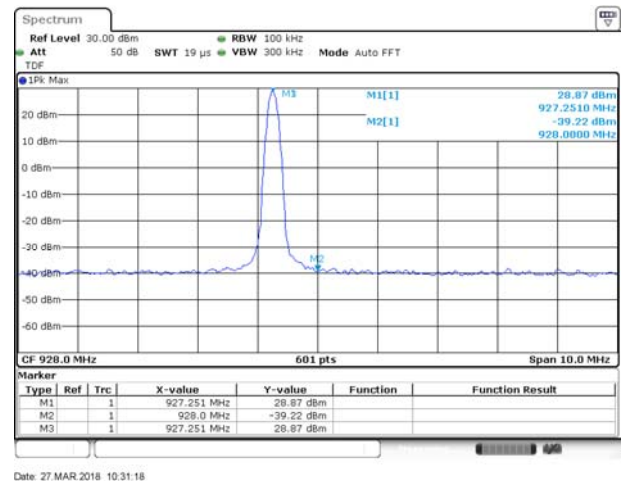
## MIDDLE CHANNEL, SPURIOUS 1 GHz ~ 10 GHz



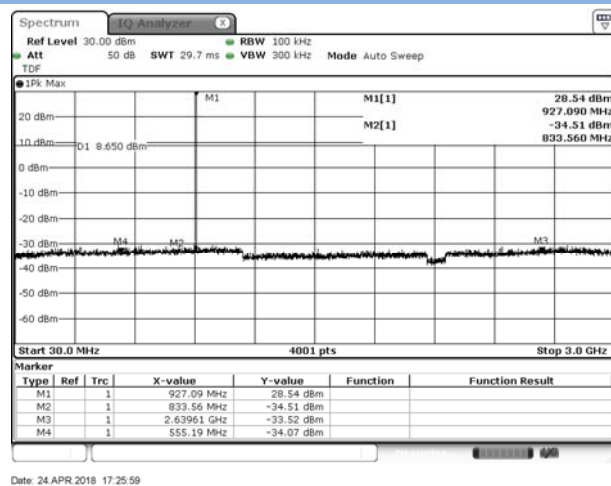
## HIGH CHANNEL, CARRIER LEVEL



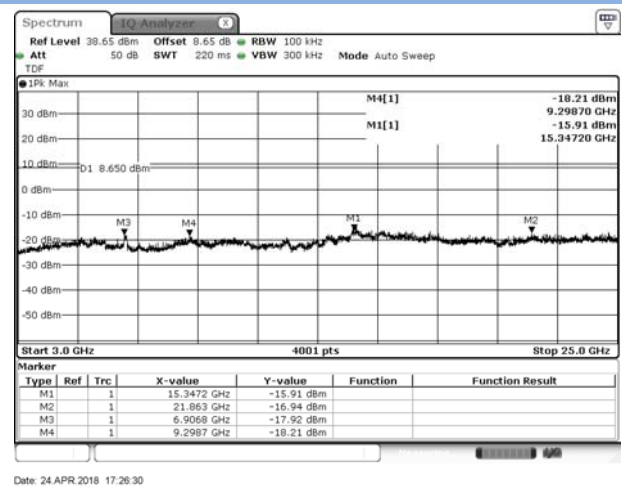
## HIGH CHANNEL, BAND EDGE



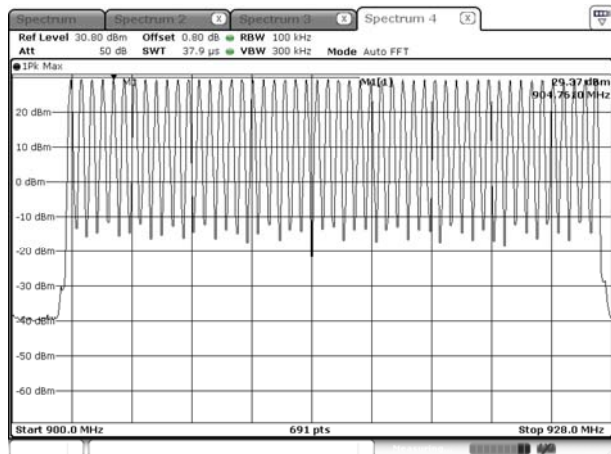
## HIGH CHANNEL, SPURIOUS 30 MHz ~ 1 GHz



## HIGH CHANNEL, SPURIOUS 1 GHz ~ 10 GHz

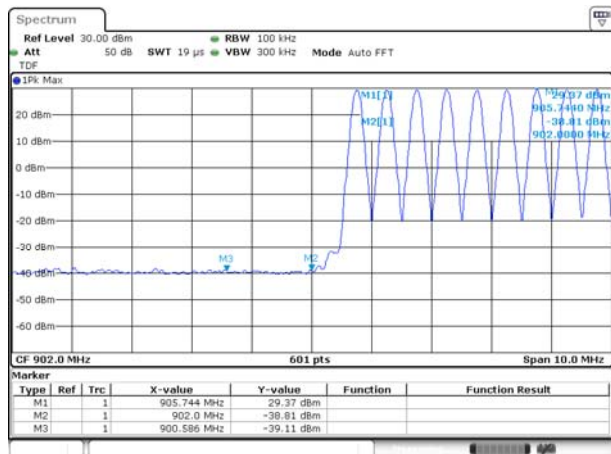


## HOPPING, CARRIER LEVEL



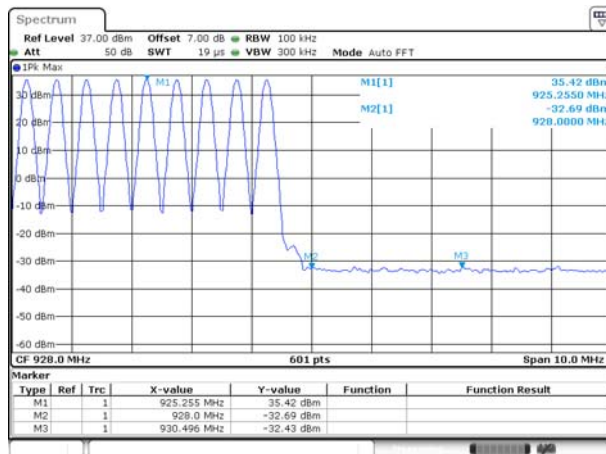
Date: 22 MAR 2018 11:28:48

## Hopping BAND EDGE (LOW)



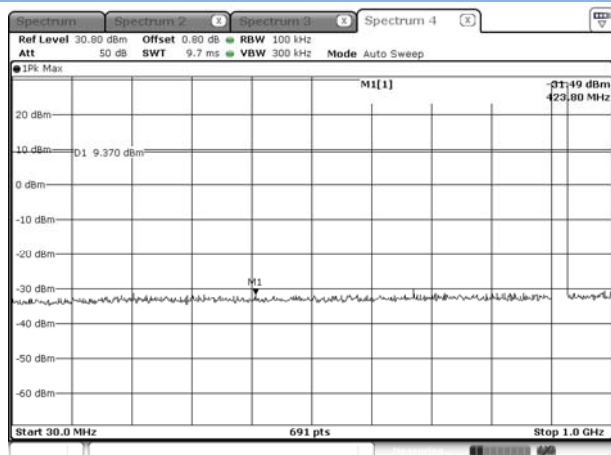
Date: 27 MAR 2018 10:43:36

## Hopping BAND EDGE (HIGH)



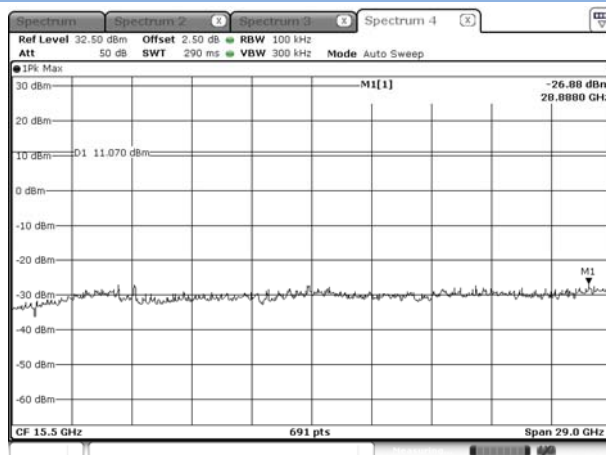
Date: 27 MAR 2018 10:44:13

## Hopping Mode, SPURIOUS 30 MHz ~ 1 GHz



Date: 22 MAR 2018 11:30:39

## Hopping Mode, SPURIOUS 1GHz ~ 10 GHz



Date: 22 MAR 2018 11:31:17

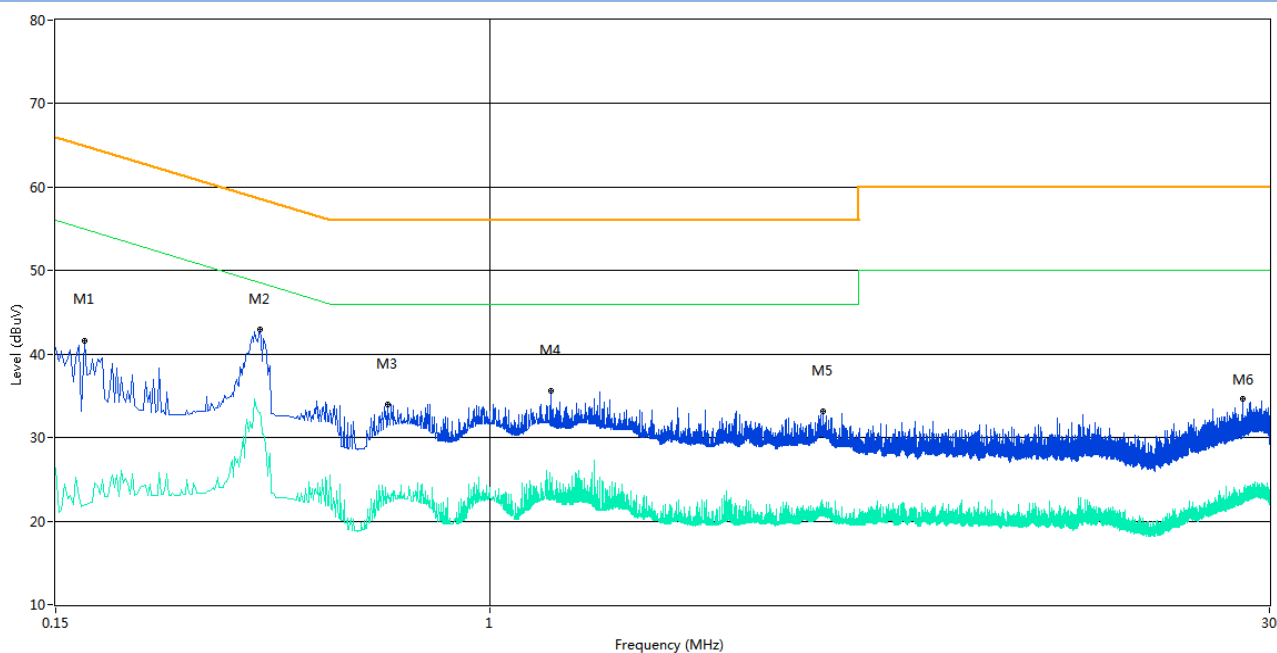
## A.7 Conducted Emissions

Note 1: The EUT is working in the Normal link mode.

Note 2: Devices subject to Part 15 must be tested for all available U.S. voltages and frequencies (such as a nominal 120 VAC, 60 Hz and 240 VAC, 50 Hz) for which the device is capable of operation. So, The configuration 120 VAC, 60 Hz and 240 VAC, 50 Hz were tested respectively, but only the worst configuration (120 VAC, 60 Hz ) shown here.

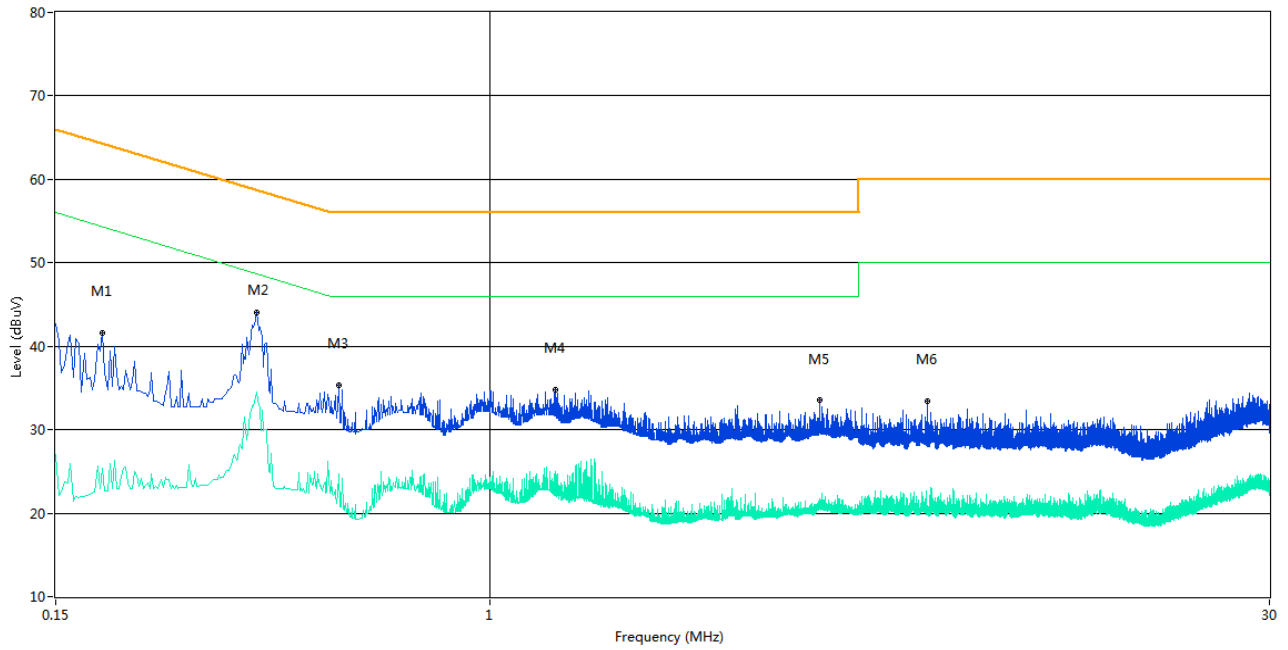
### Test Data and Plots

#### PHASE L



No.	Frequency (MHz)	Results (dBuV)	Factor (dB)	Limit (dBuV)	Margin (dB)	Detector	Line	Verdict
1	0.170	41.6	10.04	65.0	23.40	Peak	L Line	Pass
1**	0.170	21.4	10.04	55.0	33.60	AV	L Line	Pass
2	0.366	43.0	10.04	58.6	15.60	Peak	L Line	Pass
2**	0.366	33.0	10.04	48.6	15.60	AV	L Line	Pass
3	0.638	33.9	10.05	56.0	22.10	Peak	L Line	Pass
3**	0.638	23.3	10.05	46.0	22.70	AV	L Line	Pass
4	1.304	35.6	10.07	56.0	20.40	Peak	L Line	Pass
4**	1.304	24.5	10.07	46.0	21.50	AV	L Line	Pass
5	4.280	33.1	10.15	56.0	22.90	Peak	L Line	Pass
5**	4.280	20.3	10.15	46.0	25.70	AV	L Line	Pass
6	26.712	34.7	10.78	60.0	25.30	Peak	L Line	Pass
6**	26.712	23.4	10.78	50.0	26.60	AV	L Line	Pass

# PHASE N



No.	Frequency (MHz)	Results (dBuV)	Factor (dB)	Limit (dBuV)	Margin (dB)	Detector	Line	Verdict
1	0.184	41.6	10.04	64.3	22.70	Peak	N Line	Pass
1**	0.184	25.4	10.04	54.3	28.90	AV	N Line	Pass
2	0.360	44.1	10.04	58.7	14.60	Peak	N Line	Pass
2**	0.360	34.5	10.04	48.7	14.20	AV	N Line	Pass
3	0.516	35.3	10.05	56.0	20.70	Peak	N Line	Pass
3**	0.516	24.7	10.05	46.0	21.30	AV	N Line	Pass
4	1.330	34.8	10.07	56.0	21.20	Peak	N Line	Pass
4**	1.330	25.0	10.07	46.0	21.00	AV	N Line	Pass
5	4.204	33.5	10.15	56.0	22.50	Peak	N Line	Pass
5**	4.204	21.2	10.15	46.0	24.80	AV	N Line	Pass
6	6.754	33.4	10.22	60.0	26.60	Peak	N Line	Pass
6**	6.754	20.4	10.22	50.0	29.60	AV	N Line	Pass



## A.8 Radiated Spurious Emission

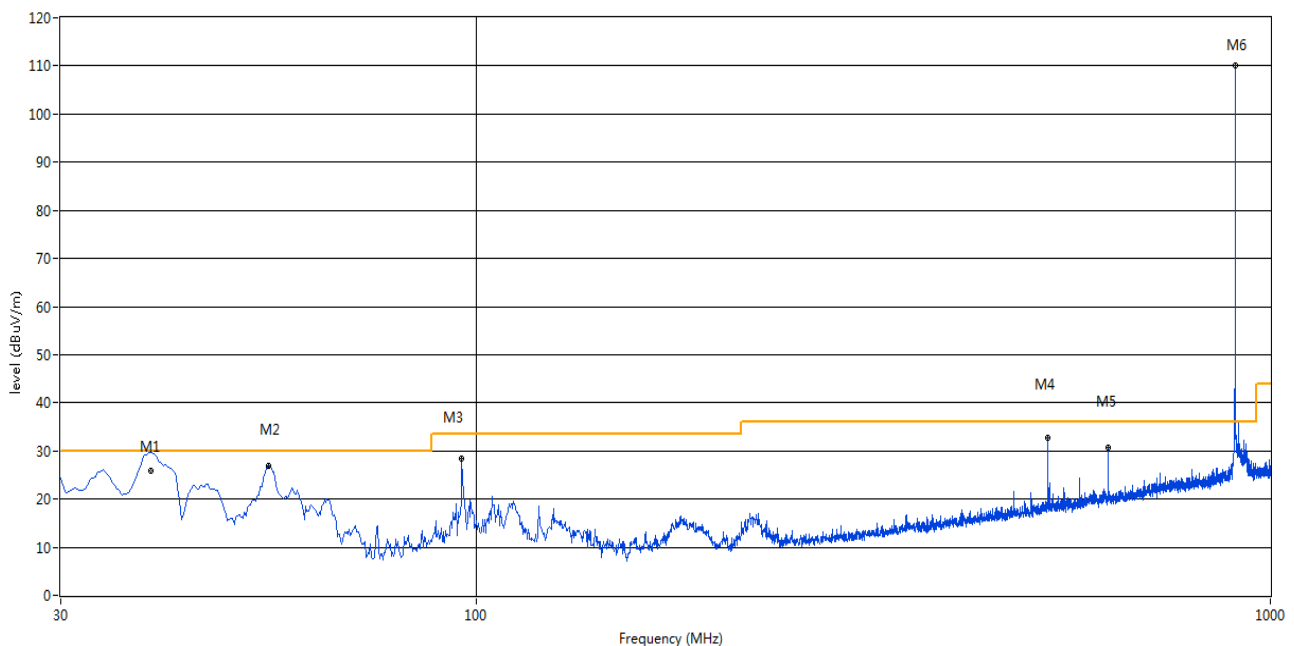
Note<sup>1</sup>: The symbol of “--” in the table which means not application.

Note<sup>2</sup>: For the test data above 1 GHz, according the ANSI C63.10-2013, where limits are specified for both average and peak (or quasi-peak) detector functions, if the peak (or quasi-peak) measured value complies with the average limit, it is unnecessary to perform an average measurement.

Note<sup>3</sup>: The low frequency, which started from 9 kHz to 30 MHz, was pre-scanned and the result which was 20 dB lower than the limit line per 15.31(o) was not reported.

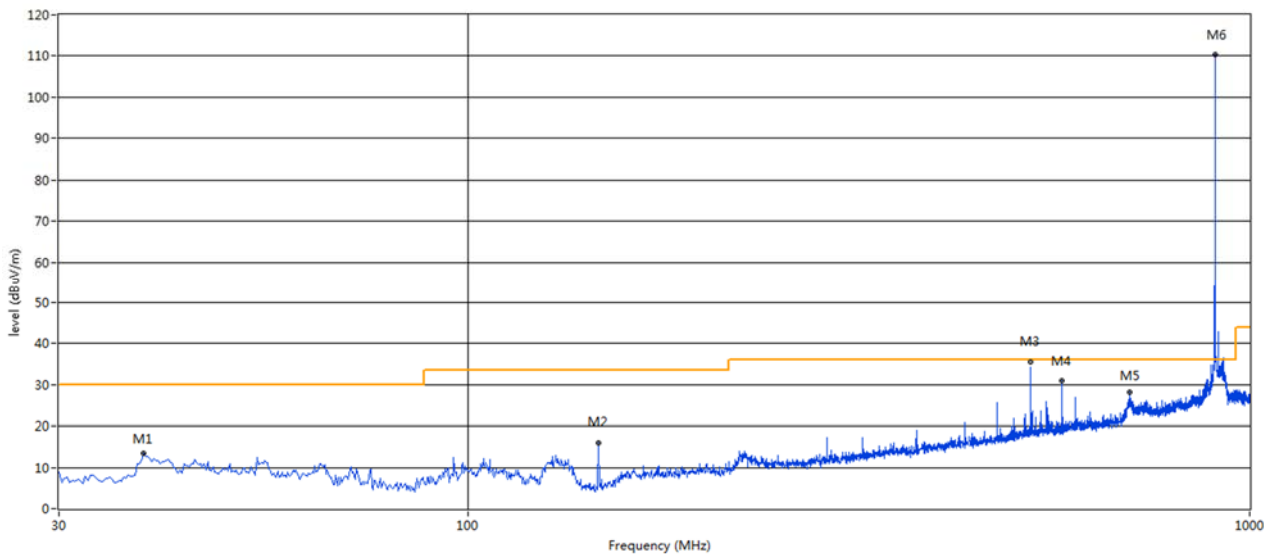
### Test Data and Plots

LOW CHANNEL ANT V



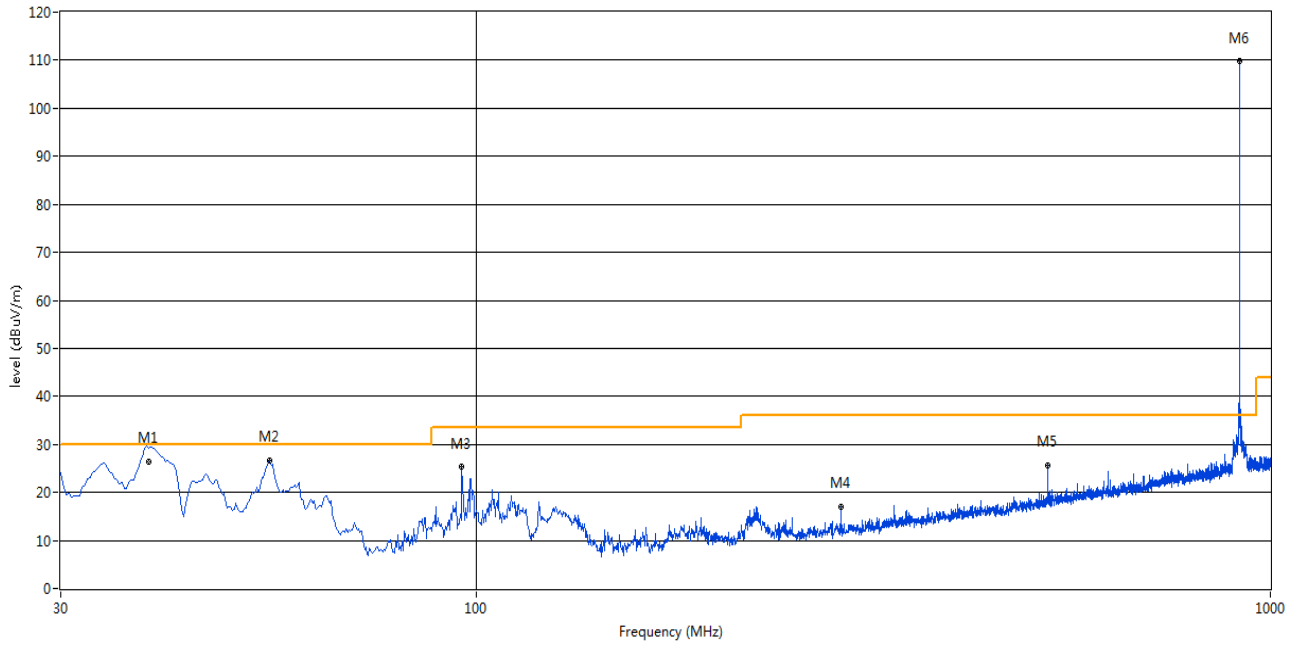
No.	Frequency (MHz)	Results (dBuV/m)	Factor (dB)	Limit (dBuV/m)	Margin (dB)	Detector	Table (o)	Height (cm)	ANT	Verdict
1	38.914	28.75	-26.04	30.0	1.25	Peak	104.00	139	Vertical	Pass
1*	38.914	25.93	-26.04	30.0	4.07	QP	104.00	139	Vertical	Pass
2	54.735	26.94	-24.97	30.0	3.06	Peak	117.00	100	Vertical	Pass
3	95.960	28.48	-26.97	33.5	5.02	Peak	60.00	100	Vertical	Pass
4	524.942	32.68	-16.81	36.0	3.32	Peak	155.00	100	Vertical	Pass
5	625.095	30.59	-14.71	36.0	5.41	Peak	142.00	100	Vertical	Pass
6	902.758	110.19	-10.47	36.0	-74.19	Peak	344.00	100	Vertical	N/A

## LOW CHANNEL, ANT H



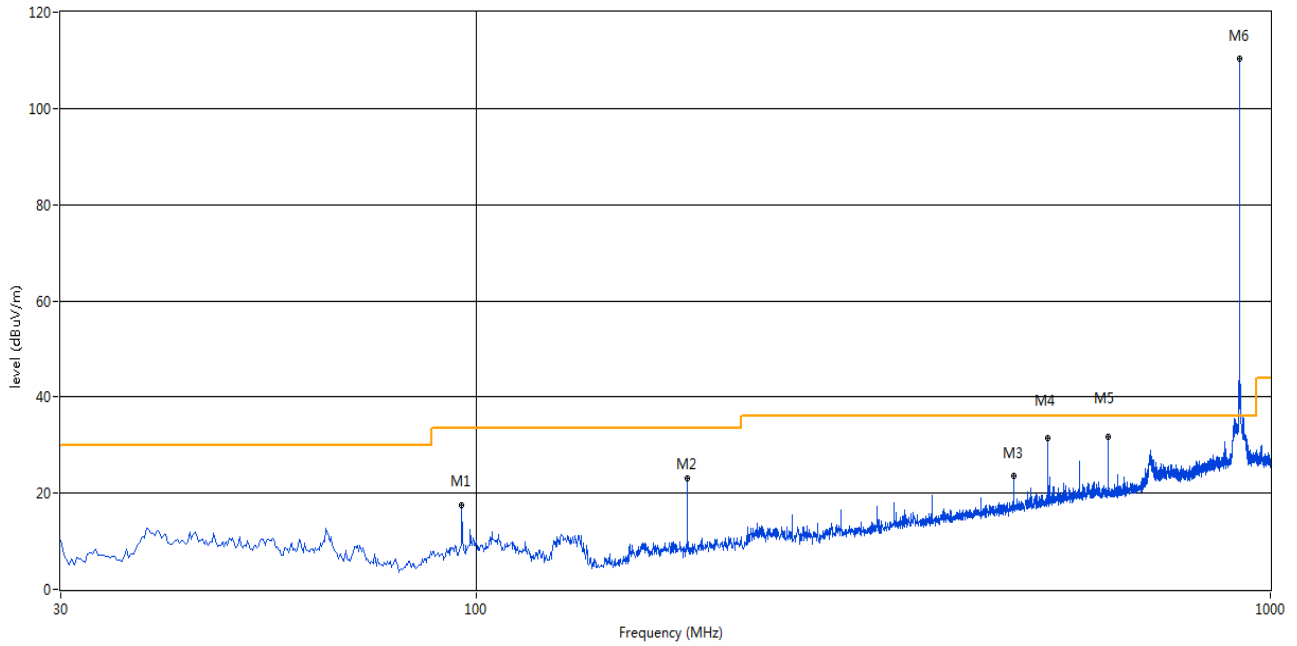
No.	Frequency (MHz)	Results (dBuV/m)	Factor (dB)	Limit (dBuV/m)	Margin (dB)	Detector	Table (o)	Height (cm)	ANT	Verdict
1	38.487	13.34	-26.16	30.0	16.66	Peak	111.00	100	Horizontal	Pass
2	146.885	16.05	-29.50	33.5	17.45	Peak	360.00	100	Horizontal	Pass
3	524.979	36.06	-16.81	36.0	-0.06	Peak	268.00	168	Horizontal	N/A
3*	524.979	35.47	-16.81	36.0	0.53	QP	268.00	168	Horizontal	Pass
4	574.898	30.86	-15.81	36.0	5.14	Peak	230.00	100	Horizontal	Pass
5	702.695	28.23	-13.59	36.0	7.77	Peak	29.00	100	Horizontal	Pass
6	902.758	110.35	-10.47	36.0	-74.35	Peak	16.00	100	Horizontal	N/A

## MIDDLE CHANNEL ANT V



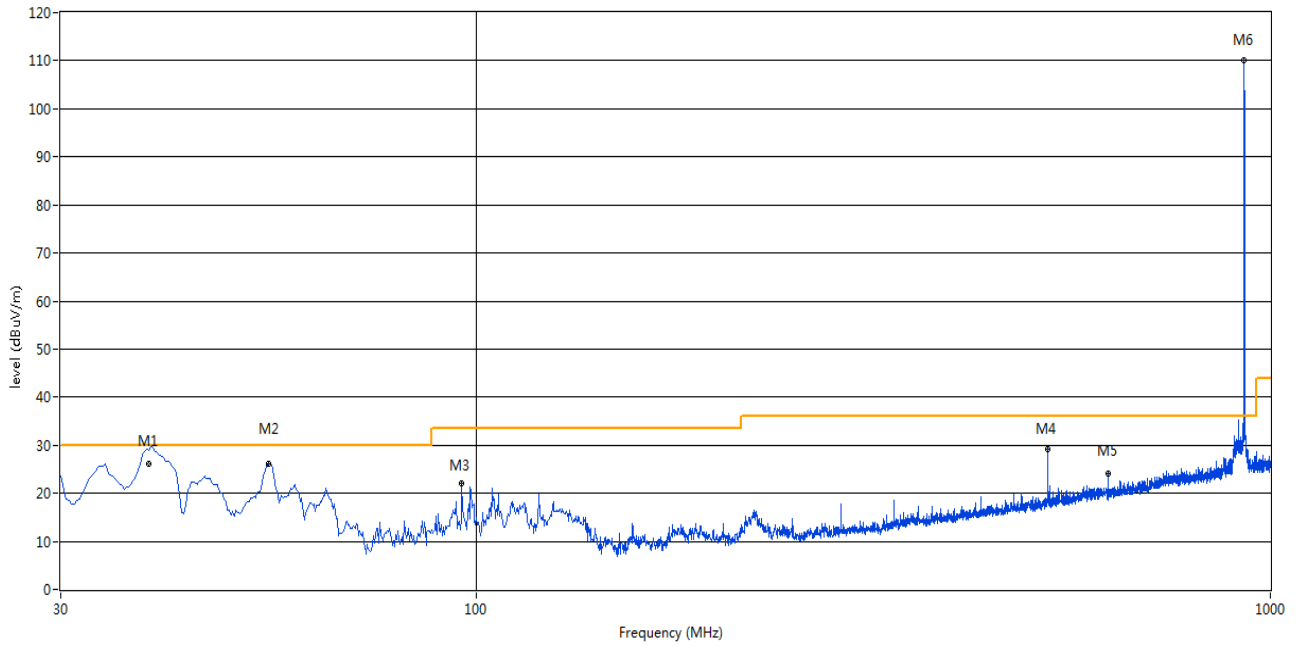
No.	Frequency (MHz)	Results (dBuV/m)	Factor (dB)	Limit (dBuV/m)	Margin (dB)	Detector	Table (o)	Height (cm)	ANT	Verdict
1	38.702	29.25	-26.10	30.0	0.75	Peak	86.00	105	Vertical	Pass
1*	38.702	26.46	-26.10	30.0	3.54	QP	86.00	105	Vertical	Pass
2	54.977	26.76	-25.07	30.0	3.24	Peak	168.00	100	Vertical	Pass
3	95.960	25.27	-26.97	33.5	8.23	Peak	0.00	100	Vertical	Pass
4	288.020	16.95	-22.86	36.0	19.05	Peak	360.00	100	Vertical	Pass
5	524.942	25.62	-16.81	36.0	10.38	Peak	168.00	100	Vertical	Pass
6	915.367	109.79	-10.48	36.0	-73.79	Peak	344.00	100	Vertical	N/A

## MIDDLE CHANNEL, ANT H



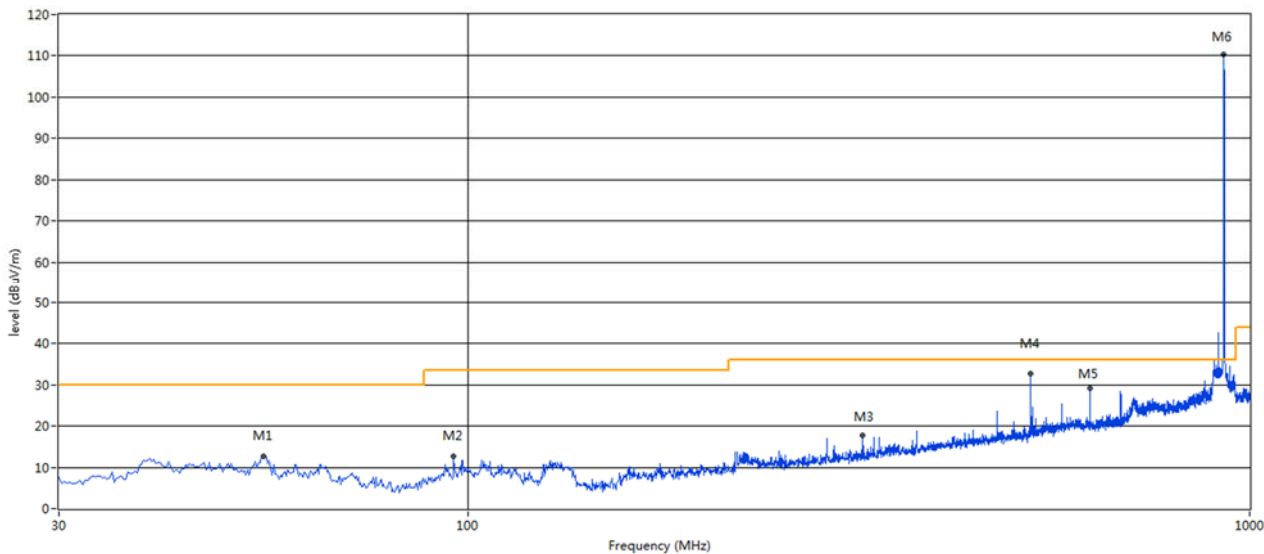
No.	Frequency (MHz)	Results (dBuV/m)	Factor (dB)	Limit (dBuV/m)	Margin (dB)	Detector	Table (o)	Height (cm)	ANT	Verdict
1	95.960	17.61	-26.97	33.5	15.89	Peak	312.00	100	Horizontal	Pass
2	184.472	22.97	-26.99	33.5	10.53	Peak	356.00	100	Horizontal	Pass
3	474.987	23.47	-17.80	36.0	12.53	Peak	217.00	100	Horizontal	Pass
4	524.942	31.44	-16.81	36.0	4.56	Peak	249.00	100	Horizontal	Pass
5	625.095	31.73	-14.71	36.0	4.27	Peak	236.00	100	Horizontal	Pass
6	915.367	110.28	-10.48	36.0	-74.28	Peak	350.00	100	Horizontal	N/A

## HIGH CHANNEL ANT V



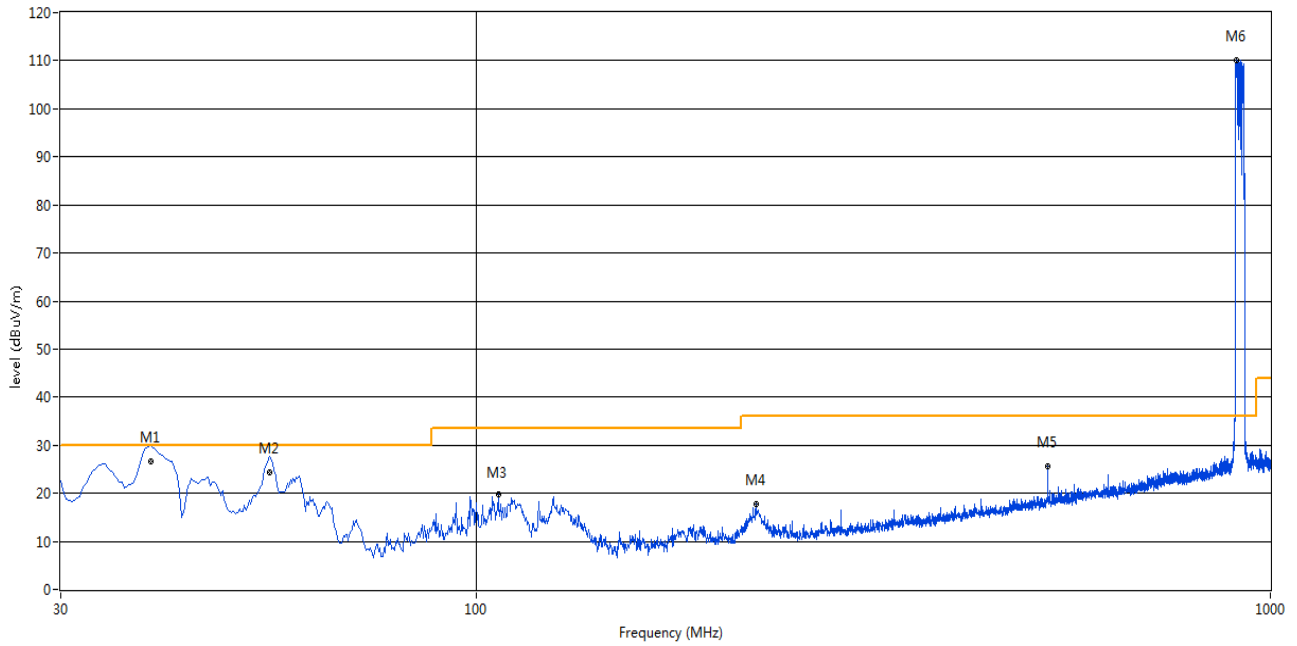
No.	Frequency (MHz)	Results (dBuV/m)	Factor (dB)	Limit (dBuV/m)	Margin (dB)	Detector	Table (o)	Height (cm)	ANT	Verdict
1	38.844	28.83	-26.10	30.0	1.17	Peak	85.00	120	Vertical	Pass
1*	38.844	26.09	-26.10	30.0	3.91	QP	85.00	120	Vertical	Pass
2	54.735	26.01	-24.97	30.0	3.99	Peak	111.00	100	Vertical	Pass
3	95.960	22.12	-26.97	33.5	11.38	Peak	287.00	100	Vertical	Pass
4	524.942	29.24	-16.81	36.0	6.76	Peak	174.00	100	Vertical	Pass
5	625.095	24.04	-14.71	36.0	11.96	Peak	155.00	100	Vertical	Pass
6	927.250	110.13	-10.33	36.0	-74.13	Peak	344.00	100	Vertical	N/A

## HIGH CHANNEL, ANT H



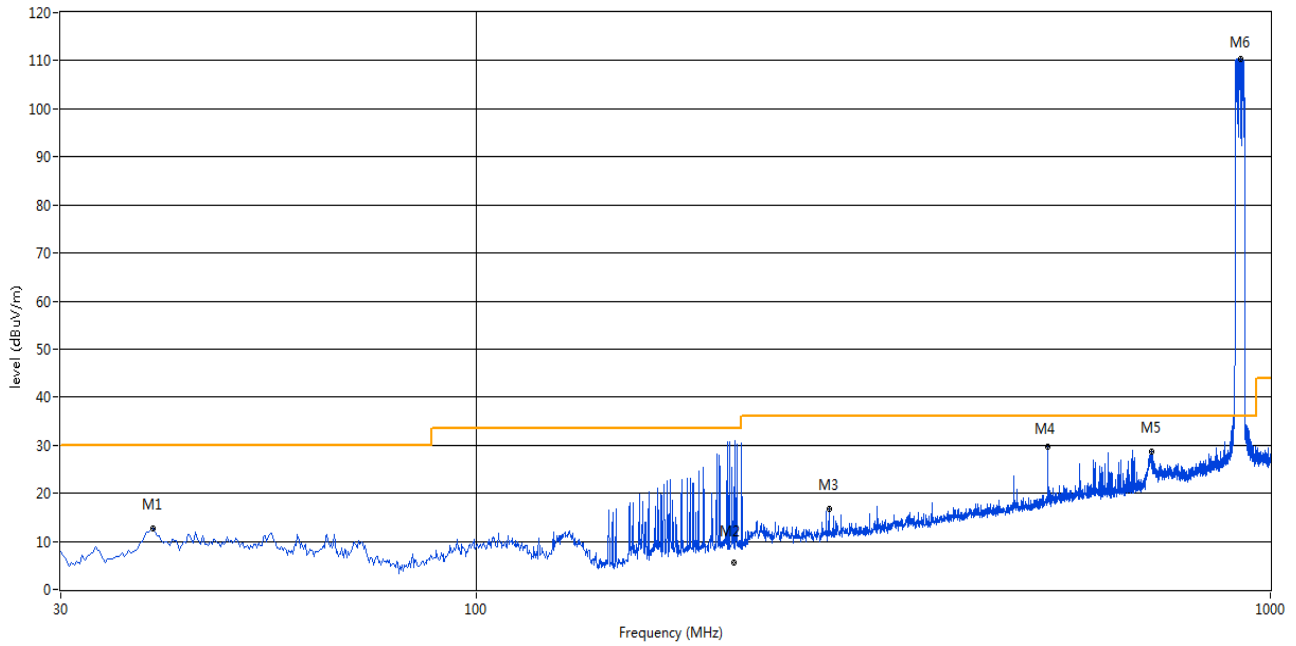
No.	Frequency (MHz)	Results (dBuV/m)	Factor (dB)	Limit (dBuV/m)	Margin (dB)	Detector	Table (o)	Height (cm)	ANT	Verdict
1	54.735	12.80	-24.97	30.0	17.20	Peak	218.00	100	Horizontal	Pass
2	95.960	12.76	-26.97	33.5	20.74	Peak	155.00	100	Horizontal	Pass
3	320.030	17.73	-21.99	36.0	18.27	Peak	205.00	100	Horizontal	Pass
4	524.942	32.66	-16.81	36.0	3.34	Peak	256.00	100	Horizontal	Pass
5	625.095	29.17	-14.71	36.0	6.83	Peak	130.00	100	Horizontal	Pass
6	927.250	110.32	-10.33	36.0	-74.32	Peak	1.00	100	Horizontal	N/A

## HOPPING LOW CHANNEL ANT V



No.	Frequency (MHz)	Results (dBuV/m)	Factor (dB)	Limit (dBuV/m)	Margin (dB)	Detector	Table (o)	Height (cm)	ANT	Verdict
1	38.735	29.14	-26.04	30.0	0.86	Peak	54.00	109	Vertical	Pass
1*	38.735	26.54	-26.04	30.0	3.46	QP	54.00	109	Vertical	Pass
2	54.772	28.72	-25.07	30.0	1.28	Peak	92.00	109	Vertical	Pass
2*	54.772	24.35	-25.07	30.0	5.65	QP	92.00	109	Vertical	Pass
3	106.630	19.81	-25.85	33.5	13.69	Peak	10.00	100	Vertical	Pass
4	224.970	17.80	-24.85	36.0	18.20	Peak	174.00	100	Vertical	Pass
5	524.942	25.62	-16.81	36.0	10.38	Peak	186.00	100	Vertical	Pass
6	907.365	110.21	-10.38	36.0	-74.21	Peak	337.00	100	Vertical	N/A

## HOPPING LOW CHANNEL, ANT H



No.	Frequency (MHz)	Results (dBuV/m)	Factor (dB)	Limit (dBuV/m)	Margin (dB)	Detector	Table (o)	Height (cm)	ANT	Verdict
1	39.215	12.67	-26.01	30.0	17.33	Peak	111.00	100	Horizontal	Pass
2	211.496	11.56	-25.66	33.5	21.94	Peak	5.00	182	Horizontal	Pass
2*	211.496	5.60	-25.66	33.5	27.90	QP	5.00	182	Horizontal	Pass
3	278.078	16.73	-23.03	36.0	19.27	Peak	0.00	100	Horizontal	Pass
4	524.942	29.64	-16.81	36.0	6.36	Peak	243.00	100	Horizontal	Pass
5	708.030	28.67	-13.50	36.0	7.33	Peak	23.00	100	Horizontal	Pass
6	916.823	110.25	-10.43	36.0	-74.25	Peak	23.00	100	Horizontal	N/A



## LOW CHANNEL 1 GHz to 10 GHz, ANT V

No.	Frequency (MHz)	Results (dBuV/m)	Factor (dB)	Limit (dBuV/m)	Margin (dB)	Detector	Table (o)	Height (cm)	ANT	Verdict
1	1535.000	47.35	-11.51	74.0	26.65	Peak	324.00	150	Vertical	Pass
2	1781.500	49.25	-11.14	74.0	24.75	Peak	360.00	150	Vertical	Pass
3	1909.500	51.20	-9.87	74.0	22.80	Peak	13.00	150	Vertical	Pass
4	2163.000	48.63	-6.61	74.0	25.37	Peak	204.00	150	Vertical	Pass
5	2979.000	49.88	-0.92	74.0	24.12	Peak	25.00	150	Vertical	Pass
6	4485.000	50.68	-2.38	74.0	23.32	Peak	94.00	150	Vertical	Pass

## LOW CHANNEL 1 GHz to 10 GHz, ANT H

No.	Frequency (MHz)	Results (dBuV/m)	Factor (dB)	Limit (dBuV/m)	Margin (dB)	Detector	Table (o)	Height (cm)	ANT	Verdict
1	1535.000	47.76	-11.51	74.0	26.24	Peak	234.00	150	Horizontal	Pass
2	1876.000	44.28	-10.33	74.0	29.72	Peak	61.00	150	Horizontal	Pass
3	2275.000	46.94	-5.04	74.0	27.06	Peak	103.00	150	Horizontal	Pass
4	2970.000	50.74	-1.19	74.0	23.26	Peak	240.00	150	Horizontal	Pass
5	3579.750	46.63	-4.28	74.0	27.37	Peak	76.00	150	Horizontal	Pass
6	5196.000	51.71	-0.19	74.0	22.29	Peak	88.00	150	Horizontal	Pass

## MIDDLE CHANNEL 1 GHz to 10 GHz, ANT V

No.	Frequency (MHz)	Results (dBuV/m)	Factor (dB)	Limit (dBuV/m)	Margin (dB)	Detector	Table (o)	Height (cm)	ANT	Verdict
1	1534.500	47.43	-11.49	74.0	26.57	Peak	324.00	150	Vertical	Pass
2	1991.500	51.90	-8.47	74.0	22.10	Peak	19.00	150	Vertical	Pass
3	2745.500	50.37	-3.98	74.0	23.63	Peak	1.00	150	Vertical	Pass
4	3326.250	49.05	-5.43	74.0	24.95	Peak	199.00	150	Vertical	Pass
5	4254.000	48.67	-3.12	74.0	25.33	Peak	294.00	150	Vertical	Pass
6	5603.250	52.06	1.84	74.0	21.94	Peak	199.00	150	Vertical	Pass

## MIDDLE CHANNEL 1 GHz to 10 GHz, ANT H

No.	Frequency (MHz)	Results (dBuV/m)	Factor (dB)	Limit (dBuV/m)	Margin (dB)	Detector	Table (o)	Height (cm)	ANT	Verdict
1	1535.000	47.23	-11.51	74.0	26.77	Peak	239.00	150	Horizontal	Pass
2	1992.500	48.85	-8.55	74.0	25.15	Peak	351.00	150	Horizontal	Pass
3	2872.500	50.73	-1.24	74.0	23.27	Peak	293.00	150	Horizontal	Pass
4	4235.250	47.40	-3.85	74.0	26.60	Peak	341.00	150	Horizontal	Pass
5	5101.500	51.29	-0.10	74.0	22.71	Peak	291.00	150	Horizontal	Pass
6	5563.500	51.05	1.15	74.0	22.95	Peak	360.00	150	Horizontal	Pass

## HIGH CHANNEL 1 GHz to 10 GHz, ANT V

No.	Frequency (MHz)	Results (dBuV/m)	Factor (dB)	Limit (dBuV/m)	Margin (dB)	Detector	Table (o)	Height (cm)	ANT	Verdict
1	1524.000	47.35	-11.46	74.0	26.65	Peak	239.00	150	Vertical	Pass
2	1987.500	47.12	-8.23	74.0	26.88	Peak	168.00	150	Vertical	Pass
3	2905.500	49.34	-0.65	74.0	24.66	Peak	360.00	150	Vertical	Pass
4	3832.500	47.42	-4.87	74.0	26.58	Peak	360.00	150	Vertical	Pass
5	4381.000	49.02	-3.58	74.0	24.98	Peak	310.00	150	Vertical	Pass
6	5847.750	51.63	1.37	74.0	22.37	Peak	316.00	150	Vertical	Pass

## HIGH CHANNEL 1 GHz to 10 GHz, ANT H

No.	Frequency (MHz)	Results (dBuV/m)	Factor (dB)	Limit (dBuV/m)	Margin (dB)	Detector	Table (o)	Height (cm)	ANT	Verdict
1	1535.000	47.85	-11.51	74.0	26.15	Peak	239.00	150	Horizontal	Pass
2	1996.500	47.62	-8.14	74.0	26.38	Peak	168.00	150	Horizontal	Pass
3	2983.500	50.48	-0.68	74.0	23.52	Peak	360.00	150	Horizontal	Pass
4	3818.250	46.95	-4.94	74.0	27.05	Peak	360.00	150	Horizontal	Pass
5	4341.000	48.61	-3.53	74.0	25.39	Peak	310.00	150	Horizontal	Pass
6	5553.750	52.24	1.41	74.0	21.76	Peak	316.00	150	Horizontal	Pass

## Hopping Low Channel 1 GHz to 10 GHz, ANT V

No.	Frequency (MHz)	Results (dBuV/m)	Factor (dB)	Limit (dBuV/m)	Margin (dB)	Detector	Table (o)	Height (cm)	ANT	Verdict
1	1614.500	48.76	-11.31	74.0	25.24	Peak	239.00	150	Vertical	Pass
2	2004.250	48.17	-8.01	74.0	25.83	Peak	168.00	150	Vertical	Pass
3	3102.250	49.39	-0.52	74.0	24.61	Peak	360.00	150	Vertical	Pass
4	3998.000	48.16	-4.76	74.0	25.84	Peak	360.00	150	Vertical	Pass
5	4462.500	49.86	-3.56	74.0	24.14	Peak	310.00	150	Vertical	Pass
6	6243.500	50.48	2.09	74.0	23.52	Peak	316.00	150	Vertical	Pass

## Hopping Low Channel 1 GHz to 10 GHz, ANT H

No.	Frequency (MHz)	Results (dBuV/m)	Factor (dB)	Limit (dBuV/m)	Margin (dB)	Detector	Table (o)	Height (cm)	ANT	Verdict
1	1374.500	47.43	-11.42	74.0	26.57	Peak	239.00	150	Horizontal	Pass
2	1879.500	47.91	-8.65	74.0	26.09	Peak	168.00	150	Horizontal	Pass
3	2845.250	51.05	-0.78	74.0	22.95	Peak	360.00	150	Horizontal	Pass
4	3964.000	47.92	-4.87	74.0	26.08	Peak	360.00	150	Horizontal	Pass
5	4567.500	48.65	-3.58	74.0	25.35	Peak	310.00	150	Horizontal	Pass
6	6053.500	51.97	1.48	74.0	22.03	Peak	316.00	150	Horizontal	Pass

## A.9 Band Edge (Restricted-band band-edge)

Pass

Note: The adjacent to the restricted frequency band (608-614MHz and 960-1240MHz) is far away the fundamental, it is noise only. Please refer to Section A.8 for test data.

## **ANNEX B TEST SETUP PHOTOS**

Please refer the document “BL-HK1830324-AR.PDF”.

## **ANNEX C EUT EXTERNAL PHOTOS**

Please refer the document “BL-HK1830324-AW.PDF”.

## **ANNEX D EUT INTERNAL PHOTOS**

Please refer the document “BL-HK1830324-AI.PDF”.

--END OF REPORT--